

LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

Volume 3 of 3

2012

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Longhorn Army Ammunition Plant

1976 – 2012

**LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
ADMINISTRATIVE RECORD – CHRONOLOGICAL INDEX**

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2012

Note: Volume 3, Year 2012, A., B., C., D., E., F., and G. are listed Out of Date in Sequence and should have been inserted in Years 1980, 1983, 1985, 1986, and 2002 respectively.

- A. Title: Report - Installation Assessment of Longhorn Army Ammunition Plant
Author(s):
Recipient: U.S. Army Toxic and Hazardous Materials Agency
Date: February 1, 1980
Bate Stamp: 00116270 - 00116348
- B. Title: Report - Phase 2 Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-Detonation Grounds Evaluation, Longhorn Army Ammunition Plant, Marshall, Texas, 31 July-3 August 1981
Author(s): Department of the Army
Recipient: US Army Materiel Development and Readiness Command
Date: September 21, 1983
Bate Stamp: 00116349 - 00116378
- C. Title: Report - Groundwater Quality Assessment, Groundwater Contamination Related to Seepage from Unlined Evaporation Pond, Longhorn Army Ammunition Plant, Marshall, Texas
Author(s): Camp Dresser & McKee Inc.
Recipient: US Army Materiel Development and Readiness Command
Date: March 15, 1985
Bate Stamp: 00116379 - 00116413
- D. Title: Report - Addendum to Groundwater Quality Assessment, Groundwater Contamination Related to Seepage from Unlined Evaporation Pond, Longhorn Army Ammunition Plant, Marshall, Texas - Part 1
Author(s): Camp Dresser & McKee Inc.
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Date: May 8, 1986
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- E. Title: Report - Addendum to Groundwater Quality Assessment, Groundwater Contamination Related to Seepage from Unlined Evaporation Pond, Longhorn Army Ammunition Plant, Marshall, Texas - Part 2
Author(s): Camp Dresser & McKee Inc.
Recipient: US Army Materiel Development and Readiness Command
Date: May 8, 1986
Bate Stamp: 00116436 - 00116454
- F. Title: Report - Addendum to Groundwater Quality Assessment, Groundwater Contamination Related to Seepage from Unlined Evaporation Pond, Longhorn Army Ammunition Plant, Marshall, Texas - Part 3
Author(s): Camp Dresser & McKee Inc.
Recipient: US Army Materiel Development and Readiness Command
Date: May 8, 1986
Bate Stamp: 00116455 - 00116464
- G. Title: Report - Final First Five-Year Review Report, Longhorn Army Ammunition Plant Sites 18 & 24, Site 16, and Site 12, Karnack, Texas
Author(s): Complete Environmental Service
Recipient: U.S. Army Corps of Engineers
Date: August 13, 2002
Bate Stamp: 00116465 - 00116603
- H. Title: Meeting Minutes - Longhorn AAP Monthly Managers' Meeting
Author(s): AECOM Technical Services
Recipient: All Stakeholders
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- I. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): U.S. Army Corps of Engineers Tulsa District
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- J. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix A: Conceptual Design Report, 1993
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
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- K. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix B: Closure of an Unlined Evaporation Pond: a Case History, 1990
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116653 - 00116662
- L. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix C: Final Work Plan Addendum Phase I for LHAAP-18/24, September 1993
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116663 - 00116685
- M. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix D: Interim Remedial Action - Phase I Letter Report, February 1994
Author(s): U.S. Army Corps of Engineers Tulsa District (AWD Technologies)
Recipient: All Stakeholders
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- N. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix E: Interim Remedial Action Pilot Study Report - Phase II, March 1995
Author(s): U.S. Army Corps of Engineers Tulsa District (Dow Environmental, Inc.)
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116776 - 00116847
- O. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix F: Documentation of IRA Construction Field Activities
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
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- P. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix G: Photographs of IRA Construction Field Activities
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116884 - 00116897
- Q. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix H: Table of ICT Information Available from Quality Control Reports
Author(s): U.S. Army Corps of Engineers Tulsa District
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- R. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix I: ICT As-Built Drawings, August 1998
Author(s): U.S. Army Corps of Engineers Tulsa District (Radian International LLC)
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116908 - 00116934
- S. Title: Memorandum for Record - Documentation of the Interim Remedial Action prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant, Karnack, Texas - Appendix J: Table of Source Material Data Available from Quality Control Reports
Author(s): U.S. Army Corps of Engineers Tulsa District
Recipient: All Stakeholders
Date: October 14, 2012
Bate Stamp: 00116935 - 00116947
- T. Title: Meeting Minutes - Longhorn AAP Restoration Advisory Board (RAB) Meeting
Author(s): AECOM Technical Services
Recipient: All Stakeholders
Date: October 18, 2012
Bate Stamp: 00116948 - 00116967
- U. Title: Meeting Minutes - Longhorn AAP Monthly Managers' Meeting
Author(s): AECOM Technical Services
Recipient: All Stakeholders
Date: October 19, 2012
Bate Stamp: 00116968 - 00117001
- V. Title: Memorandum for Record - Additional Records Pertinent to Remedial Action at LHAAP-18/24 (Burning Ground 3), Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): U.S. Army Corps of Engineers, Tulsa District
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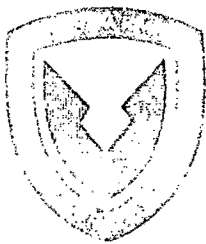
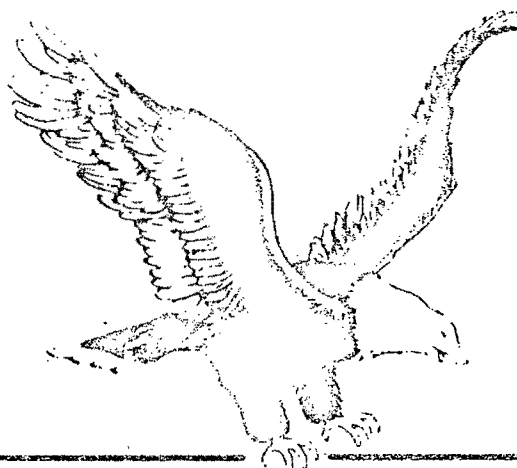
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- W. Title: Meeting Minutes - Longhorn AAP Monthly Managers' Meeting
Author(s): AECOM Technical Services
Recipient: All Stakeholders
Date: November 14, 2012
Bate Stamp: 00117003 - 00117179
- X. Title: Letter - Approval of Schedule Extension Request for LHAAP-18/24 and LHAAP-03
Author(s): United States Environmental Protection Agency
Recipient: Department of Army
Date: November 16, 2012
Bate Stamp: 00117180 - 00117181
- Y. Title: Report - Final Proposed Plan for LHAAP-04, Former Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack Texas
Author(s): AECOM Technical Services
Recipient: U.S. Army Corps of Engineers
Date: December 1, 2012
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- Z. Title: Meeting Minutes - Longhorn AAP Monthly Managers' Meeting
Author(s): AECOM Technical Services
Recipient: All Stakeholders
Date: December 11, 2012
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INSTALLATION ASSESSMENT
OF
LONGHORN ARMY AMMUNITION PLANT

REPORT NO. 150

FEBRUARY 1980



US ARMY
TOXIC AND HAZARDOUS MATERIALS AGENCY

ABERDEEN PROVING GROUND, MARYLAND 21010

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ABSTRACT

A records search was conducted to assess the environmental quality of Longhorn Army Ammunition Plant (LHAAP) with regard to the use, storage, treatment, and disposal of toxic and hazardous materials and to define any conditions which may adversely affect health and welfare or result in environmental degradation.

The review of records identified the major areas of potential contamination as burial sites, testing areas, the TNT production area, industrial (LAP) areas, and burning grounds. The major contaminants suspected include pyrotechnic ingredients, TNT scrap, red water, and explosive contamination scrap.

The most likely routes of any potential off-post migration are via groundwater flow and surface runoff into the bayous feeding Caddo Lake, a recreational area.

I. GENERAL

A. Purpose of the Assessment

To assess the environmental quality of Longhorn Army Ammunition Plant (LHAAP) with regard to the use, storage, treatment, and disposal of toxic and hazardous materials and to define any conditions which may adversely affect health and welfare or result in environmental degradation.

B. Authority

DARCOM Regulation 10-30, Mission and Major Functions of the U.S. Army Toxic and Hazardous Materials Agency, 22 May 1979.

C. Introduction

1. In response to a letter from the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) requesting the identification of potentially contaminated installations, the Commander, U.S. Army Armament Materiel Readiness Command (ARRCOM) identified LHAAP as such an installation.

2. Presurvey instructions were forwarded to LHAAP on 22 December 1978 to outline the assessment scope, provide guidelines to LHAAP personnel, and obtain advance information for review by the Records Search Team prior to the onsite search.

3. LHAAP personnel were briefed by USATHAMA on the Installation Restoration Program on 12 March 1979 prior to the onsite records search.

4. Various Government agencies were contacted during the period of 22 January through 28 March 1979 for documents pertinent to the records search. Agencies contacted include:

- a. Department of Defense Explosives Safety Board (DDESB).
- b. U.S. Army Environmental Hygiene Agency (USAEHA).
- c. U.S. Army Engineer Waterways Experiment Station (WES).
- d. National Archives.
- e. National Records Center, St. Louis.
- f. U.S. Army Armament Materiel Readiness Command (ARRCOM).

- g. U.S. Army Engineers, Fort Worth District Office.
- h. U.S. Geological Survey, Water Resources Division (USGS), Austin, Texas.

5. The onsite phase of the search was conducted from 12 through 16 March 1979. The following personnel from the Chemical Systems Laboratory and Robert B. Balter Co. (contractor) were assigned to the Team and prepared the report:

- a. Mr. Donald Gross, Team Leader, Chemical Engineer (CSL).
- b. Mr. John Bane, Assistant Team Leader, Chemist (CSL).
- c. Mr. Ronald Kassel, Chemist (CSL).
- d. LT Maureen McLeod, Chemical Engineer (CSL).
- e. Major Jay Abercrombie, Ecologist (CSL).
- f. Mr. Robert Benson, Hydrogeologist (Contractor).

6. In addition to the review of the records, interviews were conducted. A tour of the installation was made; photographs taken during the tour are included as Appendix A.

7. Findings are based on records and statements made available to the Team during the search, and are current as of 16 March 1979.

D. Installation History

1. Location

LHAAP occupies 8,437 hectares between State Highway 43 at Karnack, Harrison County, Texas; and the edge of Caddo Lake, a recreational area. The nearest major communities are Marshall, Texas, approximately 22 kilometers southwest, and Shreveport, Louisiana, 64 kilometers east (Figure 1).

2. Mission

LHAAP is a Government-owned, contractor-operated (GOCO) industrial installation under the jurisdiction of ARRCOM with the primary mission of load, assembly, and packout (LAP) of pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The Longhorn Division of Thiokol Corporation is the current operating contractor.

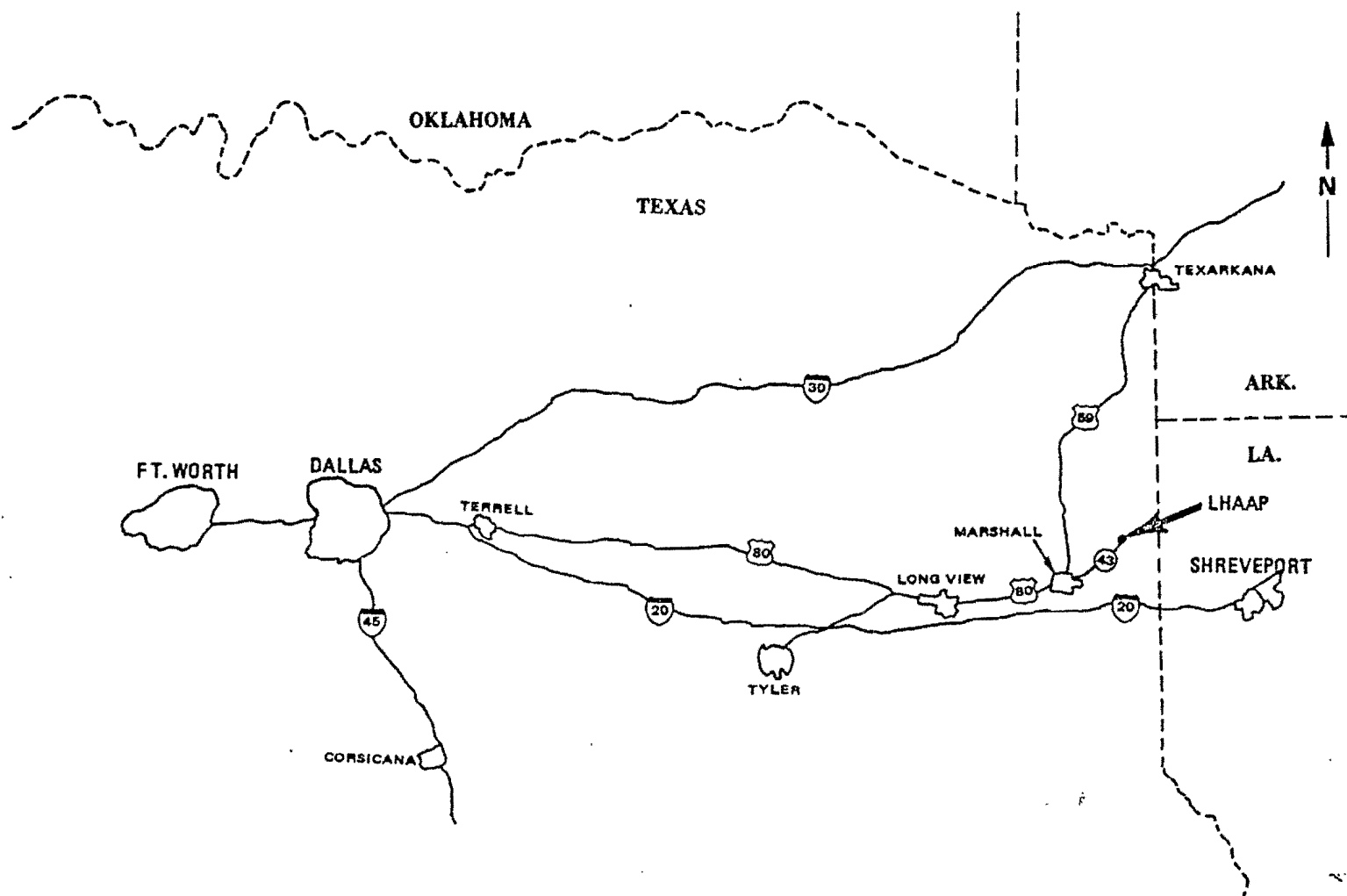


Figure 1. LHAAP Site Location

3. Geology

a. Physiography - Topography^{1,2}

LHAAP lies in an extensive region commonly called the Pineywoods, a deep inland extension of the Gulf Coastal Plain that extends into Louisiana, Arkansas, and Oklahoma. The area is characterized by pine-hardwood forests that cover gently rolling to hilly terrain. Streams on the installation generally flow north or northeast into Caddo Lake.

LHAAP is situated on gently sloping land southwest of Caddo Lake. The average slope is 3 percent toward the northeast. Most of the land is flat (0 to 3 percent) but slopes as steep as 12 percent are common in the northwest and west regions and along the Harrison Bayou flood plain. Elevations vary from a high of 102 meters to a low of 52 meters above sea level.

The installation is located in the West Gulf Coastal Plain section of the Coastal Plain physiographic province. The installation lies on the north flank of the Sabine Uplift which is bordered on the west by the East Texas Basin. To the north lies the Rodessa Fault Zone. Figure 2 illustrates these structural features and the relationship of the rock formations.

Underlying LHAAP are rocks ranging in age from Jurassic to Tertiary. These rocks dip to the northwest at 3 1/2 to 9 meters per kilometer. The relative ages of the following geologic formations are described in Table I.

(1) The Trinity Group is of Lower Cretaceous age and lies unconformably on the eroded Jurassic basement rocks. The Trinity Group consists of 1,615 meters of sand, clay, limestone, marl, anhydrite, and conglomerate.

(2) The Fredricksburg and Washita Groups are Lower Cretaceous age rocks which overlie the Trinity Group and consist of 280 meters of limestone, chalk, and marl.

(3) The Austin, Taylor, and Navarro Groups consist of 975 meters of Upper Cretaceous age chalk, marl, clay, and sand. The Austin Group lies unconformably on the Washita Group.

(4) The Midway Group overlies the Navarro Group and is made up of 275 meters of Tertiary age marine limestone, clay, and sand.

(5) The Carrizo Sand-Wilcox Formation is an undifferentiated Tertiary formation and is the youngest formation in LHAAP. This 122-meter thick formation covers the entire base, overlies the Midway Group, and consists of crossbedded sand, interbedded with clay, lignite, and silt. There is some disagreement in the literature as to whether the formation is actually consolidated rock. It is referred to sometimes as unconsolidated sands and clays and sometimes as sandstone and shale (Figure 3).

3. Geology

a. Physiography - Topography^{1,2}

LHAAP lies in an extensive region commonly called the Pineywoods, a deep inland extension of the Gulf Coastal Plain that extends into Louisiana, Arkansas, and Oklahoma. The area is characterized by pine-hardwood forests that cover gently rolling to hilly terrain. Streams on the installation generally flow north or northeast into Caddo Lake.

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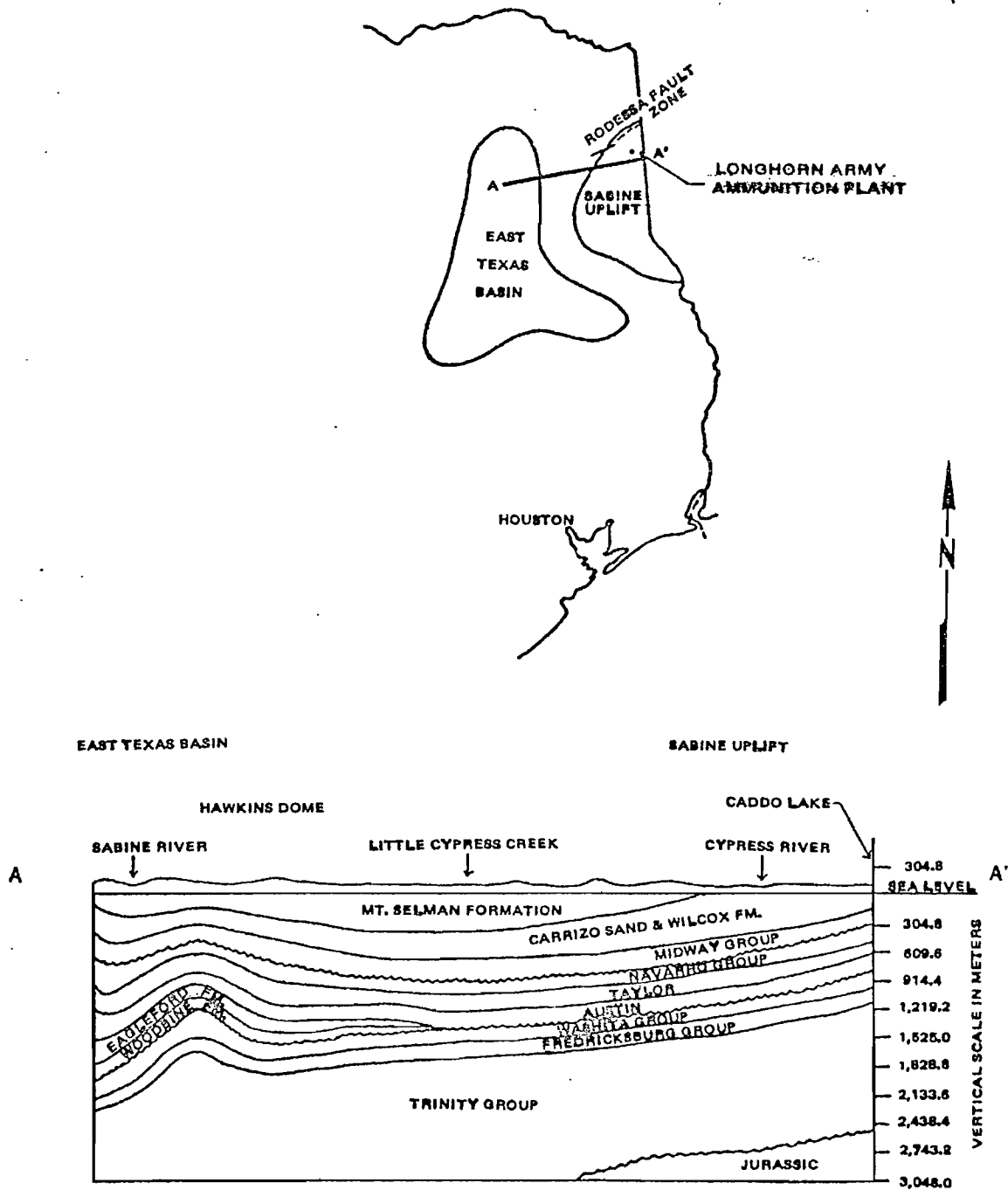


Figure 2. Geologic Structure

Table I. Geologic Time Scale

Era	Period	Epoch	Millions of Years Ago (Approximate)
Cenozoic	Quaternary	Recent	
		Pleistocene	2.5
	Tertiary	Pliocene	7
		Miocene	26
		Oligocene	38
		Eocene	54
Paleocene		65	
Mesozoic	Cretaceous		136
	Jurassic		190
	Triassic		225
Paleozoic	Permian		280
	Carboniferous	North America: Pennsylvanian	345
		Mississippian	
	Devonian		395
	Silurian		430
	Ordovician		500
Cambrian		570	
Precambrian			

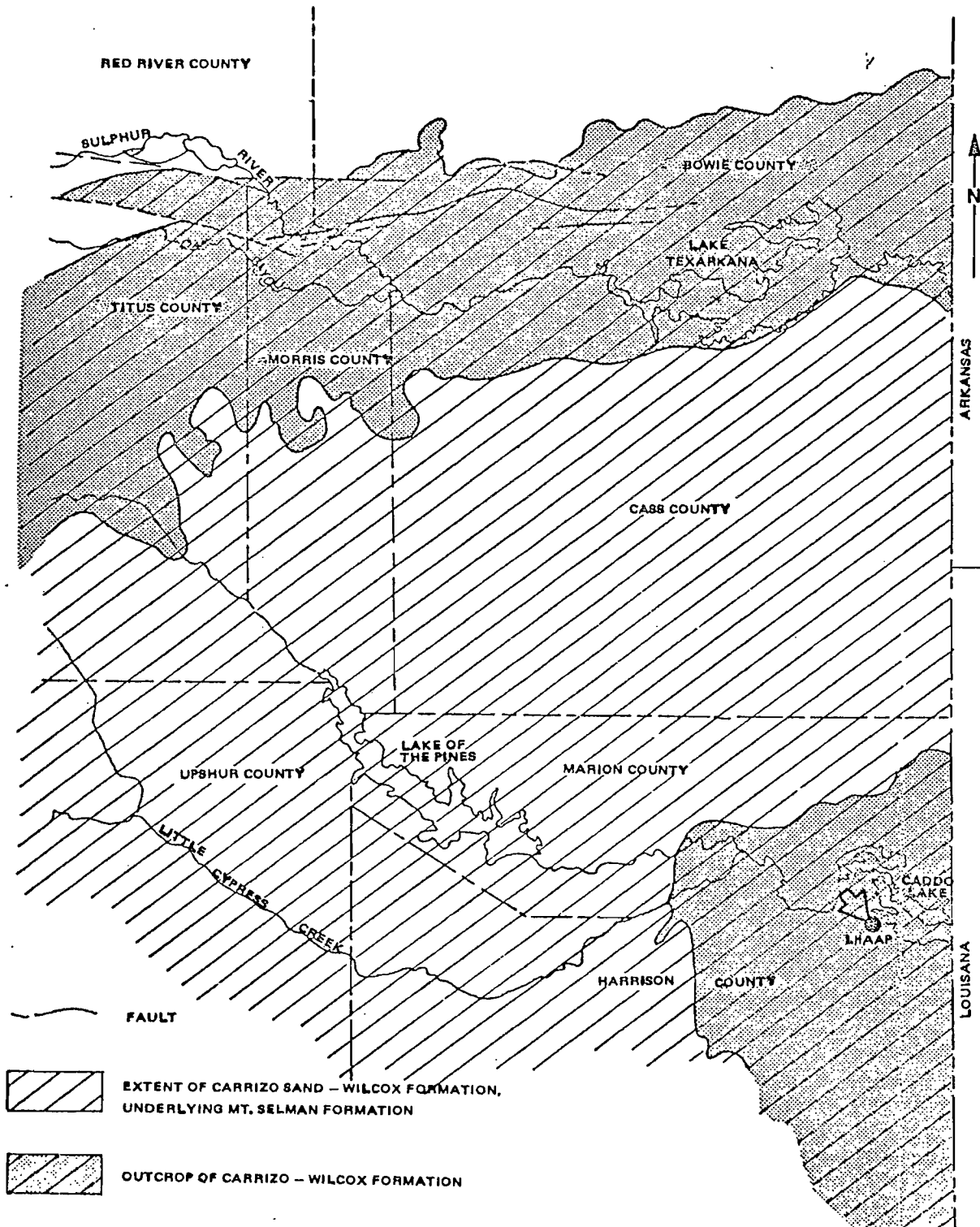


Figure 3. Carrizo Sand-Wilcox Formation

b. Surface Waters

Surface waters of LHAAP drain into Caddo Lake which is a part of the Big Cypress Bayou. At Shreveport, Louisiana, Big Cypress Bayou joins the Red River which flows southeast across Louisiana to enter the Mississippi River at Simmesport, Louisiana.

Caddo Lake is a manmade lake into which all drainage from LHAAP eventually flows. The spillway elevation at the Caddo Lake dam is 51.2 meters. Water levels at the installation are usually less than 51.8 meters elevation although during the wet seasons, the water level may rise as high as 51.9 meters. Property along Caddo Lake is generally inundated during periods of heavy rainfall. The possibility exists that the spillway elevation may be raised 61 centimeters to provide additional municipal water supplies. Raising the spillway elevation will decrease usable property at the installation.

Most of LHAAP is drained through four bayous into Caddo Lake. These four systems consist of dendritic streams which are effluent; i.e., they, in part, drain the groundwater reserves. A very small parcel of 0.26 square kilometers drains directly toward Big Cypress Bayou. The location and extent of these drainage areas are presented in Figure 4. Storm water on the installation reaches the bayous by means of approximately 161 kilometers of maintained small drainage ditches and channels. For ease of presentation, each bayou system is treated individually.

(1) Saunder's Branch of Martin's Creek has a total drainage area of 8.8 square kilometers of which 3.6 square kilometers are on the installation. This creek drains 11 percent of the installation, all of which is woodland or farmland.

(2) Harrison Bayou is the largest bayou with a continuous flow passing directly through the installation. This system drains approximately 130 square kilometers of farmland with no industrial discharges or population centers. Harrison Bayou drains 10.1 square kilometers or 30 percent of the installation area (including the old landfill, the burning grounds, and part of the static test area). At the installation, there are no point discharges into this bayou.

(3) Central Bayou, Karnack Creek (unnamed on the USGS map) begins in Karnack and drains a total of 17 square kilometers. Its flow is intermittent. The system drains 9.8 square kilometers or 29 percent of the installation area (including most of the old TNT area, the sanitary landfill, the warehouse, the magazine, and the igniter areas).

(4) The flows from Goose Prairie Bayou, North Bayou, and Moray Ditch (unnamed on the USGS map) are intermittent; in dry season all flows originate on the installation. Almost all of this 12.2 square kilometers drainage basin is located on the installation. The 10.4 square kilometers

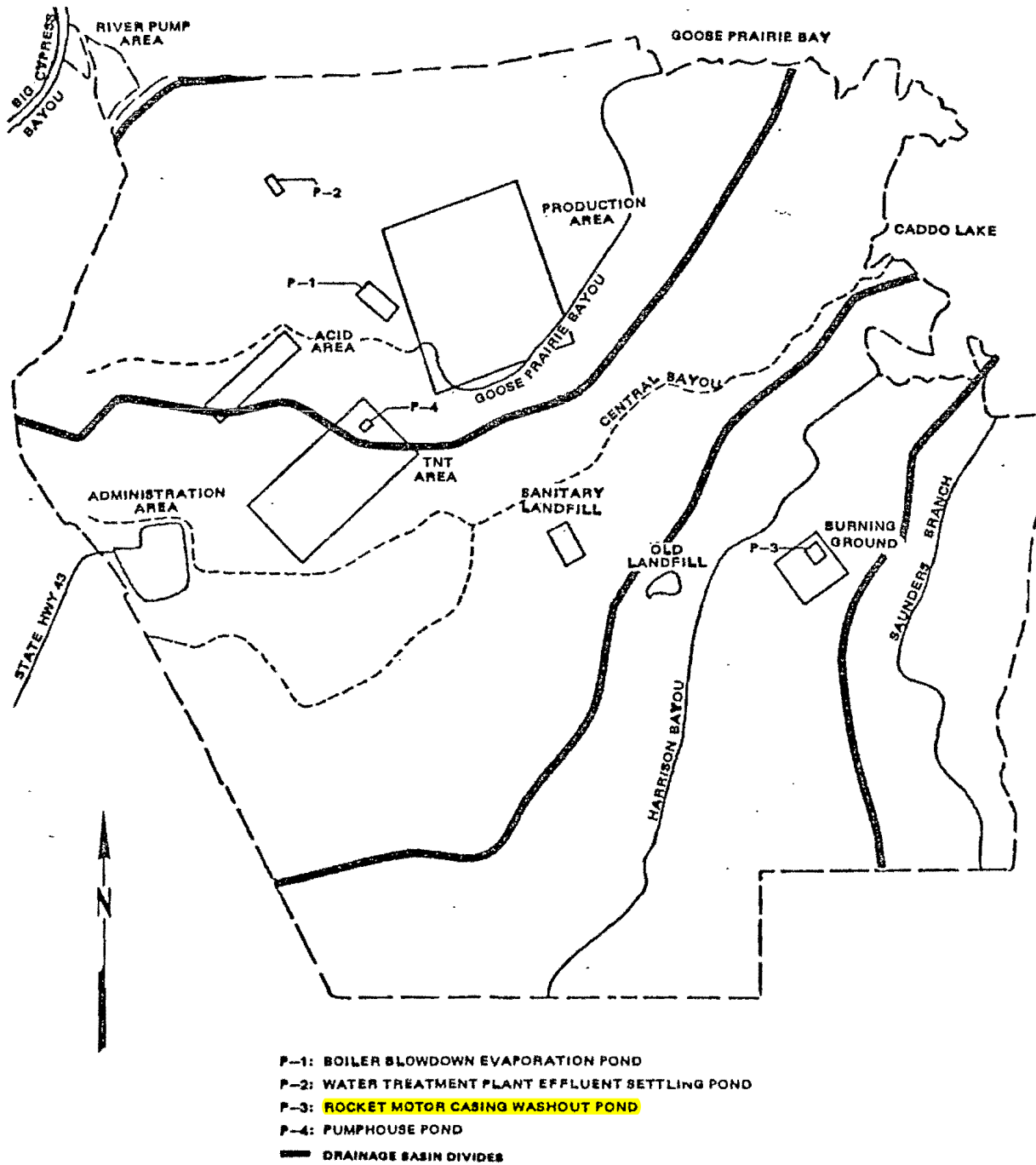


Figure 4. Drainage Basins and Holding Ponds

overlapping LHAAP include 30 percent of the installation area. Draining into the basin is the surface runoff from the shops area (including the water treatment plant and powerhouse), the production area, the sewage treatment plant, a small part of the TNT area, and the acid area.

The 34.2 square kilometers covered by LHAAP make up 0.2 percent of Caddo Lake's 14,500 square kilometer drainage basin.

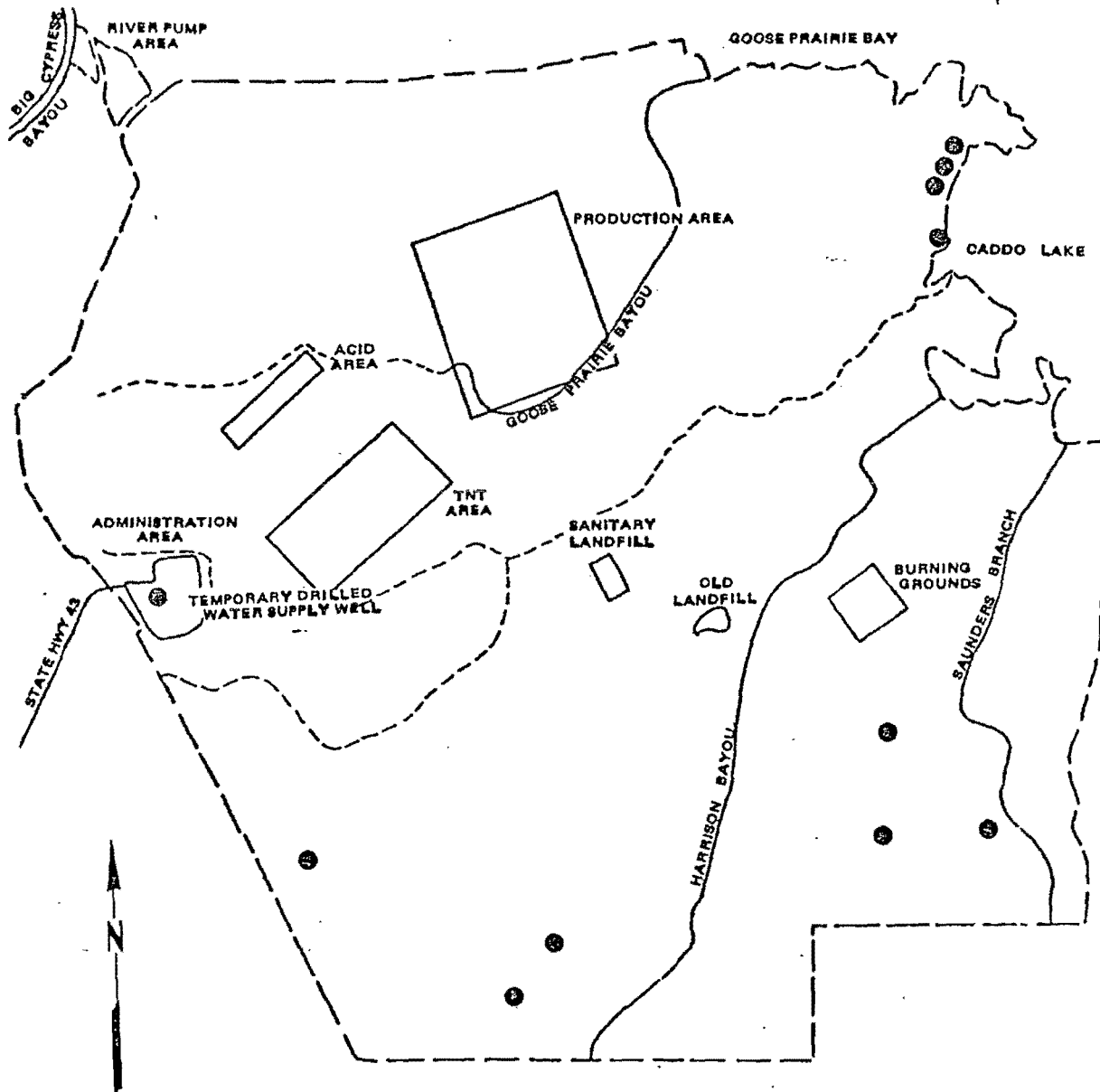
c. Subsurface Waters²⁻⁶

LHAAP is located within the southern outcrop region of the Carrizo Sand-Wilcox Formation. This formation is the major aquifer for water supply in the northeast Texas/northwest Louisiana area. The locations of the aquifer and recharge zones in relation to LHAAP are shown on Figure 3. The groundwater in outcrop areas is under water table conditions. Where the formation dips below the Mt. Selman Formation, artesian pressures exist. It has been noted recently that artesian pressures within the aquifer have declined, although supply is still plentiful and outcrop areas are saturated.

The saturation of the Wilcox Formation is evident on LHAAP by the relatively high water table (phreatic surfaces). Shallow borings from various sections of the installation generally encountered groundwater from 30 to 91 centimeters deep in low-lying areas (below 61 meters elevation). During the wet spring season, water was reported to be just below ground surface in these areas. Above 61 meters elevation, depth to groundwater increases substantially. The groundwater level can fluctuate 150 to 300 centimeters annually, depending upon rainfall and pumping rates.

Several abandoned wells are located in the area (Figure 5). The shallow hand dug wells are 91 to 122 centimeters in diameter and are estimated to be a maximum of 9 meters deep. They were used by homesteads located in the area prior to installation construction. During initial construction of the installation, a temporary 37 to 40-meter deep well was drilled to provide water while the present surface water supply facilities were being built. This well had not been used, except by State or Federal agencies for observation of water levels and water quality. During utility work on the installation, the top section of the well was destroyed and the excavation backfilled. Consequently, the well was lost; however, some data concerning the well was obtained from old construction plans and State well records. Available information pertinent to the well is presented in Appendix C.

Direction of groundwater flow in the Carrizo Sand-Wilcox Formation is estimated to be north to northwest following the slope of the Sabine Uplift toward the axis of the East Texas Basin. It is then considered to move northward in the general direction of southern Arkansas and northern Louisiana. Because the outcrop area is saturated, only a small percentage of precipitation is used to recharge the aquifer; thus, the remainder is rejected



ALL WELLS, EXCEPT THE DEEP WELL IN THE ADMINISTRATION AREA, ARE SHALLOW DUG WELLS (ABANDONED).

Figure 5. Groundwater Wells

in springs, marshes, and effluent streams. It is probable that water moving laterally through the upper soil strata follows ground surface contours to low-lying areas. Fresh to slightly saline water in the Carrizo Sand-Wilcox Formation is estimated to extend to a depth of 30 to 46 meters.

d. Soil Types^{3,4,7,8}

Soils on LHAAP are generally fine-grained (clays, silts, and fine sands) and are from two basic origins. Residual soils, being formed from decomposition of the underlying Wilcox Formation, consist of silty or sandy clay occasionally interbedded with sand strata. Soil borings on the installation show that these soils become intermixed with soft clay shales at depths greater than 3 to 4.5 meters. The second major category comprises alluvial soils. These soils are found predominantly along bayou flood plains and along Caddo Lake. These are fine-grained clays, silts, and fine sand in varying combinations. Agriculturally, soils on LHAAP are described as belonging to the Forested Coastal Plains Problems Area. These soils are of low fertility, and are generally moderately drained. Erosion is usually not a factor on LHAAP except on the western or northwestern areas and along Harrison flood plain where slopes are steeper. Permeability of various soils ranges qualitatively from moderate to very slow.

e. Geological Aspects of Potential Migration

Due to high groundwater conditions across much of LHAAP and surface disposal of possibly toxic substances, contaminant migration from certain areas is a possibility. Areas of concern are identified below.

(1) The old TNT area, though no longer active, is still contaminated by TNT waste as evidenced by leached consolidated material on the surface and red-colored water seepage into an existing drainage ditch, which flows via drainage ditches from the packhouse to Goose Prairie Bayou.

(2) During the Team's visit to the landfills, it was noted that varicolored effluent was flowing from the new landfill. This leachate effluent drains to the major bayou system (Central Creek).

(3) A contaminated site results from the direct dumping of chemicals into the unlined pond within the burning ground. Borings for the roadway leading to the rocket casing washout pond show sand layers underlying the pond at shallow depths, providing a potential migration route.

F. Leases

1. Industrial

The Gulf Liquid Fertilizer Company leased 12 ammonia storage tanks from 1951 to 1952. No other records of industrial leases could be found.

2. Agricultural/Grazing

There are presently no agricultural or grazing leases at LHAAP. The last grazing leases terminated in 1952. During that year, two leases, one by J. F. Priest and the other by Key, Odom, and Powell, were phased out. No information could be found to indicate that leases involving crop raising have ever been let at LHAAP.

G. Legal Actions

There were no known legal actions against LHAAP pending at the time of the survey.

A personal injury incident (28 May 1970) was reported, involving scrap metal sold to an industrial firm located in Longview, Texas. A 4.2-inch white phosphorous (WP) loading assembly was included in the scrap lot. The WP assembly detonated at the industrial firm's plant during melting operations. Three employees were injured and equipment damage resulted from the accident. The cost for reparations was \$156,217.74.

II. PAST AND CURRENT ACTIVITY REVIEW

A. Installation Operations

1. Industrial Operations*

From April 1943 until August 1945, a six-line plant with a supporting acid plant produced over 180 million kilograms of TNT. This site is known as the Plant 1 Area. Although documents^{9,10,11} state that "line six" never operated due to a lack of acid production capability, three USAEHA reports^{12,13,14} indicate that lines "A" through "F" all operated at one time or another. Interviewees stated that the sixth line "F" was used as a reserve line when one of the other lines was down for repairs.

During the ground tour, the sites of former TNT Washhouses 806A and 806F were visited and small pieces (1-2 cm square) of TNT were found at both locations (locations 1 and 2).

Red water from the TNT washhouses flowed via an underground line to wooden Storage Tank 618B and Pumphouse 618A (both at location 3). From there, the red water was pumped to the TNT Waste Disposal Plant (location 4), which consisted of a number of settling and holding tanks, equalization tanks, an evaporation tank, and an incineration facility. Ash from the incineration of the concentrated red water was originally deposited in an old landfill. It was reported in later periods of operation, that ash was dissolved in water at the TNT Waste Disposal Plant and that this waste was routed by a ditch to Goose Prairie (North) Bayou. Condensate from the TNT Waste Disposal Plant and cooling water ("blue water") from both the TNT plant and acid plant were disposed of in the same manner.

The TNT Plant was not operated after World War II and was razed in 1959. Materials and equipment were burned or flashed at the flashing area (the "old" burning ground).

Several areas are known or suspected of being contaminated with TNT and/or red water as a result of operations involving TNT manufacture. Available records did not indicate that any decontamination by burning or flashing was conducted in the former TNT production area. The line which carried red water to the TNT Waste Disposal Plant has not been removed. Some old plant drawings show one wooden "trade waste" line to the disposal facility; other drawings show a transite "red liquor" line and a wooden "yellow liquor" line. It is not certain whether one or two lines remain buried nor could the method of yellow water treatment or disposal be determined.

*Locations are indicated in Figure 6.

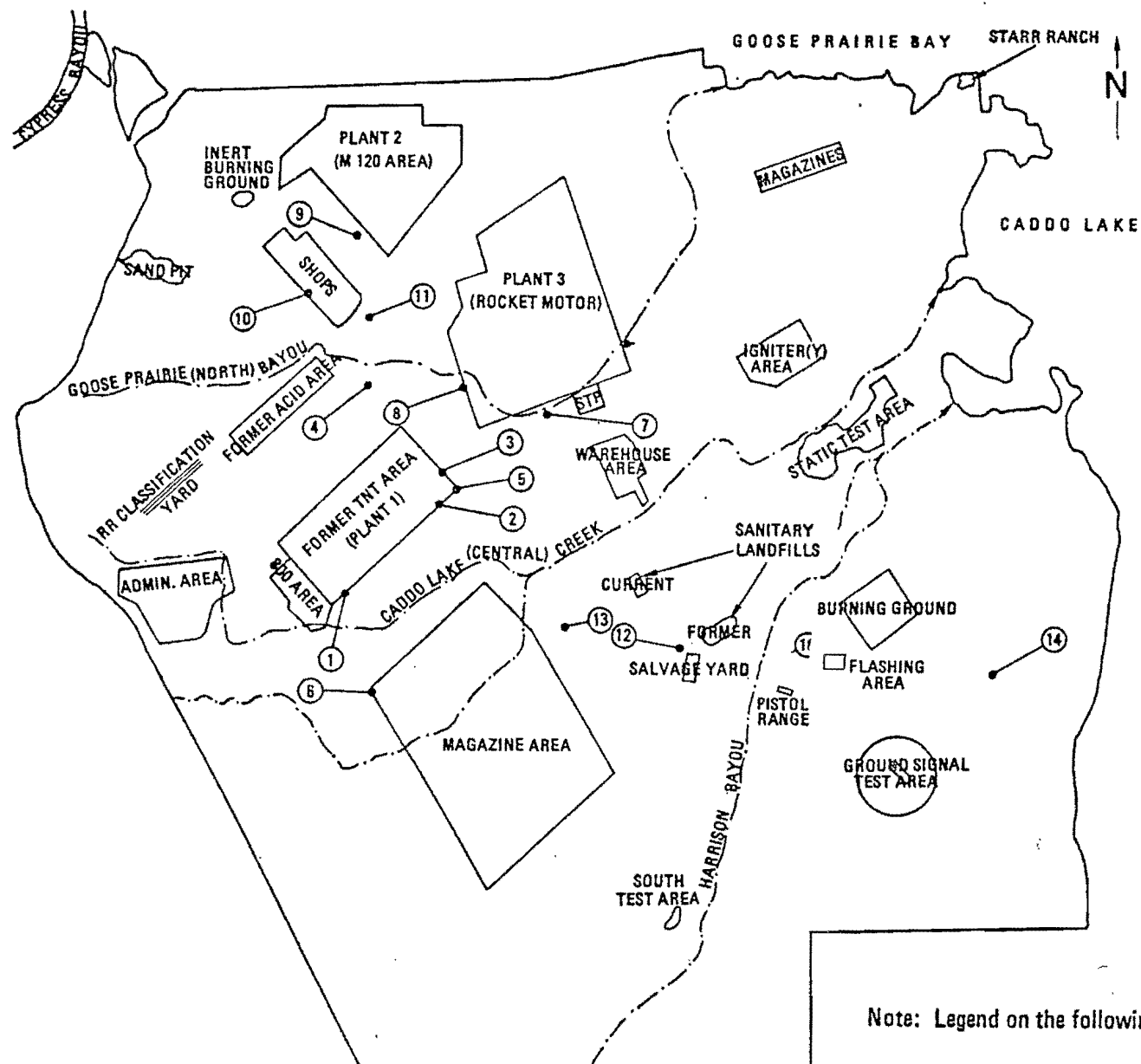


Figure 6. Locations of Known or Suspected Waste Materials

<u>Site</u>	<u>Location Number</u>
TNT Washhouse (Building 806A)	1
TNT Washhouse (Building 806F)	2
Storage Tank (Building 618B)	3
TNT Waste Disposal Plant	4
Blue Water Ditch Origin	5
Standpipe	6
Plant 3 Waste Water Tank	7
Chemical Laboratory (Building 29A)	8
Research and Development Laboratory (Building 207)	9
Former Pesticide Storage Site (Building 714)	10
Current Pesticide Storage Site (Building 411)	11
Rubble Burial Site	12
Suspect TNT Disposal Site	13
Burial/Demilitarization Pits	14

Figure 6. Locations of Known or Suspected Waste Materials - Legend

Although vegetation has grown up in the TNT production areas, the surface route above the buried line(s) has been kept clear and is well marked.

When Pumphouse 618A and Storage Tank 618B were dismantled, a quantity of earth, presumably contaminated, was excavated; the resultant pit is approximately 15 to 20 meters in diameter and of unknown depth. The pit is now filled with rain and drainage water. Although this water was said to have had a red color at one time, this is not evident now. Small fish were observed in the pond.

A cooling water ditch which originates just south of 16th Street (location 5) and flows east to Goose Prairie (North) Bayou is said to have contained red-colored water in the 1960's. More recently, traces of TNT, 2,6 DNT, and 2,4 DNT have been found in its waters.¹⁵

Several of the tanks at the TNT Waste Disposal Plant were wooden, and leakage was a constant operational problem. The ground in the area was "mushy and soft" from waste water leakage. With the facility inactive, the ground is now firm.

The Plant 1 Magazine Area contains 58 Richmond-type magazines and two aboveground magazines, all of which had been used for the storage of TNT. A standpipe near the intersection of Avenue E and 19th Street was used to wash out trucks used for the transport of TNT. Waste waters from this operation flowed onto the ground (location 6).

Disposal of out-of-specification TNT and other TNT contaminated materials is discussed in Sections II.B.2. and 3.

Plant 2, the main site of pyrotechnic operations at LHAAP, operated from June 1952 to 1956 and from April 1963 until the present. Items produced in the area include:

- a. Photoflash bombs
- b. Ground and aircraft signals
- c. Simulators
- d. Illuminating rounds
- e. Flares

Polysulfide polymer solid propellant rocket motors have been produced in the Plant 3 Area since 1955. This plant has the capabilities to produce rocket motors ranging in size from 0.5 to 6,804 kilograms. Operations integral to this activity are vapor degreasing, grit blasting, particle size

reduction, mixing and blending, teflon coating, and vacuum and pressure casting of solid fuel rocket motors. Other operations conducted in Plant 3 include:

- a. 60/81mm fuze assembly
- b. 60/81mm load assembly
- c. LAP of trip flares
- d. 40mm candle consolidation
- e. LAP of M115/M116 simulators
- f. Anti-intrusion mine manufacture

Several buildings in the old sellite mixing area of Plant 1 have been used for the production of 60mm and 80mm mortar rounds.

Rocket motor igniters have been produced in the Igniter Area (also called the Y area).

A comprehensive list of items produced at LHAAP is provided in Table II, and the chemical compositions of the various components of a number of these devices are listed in Appendix D. It should be noted that CS and WP rounds were produced at LHAAP. These were assembly and packout operations; no loading operations took place with these materials.

Appendix E contains a list of facilities considered contaminated, along with suspected contaminants, as of June 1969. No records were found to indicate that these facilities have been decontaminated.

Most of the installation's current operations consist of compounding pyrotechnic and propellant mixtures, and LAP operations rather than manufacturing; therefore, only small amounts of industrial waste waters are generated. These waste waters, which result from washing down facilities, are discharged to sumps. These sumps, numbering approximately 150, are periodically pumped into tank trucks, and the wastes are deposited in an evaporation pond at the explosive burning grounds. The use of this pond for the deposition of waste water has increased gradually over the past 10 to 15 years. Until 1976, the lack of adequate monitoring of sump liquid levels and a general belief that these liquids were harmless eventually led to overflows. A 1976 study of the contents of representative sumps led to the conclusion that "the concentrations of barium, lead, total nitrogen, and solids, the lack of mixing and the continuing chemical activity---preclude its discharge to surface drainage"; and the recommendations to prevent the overflow were reported to have been implemented.¹⁶

Table II. Items Produced at LHAAP

Rocket Motors

M7A2B1 Honest John Spinners	M130A2 NIKE-Hercules Sustainer
T-2006 Loki	XM100 Sergeant
T-2007 5-centimeter Aircraft Rocket	XM101 Pershing
T-2008 5-centimeter Aircraft Rocket	XM102 Pershing
M58A2 Falcon	Rocket Catapults
XM10E2 Lacrosse	

Igniters

M50 Falcon	M28A1 M7A2B1
TX22 Sergeant	M71 Pershing
XM47 Lacrosse	M72 NIKE-Hercules

Illuminating Rounds

M83A3 60mm Cartridge	M314A3 105mm Cartridge
M301A3 81mm Cartridge	M485E2 155mm Projectile
M335A2 11-centimeter Cartridge	

Ground Signals

M125A1 Green Star Cluster	M131 Red Star Cluster
M126A1 Red Star Parachute	M18A1 White Star Cluster
M127A1 White Star Cluster	M119A1 Green Star Parachute
M158 Red Star Cluster	M52A1 Red Star Cluster
M159 White Star Cluster	M583A1 White Star Parachute

Simulators

M110 Gunflash	M118 Booby Trap, Illuminating
M115 Shell Burst	M119 Booby Trap, Whistling
M116 Handgrenade	M74 Air Burst
M117 Booby Trap, Flash	

Aircraft Signals

AN-M37A2 Double Star, R-R	AN-M41A2 Double Star, R-G
AN-M38A2 Double Star, Y-Y	AN-M57A2 Red Tracer, Double Star
AN-M39A2 Double Star, G-G	R-R
AN-M40A2 Double Star, R-Y	

Table II. Items Produced at LHAAP - Continued

Smoke, CS, and WP

XM629 105mm, TAC, CS
 XM630 4.2-inch, CS
 M116E2 155mm Smoke

M84A1 105mm Smoke, HC
 M328A1 4.2-inch, WP
 81mm WP

Photoflash Bombs

M120
 T93

Spotting Charges for

Honest John Warhead
 Fuze MTSQ 564 and 565
 Fuze VT414

Flares

AN/ALA-17
 M49A1
 M-206

Anti-Intrusion Mines

XM140E5

Smoke Pellets

M8A1

50 From 1955 to the early 1970's, a waste disposal facility (location 7) disposed of waste waters from the rocket motor plant by discharging from a 132,475-liter tank to North Bayou when flow was sufficient for adequate dilution. ~~Ammonium perchlorate containers~~ were also washed out here.¹⁷ This facility is also reported to have been used for the disposal of Plant 2 wash waters. Minnows are said to have been kept downstream to monitor for adverse effects of discharged waters. No adverse effects are reported to have been observed.

Paint booths have operated at Plant 3 Buildings 28G, 45E, 45G, 62D, 68F, 68G, 68H, 75I, and 722P. Wash water from scrubbing of exhaust fumes at one time was allowed to overflow sumps to surface drainage.¹⁷

Waste oils from the motor pool (Building 716) and the round-house (Building 718A) were formerly used to treat Starr Ranch Road. At present, all waste oils and materials collected at grease and oil traps are burned at the burning ground.

Degreasing has taken place at Plant 3 Buildings P9, 28G, 32H, 45G, and 50G, using trichloroethylene, trichlorethane, and methylene chloride. Solvents are recovered by distillation and the remaining solids are disposed of at the explosives burning ground.¹⁷ One or two 208-liter drums of waste trichloroethylene and methylene chloride were dumped per week on the ground east of the old landfill in 1966 and 1967, as related by interviewees.

A small number of chromic acid washings of rocket motor casings have taken place in Building 62D circa 1964 to 1966. Waste waters drained to a sump and then were transported to the lagoon at the explosives burning ground.

From 1959 to the mid-1970's, out-of-specification rocket motors were "soaked out" at tank 801-F with Turco ®, a methylene chloride-based industrial solvent. Waste from this operation was burned at the explosives burning ground.

2. Lessee Industrial Operations

As noted above in Section I.F.1., the Gulf Liquid Fertilizer Company leased 12 ammonia storage tanks in the Acid Area from 1951 to 1952. No contamination was reported as a result of this lease.

3. Laboratory Operations

Building 29A, Plant 3, houses a Chemical Laboratory for quality control testing of both raw materials and products (location 8). For several years in the early 1960's, a Research and Development Laboratory operated in Building 207 (location 9). A red phosphorus smoke test device is currently being developed at this location. Wastes from both laboratories have been disposed of at the explosives burning ground.

A Photographic Laboratory for processing X-ray film is located in Building 60B (Plant 3). Spent developer is discharged to the sanitary sewer and spent fixer is discharged to surface drainage after silver recovery.¹⁷

A Calibration Laboratory exists at Building 41W (Plant 3).

4. Materiel Proof and Surveillance Tests

Surveillance testing is presently conducted at the Ground Signal Test Area and the Static Test Area.

The Static Test Area, which includes the Candle Test Site, is used primarily for testing NIKE and Sergeant rocket motors, illuminating candles, and red phosphorus smoke wedges.

The Ground Signal Test Area is used for testing red phosphorus smoke wedges, 4.2 illuminating shells, and munitions ranging from 40 to 155mm.

Before 1960, limited testing was also conducted in the South Test Area. This included the first test of the photoflash bomb in 1954. Some fragments from this test were known to have gone beyond the installation boundary.

5. Training Areas

There are no reported uses of installation areas for National Guard or Reserve training.

6. Toxic/Hazardous Materials - Handling and Storage

a. Industrial and Miscellaneous Laboratory Chemicals and Materials

The ingredients used in the various LHAAP formulations are listed in Appendix D.

As part of the normal complement of reagents, the chemical laboratory (Building 29A) stocks small quantities (less than 1 kg) of carcinogens, including the following:

- (1) Benzidine
- (2) Benzidine dehydrochloride
- (3) Naphthylamine
- (4) 4,4'-methylene-(bis)-2-chloraniline

LHAAP has requested disposal instruction from ARRCOM.

Prior to 1970, some white phosphorus (WP) rounds (4.2-inch mortars) were shipped to LHAAP from Pine Bluff Arsenal. LHAAP assembled and packed these rounds. They were stored and worked on in the east line area (side A) of Plant 2. After the rounds were finished, they were shipped back to Pine Bluff Arsenal.

There is a limited research and development project involving red phosphorus in Buildings 54H and 207 (location 9).

It was reported that at one time, CS was assembled and packed in 4.2-inch mortars. Afterwards they were unpacked and disassembled. It is not known when or where this was accomplished or the rationale for the operations.

During the TNT production operations, all of the magazines were used for storage of TNT. The magazines were cleaned after the TNT was removed. The last row (52-58) of magazines was formerly used to store black powder.

b. Chemical Agents

WP and CS munitions were assembled and packed. No lethal chemical agents were reported as having been used or stored at LHAAP.

c. Biological

No biological agents or simulants were reported having been used or stored at LHAAP.

d. Radiological - Permits and Licenses

There is no indication of radiological agents/simulants having been used at LHAAP. Thiokol Corporation is authorized to possess and use various radioactive isotopes under Department of Army Permit No. 42-77-01 and Texas State Department of Health Radioactive Material License 7-82, Amendment Number 17. Isotopes covered include sealed sources of cobalt 60 for use in radiography and calibration of survey meters and dosimeter, nickel 63 (foil) for chromatography, tritium (titanium tritide foil) for static measurement, and strontium 90 (plated on lead wafer) for two remote sensing units. Use of depleted uranium (up to 999 kilograms) for shielding of radiography devices is also covered by these regulations. The isotopes inventory is presented in Table III.

During the late 1960's, a metal table, reportedly contaminated with cobalt 60, was taken to the explosive burning ground and buried on the northwest side (Area 29-X). In the fall of 1978, the table was recovered, found to have negligible levels of radioactivity, and was subsequently reburied in the present sanitary landfill.

Table III. Inventory of Radioactive Material

328 Co ⁶⁰	60 millicuries	Building 49B
1371 Co ⁶⁰	33 curies	Building 49B
1370 Co ⁶⁰	33 curies	Building 45E
Ni ⁶³	12 millicuries	Building 29A
H ³ (Tritium)	200 millicuries	Building 720A
Sr ⁹⁰	10 microcuries	Building 45E

e. Pesticide/Herbicide/Fertilizer

Termites are the chief pests encountered at LHAAP. Pest controllers use chlordane to control termites, resulting in rather large stockpiles of this insecticide in the pesticide storage room. At the time of the assessment, 386 kilograms of 10 percent chlordan was on hand. Mosquito control is limited to aerosol sprays in buildings. No fogging, larviciding, or aquatic weed control measures are conducted.

Pesticides were originally stored in Building 714 (location 10). In 1970, the stock was moved to Building 411, which is the current preparation and storage site (location 11).

There is no fertilizer usage at LHAAP.

B. Disposal Operations

1. Liquid Waste Treatment

a. Sanitary Waste Water Treatment

Most of LHAAP's domestic waste waters are treated at the main Sewage Treatment Plant (STP). The STP operates under NPDES Permit No. TX0061069* and provides primary and secondary treatment to sanitary wastes from the administration, shops, and production areas. Zeolite resin backwash and boiler blowdown from the power plant discharge to the STP. Sewage passes successively through a grit chamber, a comminutor or bar screen, an Imhoff tank, and one of four Dunbar filters, which is a modified sand filter that provides effluent secondary treatment. The sewage then flows over aeration steps and into a post-chlorination building. The STP effluent travels through a drainage ditch to North Bayou which subsequently empties into Caddo Lake.

*Update information received on 13 August 1980, subsequent to preparation of this report indicate that: Sanitary Waste Water Treatment, the permit number should read TX0000035. The Zeolite resin backwash now goes to 5.7 acre evaporation pond.

Three sludge drying beds are used to dry STP sludge prior to its disposal in the sanitary landfill.

Outlying areas are serviced by septic tanks (ST) (numbers 1-10) equipped with tile drainage fields. These effluents are also monitored under NPDES Permits. ST-1 serves the Warehouse Area, ST-2 through ST-4 serve the Igniter Area, and ST-5 through ST-10 serve the Static Test (Test Services) Area as follows:

<u>Outfall</u>	<u>Building Number</u>	<u>NPDES Permit Number</u>
ST-1	45W	TX0060836
ST-2	18Y	TX0060852
ST-3	16Y	TX0060810
ST-4	4Y	TX0060895
ST-5	8T	TX0060861
ST-6	25T	TX0060917
ST-7	16T	TX0060879
ST-8	13T	TX0060887
ST-9	34T	TX0060828
ST-10	39T	TX0060844

The septic tank at Building 39T is currently inactive and is not being monitored; however, there are plans to reactivate it.

Effluent from ST and STP are monitored for the following parameters: flow, biochemical oxygen demand, total suspended solids, pH, fecal coliform, and chlorine residual. Septic tanks ST-2, ST-3, and ST-9 have frequently failed to meet NPDES requirements for minimum chlorine residual.

The STP has a history of storm water infiltration. This has caused system overload and upset. This in turn can produce water quality parameter excursions.

b. Industrial Waste Water Treatment

There is no current industrial treatment facility at LHAAP. Waste waters are accumulated in approximately 150 sumps, then transported and dumped into the rocket motor washout pond (unlined).

During past operations, spent film developer and fixer solutions (after silver was recovered) from the photographic laboratory and floor drains from the Maintenance Shops were discharged to the sewer system.¹⁷

During the period of TNT manufacture, red water was incinerated. This facility has been razed and only the foundation remains. Ash disposal has been by landfill or slurring and discharge to Goose Prairie Bayou.

*Update information received on 13 August 1980, subsequent to preparation of this report indicate that: The outfall numbers should be in the following order starting from the top: 4, 6, 2, 10, 11, 8, 9, 3, 5. The permit number should be changed to TX 0000035 for all points. We have only one permit now that covers all areas.

North Bayou begins just north of the former TNT Acid Plant Area and flows east-northeast into Caddo Lake. This stream has traditionally received the major portion of LHAAP's industrial and domestic waste waters. Present discharges include STP effluent, discharge from waste treatment plant (WTP) holding/settling ponds, laundry waste water from a three-chambered sedimentation tank, vehicle wash rack waste water, overflow from sediment traps, and occasional minor overflow from production area waste water sumps. Before use of the boiler house evaporation pond (401-B) began in 1978, it was also routine practice to discharge to North Bayou waste waters generated during backwash, brine regeneration, and rinsing of zeolite ion exchange resins.

c. Holding Ponds⁴ (Figure 4)

(1) Boiler Blowdown Evaporation Pond (P-1)

This holding pond is located approximately 183 meters east-southeast of the powerhouse building. It is 276 meters long, 99 meters wide, and covers 2.7 hectares. The depth of the pond is unavailable. The pond is underlain with a plastic waterproof liner covered by 15 to 20 centimeters of soil. The pond, which overflows at the southeast and into Goose Prairie Bayou, contains effluent from boiler washout.

(2) Water Treatment Plant Effluent Settling Pond (P-2)

This facility consists of 2 adjacent ponds of 0.1 hectare by 1.5 meters deep each. They are located just north of the shops area. Synthetic waterproof sheeting with soil cover constitutes the pond liner. The purpose of the facility is to settle out solids from backwashing water treatment sand filters. Drainage is to Goose Prairie Bayou.

(3) Burning Ground - Rocket Motor Casing Washout Pond (P-3)

This pond in the northern corner of the burning ground is apparently used as an all-purpose dumping pit for industrial wastes. The pond is approximately 82 meters long by 55 meters wide and is of unknown depth. There are no known surface outlets. There is no lining and soil borings around the pond show sandy soils at a depth of 4.5 meters below the surrounding ground elevation.

(4) Former TNT Manufacturing Area - Pumphouse Pond (P-4)

Located northwest of 16th Street near the intersection of 16th Street and Avenue D, this pond fills an area once occupied by a pumphouse used to lift TNT waste water into storage tanks across Avenue D. After the pumphouse was dismantled and the area excavated, the roadway into the depression was filled with soil, sealing it. Groundwater and surface runoff into the depression combined to form the pond. Inflow and outlet points

*Update information received on 13 August 1980, subsequent to preparation of this report indicate that: The referenced pond does not have a normal overflow provision.

could not easily be determined. Dimensions were visually estimated to be 90 meters by 45 meters. The pond is unlined, but presently no waste is known to be dumped or discharged into the pond.

d. Storm Water Drainage

LHAAP is located in the Cypress Bayou drainage basin and all drainage via surface streams from within the installation eventually enters Caddo Lake, which is located immediately northeast of the installation.

Harrison Bayou receives storm runoff from the southern portion of the installation along with ditched drainage from periodic washout activities in the nearby burning ground. Storm runoff from the flashing and burning grounds and from the former sanitary fill/old general purpose dumping ground drain to this stream. Seepage of dissolved and suspended materials from the unlined explosives burning ground rocket motor washout pond (P-3) into this bayou is a potential.

Central Bayou originates on the western edge of the installation as two branches in the general vicinity of the Administration Area. It drains northeasterly through the magazine and Static Test Areas before emptying into Caddo Lake. Flow is intermittent and consists almost entirely of storm drainage.

2. Solid Waste Treatment

a. Sanitary Landfills

The present sanitary landfill is located off Avenue Q just northeast of the intersection of Avenues Q and P on the site of a former dirt 'borrow' area. Texas State Department of Health has classified the landfill as a Type IV operation since it serves fewer than 1,500 people. Putrescible and nonputrescible wastes from administrative, dining, and dispensary areas along with small volumes of inert industrial materials are disposed in this landfill. (There was no indication of explosives or other hazardous wastes having been put in this landfill.) Texas regulations and EPA guidelines require that whenever sanitary waste containing putrescible material is put into the landfill, it must be covered by a 15-centimeter layer of compacted soil at the end of that day.³ It was noted during the Team's visit that there was a great deal of uncovered refuse in the landfill area. Some surface ponding and leachate was also evident following a recent rain.

Industrial refuse inputs to the sanitary landfill consist of combustible/noncombustible materials having no scrap value. The noncombustible materials include residue from the explosives flashing/burning grounds thermal decontamination operation.

A site near Avenue Q and west of the cutoff road, to the sanitary landfill was used for burial of barbed wire, fence posts, etc., probably remaining from the original land owners (location 12, Figure 6).

Other inert wastes were buried in the northwest corner of LHAAP. This site is presently identified as the Inert Burning Ground (Figure 6) and is located just northwest of the intersection of 32nd Street and Avenue P. Between the late 1940's and early 1950's, inert materials identified as trash, ashes, scrap lumber, and wastes from burned TNT were buried there.

b. Contaminated Waste

Burial of contaminated wastes on LHAAP has been limited primarily to the general area just north of Avenue Q, bounded by Avenue P on the west and the explosive burning ground on the east. An area near the intersection of Avenues Q and P was identified as a possible TNT disposal site in use during the 1940's (location 13). A concrete block is presently located in this area, but its purpose is unknown. There is an area a few hectares in size located just west of the intersection of track 3-A and Avenue Q (near the former sanitary landfill and location 12). This area was used during the late 1940's and early 1950's for the disposal of acids, building rubble, and other trash.

The general area of the former sanitary landfill was used for the disposal of both inert material and hazardous mission related wastes. In the mid to late 1950's, three rocket motor casings were buried on the western side of this landfill. The former sanitary landfill area was used for TNT red water ash disposal during 1942 to 1944. Drawing No. LIF-9485¹⁸ identifies an area in the northwest of the landfill as an "Old TNT Burial Ground" (location 13).

An artificial lake once located to the east of this sanitary landfill served as an all-purpose junkyard for the disposal of such materials as off-specification TNT, barrels of chemicals (type unknown), oil, paint, scrap iron, and wood. The "lake" once extended from within 360 meters of Harrison Bayou on the east to the former sanitary landfill on the west. The area has subsequently been filled in.

Material thought to be TNT was uncovered in the old lake area in the late 1950's. The material was subsequently identified as sulfur by the safety personnel.

The old burning ground (flashing ground) is a potential burial site for bulk TNT, as TNT was uncovered in 1954 when a drainage ditch was dug in this area to carry waste water from a washout operation (perchlorate containers) to Harrison Bayou. This old burning ground was also used for burning bulk TNT, photoflash powder, and reject material generated when the installation was operated by Universal Match Corporation.

waste put into storm water
ditches to Harrison Bayou

The new burning ground (explosives burning ground) has also been used for industrial wastes burial. Ditches (1.8 to 2.4 meters deep and 3.0 to 3.7 meters wide) were dug on the western edge of Area 29-X for disposal of rocket motor wastes, illuminating mixtures, oxidizing agents (ammonium perchlorate and sodium nitrate), sawdust, waste oil, methylene chloride, and detergents. The dry chemicals were dumped into water found in the ditches. During excavation for the installation of a contaminated waste incinerator in the burning ground area southwest of 29-X, industrial wastes were uncovered. These materials were excavated and destroyed in the Burning Ground.

Pits are located along Bobby Jones Road (location 14) approximately 30 meters north of Long Point Road and east of the explosive burning ground. These were used in the late 1950's for the detonation of Plant 3 reject material of unknown composition.

The South Test Area, located just west of Harrison Bayou near LHAAP's south boundary, was used for the disposal of pyrotechnic material. In the late 1950's, pits were dug around the photoflash bomb test site (South Test Area) and were used to demilitarize illuminating devices.

3. Demolition and Burning Grounds

There is a former burning ground located in the northern section of the installation. For a period of 3 to 4 years, this area was occasionally used as a site for the burning of inert materials, mainly lumber. There are also reports of bulk TNT being burned at this area. Universal Match Company also used the burning ground to burn photoflash powder and other material from their operations. Since the early 1950's, the burning operation has switched to the New Burning Ground.

The waste from the Chemical Laboratory, Building 29A, is collected and taken to the burning ground daily. The waste from the Static Test Area and the Candle Illuminant Test Site also goes to the burning ground.

Rocket motors (NIKE and Sergeant) are burned at the Ground Signal Test Area. In the early 1960's, the motors were cleaned with chromic acid and the waste from this operation was collected and taken to the burning ground pits. As part of the Rocket Motor and Illuminant Mixing Operations, the mixes had to be cleaned. They were placed in a mixture of sawdust and methylene chloride. After use, the poorly flammable mixture was taken to the burning ground where it was buried. In 1967 and 1968, solvent and propellant from the plants were taken to the burning ground and burned.

In 1958, steel structures and pipes from some of the dismantling operations were taken to the burning ground and flashed. These materials were then sold and removed from the installation from late 1950's through 1971. Solid chemical wastes from the laboratories were taken to the burning ground where they were placed in two small pits with ashes and waste oil. The chemicals were then burned off.

It was reported that oil from transformers was used at the burning ground as an ignitor. Neither the type of oil nor the time period is known.

Pond P-3, located in the burning ground, is used as a dumping area for the industrial sump wastes. It has been used with increasing frequency since its construction in the middle 1950's, and during the last 4 or 5 years, it has received its largest increase in usage.

Recently, red phosphorus waste from Research and Development work was put in metal containers of water and taken to the burning ground for disposal by placing in pits and burning.

At the present time, an incinerator is being constructed at the burning ground. When digging was started for the construction, an area containing burned materials was found. At one time, there were two burning pits located on either side of the road where the incinerator is now located. The digging also revealed a metal laboratory table which had been exposed to a radiation source (cobalt 60) in the late 1960's. At that time, it was buried in the burning ground. It has since been removed and reburied in the small sanitary landfill after testing revealed no hazardous level of radiation present.

A flashing area to the west of the present burning ground is used to thermally decontaminate scrap material prior to disposal via sale or burial.

4. Demilitarization

No large scale demilitarization operations have been carried out at LHAAP.

XM40E5 "button bombs" were demilitarized by detonation in the late 1960's. Some interviewees stated that this operation took place at the Ground Signal Test Area; others said that it took place at the South (Photoflash Bomb) Test Area.

Occasional leaking WP munitions were burned at both the test areas noted above.

Illuminating devices were demilitarized in pits located to the east of the South Test Area. The pits were dug for this purpose and filled in afterwards. This operation took place circa 1958.

The pits along Bobby Jones Road (location 14) were used for the demilitarization of out-of-specification products. No details of this operation were found.

5. Miscellaneous

Several fires have occurred in Plant 2 over the years. In 1969, a fire in the west line destroyed Buildings B5, B7, B9, and P12. Also in the late 1960's, a fire occurred in Building B6. The fire was contained and the building was rebuilt. In 1957, a fire occurred in Building B15, resulting in one fatality.

Plant 3 experienced several explosions in the early 1960's. Curing ovens in Building 54F blew up. Another explosion occurred in Building 50B. A solid propellant mixing facility (Building 41G) was completely destroyed in the most serious of these events. No personal injuries resulted from these explosions.

In the 1940's, a severe acid spill caused a fish kill in North Bayou as far as Caddo Lake. In the early 1960's, approximately 11,000 liters of liquid polysulfide polymer were accidentally spilled and ran into a ditch at Building 33G in Plant 3. It was reported that most of this material was recovered. An oil tank spill occurred at Building 813 in December 1978; however, the spill was contained before it could reach Central Bayou. Recently, a transformer at Building 401 dripped oil continuously for approximately 1 year. It was not known whether this transformer contained PCB's*.

On 18 December 1952, improperly stacked 23-kilogram fiberboard boxes of TNT fell in magazine 811-50 resulting in the spill of a large quantity of TNT and the injury of a workman.¹⁹ A memorandum, signed by the Commanding Officer and dated the 16th of that same month, expressed concern with poor handling practices resulting in the spilling of TNT at the loading docks in the western portion of the magazine area.

C. Water Quality

1. Surface Water Quality

Big Cypress Bayou is located at the extreme northwest corner of the installation and is the source of water for all of LHAAP's domestic and industrial needs. The three pumps (two of 29.52 cubic meters (m^3) per minute capacity and one of 7.57 m^3 per minute capacity) located at the pumping station were originally sized to meet the high water requirements for TNT production rather than for present needs.

Raw water³ for all needs is pumped through a screened intake on the bayou to a 10,220 m^3 storage tank. Raw water for fire protection and cooling receives no further treatment, and is stored in a 1,892 m^3 ground storage tank and in an elevated 568 m^3 storage tank.

*Update information received on 13 August 1980, subsequent to preparation of this report indicate that: The referenced transformer leaking at Bldg. 401. The material has been tested and it does not contain any PCB's.

Potable water is produced from raw water in the 8,706 m³ per day Water Treatment Plant (WTP). Raw water travels by gravity flow from the storage tank through a mixing chamber where it is treated with lime, alum, and chlorine to precipitate and coagulate dissolved/suspended solids and to sterilize the water. The treated water then enters one of two upflow clarifiers where sludge is removed. The water is then polished by passage through rapid sand filters which have been treated with sodium hexametaphosphate for corrosion control. The filtered water is chlorinated and collected in a 1,419 m³ capacity clear well from which it is pumped into the distribution system. In 1978, LHAAP stopped direct discharge of wastes from the WTP (sand filter backwash, sludge drawoff from clarifiers, and raw water storage tank sediment drawoff) to North Bayou and began discharging it to two polyethylene-lined holding ponds (Figure 4, location P-2) (No. 632-A). The effluent discharged from these ponds to North Bayou is now monitored under NPDES Permit No. TX0000035. Settleable solids are the contaminant of chief concern for this outfall.

There is no current monitoring of the water quality of surface streams on the installation. However, an USAEHA report¹⁶ of a survey conducted from 2 to 10 August 1976 indicated that LHAAP's discharges were making very little impact on surface water quality. For example, the concentrations of metals in waste water entering North Bayou were in general lower than the concentrations of those in Harrison Bayou as it enters the installation. Since this study, a lined pond was opened in 1978 to receive waste waters from water softening operations (brine for zeolite resin regeneration, resin backwash, and rinse waters) that formerly entered North Bayou. Consequently, it is anticipated that North Bayou water quality parameters will appear better now than during the USAEHA study. During the same study, the quality of water discharged to Caddo Lake by Central Bayou was found to be better than that of the control samples taken from Caddo Lake, treated and untreated raw water supplies. Of the 43 parameters checked for surface waters in the USAEHA study (Table 10, Appendix B, page B-12),¹⁶ Harrison Bayou showed increases in the following parameters: conductivity, total solid, total dissolved solids, chemical oxygen demand, total phosphorus, chloride, iron, and silicon. For the remaining parameters, the discharge of Harrison Bayou to Caddo Lake was as good as or better than that of water entering the installation.

It should be noted that analyses for trace organics, TNT, and TNC (tetranitrocarbazole) were not included in the USAEHA study just cited. In an earlier work by Water and Air Research, Inc., Gainesville, FL.,²⁰ traces of TNT (2,4,6-) and DNT (2,4-; 2,6-dinitrotoluene) were found in North Bayou east of the former TNT Plant (vicinity of Building 17A). In this study, no analysis for TNC was included due to lack of a suitable analytical method.

2. Subsurface Water Quality²

The base of the Carrizo Sand-Wilcox Formation marks the bottom of fresh to slightly saline water in the area. Thus, below a depth of approximately 46 meters at LHAAP, water can be expected to become more saline. The Carrizo-Wilcox Formation forms the major fresh water aquifer in the northeast Texas - northwest Louisiana region. Quality is excellent for public water supply, being high in sodium bicarbonate, low in dissolved solids (usually less than 500 ppm), relatively soft (hardness 5 to 59 ppm), and containing acceptable amounts of fluoride (up to 1.4 ppm). At outcrop areas, groundwater may be higher in acid and iron contents. The formation's generally good regional water quality can be attributed to good circulation, abundant rainfall at recharge zones, and a relatively shallow aquifer which stays above most salt deposits. (Available information pertinent to the temporary well is presented in Appendix C.)

No information is available on the subsurface water quality within LHAAP's boundaries. The data from the 40-meter well, prior to its closure, only reflects the regional situation as it was located up-gradient from the industrial areas.

3. NPDES Permits

There are 11* permits, as designated in Section II.B.1.a.

*Update information received on 13 August 1980, subsequent to preparation of this report indicate that: It should read there is one permit.

III SURVEY PLAN

(When Required)

IV. INSTALLATION ASSESSMENT

A. Findings

1. Geology

The uppermost stratum is Carrizo Sand-Wilcox Formation from the Tertiary period ($7-65 \times 10^6$ years), is approximately 122 meters thick, and is composed of a sand matrix interspersed with silt, clay, and lignite. The major portion of LHAAP soils are fine grained silty/sandy clay formed from decomposed Wilcox regolith*. Alluvial soils, also fine-grained, are found along the bayou flood plains and Caddo Lake. The soils are acidic, of low fertility, and of moderate to very low permeability.

2. Activity Review

a. Installation Operations

(1) Industrial Operations

(a) Current operations consist of LAP of pyrotechnic devices (Plant 2) and solid propellant rocket motor loading (Plant 3).

(b) From 1943 to 1945, a six-line TNT production plant, with supporting acid plant, produced approximately 180 million kilograms of TNT.

(2) Laboratory Operations

- Laboratory
- (a) Building 29A - QC Chemical Laboratory
 - (b) Building 207 - Research and Development
 - (c) Building 60B - Photography Laboratory (X-ray)
 - (d) Building 41W - Calibration Laboratory

(3) Materiel Proof and Surveillance Tests

Pyrotechnic illuminating/signal devices are tested at the Ground Signal Test Area and the Candle Test Site. The South Test Area was also used until the early 1960's. The Static Test Area is used for rocket motor testing.

*The unconsolidated stoney material above the bedrock.

(4) Toxic/Hazardous Materials - Handling and Storage

(a) Industrial and Military

In addition to the usual inventory of oxidizers, initiators, solvents, etc associated with pyrotechnic and propellant operations, LHAAP has stocked WP, CS, TNT, and black powder; and currently stocks red phosphorous.

(b) Chemical/Biological/Radiological Activities

There are no lethal CBR agents/simulants reported stored or used at LHAAP. Radioisotopes present at LHAAP are used for metrology.

(c) Pesticide/Herbicides/Fertilizer Usage

The major usage is chlordane for termite control.

b. Disposal Operations

(1) Liquid Waste Treatment

(a) Sanitary Waste Water Treatment

The STP provides primary and secondary treatment for most LHAAP domestic waste waters.

Outlying areas use septic tanks equipped with tile drainage fields.

Storm water infiltration has been a problem for the STP.

(b) Industrial Waste Water Treatment

A red water incineration system was used during the TNT production period.

Industrial waste waters are collected in sumps and transferred to the washout pond (P-3) at the burning ground.

In the past, waste waters were released to surface drainage.

(c) Holding Ponds

The Boiler Blowdown Evaporation Pond (P-1) covers 2.7 hectares and has a plastic liner with a soil covering.

The Water Treatment Plant Effluent Settling Pond (P-2) consists of twin ponds covering a total of 0.2 hectare. It has a plastic liner with a soil covering.

The Rocket Motor Casing Washout Pond (P-3) covers 0.45 hectare and is unlined with underlying permeable soil.

The TNT Pumphouse Pond (P-4) is currently unused and covers approximately 0.4 hectare. The pond is unlined with inputs solely from groundwater flow and surface runoff.

(d) Storm Water Drainage

Three bayous provide the drainage for the active portions of LHAAP. All three outfall into Caddo Lake.

(2) Solid Waste Treatment

(a) Sanitary Landfills

A current sanitary landfill site (Type IV Classification) is located at the intersection of Avenues Q and P.

A site near Avenue Q and west of the cutoff road to the sanitary landfill was previously used for scrap and rubble.

A site in the northwest corner of LHAAP, currently identified as the Inert Burning Ground, was formerly used for trash, ashes, scrap lumber, and burned TNT waste burial.

(b) Contaminated Waste

Several burial sites have been identified. The sites are generally associated with or near the burning grounds or landfills. The majority of disposal was in an area north of Avenue Q, east of Avenue P, and west of the burning ground. Materials from all operations, including bulk TNT, were purported to have been buried in the various sites.

c. Demolition and Burning Ground

The Current Burning Ground is located in the eastern portion of the installation. The materials burned include industrial operations waste, laboratory wastes and chemicals, contaminated scrap, transformer oil, and red phosphorous.

Until the early 1950's, the burning ground was located in the northern portion of LHAAP. Input was similar to the current burning operation and included the burning of bulk TNT.

The old sanitary landfill was briefly used as a burning ground.

There is a flashing area just west of the current burning ground.

d. Demilitarization

Leaking WP items were demilitarized at the Ground Signal and South Test Areas.

XM40E5 "button bombs" were demilitarized at one of the above test areas.

Demolition pits along Bobby Jones Road (location 14) were used for demilitarizing out-of-specification items.

e. Miscellaneous

Plant 2 has experienced several fires over the years.

Plant 3 had several explosions during the 1960's.

An acid spill in the 1940's resulted in a fish kill.

A polysulfide polymer spill occurred in the 1960's. It was reported that most of the material was recovered.

An oil spill in 1978 was controlled and impounded.

An oil leak from the transformer at Building 401 was recently discovered.

3. Water Quality

a. Surface

There is no current monitoring of surface streams.

North and Central Bayous had good water quality per the normal water quality parameters.

Trace organics and explosives were not included in the analyses. In a separate environmental study, TNT was found in North Bayou.

Harrison Bayou had increases in conductivity, total solids, total dissolved solids, COD, total phosphorus, chloride, iron, and silicon.

b. Subsurface

No data available for LHAAP.

c. NPDES Permits

There are 11 permits at LHAAP, of which 10 cover the septic tanks. The other permit is for the Sanitary Treatment Plant*.

*Update information received on 13 August 1980, subsequent to preparation to this report indicate that: It should be changed to read one permit at Longhorn AAP which covers 10 septic tanks, the Sanitary Treatment Plant and the water plant settling ponds.

B. Conclusions

1. Contamination from industrial operations (TNT and solid propellant rocket motor manufacture, incendiary and signal pyrotechnic LAP) dating back to World War II, has been identified at Longhorn AAP. These contaminants include pyrotechnic ingredients and products from TNT manufacture such as TNT scrap and red water.

2. Major areas of potential contamination are burial sites, testing areas, the TNT production area, load, assembly, pack (LAP)-areas and burning grounds.

3. Many of these contaminants may be in and on the ground as a result of spills and disposal operations (e.g., burning and burial).

4. The most likely routes of potential off-post migration are groundwater flow and surface runoff into the bayous feeding Caddo Lake, an adjacent recreational area.

C. Recommendations

1. That Longhorn AAP discontinue the use of the unlined Rocket Motor Casing Washout Pond (and other unlined ponds and landfills) for the dumping of industrial waste. Some short-term alternate methods for consideration pending the availability of a permanent solution are the use of an evaporation pond, a qualified contractor to remove and dispose of wastes off-post, and incineration techniques.

2. That USATHAMA evaluate the extent of contamination in the old TNT plants area and, if required, initiate action to abate any imminent hazard.

3. That USATHAMA conduct a survey with specific attention to Caddo Lake and its juncture with the installation boundaries to determine the extent of off-post contamination migration, if any.

REFERENCES

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3. U.S. Army Environmental Hygiene Agency (USAEHA), Solid Waste Consultation Visit No. 26-003-75, Longhorn AAP, July 1974.
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 - LHAAP - Explosive Contaminated Waste Incinerator
 - LHAAP - Modernization Pyrotechnic Mixing and Consolidation - AMC Proj. 5762679
 - LHAAP - Various Buildings - Warehouse Area - AMC Projects 5702226 and 5702228
 - LHAAP - AMC Project 5725327 - boring logs and locations
 - LHAAP - Design Criteria - Motor Case Reclamation Buildings 36-X & 34-X - boring logs and locations
 - LHAAP - Improve Sewage Treatment Plant - boring logs and locations
 - LHAAP - Evaporation Pond - boring logs and locations
5. Louisiana Geological Survey, Groundwater in Louisiana, Resources Bulletin No. 1, August 1960.
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7. Land Management Plan for Longhorn Army Ammunition Plant 1973-1978, March 1973.
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16. USAEHA, Water Quality Special Study No. 24-0586-77, 2-10 August 1976.

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18. Thiokol Corporation, Longhorn Division, "Master Map, Proposed Levee, LHAAP," Drawn 3-7-68.

19. Longhorn Ordnance Works Report Investigation of Accident, 29 December 1952.

20. Fox, J. L., et al. Aquatic Field Surveys at Longhorn and Louisiana Army Ammunition Plants, Volume 1, LHAAP, January 1975, pp 18, 65.

APPENDIX A
PHOTOGRAPHS TAKEN AT LHAAP

(3)
pictures not legible

APPENDIX B
BIOTA OF LONGHORN ARMY
AMMUNITION PLANT

Plants

Black cherry	Red maple
Black locust	Honey locust
White oak	Flowering dogwood
Mockernut hickory	Allegheny chinquapin
Loblolly pine	Bitternut hickory (pignut)
Southern red oak	American beauty berry
Bald cypress	Red mulberry
Shortleaf pine	Red buckeye
Slash pine	Spanish moss
Longleaf pine	Spring beauty
Sweetgum	Star-of-bethlehem

Arthropods

Stinging scorpion	Red-spotted purple
Yellow jacket	Question mark (violet tip)
Bald-faced hornet	Alfalfa butterfly
Giant swallowtail	Pearly-eye
Tiger swallowtail	Silver-spotted skipper
Zebra swallowtail	Locust borer
Spicebush swallowtail	Giant waterbug
Black swallowtail	Green June beetle
Monarch	Luna moth
Polyphemus moth	Carolina grasshopper

Do moth	Carolina mantis
Regal moth	Field cricket
Imperial moth	True katydid
Anisota moth	Annual cicada
Pandorus sphinx	Brown-banded cockroach
Southwestern centipede	American cockroach
Lubber grasshopper	Bush katydid
Eastern lubber grasshopper	Green darner
	Cow killer

Fish

Taillight shiner	Black bullhead
Brook silverside	Blacktail shiner
Channel catfish	Paddlefish
Bluegill	White bass
Logperch	Bowfin
Black stripe topminnow	Chain pickerel
Golden topminnow	Alligator gar
Largemouth bass	Lamprey eel
	American eel

Amphibians

Green tree frog	Marbled salamander
Bull frog	

Reptiles

American anole	Red-eared turtle
Yellow-bellied watersnake	Spiny softshell
Five-line skink	Coral snake
Western Cottonmouth	Mexican milk snake
Slider	Western pygmy rattlesnake
Alligator snapping turtle	Southern copperhead

Birds

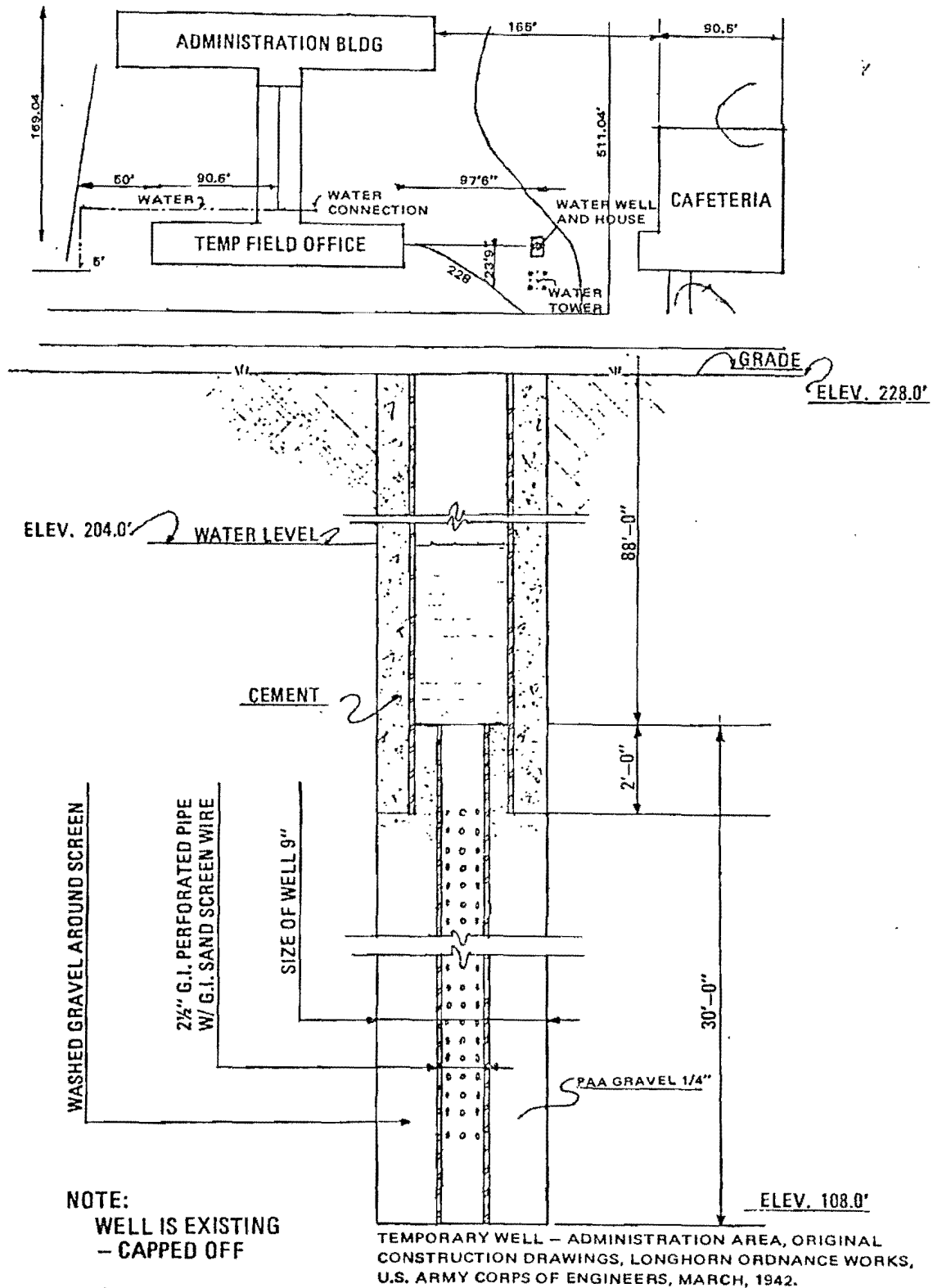
Robin	Hairy woodpecker
Great blue heron	Slate-colored junco
Coot	Cardinal
Pileated woodpecker	Red-wing
Crow	Grackle
Turkey vulture	Red-bellied woodpecker
Loggerhead shrike	Western meadowlark
Blue jay	Eastern bluebird
Mockingbird	Brown creeper
Sparrow hawk	Myrtle warbler
Downy woodpecker	Least flycatcher

Mammals

Eastern gray squirrel	Southern fox squirrel
Mink	White-tailed deer
Raccoon	Armadillo
	Bobcat

APPENDIX C

LHAAP TEMPORARY WELL DATA



TEMPORARY WELL

APRIL, 1979

002-75

Driller: B. F. Eddington

Date Completed: 1942

Depth: 133 feet

Reported yield, 20 gallons a minute, with drawdown
of 42 feet when drilled.

	Thickness (feet)	Depth (feet)
Surface Soil	15	15
Sand, fine brown gravel and iron ore	30	45
Blue Shale	30	75
Sand shale, water-bearing	31	106
Rock	2	108
Sand	25	133

Texas State Board of Water Engineers
Records of Wells and Springs in
Harrison County, Texas, 1942.

LONGHORN ARMY AMMUNITION PLANT

WELL DATA

Figure

HARRISON COUNTY, TEXAS

C-3

Horiz.
Scale =Vert.
Scale =Date = APRIL
1979

C-5877

APPENDIX D

CHEMICAL COMPOSITIONS OF DEVICE COMPONENTS

PRODUCED AT LHAAP

(Source: LHAAP EIA, July 30, 1975)

Basic Mixtures

		<u>Origin</u>
Illuminant Composition	50% Mag. 40% Sod. Nitrate 10% Laminac Lupersol Cobalt Napthinate	Plant 2 Plant 3
Black Powder	- 90% Water 8% Metal Powder 2% Inert	Plant 2 Plant 3
Polysulfide Propellant	Polymer Aluminum Iron Oxide ERL 2774 Ammonium Perchlorate	Plant 3
Contaminated Waste	30% Explosive 70%	Plant 2 & Plant 3

Solid Propellant (Weights and % of Materials are Confidential)TPH9001 Catapult

HC434 Polymer
ERL
TP-90-B
Licithin
Iron Oxide
Aluminum
CC2
Ammonium Perchlorate

XM105 & XM106 Rocket Motor Propellant

H. A. Polymer
Aluminum
Iron Oxide
ERL 2774
Ammonium Perchlorate

XM100 Rocket Motor Propellant

L.P. 33 Polysulphide Polymer
Para-Quinone Dioxine
Magnesium Oxide
Nylon
Sulphur
Ammonium Perchlorate

M30 Rocket Motor Propellant

LP 33 Polysulphide Polymer
DPG
Para-Quinone Dioxine
Nylon
Sulphur
Ammonium Perchlorate

Fuze, 81mm, M84, Chemical Compositions;1. Upper Ring

Tungsten Delay Powder	
Tungsten Powder	60.0%
Barium Chromate	30.0%
Potassium Perchlorate	10.0%
Vinyl Alcohol Acetate Resin (VAAR)	1.0%

2. Pellet "A"

Boron Potassium Nitrate (BKNO_3)	100.0%
---	--------

3. Lower Ring, Graduated

Tungsten Delay Powder	
Tungsten Powder	60.0%
Barium Chromate	30.0%
Potassium Perchlorate	10.0%
Vinyl Alcohol Acetate Resin (VAAR)	1.0%

4. Pellet "B"

Boron Potassium Nitrate (BKNO_3)	100.0%
---	--------

5. Body Assembly

Black Powder, Class 5

6. Pellet "C"

Boron Potassium Nitrate (BKNO_3)	100.0%
---	--------

7. Primer, M39A1

Potassium Chlorate	37.05%
Lead Thiocyanate	38.13%
Trinitrotoluene	5.69%
Barium Nitrate	8.68%
Ground Glass	10.45%

Fuze, 60mm, M65A1, Chemical Compositions:1. Fuze Powder:

<u>Type I</u>	90.0%
(Potassium Nitrate - 74.0%)	
(Sulfur - 10.4%)	
(Charcoal - 15.6%)	

<u>Type II</u>	10.0%
(Potassium Nitrate - 70.0%)	
(Sulfur - 16.0%)	
(Coal - 14.0%)	

2. Pellet "A"

Boron Potassium Nitrate (BKNO_3)	100.0%
---	--------

3. Pellet "E"

Boron Potassium Nitrate (BKNO_3)	100.0%
---	--------

4. Body Assembly:

Black Powder, Class 5	100.0%
-----------------------	--------

5. Primer, M39A1

Potassium Chlorate	37.05%
Lead Thiocyanate	38.13%
Trinitrotoluene	5.69%
Barium Nitrate	8.68%
Ground Glass	10.45%

Trip Flare, M49A1, Chemical Compositions:1. First Fire Composition:

Barium Chromate, Grade A or B	90.0%
Boron	10.0%

2. Ignition Composition:

Magnesium Atomized, 20/50, Type 1	48.4%
Sodium Nitrate, Grade B, Cl.2	47.2%
Vinyl Alcohol Acetate Resin Solids	4.4%

3. Illuminant Composition:

Magnesium, Atomized, 20/50, Type 1	36.0%
Sodium Nitrate, Grade B, Cl.2	54.0%
Binder Composition	10.0%
(Laminac 4116 - 97.9%)	
(Lupersol DDM - 1.5%)	
(Cobalt Napthenate - 6%, Cobalt - 0.6%)	

4. Charge, Intermediate;

Barium Chromate, Grade A or B	90.0%
Boron	10.0%

5. Primer, M42:

Basic Lead Styphnate	53.0%
Antimony Sulfide, Class 5	10.0%
Barium Nitrate, Class 1	22.0%
Aluminum, Powdered, Atomized, Type II	10.0%
Tetracen (commercial)	5.0%

6. Sealing Compound:

Thiokol LP-2	90.0%
Catalyst C5	10.0%

7. Insulating Composition:

Binder Composition	65.0%
(Laminac 4116 - 99.7%)	
(Lupersol DDM - 0.2%)	
(Cobalt Napthenate - 6%, Cobalt - 0.1%)	
Asbestos, Powdered, Technical	35.0%

Aerial Flare, AN/ALA-17, Chemical Compositions:1. Illuminant Assembly

- *Igniter Composition SI 131
- *Igniter Composition SI 119
- *Illuminant Composition FW-306

Adhesive Composition

Nitrocellulose, Grade A, Type I	10.0%
Acetone	90.0%

*Formulation and ingredients are classified information.

2. Squib, Electric, M2

Lead Thiocyanate, Class B	32.0%
Potassium Chlorate, Grade C, C1.6	40.0%
Charcoal, Class D	18.0%
Egyptian Lacquer No. CN4707	10.0%

M125 Series Hand Signals, Chemical Compositions1. Illuminant Composition

Magnesium, Type 1, 30/50	33.0%
Barium Nitrate, Class 6	46.0%
Polyvinyl Chloride	16.0%
Binder Composition	5.0%
(Laminac 4116 - 97.0%)	
(Lupersol DDM - 1.5%)	
(Cobalt Napthenate - 0.6%)	
(6% Cobalt)	

2. Priming Composition

First Fire Composition, Type II	
Strontium Nitrate	50.0%
Tetranitrocarbozole	10.0%
Silicon	16.0%
Zirconium Hydride	15.0%
Polyvinylchloride	5.0%
Laminac	4.0%
(Laminac 4116 - 99.0%)	
(Lupersol DDM - 1.0%)	

3. Quickmatch

Type II, Class A

4. Propellant Assembly

Black Powder	90.8%
Calcium Carbonate	9.2%

5. Delay Assembly

Potassium Nitrate, Class A	49.0%
Antimony Sulfide, Class A	20.0%
Black Powder, Class 8	16.0%
Sulfur Ground, Grade D	12.0%
Dextrin	3.0%

6. Initiating Charge

Black Powder, Class 5	100.0%
-----------------------	--------

7. Expelling Charge

Black Powder	100.0%
--------------	--------

155mm Illuminating Projectile, Chemical Compositions1. Illuminant Composition:

Laminac, Type A	8.0%
Magnesium, Atomized, Type I	48.5%
Sodium Nitrate, Grade B, C1.2	43.5%

2. First Fire Composition:

Potassium Nitrate	70.7%
Laminac, Type A	5.7%
(Laminac 4116 - 98.7%)	
(Lupersol DDM - 1.0%)	
(Cobalt Napthenate - 0.3%)	
Boron, 90% to 92% pure	23.6%

3. Expelling Charges:

<u>Primary:</u>	
Black Powder, Class 3	100.0%
<u>Secondary:</u>	
Black Powder, Class 6 Glazed	60.0%
Black Powder, Class 2 Glazed	40.0%

4. Delay Assembly:

Gasless Ignition Powder Increment:	
Zirconium	65.0%
Red Iron Oxide	25.0%
Inert Filler	10.0%

Manganese Delay Composition Increment:	
Manganese	33.0%
Barium Chromate	31.0%
Lead Chromate	36.0%

Black Powder, Class 7 (Increment)

APPENDIX E
CONTAMINANT SURVEY LISTING

CONTAMINANT SURVEY LISTING

Contaminant Code

- | | |
|---|---|
| 1. Composite propellants
(PBAA and polysulfide
perchlorate) | 9. AN/ALA 17 flare
illuminant compositions |
| 2. Oxidizers
(perchlorates, chlorates,
nitrates) | 10. AN/ALA 17 flare
first fire and igniter
compositions |
| 3. Black powder | 11. Button bomb composition |
| 4. Metal powders
(aluminum, magnesium,
zirconium) | 12. Hand signals
illuminant compositions |
| 5. Acids | 13. Hand signals
first fire and igniter
compositions |
| 6. Phosphorus | 14. 60mm-81mm mortar
illuminant compositions |
| 7. 105mm, 155mm, 4.2-inch
illuminant compositions | 15. Flammable solvents
lubricants, polymers
fuels, etc. |
| 8. 105mm, 155mm, 4.2-inch
first fire compositions | |
| 16. CS pyrotechnics | |

CONTAMINANT SURVEY LISTING

I. Plant 1

<u>Facility No.</u>	<u>Activity</u>	<u>Contaminant</u>
813	Pyrotechnic assembly	7, 8, 16
813-1	Service magazine	7, 8
814	60 and 80mm mortar production	3, 4, 7, 8
801-F	Motor soakout facility	1, 15

II. Plant 2A. Pyrotechnic Lines - East and West

P-1	Metal powders (Shed K)	4
P-3	Oxidizer preparation	4
P-9	Cleaning bay	15
P-10	Cannister coating	15
P-11	Cannister preparation	15
P-13	Packout (east line)	2, 3, 4, 7, 13
P-14	Metal powder surge	4
S-3	Metal powder storage	4
S-4	Warehouse	3
S-5	Delay testing	3
S-7	Black powder service magazine	3
S-8	Black powder service magazine	3
Shed A	4.2-inch assembly and packout	3, 4, 6, 7, 8, 15

B-6	155mm assembly	7, 8
B-8	155mm assembly	7, 8
B-10	105mm press	7, 8
B-11	Illuminant mixing	4, 7, 8
B-12	Illuminant mixing	4, 7, 8
B-13	400 area mixing - ALA 17	10
B-14	Illuminant mixing	4, 7, 10
B-15	First fire preparation	9
B-16	155mm delays (Shed C)	3

B. Mill Houses

212-11	Consolidated illuminant storage	4, 7, 8
212-12	Surge storage	4, 7, 8
212-12R	Ramp-press area	15
212-13	Consolidated illuminant storage	4, 7, 8
212-14	Utility press	4, 7, 8
212-15	Consolidated illuminant storage	7, 12, 14
212-16	155mm - 4.2-inch press	7, 8
212-17	Consolidated illuminant storage	7, 12, 14
212-18	Mix composition surge	9, 10
212-19	Consolidated illuminant storage	7, 8, 14
212-20	Mix composition surge	9, 10
212-25	Candle storage	7, 8, 14
212-17	Candle storage	7, 8, 14

212-29	Slurry mixing baron	8
212-31	ALA pellet storage	9
212-33	Acetone storage	15
212-35	Weighup and mixing - ALA 17	9, 10
212-35R	Ramp to weighup and mixing	9, 10
212-36	Weighup and mixing - ALA 17	9, 10
212-37	Weighup and mixing - ALA 17	9, 10
212-38	Weighup and mixing - ALA 17	9, 10
212-38R	Ramp to weighup and mixing	9, 10
212-39	ALA drying	9, 10
212-42	Fuse supply	3
212-44	Reject storage	7, 8
212-46	Illuminant storage	7, 8
212-48	First fire and illuminant mixing	8, 13
212-50	First flare and illuminant mixing	8, 13
212-51	Illuminant storage	7, 8, 14
212-53	Illuminant storage	7, 8, 14
212-54	Expelling charge storage	3
212-55	Illuminant storage	7, 8, 14
212-56	Propellant powder storage	3
212-57	Illuminant storage	7, 8, 14
212-59	Illuminant storage	7, 8, 14

C. ANIALA-17 Production

403	Case inspection - pellet press	9, 10
406	Inspection and drying	4, 9, 10
407	Illuminant testing	4, 6, 9, 10
408	Granulating and mixing	2, 4, 9
409	Assembly and packout	9, 10
410	Explosive service magazine	9, 10

D. Pyrotechnic Production

207	Office and laboratory	A11
208	Supply storage shed	A11

III. Plant 3

29A	Chemical laboratory (control)	A11
31A	Solvent storage	15
46A	Degreasing	1, 2, 5, 15
22B	Property storage	2
25B	X-ray service	1
35B	Button bomb preparation and mix	11
36B	Sample preparation	1
37B	Reject illuminant assembly	4
38B	Sample preparation	1
41B	Reject illuminant assembly	4
42B	Sample storage	1
45B	Press	1

46B	Finishing	1, 2
49B	Radiological - cobalt pill	1
53B	Radiology inspection	1
54B	Film developing	15
55B	Fluoroscope	1
59B	Service storage	1
25C	Oxidizer dryer	2
68C	Button bomb manufacture	11
25D	Oxidizer blending	2
29D	Oxidizer grinding	2
38D	Surge storage	1, 2
40D	Storage	1, 15
44D	Storage shed	1, 15
53D	Motor surge	1, 2
62D	Assembly (Pershing)	1
65D	Storage shed	1
26E	M-72 mixing and casting	1, 2, 3, 4, 11
32E	Service storage	2
39E	Ramp to mixer (41E)	2
40E	Ramp to mixer (42E)	2
41E	Propellant mixer (West)	1
42E	Propellant mixer (East)	1
45E	Casting, curing and finishing motors	1, 15

65E	Paint storage shed (62D)	15
37F	Surge and storage (Building 42E)	2, 4
39F	Storage (Building 42E)	2, 4
51F	Solvent drum shed (Building 54F)	15
54F	Motor casting	1
68F	Finish and packout	11
28G	Motor case preparation	15
30G	Solvent storage shed	15
31G	Fuel preparation	4
33G	Fuel mixing	2, 15
36G	Storage shed	15
50G	Metal parts cleaning	1, 15
54G	Motor packout	1, 15
62G	Autoclave	1, 2
68G	Button bomb finish packout	11
82G	Motor storage	1
32H	Teflon and propellant mixing	15
40H	Utility shed	15
42H	Vertical mixer	1
53H	Storage shed	15
54H	Button bomb production	11
55H	Storage shed	15
75I	Cannister assembly	4, 11, 15

75J	Service magazine	15
IV. <u>Igniter Area (Signals)</u>		
13Y	Service magazine	2, 12
16Y	Signal assembly and packout	2, 3, 4, 12
18Y	Storage and component rework	2, 3, 4, 12
20Y	Solvent storage	15
29Y	Service magazine	3
32Y	Service magazine	3
34Y	Signal assembly	12, 13, 15
38Y	Propellant consolidation	3
40Y	Signal production	3
45Y	Delay manufacture	3
48Y	Service magazine	13
V. <u>Magazine Area</u>		
722G	Loading dock pad	
811-1 thru 811-58	Storage magazines (58)	Finished product
821A	Loading dock	Finished product
823	Above ground magazine	Finished product
824	Above ground magazine	Finished product
VI. <u>Plant 3 Magazines</u>		
31M	Magazine	Finished product
35M	Magazine	Finished product

39M	Magazine	Finished product
VII. <u>Warehouse Area</u>		
31W	Warehouse	1
33W	Warehouse	4
35W	Warehouse	1
VII. <u>Static Test Area</u>		
16T	Reclamation unit	1, 2, 4, 15
18T	Service Magazine	1, 2
20T	Conditioning	1
21T	Explosive storage magazine	1, 2, 4
23T	Conditioning	1
25-TT-1	Test pad	1
25-TT-2	Test pad	1
26T	Conditioning box	1
31T	Constant temperature building	1, 2
35T	Illuminant test tunnel	9
36-T-1	Static test firing pad	1
36-T-2	Static test firing pad	1
36-T-3	Static test firing pad	1, 11
36-T-4	Static test firing pad	1
39T	Test preparation production assembly	1, 2, 4
IX. <u>Plant 2 Test Area</u>		
BST-2	Storage igloo	12, 13

BST-4 Explosive storage igloo 12, 13

BST-3 Storage igloo 12, 13

X. Explosive Burning Grounds

24X	Waste storage wash rack	A11
25X	Cleaning pit	A11
27X	Explosive magazine (storage)	A11
29X	Burning pad	A11
30X	Burning pad	A11
31X	Burning pad	A11
32X	Burning pad	A11
34X	Motor washout	A11
37X	Flash pits	A11
41X	Storage	A11
43X	Explosive magazine	A11



DEPARTMENT OF THE ARMY CPT Sandrin/csp/AUTOVON
 U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY 584-2024
 ABERDEEN PROVING GROUND, MARYLAND 21010

REPLY TO
 ATTENTION OF

HS HB-ES-E/WP

21 SEP 1983

SUBJECT: Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83,
 DARCOM Open-Burning/Open-Detonation Grounds Evaluation, Longhorn
 Army Ammunition Plant, Marshall, Texas, 31 July - 3 August 1981

Commander
 US Army Materiel Development and
 Readiness Command
 ATTN: DRCSG
 5001 Eisenhower Avenue
 Alexandria, VA 22333

1. Copies of subject report are inclosed.
2. The information contained in this report is based on a limited number of samples taken for the specific purposes of this study and may not be representative of the total situation at the installation. Therefore, pending promulgation of final environmental standards and complete interpretation of all data, this report should be used for informational purposes only and should not be released to other agencies without your approval.

FOR THE COMMANDER:

1 Incl
 as (10 cy)

Robert H. Lund, MAJ, MSC
 NELSON H. LUND, P.E.
 for Colonel, MSC
 Director, Environmental Quality

CF:
 HQDA (DASG-PSP) wo incl
 Cdr, DARCOM (DRCIS-A)
 Cdr, HSC (HSPA-P)
 Cdr, TEAD (SDSTE-AE)
 Cdr, LHAAP (2 cy)
 Cdr, BAMC (PVNTMED Actv)
 Cdr, MEDDAC, Ft Hood (PVNTMED Actv) (2 cy)
 Cdr, AMCCOM [DRSMC-ISE(R)/DRSMC-DS(R)/DRSMC-SG(R)]
 C, USAEHA-Rgn Div South



REPLY TO
ATTENTION OF

HSHB-ES-E/WP

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

PHASE 2
HAZARDOUS WASTE MANAGEMENT SPECIAL STUDY NO. 39-26-0147-83
DARCOM OPEN-BURNING/OPEN-DETONATION GROUNDS EVALUATION
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS
31 JULY - 3 AUGUST 1981

1. AUTHORITY. Letter, DRCIS-A/DRCSG, HQ DARCOM, 13 March 1981, subject: Request for Services, Open-Burning/Open-Detonation Grounds, with initial indorsement, HSPA-P, HQ HSC, 20 March 1981.

2. REFERENCES. A list of references is included in Appendix A.

3. PURPOSE AND OBJECTIVES.

a. The overall purposes of the DARCOM Open-Burning/Open-Detonation Grounds Evaluation are:

(1) To evaluate the status of OB/OD grounds relative to existing Federal hazardous waste regulations (references 1 through 6, Appendix A).

(2) To evaluate the potential for contaminant migration from OB/OD grounds to the ground and surface waters (reference 7, Appendix A).

(3) To determine, based on these evaluations, which OB/OD grounds are the best sites for continued future OB/OD operations.

b. The specific objectives of the LHAAP site investigation are:

(1) To determine the total explosive content of soil and residue samples from active OB/OD grounds at LHAAP.

(2) To determine if the soil and residues at active OB/OD grounds at LHAAP are hazardous wastes by characteristic of EP toxicity for heavy metals content.

(3) To determine the need for additional sampling and analyses of OB/OD areas at LHAAP based on results of these data.

4. GENERAL.

a. Abbreviations and Definitions. Definitions of terms and abbreviations used in this report are included in Appendix B.

b. Personnel Contacted. Installation personnel contacted during this investigation were:

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

- (1) Mr. D. Miley, Chief Engineer
- (2) Mr. A. B. Childress, Environmental Coordinator, Thiokol Corporation
- (3) Mr. W. Tunnell, Safety Specialist
- (4) CPT D. R. Christensen, Executive Officer
- (5) Mr. A. Morgan, Supervisor, BG Area, Thiokol Corporation

c. Background. A general background description of OB/OD operations and a discussion of environmental issues related to OB/OD are included in Appendix C.

d. Installation. A general description of LHAAP, its location and operations, can be found in reference 8, Appendix A.

e. OB/OD Operations. All active OB operations at LHAAP are currently located on approximately 30 acres of land in the eastern portion of the installation. All active OD operations are located on approximately 10 acres at a separate site in the southern portion of the installation (see Appendix D).

f. Sampling. A study team from this Agency visited LHAAP on 31 July - 3 August 1981 (reference 9, Appendix A). The team took a total of 48 samples from the two active OB/OD areas. A summary of sampling procedures is provided in paragraph 3a, Appendix C.

5. FINDINGS AND DISCUSSION.

a. Analytical Data. A summary of the analytical data is shown in the following Table, and a description of findings for each active area follows.

b. OB Trench.

(1) A trench approximately 90 by 15 feet was being used to burn all pyrotechnic explosive wastes except the M206 wastes (see Figure D-1, Appendix D). Combustible materials and contaminated wastes were being used as supplemental fuels.

(2) Three residue and six soil samples were taken at three points in the trench, and three additional soil samples were taken in a small ditch draining from the north end of the burn trench.

TABLE. SUMMARY OF ANALYTICAL RESULTS

Area Sampled	Explosives Analysis	EP Toxicity Metals Analysis	Remarks
Burn Trench	No explosives detected in any samples.	12 Samples - Ba in three residue and one soil samples from 24-200 mg/L, with two residue samples over hazardous waste criteria limit; Pb in two soil samples at 1.6 and 4.8 mg/L; no other metals detected.	The residues are a hazardous waste by characteristic of EP toxicity for Ba.
Burn Pads M206	No explosives detected in any samples.	22 Samples - Ba in three residue and three soil samples from 11-609 mg/L, with two residue samples over hazardous waste criteria limit; Pb in two soil samples at 0.7 and 1.5 mg/L; no other metals detected.	The residues are a hazardous waste by characteristic of EP toxicity for Ba.
Demolition Area	No explosives detected in any samples.	10 Samples - Ba in five samples from 10-14 mg/L; no other metals detected.	Not hazardous by characteristic of EP toxicity for Ba.

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(3) Analysis for characteristic of EP toxicity showed measurable concentrations of Ba in all three residue samples, with two samples above the RCRA hazardous waste criteria limit at 139 and 200 mg/L. There was also Pb at 1.6 mg/L in one soil sample in the trench and at 4.8 mg/L in the ditch draining from the burn trench. A soil sample taken 90 feet downslope of the burn trench in the ditch contained 45 mg/L Ba, which is below the RCRA hazardous waste criteria limit of 100 mg/L, but is still significant because it indicates the potential for runoff from this burn area. No other metals were detected in any samples. Complete data are provided in Table E-1, Appendix E.

(4) Analysis for explosives showed no detectable concentrations in any samples, which is to be expected because current operations at LHAAP do not include any manufacturing or processing of explosives.

c. M206 Pads.

(1) A series of 10 small earthen pads approximately 12 feet square were being used to burn M206 wastes. The pads have earthen dikes on three sides and the roadway on the fourth side. There is a drainage ditch which runs alongside the pads and is used to drain any water which may accumulate in the pads (see Figure D-2, Appendix D).

(2) Sets of six samples including two residue and four soil samples were taken from each pad. Four soil samples were also taken from the drainage ditch.

(3) Analysis for characteristic of EP toxicity showed measurable quantities of Ba in three residue and one soil sample, with two residue samples over the RCRA hazardous waste criteria limit of 100 mg/L at 143 and 609 mg/L. There was Ba at 46 mg/L in one other residue sample and 11 mg/L in one soil sample. No other metals were detected in any samples from the burn pads. Measurable quantities of Pb at 0.7 and 1.5 mg/L and Ba at 19 and 87 mg/L were also found in soil samples from the drainage area. These values are all below RCRA hazardous waste criteria limits, but they do indicate the potential for runoff from this burn area. No other metals were detected in any samples. Complete data are presented in Table E-2, Appendix E.

(4) Analysis for explosives showed no measurable concentrations in any samples, which is to be expected because current operations at LHAAP do not include any manufacturing or processing of explosives.

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c. OD Area.

(1) All OD operations were conducted in a small bermed area consisting of five 12-foot-square pits. The area was last used to destroy photoflash bombs approximately 1 year prior to the study team visit. A total of 10 soil samples was taken from three of the pits (see Figure D-3, Appendix D).

(2) Analysis for characteristic of EP toxicity showed measurable quantities of Ba in five samples, ranging from 10 to 14 mg/L, all of which are well below the RCRA hazardous waste criteria limit. No other metals were detected in any samples. Complete data are presented in Table E-3, Appendix E.

(3) Analysis for explosives showed no detectable concentrations in any samples because current operations at LHAAP do not include any manufacturing or processing of explosives.

6. CONCLUSIONS. Based upon the analytical results described in the preceding paragraphs, the following conclusions can be drawn about OB/OD operations at LHAAP.

a. The residues from the burn trench and the M206 burn pads are a hazardous waste by characteristic of EP toxicity for Ba.

b. The soils from the burn trench, M206 burn pads, and the demolition area are not a hazardous waste by characteristic of EP toxicity for Ba.

c. The presence of Ba in the drainage areas indicates the potential for contaminated runoff from the burn trench and M206 burn pads.

d. Additional sampling by this Agency is not required at this time for purposes of this study.

e. The information contained in this report is based on a limited number of samples taken for the specific purposes of this study and may not be representative of the total situation at the installation. Therefore, pending promulgation of final environmental standards and complete interpretation of all data, this report should be used for informational purposes only and should not be released to other agencies without your approval.

7. RECOMMENDATIONS. Recommendations pertaining to the overall DARCOM OB/OD Grounds Evaluation will be addressed in the final report to be issued in First Quarter, FY 84.

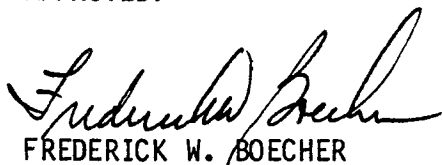
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8. ADDITIONAL INFORMATION. For additional information or assistance, contact the Chief, Waste Disposal Engineering Division, this Agency, AUTOVON 584-2024.



JOSEPH A. SANDRIN
CPT, MSC
Environmental Engineer
Waste Disposal Engineering Division

APPROVED:



FREDERICK W. BOECHER
MAJ, MSC
Chief, Waste Disposal Engineering Division

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APPENDIX A

REFERENCES

1. Public Law (PL) 94-580, Resource Conservation and Recovery Act of 1976, 21 October 1976.
2. Title 40, Code of Federal Regulations (CFR), 1982 rev, Part 261, Identification and Listing of Hazardous Waste.
3. Title 40, CFR, 1982 rev, Part 262, Standards Applicable to Generators of Hazardous Waste.
4. Title 40, CFR, 1982 rev, Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
5. Title 40, CFR, 1982 rev, Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
6. Interim Final Rules, Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, and EPA Administered Permit Programs, 47 Federal Register (FR) 32349, 26 July 1982.
7. Letter, HSE-ES/WP, this Agency, 2 March 1982, subject: Phase I, Hazardous Waste Special Study No. 39-26-0147-82, DARCOM Open Burning/Open Detonation Ground Evaluation, March-November 1981.
8. Installation Assessment of Longhorn Army Ammunition Plant Records Evaluation Report No. 150, February 1980, USATHAMA, Aberdeen Proving Ground, MD.
9. Letter, HSE-ES, this Agency, 6 November 1981, subject: Phase II, Hazardous Waste Management Special Study No. 39-26-0147-82, Red River Army Depot, Lone Star Army Ammunition Plant, Longhorn Army Ammunition Plant, 19 July-5 August 1981.
10. Letter, HSHB-ES/WP, this Agency, 17 May 1983, subject: Draft Interim Environmental Criteria for Open Burning and Open Detonation (OB/OD) Grounds (USAEHA Control No. 39-26-0197-83).

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APPENDIX B

ABBREVIATIONS AND DEFINITIONS

BG	burning ground
COR	Contracting Officer's Representative
CWP	Contaminated Waste Processor
demolition range	same as OD grounds, sometimes including OB grounds
detonation	A violent chemical reaction within a chemical compound or a mechanical mixture evolving heat and pressure and which proceeds through the reacted material toward the unreacted material at a supersonic velocity, exerting extremely high pressure on the surrounding medium, forming a propagating shock wave which is originally of supersonic velocity.
disposal	The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.
EPA	US Environmental Protection Agency
EP toxicity	An extraction test to evaluate the leachability of eight different metals from a hazardous waste. The metals are arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), silver (Ag), and selenium (Se).
EWI	Explosive Waste Incinerator
facility	All contiguous land and structures, other appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. For permitting purposes a facility may consist of an entire installation or any part or combination of parts of that installation where treatment, storage, or disposal operations are located (see OB grounds, OD grounds, OB area, OD area, and demolition range).
ground water	Water below the surface in a zone of saturation.

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ignitability	A characteristic of solid waste whereby the waste is capable, under standard temperature and pressure, of causing fire through friction, adsorption of moisture, or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it presents a hazard.
LHAAP	Longhorn Army Ammunition Plant
leachate	Any liquid, including suspended components in the liquid, that has percolated through or drained from hazardous waste.
OB	open burning
OB area	That area or portion of the facility where open-burning operations are conducted (syn OB-grounds).
OB grounds	That area or portion of the facility where open-burning operations are conducted (syn -OB area).
OD	open detonation
OD area	That area or portion of the facility where open-detonation operations are conducted (syn-OD grounds, demolition range).
OD grounds	That area or portion of the facility where open-detonation operations are conducted (syn-OD area, demolition range).
open burning	Combustion of any material without the following characteristics: (1) Control of combustion air. (2) Containment of combustion reaction in an enclosed device. (3) Control of gaseous combustion product emissions. This definition includes open detonation.
PEP	pyrotechnics, explosives, and propellants
RCRA	Resource Conservation and Recovery Act of 1976

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reactivity	A characteristic of a solid waste whereby the waste is: (1) Capable of detonation or explosion if subjected to a strong initiating source or if heated under confinement. (2) Readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.
treatment	Any method, technique, or process designed to change the chemical, physical, or biological character or composition of any hazardous waste so as to recover energy or material resource from the waste, or to render such waste nonhazardous, or less hazardous, or safer to transport.
USATHAMA	US Army Toxic and Hazardous Materials Agency

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APPENDIX C

OB/OD BACKGROUND

1. GENERAL.

a. As part of routine operations, the Department of Defense produces, stores, and uses large quantities of munition items commonly referred to as PEP. Each year large quantities of PEP and PEP-related materials must be disposed of as waste. These wastes include manufacturing wastes and residues; items in storage or manufacture which have failed quality assurance tests; out-of-date and obsolete explosives, propellants, and munitions items; and any unsafe munitions items, components, or explosives. Other related wastes include materials which may have become contaminated by contact with PEP during production, storage, and handling.

b. At present, OB/OD of PEP and PEP-contaminated wastes are the safest and most effective means of destroying many items, decontaminating large metal objects, and reducing combustible materials to a smaller volume. The Army has developed an EWI and a CWP for the incineration of PEP and PEP-contaminated wastes. These units are expensive to construct and difficult to operate. Also, due to the size and infrequent, small quantities of some of the wastes requiring open-flame treatment, an EWI or CWP is often impractical or economically unjustifiable. The OB/OD are presently the most economical methods available for disposal of many PEP and PEP-contaminated wastes.

2. REGULATIONS.

a. The RCRA and the regulations promulgated through it (references 1 through 6, Appendix A) set forth standards and guidance for the "cradle to grave" management of hazardous wastes. Under these regulations (reference 2, Appendix A), one of the criteria for designating a waste as hazardous is reactivity, which is defined to include wastes which may detonate from strong initiation or when heated under confinement, and specifically includes "forbidden," "Class A," and "Class B" explosives as specified by the Department of Transportation in 49 CFR. This definition includes most PEP wastes and certain PEP-contaminated wastes.

b. The OB/OD meet the definition of hazardous waste treatment (reference 2, Appendix A). The regulations prohibit the open burning of hazardous waste. However, an exemption is granted for OB/OD of waste explosives and propellants which cannot be safely disposed of by other means (40 CFR 265.832). This exemption is only from the prohibition on OB and does not in any way exempt the facility or its operations from compliance with all other applicable regulations for treaters, storers, and disposers of hazardous waste. The OB/OD is also subject to regulations under the Clean Air Act and may require waivers or permits under existing state air pollution abatement plans.

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

c. The OB/OD are regulated as a Thermal Treatment process under 40 CFR 265. Under the general facility requirements of these regulations, OB/OD facilities must have waste analysis plans, training plans, inspection plans, contingency plans, closure plans, and comply with recordkeeping requirements. Facilities must also comply with specific quantity distance requirements which parallel those already in use by the Department of Defense.

d. There are presently no 40 CFR 264, Phase II regulations for OB/OD facilities. It is expected, however, that the EPA will eventually issue some type of standards for such facilities. A separate, ongoing project at this Agency is the development of interim standards for DARCOM, consistent with existing regulations which will be applicable to OB/OD facilities.

e. According to the hazardous waste definition (reference 2, Appendix A), residues from hazardous waste treatments are, themselves, considered to be hazardous until proven otherwise. Since the original PEP wastes treated are hazardous by characteristic of reactivity, the residues must also be considered reactive until proven otherwise. It is the explosive content of the PEP wastes which make them reactive, and, though there are presently no established environmental regulatory standards for concentrations of explosive compounds, such materials may present an environmental problem due to their chemical properties. Hence, the amount of explosive in the waste residue should be measured. Also, since many PEP wastes contain toxic heavy metals, there is the potential for some of these metals to be released from the waste to the environment. The waste residues should, therefore, be analyzed for the characteristic of EP toxicity to determine if they are a hazardous waste based on heavy metals content. The incomplete combustion or detonation of a PEP waste could lead to the formation of byproducts. These byproducts will be chemically different from the pure compounds and may not be reactive enough to detonate but, because of their composition, may still present a significant ignitability hazard. Additional testing should, therefore, be performed to determine if the waste residues are, in fact, ignitable.

f. Presently, most OB facilities bury the ash and residues onsite, while the very nature of OD operations causes any residues to be incorporated into the soil. Either of these processes constitutes disposal as defined in 40 CFR 261, and, should the residues be hazardous, the OB or OD area could be construed as a hazardous waste disposal site and subject to regulation as such. Should the residues be nonhazardous, OB/OD areas could still be considered solid waste disposal sites and subject to existing applicable regulations.

g. The main thrust of the Federal hazardous waste regulations is the protection of ground water. Hazardous waste disposal sites are required, under new regulations (reference 6, Appendix A), to install ground-water monitoring systems which will measure the impact of the disposal facility on

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

the uppermost aquifer. As previously mentioned, there are explosive and heavy metals constituents in PEP wastes which could migrate from the OB/OD facility to the ground water and/or surface water. Analysis of soil and residue samples for EP toxicity (heavy metals leachability) and explosive content, coupled with a knowledge of site geology, will allow for assessment of the potential of any given site to contaminate the ground water due to OB/OD operations.

3. OB/OD STUDY. In order to evaluate the status of OB/OD operations relative to the previously discussed Federal regulations, 27 DARCOM installations were visited and 1,125 soil and residue samples taken to be analyzed for EP toxicity (heavy metals leachability) and total explosive content (reference 7, Appendix A).

a. Sampling.

(1) Samples of soil and residue were taken from all active OB/OD areas at the installations visited. The primary consideration in taking the samples was the safety of the study team.

(2) In order to insure the safety of the study team, soil samples at OB areas were taken with a remotely operated, trailer-mounted drill rig, unless soil characteristics or site conditions were not conducive to drilling and/or drill rig access. Due to physical layout and soil characteristics, some OB areas had to be hand-sampled.

(3) At active OB areas at each sample point, samples were taken of any surface residues present plus soil samples at depths of 0 to 6 inches and 6 to 18 inches. It was felt that this depth of sampling would provide information on the presence of contamination from recent OB operations while limiting the total number of samples requiring analysis.

(4) At OD areas at each sampling point, only surface soil samples were taken and no drilling was done due to the potential for encountering unexploded ordnance in these areas. However, since the OD process violently disturbs the soil at the site, it was felt that surface samples of resettled soil would provide a reasonably homogeneous sample of OD residues.

(5) The actual number and location of samples taken at each OB/OD area was determined onsite by the study team leader, based on the size and configuration of the area, its level of activity, and the variety of materials being open burned and/or open detonated. The individual samples taken are not necessarily representative of the overall situation at any given location. The analyses do, however, represent the range of potential contaminants and concentrations that may be expected at OB/OD areas. The issue of what constitutes a representative sample for determining whether the

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

residues are hazardous wastes and the OB/OD areas are hazardous waste disposal facilities is presently being investigated and must be evaluated before the final status of OB/OD areas can be resolved.

b. Analysis and Data Evaluation.

(1) The measurement of EP toxicity will determine if the soils and residues are hazardous by that characteristic. However, a conclusion to this evaluation is frustrated by the lack of environmental regulatory standards for concentrations of explosives in soil or water. Therefore, the explosives content data cannot be used directly to determine if the soils or residues are hazardous. There are also insufficient data available on the migration potential of these compounds from the soil to the ground water and/or surface water. A complete evaluation of the total environmental impact of OB/OD operations and their potential effect on ground water will require research and development on the mobility/leachability of explosive compounds leading to the setting of standards for acceptable environmental soil and water concentrations of these compounds.

(2) Evaluation of the soil and residues for reactivity and ignitability is also not possible at this time because there are no available EPA-approved tests for explosive reactivity or solid ignitability. The EPA and USATHAMA are currently working on the development of methods to evaluate explosives reactivity. The EPA is also investigating methods to test solids ignitability. Development of these tests will be essential to the total evaluation of OB/OD residues, and efforts should be made to standardize such tests as soon as possible. A representative group of samples with high concentrations of explosives from each installation is being retained by this Agency and is available for testing, pending standardization.

(3) The compilation of the data discussed above, plus satisfaction of the identified data gaps, will allow for a complete assessment of the status of DARCOM OB/OD facilities relative to existing (and expected) Federal hazardous waste regulations. Such a data base will permit assessment of which sites show the best potential for future continued OB/OD operations.

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

APPENDIX D

OB/OD AREAS, LHAAP

FIGURE D-1. OE/OD Areas, LHAAP

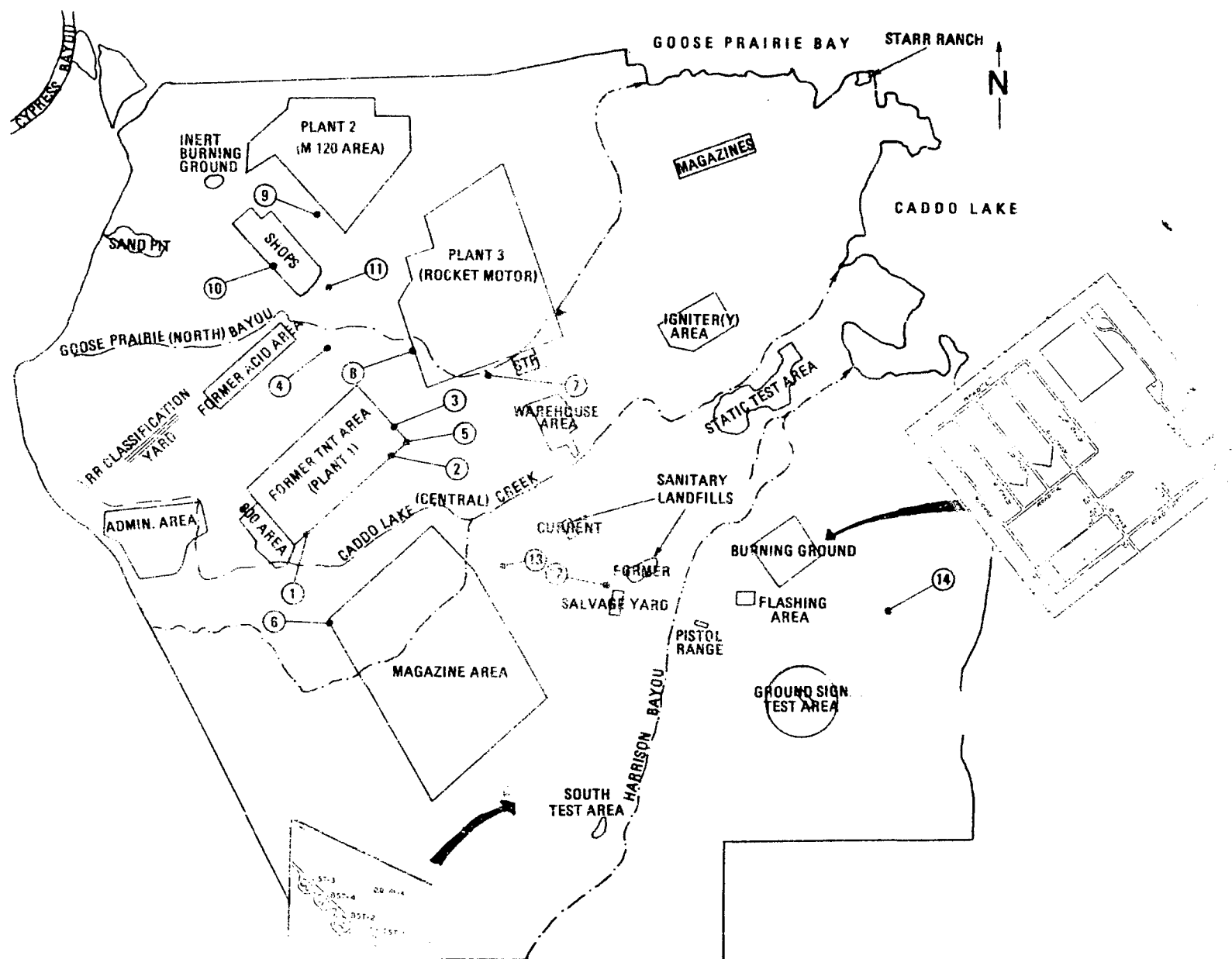
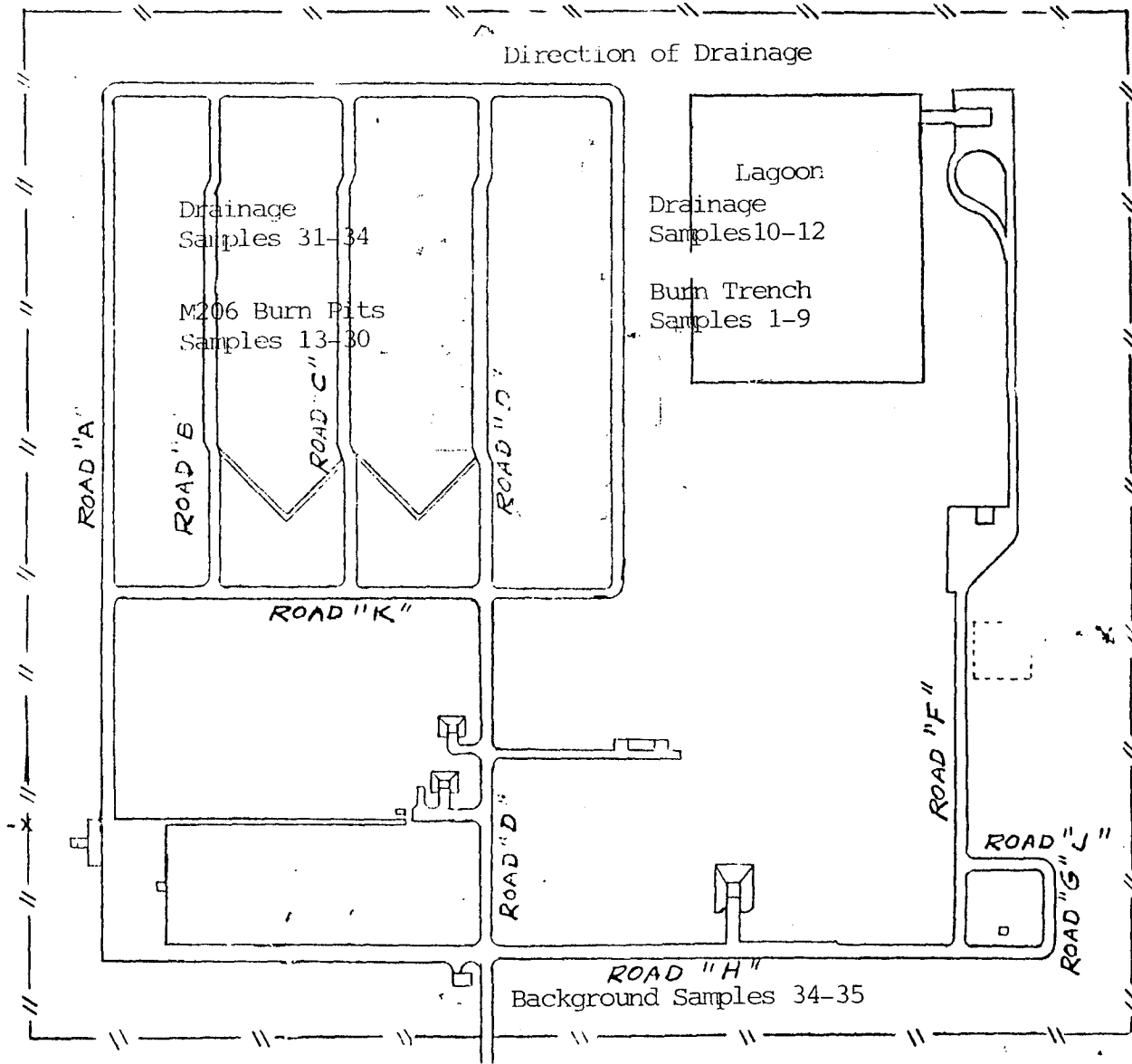


FIGURE D-2. 08 Area - LHAAP



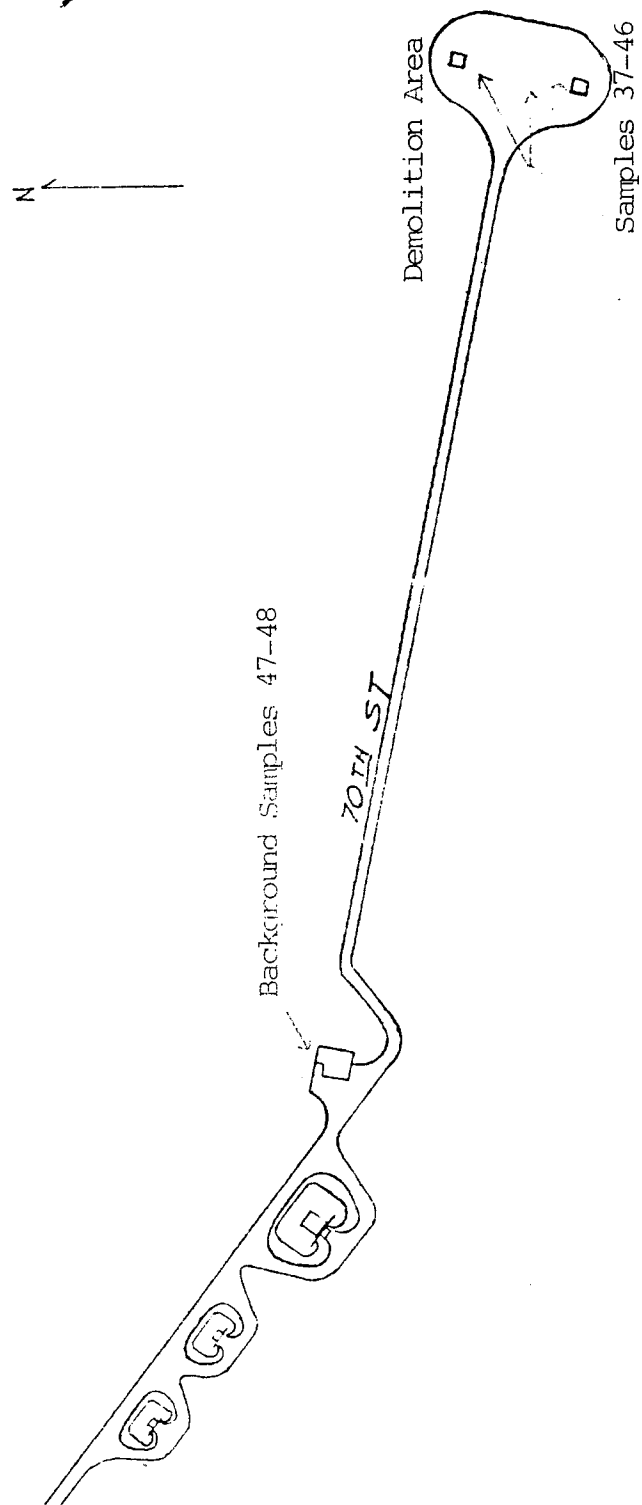


FIGURE D-3. OD Area - LHAAP

Phase 2, Hazardous Waste Mgt Sp Study No. 39-26-0147-83, LHAAP, TX, 31 Jul-3 Aug 81

APPENDIX E
ANALYTICAL RESULTS - LHAAP

TABLE E-1. BURN TRENCH

Sample No. and Description			EP Toxicity*								Explosives††					
			As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
4704-001	Point 1	residue	ND	24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-002	Point 1	0-6 inches	ND	ND	ND	ND	1.6	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-003	Point 1	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-004	Point 2	residue	ND	139	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-005	Point 2	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-006	Point 2	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-007	Point 3	residue	ND	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-008	Point 3	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-009	Point 3	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-010	Drainage Area		ND	ND	ND	ND	ND	4.8	ND	ND	ND	ND	ND	ND	ND	ND
4704-011	Drainage Area, 30 feet away		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-012	Drainage Area, 90 feet away		ND	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE E-2. M206 BURN PAD

Sample No. and Description				EP Toxicity*								Explosives††				
				As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT
4704-013	Pit 2	Point 1	residue	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-014	Pit 2	Point 1	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-015	Pit 2	Point 1	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-016	Pit 2	Point 2	residue	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-017	Pit 2	Point 2	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-018	Pit 2	Point 2	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-019	Pit 5	Point 1	residue	ND	46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-020	Pit 5	Point 1	0-6 inches	ND	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-021	Pit 5	Point 1	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-022	Pit 5	Point 2	residue	ND	609	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-023	Pit 5	Point 2	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-024	Pit 5	Point 2	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-025	Pit 10	Point 1	residue	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-026	Pit 10	Point 1	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-027	Pit 10	Point 1	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-028	Pit 10	Point 2	residue	ND	143	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-029	Pit 10	Point 2	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-030	Pit 10	Point 2	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-031	Drainage Area			ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND
4704-032	Drainage Area			ND	19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-033	Drainage Area			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-034	Drainage Area			ND	87	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND
4704-035	Upslope Background			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-036	Upslope Background			ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE E-3. DEMOLITION AREA

Sample No. and Description		EP toxicity*										Explosives††			
		As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
4740-037	Demo crater	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-038	Demo crater	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-039	Demo crater	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-040	Demo crater	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-041	Demo crater	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-042	Demo crater	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-043	Demo crater	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-044	Demo crater	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4707-045	Demo crater	ND	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-046	Demo crater	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-047	Upslope background	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4704-048	Upslope background	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

TABLE E-4. ANALYTICAL LIMITS*

	As	Ba	Cd	Cr	Hg	Pb	Se	Ag
Detection Limit	0.5	10	0.1	0.5	0.02	0.5	0.1	0.5
RCRA Criteria Limit	5.0	100	1.0	5.0	0.2	5.0	1.0	5.0

* All units in mg/L

* All units in ug/g

† Detection limit for all explosives was 1.0 ug/g.

ND - not detected

Rodolfo Bongiovanni
 RODOLFO BONGIOVANNI
 CFT, M.C.
 Chief, Chromatographic Analysis Branch
 Organic Environmental Chemistry Division

Peter Fianu
 PETER FIANY
 Chief, Metals Analysis Branch
 Radiological and Inorganic Chemistry Division



DEPARTMENT OF THE ARMY CPT Springer/csp/AUTOVON
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

584-2024

REPLY TO
ATTENTION OF

HSHB-ES/WP

22 MAR 1984

SUBJECT: Preliminary Report, Hazardous Waste Study No. 37-26-0453-84,
Investigation of Soil Contamination at Open-Burning Grounds,
Longhorn Army Ammunition Plant, Marshall, Texas, 6-17 February 1984

Commander
US Army Materiel Development
and Readiness Command
ATTN: DRCSG
5001 Eisenhower Avenue
Alexandria, VA 22333

1. AUTHORITY. Letter, DRCSG-S, HQ DARCOM, 14 November 1983, subject: USAEHA Assistance, and inclosure thereto.

2. REFERENCES.

a. Letter, HSHB-ES/WP, this Agency, 3 January 1984, subject: Hazardous Waste Special Study No. 37-26-0291-84, Longhorn Army Ammunition Plant, Marshall, Texas, 29 October - 2 November 1982.

b. Letter, HSHB-ES-E/WP, this Agency, 21 September 1983, subject: Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-Detonation Grounds Evaluation, Longhorn Army Ammunition Plant, Marshall, Texas, 31 July - 3 August 1981.

c. Draft Final Report No. DRXTH-AS-CR-83236, subject: Longhorn Army Ammunition Plant Contamination Survey, Environmental Protection Systems, Inc., Pensacola, Florida.

3. PURPOSE. This study was conducted to determine the extent of horizontal and vertical migration of barium contamination in the soil of the burning grounds at Longhorn Army Ammunition Plant (LHAAP).

4. GENERAL.

a. Background. This study was requested by HQ US Army Armament Materiel and Chemical Command based on reports (references 2a and 2b) of barium contamination at the LHAAP open-burning pits and in the sediment of the unlined evaporation pond. Reference 2c reported that barium contamination had also been detected in ground-water monitoring wells in the burning ground area. Figure 1 shows the location of the burning ground with respect to other major facilities on the installation.

HSHB-ES/WP

SUBJECT: Preliminary Report, Hazardous Waste Study No. 37-26-0453-84,
Investigation of Soil Contamination at Open-Burning Grounds,
Longhorn Army Ammunition Plant, Marshall, Texas, 6-17 February 1984

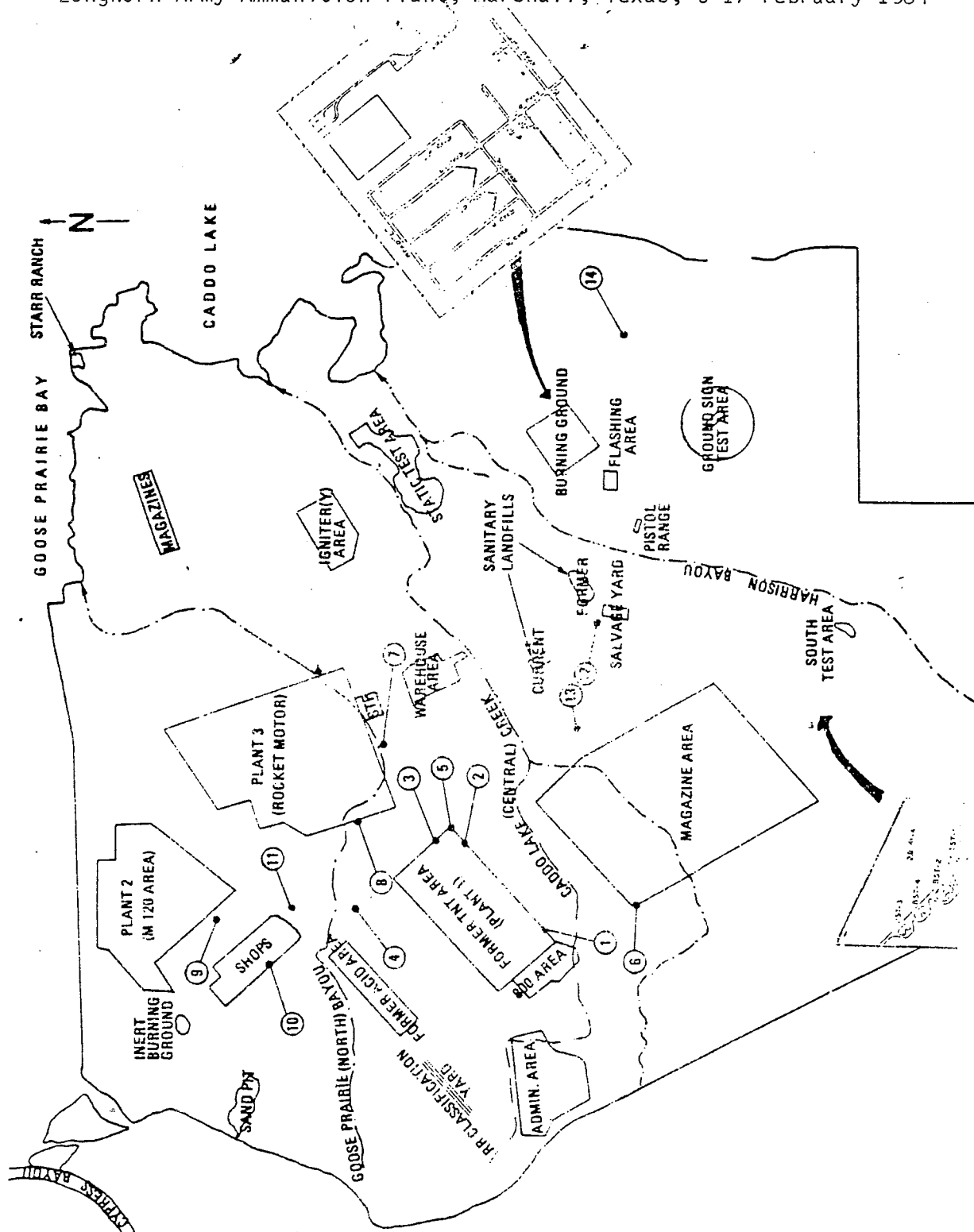


FIGURE 1. LHAAP

HSHB-ES/WP

SUBJECT: Preliminary Report, Hazardous Waste Study No. 37-26-0453-84,
Investigation of Soil Contamination at Open-Burning Grounds,
Longhorn Army Ammunition Plant, Marshall, Texas, 6-17 February 1984

LEGEND

● Bore Holes Drilled

▲ Bore Holes Omitted

Scale: 1" = 200'

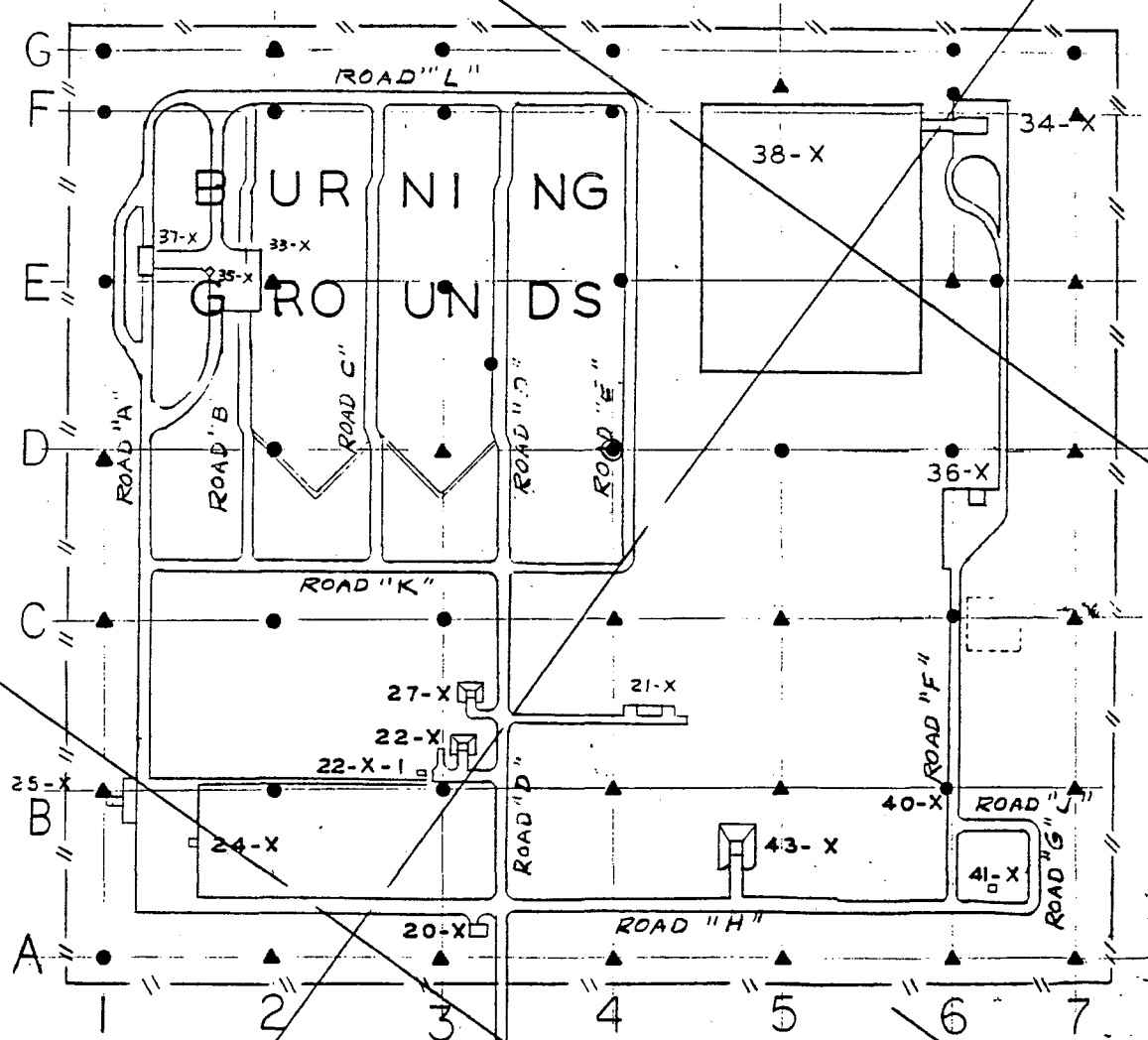


FIGURE 2. BURNING GROUND, LHAAP.

5 970 5
2-01850
1-0-1

DRSAR-ISE (6 Jan 83) 2d Ind CPT McNulty/11/AUTOVON 793-6244
SUBJECT: Preliminary Report, Hazardous Waste Special Study No. 39-26-0291-83,
Longhorn Army Ammunition Plant, Marshall, TX, 29 Oct - 3 Nov 1982

HQ, ARRCOM, Rock Island, IL 61299 **28 FEB 1983**

TO: Commander, Longhorn AAP, ATTN: SARLO-EN

Subject preliminary report forwarded for information and appropriate action.

PCO concurrence has been received.

FOR THE COMMANDER:

1 Incl
nc



RONALD T. SHINBORI
Chief, Environmental Quality Division

DRCSG-S (6 Jan 83) 1st Ind

SUBJECT: Preliminary Report, Hazardous Waste Special Study No. 39-26-0291-83,
Longhorn Army Ammunition Plant, Marshall, TX, 29 Oct - 3 Nov 1982

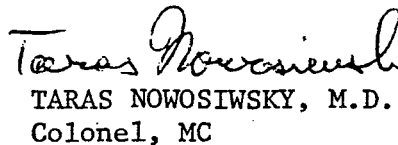
HQ, USA DARCOM, 5001 Eisenhower Avenue, Alexandria, VA 22333 4 Feb 83

TO: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-ISE,
Rock Island, IL 61299

Subject report has been reviewed by this office and is forwarded for
information.

FOR THE COMMANDER:

1 Incl
nc


TARAS NOWOSIWSKY, M.D.
Colonel, MC
Command Surgeon

CF:
DRCIS-A
DRCIS-EF
DRCIS-RI-IU
DRXTH-ES
DAEN-ZCE
DAEN-MPO-U
HSHA-IPM

REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY CPT Wiggans/dkw/AUTOVON
ABERDEEN PROVING GROUND, MARYLAND 21010 584-2024

6 JAN 1983

HSHB-ES-T

SUBJECT: Preliminary Report, Hazardous Waste Special Study No. 39-26-0291-83,
Longhorn Army Ammunition Plant, Marshall, TX, 29 Oct - 3 Nov 1982

Commander
US Army Materiel Development and
Readiness Command
ATTN: DRCSG
5001 Eisenhower Ave.
Alexandria, VA 22333

The inclosed report summarizes preliminary findings and conclusions resulting
from subject study. A final report will be forwarded in approximately 3 months.

FOR THE COMMANDER:

1 Incl
as


NELSON H. LUND, P.E.
Colonel, MSC
Director, Environmental Quality

CF:
Cdr, HSC (HSPA-P)
Cdr, ARRCOM (DRSAR-SG)
Cdr, MEDDAC Ft Hood (PVNTMED Actv) (2 cy)
C, USAEHA Rgn Div-South



REPLY TO
ATTENTION OF

HSHB-ES-T

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

PRELIMINARY REPORT
HAZARDOUS WASTE SPECIAL STUDY NO. 39-26-0291-83
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS
29 OCT - 3 NOV 1982

1. **AUTHORITY.** Message, HQ DARCOM, DRCIS-A, 031626Z Feb 82, subject: Request for Assistance, Installation Wastewater Evaporation Lagoon, Longhorn AAP.

2. **PURPOSE.** To sample and characterize liquid and solid wastes contained in the hazardous industrial waste surface impoundment and to evaluate treatment and disposal alternatives for these wastes.

3. **GENERAL.**

a. Background. This study constitutes the second phase of this Agency's effort to assist in the development of alternative treatment and disposal strategies for wastes entering the hazardous industrial waste surface impoundment. The first phase consisted of Hazardous Waste Special Study No. 39-26-0215-82, conducted during the period 16-27 July 1982 for the purpose of characterizing and determining the generation rate of hazardous wastes collected in the sumps servicing active installation industrial operations facilities, primarily buildings involved in the preparation and mixing of illuminants, ignitors, intermediate charges, and first fire materials. These data will be used to investigate alternative methods for the treatment and disposal of these hazardous industrial wastes. Data resulting from this particular investigation of the surface impoundment will support the development of treatment and disposal methods for the eventual closure of the surface impoundment, after the alternative treatment system is constructed and on-line.

b. Personnel contacted.

(1) Mr. D. Maley, Chief Engineer, DAC.

(2) Mr. A. B. Childress, Occupational and Environmental Health Coordinator, Thiokol Corporation.

(3) Mr. A. Morgan, Burning Ground Operator, Thiokol Corporation.

4. **FINDINGS AND DISCUSSION.**

a. General. Sampling was performed at the hazardous industrial waste surface impoundment, also known as the unlined evaporation pond (UEP), which is located within the burning ground area of Longhorn Army Ammunition Plant (LHAAP) (see Fig 1). In general, the UEP currently receives wash water, solvent residues,

Preliminary Report, Hazardous Waste Special Study No. 39-26-0291-83, Longhorn Army Ammunition Plant, Marshall, Texas, 29 Oct - 3 Nov 1982

and solids collected from buildings involved in pyrotechnic material preparation and mixing, as well as water, essentially precipitation, pumped from sumps of inactive industrial operations buildings. The UEP has been in use since the mid 1950's for collecting and holding various aqueous and solid wastes.

b. Sample Collection.

(1) Prior to sampling, the UEP was measured and a sampling grid utilizing EPA sampling methodology, containing 16 sample points was established (see Fig 2). Aqueous, sludge, and soil samples were collected at each point. In addition, a composite sample of floating material from various locations in the UEP and a sample from an exposed sludge mound near the truck discharge point were also taken. Water depth, sludge depth, pH and conductivity were measured at each grid point. Due to less than normal rainfall to date, the water level of the UEP was approximately 2 feet lower than usual at this particular time of the year. The UEP is approximately 12 feet from the top of the berm to the bottom of the pond. The water averaged 6 1/2 feet in depth, while the sludge layer ranged from 2-12 inches in depth at the sampled locations. Diagrams, based on limited measurements and estimates, showing the approximate UEP bottom contour and sludge layer contour, are provided in Figures 3 and 4, respectively (Fig 3. depths are from surface of UEP).

(2) Field measurement results for pH and conductivity on aqueous samples are listed in the Table (Appendix). The pH averaged 10.75 while the conductivity ranged from 2250 to 2500 μ mhos/cm. The pH was measured on several sludge samples and averaged 11.5.

(3) A modified composite liquid waste sampler was used to collect the aqueous samples from the UEP in an effort to obtain a column of liquid representing the entire depth of the pond. The object was to include subsurface waste layers in the sample in the event they existed. The turbid conditions made it difficult to visually confirm the existence of any layering. Sludge samples were collected at each point using a clamshell dredge. Soil samples were obtained by manually hammering in 3 inch OD shelby tubes and extracting the sample from the tubes. The depth of penetration into the soil varied from 12-15 inches depending on the type of soil encountered. The soils found in sample points 1 through 8 were typically clays, while points 9 through 16 consisted of sandy silt soils.

c. Sample Analysis. Analyses of aqueous, sludge and soil samples will include general hazardous waste categories as well as additional inorganic and organic constituents suspected of being present in wastes generated during past and present production. All analyses are scheduled to be completed by Jan 83. The results of the chemical analyses will be presented and discussed in the final report.

5. CONCLUSIONS.

a. Aqueous and sludge samples collected during the field study should provide an adequate characterization of wastes contained in the UEP.

b. Field measurements indicated that the aqueous and sludge phases of the waste are alkaline in nature.

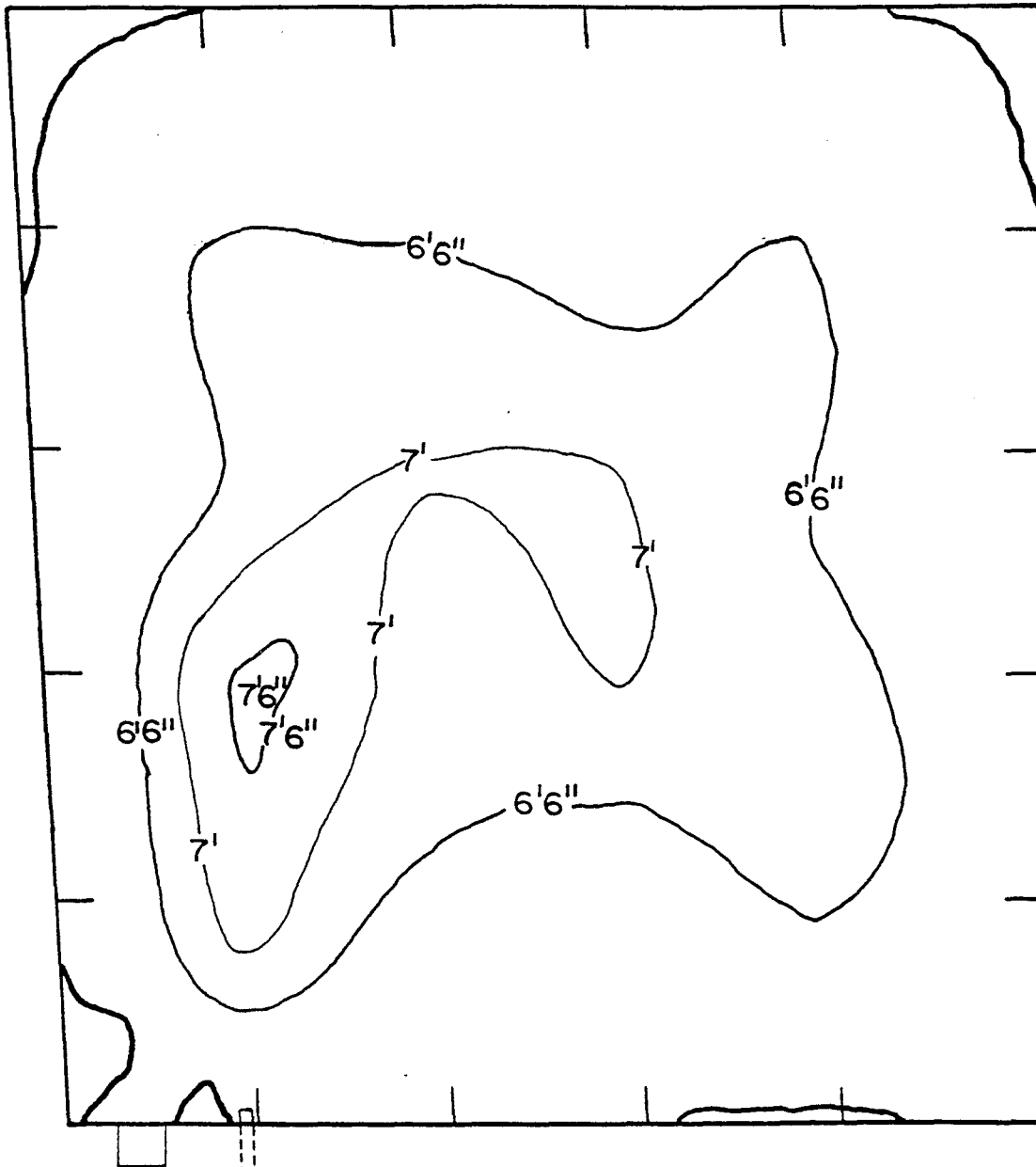


Figure 3 UEP BOTTOM CONTOUR

U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY

WASTE DISPOSAL ENGINEERING DIVISION

DATE 12-20-82

DRAWN QPB

APPR. KEW

APPENDIX

FIELD MEASUREMENTS

SAMPLE POINT	pH	CONDUCTIVITY (umhos/cm)
01	10.5	2500
02	10.5	2450
03	10.5	2550
04	10.5	2350
05	10.5	2300
06	10.5	2500
07	10.5	2350
08	10.5	2250
09	11.0	2400
10	11.0	2350
11	11.0	2300
12	11.0	2250
13	11.0	2300
14	11.0	2300
15	11.0	2400
16	11.0	2400

Prepared for:

U.S. ARMY ENGINEERING DIVISION, HUNTSVILLE
P.O. Box 1600
Huntsville, Alabama 35807

GROUNDWATER QUALITY ASSESSMENT
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS

Groundwater Contamination Related to
Seepage from an Unlined Evaporation Pond

Contract No. DAC87-830-C-0091
March 15, 1985 Vol. I - Text

Prepared by:

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environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

3445 Executive Center Drive, Suite 220
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March 15, 1985

Commander
U.S. Army Engineering Division,
Huntsville
ATTN: HNDED-PM, Mr. Wendell C. King
106 Wynn Drive
Huntsville, Alabama 35807

RE: Contract DSC87-83-0091

Dear Sir:

Transmitted herewith is Camp Dresser & McKee Inc.'s final report "Groundwater Quality Assessment, Longhorn Army Ammunition Plant, Marshall, Texas: Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond." The report contains a summary of data acquired previously by USATHAMA and USAEHA, data acquired by Camp Dresser & McKee Inc., and conclusions with respect to groundwater contamination in the vicinity of the unlined pond. Comments on the Draft Groundwater Quality Assessment and responses are contained in the last section of this report.

We are prepared to come to Huntsville and present the results of the Groundwater Quality Assessment if that is desired. We appreciate the opportunity to perform these investigations and look forward to future work with you.

Should you have any questions, please do not hesitate to contact us.

Sincerely yours,

CAMP DRESSER & McKEE INC.

A handwritten signature in dark ink, appearing to read 'Robert S. Kier', written over the printed name.

Robert S. Kier
Deputy Program Manager

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SECTION 1. SUMMARY

The purpose of this report, prepared by Camp Dresser & McKee Inc. (CDM), is to present an initial assessment of groundwater quality in the vicinity of the Active Burning Grounds of Longhorn Army Ammunition Plant (LHAAP) near Marshall, Texas. The focus of the report is on the extent, rate of migration, and concentration of groundwater contamination related to leakage from an unlined evaporation pond (UEP) in the northern corner of the Active Burning Grounds. The intent in performing this initial assessment is:

- 1) To bring together into a single document all the information relevant to suspected groundwater contamination.
- 2) To present the results of the laboratory analyses performed for CDM on samples obtained from wells installed before this study and the hydrodynamic evaluation and analytical results for samples obtained from monitor wells installed outside of the Active Burning Grounds during the course of the study
- 3) To evaluate the significance of these data with respect to groundwater contamination that might result from leakage of wastewater placed into the pond since its construction.
- 4) To make recommendation, along with justifications, for installation of additional wells and further sampling and testing.

Previous investigations of potential groundwater contamination have been carried out by or under the auspices of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) and the U.S. Army Environmental Hygiene Agency. With respect to contamination emanating from the UEP, these investigations have consisted of:

- Determining potential sources of ground (and surface) water contamination.
- Installation and sampling of twenty-three monitor wells in the vi-

cinity of the UEP and chemical analyses of the water and selected soils samples from the wells.

- Water level measurements and well logs.
- Sampling and analyses of surface stream waters and stream bottom sediments.
- Chemical analyses of liquid wastes and sediments in sumps that are periodically pumped out and disposed of in the UEP.
- Chemical analyses and materials types of the liquid and sludge materials in the UEP and the underlying soils.

There is no historical record of the kinds of wastes or waste products which have been placed in the UEP since it was constructed. USAEHA's 1982 study of wastes accumulating in LHAAP plant sumps found significant concentrations of metals, nitrate and phosphate, and organic solvents in the wastes that are currently being discharged to the UEP. Analyses of the liquid and bottom sludge in the UEP showed that the pond liquid and bottom sludge are highly alkaline (ave. pH= 10.75 and 11.85, respectively). Nitrate, fluoride, strontium and barium concentrations are high in the pond water and the concentration of barium is also high in the bottom sediment.

Monitor well water level data and groundwater sample analyses obtained by USATHAMA and USAEHA present a confusing picture as to what contaminants are leaking from the UEP and where they are being transported by the underlying groundwater. Although the available data suggest that leakage from the UEP is contributing to groundwater contamination, the data contain numerous inconsistencies within data sets, between repetitive data sets acquired by a single investigating agency and among the data acquired by different investigating agencies. No previous investigative group has attempted to explain and logically integrate the water level and quality data into a comprehensive evaluation of groundwater contamination related to the UEP. Compounding the problem is the fact that the UEP is not the only potential source of groundwater contamination on the LHAAP.

Based on the previously collected data and the lithologic, water level, and quality data obtained for this study, the following conclusions are offered:

- The hydrologic system in the vicinity of the Active Burning Grounds is behaving as a two layer aquifer system.
 - The upper layer is a perched aquifer supported by downward infiltration at the Active Burning Grounds. Disturbed drainage has contributed to the recharge and clearing of trees from the site has reduced transpiration losses.
 - The lower layer is a more regional flow system, flowing generally toward Caddo Lake and discharging also into Harrison Bayou and probably Saunders Branch. Downward leakage from the upper aquifer has distorted the hydrologic regime in the lower aquifer.
- Leakage from the UEP is neither the principal source of recharge to the groundwater mound beneath the Active Burning Grounds nor the major source of contamination detected in the groundwater system
 - The center of the mound lies south and east of the pond. Leakage along well bores contributes to recharge of the mound, but direct infiltration is probably more significant.
 - Quality data show that most of the contamination detected in the groundwater has entered the system through and south of the berm surrounding the UEP, near the incinerator at the western corner of the Active Burning Grounds, and near Well No. 126 at the entrance to the Active Burning Grounds. Contamination that occurs at Well C-6 may also be being introduced elsewhere.
 - Most of the contaminants introduced into the UEP have probably remained there; leakage to the north is probably the principal avenue of escape.

- Contamination related to the UEP and the Active Burning Grounds has not moved far in significant concentrations, except, perhaps, toward well C-6.
- Harrison Bayou may be receiving discharge of contaminated groundwater.
- A contamination plume may extend to the northeast of the Active Burning Grounds past Well C-6; the principal source of this contamination is likely not the pond, however, and may not even be the Active Burning Grounds.

Data obtained to date fulfills Federal Regulations CFR 265.93 (d)(4), which requires determination of rate and extent of migration as well as concentrations of hazardous waste or hazardous waste constituents in the groundwater. The data indicate that closure of the pond and removal of its contaminated material should be sufficient action to clear up contamination associated with leakage from the pond, but not all the contamination in the general vicinity of the Active Burning Grounds.

SECTION 2. INTRODUCTION

2.1 PURPOSE

The purpose of this report is to present a preliminary groundwater quality assessment with respect to the rate, extent and concentration of contamination in groundwater within or adjacent to the Longhorn Army Ammunition Plant (LHAAP) near Marshall, Texas. The scope of the report and subsequent work efforts is limited, however, to contamination related to seepage of waste materials placed in an unlined evaporation pond (UEP) located within a clearing known as the Active Burning Grounds. A summary of the intent of this assessment is:

1. To bring together into a single document all the relevant information pertaining to operation of the pond and indicated contamination of the groundwater.
2. To present the results of construction and sampling of six newly installed monitor wells and the laboratory analyses of samples obtained from those wells and the previously installed wells.
3. To present an evaluation of all available data with respect to the rate of movement, extent, and concentrations of groundwater contamination attributable to leakage from the UEP.
4. To provide the basis and justification for siting and installation of additional wells, if necessary, to further define the rate, extent and concentration of contamination that may have emanated from the UEP.

The work and evaluations described in this report were performed in accordance with Contract No. DACA87-83-C-0091 with the Huntsville Division of the U.S. Army Corps of Engineers. This assessment has been submitted to the contracting officer for review and approval prior to performing additional work. The contract and the scope of work, along with contract modification P00002 are contained in Appendix A (Volume II).

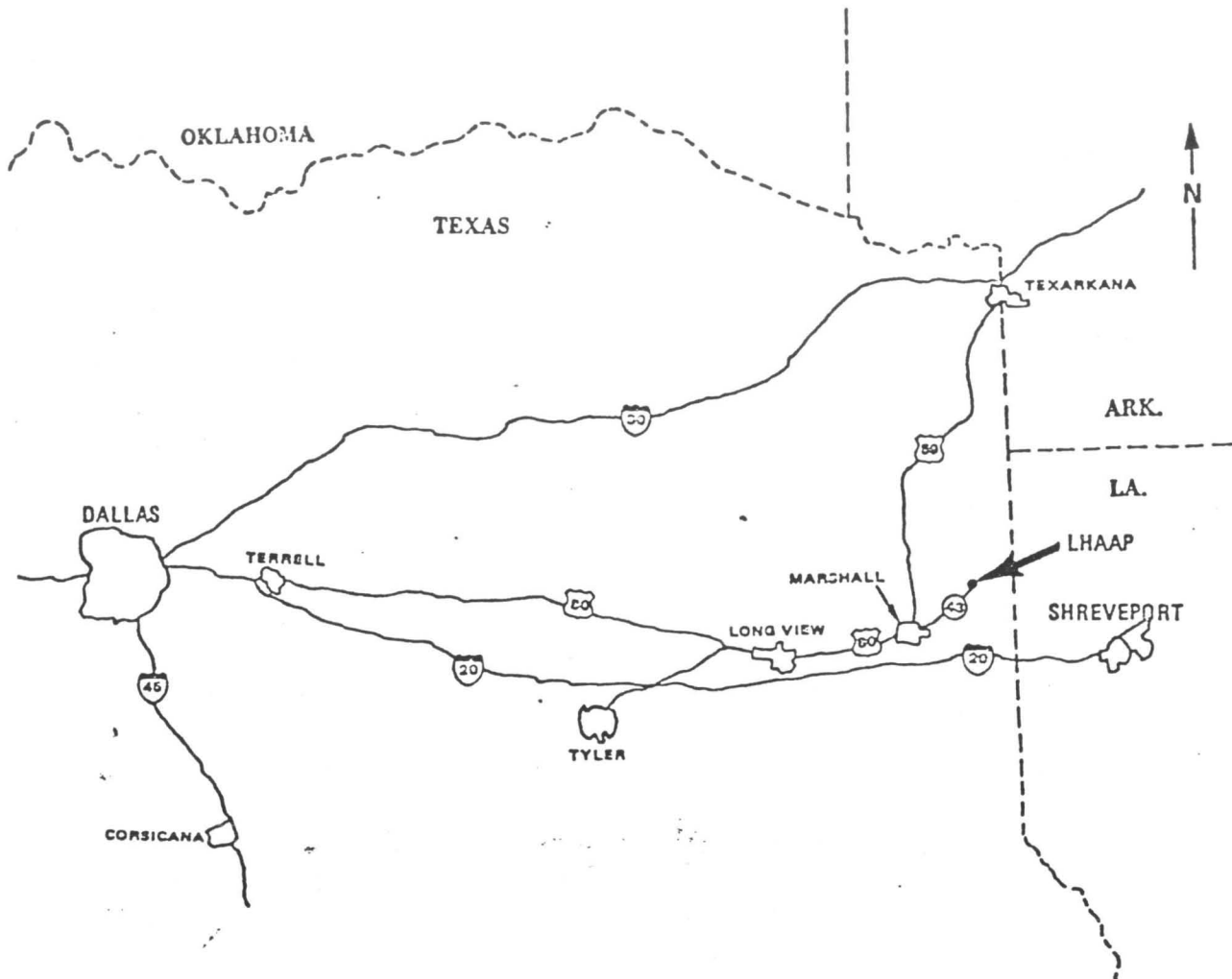
2.2 LOCATION OF LHAAP

LHAAP occupies approximately 8,542 acres in Harrison County, Texas. The facility is located on the southwestern shore of Caddo Lake, approximately 15 miles northeast of Marshall, Texas, and approximately 38 miles west-northwest of Shreveport, Louisiana (Figure 1). Karnack, at the entrance to the facility on the west, and Uncertain, on the north, are the nearest incorporated municipalities. An unnamed community where the eastern border of the facility intersects the shore of Caddo Lake is the only other nearby concentration of population.

2.3 GENERAL SETTING

LHAAP is located in a region of Texas known as the Pineywoods, a deep inland extension of the Gulf Coastal Plain that also covers portions of Louisiana, Arkansas and Oklahoma. The area is characterized by mixed pine-hardwoods that cover a gently rolling to hilly terrain. Much of the installation is still under a forest cover. Three basic types of forest cover have been identified: Loblolly-short leaf pine, pine-hardwoods and mixed hardwoods. The loblolly-short leaf pine occurs on subdued ridges and slopes where the depth to groundwater is greatest. The mixed hardwoods, such as red maple, sweetgum and bald cypress, occur in the bottom lands where groundwater is very close to the ground surface (less than five feet). The pine-hardwood group occupies the lower ridges and slopes where the depth to groundwater is intermediate and fluctuates seasonally. Locally, grasslands occur, consisting predominantly of broom sedge, bermuda, panic and vasey grasses. Wildlife on the installation consists of four mammal species--fox squirrel, gray squirrel, armadillo and feral dogs--and a large number of permanent and migratory birds.

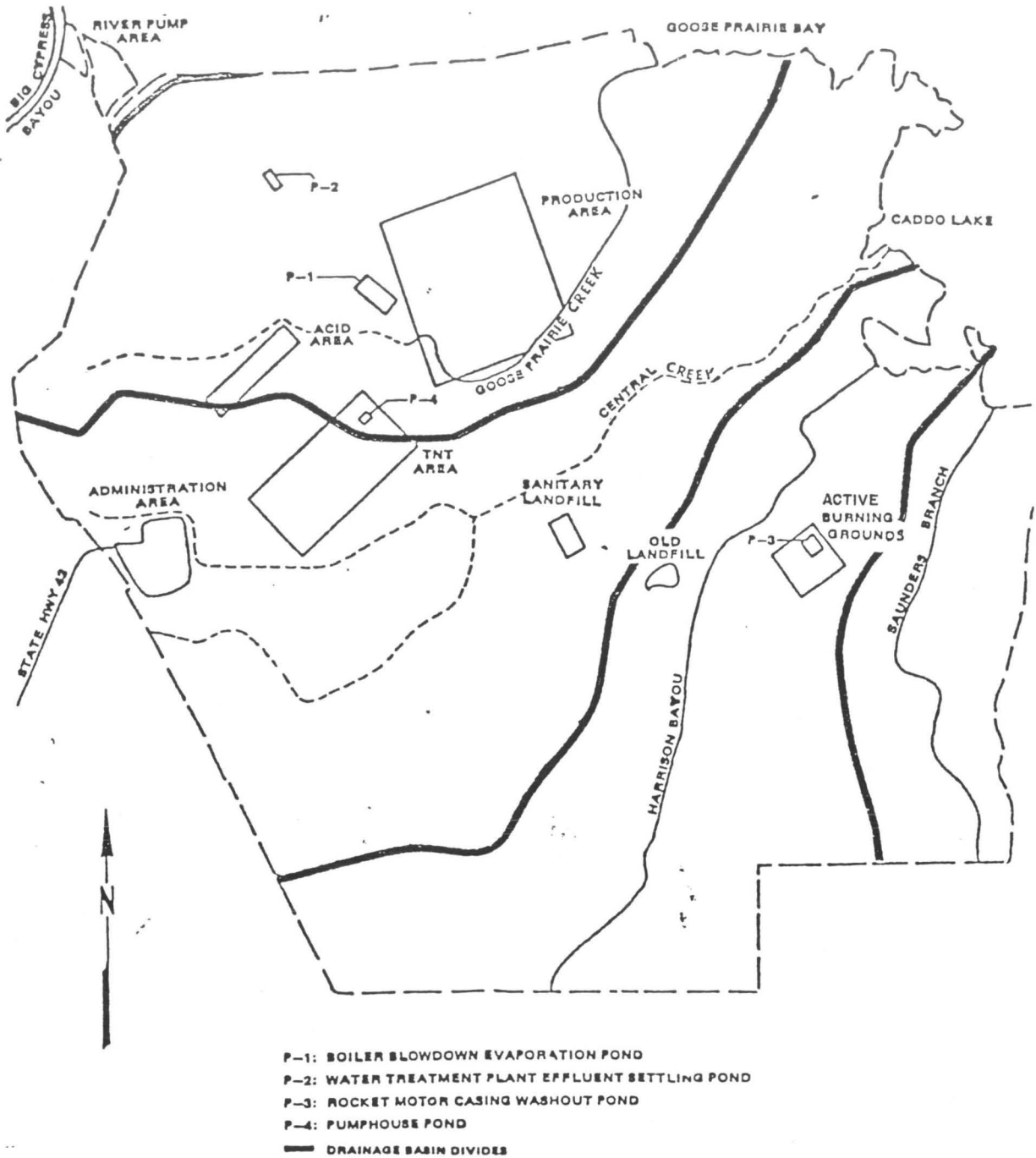
LHAAP is drained by four streams or bayous which empty into Caddo Lake (Figures 2 and 3). The northern two bayous originate on the installation and are unnamed. (These streams are identified as Goose Prairie Creek and Central Creek on Figure 2, but these names are not shown on U.S. Geological Survey 7-1/2 minute topographic maps of the area.) The northern two

Figure 1**LHAAP SITE LOCATION**

**CONTAMINATION SURVEY
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS**

**U. S. ARMY TOXIC AND HAZARDOUS
MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND**

FIGURE 2

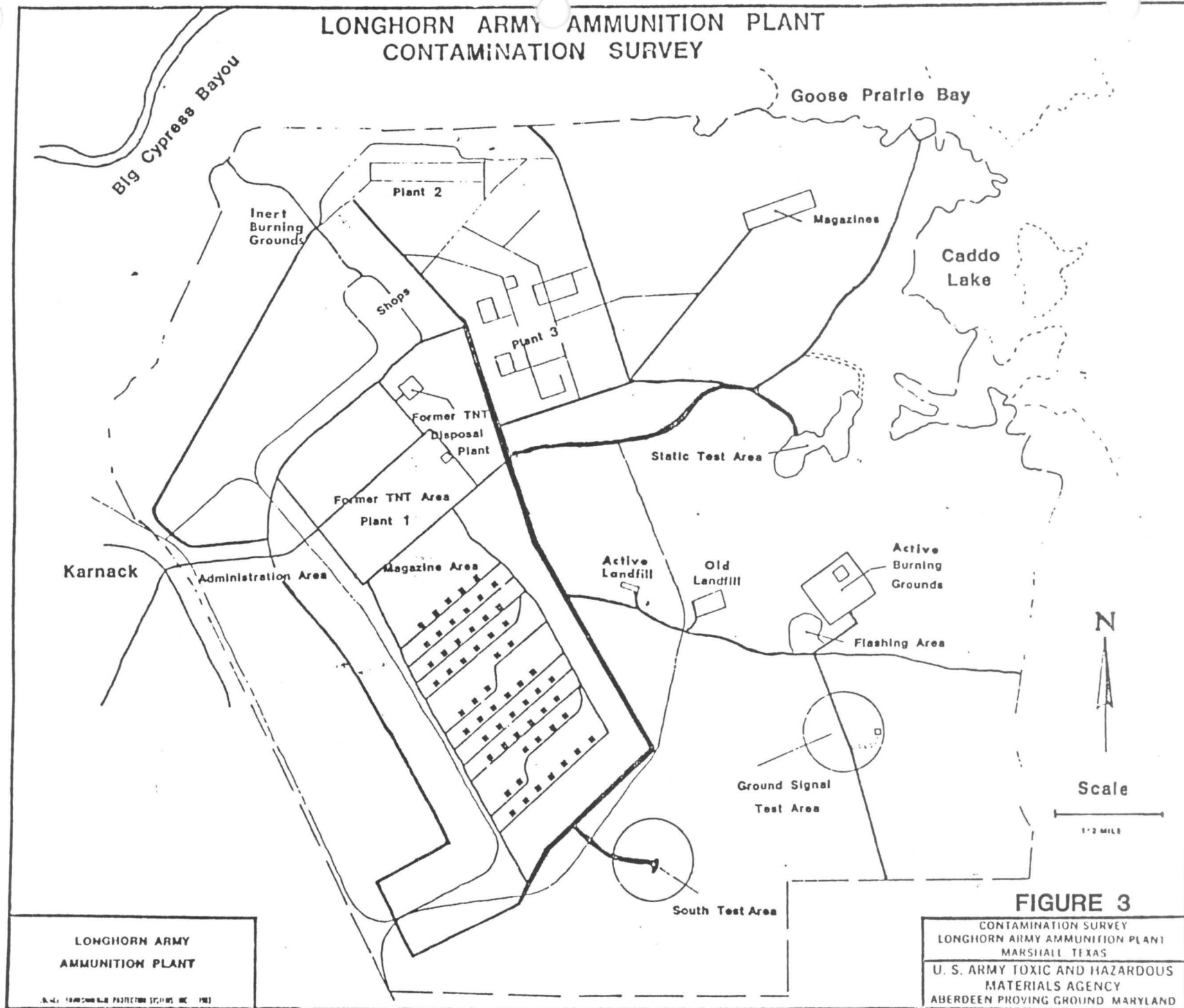


DRAINAGE BASINS
AND
HOLDING PONDS

CONTAMINATION SURVEY
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS

U. S. ARMY TOXIC AND HAZARDOUS
MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND

LONGHORN ARMY AMMUNITION PLANT CONTAMINATION SURVEY



LONGHORN ARMY
AMMUNITION PLANT

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY

streams are probably not of concern with respect to contamination from the UEP.

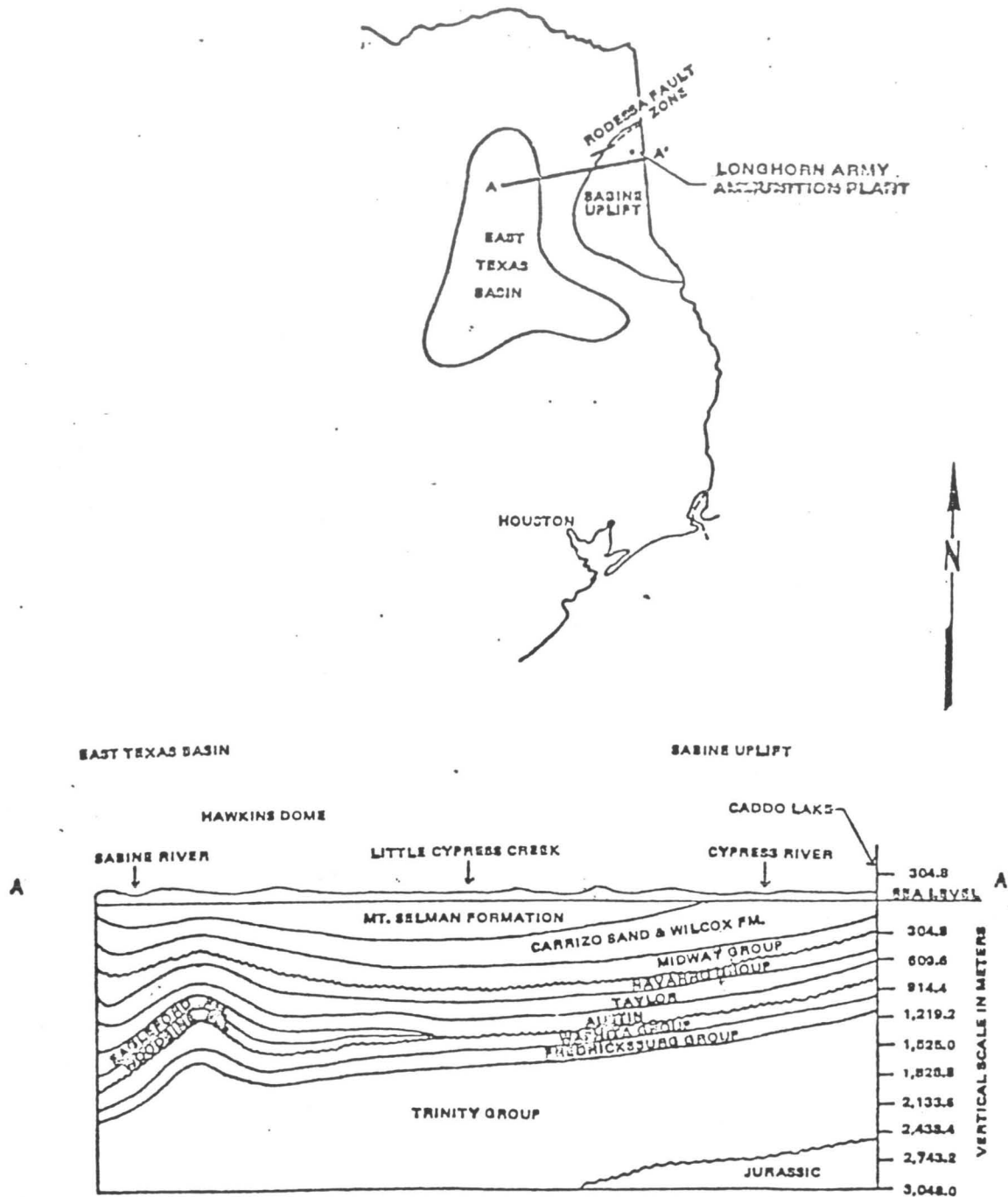
Harrison Bayou, the principal bayou in the southern part of the installation, originates off the installation and flows past the northwest side of the Active Burning Grounds. Harrison Bayou drains approximately 50 mi² of woodlands and farmland, of which about 4 mi², or 30 percent of the installation, is on LHAAP grounds. There are no known industrial or municipal discharges to Harrison Bayou, nor any known point discharges on the installation. Besides the Active Burning Grounds, Harrison Bayou also flows past the Old Landfill, the Old Burning Grounds (Flashing Area), the Static Test Area (Ground Signal Test Area), and the Bomb Test and Demolition Areas.

Saunders Branch, which also originates off the installation, is the fourth bayou and flows northward just west of the eastern boundary of the installation and immediately to the east of the Active Burning Grounds. Total drainage area of Saunders Branch is 3.4 mi² of which 1.4 mi², or 11 percent of the installation, is on LHAAP grounds. All the drainage basin is comprised of farmlands or woodlands.

Geologically, LHAAP lies on the north side of a structural high called the Sabine Uplift. Strata dip gently to the north-northwest into an extension of the East Texas Basin or Embayment, which wraps around the Sabine Uplift on the north to join the North Louisiana Basin further east (Figure 4).

The principal geologic formations of interest are the Wilcox Group and the Carrizo Formation. These formations, of Early Tertiary age, consist predominantly of fluvial-deltaic sand and mud. For the most part, although the groundwater hydrology of the area is complex, from a regional basis the Wilcox and Carrizo, along with the overlying Reklaw and Queen City Formations, are considered as a single aquifer known as the Cypress aquifer. In that only the Wilcox, along with some younger alluvium and terrace deposits, occur at LHAAP; the other formations are not of concern. At LHAAP, the aquifer is about 350 feet thick and consists entirely of the Wilcox Group and the younger alluvial deposits. The base of the Wilcox is considered to be the base of fresh water in the area.

FIGURE 4



GEOLOGIC STRUCTURE

CONTAMINATION SURVEY
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS

U. S. ARMY TOXIC AND HAZARDOUS
MATERIALS AGENCY
ABERDEEN PROVING GROUND, MARYLAND

To date, soils mapping in Harrison County by the U.S. Soil Conservation Service (SCS) has not been completed. Preliminary information indicates that within the immediate vicinity of the UEP, three basic soils series have been identified (Figure 5). Descriptions of these soils series are presented in Table 1. Most of the soils in the area have been derived from weathering of the underlying Wilcox Group. Based on the soils mapping, much of the upland area between Harrison Bayou and Saunders Branch, including part of the Active Burning Grounds, may be a remnant of a fluvial terrace deposited on the Wilcox. The UEP, however, is not on this terrace. Modern alluvial deposits also occur in the floodplains of the nearby streams.

2.4 HISTORY OF LHAAP OPERATION

LHAAP is a government-owned, contractor-operated (GOCO) industrial facility under the jurisdiction of AMCCOM. Its primary mission is to load, assemble and packout pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The Longhorn Division of Thiokol Corporation is the current operating contractor.

Operation of LHAAP began on October 19, 1942, with the production of TNT flake in the Plant 1 area (Figure 3). Monsanto Chemical Company was the first contract operator of the plant. Production of TNT continued through World War II until August 15, 1945. By June of 1946, the Monsanto's role ceased and the plant went on standby status as a government-owned, government operated (GOGO) facility. Standby status continued until February, 1952. From June 18, 1952, to August 31, 1956, Universal Match Corporation was the operating contractor, producing pyrotechnic ammunition.

In November 1955, Thiokol Corporation began operation of the Plant 3 area rocket motor facility. Thiokol assumed responsibility for total operation of the facility with the departure of Universal Match Corporation in 1956. Production of rocket motors continued to be the primary mission until 1965. Production of pyrotechnic and illuminating ammunition was then reestablished. Appendix B (Volume II) contains a list of the items produced at LHAAP,

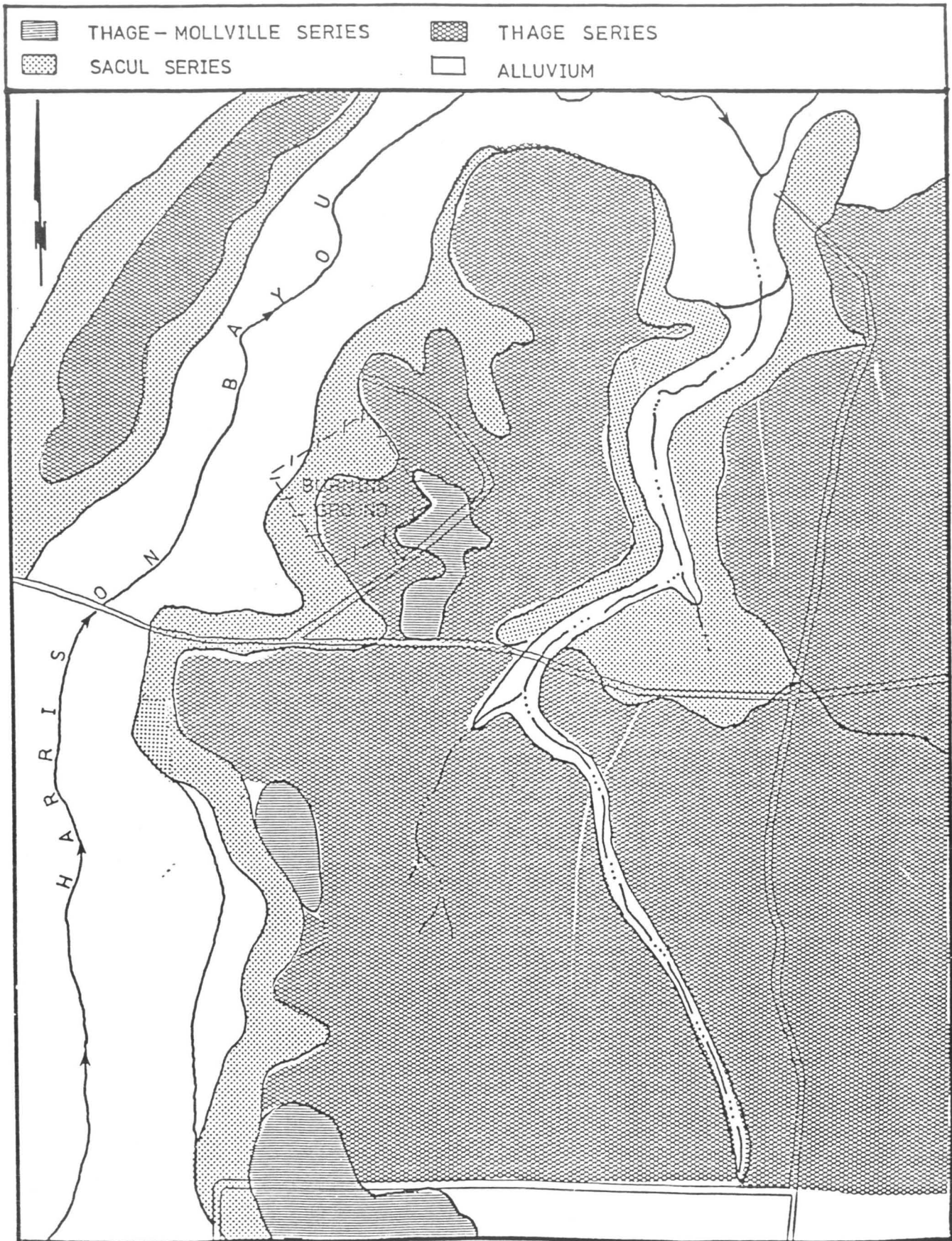


FIGURE 5 SOILS MAP OF BURNING GROUNDS/UEP AREA

Table 1

Soil Series in Vicinity of UEP*

Thage Series. This soil series ranges from a loam (on the surface) to a clay loam at depth (fluvial terrace). It occupies the nearly flat areas in the uplands between streams. The soil is fairly acid, ranging from a pH of 4.5 to 6.5. It is a deep, somewhat well drained soil whose permeability is moderate (2 to 6 in/hr) but decreases with depth to (0.2 to 0.6 in/hr). The percent clay increases with depth from 15 to 35 percent. A fragipan occurs at a distance of 32 to 42 inches below the surface.

Thage-Mollville Series. This soil series occurs in localized depressions in the upland areas. It ranges from a loam on the surface to a silty clay loam at depth (fluvial terrace). The soil is fairly acid on the surface like the Thage-Cart series but tends to become more basic with depth. It is a deep, poorly drained soil whose permeability is low (0.2 to 0.16 in/hr) and decreases with depth to a very low permeability (0.06 to 0.2 in/hr). The percent clay is high and increases with depth to 35 percent.

Sacul Series. This is the soil series on which the UEP is located (weathered Wilcox Group). This series ranges from loam on the surface to a clay with depth. It is a deep, moderately well drained soil that occupies the slopes of the uplands (5 to 20 percent slopes) in the LHAAP area. The soil is acid (pH - 4.5 to 5.5), and pH is consistent with depth. It is of low permeability (0.2 to 0.6 in/hr), and the permeability decreases with depth (0.06 to 0.2 in/hr). The clay content increases with depth. From approximately 10- to 25-inches below the surface, a red clay layer is normally present which ranges from 35 to 60 percent clay content. No fragipan occurs in this series.

*Modified from USAEHA, Groundwater Quality Assessment Plan No. 38-26-0252-83, 28 March - 1 April 1983.

the chemical compositions of the various components of a number of the devices, as of 1975, and materials for which LHHAP must maintain mobilization capacity or production.

2.5 PREVIOUS INVESTIGATIONS AND SOURCES OF DATA

Several governmental agencies have investigated and assessed operations and potential contamination problems at LHAAP in general, and the UEP in particular. Both the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) and the U.S. Army Environmental Hygiene Agency (USAEHA) prepared reports during 1983. USATHAMA's report (Longhorn Army Ammunition Plant Contamination Survey) is more general and deals with the entire installation. A draft report was issued in June 1983; the final report was released in June 1984. Much of the actual work for USATHAMA's study was performed by a private contractor, Environmental Protection Systems, Inc. (EPS) of Pensacola, Florida. Thirty-two wells, of which eight are near the UEP, were installed by EPS and sampled on a one-time basis.

USAEHA's study (most recent) focused principally on the UEP. The purpose of their study was to develop a groundwater quality assessment plan consistent with the requirements of the Resource Conservation and Recovery Act (RCRA) and the industrial solid waste rules of the State of Texas. A draft report was prepared at the end of March, 1983. This report was subsequently accepted as final. Thirteen wells were installed around the UEP by USAEHA. All the USAEHA wells and the USATHAMA wells were sampled by USAEHA. In addition, the USAEHA wells have been sampled quarterly since November 1981.

Prior to submission of the above reports, numerous preliminary reports and letters summarizing findings and progress were prepared. Appendix C (Volume II) is a list of all reports that appear to be pertinent to contamination related to seepage from the UEP. Most of these have been examined in preparing this summary report; those that were examined are indicated with an asterisk. The others could not be located during the course of this study.

2.6 CONTACTS

The following people have been contacted during preparation of this summary report:

Mr. Don Maley, Chief Engineer, Thiokol Corporation, LHAAP

Mr. A. Bruce Childress, Environmental Coordinator, Thiokol Corporation, LHAAP

Mr. Bob Lee, Texas Department of Water Resources

Mr. Roger Young, USACOE, Huntsville Division

Mr. Joseph M. Murphy, Environmental Engineer, USATHAMA

Mr. John Bouer, USAEHA

Mr. Mark Nickolson, USAEHA

SECTION 3. UNLINED EVAPORATION POND

3.1 SETTING

The Active Burning Grounds are located on, but slightly to the west of, the crest of a small topographic divide between Harrison Bayou and Saunders Branch (Figures 2 and 3). The UEP is in the northern corner of the Active Burning Grounds, less than 0.25 miles east of Harrison Bayou and approximately 0.5 miles west of Saunders Branch. Access to the site is provided by Avenue Q.

The UEP appears to be constructed in soil developed from weathering of the Wilcox Group. The Wilcox Group in this area consists predominantly of fine sand and mud. Based on the original boring logs for the UEP, a clay layer 6.5 to 7.5 feet thick is reported to occur 2.0 to 3.5 feet below the ground surface at the UEP (USAEHA, 1983). Excavation of the pond, however, was reportedly extended below the clay layer. Boring logs of all wells made to date, however do not show any relatively continuous clay layer, but do indicate that strata below the UEP consist of interbedded sandy clay, clay and silty sand. Individual layers tend to be thin, of limited lateral extent, and correlation is difficult.

The Active Burning Grounds have been cleared of all wooded vegetation. Native grasses are the predominant vegetation types. Dense woodland surrounds the site on all sides except where the access road enters the Active Burning Grounds.

3.2 HISTORY OF USE

Use of the Active Burning Grounds began in the early 1950's (1954?). A variety of wastes and waste products from operations at LHAAP have been burned there, including industrial wastes, laboratory wastes, chemically contaminated scrap materials, transformer oil and red phosphorus. The site is still being used today. The principal incineration process is open air curtain destruction in an incinerator and in a trench. Three specially constructed cages are sometimes used for explosive materials.

In addition, in the past, certain industrial wastes apparently were buried in pits along the northwestern side of the Active Burning Grounds. Wastes from rocket motors, illuminating mixtures, waste oil, oxidizing agents (including ammonium perchlorate and sodium nitrate), sawdust and methylene chloride were buried there. Some of these buried wastes have been re-excavated and burned. Apparently, no TNT was buried there; however, TNT has been buried elsewhere on LHAAP.

The UEP was constructed in the northern corner of the Active Burning Grounds in 1963 as part of a washout facility for rocket motor casings. A report by USATHAMA, Report No. 150, "Installation Assessment of Longhorn Army Ammunition Plant" (February 1980), indicates that the pond was constructed in 1955. Design documents, however, suggest that the pond was built in the 1960's. The structure into which the rocket motors were placed is still located at the northern corner of the site. The dimensions of the pond are variously shown to be 260 feet by 260 feet and approximately 250 feet by 315 feet for outside edge of the embankments, depending on the source of the information. Measurement by CDM personnel and representatives of the Huntsville Division of the Corps indicate that the pond is approximately 260 to 265 feet on the northwest and southeast sides and approximately 325 feet on the northeast and southwest sides.

In 1972, when discharge of LHAAP wastewaters to surface streams was precluded by the Federal Water Pollution Control Act, the UEP became the receiving body for industrial wastewaters from washout water sumps on LHAAP. As of January 1984, an estimated 16,000 gallons per day of wastewaters, solvents and solids from approximately 112 sumps were discharged into the UEP by a vacuum truck, and sawdust impregnated with methylene chloride from cleaning operations was stockpiled along the southeast side of the pond. At one time (year not known), the pond was reportedly nearly overtopped and perimeter dikes, 2.5 to 3.0 feet high, were added. Since that time, there has been no record of surface discharges from the pond. Currently, LHAAP has ceased disposing of wastewater in the pond. As of June 1984, no new accumulations of sawdust were observed.

3.3 DISCHARGES TO THE POND

There are no daily logs of the specific types of wastes or waste products that have been placed into the UEP since its inception. USAEHA conducted a study (Hazardous Waste Special Study No. 39-26-0215-83) during the period 16-27 July 1982, to characterize and to determine the rate at which wastes are collected from the sumps at the active industrial operation facilities on the installation. These are primarily facilities involved in preparation and mixing of illuminants, ignitors, intermediate charges and first fire materials.

Of the approximately 60,000 gallons of wastewater generated per week at LHAAP, the USAEHA study determined that 21,000 gallons are from pyrotechnic material preparation and mixing. Samples of liquids and sediments in 51 sumps contained significant concentrations of metallic cations such as aluminum, arsenic, barium, cadmium, chromium, iron, lead, magnesium, sodium, strontium and zinc; nonmetallic anions such as nitrate/nitrite and phosphates; and organic solvents, including acetone, ethyl alcohol, methyl ethyl ketone, methylene chloride, and toluene. Sediments in sumps at several of the active, as well as the inactive buildings, contained high concentrations of aluminum (up to 26 percent), barium (up to 10 percent), iron (up to 10 percent) and magnesium (up to 40 percent). The sump sediments at several buildings were also found to be hazardous with respect to extraction procedure toxicity (EP toxicity) for barium, cadmium and chromium. Appendix D contains these analytical results.

3.4 POND QUALITY CHARACTERISTICS

USAEHA conducted several sampling and analysis programs of the UEP supernatant, benthic sediments and underlying soils between 1976 and 1981. Additional studies have been performed on the potential for leachate migration and subsequent groundwater contamination. The objectives and conclusions of some of these studies are summarized in Table 2.

USAEHA conducted a more recent sampling and analysis program (Hazardous Waste Special Study No. 39-26-0291-83, 37-26-0291-84) of the UEP waters,

TABLE 2
Summary of USAEHA Sampling Programs

Study No.	Date	Objective	Conclusions
24-0586-77	August 2 - 10, 1976	To characterize the liquid and settled sludges in the industrial waste sumps and the industrial waste pond to ascertain if the supernatant could be discharged directly to the surface drainage or would require treatment prior to discharge.	The high concentrations of barium, total nitrogen, lead and total solids render the supernatant quality unsatisfactory for discharge. The pond contents are chemically active (indicated by a drop on pH from 6.5 to 4.1 during storage and transport of samples) with no apparent point where waste supernatant is sufficiently stabilized to allow discharge.
38-26-0104-81	January 23 - February 8, 1980	To determine if groundwater contamination occurred in areas contiguous to the UEP as a result of leachate migration.	Barium, iron, manganese, total dissolved solids and nitrates exceeded drinking water standards and were prevalent throughout the field sampled. Cadmium and lead were prominent at single sites only.
32-62-0182-82	March 15 - September 30, 1981	To characterize the UEP supernatant and benthic sediment.	Because LHAAP process - assembly wastes fluctuate in type, quantity and quality directly with the demand for pyrotechnic ammunition and rocket motors, permutations of UEP waste characteristics are unavoidable should be expected. Compared to the 1976 results, the waste is now alkaline and more stable, as indicated by an increase in alkalinity. Nitrates, barium, and total dissolved solids in the supernatant exceed federal non-community drinking water standards and Texas stream quality standards, respectively. Traces of trichloroethylene and toluene were found in the UEP sediment (toxic hazardous waste by RCRA Hazardous Waste Management System).
39-26-0147-83	July 31 - August 3, 1981	To determine if soils and residues at active OB/OD grounds at LHAAP are hazardous wastes by characteristics a of EP toxicity for heavy metals content.	Residues from burn trench and M206 burn pads are hazardous wastes by characteristic of EP toxicity for Barium and as such represent potential for contaminated runoff. Although present in several soil and residue samples, lead concentrations were below the RCRA hazardous waste criteria limits.

bottom sludge, and underlying soil between October 29 and November 2, 1982. A composite sample of material floating at various locations on the pond and a sample from an exposed mound near the vacuum truck discharge point were also taken. The date(s) on which samples were taken are not specified in the report.

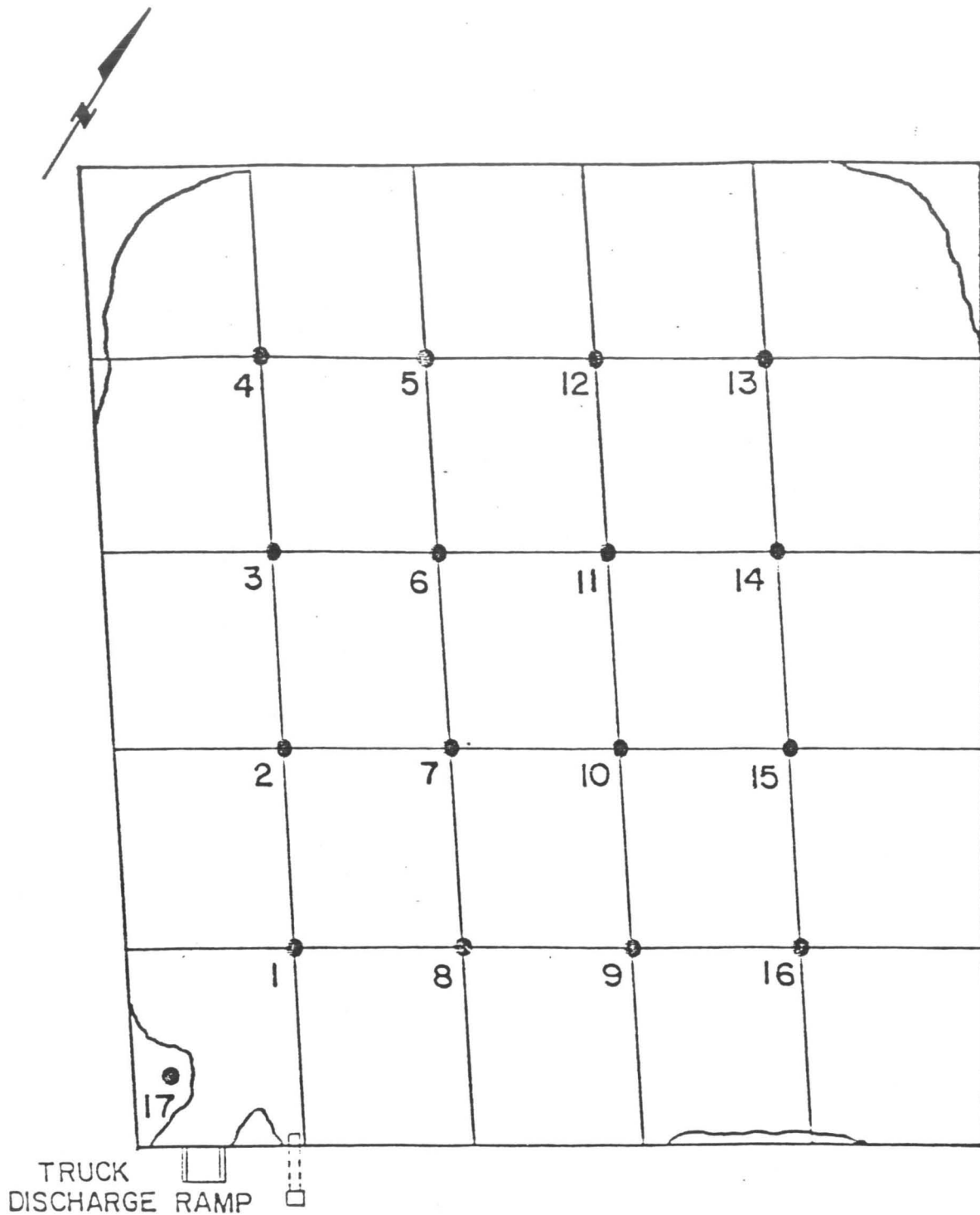
Prior to sampling, the UEP was measured and a sampling grid, utilizing EPA sampling methodology and containing 16 sample points, was established (see Figure 6). Water and bottom samples were collected at each grid point. Water depth, sludge depth, pH and conductivity also were measured at each grid point. The UEP was determined to be approximately 12 feet deep from the top of the berm to the bottom of the pond. The water in the pond averaged 6-1/4 feet in depth and the sludge layer ranged from 2 to 12 inches in depth at the sampled locations. Diagrams, based on limited measurements and estimates, showing the approximate UEP bottom contours and thickness of the sludge layer are provided in Figures 7 and 8, respectively. The depths shown in Figure 7 were determined from the water surface of the UEP. Due to less-than-normal rainfall prior to the time of sampling, the water level of the UEP was approximately two feet lower than usual at this particular time of the year.

Field measurements for pH and conductivity of the aqueous samples are listed in the Table 3. The pH averaged 10.75 and the conductivity ranged from 2,250 to 2,500 umhos/cm. The pH measured on several sludge samples averaged 11.5.

A modified composite liquid waste sampler was used to collect the aqueous samples from the UEP in an effort to obtain liquid representing the entire water column of the pond. The object was to include subsurface liquid waste layers in the sample in the event they existed. Turbid conditions made it difficult to visually confirm the existence of any layering.

Sludge (sediment) samples were collected at each point using a clamshell dredge. Soil samples were obtained by manually inserting three-inch OD Shelby tubes into the bottom and extracting the samples from the tubes. The depth of penetration into the soil varied from 12 to 15 inches

Elim Rept, Hazardous Waste Special Study No. 39-26-0291-83, Longhorn AAP,
Marshall, TX, 29 Oct - 3 Nov 82



Scale: 1" equals approximately 50'

Figure 6 UEP SAMPLING GRID

U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY

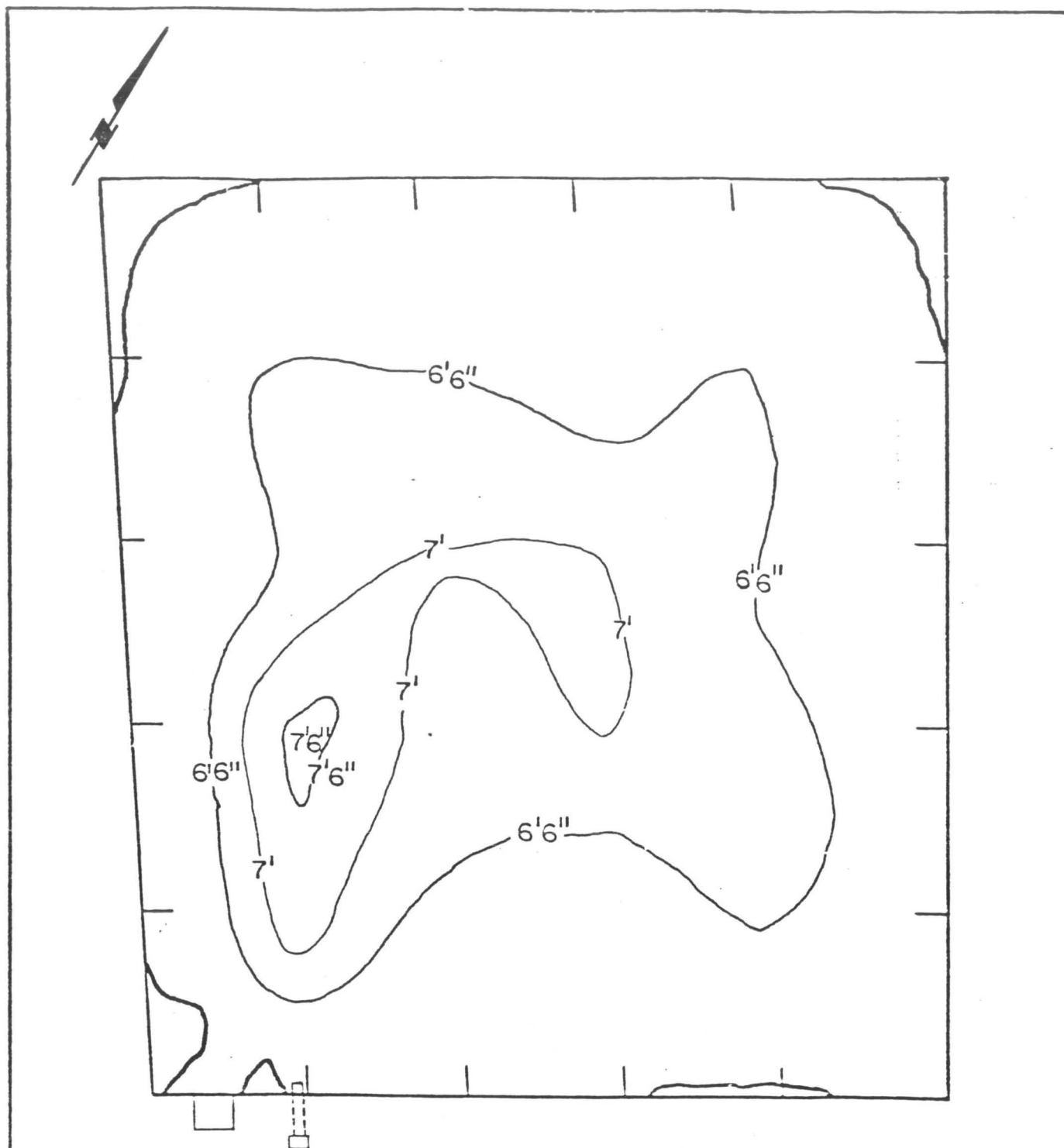
WASTE DISPOSAL ENGINEERING DIVISION

3-6

DATE 12-20-82

DRAWN REB

APPROVED YEW



Scale: 1" equals approximately 50'

Depths measured from water surface on 29 Oct - 3 Nov, 1982.

Figure 7 UEP BOTTOM CONTOURS

U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY

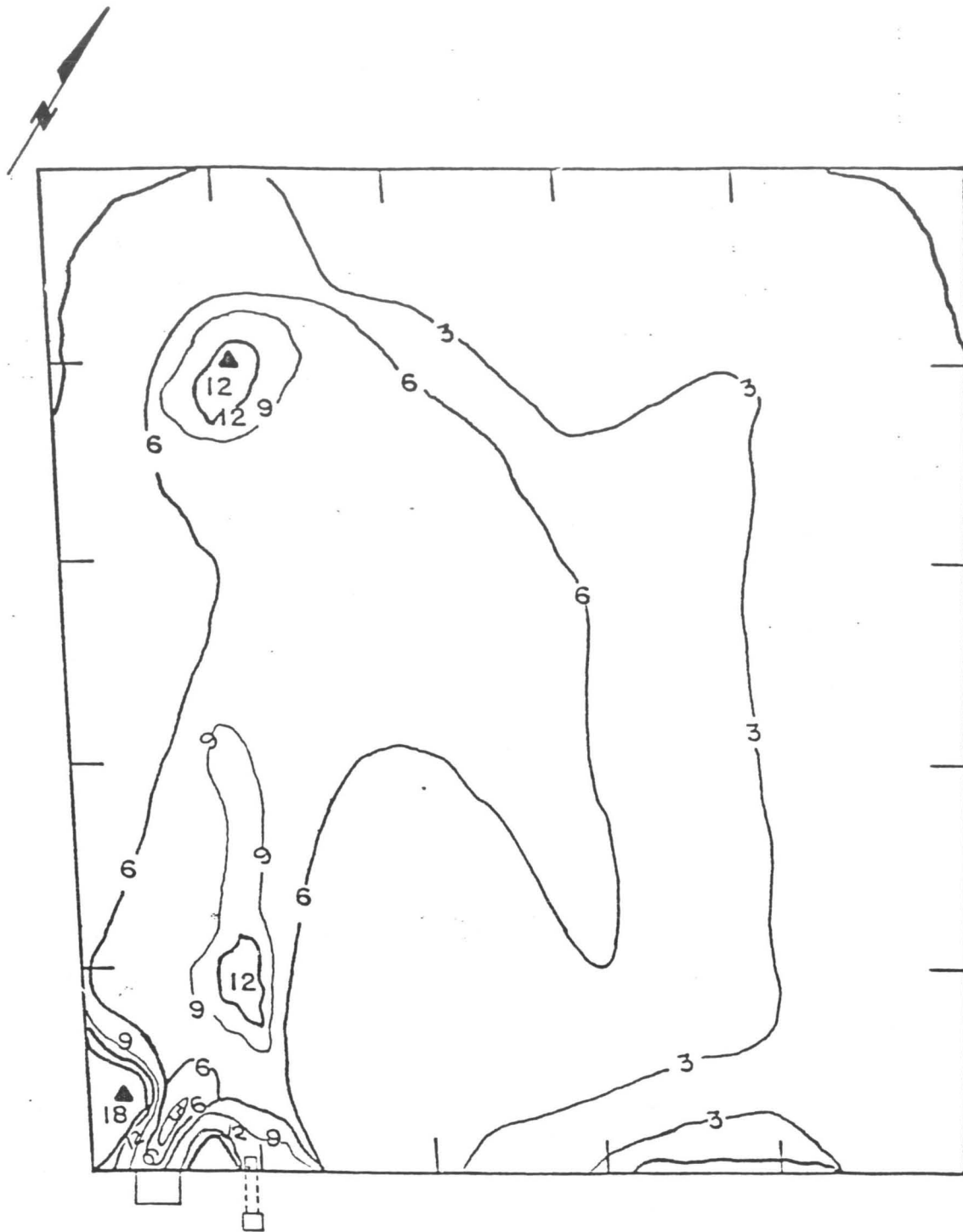
WASTE DISPOSAL ENGINEERING DIVISION

DATE 12-20-82

DRAWN QPB

APPR. JKW

Prelim Rept, Hazardous Waste Special Study No. 39-26-0291-83, Longhorn AAP,
Marshall, TX, 29 Oct - 3 Nov 82



Scale: 1" equals approximately 50'
Sludge depths in inches.

Figure 8 UEP SLUDGE DEPTH CONTOUR

U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY
WASTE DISPOSAL ENGINEERING DIVISION

DATE 12-20-82

DRAWN TPB

APPR. OKSW

Prelim Rept, Hazardous Waste Special Study No. 39-26-0291-83, Longhorn AAP,
Marshall, TX, 29 Oct - 3 Nov 82

FIELD MEASUREMENTS		
SAMPLE POINT	pH	CONDUCTIVITY (umhos/cm)
01	10.5	2500
02	10.5	2450
03	10.5	2550
04	10.5	2350
05	10.5	2300
06	10.5	2500
07	10.5	2350
08	10.5	2250
09	11.0	2400
10	11.0	2350
11	11.0	2300
12	11.0	2250
13	11.0	2300
14	11.0	2300
15	11.0	2400
16	11.0	2400

TABLE 3

depending on the type of soil encountered. Soils found at sample point Nos. 1 through 8 are typically clays, while Nos. 9 through 16 consisted of sandy silt.

The analyses of aqueous, bottom sludge and soil samples included general constituent categories, as well as organic and inorganic constituents suspected as being present in wastes generated during past and current LHAAP operations. These analytical results are contained in Appendix E and indicate the following:

- The aqueous and sludge phases of the waste are alkaline in nature.
- The distribution of bottom sediment types does not correspond to the distribution which would be expected based on soils mapping.

No detailed evaluation or discussion of these results was prepared by USAEHA.

The aqueous layer was found to exceed the drinking water standards for the following parameters: chlorides (475 mg/L), nitrates (290 mg/L), barium (39.5 mg/L), chromium (0.4 mg/L), lead (0.17 mg/L) and manganese (0.11 mg/L). In addition, 37 organic parameters were detected with 1,2-dichloroethane (trans), tetrachloroethylene, 1,1,1-trichloroethane, 1,1,2-trichloroethane, di-n-butyl phthalate, and phosphoric acid triethyl ether being the most prevalent. The constituents identified in the sediment and the soil layers were generally the same as those detected in the aqueous layer; however, the concentrations decreased in the downward direction. No metals analyzed for by toxic extraction procedure were found to be hazardous according to RCRA criteria.

EPS (USATHAMA) also sampled the UEP waters and bottom sediments (sludge or actual sediments) during November 1982. These analytical results are contained in Appendix E. Pond waters were found to be high in nitrate (165,500 ug/L) and fluoride (66,000 ug/L). Detectable concentrations of barium (1,620 ug/L) and strontium (14,400 ug/L) also were found, and a number of organic compounds were detected. Similarly, barium was measured

in significant proportions (1,031 ug/L) in the bottom sediments. Only one organic, dibutylphthalate was found; however, other organics (8) detected in the water samples were not analyzed for in the sediment samples. Concentrations of chlorides, sulfates and manganese in the pond waters were relatively low. One explosive (1,3-DNB) was detected in the surface water sample.

On January 27, 1984 USAEHA collected and analyzed water samples at four sites in the UEP. Concentrations for most of the parameters sampled were in the same range as those measured in the 1982 study with the exception of nitrites and nitrates, which were two orders of magnitude lower. Some metals (aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, molybdenum, manganese, mercury, silver, and zinc) were much lower in the 1984 samples, while others (boron, calcium, magnesium, potassium, and sodium) remained virtually unchanged. The constituents with lowered concentrations may have partially settled out of the supernatant liquid. Organic compounds found in the highest concentrations included methylene chloride (800 mg/L) and 1, 1, 1-Trichloroethane (780 mg/L). The UEP waters were alkaline in nature (average pH - 9.6) and appeared to be fairly stable, with alkalinity ranging from 750 to 825 mg/L. The analytical results are presented in Appendix E.

3.5 GROUND CONTAMINATION AT THE ACTIVE BURNING GROUNDS

In August 1983, USAEHA conducted a cursory evaluation of the Open-Burning/Open Detonation grounds for the purpose of evaluating the potential for contamination migration from OB/OD grounds to the ground and surface waters. Specifically, 48 soil and residue samples from active OB/OD grounds at LHAAP were evaluated for total explosive content and hazardous waste classification by characteristic of EP toxicity for heavy metals content.

The results indicate that the OB ground residues are a hazardous waste by characteristic of EP toxicity for barium and as such represents a potential for migration and contamination of both surface and groundwater in the area. Although not a hazardous waste by characteristic of EP toxicity,

lead detected at the 0B ground also represents potential for surface and groundwater contamination. No other metals and no explosives were detected in any samples. The analytical results, sampling procedures, and sampling point location map are presented in Appendix E.

Camp Dresser & McKee



CDM

ED-CS (GEOTECH)
Young

Prepared for:

U.S. ARMY ENGINEERING DIVISION, HUNTSVILLE
P.O. Box 1600
Huntsville, Alabama 35807

ADDENDUM
TO
GROUNDWATER QUALITY ASSESSMENT
LONGHORN ARMY AMMUNITION PLANT
MARSHALL, TEXAS
Groundwater Contamination Related to
Seepage from an Unlined Evaporation Pond
Contract No. DAC87-830-C-0091
May 8, 1986

—DRAFT—

Prepared by:

CAMP DRESSER & MCKEE INC.
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environmental engineers, scientists,
planners, & management consultants

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3445 Executive Center Drive Suite 220
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512 345-6651

May 8, 1986

Commander
U.S. Army Engineering Division,
Huntsville
ATTN: HNDED-PM, Mr. Wendell C. King
106 Wynn Drive
Huntsville, Alabama 35807

Re: Contract DAC87-83-0091

Dear Sir:

Transmitted herewith is Camp Dresser & McKee Inc.'s draft addendum to the final report, "Groundwater Quality Assessment, Longhorn Army Ammunition Plant, Marshall, Texas: Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond", submitted March 15, 1985. This addendum report contains descriptions of the four new wells installed at the facility, analytical results from groundwater samples taken from the four new wells and eight other wells, and analytical results for stream water and bottom sediments taken at eight localities on two streams flowing near the pond.

This report is not intended as a "stand alone" document, but is a companion document to CDM's Groundwater Quality Assessment report. In accordance with the Contract Scope of Work, emphasis was on data acquisition rather than a reinterpretation of the geohydrology of the area.

The conclusions stated in this draft of the addendum must be considered preliminary. The extent to which bacteria in the groundwater influence its quality is only now being understood and references are scarce. Within budgetary limits, CDM will continue to investigate the potential for biologic degradation at the Longhorn facility and, hopefully, to firm up our conclusions.

Should you have any questions, please do not hesitate to contact us.

Sincerely yours,

CAMP DRESSER & McKEE INC.

A handwritten signature in cursive script that reads 'Robert S. Kier'.

Robert S. Kier
Program Manager

RSK:ab

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1.0 SUMMARY

The purpose of this report is to present pertinent new information and conclusions with respect to the sources, extent, and rates of migration of contaminated groundwater that might have seeped from the unlined evaporation pond (UEP) in the Active Burning Grounds at the Longhorn Army Ammunition Plant (LHAAP) near Marshall, Texas. This work was carried out under modification 7 of the contract (DA87-830-C-0091) between the Huntsville Division of the U.S. Army Corps of Engineers and Camp Dresser & McKee Inc. (CDM). This report was prepared as an addendum to CDM's final Groundwater Quality Assessment, Longhorn Army Ammunition Plant, Marshall, Texas: Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond (March 15, 1985).

During CDM's previous investigation, contamination was detected up hydraulic gradient from the UEP, suggesting that sources of contamination in addition to the UEP were present in the area. Contamination plumes appeared to be migrating toward nearby streams, raising the concern that contaminated groundwater was being discharged to the streams with base flow. Thus, the focus of this investigation was on the quality of groundwater up hydraulic gradient from the UEP and on the possibility that contaminants in the groundwater, especially barium, were being discharged to the surface streams.

CDM installed four new wells (C-7, C-8, C-9, and C-10) up hydraulic gradient from the UEP. Three of the wells were shallow (less than 50 feet in depth) and were screened in the water table aquifer. The fourth well, installed next to one of the shallow wells, was screened in the next deeper aquifer. These four wells and eight other wells, six previously installed by CDM (C-1 through C-6) and two installed by EPS for USATHAMA (126 and 130) were sampled for laboratory analyses. In addition, insitu field permeability tests were performed on the four new wells and stream water and bottom sediments were sampled at eight localities along Harrison Bayou and Saunders Branch.

Laboratory analyses of the groundwater revealed that the concentration of barium exceeds drinking water standards in three of the twelve wells sampled and the concentration of chloride exceeds secondary guidelines in six of the wells. No priority pollutant organics were detected in any of the wells, however.

Because the laboratory data on the organic analyses were inconsistent with all previous analyses performed on wells in the vicinity of the UEP, five wells (C-2, C-3, C-9, C-10, and 126) were analyzed for benzene, chloroform, trichloroethene, and chloride. Again, no organic contamination was detected. EPA sampled selected wells in November 1985, including C-1, C-4, and C-5, and also found little or no contamination by organic priority pollutants.

The reasons for the disappearance of organic contamination in the vicinity of the UEP are not totally clear. It seems unlikely that closure of the UEP in late 1985-early 1986 can account for this disappearance, especially up hydraulic gradient. Small, seasonal changes in groundwater flow, such that the most contamination was carried away from the wells, are likely too insignificant to account for the disappearance of organic contamination. The most likely cause for the disappearance of organic contamination from the groundwater is biologic degradation. Data collected as part of this study are insufficient to support this conclusion, but there is no other known mechanism. Whether biologic degradation alone can account for the disappearance of organic contaminants is unknown.

Analyses of the water and bottom sediments in Bayou de la Poudre Branch revealed that no barium is being carried in the stream water, but barium does occur in the bottom sediments, generally in increasing concentrations downstream. It is unlikely that discharge of barium laden groundwater into the streams is occurring; the barium would be sorbed onto soil particles, especially the finer soil particles, through which the groundwater flows. Rather it is likely that the barium in the bottom sediments was transported into the streams by surface runoff and deposited in pools and the backwaters of Caddo Lake.

2.0 INTRODUCTION

The purpose of this report is to present pertinent new information and conclusions concerning the sources, extent, and rates of migration of contaminated groundwater at the Longhorn Army Ammunition Plant (LHAAP) near Marshall, Texas, and possible indications of discharge of the contaminated groundwater into local surface waters. During CDM's earlier investigation of groundwater contamination related to the unlined evaporation pond (UEP) in the Active Burning Grounds, widespread pollution of shallow groundwater was detected, including groundwater that lies up hydraulic gradient from the UEP. Contamination plumes appeared to be migrating toward nearby streams, raising the concern that contaminated groundwater was discharging into the streams and subsequently being transported to Caddo Lake.

The focus of the work effort, therefore, was on possible sources of contamination up hydraulic gradient from the UEP and possible discharge of contaminated groundwater into Harrison Bayou and Saunders Branch, which flow north into Caddo Lake on the east and west of the Active Burning Grounds. Four new wells were installed upgradient from the UEP — three wells into the shallowest aquifer (less than 50 feet in depth) and one well into the next deeper aquifer (less than 100 feet in depth). These four wells and eight others — the other six wells CDM installed (C-1, C-2, C-3, C-4, C-5, and C-6) and two wells installed by USATHAMA (126 and 130) — were sampled for water quality analyses. In addition, eight surface water and stream sediment samples were collected for analyses.

The intent of this report is, then:

1. To present data with respect to the installation and sampling of the four new wells installed up hydraulic gradient from the UEP;
2. To present the analytical results from sampling of eight other previously installed wells in the vicinity of the UEP;

3. To present the analytical results for the stream water and sediment samples taken in Harrison Bayou and Saunders Branch; and
4. To evaluate these data in terms of the sources, extent, and rates of migration of groundwater contamination in the vicinity of the UEP.

The work and evaluations described in this report were performed in accordance with Contract No. DACA87-83-C-0091 with the Huntsville Division of the U.S. Army Corps of Engineers. This report is an addendum to CDM's final report, "Groundwater Quality Assessment, Longhorn Army Ammunition Plant, Marshall, Texas" dated March 15, 1985. To ~~insure~~ insure brevity, where possible, data presented in the final report is not reproduced in this addendum, but is incorporated by reference only. Reevaluation of all previously obtained data was not required; furthermore, the emphasis in this addendum is on the data acquired, not their interpretation. For convenience, however, results from two rounds of groundwater sampling performed by CDM in July and in September 1984 are presented in Tables 2-1 and 2-2, respectively; sampling locations are shown in Figure 2-1. The UEP referred to in the Active Burning Grounds is now closed; closure took place in late 1985 and early 1986.

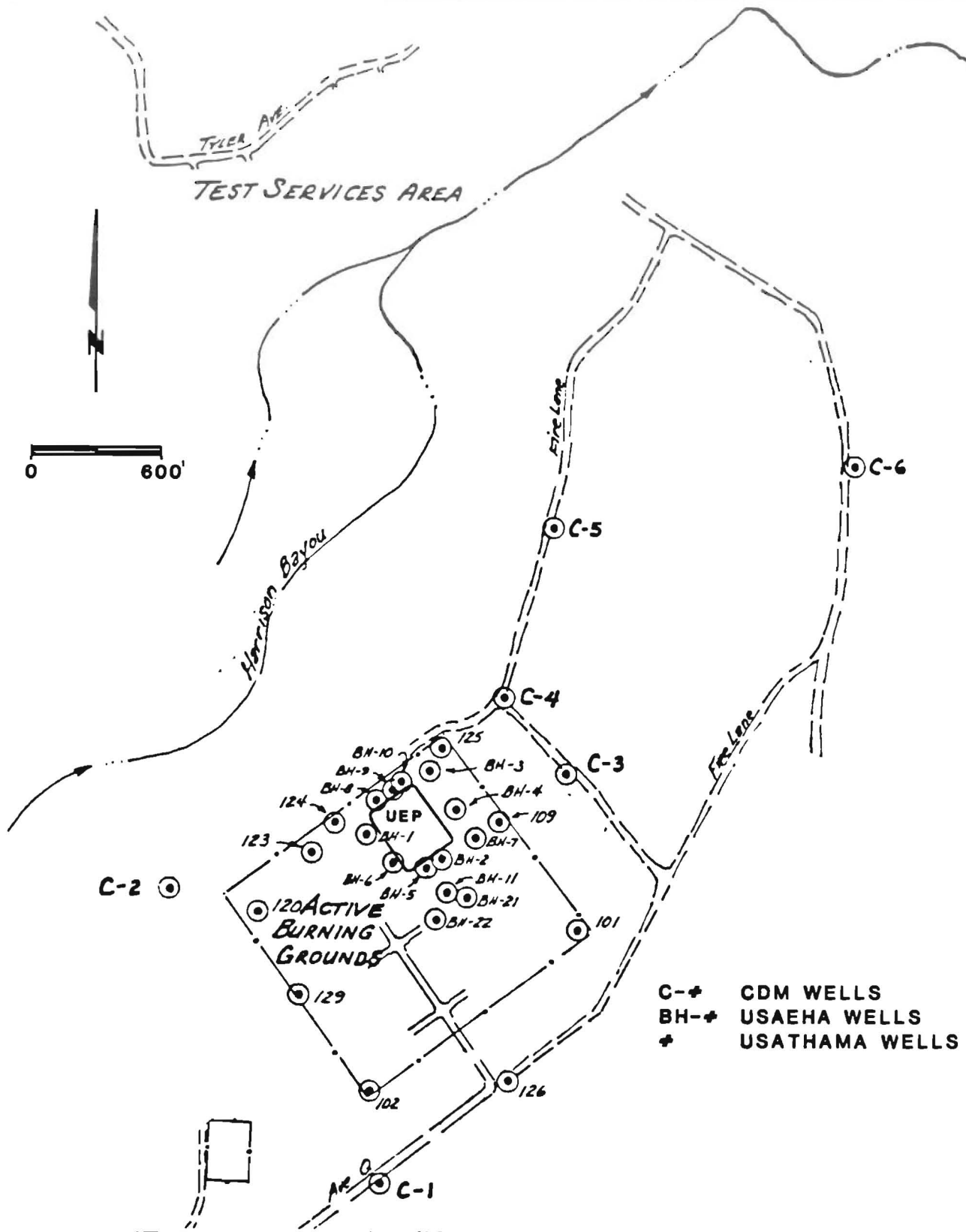


FIGURE 2-1
PREVIOUS GROUNDWATER SAMPLING SITES

3.0 WELL INSTALLATION/DEVELOPMENT

3.1 APPROACH

Data previously gathered did not present a complete picture of the extent to which contaminants have migrated away from the UEP and the concentration of these contaminants. The data did, however, suggest that sources of contamination up hydraulic gradient were affecting the quality of groundwater in the vicinity of the UEP. Installation of four additional monitor wells to investigate a possible source of contamination upgradient from the UEP and sampling of these wells and eight other wells to further define the aerial extent of groundwater contamination downgradient from the UEP were necessary.

Three shallow wells (maximum depth - 50 feet) were placed to maximize the amount of data that can be gathered, thereby extending the investigation, without incurring the unnecessary expense of providing access into areas that are normally inaccessible to wheeled vehicles.

The deep well was designed to penetrate the aquitard beneath the shallow aquifer and to be screened in the next lower aquifer. This well was installed using "telescoping" procedures to prevent downward migration of contaminants. The location of the deep well was chosen to further characterize the nature and possible presence of contamination in the lower aquifer that may originate up hydraulic gradient from the UEP.

3.2 INSTALLATION PROCEDURE

Installation of the new monitor wells was performed in compliance with CDM's Project Operation Plan (POP). The four new CDM wells: C-7, C-8, C-9, & C-10 were installed by Underground Resource Management (URM) using a Mobile B-61 drill rig and dry hollow stem augers when possible; however, mud rotary drilling was necessary with the deep well. Locations of these wells are shown in Figure 3-1.

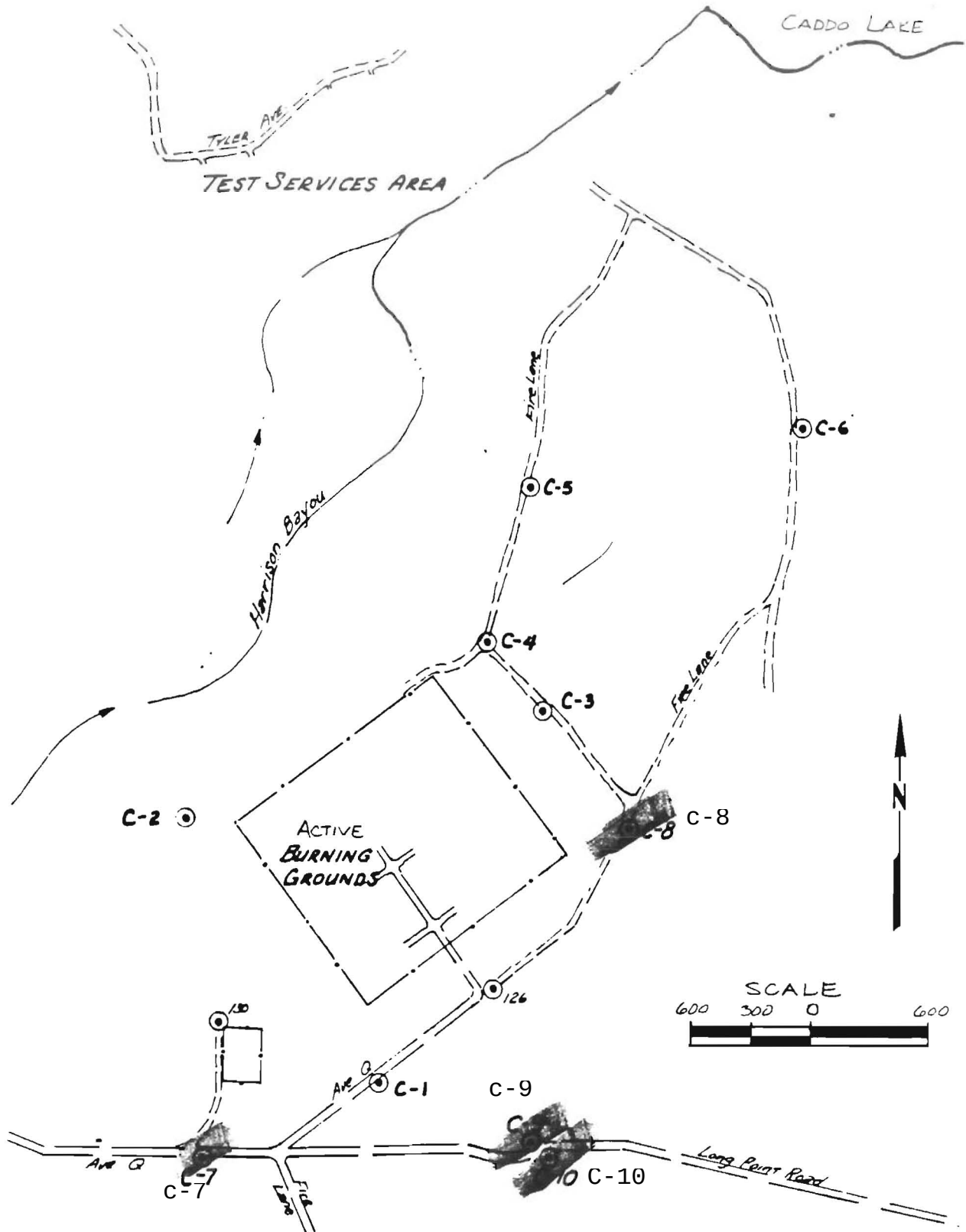


FIGURE 3-1
MONITOR WELL LOCATION MAP

The City of Karnack water supply was used during all drilling activities. This water was tested in 1984 during CDM's initial well installation program and was determined to be satisfactory for drilling purposes.

The depth of the wells ranged from 30 to 80 feet. The exact depth of each well varied and was based on determinations made in the field by CDM's onsite geologist. Split spoon or Shelby tube samples were collected at 5-foot intervals, as well as at detectable stratigraphic changes, and at the termination of the borehole. Individual borehole log records were compiled by CDM's onsite geologist and are found in the Appendix.

After completion and development of the wells, a 5-foot metal protective casing sleeve and locking cap were installed and cemented into place. A 3 by 3 foot concrete pad and three steel and concrete protective barriers were also installed. Each well was clearly marked with a waterproof paint. Well completion details are shown in Table 3-1.

Individual well construction summaries prepared by the onsite geologist as well as driller's reports are included in the Appendix. All downhole equipment was steam cleaned prior to introduction into the boreholes. Following well completion, all drilling equipment and materials were removed from the site to a cleaning area. Equipment and materials were then thoroughly steam/high pressure cleaned to remove all solid and oily materials before transport to a new well site. All cuttings were drummed and labeled, then transported to Area 49W for storage. The land surface immediately around each well was graded by hand to drain surface runoff away from the well bore.

3.2.1 SHALLOW WELL INSTALLATION

The shallow wells (c-7, c-8, & c-9)

~~_____~~ were completed in the water table aquifer using dry hollow stem augering. Total depth varied and was a function of the depth of the clay aquitard lying below the water table aquifer. Split-spoon samples were logged and jarred for archival storage. After the augers were removed, the well casing and screen were assembled and lowered into the hole. The screen is factory perforated 0.010-inch mill slot,

TABLE 3-1
WELL CONSTRUCTION DETAILS AND WATER LEVELS

Well No.	Total Depth ^a (ft. below GS)	Bentonite Interval (ft. below GS)	Screened Interval (ft. below GS)	Elevation of Ground Surface (ft. above MSL)	Stick-up Height ^b (TOC ^c to GS)	Water Level ^a (ft. below TOC ^c)	Piezometric Surface Elevation (ft. above MSL)
C-1	47.37	13.8-19.9	27.6-47.6	192.48	2.03	21.39	173.12
C-2	28.16	9.0-13.8	17.8-27.9	175.00	1.57	3.46	173.17
C-3	59.60	40.9-47.8	51.0-61.2	194.06	3.05	24.30	172.81
C-4	53.47	33.7-39.2	43.6-53.7	192.57	1.89	22.89	171.57
C-5	37.81	15.1-24.0	27.5-37.5	179.90	1.66	10.75	170.81
C-6	52.85	33.2-39.6	43.0-53.2	191.01	2.06	24.03	169.04
C-7	36.75	13.0-17.5	20.0-30.0	195.18	2.80	25.28	172.70
C-8	30.57	6.0-14.0	15.0-25.0	190.89	2.41	20.25	173.05
C-9	39.17	14.0-19.0	20.0-40.0	200.49	3.65	30.43	173.71
C-10	80.52	58.0-63.0	65.0-75.0	199.44	4.09 ^d	29.63 ^d	173.90
126	37.53	2.0-8.50	22.3-37.3	196.21	2.45	25.54	173.12
130	23.35	0.0-3.0	8.2-23.2	174.44	2.27	7.10	169.59

^a As measured February 18, 1986

^b From Collins surveys

^c TOC denotes top of PVC standpipe except where denoted with a ^d

^d TOC denotes top of steel protective casing

11' 1.57
5.00
2.11
1.57

4-inch (nominal), schedule 40, PVC pipe. The well casing is blank, schedule 40, 4-inch I.D. (nominal) PVC pipe. All casing and screen connections are screw threaded and all joints are flush with the casing interior and exterior. The bottom of the well screen was sealed by a screw threaded cap. All screens are 10 feet long, except for C-9 which is 20 feet long, and are set in a saturated silty sand interval, as determined by CDM's onsite geologist. With the exception of C-9, all the wells have a 5-foot sediment trap below the screen made of the same type of blank casing used above the screens. A longer screen was used in Well C-9 because the aquifer was very silty; despite the longer screen, C-9 quickly pumped dry during presampling purges. With the longer screen, there was no room for a sediment trap.

The annular space between the well bore and the well screen/casing was packed with No. 2 filter sand from the bottom of the boring to approximately one foot above the screen. The filter sand was sounded periodically to verify accurate placement. From the top of the filter pack, for approximately five feet, the annular space around the well casing was sealed with bentonite pellets, with the exception of C-8, in which a bentonite/water slurry was used. The slurry was used in C-8 due to difficulty in obtaining sufficient quantities of bentonite pellets. The remaining annular space was grouted to within three feet of the surface. The grout (ASTM C150) consisted of a mixture of approximately 30 gallons of water, 240 pounds of Portland cement, and six pounds of bentonite.

Each well was developed by bailing and pumping for a minimum of four hours or until the groundwater became clear and free of all visible turbidity or material. Groundwater produced during development was pumped to waste onsite.

3.2.2 DEEP WELL INSTALLATION

The deep well, C-10, was drilled using a "telescoping" procedure in order to prevent shallow contamination, if present in the water table aquifer, from infiltrating into the deeper aquifer. A test hole was initially drilled using dry hollow stem auger techniques to locate the aquitard

between the shallow, water table aquifer and the next deeper aquifer. Failure to encounter a distinct clay horizon with substantial thickness resulted in uninterrupted drilling to a depth of 65 feet. Based on the borehole log, it appeared that a 10 feet thick, interlaminated hard clay and silt horizon at 45 feet in depth would act as an aquitard and that the outer surface casing should be set to that level. A bentonite/water mixture was used to keep the borehole open while the augers were removed and to assure isolation from possible cross-contamination.

As cross-contamination was the primary concern, this hole was deemed inadequate for the deep well. Consequently, a bentonite/cement mixture was pumped down the drill stem to the total depth, displacing the bentonite/water mixture out the top of the borehole and sealing the borehole to the surface with the cement.

The drilling rig was moved approximately eight feet to the east and a new hole drilled using a tricone 7-7/8" rotary bit with a neat bentonite/water mixture. All bentonite used on the project consisted of pure Wyoming bentonite with no organic polymer additives.

At a depth of 45 feet, where the hard clay and silt horizon was reached, the borehole was reamed with a 12-inch "hole-opener" attached above the tricone bit. The bit was used to guide the reamer downhole. A bentonite/cement mixture was pumped downhole through the drill stem displacing the drilling mud. A capped PVC casing, 8-inch I.D. (nominal), schedule 40, bell ended, was then inserted. To facilitate the installation, the pipe was filled with a clean bentonite/mud mixture giving it sufficient weight to be pushed into and displace the cement slurry.

After the cement had set overnight, drilling was continued inside the casing to a depth of 58.5 feet using mud rotary techniques. This horizon had already been sampled in the adjacent borehole. From that point the drilling/sampling continued to a total depth of 81 feet. All samples have been archived by the drillers.

Upon completion of the drilling the inner casing and screen were inserted into the well. The inner casing of the deep well is 4-inch I.D. (nominal), schedule 40, flush-joint, threaded PVC pipe. The screen, 0.010-inch millslot, 4-inch I.D. (nominal), schedule 40, flush-joint, threaded PVC, ten feet in length was set from 65 to 75 feet in depth. Due to the siltiness of the formation, a 5-foot section of blank casing with the same specifications was placed below the screen to total depth as a sediment trap.

After the casing and screen were placed in the hole, the filter pack (No. 2 blasting sand) was tremied in from the bottom of the hole to two feet above the top of the screen. The annular space between the screen and the outer wall of the borehole was periodically sounded to assure correct placement of the filter pack. Five feet of bentonite pellets were then placed as a seal above the filter pack. In order to expedite the well installation program, grout placement was delayed until after preliminary development of the well. Preliminary development consisted of two hours of bailing with a 20-foot stainless steel rig-mounted bailer. A submersible pump was used to complete the development. As a direct result of the careful construction procedure, the deep well produces sediment-free water in substantial quantities, i.e.: in excess of 5 gpm. The grout mixture was the same as used in the shallow wells.

4.0 ENVIRONMENTAL SAMPLING

4.1 GROUNDWATER

4.1.1 APPROACH

Although only one round of sampling and analysis was scheduled, two rounds were made, one in February 1986 and one in April 1986. During the first round, all ten CDM wells (C-1 through C-10) and USATHAMA Well Nos. 126 and 130 were sampled. Sampling was carried out in accordance with the POP for Longhorn Army Ammunition Plant, Marshall, Texas, dated December 18, 1985. The six existing CDM wells and Well No. 126 had been sampled by CDM in two previous rounds in July and September 1984.

The primary objective of the first sampling round in 1986 was to establish the extent and nature of groundwater contamination up hydraulic gradient from the UEP as compared to the groundwater quality in the vicinity of the UEP. Locations of all wells sampled are shown in Figure 3-1. Analytical results from this round were inconsistent with the analytical results obtained in 1984 from these wells. Therefore, a confirmation round was performed on April 11, 1986. Monitor wells sampled in this round included C-2, C-3, C-9, C-10 and 126. A duplicate sample set was taken at C-10 and the volatile organic samples split between NUS laboratories and CDM's laboratory in Boston, Massachusetts.

4.1.2 PROCEDURES

Prior to collection of groundwater samples, water levels in all wells were measured. These measurements allowed for calculation of purge volumes as well as allowing definition of the current water table configuration in the area. The three new shallow CDM wells provided more control on the configuration of the water table up hydraulic gradient from the UEP. The procedure for measuring water levels involved checking the well for possible damage; measuring the head space with a HNu meter for any volatile organic emissions; measuring the water level with a M-scope (a battery operated water level indicator); and finally, decontamination of all down

hole equipment prior to use in the next well. Field personnel proceeded from upgradient wells to downgradient wells in order to further minimize all chances of cross-contamination. All wells were measured on the same day. Results from these measurements are shown in Table 3-1 along with relevant well construction details.

With water levels determined, calculation of necessary purge volumes (i.e. at least three casing volumes) was possible. Before purging the wells, a plastic sheet was placed around the well head to prevent sampling equipment from becoming contaminated by the surrounding soil. A HNu meter was then used to check well head space. A 1.7-inch Brainard-Kilman head pump (a portable hand operated downhole pump manufactured from PVC) was assembled and lowered into the well with the pumping mechanism just below water level. With a vertical hand stroke of approximately 10 inches, about 3 gpm of water was pumped. Pumping continued until the necessary volumes of groundwater were purged. During the February 1986 sampling, samples from the CDM wells were collected from the pump; samples from the USATHAMA wells were collected with the dedicated PVC bailer.

For quality assurance/quality control, two duplicate samples and two field blanks were also collected. During the purging, water quality measurements of pH, conductivity and temperature were taken. The pump was then pulled, disassembled and thoroughly decontaminated before moving to the next well. As with the water level measurements, to avoid cross-contamination, personnel proceeded from upgradient wells to downgradient wells. All purge water was removed from the well sufficiently far to avoid infiltration along the well bore.

Sampling methodology used for the second round in April 1986 was similar to the February 1986 round. Water levels measured during this confirmation round are as follows:

<u>Well No.</u>	<u>Piezometric Surface (ft. MSL)</u>
C-2	172.72
C-3	172.82
C-9	174.26
C-10	174.08
126	171.28

These may be compared to the water levels in Table 3-1, which were measured in February 1986. In all wells except for 126, at least three casing volumes were purged from the well with the hand pump; 126 was purged with the dedicated bailer. All samples were collected with a stainless steel bailer. In order to assure the legitimacy of samples, at least three bailers of water were removed with the stainless steel bailer before the sample was taken. This was done to evacuate, if present, any leachate originating from the PVC pump. The bailer, pump and all other downhole equipment were decontaminated after each use.

Sample bottles were packed in ice to be shipped to NUS Laboratories in Houston, Texas, via Federal Express. A VOA sample was shipped to CDM's laboratory in Boston. Results from these rounds are discussed in Section 6.0.

4.2 SURFACE WATER/SEDIMENT

4.2.1 APPROACH

To fully analyze the extent of contamination and to better understand the local hydrology in the vicinity of the Active Burning Grounds, stream sampling of applicable drainageways was included. Sampling points were selected based on topographic maps, i.e. drainage basins, the locations of existing CDM wells (for hydrologic correlation), previous CDM investigations, and accessibility. Four sites along Harrison Bayou (HB-1, HB-2, HB-3, and HB-4) and four sites along Saunders Branch (SB-1, SB-2, SB-3, and SB-4) were chosen. These sites, shown in Figure 4-1, were selected during a site visit in November 1985 by Robert S. Kier, CDM, accompanied by Bruce Childress, Morton-Thiokol Corp. The sites were plotted on a topographic map and flagged in the field. On February 19 and 20, 1986, in conjunction

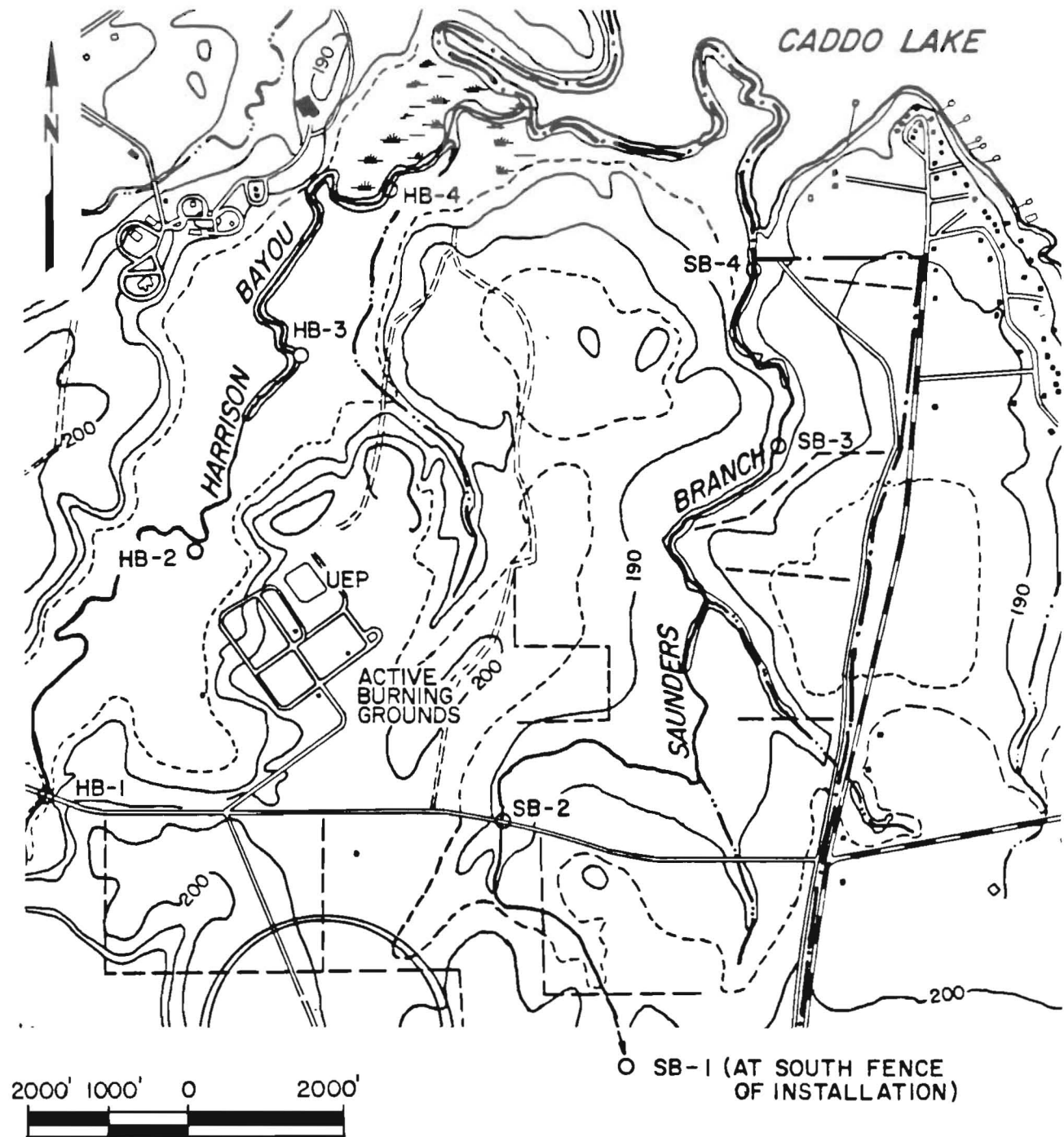


FIGURE 4-1
SURFACE WATER/SEDIMENT SAMPLING SITES

with the groundwater sampling, stream water and bottom sediment samples were taken for barium analysis. Measurement of basic water quality parameters: conductivity, temperature and pH was also performed on the surface water.

The stream sampling was carried out in accordance with the POP for LHAAP, Marshall, Texas. The POP outlined that sampling during base flow would ensure presence of the maximum possible concentration of contaminants. Sampling during February 1986 (a dry period) fulfilled the objective.

4.2.2 SAMPLING PROCEDURES

Surface water samples were collected from midstream in laboratory cleaned sample jars in a depth integrated fashion, providing representative samples. After the water samples were collected, sediment samples were obtained with a shovel. The sediment was transferred from the shovel to sample jars with a clean stainless steel trowel. Water quality measurements were then taken at this time. All equipment was decontaminated before sampling at the next site. For quality assurance compliance two duplicate water samples and one field rinsate blank were collected and analyzed along with the other eight samples. The field rinsate blank was collected by pouring distilled water over the sediment sampling tool after it had been decontaminated. Results from the stream sampling are discussed in Section 6.0.

5.0 AQUIFER TESTS

CDM conducted field permeability tests on the four newly installed wells following groundwater sampling. As in the previous CDM investigation, a field slug test was used, and hydraulic conductivity values were derived according to a method developed by Hvorslev (1951). These tests differed from the aquifer tests performed by CDM in 1984 only in that a mechanical slug was introduced, rather than initially evacuating water from the casing, and water levels were recorded using an electronic measuring device rather than manually. A discussion of assumptions and methodology was presented in the Groundwater Quality Assessment Final Report (March 15, 1984).

The slug consisted of a clean 5-foot section of 3-inch (O.D.) PVC casing filled with No. 2 blasting sand. Both ends were sealed tight. A pressure transducer was attached to the top of the slug so that it was able to begin recording water level variations at the instant the slug was introduced. All downhole equipment was deconned after each use.

Water levels were measured using a Druckr silicon strain gauge pressure transducer and an Omnidata Easy-Logger digital data logger. The pressure transducer receives the necessary excitation voltage of 10 volts DC from the logger unit. The transducer returns an analog signal ranging from 0 to 100 millivolts, proportional to the fluid pressure. The data logger was programmed to measure this voltage and convert it to pressures or depth of submergence at preset time intervals. The data were stored in binary form in a removable data pack consisting of several EPROM (erasable programmable read-only memory) chips. At the conclusion of the tests, the logger unit was returned to the office and connected to a desktop computer through an RS-232 interface, and, using commercially available communications software, the data were transferred to the microcomputer for processing and plotting.

Following are the results of the aquifer tests:

<u>Well No.</u>	<u>Hydraulic Conductivity</u>	
	<u>(ft/day)</u>	<u>(cm/sec)</u>
C-7	6.2	$2.2 (10^{-4})$
C-8	15.6	$5.4 (10^{-4})$
C-9	2.0	$7.0 (10^{-5})$
C-10 (deep well)	30.2	$1.0 (10^{-3})$

As the shallow wells were completed in a fairly tight silty sand and the deep well in a clean sand, these values appear valid and reasonable.

6.0 ANALYTICAL RESULTS

The samples were analyzed by NUS Laboratories in Houston, Texas. Specific parameters included in laboratory analysis of the groundwater samples obtained in February 1986 are shown in Table 6-1. Results from the groundwater sampling are detailed in Table 6-2. Some parameters included in Table 6-1 were not detected in any of the samples, and, therefore, were omitted from Table 6-2. Quality assurance analyses were run by the laboratory; the initial spike concentrations and spike recoveries for the volatile samples from the February 1986 round are shown in Table 6-3. Data from the April 1986 confirmation round are tabulated in Table 6-4. Results from the EPA sampling, in November 1985, are shown in Table 6-5 for comparison.

Results from the surface water/sediment sampling are displayed in Table 6-6.

TABLE 6-1

LIST OF ANALYTICAL PARAMETERS

Aluminum (Al)	VOLATILES (CONT.)
Barium (Ba)	cis-1,3-Dichloropropene
Chromium (Cr)	Ethylbenzene
Lead (Pb)	Methyl bromide
Magnesium (Mg)	Methyl chloride
Mercury (Hg)	Methylene chloride
Strontium (Sr)	1,1,2,2-Tetrachloroethane
Zinc (Zn)	Tetrachloroethane
Bromide (Br)	Toluene
Chloride (Cl)	trans-1,2-Dichloroethane
Fluoride, Soluble (F)	1,1,1-Trichloroethane
Nitrate (N)	1,1,2-Trichloroethane
Sulfate, Turbidimetric (SO ₄)	Trichloroethene
	Vinyl chloride
VOLATILES-PP IN WATER	d8-Toluene (Surrogate)
Acrolein	Bromofluorobenzene (Surrogate)
Acrylonitrile	d4-1,2-Dichloroethane (Surrogate)
Benzene	
Bromoform	SURROGATES/BN EXT. IN WATER
Carbon tetrachloride	d5-Nitrobenzene (Surrogate)
Chlorobenzene	2-Fluorobiphenyl (Surrogate)
Dibromochloromethane	d-14-p-Terphenyl (Surrogate)
Chloroethane	Decafluorobiphenyl (Surrogate)
2-Chloroethylvinyl ether	2,4-Dinitrotoluene
Chloroform	2,6-Dinitrotoluene
Bromodichloromethane	Nitrobenzene
trans-1,3-Dichloropropene	Silica Gel Cleanup
1,1-Dichloroethane	2,4,6-Trinitrotoluene
1,2-Dichloroethane	Nitrotoluene
1,1-Dichloroethene	Hydrocarbons (SM 503A)
1,2-Dichloropropane	

TABLE 6-2
GROUNDWATER SAMPLING RESULTS [REDACTED] SAMPLING ROUND
ACTIVE BURNING GROUNDS, LHAAP

Sample Location	Sample ID. No.	FIELD			LABORATORY														Benzene
		Conductivity (umhos)	pH (S.V.)	Temp (°C)	Ba	Sr	F ^a	Cl	Br	NO ₃ ^b	SO ₄	Pb	Zn	Mg	Al	Hg	Cr	Methylene Chloride ^c	
					mg/L														ug/L
C-1	LHA-OW-OW1-001	2400	6.8	18.6	0.6	1.8	0.3	800	5	<0.1	20	<0.05	0.01	64	0.2	<0.0002	<0.03	13	<10
C-2	LHA-OW-OW2-001	600	5.8	18.0	0.4	0.4	0.1	200	<2	0.1	<1	<0.05	0.04	9.8	0.1	<0.0002	<0.03	10	<10
C-2 ^d	LHA-OW-OW13-001				0.4	0.4	0.1	180	<2	0.1	<1	<0.05	0.03	9.8	0.4	<0.0002	<0.03	13	<10
C-3	LHA-OW-OW3-001	700	8.0	19.0	0.3	0.6	<0.1	210	<2	0.1	<1	<0.05	0.02	8.8	0.2	<0.0002	<0.03	17	<10
C-4	LHA-OW-OW4-001	330	7.2	22.0	<0.2	0.2	<0.1	29	<2	<0.1	<1	<0.05	0.07	3.9	0.2	<0.0002	<0.03	17	<10
C-5	LHA-OW-OW5-001	250	7.7	22.0	<0.2	0.6	0.2	52	<2	<0.1	8	<0.05	0.01	3.0	0.7	<0.0002	<0.03	17	<10
C-6	LHA-OW-OW6-001	1750		18.5	1.4	1.0	0.1	600	2	0.1	<1	<0.05	0.07	24	2.2	<0.0002	<0.03	14	<10
C-7	LHA-OW-OW7-001	580	6.7	22.0	<0.2	0.4	0.3	100	<2	0.5	30	<0.05	<0.01	11	0.4	<0.0002	<0.03	16	<10
C-8	LHA-OW-OW8-001	4200	6.9	17.0	3.3	3.2	0.8	1600	8	<0.1	1	<0.05	<0.01	96	4.6	<0.0002	<0.03	14	<10
C-8 ^d	LHA-OW-OW14-001				3.2	3.0	0.7	1600	8	<0.1	2	<0.05	0.02	100	4.7	<0.0002	<0.03	11	<10
C-9	LHA-OW-OW9-001	10200	6.7	20.0	0.6	12.0	0.5	3800	15	0.1	120	<0.05	0.23	400	11	<0.0002	<0.03	16	<10
C-10	LHA-OW-OW10-001	1080	9.3	21.5	<0.2	0.8	0.2	270	<2	<0.1	4	<0.05	0.08	3.8	0.3	<0.0002	<0.03	16	<10
126	LHA-OW-OW11-001	520	6.4	22.0	7.4	2.5	0.2	2000	11	0.1	<1	<0.05	0.10	180	9.1	0.0002	<0.03	15	<10
130	LHA-OW-OW12-001	4600	6.8	20.0	<0.2	1.0	0.7	1600	8	<0.1	150	<0.05	0.04	38	5.6	<0.0002	<0.03	15	<10
e	LHA-OW-OW15-001				<0.2	<0.1	<0.1	<1	<2	<0.1	<1	<0.05	<0.01	<0.1	<0.1	<0.0002	<0.03	45	<10
e	LHA-OW-OW16-001				<0.2	<0.1	<0.1	<1	<2	<0.1	<1	<0.05	0.03	<0.1	<0.1	<0.0002	<0.03	17	<10

^a Fluoride, Soluble (F)

^b Analyzed as Nitrogen

^c These values are insignificant. Introduction during laboratory analytical procedures is likely.

^d Duplicate of previous sample

^e Field blank

TABLE 6-3
 QUALITY ASSURANCE SAMPLES
 VOLATILE SURROGATE RECOVERIES
 FEBRUARY 1986 SAMPLING
 (all values in ug/L)

Sample ID. No.	d8-Toluene		Bromofluro-		d4-1, 2-Di Chloroethene	
	Concentration	Recovery	Concentration	Recovery	Concentration	Recovery
LHA-OW-OW1-001	100	98	100	120	100	97
LHA-OW-OW2-001	100	110	100	110	100	120
LHA-OW-OW13-001	100	100	100	110	100	140
LHA-OW-OW3-001	100	110	100	88	100	100
LHA-OW-OW4-001	100	110	100	81	100	120
LHA-OW-OW5-001	100	100	100	70	100	110
LHA-OW-OW6-001	100	96	100	110	100	120
LHA-OW-OW7-001	100	97	100	74	100	120
LHA-OW-OW8-001	100	96	100	100	100	120
LHA-OW-OW14-001	100	92	100	100	100	130
LHA-OW-OW9-001	100	100	100	77	100	120
LHA-OW-OW10-001	100	100	100	80	100	120
LHA-OW-OW11-001	100	97	100	100	100	120
LHA-OW-OW12-001	100	99	100	120	100	120
LHA-OW-OW15-001	100	92	100	81	100	100
LHA-OW-OW16-001	100	94	100	130	100	98

TABLE 6-4
GROUNDWATER SAMPLING RESULTS
APRIL - 1986

Well No.	Sample No.	Chloride (mg/L)	Methylene Chloride (ug/L)	Trichloroethene (ug/L)
C-2	LHAAD-OW-C2-002	180	12	<5
C-3	LHAAD-OW-C3-002	170	13	<5
C-9	LHAAD-OW-C9-002	4500	14	<5
C-10	LHAAD-OW-C10-002	270	13	<5
C-10	LHAAD-OW-DUP-002	260	12	<5
126	LHAAD-OW-C11-002	1800	11	<5
	Field Blank	NA	13	<5

TABLE 6-5
EPA GROUNDWATER SAMPLING RESULTS
NOVEMBER 1985

Sample Location	Sample ID No.	FIELD	FIELD/LAB	LAB													
		Temp. °C	pH (S.U)	SO ₄	F	Cl	NO ₃	Ba	Pb	Zn	Mn	Hg	TOC	Phenols	TOX	Bis(2 ethylhexyl) phthalate	Methylene Chloride
					mg/L							ug/L					
C-1	-04	23	6.1/	16.4	0.248	662.7	0.051	548	<30	<20	140	<0.2	21.6	<5	<1	4	ND
C-4	-03	21	6.1/7.53	1.0	<0.09	12.3	0.027	137	<30	63	478	<0.2	22.8	<5	<1	4	ND
C-5	-02	22	9.6/10	<1	0.294	53.4	0.062	138	<30	31	100	<0.2	15.2	<5	<1	ND	ND

From EPA report, "Groundwater Monitoring Evaluation, Longhorn Army Ammunition Plant (LHAAP), Marshall, Tx." dated January 13, 1986

TABLE 6-6
SURFACE WATER SEDIMENT SAMPLING RESULTS - LHAAP
FEBRUARY 1986

SAMPLE LOCATION	SAMPLE I.D. NO.	FIELD			LAB	COMMENTS
		CONDUCTIVITY (umhos/cm)	TEMP. (°C)	pH (s.u.)	Ba (ppm)	
HB-01	LHA-SW-SW01-001	195	19	6.8	<0.2	Good flow.
HB-01	LHA-SD-SD01-001				80	
HB-02	LHA-SW-SW02-001	190	18	6.7	<0.2	Moderate flow.
HB-02	LHA-SD-SD02-001				140	
HB-03	LHA-SW-SW03-001	205	19	6.4	<0.2	Slight flow.
HB-03	LHA-SD-SD03-001				240	
HB-03 ^a	LHA-SW-SW09-001				<0.2	
HB-04	LHA-SW-SW04-001	200	19	6.4	<0.2	Moderate to considerable iri- descent sheen on water surface, treated wood fence nearby, minnows/tadpoles abundant, flow unnoticeable.
HB-04	LHA-SD-SD04-001				280	
SB-01	LHA-SW-SW05-001	105	20	7.2	<0.2	Good flow.
SB-01	LHA-SD-SD05-001				30	
SB-02	LHA-SW-SW06-001	450	14	6.8	<0.2	Moderate flow.
SB-02	LHA-SD-SD06-001				60	
SB-03	LHA-SW-SW07-001	40	18	5.9	<0.2	Slight iridescent sheen on water surface, good flow.
SB-03	LHA-SD-SD07-001				280	
SB-04	LHA-SW-SW08-001	meters malfunctioning			<0.2	Very slight flow, moderate iridescent sheen on water surface.
SB-04	LHA-SD-SD08-001				200	
SB-04 ^a	LHA-SW-SW10-001				<0.2	
field blank ^b	LHA-SW-SW11-001				<0.2	

a - duplicate sample for QA

b - field blank on shovel used for sediment sample collection

7.0 CONCLUSIONS

7.1 GROUNDWATER

Analytical results from the February 1986 round of groundwater sampling (Table 6-2) suggest that although the basic chemistry of the groundwater is the same as in 1984 — July and September 1984 sampling rounds (Tables 2-1 and 2-2) — for the most part, organic contaminants can no longer be detected. The levels of methylene chloride found are those normally found in any sample analyzed in a laboratory and probably should be disregarded; no trichloroethylene was found. The 24 ppb benzene found in a duplicate of the sample from Well C-8, (although the level of benzene is above accepted criteria for human health) is probably also extraneous contamination and therefore can be ignored. Low levels of non priority pollutants were also found.

With respect to inorganic quality parameters, only barium exceeds primary drinking water standards (1 ppm), in three of the twelve wells sampled; Well 126 had the highest concentration of barium at 7.4 ppm; Well C-8 contained 3.2/3.3 ppm barium; Well C-6 contained only 1.4 ppm. Of the other inorganic parameters, chloride exceeds the secondary drinking water guidelines in six of the twelve wells sampled. Well C-9 has the highest chloride concentration at 3800 ppm; Wells C-8 and 130 had the next highest concentrations at 1600 ppm; Wells C-1 and C-6 had lower concentrations at 800 ppm and 600 ppm, respectively.

Because of the unexpected finding of virtually no organic contamination in the groundwater, and in the absence of any discernable sampling or laboratory error, a second round of sampling was performed in April 1986 on selected wells. Wells C-2, C-3, C-9, C-10, and 126 were resampled and analyzed for methylene chloride, trichloroethylene, and chloride. Methylene chloride and trichloroethylene were the most common organic contaminants found in the 1984 sampling and typically occurred at higher concentrations than other organic contaminants; chloride, a conservative substance, is an indicator of basic water quality.

The chloride concentrations found in the wells were within the normally accepted variance found in samples from the same source. Again, the concentration of methylene chloride was at the level that would normally be introduced in the analytical laboratory; the concentration of trichloroethene was below detection limits. In addition CDM's lab found no volatile organics in the sample split sent there from Well C-10. These analyses confirmed that the groundwater, at the times and in the wells sampled, was essentially free of organic contamination.

In November 1985, the U.S. Environmental Protection Agency (EPA) also sampled selected wells on the Longhorn facility. Wells C-1, C-4, and C-5 were included in the eight wells sampled by EPA. The concentrations of corresponding inorganic parameters were essentially the same as found by CDM in September 1984 and in February 1986. EPA also found no methylene chloride or trichloroethene. The only organic priority pollutant found was 4 ppb of bis(2 ethylhexyl)phthalate in Wells C-1 and C-4. EPA also found relatively low concentrations of unidentifiable, but non priority pollutant organic constituents.

The precise reasons why organic contamination in groundwater in the vicinity of the UEP is no longer discernable are not entirely clear. The apparent absence of organics appears to be related to one or a combination of factors involving directions of groundwater flow and/or biologic degradation. That the sources of contamination on the facility have all been closed, reclaimed, or evaporated seems unreasonable. The UEP has indeed been closed, but could not have been the sole source of contamination at the facility, even in the vicinity of the UEP. Seasonal or other temporal changes in the hydraulic flow regime are possible, but such changes, by themselves, would not seem capable of accounting for all the water quality changes seen, especially considering the relatively low velocity with which the groundwater moves through the aquifer. The available well data are not so dense that the groundwater flow regime can be tightly defined, and the nature of the Wilcox aquifers is such that seasonal or temporal changes in the local flow direction are probable, but radical changes in the flow field should not be expected without outside influences. Indeed, the water level data obtained in February 1986 are

consistent with the earlier interpretation of the piezometric surface, with the exception that it appears recharge is enhanced in the Ground Signal Test Area for the same reasons it is enhanced in the Active Burning Grounds — lack of deep rooted vegetation reduces the losses from the flow system.

In that the basic groundwater quality is the same in 1986 as it was in 1984, there has been no influx of new water to the area. Natural biologic degradation is undoubtedly occurring, however, and possibly accounts for all or much of the loss of organics from the groundwater. Recent discoveries by EPA in Michigan and other places confirms that biologic degradation can significantly reduce the concentrations of organic pollutants in groundwater. The level of organic contamination found in groundwater is a function of the dynamic equilibrium between the influx of contaminants and biologic activity. Other factors influencing the rates of biologic degradation are the permeability of the aquifer, the level of dissolved oxygen in the groundwater, the availability of nutrients, and temperature. Whether biologic decomposition of the contaminants in the groundwater is sufficient to totally remove (apparently) all traces of what once were high levels of organic contamination in the groundwater is unknown at this time.

Future work at LHAAP should take into account the potential for biologic decomposition of organic pollutants. Analyses for standard quality indicators likely will be insufficient to arrive at valid conclusions. Placement of wells should be influenced by the need to detect contaminant source areas and to better define the hydrologic flow system. For example, some wells should be placed in the clay and silt horizons where lack of flushing may preserve the contaminants. Perhaps more important, analyses of the aquifer matrix should be included to gain a better understanding of the interaction between the matrix and the groundwater. The investigation will undoubtedly require some flexibility in the field program and should use a phased approach.

7.2 SURFACE WATER AND STREAM SEDIMENTS

Barium was not detected in any of the stream water samples taken in February 1986. Barium concentrations in the sediment ranged from 30 ppm to 280 ppm and, in general, barium concentrations increased downstream in both Harrison Bayou and Saunders Branch. The only exception is that the barium concentration in sediment at the most downstream station on Saunders Branch (SB-04) decreased slightly from the concentration at the next station upstream (SB-03). These concentrations are in the same range as found by Environmental Protection Systems (EPS) in their earlier stream water and bottom sediment sampling and analyses for USATHAMA (concentrations of barium in sediments were erroneously reported in CDM's final Groundwater Quality Assessment as ug/L, or ppb and should have been reported as ug/g or ppm).

That Harrison Bayou and Saunders Branch receive groundwater discharges is clear. Any barium being transported by the groundwater is being effectively removed by the sorption onto soil particles, however, before the base flow discharge is received by the streams. Thus, groundwater discharge is probably not contributing barium to the stream waters nor to Caddo Lake.

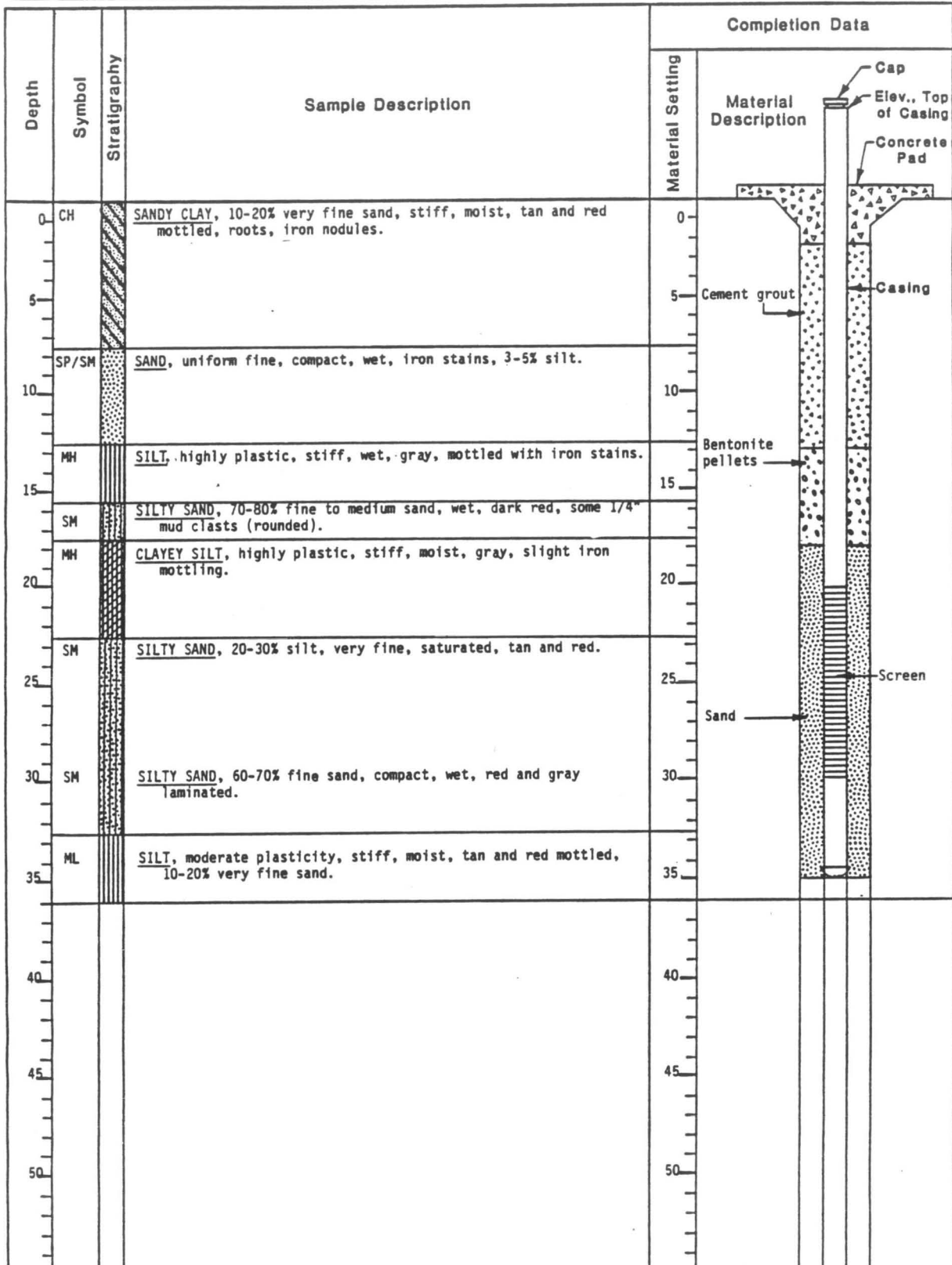
Rather the barium found in the surface sediment most likely enters the stream sorbed to soil particles moved by surface water runoff. Sorption would be greater on the smaller (clay) soil particles carried further downstream during a runoff event. Ponding and backwater effects in the downstream reaches of Harrison Bayou and Saunders Branch near Caddo Lake would facilitate settlement of the fine soil particles concentrating the barium there. Sorption is apparently sufficiently strong that the barium is not readily dissolved in the stream water, at least in amounts that would cause concern.

APPENDIX

URM Monitor Well Installation Diagrams,
CDM Well Construction Summaries and
CDM Borehole Log Records

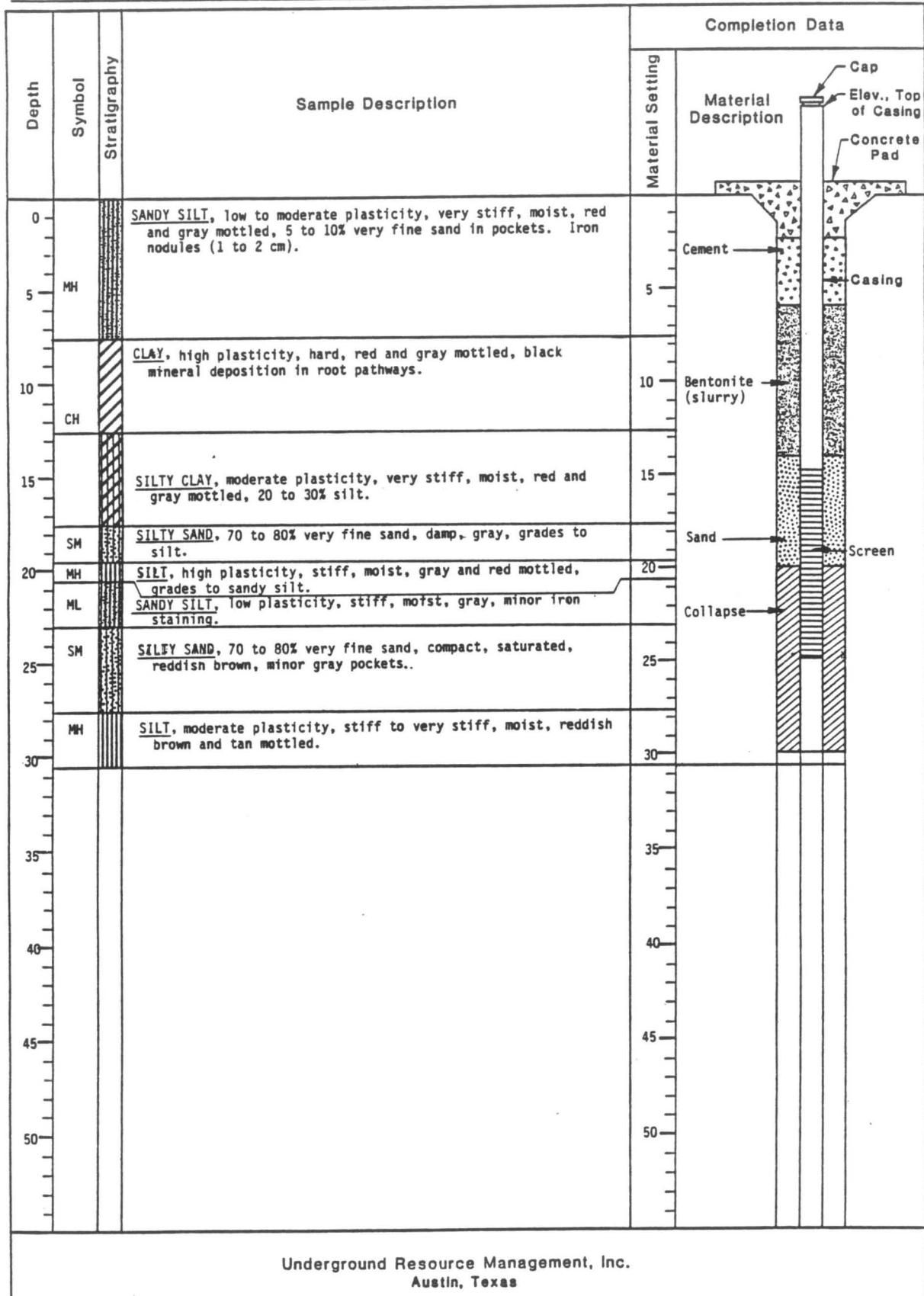
Monitor Well Installation

Client: Camp Dresser & McKee Job No.: J85-874 Date Drilled: 2/1/86 Well No.: C-7
 Site: LHAAP Elevation: GL Top of PVC Casing _____
 Total Depth: 36 feet Casing Size & Type: 4-inch Schedule 40 Flush-joint Threaded PVC Screen Size: .010 PMS
 Comments: _____



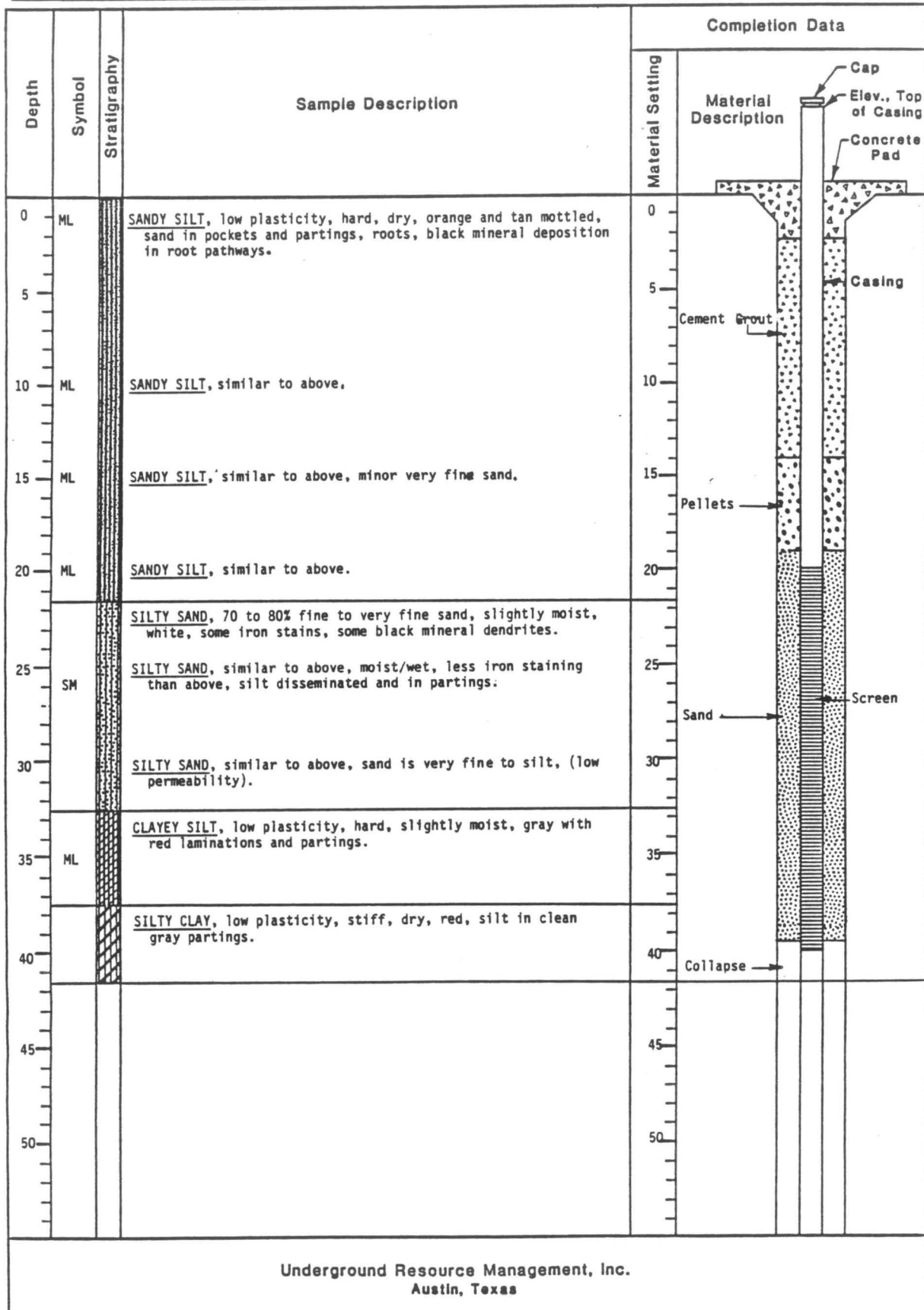
Monitor Well Installation

Client: Camp, Dresser & McKee Job No.: J85-874 Date Drilled: 2/26/86 Well No.: C-8
 Site: Karnack, Texas Elevation: GL Top of PVC Casing: _____
 Total Depth: 30 feet Casing Size & Type: 4-inch Flush-Joint Threaded PVC Screen Size: 010
 Comments: _____



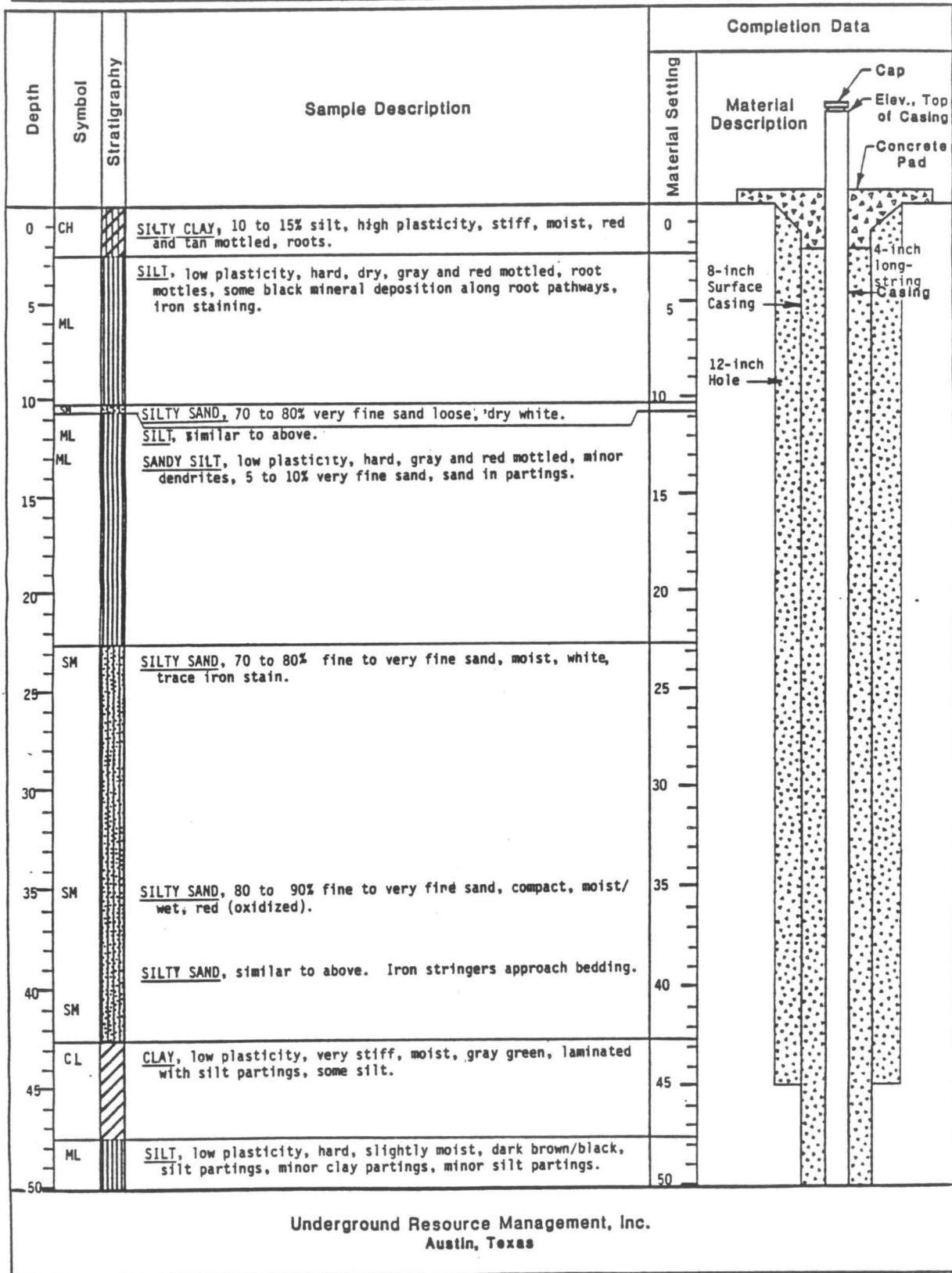
Monitor Well Installation

Client: Camp, Dresser & McKee Job No.: 085-874 Date Drilled: 1/31/86 Well No.: C-9
 Site: Karnack, Texas Elevation: GL Top of PVC Casing _____
 Total Depth: 41.5 feet Casing Size & Type: 4-inch Flush-joint Threaded PVC Screen Size: .010 Millislot
 Comments: _____



Monitor Well Installation

Client: Camp, Dresser & McKee Job No.: J85-874 Date Drilled: 2/28-2/29/86 Well No.: C-108
 Site: LHAAP Elevation: GL Top of PVC Casing _____
 Total Depth: 81 feet Casing Size & Type: 8-inch Schedule 40 BE Surface Casing, 4-inch Flush-joint Threaded Screen Size: .010 Millslot
 Comments: _____ Schedule 40 PVC Long-string



Monitor Well Installation

Client: Camp, Dresser & McKee Job No.: J85-874 Date Drilled: 2/28-2/29/86 Well No.: C-108
Site: 1HAAP Elevation: GL Top of PVC Casing
Total Depth: 81 feet Casing Size & Type: 8-inch Schedule 40 BE Surface Screen Size: 210 Millislot
Casing, 4-inch Flush-joint Threaded
Comments: Schedule 40 PVC Long-string

Depth	Symbol	Stratigraphy	Sample Description	Completion Data	
				Material Setting	Material Description
			<u>SILT</u> , same as above.		
55	SM		<u>SILTY SAND</u> , 70 to 80% fine sand, dark brown to black, slightly moist, lignite, silt and sand partings, clay lenses.	55	Cement Grout
60	ML		<u>SILT</u> , low plasticity, moist, brown to black, lenses of clay, pockets of fine sand (erosional bases), lignite.	60	Bentonite Pellets
65	SM		<u>SILTY SAND</u> , 70 to 80% fine to very fine sand, moist, gray, clay stringers.	65	
70	SM		<u>SILTY SAND</u> , similar to above.	70	Sand
75	SM		<u>SILTY SAND</u> , similar to above.	75	
80	SM		<u>SILTY SAND</u> , similar to above.	80	

CDM

environmental engineers, scientists,
planners, & management consultants

C-7 WELL CONSTRUCTION SUMMARY

Project LHAAPBy LANDTISERDate 2/2/86

No. _____

Page 1 of 1

Date _____

Q.A. No. F6216

Rev. _____

Page _____

of _____

Project ID* _____

Well No.* C-7Record Type W C S

Site No.* _____

Date* 8.6.0.2.0.2Time* 0.9.0.0

Twp _____

Rng _____

Sec _____

1/4 _____

1/4 _____

1/4 _____

Location N _____

E _____

SR. EL.* _____

FT
M

Survey Elevation _____

FT
MPERSONNEL Landtiser, URM (4)

TOP OF CASING ELEVATION _____

DRILLING SUMMARY

Total Depth 36Borehole Diameter From 0 to 3.5
8-inchDriller URMRig Mobil Drill B-61Bt(s) AugerDrilling Fluids From N/A to _____Surface Casing From N/A to _____

WELL DESIGN

Basis: Geologic Log ☒

Geophysical Log _____

Casing String(s): C-Casing 8-Screen

+2.5 - 20 C₁20 - 30 S₁30 - 35 C₁

CONSTRUCTION DESCRIPTION

Casing: C1 10' 4" OD, FJT, S&L 40 PVC

C2 _____

C3 _____

C4 _____

Screen: S1 10' 4" OD FJT, S&L 40 PVC

S2 _____

S3 _____

S4 _____

Centralizers N/AFilter Material (17.5' - 24')Cement portland (0' - 13')w/ bentonite powderSlot Sizes .010 mill slotOther bentonite pellets (13' - 17.5')

CONSTRUCTION TIME LOG

Task	Start		Finish	
	Date	Time	Date	Time
Drilling	<u>2/1/86</u>	<u>1715</u>	<u>2/1/86</u>	<u>1830</u>
	<u>2/2/86</u>	<u>0830</u>	<u>2/2/86</u>	<u>0915</u>
Geophysical Logging				
Casing	<u>2/2/86</u>	<u>0920</u>	<u>2/2/86</u>	<u>0930</u>
Filter Placement	<u>2/2/86</u>	<u>0935</u>	<u>2/2/86</u>	<u>0950</u>
Cementing of bentonite Development	<u>2/2/86</u>	<u>1030</u>	<u>2/2/86</u>	<u>1050</u>
	<u>2/2/86</u>	<u>1000</u>	<u>2/2/86</u>	<u>1030</u>
Other "	<u>2/2/86</u>	<u>1230</u>	<u>2/2/86</u>	<u>1600</u>

* SEE EXPLANATIONS ON BACK

Q.C. _____

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C-8 WELL CONSTRUCTION SUMMARY

Project LHAAP

No. _____

By LANDTISER Date 2/2/86Page 1 of 1

Q.A. No. F6216

Rev. _____

Chkd By _____

Date _____

Page _____ of _____

Project ID* _____ Well No.* C-8Record Type W C S Site No.* _____ Date* 8 6 0 2 0 2 Time* 2 0 0 0

Twp _____ Rng _____ Sec _____ 1/4 _____ 1/4 _____ 1/4 _____

Location N _____ E _____

SR. EL.* _____ FT _____ M _____ Survey Elevation _____ FT _____ M _____

PERSONNEL Landtiser, URM (4)

TOP OF CASING ELEVATION _____

DRILLING SUMMARY

Total Depth 31Borehole Diameter From 0 to 30
8" (30-31' = 3")-SSDriller URMRig Mobil Drill 3-61Bt(s) AugerDrilling Fluids From N/A to _____Surface Casing From N/A to _____

WELL DESIGN

Basis: Geologic Log ☒

Geophysical Log _____

Casing String(s): C-Casing S-Screen

12.5-15 C1 _____15-25 S1 _____25-30 C1 _____

Screen: S1 10' 4" FJT, Sch 40 PVC -

S2 _____

S3 _____

S4 _____

Centralizers N/AFilter Material (14'-20') #2 Blast sandCement (0'-6') Portland + bentonite powderSlot Sizes 010 mill slotOther Bentonite slurry (6'-14')(15 gal. H₂O: 35# bent. powder)

CONSTRUCTION TIME LOG

Task	Start		Finish	
	Date	Time	Date	Time
Drilling	2/2/86	1500	2/2/86	1715
Geophysical Logging				
Casing	2/2/86	1715	2/2/86	1750
Filter Placement	2/2/86	1850	2/2/86	1900
Cementing	2/2/86	1910	2/2/86	1950
Development	2/4/86	1630	2/4/86	1900
Other				

Bentonite

* SEE EXPLANATIONS ON BACK

Q.C. _____

CDM

environmental engineers, scientists,
planners, & management consultants

C-10 WELL CONSTRUCTION SUMMARY

Project LHAAP No. _____ Q.A. No. F8216
 By LANDTISER Date 1/31/86 Page 1 of 1 Rev. _____
 Chkd By _____ Date _____ Page _____ of _____

Project ID* _____ Well No. C-10
 Record Type W C S Site No. _____ Date* 8.6.0.1.3.1 Time* 0.9.0.0
 Twp _____ Rng _____ Sec _____ 1/4 _____ 1/4 _____ 1/4 _____
 Location N _____ E _____
 SR. EL.* _____ FT _____ M _____ Survey Elevation _____ FT _____ M _____

PERSONNEL Kier, Landtiser, URM (4)

TOP OF CASING ELEVATION _____

DRILLING SUMMARY

Total Depth 81'
 Borehole Diameter From 0 to 80
7 7/8" (2" from 80-81)
 Driller URM
 Rig Mobil Drill B-61
 Bht(s) 7 7/8-inch tri-cmb
 Drilling Fluids From 0 to 80
 Surface Casing From 0 to 45

WELL DESIGN

Base: Geologic Log ☒
 Geophysical Log _____
 Casing String(s): C-Casing S-Screen

0 - 45	C1	
+2 - 65	C2	
65 - 75	S1	
75 - 80	C2	

CONSTRUCTION TIME LOG

Task	Start		Finish	
	Date	Time	Date	Time
Drilling	0-45	1/29 1245	1/29	1800
	0-80	1/30 1300	1/30	1850
Geophysical Logging				
Casing	1	1/29 1800	1/29	2045
	2	1/30 1850	1/30	1955
Filter Placement		1/30 1915	1/30	2130
Cementing		1/30 2130	1/30	2200
Development		1/31 0900	1/31	1100
Other (BAIL)				
(PUMP)	2/3	1130	2/3	1230

CONSTRUCTION DESCRIPTION

Casing: C1 8" BE, PVC, Sch 40
 C2 4" FJT, PVC, Sch 40
 C3 _____
 C4 _____
 Screen: S1 4" .010 mill slot PVC, Sch 40 FJT
 S2 _____
 S3 _____
 S4 _____
 Centralizers NA
 Filter Material (63'-80')
#2 Blast sand 3 1/2 sack
 Cement (58'-surface-C2) (Per 1/2)
(45'-surface-C1) (2.00)
 Slot Sizes .010 mill slot
 Other Bentonite pellets (53'-63')

* SEE EXPLANATIONS ON BACK

Q.C. _____

C-7

Page _____ of _____

Time

114

FT	
----	--

Date: 8/21/54 En 21/54 Status

[illegible]

*** SEE EXPLANATIONS ON BACK**

full recovery unless otherwise noted Q.C.

Q.C. _____

CDM

Government/Engineers, Scientists,
Planners, & Management Consultants

BOREHOLE LOG RECORD

C-8

Project LHAP No. _____ Q.A. No. F6132
 By S. Landwehr Date 2/2/86 Page _____ of _____ Rev. _____
 Chkd By _____ Date _____ Page _____ of _____

Project ID# _____ Hole No. C-8
 Record Type B L R Site No. _____ Date _____ Time _____
 Twp _____ Rng _____ Sec _____ 1/4 _____ 1/4 _____ 1/4 _____
 Location N _____ E _____
 SR. EL. _____ FT _____ M _____ Survey Elevation _____ FT _____ M _____

Contractor URM P. G. Gaudin & Co. Driller Joselander Rig Model B-61
 Bit(s) Dry Hollow Stem Auger Core N/A Fluid N/A
 Borehole Diameter(s) 8" (0'-3") 3" (30-31) Total Depth 31.0
 Geophysical Log: Yes _____ No ☒ Date: 2/2/86 2/2/86 Status _____

Depth (ft)	SAND	Symbol	Material Description and Comments	H/W
			auger to 4.5	
4.5-6.0	1	5.1-5.4 ML	SANDY SILT, hard moist (slightly), mod plasticity, 4.5-5.0 reddish brown 5.0-6.0 grey w/ red mottles, roots, iron nodules, sand (fine-gr) pockets throughout making sample crumbly	1.6
6.0-9.5	2	10.5-10.8 CM	CLAY mod plastic, hard, dry crumbly, red to grey, trace sand particles (1-2%) no dendrites 100- pathways	1.0
9.5-14.5	3	15.2-15.5 CM	SILTY CLAY mod. plas., hard dry (40% silt) red w/ grey mottling, slightly moist, and tan color change last 2' w/ dry whitish w/ sand pockets (<5%)	1.0
14.5-19.5		SM	SAND, m-vt. gr. subang. and, wet loose, grey w/ red mottles	1.0
19.5-20.2		MH	SILT, mod plas., stiff, moist, grey and red mottles	1.0
20.2-21.0	4	20.3-20.6 MH	SANDY SILT, mod plas., stiff moist, grey w/ red mottles	1.0
21.0-24.5	5	25.3-25.6 SM	SILTY SAND, fine gr. 30% silt, loose, saturated-wet, greyish-red	1.0
24.5-31.0	6	30.4-30.7 MH	SILT, mod plastic, stiff moist drier & crumbly at base, red & grey, fr. clay (5-10%)	1.0
TD=31.0				

* SEE EXPLANATIONS ON BACK

full recovery unless otherwise noted. C.

all
samples
tested
w/ split
spins

CDMEnvironmental Engineers, Scientists,
Planners & Management Consultants**WELL / BOREHOLE LOG RECORD****C-9**Project Longhorn Army Ammunition Plant
By S. Lanthier Date 2/1/86
Chkd By _____No. _____
Page _____ of _____
Date _____Q.A. No. **F6132**Rev. _____
Page _____ of _____Project ID# _____ Hole No. _____
Record Type **B L R** Site No. **C-9** Date **8.6.01.31** Time **1.8.00**
Twp _____ Rng _____ Sec _____ 1/4 _____ 1/4 _____ 1/4 _____
Location N _____ E _____
SR. EL. _____ FT _____ M _____ Survey Elevation _____ FT _____ M _____Contractor Underground Resource Mgmt Driller P. Goodson - Geologist Rig Mobile B-61
Bit(s) hollow stem auger Core Jose Landeros - Driller Fluid dry
Borehole Diameter(s) 8" Total Depth 41.5
Geophysical Log: Yes _____ No ☒ Date: St 1/31 Fn 1/31 Status _____

Depth (ft)	SAMPLE # At _____ interval	Symbol	Material Description and Comments	HNu
0-5			auger - dry hollow stem ss:	
5-6.5	1: 6-6.3	CL	sandy clay, hard, dry, red clay & f. sand w/ grey mottles recovery on SS = 0.8'	1.0
6.5-10			auger ss:	
10-11.5	2: 11-11.3	ML	SANDY SILT, loose, dry, red & grey w/ seams and pockets of whitish-fan f. sand, roots and Mn filled root pathways recovery on SS = full (1.5')	1.0
10-15			auger ss:	
15-16.5	3: 16.2-16.5	ML	SANDY SILT, hard, dry, grey w/ orange-red mottles and pockets of dry loose crumbly med. fine sand, Mn root filled pathways, iron concretions recovery on SS = full	1.0
15-20			auger ss:	
20-21.5	4: 21.2-21.5	ML (20-21)	same as above	
		SM (21-21.5)	SILTY SAND, very fine sand, tight, moist, grey w/ orange-red mottles, Mn filled root pathways / dendrites	1.0
20-25			auger ss:	
25-26.5	5: 26.2-26.5	SM	SILTY SAND, very fine sand, tight, moist, grey, w/ some iron staining recovery on SS = full	1.0
25-30			auger ss: (moisture content increases)	
30-31.5	no sample	SM	SILTY SAND, very fine sand, silt (~40%), tight, moist, grey	1.0
30-35			auger ss:	
35-36.5	6: 36.1-36.3	CL	SILTY CLAY, hard, moderate plasticity, is slightly moist, grey w/ orange-red clean silt partings, is laminated, trace gross Mn staining	1.0
35-40			auger ss:	
40-41.5	7: 41.-41.3	CL	SILTY CLAY, stiff, mod. plastic, dry, red w/ grey silt partings	1.0

* SEE EXPLANATIONS ON BACK

Q.C. _____

TD: 41.5

(full recovery unless otherwise noted
cc = calc. + error)

CDMEnvironmental Engineers, Scientists,
Planners & Management Consultants**BOREHOLE LOG RECORD** C-10A
 Project LHAAP No. _____
 By S. Landruser Date 1/28/86 Page 1 of 2
 Chkd By _____ Date _____

 Q.A. No. F6132
 Rev. _____
 Page _____ of _____

 Project ID# _____ Hole No. C-10A
 Record Type B L R Site No. _____ Date 8.6.0128 Time 1.80.0
 Twp _____ Rng _____ Sec _____ 1/4 _____ 1/4 _____ 1/4 _____
 Location N _____ E _____
 SR. EL. _____ FT _____ M _____ Survey Elevation _____ FT _____ M _____

 Contractor URM Driller P. Goodson Rig Mobile B-61
 Bit(s) Hollow Stem Auger Core _____ Fluid Dry
 Borehole Diameter(s) 8" (0-65') 3" (65-70') Total Depth 66.6
 Geophysical Log: Yes _____ No ☒ Date: 8/28/86 Fr 1/28/86 Status _____

Depth (ft)	SAMPLE ACCT (ft) # Interval	Symbol	Material Description and Comments	HALU
			Auger to 5' - ST:	
5-6.5	no sample	ML	CLAYEY SILT, moist, loose, grey w/ orange mottles	1.0
			Auger to 10' - SS:	
10-10.6	1 10-10.3	ML	same as above	
	2 10.3-10.6	SM	SAND, v.f. grained, loose, light grey	1.0
			Auger to 16' - SS:	
16-16.3	3 16-16.3	ML	SILT, clayey, sandy, hard, grey w/ orange mottles, black dendritic manganese, sand partings, breaks along conchoidal fr.	1.0
			Auger to 20' - SS:	
20-21.5	4 21.1-21.4	ML	same as above	1.0
			Auger to 25' - SS:	
25-26.5	5 26.2-26.5	SM	SAND, v.f. gr., silty, moist, grey w/ trace tan-orange staining, loose	1.0
			Auger to 30' - ST:	
30-31.5	6	SM	SAND, v.f. gr., moist, grey w/ orange Fe staining	1.0
			Auger to 35' - SS:	
35-36.5	7 36.2-36.5	SM	SAND, silty, wet, grey-tan w/ orange Fe staining and birdseyes, dark grey clay stringer	1.0
40-41.5	8 41.2-41.5	SM	SAND, silty, f. gr., wet, tan w/ Fe staining as mottles and stringers	1.0
			Auger to 45' - SS:	
45-46.5	9 46.2-46.5	CL	CLAY hard, (tan-grey) laminated w/ silt partings (grey-white), black Mn & red Fe stains	1.0
			Auger to 50' - SS:	

* SEE EXPLANATIONS ON BACK

 ST = Shelby Tube
 SS = Split Spoon

Q.C. _____

BOREHOLE LOG RECORD

C-10A

COMMENTS

DEPTH	SAMPLE# Interval	SYMBOL	DESCRIPTION
50 - 51.5	10 51.2-51.5	ML	SILT, hard, dark grey w/ white grey f.-gr. sand and black clay partings, orange Fe staining auger to 55' ss:
55-56	11 55.7-56	SM	SAND, f.-gr., silty brown-dark grey w/ black clay lens and some lignite, moist. auger to 60' ss:
60-61.0	12 60.7-61	ML	SILT, moist, light-grey w/ several seams of dark grey clay, some white grey f.-gr. sand, pockets auger to 65' ss:
65-66.6	13 65-65.3	SM	SAND, f.-gr., silty, moist, dark gray trace dark grey clay lens
	14 66.3-66.6	SM	same as above
TD= 66.6			
			hole grouted to surface

HNU

1.0

1.0

1.0

PROJECT ID - Two Letter Designation

HOLE NO. - Four Character Alphanumeric Designation

SITE NO. - Four Character Alphanumeric Designation

DATE - Yr Yr Mo Mo Day Day

TIME - Military

SR. EL. - Surface Elevation

CDMEnvironmental Engineers, Scientists,
Planners, & Management Consultants**BOREHOLE LOG RECORD** C-10BProject LHAAP

No. _____

Q.A. No. F6132

By S. LandtserDate 1/29/86Page 1 of 2

Rev. _____

Chkd By _____

Date _____

Page _____ of _____

Project ID# _____

Hole No. C-10BRecord Type BLR

Site No. _____

Date 860129Time 1800

Twp _____

Rng _____

Sec _____

1/4 _____

1/4 _____

1/4 _____

Location N _____

E _____

SR. EL. _____

FT
M

Survey Elevation _____

FT
MContractor URMDriller P. GoodsonGeologist Tose LanderosRig Mobile B-61Bit(s) 7 7/8" Tricomb

Core _____

Fluid Mud

Borehole Diameter(s) _____

Total Depth 81Geophysical Log: Yes _____ No XDate: St 1/29 Fr 1/29

Status _____

Row Count

E intervals
unless otherwise
noted)push
61 1005' = 4.9
2' = 10028
1005' = 50
3 = 10028
100

Depth (ft) (recovery)	SAMPLE # (interval)	Symbol	Material Description and Comments
			hole drilled and reamed to 45'
			(see Borehole Log C-10A for lithology)
			8" diam BE Sch 40 casing set to 45'
			14 samples for C-10A collected
58.5-59.7 (1.2')	15/59.2-59.5	SM	SAND f.g., slightly silty, moist, dark grey, black & white flecks throughout
			drill to 63.5 : ss
63.5-64.2 (.7')	16/63.7-64.	SM	SAND f.g., hard, moist, uniform size, subang., dark grey, some black clay silt partings
			drill to 68.5 : ss
68.5-69.5 (.7')	17/68.2-69.5	SM	SAND, f.g., silty, moist, dark grey, uniform size, subang., blk & white flecks, rock frags, no partings
			drill to 75.2' : ss
75.2-75.7 (.55')	18/75.4-75.7	SM	SAND, f.g., silty, moist, some LIGNITE clasts - very discontinuous, blk & wh rock frags.
			drill to 80' : ss
80-81 (.4')	19/80.7-81.	ML	SILT, sandy, clayey, hard, dark grey
			TD = 81'

HNU

1.0

1.0

1.0

response
suspect
exhaust

1.0

* SEE EXPLANATIONS ON BACK

Q.C. _____

FINAL

Five-Year Review Report

First Five-Year Review Report
for
Longhorn Army Ammunition Plant

- **Sites 18 & 24 (Burning Ground 3)**
- **Site 16 (Old Landfill)**
- **Site 12 (Sanitary Landfill)**

Karnack
Harrison County, Texas

August 2002

PREPARED BY:

Complete Environmental Service
Contract No. DACA56-00-C-2014

Approved By: David Tolbert Comm. Rep.
LHAAP

[Name]
[Title]
[Affiliation]

Date:

8/13/02



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List of Acronyms and Abbreviations

ACD	Air Curtain Destructor
ARAR	Applicable or Relevant and Appropriate Requirements
BG3	Burning Ground No. 3
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Complete Environmental Service
CFR	Code of Federal Regulations
COC	Chemical of Concern
DERA	Defense Environmental Restoration Act
DOD	Department of Defense
DSERTS	Defense Site Environmental Restoration Tracking System
EPA	U.S. Environmental Protection Agency
EPS	Environmental Protection Systems
FBR	Fluidized Bed Reactor
FFA	Federal Facility Agreement
FS	Feasibility Study
ft ³	cubic feet
GWTP	Groundwater Treatment Plant
gpm	gallons per minute
HASP	Health and Safety Plan
ICT	Interceptor Collection Trench
IRA	Interim Remedial Action
IRP	Installation Restoration Program
lbs	pounds
LHAAP	Longhorn Army Ammunition Plant
LTTD	Low Temperature Thermal Desorption
MC	Methylene Chloride
mg/Kg	Milligrams per kilogram
mg/L	Milligrams per liter
MSC	Medium Specific Concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
PCL	Protective Concentration Level
PEP	Pyrotechnics, Explosives, and Propellant
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Remedial Action Objectives
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RD/RA	Remedial Design / Remedial Action
RfD	Reference Dose

RG	Regulatory Guidance
RI	Remedial Investigation
RI/FS	Remedial Investigation / Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RP/CP	Release Prevention / Contingency Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SCAPS	Site Characterization and Analysis Penetrometer System
SRI	Supplemental Remedial Investigation
TAC	Texas Administrative Code
TACB	Texas Air Control Board
TBC	To Be Considered
TCE	Trichloroethylene
TDWR	Texas Department of Water Resources
TNRCC	Texas Natural Resource Conservation Commission
TOC	Total Organic Carbon
TRRP	Texas Risk Reduction Program
TSDF	Treatment Storage Disposal Facility
TWQB	Texas Water Quality Board
TWQS	Texas Water Quality Standards
TWC	Texas Water Commission
UEP	Unlined Evaporation Pond
µg/L	Micrograms per liter
µg/m ³	Micrograms per cubic meter
USACE	U.S. Army Corps of Engineers
USAEHA	U. S. Army Environmental Hygiene Agency
VOC	Volatile Organic Compounds
yd ³	cubic yards

EXECUTIVE SUMMARY

The purpose of this five-year review is to 1) evaluate whether the selected Early Interim Remedial Action for the Burning Ground No. 3 (BG3) and the Unlined Evaporation Pond/Rocket Motor Washout Facility (UEP) at Longhorn Army Ammunition Plant (LHAAP) have addressed the principal risk to human health and the environment by preventing or reducing further migration of contaminants (high concentrations of chlorinated solvents & heavy metals in the shallow groundwater) into deeper groundwater zones and possibly surface water bodies, and 2) also to evaluate whether the Early Interim Remedial Action for landfills (Sites 12 and 16) has minimized long-term vertical infiltration of water through the landfills and minimized contaminant transport.

BG3 designated as Site 18 and the UEP/Rocket Motor Washout Facility, designated as Site 24, are located within a fenced area of 34.5 acres located in the southeastern quadrant of LHAAP. The UEP was closed as a Resource Conservation Recovery Act (RCRA) interim status surface impoundment in 1985 by removing all wastewater and sludge and capping the impoundment. Approximately 7850 cubic yards of solids and two million gallons of water were hauled offsite as hazardous waste to a permitted RCRA Treatment Storage Disposal Facility (TSDF).

A Record Of Decision (ROD) was signed on May 12, 1995 for an Early Interim Remedial Action consisting of soil and groundwater treatment at the Burning Ground No. 3/UEP area. The Groundwater Treatment Plant (GWTP) was approved for operation in February 1997. Two temporary Low Temperature Thermal Desorption (LTTD) units began treating soil in February 1997. The Remedial Action Construction completion date was August 31, 1999. In 1998 perchlorate was discovered in the groundwater at LHAAP including Burning Ground No. 3, Landfill 16 and other sites at LHAAP. A Fluidized Bed Reactor (FBR) for biological treatment of perchlorate became operational in February 2001 at the GWTP.

The Old Landfill or Retail Sales, subsequently called Site 16, encompasses approximately 16 acres in the south-central portion of LHAAP. Waste disposal and treatment activities took place until sometime in the 1980's when the site became inactive. A ROD was signed in September 1995 for an Early Interim Remedial Action to place a cap on the landfill. Prior to being capped, Site 16 received 35,840 cubic yards of LTTD treated soil from the Site 18/24 remedial action. Eight extraction wells were added to Site 16 as a treatability study under an Accelerated Remedial Investigation/Feasibility Study (RI/FS) to reduce the flow of groundwater transporting contaminants into Harrison Bayou. All water from the extraction wells is pumped to and treated at the Site 18/24 Groundwater Treatment Plant.

Site 12, previously called the "Sanitary Landfill", occupies seven acres just west of Site 16. Site 12 was used for disposal of non-hazardous industrial waste including cafeteria waste, non-hazardous chemical waste, oil/diesel soaked dirt, and asbestos until March 1994. Site 12 was included in the ROD for Site 16 and was signed in September 1995. As with Site 16, the Early Interim Remedial Action for Site 12 consisted of capping the landfill. Site 12 received 2000 cubic yards of treated soil from Burning Ground No. 3.

The Remedial Action Construction completion date was August 31, 1999 for both landfills.

Site 18/24

The Early Interim Remedial Action at Site 18/24 currently protects human health and the environment, because exposure pathways that could result in unacceptable risks are being controlled. The Early Interim Remedial Action at Site 18/24 is serving its intended purpose of minimizing potential risks to the environment by reducing the migration of contaminated groundwater into deeper groundwater zones near the site. Contamination in wells screened in the deeper or intermediate groundwater zones at the site have been stable or declining. An assessment of the site found that the interim remedy was constructed in accordance with the requirements of the ROD for Sites 18/24. The Early Interim Remedial Action to pump and treat groundwater is still in progress and must continue until a final remedy is implemented. As an Early Interim Remedial Action this was not intended to be the final remedy. Although it is recognized that this is not the final remedy, concentrations have not decreased in the five years of operation. Further study is needed to determine an appropriate final remedial action in the near future.

Site 16

The Early Interim Remedial Action at Site 16 consisting of the landfill cap and the eight vertical extraction wells installed as a treatability study under the accelerated RI/FS currently is expected to protect human health and the environment because it is serving its intended purpose to reduce the potential for vertical infiltration of water through the landfill, and to minimize contaminant transport. For the landfill cap to be effective in minimizing contaminant transport, the eight vertical extraction wells will continue to operate until a final remedy is addressed. For the remedy to be protective in the long-term, further remedial actions need to take place as determined by the Feasibility Study. As an early interim action this was not intended to be the final remedy.

Groundwater is currently being removed from Site 16 with eight extraction wells. The eight extraction wells were subsequently installed after the cap as part of the RI/FS. They assist in removing contamination from the environment between a source at the landfill and Harrison Bayou. Operation of the eight wells will continue until a final remedy is implemented. The assessment of the site found the interim remedy was constructed in accordance with the requirements of the ROD for Sites 12 and 16. The Feasibility Study (FS) for Site 16 is final.

Site 12

The Early Interim Remedial Action at Site 12 currently protects human health and the environment because it is serving its intended purpose to reduce the potential for vertical infiltration of water through the landfill and to minimize contaminant transport. The assessment of the site found that the interim remedy was constructed in accordance with the requirements of the ROD for Sites 12 and 16.

Five-Year Review Summary Form (Burning Ground/ UEP Site 18/24)

SITE IDENTIFICATION

Site Name (from WasteLAN): Longhorn Army Ammunition Plant

EPA ID (from WasteLAN): TX6213820529

Region: 6

State: TX **City/County:** Karnack/Harrison

SITE STATUS

NPL Status: ☒ Final ☐ Deleted ☐ Other (specify) _

Remediation Status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple OUs? ☒ YES ☐ NO **Construction Completion Date:** 2008 (anticipated)

Has Site been put into reuse? ☐ YES ☒ NO

REVIEW STATUS

Lead Agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency

Author Name: William R. Corrigan

Author Title: Project Manager

Author Affiliation: Corps of Engineers
Contractor

Review Period: 09/01/2001 to 01/30/2002

Date(s) of Site Inspection: 10/16/2001 through 10/18/2001

Type of review: ☒ Statutory
☐ Policy (☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL
☐ Regional Discretion) State/Tribe-lead

Review Number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _

Triggering Action:

☒ Actual RA On-Site Construction at OU # Burning Ground/ UEP Site 18/24

☐ Actual RA Start at OU #

☐ Construction Completion

☐ Previous Five-Year Review Report

☐ Other (specify) _____

Triggering Action Date (from WasteLAN): 02/12/1997

Due Date (Five Years After Triggering Action Date) 02/12/2002

Five-Year Review Summary Form (continued) **Burning Ground/UEP Site 18/24**

Issues:

1. Site 18/24 - The ROD states that 5,000 feet of Interceptor Collection Trenches (ICT) and eight vertical extraction wells will be used to collect shallow groundwater. The ICT's were constructed and are in use. However, there were no vertical extraction wells constructed or in use.
2. Contracting groundwater plume due to pumping the ICT's may allow reduction in number or frequency of groundwater wells sampled.
3. Growth in fence line around the site.
4. Fencing around site does not contain ICT's.
5. Lack of restricted access signs around the site.
6. Roads in site have potholes.
7. Slip flanges and bolts on pipe junctions at ICT wellheads deteriorating.
8. High frequency of repair of electronic equipment following lightning storms indicates need for lightning arrestors/lightning rods to prevent damage to sensitive equipment.
9. Metal precipitation process may not be required.
10. Control wires at junction box are not protected.
11. Release of approximately 50,000 gallons of untreated groundwater in January 2001 (due to freezing temperatures).
12. Contaminants in monitoring well C-06 may indicate an isolated source area of contamination.
13. Contamination outside of ICT capture zone at northwest of site may require groundwater extraction.
14. Monitoring wells 18WW08 and 18WW17 have high levels of perchlorate and are not in the scheduled sampling.
15. Constituents regularly detected at site during routine groundwater monitoring not included in investigations.

Recommendations and Follow-up Actions:

1. Evaluate need for vertical extraction wells and install or obtain release from State and EPA.
2. Review monitoring wells sampled for most efficient well locations to be sampled.
3. Cut trees along fence line.
4. Determine applicability for fencing around ICT's to be addressed with final disposition of site in Final ROD issue.
5. Place warning signs around site (Final ROD issue).
6. Fill in potholes on roadway.
7. Paint flanges and monitor for deterioration.
8. Perform cost analysis for installing lightning protection.
9. Review data and monitoring information from groundwater analysis and RI.

Five-Year Review Summary Form (continued)
Burning Ground/UEP Site 18/24

10. Protect wires at junctions.
11. Review spill response procedure and freeze protection plan.
12. Further investigation to determine if there is another source area or if the contamination was from Site 18/24.
13. Further study to determine if groundwater needs to be removed and treated.
14. Sample monitor wells 18WW08 and 18WW17 in the scheduled rounds for perchlorate.
15. Review analysis of ICT's and monitoring wells conducted by onsite GWTP contractor for COCs. Include new COCs in subsequent investigations as necessary.

Protectiveness Statement(s):

The Early Interim Remedial Action at Site 18/24 currently protects human health and the environment, because exposure pathways that could result in unacceptable risks are being controlled. The removal action and operation of the ICT's are protective of the environment and human health by greatly reducing the chance of contaminants migrating to deeper groundwater zones and/or leaving the site. As long as the ICT's remain in operation, this will remain true. As an Early Interim Remedial Action measure this was not intended to be a final solution.

Other Comments:

The RI for the site was completed between April 1993 and October 1998. The final RI report was published during April 2001. Risk assessments for human health and the environment are being prepared for the site. The FS for the site is scheduled to be complete in July 2002. The final ROD for the site will be prepared following the completion of the RI/FS.

Five-Year Review Summary Form (Landfill 16 Site 16 & Landfill 12 Site 12)

SITE IDENTIFICATION

Site Name (from WasteLAN): Longhorn Army Ammunition Plant

EPA ID (from WasteLAN): TX6213820529

Region: 6

State: TX **City/County:** Karnack, Harrison

SITE STATUS

NPL Status: ☒ Final ☐ Deleted ☐ Other (specify) _

Remediation Status (choose all that apply): ☐ Under Construction ☒ Operating ☐ Complete

Multiple OUs? ☒ YES ☐ NO **Construction Completion Date:** 2002 (anticipated)

Has Site been put into reuse? ☐ YES ☒ NO

REVIEW STATUS

Lead Agency: ☐ EPA ☐ State ☐ Tribe ☒ Other Federal Agency _

Author Name: William R. Corrigan

Author Title: Project Manager

Author Affiliation: Corps of Engineers
Contractor

Review Period: 09/01/2001 to 01/30/2002

Date(s) of Site Inspection: 10/16/2001 through 10/17/2001

Type of review: ☒ Statutory
☐ Policy (☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only
☐ Non-NPL Remedial Action Site ☐ NPL
☐ Regional Discretion)State/Tribe-lead

Review Number: ☒ 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify) _

Triggering Action:

☒ Actual RA On-Site Construction at OU # Landfill 16 – Old Landfill & Landfill Sanitary – Site 12

☐ Actual RA Start at OU #

☐ Construction Completion

☐ Previous Five-Year Review Report

☐ Other (specify) _____

Triggering Action Date (from WasteLAN): 10/25/1996

Due Date (Five Years After Triggering Action Date) 10/25/2001

Five-Year Review Summary Form (continued)
Landfill 16 Site 16 &
Landfill 12 Site 12

Issues:

Site 12

1. Groundwater monitoring (chemical sampling and water levels) not conducted regularly.
2. Erosion on landfill near cap boundary.
3. Need O&M Plan for site.
4. Non-source soils not protected by cap.

Site 16

1. Groundwater monitoring (chemical sampling and water levels) not conducted regularly.
2. Need O&M Plan for Site.
3. Evaluate the hydrogeologic effectiveness of the groundwater extraction system.
4. Groundwater model in RI/FS should provide modeling of perchlorate and possibly other contaminants.
5. Steel covers off of housing at extraction wells.

Recommendations and Follow-up Actions:

Site 12

1. Conduct groundwater monitoring on a regular basis.
2. Repair erosion near cap boundary.
3. Write and implement an O&M Plan for Site.
4. Investigate and determine if action is necessary and include in final ROD.

Site 16

1. Conduct groundwater monitoring on a regular basis.
2. Write and implement an O&M Plan for Site.
3. Perform study to determine effectiveness of extraction system.
4. Perform study to determine impact of other contaminants on environment.
5. Place covers on housing or replace with lightweight covers more easily moved.

Five-Year Review Summary Form (continued)

Landfill 16 Site 16 &

Landfill 12 Site 12

Protectiveness Statement(s):

Site 12

The Early Interim Remedial Action at Site 12 currently protects human health and the environment because it is serving its intended purpose to reduce the potential for vertical infiltration of water through the landfill and to minimize contaminant transport. The assessment of the site found that the interim remedy was constructed in accordance with the requirements of the ROD for Sites 12 & 16.

As an Early Interim Remedial Action this was not intended to be final solution. The cap does not prevent infiltration of surface water through non-source area soil that contains contaminants.

Site 16

The Early Interim Remedial Action at Site 16 consisting of the landfill cap and the eight vertical extraction wells installed as a treatability study under the accelerated RI/FS is expected to protect human health and the environment because it is serving its intended purpose to reduce the potential for vertical infiltration of water through the landfill, and to minimize contaminant transport. For the landfill cap to continue to be effective in minimizing contaminant transport, the eight vertical extraction wells will continue to operate until a final remedy is addressed. For the remedy to be protective in the long-term, further remedial actions need to take place as determined by the Feasibility Study. As an Early Interim Remedial Action this was not intended to be final solution.

Other Comments:

Site 12

Groundwater moving through source material could still be a source of contamination from Site 12. The effectiveness of the cap needs to be further evaluated by monitoring seasonal variations in groundwater levels. A RI/FS is being prepared for the Site and a final ROD will determine subsequent remedial action if necessary. Risk assessments for human health and the environmental are being prepared for the site.

Site 16

The effectiveness of the cap and the extraction system needs to be evaluated. The Baseline Risk Assessment for Human Health states, "Based on the results of the Site 16 baseline risk assessment, it appears that groundwater is the primary medium of concern at the site."

1.0 INTRODUCTION

Complete Environmental Service (CES) under contract with the U.S. Army Corps of Engineers (USACE) has conducted the first five-year review of the Early Interim Remedial Actions implemented at the Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. This report documents the results of the review, conducted from August 2001 to January 2002.

The purpose of this five-year review is to evaluate whether the selected Early Interim Remedial Actions for the Burning Ground No. 3/Unlined Evaporation Pond (Sites 18 and 24) and two landfills (Sites 12 and 16) NPL sites have addressed the principal risk to human health and the environment. The principle risk at Sites 18 and 24 is addressed by preventing or reducing further migration of contaminants (high concentrations of chlorinated solvents & heavy metals in the shallow groundwater) into deeper groundwater zones and possibly surface water bodies. The principle risk at Sites 12 & 16 is addressed by reducing long-term vertical infiltration of water through the landfills and to minimize contaminant transport. Contained in this report are recommendations for addressing any deficiencies found during the review.

This review is required by statute. The statutory five-year review requirement was added to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as part of the Superfund Amendments and Reauthorization Act of 1986. The U.S. Army must implement five-year reviews consistent with CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

CERCLA §121(c), as amended, states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the Site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The NCP, Part 300.430(f)(4)(ii) of Title 40 of the Code of Federal Regulations (CFR), states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

This is the first five-year review for any of the sites at LHAAP. The triggering date for this review was 25 October 1996, which was the date of Remedial Action (RA) onsite

construction for Site 12 & 16. The RA construction start date for Sites 18/24 is 12 February 1997. Cleanup criteria have not been achieved and the remedy is still in progress. Because hazardous substances, pollutants, or contaminants remain at the sites above levels that allow for unrestricted use and unlimited exposure, another five-year review is required.

The following sites at LHAAP are still actively being investigated under the Installation Restoration Program (IRP) as active Defense Sites Environmental Restoration Tracking System (DSERTS) sites.

Site No.	Description	Contaminants of Concern
LHAAP 12	Sanitary Landfill	Explosives, metals, VOC's, Chlorides
LHAAP 16	Old Landfill	Explosives, metals, VOC's, Perchlorate
LHAAP 18/24	Burning Ground 3	Explosives, metals, VOC's, Perchlorate, chlorides
LHAAP-17	No. 2 Flashing Area/Burning Ground	Explosives, VOC's
LHAAP-29	Former TNT Production Area	Explosives, VOC's, Perchlorate
LHAAP-32	Former TNT Wastewater Treatment Plant	Explosives, metals
LHAAP-35	Process Wastewater Sumps-Variou	Heavy metals, VOC's, Perchlorate
LHAAP-45	Magazine Area	Pentachlorophenol, metals, Perchlorate
LHAAP-50	Former Waste Disposal Facility	Heavy metals, chlorinated solvents
LHAAP-60	Former Storage Building 411 and 714	Pesticides
LHAAP-67	Above Ground Storage Tank	POC, Solvents

Sites 12, 16, and 18/24 are included in this five-year review. Sites 17, 27, 29, 32, 35, 45, 50, 60, and 67 are currently in the Phase III RI/FS stage to address contaminants of concern.

2.0 SITE CHRONOLOGY

Table: 2.0-1 Chronology of Site Events for Sites 18 & 24

Event	Date
Burning Ground 3 (BG#) begins operation for disposal of PEP wastes.	1955
Unlined Evaporation Pond (UEP) constructed for disposal of manufacturing plant wastewater.	1963
United States Army Environmental Hygiene Agency (USAEHA) Water Quality Special Study first identifies contamination at the UEP (Site 24) in BG3 (Site 18)	August 2 -10, 1976
Land Disposal Study No. 38-26-0104-81, LHAAP. USAEHA installs thirteen monitor wells and finds groundwater contamination at UEP (Site 24) in Burning Ground No. 3 (Site 18)	January 23 - February 8, 1980
Environmental Protection Systems (EPS) installs nine monitor wells and samples twenty-two monitor wells	1982
Hazardous Waste Management Special Study No. 39-26-147-83, US Army Material Command Development and Readiness Command (DARCOM) Open Burning/Open Detonation Grounds Evaluation.	September 1, 1983
Waste disposal terminated at UEP.	June 1, 1984
Burning Ground 3/Washout Ponds & Former Unlined Evaporation Pond, Waste Removal and Capping of UEP under the Resource Conservation Recovery Act (RCRA). Quarterly groundwater monitoring was initiated and has continued to the present on a semi-annual basis.	1986
EPS collects groundwater samples from three wells	1987
Closure Report for UEP	June 1, 1986
Installation RCRA Facility Assessment reviewed all sites at LHAAP and assigns numbers to identify them.	April 8, 1988
Compliance groundwater monitoring wells installed by USACE at LHAAP 18 & 24 as a RCRA Facility Investigation.	1989
LHAAP Placed on National Priorities List (NPL)	August 29, 1990
LHAAP, Texas Water Commission, now Texas Natural Resource Conservation Commission (TNRCC), and EPA enter into a Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) Section 120 Agreement for remedial activities at LHAAP, referred to as the Federal Facility Agreement (FFA).	December 30, 1991
RCRA Part B Permit signed. As a result of the RCRA Facility Assessment, 57 potential Sites of concern were identified on LHAAP. Since that time, removal of the non- Defense Environmental Restoration Act (DERA) eligible Sites has resulted in the current DSERTS list of 47 sites.	February 7, 1992
Interim Remedial Action Design Initiated for LHAAP 18 & 24.	1994
Interim Risk Assessment for Burning Ground 3 and UEP Sites 18 & 24.	January 18, 1994

Final ROD for Early Interim Remedial Action at BG3, Sites 18 & 24.	May 12, 1995
Phase II Field Investigation by Sverdrup installed eighteen additional monitoring wells and collected soil, sediment, groundwater, and surface water samples.	1995
Start of construction on ICT's, GWTP, and associated systems for groundwater pump and treat.	March 1995
Final Work Plan for Phase III Interim Remedial Action at Burning Ground 3.	January 3, 1996
Remedial Action Construction start date.	October 25, 1996
GWTP approved for operation. Approximately 5,000 linear feet of interception collection trench installed to control migration of contaminated groundwater.	January 1997
Start date for the excavation of 37,840 cubic yards of soil and treatment by low temperature thermal desorber unit.	Feb. 12, 1997
Proof of Performance Test Conducted for Soil Treatment Plant	February 13-15, 1997
Proof of Performance Test Conducted at GWTP	March 24, 1998
Phase III Field Investigation by Sverdrup collected groundwater, sediment, and surface water samples	1998
Removal of burning cages at Burning Ground No. 3.	1998
RCRA Closure of burning cages No. 4, 5, 7, & 8 as listed in the LHAAP RCRA permit.	October 2, 1998
RCRA Closure of burning cages No. 6 as listed in the LHAAP RCRA permit.	October 2, 1998
Perchlorate discovered in groundwater at Site 18.	April 1999
Remedial Action construction completion date.	August 31, 1999
RCRA Closure of 90-Day Container Storage Areas 41-X and 24-X. Listed as Notice of Registration numbers NOR013 and NOR014.	August 21, 2000
RCRA Closure of 90-Day Container Storage Area 43-X. Listed as Notice of Registration number NOR015.	November 21, 2000
RCRA Closure of 90-Day Container Storage Area 21-X. Listed as Notice of Registration number NOR016.	January 25, 2001
Second Quarter Data Summary for Perchlorate Investigation.	March 2001
Fluidized Bed Reactor (FBR) for treatment of perchlorate in water goes online at GWTP.	April 2001
Final Remedial Investigation Report for Sites 18 & 24, LHAAP	April 2001

Table: 2.0-2 Chronology of Site Events for Site 12

Event	Date
First use of landfill	1963
Land Disposal Study No. 38-26-0104-81, LHAAP. USAEHA installs and samples four monitor wells at Active Landfill (Site 12).	1980
Environmental Protection Systems (EPS) installs two monitor wells and samples all six wells.	1982
Installation RCRA Facility Assessment reviewed all sites at LHAAP and assigns numbers to identify them.	April 8, 1988
LHAAP Placed on National Priorities List (NPL)	August 29, 1990
LHAAP, Texas Water Commission (now TNRCC), and EPA enter into a Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) Section 120 Agreement for remedial activities at LHAAP, referred to as the Federal Facility Agreement (FFA).	December 30, 1991
Phase I Field Investigation by Sverdrup installed seven additional monitoring wells and collected soil, sediment, groundwater, and surface water samples.	1993
Use of landfill stopped by Thiokol, operator of LHAAP. All trenches covered and compacted.	March 1994
Phase II Field Investigation by Sverdrup installed five additional monitoring wells and collected soil, sediment, groundwater, and surface water samples.	1995
Final Report-LHAAP Installation Restoration Program, Sites 12 And 16 Interim Remedial Action Focused Feasibility Study, recommends cap design for Sites 12 and 16.	March 1995
Final ROD for Early Interim Remedial Action at Landfill Sites 12 & 16.	September 1995
Remedial Action Construction start date.	October 25, 1996
2,000 cubic yards of treated soil placed in landfill.	1997
Early Interim Remedial Action Completed (Landfill Cap Construction Completed)	October 1997
Landfill Cap Long-term Maintenance started.	1998
Phase III Field Investigation by Sverdrup installed seven monitoring wells and collected soil, sediment, groundwater, and surface water samples.	1998
Final Construction Completion Report, Interim Remedial Action, Landfills 12 and 16 Cap Construction, LHAAP	December 1998
Remedial Action Construction completion date.	August 31, 1999
Final Remedial Investigation Report for Site 12, LHAAP	April 2001
Second Quarter Data Summary for Perchlorate Investigation.	March 2001

Table: 2.0-3 Chronology of Site Events for Site 16

Event	Date
First use of landfill	1942
U.S. Army Environmental Hygiene Agency (USAEHA) Air and Water Pollution Survey Investigates Old Landfill (Site 16) Five monitoring wells installed. (BH 12-16)	April 20, 1978
Land Disposal Study No. 38-26-0104-81, LHAAP. USAEHA installs and samples three monitor wells at Old Landfill (Site 16).	1980
Environmental Protection Systems (EPS) installs one monitor well (MW-122) and samples collects groundwater and soil samples.	1982
EPS sampled groundwater, surface soil, and sampled twenty soil borings on the landfill.	1987
Installation RCRA Facility Assessment reviewed all Sites at LHAAP and assigns numbers to identify them.	April 8, 1988
LHAAP Placed on National Priorities List (NPL).	August 29, 1990
LHAAP, Texas Water Commission (now TNRCC), and EPA enter into a CERCLA Section 120 Agreement for remedial activities at LHAAP, referred to as the Federal Facility Agreement (FFA).	December 30, 1991
Phase I Field Investigation by Sverdrup installed eleven monitor wells, seven soil borings, and collected groundwater, surface water, and sediment samples.	1993
Phase II Field Investigation by Sverdrup installed seven monitor wells, drilled ten soil borings, and collected twenty-one Geoprobe samples. Groundwater, surface water, and sediment samples were also collected.	1995
USACE begins quarterly sampling of seep near toe of landfill.	1995
Final Report-LHAAP Installation Restoration Program, Sites 12 And 16 Interim Remedial Action Focused Feasibility Study, recommends cap design for Sites 12 & 16.	March 1995
Final ROD for Early Interim Remedial Action at Landfill Sites 12 & 16.	September 1995
USACE conducts a post Phase II investigation collecting surface water and installing two extraction wells and twelve piezometers.	August 1995
Final Project Work Plans for Interim Remedial Action Landfill 12 & 16 Caps complete.	June 10, 1996
Two pilot extraction wells and twelve piezometers installed by Sverdrup as part of Groundwater Treatability Study.	February 1996
Remedial Action Construction start date.	October 25, 1996
Phase III investigation by Sverdrup to install eight piezometers and twenty monitoring wells. Six extraction wells were installed under the Accelerated Remedial Investigation to contain contamination seeping from groundwater into Harrison Bayou. Water piped to GWTP. Groundwater, soil, surface water, and sediment samples collected.	June 1997
35,840 cubic yards of treated soil from Site 18/24 RA placed in landfill.	1997
Phase III investigation by Sverdrup continues to collect geoprobe samples and groundwater samples.	1998
USACE collects 10 SCAPS probe holes in landfill.	1998
Early Interim Remedial Action Completed (Landfill Cap Construction Completed)	October 1998
Landfill Cap Long-term Maintenance begins.	1998
Final Sampling and Data Results Report, Site 16 Phase III RI/FS and Groundwater Treatability Study, LHAAP.	December 1998
Final, Construction Completion Report, Interim Remedial Action, Landfills 12 and 16 Cap Construction, LHAAP.	December 1998
Remedial Action Construction completion date.	August 31, 1999
Site 16 Landfill Draft Remedial Investigation Report	August 1999
Second Quarter Data Summary for Perchlorate Investigation.	March 2001
Draft Final Feasibility Study for Site 16	December 2001

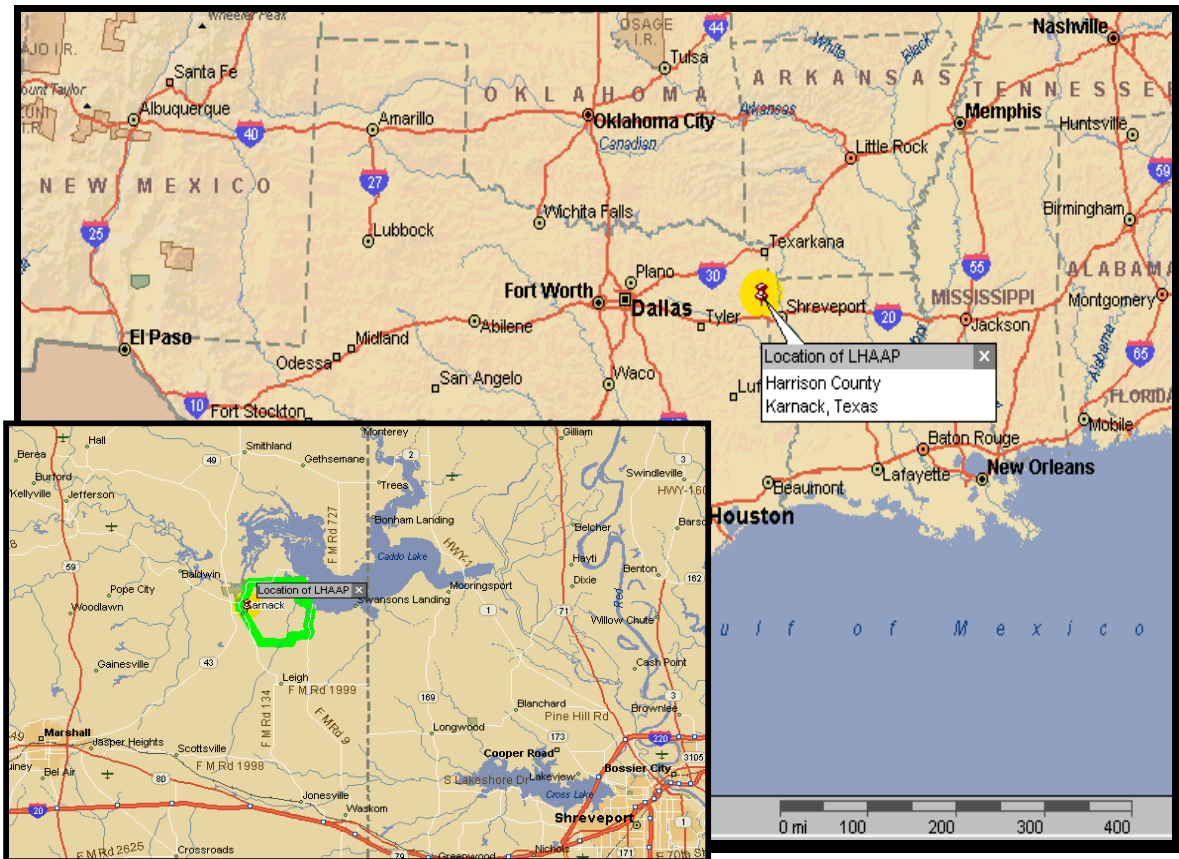
3.0 BACKGROUND

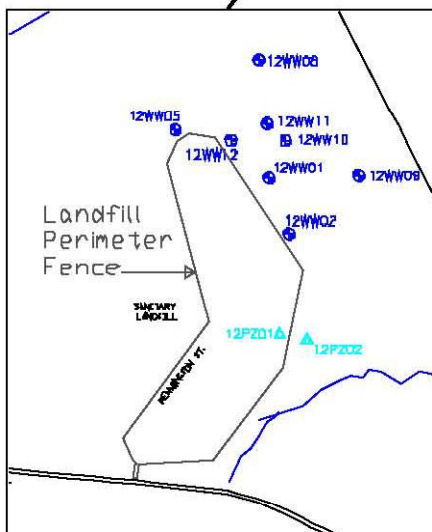
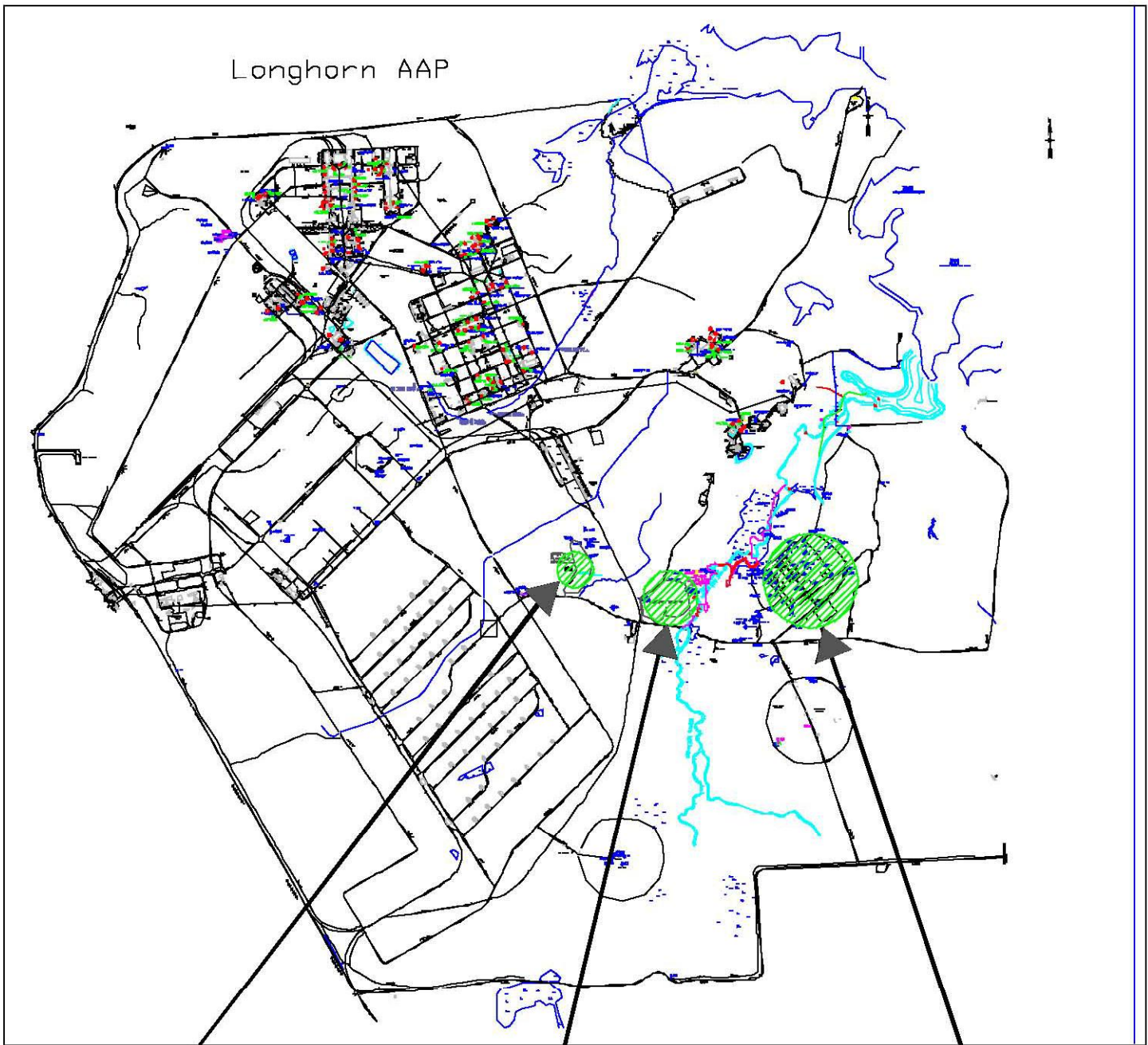
3.1 Physical Characteristics

Longhorn Army Ammunition Plant (LHAAP) is located in the northeast corner of Harrison County, Texas, approximately 3.6 miles from the Louisiana border as shown in Figure 3.1-1. Harrison County is located in the northeast corner of Texas. Caddo Lake, Caddo Lake State Park, and the small town of Karnack border LHAAP.

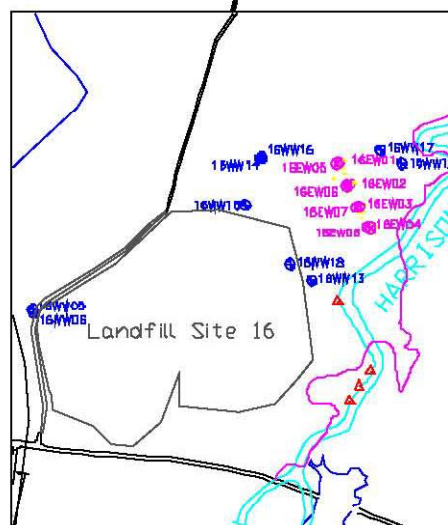
LHAAP is located approximately 30 miles west of Shreveport, Louisiana, with the nearest major city being Marshall, Texas, 15 miles to the southwest. The installation has a total area of approximately 8,493 acres. State Highways 43 and 134 access the installation.

Figure: 3.1-1 Location of LHAAP in Texas

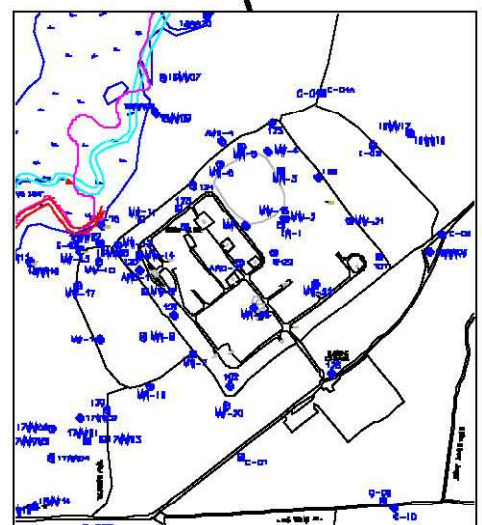




Site 12



Site 16



Site 18/24

All four Sites considered in this five-year review are located in a remote area in the southeastern portion of LHAAP as indicated in Figure 3.1-2. The Old Landfill (Site 16) encompasses approximately 16 acres in the south-central portion of LHAAP. Harrison Bayou borders Site 16 along the east and southeast edge. Along the southeastern edge of the landfill is the 100-year floodplain. Burning Ground No. 3 (Sites 18 and 24) is east of Site 16 and on the east side of Harrison Bayou and a portion of this site is along the 100-year flood plain. Site 12 is west of the Old Landfill and on higher ground. Site 12 encompasses approximately seven acres of grass and is surrounded by timber.

3.2 Geology of LHAAP

LHAAP, including Sites 18, 24, 12, & 16, is situated on an out crop of the Wilcox Group, which crops out over a large part of the eastern half of Harrison County. The Wilcox consists mostly of fine- to medium-grained sands interbedded with a considerable amount of clay and seams of lignite. The Wilcox Group is underlain conformably by the predominantly calcareous clay of the Midway Group. Regional dip of the Wilcox is to the northwest into the East Texas Syncline, while the ground surface generally dips to the southeast.

The Wilcox Group has been identified by the Texas Water Development Board as the basal unit of the Cypress aquifer, also known as the Carrizo-Wilcox aquifer. The Cypress aquifer outcrops over most of Harrison County and is comprised of, in ascending order, the Wilcox Group, the Carrizo Sand, the Reklaw Formation, and the Queen City Sand. All units are believed to be hydraulically connected. All of these units dip to the northwest into the East Texas Syncline.

The availability of groundwater in Harrison County is largely dependant on the hydrologic characteristics of the units comprising the Cypress aquifer. The Wilcox Group, outcropping in the area of LHAAP yields small (less than 50 gallons per minute) (gpm) to moderate (50-500 gpm) quantities of fresh water to wells throughout the county. As a basal unit of the Cypress aquifer, the Wilcox is also considered as the base of fresh water in the area. The Midway Group, which does not yield usable quantities of water, tends to serve as a relatively impermeable basement of the overlying water-bearing Wilcox. The top of the Midway Group has been encountered 75 to 190 feet below the ground surface under Burning Ground No. 3 (Sites 18 and 24). It is 141 feet below ground surface at Landfill 12 (Site 12). It is 225 to 307 feet below ground surface at the Old Landfill (Site 16).

LHAAP Site 12 landfill is located on the outcrop of the Wilcox. Sites 16 landfill and 18 & 24 are along Harrison Bayou, which has recent alluvium in its floodplain. The 100-year floodplain elevation of 180 feet mean sea level (msl) marks the contact between the Wilcox and recent alluvium on the surface. Borings drilled at all three Sites have shown that correlation is difficult due to the lateral and vertical heterogeneity of the materials

comprising the Wilcox Group. Subsurface data from soil borings and monitor wells drilled and constructed as part of past investigations show very few strata to be continuous across the Sites.

Groundwater at all three Sites generally occurs under unconfined conditions and the elevation fluctuates with seasonal variations in rainfall. The groundwater is encountered at depths of 20-25 feet beneath the surface at LHAAP 12 landfill and flows to the east and northeast. The groundwater is encountered at depths of 5-10 feet beneath the surface of the LHAAP 16 landfill and flows generally to the east and southeast. The groundwater is encountered at depths of 5 to 20 feet beneath the surface of the LHAAP 18 & 24 burning ground and flows generally to the northeast. Maps showing typical groundwater elevations for the Sites are in Appendix F (Site 12) and Appendix G (Site 16).

3.3 Land and Resource Use

Before LHAAP was constructed in 1940, the area was rural farms and forests. For the past 60 years the land surrounding the Sites has been part of the plant. The Landfills (Sites 12 and 16) and the Burning Ground No. 3 are no longer in use by LHAAP. Ammunition plants have maintained buffer areas for safety in case of explosions. Much of LHAAP is forest and the disposal sites are located within the plant. The nearest boundary of LHAAP to any of the sites is 3000 feet east of Burning Ground No. 3 (Site 18). Future use of the land is going to be limited. Clean areas may be turned over to the U. S. Fish and Wildlife Service for use as a wildlife refuge. The U.S. Army will hold contaminated areas as long as necessary. Caddo Lake and its tributaries are considered sensitive environmental areas. Harrison Bayou, which runs between Sites 16, and 18/24, is a tributary to Caddo Lake. Caddo Lake is a water supply for several nearby communities.

3.4 History of contamination

3.4.1 Burning Ground No. 3 LHAAP Site 18/24

Burning Ground No. 3 was in operation from 1955 to 1997 and historical waste management units included open burn pits, an Unlined Evaporation Pond (UEP), stockpiles of solvent-soaked sawdust, and suspected waste burial pits. The UEP was constructed at the burning ground in 1963 as a holding pond to store flammable, volatile, and pyrotechnic wastes resulting from the washout of rocket motor casings. In 1973, the pond also began receiving wash water containing solvent residues and solids collected from operations involving pyrotechnic material preparation and mixing commonly containing the metallic cations aluminum, arsenic, barium, cadmium, chromium, iron, lead, magnesium, sodium, strontium, and zinc; nonmetallic anions including nitrite, nitrate, perchlorate, and phosphate, and; various organic solvents such as acetone, 1,1,1-trichloroethane, trichloroethene, ethyl alcohol, methyl ethyl ketone, methylene chloride, and toluene. An Air Curtain Destructor (ACD) was built in 1979 for the purpose of disposing of explosive-contaminated wastes by burning.

Use of burn pits and trenches was reportedly discontinued in 1984 and subsequent burning took place in aboveground pans or burning cages. A RCRA Interim Status Hazardous Waste Permit for the thermal treatment of Pyrotechnics, Explosives, and Propellant (PEP) wastes at Burning Ground No. 3 was issued to LHAAP on 7 February 1992.

In 1976 the U.S. Army Environmental Hygiene Agency (USAEHA) first identified a suspected release of contaminants from the site. The use of the UEP was discontinued in 1984 when it was discovered that the pond was contaminating groundwater beneath the Site. The UEP was closed as a RCRA interim status surface impoundment in 1986 by removing all wastewater and sludge and capping the impoundment. Use of the burning ground was discontinued in 1997. Final closure of the burning cages was completed in 1999.

3.4.2 LHAAP Site 12

Landfill 12, previously called the “Sanitary Landfill”, was used for disposal of non-hazardous industrial waste including cafeteria waste, non-hazardous chemical waste, oil/diesel soaked dirt, transite siding, and asbestos. The landfill was used intermittently since 1963. Continuous use of the landfill began in approximately 1978. As early as 1980 an USAEHA Land disposal study recommended changes in disposal practices due to leachate escaping from the landfill. The last used portion of the landfill was closed in March 1994.

3.4.3 LHAAP Site 16

The Old Landfill (Site 16) was originally used from 1942 to 1944 for the disposal of TNT red water ash. The central section of the site was reportedly used as an all-purpose junkyard for disposal of such materials as substandard TNT, barrels of chemicals, oil, paint, scrap iron, and wood. In the mid to late 1950's, rocket motor casings were reportedly burned and possibly buried at the site. Burn pits, waste storage, and landfill operations continued as waste disposal and treatment activities until sometime in the 1980's. As early as 1980 an USAEHA Land disposal study recommended changes in disposal practices due to leachate escaping from the landfill. Leachate escaping from Landfill 16 is of particular interest due to the proximity of the landfill to Harrison Bayou, a surface water stream that feeds Caddo Lake.

3.5 Initial response (removal)

3.5.1 LHAAP Site 18/24

Industrial wastes ceased going to the UEP in June of 1984. The UEP was closed in 1986 under RCRA. Approximately two million gallons of water were pumped out of the UEP and disposed offsite at a RCRA permitted hazardous waste injection well. Approximately 7,850 cubic yards of sludge were removed, mixed with concrete for

stabilization and disposed at a RCRA permitted hazardous waste landfill offsite. The pond was backfilled with clean fill and capped.

In 1990 LHAAP was placed on the NPL as a “fence to fence” Site, and in 1991 the U.S. Army, EPA, and State Regulatory Agency, then known as the Texas Water Commission entered into a Federal Facility Agreement (FFA). The Burning Ground and UEP were included in the FFA as solid waste management units.

Due to the proximity of Site 18/24 to Harrison Bayou and high concentrations of chlorinated solvents, further action to control the spread of contamination was required. A ROD was subsequently finalized in 1995 to remove and thermally treat source material. The ROD also required for groundwater to be pumped and treated in an onsite Groundwater Treatment Plant (GWTP).

LHAAP ceased to be an active production facility in 1995. Subsequently, the use of the Burning Ground was ceased in 1997 with the final open burning of all waste PEP. Radian International removed the burning cage structures in 1998 and subsequent RCRA closure of the units took place between 1998 and 2001.

The RA construction start date at Site 18/24 was 12 February 1997. The project was to remove and treat contaminated soil, install a series of interceptor collection trenches & extraction wells, and build a groundwater treatment plant for treatment of the groundwater extracted from the site. Approximately 30,000 yd³ of contaminated soil was thermally treated onsite in low temperature thermal desorbers. The GWTP was constructed and placed online in 1997 for the treatment of groundwater.

To date there have been approximately 60 million gallons of groundwater treated to remove metals and volatiles, and subsequently released from the GWTP to Harrison Bayou. Due to concerns over perchlorate contamination at the site, a Fluidized Bed Reactor (FBR) was placed online at the GWTP in April 2001. The FBR is a biological treatment process that removes perchlorate from the water. From April 2001 through January 2002 the FBR has treated approximately 11 million gallons of water.

3.5.2 LHAAP Site 12

Monitor wells were first installed at the site in 1980. In 1990, LHAAP was placed on the NPL, and in 1991 the U.S. Army, EPA, and Texas Water Commission entered into a FFA designating LHAAP as a “fence to fence” site. The landfill Site 12 was included in the FFA as a solid waste management unit.

Industrial waste stopped going to Landfill 12 in March 1994. Any open trenches were covered with soil and compacted.

In 1995 an Interim Remedial Action Feasibility Study recommended that a cap be designed for the landfill and constructed to control surface water migration into and 12

through the landfill. A ROD was finalized in September 1995 directing the capping of the landfill. Construction began to place a cap on the landfill in 1996. Some of the treated material from Site 18/24 was placed on the landfill prior to the construction of the cap. The cap was completed in 1997 and the Site was fenced with barbed wire and warning signs were placed around the landfill.

Long-term maintenance of the cap began in 1998. A Final Remedial Investigation Study was completed in April of 2001. The RI/FS Report will include a groundwater to surface water interface model.

3.5.3 LHAAP Site 16

In 1976 the USAEHA identified a suspected release of contaminants from the site. As a result of the USAEHA Air and Water Pollution Survey, monitor wells were first installed at the site in 1980. In the 1980's, Landfill 16 ceased to be utilized for waste disposal.

In 1990 LHAAP was placed on the NPL, and in 1991 the U.S. Army, EPA, and Texas Water Commission entered into a FFA designating LHAAP as a "fence to fence" site. The landfill Site 16 was included in the FFA as a solid waste management unit.

In 1995 an Interim Remedial Action Feasibility Study recommended that a cap be designed for the landfill and constructed to control surface water migration into and through the landfill. A ROD was finalized in September 1995 directing the capping of the landfill. Construction began to place a cap on the landfill in 1996. Some of the treated material from Site 18/24 was placed on the landfill prior to the construction of the cap. The cap was completed in 1997 and the site was fenced with barbed wire and warning signs were placed around the landfill.

As a treatability study under an accelerated RI/FS to keep landfill leachate from entering Harrison Bayou, two vertical extraction wells were installed in 1996, and an additional six vertical extraction wells were installed in 1997. Groundwater extracted from these wells is pumped to the GWTP and treated for release. These extraction wells have produced an estimated 4.5 million gallons of groundwater for treatment at the GWTP.

Long-term maintenance of the cap began in 1998. As a part of the RI/FS, a Baseline Risk Assessment for Human Health was completed during June 2001 and an Ecological Risk Assessment was completed during October 2001. The RI/FS will include a groundwater to surface water interface model. With current information, a Monitored Natural Attenuation Study is planned to begin at the site in 2002.

3.6 Basis for Taking Action

3.6.1 Site 18/24 Constituents of Concern

The chemicals of concern presented for Sites 18/24 are based on the Final Remedial Investigation. The results of the RI are documented in the Final Remedial Investigation Report Volume 1, April 2001.

As documented by the RI, the following chemicals of concern have exceeded the TNRCC soil and groundwater Protective Concentration Level (PCL) and LHAAP background values. When PCL's were not available, EPA Region 6 Human Health Medium-Specific Screening Levels were utilized. The hazardous substances that have been released at the site in each media are included in Table 3.6.1-1.

Table 3.6.1-1: Site 18/24 Constituents of Concern Based on Remedial Investigation

<u>Soil</u>	<u>Surface water</u>	<u>Sediment</u>	<u>Groundwater</u>
Methylene-chloride Barium Cadmium Lead Mercury	Arsenic Copper Lead	Trichloroethene 1,2-Dichloroethane cis-1,2-Dichloroethylene Barium Lead Selenium Perchlorate	Trichloroethene Methylene chloride cis-1,2-Dichloroethylene Antimony Barium Chromium Iron Nickel Silver Thallium Chloride Nitrate+Nitrite Perchlorate

In addition to the constituents listed in the Remedial Investigation Report, Volume I, the chemicals in Table 3.6.1-2 have been regularly detected in groundwater sampled from ICT's and monitoring wells. The table illustrates the COCs that exceeded the TNRCC MSC's groundwater and soil protection standards for residential use effective September 23, 1999. The table compares only the groundwater samples collected from the ICT's and monitoring wells during the November 2001 sampling event.

Table 3.6.1-2: Site 18/24 Constituents of Concern Based on Semi-Annual Monitoring Events

<u>Groundwater</u>	<u>Constituent Exceeds Groundwater Protection Standard for Residential Use</u>	
	ICT's	Monitoring Wells
Benzene	Yes	Yes
Carbon Tetrachloride	Yes	Yes
Chloroform	Yes	Yes
1,1-Dichloroethane	No	No
1,2-Dichloroethane	Yes	Yes
1,1-Dichloroethene	Yes	Yes
Ethylbenzene	Yes	No
Methylene Chloride	Yes	Yes
Tetrachloroethene	Yes	Yes
Toluene	No	No
1,1,1-Trichloroethane	No	No
1,1,2-Trichloroethene	Yes	Not Analyzed
Trichloroethene	Yes	Yes
Vinyl Chloride	Yes	Yes
Freon-113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	Yes	Not Analyzed
Perchlorate	Yes	Yes

3.6.1.1 Human Health and Ecological Risk Assessment

A Risk Assessment for human and ecological risks is currently being performed as part of the RI/FS. When the risk assessment is available the contaminants of concern may change.

3.6.2 Site 12 Constituents of Concern

The chemicals of concern presented for Site 12 are based on the Remedial Investigation Report Volume 1, April 2001. The hazardous substances that have been detected at the site in each media are included in Table 3.6.2-1. The COCs have exceeded the TNRCC soil and groundwater PCL and LHAAP background values.

3.6.2.1 Human Health and Ecological Risk Assessment

A Risk Assessment for human and ecological risks is currently being performed as part of the RI/FS. When the risk assessment is available the contaminants of concern may change.

Table 3.6.2-1: Site 12 Constituents of Concern Based on Remedial Investigation

Soil	Surface water	Sediment	Groundwater
Methylene chloride Arsenic Barium Lead Silver	Copper Zinc	Barium Cadmium Lead	Trichloroethene 1,2-Dichloroethene Bis(2-ethylhexyl)phthalate Antimony Cadmium Chromium Iron Lead Nickel Chloride Sulfate

3.6.3 Site 16 Constituents of Concern

The COC presented for Site 16 in Table 3.6.3-1 are based on the Remedial Investigation Report Volume 1, August 1999.

Table 3.6.3-1: Site 16 Constituents of Concern Based on Remedial Investigation

Soil	Surface water	Sediment	Groundwater
Trichloroethene Vinyl chloride	Copper Lead Zinc	None	1,1,2-Trichloroethane 1,1-Dichloroethene 1,2-Dichloroethane 1,2-Dichloroethene cis-1,2-Dichloroethylene trans-1,2-Dichloroethene Methylene chloride Trichloroethene Vinyl chloride Bis(2-ethylhexyl)phthalate) Barium Beryllium Chromium Iron Lead Manganese Nickel Silver Thallium Zinc Perchlorate

The chemical concentration levels are based on Medium Specific Concentrations (MSC) from TNRCC Risk Reduction No. 2 (August 1998) and the Texas Water Quality Standards (TWQS). See Section 4.1 of RI for Site 16 (Sverdrup, August 1999).

3.6.3.1 Human Health Baseline Risk Assessment

In accordance with the Baseline Risk Assessment: Human Health Evaluation for Site 16, June 2001, it was determined that human health risks at Site 16 are mainly driven by exposure to groundwater and less significantly, soil.

Soil health risks at the site are associated mainly with arsenic. Concentrations of arsenic are above the Reasonable Maximum Exposure (RME) limit in subsurface soils, surficial soils, Harrison Bayou surface water, sediment, and fish ingestion. However, there is some question about the concentration of acceptable background levels of arsenic. In the study, arsenic concentrations above the RME in soil are thought to be a result of background concentrations.

Groundwater risk estimates place the carcinogenic risk estimate above EPA acceptable thresholds. The groundwater carcinogenic risk estimates were largely driven by cis-1,2-dichloroethylene, trichloroethene, and vinyl chloride. The groundwater noncarcinogenic risk estimates were well above the EPA acceptable risk threshold and were driven by cis-1,2-dichloroethylene and trichloroethene.

Further information can be found in the Baseline Risk Assessment: Human Health Evaluation Volume 1 report.

3.6.3.2 Ecological Risk Assessment

In accordance with the Ecological Risk Assessment for Site 16, constituents of potential concern were identified for further evaluation. It was recommended in the document that the screening process continue in accordance with the Superfund Ecological Risk Assessment Process. The screening process will be completed in a site-wide baseline ERA.

4.0 REMEDIAL ACTIONS

The following sections discuss the remedies selected, remedy implementation, and system operations.

4.1 Remedy Selection

4.1.1 Site 18/24

The ROD for Site 18/24 addressed both groundwater contamination and soil contamination. The selected remedy for addressing the site contaminants and meeting the remedial objectives of the Early Interim Remedial Action is a combination of groundwater extraction and treatment and soil removal and treatment. The EPA signed the ROD on May 12, 1995.

The Remedial Action Objectives (RAO) of the ROD were to mitigate potential risks posed by high concentrations of chlorinated solvents and heavy metals in the shallow groundwater and buried source material at the site. The selected remedy addresses the principal risk at the site by reducing or preventing further migration of contaminants into deeper groundwater zones and possibly surface water bodies. The major components of the selected remedy include:

- Extraction of shallow groundwater and treatment using metal precipitation, air-stripping, and off-gas treatment for VOC's, and
- Excavation of source material and treatment using low temperature thermal desorption and off-gas treatment for VOC's.

The Remedial Actions at the site associated with the contaminated soils and source materials excavation, treatment, and disposal required by the ROD consisted of the following:

- Construction of a Soil Handling and Dewatering Pad for ICT excavated soils and contaminated soils and source material.
- Construction of a storage pad for treated soils and source material.
- Mobilization, setup, and performance testing of a Low Temperature Thermal Desorption (LTTD) soil treatment system.
- Excavation and treatment of source material.
- Perimeter monitoring of site during source material excavation.
- Disposal/placement of treated soils and source material.
- Drilling of 20 soil borings to investigate the potential presence of other source material.
- Restoration of the site by importing clean fill material and backfilling source material excavations, and restoration of utility lines.

The Remedial Actions at the Site associated with the groundwater extraction and treatment system consisted of the following:

- Construction of a total of 5,000 feet of ICT Sections.
- Installation of a piping network to collect the extracted water and convey it to the GWTP.
- Construction of the GWTP to treat the extracted groundwater.
- Installation of a piping system to convey the treated water to Harrison Bayou.
- Startup of the GWTP and completion of proof of performance testing.
- Operation and maintenance of the GWTP.
- Evaluation of the hydraulic effectiveness of the treatment system.

In addition to the requirements in the ROD, an Agreed Order issued by the State required remedial activities and submittals in relation to Site 18/24. LHAAP was issued the Agreed Order by the TNRCC on December 4, 1995 for ongoing RCRA violations. Items required by the Agreed Order in relation to the CERCLA work at Site 18/24 are listed in Table 4.1.1-1. Only the items that require ongoing submittals are listed. Items that were answered to the satisfaction of the State are not listed. It was agreed with the State that the requirements of RCRA would be addressed under CERCLA activities as an ARAR.

Table 4.1.1-1: LHAAP Agreed Order Items related to CERCLA Site 18/24

Agreed Order Item	Requirement	Submittal	Submittal Date
Number 7	Revise Groundwater Sampling & Analysis Plan	LHAAP Groundwater Sampling and Analysis Plan (CERCLA RI/FS Workplan – Amended as additional work is performed.)	Ongoing
Number 8	Maintain all Documents, Records and Reports	Documents submitted and maintained per FFA	Ongoing
Number 9	Submit copies of final FFA primary documents and work plans to TNRCC Region V office and TNRCC Project Manager	Documents submitted and maintained per FFA	Ongoing
Number 12	Annual Report Summarizing previous year's remedial activities and schedule for future activities	Annual Report (Requirement met with Installation Action Plan)	Ongoing
Number 15(2)	Complete construction or abandonment of monitoring wells in accordance with State rules	As Required	Ongoing

Number 16	Construct monitoring wells in accordance with State Rules or receive approval from State	As Required	Ongoing
Number 17	Submit an Annual Groundwater Monitoring and Remediation Report Summary	Annual Report (Requirement met per monthly, quarterly, and annual GWTP Reports)	Ongoing
Number 18	Corrective Action Measures to remediate existing contamination in the UEP and Burning Ground areas	As Required	Ongoing
Number 20	Provide survey information of UEP	Letter with Survey Information	May 20, 1996

In addition to the ROD and the Agreed Order issued by the State, several non-CERCLA removal activities have taken place at the site. Each RCRA permitted unit and 90-day permit exempt RCRA unit at the site has undergone a RCRA closure in accordance with closure plans approved by the TNRCC.

There were five burning cages located at the Burning Ground. The burning cages were permitted as interim status units in the LHAAP Hazardous Waste Permit Number 50195. Each burning cage was closed in accordance with RCRA closure requirements to the TNRCC Risk Reduction Standard in effect at the time.

Risk Reduction Standards are the medium-specific concentrations (MSC), standards, and criteria for health-based closure/remediation and are based on Title 30 Chapter 335 Subchapter S. The Risk Reduction Standards may be defined as follows:

- Risk Reduction Standard No. 1 (RR1S) – Closure/Remediation to Background
- Risk Reduction Standard No. 2 (RR2S) – Closure/Remediation to Health-Based Standards and Criteria
- Risk Reduction Standard No. 3 (RR3S) – Closure/Remediation with Controls

Once a property owner has a closure to RR1S approved by the State regulatory agency, no further action is necessary by the property owner. Closure to RR2S requires a deed record of the site but no post closure care is required. Closure to RR3S requires a corrective measure study by the property owner to determine an acceptable remedy or remedies. Once the RR3S remedy is achieved, a document to fulfill the requirements of a deed record is required.

Table 4.1.1-2: Closure Status of Permitted Thermal Treatment Units at Site 18/24

Cage Permit Number	Cage Notice of Registration (NOR) Number	Cage Description	Closure Date	Closure Status	Reason for Risk Reduction Status
No. 4	NOR 003	East Burning Cage	2 Oct. 1998	RR2S	Metals
No. 5	NOR 155	Center Burning Cage	2 Oct. 1998	RR2S	Metals, Volatiles
No. 6	NOR 156	West Burning Cage	27 May 1999	RR3S	Volatiles, Semi-Volatiles
No. 7	NOR 157	North Burning Cage	2 Oct. 1998	RR2S	Metals
No. 8	NOR 158	South Burning Pan	2 Oct. 1998	RR2S	Metals, Volatiles, RDX

In accordance with the closure plan, the structures were removed and decontaminated and surrounding surface soils were sampled for metals, explosives, volatiles, perchlorate, and explosives. Where contamination was present above Risk Reduction Standard No. 2 (RR2S) concentrations, the soils were removed for disposal offsite to a permitted waste Treatment Storage Disposal Facility (TSDF). Soils at each burning cage location contaminated with volatiles were not removed due to widespread contamination at the burning ground and the fact that the units are present on a CERCLA site undergoing remedial action for volatiles. The location of each cage was surveyed and deed recorded after closure. Table 4.1.1-2 describes each cage identification and final closure date.

As indicated in Table 4.1.1-2, NOR 156 could not be closed to RR2S due to the elevated levels of contamination from volatiles. Comments in the closure report indicate visible areas of contamination were evident in the soils several feet beneath the area of the burning cage and that contamination in the soils was from previous waste disposal activities rather than contamination from the burning cage.

Four ninety-day permit exempt container storage areas at the burning ground were also closed in accordance with closure plans approved by the TNRCC. The closure of each 90-day unit followed the same guidelines as the permitted units including structure decontamination, soil sampling & analysis, soil removal as required, and deed recording. Table 4.1.1-3 describes each 90-day unit and the final closure status.

Table 4.1.1-3: Closure Status of 90-Day Permit Exempt Areas at Site 18/24

Notice of Registration Number	LHAAP Building Number	Description	Closure Date	Closure Status	Reason for Risk Reduction Status
NOR 013	41-X	Container Storage Area	21 Aug. 2000	RRS No. 2	Metals
NOR 014	24-X	Washout Area	21 Aug. 2000	RRS No. 2	Metals, Perchlorate
NOR 015	43-X	Container Storage Area	21 Nov. 2000	RRS No. 2	Metals, Perchlorate
NOR 016	21-X	Container Storage Area	25 Jan. 2001	RRS No. 2	Metals

Since the implementation of the Remedial Action, the pump & treat system is performing as expected. The groundwater plume is well defined and maps are updated regularly. Groundwater elevations are measure monthly and mapped. The groundwater drawdown area at the site is well defined. Volume of groundwater removed from the site is documented monthly. From the groundwater volume and contaminant concentrations, volatiles removed from the site are calculated twice per year. Contaminant trends in monitoring wells are updated twice per year and should assist in long-term trend analysis.

4.1.2 Sites 12 & 16

The ROD for Sites 12 & 16 addressed an Early Interim Remedial Action. The Early Interim Remedial Action was necessary to mitigate potential risks posed by buried source material at the Site. The ROD was signed on September 27, 1995.

In addition to the requirements in the ROD, an Agreed Order issued by the State required remedial activities and submittals in relation to Sites 12 & 16. LHAAP was issued the Agreed Order by the TNRCC on December 4, 1995 for ongoing RCRA violations. Items required by the Agreed Order in relation to the CERCLA work at Site 12 & 16 are listed in Table 4.1.2-1. Only the items that require ongoing submittals are listed. Items that were answered to the satisfaction of the State are not listed.

The Remedial Action Objective is to provide reliable long-term protection by minimizing the infiltration of water into the landfills. This reduces the possibility of contaminant transport into surface water bodies. Groundwater monitoring will be carried out during and after placement of the landfill caps.

Table 4.1.2-1: LHAAP Agreed Order Items related to CERCLA Site 12 & 16

Agreed Order Item	Requirement	Submittal	Submittal Date
Number 7	Revise Groundwater Sampling & Analysis Plan	LHAAP Groundwater Sampling and Analysis Plan (CERCLA RI/FS Workplan – Amended as additional work is performed.)	Ongoing
Number 8	Maintain all Documents, Records and Reports	Documents submitted and maintained per FFA	Ongoing
Number 9	Submit copies of final FFA primary documents and work plans to TNRCC Region V office and TNRCC Project Manager	Documents submitted and maintained per FFA	Ongoing
Number 12	Annual Report Summarizing previous year' remedial activities and schedule for future activities	Annual Report (Requirement met with Installation Action Plan)	Ongoing
Number 15(2)	Complete construction or abandonment of monitoring wells in accordance with State rules	As Required	Ongoing
Number 16	Construct monitoring wells in accordance with State Rules or receive approval from State	As Required	Ongoing
Number 17	Submit an Annual Groundwater Monitoring and Remediation Report Summary	Annual Report (Requirement met per monthly, quarterly , and annual GWTP Reports)	Ongoing

The selected remedy consisted of a multilayer landfill cap section, which included the following components:

- Foundation soil layer,
- A low permeability sodium bentonite geocomposite, geosynthetic membrane liner,
- A final soil cover with adequate slopes and vegetation,
- Perimeter berms and drainage swales to control surface water runoff,

As a result of an accelerated treatability study, two extraction wells were installed in February of 1996 and tested to develop a more complete extraction system. Six more extraction wells were installed in June of 1997 as part of the treatability study under the

accelerated RI/FS. Water extracted from the system during 1996 was stored in Frac-Tanks, until the GWTP was operational. In 1997, a sixty-thousand gallon storage tank was constructed at Site 16. A double wall containment pipeline was built to transport groundwater from the storage tank at Site 16 to the GWTP.

4.2 Remedy Implementation

This section discusses implementation of the remedy at each Site, addressing Sites 18 & 24 as a unit and Sites 12 & 16 as a unit.

4.2.1 Site 18/24 Remedy

In the Federal Facility Agreement, signed 30 December 1991, the US Army agreed to perform the remedial design/remedial action (RD/RA) and pay costs for cleaning up and monitoring the Site. The EPA approved the ROD on 12 May 1995.

In accordance with the ROD an Interim Remedial Action was implemented prior to the RI/FS and a Remedial Design. The IRA consisted of three phases.

- Phase I work included several laboratory treatability verifications for the onsite contaminated soils and groundwater.
- Phase II work was to determine the effectiveness of different systems for groundwater extraction. In the spring of 1994, a pilot study was conducted to determine the most effective method to extract the contaminated shallow groundwater. Three systems were installed and used in the pilot study:
 - An Interceptor Collection Trench,
 - A horizontal extraction well,
 - A vertical extraction well.
- Phase III work included the activities associated with the IRA, which consisted of the construction and maintenance of a groundwater extraction and treatment system, contaminated soils and source material excavation and treatment, and site restoration. The workplan was designed to meet the early interim remedial action objectives to address and mitigate potential risks associated with the high concentrations of contaminants in the shallow groundwater and source material.

Figure 4.2.1-1 illustrates the Site 18/24 Area with the layout of the ICT's and the location of the Groundwater Treatment Plant.

Conducted simultaneously with the construction of the GWTP, was treatment of soil as required by the ROD and incorporated into the Phase III workplan. The following work was completed:

- Construction of a Soil Handling and Dewatering Pad for ICT excavated soils and contaminated soils and source material.
- Construction of a storage pad for treated soils and source material.
- The mobilization, setup, and performance testing of a LTDD soil treatment system.

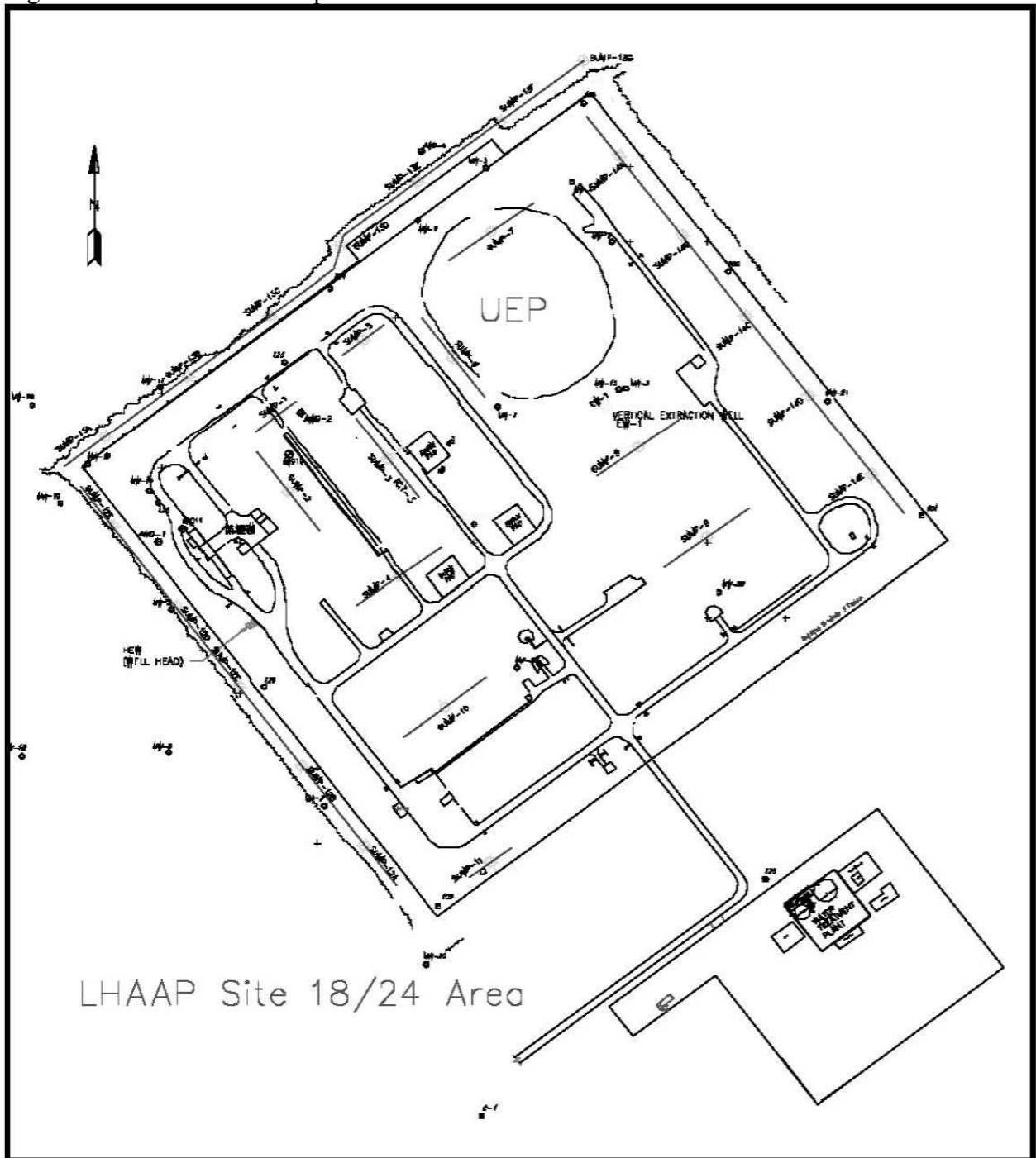
- LTTD Proof of Performance test conducted on February 13-15, 1997.
- Excavation and treatment of source material. Soil treatment took place from February 22, 1997 through December 10, 1997. Soil treated was as follows:
 - 30,000 cubic yards source material
 - 1,029 cubic yards of material from ICT trenches
 - 105 yards of material from burning cages
 - 1,157 yards of material from floor of storage and treatment areas.
- Perimeter air monitoring during excavation and soil treatment.
- Placement of clean ICT material, evaluated by sampling, into source material excavations during August 1997. ICT material was sampled to meet a 95% confidence level that it was clean.
- Disposal/placement of treated soils and source material on Landfills Site 12 and Site 16.
- Drilling 20 soil borings to investigate the potential presence of other source material.
- Restoring the site by importing clean fill material and backfilling source material excavations, and restoring utility lines.

The tasks for the groundwater extraction and treatment system are described as follows:

- Construction of tank, tank containment, and HDPE dual wall piping system at Site 16 during May 1997.
- Construction of a total of 5,000 feet of ICT Sections. The last ICT well was developed in October 1997.
- Installation of a piping network to collect the extracted water and convey it to the GWTP. Piping system composed of HDPE dual wall containment pipe.
- Construction of the GWTP to treat the extracted groundwater.
- Installation of a piping system to convey the treated water to Harrison Bayou.
- Starting up the GWTP.
- GWTP Proof of Performance test conducted on March 24, 1998. The test was conducted with the GWTP operating at full capacity.
- Addition of carbon treatment units to the GWTP placed online in October 1997.
- Operating and maintaining the GWTP for 1st year prove-out to May 1998.
- Evaluating the hydraulic effectiveness of the treatment system.

Dow Environmental prepared the Phase III workplan on December 28, 1995. The workplan generally followed the ROD, but a couple of exceptions apply. The Phase III workplan, incorporated information from the ROD that a combination of 5,000 feet of ICT's and eight vertical extraction wells would be used to collect onsite shallow groundwater at Site 18/24. The vertical extraction wells were not installed.

Figure 4.2.1-1 Site 18/24 Map



Changes that may have enhanced the performance of the GWTP system during construction and after operations began include the following:

1. Addition of carbon adsorption units to the process. It was found that water from Site 16 has a yellow color that was difficult to remove in the GWTP process. A Model 8 granular carbon adsorption system manufactured by Calgon was installed as an “end of pipe” treatment. Two vessels were installed with a capacity of 10,000 pounds each.
2. The backfill in the ICT’s was changed from geotextile to a “washed gravel screen” and smaller screen size to inhibit small sand particles from entering the ICT. Engineering studies concluded that the wash gravel screen would produce water in greater quantities than the geotextile.
3. ICT’s 12 and 13 have a HDPE liner installed between the Site and Harrison Bayou as an impermeable barrier. This barrier is intended to inhibit the plume from Site 18/24 from further migrating towards Harrison Bayou and to focus the water extraction within the fenced area rather than pull-ins from the bayou.
4. In 2000, heat trace was added to all twenty-eight ICT header systems at the site. With the installation of heat trace, no freezing of the pipelines has occurred during winter months.
5. A pipeline for treated effluent was installed to a lined pond, formerly the INF Pond. The pond capacity is about 3-million gallons. The pond is used for a holding pond when flow in Harrison Bayou does not allow for discharge of effluent to the bayou. This allows the GWTP more latitude in operating when the plant would not otherwise be able to operate.
6. Prior to June 1999, the GWTP had ongoing problems with the catalytic oxidizer fan needing to be balanced due to corrosion, with bearing wear, and the fan shaft bending. The carbon steel fan was replaced with a stainless steel fan and the fan shaft upgraded to high tensile strength steel.
7. During August 1999 chemical tests were performed to optimize polymer addition to process. Polymer process changed to premix a .5% solution rather than injecting a 100% solution to the process. The premix goes into solution much better and allows for more efficient use of the polymer.
8. Installation of a Fluidized Bed Reactor (FBR) that went into operation on 16 February 2001 to treat all water at the GWTP for perchlorate. With the installation of the FBR, sumps at ICT No. 4 and ICT 12-B were placed back online. The ICT’s had been valved off due to the elevated levels of perchlorate.
9. Check valve installed in HCl line during January 2001 to prevent process water from entering acid line when acid pump is off. If water enters line during cold weather, line would freeze and GWTP would not be able to operate.
10. During 2001 a desiccant air dryer was added to the instrument air system at the GWTP. With moisture in instrument air adequately controlled, automated control valves will not degrade and need repairs nearly as often as otherwise.

4.2.2 Sites 12 & 16 Remedy

The ROD, signed on 27 September 1995, in order to address and mitigate potential risks posed by buried source material at the Site, called for the following components:

- Foundation soil layer,
- A low permeability sodium bentonite geocomposite, geosynthetic membrane liner,
- A final soil cover with adequate slopes and vegetation,
- Perimeter berms and drainage swales to control surface water runoff.

The Remedial Action construction began in July 1996 by mobilization of personnel and equipment from an OHM office in Houston, Texas. The following tasks were completed as follows:

- A temporary support facility was constructed east of the entrance to Landfill 16 off Avenue Q.
- Construction of temporary access roads to the borrow pit and both landfills.
- Preparation of 8.5 acres at LHAAP Borrow Area.
- Installation of stormwater controls around the borrow source and each landfill to control silt migration caused by stormwater.
- Preliminary site survey to set up control points and grade stakes at the landfills.
- Construction and operation of Landfill 12 and Landfill 16 stockpiles of treated soil from the Site 18/24 Thermal Desorbers.
- Perimeter air monitoring of treated soil stockpiles when being handled by employees.
- Plugging and abandonment of existing monitoring wells within the limits of the new landfill caps.
- Demolition of existing stormwater culverts, pavement, signage, etc. at landfills and disposed of items in landfills prior to installing cap.
- Construction of Landfill 12 and Landfill 16 Cap, including:
 - Clear and proofroll the surface
 - Place grading layer which included treated soil. A total of 2000 cubic yards of treated soil went into landfill 12 and 35,840 cubic yards of treated soil went into landfill 16.
 - Installation of geosynthetic membrane liner and flexible membrane liner.
 - Placement of cover layer
 - Placement of topsoil.
 - Construction of landfill drainage swales.
 - Vegetation of the Landfill Cap surface.
 - Construction of perimeter fence around each Site comprised of a four-strand barbwire fence and access gate.
 - Posting of warning signs on perimeter fence.
 - Demobilization including trailers and housekeeping of Site.

The final Construction Completion Report was approved in December 1998. The construction completion date for both landfills is 31 August 1999.

4.3 System Operations & Maintenance

4.3.1 Site 18/24 Operations and Maintenance

USACE has currently contracted to Complete Environmental Service (CES) to carry out the O&M activities according to the O&M plan for Sites 18 and 24. The primary activities for Sites 18 and 24 are as follows:

- Operate and maintain the GWTP
- Maintain the ICT system in Burning Ground No. 3
- Maintain the Storage Tank and groundwater extraction system at Site 16
- Evaluate the effectiveness of the groundwater collection system
- Perform compliance monitoring of GWTP and monitoring wells
- Perform chemical monitoring of ICT's
- Maintain the fences, signs, and mow the associated areas
- Submit scheduled reports on the operation of the GWTP to USACE

A full-time staff of five employees works at the GWTP and they are responsible for operations, maintenance, administration, and management. The staff is supported as necessary by outside consultants and engineering firms.

In accordance with contract requirements an "Onsite Remediation System Operations Plan for Groundwater Treatment Plant and Wellfields" is maintained at the site and updated annually. The plan consists of all written procedures, plans, permits, records, equipment database, spare parts inventory, etc. All records pertaining to compliance of the GWTP such as sampling and analysis records, discharge flow calculations, and CEM data are maintained as part of the database. This database is maintained in a hard copy format at the GWTP as well as in a computer database. The database is updated throughout the year and distributed to the USACE and Army Staff once per year. Recent additions to the plan include a Freeze Protection Plan and procedures for responding to electrical callouts.

Provided is an abbreviated index to the "*ONSITE REMEDIATION SYSTEM OPERATIONS PLAN FOR GROUNDWATER TREATMENT PLANT AND WELLFIELDS*".

**ONSITE REMEDIATION SYSTEM OPERATIONS PLAN FOR GROUNDWATER
TREATMENT PLANT AND WELLFIELDS
VOLUME I**

- | | |
|---|--|
| <ul style="list-style-type: none"> • Annual Calendar • Bacteriological Site Sampling Plan • TNRCC Water Rules • Installation Spill Contingency Plan Parts A&B • Onsite Health & Safety Plan • RCRA Training Plan • Staffing Plan • Transition Training Plan • Waste Analysis Plan • Property Inventory • Database Management Plan • Reports <ul style="list-style-type: none"> o Annual Reports o Quarterly Reports o Quality Control Reports – FBR o Various Daily Construction Reports o Miscellaneous Meetings o Monthly Summary Report o Weekly Status Memos • GWTP Sampling and Analysis Program • Record of Decision • Sampling and Analysis Records <ul style="list-style-type: none"> o Weekly Perchlorate o BiWeekly o Monthly Metals o Quarterly Influent | <ul style="list-style-type: none"> • Sampling and Analysis Records (continued) <ul style="list-style-type: none"> o Quarterly Effluent o Quarterly FBR Samples o Quarterly Site 16 o Semi-Annual Site 16 o Semi-Annual ICT Wells o Semi-Annual Monitoring Wells o Special Analysis o Chain of Custody • Harrison Bayou Discharge Calculations <ul style="list-style-type: none"> o Outfall calculation sheets o Open channel discharge sheets o Flow from INF Pond to Harrison Bayou Outfall Calculation Sheets • Monitoring Wells <ul style="list-style-type: none"> o Site 18&24 Contaminant Plume Maps o Sample Field Measurements o Purge Data • Quarterly Inspections • Weekly Flowmeter Inspections • Chemical Data <ul style="list-style-type: none"> o Chemical Trends at GWTP o ICT Information 2001 o ICT Summaries o Monitoring Well Trends • Groundwater Elevations • Freeze Protection Plan |
|---|--|

**ONSITE REMEDIATION SYSTEM OPERATIONS PLAN FOR GROUNDWATER
TREATMENT PLANT AND WELLFIELDS
VOLUME II**

- | | |
|--|--|
| <ul style="list-style-type: none"> • Air Monitoring Plan • Electrical Callout Procedure • Equipment Lists and Descriptions • GWTP English Language Control Strategy • PLC Operating Programs • IC Procedure • INF Pond Discharge Procedure • Fluidized Bed Reactor <ul style="list-style-type: none"> o FBR Discharge Calculation Chart o Monitoring Program for FBR System o Nutrient Solution and Pump Settings o FBR Bed Sample Collection Procedure | <ul style="list-style-type: none"> • FBR Reports • Spare Parts Inventory • Standing Operating Instructions • Well Maintenance • Potable Water Log <ul style="list-style-type: none"> o ICT Sump Information o PZ Total Depth |
|--|--|

Reports pertaining to the site are provided to USACE weekly, monthly, quarterly, and annually. The reports summarize all compliance monitoring and events that take place at the GWTP.

As part of the LHAAP GWTP preventative maintenance system, CES has developed written checklists for inspections of all pumps, gauges, pH meters, and other process controlling hardware. Equipment is inspected and maintained according to manufactures guidelines and experience.

CES has developed a comprehensive database and spare parts inventory for maintenance parts that are practical to keep in stock. Parts that are not available locally or that routinely have to be replaced, such as pumps in the Site 18/24 wellfield are kept in the spare parts inventory.

As part of contractual requirements, the O&M contractor maintains the Administrative Record and Index of Records at LHAAP. This record was last updated in July 2000 for information through December 1999. Copies of the record are distributed to EPA and TNRCC. During 2001, the entire Administrative Record was scanned and placed in an electronic "PDF" file. Copies of the file were distributed on compact disc to USACE and the Army Commander's Representative.

4.3.1.1 GWTP Processes

The GWTP is located at Site 18/24. The treatment plant processes include the following:

- Pretreatment and Sludge Conditioning – This step removes excessive scaling and fouling chemicals dissolved in the groundwater as well as heavy metals. These materials are removed by conventional alkaline precipitation and chemical adsorption followed by flocculation with a cationic polymer into a plate clarifier. The water is then gravity fed into a sand filter.
- Air Stripping – An eighty-foot tall air stripper is utilized to remove volatile contaminants from the water after pretreatment. The contaminated water is fed into the top of the air-stripping tower that contains a packing material that provides the proper environment for the transfer of Volatile Organic Compounds (VOC) to the airstream. An air supply of 4600 CFM is fed into the bottom of the air stripper that flows upward through the tower.
- Catalytic Oxidation and Vent Scrubbing – The VOC's in the airstream are routed to a thermal catalytic oxidizer. The VOC's in the airstream are converted to carbon dioxide, water and hydrogen chloride gases. These gases are then scrubbed using water to produce a very dilute acid stream. The dilute acid is then utilized in the water treatment process for pH adjustment.
- Carbon Columns – Two Calgon carbon columns are utilized to polish the water that has been treated for metal removal and VOC removal. The carbon columns contain 10,000 pounds of carbon each.

- Fluidized Bed Reactor – The FBR follows the carbon columns. The FBR is a twenty-one foot tall by five-foot diameter column that contains a carbon bed. The circulation of water fluidizes the carbon bed. The FBR is fed a nutrient stream and a carbon donor. A biomass grows on the carbon bed and consumes perchlorate in the influent water stream. The FBR process takes place as the last treatment step in the water treatment process prior to discharge.
- Sludge Treatment - Sludge is processed into settling tanks and devolatilized. Upon devolatilizing, the sludge can be fed through a belt press where a filtercake is generated. The filtercake is transferred to a rolloff box. When the rolloff box is full, the filtercake is shipped for disposal to a hazardous waste landfill. Land ban requirements apply to the filtercake waste.

Besides water from Site 18/24, water from Site 16 is treated at the GWTP. Other water treated at the GWTP includes water captured in the containment area from rainfall, process water generated at the GWTP, and purge water generated on LHAAP from monitoring wells at other sites. Treated water from the GWTP is discharged into Harrison Bayou.

4.3.1.2 Interceptor Collection Trench Operations

The Interceptor Collection Trench (ICT) system in Burning Ground No. 3 is composed of 14 sections ranging in length between 100 feet and 1,300 feet. Approximately 5,000 linear feet of trench were installed within and around three sides of the Burning Ground. The trench sections extend approximately 25 to 55 feet in depth. The trenches are as deep as the confining clay layer of the shallow groundwater zone.

Upon construction of the ICT system, piezometers were installed for evaluation of ICT effectiveness. Groundwater levels are measured monthly in twelve piezometers and approximately forty-seven monitoring wells. Groundwater contours of the Site are mapped monthly from these water level readings.

Twenty-eight sumps and pumps remove water from the ICT sections. The ICT's are piped into dual wall containment piping and transferred to a 300,000-gallon equalization-holding tank at the GWTP.

Electronic probes control water levels within the trenches. The probes are set at various levels to activate or deactivate the electric pumps and to maximize groundwater capture. As the level of the probes are adjusted, the groundwater level and probe settings are placed in maintenance records.

4.3.1.3 Chemical Monitoring

Chemical monitoring is performed in accordance with State and Federal regulatory requirements. A Site Sampling and Analysis Plan is maintained as a part of the onsite operations plan. The GWTP influent & effluent, ICT's, Site 16 extraction wells,

monitoring wells, and plant emissions are sampled according to a schedule maintained in the plan. Provided in Table 4.3.1.3-1 is the current onsite testing plan.

4.3.1.3.1 Changes to Chemical Monitoring Procedures

During a Quarterly Technical Review Committee meeting at LHAAP, CES requested some changes in sampling analysis and frequency at the LHAAP GWTP and wellfields. Most of these changes were to reduce sampling frequency and the number of chemical parameters. Some of these changes were approved at the meeting. Other changes, having to do with effluent monitoring, had to be approved by TNRCC. The TNRCC subsequently submitted a memorandum on 26 July 2000 to the Commander's Representative that approved some changes to the sampling frequency for the GWTP influent and effluent sampling. These changes were incorporated into the site sampling and analysis plan.

In addition to the changes in sampling parameters and collection frequency, the collection of samples has changed to include the collection of effluent "grab" samples in addition to the "composite" samples. The GWTP standard permit conditions require the collection of grab and composite effluent samples.

Table 4.3.1.3-1 Groundwater Treatment Plant and Wellfields Testing Plan

Location	Frequency Of Testing	Parameters	Test Method
GWTP Air Emissions	Continuous	1. Total Hydrocarbons	1. Model 51 FID
GWTP Air Emissions	Quarterly	1. Volatile Organics	1. TO-14
GWTP Influent	Monthly FLOW WEIGHTED COMPOSITE SAMPLE	1. Chromium (hexavalent), Silver (Total Equivalent), Selenium (Total), Lead (Total)	1. 6010B
GWTP Influent	Quarterly FLOW WEIGHTED COMPOSITE SAMPLE FOR ALL BUT VOLATILES	1. Record of Decision Table 2 Volatiles 2. Hexachlorobenzene 3. Record of Decision Metals 4. Oil & Grease 5. Chemical Oxygen Demand 6. Chloride 7. Sulfate 8. Perchlorate	1. 8260B 2. 8270B 3. 6010B, 7000, 7421 4. 9070/1664 5. 410.4 6. 325.3/9056 7. 375.4/9056 8. 9058/314 (IC)
GWTP Effluent	Continuous	1. pH 2. Flow	1. pH probes and Transmitter 2. Endress Hauser Electromagnetic Flowmeter
GWTP Effluent	Daily (Onsite)	1. Chloride 2. Sulfate	1. 325.3/9056 2. 375.4/9056
GWTP Effluent	BiWeekly (Every Other Week) GRAB SAMPLE & FLOW WEIGHTED COMPOSITE FOR ALL BUT VOLATILES	1. Record of Decision Table 2 Volatiles 2. Barium (Total) 3. Lead (Total) 4. Chloride 5. Sulfate 6. Perchlorate	1. 8260B 2. 6010B 3. 6010B 4. 325.3/9056 5. 375.4/9056 6. 9058/314 (IC)
GWTP Effluent	Monthly GRAB AND FLOW WEIGHTED COMPOSITE	1. Chromium (hexavalent), Silver (Total Equivalent), Selenium (Total), Lead (Total)	1. 6010B
GWTP Effluent	Quarterly GRAB AND FLOW WEIGHTED COMPOSITE FOR ALL BUT VOLATILES	1. Record of Decision Table 2 Volatiles 2. Hexachlorobenzene 3. Record of Decision Table 2 Metals 4. Oil & Grease 5. Chemical Oxygen Demand 6. Chloride 7. Sulfate 8. Perchlorate	1. 8260B 2. 8270B 3. 6010B, 7000, 7421 4. 9070/1664 5. 410.4 6. 325.3/9056 7. 375.4/9056 8. 9058/314 (IC)
Site 16 Extraction Wells	Quarterly 8-each Vertical Extraction Wells	1. Perchlorate	1. 9058/314 (IC)
Site 16 Extraction Wells	Semi-Annual 8-each Vertical Extraction Wells	1. Volatiles 2. Chloride	1. 8260B 2. 9253
Site 18/24 Interceptor Collection Trenches	Semi-Annual 28-each Interceptor Collection Trench Sumps	1. Volatiles 2. Perchlorate 3. Chloride	1. 8260B 2. 9058/314 3. 325.3/2253
Site 18/24 Monitoring Wells	Semi-Annual 47-each monitoring wells	1. Record of Decision Table 2 Volatiles 2. Arsenic (Total), Barium (Total), Cadmium (Total), Chromium (Total), Lead (Total), Silver (Total), Selenium (Total), Zinc (Total), Nickel (Total) 3. Perchlorate 4. Chloride	1. 8260B 2. 6010B, 7000, 7421 3. 9058/314 (IC) 4. 9253

4.3.1.3.2 Compliance Sampling at GWTP

During the years since the operation of the GWTP began, there were intermittent difficulties documented concerning excursions of the effluent discharge limitations. These various difficulties appear to have been resolved.

1. There was an excursion of an effluent for lead during the 11 July 2000 Bi-weekly sampling event for lead and the monthly sample for lead. This problem was carried over from June, when there was also an excursion for lead. At that time, sampling frequencies were increased. An extensive review of the treatment process revealed no significant changes to the metals precipitation process during that time period.

As part of the technical review, samples of tap water and deionized water were collected and analyzed for lead. The lead levels in the potable water were 0.011 mg/L, which is in excess of the maximum allowable discharge level of 4.6 ug/L. Levels of lead in the deionized water were non-detect at 0.01 mg/L. Because of the levels of lead in the tap water, procedures to clean the vessel used to collect the composite sample were changed to utilize deionized water for decontamination rather than tap water. Since the decontamination procedure has been changed, no excursions for lead in the effluent have been noted.

2. Compliance samples collected from the FBR on 4 January 2002 exceeded the discharge limitations for perchlorate. The excursion was attributed to the Media Capture Tank eductor system. The GWTP Operators periodically vacuum out the media capture tank into the FBR using the eductor system. The carbon/biomass vacuumed from the media capture tank is piped from the media capture tank up over the top of the FBR and down into the FBR approximately 6-7 feet.

A valve on the piping between the FBR and the media capture tank was left open and when the vacuum system was not in operation, untreated water was siphoning into the media capture tank from the FBR. This is a 1-inch dia. pipe and a full stream was flowing. Any sample collected on 3rd. or 4th. of January 2002 would have water not fully treated for perchlorate added to the treated effluent.

Closing the valve has been added to the GWTP procedures and all employees were notified of the problems with leaving the valve open. The manufacturer of the FBR was notified to place this valve on the piping drawings for future systems.

4.3.2 Site 18/24 Operations and Maintenance Costs

The table below is copied from the 1995 ROD for Site 18/24. The estimated annual operations & maintenance expense utilizes air stripping and metals precipitation as the selected remedy.

Table 4.3.2-1 Estimated Operations and Maintenance Costs from 1995 ROD

Item	Shallow Groundwater Treatment & Disposal	Source Material Excavation, Treatment, & Onsite Disposal
Annual Operations & Maintenance	\$400,000	\$50,000 (One-year Only)

As illustrated in Table 4.3.2-2 below, soil treatment was conducted in 1997 only. Many expenses were associated with the operation of the LTTD including, LTTD Setup & Teardown, soil excavation, soil treatment, soil backfill, transport, and air monitoring. Expenses are included in the table below.

Table 4.3.2-2 Annual Operations & Maintenance Cost for Soil Treatment

Year	Estimated Maintenance Costs per ROD	Actual Operations and Maintenance Costs	Notes
1997	\$50,000	\$4,311,055	1) Soil treatment was conducted in 1997 only. 2) Labor costs were approximately \$750,000. Other costs include subcontracts & materials. 3) Excavation and backfill cost were \$871,052

Table 4.3.2-3 illustrates the actual costs for O&M of the onsite GWTP. Actual operations and maintenance costs of the GWTP exceed the estimated costs in the ROD. Several reasons may be considered why the actual costs are more than the estimated cost. They are listed as follows:

1. Other expenses, besides routine operation and maintenance expenses, such as emergency maintenance due to storm damage, are included in the cost of O&M.
2. Carbon treatment added a capital expense. This was added to the O&M expense.
3. The FBR added an additional O&M expense in 2001, due to chemical expense and additional monitoring requirements.

Table 4.3.2-3 Annual Operations & Maintenance Cost for Water Treatment

Year	Estimated Maintenance Costs per ROD	Actual Operations and Maintenance Costs	Notes
1997	\$400,000	\$907,721 estimated. Some costs mixed due to construction contract.	GWTP began treating groundwater as test phase in February 1997. Carbon treatment added to process.
1998	\$400,000	\$779,278 estimated. Some costs mixed due to construction contract.	GWTP O&M contract began in April 1998
1999	\$400,000	\$1,007,209	Some emergency maintenance expenses incurred due to storm damage.
2000	\$400,000	\$692,370	
2001	\$400,000	Actual cost through August and projected to rest of calendar year: \$1,345,000	Fluidized Bed Reactor Installed in February 2001 at a cost of \$645,000

Looking forward five years, the actual GWTP expense is expected to exceed the estimated operating expense as listed in the ROD due to the addition of perchlorate treatment and current operational requirements. Some maintenance costs associated with the extraction system and Site 16 is included with the GWTP expenses.

4.3.3 Sites 12 & 16 Operations & Maintenance

The Operations and Maintenance of Sites 12 and 16 have fallen to different contractors since the maintenance of the landfills began in 1998. This maintenance includes the following:

- Inspect the caps for both Sites and perform repairs as required
- Maintain the fences, signs, and mow the areas for Sites 12 and 16

The operation of the extraction wells and collection of piezometer well water levels near the extraction wells is now included with the contract to operate the GWTP. Since 2000, CES has performed this task. Prior to June 2000, Radian International performed the O&M activities.

For calendar year 2001, CES is performing the O&M activities for Sites 12 and 16. The primary activities for Sites 12 and 16 are as follows:

- Maintain the extraction well system for the old Landfill (Site 16)
- Collect water levels from piezometers associated with the extraction wells
- Inspect the caps for both Sites and do repairs as required
- Maintain the fences, signs, and mow the areas for Sites 12 and 16
- Perform chemical monitoring of Site 16 extraction wells

As of January 2002, over 4.5 million gallons of water have been removed from Site 16 extraction wells for treatment at the GWTP.

The following tables illustrate the costs for maintaining the landfills.

Table 4.3.3-1 Annual Operations & Maintenance Cost for Site 12

Year	Estimated Costs per ROD	Actual Costs	Notes
1997	\$75,000	None	
1998	\$75,000	None	Long-term maintenance begins.
1999	\$75,000	\$1,920.00	
2000	\$75,000	\$1,920.00	
2001	\$75,000	\$2,800.00	

To date, maintenance at Site 12 has been comprised of grounds maintenance. Grounds maintenance consists of cutting the grass, and, as required, repairing erosion, replacing warning signs and repairing the fence. Without any further remedial action, maintenance costs at Site 12 should not exceed the estimated \$75,000 costs in the ROD. During the next five years, maintenance costs will increase due to long term monitoring of the groundwater. Maintenance costs will be driven largely by the groundwater sampling and monitoring schedule.

Table 4.3.3-2 Annual Operations & Maintenance Cost for Site 16

Year	Estimated Costs per ROD	Actual Costs	Notes
1997	\$75,000	None	
1998	\$75,000	None	Long-term maintenance begins.
1999	\$75,000	\$11,342.14	Maintenance of Extraction Wells included in GWTP contract costs. \$9,422.14 included in actual cost for watering landfill cap to establish grass.
2000	\$75,000	\$1,920.00	Maintenance of Extraction Wells included in GWTP contract costs.
2001	\$75,000	\$2,800.00	Maintenance of Extraction Wells included in GWTP contract costs.

Maintenance at Site 16 has included two areas, O&M of the extraction system and grounds maintenance for the cap.

Since the operation of the groundwater extraction system began in 1998, the onsite contractor for the GWTP has been responsible for operating and maintaining the extraction system. Costs for maintaining this system are largely mixed with costs with maintaining the GWTP. The onsite records indicate that the compressor at Site 16 has been replaced once and the well pumps are removed for maintenance regularly. Other routine maintenance procedures consist of cleaning check valves, changing the oil in the compressor, and quarterly extraction well monitoring.

Grounds maintenance consists of cutting the grass, and, as required, repairing erosion, replacing warning signs, and repairing the fence.

Maintenance costs at Site 16 during the next five years will likely increase due to long term groundwater monitoring. The final ROD may also affect long term monitoring and maintenance costs according to the final remedial action.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This was the first five-year review for any of the Sites at LHAAP.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

Survey forms were sent out on September 17, 2001 and a public notice was run in the Marshall News Messenger on the 6th. and 7th of October, 2001.

A team composed of the following members listed in Table 6.1-1 completed the five-year review at the Site.

Table 6.1-1 Five-Year Review Team Members

Complete Environmental Service	Onsite Manager – William R. Corrigan III Chemist – Ken Poush Quality Control Manager – Scott Beesinger Project Administrator – LaNita Burchfield
Outside Consulting Company - Sniffen Around	Geologist – Bill Sniffen
U.S. Army	Installation Restoration Program Manager – David Tolbert
U.S. Army Corps of Engineers	Geologist/Environmental – Cliff Murray Civil/Environmental - Dawn Knight
Environmental Protection Agency	Project Manager – Chris Villarreal

The LHAAP Five-Year Review team was led by William (Bill) R. Corrigan III of Complete Environmental Service, Project Manager for the Site 18/24 Operations and Maintenance, and included members from the USACE with expertise in geology, civil, and environmental engineering. An outside consultant, of Sniffen Around assisted with review of hydrogeology. The local Army Installation Restoration Program Manager David Tolbert and EPA Project Manager Chris Villarreal assisted with background reviews of the Site and regulatory guidance.

From August 1 through October 30, 2001, the review team established the review schedule whose components consisted of the following activities:

1. a review of relevant documents
2. data review
3. site inspections
4. local interviews
5. community involvement
6. interviews with local Army officials

The five-year review was conducted in accordance with EPA's Comprehensive Five-Year Review Guidance (June 2001). The purpose of the five-year review is to determine whether the remedy selected and implemented at the Site is protective of human health

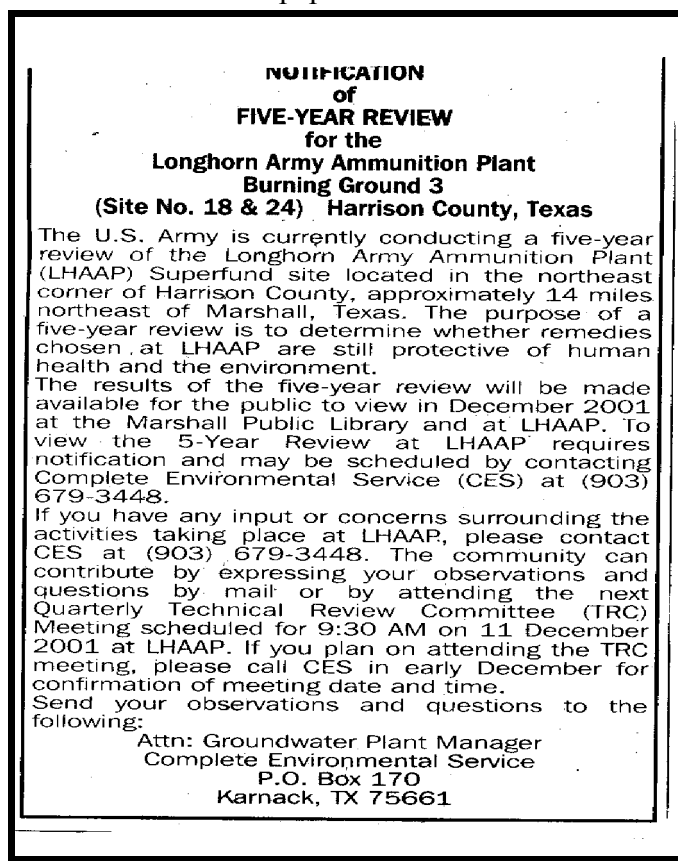
and the environment. The five-year review documents any deficiencies identified during the review and recommends specific actions to ensure that a remedy is protective.

6.2 Community Involvement

Community Notification was accomplished by sending out questionnaires, interviews, and publishing a notice in the local newspaper. The Public Notice was run in the Marshall News Messenger on October 6 and 7, 2001.

The public notice reads as follows:

Figure 6.2-1 Five-Year Review Newspaper Notification



Five-Year Review Survey Forms were also placed at the Karnack Post Office during the months of October and November, 2001. The Forms were left at the post office until the review was complete.

6.3 Document Review

This five-year review consisted of a review of relevant documents including O&M records, ROD's, remedial investigations, risk assessments, work plans, construction reports, LHAAP Federal Facility Agreement, LHAAP Installation Action Plan, LHAAP Agreed Order, monitoring data, and various maintenance and operation reports (see References).

6.4 Data Review

6.4.1 Site 18/24 Groundwater Monitoring

Groundwater sampling was first carried out in 1980 at Site 18/24. Continuous groundwater monitoring started at Site 18/24 in 1986 on a quarterly basis and became semi-annual in 1996. Even though a large amount of data is available, this review will concentrate on the information collected just before and following the Interim Remedial Action (IRA). Data collected during this time period should best determine the protectiveness of the IRA.

As part of groundwater studies, environmental monitoring has been conducted by sampling monitoring wells in 1980, 1982, and 1987. As part of Remedial Investigation sampling, environmental monitoring has been conducted as follows:

- Sampling of monitor wells in Site 18/24 has been carried out in 1980, 1982, 1987, 1993, 1995, and 1998.
- Site 18/24 had surface water and sediment sampling in 1993, 1995, and 1998.
- Site 18/24 had soil sampling carried out in 1995.
- Sampling specifically for perchlorate has been conducted in May 2000, September 2000, and January 2001.

As part of contractual requirements, the contractor performing O&M of the site is required to perform regular sampling of the monitoring wells and ICT's. The sampling schedule is maintained in the Sampling and Analysis Plan for the site. Currently 47 monitoring wells are sampled semi-annually, the ICT's are sampled quarterly. Groundwater elevations are measured monthly.

Figures No. 6.4.1-1 and No. 6.4.1-2 show the shallow groundwater for Site 18/24 as measured in April of 1994 and in April of 2001, respectively. The April 1994 contour drawing was provided in the ROD for Site 18/24. Extraction of water from the ICT's has made a very noticeable depression in the groundwater contours of Site 18/24 since their installation. This is an indication that the extraction system is functioning as designed.

Contaminant concentration maps for Site 18/24 dated April 2001 are located in Appendix E. These may be compared to the methylene chloride and trichloroethene contours dated April 1994 that were provided in the ROD and also reproduced in Appendix E. The highest concentrations are within the interior portion of the site around monitor wells

MW-2 and MW-120. They are basically unchanged from 1994 data. The plumes of TCE and MC have receded from the outer fringes of the area as indicated by comparing the contours. There is a very noticeable reduction in the concentrations and extent of methylene chloride. The changes in the trichloroethylene plume are not as pronounced as in the reduction in the concentrations of methylene chloride.

Perchlorate was not a COC when the ROD was signed, therefore there was not any historical sample data from 1995. Monitoring of perchlorate began at Site 18/24 in September 2000. The perchlorate concentration drawings for April 2001 are located in Appendix E. High concentrations of perchlorate are located near the UEP and also near the northwest corner of the Burning Ground. Some high concentrations are also near MW-7 and MW-8. MW-7 and MW-8 are located on the southwest side of Site 18/24. High levels of perchlorate have been found in monitor wells 18WW08 and 18WW17. Site 17, Burning Ground No. 2 has high levels in monitor wells 17WW02 and 17WW06 which are 1000 feet southwest of Site 18/24. All of these areas appear to be interconnected making perchlorate the most widespread contaminant at the site.

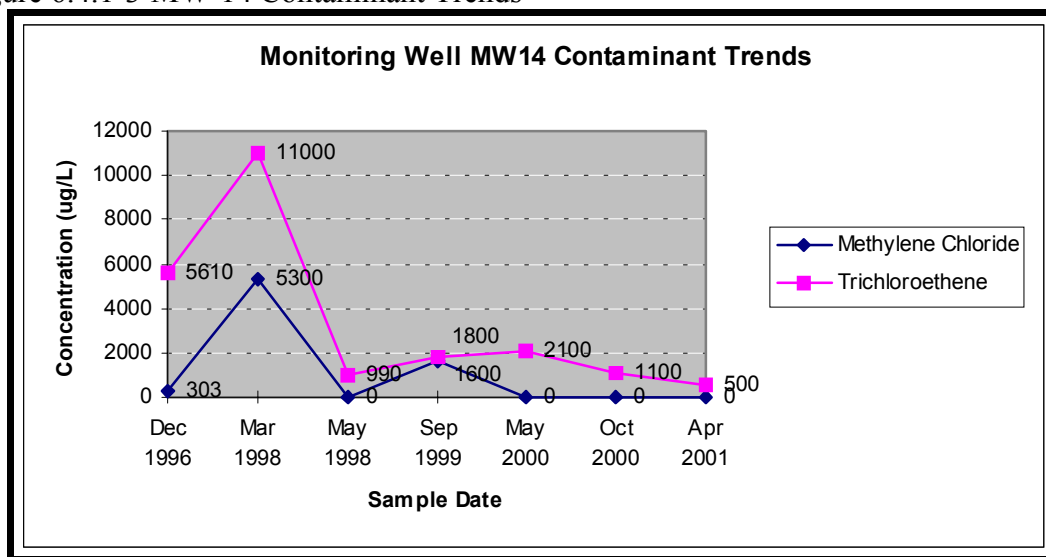
Groundwater Contours

Data from the semi-annual sampling done by Radian and continued by CES indicates many of the monitor wells have declining contaminant concentrations in them. Most of the eleven C-Series monitor wells have declining contaminant concentrations to below the detection limit for volatiles at 5 ppb. The C-Series wells were installed in 1984 by Camp, Dresser, & McKee, Inc., and generally surround the 34.5-acre site.

In other monitor wells, contaminant concentrations, namely methylene chloride, trichloroethene, and perchlorate, are steady and some are increasing. Most of these monitoring wells are located within the confines of the BG3 perimeter fence. Some of the wells with increasing concentrations are between the ICT and high concentrations of contaminants. The ICT may be pulling the contaminants into the area of the well bore.

The deep wells do not have increases of contaminant concentrations, indicating a lack of downward movement of groundwater. The following table presents the sampling history of monitor well MW-14, considered a deep well that is located near a highly contaminated area near the northwest corner of the Burning Ground. MW-14 is a well that is 51 feet in depth and screened from 43 feet to 48 feet depth.

Figure 6.4.1-3 MW-14 Contaminant Trends



Some monitoring wells that have high concentrations of contaminants continue to exhibit high concentrations. The most highly contaminated well for methylene chloride and trichloroethene is MW-2. MW-2 is located near the center of the burning ground. Also highly contaminated, and in the northwest portion of the Burning Ground is MW-120. MW-120 is also located near MW-14, a deeper well that exhibits a decrease in contaminant concentrations. Both MW-2 and MW-14 exhibit a concentration of contaminants that has not increased or decreased significantly as illustrated in figures 6.4.1-4, 6.4.1-5, 6.4.1-6 and 6.4.1-7.

Figure 6.4.1-4 Monitor Well MW-2 Historical TCE Concentrations

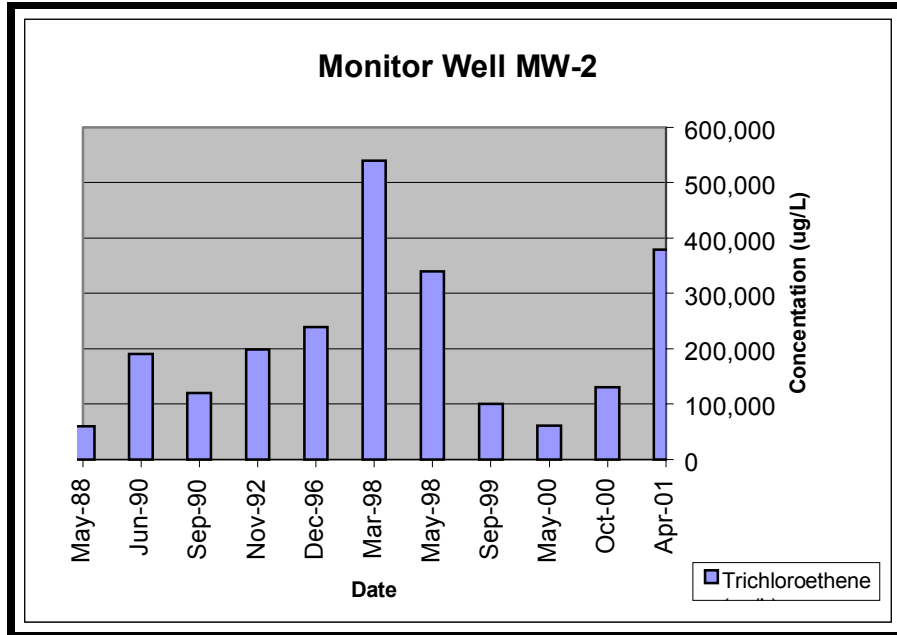


Figure 6.4.1-5 Monitor Well MW-2 Historical MC Concentrations

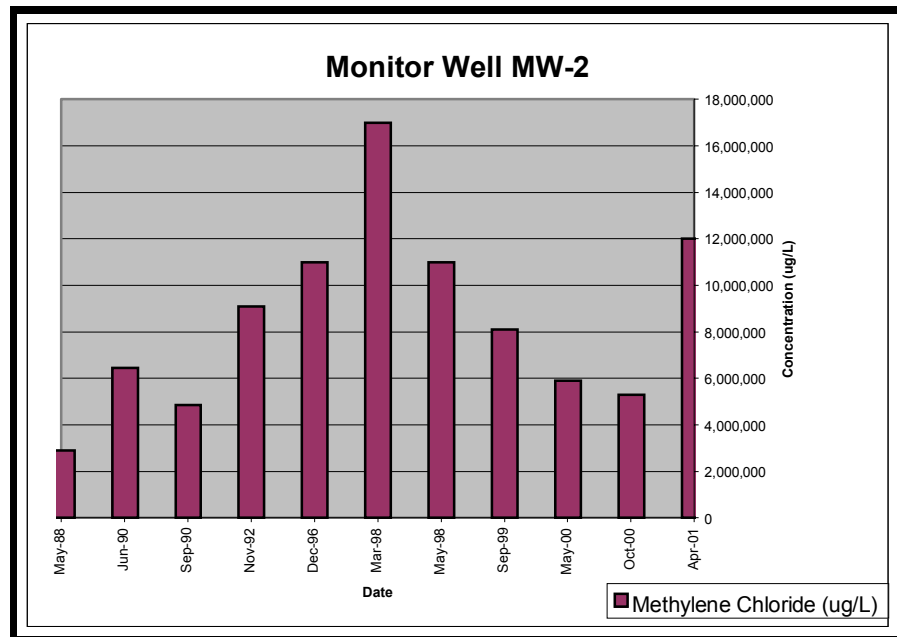


Figure 6.4.1-6 Monitor Well MW-120 Historical TCE Concentrations

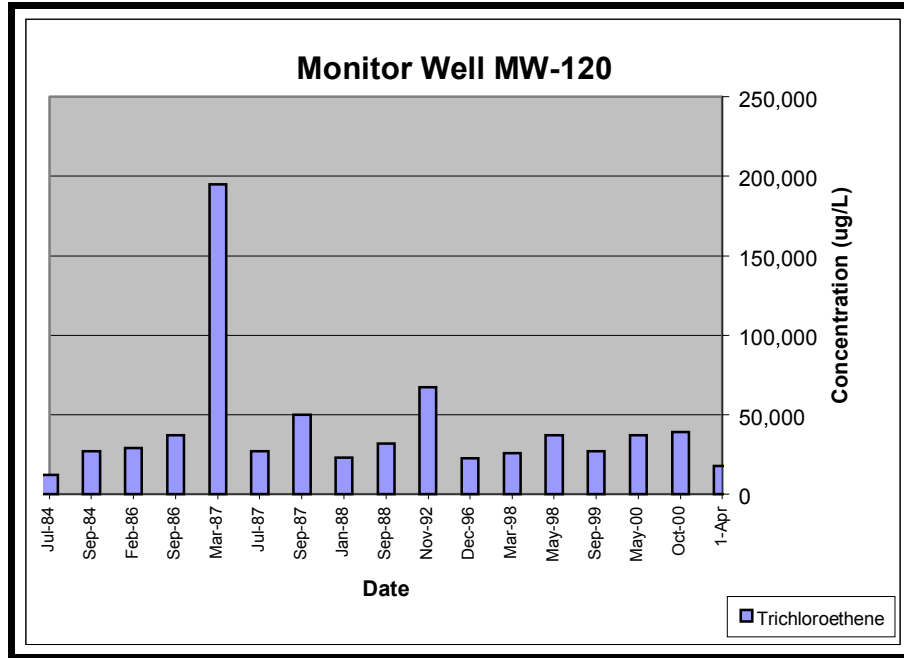
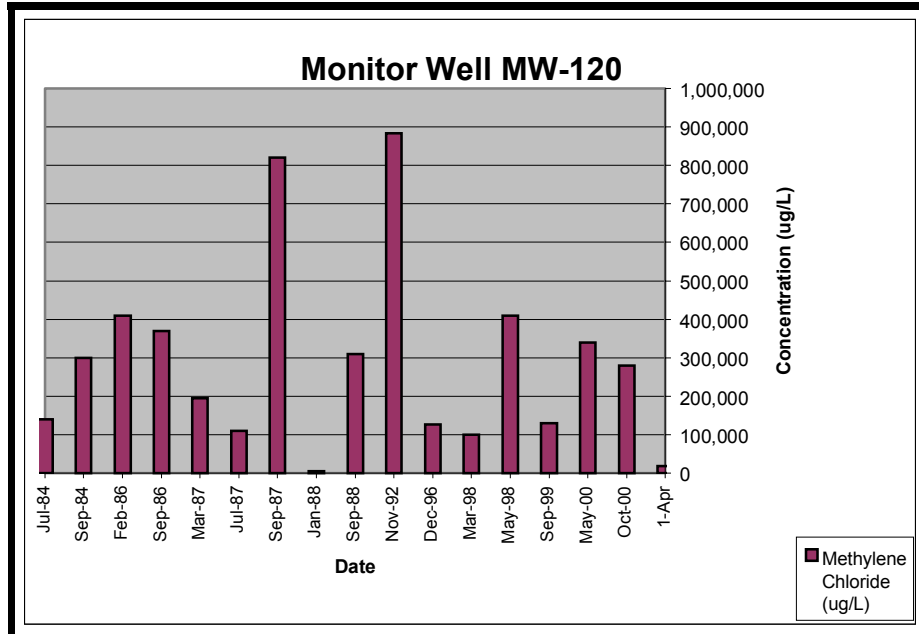


Figure 6.4.1-7 Monitor Well MW-120 Historical MC Concentrations



Towards the west side of Site 18/24 and near monitoring wells MW-7 and MW-8, Trichloroethylene (TCE) plumes are outside the perimeter of the Burning Ground and on the outside perimeter of the ICT extraction trenches. ICT-12 (west side) and CT-13 (north side) each have an impermeable synthetic liner in them on the outer wall to help contain contaminated groundwater within Site 18/24. The groundwater sampling of these monitor wells shows no decline in TCE contamination. Perchlorate is also high in MW-7 and MW-8. This should be addressed in the evaluation of the extraction system.

Figure 6.4.1-8 Monitor Well MW-07 Historical MC and TCE Concentrations

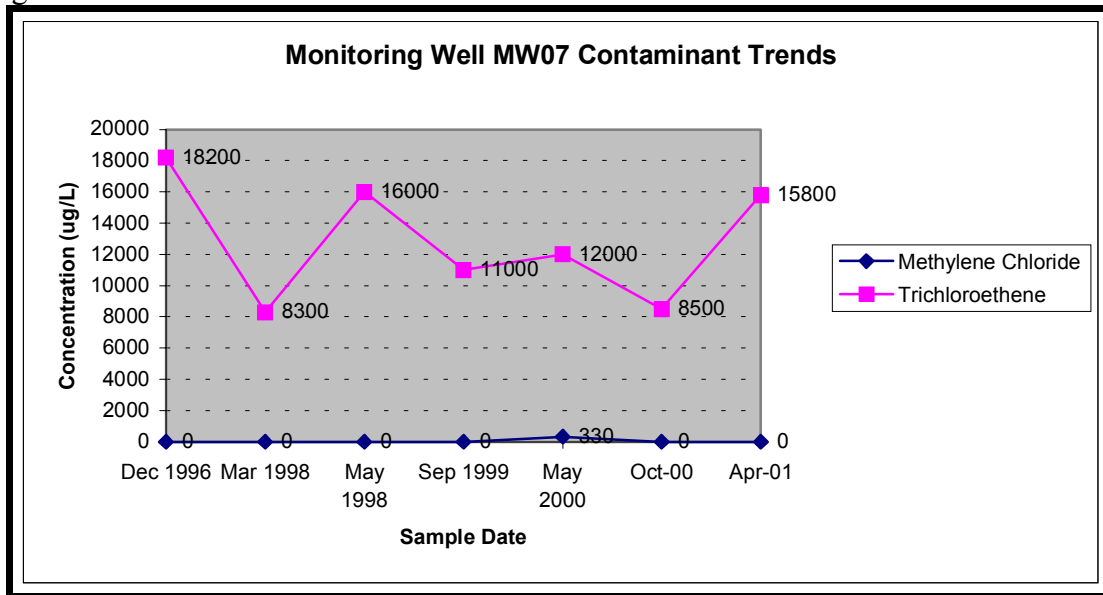
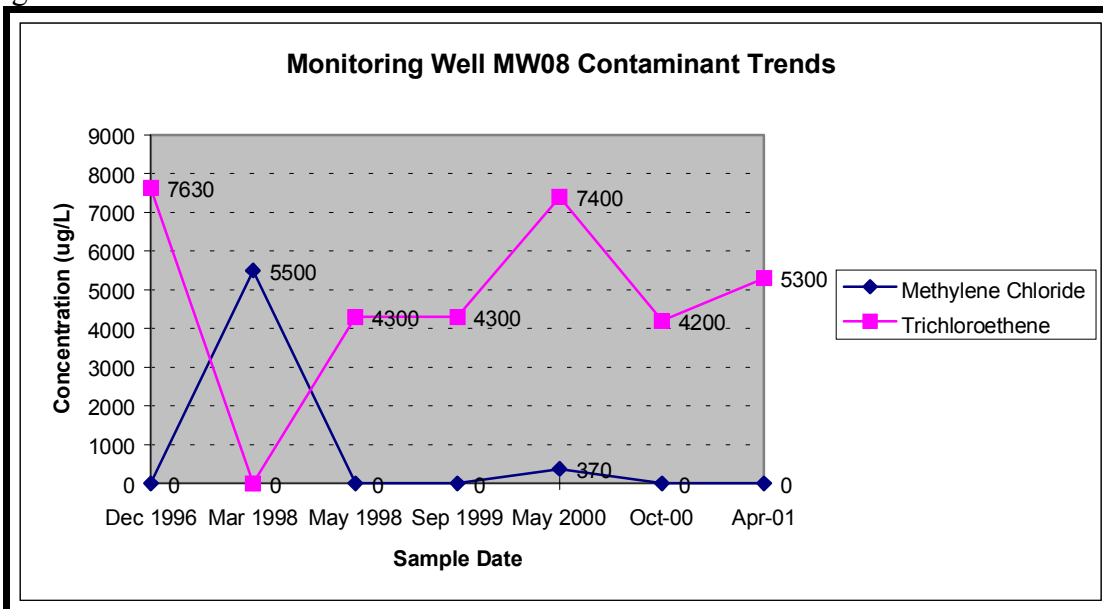
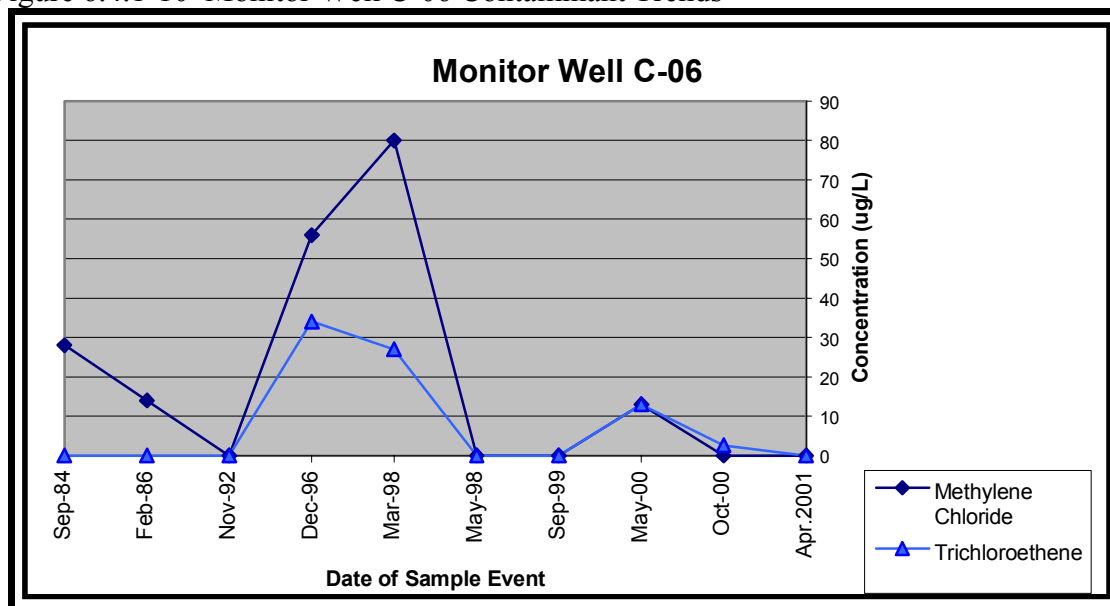


Figure 6.4.1-9 Monitor Well MW-08 Historical MC and TCE Concentrations



Monitor well C-06 has had detections of contaminants through the years and may be too far from Site 18/24 for it to be the source. Air photos do not indicate any activity and a ground search around the well did not find any indications of disposal activity. Figure 6.4.1-10 shows some of the significant detections in well C-06. Further investigation is recommended to locate a source or to establish that the contamination may have been from Site 18/24.

Figure 6.4.1-10 Monitor Well C-06 Contaminant Trends



6.4.2 Site 12 Groundwater Monitoring

Groundwater sampling was first carried out in 1980 and repeated in 1982 as a part of the environmental studies at Site 12.

As part of the Remedial Investigation sampling, environmental monitoring has been conducted as follows:

- Sampling of monitor wells in Site 12 has been carried out in 1980, 1982, 1993, 1995, and 1998.
- Site 12 had surface water and sediment sampling in 1993, 1995, and 1998.
- Site 12 had soil sampling carried out in 1993.
- Three monitoring wells sampled in May 2000, September 2000, and January 2001 specifically for perchlorate. Five soil samples also collected in May 2000.

The first figure in Appendix F, from the Site 12 & 16 1995 ROD shows the groundwater level at Site 12 in 1994. The contours indicate a relatively low gradient of about one foot vertical per 200 feet horizontal, which indicates a low groundwater velocity. The next figure shows the groundwater levels in August 1998. When the landfill was capped, many of the wells were plugged which reduced the available information. This makes a

comparison of the data more difficult. It would be useful to have seasonal water levels measured for Site 12.

Groundwater sampling at Site 12 was performed in 1993, 1995, 1998, and during April 2001. Table 6.4.2-1 shows some of the available data for TCE from a hits only table included in the Final RI Report for Group 2, April 2001. The detections for TCE in the Site 12 wells are very low compared to the other sites in this review and there were very few detections. The low number of detections indicates low levels of source materials and low concentrations in groundwater.

Table 6.4.2-1 Site 12 Trichloroethene Concentration (ug/L)

Monitor Well No.	Sample Date Jun-93	Sample Date April 95	Sample Date July-98
12WW01	27	<5	Not Analyzed
12WW03	16	<5	Plugged
12WW12	Not Drilled	495	Not Analyzed

Perchlorate sampling began in May 2000 as a part of the LHAAP plant wide investigation, and was repeated in September 2000, and January 2001 in four monitor wells. The highest concentration was 56 ug/l in well 12WW01. More sampling is planned for Site 12.

Table 6.4.2-2 Site 12 Perchlorate Concentration (ug/L)

Monitor Well No.	Sample Date May 00	Sample Date Sept. 00	Sample Date Jan. 01
12WW01	8.6	<8	56
12WW02	1.6	<4	<4
12WW05	<1	6	<4
12WW12	8.7	Not sampled	Not sampled

6.4.3 Site 16 Groundwater Monitoring

Groundwater sampling was first carried out in 1980 at Site 16. As part of the groundwater studies, environmental monitoring has been conducted by sampling monitoring wells in 1980, 1982, and 1987. Surface water, sediment, and soil sampling has been conducted in 1982.

As part of the Remedial Investigation sampling, environmental monitoring has been conducted as follows:

- Sampling of monitor wells in Site 16 has been carried out in 1993, 1995, 1997, and 1998 (two sets).
- Site 16 had surface water and sediment sampling in 1993, 1995, 1997, and 1998.

- Site 16 had soil sampling carried out in 1987, 1993, 1995, and 1997.
- Groundwater samples specifically for perchlorate were collected from 10 wells in May 2000, 37 wells in September 2000, and 20 wells in January 2001. Four soil samples were collected in May 2000.

Figures provided in Appendix G show the shallow groundwater elevation maps for Site 16 from the September 1995 ROD, October 1997 and in October 1998. Figures No. 11 and No. 12 illustrate the intermediate groundwater for Site 16 in October 1997 and October 1998. A distinct depression has resulted in both levels in the 1998 data due to the operation of the extraction wells at Site 16. This is an indication the groundwater extraction system is functioning as designed.

Like Site 12, wells at Site 16 were plugged in the vicinity of the landfill cap, which reduces the available information to evaluate the impact of the cap. It would be useful to have seasonal water levels measured for Site 16.

Monitoring of groundwater around the landfills was in the ROD for Sites 12 and 16. The ROD does not detail how to monitor the sites, but it could be assumed that measuring groundwater levels and sampling of groundwater on a regular basis are implied.

Sampling for perchlorate was started in 2000 as part of a LHAAP wide study. This is separate from the sampling of the extraction wells done by the contractors operating the GWTP. The data is provided in a separate report.

USACE contractors have sampled the extraction wells for Site 16 periodically. The data from the last sampling event is summarized for perchlorate and TCE in Table 6.4.3-1. The extraction well data does not indicate any distinct trends. The data does indicate the water being treated is highly contaminated. Water levels have been measured for the piezometers associated with the extraction wells. These measurements show a distinct depression around the extraction wells.

Table 6.4.3-1 Site 16 Extraction Well Analysis June 2001

Extraction Well No.	Analyte	Result (ug/L)	Analyte	Result (ug/L)
1.	Perchlorate	610	Trichloroethene	24000
2.	Perchlorate	467	Trichloroethene	18000
3.	Perchlorate	512	Trichloroethene	21000
4.	Perchlorate	446	Trichloroethene	20000
5.	Perchlorate	486	Trichloroethene	24000
6.	Perchlorate	323	Trichloroethene	21000
7.	Perchlorate	387	Trichloroethene	13000
8.	Perchlorate	486	Trichloroethene	20000

The main concern at Landfill 16 is the potential of groundwater to transport contaminants into Harrison Bayou. It is not clear from the review of the reports if the extraction system at Site 16 protects Harrison Bayou adequately from groundwater contamination moving east or southeast directly to the bayou. Geologic cross sections in the Draft RI done by Sverdrup (August 1999) show the shallow sands as continuous down to well 16WW27 on Harrison Bayou. Historical RI monitor well samples show that the contaminants are moving northeast along the bayou. Since there is not a clearly defined explanation for this movement it may warrant further study.

Sverdrup (August 1999) sampled groundwater from wells surrounding the extraction system from 1995 through 1998 for Site 16. This gives an indication of the effectiveness of the extraction system. This data is summarized for TCE in Table 6.4.3-2. It is believed that a detailed evaluation would show the extraction system is beginning to be effective.

Groundwater levels measured before the landfills were capped covered the whole site at both landfills. This established pre-construction groundwater levels for both landfills. Monitor wells in and around the caps were plugged for both landfill sites and not replaced after construction of the caps. Groundwater measurements since the capping are north of both sites and give little information about the caps. To better evaluate the effectiveness of the caps, monitor wells or piezometers could be installed within the capped area.

Table 6.4.3-2 Trichloroethylene Concentrations in Monitoring Wells Around Extraction System at Site 16

Monitoring Well No.	Sample Date Jun-95	Sample Date Oct-97	Sample Date Jan-98	Sample Date Jun-98
16WW12	1390	7500	5100	7100
16WW13	4820	12000	Not Sampled	Not Sampled
16WW14	38	53	82	45
16WW16	20900	25000	19000	15000
16WW22	Not Available	2700	4300	2000
16WW26	Not Available	95	270	32
16WW29	Not Available	59	66	25
16WW30	Not Available	36	9.3	11
16WW35	Not Available	1800	490	340
16WW36	Not Available	11000	8600	8900
16WW37	Not Available	1200	1500	1400
16WW38	Not Available	23	160	73

6.4.4 Site 16 Surface Water and Sediment Samples

Surface water and sediment samples for Site 16 were collected as a part of the RI program. This was done prior to or during the construction of the landfill cap as reported by Sverdrup, August 1999. They appear to have been only sampled once from information in the RI. The metals copper, lead, and zinc were above MSC in surface water samples. No contaminants were above the MSC in sediment samples.

Additional surface water and sediment sampling of Harrison Bayou has been carried out by the USACE on a quarterly schedule. TCE has been detected in surface water samples from Harrison Bayou at location HBW-1 since 1995. The location is 100 feet northeast of monitor well 16WW12 on Harrison Bayou. It can range between 282 ug/l to non-detect depending amount of flow in Harrison Bayou. The higher concentrations generally occur during late summer when flow can be very low. At the time of the highest detection, no detection was made at four downstream sample locations on Harrison Bayou.

6.5 Site Inspection

Representatives of the USACE Tulsa District, an independent consultant, and the operating contractor on the site carried out inspections at the Site on October 17 and 18, 2001. CES has the operating contract for the site. The purpose of the inspections was to assess the protectiveness of the early interim remedial actions at Site 18/24 and Site 12 & 16. This includes the groundwater treatment system, caps, fences, and signs.

No significant issues have been identified at any time regarding the groundwater treatment system, caps, fences, and signs. The groundwater treatment system was functioning well and had no major deficiencies.

Weather was clear and temperature in the mid 60's at the time of the site inspection. The ground was dry and the last rains were the week before when more than five inches fell.

The inspection team divided into two teams to look at Sites 18 & 24 and Sites 12 and 16 separately. Dawn Knight of USACE and Bill Corrigan of CES reviewed Site 18 and 24. They inspected the Burning Ground No. 3 (Site 18) and UEP (Site 24), including ICT's, monitor wells, fences, and signs. Discrepancies were noted in regard to signs, roads, and keeping fences clear of vegetation.

The same group inspected the GWTP and no major problems were encountered. Equipment at the plant has been maintained and is functioning as designed. Maintenance records are updated daily and provided to regulators in a monthly report. As indicated in the maintenance records, equipment at the plant has been periodically damaged due to lightning strikes so it is recommended that installation of lightning grounding system be considered. All compliance records at the GWTP are filed by date and sampling event. Records appear to be intact and are well organized. Each laboratory report is evaluated

according to USACE data validation guidelines. A data validation checklist is filled out and filed with each report. Daily flow, process changes, and onsite monitoring data is kept onsite and filed accordingly. A computer database of most information is maintained for electronic storage.

Cliff Murray of the USACE and Bill Sniffen of Sniffen Around, LLC inspected Sites 12 and 16. The caps on the landfills were a primary concern and are in good overall condition. Erosion was noted at the east/northeast edge of Site 12. Grass cover was thin in areas, but erosion has not resulted. Some of the monitor wells and piezometers needed maintenance. An operations and maintenance plan does not exist for the landfills caps specifically. However, on the whole the maintenance is being carried out without problems.

On October 18, 2001, the entire inspection team reviewed their findings and discussed any outstanding issues.

The site inspection checklist is included in this report as Appendix A.

6.6 Interview Summary

Interviews were conducted in person or by mail. The interview forms were distributed on September 17, 2001.

The following nine persons were interviewed either by mail or in person as a part of the five-year review:

Mr. William R. Corrigan III, the Plant Manager for the Groundwater Treatment Plant operated by Complete Environmental Service stated that the plant is well designed and has more capacity available. The FBR is working well but requires constant attention.

Mr. Roy Darville, a professor of biology at East Texas Baptist University states that the three projects are well done and performing as expected. He added that there is a positive effect on the community to know the cleanup is in-progress. He says the LHAAP TRC meetings have been informative to him.

Wes and Joann Hodges, owners of the Hodgepodge Cottages in Karnack, Texas did not have a direct knowledge of the sites, but did have confidence in Dwight Shellman's activities and found him to be a source of information.

Mr. H. L. (Bud) Jones of B. Jones Environmental feels that much progress has been made, but there needs to be some fine tuning in the Landfill 16 and BG 3/UEP (Site 18/24) Areas. Possibly additional remediation, such as insitu treatment may be required. The interim action has calmed down many of the community fears. There is still some community concern about leaving the source material at Site 16 Landfill. He suggested

that confirmation Site Characterization and Analysis Penetrometer System (SCAPS) data be collected at BG 3/UEP Area, similar to the work done at Landfill 16.

Mr. Cliff Murray, Environmental Engineer with the Tulsa District, U. S. Army Corps. Of Engineers, stated that things are going smoothly especially the maintenance of the sites. He also says the current operator at the site has done an outstanding job of maintaining records (operational and historical) of the site.

Mr. Jim Sher, Team Leader for the project for TNRRC states the organization of these areas and the work done at them has been well thought out. After years of investigation, progress is steadily increasing. He says the public is anxious to have the site turned over for public use and adds that there are many interested parties involved in this site, but all seem to be willing to work together.

Mr. William Sniffen, a consulting geologist stated that the landfill sites, burning ground, and the groundwater treatment plant are well managed and progress is being made on final solutions for all the sites. He added that the Army and regulatory community have worked hard to provide information on the sites to the public.

Mr. Bob Speight, the President of the Greater Caddo Lake Association and a resident of Karnack, Texas had a very good impression of the project. He added the site operations had a good effect on the community and were well run.

Mr. Chris Villarreal, Project Manager with the U. S. EPA, Region 6, stated that the project is very complex with multiple operable units. Considerable resources have been expended on this project over the years. Progress has been made in identifying and addressing contamination resulting from 50+ years of Army operations, however there is still a lot of work to be done.

The individual interview forms are included in this report as Appendix H.

7.0 TECHNICAL ASSESSMENT

7.1 Site 18/24 Technical Assessment

7.1.1 Question A: Is the remedy functioning as intended by the decision documents?

- **Remedial Action.** The Site 18/24 construction project was completed in August 1999. Some locations of contaminated source material were removed and treated from the old Burning Ground 3 Area, five thousand linear feet of ICT's were installed and the GWTP was built. The GWTP continues to operate. To date approximately 60 million gallons of contaminated water has been treated through the GWTP.

Groundwater elevation levels are monitored monthly at Site 18/24 and COCs are currently monitored semi-annually by sampling forty-seven selected monitor wells. Data from the sampling events is tabulated and monitor well trend charts are updated. Contaminant trend maps are generated semi-annually and groundwater contour maps are generated monthly. Contaminants have been monitored at the Site semi-annually since 1997 and quarterly between 1986 and 1994. Random sampling events have occurred at the site since 1976. Semi-annual sampling is intended to continue well beyond the next scheduled five-year review.

Contaminants are measured in ICT's semi-annually. Water removed from each ICT is measured daily. From this data, pounds of contaminants removed are calculated semi-annually. From April 1998 through December 2000, approximately 22,225 pounds of Methylene Chloride (MC) was removed from Site 18/24 and over 2100 pounds of TCE. In calendar year 2001, 170 pounds of perchlorate was removed from Site 18/24. Provided in Table 7.1.1-1 is a summary of contaminants removed at the site from 1998 through December 2001. Various other volatiles and byproducts were removed at lower quantities.

Review of documents, Applicable or Relevant and Appropriate Requirements (ARAR)'s, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD. The selected remedy to pump and treat groundwater continues to be effective in removing and controlling the groundwater gradient at the site. Large quantities of contaminants are being removed. As long as the water extraction system is operating, the contaminants should be contained.

Table 7.1.1-1 Contaminants Removed for Site 18/24 Apr.-98 to Dec.-01

Contaminants	Pounds Removed 1998	Pounds Removed 1999	Pounds Removed 2000	Pounds Removed 2001	Total Removed to Date
1, 1 Dichloroethene	0.00	0.00	0.17	14.24	14.41
1, 2 Dichloroethane	0.00	0.00	0.73	5.89	6.61
Acetone	0.00	192.54	227.93	0.92	421.39
Benzene	0.00	0.00	0.00	0.44	0.45
cis-1, 2- Dichloroethene	0.00	14.04	16.94	0.00	30.98
Toluene	0.00	0.00	0.00	0.44	0.44
trans-1,2- Dichloroethene	0.00	0.00	0.00	0.00	0.00
Trichloroethene	134.03	213.19	1168.32	1788.98	3304.51
Vinyl Chloride	0.00	0.00	5.34	8.57	13.91
1, 1, 2- Trichloroethane	0.00	0.00	0.01	0.53	0.54
1, 1- Dichloroethane	0.00	0.00	0.04	0.16	0.19
Chloroform	0.00	0.00	0.03	2.64	2.67
Methylene Chloride	2061.97	2042.18	14620.72	20584.32	39309.19
Tetrachloroethene	0.00	0.00	0.32	1.48	1.80
1, 2, 4-Trimethylbenzene	0.00	0.00	0.00	0.00	0.00
Carbon tetrachloride	0.00	0.00	0.00	0.20	0.20
Trichlorofluoromethane	0.00	0.00	0.00	0.00	0.00
Dichlorodifluoromethane	0.00	0.00	0.00	0.00	0.00
Chloroethane	0.00	0.00	0.00	0.00	0.00
Carbon disulfide	0.00	0.00	0.00	0.00	0.00
Xylene	0.00	0.00	0.00	0.13	0.13
2-Butanone	0.00	0.00	0.00	0.00	0.00
Ethyl Benzene	0.00	0.00	0.00	0.80	0.80
1,1,1-Trichloroethane	0.00	0.00	0.00	0.33	0.33
Freon-113	* 0.00	* 0.00	* 0.00	* 679.70	* 679.70
Total Volatiles Removed Per Year	2195.99	2461.96	16040.55	23089.76	
Total Volatiles Removed to Date					43788.26
Total Perchlorate Removed to Date	0.00	0.00	102.59	2577.00	2679.59

* Freon-113 has not been monitored prior to 2001. The 679.70 pounds removed is based only on a few ICT's and one sampling event.

- **Implementation of Institutional Controls and Other Measures.** Access controls such as fencing and warning signs are in place. Security personnel regularly patrol the site daily. The property is under the jurisdiction of the Army, who has no plans on transferring the property. No deed records are in place for each site. Property owned by the federal government is not deeded.

- **HASP/Contingency Plan.** Both the Health and Safety Plan (HASP) and contingency plan are in place, are adequate to control risks, and are being properly implemented. Employee training is up to date. Hazwoper training occurs annually along with a simulated spill training exercise. First-Aid, CPR, and RCRA training occur annually. During the occurrence of a spill of contaminated groundwater during an extended freeze in January 2001, the contingency plan was implemented and functioned effectively.
- **System Operations O&M.** System operations are consistent with requirements.
- **Cost of Systems/O&M.** Total estimated remedial cost of the project is \$36,890,000. Current O&M exceeds the estimated \$400,000/year O&M costs in the ROD by approximately \$200,000/year. The original estimated O&M cost is exceeded partially due to the operation and maintenance of the FBR, which was not part of the original ROD. Other non-planned events have impacted the cost of operation of the GWTP such as weather events and emergency maintenance due to equipment failure. Costs of maintaining the extraction system at Site 16 has also been rolled into the contract for GWTP operations and therefore increases the costs associated with O&M of the GWTP.
- **Opportunities for Optimization.** Optimization of the remedial process has been an ongoing activity since the GWTP began operations in 1997.

Water levels and pump efficiency from each ICT are monitored and recorded on a monthly basis. Contaminant removal from Site 18/24 is quantified semi-annually for volatiles, perchlorate, and chloride. Water level probes are adjusted accordingly for maximum removal efficiency and for controlling groundwater contours.

Equipment at the wellfield and GWTP is maintained through a preventative maintenance program. All maintenance performed is recorded daily and summarized monthly and again in a yearly report. A spare parts inventory is kept onsite for long-lead time parts. Manufacturers technical guidance for all equipment is kept on file at the GWTP. Opportunities to improve the system are presented to the Army by the contractor on a quarterly basis and evaluated for cost and benefits.

The sampling program is evaluated at least yearly to ensure compliance and effective monitoring of the Site. Monitoring procedures were updated in 2001 to ensure collection of grab and composite samples from the GWTP. Some monitoring for specific constituents was reduced. Further improvements to the sampling are feasible during the next few years. Some reduction or change in

monitoring wells sampled is feasible. All data is filed at the GWTP and is also converted for electronic storage.

A GWTP and Wellfield Operations and Maintenance Plan has been developed which is comprised of all procedures, plans, and records for GWTP operation. The Plan is updated annually and distributed on a CD to the Army. Working copies are kept onsite at the GWTP.

The possibility of using treated water from the ground water treatment plant (GWTP) as injection water for Site 18/24 should be evaluated. Using the treated water in such a manner could provide the following benefits:

- Injecting the treated water within Site 18/24 could serve to mobilize contaminants (i.e., volatiles & perchlorate), thereby accelerating contaminant collection in the existing extraction system and subsequent treatment at the GWTP.
- The injected water could be amended with nutrients to enhance in-situ bioremediation of contaminants (i.e., Perchlorate).
- A current limiting factor for the GWTP discharge is the flow rate in Harrison Bayou which varies seasonally. Providing another place to send treated water would allow the GWTP to operate with less dependence on the flow in Harrison Bayou.

■

- **Early Indicators of Potential Remedy Failure.** No early indicators of potential remedy failure were noted in the review.

7.1.2 Question B: Are the assumptions used at the time of remedy selection still valid?

- **Changes in Standards and To Be Considered (TBC) Requirements.** ARAR's included in the ROD must still be met at this time. A list and review of ARAR's is included in Appendix C.

30 TAC Chapter 307 was revised and became effective on 17 August 2000. Although encompassing many changes, of applicable and relevant interest is the revision of toxic criteria to protect aquatic life. Changes to the ROD Table 2 discharge requirements for treated groundwater have been recently considered by the TNRCC. As a result of the review perchlorate effluent limitations have been reduced by the TNRCC.

30 TAC 106.533, (formerly Texas Air Control Board Standard Exemption No. 68 of 30 Texas Administrative Code (TAC) 116) concerns exemptions for waste processes and remediation facilities. The GWTP facility must meet emissions limitations and certain record keeping requirements. Effective 15 November 1996, all exemptions are included under 30 TAC Chapter 106.

- **Changes in Exposure Pathways.** The land at Site 18/24 is no longer used by any LHAAP Facility Contractor for open burning of propellant, explosives, or pyrotechnics. The land is still under the control of the Army and there have been no changes in exposure pathways due to changes in land use. The land surrounding the sites is controlled by the U. S. Army and may be transferred to the U. S. Fish and Wildlife Service.

No human health or ecological routes of exposure or receptors have changed or been newly identified.

- **Changes in Toxicity and Other Contaminant Characteristics.** Perchlorate has been identified in the groundwater at Site 18/24 and the GWTP has been modified to remove them. Effluent discharge guidelines for perchlorate and other COCs in the ROD have been reviewed and recently set by the TNRCC.

EPA set a provisional reference dose (RfD) level of 0.0009 mg/kg/day for perchlorate in 1998. Based on the RfD, TNRCC set the state risk levels for perchlorate in water to 33 ppb for residential and 92 ppb for industrial/commercial exposure. From more recent information, it appears that these levels will be lowered or both residential and industrial/commercial exposure. The maximum contaminant level for perchlorate is currently 22 ppb and subject to change. Perchlorate was added to the EPA's contaminant candidate list on 2 March 1998.

In addition to the constituents monitored in the ROD, the constituent Freon-113 has been detected in the groundwater at Site 18/24. The addition of this COC to the GWTP effluent table is recommended.

The ROD for the site addresses an interim remedy to mitigate potential risks associated with the shallow groundwater at the site and sets performance standards for the treated groundwater. As part of the RI/FS a risk assessment is being performed for the site. The final ROD will take into consideration the human health and ecological risk assessment for the site and toxicity and other contaminant characteristics.

- **Changes in Risk Assessment Methodologies.** Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the interim remedy.
- **Expected Progress Towards Meeting Remedial Action Objectives.** Since these are interim remedial actions, no objectives in terms of meeting set standards have been established. Progress has been good in controlling the groundwater migration at the site.

7.1.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

- Human health and ecological risks at the site have not been fully defined. However, a risk assessment is being performed as part of the RI/FS. All documents should include COCs that have not only been detected during the RI, but are present in sampling performed as part of O&M of the site. A final ROD after the RI/FS will later set remediation criteria as necessary.

7.2 Site 12 & 16 Technical Assessment

7.2.1 Question A: Is the remedy functioning as intended by the decision documents?

- **Remedial Action.** The caps, as agreed upon in the ROD, were built on Sites 12 and 16 officially completed on August 1999.

The study performed under the RI/FS at Site 16 of extracting contaminated groundwater is progressing. The selected remedy to pump and treat groundwater continues to be effective in removing COCs and seems to be controlling the groundwater gradient at the site. However, monitoring data is limited and/or not compiled does not confirm the effectiveness of the system.

Site wide groundwater elevation levels are not monitored regularly at Sites 12 and 16. Random groundwater sampling events have occurred since 1980.

The final RI/FS was complete for Site 16 in early 2002.

- **System Operations/O&M.** The caps seem to be functioning as designed and need only routine maintenance. The caps are maintained regularly and inspected quarterly in accordance with RCRA requirements. Neither site has a written O&M Plan for the maintenance on the caps.

The Site 16 groundwater extraction system is maintained by contract by the GWTP operator. Groundwater extracted is tallied monthly.

- **Cost of System Operations/O&M.** Cost of the remedial project through 1998 to cap the landfills was \$5,500,000. According to the LHAAP Installation Action Plan, the total estimated remaining remedial cost of the Site 12 project is \$1,012,000 and the Site 16 project is \$5,302,000.
- **Opportunities for Optimization.** The groundwater extraction system needs to be evaluated for effectiveness. Although samples have been taken from the extraction wells on a semi-annual basis since their installation, quarterly measurements of groundwater depths and COCs in surrounding monitor wells would be useful in evaluating the system and the caps. Since the extraction system was installed as a design measure, the final remedy for Site 16 will be determined following the Feasibility Study.
- **Early Indicators of Potential Remedy Failure.** Frequent problems with the pumps due to fouling at the Site 16 extraction system require a stringent maintenance schedule to remove and clean the pumps. However, with proper maintenance the pumps perform as designed.
- **Implementation of Institutional Controls and Other Measures.** Access controls such as fencing and warning signs are in place. Security personnel regularly patrol the site each day. The property is under the jurisdiction of the Army, who has no plans on transferring the property. Although no deed records are in place, this should be considered in the final ROD.
- **HASP/Contingency Plan.** Both the HASP and contingency plan are in place, are adequate to control risks, and are being properly implemented.

7.2.2 Question B: Are the assumptions used at the time of remedy selection still valid?

- **Changes in Standards and To Be Considered Requirements.** Since the caps have been constructed and maintained, the goal of minimizing long-term vertical infiltration of water through the landfills is being attained. Minimizing long-term vertical infiltration of water through the landfills will be dependent upon long-term maintenance of the landfill caps.

The requirement of the Early Interim Remedial Action to minimize contaminant transport through landfill Site 16 is only met by the continued operation of the eight vertical extraction wells installed as part of a treatability study after the installation of the landfill cap. Operation of the wells will continue until a final remedy is developed and in operation.

The RI/FS addresses toxicity and of the contaminants and the human health and ecological risk assessment. The final ROD for the site will determine the final remedy selection.

- **Changes in Exposure Pathways.** The land at Sites 12 and 16 are no longer used by a LHAAP Facility Contractor as landfills. The land is still under the control of the Army and there have been no changes in exposure pathways due to changes in land use. A fence and warning signs restrict access to the landfill. The land surrounding the sites is controlled by the U. S. Army and may be transferred to the U. S. Fish and Wildlife Service.

No human health or ecological routes of exposure or receptors have changed or been newly identified.

- **Changes in Toxicity and Other Contaminant Characteristics.** Perchlorate has been identified in the groundwater at Site 16 and groundwater extraction from the site is being treated at the GWTP. The GWTP has been modified to treat for perchlorate. The groundwater is being extracted and treated in the GWTP.

EPA set a provisional RfD level of 0.0009 mg/kg/day for perchlorate in 1998. Based on the RfD, TNRCC set the state risk levels for perchlorate in water to 33 ppb for residential and 92 ppb for industrial/commercial exposure. From more recent information, it appears that these levels will be lowered for both residential and industrial/commercial exposure. The maximum contaminant level for perchlorate is currently 22 ppb. Perchlorate was added to the EPA's contaminant candidate list on 2 March 1998.

As part of the RI/FS a risk assessment is being performed for the site, which takes into consideration the human health and ecological risks for the Site and toxicity and other contaminant characteristics.

The ROD for the site addresses an Early Interim Remedial Action and is designed to mitigate potential risks associated with the groundwater at the Site. The final ROD will address a permanent remedy for the site.

- **Changes in Risk Assessment Methodologies.** Changes in risk assessment methodologies since the time of the ROD do not call into question the protectiveness of the remedy. The ROD is an Early Interim Remedial Action and not the final remedy.
- **Expected Progress Towards Meeting Remedial Action Objectives.** The objectives of the remedy are to perform the following 1) minimize long-term

vertical infiltration of water through the landfills; and 2) minimize contaminant transport.

Since the caps have been constructed and maintained, the goal of minimizing long-term vertical infiltration of water through the landfills is being attained. Minimizing long-term vertical infiltration of water through the landfills will be dependent upon long-term maintenance of the landfill caps. As stated in Section 6.5, “an operations and maintenance plan does not exist for the landfill caps specifically.” To help ensure long-term maintenance, a landfill cap operations and maintenance plan will be developed and implemented.

The requirement of the Early Interim Remedial Action to minimize contaminant transport through landfill Site 16 is only met by the continued operation of the eight vertical extraction wells installed as part of a treatability study after the installation of the landfill cap. Operation of the wells will continue until a final remedy is developed and in operation.

7.2.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

- A portion of the Site is within the 100-year floodplain. This does not effect operations now but should be considered when designing the remedy in the final ROD.
- Human health and ecological risks at the site have not been fully defined. However, a risk assessment is being performed as part of the RI/FS. A final ROD after the RI/FS will later set remediation criteria as necessary.
- The observance of perchlorate in the shallow ground water close to Harrison Bayou (i.e., Monitoring Well 16 WW12 with a detected perchlorate concentration of 2,430 µg/L) calls into question the protectiveness of the remedy. Not enough historical data for perchlorate or other known contaminants is available to establish contaminant trends in groundwater. Surface water has been monitored on a quarterly basis since 1995.

8.0 ISSUES

Several issues for Sites 18/24 and 12 & 16 were identified during the Site Inspection. The issues are provided in tables 8.0-1, 8.0-2, and 8.0-3.

Table 8.0-1 Issues for Site 18/24

Issue	Currently Affects Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Eight vertical extraction wells required by ROD not installed.	No	No
Contracting groundwater plume due to pumping may allow reduction in number of monitoring wells sampled.	No	No
Growth in fence line around the Site.	No	No
Fencing around Site does not contain ICT's.	No	No
Lack of restricted access signs around the Site.	No	Yes
Roads in Site have potholes.	No	No
Slip flanges and bolts on pipe junctions at ICT wellheads deteriorating.	No	No
High frequency of repair of electronic equipment following lightning storms indicates need for lightning arrestors/lightning rods to prevent damage to sensitive equipment.	No	No
Metal precipitation process may not be required.	No	No
Control wires at Site at junction box are not protected.	No	No
Release of approximately 50,000 gallons of untreated groundwater in January 2001.	No	No
Contaminants in monitor well C-06.	No	No
Contamination at Northwest of Burning Ground outside ICT capture zone.	No	Yes
Monitor wells 18WW08 and 18WW17 not in perchlorate sampling of Site 18/24.	No	Yes
COC's detected in onsite monitoring should be included in subsequent documents.	No	Yes

Table 8.0-2 Issues for Sites 12

Issue	Currently Affects Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Groundwater monitoring (chemical sampling and water levels) not conducted regularly or documented properly	No	Yes
Erosion on landfill cap near toe of cap	No	Yes
Need O&M Plan for Site	No	Yes
Non-source soils not protected by cap	No	Yes

Table 8.0-3 Issues for Sites 16

Issue	Currently Affects Protectiveness (Yes/No)	Affects Future Protectiveness (Yes/No)
Groundwater monitoring (chemical sampling and water levels) not conducted regularly or documented properly	No	Yes
Need O&M Plan for Site	No	Yes
Evaluate the hydrogeologic effectiveness of the groundwater extraction system	No	Yes
Groundwater model in RI/FS should provide modeling of perchlorate and possibly other contaminants	No	Yes
Steel covers off of housing at extraction wells	No	No

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Recommendations and follow-up actions are provided in table 9.0-1, 9.0-2, and 9.0-3.

Table 9.0-1 Recommendations for Site 18/24

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes/No)	
					Current	Future
Eight extraction wells required by ROD not installed.	Evaluate need for wells and install or obtain release from State and EPA	USACE	State/EPA	11/30/02	No	Yes
Contracting groundwater plume due to pumping may allow for reduction in number of monitoring wells sampled	Review monitoring wells sampled and change as necessary	CES / USACE	State/EPA	11/30/02	No	No
Growth in fence line around the Site	Cut trees along fence line	CES	State/EPA	3/30/02	No	No
Fencing around Site does not contain ICT's	Determine applicability for fencing around ICT's	USACE	State/EPA	To Be Determined	No	No
Lack of restricted access signs around the Site	Place signs around site	CES / USACE	State/EPA	5/30/02	No	Yes
Roads in Site have potholes	Fill in potholes	CES	State/EPA	12/30/01	No	No
Slip flanges and bolts on pipe junctions at ICT wellheads deteriorating	Paint flanges and monitor for deterioration	CES	State/EPA	12/30/01	No	No
High frequency of repair of electronic equipment following lightning storms indicates need for lightning arrestors/lightning rods to prevent damage to sensitive equipment.	Perform cost analysis for installing lightning protection	USACE	State/EPA	12/30/01	No	No
Metal precipitation process may not be required	Review data and monitoring information	USACE	State/EPA	11/30/02	No	No
Control wires at Site at junction box are not protected	Protect wires at junctions	USACE	State/EPA	5/30/02	No	No
Release of approximately 50,000 gallons of untreated groundwater in January 2001	Review spill procedure and implement Freeze Protection Plan	USACE	State/EPA	11/30/01	No	No
Contaminants in monitor well C-06	Further investigation to determine if there is another source area.	USACE	State/EPA	11/30/02	No	No
Contamination at Northwest of Burning Ground outside of ICT capture zone.	Further study to determine if groundwater extraction from area is required.	USACE	State/EPA	11/30/02	No	Yes
Monitor wells 18WW08 and 18WW17 not in perchlorate sampling of Site 18/24	CES will include these wells in Site 18/24 sampling	CES	State/EPA	5/30/02	No	Yes
COC's detected in onsite monitoring not included in investigations.	Review analysis of ICT's and monitoring wells conducted by onsite GWTP contractor for COC's. Include new COC's in subsequent investigations as necessary.	USACE	State/EPA	8/30/02	No	Yes

Table 9.0-2 Recommendations for Site 12

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes/No)	
					Current	Future
Groundwater monitoring not conducted regularly or documented properly	Monitor the wells on a regular basis and document in annual report.	USACE	State/EPA	11/30/02	No	Yes
Erosion on landfill near cap toe	Repair erosion	CES	USACE	2/30/02	No	Yes
Need Operation & Maintenance Plan for Site	Write and implement a O&M Plan for Site	USACE	State/EPA	8/30/02	No	Yes
Non source soils not protected by cap	Investigate and determine if action is necessary and include in final ROD.	USACE	State/EPA	11/30/02	No	Yes

Table 9.0-3 Recommendations for Site 16

Issue	Recommendations/Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Yes/No)	
					Current	Future
Groundwater monitoring not conducted regularly or documented properly	Monitor the wells on a regular basis and document in annual report.	USACE	State/EPA	5/30/02	No	Yes
Need Operation & Maintenance Plan for Site	Write and implement a O&M Plan for site	USACE	State/EPA	8/30/02	No	Yes
Evaluate the hydrogeologic effectiveness of the groundwater extraction system	Perform study to determine effectiveness of extraction system	USACE	State/EPA	11/30/02	No	Yes
Groundwater model in RF/FS should provide modeling of perchlorate and possibly other contaminants	Perform study to determine impact of other contaminants on environment	USACE	State/EPA	11/30/02	No	Yes
Steel covers off of housing at extraction wells.	Place covers on housing or replace with lighter covers more easily moved	CES / USACE	State/EPA	5/30/02	No	No

10.0 PROTECTIVENESS STATEMENT(S)

The protection of human health and the environment by the remedial actions at Site 18/24, Site 12, and Site 16 are discussed below. Both the Onsite Health and Safety Plan and the Contingency plan are in place and are adequate to control risks, and are properly implemented. These apply to all sites and substantially reduce the chance of exposure to contaminants even if the caps or extraction systems fail.

10.1 Sites 18 and 24

The Early Interim Remedial Action at Site 18/24 currently serves the purpose of protecting human health and the environment by controlling exposure pathways that could result in unacceptable risks. The migration of contaminants to wells screened in the intermediate and deeper groundwater zones has been stable and/or declining.

The removal action and operation of the ICT's and treatment of the water at the GWTP are protective of the environment and human health by greatly reducing the chance of contaminants leaving the site. As long as the ICT's and the GWTP are in operation, this will remain true. As an early interim action this was not intended to be final solution. Risk assessments for human health and the environment are being prepared for the site in accordance with the RI/FS.

10.2 Site 12

The Early Interim Remedial Action at Site 12 is expected to be protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

The early interim remedial action at Site 12 is expected to reduce the potential for vertical infiltration of water through the landfills and to minimize contaminant transport. The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the ROD for Site 12.

Although the cap is protective of the environment and human health by reducing the amount of water moving through the source material, the effectiveness of the cap needs to be further evaluated. Groundwater monitoring has not been conducted frequently enough to establish seasonal groundwater contours or contaminant trends. In addition, non-source area soil that contains contaminants is not protected by the cap from infiltration of water and may be a cause of concern.

The risk assessment for the site also needs to be completed. As an Early Interim Remedial Action, the cap was not intended to be final solution. However, pending the outcome of the risk assessment and groundwater monitoring, the cap may be the final solution.

10.3 Site 16

The remedial action at Site 16 is expected to be protective of human health and the environment by serving its intended purpose to reduce the potential for vertical infiltration of water through the landfill. With the addition of eight extraction wells as part of the accelerated RI/FS, the remedial action meets the objective to minimize contaminant transport. The removal action and operation of the eight extraction wells assist in protection of the environment and human health by greatly reducing the chance of contaminants leaving the site. For the remedial action to remain effective, the extraction wells will remain in operation. As an Early Interim Remedial Action this was not intended to be final solution. A Feasibility Study is still in progress.

Future remedies at Site 16 need to evaluate the following:

- The effectiveness of the cap needs to be evaluated through regular groundwater monitoring.
- Determine if additional monitoring wells and piezometers need to be installed between the landfill and Harrison Bayou.
- The Baseline Risk Assessment for Human Health states “Based on the results of the Site 16 baseline risk assessment, it appears that groundwater is the primary medium of concern at the site. The hypothetical future use of groundwater should be further evaluated by 1) identifying the effect of the current groundwater extraction system on groundwater concentrations relative to potential future sites uses: and 2) identifying the potential for contaminants identified in onsite groundwater to migrate off-site.”
- Site 16, needs additional ecological risk assessment work before a final decision can be made concerning the final remedy.

11.0 NEXT REVIEW

This Site requires ongoing five-year reviews. The next review will be conducted within 5 years of the completion of this five-year review report. The completion date is the date of the signature shown on the signature cover attached to the front of the report.

END OF REPORT

for

Five-Year Review

Longhorn Army Ammunition Plant
Karnack, Texas

Site 18/24 (Burning Ground 3)
Site 16 (Old Landfill)
Site 12 (Sanitary Landfill)

Appendix

- A. Five Year-Review Site Inspection Checklist**
- B. Documents Reviewed**
- C. Regulatory Review**
- D. Photographs**
- E. Site 18/24 Contaminant Contour Maps**
- F. Site 12 Groundwater Elevation Contour Maps**
- G. Site 16 Groundwater Elevation Contour Maps**
- H. Survey Forms**

APPENDIX A

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

Information may be completed by hand and attached to the five-year review report as supporting documentation of site status. "N/A" refers to "not applicable."

I. SITE INFORMATION	
Site Name: <u>Longhorn Army Ammunition Plant</u>	Date of Inspection: <u>10/17-18/01</u>
Location and Region: <u>Harrison County, Texas, Region 6</u>	EPA ID: <u>TX6213820529</u>
Agency, office, or company leading the five-year review: Complete Environmental Service (Onsite Contractor) Corps of Engineers (Tulsa District)	Weather/temperature: Clear & Sunny/ 60 °F
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☒ Ground water pump and treatment ☐ Surface water collection and treatment ☐ Other	
Attachments: ☐ Inspection team roster attached ☒ Site map attached	

II. INTERVIEWS (Check all that apply)		
1. O&M Site Manager		
<u>William Richard Corrigan</u> Name	<u>O&M Project Manager</u> Title	<u>10/17/01</u> Date
Interviewed: ☐ by mail ☒ at office ☐ by phone Phone no.		
Problems, suggestions: ☒ Report attached		
2. O&M Staff		
<u>Scott Beesinger</u> Name	<u>Quality Control Manager</u> Title	<u>10/17/01</u> Date
<u>Lanita Burchfield</u>	<u>Office Administrator</u>	<u>10/17/01</u>
<u>Robert Owen</u>	<u>Plant Operator</u>	<u>10/17/01</u>
<u>William Corrigan II</u>	<u>Plant Operator/Maintenance</u>	<u>10/17/01</u>
Interviewed: ☐ by mail ☒ at office ☐ by phone Phone no.		
Problems, suggestions: ☒ Report attached		

II. INTERVIEWS (continued)

3. Local regulatory authorities and response agencies (i.e.; State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.). Fill in all that apply.

Agency Texas Natural Resource Conservation Commission

Contact <u>Jim Sher</u>	<u>Team Leader</u>	<u>9/12/01</u>	<u>512-239-2444</u>
Name	Title	Date	Phone no.

Problems, suggestions: ☒ Report attached See survey

Agency U.S. Environmental Protection Agency – Region VI

Contact <u>Chris G. Villarreal</u>	<u>Remedial Project Manager</u>	<u>9/18/01</u>	<u>214-665-6758</u>
Name	Title	Date	Phone no.

Problems, suggestions: ☒ Report attached See survey

4. Other interviews (optional): ☒ Report attached to Five-Year Review Report

1. Cliff Murray, Environmental Engineer, Corps of Engineers
2. Bob Speight, Vice President, Greater Caddo Lake Association
3. Wes & Joann Hodges, Local Business Owners
4. Roy Darville, Professor of Biology, East Texas Baptist University
5. Bill Sniffen, Geologist
6. H.L. (Bud) Jones

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)**1. O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: O&M manual kept at onsite, scheduled inspections up to date. All process monitoring logs, maintenance logs, calibration logs, air emissions reports, monthly reports, quarterly reports and annual reports available.

2. Site-Specific Health and Safety Plan

☒ Contingency plan/emergency response plan	☒ Readily available	☒ Up to date	☐ N/A
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Remarks: Reviewed annually.

III.2 ONSITE DOCUMENTS & RECORDS VERIFIED (continued)

- 3. O&M and OSHA Training Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: Confined Space and Hot Work Permits utilized. Training records for Hazwoper, CPR, and First-Aid training and RCRA training records onsite.

4. Permits and Service Agreements

- ☐ Air discharge permit ☐ Readily available ☐ Up to date ☒ N/A
☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☒ N/A
☒ Other permits ☒ Readily available ☒ Up to date ☐ N/A

Remarks: 1) Site operates by Standard Exemption for air emissions. Exemption requirements documented onsite. 2) Site has effluent limitations in ROD that it monitors by a testing plan listed in the "Groundwater Treatment Plant and Wellfields Sampling and Analysis Plan."

- 5. Gas Generation Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks:

- 6. Settlement Monument Records** ☐ Readily available ☐ Up to date ☒ N/A

Remarks:

- 7. Ground Water Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks:

- 8. Leachate Extraction Records** ☒ Readily available ☒ Up to date ☐ N/A

Remarks:

9. Discharge Compliance Records

- ☒ Air ☒ Readily available ☒ Up to date ☐ N/A
☒ Water (effluent) ☒ Readily available ☒ Up to date ☐ N/A

Remarks: Discharge compliance records are available in the Monthly Reports and in the Quarterly Reports prepared by the onsite contractor. Analytical reports are filed onsite by event and date. Onsite air monitoring is verified by continuous emissions monitoring and hourly averages are printed and filed.

- 10. Daily Access/Security Logs** ☒ Readily available ☒ Up to date ☐ N/A

Remarks: Access to the site controlled by Security. Entrance logs onto LHAAP available at LHAAP Security and access to Site 18/24 available at the Groundwater Treatment Plant.

IV. O&M COSTS

1. O&M Organization

- ☐ State in-house
 ☐ Contractor for State
☐ PRP in-house
 ☐ Contractor for PRP
☒ Other (Contractor for U.S. Army Corps of Engineers)

2. O&M Cost Records

- ☒ Readily available
 ☒ Up to date
☒ Funding mechanism/agreement in place
 Original O&M cost estimate \$400,000 per year
☐ Breakdown attached

Total annual cost by year for review period, if available

(Groundwater Treatment Plant)

From <u>January 1997</u> Date	to <u>December 1997</u> Date	<u>\$ 907,721</u> Total cost	☐ Breakdown attached
From <u>January 1998</u> Date	to <u>December 1998</u> Date	<u>\$ 779,278</u> Total cost	☐ Breakdown attached
From <u>January 1999</u> Date	to <u>December 1999</u> Date	<u>\$ 1,007,209</u> Total cost	☐ Breakdown attached
From <u>January 2000</u> Date	to <u>December 2000</u> Date	<u>\$ 692,370</u> Total cost	☐ Breakdown attached
From <u>January 2001</u> Date	to <u>October 2001</u> Date	<u>\$ 580,066</u> Total cost	☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons:

1. Addition of carbon treatment units added about \$ 63,000 in 1998-1999.
2. Additional expense of \$ 12,000 in July 1999 due to Catox Blower failure.
3. Additional expense of \$ 20,722 in October 1999 due to lightning damage.
4. Additional expense \$ 7,000 in August 2001 due to lightning damage.
5. Additional expense of \$645,000 during CY 2000-2001 to install perchlorate treatment system. Ongoing operational expense of \$20,000 per year.

V.D.2 ACCESS AND INSTITUTIONAL CONTROLS (continued)

2. **Land use changes onsite** ☐ N/A
 Remarks: Land will remain under federal/Army control.

3. **Land use changes offsite** ☒ N/A
 Remarks:

VI. GENERAL SITE CONDITIONS

A. **Roads** ☒ Applicable ☐ N/A

1. **Roads damaged** ☒ Location shown on site map ☒ Roads adequate ☐ N/A
 Remarks: Potholes roadway at Site 18/24 Area were noted during Site Inspection.

B. Other Site Conditions

Remarks: Site was in good condition during visit, but vegetation sparse and distressed in many areas due to lack of topsoil after construction of ICT's, etc..

VII. LANDFILL COVERS☒ Applicable☐ N/A**A. Landfill Surface**

1. **Settlement** (Low spots) ☒ Location shown on site map ☒ Settlement not evident
 Areal extent Depth

Remarks: Grass on landfill cover well maintained. Landfill undergoes quarterly inspection per RCRA requirements. Some minor erosion on Northeast location of Site 12. Under contract to be repaired.

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
 Lengths Widths Depths
 Remarks:

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
 Areal extent Depth
 Remarks:

VII.A.3 LANDFILL COVERS (continued)			
4. Holes Areal extent Remarks:	☐ Location shown on site map Depth	☒ Holes not evident	
5. Vegetative Cover ☐ Trees/Shrubs (indicate size and locations on a diagram) Remarks: <u>Cover sparse and stressed in several locations where topsoil is thin. However, cover appears to be holding and not much erosion is evident.</u>	☒ Grass ☒ Cover properly established	☐ No signs of stress	
6. Alternative Cover (armored rock, concrete, etc.) Remarks: <u>Rip-rap on Site 16 constructed of concrete. The riprap is in good condition with no vegetation within.</u>	☒ N/A		
7. Bulges Areal extent Remarks:	☐ Location shown on site map Depth	☒ Bulges not evident	
8. Wet Areas/Water Damage ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade	☒ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	☐ Areal extent ☐ Areal extent ☐ Areal extent ☐ Areal extent	Remarks: <u>Area dry during inspection.</u>
9. Slope Instability Areal extent Remarks:	☐ Slides ☐ Location shown on site map	☒ No evidence of slope instability	
B. Benches	☐ Applicable	☒ N/A	
1. Flows Bypass Bench Remarks:	☐ Location shown on site map	☒ N/A or okay	

VII.B LANDFILL COVERS (continued)			
2. Bench Breached Remarks:	☐ Location shown on site map	☒ N/A or okay	
3. Bench Overtopped Remarks:	☐ Location shown on site map	☒ N/A or okay	
C. Letdown Channels ☒ Applicable ☐ N/A (Channel lined with erosion control mats & rip-rap that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)			
1. Settlement Areal extent Remarks:	☐ Location shown on site map Depth	☒ No evidence of settlement	
2. Material Degradation Material type Remarks:	☐ Location shown on site map Areal extent	☒ No evidence of degradation	
3. Erosion Areal extent Remarks:	☐ Location shown on site map Depth	☒ No evidence of erosion	
4. Undercutting Areal extent Remarks:	☐ Location shown on site map Depth	☒ No evidence of undercutting	
5. Obstructions Type ☐ Location shown on site map Areal extent Size Remarks:	☒ No obstructions		
6. Excessive Vegetative Growth Type ☒ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent Remarks: <u>Landfills cut twice yearly.</u>			

VII. LANDFILL COVERS (continued)			
D. Cover Penetrations		☐ Applicable	☒ N/A
1. Gas Vents ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A Remarks:			
2. Gas Monitoring Probes ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs O&M ☒ N/A Remarks:			
3. Monitoring Wells (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs O&M ☒ N/A Remarks:			
4. Leachate Extraction Wells ☐ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A Remarks:			
5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☒ N/A Remarks:			
E. Gas Collection and Treatment		☐ Applicable	☒ N/A
1. Gas Treatment Facilities ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks:			
2. Gas Collection Wells, Manifolds, and Piping ☐ Good condition ☐ Needs Maintenance Remarks:			
3. Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☒ N/A Remarks:			

VII. LANDFILL COVERS (continued)			
F. Cover Drainage Layer		☐ Applicable	☒ N/A
1. Outlet Pipes Inspected		☐ Functioning	☒ N/A
Remarks:			
2. Outlet Rock Inspected		☐ Functioning	☒ N/A
Remarks:			
G. Detention/Sedimentation Ponds		☐ Applicable	☒ N/A
1. Siltation	Areal extent Siltation not evident	Depth	☒ N/A
Remarks:			
2. Erosion	Areal extent Erosion not evident	Depth	
Remarks:			
3. Outlet Works	☐ Functioning	☒ N/A	
Remarks:			
4. Dam	☐ Functioning	☒ N/A	
Remarks:			
H. Retaining Walls		☐ Applicable	☒ N/A
1. Deformations	☐ Location shown on site map	☐ Deformation not evident	
Horizontal displacement		Vertical displacement	
Rotational displacement			
Remarks:			
2. Degradation	☐ Location shown on site map	☐ Degradation not evident	
Remarks:			

VII. LANDFILL COVERS (continued)**I. Perimeter Ditches/Off-Site Discharge** ☐ Applicable ☒ N/A

1. Siltation ☐ Location shown on site map ☐ Siltation not evident
 Areal extent Depth
 Remarks:

2. Vegetative Growth ☐ Location shown on site map ☐ N/A
☐ Vegetation does not impede flow
 Areal extent Type
 Remarks:

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
 Areal extent Depth
 Remarks:

4. Discharge Structure ☐ Functioning ☐ N/A
 Remarks:

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. Settlement ☐ Location shown on site map ☐ Settlement not evident
 Areal extent ☐ Depth
 Remarks:

2. Performance Monitoring Type of monitoring
☐ Performance not monitored
 Frequency ☐ Evidence of breaching
 Head differential
 Remarks:

IX. GROUND WATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A**A. Ground Water Extraction Wells, Pumps, and Pipelines** ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical
☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: Slip flanges at wellheads warrant watching due to deterioration of carbon steel bolts.

IX. GROUND WATER/SURFACE WATER REMEDIES (continued)**2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☒ Good condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks:

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A**1. Collection Structures, Pumps, and Electrical**
☐ Good condition ☐ Needs Maintenance

Remarks: Underground control wire at junction box in Site 18/24 exposed to weather.

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances
☐ Good condition ☐ Needs Maintenance

Remarks:

3. Spare Parts and Equipment
☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks: Spare parts inventory is kept onsite. All manufacturer's literature is filed onsite and readily available. Spare parts and description of all parts ordered are kept on electronic file.**C. Treatment System** ☒ Applicable ☐ N/A**1. Treatment Train (Check components that apply)**
☒ Metals removal ☐ Oil/water separation ☒ Bioremediation

☒ Air stripping ☒ Carbon adsorbers
☒ Filters Sand☒ Additive (e.g., chelation agent, flocculent) Cationic Polymer☐ Others
☒ Good condition ☐ Needs Maintenance
☒ Sampling ports properly marked and functional☒ Sampling/maintenance log displayed and up to date☒ Equipment properly identified☒ Quantity of ground water treated annually☐ Quantity of surface water treated annuallyRemarks: All construction and process control drawings of GWTP onsite.

IX. C GROUND WATER/SURFACE WATER REMEDIES (continued)**2. Electrical Enclosures and Panels** (Properly rated and functional)
☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks:

3. Tanks, Vaults, Storage Vessels
☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs Maintenance

Remarks:

4. Discharge Structure and Appurtenances
☐ N/A ☒ Good condition ☐ Needs Maintenance

Remarks: Some brush around discharge structure.

5. Treatment Building(s)
☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair
☒ Chemicals and equipment properly stored
Remarks: Most chemical storage in large tanks within containment area. Only chemical storage outside containment area is polymer in 55-gallon drums or dry chemical (urea) in equipment shed.**6. Monitoring Wells** (Pump and treatment remedy)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☒ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks: Monitor well inspected when sampled twice yearly. Inspection records onsite. Repairs made to wells twice yearly when inspection is completed.**D. Monitoring Data****1. Monitoring Data**
☒ Is routinely sampled on time ☒ Is of acceptable quality
1. Monitoring Data Suggests
☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining.
D. Monitored Natural Attenuation**1. Monitoring Wells** (Natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A

Remarks:

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

At Site 18/24 the interim remedies have been implemented as designed. The treatment of soil reduced the amount source material. The extraction system contains and reduces the groundwater contamination. Hydraulic control has been accomplished as evidenced by the piezometric surface map showing zones of depression. Contaminant concentrations appear to have decreased in wells at the perimeter of the impacted areas. Issues that need to be addressed do not compromise the overall effectiveness of the action.

Landfill Site 12 the interim remedies have been implemented as designed. The cap should reduce the amount of leaching of the contaminants out of the landfill. The issues that need to be addressed do not compromise the overall effectiveness of the landfill cap.

Landfill Site 16 the interim remedies have been implemented as designed. The cap should reduce the amount of leaching of the contaminants out of the landfill. The extraction system contains and reduces the groundwater contamination. The issues that need to be addressed do not compromise the overall effectiveness of the extraction system and the cap.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

The O& M have been carried out in an efficient manner. Operations and maintenance consists of plant maintenance and repairs, compliance monitoring, maintain spare parts inventory, grounds maintenance, and maintenance of all extraction systems. Employees are well trained and attend at least one training class per year. Maintenance and operations procedures are in place and well documented. Changes have been made when they were required.

Regular monitoring of landfills should be implemented to compare concentrations of contaminants over time to determine if reduction of infiltration reduces concentrations downgradient of landfill.

XI. OVERALL OBSERVATIONS (continued)
C. Early Indicators of Potential Remedy Failure
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future.
<u>There was nothing in the document review, site visit, or interviews that would suggest that the protectiveness of the remedy has been compromised. Costs of plant operations & maintenance have escalated due to implementation of a fluidized bed reactor process.</u>
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
<u>1. Groundwater monitoring needs to be carried out on a regular basis and summarized in report for Sites 12 and 16.</u> <u>2. The groundwater extraction systems for sites 16 and 18/24 need to be evaluated to make sure they have the maximum effectiveness.</u> <u>3. A reduction in monitoring well sampling at Site 18/24 could be reduced as the plume retracts.</u> <u>4. The metal precipitation process at the GWTP may not be required.</u>

APPENDIX B

DOCUMENTS REVIEWED

Dow Environmental, Final General Work Plan, Interim Remedial Action, Burning Ground No. 3, Longhorn Army Ammunition Plant, Karnack, TX, December 28, 1995.

Complete Environmental Service, Onsite Remediation System Operations Plan for Groundwater Treatment Plant and Wellfields, Longhorn Army Ammunition Plant, Karnack, TX, June 2000.

Jacobs Engineering Group, Inc. Draft Final Feasibility Study for Site 16, Longhorn Army Ammunition Plant, Karnack, TX, December 2001.

Jacobs Engineering Group, Inc. Final Baseline Risk Assessment: A Supplement to the Remedial Investigation report, Site 16 Landfill RI/FS, Longhorn Army Ammunition Plant, Karnack, TX, June 2001.

Jacobs Engineering Group, Inc. Final Ecological Risk Assessment, A Supplement to the Remedial Investigation report, Site 16 Landfill, Longhorn Army Ammunition Plant, Karnack, TX, October 2001.

Jacobs Engineering Group, Inc. Final Remedial Investigation, Group 2 Sites, Longhorn Army Ammunition Plant, Karnack, TX, April 2001.

Jacobs Engineering Group, Inc. Second Quarter Data Summary Report for the Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, TX, March 2001.

OHM Remediation Services Corporation, Final Construction Completion Report, Interim Remedial Action, Landfill 12 and 16 Cap Construction, Longhorn Army Ammunition Plant, Karnack, TX, December 1998.

Sverdrup Environmental, Inc., Final Work Plan for the Site 16-Old Landfill Groundwater-Control System, Longhorn Army Ammunition Plant, Karnack, TX, January 1996.

Sverdrup Environmental, Inc., Draft Remedial Investigation Report, Site 16 Landfill Remedial Investigation and Feasibility Study, Longhorn Army Ammunition Plant, Karnack, TX, August 1999.

U.S. Environmental Protection Agency. EPA Superfund Record of Decision: Longhorn Army Ammunition Plant, (Burning Ground 3), Karnack, TX, 12 May 1995.

U.S. Environmental Protection Agency. EPA Superfund Record of Decision: Longhorn Army Ammunition Plant, (The LHAAP 12 and 16 Landfills), Karnack, TX, 12 September 1995.

U.S. Environmental Protection Agency. Comprehensive Five-Year Review Guidance, Office of Emergency and Remedial Response, Washington, D. C., June 2001

U.S. Environmental Protection Agency Region 6 and the U.S. Department of the Army and the State of Texas. Federal Facility Agreement under CERCLA Section 120, Longhorn Army Ammunition Plant, Karnack, TX, September 1991.

U.S. Army Industrial Operations Command. Installation Action Plan for Longhorn Army Ammunition Plant, March 2000.

APPENDIX C

REGULATORY REVIEW

The Record of Decision's (ROD) for Sites 18/24 and for Sites 12 & 16 identified many specific ARAR's pertaining to each site. Types of ARAR's applicable to the sites include Chemical Specific ARAR's, Action Specific ARAR's, and Location Specific ARARs. ARAR's applicable for each Site are listed and discussed in Tables C-1 and C-2. A description of the ARAR review areas are described below.

ROD ACTION-SPECIFIC REQUIREMENTS

Action-specific ARARs are usually technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial site, very different requirements can come into play. These action-specific requirements do not in themselves determine the remedial alternative; rather, they indicate how a selected alternative must be achieved.

ROD CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are health or risk-based numerical values or methodologies that, when applied to site-specific conditions, establish the acceptable amount or concentration of a chemical that may be found in or discharged to the ambient environment. If more than one chemical-specific ARAR exists for a chemical of concern (COC), the most stringent level would be identified as an ARAR for the remedial action.

ROD LOCATION-SPECIFIC ARARs

Location-specific ARARs are restrictions on remedial activities solely based on the location of the remedial activity. Some examples of locations that might prompt a location-specific ARAR include wetlands, sensitive ecosystems or habitats, flood plains, and areas of historical significance.

TO BE CONSIDERED REQUIREMENTS (TBCs)

Many Federal and State environmental and public health agencies develop criteria, advisories, guidance, and proposed standards that are not legally enforceable but contain information that would be helpful in carrying out, or in determining the level of protectiveness of, selected remedies. "To be considered" (TBCs) are environmental policies or proposals that are not ARARs, but to address site-specific concerns and may be used in determining the cleanup levels necessary for protection of human health and the environment. TBCs are meant to complement the use of ARARs, not to compete with or replace them. No TBC's were identified in the ROD's for Site 18/24 or for Site 12 & 16.

The following conclusions support the determination that the Early Interim Remedial Action at the site is expected to be protective of human health and the environment until the final ROD.

Table C-1 Site 18/24

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Soil/RCRA	Federal – 40 CFR 268.44 Treatability Variance Procedures for the thermal desorption treatment of soils and source material	Relevant and Appropriate	40 CFR 268.44 requires the treatment level range that will be established throughout the Treatability Variance for the treatment technologies is a 90 to a 99.9 percent reduction in the concentration of the contaminants upon the completion of the treatment process.	Remediation technology attains treatment levels of contaminants to 99.9% reduction in contaminants prior to land disposal.
Groundwater/ CWA	State – 30 TAC Chapter 307 and 30 TAC Chapter 319 Subchapter B	Applicable, Relevant and Appropriate	30 TAC Chapter 307 establishes the minimum requirements by the State to maintain the quality of water in the state consistent with public health and enjoyment, propagation and protection of terrestrial and aquatic life, etc. 30 TAC Chapter 307 was revised and became effective on 17 August 2000. Although encompassing many changes, of applicable and relevant interest is the revision of toxic criteria to protect aquatic life.	Remediation of contaminated groundwater will reduce ongoing discharges of contaminants to groundwater. Treated effluent discharged will meet the requirements of the State Antidegradation policy. Treatment levels are established in Table 2 of the ROD.
Solid Waste/RCRA	Federal – 40 CFR Part 261 Hazardous Waste Identification and Listing	Applicable, Relevant and Appropriate	40 CFR Part 261 establishes the guidelines to identify wastes subject to regulation and those excluded.	Treatment residuals will be managed in accordance with hazardous waste identification rules. 40 CFR Part 261 allows for some exclusions under 40 CFR Part 273 for universal waste.
Water/CWA	Federal – 40 CFR Part 125 Establishes criteria and standards for the effluent limitations	Applicable, Relevant and Appropriate	40 CFR Part 125 establishes the basis for water discharges to a surface body of water for protection of human health and the environment.	Treatment of the groundwater effectively meets the requirements of the Federal NPDES Program The State program effectively meets the requirements of the federal program.
Water/CWA	State – 30 TAC 308 Establishes criteria and standards for the effluent limitations. 40 CFR 125 adopted by reference.	Applicable, Relevant and Appropriate	30 TAC 308 establishes the basis for water discharges to a surface body of water for protection of human health and the environment. 30 TAC 308 adopts 40 CFR 125 by reference.	Treatment of the groundwater effectively meets the requirements of the State TPDES Program

Air/CAA	State – 30 TAC Chapter 106.262 References to Standard Exemptions and Exemptions from Permitting	Applicable, Relevant and Appropriate	30 TAC 106.262, (formerly TACB Standard Exemption No. 188 of 30 TAC 116) concerning emissions and distance exemptions for physical or operational changes to certain types of facilities.	Treatment of the contaminated water at the GWTP generates a solvent laded airstream (SLA) that is treated in a thermal catalytic oxidizer. The air emissions are monitored continuously with a Continuous Emissions Monitor (CEM). The GWTP emission are not permitted but are operated under a standard exemption. The selected remedy meets the applicable sections of the Rule concerning the emissions limitation of 5 tons/year requirement and distance to offsite receptor requirements of the Rule. This rule is applicable because soil thermal desorption and groundwater treatment by air stripping and catalytic oxidation are part of the remedy.
Air/CAA	State – 30 TAC Chapter 106.533 References to Standard Exemptions and Exemptions from Permitting	Applicable, Relevant and Appropriate	30 TAC 106.533, (formerly TACB Standard Exemption No. 68 of 30 TAC 116) concerns exemptions for waste processes and remediation facilities. Facility must meet emissions limitations and certain record keeping requirements. Effective 15 November 1996, all exemptions are included under 30 TAC Chapter 106.	The selected remedy meets the applicable sections of the Rule concerning total emissions of TPH are not to exceed one pound/hour. This rule is applicable because soil thermal desorption and groundwater treatment by air stripping and catalytic oxidation are part of the remedy.
Air/OSHA	Federal - 29 CFR 1910 Occupational Safety and Health	Applicable, Relevant and Appropriate	29 CFR 1910 establishes standards for occupational health and safety.	Action levels for volatile and semi-volatile air contaminants will be established for implementation during onsite remedial activities. Action levels will be established for hearing protection and respiratory protection during onsite remedial activities. Furthermore, an onsite training program and mandatory health and safety standards will be enforced during the remedial activities

Floodplains/ RCRA	Federal - 40 CFR 264.18 Location Standards	Applicable, Relevant and Appropriate	This regulation identifies geological features that a proposed location for a RCRA hazardous waste treatment and/or disposal facility must avoid. One of the three specific features applies to the site: Floodplain – A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or any hazardous waste by a 100-year flood unless the owner or operator can demonstrate to the Regional Administrator that he can meet the criteria established under this subpart, which exempts him from the requirement.	RCRA requirements for the location of a treatment, storage, or disposal facility in a flood plain were noted to apply in the 1995 ROD because part of the Burning Ground is within a 100-year floodplain.
Water/CWA	State – 30 TAC Chapter 350 Ground Water Restoration.	Applicable, Relevant and Appropriate	30 TAC Chapter 350 concerning the Texas Risk Reduction Program (TRRP) became effective on 23 September 1999 and replaced 30 TAC 335 Subchapter S. The purpose of the TRRP is to develop a consistent and reasonable risk based corrective action program. The rule allows for a choice of three levels of cleanup values, each with a different level of effort. The new rule utilizes different exposure factors that the 30 TAC 335 Subchapter S Risk Reduction Standards that it replaced. The TRRP rule establishes Protective Concentration Levels determined by land use, groundwater classification, and receptors lieu of specific cleanup levels	The State of Texas Groundwater Rules were cited in the 1995 ROD as a location-specific ARAR. It is applicable because the site's underlying ground water is affected. This rule requires ground water to be monitored and restored, if feasible. Ground water has not yet been restored at the site, as remediation is still underway.
Historic Sites/NHPA	Federal – 36 CFR 800 National Historic Preservation Act of 1966, archeological concerns.	Applicable, Relevant and Appropriate	A location-specific ARAR, this Act establishes procedures to preserve historical and archeological data that could be destroyed through terrain alteration as a result of federal construction projects or federally licensed activities or programs	The selected remedy should not disturb areas that have not previously been disturbed. No archeological concerns have been discovered at the site.

Table C-1 Site 12 & 16

Medium/ Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Water/CWA	Federal – 40 CFR Part 125 Establishes criteria and standards for the effluent limitations	Applicable, Relevant and Appropriate	40 CFR Part 125 establishes the basis for water discharges to a surface body of water for protection of human health and the environment.	Minimizing infiltration of the groundwater into the landfills reduces contaminant transport.
Groundwater/ CWA	State – 30 TAC Chapter 307	Applicable, Relevant and Appropriate	30 TAC Chapter 307 establishes the minimum requirements by the State to maintain the quality of water in the state consistent with public health and enjoyment, propagation and protection of terrestrial and aquatic life, etc. 30 TAC Chapter 307 was revised and became effective on 17 August 2000. Although encompassing many changes, of applicable and relevant interest is the revision of toxic criteria to protect aquatic life.	Minimizing infiltration of the groundwater into the landfills reduces contaminant transport to surface water bodies and will meet the requirements of the State Anti-degradation policy.
Workplace/ OSHA	Federal - 29 CFR 1910 Occupational Safety and Health	Applicable, Relevant and Appropriate	29 CFR 1910 establishes standards for occupational health and safety.	Action levels for volatile and semi-volatile air contaminants will be established for implementation during onsite remedial activities. Action levels will be established for hearing protection and respiratory protection during onsite remedial activities. Furthermore, an onsite training program and mandatory health and safety standards will be enforced during the remedial activities
Wetland/ CWA	Federal - 40 CFR Parts 133 and 230 and 33 CFR Parts 320-330	Applicable, Relevant and Appropriate	40 CFR Parts 133 and 230 and 33 CFR Parts 320-330 prohibit the discharge of dredged or fill material into wetlands unless those actions comply with the substantive requirements which are identified under these regulations.	Discharges to wetlands around the site will comply with these requirements.

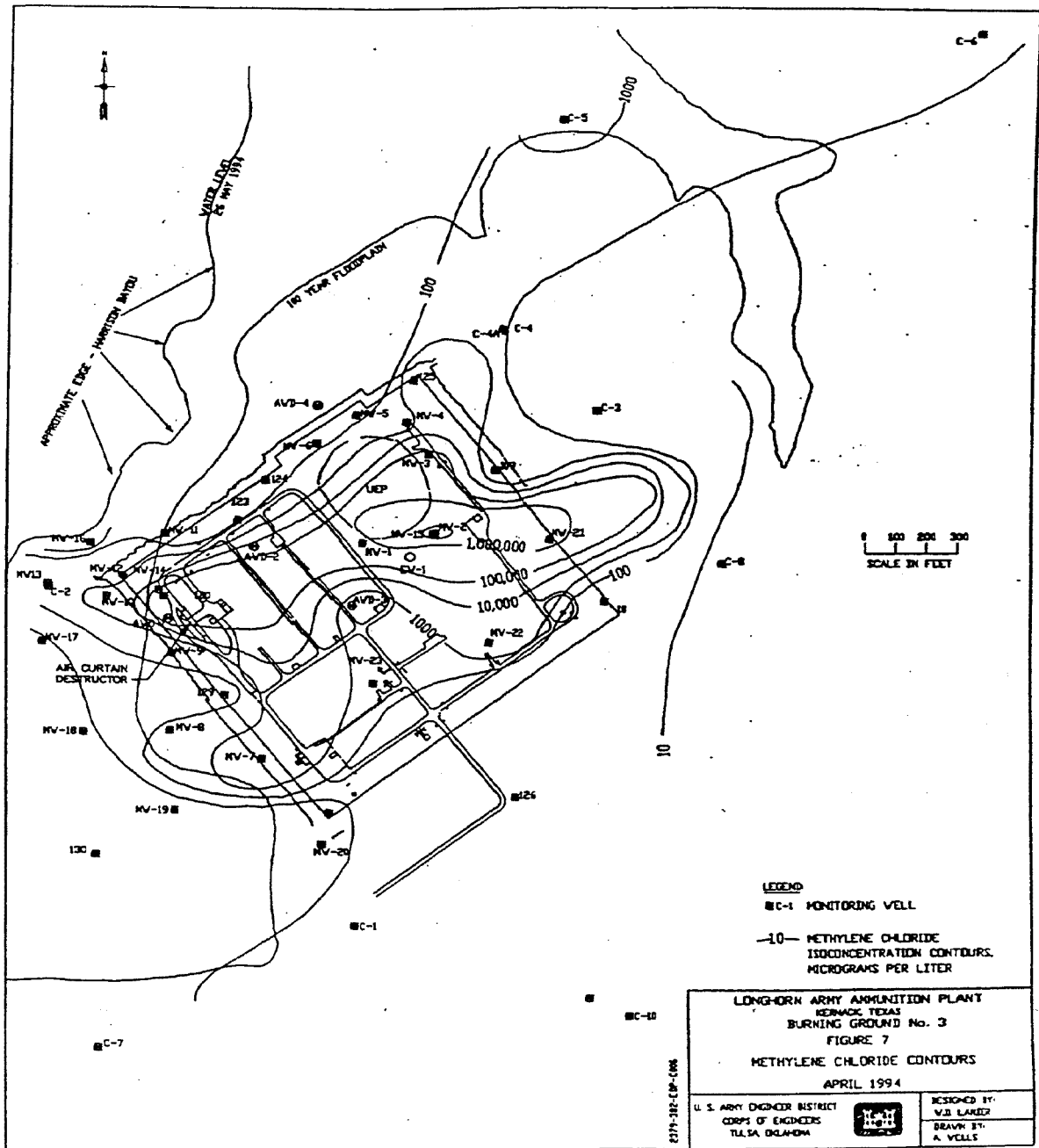
Landfill/ RCRA	State - 30 TAC 335.112, 335.118, 335.119, and 335.174	Applicable, Relevant and Appropriate	30 TAC 335.112 adopts 40 CFR 265 by reference. These regulations establish general facility standards, preparedness and prevention, contingency plan and emergency procedures, manifest system, groundwater monitoring, and closure and post-closure care.	Remedial activities will comply with all provisions of this regulation with the exception of the financial standards. Federal facilities are exempt from financial standards.
Landfill/ RCRA	Federal - 40 CFR 264.228 and 264.310 Concerning closure and post-closure care	Applicable, Relevant and Appropriate	Action-specific guidelines for areas which may be capped as set forth in 40 CFR 264 include the following: (1) conduct and maintain post-closure care for 30 years; (2) maintain the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover; (3) maintain and operate a leachate collection system unless leachate is deemed to be no longer a threat to human health and the environment; (4) monitor ground water and adequately maintain the ground water recovery system; (5) develop a written post-closure plan that includes a description of monitoring and maintenance, and the name, address, and telephone number of the person or office to contact about the facility during the post-closure period; and (6) document a description of the planned uses of the property during the post-closure period. When the site is prepared to enter the O&M period, an O&M plan will outline the type and frequency of monitoring and maintenance activities to be performed at the site.	Remedial activities will comply with all provisions of this regulation with the exception of the financial standards. Federal facilities are exempt from financial standards.

Floodplains/ RCRA	Federal - 40 CFR 264.18 Location Standards	Applicable, Relevant and Appropriate	This regulation identifies geological features that a proposed location for a RCRA hazardous waste treatment and/or disposal facility must avoid. One of the three specific features applies to the site: Floodplain – A facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout or any hazardous waste by a 100-year flood unless the owner or operator can demonstrate to the Regional Administrator that he can meet the criteria established under this subpart, which exempts him from the requirement.	RCRA requirements for the location of a treatment, storage, or disposal facility in a flood plain were noted to apply in the 1995 ROD because part of the Burning Ground is within a 100-year floodplain.
Historic Sites/NHPA	Federal - 36 CFR 800 National Historic Preservation Act of 1966, archeological concerns.	Applicable, Relevant and Appropriate	A location-specific ARAR, this Act establishes procedures to preserve historical and archeological data that could be destroyed through terrain alteration as a result of federal construction projects or federally licensed activities or programs	The selected remedy should not disturb areas that have not previously been disturbed. No archeological concerns have been discovered at the site.

APPENDIX E

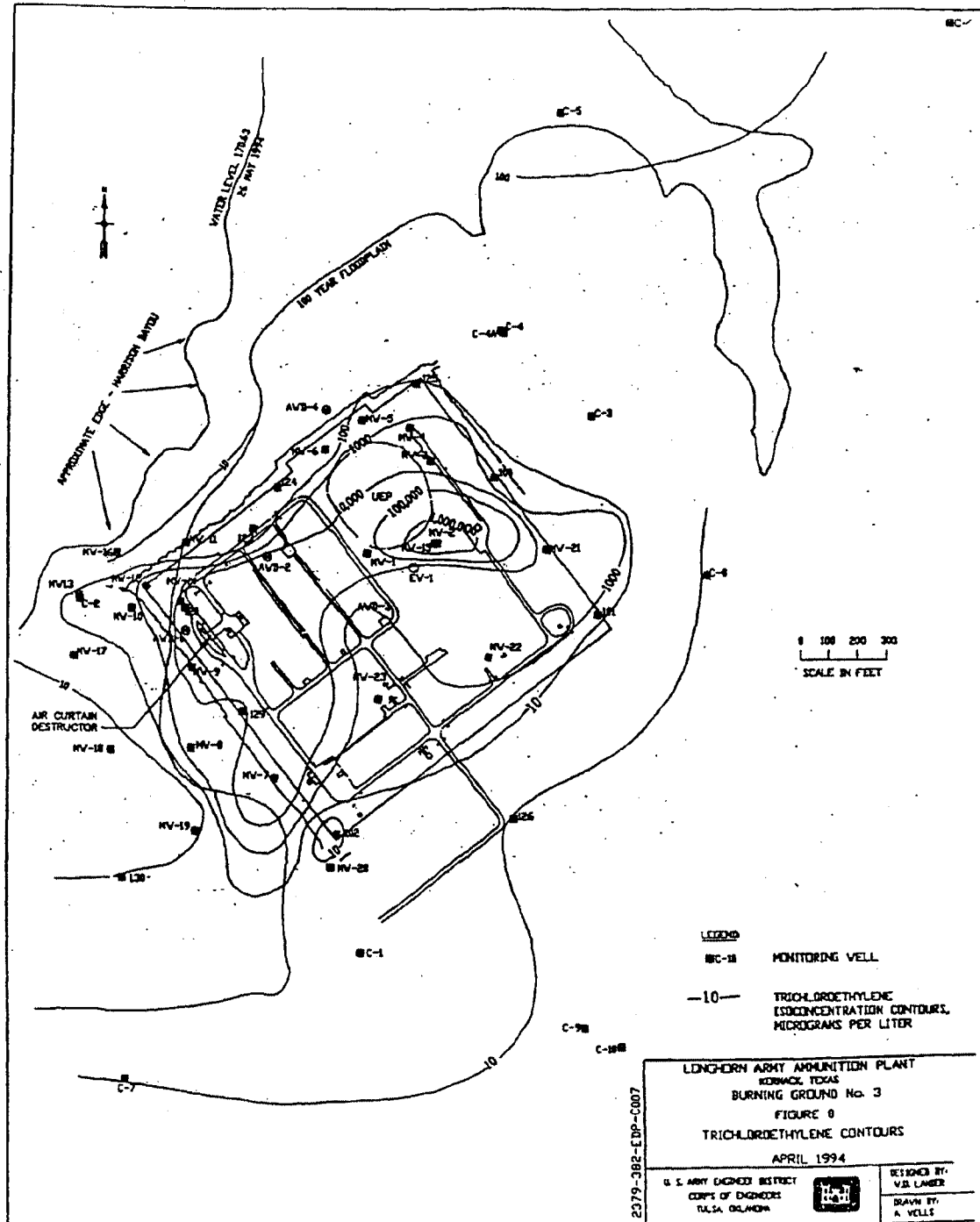
CONTAMINANT CONTOUR MAPS

012699

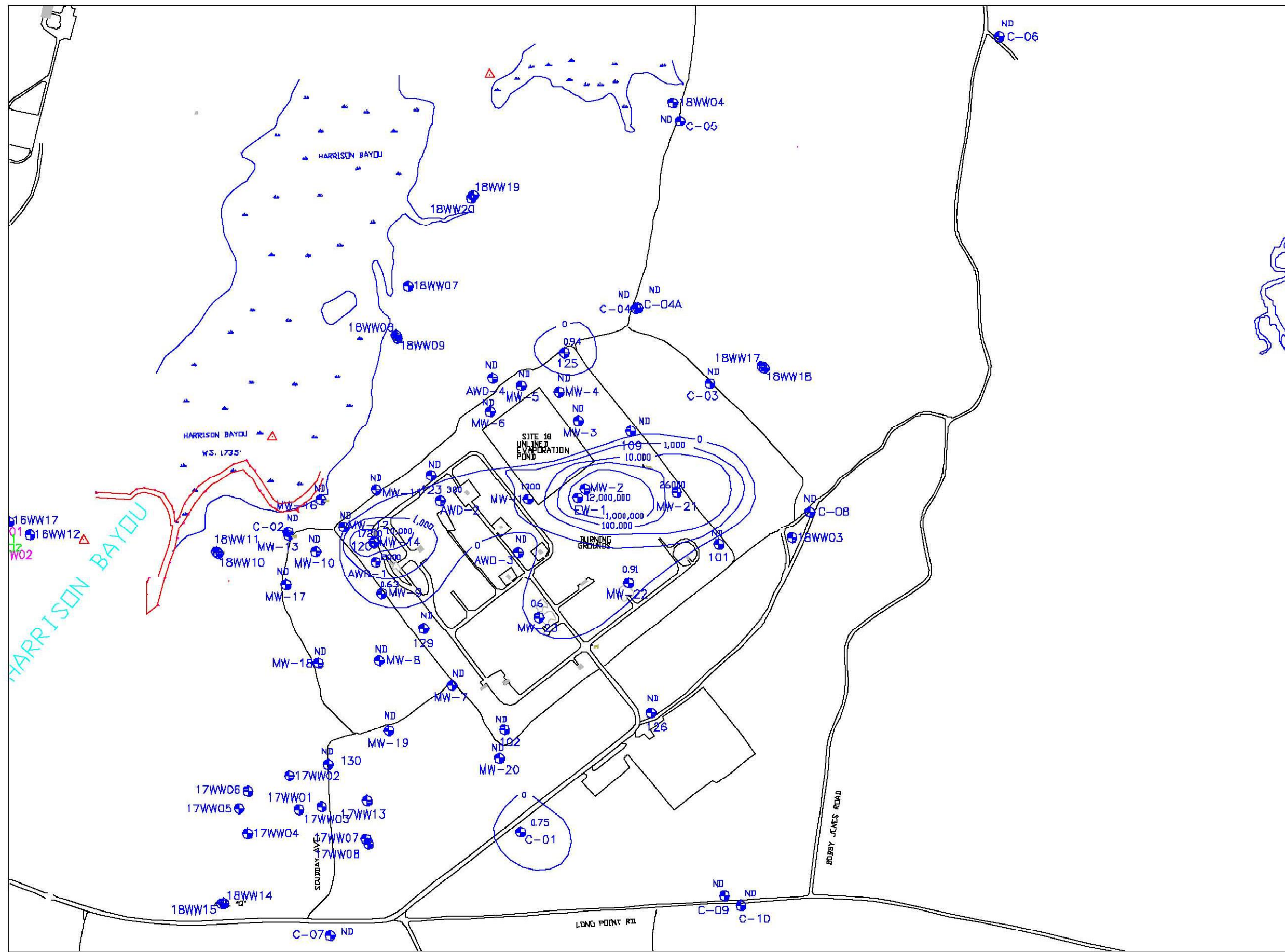


Site 18/24 Methylene Chloride Contour Map from 1995 ROD

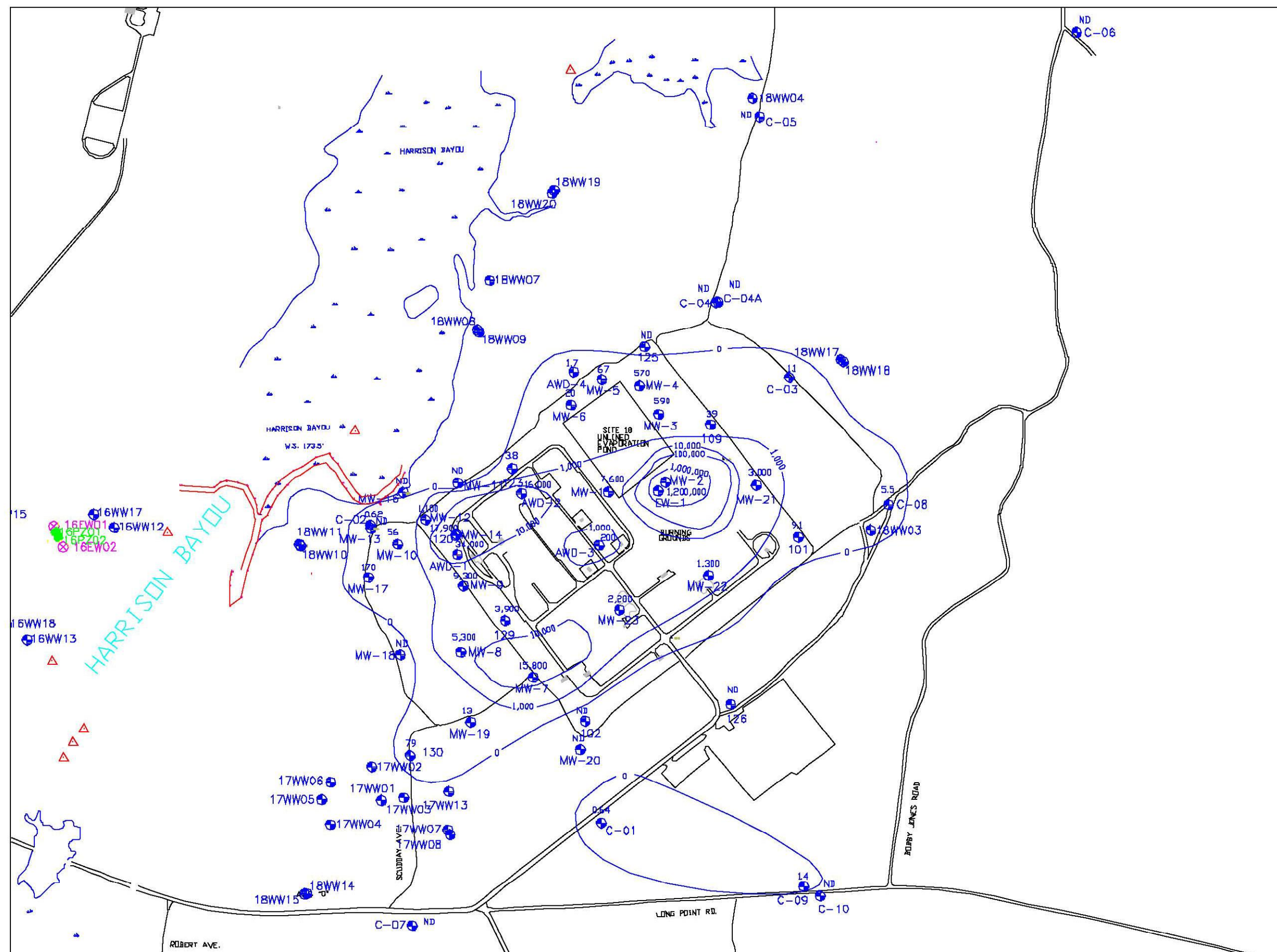
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Site 18/24 Trichloroethene Contour Map from 1995 ROD



Complete Environmental Service
Longhorn AAP Sites 18 & 24
Methylene Chloride Contours, ug/L
DATE: April 2001

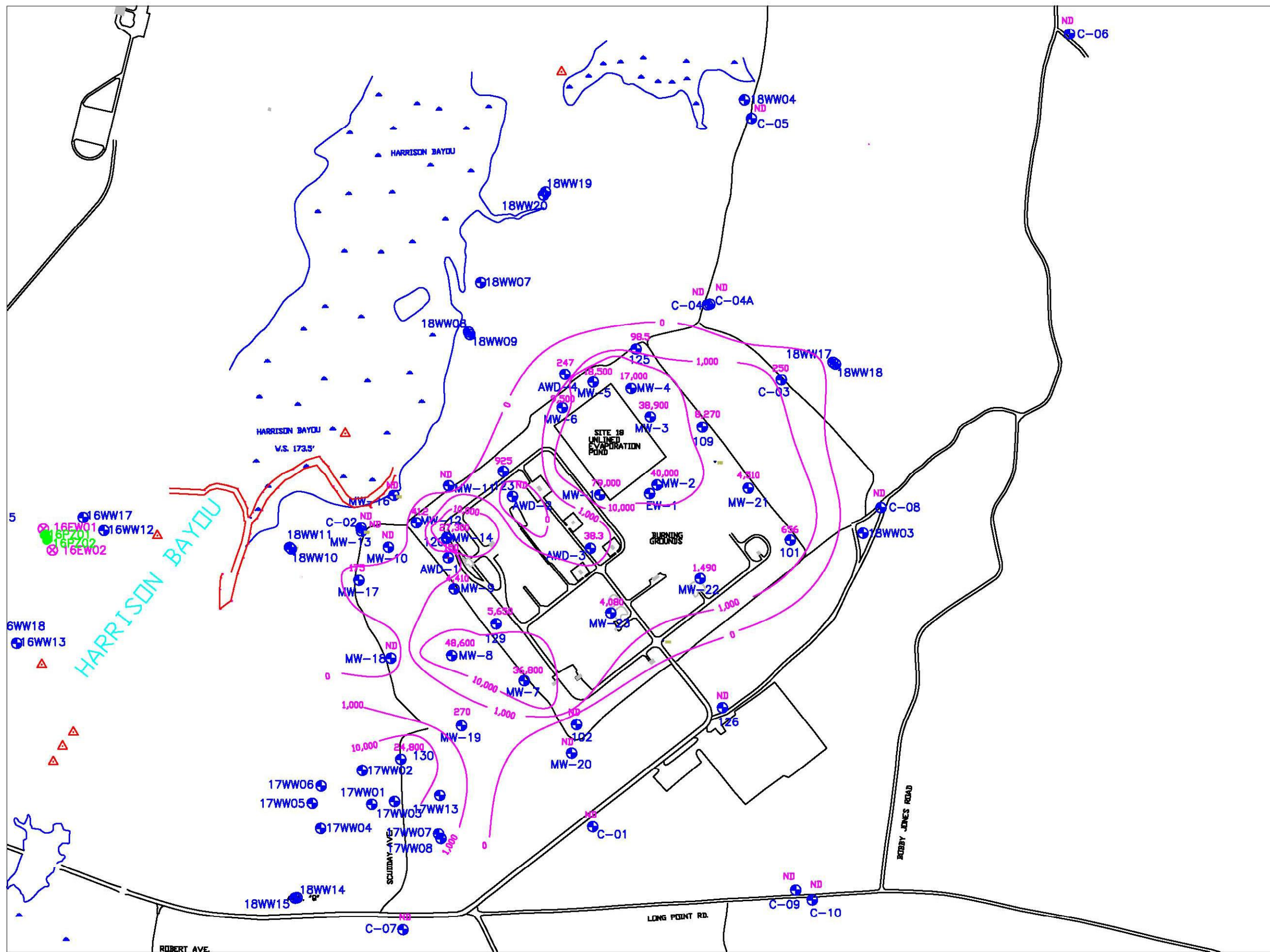


Complete Environmental Service

Longhorn AAP Sites 18 & 24

Trichloroethene Contours, ug/L

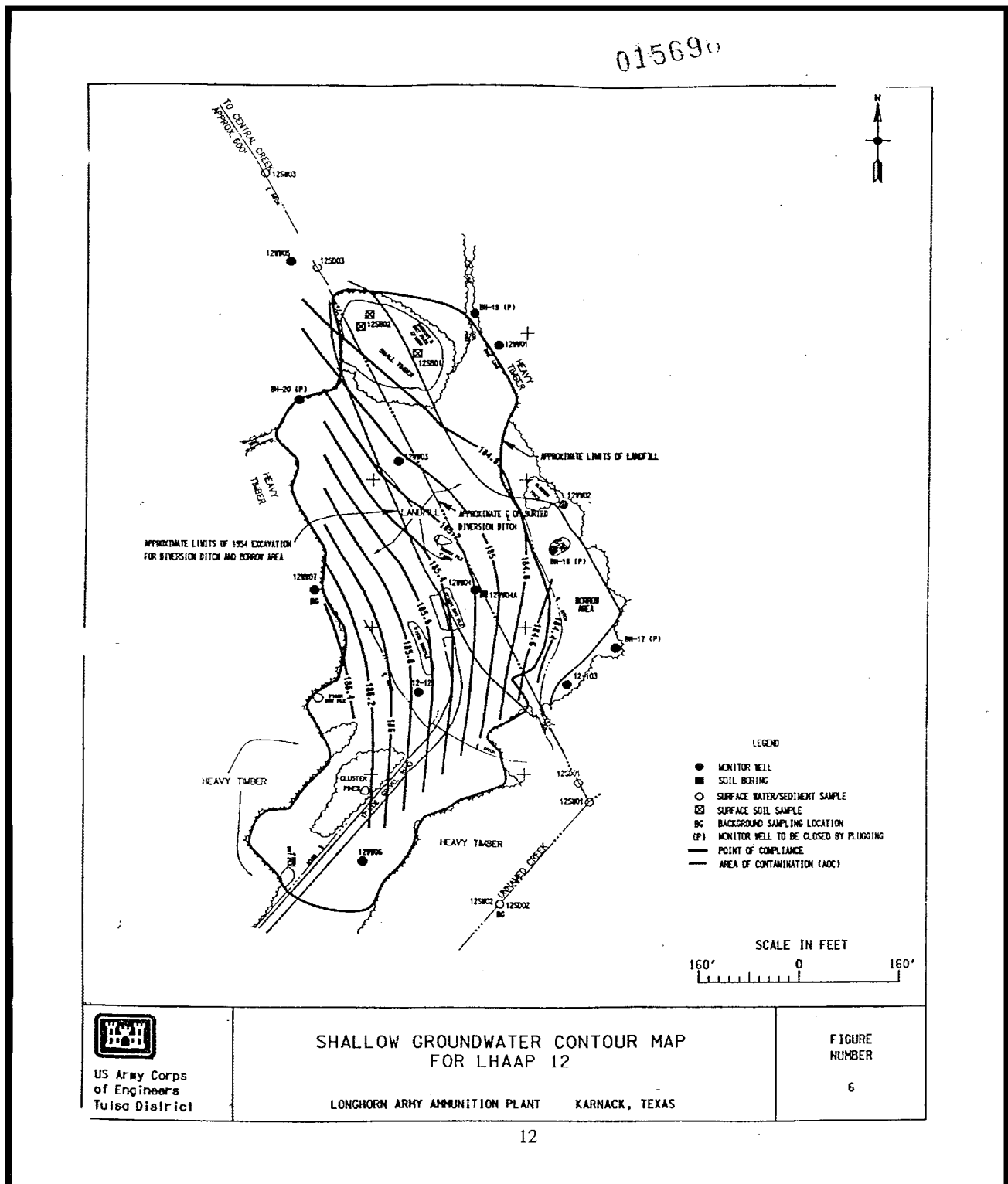
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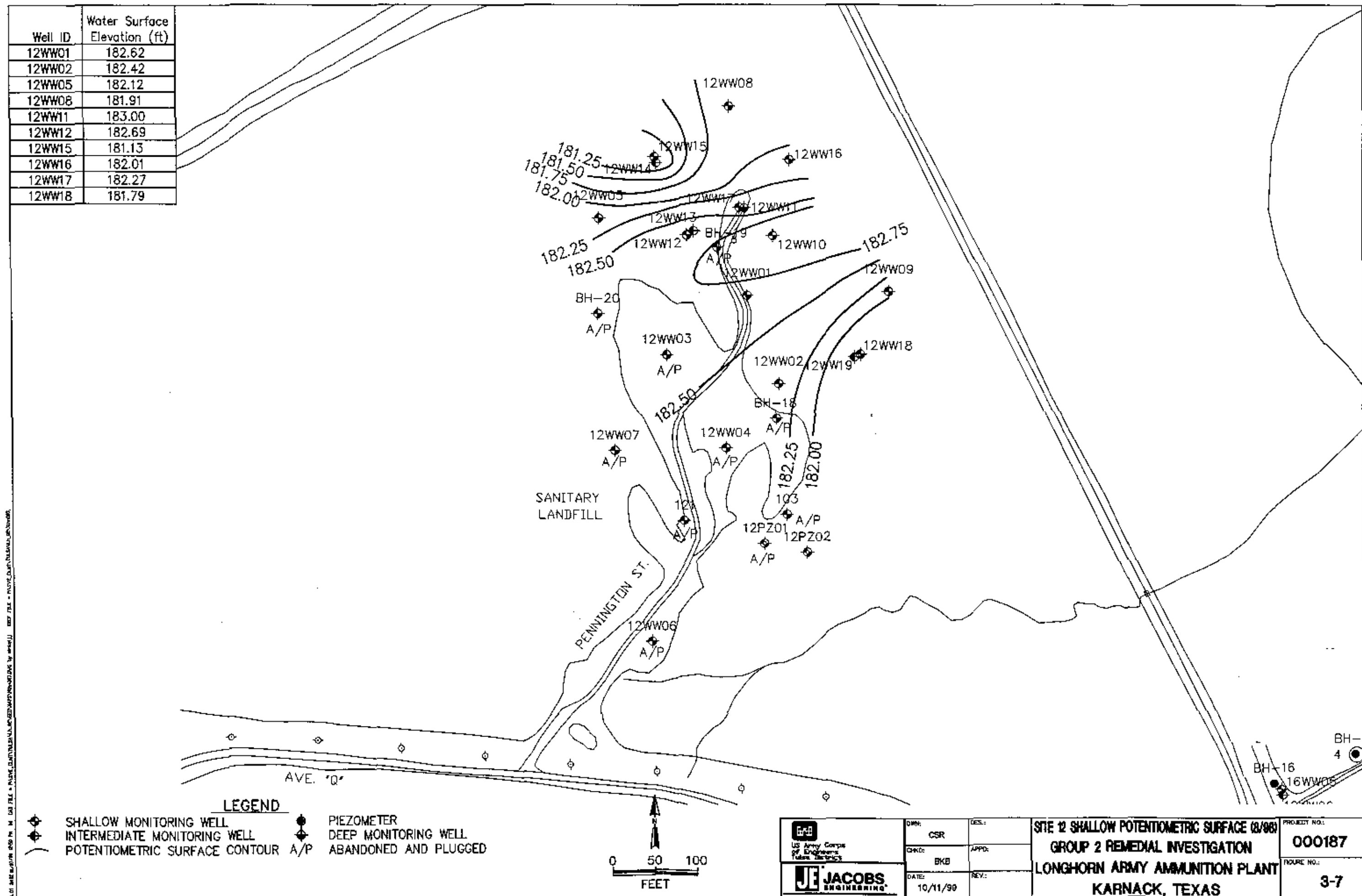
Complete Environmental Service
 Longhorn AAP Sites 18 & 24
 Perchlorate Contours, ug/L
 DATE: April 2001

APPENDIX F

SITE 12 GROUNDWATER ELEVATION CONTOUR MAPS

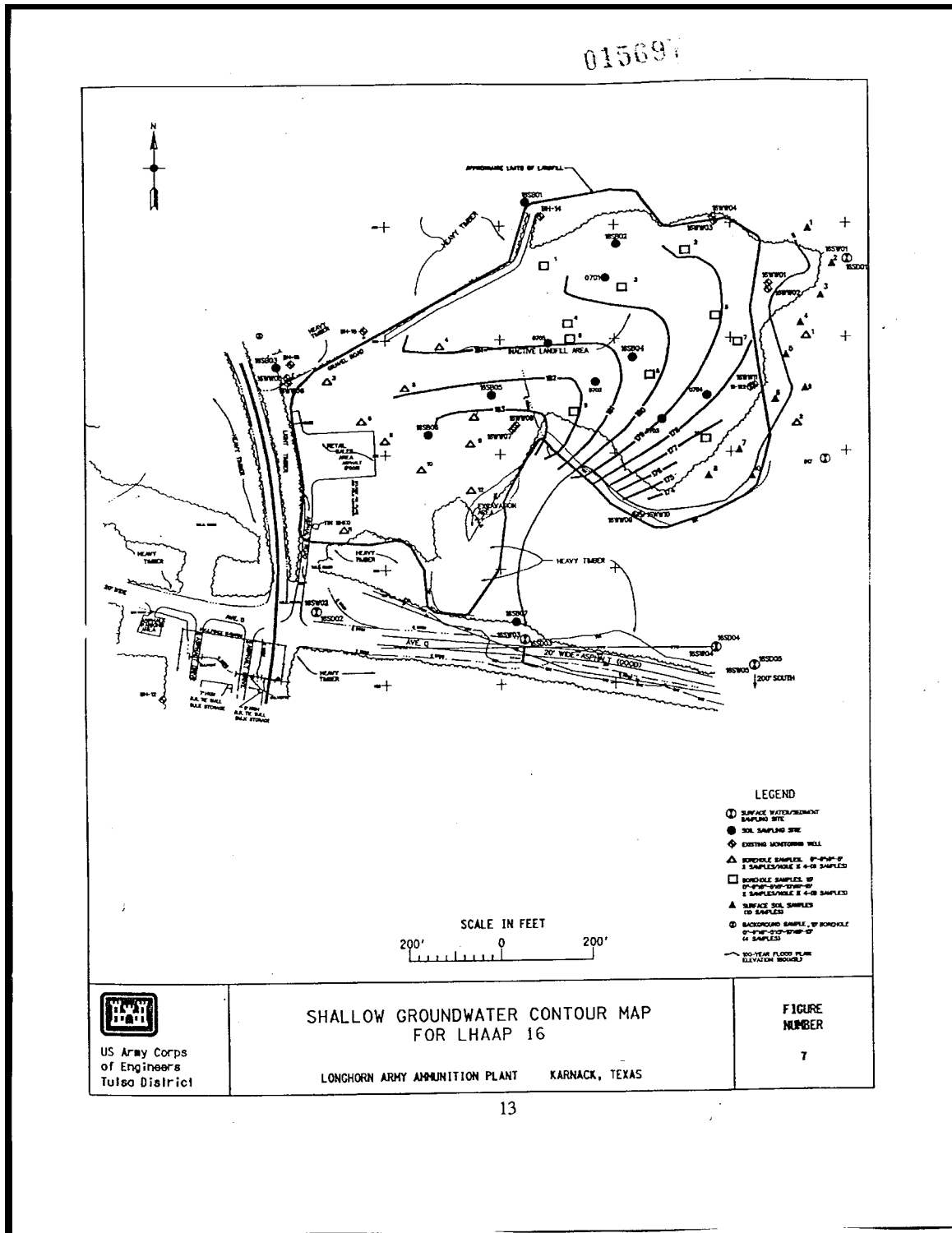


Site 12 Shallow Groundwater Contour Map from 1995 ROD



APPENDIX G

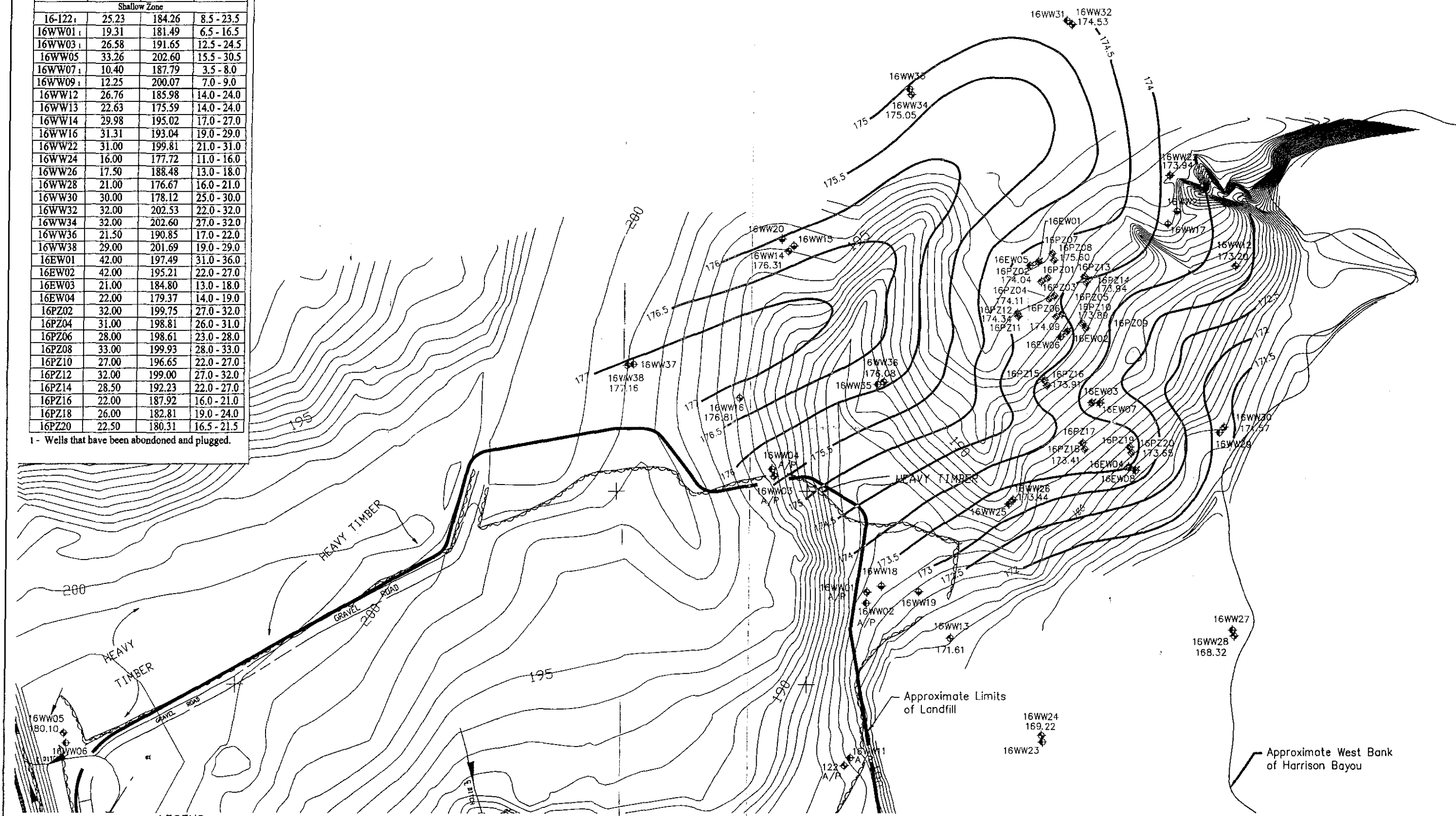
SITE 16 GROUNDWATER ELEVATION CONTOUR MAPS



Site 16 Shallow Groundwater Contour Map from 1995 ROD

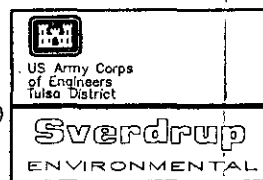
Well Identification No.	Total Depth of Well ft	Ground Surface Elevation ft	Depth of Screen Interval ft
Shallow Zone			
16-122	25.23	184.26	8.5 - 23.5
16WW01	19.31	181.49	6.5 - 16.5
16WW03	26.58	191.65	12.5 - 24.5
16WW05	33.26	202.60	15.5 - 30.5
16WW07	10.40	187.79	3.5 - 8.0
16WW09	12.25	200.07	7.0 - 9.0
16WW12	26.76	185.98	14.0 - 24.0
16WW13	22.63	175.59	14.0 - 24.0
16WW14	29.98	195.02	17.0 - 27.0
16WW16	31.31	193.04	19.0 - 29.0
16WW22	31.00	199.81	21.0 - 31.0
16WW24	16.00	177.72	11.0 - 16.0
16WW26	17.50	188.48	13.0 - 18.0
16WW28	21.00	176.67	16.0 - 21.0
16WW30	30.00	178.12	25.0 - 30.0
16WW32	32.00	202.53	22.0 - 32.0
16WW34	32.00	202.60	27.0 - 32.0
16WW36	21.50	190.85	17.0 - 22.0
16WW38	29.00	201.69	19.0 - 29.0
16EW01	42.00	197.49	31.0 - 36.0
16EW02	42.00	195.21	22.0 - 27.0
16EW03	21.00	184.80	13.0 - 18.0
16EW04	22.00	179.37	14.0 - 19.0
16PZ02	32.00	199.75	27.0 - 32.0
16PZ04	31.00	198.81	26.0 - 31.0
16PZ06	28.00	198.61	23.0 - 28.0
16PZ08	33.00	199.93	28.0 - 33.0
16PZ10	27.00	196.65	22.0 - 27.0
16PZ12	32.00	199.00	27.0 - 32.0
16PZ14	28.50	192.23	22.0 - 27.0
16PZ16	22.00	187.92	16.0 - 21.0
16PZ18	26.00	182.81	19.0 - 24.0
16PZ20	22.50	180.31	16.5 - 21.5

1 - Wells that have been abandoned and plugged.



LEGEND

- SHALLOW MONITORING WELL
- INTERMEDIATE MONITORING WELL
- UPPER DEEP ZONE MW
- LOWER DEEP ZONE MW
- SHALLOW EXTRACTION WELL
- INTERMEDIATE EXTRACTION WELL
- SHALLOW PIEZOMETER
- INTERMEDIATE PIEZOMETER
- ABANDONED AND PLUGGED
- PIEZOMETRIC SURFACE CONTOURS

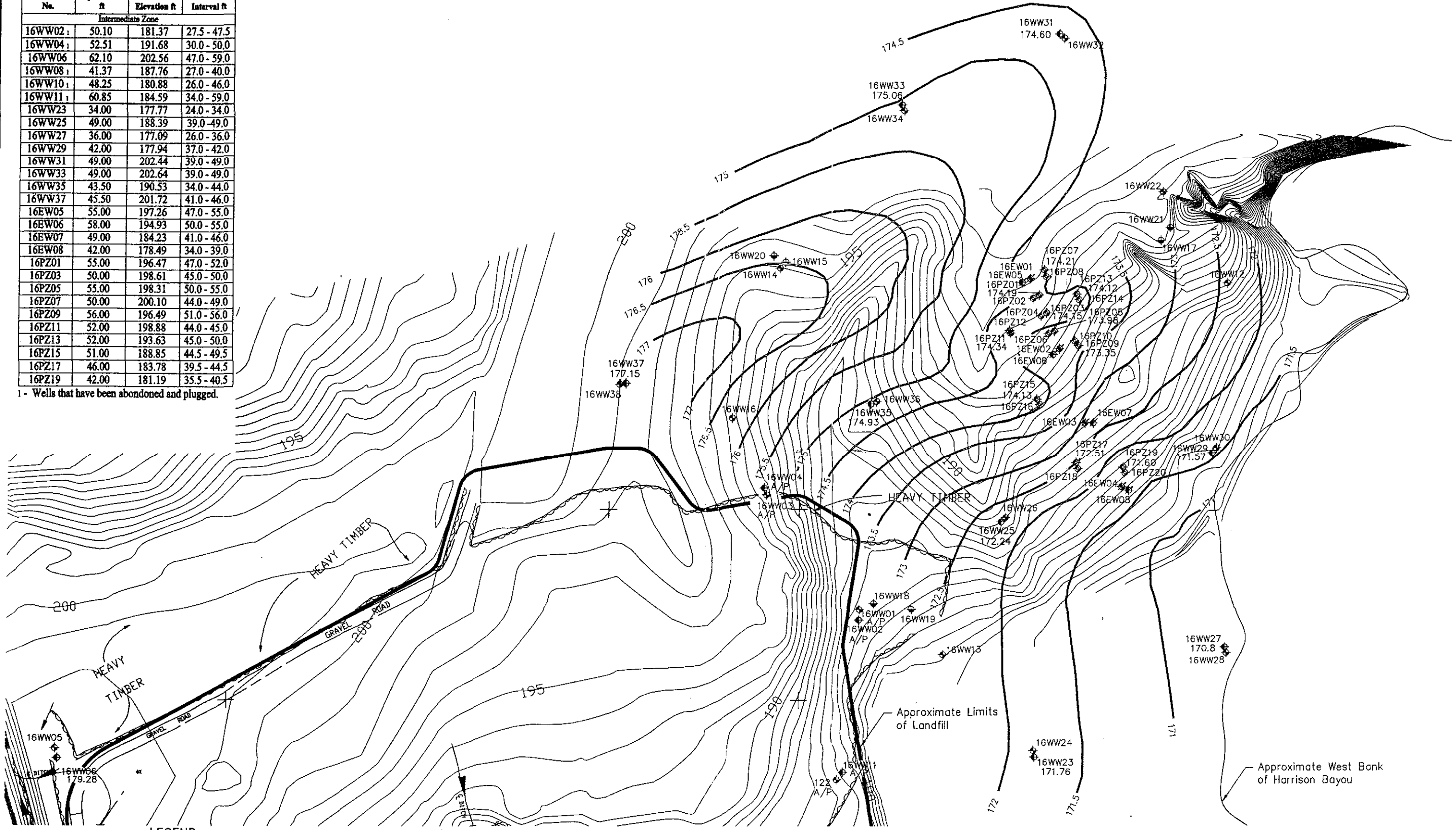


SHALLOW ZONE PIEZOMETRIC SURFACE MAP - 10-20-97
SITE 16 REMEDIAL INVESTIGATION
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OWN: BSM	DES:	PROJECT NO.: 000187
CHKD: PTS	APPD:	FIGURE NO.: 3-3
DATE: FEB 99	REV:	

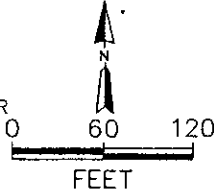
Well Identification No.	Total Depth of Well ft	Ground Surface Elevation ft	Depth of Screen Interval ft
Intermediate Zone			
16WW02	50.10	181.37	27.5 - 47.5
16WW04	52.51	191.68	30.0 - 50.0
16WW06	62.10	202.56	47.0 - 59.0
16WW08	41.37	187.76	27.0 - 40.0
16WW10	48.25	180.88	26.0 - 46.0
16WW11	60.85	184.59	34.0 - 59.0
16WW23	34.00	177.77	24.0 - 34.0
16WW25	49.00	188.39	39.0 - 49.0
16WW27	36.00	177.09	26.0 - 36.0
16WW29	42.00	177.94	37.0 - 42.0
16WW31	49.00	202.44	39.0 - 49.0
16WW33	49.00	202.64	39.0 - 49.0
16WW35	43.50	190.53	34.0 - 44.0
16WW37	45.50	201.72	41.0 - 46.0
16EW05	55.00	197.26	47.0 - 55.0
16EW06	58.00	194.93	50.0 - 55.0
16EW07	49.00	184.23	41.0 - 46.0
16EW08	42.00	178.49	34.0 - 39.0
16PZ01	55.00	196.47	47.0 - 52.0
16PZ03	50.00	198.61	45.0 - 50.0
16PZ05	55.00	198.31	50.0 - 55.0
16PZ07	50.00	200.10	44.0 - 49.0
16PZ09	56.00	196.49	51.0 - 56.0
16PZ11	52.00	198.88	44.0 - 45.0
16PZ13	52.00	193.63	45.0 - 50.0
16PZ15	51.00	188.85	44.5 - 49.5
16PZ17	46.00	183.78	39.5 - 44.5
16PZ19	42.00	181.19	35.5 - 40.5

1 - Wells that have been abandoned and plugged.



LEGEND

- SHALLOW MONITORING WELL
- INTERMEDIATE MONITORING WELL
- UPPER DEEP ZONE MW
- LOWER DEEP ZONE MW
- SHALLOW EXTRACTION WELL
- INTERMEDIATE EXTRACTION WELL
- SHALLOW PIEZOMETER
- INTERMEDIATE PIEZOMETER
- A/P ABANDONED AND PLUGGED
- PIEZOMETRIC SURFACE CONTOUR



US Army Corps of Engineers
Tulsa District

Sverdrup
ENVIRONMENTAL

PROJECT NO.:	DWN:	BSM	DES.:
000187	CHKD:	PTS	APPD:
	DATE:	FEB 99	REV.:

INTERMEDIATE ZONE PIEZOMETRIC SURFACE MAP - 10-20-97

SITE 16 REMEDIAL INVESTIGATION

LONGHORN ARMY AMMUNITION PLANT

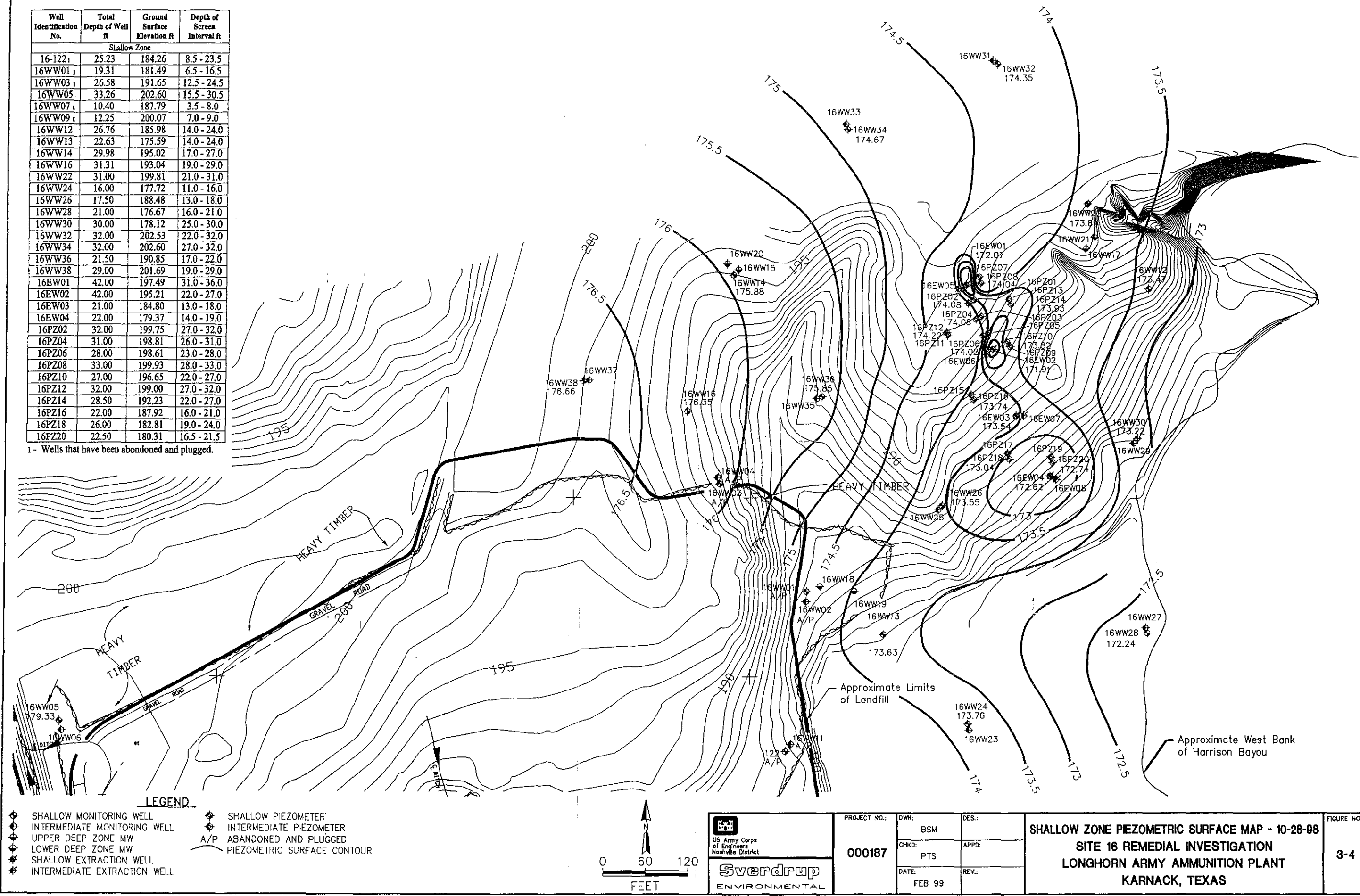
KARNACK, TEXAS

FIGURE NO.:

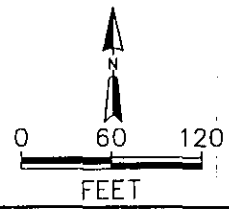
3-5

Well Identification No.	Total Depth of Well ft	Ground Surface Elevation ft	Depth of Screen Interval ft
Shallow Zone			
16-122	25.23	184.26	8.5 - 23.5
16WW01	19.31	181.49	6.5 - 16.5
16WW03	26.58	191.65	12.5 - 24.5
16WW05	33.26	202.60	15.5 - 30.5
16WW07	10.40	187.79	3.5 - 8.0
16WW09	12.25	200.07	7.0 - 9.0
16WW12	26.76	185.98	14.0 - 24.0
16WW13	22.63	175.59	14.0 - 24.0
16WW14	29.98	195.02	17.0 - 27.0
16WW16	31.31	193.04	19.0 - 29.0
16WW22	31.00	199.81	21.0 - 31.0
16WW24	16.00	177.72	11.0 - 16.0
16WW26	17.50	188.48	13.0 - 18.0
16WW28	21.00	176.67	16.0 - 21.0
16WW30	30.00	178.12	25.0 - 30.0
16WW32	32.00	202.53	22.0 - 32.0
16WW34	32.00	202.60	27.0 - 32.0
16WW36	21.50	190.85	17.0 - 22.0
16WW38	29.00	201.69	19.0 - 29.0
16EW01	42.00	197.49	31.0 - 36.0
16EW02	42.00	195.21	22.0 - 27.0
16EW03	21.00	184.80	13.0 - 18.0
16EW04	22.00	179.37	14.0 - 19.0
16PZ02	32.00	199.75	27.0 - 32.0
16PZ04	31.00	198.81	26.0 - 31.0
16PZ06	28.00	198.61	23.0 - 28.0
16PZ08	33.00	199.93	28.0 - 33.0
16PZ10	27.00	196.65	22.0 - 27.0
16PZ12	32.00	199.00	27.0 - 32.0
16PZ14	28.50	192.23	22.0 - 27.0
16PZ16	22.00	187.92	16.0 - 21.0
16PZ18	26.00	182.81	19.0 - 24.0
16PZ20	22.50	180.31	16.5 - 21.5

1 - Wells that have been abandoned and plugged.



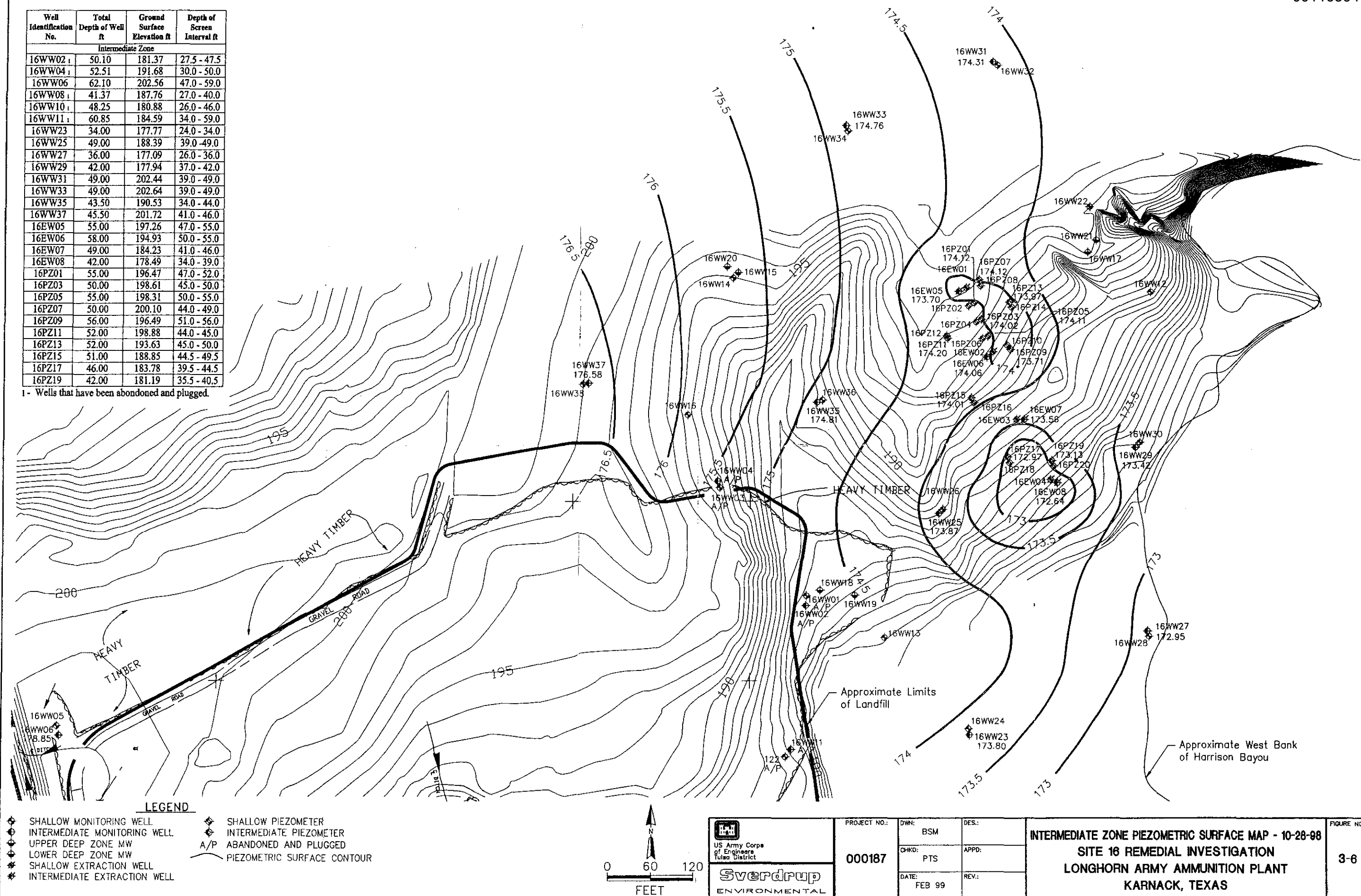
- SHALLOW MONITORING WELL
- INTERMEDIATE MONITORING WELL
- UPPER DEEP ZONE MW
- LOWER DEEP ZONE MW
- SHALLOW EXTRACTION WELL
- INTERMEDIATE EXTRACTION WELL
- SHALLOW PIEZOMETER
- INTERMEDIATE PIEZOMETER
- A/P ABANDONED AND PLUGGED
- PIEZOMETRIC SURFACE CONTOUR



 US Army Corps of Engineers Nashville District Sverdrup ENVIRONMENTAL	PROJECT NO.:	DWN:	DES:	SHALLOW ZONE PIEZOMETRIC SURFACE MAP - 10-28-98 SITE 16 REMEDIAL INVESTIGATION LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS	FIGURE NO.: 3-4
	000187	BSM			
		PTS			
	DATE:	FEB 99	REV.:		

Well Identification No.	Total Depth of Well ft	Ground Surface Elevation ft	Depth of Screen Interval ft
Intermediate Zone			
16WW02	50.10	181.37	27.5 - 47.5
16WW04	52.51	191.68	30.0 - 50.0
16WW06	62.10	202.56	47.0 - 59.0
16WW08	41.37	187.76	27.0 - 40.0
16WW10	48.25	180.88	26.0 - 46.0
16WW11	60.85	184.59	34.0 - 59.0
16WW23	34.00	177.77	24.0 - 34.0
16WW25	49.00	188.39	39.0 - 49.0
16WW27	36.00	177.09	26.0 - 36.0
16WW29	42.00	177.94	37.0 - 42.0
16WW31	49.00	202.44	39.0 - 49.0
16WW33	49.00	202.64	39.0 - 49.0
16WW35	43.50	190.53	34.0 - 44.0
16WW37	45.50	201.72	41.0 - 46.0
16EW05	55.00	197.26	47.0 - 55.0
16EW06	58.00	194.93	50.0 - 55.0
16EW07	49.00	184.23	41.0 - 46.0
16EW08	42.00	178.49	34.0 - 39.0
16PZ01	55.00	196.47	47.0 - 52.0
16PZ03	50.00	198.61	45.0 - 50.0
16PZ05	55.00	198.31	50.0 - 55.0
16PZ07	50.00	200.10	44.0 - 49.0
16PZ09	56.00	196.49	51.0 - 56.0
16PZ11	52.00	198.88	44.0 - 45.0
16PZ13	52.00	193.63	45.0 - 50.0
16PZ15	51.00	188.85	44.5 - 49.5
16PZ17	46.00	183.78	39.5 - 44.5
16PZ19	42.00	181.19	35.5 - 40.5

1 - Wells that have been abandoned and plugged.



APPENDIX H
SURVEY FORMS

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Bob Speight

Title: President, Vice President

Organization: Greater Caddo
Lake Association

Telephone No.: (903) 679-3145

E-mail Address:

Street Address: 1727 Dorrough Rd

City, State, Zip: Karnack, TX 75661

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

- | | | |
|---|-----|--------------------------|
| 1. Are you familiar with the following: | yes | no |
| a. Site 18/24 Burning Grounds and Groundwater Treatment Plant
(Groundwater from Burning Grounds and Landfill 16) | x | ☐ |
| b. Site 16 Landfill Cap (Old Landfill) | x | ☐ |
| c. Site 12 Landfill Cap (Sanitary Landfill) | x | ☐ |
2. What is your impression of the project (general sentiment)?
Very good.
3. What effect have site operations had on the surrounding community?
Good.
4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
You cannot please everyone.
5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing,
or emergency responses from local authorities? If so, please give details. No.
6. Do you feel well informed about the site's activities and progress?
Yes.
7. Do you have any comments, suggestions, or recommendations regarding the site's management
or operation? Very good.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Wes and Joann Hodges

Title: Owners

Organization: Hodgepodge
Cottages

Telephone No.: (903) 789-3901

E-mail Address:
Joann@hodgepodecottages.com

Street Address: 724 Cypress Dr.

City, State, Zip: Karnack, TX 75661

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

- | | yes | no |
|---|--------------------------|----|
| 1. Are you familiar with the following: | | |
| a. Site 18/24 Burning Grounds and Groundwater Treatment Plant
(Groundwater from Burning Grounds and Landfill 16) | ☐ | x |
| b. Site 16 Landfill Cap (Old Landfill) | ☐ | x |
| c. Site 12 Landfill Cap (Sanitary Landfill) | ☐ | x |
| 2. What is your impression of the project (general sentiment)?
None. | | |
| 3. What effect have site operations had on the surrounding community?
Not aware of any. | | |
| 4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
We agree with Dwight Shellman and his recommendations and follow-up. | | |
| 5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing,
or emergency responses from local authorities? If so, please give details.
No. | | |
| 6. Do you feel well informed about the site's activities and progress?
Yes, through Dwight Shellman. | | |
| 7. Do you have any comments, suggestions, or recommendations regarding the site's management
or operation?
No. | | |

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Bud Jones

Title:

Organization:

Telephone No.:

E-mail Address:

Street Address:

City, State, Zip:

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

1. Are you familiar with the following:

	yes	no
a. Site 18/24 Burning Grounds and Groundwater Treatment Plant (Groundwater from Burning Grounds and Landfill 16)	x	☐
b. Site 16 Landfill Cap (Old Landfill)	x	☐
c. Site 12 Landfill Cap (Sanitary Landfill)	x	☐

2. What is your impression of the project (general sentiment)?
I feel that much progress has been made, but there needs to be some time-timing in the Landfill 16/B63/UEP Areas, and possibly some sort of remediation, possibly in sites.

3. What effect have site operations had on the surrounding community?
In general, I feel that they have calmed some of the fears originally existing among some of the local citizens.

4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
General concern about the effectiveness of the Landfill 16 cap. Some feel that the contaminants in the Landfill 16 should have been removed prior to placement of the cap. Others feel that some sort of site remediation should be implemented.

5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
No.

6. Do you feel well informed about the site's activities and progress?
Yes.

7. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
Feel that confirmation SCAPS data should be collected at B63/UEP Area, similar to that of Landfill 16.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Roy Darville

Title: Professor of Biology

Organization: East Texas
Baptist University

Telephone No.: (903) 935-7963 x3182

E-mail Address: rdarville@etbu.edu

Street Address: 1209 N. Grove St.

City, State, Zip: Marshall, TX 75670

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

- | | | |
|---|-----|--------------------------|
| 1. Are you familiar with the following: | yes | no |
| a. Site 18/24 Burning Grounds and Groundwater Treatment Plant
(Groundwater from Burning Grounds and Landfill 16) | x | ☐ |
| b. Site 16 Landfill Cap (Old Landfill) | x | ☐ |
| c. Site 12 Landfill Cap (Sanitary Landfill) | x | ☐ |
2. What is your impression of the project (general sentiment)?
It appears the three projects are well done and performing as expected
3. What effect have site operations had on the surrounding community?
No effects except perhaps a positive one to know the cleanup un in-progress.
4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
No.
5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing,
or emergency responses from local authorities? If so, please give details.
No.
6. Do you feel well informed about the site's activities and progress?
Yes, through attendance at the LHAAP TRC meetings.
7. Do you have any comments, suggestions, or recommendations regarding the site's management
or operation?
No.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Robert Speight Jr.

Title:

Organization:

Telephone No.: (903) 679-3875

E-mail Address:

Street Address: 2757 Blairs Landing Rd.

City, State, Zip: Karnack, TX 75661

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

- | | | |
|---|-----|--------------------------|
| 1. Are you familiar with the following: | yes | no |
| a. Site 18/24 Burning Grounds and Groundwater Treatment Plant
(Groundwater from Burning Grounds and Landfill 16) | x | ☐ |
| b. Site 16 Landfill Cap (Old Landfill) | x | ☐ |
| c. Site 12 Landfill Cap (Sanitary Landfill) | x | ☐ |
| 2. What is your impression of the project (general sentiment)?
CES is doing a very good job. | | |
| 3. What effect have site operations had on the surrounding community?
Very little impact on community. | | |
| 4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
No. | | |
| 5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing,
or emergency responses from local authorities? If so, please give details.
No. | | |
| 6. Do you feel well informed about the site's activities and progress?
Yes. | | |
| 7. Do you have any comments, suggestions, or recommendations regarding the site's management
or operation?
Not at this time. | | |

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Jim Sher

Title: P.E., Team Leader, PM

Organization: TNRCC

Telephone No.: (512) 239-2444

E-mail Address: Jsher@TNRCC.State.TX.US

Street Address: 12100 Park 35 Circle Building D

City, State, Zip: Austin, TX 78753

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

1. Are you familiar with the following:

	yes	no
a. Site 18/24 Burning Grounds and Groundwater Treatment Plant (Groundwater from Burning Grounds and Landfill 16)	x	☐
b. Site 16 Landfill Cap (Old Landfill)	x	☐
c. Site 12 Landfill Cap (Sanitary Landfill)	x	☐

2. What is your impression of the project (general sentiment)?
This is a large site with many areas of concern. The organization of these areas and the work done at them has been well thought out. After many years of investigation, progress is steadily increasing.

3. What effect have site operations had on the surrounding community?
Remedial activities have had little impact on the community. However, with the site being inactive for many years the community is in support of the site becoming a wildlife refuge.

4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
No. However, the community is anxious to have the site turned over for public use.

5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
Local fire departments responded to a fire in one of the buildings on site.

6. Do you feel well informed about the site's activities and progress?
Yes. Monthly meetings with schedules provided, as well as e-mails keep everyone up to date.

7. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
There are many interested parties involved in this site, but all seem to be willing to work together.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Cliff Murray

Title: Environmental Engineer

Organization: Tulsa District,
USACE

Telephone No.: (918) 669-7573

E-mail Address: Cliff.Murray@usace.army.mil

Street Address: 1645 S 101 E Ave

City, State, Zip: Tulsa, OK 74128

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

1. Are you familiar with the following:

	yes	no
a. Site 18/24 Burning Grounds and Groundwater Treatment Plant (Groundwater from Burning Grounds and Landfill 16)	x	☐
b. Site 16 Landfill Cap (Old Landfill)	x	☐
c. Site 12 Landfill Cap (Sanitary Landfill)	x	☐
2. What is your impression of the project (general sentiment)?
Things are going smoothly especially the maintenance of the affected sites.
3. What effect have site operations had on the surrounding community?
Employment of worker, both temporary (installation of caps, trenches, and treatment plant) as well as long-term employment of personnel at the Groundwater Treatment Plant.
4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
No.
5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing,
or emergency responses from local authorities? If so, please give details.
A four-wheeled recreation vehicle and lawn mower were stolen from the treatment plant approximately 2 years ago. The items were replaced by the operator at the time (Radian).
6. Do you feel well informed about the site's activities and progress?
Yes.
7. Do you have any comments, suggestions, or recommendations regarding the site's management
or operation?
The current operator at the site has done an outstanding job of maintaining records (operational and historical) of the site.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT, SUPERFUND SURVEY

Site Name: Longhorn Army Ammunition Plant, Superfund Site

Subject: 5-Year Review Background Information Survey

Date: 17 September 2001

Contact Made By:

Name: William R. Corrigan

Title: Groundwater Treatment
Plant Manager

Organization: Complete
Environmental Service

Telephone No.: (903) 679-3448

E-Mail Address: ces@shreve.net

Street Address: P.O. Box 170

City, State, Zip: Karnack, TX 75661

Individual Contacted:

Name: Chris G. Villarreal

Title: Remedial Project Manager

Organization: U.S.
Environmental Protection Agency-
Region 6

Telephone No.: (214) 665-6758

E-mail Address: villarreal.chris@epa.gov

Street Address: 1445 Ross Avenue

City, State, Zip: Dallas, TX 75202-2733

Survey Questions:

Please direct questions or comments regarding this survey to William R. Corrigan (at the address listed above).

1. Are you familiar with the following:

	yes	no
a. Site 18/24 Burning Grounds and Groundwater Treatment Plant (Groundwater from Burning Grounds and Landfill 16)	x	☐
b. Site 16 Landfill Cap (Old Landfill)	x	☐
c. Site 12 Landfill Cap (Sanitary Landfill)	x	☐

2. What is your impression of the project (general sentiment)?
The project is very complex with multiple operable units. Considerable resources have been expended on this project over the years. Progress has been made in identifying and addressing contamination resulting from 50+ years of Army operations, however, there is still a lot of work to be done.

3. What effect have site operations had on the surrounding community?
The ending of Army operations at the facility and subsequent loss of jobs undoubtedly had a negative effect on the local economy. However, the establishment of a formal process to establish the Caddo Lake national Wildlife Refuge has the potential to bring new income to the local community. Local people and organizations have expressed support for the refuge.

4. Are you aware of any community concerns regarding the site or its operation and administration?
If so, please give details.
No.

5. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
There have been two fires at the Longhorn Army Ammunition Plant within the last year or so. Local fire departments were contacted to respond. Additionally, 189,000 gallons of effluent were released at the Site 18/24 Groundwater Treatment Plant (GWTP) in January 2001. Of the 189,000 gallons, approximately 50,000 gallons spilled over the GWTP containment onto surrounding soils.

6. Do you feel well informed about the site's activities and progress?
Yes.

7. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?
A new U.S. Army Corps of Engineer's contractor management team was recently put in place. The new contractor team appears to be very competent and I am looking forward to making significant progress on the Site 16 and the Group 2 and 4 sites this next year.

Please mail responses to William R. Corrigan at Complete Environmental Service, P.O. Box 170, Karnack, TX 75661

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

FINAL MONTHLY MANAGERS' MEETING

AGENDA

DATE: September 18, 2012
TIME: 10:00 a.m.
PLACE: Teleconference – 866-203-6896 Code - 1759304791

Welcome

RMZ

Action Items

AECOM

- Get the GWTP back up and running – System started 09/06
- Provide Administrative Record update in September – In-progress
- Provide EPA and TCEQ email responses to interim air monitoring plan for concurrence – Complete, air monitoring results provided 09/11
- Provide confirmed Compliance Sampling event schedule- Compliance sampling planned for September 24 start
- Provide email identifying potential paths forward for LHAAP-03 to Mr. Mayer to discuss with Mr. Tzhone and respond – Complete, separately provided path forward for overall strategy to include groundwater
- Provide comments on EPA Site 18 24 wells recommended for sampling – Completed as part of LHAAP-18/24 PSI WP
- Ensure access for all users to Sharepoint

Army

- Provide comments on EPA well list for Site 18 24 – Complete through comment on LHAAP-18/24 PSI WP
- Provide Memo For Record for Site 18 24 Historical Research including providing scanned copies of all drawings/documents which are not currently in the Admin Record – In-progress
- Provide supplemental BERA schedule to EPA and TCEQ
- Provide scanned copies of all drawings/documents which are not currently in the AR

EPA

- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update
- Provide response to Army's question regarding CERCLA process and the use of an EECA

TCEQ

- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update

Defense Environmental Restoration Program (DERP) PBR Update

AECOM

- Upcoming document submissions to regulators see Document status table

- Upcoming field work
- Monthly data submission
- Quarterly reports - status
 - Surface water monitoring
 - Groundwater Treatment Plant
 - Report
 - UIC
- Perimeter Well Sampling and Reporting
- Status of Groundwater Treatment Plant
 - Air monitoring
 - Discharge
 - Other
- Status of regulator comments on LHAAP-28/24 PSI Work Plan
Regulators schedule extension request (**RMZ**)

Other DERA Program Update

Army

- LHAAP-37 Pilot Demonstration update
- Status of Supplemental BERA
- Decision Document for multiple sites
- Five Year Review Report
- Sitewide LUC Management Plan – annual update

MMRP Update

Army

- Update status of EPA Groundwater Sampling

Other Environmental Restoration

Army

- CRP/CIP Update
- Site 19 Decision Document update

Programmatic Issues

RMZ/RM/FD

- Status of Dispute

USFWS Update

RMZ/PB

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

EPA – Non-CERCLA

- Update on Phytoforensics Study

RM

Adjourn

ACRONYM LIST

DERP-	Defense Environmental Restoration Program
EPA-	Environmental Protection Agency
FS-	Feasibility Study
IRP-	Installation Restoration Program
ITS-	Intertek Testing Services
LHAAP-	Longhorn Army Ammunition Plant
MMRP-	Military Munitions Response Program
MNA-	Monitored Natural Attenuation

PB-	Paul Bruckwicki
PBC-	Performance Based Contract
PS-	Praveen Srivastav
QA-	Quality Assurance
QC-	Quality Control
RMZ-	Rose M. Zeiler
RD-	Remedial Design
ROD-	Record of Decision
SAP-	Sampling and Analysis Plan
TCEQ-	Texas Commission on Environmental Quality
USFWS-	United States Fish and Wildlife Service

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

FINAL MONTHLY MANAGERS' MEETING

MINUTES

DATE: September 18, 2012

TIME: 10:00 a.m.

PLACE: Teleconference – 866-203-6896 Code - 1759304791

Attendees:

Army BRAC - Rose Zeiler

AEC – Marilyn Plitnik, Robin Paul

USACE – John Lambert, Aaron Williams, Wendy Lanier

EPA - Rich Mayer, Kent Becher (USGS), Paul Torcoletti

TCEQ – Fay Duke, Dale Vodak

USFWS – Paul Bruckwicki

AECOM - Dave Wacker, Gretchen McDonnell, Marwan Salameh

Welcome

RMZ

Action Items

AECOM

- Get the GWTP back up and running – System started 09/06 - COMPLETE
 - AECOM collected one set of air monitoring data
 - Operated one day, collected grab Summa air data samples after 8 hours of operation from stack, outside of GWTP office and from distance to offsite receptor. Results provided. Air results were favorable. System has been dormant for awhile so FBR water was re-circulated for a few more days and results came back showing we achieved discharge criteria, but have NOT discharged to the creek, returned to site via sprinklers.
 - Will take additional air samples during continued operation over an 8 hour period and in accordance with interim air monitoring plan
 - Discussion of treated water disposal methods by Dr. Zeiler, reinjection, Harrison Bayou and sprinkler system, most concerned with discharge to Harrison Bayou.
 - Add action item going forward for “GWTP Longer-Term Plan”
 - Mr. Bruckwicki stated that liner is exposed around the crest of the INF Pond, along the back side bank. AECOM will take as an action item to investigate and address.
- Provide Administrative Record update in September – In-progress
 - Army has not yet provided dispute documents and the historical 18/24 information to be added. Need to cut AECOM loose to do the update with what we have.
 - Army requested TCEQ and EPA provide all their dispute related letterhead documents to be put in the Administrative Record for September 2012 update. Should only be a couple of documents for each agency. Letterhead plus attachments. January 1 through September 30th, 2012 to be provided by Friday, Sept 21.
 - Particularly important is the recapitulation of eight-issues letter.
 - Dr. Zeiler prefers that dispute documents be bundled in the AR, not added chronologically and the regulators had no objections.

- Provide EPA and TCEQ email responses to interim air monitoring plan for concurrence – Complete, air monitoring results provided 09/11
 - Results from tomorrow's testing will be available next Tuesday or Wednesday. Results will go to Mr. Williams at USACE for distribution
- Provide confirmed Compliance Sampling event schedule - Compliance sampling planned for September 24 start - COMPLETE
- Provide email identifying potential paths forward for LHAAP-03 to Mr. Mayer to discuss with Mr. Tzhone and respond – Complete; however, AECOM will follow-up with path forward for Site 03 to include groundwater to the Army and EPA/TCEQ by end of September
 - Change to “Path Forward for LHAAP-03” and retain the action item
 - Army still needs to hear from Mr. Tzhone on process opinion for three possible paths forward. Mr. Mayer said Mr. Tzhone has responded but is holding EPA process opinion to review in conjunction with AECOM path forward
- Provide comments on EPA Site 18 24 wells recommended for sampling – Completed as part of LHAAP-18/24 PSI WP
 - AECOM's revised submittal provided a rationale for each well
 - EPA comments received by AECOM
 - Mr. Becher felt the WP portion addressing compliance sampling was pretty complete. Once this next round is done, we'll be able to evaluate the data to determine if we have good coverage.
- Ensure access for all users to Sharepoint
 - AEC cannot access the external Sharepoint site due to Army Firewall
 - Comments from AEC go to USACE (Mr. Williams) for compilation and addition to the RTC
 - USACE will forward electronic copies of documents to AEC for review since AEC does not have SharePoint access
 - AECOM will provide the RTC matrix document by email to reviewers

Army

- Provide comments on EPA well list for Site 18 24 – Complete through comment on LHAAP-18/24 PSI WP
- Provide Memo For Record for Site 18/24 Historical Research including providing scanned copies of all drawings/documents which are not currently in the Admin Record – In-progress:
 - Goal for completion of draft MFR is end of September 2012
 - In October, group should work to identify what historical data should go into the AR along with the workplan or completion report submittal as supporting documentation
 - TCEQ and EPA will choose what goes in as supporting documentation for decisions after they review MFR that says what is available
 - Mr. Becher is compiling a list of documents that are referenced in other AR documents, and he will compare that list against the MFR of newly available historical documents.
- Provide supplemental BERA schedule to EPA and TCEQ – In review with Dr. Zeiler
 - Dr. Zeiler must review for concurrence and then schedule will go to regulators
 - First deliverable to the regulators is the data gap memo in early November
 - Phil Turner and Barry Forsythe will be EPA reviewers per Mr. Mayer
- Provide scanned copies of all drawings/documents which are not currently in the AR – Ongoing as Lanier finds documents

EPA

- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update
 - By the end of this week
- Provide response to Army's question regarding CERCLA process and the use of an EECA – Pending new path forward

TCEQ

- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update – By the end of this week to Rose

Defense Environmental Restoration Program (DERP) PBR Update**AECOM**

- Upcoming document submissions to regulators (see attached Document and Issue Tracking table)
 - Discussed plan to finalize 18/24 PSI WP
 - TCEQ will focus on the well locations for sampling at the start of their review and provide comments so we can consider those for the upcoming compliance monitoring event
 - Dr. Zeiler advised regulators to request an extension for any comments they want to submit after the FFA-prescribed 30-day comment period.
 - Mr. Wacker explained that the CSM effort must be dovetailed with PSI WP effort and historical data being retrieved by Ms. Lanier
 - Path forward for dovetailing has been provided to Army
 - Objective is to get Ms. Lanier's data to everyone for review in advance of October Manager's Meeting
 - Preliminary CSM will be presented to EPA/TCEQ mid-October and the objective is to baseline everyone on the CSM at the Managers' Meeting on October 18th
 - AECOM will provide their confidence level in the CSM presented
 - PSI WP data collection in late October/November will add confidence to the CSM
 - Data presented at December meeting, objective to obtain final agreement from all parties on CSM
- Upcoming field work
 - Compliance Sampling – Sept 24
 - PSI WP 18/24 – end of October/beginning of November
- Monthly data submission
 - Dr. Zeiler stated that, per the FFA, a monthly data submission must be made covering all the data collected during the month
 - A spreadsheet of all the data validated within the month could be submitted along with the Managers' Meeting agenda.
 - Air monitoring data was validated and submitted to the regulators 1 ½ weeks ago
 - Discharge data has not been validated yet for submission
 - Electronic copies of complete data will be provided to TCEQ/EPA if desired.
 - EPA made standing request so Mr. Becher can review it.

- AECOM recommends surface water and perimeter groundwater be supplied in draft with monthly submittal, and will be submitted formally in quarterly reports.
- Status of Groundwater Treatment Plant
 - Air monitoring – additional sampling planned during operation on 9/19 – 9/20
 - Discharge – planned through sprinkler system
 - Other
 - AECOM has developed a list of equipment that needs repair
 - Scott Beesinger will be moving to a role to only supervise compliance sampling versus performing compliance sampling, allowing him to be more focused on GWTP operation
 - AECOM evaluating the status of the pumps and level switches. Will examine ICT-13 for proper function.
 - AECOM is buying 5 new pump sets to replace existing

Other DERA Program Update

Army

- LHAAP-37 Pilot Demonstration update (AEC)
 - Ms. Plitnik stated all wells have been drilled. Contractor is installing nutrient distribution system and is 90% complete. Start-up by end of September. Baseline data collection completed in July, with those results currently in ATC review
 - Due to high suspended solids microbial enumeration procedure had to be modified. Resampling took place on 13 September
 - Data should be ready from ATC by October Manager's Meeting
- Status of Supplemental BERA (USACE – Mr. Williams)
 - Schedule will be provided to regulators after Dr. Zeiler's review.
- Decision Document for multiple sites
 - TCEQ-lead sites
 - NFA DD covering 13 sites with past TCEQ NFA concurrence. DD is being completed to memorialize NFA for the record. Some sites have already been transferred.
 - DD will go to TCEQ for review and in response to a question from TCEQ, LHAAP-45 will not be included in this DD
- Five Year Review Report
 - USACE EM Center of Expertise has a lead role on all 5-year reviews in support of Army
 - This week, the initial call to kick-off the effort (formats, objectives) Army coordination with AECOM on schedule and processes
 - Report must be finalized and signed by October 2, 2013.
- Sitewide LUC Management Plan – annual update
 - Mr. Williams has added 19 sites
 - Annual update scheduled for the end of each fiscal year
 - If no changes, still must be updated annually so it's easy to tell the version being referenced is the most current.

MMRP Update

Army

- Update status of EPA Groundwater Sampling
 - Mr. Lambert – USACE is validating their split sample results at this time. Will share upon validation.
 - Mr. Mayer – will finalize and share their sample data. Awaiting final report.

- At next meeting EPA and USACE will provide spreadsheets for MMRP data collected.

Other Environmental Restoration

Army

- CRP/CIP Update (AEC)
 - Ms. Paul advised community interviews are taking place this week
 - EPA would like to have a call with Army on community plan. EPA and Army will schedule a meeting for further discussion.
- Site 19 Decision Document update – future discussion

Programmatic Issues

RMZ/RM/FD

- Status of Dispute
 - The last exchange indicates Army was waiting for Herschel Wolf to get back into the office to see what Army's concern was with the proposed change in language.

USFWS Update

RMZ/PB

- Environmental Restoration Issues with Transfer Schedule Impact
 - Transfer Document update will take place off-line.
- USFWS Comments on Documents
 - None

EPA – Non-CERCLA

RMZ

- Update on Phytoforensics Study
 - Mr. Mayer sent out draft report was sent out to team about 2 weeks ago but was rejected/returned by email. Mr. Becher will put the draft report out to an FTP site for everyone to access.
 - EPA would like to see 16/17/18/24 area historical groundwater data from last 5-6 years. Mr. Williams did a data dump that should be searchable to find the data they need. Mr. Williams will resend or provide status on accessing the data dump previously submitted.

***Next Meeting Scheduled for:
12PM – 4PM October 18th
LHAAP Army Trailer***

***630PM October 18th - RAB Meeting @ Karnack Community Center
800AM October 19th Monthly Managers' Meeting – TBD (AECOM to advise location)***

Adjourn

Attachments:

- 1. August 2012 Draft Managers' Meeting Minutes**
- 2. September 2012 Managers' Meeting Agenda**
- 3. 17 September 2012 Document and Issue Tracking**

Action Items

AECOM

- GWTP Longer-Term Plan Update

- INF Pond – Evaluate Exposed Liner for Corrective Action
- Submit GWTP air analytical data from 19 September sampling to Mr. Williams
- “Path Forward for LHAAP-03”
- Provide the RTC matrix documents in Word format by email to reviewers.
- Examine ICT-13 for proper function.
- Decide location for October 19th Monthly Managers’ Meeting

Army

- Distribute GWTP air analytical data from 19 September sampling (Mr. Williams)
- Forward electronic copies of documents to AEC for review since AEC does not have SharePoint access
- Provide Memo For Record for Site 18/24 Historical Research including providing scanned copies of all drawings/documents which are not currently in the Admin Record
- Provide supplemental BERA schedule to EPA and TCEQ
- Provide scanned copies of all drawings/documents which are not currently in the AR
- USACE will provide spreadsheets for site 37 MMRP groundwater split sample data collected at the October Managers’ Meeting.
- Mr. Williams will resend to EPA the 16/17/18/24 area historical ground water data dump previously provided, or provide update on how the data can be accessed.

EPA

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September.
- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide response to Army’s question regarding CERCLA process and the use of an EECA – Pending submittal of new path forward
- EPA will provide spreadsheets for site 37 MMRP groundwater split sample data collected at the October Managers’ Meeting.
- Mr. Becher will put the draft phytoforensics study report out to an FTP site for everyone to access.
- Provide comment for the revised LHAAP-03 EE/CA.

TCEQ

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September.
- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide input wells planned for sampling at LHAAP-18/24 as part of compliance sampling event
- Provide comment for the revised LHAAP-03 EE/CA.

AEC

- Provide LHAAP-37 Pilot Demonstration data at October Managers’ Meeting

ACRONYM LIST

AEC	Army Environmental Command
AR	Administrative Record
ATC	Aberdeen Test Center
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CIP	Command Inspection Program
CRP	Compliance Restoration Program
CSM	Conceptual Site Model
DD	Due Diligence
DERA	Defense Environmental Restoration Act
DERP	Defense Environmental Restoration Program
EECA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency
FBR	Filter Bed Reactor
FFA	Federal Facility Agreement
FTP	File Transfer Protocol
GWTP	Groundwater Treatment Plant
ICT	Interceptor Collector Trench
INF Pond	Infiltration Pond
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
MFR	Memorandum for the Record
MMRP	Military Munitions Response Program
NFA	No Further Action
PBR	Performance Based Remediation
PSI WP	Post-Screening Investigation Work Plan
RMZ-	Rose M. Zeiler
RTC	Response to Comments
TBD	To Be Determined
TCEQ-	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USFWS-	United States Fish and Wildlife Service
WP	Work Plan

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

DRAFT MONTHLY MANAGERS' MEETING

MINUTES

DATE: August 21, 2012

TIME: 10:00 a.m.

PLACE: Teleconference - 866-203-6896 Code - 1759304791

Attendees:

Rose Zeiler, Army-BRAC

Robin Paul - USAEC,

John Lambert, Wendy Lanier, Aaron Williams – USACE

Rich Mayer, Kent Becher (USGS liason), Terry Burton – USEPA

Fay Duke, Dale Vodak - TCEQ

Paul Bruckwicki - USFWS

Dave Wacker, Gretchen McDonnell - AECOM

Welcome

RMZ

Action Items

AECOM

- Get the GWTP back up and running - Status:
 - AECOM provided a supplementary “Start-Up Status” document (attached) by email just prior to the call for review during the call.
 - Discharge of stored treated water from effluent tank via sprinkler system back onto 18/24 site completed 16 August.
 - Analytical data associated with discharge provided along with the “Start-Up Status” document by email just prior to the call.
 - Interim air monitoring plan comments received from TCEQ and EPA and comment incorporation is in progress.
 - Multiple repairs and assessment in progress now and projected for next few months which will result in periodic downtime.
- Provide recommendations for well sampling at 18/24 –
 - AECOM has received EPA recommendations from Mr. Mayer with recommendations planned in the Data Gap Work Plan planned for submittal to the agencies August 31.
- Provide Administrative Record update in September – In Progress
 - Administrative Record update will cover from 31 March 2012 forward
NOTE: This should be from 28 February 2012 forward.
- New actions –

Army

- Provide MFR with findings regarding site 18/24 historic documents – In Progress
 - Ms. Lanier has located field manager from source excavation/thermal-treatment and he has agreed to do a phone interview with her to confirm locations excavations of source material and volumes thermally treated

- Preliminarily the field manager confirmed that some of the source excavations were 8-10 feet deep, and,
 - Confirmation sampling was performed on all excavations using PID in the field and submitting a percentage of samples for lab analysis. Ms. Lanier has not yet found the analytical data associated with that confirmation sampling, but feels the reports are likely in the GWTP storage building.
- Contractor was able to confirm as-built depths on interceptor collector trenches from their QC reports.
- Ms. Lanier will be creating a table of the information found/confirmed with documents found as appendices to the MFR.
- Provide scanned copies of all drawings/documents which are not currently in the Admin Record – In Progress
 - Ms. Lanier sent notification to the group that historical files she found were available to download at FTP site.
 - Some participants did not receive the notifications, which were valid for two weeks.
 - Mr. Becher will put documents on an FTP site for USFWS to access it without having to download all documents.
- Seek approval in pursuing interim RODs for the RODs in dispute – Complete
 - Army did not hear anything further from Mr. Tzhone on this.
- Get current data dump from Shaw (Mr. Williams) - Complete
- Provide drill cutting results to Army and regulators - Complete
 - Decision was that cuttings from the LHAAP-37 demo need to be disposed of off-site.
 - 12 roll-offs are ready to be shipped pending paperwork completion. Class 2 waste.
- Send Site 18/24 powerpoint and EPA's evaluation to AECOM - Complete
- Provide link for Site 18/24 logs (Ms. Lanier) - Complete

EPA

- Provide list of wells at site 18/24 recommended for sampling – Completed 21 August
 - Increase of eleven wells recommended
 - EPA's approach was to try to ensure there are enough data points to be able to map plumes.
- Provide list of site 18/24 historic documents for the Admin Record – In Progress
 - Group will need to decide later which of the historical documentation collected by Ms. Lanier to add to the AR and how to add it in a logical sequence as documents supporting the path forward.
- Submit proposal for interim RODs for the RODs in dispute (Mr. Tzhone) – In Progress.
 - Carlos Sanchez will be handling dispute issues in Mr. Tzhone's absence.
- Provide comments for Redline RODs – Completed
- Provide comments on LHAAP-03 – Complete
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update. – In Progress.
 - Need all of 2012 documents starting from 01 January. Only letterhead documents (and attachments) that document decision points.
 - AECOM plans to do AR update the first part of September, so all 2012 CY documents should be turned in by 13 September to make the next AR update.

TCEQ

- Provide list of site 18/24 historic documents for the Admin Record – In Progress pending Ms. Lanier Memo for Record
- Provide email concurrence on LHAAP-04 tracked-change FS – Complete.
- Provide comments on LHAAP-03 – In Progress
 - Shaw has made revisions to address regulator comment and has gone back to regulators for approval, before we can go to 30-day public notice.
- Provide letter of concurrence on force majeure schedule change request. - Complete
- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update. – In Progress

Defense Environmental Restoration Program (DERP) Update

AECOM

1. **AECOM SharePoint Access to Obtain Documents and Use of Web Ex for Meetings – In-Progress**
 - a. This week, AECOM staff will be following up with individual users to ensure all users have access and can attend meetings to avoid problems accessing documents and meetings.
2. **Sitewide Plans – In Progress**
 - a. Currently using existing plans to guide on-going work over the next 30-45 days, but updated documents are being generated for the long-term.
 - Updated **Work Plan** with previous regulatory comments addressed and AECOM procedures added planned for completion at end of August
 - **Accident Prevention Plan/Health and Safety Plan** (Appendix to the Work Plan) planned for completion at the end of August
 - **UFP QAPP** (Appendix to Work P) planned for completion in September
 - b. **Plan for Site-Wide Work Plans Finalization** – Group prefers to do review after all updated plans are complete, which will be mid-September.
 - c. GWTP Interim Air Monitoring Plan submitted to regulators and questions received from EPA. AECOM will provide these responses in an email response to EPA for Mr. Mayer's reply.
 - **Ambient air collection location?** – AECOM recommends collection just outside the GWTP Office as the most likely potential exposure point.
 - **Standard to compare summa canister and PID results?** – Air stripper sample from Summa canister will be converted to lb/hr and compared to allowable limits per 30 TAC 106.533(f)(1)(i) or TAC 106.533(f)(1)(ii) limits. The ambient air PID concentration will be compared to the ESLs after the ppmv concentration is converted to ug/m3 concentration per 30 TAC 106.533(h) after accounting for the mass fraction of each chemical [this will be based on Summa Canister analytical results]. The PID reading will be corrected for background interference such as moisture content. Background concentration will be measured upwind ~500 feet from GWTP.
 - **Date/time for monthly report submittal** – Planned data submittal to regulators within 3-4 days (results have quick TAT for Summa canister), abbreviated memo report to follow the third week of each month.

3. **Technical Document Status –**

- a. LHAAP-04 Proposed Plan – to Army 08/24/12, to EPA/TCEQ, 09/28/12
- b. LHAAP-46 Draft RAWP – to Army 09/13/12, to EPA/TCEQ, 10/29/12
- c. LHAAP-67 Draft RAWP – to Army 09/13/12, to EPA/TCEQ, 10/29/12
- d. LHAAP-18/24 Draft Data Gap Work Plan – to Army 08/24/12, to EPA/TCEQ, 08/31/12
- e. Additional sites/deliverable documents/dates will be reflected in a Document Tracking Sheet AECOM will produce and maintain.

4. **Site Specific Issues**

a. **LHAAP-18/24 CSM Update – In Progress**

- Additional information that will come out with Ms. Lanier's MFR for historical documents located at USACE Tulsa and the GWTP may add to understanding based upon all other info known now – CSM Update to Army 09/14/12
- Goal is to submit updated CSM to regulators by the end of September with plan to present at the October Managers Meeting to baseline all parties understanding of Site 18/24
- If data gap investigation work plan approval is received, data gap investigation can be done along with the field effort for the compliance monitoring round scheduled for the last week of September. With that timing, that data gap investigation information could feed into the CSM before it is finalized and presented to public. Because of the schedule timing requiring Data Gap Work Plan to regulators by August 31, CSM and plan will have to be integrated.
- Last week of September would work well for EPA for compliance sampling round.
 - o Scott and Ray may not be available to personally assist due to focus on GWTP, but other AECOM crews will be performing sampling.
 - o AECOM will contact EPA (Mr. Becher) with confirmation of the event schedule by 10 September.

b. **LHAAP-03 –Potential Paths Forward**

- AECOM is trying to find a path forward that can meet existing schedule and requested agency input on issues with either of these alternatives (assuming no groundwater issues need be addressed here)
- AECOM took the action to provide the potential alternatives to the group in a separate email for internal discussion
- Ms. Duke expressed concern that groundwater at LHAAP-03 is not dealt with under the LHAAP-58 ROD, so is formally unaddressed which may impact the path the site needs to take. The potential groundwater issue (soil to groundwater pathway) is what returned the site to NPL status, so seems strange that it would not be addressed as part of LHAAP-03.
 - o Ms. Zeiler identified that Site 03 groundwater is supposed to be addressed under Site 58 as they are co-located and Ms. Duke stated

this was true but the Site 58 ROD did not address metals. Ms. Zeiler stated only one groundwater sample result exceeded for Arsenic (no confirmation of that single exceedance). After source removal, a well could be installed for sampling to confirm no groundwater impacts. However, AECOM needs to develop an approach they feel is appropriate if groundwater is to be addressed under LHAAP-03.

- Army is awaiting input from Mr. Tzhone on whether some version of a feasibility study is going to be required by EPA before the PP if the RA remediates to residential levels? To industrial levels?
- Army (Ms. Zeiler) has verbally indicated to Mr. Tzhone, EPA that a schedule extension will be required.

5. **Groundwater Treatment Plant** – Discharge of treated effluent completed on 16 August, working toward re-start of treatment with air monitoring, planned for 30 August.

a. Repairs Preventing Operation

- Power Lines
- HCL tank repair, flange assembly replacement
- Compressor Motor

b. Multiple other on-going repairs/training planned for September through December. Note repairs and equipment upgrades during this time will require several GWTP shutdowns for 1-3 days at a time to complete

c. Short-term and Long-term evaluations underway – Potential longer-term solution to replace/upgrade/implement the final treatment process strategy may result in 90-180 day implementation window.

6. **Upcoming Fieldwork** –Planned Start 09/24/12

a. Compliance Sampling LHAAP-18/24 wells

b. LHAAP 18/24 data gaps (if possible, combine with 18/24 Compliance Sampling field effort, if not this effort will take place when approved)

c. LHAAP-12

- TCEQ recommended sampling in a different season to determine if there are seasonal fluctuations in COC concentrations
- Sampling of these wells will be added to September field effort
- USACE requested gauging of all wells during the event, per regulator comment. AECOM will incorporate into the plan.

d. Perimeter Wells and Surface Water Locations

- Will also complete as part of the September/October field effort.

- LHAAP-04 Final FS, completed and will be included in next AR update, Proposed Plan in progress

- LHAAP-12 RAO Reports – Final transmitted to EPA/TCEQ

- Forecast Activities for the Next Month – Tracking documents forthcoming, see above status

Other DERP Contracts Update

Army

- LHAAP-37 Pilot Demonstration Update

- o AEC has no update at this time
- o IDW disposal must be coordinated through Army (Ms. Zeiler) – 12 roll-off containers

- Status of Supplemental BERA
 - Kick-off teleconference this week.
 - AGEISS subcontracting to Shaw
 - A workplan for additional sampling is forthcoming; Army takes action item to get a proposed schedule to provide to regulators.
- CRP/CIP Update
 - Ms. Zeiler received EPA RTCs and submitted revisions to AEC.
 - Ms. Paul will work with Cindy Judd at AEC to complete the task.

MMRP Update

Army

- Update status of EPA Groundwater Sampling (Mr. Mayer)
 - TetraTech completed well development completed last week, sampling started yesterday.
 - Army (FWD) is on site to collect split samples.
 - Two wells at LHAAP-54 did not “clean-up” very well.
 - May be out there all week to complete sampling since it’s been slow-going.

Other Environmental Issues

Army

- Mr. Mayer will forward Mr. Tzone’s email regarding a stakeholder webinar invitation. As the funders of community relations, Ms. Paul, AEC will evaluate the email and discuss with their Public Relations office.

Programmatic Issues

RMZ/ST/FD

- Status of Dispute – Red-tracked RODs, SEC Issues
 - Not yet elevated to SEC
 - Some discussion was held regarding status. Both EPA and TCEQ believe it is in Army’s court. Army disagrees because the record does not indicate any further response from EPA after the red-track submittal to EPA and TCEQ.

NOTE: Later learned that EPA’s emails were not received by Army, but were by TCEQ – apparently an email problem.

USFWS Update

RMZ/PB

- AECOM notified that USFWS needs to be copied on any documents that are sent out.
- Environmental Restoration Issues with Transfer Schedule Impact – None identified
- USFWS Comments on Documents – None identified

EPA – Non-CERCLA

- Update on Phytoforensics Study **ST**
 - Draft report has been issued, but the group did not receive. Mr. Mayer will send today to Ms. Zeiler, Mr. Lambert, Mr. Williams, Ms. Lanier, Ms. Duke, and Mr. Bruckwicki.

***Next Meeting Scheduled for:
18 September 2012 @ 1000
AECOM will work to issue agenda by 11 September***

Action Items

AECOM

- Get the GWTP back up and running
- Provide Administrative Record update in September – In Progress
- Provide EPA and TCEQ email responses to interim air monitoring plan for concurrence
- Provide confirmed Compliance Sampling event schedule by 10 September
- Provide email identifying potential paths forward for Mr. Mayer to discuss with Mr. Tzhone and respond
- Provide comments on EPA Site 18 24 wells recommended for sampling
-

Army

- Provide comments on EPA well list for Site 18 24

Adjourn

Meeting Handouts/Submittals

1. July 2012 Managers' Meeting Minutes
2. Agenda
3. Data: Site 18/24 treated water analytical results
4. AECOM Forecast and Start-Up Status (20 August 2012)

ACRONYM LIST

AR	Administrative Record
BERA	Baseline Ecological Assessment
CY	calendar year
DERP-	Defense Environmental Restoration Program
EPA-	Environmental Protection Agency
FD-	Fay Duke
FS-	Feasibility Study
FTP-	File Transfer Protocol
IRP-	Installation Restoration Program
ITS-	Intertek Testing Services
LHAAP-	Longhorn Army Ammunition Plant
MFR	Memorandum for Record
MMRP-	Military Munitions Response Program
MNA-	Monitored Natural Attenuation
PB-	Paul Bruckwicki
PID-	Photo-ionization detector
PBC-	Performance Based Contract
PS-	Praveen Srivastav
QA-	Quality Assurance
QC-	Quality Control
RMZ-	Rose M. Zeiler
RD-	Remedial Design
ROD-	Record of Decision
SAP-	Sampling and Analysis Plan

SEC	Senior Executive Committee
ST-	Steve Tzhone
TCEQ-	Texas Commission on Environmental Quality
USACE-	United States Army Corps of Engineers
USAEC-	United Stes Army Environmental Command
USFWS-	United States Fish and Wildlife Service
USGS-	United Stated Geological Survey

Attachment
AECOM Forecast and Start-up Status
08/20/12

This document is meant as a comprehensive update for on-going activities. Separate tracking tools (document tracking spreadsheet and monthly forecasting schedule for fieldwork and document review) are under development and will be implemented in the coming weeks once format and content have been finalized.

In-progress activities:

7. AECOM SharePoint Access to Obtain Documents and Use of Web Ex for Meetings – In-Progress

- a. This week, AECOM staff will be following up with individual users to ensure all users have access and can attend meetings to avoid problems accessing documents and meetings.

8. Sitewide Plans – In Progress

- a. Currently using existing plans to guide on-going work over the next 30-45 days, but updated documents are being generated for the long-term.
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10. Site Specific Issues

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confirmation of that single exceedance). After source removal, a well could be installed for sampling to confirm no groundwater impacts. However, AECOM needs to develop an approach they feel is appropriate if groundwater is to be addressed under LHAAP-03.

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- Army (Ms. Zeiler) has verbally indicated to Mr. Tzhone, EPA that a schedule extension will be required.

11. Groundwater Treatment Plant – Discharge of treated effluent completed on 16 August, working toward re-start of treatment with air monitoring, planned for 30 August.

a. Repairs Preventing Operation

- Power Lines
- HCL tank repair, flange assembly replacement
- Compressor Motor

b. Multiple other on-going repairs/training planned for September through December. Note repairs and equipment upgrades during this time will require several GWTP shutdowns for 1-3 days at a time to complete

c. Short-term and Long-term evaluations underway – Potential longer-term solution to replace/upgrade/implement the final treatment process strategy may result in 90-180 day implementation window.

12. Upcoming Fieldwork –Planned Start 09/24/12

a. Compliance Sampling LHAAP-18/24 wells

b. LHAAP 18/24 data gaps (if possible, combine with 18/24 Compliance Sampling field effort, if not this effort will take place when approved)

c. LHAAP-12

- TCEQ recommended sampling in a different season to determine if there are seasonal fluctuations in COC concentrations
- Sampling of these wells will be added to September field effort
- USACE requested gauging of all wells during the event, per regulator comment. AECOM will incorporate into the plan.

d. Perimeter Wells and Surface Water Locations

- Will also complete as part of the September/October field effort.

**Document and Issue Tracking
Longhorn Army Ammunition Plant
September 17, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
1	LHAAP-04 Proposed Plan	Army Legal Review	09/26/12	On schedule	Due to EPA/TCEQ 09/28
2	LHAAP-47 Proposed Plan	AECOM Submit Army Draft	09/21/12	Incorporating comments from Site 04 PP, on schedule	Due to EPA/TCEQ 10/31
3	LHAAP-18/24 PSI WP	EPA/TCEQ Review	10/01/12	EPA comments received 09/07, Draft responses to Army 09/11	Discuss plan to finalize, list of wells in WP is same as compliance sampling list
4	LHAAP-46 RAWP	AECOM Submit Army Draft	09/20/12	In-progress, may be delayed 1-2 days	Due to EPA/TCEQ 10/31
5	LHAAP-67 RAWP	AECOM Submit Army Draft	09/27/12	In-progress, on schedule	Due to EPA/TCEQ 10/31
6	LHAAP-16 RD WP	AECOM Submit Army Draft	TBD	TBD	
7	LHAAP-17 RD WP	AECOM Submit Army Draft	TBD	TBD	
8	LHAAP-03Path Forward	AECOM submits plan to Army	09/18/12	Need to address groundwater and identify soil path forward in addition to providing revised schedule	

**Document and Issue Tracking
Longhorn Army Ammunition Plant
September 17, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
9	GWTP Air Monitoring	Continue Air Monitoring	09/12/12	GWTP Back-up Plan for Staffing in Progress	Response from regulators indicated results were satisfactory. TCEQ indicated conference call was not necessary.
11	Compliance Sampling LHAAP-18, 24, Perimeter Wells, Surface Water Locs	AECOM complete sampling	09/24/12	On schedule, In-progress	
12	LHAAP-29 PSI WP	AECOM submits draft	TBD	Working	Soil and groundwater sampling, aquifer testing planned similar to 18/24
13					
14					

CESWT-EC-ER

14 October 2012

MEMORANDUM FOR RECORD

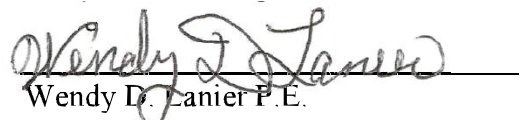
SUBJECT: Documentation of the Interim Remedial Action (IRA) prior to 1999 at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant Karnack, Texas, U.S. Army Corps Of Engineers, Tulsa District

1. The Purpose of this Memorandum For Record (MFR) is to present documentation of a review of available information pertaining to the IRA field activities regarding soil excavation and construction of the groundwater collection system from the Burning Ground 3 (BG3) and some of the background leading to the IRA.
2. In late 1991, when Tulsa District was given the task to assist LHAAP in their environmental remediation/compliance, I was assigned the Burning Ground 3 site as the project/design engineer. This history with the project provides me with some firsthand knowledge of the project from that period until I left the project in October of 1994. After that period I had limited contact with project through my continued contact with Tulsa District personnel as well as other contacts in the environmental field.
3. The IRA was implemented in 1993-1995 to minimize the migration of high concentrations of the contaminants of concern (CoC) which were Methylene chloride (MC) and Trichloroethylene (TCE) in the groundwater. It was believed that the highly contaminated soils in the vadose zone and the highly contaminated shallow groundwater were acting as a continuing "source" to an expanding contaminant plume which was migrating primarily laterally but also vertically. The term "source material" was used to describe this groundwater and soil.
4. Remediation of the less contaminated deeper groundwater and less contaminated soils were intended to be investigated and remediation implemented by the final Remedial Action Process that was ongoing for LHAAP. The justification for implementing an IRA was to minimize risk to the environment and nearby population.
5. Adequate documentation is available for the Low Temperature Thermal (Soil) Treatment Plant (LTTT) operations and management of the solid source material and disposal.
6. Adequate documentation is available for the groundwater treatment plant (GWTP) construction and operations.
7. My initial intent was to locate the documentation that would have been done when the field activities referenced in Paragraph 1 were completed.
8. Based on my review of available documentation located in the archived contract documents, at the LHAAP GWTP, interviews with government and contract personnel and Tulsa District files, I don't believe that a comprehensive document of the field activities exists.

9. The only record I have found of a reference to such a document is in the June 1998 Managers Meeting Minutes. At that point in the project Perchlorate concerns were first initiated. The determination of that contaminants presents at LHAAP and managing it became a the major concern.
10. The other cause I have found for a lack of documentation is personnel changes within the government as well as the contractor performing the work who would have been tasks with writing the report.
 - a. Also the administration of the contract was taken from Tulsa District and given to the geographic district (Ft Worth) for political and upper management reasons, although the Contracting Officer was in Tulsa District.
 - b. Fort Worth District had provided support to the Army on the project through the 1980's to 1991-2 and provided the Quality Assurance Representative (QAR) during the field activities, while the Administrating Contracting Officer (AOC) was the Chief of the HTRW Cost Plus Section in Tulsa District. There has been several disagreements between the AOC and the QAR on the contract regarding the ratings on the Award Fee.
 - c. Tulsa District had originally been task to support LHAAP environmental activities due to the districts experience with the CERCLA process and Tulsa Districts Designation as the HTRW Design District for Southwest Division when LHAAP became listed on the NPL.
 - d. The IRA construction contract was initially awarded to AWD, by the end of 1994 the company had been bought by Dow Environmental and by January 1997 that company was purchased by Radian, Inc.
 - e. Amine Bou Onk who had been the Project Manager on site since the start of the project was replaced with Bryan Smith in early 1997.
11. I did find (at storage at the GWTP) drawings for all of the Interceptor Collection Trenches (ICT)s with a signed cover letter from the construction contractor dated after the construction was completed that are considered "As Built" drawings. I also found the boring logs, survey coordinates and location map for the 101 borings that were used in the final design for the ICTs. These have been dispersed to project regulators and current contractor.
12. In lieu of an existing document regarding excavation of the source material I have used a multiple point reference to determining the location and depth of the excavations. The references include the IRA workplan, an eye witness account from the contractor Field Manager, Chris Edgemon, photographs, the daily Quality Control (QC) reports in the contract documents, comparisons of aerial photographs prior to and after field activities and changes in topography from before field activities.

1Encls

BG3 IRA Source Material Removal
Review Document


Wendy D. Lanier P.E.
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DOCUMENTATION OF THE
CONSTRUCTION FIELD ACTIVITIES FOR THE
EARLY INTERIM REMEDIAL ACTION (IRA)
AT
LHAAP 18/24
(a.k.a. Burning Ground 3 & the Unlined Evaporation Pond)

Longhorn Army Ammunition Plant

Karnack, Texas
October 2012



Burning Ground 3 Operational Burning Cages in 1994 -Prior to closure of LHAAP

Prepared By:
Wendy Lanier P.E.
Us Army Corps Of Engineers Tulsa District

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Appendixes

Appendix A - Conceptual Design Report 1993, Tulsa District UUACE

Appendix B - **Closure Of An Unlined Evaporation Pond:** A Case History, 1990

Appendix C - Final Work Plan Addendum Phase I For Site Lhaap-18 & 24 Burning Ground 3 & The Unlined Evaporation Pond September 1993

Appendix D - Interim Remedial Action - Phase I Letter Report Physical, Surveying And Other Field Data 2 From AWD Technologies February 17, 1994

Appendix E- Pilot Study Report - Phase II, Prepared By Dow Environmental, Inc.

Appendix F - Letters, Quality Assurance Reports & Managers Meeting Minutes Used to Document IRA Construction Field Activities

Appendix G - Photographs of IRA Construction Field Activities

Appendix H - Table of ICT information Available from Quality Control Reports

Appendix I - ICT As-built Drawings

Appendix J - Table of Source Material Data Available from Quality Control Reports

Interim Remedial Action Phase III Field Construction at Burning Ground 3

1. INTRODUCTION.

This report presents documentation for the construction activities that were performed as part of the Early Interim Remedial Action (IRA) for the Burning Ground 3 and Unlined Evaporation Pond (BG3 & UEP) Site at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. This report also presents some of the site background leading to the IRA. The IRA included collection and treatment of the highly contaminated shallow water at the site, excavation and treatment of the highly contaminated soils and debris (source material) present at the site, and restoration of the surface. The work was to be done at an active burning ground and was to minimize impact to the burning ground operations as much as possible.

The IRA cost-plus-award-fee remediation contract was initially awarded to AWD, by the end of 1994 the company had been bought by Dow Environmental and by January 1997 that company was purchased by Radian, Inc.

1.1 Location.

The LHAAP installation is adjacent to the communities of Karnack (to the west), Uncertain (to the north), and the western shore of Caddo Lake in Harrison County in the northeast section of Texas. LHAAP is 14 miles northeast of Marshall, Texas and 40 miles west of Shreveport, Louisiana. BG3 and UEP are located in the east central section of the installation.

1.2 US Army, Federal and State Regulators Roles.

The Department of Army implementing the Defense Environmental Restoration Program (DERP) is the lead agency. LHAAP was placed on the National Priority List (NPL) on 9 August 1990. A CERCLA section 120 agreement known as the Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), the Texas Natural Resource Conservation Commission (THRCC, formally the TWC) (support agencies) and the Department of the Army became effective 30 December 1991. The FFA requires an RI/FS under CERCLA to characterize the nature and extent of contamination at 13 Solid waste Management Units (SWKUs) at LHAAP develop a remedy for each area. LHAAP was issued a RCRA Part B permit, Permit Mo. HW-50195, in February 1992. The permit requires corrective action at 8 SWMU's, but specifies that corrective action can be accomplished within the CERCLA process. The Burning Ground 3 and UEP site was one of the 8 RCRA SWMU's, and was known as SWMU LHAAP 18 & 24.

An Agreed Order issued by the State required remedial activities and submittals in relation to Site 18/24. LHAAP was issued the Agreed Order by the TNRCC on December 4, 1995 for ongoing RCRA violations. It was agreed with the State that the requirements of RCRA would be addressed under CERCLA activities as an ARAR.

1.3 Site Description and Background.

Interim Remedial Action Phase III Field Construction at Burning Ground 3

The site consisted of a burning ground that has been used to burn, bury, and evaporate production waste from Longhorn Army Ammunition Plant (LHAAP) from the 1950's till closure & clean-up in 1998. The inactive waste units at the site have include various burn/demolition burial pits, a row of 18 burn pits, a heavy propellant pit, locations of burn pans, a liquid waste sump, a previously covered unlined evaporation pit, and the waste trenches surrounding the active air curtain destroyer. The fenced area of the burning ground is approximately 36 acres. Prior to closure, the 8,483 acre facility was a government-owned, contractor-operated (Longhorn Division of Thiokol Corporation) facility under the jurisdiction of the U.S. Army Armaments, Munitions, and Chemical Command (AKCCOM). This site was also an active unit under the Resource Conservation and Recovery Act (RCRA) for burning production waste in burn cages and the air curtain destroyer (used for burning non-hazardous waste).

2. Components Of Burning Ground

Common Name	Original Designation	NOR No.	SWMU No.s	RCRA Unit	IRP/ DSERTS	ESA Section	Description/Sump Number
Unlined Evaporation Pond (UEP)	38-X	2	24		24	1016	Surface Impoundment (38-X, Rocket Motor Washout Pond)
22E		3	22	4	18/24, 41	1016	East Burning Cage
Air Curtain Destructor	35-X	5	21		18/24, 40	1016	Incinerator or burning cage with smoke control
Building 41- X	41-X	13	25		44	1016	Container Storage Area
Building 24-X	24-X	14	19		38	1016	Miscellaneous Container Storage, Sorting
Building 43-X	43-X	15			62	1016	Container Storage Area - Earthen Igloo
Building 21-X,	21-X	16				1016	Container Storage Area - Building with Blast-Wall Divider
Sump at 25-X		143	34		35	1016	Sump 114
Sump at 33-X		144	34		35	1016	Sump 115
ACD Sump	37-X	145	34		35	1016	Sump 116
22C	22C	155	22	5	18/24, 41	1016	Center Burning Cage
22W	22W	156	22	6	18/24, 41	1016	West Burning Cage
INF Burn Pan	23N	157	23	7	18/24, 42	1016	North Burning Pan
23S	23S	158	23	8	18/24, 42	1016	South Burning Pan
Rocket Motor Washout Rack		159		10	In 53	1013	Pershing Rocket Motor Stand, 36-T-4
Rocket Motor Washout Rack		160		12	54	NA	Pershing Rocket Motor Stand, 36-S-2

Interim Remedial Action Phase III Field Construction at Burning Ground 3

Burning Ground No. 3	24		18		18	1016	Active Burning Grounds
Rocket Motor Washout Pad	25-X		20		39	1016	25-X Washout Pad

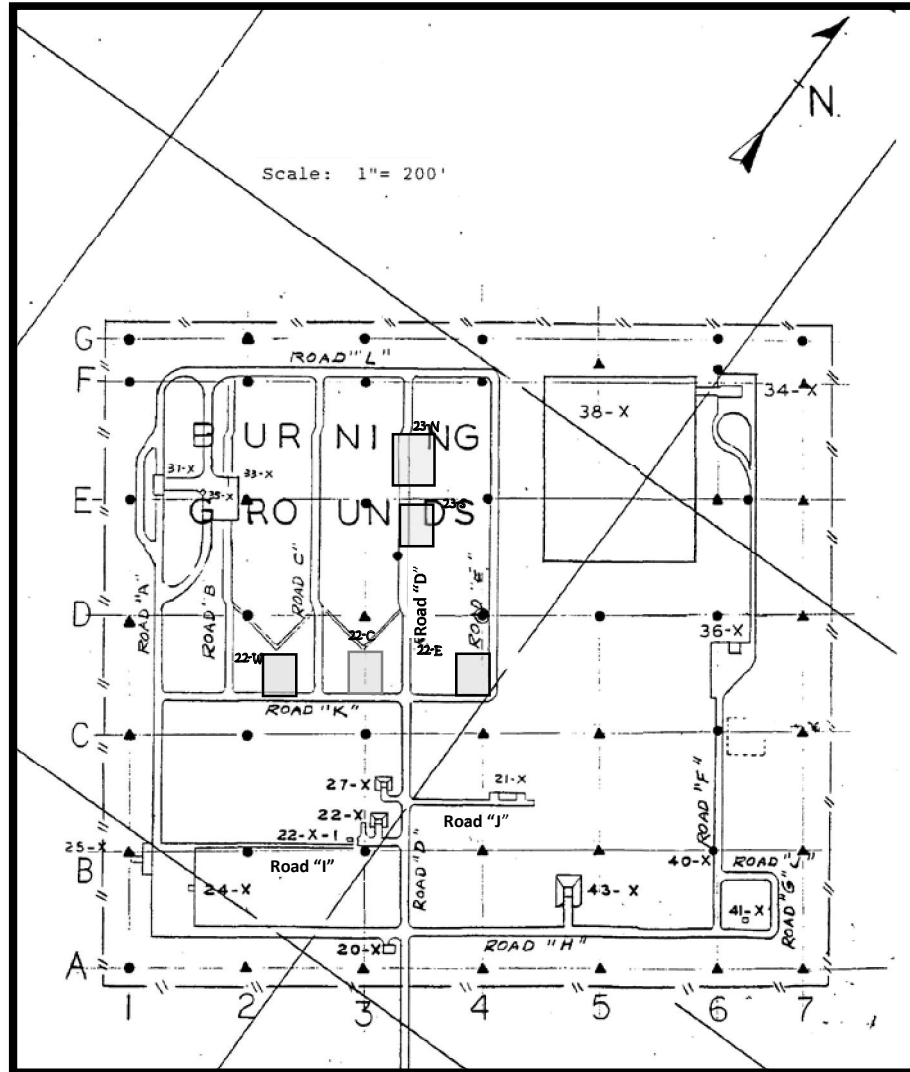


Figure 1 Active Burning Ground Prior to 1986

Interim Remedial Action Phase III Field Construction at Burning Ground 3

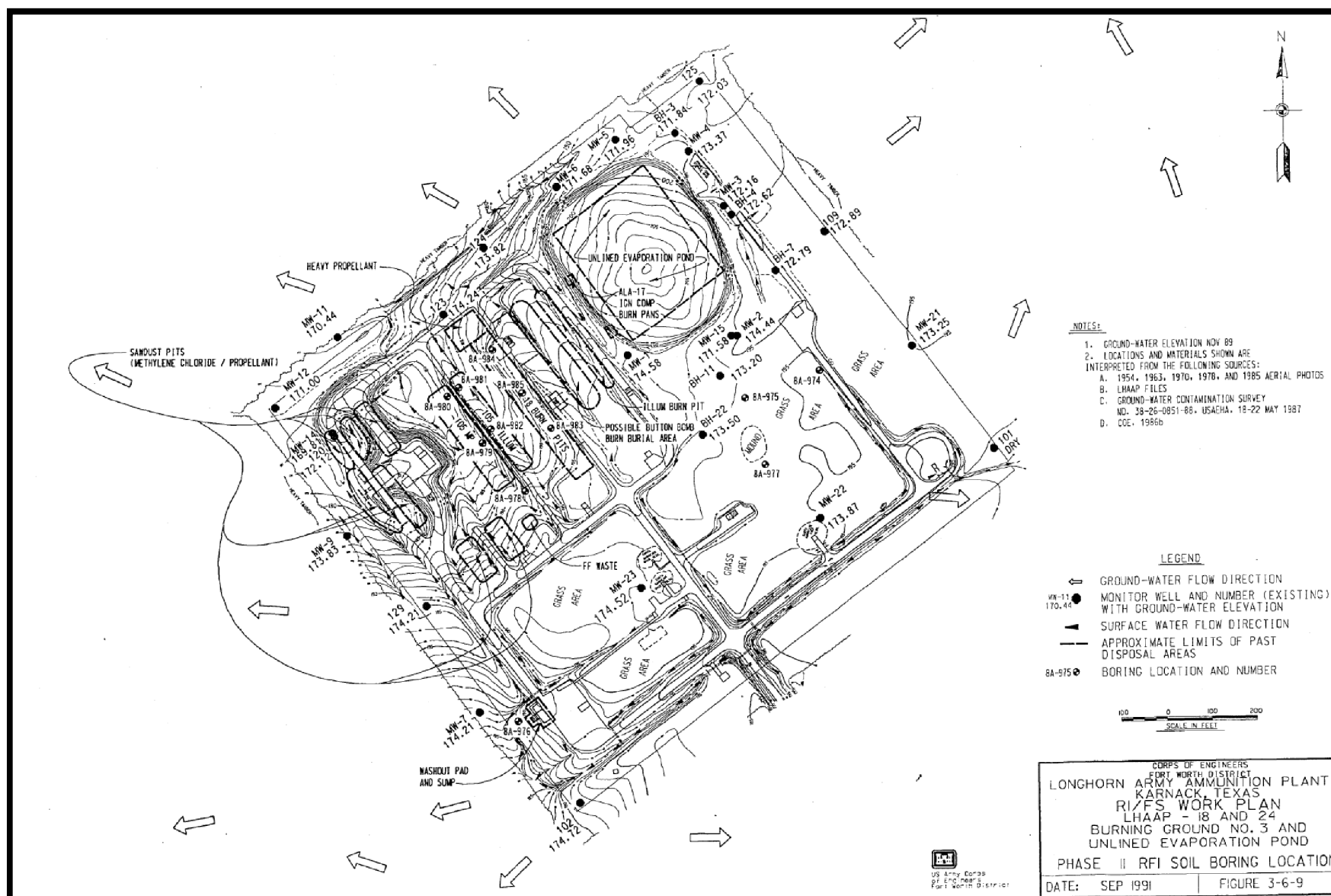
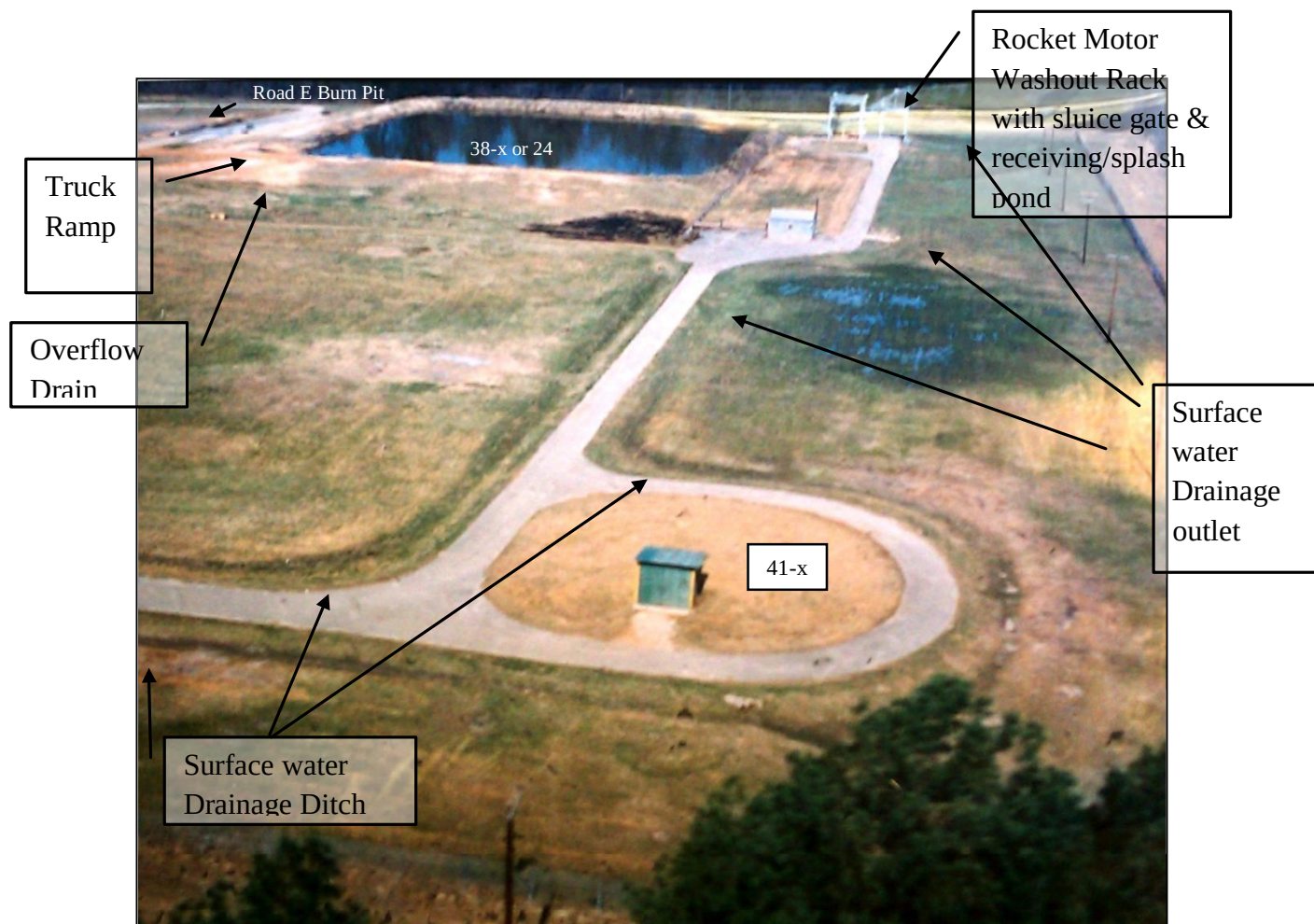


Figure 2 Suspected Past Waste Locations

Interim Remedial Action Phase III Field Construction at Burning Ground 3

3. Previous Remedial Activity.**3.1. Unlined Evaporation Pond.**

The UEP was constructed at the burning ground in 1963 as a holding pond to store flammable, volatile, and pyrotechnic wastes resulting from the washout of rocket motor casings. In 1973, the pond also began receiving wash water containing solvent residues and solids collected from operations involving pyrotechnic material preparation and mixing commonly containing the metallic cat ions aluminum, arsenic, barium, cadmium, chromium, iron, lead, magnesium,



Picture 1 The UEP Prior to Closure Looking Northwest

sodium, strontium, and zinc; nonmetallic anions including nitrite, nitrate, perchlorate, and phosphate, and; various organic solvents such as acetone, 1,1,1- trichloroethane, trichloroethene, ethyl alcohol, methyl ethyl ketone, methylene chloride, and toluene.

This pond was closed in 1985 due to concerns of barium contaminating surface water. The water was pumped out and sent for disposal in a deep injection well. The sludge was mixed with portland cement to achieve a workable consistency. A total volume of 8,116 cy was removed

Interim Remedial Action Phase III Field Construction at Burning Ground 3

and sent to a permitted landfill owned and operated by Chemical Waste Management, Inc. in Carlyss, Louisiana. The pond was closed with a 4 foot clay layer and topsoil with vegetative cover. It has been verified from existing data documenting the 1986 closure of the UEP that VOCs were not parameters for determining clean closure of the unit although testing of the UEP water and sediments for VOC's was performed before closure. A *Closure Report, Unlined Evaporation Pond*, published by the U. S. Army Corps of Engineers (1986).is is the Administrative Record and **Closure of an Unlined Evaporation Pond:** a Case History, 1990 is presented in Appendix B.



Picture 2 Unlined Evaporation pond Looking North at the Rocket Motor Washout Rack

Interim Remedial Action Phase III Field Construction at Burning Ground 3



Picture 3 From the Rocket Motor Washout Rack Looking South

Interim Remedial Action Phase III Field Construction at Burning Ground 3

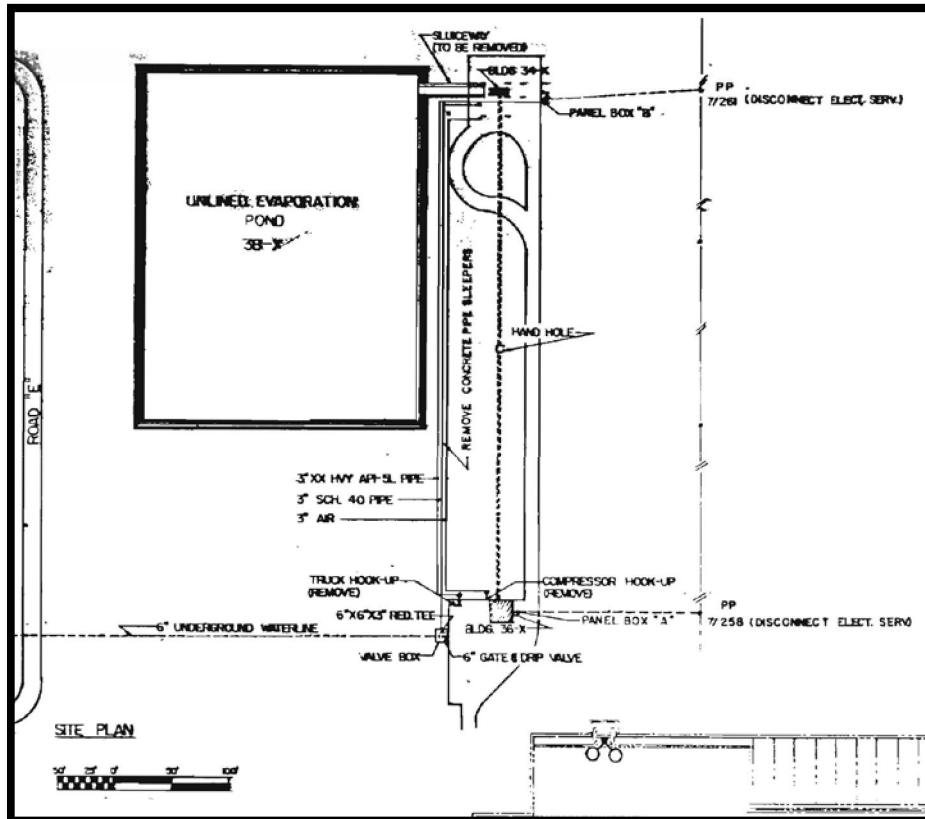


Figure 3 UEP & Rocket Motor Washout Rack Prior to closure

3.2. Air Curtain Destructor (ACD)

An Air Curtain Destructor (ACD) was built in 1979 for the purpose of disposing of explosive-contaminated wastes by burning. Use of burn pits and trenches was reportedly discontinued in 1984 and subsequent burning took place in aboveground pans or burning cages. When the ACD was built muck from burn pits under the foundation was excavated and disposed off site.

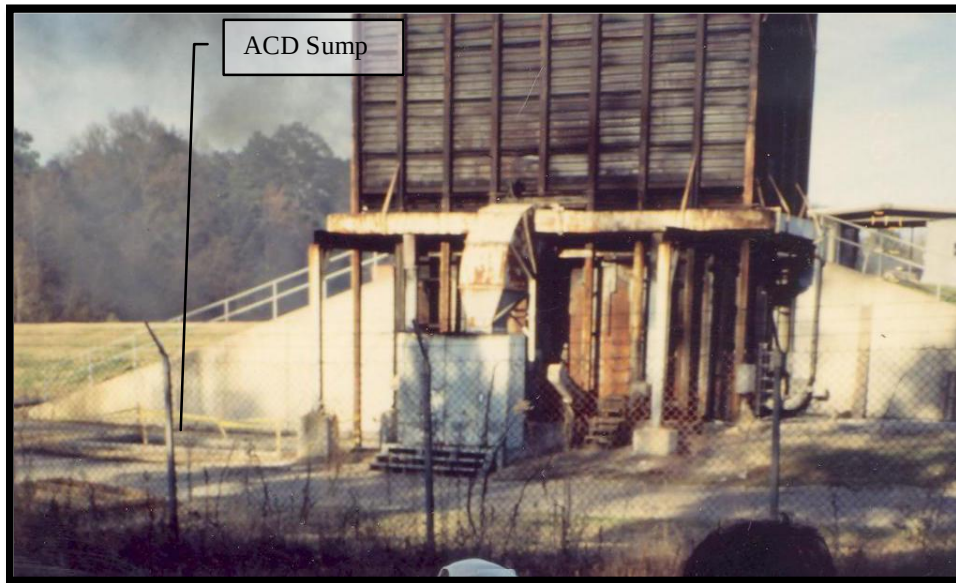
The main operating principle of the ACD is the high velocity air (curtain) blown across and into the upper portion of the combustion chamber. This powerful curtain of air has two effects. First, the high volume of air causes over oxygenation of the fire, and secondly the high velocity airflow over the combustion chamber entraps particulates (smoke), which then completes combustion in the combustion chamber, thus limiting emissions and smoke. The high turbulence along with increased combustion time and high temperatures results in a more complete combustion and significantly

Interim Remedial Action Phase III Field Construction at Burning Ground 3

reduced air emissions.



Picture 4 ACD Looking north - 1994 – shows wagon loaded with off spec production material and control building



Picture 5 West side of ACD -1993

A RCRA Interim Status Hazardous Waste Permit for the thermal treatment of Pyrotechnics, Explosives, and Propellant (PEP) wastes at Burning Ground No. 3 was issued to LHAAP on 7 February 1992.

Interim Remedial Action Phase III Field Construction at Burning Ground 3

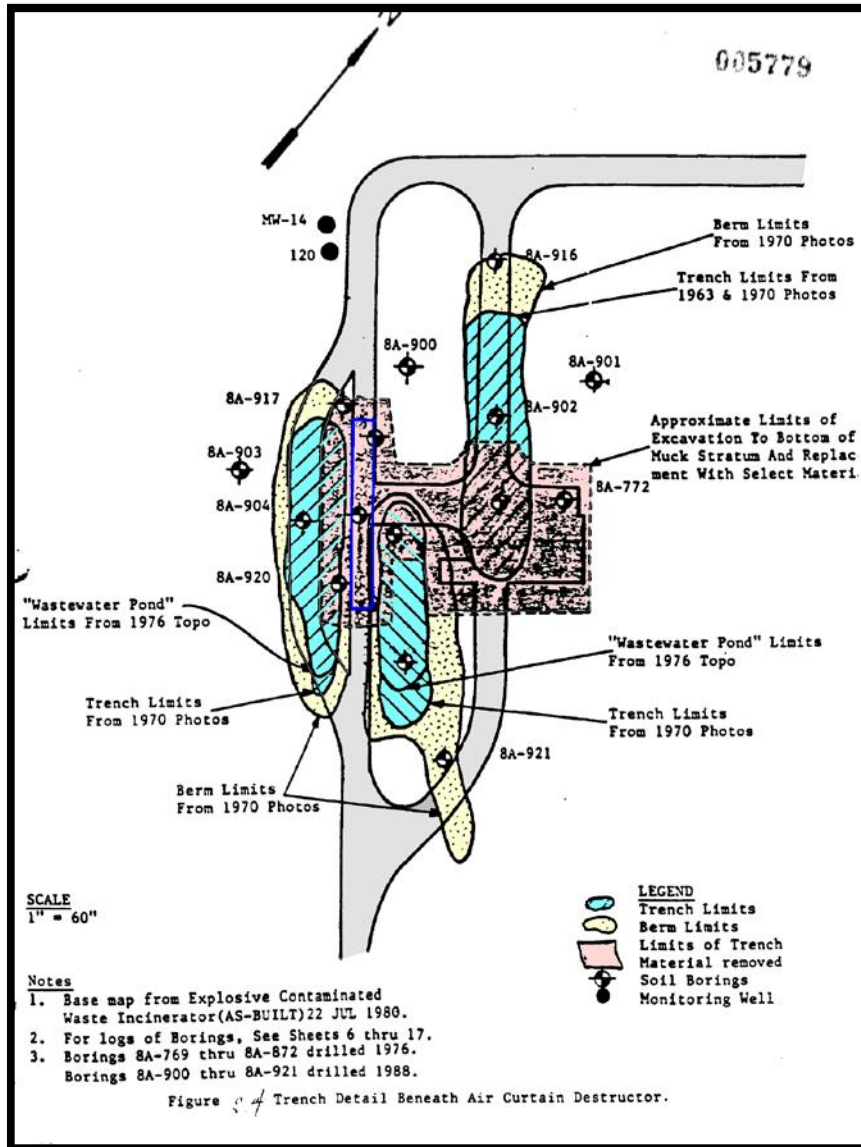


Figure 4 ACD Burn Pits Prior to IRA

Use of the burning ground was discontinued in 1997. Final closure of the burning cages was completed in 1999.

Interim Remedial Action Phase III Field Construction at Burning Ground 3

4. Timeline for BG 3 Through IRA Construction

Date	Activity	Admin Record
1955	Burning Ground is Operational	yes
1963	Rocket Motor Washout Pond is installed	yes
1976	Environmental Investigations Begin	yes
1985	Closed the Unlined Evaporation Pond under RCRA for Heavy Metals	Yes& Appendix B
Sep-91	Phase I RI/FS Workplan	Appendix C
Dec-91	Federal Facilities Agreement	yes
May-93	Final Data Summary Report for investigation from 1976 to 1992	yes
Sep-93	Final Addendum to RI/FS Workplan	Yes & Appendix C
Nov-93	Additional RI	Appendix C & D
Nov- 93	Conceptual IRA Design	Appendix A
Dec-93	EA for IRA completed	yes
Feb-94	Phase 1 BG 3 - Treatability Studies	Appendix D
Apr-94	Phase II Pilot Study (ICT1, ICT2, HEW, & VEW)	Appendix E
Jul-94	IRA Proposed Plan	yes
Sep-94	IRA Final Workplan	yes
Jul-95	Completed 20 new borings for source material outside	Appendix E
Oct-95	Completed 101 borings for ICT Design	Appendix I
Dec-95	IRA ROD	yes
Dec-96	Construction of GWTP	yes
Apr-97	Construction of LTTP	yes
Jun-97	Soil Source Removal	Appendix J
Nov-97	ICT Construction	Appendix H & I
Feb-98	Dismantle LTTP	yes
Apr-98	GWTP Operational	yes

Interim Remedial Action Phase III Field Construction at Burning Ground 3

A ROD was finalized in 1995 to remove and thermally treat source material. The ROD also required for groundwater to be pumped and treated in an onsite Groundwater Treatment Plant (GWTP). LHAAP was closed in 1997, subsequently, the use of the Burning Ground was ceased in 1997 with the final open burning of all waste PEP. .

IRA The IRA construction start date at Site 18/24 was 12 February 1997. The project was to remove and treat contaminated soil, install a series of interceptor collection trenches & extraction wells, and build a groundwater treatment plant for treatment of the groundwater extracted from the site.

5. Preliminary & Design Activities Required to Accomplish the IRA:

- Installed 4 monitoring wells (AWD-1 through AWD-4)
- 3 Test pits for treatability studies
- Revising the Final Rod
- Writing the IRA Work Plan
- Clearing & constructing the treatment plant site
- Constructing a potable water line to the site
- Constructing a gas line to the treatment plant site
- Clearing & constructing access roads around the outside of the Burning Grounds
- Sampling of monitor wells in Site 18/24 has been carried out in 1980, 1982, 1987, 1993, 1995, and 1998.
- Drilling of 20 soil borings to investigate the potential presence of other source material.
- Drilling 101 borings for Design of the ICT's
- Dow Environmental prepared the Phase III workplan on December 28, 1995.
-The workplan generally followed the ROD, but a couple of exceptions apply. The Phase III workplan, incorporated information from the ROD that a combination of 5,000 feet of ICT's and eight vertical extraction wells would be used to collect onsite shallow groundwater at Site 18/24. The vertical extraction wells were not installed.

6. Source Materials Excavation, Treatment, And Disposal Activities:

- Construction of a Soil Handling and Dewatering Pad for ICT excavated soils and contaminated soils and source material.
- Construction of a storage pad for treated soils and source material.
- Mobilization, setup, and performance testing of a Low Temperature Thermal Desorption (LTTD) soil treatment system.
- Excavation and treatment of source material. Soil treatment took place from February 22, 1997 through December 10, 1997.
- UXO Removal- included munitions casings and button bombs
- Perimeter air monitoring of site during source material excavation.
- Disposal/placement of treated soils and source material.
- LTTD Proof of Performance test conducted on February 13-15, 1997.

Interim Remedial Action Phase III Field Construction at Burning Ground 3

Soil treated included:

- From Quality Control Dailey (QC) Reports: 29,744 cubic yards $\approx$ 30,000 cubic yards source material

- o The following from the QC Reports

• Total cy from NW of burn cage	105
• Total cy for a long Road E	975.5
• Total cy for area along Road D to C	4,696
• Total cy for No Location in June 1997	981
• Total cy for North of ACD	459
• total cy adjacent to ACD	14,927
• Total cy for No info in September-October 1997	6,570
• Total cy from ICT's	1,030

- 105 yards of material from burning cages
- 1,157 yards of material from floor of storage and treatment areas. Perimeter air monitoring during excavation and soil treatment.
- Disposal/placement of treated soils and source material on Landfills Site 12 and Site 16.
- Restoring the site by backfilling source material excavations, were filled using the ICT excavated material and importing clean fill material.
- Restoring utility lines.
- The source material excavations were "capped" with 18 inches of "clean" offsite clay.

7. The Tasks For The Groundwater Collection System

- The Interceptor Collection Trench (ICT) system in Burning Ground No. 3 is composed of 14 ICT with 28 sections ranging in length between 100 feet and 200 feet.
- Approximately 5,075 linear feet of trench were installed within and around three sides of the Burning Ground.
- Estimated excavation of 14,820 cubic yards of soil to construct the ICTs.
- All of the material excavated from the ICT other than 1,030 cubic yards was used to backfill the source material excavations. Placement of clean ICT material, evaluated by sampling, into source material excavations during August 1997. ICT material was sampled to meet a 95% confidence level that it was clean.
- The last ICT well was developed in October 1997.
- The trench sections extend approximately 25 to 55 feet in depth, most of the trenches are as deep as the confining clay layer of the shallow groundwater zone.
- Piezometers were installed for evaluation of ICT effectiveness. Groundwater levels are measured monthly in twelve piezometers and approximately forty-seven monitoring wells.
- Twenty-eight sumps and pumps collect water from the ICT sections. The ICT's are piped into dual wall containment piping and transferred to a 300,000-gallon equalization holding tank at the GWTP. Electronic probes control water levels within the trenches. The probes are set at various levels to activate or deactivate the electric pumps and to

Interim Remedial Action Phase III Field Construction at Burning Ground 3

maximize groundwater capture. As the level of the probes are adjusted, the groundwater level and probe settings are placed in maintenance records.

- Installation of a piping network to collect the extracted water and convey it to the GWTP. Piping system composed of HDPE dual wall containment pipe.
- Evaluated the hydraulic effectiveness of the collection system.

Groundwater Treatment System Activities:

- Construction of the GWTP to treat the extracted groundwater.
- Installation of a piping system to convey the treated water to Harrison Bayou.
- Starting up the GWTP.
- GWTP Proof of Performance test conducted on March 24, 1998. The test was conducted with the GWTP operating at full capacity.
- Operating and maintaining the GWTP for 1st year prove-out to May 1998.
- A pipeline for treated effluent was installed to a lined pond, formerly the INF Pond. The pond capacity is about 3-million gallons. The pond is used for a holding pond when flow in Harrison Bayou does not allow for discharge of effluent to the bayou. This allows the GWTP more latitude in operating when the plant would not otherwise be able to operate.

8. Cost of IRA Project

Total estimated IRA cost of the project is \$36,890,000 from 1993 to 1998. LTTD of the source material/soil treatment was conducted in 1997 only for a total costs of \$4,311,055. Many expenses were associated with the operation of the LTTD including, LTTD Setup & teardown, soil excavation, soil treatment, soil backfill, transport, and air monitoring. Labor costs were approximately \$750,000. Other costs include subcontracts & materials. Excavation of source material and backfill cost were \$871,052.

9. Contract Activities That Were Not For BG 3 IRA

- Construction of tank, tank containment, and HDPE dual wall piping system at Site 16 during May 1997
- It was found that water from Site 16 has a yellow color that was difficult to remove in the GWTP process. A Model 8 granular carbon adsorption system manufactured by Calgon was installed as an “end of pipe” treatment. Two vessels were installed with a capacity of 10,000 pounds each
- As a treatability study under an accelerated RI/FS to keep landfill leachate from entering Harrison Bayou, two vertical extraction wells were installed in 1996, and an additional six vertical extraction wells were installed in 1997. Groundwater extracted from these wells is pumped to the GWTP and treated for release.

Interim Remedial Action Phase III Field Construction at Burning Ground 3

10. Non-CERCLA Removal Activities

Several have taken place at the site. Each RCRA permitted unit and 90-day permit exempt RCRA unit at the site has undergone a RCRA closure in accordance with closure plans approved by the TNRCC.

There were five burning cages located at the Burning Ground. The burning cages were permitted as interim status units in the LHAAP Hazardous Waste Permit Number 50195. Radian International removed the burning cage structures in 1998 and subsequent RCRA closure of the units took place between 1998 and 2001.



Picture 6 22W Burn Cage in 1994



Picture 7 All 3 Burn Cages Looking North

Interim Remedial Action Phase III Field Construction at Burning Ground 3



Picture 8 Burn Pan 23N or INF Burn Pan Looking East

Each burning cage was closed in accordance with RCRA closure requirements to the TNRCC Risk Reduction Standard in effect at the time. Risk Reduction Standards are the medium-specific concentrations (MSC), standards, and criteria for health-based closure/remediation and are based on Title 30 Chapter 335 Subchapter S.

Burning Cages & Burn Pan Closure					
Cage Permit Number	Cage Notice of Registration (NOR) Number	Cage Description	Closure Date	Closure Status	Reason for Risk Reduction Status
No. 4	NOR 003	East Burning Cage	2 Oct. 1998	RR2S	Metals
No. 5	NOR 155	Center Burning Cage	2 Oct. 1998	RR2S	Metals, Volatiles
No. 6	NOR 156	West Burning Cage	27-May 1999	RR3S due to the elevated levels of contamination from volatiles	Volatiles, Semi-Volatiles
No. 7	NOR 157	North Burning Cage(INF)	2 Oct. 1998	RR2S	Metals
No. 8	NOR 158	South Burning Pan	2 Oct. 1998	RR2S	Volatiles, RDX

The Risk Reduction Standards may be defined as follows:

- Risk Reduction Standard No. 1 (RR1S) – Closure/Remediation to Background
- Risk Reduction Standard No. 2 (RR2S) – Closure/Remediation to Health-Based Standards and Criteria (*Closure to RR2S requires a deed record of the site but no post closure care is required*)
- Risk Reduction Standard No. 3 (RR3S) – Closure/Remediation with Controls (*Closure to RR3S requires a corrective measure study by the property owner to determine an acceptable remedy or remedies. Once the RR3S remedy is achieved, a document to fulfill the requirements of a deed record is required.*)

Interim Remedial Action Phase III Field Construction at Burning Ground 3

- Once a property owner has a closure to RR1S approved by the State regulatory agency, no further action is necessary by the property owner.

In accordance with the closure plan, the structures were removed (by IRA Contractor) and decontaminated and surrounding surface soils were sampled for metals, explosives, volatiles, perchlorate, and explosives. Where contamination was present above Risk Reduction Standard No. 2 (RR2S) concentrations, the soils were removed for disposal offsite to a permitted waste Treatment Storage Disposal Facility (TSDF). *Soils at each burning cage location contaminated with volatiles were not removed due to widespread contamination at the burning ground and the fact that the units are present on a CERCLA site undergoing remedial action for volatiles.* The location of each cage was surveyed and deed recorded after closure. Table xx describes each cage identification and final closure date.

Note: Comments in the closure report indicate visible areas of contamination were evident in the soils several feet beneath the area of the burning cage and that contamination in the soils was from previous waste disposal activities rather than contamination from the burning cage.



Road D Excavation

Points of Reference

1. IRA Work Plan
2. QC Reports (list excavations in borings 39 to 45 from 3-22-97 to 5-5-97 for at least 4,444 cy)
3. Eye Witness (C Edgmon)
4. Photographs
5. Aerial Photograph changes

ACD Area Excavation

Points of Reference (depths to 15 feet)

1. IRA Work Plan
2. QC Reports (lists excavations adjacent to ACD from 6-11-97 to 9-11-97 with removal of 14,927 cy)
3. Eye Witness (C Edgmon)
4. Photographs
5. Aerial Photograph
6. Changes in topography



Boring 811 and 875 Excavation

(3 to 4 feet deep)

References

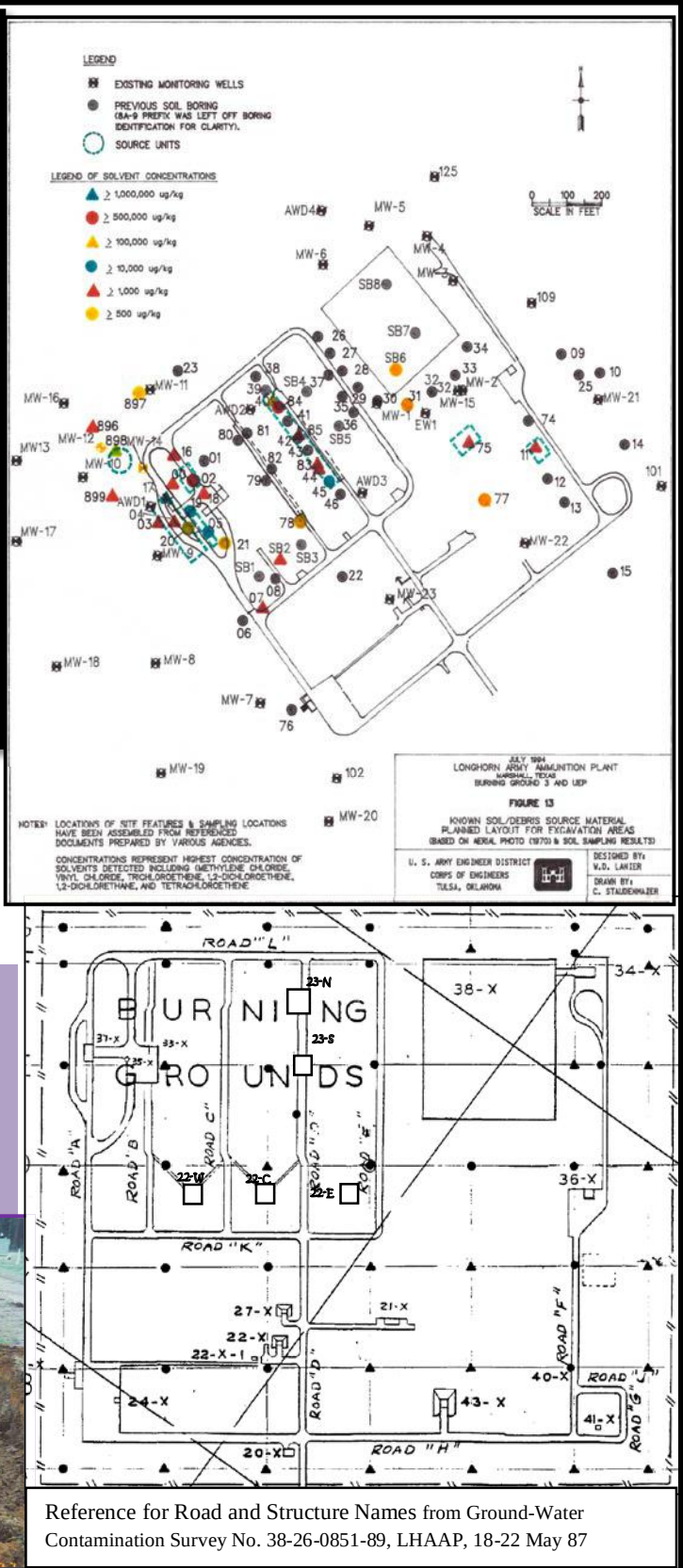
1. IRA Work Plan
2. Eye Witness (C Edgmon)



Road E Excavation

References

1. IRA Work Plan
2. QC Reports
3. Eye Witness (C Edgmon)
4. Photographs



Interim Remedial Action Source Material Excavation Approximate Locations Burning Ground 3 (LHAAP 18/24) Longhorn Army Ammunition Plant			
US Army Corps of Engineer Tulsa District Tulsa, OK		Excavations performed by Dow Inc./Radian 1997 under contract to USACE Tulsa District	Designed by: W. D. Lanier PE Date October 2012

Appendix A

Conceptual Design Report

1993, Tulsa District USACE

ASSUMED REMEDIATION FOR
BURNING GROUND 3 & UNLINED EVAPORATION POND (UEP)
LHAAP 18 & 24
Longhorn Army Ammunition Plant
18 March 1993

1. General. The information provided below is for an initial cost estimate of the Interim Remedial Action at Longhorn Army Ammunition Plant (LHAAP) 18 & 24. This site is a operable unit of the LHAAP CERCLA site and it is also a RCRA site. This work will be performed as an Interim Remedial Action utilizing a Cost Plus Award Fee remediation contract to remove and control migration of extremely contaminated groundwater and soils in the shallow zone (less than 25 ft. in depth). Any remaining contamination will be remediated under the ongoing RI/FS. The work will include groundwater collection (and treatment) of the shallow water table at the site and excavation (and treatment) of the buried contaminated soils and debris present at the site. Work items will be broken down by Groundwater Collection, Water treatment, Soil Excavation, Soil Treatment, and Soil Placement. Cost estimates for the water and soil remediation should be provided separately so that they can be awarded and funded separately if needed. Assume modified level C for health and safety requirements.

2. Groundwater Collection. The groundwater will be collected via Interceptor/Collection Trenches (ICT) with sumps that pump into a piping system to go to the treatment plant. The trenches will have a low permeability liner on the outside to avoid collection of the cleaner water that does not require treatment at this time. The trenches will also operate as a surface water collection to prevent off site migration of any contaminated precipitation during the excavation.

- a. 6,500 feet long
- b. 25 feet deep
- c. The outside (on the side away from the site) ICT (4,800 feet) will have an outer vertical liner (high density polyethylene (HDPE)), a synthetic geogrid drainage material, a nonwoven filter fabric (sufficient to prevent clay particles from clogging the geogrid), and a slotted fiberglass epoxy (to resist solvent degradation) collection pipe at the bottom.
- d. The inner ICT (1,700) will have a synthetic geogrid drainage material sandwiched between two nonwoven filter fabric layers (same as above) and a slotted fiberglass epoxy pipe with a filter sock at the bottom.
- e. Soil that is excavated for the ICT will be stored on site for treatment.
- f. Seven sumps that are 30 feet deep with submersible pumps with flotation switches with a flow rate of 5 gpm
- g. 3600 feet of fiberglass epoxy collection piping with fittings

3. Water treatment.

- a. Assume a flow of 15,000 to 20,000 gpd
 - b. The treatment units should be transportable (so that

- they may be utilized at other sites on LHAAP if possible
 - c. Metals precipitation - ferrous sulphite
 - d. Volatile organic removal - air stripper
 - e. Off-gas treatment on carbon
 - f. Sand filter required
 - g. Table with primary contaminants attached
4. Soil Excavation.
- a. Removal of a 4 ft thick layer of clay with an area of 150,000 sf - to be set aside during the excavation then replaced
 - b. Excavate 261,000 cy of contaminated material with a surface area of 7.05×10^6 sf and an average depth of 15 feet
 - c. Table with primary contaminants attached
 - d. Typical section is attached
5. Soil Treatment.
- a. Units should be sized to handle up to 5,000 cy per working day
 - b. A drying bed will be required for the first stage - all water will be collected and sent through the water treatment plant
 - c. Mechanical screens will be the second stage
 - d. Debris will be decontaminated in a steam washing facility for off site non-hazardous disposal assume 5% of excavated volume
 - e. A shredder will be required for 20% of the volume
 - f. A low temperature volatile extraction with a auger kiln will be used to remove volatile organic below action limits
 - g. A mixing unit or pug mill will be required to stabilize soil with lime (at 15%) to prevent leaching of heavy metals
6. Soil Placement.
- a. Soil will be placed in 6 inch lifts to fill the voids left from the excavation
 - b. A six inch topsoil layer will be placed over fill with a suitable vegetative layer
 - c. Final grade will be constructed to blend with the remainder of the site and provide adequate drainage (no ponding)

Appendix B

Closure of an Unlined Evaporation Pond: a Case History,

1990



Closure of an Unlined Evaporation Pond: a Case History

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ABSTRACT

In 1985, the Fort Worth District, Corps of Engineers, successfully permitted and executed the closure of an unlined evaporation pond at the Longhorn Army Ammunition Plant in east Texas. The pond, constructed in 1963 at the site of an active explosive waste-burning ground area, had been used to store explosive wastes resulting from the washout of rocket motor casings and solvent residues from operations involving pyrotechnic material preparation and mixing. Because operation of the unlined evaporation pond appeared to be primarily responsible for locally contaminating the ground water, the Army ceased operation of the pond in 1984 and began formal closure activities for the unit as a Resource Conservation and Recovery Act (RCRA) interim status surface impoundment. Under Phase I of the closure contract, a total of 1,877,113 gal of wastewater was removed and shipped via tank truck to a permitted disposal well some 80 mi from the site. The Phase II contract consisted of removal and transporting of contaminated sludges and soils to a permitted hazardous waste disposal site, backfilling the pond, installing a filter drain system, and turfing. A total of 8,116 yd³ of material was excavated and shipped from the site.

INTRODUCTION

In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA), PL 94-580, as amended, which mandated the development of regulations governing the actions of owners or operators who generate, transport, treat, store, or dispose of solid wastes. The U.S. Environmental Protection Agency (EPA) was charged with the responsibility for development of the regulations. Executive Order No. 12088, issued October 13, 1978, directed all Federal installations to comply with all solid and

hazardous waste management regulations as developed under the RCRA. Most Federal installations, when ordered to comply with RCRA regulations, required technical assistance in addressing the requirements of the RCRA as it pertained to their individual situation. The Huntsville Division was selected by the Army as the lead organization within the Corps of Engineers in the administration of technical assistance to Federal installations. The Huntsville Division, in most instances, contracts with qualified consulting engineer firms for the

permitting and design of hazardous waste management facilities, including closure plans for formerly used facilities. Closure plans for the unlined evaporation pond at the Longhorn Army Ammunition Plant were prepared by Kindle, Stone & Associates, Marshall, Texas. Permitting, final design, and plans and specifications were prepared by the Fort Worth District, Corps of Engineers. Final cleanup and construction, also managed and supervised by the Fort Worth District, were documented in *Closure Report: Unlined Evaporation Pond*, published in 1986 by the U. S. Army Corps of Engineers.

GENERAL DESCRIPTION OF PROJECT

The Longhorn Army Ammunition Plant is located in Harrison County, near the town of Karnack in northeast Texas (Figure 1). The facility is a government-owned, contractor-operated industrial installation under the jurisdiction of the U.S. Army Armament, Munitions and Chemical Command, with the primary mission to load, assemble, and pack pyrotechnics, illuminating/signal ammunition, and solid propellant motors. The project involved the closure of an unlined evaporation pond located within the boundaries of the Longhorn installation. The pond is located within a 34.5-acre active burning ground, a secured area used since 1955 for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and combustible solvent wastes by open burning, incineration, evaporation, and burial.

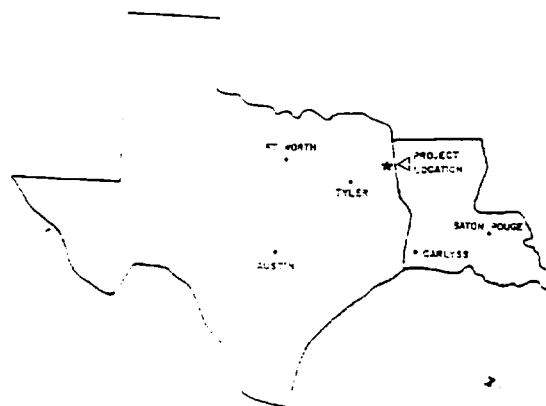


Figure 1. Location of the Longhorn Army Ammunition Plant in northeast Texas.

The unlined evaporation pond, shown in Figure 2, was approximately 300 ft by 260 ft, and at the time of closure contained approximately 1.9 million gallons of wastewater generated by wash down of the plant's blending and mixing operations over a period of 20 yr. The pond received wash water containing solvent residues and solids collected from areas involved in pyrotechnic material preparation and mixing. Chemical analyses of the contents of the pond resulted in its being identified as a hazardous waste storage facility. Additionally, ground water, encountered at a depth of about 22 ft below ground surface, was shown to have been contaminated by percolation from the pond. Use of the pond for

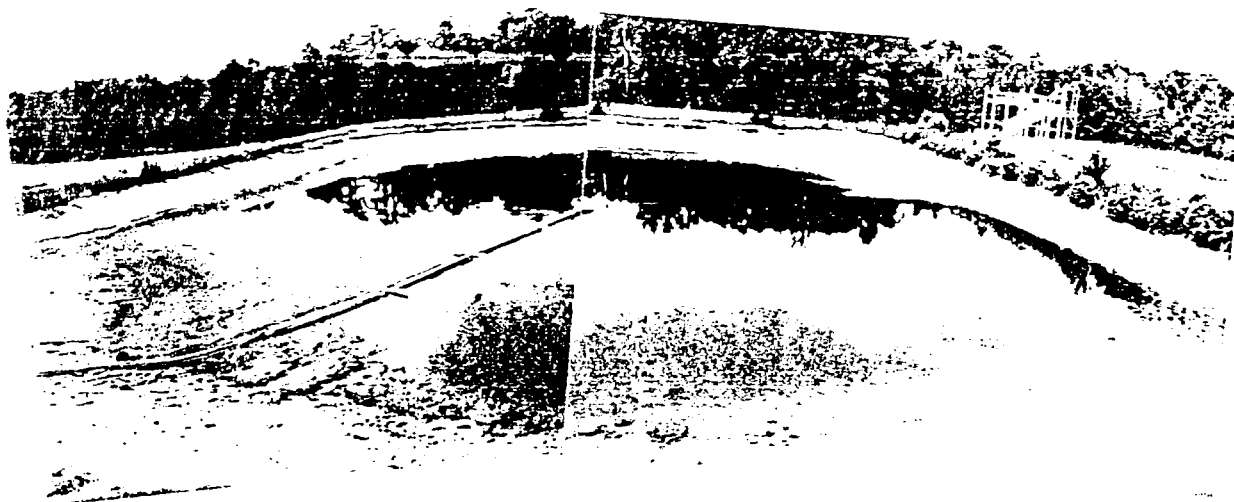


Figure 2. View of unlined evaporation pond during Phase 1 unwatering. Flexible suction line is supported by pontoons extending approximately 80 ft out into the pond. Assembly at right is rocket launch motor wash facility.

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disposal of waste was terminated on June 1, 1984. Closure of the facility was accomplished in two phases: Phase I consisted of removal and disposal of the wastewater in the pond and Phase II consisted of removal of sludges and restoration of the pond site.

GEOLOGIC SETTING

The Longhorn Army Ammunition Plant is physiographically situated within the East Texas Timber Belt, an area of land characterized by a sandy, rolling, forested surface that is underlain by the Wilcox Group of Tertiary age. The Wilcox has a maximum thickness of 700 ft, and consists mostly of fine-to medium-grained sands interbedded with a considerable amount of clay and seams of lignite. Although sand beds up to 50 ft thick are present locally, individual beds are generally lenticular, with lenses of clay, sand, and silt pinching out or grading into each other over very short distances, making correlation difficult. The Wilcox yields small (< 50 gal/min) to moderate (50–500 gal/min) quantities of fresh water to wells throughout the county. The

Group, a predominantly calcareous, non-water-bearing clay conformably underlies the Wilcox. The beds dip gently in a westward direction.

CLOSURE REQUIREMENTS

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government. Subpart G of Title 40 CFR, Part 264, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities* (U. S. Environmental Protection Agency, 1958a), states that the owner or operator of a hazardous waste management facility must have a written closure plan which is approved by the EPA Regional Administrator. The purpose of the closure plan is to assure that subsequent to facility closure, there will be no need for further maintenance of the facility, and the threat to human health and the environment will be controlled, minimized, or eliminated. The Texas Department of Water Resources (since reorganized under the name Texas Water Commission) was granted primacy by the EPA Regional Administrator for the authority to approve or reject a proposed closure plan for facilities located within State boundaries. The Closure Plan for the Longhorn Unlined Evaporation Pond was prepared by Kindle Stone &

Associates, for the Corps of Engineers, Huntsville Division, and was submitted to the State of Texas for approval. The Texas Department of Water Resources approved the Closure Plan on April 19, 1985. Concurrent with the preparation and submittal of the Closure Plan, the Fort Worth District Corps of Engineers, was requested by the Huntsville Division to assist in the closure planning by securing the necessary permits to dewater the pond and to advertise, award, and administer the contract for Phase I dewatering. Subsequently, the Fort Worth District was tasked with the award of the Phase II closure contract and management of the two consecutive contracts.

INVESTIGATIONS AND TESTING

Special studies to characterize wastes contained in the pond were conducted by the U.S. Army Environmental Hygiene Agency in 1976, 1981, and 1982. Studies included analyses of the aqueous layer, the sediment layer, and the underlying soil layer within the pond limits. The results of these studies, which were presented in *Hazardous Waste Special Study No. 37-26-0291-84* published by the U.S. Army Environmental Hygiene Agency in October 1982, concluded that the pond should be classified as a hazardous waste storage facility, in spite of the fact that test results showed only the floating material in the pond to be marginally hazardous.

A current chemical analysis was required for formulation of the Closure Plan and for the application for a temporary permit from the Texas Department of Water Resources to dispose of the wastewater in the pond. In June 1984, the Fort Worth District, assisted by the Corps of Engineers Southwestern Division Laboratory in Dallas, Texas, collected samples of the wastewater and performed chemical analyses. Results of the analyses were documented in *Laboratory Report No. 13845*. The pollutants tested for during these analyses were a reflection of the pollutants previously documented in the 1982 report. Table 1 shows a comparison of the levels of contaminants in the pond's aqueous layer, as detected during the various studies, to the maximum contaminant levels (MCL) for drinking water as specified by the *National Interim Primary Drinking Water Regulations* (U. S. Environmental Protection Agency, 1985b), and the recommend contaminant levels specified by the *National Secondary Drinking Water Regulations* (U. S. Environmental Protection Agency, 1985c).

Table 1. Comparison of the results of chemical analyses of the UEP prior to closure of the UEP.

Parameters	NIPWR/NSDWR Standards	Average Values			
		1976 ¹	1980 ²	1982 ³	1984 ⁴
pH	6.5-8.5	4.1	9.43	10.75	10.14
Total Dissolved Solids	500	2711	1231	1565	1100
Chloride	250	817	368	407	194
Sulphate	250	23	< 0.5	53	15.4
Fluoride	1.6	0.11	0.18	0.2	1.0
MBAS	0.5	ND	0.35	1.29	0.011
Nitrate-N	10.0	ND	138	204	0.64
Arsenic	0.05	ND	ND	0.002	0.1
Barium	1.0	20.2	9.9	39.5	24.2
Cadmium	0.01	0.011	ND	0.0013	0.0073
Chromium	0.05	ND	ND	0.398	0.01
Copper	1.0	ND	ND	0.09	0.01
Iron	0.3	0.51	0.21	4.8	0.126
Lead	0.05	0.09	ND	0.17	0.106
Manganese	0.05	0.145	0.076	0.11	0.018
Mercury	0.002	0.00014	0.004	0.0005	0.005
Selenium	0.01	ND	ND	ND	0.004
Silver	0.05	ND	ND	0.028	0.01
Zinc	5.0	0.046	0.036	0.619	0.04

Values shown in mg/liter (except pH)

¹Average of 3 samples

²Average of 2 samples

³Average of 16 samples

⁴Average of 5 samples

ND = Not Detected

The comparison shows that approximately half of the contaminants in the pond's aqueous layer exceeded primary and secondary drinking water standards at some point in time. The gradual increase in some parameters, while others fluctuated, was caused by the fact that wastes discharged into the pond varied as a result of changes in the production schedule of pyrotechnic ammunition.

Samples were collected from the floating material in the pond, the sediment layer on the pond's bottom, and the soil layer beneath the pond, and were characterized for Extraction Procedure (EP) Toxicity, selected inorganic standard parameters, and a number of organic compounds. Results of the testing were published in *Hazardous Waste Special Study No. 37-26-0291-84* (U.S. Army Environmental Hygiene Agency, 1982). Table 2 shows the range and average values of contaminants found in the leachate during EP Toxicity testing on the various pond layers.

None of the samples leached out detectable amounts of the heavy metals cadmium, selenium, or silver. Quantities of arsenic, chromium, lead, and mercury detected in the leachate were well below their re-

spective EP Toxicity MCL. The leachate from one of 17 sediment samples contained 94 mg/liter of barium and a composite sample of the floating material leached out 100 mg/liter of barium. While neither value exceeded the EP Toxicity MCL for barium (100 mg/liter), the sample of floating material was considered hazardous with respect to EP Toxicity as defined by Title 40, CFR, Part 261, *Identification and Listing of Hazardous Waste* (U. S. Environmental Protection Agency, 1985d).

Each layer of the pond was analyzed for a number of standard inorganic parameters. Contaminants found in the pond's sediment layer and the floating material showing higher concentrations included chemical oxygen demand, nitrates, elemental phosphorus, aluminum, barium, chromium, iron, lead, magnesium, and sodium. Some of the same inorganic contaminants, including chemical oxygen demand, nitrates, aluminum, iron, magnesium, and sodium, were found in lower concentrations in the soil layer.

Of the organics for which tests were conducted, some were found consistently within one layer, but

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Table 2. Results of Toxic Extraction Procedure analyses prior to UEP closure.

Parameter	Sediment Layer Range/Average values ¹	Soil Layer Range/Average values ²	Floating Material ³
Arsenic	ND	ND-0.016 / 0.001	0.027
Barium	4.4-9.4 / 32	1.4-5.1 / 2.8	100
Cadmium	ND	ND	ND
Chromium	0.05-0.64 / 0.17	ND	ND
Lead	0.05-0.64 / 0.1	ND-1.031 / 0.38	0.14
Mercury	ND	0.006-0.007 / 0.0065	ND
Selenium	ND	ND	ND
Silver	ND	ND	ND

All values shown in mg/liter

¹Average of 17 sample points²Average of 16 sample points³One composite sample

ND=Not Detected

were detected consistently in all layers. Organic compounds detected in samples of the aqueous layer included tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene. Organic compounds that appeared in measurable quantities in the sediment layer were phenanthrene, hexachlorobenzene, benzylbutylphthalate, bisphthalate, and diethylphthalate. Organic compounds detected in the soil layer included hexachlorobenzene, bis(2-ethylhexyl)phthalate, and di-n-butyl phthalate.

The Fort Worth District also conducted physical surveys in an attempt to measure the volume of water and sludges in the pond for contract requirements and estimates of volumes to be removed. Sludge thickness and water depth measurements were made at selected points located by back sighting from on-shore control points. A survey rod was lowered from a boat to the estimated top and base of the sludge. Measurements of the base of the sludge proved reasonably accurate; however, measurements of the top of the sludge were not, primarily because of the inability of the rodman to "feel" the top of the sludge which was in the form of a semisuspended jelly-like substance. This inability to detect the contact between water and sludges resulted in errors in the contract estimates. The estimated volume of water in the pond was 2,500,000 gal; the actual volume removed was 1,877,113 gal. The estimated volume of sludges was 4,650 yd³; the actual volume removed was 8,116 yd³.

CLOSURE PLANNING

Because of the uncertainties of being allowed to dispose of treated wastewater into a natural drainage tributary to a water supply reservoir, it was decided that two methods of disposing the wastewater would be evaluated concurrently: treatment and release, and underground injection. If both proposals were approved by the State, the contractor would be given the option on which procedure to employ.

A meeting with members of the Greater Caddo Lake Association, a local group of landowners, was held on February 16, 1985, to discuss the closure. The Army's plan to release the treated wastewater into nearby Harrison Bayou, a feeder stream into Caddo Lake, was viewed with skepticism by some of the members who owned property near the Bayou and downstream near Caddo Lake. In an attempt to alleviate the fears of the locals, the Army assembled a panel of experts to address the concerns of the group. There was little discussion and no objection to deep well injection.

A public hearing was held on February 27, 1985, by the Texas Water Commission in order to hear testimonies in regard to the Temporary Order Application by Longhorn for a permit to discharge the treated wastewater into Harrison Bayou. After posing several questions as to the level of treatment required and the length of time involved for the process, the Commission approved the application. As a result, the Texas Department of Water Resources issued Temporary Order No. 85-7E, dated

Table 3. *Parameters for effluent discharge into Harrison Bayou.*

Parameters	Concentrations (mg/liter)
Total Organic Carbon	≤ 50
Total Suspended Solids	≤ 100
Barium	≤ 4.0
Lead	≤ 1.0

February 27, 1985, which authorized discharge of the wastewater into Harrison Bayou subject to the parameters for effluent discharge shown on Table 3.

In addition, pH of the discharge had to be between 6.0 and 9.0 standard units, and the volume of discharge could not exceed 200,000 gal/day.

The EPA subsequently issued an Administrative Order effective April 2, 1985, which authorized discharge of the wastewater subject to the same parameters as listed in the State Temporary Order.

With all of the planning and coordination efforts accomplished, and the methods of wastewater disposal approved, the State of Texas (Texas Department of Water Resources) approved the Closure Plan on April 19, 1985.

CLOSURE PHASE I - DEWATERING

Closure of the unlined evaporation pond was accomplished in two phases, under separate contracts, which were advertised, awarded, and managed by the Fort Worth District. Phase I consisted of dewatering the pond. Fort Worth issued a Request for Proposals (RFP) from prospective contractors interested in performing the dewatering. The RFP presented existing site conditions, specified the mandatory parameters for release of treated wastewater, and listed two acceptable dewatering schemes: on-site treatment and release, or disposal by deep well injection. After considering all proposals anonymously from a technical and economic standpoint, an evaluation board consisting of representatives from the Fort Worth District and the Longhorn Army Ammunition Plant recommended that the dewatering contract be awarded to Gibraltar Chemical Resources, Tyler, Texas. Gibraltar's proposal was for disposal of the water by deep well injection.

Within days, Gibraltar commenced work by situating nine 20,000 gal coal tar epoxy-lined tanks near the pond to be used as treatment and decant tanks. The ground surface around the tanks was graded and protected with visqueen liner so that any leakage or spills would be contained. Wastewater was pumped

from the pond into the tanks through a flexible suction line which was supported by pontoons extending approximately 80 ft out into the pond (Figure 2). Inside the tanks, 98 percent sulfuric acid was added to the wastewater to reduce its pH to a level of 2-3 to kill algae. After the algae precipitated out, the highly acidic wastewater was pumped into other holding tanks to await shipment via tank truck (Figure 3) to the site of Gibraltar's permitted disposal well near Tyler, Texas, about 80 mi west of Karnack. The remaining algae sludge was pH adjusted to a neutral level and returned to the pond. A total of 1,877,113 gal of wastewater was removed from the pond within a period of about 33 days using around-the-clock pumping operations.

Since the actual boundary between the wastewater and sludges was more of a transition zone from liquid to solid, a boundary was established at a suspended solids level of 2 percent for contract purposes. In other words, the dewatering contractor was required to remove all liquids from the pond that contained 2 percent or less solids. Upon arrival at the injection site, the wastewater was transferred into holding tanks and a final signature analysis was made before injection. The Phase I dewatering contract was completed on October 11, 1985.

PHASE II - REMOVAL OF SLUDGES AND BACKFILL

The contract for removal of the sludges and the backfilling of the pond was awarded to 413 Inc., Texarkana, Texas, on September 30, 1985, and work commenced on October 18, 1985. It was important that the delay between the end of Phase I and the start of Phase II be minimized due to the fact that runoff entering the pond would be considered to be contaminated; thus, if large amounts of rain occurred during the interim period, site conditions for the Phase II contract would be altered. During the one-week interval rainfall did occur resulting in an accumulation of about 15,000 gal of water in the pond. The water was removed and deep well injected by Gibraltar.

The Phase II contract consisted of removing and transporting all contaminated sludges and soils to a permitted hazardous waste disposal site, backfilling the pond, installing a filter drain system, and turfing. Initially, the contractor mixed Portland cement into the sludge which altered the sludge to a tractable consistency. Cement in the amount of about 10 percent by weight was used to produce a truckable

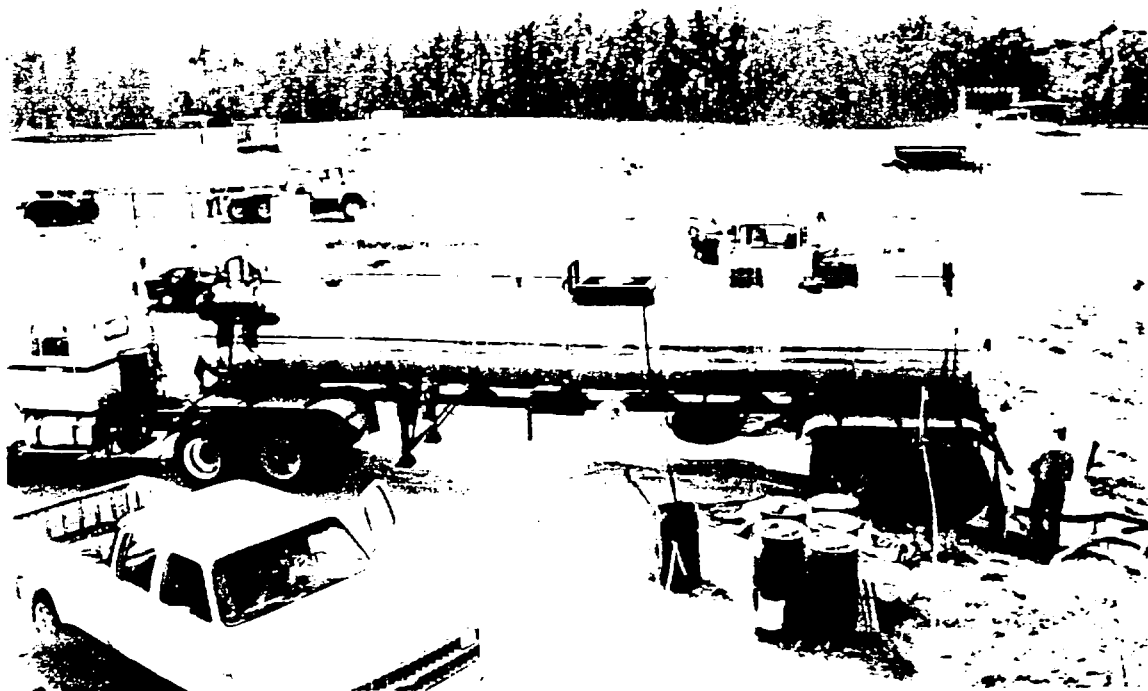


Figure 3. Transport trucks being loaded.

cake. A total of 565 tons of dry cement was delivered to the site in hopper-bottom bulk transport trailers and deposited in random piles in the pond. A crawler tractor was used to spread the cement over the surface of the sludge and to incorporate the cement into the sludge by disking and blading. The dried sludge was then loaded into dump trailer transports lined and covered with a visqueen liner. A total of 8,116 yd³ of material was excavated from the site and shipped to an approved permitted landfill site owned and operated by Chemical Waste Management, Carlyss, Louisiana.

During excavation a testing program was executed at the pond site to verify that all contaminated sludges had been removed. Soil samples were collected on maximum 2,500 ft² intervals to define the limits of contamination and to determine if additional excavation and removal were required. As the controlling parameter for determining whether additional sludge or soil removal was required, the Closure Plan recommended using the level of chemical oxygen demand with the maximum limit of 10,000 micrograms/gram. However, at the request of the State of Texas, additional tests for levels of barium and chro-

Table 4. Comparison of results of chemical analyses on the UEP soil layer before and after closure.

Parameter	Before Closure ¹		After Closure ²	
	Range	Average	Range	Average
Chemical Oxygen Demand	5,300-10,000	7,719	750-13,000	3,482
Barium	60-800	169	36-113	155
Chromium	5-16	11	4.9-27	14.3

All values shown in microgram/gram

¹Average of 16 samples

²Average of 46 samples



Figure 4. Fill being placed and compacted.



Figure 5. Filter sand and french drains being installed.

mium were conducted. Results of all analyses were reported by Continental Technical Services Laboratories (1984) in *Laboratory Report No. 84-0879*. Table 4 shows the results of chemical analyses of soil samples collected from beneath the pond before closure, compared with results of analyses on samples from the bottom of the pond excavation during closure.

On November 27, 1985, the pond site was declared free of contaminants and the contractor was notified that backfilling could commence.

Materials used to backfill the site were obtained from two approved off-site sources. Suitable material used as common fill was placed in 8-in.-thick horizontal layers and compacted (Figure 4) to 90–95 percent of maximum density. A 12-in.-thick compacted layer of sand was installed over the clay cap to allow percolated rainfall to flow into a system of french drains (Figure 5) to convey water to ditches leading away from the site. Finally, a layer of topsoil was spread over the sand so that permanent vegeta-

tive covering could be established over the site. Placement of topsoil was completed on January 24, 1986. As a temporary measure, a stand of rye grass was established over the site, with permanent turf to be established in the spring of 1986. A typical cross-section of the backfill is shown on Figure 6. A view of the completed project is shown on Figure 7.

POST-CLOSURE MONITORING

Upon closure of the unlined evaporation pond, the Longhorn Army Ammunition Plant began a quarterly monitoring program for eight wells located in the active burning ground area. Some hazardous constituents, primarily barium, which had been previously found in all layers of the pond, trichloroethylene, previously found only in the pond's aqueous layer, and methylene chloride, which had not been detected in previous analyses prior to closure, continued to show up in ground-water samples. The Army also initiated a ground-water quality assess-

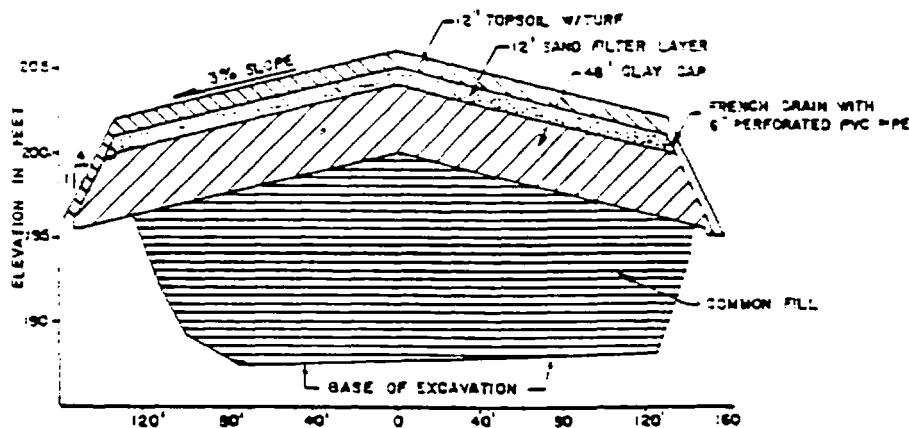


Figure 6. Typical cross-section of fill.

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Figure 7. Completed project.

ment to evaluate contamination caused by past operation of the unlined evaporation pond. The results of the ground-water quality assessment, published in March 1985, by the consulting engineering firm of Camp Dresser and McKee, concluded that the pond had been a secondary source, but not the primary source of contamination within the burning ground area.

In response to the assessment, the Army developed a program for continued ground-water monitoring efforts at the active burning ground area designed to demonstrate whether or not the unlined evaporation pond site remains a source of ground-water contamination or, if not, to locate other sources of contamination in or near the active burning ground area. A Compliance Monitoring Program was developed which included the installation and sampling of six new monitoring wells around the closed unlined evaporation pond site, in addition to sampling previously existing wells within the burning ground area. The conclusions of these studies presented in *Installation and Sampling of Compliance Monitoring Wells* (U. S. Army Corps of Engineers, 1989) were that a contaminant plume with limited horizontal and vertical extent is still present in the immediate vicinity of the closed unlined evaporation pond.

Further investigations are planned to address the contaminant plume existing beneath the pond and to identify additional sources of contamination within the burning grounds area.

CONCLUSION

The closure of the unlined evaporation pond at the Longhorn Army Ammunition Plant, Karnack, Texas,

was performed in accordance with the rules and regulations as set forth in the Resource Conservation and Recovery Act of 1976. The planning and execution of the closure proceeded reasonably well considering the great amount of coordination involved between the Installation, the planners, various regulatory agencies, and affected local individuals. Documentation of the closure was presented in *Closure Report, Unlined Evaporation Pond*, published by the U. S. Army Corps of Engineers (1986). The report described in detail the steps required for the planning, execution, and verification of the project. An increasing number of closures of hazardous waste facilities are anticipated in the future. A detailed project summary of the case history on each project should be documented and published so that planners of similar projects may benefit.

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Appendix C

FINAL

WORK PLAN ADDENDUM PHASE I

FOR SITE LHAAP-18 & 24

BURNING GROUND 3 & THE UNLINED EVAPORATION POND

September 1993

Prepared by

TULSA DISTRICT

U.S. ARMY CORPS OF ENGINEERS

007255

**LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS**

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

**FINAL
WORK PLAN ADDENDUM PHASE I**

**FOR SITE LHAAP-18 & 24
BURNING GROUND 3 &
THE UNLINED EVAPORATION POND**

September 1993

Prepared by

**TULSA DISTRICT
U.S. ARMY CORPS OF ENGINEERS**

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EXECUTIVE SUMMARY

This Work Plan Addendum has been prepared by the U.S. Army Corps of Engineers, Tulsa District for Longhorn Army Ammunition Plant (LHAAP). It is intended as an addendum to the Longhorn Army Ammunition Plant (LHAAP) Remedial Investigation/Feasibility (RI/FS) Work Plan (June 1992), which describes remedial investigations at 13 Solid Waste Management Units (SWMUs) at LHAAP. This Work Plan Addendum describes additional investigations to be conducted at site No. LHAAP-18 & 24, the Active Burning Grounds (Burning Ground 3) and the Unlined Evaporation Pond (UEP). The description of investigations presented in this addendum is given in the same format as in the final RI/FS Work Plan, Volume I - General, with additional information added as necessary. Pertinent sections from the RI/FS Work Plan have been included by reference where possible to avoid unnecessary duplication. Proposed sampling locations were selected based on site history, physical characteristics, and field reconnaissance. A total of 8 soil borings with soil sampling, installation of 4 monitoring wells, collection and testing of 50 groundwater samples, and a small scale trench into the contaminated buried soil/debris with a small bucket backhoe for collection of samples for bench scale tests are proposed for the RI/FS Addendum Phase I Investigations.

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SECTION 1.0 INTRODUCTION

Under a Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), the Texas Water Commission (TWC) and the Department of the Army, a Remedial Investigation/Feasibility Study (RI/FS) is underway at Longhorn Army Ammunition Plant (LHAAP) in Marshall, Texas. The FFA requires an RI/FS under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to characterize the nature and extent of contamination at 13 Solid Waste Management Units (SWMUs) at LHAAP and to develop a remedy for remediation of each area. The U.S. Army Corps of Engineers (USACE) prepared a comprehensive RI/FS Work Plan to address remedial activities required at the 13 SWMUs following CERCLA guidelines. During the RI Work Plan development for the Active Burning Grounds #3, SWMU No. LHAAP-18 & 24, additional investigations were identified as required to evaluate the Interim Remedial Action (IRA) at the site for source control.

This Work Plan Addendum is intended as a supplement to the final Longhorn Army Ammunition Plant RI/FS Work Plan, Volume I - General, dated June 1992, which contains detailed information about the facility background and history; each area to be investigated; previous investigations; potential contaminants; migration pathways; potential receptors; sampling rationale; number and type of samples; analytical parameters; feasibility study and risk assessment activities. The purpose of this Work Plan Addendum is to present a description of the additional investigations to be conducted, a map showing proposed sample locations, and an estimate of the volume of investigation-derived waste to be generated. This document follows the same format as the final RI/FS Work Plan Volume I - General, with additional information added as needed to describe investigations to be conducted at the site. Pertinent sections from the RI/FS Work Plan have been included by reference where possible to avoid unnecessary duplication. Since the investigation-derived waste will increase with the additional field work at LHAAP-18 & 24, the waste descriptions and quantity estimates are provided as Appendix A.

All procedures described in the final RI/FS Work Plan Volume II - Chemical Data Acquisition Plan (CDAP), and Volume III - Site Safety and Health Plan (SSHP) will remain

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applicable for the investigation at LHAAP-18 & 24. The CDAP discusses the data quality procedures and techniques used to insure that all data obtained are of acceptable quality and the Investigation-Derived Waste (IDW) Management Plan. The SSHP establishes procedures to protect personnel during the field activities at LHAAP-18 & 24.

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SECTION 2.0
FACILITY BACKGROUND

General information about Longhorn Army Ammunition Plant including location, boundary features, facility background, and environmental conditions is described in Section 2.0, Facility Background, of the final RI/FS Work Plan, Volume I - General.

SECTION 3.0

SITE NATURE AND EXTENT OF CONTAMINATION

3.1 LHAAP-18 & 24 - BURNING GROUNDS 3 AND UNLINED EVAPORATION POND.

3.1.1 Site History. Historical use of this site is assumed to be the same as that described in Section 3.6.1 of the final RI/FS Work Plan, Volume I - General.

3.1.2 Site Description. The site description is the same as that described in Section 3.6.1 of the final RI/FS Work Plan, Volume I - General.

3.1.3 Previous Investigations. Previous investigations in the area have been described for this site in Section 3.6.3 of the final RI/FS Work Plan, Volume I - General.

3.1.4 Assessment of Existing Data and Historic Records. Assessment of existing data in the area have been described for this site in Section 3.6.4 of the final RI/FS Work Plan, Volume I - General.

3.1.5 Potential Contaminants and Migration Pathways. The potential contaminants and migration pathways will be the same as those described in Section 3.6.5 of the final RI/FS Work Plan, Volume I - General.

3.1.6 Identification of Potential Receptors. The identification of potential receptors will be the same as those described in Section 3.6.6 of the final RI/FS Work Plan, Volume I - General.

3.1.7 Initial Remedial Action. The initial remedial action will be the same as described in Section 3.6.7 of the final RI/FS Work Plan, Volume I - General.

The interim remedial action (IRA) will include source material and groundwater removal and treatment. The need for an IRA is shown by the increase in concentrations of volatile organics detected in the groundwater. In the shallow aquifer zone, monitoring well (MW) 2 went from a methylene chloride (MEC) concentration of 2,900,000 ug/l in June 1988 to 9,080,000 ug/l in November 1992 and a trichloroethylene (TCE) concentration of 60,000 ug/l in June 1988 to 199,000 ug/l in November of 1992, several other wells in this zone had concentrations over DNAPL indicator limits. In the deeper zone at the site, MW-15 went from a MEC concentration of 37 ug/l in June 1988 to 68,000 ug/l in November 1992 and a TCE concentration of 54 ug/l in June 1988 to 9,390 ug/l in November of 1992, this is particularly alarming since it indicates an increased vertical migration rate.

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SECTION 4.0

PLAN OF INVESTIGATION

The plan of investigation described below is designed to obtain site-specific data about both the physical and chemical characteristics of the Burning Ground 3 & UEP site. Table 4.0 presents the parameters will be analyzed for all soil and groundwater samples. Additionally, six bench scale test will be performed on samples from the trench soil/debris and six bench scale test will be performed on samples of groundwater that will be obtained from the most heavily known contaminated areas, the planned bench scale test are also listed in Table 4.0.

TABLE 4.0 SAMPLING PARAMETERS FOR BURNING GROUND 3 & UEP PHASE I ADDITIONAL INVESTIGATION		
Sampling Matrix	Chemical Parameters	Physical Parameters
SOIL from borings & monitoring wells	pH; volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); explosives; antimony; arsenic; barium; cadmium; chromium; lead; mercury; nickel; selenium; silver; thallium; nitrate; sulfate; and chloride	visual classification, moisture content, gradation, plastic limit, and liquid limit tests
GROUND WATER	pH; specific conductance; volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); explosives; antimony; arsenic; barium; cadmium; chromium; lead; mercury; nickel; selenium; silver; thallium; nitrate; sulfate; and chloride	
Soil Bench Scale Test (BST)	Incineration, Thermal Desorption, Aeration, Bio-remediation, Stabilization, Chemical Extraction (samples will also be tested before and after BST for the chemical parameters to show effectiveness of the procedure)	
Water Bench Scale Test (BST)	Air stripping, Activated Carbon, Ultraviolet Photolysis, Ion exchange, Reverse Osmosis, Precipitation (samples will also be tested before and after BST for the chemical parameters to show effectiveness of the procedure)	

Note: For more detail see the CDAP in the RI/FS Work Plan.

All sampling and analyses will be performed in accordance with the procedures outlined in Volume II - Chemical Data Acquisition Plan (CDAP) and Volume III - Site Safety and Health Plan (SSHP) of the final RI/FS Work Plan. A preliminary list of alternatives to be

evaluated for the IRA at Burning Ground 3 & the UEP site is given on Table 4.1.

Field investigations for the site will consist of multiple phases. The first phase of investigations, RI Phase I, will be performed to obtain the data requirements to complete the site characterization to proceed with the IRA on the near surface source material. The estimated number and types of samples to be taken during the RI Phase I Additional investigations are shown on Table 4.2. After completing the first phase field efforts, starting the IRA, and evaluating the existing data needs, the total site RI will continue to more fully assess the deeper groundwater at the site. Additional groundwater monitoring wells and soil borings may be drilled to determine the full extent of soil and groundwater contamination, if necessary.

Table 4.1.
PRELIMINARY LIST OF TREATMENT ALTERNATIVES
FOR THE IRA

Matrix	IN-SITU/ EX-SITU	CONTAMINANT/ PROCEDURE TYPE	TECHNOLOGY
GROUNDWATER	IN-SITU	VOC	Bioremediation Vapor Extraction Note: (Low permeability of soils limits effectiveness of in-situ treatment.)
		METALS	
	EX-SITU	VOC	Air stripping Activated Carbon Ultraviolet Photolysis
		METALS	Ion exchange Reverse Osmosis Precipitation
		COLLECTION	Well-point System Interceptor/Collection Trenches I/C Trenches with Vacuum Enhanced Extraction
SOIL/WASTE	IN-SITU	VOC	stabilization Vitrification Soil Vapor Extraction Note: (Low permeability of soils limits effectiveness of in-situ treatment.)
		METALS	stabilization Vitrification
	EX-SITU	VOC	Incineration Thermal Desorption Aeration Bio-remediation
		METALS	Stabilization Chemical Extraction
		EXCAVATION/ PRETREATMENT	Staging area Dewatering unit Soil shredding Soil screening
AIR/ VAPOR EMISSIONS		VOC	Activated Carbon Flaring
		DUST	Water Spray Baghouse Scrubber

4.1 LHAAP 18 & 24 - Burning Grounds 3 and UEP.

4.1.1 Data Requirements for Site Characterization. Additional data is needed to more fully characterize the site before proceeding with the IRA. A list of additional investigations for this phase with a description, specific purpose, and type of sampling to be performed are provided in Table 4.2.

4.1.2 General Plan for Site Investigation - RI Phase I. The overall A field investigation plan for area LHAAP-18 & 24 was developed and approved in Section 4.6 of the final RI/FS Work Plan, Volume I - General. The field investigation (listed in Section 4.6.2 of the final RI/FS Work Plan, Volume I - General) for area LHAAP-18 & 24 includes the following:

- 8 - surface water/sediment sampling
- 41 - monitoring well sampling
- 7 - monitoring wells to be plugged

The changes from this plan are to include installation and sampling of 8 borings, install 4 wells, sample all wells at the site that can yield a water sample, collect soil/waste & water samples for bench scale tests. Well abandonment scheduled under the RI/FS Work Plan will take place as part of the IRA.

The objectives in performing the first phase of additional field investigations for the RI at the Burning Ground 3, LHAAP-18 & 24 are to determine if low density compounds are floating on the near surface groundwater, delineate the TCE plume north of the UEP, investigate areas of suspected contamination (including the UEP) that have not previously been sampled, and to collect samples for bench scale tests.

4.1.2.1 Soil Borings Eight additional soil borings will be drilled at the locations shown on Figure 4-1-1. The objective of the additional soil borings is to gather analytical and stratigraphic data from the suspected source areas. Two of the borings are located in the center of the suspected burn trench next to borings 935-937. Three of the borings are in the UEP, one near the truck ramp in the southern corner, one in the north corner near the rocket motor washout, and one near the east corner near the well MW-2. The last three are in 3 separate suspect areas that have never been investigated near 908 and operating burn cages.

Boring depths are estimated based on an anticipated depth of contamination. Actual depths may vary depending on the subsurface conditions encountered during investigations.

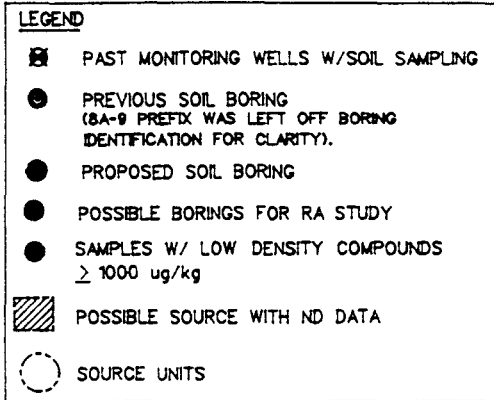
TABLE 4.2.
PROPOSED INVESTIGATIONS FOR PHASE 1 ADDITIONAL INVESTIGATIONS FOR IRA OF
SOURCE MATERIAL
AT BURNING GROUND 3 & UEP

WORK ITEM	NUMBER/LOCATION	PURPOSE	DEPTH	SAMPLING
1. Install shallow wells	3 down gradient from areas where soil samples had low density compounds at concentration over 1,000 ug/l (near ACD and burn pits see map of past soil investigations with proposed borings)	To detect LNAPL plume and collect hydrogeologic characteristics for developing fate and transport models to address remediation measures, should they be necessary.	Fifteen feet below water table with a 20 foot screen 5 feet above the water table .	Sample all 3 wells for LNAPL and full range of sampling.
2. Perform soil borings and collect soil samples	3 - in UEP 2 - in suspected burn trench next to borings 935-937 3 - in 3 separate areas near 908 (see map of past soil investigations with proposed borings)	To confirm suspect source areas of presence of buried waste	At least 15 feet, or till no indication of disturbed material is encountered whichever comes first	Sample every 5 feet and collect sample at noticeably high contamination in the field.
3. Install monitoring well	1 - downgradient (northwest) of MW-5 & MW-6	To close the plume north west of mw-5 & mw-6	Twenty foot screen at approximately 15 to 35 feet below land surface	Sample with the other monitoring wells for voc's. Semi-voc's, explosives, and metals.
4. Sample all existing monitoring wells including 123, 125, BH-11, and BH-22	50 - wells	To provide a "snap shot" of contaminant plume before interim remedial action and monitor the migration since november 1992	NA	Sample for voc's. Semi-voc's, explosives, and metals
5. Trenching with a small back hoe to collect soil samples for bench scale test	Approximately 6 samples from two "hot areas" near acd and north end of middle burn pit	To test effectiveness of remedial technology and to gather site condition information for implementation of the ira (such as inflow seepage & side slope stability in waste material)	Approximately 10 feet deep	Samples for bench scale test
6. Collect water samples from most contaminated wells for water treatment bench scale test	As needed to perform test	To test effectiveness of remedial technology	NA	Samples for bench scale test

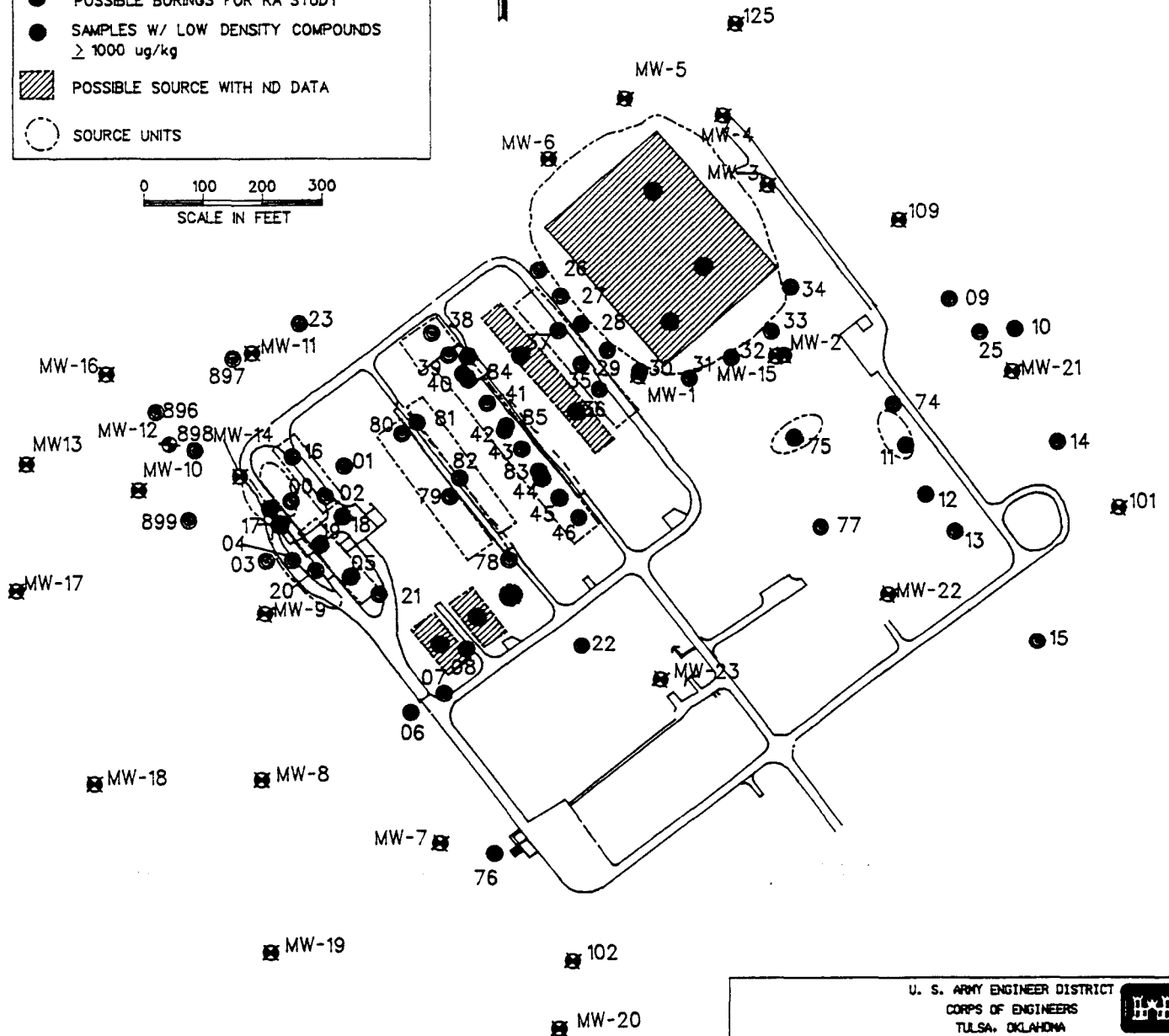
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FIGURE 4-1-1

PROPOSED SOIL BORING FOR PHASE I SITE INVESTIGATIONS



0 100 200 300
SCALE IN FEET



0 100 200
SCALE IN FEET

NOTE: LOCATIONS OF SITE FEATURES AND SAMPLING LOCATIONS HAVE BEEN ASSEMBLED FROM REFERENCED DOCUMENTS PREPARED BY VARIOUS AGENCIES.

U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA		
LONGHORN ARMY AMMUNITION PLANT MARSHALL, TEXAS		
DESIGNED BY: W. LANIER	LHAAP 18 & 24 INTERIM REMEDIAL ACTION PAST SOIL INVESTIGATIONS WITH PROPOSED SOIL BORINGS	
DRAWN BY: C. STAUDENMAIER		
CHECKED BY:		
SUBMITTED BY:		
CHIEF: C. WORD ENVIRO. DESIGN	SCALE: AS SHOWN DATE: AUGUST 1993 DWG CODE:	FIGURE 4-1-1
DIGITAL FILE: PPINSOIL.DGN		

4.1.2.2 Monitoring Wells and Groundwater Samples Four groundwater monitoring wells will be installed at the site to determine the presence of a Low density non-aqueous phase liquid (LNAPL) plume and define TCE migration northwest of the UEP in the upper saturated zone. The wells will also provide groundwater depth and flow direction. Sampling of all of the wells will monitor the migration and changes in concentration of contamination present in the groundwater and variations of the groundwater elevation at the site .

4.1.2.2.1 Monitoring Well Installation The proposed well locations for the site are shown on Figure 4-1-2 and are as follows:

- TO DETECT A POSSIBLE LNAPL PLUME

Three monitoring wells are to be installed hydraulically down gradient from areas with the highest concentration of low density volatile organic compounds in the soil samples

- TO DETERMINE THE TCE CONCENTRATION DOWNGRAIENT OF MW-5 AND MW-6 WELLS

One monitoring well will be located northwest of the UEP to determine

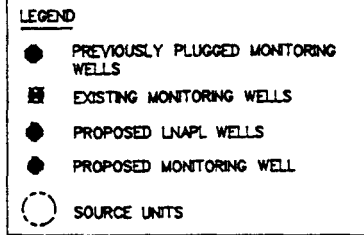
The wells will be installed based on observation in the field, the approximate depth of the well screens are shown on Table 4.2.

All sampling and analyses will be performed in accordance with the procedures outlined in Volume II - Chemical Data Acquisition Plan (CDAP) and Volume III - Site Safety and Health Plan (SSHP) of the final RI/FS Work Plan. Soil sampling for both physical and chemical analyses will be performed following the same procedures described for sampling the soil borings to be drilled at the site, with the exception that soil samples for chemical analyses will be taken only from the unsaturated zone. Analytical parameters will be the same as listed in Table 4.0 and the RI/FS Work Plan.

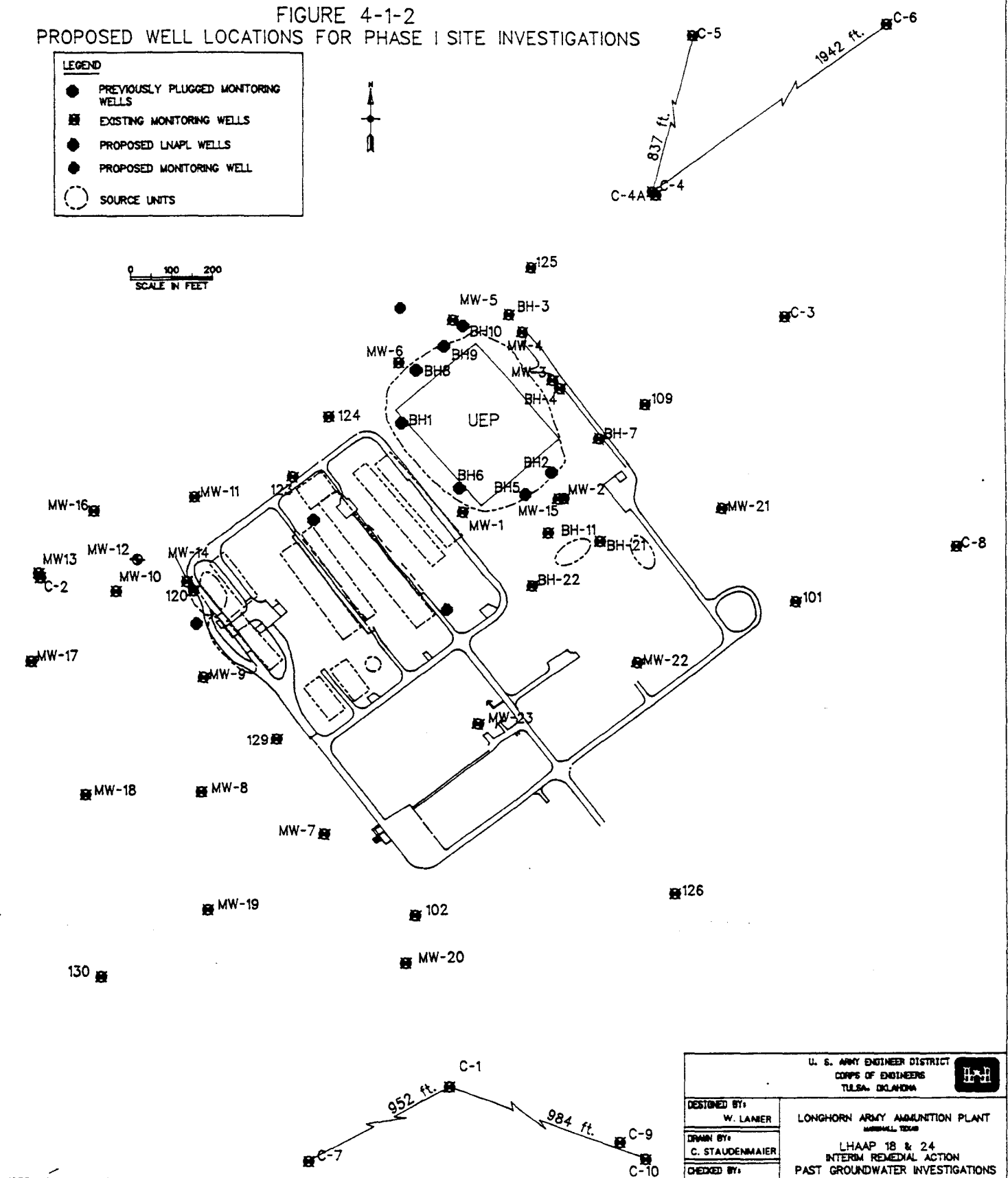
4.1.2.2.2 Groundwater Sampling The newly installed monitoring wells will be slug tested and sampled for analytical and physical parameters listed in Table 4.0 of this document and section 4.6.2 of the final RI/FS Work Plan, Volume I - General.

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FIGURE 4-1-2
PROPOSED WELL LOCATIONS FOR PHASE I SITE INVESTIGATIONS



0 100 200
SCALE IN FEET



NOTE: LOCATIONS OF SITE FEATURES AND SAMPLING LOCATIONS HAVE BEEN ASSEMBLED FROM REFERENCED DOCUMENTS PREPARED BY VARIOUS AGENCIES.

U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA		
LONGHORN ARMY AMMUNITION PLANT MARIETTA, TEXAS		
DESIGNED BY: W. LANIER	LHAAP 18 & 24 INTERIM REMEDIAL ACTION PAST GROUNDWATER INVESTIGATIONS WITH PROPOSED MONITORING WELLS	
DRAWN BY: C. STAUDENMAIER		
CHECKED BY:		
SUBMITTED BY:		
CHIEF: C. WORD	DATE: AUGUST 1993	FIGURE 4-1-2
ENVIRO. DESIGN	DWG CODE:	
DIGITAL FILE NUMBER:		

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SECTION 5.0
FEASIBILITY STUDY ACTIVITIES

The feasibility study activities are described in Section 5.0 of the final RI/FS Work Plan, Volume I - General. The preliminary list of alternatives as provided in Table 4.1 will be evaluated for the IRA.

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SECTION 6.0 RISK ASSESSMENT

The Baseline Risk Assessment will consist of two basic assessments - a Health Risk Assessment and an Ecological Risk Assessment.

The Health Risk Assessment for LHAAP-1 is described in Section 6.2.10 of the final RI/FS Work Plan, Volume I - General and the Ecological Risk Assessment is described in Section 6.4 of the final RI/FS Work Plan, Volume I - General.

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SECTION 7.0**PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND
APPROPRIATE REQUIREMENTS (ARARs)**

The identification of ARARs is described in Section 7.0 of the final RI/FS Work Plan,
Volume I - General.

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SECTION 8.0
BUDGET AND SCHEDULE

8.1 BUDGET. All remedial activities at LHAAP will be funded with the Defense Environmental Restoration Account (DERA) which is managed by the U.S. Army Environmental Center (AEC). DERA funds are appropriated by Congress annually. Funding requirement for this effort shall be identified in a timely manner through the chain of command to AEC.

Funding for installation restoration program projects at Army installations is done on a priority basis. Because of the number of Army installations requiring environmental restoration work and the limited amount of funding, not all work is funded immediately. Funding for Phase I Investigations for LHAAP-18 & 24 has been received in fiscal year 1993.

8.2 SCHEDULE. A schedule of 87 months was proposed for remedial activities at LHAAP as outlined in Section 8.0, Budget and Schedule, of the final RI/FS Work Plan, Volume I - General. The schedule includes all activities from project planning through the completion of the remedial design.

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APPENDIX A
INVESTIGATION DERIVED WASTE
MANAGEMENT PLAN

WASTE DESCRIPTION

WASTE DESCRIPTION

1.1 Types and Estimated Quantities of Investigation Derived Waste (IDW). The estimated waste quantities for LHAAP-18 & 24 and the description and total amount for each type are provided in the following table. Please refer to Appendix C of the RI/FS Work Plan, Volume II -Chemical Data Acquisition Plan, Investigation-Derived Waste Management Plan for additional detail.

IDW ESTIMATED QUANTITIES AND TYPE										
INVESTIGATIONS							ESTIMATED WASTE QUANTITIES			
PHASE	MONITORING WELLS (depth)	BORINGS (depth)	SAMPLES				SOIL CUTTINGS (cf)	PURGE WATER (gal)	DECON. FLUIDS (gal)	PPE & DISP. EQUIPMENT (20 gal bags)
			SEDIMENT	SOIL	GROUNDWATER	Surface water				
Original	0	0	8	0	39	8	0	16,365.	219	28
New	3 @ 25' 1 @ 35'	8 @ 15' 2 trenches @ 10'	0	32 6 FOR TREATABILITY TESTING	11 6+ FOR TREATABILITY TESTING	0	102	5,220.	100	10
Total	4	8 borings 2 trenches	8	38	55	8	102	21,585.	319	38

007276

PUBLIC NOTICE
FINDING OF NO SIGNIFICANT IMPACT
ENVIRONMENTAL ASSESSMENT

LONGHORN ARMY AMMUNITION PLANT (LHAAP)
KARNACK, TEXAS

Pursuant to the regulations implementing the provisions of the National Environmental Policy Act (NEPA) (40CFR, Part 1500 et al), the Department of the Army (DA) gives notice that it has prepared the required environmental documentation for construction of a treatment area near Burning Ground 3 (BG-3) at LHAAP. The documentation is on file and may be reviewed by interested parties at the Public Affairs Office, LHAAP, P. O. Box 1029, Marshall, Texas 75671, (903) 679-2228.

The proposed action is for the construction of a treatment area near BG-3. The soils and ground water at BG-3 have been contaminated from past activities and need to be remediated. The construction of the treatment area is necessary for the proper storage and eventual treatment of the soil and water. It will consist of a curbed concrete pad with a sump for handling soil and a gravel parking area. There will be space for treatment facilities in the future.

The proposed action is not expected to have a significant environmental impact on air, water, soils, plants, animals or humans. The program is also not expected to conflict with existing or proposed federal, state or local land use plans, policies, laws and controls, including the Clean Air Act, Federal Water Pollution Control Act Amendments, and Resource Conservation and Recovery Act. It does not constitute a significant change relevant to environmental concerns associated with the no-action alternative.

The Department of the Army will receive comments on this proposed action for a thirty-day period from the date this Finding of No Significant Impact (FNSI) is published. Address comments to Commander, Longhorn Army Ammunition Plant, ATTN: Public Affairs Office, P. O. Box 1029, Marshall, Texas 75671.

12/93

Appendix D

Interim Remedial Action - Phase I Letter Report

Physical, Surveying and other Field Data

Delivery Order No. 0002, Mod. No. 000202

From AWD Technologies

February 17, 1994



007897

ABO-94-LHAAP-0033
February 17, 1994

A Subsidiary of
The Dow Chemical Company

Mr. Clif B. Warren, P.E.
HTRW Cost Plus Contract
Resident Office
U.S. Army Corps of Engineers
Tulsa District
1645 S. 101st East Avenue
Tulsa, Oklahoma 74128

Reference: **Contract No. DACA56-93-D-0016**
 Interim Remedial Action - Phase I
 Burning Ground 3 and Unlined Evaporation Pond LHAAP 18 and 24
 Longhorn Army Ammunition Plant, Karnack, Texas

Subject: **Physical, Surveying and other Field Data**
 Delivery Order No. 0002, Mod. No. 000202

Dear Mr. Warren:

Per our discussion during the project meeting in Tulsa on February 16, 1994, I am enclosing a copy of the following data which had been previously submitted in stages:

- Drilling Logs for the extraction well and four monitoring wells;
- Well completion forms;
- State of Texas Well Reports, prepared and submitted by the driller;
- Drilling Logs for the soil borings;
- Survey data for the wells and soil borings;
- Field parameters collected during well purging and sampling activities;
- Calculated well volumes and purging data;
- Slug test data and evaluation reports for the four monitoring wells;
- Geotechnical test results; and
- Test Pit logs; these test pits were excavated for collection of treatability samples.

AWD Technologies, Inc.

15204 Omega Drive Suite 200 Rockville Maryland 20850 Telephone 301 948 0040 Fax 301 948 6094

007898

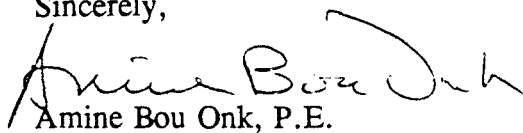
ABO-94-LHAAP-0033
February 17, 1994
Page 2

Mr. Clif B. Warren, P.E.

A site plan showing the locations of the extraction well, monitoring wells, soil borings, and test pits is also included with this package.

Do not hesitate to contact me if you have any questions or require additional information.

Sincerely,

A handwritten signature in dark ink, appearing to read "Amine Bou Onk". The signature is fluid and cursive, with a large loop at the end.

Amine Bou Onk, P.E.
Project Manager

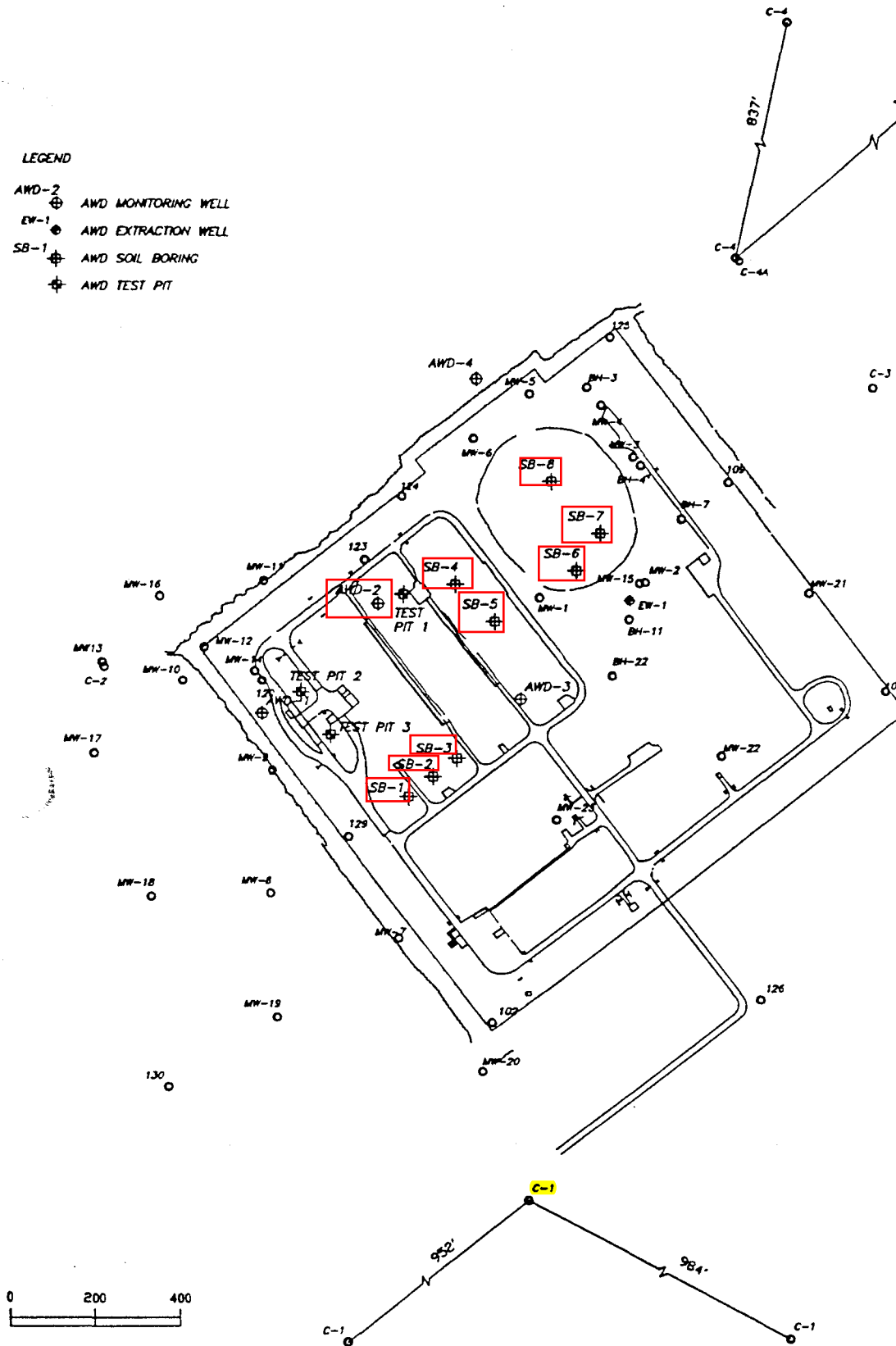
enclosure

cc: Wendy Lanier: USACE, Tulsa, District (3 copies of package)

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LEGEND

- AWD-2  AWD MONITORING WELL
- EW-1  AWD EXTRACTION WELL
- SB-1  AWD SOIL BORING
-  AWD TEST PIT



Soil Boring 6 -27 ft bgs
Soil Boring 7 -27 ft bgs
Soil Boring 8 -32 ft bgs



US Army Corps
of Engineers
Tulsa District



A Subsidiary of
The Dow Chemical Company

PHASE I
WELLS, SOIL BORINGS AND TEST PITS
SITE PLAN

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

PROJECT: LHAAP 18 & 24, PHASE I, IRA

PROJECT NO.: 2379

SCALE: AS SHOWN

FIGURE
NUMBER

REV

007900

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Descriptive)	SOIL RECORD NO.	SOIL SAMPLE NO.	REMARKS (Drilling time, nature of logs, state of consolidation, etc. as experienced)
	0				HSA	1. WATER LEVEL: 22.30' BGS.; MEASURED ~ 2 HOURS AFTER COMPLETING BOREHOLE
	5		5.0' TO 7.0' <u>SILT</u> : BROWN & GRAY, SOME FINE SAND, LITTLE CLAY, DAMP 6.5'	100	SS1	2. JAR SAMPLES SS1: 5.0' - 7.0' SS2: 8.0 - 9.5' SS3: 10.0 - 12.0' SS4: 15.0' - 17.0' SS5: 20.0' - 22.0' SS6: 23.0' - 24.5'
			<u>SAND</u> : BROWN, FINE GRAINED, LITTLE SILT DAMP		HSA	SS7: 25.0 - 27.0' SS8: 28.0 - 29.5'
			8.0 TO 9.5' <u>SILT</u> : FINE SAND, BROWN & GRAY MOTTLED, TRACE CLAY, DAMP	100	SS2	SS9: 30.0' - 32.0' SS10: 35.0 - 36.5'
	10		10.0' - 12.0' <u>SILT</u> : BROWN & LT GRAY MOTTLED, SOME FINE SAND, TRACE CLAY, IRON & ORGANIC STAINING DAMP TO MOIST	50	SS3	3. JAR SAMPLES (PHYSICAL TESTS) SS2: 8.0' - 9.5' SS6: 23.0' - 24.5' SS8: 28.0' - 29.5'
					HSA	4. DRILLING 8" ID HSA 0.0' - 38.0' NOTE: 3" X 24" & 3" X 18" SPLIT SP USED TO COLLECT SOIL SAMPLES
	15		15.0' TO 17.0'. <u>SILT</u> : LT GRAY, IRON STAINED, LITTLE CLAY, TRACE FINE SAND AND BLACK ORGANIC STAINING, MOIST	83	SS4	5. NOTE: EXTRA WELL INSTALLA STARTED 11/9 20-40 SILICA SA PACK & BENTON SEAL EMPLOYED
	20				HSA	

PROJECT

EXTRACTION
WELL - 1

EXTRACTION Well - 1

007901

DRILLING LOG	Project	Well	Sheet
1. PROJECT	2379	II. DATE AND TYPE OF BIT	B-1/4" ID 175A
2. LOCATION	LONGHORN AAP	III. BITUMEN ELEVATION	
3. DRILLING AGENCY	CCI/Alliance	IV. ALLOWANCE FOR DEFORMATION OF MUD	FAILING F6
4. WELL NO. (as shown on drilling plan)	Extraction	V. TOTAL NO. OF OVER-DRUMS SAMPLES TAKEN	10
5. NAME OF DRILLER	DMN Loden Well-1	VI. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE	☒ VERTICAL ☐ SLOPED	VII. ELEVATION TOP OF HOLE	
7. THICKNESS OF OVERBURDEN		VIII. DATE HOLE	STARTED 11/4/93 COMPLETED 11/4/93
8. DEPTH DRILLED INTO ROCK		IX. TOTAL CORE RECOVERY PER CENT	
9. TOTAL DEPTH OF HOLE	38.0 FL	X. SIGNATURE OF INSPECTOR	<i>Michael W. Montanari</i>

ELEVATION	DEPTH	LOGGING	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Flowing, foam, loss of circulation, etc., if appropriate)
	20		20.0' TO 22.0'	100	SS5	6. PID HEADSPACE READINGS (PPM)
			SILT: BROWN & GRAY MOTTLED, LITTLE CLAY & FINE SAND, BROWN FINE SAND @ 22.0', WET			SS1: 41.0
			23.0 TO 24.5'		HSA	SS2: 41.0
			SAND: BROWN WITH GRAY MOTTLES, VERY FINE TO FINE GRAINED, LITTLE SILT, SATURATED	100	SS6	SS3: 41.0
			25.0' TO 27.0'		HSA	SS4: 9.2
			SAND: BROWN, VERY FINE TO FINE GRAINED, BROWN & GRAY MOTTLED CLAY @ 27.0', SATURATED	100	SS7	SS10: 1218
			28.0 TO 29.5'		HSA	
			CLAY: BROWN & GRAY, LITTLE SILT & FINE SAND, MOIST, GRAY FINE SAND SAME @ 28.5', SATURATED	100	SS8	
			30.0' TO 32.0'		HSA	
			SAND: 30.0' - 30.5' GRAY, IRON STAINED, VERY FINE TO FINE, GRAINED, SATURATED	100	SS9	
			CLAY: 30.5' TO 32.0', BROWN AND GRAY MOTTLED, SOME SILT AND VERY FINE SAND, CHEMICAL ODOR		HSA	
			35.0' - 36.5'			
			CLAY & FINE SAND: BROWN, GRAY MOTTLES, BECOMING A VERY FINE TO FINE SAND, SATURATED, CHEMICAL ODOR	100	SS10	
			T.D. 38.0'			

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PROJECT LHTAP

WELL NO. EXTRACTION Well - 1

LONGHORN AAP AWD-1
3379

007903

DRILLING LOG			DATE			
1. PROJECT			10. DATE AND TYPE OF SOIL			
2. LOCATION (Continuation of Form)			11. DATE FOR ELEVATION MEASUREMENT			
3. DRILLING AGENCY			12. NAME OF TESTER/OPERATOR OF DRILL			
4. NAME OF THE PERSON OR COMPANY WHO OWNED THE DRILL			13. TOTAL NO. OF SOIL SAMPLES TAKEN			
5. NAME OF DRILLER			14. TOTAL NUMBER CORE BOXES			
6. DIRECTION OF HOLE			15. ELEVATION DRILLING START			
7. THICKNESS OF OVERBURDEN			16. DATE HOLE			
8. DEPTH DRILLER INTO ROCK			17. ELEVATION TOP OF HOLE			
9. TOTAL DEPTH OF HOLE			18. TOTAL CORE RECOVERY FOR BOXES			
			19. SIGNATURE OF INSPECTOR			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	NO. OF SAMPLES	REMARKS (Including any notes from tests of permeability, etc., if requested)
	20		MED. STIFF BROWN TO GRAY FINE SAND AND SILT, RUST MOTTLING, SATURATED	92%	5-5	
	25.0		MED. STIFF LT. GRAY CLAY LITTLE SILT, BROWN MOTTLING, MOIST	100%	5-6	
			TOTAL DEPTH = 26 FT			

← Highest Head Space PID

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MAR 71

PROJECT
LONGHORN AAT
2379

DATE
AWD-1

AWD-2

ENC FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE

LHAAP

Awb-2

007905

[illegible]

007906

AWD-3

DRILLING LOC		PROJECT		SHEET	
2379		10. DATE AND TYPE OF DT		11. DATE OF RECEIVING	
LOCATION: LONGHORN AAP		6 3/4" ID HSA		12. MANUFACTURER'S DESCRIPTION OF SOIL	
CCT / ALLIANCE		FAILING F6		13. TOTAL NO. OF OVER-DRILLED SAMPLES TAKEN	
AWD-3		14. TOTAL NUMBER CORE BORES		15. ELEVATION GROUND WATER	
JOHN LODEN		16. DATE MOLE		17. ELEVATION TOP OF MOLE	
18. THICKNESS OF OVERBURDEN		19. TOTAL CORE RECOVERY FOR BORING		20. SIGNATURE OF INSPECTOR	
21. DEPTH DRILLED INTO ROCK		22. TOTAL DEPTH OF MOLE		35.0'	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	SOIL RECORD	SOIL SAMPLE NO.	REMARKS
0						1. WATER LEVEL: 21.30 FT BELOW GROUND SURFACE; MEASUREMENT TAKEN 1/2 HR AFTER BORE- HOLE COMPLETION INSIDE AUGERS
5			4.0' TO 6.0'			2. JAR SAMPLES
			SILT: BROWN, DK ORANGE- BROWN, SCATTERED LT GRAY MOTTLES, LITTLE CLAY, TRACE ORGANIC DEBRIS, DAMP	100	SS1	SS1 4.0' - 6.0'
						SS2 9.0' - 10.5'
						SS3 14.0' - 16.0'
						SS4 19.0' - 20.5'
						SS5 24.0' - 26.0'
						SS6 29.0' - 30.5'
10			9.0 TO 10.5'			3. JAR SAMPLES (CHEMICAL SAMPLES)
			SILT: BROWN, LT GRAY MOTTLES, SOME CLAY, TRACE BLACK ORGANIC STAINING, PLANT DE- BRIS, DAMP TO MOIST	100	SS2	SS1 4.0' - 6.0'
						SS2 9.0' - 10.5'
						SS3 14.0' - 16.0'
						SS4 19.0' - 20.5'
15			14.0 TO 16.0'			4. JAR SAMPLES (PHYSICAL TESTING)
			SILT & CLAY: BROWN, ORANGE-BROWN, LT GRAY MOTTLES, LT BROWN 3" SAND SEAM @ 14.5, ORGANIC STAIN- ING, SATURATED	100	SS3	SS2 9.0' - 10.5'
						SS5 24.0' - 26.0'
						SS6 29.0' - 30.5'
20			19.0 TO 20.5'			5. DRILLING 6 3/4" ID HSA 0.0 TO 35.0' NOTE: SAMPLES COL- LECTED WITH 3" X 18" & 3" X 24" SPLIT SPDRON SAMPLERS
			SILT: LT GRAY & BROWN, LITTLE CLAY, MOIST	100	SS4	

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MAR 71

PROJECT

SHEET NO.

007907

Hole No. AWD-3

DRILLING LOG		HOLE NO.		DATE	
PROJECT		HOLE NO.		DATE	
2379		HOLE NO.		DATE	
LOCATION		HOLE NO.		DATE	
LONG HORN AAP		HOLE NO.		DATE	
DRILLING AGENCY		HOLE NO.		DATE	
CCI/ALLIANCE		HOLE NO.		DATE	
HOLE NO. (as shown on drawing and on record)		HOLE NO.		DATE	
AWD-3		HOLE NO.		DATE	
NAME OF DRILLER		HOLE NO.		DATE	
DHN LODEN		HOLE NO.		DATE	
DIRECTION OF HOLE		HOLE NO.		DATE	
☒ VERTICAL ☐ INCLINED		HOLE NO.		DATE	
THICKNESS OF OVERBURDEN		HOLE NO.		DATE	
DEPTH DRILLED INTO ROCK		HOLE NO.		DATE	
TOTAL DEPTH OF HOLE		HOLE NO.		DATE	
35.0'		HOLE NO.		DATE	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	1. CORE RECOVERY	2. CORE SAMPLE NO.	REMARKS
20						6: NOTE: MONITORING WELL CONSTRUCTION INITIATED 11/11/93; 20-40 SILICA SAND & BENTONITE PELLETS EMPLACED
25			24.0' TO 26.0'			7. HEADSPACE RESULTS (PPM)
			SAND: BROWN, VERY FINE GRAINED, GRAY MOTTLES, LITTLE CLAY @ 26.0', SATURATED	100	SS5	SS1 21 SS2 41 SS3 9.2 SS4 5.5 SS5 4.2 SS6 31.4
30			29.0 - 30.5'			
			SAND: BROWN & LT GRAY, VERY FINE TO FINE GRAINED, SATURATED	100	SS6	
35			T.D. 35.0'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

DATE

ENC FORM 1836 FOR YOURS CONTAINS ARE CORRECTED.

2379

AWD - 4

007909

Hole No. **AWD-4**

DRILLING LOG		DATE		TIME	
PROJECT 2379		DATE AND TYPE OF SOIL SHOWN IN DATA		TIME OF DAY 11:13-93	
LOCATION LONGHORN AAP		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
DRILLING METHOD CCI/ALLIANCE		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
HOLE NO. (as shown on drilling log) AWD-4		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
NAME OF DRILLER JOBY RARR		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
DIRECTION OF DRILL ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
THICKNESS OF OVERBURDEN		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
DEPTH DRILLED INTO ROCK		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	
TOTAL DEPTH OF HOLE 36 FT		DATE OF TEST MOBILE DRILL		TIME OF DAY 11:13-93	

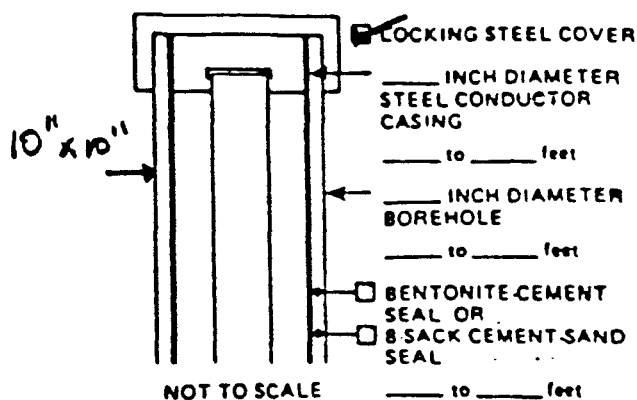
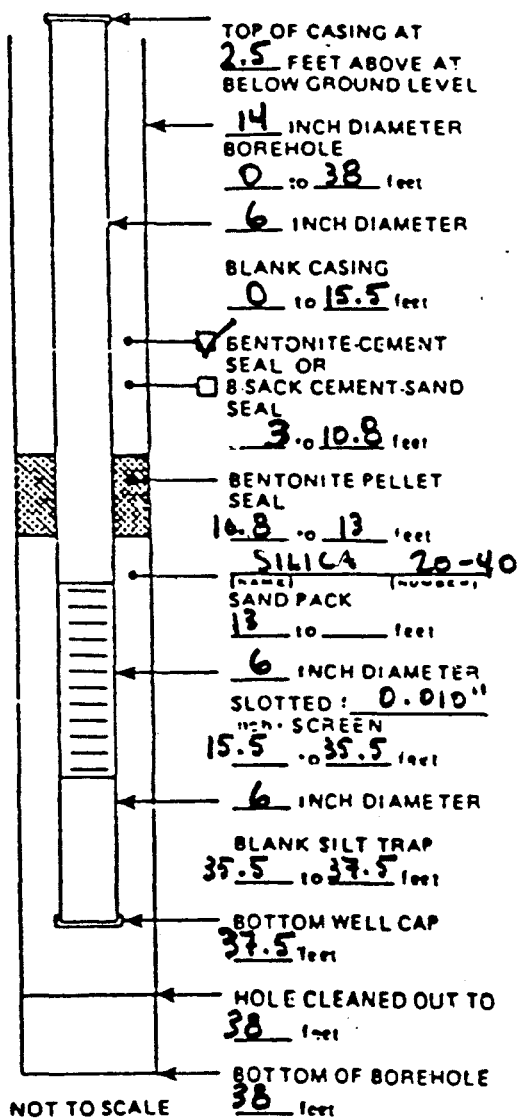
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	SOIL OR SAMPLE NO.	REMARKS (Finding from test, name of investigator, etc., if required)
20			STIFF TAN CLAY, LITTLE SILT, TRACE FINE SAND; SATURATED CEMENTED SILT LAYERS FROM 20.5 TO 20.7 FT.	100%	2-5-9	
30.0			30.5 STIFF GRAY CLAY, LITTLE SILT; IRON STAINED MOIST	100%	5-5-9	
35			SOFT TAN SILT, SOME SAND; IRON STAINED - SATURATED LITTLE GRAY CLAY BELOW 31.5 FT.			
			TOTAL DEPTH 36.0 FT			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT **2379** HOLE NO. **AWD-4**

FIELD WELL COMPLETION FORM

JOB NAME: <u>LHAAP 18124</u>	
JOB NUMBER: <u>2379</u>	PROJECT MANAGER: <u>A. BOUDNR</u>
LOGGED BY: <u>MARTINEK</u>	EDITED BY:
WELL NAME: <u>SW-1</u>	DATE: <u>11/9/93</u>
DRILLING COMPANY: <u>CCI / ALLIANCE</u>	
EQUIPMENT: ☒ <u>8 3/4</u> INCH HOLLOW STEM AUGER	DRILLER: <u>J. LOREN</u>
☐ INCH ROTARY WASH	HOURS DRILLED: <u>3 HRS.</u>

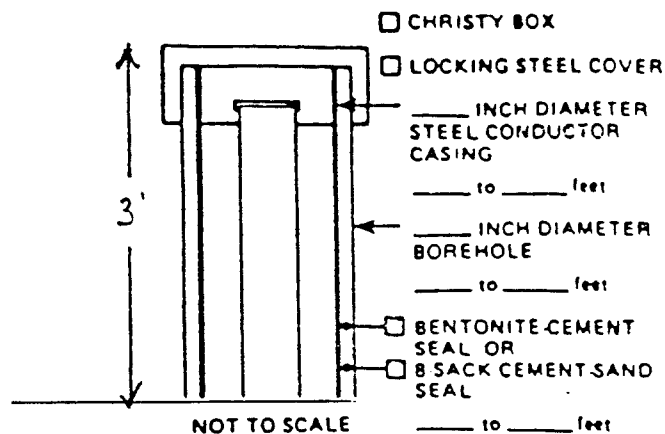
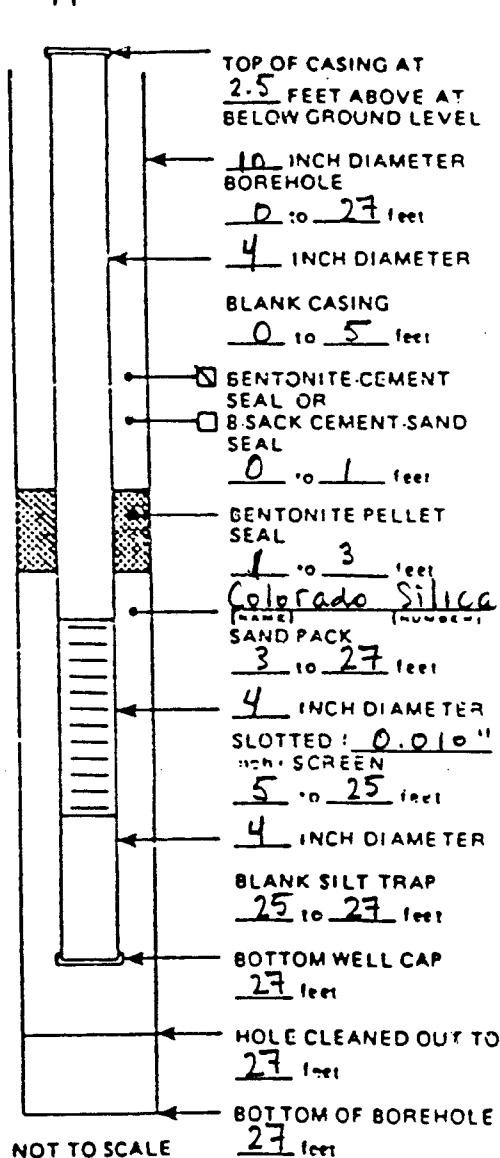


ADDITIONAL INFORMATION: 4' x 4' x 6"
CONCRETE PAD
w/ GUARD
POSTS

FIELD WELL COMPLETION FORM

JOB NAME: <u>LONGHORN AAP 18:24</u>	
JOB NUMBER: <u>2379</u>	PROJECT MANAGER: <u>A. Bow Dnk</u>
LOGGED BY: <u>DNM</u>	EDITED BY:
WELL NAME: <u>AWD-1</u>	DATE: <u>11/12/93</u>
DRILLING COMPANY: <u>CCI / ALLIANCE</u>	
EQUIPMENT: ☒ <u>6 3/4</u> INCH HOLLOW STEM AUGER	DRILLER: <u>J BARR</u>
☐ INCH ROTARY WASH	HOURS DRILLED:

AWD-1



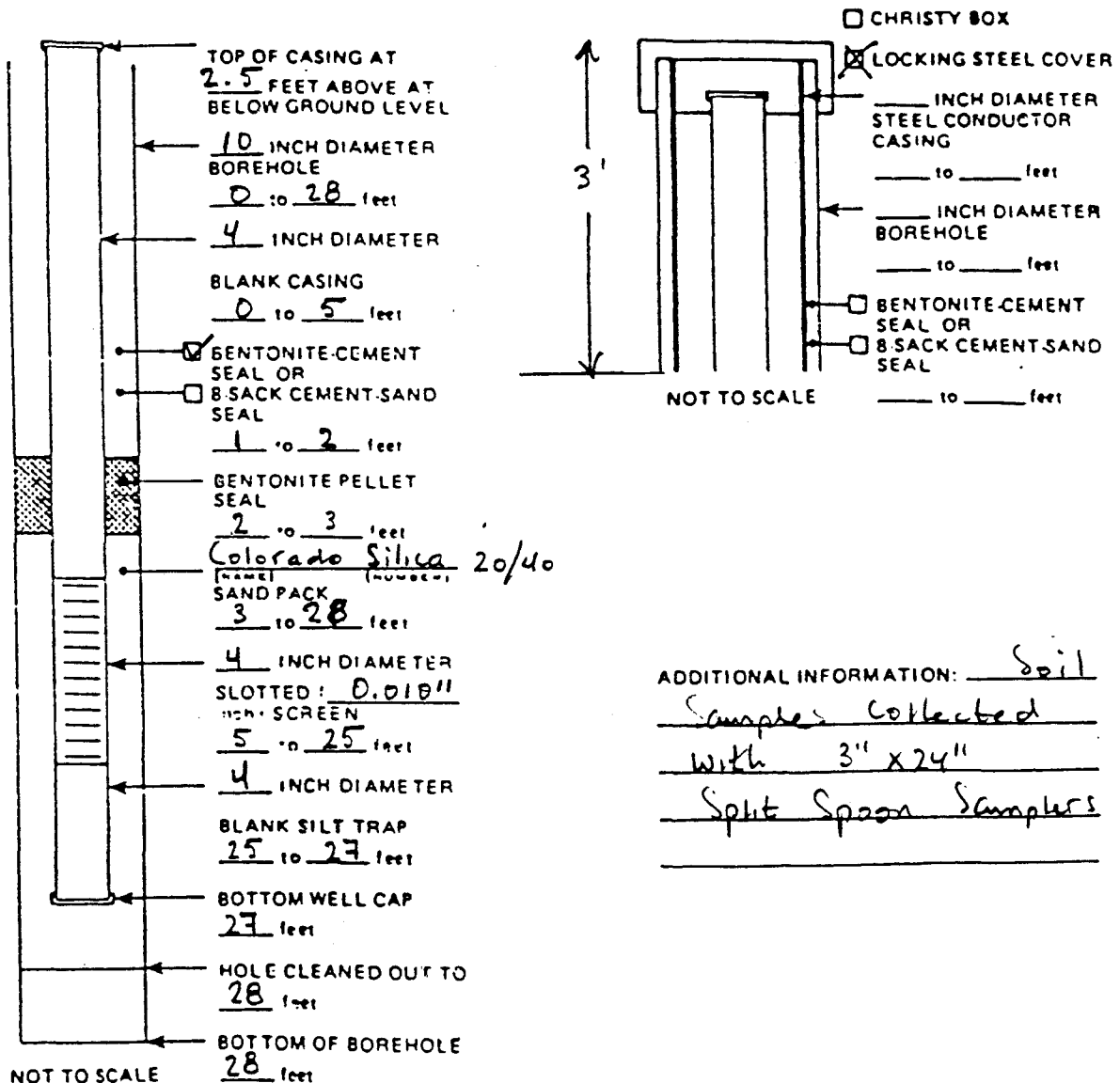
ADDITIONAL INFORMATION: Soil Samples collected
with 3" x 24" Split
Spoon Samplers

007912

FIELD WELL COMPLETION FORM

JOB NAME: <u>LONGHORN AAP 18:24</u>	
JOB NUMBER: <u>2379</u>	PROJECT MANAGER: <u>A. Bou Ank</u>
LOGGED BY: <u>DNM</u>	EDITED BY:
WELL NAME: <u>AWD-2</u>	DATE: <u>11/10/93</u>
DRILLING COMPANY: <u>CCI / ALLIANCE</u>	
EQUIPMENT: ☒ <u>6 3/4"</u> INCH HOLLOW STEM AUGER	DRILLER: <u>J. Loden</u>
☐ _____ INCH ROTARY WASH	HOURS DRILLED: <u>1 1/2</u>

AWD-2

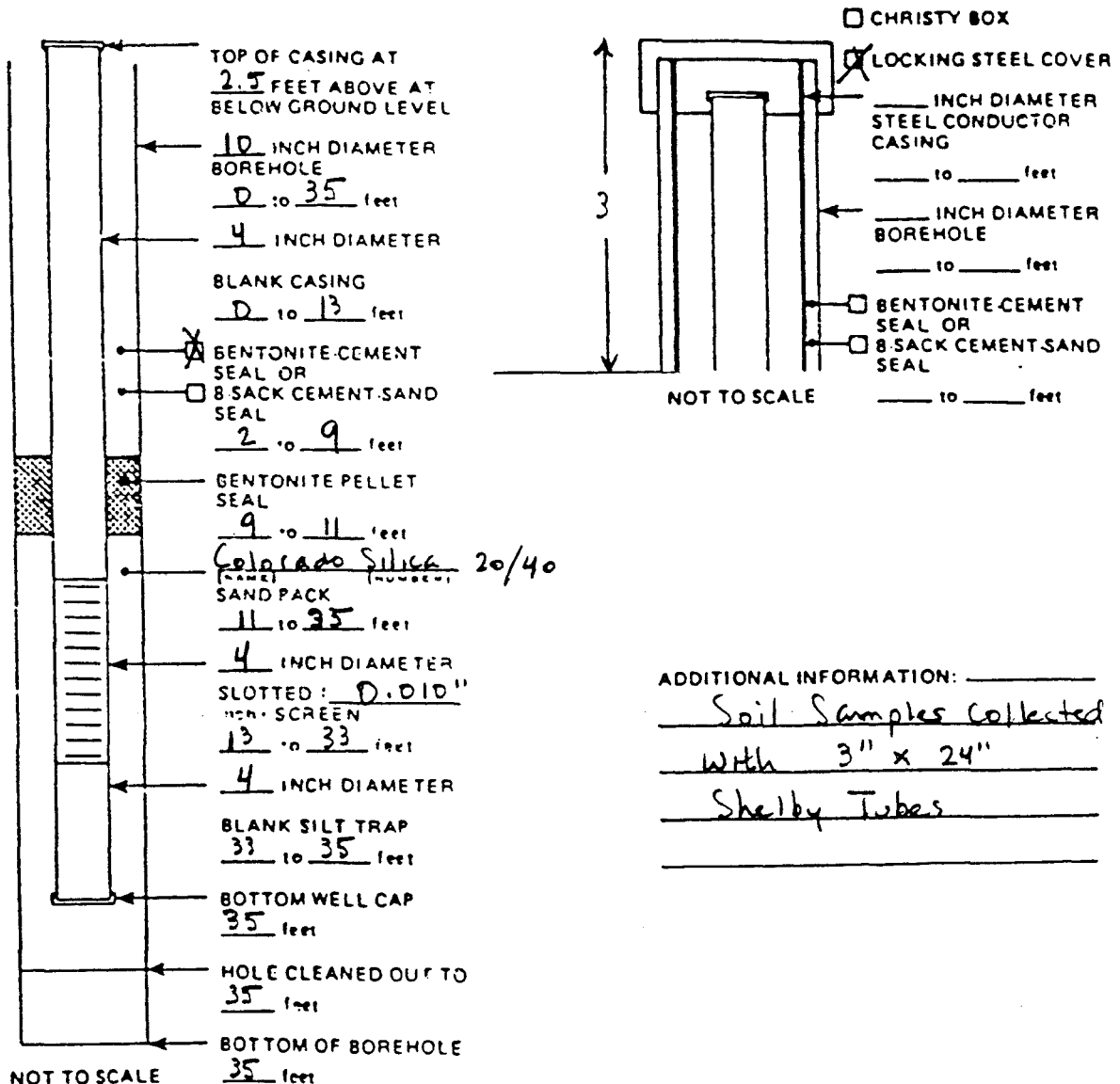


007913

FIELD WELL COMPLETION FORM

JOB NAME: <u>LONGHORN AAP 18:24</u>	
JOB NUMBER: <u>2379</u>	PROJECT MANAGER: <u>A BOONK</u>
LOGGED BY: <u>DNM</u>	EDITED BY:
WELL NAME: <u>AWD-3</u>	DATE: <u>11/11/93</u>
DRILLING COMPANY: <u>CCI / ALLIANCE</u>	
EQUIPMENT: ☒ <u>6 3/4"</u> INCH HOLLOW STEM AUGER	DRILLER: <u>J. Loden</u>
☐ _____ INCH ROTARY WASH	HOURS DRILLED:

AWD-3



ADDITIONAL INFORMATION: _____

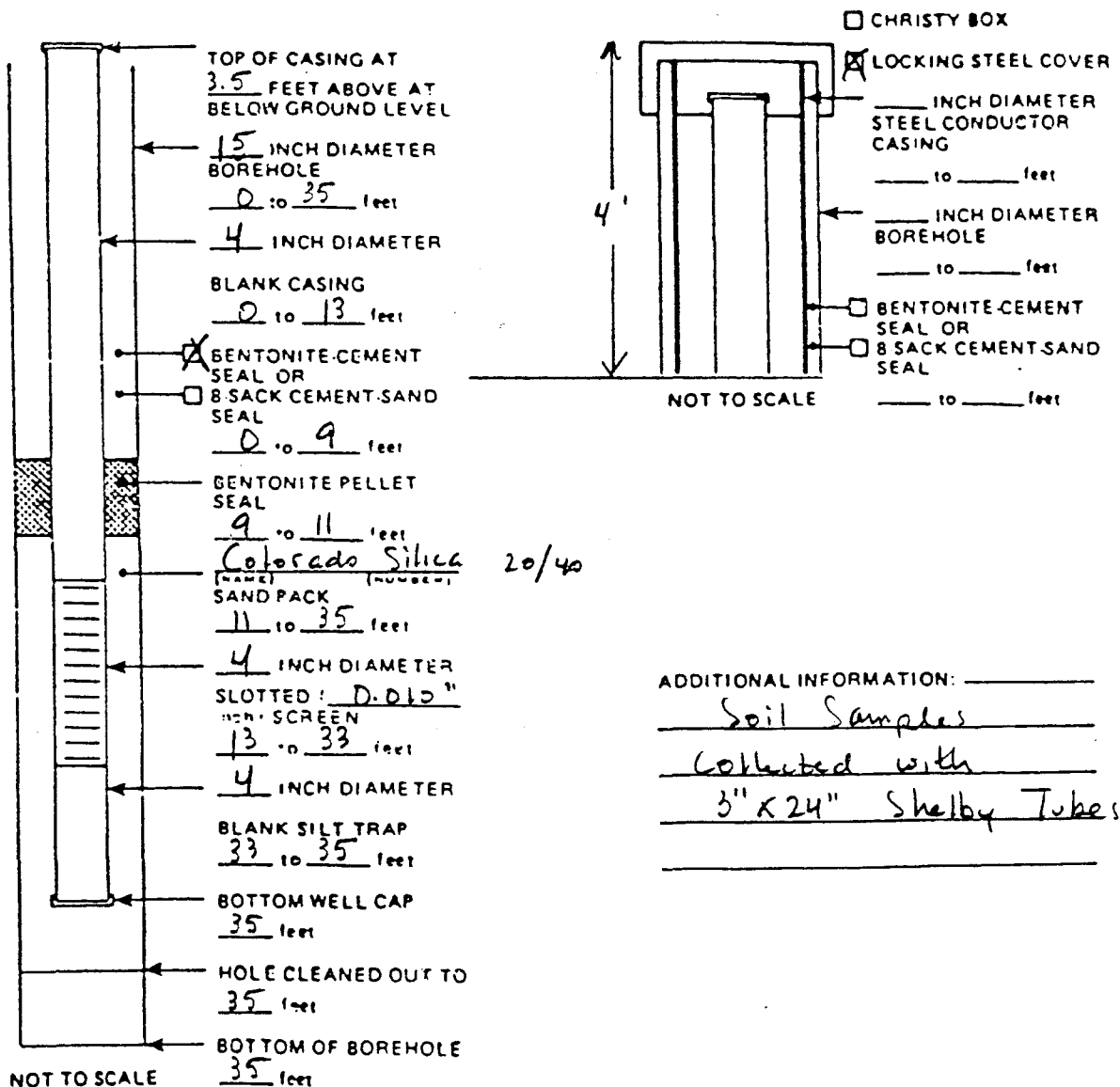
Soil Samples collected
with 3" x 24"
Shelby Tubes

007914

FIELD WELL COMPLETION FORM

JOB NAME: <u>LONGHORN AAP 18:24</u>	
JOB NUMBER: <u>2379</u>	PROJECT MANAGER: <u>A BOUDNE</u>
LOGGED BY: <u>K.D.</u>	EDITED BY:
WELL NAME: <u>AWD-4</u>	DATE: <u>11/13/93</u>
DRILLING COMPANY: <u>CCT / ALLIANCE</u>	
EQUIPMENT: ☒ <u>8 3/4</u> INCH HOLLOW STEM AUGER	DRILLER: <u>J. BARR</u>
☐ INCH ROTARY WASH	HOURS DRILLED: <u>1 1/2</u>

AWD-4



ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse SideState of Texas
WELL REPORT

EW # 1

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711WNER LONGHORN ARMY AMMUNITION PLANT

ADDRESS

KARNACK TEXAS

(Name)

(Street or RFD)

(City)

(State)

(Zip)

2) LOCATION OF WELL:

County HARRISON15

miles in

NE

direction from

MARSHALL TEXAS

(NE, SW, etc.)

(Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):

- ☒
- New Well
- ☐
- Deepening
-
- ☐
- Reconditioning
- ☐
- Plugging

4) PROPOSED USE (Check):

- ☐
- Domestic
- ☐
- Industrial
- ☐
- Monitor
- ☐
- Public Supply
-
- ☐
- Irrigation
- ☐
- Test Well
- ☐
- Injection
- ☐
- De-Watering

5) DRILLING METHOD (Check):

- ☐
- Mud Rotary
- ☐
- Air Hammer
- ☐
- Jetted
- ☐
- Bored
-
- ☐
- Air Rotary
- ☐
- Cable Tool
- ☐
- Other
- HSA

☐ Driven

6) WELL LOG:

Date Drilling:

Started 11-9 19 93Completed 11-9 19 93

DIAMETER OF HOLE

Dia. (in.) From (ft.) To (ft.)
12 1/4 Surface 37'

7) BOREHOLE COMPLETION:

- ☐
- Open Hole
- ☐
- Straight Wall
- ☐
- Underreamed
-
- ☒
- Gravel Packed
- ☐
- Other _____

If Gravel Packed give Interval ... from 37 ft. to 13' ft.

From (ft.) To (ft.)

Description and color of formation material

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

0'-5' REDISH ORANGE SI CLAY

5'-23' BROWN AND GRAY SH

23'-28' BROWN AND GRAY FINE SAND

28'-30' BROWN AND GRAY CLAY

GRAY V/ FINE SAND

BROWN AND GRAY CLAYEY SAND VERY FINE

Dia.
(in.)New
or
UsedSteel, Plastic, etc.
Perf., Slotted, etc.
Screen Mfg., If commercial

Setting (ft.)

From

To

Gage
Casting
Screen

6"

NEW

STAINLESS STEEL (BK)

37'

35'

SUMP

6"

NEW

STAINLESS STEEL (BK)

35

15

.010 SCREEN

6"

NEW

STAINLESS STEEL (BK)

15

+2 1/2'

SEH 40-13

(Use reverse side if necessary)

13) TYPE PUMP:

- ☐
- Turbine
- ☐
- Jet
- ☐
- Submersible
- ☐
- Cylinder
-
- ☐
- Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

Type Test: ☐ Pump ☐ Baller ☐ Jetted ☐ Estimated

Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?

☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? _____ Depth of strata _____

Was a chemical analysis made? ☒ Yes ☒ No

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from 11 ft. to 0 ft. No. of Sacks Used 5

_____ ft. to _____ ft. No. of Sacks Used _____

Method used MOYND PUMP SURVEYCemented by JOHN LODEN

10) SURFACE COMPLETION

- ☒
- Specified Surface Slab Installed [Rule 287.44(2)(A)]
-
- ☐
- Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
-
- ☐
- Pitless Adapter Used [Rule 287.44(3)(B)]
-
- ☐
- Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

Static level 23 ft. below land surface Date 11-10-93

Artesian flow _____ gpm. Date _____

12) PACKERS:

Type

Depth

BENTONITEPELLETS13' to 11'

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME CCI/ALLIANCE ENVIRONMENTAL

(Type or print)

WELL DRILLER'S LICENSE NO. TX 3213 DMN2032 KARBACHHOUSTONTEXAS77092

(Street or RFD)

(City)

(State)

(Zip)

(Signed)

John Loden
(Licensed Well Driller)

(Signed)

(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

State of Texas

REPORT OF
UNDESIRABLE WATER

I. To be completed by well driller. (Type or Print)

1. Well Driller: John D. Loden Jr.
Company Name: CCI Alliance
Address: 2032 Karnbach Houston Tx
(Street or RFD) (City) (State)
2. Landowner or Person Having Well Drilled: Longhorn Army Ammunition Plant
Address: Karnbach Texas
(Street or RFD) (City) (State)
3. Location of Well: County Harrison Labor
League Abstract No.
NW⁴, NE⁴, SW⁴, SE⁴, of Section Block
Survey
1 miles in East direction.
(NE, SW, etc.)
from Karnbach
(Town)
4. Reason why Report of Undesirable Water was submitted:
☐ Naturally-occurring, poor-quality groundwater encountered;
☐ Hydrocarbon contamination encountered (includes gasoline, diesel, etc.);
☒ Hazardous material/hazardous waste contamination encountered;
☐ Other; describe
5. Date Well Drilled: 11-9-93 Type Well: Extraction Well EW# 1
6. Has a Well Report form relating to this well been forwarded to the Texas Water Commission?
Yes X No Date 12-10-93
7. I do hereby certify that in drilling, deepening, or otherwise altering the above described well, water injurious to vegetation, to land, or to fresh water has been encountered and the landowner or person having the well drilled has been informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.
Date: 11-23-93
Reg. No. (Signed) John Loden ms
(Well Driller)

II. To be completed by landowner or person having well drilled. N/A

1. I do hereby certify that I have been informed that the above described well encountered water injurious to vegetation, to land or to fresh water and that the well must be completed or plugged in such a manner as to avoid injury or pollution.
Date (Signed)
(Landowner or person having well drilled)

Send Original Copy by Certified Mail to the: TEXAS WATER COMMISSION, P.O. Box 13087, Austin, Texas 78711

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13067, Austin, Texas 78711

Please use black ink.

ATTENTION OWNER: Confidentially
Privilege Notice on Reverse SideState of Texas
WELL REPORTTexas Water Well Drillers Board
P.O. Box 13067
Austin, Texas 78711

AWD #1

OWNER Chap ADDRESS Hwy 43 Karaak Tx
(Name) (Street or RFD) (City) (State) (Zip)2) LOCATION OF WELL:
County Harrison 2 miles in E direction from Karaak
(NE, SW, etc.) (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):

☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):

☐ Domestic ☐ Industrial ☒ Monitor ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):

☐ Driven
☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored
☐ Air Rotary ☐ Cable Tool ☒ Other HSA

6) WELL LOG:

Date Drilling: Nov 19 93
Started 19
Completed 19

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
<u>12</u>	<u>Surface</u>	<u>27</u>

7) BOREHOLE COMPLETION:

☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 27 ft. to 5 ft.

From (ft.) To (ft.) Description and color of formation material

0 10 Tan Lite Tan Silty Clay

10 27 Tan Lite Tan Clay Sand

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mtg., if commercial	Setting (ft.)		Gate Casting Screen
			From	To	
4	N	Steel	27	7	010
4	N	Steel	7	0	40

(Use reverse side if necessary)

13) TYPE PUMP:

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

Type Test: ☐ Pump ☐ Baller ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?

☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? _____ Depth of strata _____

Was a chemical analysis made? ☐ Yes ☐ No

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from 3 ft. to 0 ft. No. of Sacks Used 1
_____ ft. to _____ ft. No. of Sacks Used _____Method used hand mixCemented by OCI

10) SURFACE COMPLETION

☒ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☐ Pileless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Bentonite Type Pellets Depth 5-3

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME OCI AllianceWELL DRILLER'S LICENSE NO. 3182 DMJ

15289 Addison Rd.

Dalls

Tx

17248

(Signed) [Signature]
(Licensed Well Driller)(Signed) _____
(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13067, Austin, Texas 78711

Please use black ink.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse SideState of Texas
WELL REPORT

AWD #2

Texas Water Well Drillers Board
P.O. Box 13067
Austin, Texas 78711

WELLER Longhorn Army Ammunition Plant ADDRESS Karbach Tx
(Name) (Street or RFD) (City) (State) (Zip)

2) LOCATION OF WELL:
County Harrison 15 miles in NE direction from Marshall
(NE, SW, etc.) (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):

- ☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):

- ☐ Domestic ☐ Industrial ☒ Monitor ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):

- ☐ Driven ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored
☐ Air Rotary ☐ Cable Tool ☐ Other HSA

6) WELL LOG:

Date Drilling: 11-10 93
Started 11-10 1993
Completed 11-10 1993

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
10 1/4	Surface	27

7) BOREHOLE COMPLETION:

- ☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 27' ft. to 3' ft.

From (ft.) To (ft.) Description and color of formation material

0'-5' Brown and Orange Clayey Silt
5'-18' Sand Lt. Gray Fine
18'-28' Brown and Gray Very Fine Clayey Sand

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
4	New	Stainless Steel Riser	5'	2 1/2'	Sch40
4	New	Stainless Steel Screen	25'	5'	.010
4	New	Stainless Steel Sump	27'	25'	Sch40

(Use reverse side if necessary)

13) TYPE PUMP:

N/A

- ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

N/A

Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?

☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? _____ Depth of strata _____

Was a chemical analysis made? ☐ Yes ☐ No

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from 1 ft. to 0 ft. No. of Sacks Used 1/2
Bent. Pellets 0 ft. to 3 ft. No. of Sacks Used 1/4
Method used Surface Pour
Cemented by John Loden

10) SURFACE COMPLETION

- ☒ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☒ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☐ Pileless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

N/A

Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS:

Type

Depth

Bentonite Pellets 3' to 1'

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME CCI Alliance Environmental

(Type or print)

WELL DRILLER'S LICENSE NO. Tx 3213 DMN2032 Karbach

(Street or RFD)

Houston

(City)

Tx

(State)

77092

(Zip)

Signed John Loden
(Licensed Well Driller)Signed _____
(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

State of Texas

REPORT OF
UNDESIRABLE WATER

I. To be completed by well driller. (Type or Print)

1. Well Driller: John D. Loden Jr.
Company Name: OCT Alliance
Address: 2032 Karnbach Houston Tx
(Street or RFD) (City) (State)
2. Landowner or Person Having Well Drilled: Longhorn Army Ammunition Plant
Address: Karnbach Tx
(Street or RFD) (City) (State)
3. Location of Well: County Harrison Labor _____
League _____ Abstract No. _____
NW⁴, NE⁴, SW⁴, SE⁴, of Section _____ Block _____
Survey _____
_____ 1 _____ miles in _____ East _____ direction.
(NE, SW, etc.)
from Karnbach
(Town)
4. Reason why Report of Undesirable Water was submitted:
☐ Naturally-occurring, poor-quality groundwater encountered;
☐ Hydrocarbon contamination encountered (includes gasoline, diesel, etc.);
☒ Hazardous material/hazardous waste contamination encountered;
☐ Other; describe _____
5. Date Well Drilled: 11-10-93 Type Well: Monitor AWD #2
6. Has a Well Report form relating to this well been forwarded to the Texas Water Commission?
Yes X No _____ Date 12-05-93
7. I do hereby certify that in drilling, deepening, or otherwise altering the above described well, water injurious to vegetation, to land, or to fresh water has been encountered and the landowner or person having the well drilled has been informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.
Date: 11-23-93
Reg. No. _____ (Signed) John Loden
(Well Driller)

II. To be completed by landowner or person having well drilled. N/A

1. I do hereby certify that I have been informed that the above described well encountered water injurious to vegetation, to land or to fresh water and that the well must be completed or plugged in such a manner as to avoid injury or pollution.
Date _____ (Signed) _____
(Landowner or person having well drilled)

Send Original Copy by Certified Mail to the: TEXAS WATER COMMISSION, P.O. Box 13087, Austin, Texas 78711

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse SideState of Texas
WELL REPORT

AWD #3

Texas Water Well Drillers Board
P.O. Box 13067
Austin, Texas 787111) Longhorn Army Ammunition Plant
(Name)ADDRESS Kamack
(Street or RFD)(City) Tx
(State) (Zip)

2) LOCATION OF WELL:

County Harrison 15 miles in NE direction from Marshall Tx
(NE, SW, etc.) (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):

☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):

☐ Domestic ☐ Industrial ☒ Monitor ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):

☐ Driven
☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored
☐ Air Rotary ☐ Cable Tool ☒ Other HSA

6) WELL LOG:

Date Drilling: 11-11 19 93
Started 11-11 19 93
Completed _____ 19 _____

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
<u>10 1/4</u>	Surface	<u>35'</u>

7) BOREHOLE COMPLETION:

☐ Open Hole ☐ Straight Wall ☐ Underreamed
☐ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 35' ft. to 11' ft.

From (ft.) To (ft.) Description and color of formation material

0'-5' Brown & Orange Sil Clay
5'-24' Brown & Gray Silty Clay to Clayey Silt
24'-35' Brown Very Fine Sand Slightly Clayey

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Part., Slotted, etc. Screen Mig., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
<u>4"</u>	<u>N</u>	<u>Stainless BK</u>	<u>+3</u>	<u>13'</u>	<u>Sch. 40</u>
<u>4"</u>	<u>N</u>	<u>Stainless BK Screen</u>	<u>13</u>	<u>33'</u>	<u>.010</u>
<u>4"</u>	<u>N</u>	<u>Stainless BK Sump</u>	<u>33'</u>	<u>35</u>	<u>Sch. 40</u>

(Use reverse side if necessary)

13) TYPE PUMP:

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

Type Test ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?

☒ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? _____ Depth of strata _____

Was a chemical analysis made? ☐ Yes ☐ No

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from _____ ft. to _____ ft. No. of Sacks Used 4
_____ ft. to _____ ft. No. of Sacks Used _____Method used Mono Pump SlurryCemented by John Loden

10) SURFACE COMPLETION

☒ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☒ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☐ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS:

Type _____ Depth _____
Bentonite Pellets 11' to 9'

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME CCI Alliance Environmental
(Type or print)WELL DRILLER'S LICENSE NO. Tx 3213 MN2032 Karbach

(Street or RFD)

Houston

(City)

Tx

(State)

77092

(Zip)

Signed

John Loden MD

(Licensed Well Driller)

(Signed)

(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

State of Texas

REPORT OF
UNDESIRABLE WATER

I. To be completed by well driller. (Type or Print)

1. Well Driller: John D. Loden Jr.
Company Name: CCI Alliance
Address: 2032 Karnach Houston Tx
(Street or RFD) (City) (State)
2. Landowner or Person Having Well Drilled: Longhorn Army Ammunition Plant
Address: Karnach Tx
(Street or RFD) (City) (State)
3. Location of Well: County Harrison Labor _____
League _____ Abstract No. _____
NW⁴, NE⁴, SW⁴, SE⁴, of Section _____ Block _____
Survey _____
1 miles in East direction.
(NE, SW, etc.)
from Karnack
(Town)
4. Reason why Report of Undesirable Water was submitted:
☐ Naturally-occurring, poor-quality groundwater encountered;
☐ Hydrocarbon contamination encountered (Includes gasoline, diesel, etc.);
☒ Hazardous material/hazardous waste contamination encountered;
☐ Other; describe _____
5. Date Well Drilled: 11-11-93 Type Well: Monitor AWD #3
6. Has a Well Report form relating to this well been forwarded to the Texas Water Commission?
Yes X No _____ Date 12-15-93
7. I do hereby certify that in drilling, deepening, or otherwise altering the above described well, water injurious to vegetation, to land, or to fresh water has been encountered and the landowner or person having the well drilled has been informed that such well must be completed or plugged in such a manner as to avoid injury or pollution.
Date: 11-23-93
Reg. No. _____ (Signed) John Loden MD
(Well Driller)

II. To be completed by landowner or person having well drilled.

1. I do hereby certify that I have been informed that the above described well encountered water injurious to vegetation, to land or to fresh water and that the well must be completed or plugged in such a manner as to avoid injury or pollution.
Date _____ (Signed) _____
(Landowner or person having well drilled)

Send Original Copy by Certified Mail to the: TEXAS WATER COMMISSION, P.O. Box 13087, Austin, Texas 78711

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13067, Austin, Texas 78711

Please use black ink.

ATTENTION OWNER: Confidentiality
Privilege Notice on Reverse SideState of Texas
WELL REPORT

AWD #4

Texas Water Well Drillers Board
P.O. Box 13067
Austin, Texas 78711OWNER Chap ADDRESS Hwy 43 Karaak Tx
(Name) (Street or RFD) (City) (State) (Zip)2) LOCATION OF WELL:
County Harrison 2 miles in E direction from Karaak
(NE, SW, etc.) (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____☒ SEE ATTACHED MAP

3) TYPE OF WORK (Check):

☒ New Well ☐ Deepening
☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):

☐ Domestic ☐ Industrial ☒ Monitor ☐ Public Supply
☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):

☐ Driven
☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored
☐ Air Rotary ☐ Cable Tool ☒ Other HSA

6) WELL LOG:

Date Drilling: Nov 19 1993
Started Nov 19 1993
Completed Nov 19 1993

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
12	Surface	35

7) BOREHOLE COMPLETION:

☐ Open Hole ☐ Straight Wall ☐ Underreamed
☒ Gravel Packed ☐ Other _____
If Gravel Packed give interval ... from 35 ft. to 13 ft.

From (ft.) To (ft.) Description and color of formation material

0 12 Tan Lite Tan Silty Clay
12 35 Tan Lite Tan Clay

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Gage Casting Screen
			From	To	
4	N	Steel	35	15	.010
4	N	Steel	15		40

(Use reverse side if necessary)

13) TYPE PUMP:

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

Type Test: ☐ Pump ☐ Baller ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did you knowingly penetrate any strata which contained undesirable constituents?
☐ Yes ☒ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from 11 ft. to 0 ft. No. of Sacks Used 5
_____ ft. to _____ ft. No. of Sacks Used _____
Method used tremmie
Cemented by CCI

10) SURFACE COMPLETION

☒ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☐ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Bentonite Type Pellets Depth 13-11

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME CCI AllianceWELL DRILLER'S LICENSE NO. 3182 DMI

15289 Addison Rd.

Dallas

Tx

17248

(Street or RFD)

(City)

(State)

(Zip)

(Signed)

John Bon
(Licensed Well Driller)

(Signed)

(Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

5861

ENC FORM 1136 - THE UNITED STATES OF AMERICA
MAR 21

SR 91

ENC POE # 1836 FROM: [redacted] TO: [redacted] DATE: 07/18/2011

2-9

3244

Hole No. **SB-6**

DRILLING LOG		Project		Date	
PROJECT 2379		LOCATION LONGHORN AAP		HOLE NO. AND TYPE OF HOLE 6 3/4 IN ID HSA	
DRILLING AGENCY CCI ALLIANCE		DRILLER MOBILE DRILL B61		HOLE DEPTH 27.0 FT	
HOLE NO. (AL. NUMBER OR OTHER NO.) SB-6		TOTAL NO. OF OVER-DRIVEN SAMPLES TAKEN 7		UNDISTURBED	
NAME OF DRILLER JOBY BARR		TOTAL NUMBER CORE BOXES		ELEVATION CHANGED DATES	
DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		DATE HOLE 11-9-93		COMPLETED 11-9-93	
THICKNESS OF OVERBURDEN		ELEVATION TOP OF HOLE		TOTAL CORE RECOVERY FOR BORING	
DEPTH DRILLED INTO ROCK		DATE OF INSPECTION		INSPECTION BY	
TOTAL DEPTH OF HOLE 27.0 FT		11-9-93		11-9-93	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERED	BOX OR SAMPLE NO.	REMARKS (Including Name, Date, Time, Depth, of Penetration, etc., of equipment)
	0					1. PERCHED WATER ENCOUNTERED BETWEEN 23-23.5'
	5		5.0 STIFF RED CLAY FILL; DAMP-TO-MOIST	85%	SS-1	2. SAMPLES SS-1: 5-7' SS-2: 10-12' SS-3: 15-17' SS-4: 17.5-19' SS-5: 20-21' SS-6: 23-24.5' SS-7: 25-27'
	10		6.5 MED STIFF TO STIFF TAN SILT, LITTLE CLAY (FILL); DAMP			3. DRILLING 3 IN SPLIT SPOON SAMPLES TAKEN THROUGH 6 3/4 IN ID HOLLOW STEM ANGULAR WITH PULL OUT AUG
	15		15.0 MED. STIFF TO STIFF LT. BROWN AND LT. GRAY SILT AND CLAY (FILL); DAMP TO MOIST	90%	SS-2	4. HOLE ABANDONED WITH GRUNT
	20		20.0 MED. DENSE TAN TO BROWN FINE SAND, TR. SILT-MOIST	90%	SS-3	5. PID HEADSPACE RESULTS: SS-1: 0.77" SS-2: 9.2 PPM SS-3: 31 PPM SS-4: 205 PPM SS-5: 67 PPM SS-6: 1017 PPM SS-7: 711 PPM
	25			90%	SS-4	
	27.0				SS-5	

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT **SB-6**

Sheet No. SB-6

DRILLING LOG		SYMBOLS		INSTALLATION		SHEET 2 OF 2 SHEETS	
1. PROJECT 2379				10. SIZE AND TYPE OF BIT FLUID BED			
2. LOCATION LONGHORN APT				11. DATE OF ELEVATION MEASUREMENT NOV 11 1993			
3. DRILLING AGENCY CCIT ALLIANCE				12. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN 7			
4. HOLE NO. (AS SHOWN ON DRILLING PLAN AND ON LOG) SB-6				13. TOTAL NUMBER CORE DEEKS			
5. NAME OF DRILLER JOBY BARR				14. ELEVATION GROUND WATER			
6. DIRECTION OF HOLE VERTICAL ☒ INCLINED ☐ DEEP FROM VEAT.				15. DATE HOLE STARTED 11-9-93			
7. THICKNESS OF OVERBURDEN				16. ELEVATION TOP OF HOLE			
8. DEPTH DRILLED INTO ROCK				17. TOTAL CORE RECOVERY PER DECK			
9. TOTAL DEPTH OF HOLE 27.0 FT				18. REMARKS SEE LOG			

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Thompson)	% CORE RECOVERED	BOX OR SAMPLE NO.	REMARKS
20.0			LOOSE TO MED. DENSE LT. GRAY TO BROWN FINE SAND, SOME SILT; DAMP	50%	1-5-5	
23.0			LOOSE BROWN FINE SAND; WET	100%	5-5-5	
23.5			STIFF, RUST SILT; DRY			
23.7			STIFF, RUST SILT; DRY			
25.0			MED. STIFF LT. GRAY SILT DRY	90%	5-5-5	
25.3			MED. DENSE RUST FINE SAND; DAMP			
			STIFF LT. TAN AND RUST SILT AND CLAY; DAMP			
TOTAL DEPTH: 27.0 FT						

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MAR 71

007931

Hole No. SB-7

DELLING LOG		Hole No. SB-7	
PROJECT 2379		Hole No. SB-7	
LOCATION LONGHORN AAP		Hole No. SB-7	
DRILLING AGENCY CCI/ALLIANCE		Hole No. SB-7	
Hole No. (As shown on drawing and on log)		Hole No. SB-7	
NAME OF DRILLER JOBY BARR		Hole No. SB-7	
DIRECTION OF HOLE		Hole No. SB-7	
VERTICAL ☒ INCLINED ☐ DEEP FROM VERT.		Hole No. SB-7	
THICKNESS OF OVERBURDEN		Hole No. SB-7	
DEPTH DRILLED INTO ROCK		Hole No. SB-7	
TOTAL DEPTH OF HOLE 27.0 FT		Hole No. SB-7	
ELEVATION		Hole No. SB-7	
DEPTH		Hole No. SB-7	
LEGEND		Hole No. SB-7	
CLASSIFICATION OF MATERIALS		Hole No. SB-7	
CORRECTION		Hole No. SB-7	
REMARKS		Hole No. SB-7	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	CORRECTION	REMARKS
	20		LOOSE LT. TAN V. FINE SAND; DRY	100%	SS-5
			LOOSE LT. TAN TO LT. BROWN FINE SAND, LITTLE SILT; DAMP	90%	SS-6
	25.0		LOOSE LT. GRAY FINE SAND LITTLE LT. BROWN SILT; DAMP	85%	SS-7
			LOOSE LT. GRAY FINE SAND DRY and silt		
			TOTAL DEPTH = 27 FT		

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT

Hole No.

SB-7

ENC FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROBES CT
LONGHORN AAP
2379
SE-E

SB-8

007933

DRILLING LOG		PROJECT		DATE		SHEET	
2379		LONGHORN AAP		11-10-93		11-10-93	
CITY ALLIANCE		MOBILE DRILL		361			
SB-E		TOTAL NO. OF CORE SAMPLES TAKEN		7			
JOB# 73412		TOTAL NUMBER CORE SAMPLES					
ELEVATION OF BOREHOLE		ELEVATION OF BOREHOLE					
DIRECTION OF DRILL		DATE DRILL		11-10-93		11-10-93	
THICKNESS OF OVERBURDEN		ELEVATION TOP OF HOLE					
DEPTH DRILLED INTO ROCK		TOTAL CORE RECOVERY FOR BORING					
TOTAL DEPTH OF HOLE		32 FT					

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS	% CORE RECOVERY	SOIL SAMPLE NO.	REMARKS
			MED. STIFF, BROWN SILT, TRACE FINE SAND AND ORGANIC MATTER (FILL); DRY	90%	5-5	
	25.0		LOOSE, TAN FINE SAND, LITTLE SILT; DRY	90%	5-5-6	
	30.0		LOOSE BROWN FINE SAND AND 3.0 SILT; SATURATED	95%	5-5-7	
			MED. STIFF GRAY CLAY; BROWN MOTTLED, MOIST			
			TOTAL DEPTH 32 FT			

ENC FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT LONGHORN AAP SB-8 2379

SD 9

A-9

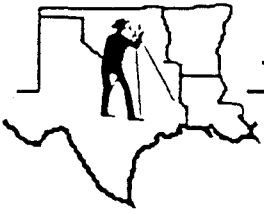
007936

BELLING LOG		DATE		TIME		SB10	
PROJECT		2379		DATE AND TIME OF DAY			
LOCATION		LONGHORN AAP		ELEVATION			
BELLING PROJECT		CCI / ALLIANCE		ELEVATION		FALLING PG	
NAME OF BELLING		SB10		TOTAL NO. OF BELLING		4	
NAME OF BELLING		JOHN LODEN		TOTAL NUMBER OF BELLING			
DIRECTION OF BELLING				ELEVATION			
☒ VERTICAL ☐ HORIZONTAL				DATE BELLING		11/13/93	
THICKNESS OF OVERBURDEN				ELEVATION			
DEPTH BELLING INTO SOIL				TOTAL CORE RECOVERY FOR BELLING			
TOTAL DEPTH OF BELLING		21.0'		SIGNATURE OF INSPECTOR		<i>David J. [Signature]</i>	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIAL	TEST NO.	TEST NO.	REMARKS	
20			AND ORANGE BROWN,	88	SS4		
21			TRACE CLAY, WET				
			21.0'				
			T.D. - 21.0'				

ENC. FORM 1136 USE PREVIOUS EDITIONS ARE OBSOLETE

SB10

007937



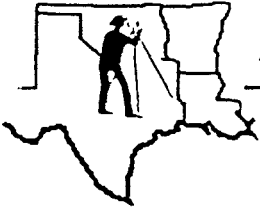
ARK-LA-TEX SURVEYING CO., INC.

P.O. Box 910 • 305 W. Rusk • Marshall, Texas 75671 • 903/938-9939 • FAX 903/938-0601

January 25, 1994

MONITORING WELLS

AWD-1	X Coord.	Y Coord.	Z Elev.
Well	3,040,093.100	380,601.687	
"x" in Slab			178.48'
Casing			181.06'
Cover			181.03'
Natural Ground			177.87'
AWD-2			
Well	3,040,368.409	380,860.421	
"x" in Slab			183.88'
Casing			186.75'
Cover			186.91'
Natural Ground			183.42'
AWD-3			
Well	3,040,701.110	380,636.144	
"x" in Slab			197.59'
Casing			200.13'
Cover			200.13'
Natural Ground			197.04'
AWD-4			
Well	3,040,599.684	381,381.439	
"x" in Slab			190.61'
Casing			193.56'
Cover			193.46'
Natural Ground			190.13'
EW-1			
Well	3,040,957.225	380,867.664	
"x" in Slab			196.34'
Casing			198.63'
Cover			198.61'
Natural Ground			195.80'



ARK-LA-TEX SURVEYING CO., INC.

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January 25, 1994

SOIL BORING LOCATIONS

	<u>X Coord.</u>	<u>Y Coord.</u>	<u>Z Elev.</u>
SB-1	3,040,438.813	380,407.100	191.99'
SB-2	3,040,496.800	380,454.128	192.32'
SB-3	3,040,552.607	380,496.593	192.90'
SB-4	3,040,549.000	380,903.967	193.15'
SB-5	3,040,642.431	380,817.805	196.04'
SB-6	3,040,831.757	380,935.212	202.76'
SB-7	3,040,887.980	381,022.389	204.15'
SB-8	3,040,774.856	381,143.619	205.46'

007939

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-6				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
18	5.63	1571	71	Clear purge water
20				Purging interrupted for recharge
21	5.69	1662	70	
23	5.72	1675	70	Purging interrupted for recharge
30	5.74	1668	69	Purging completed

MW-7				
9	7.21	1478	65	Purging interrupted for recharge
18	7.08	1488	65	Purging interrupted for recharge
22	6.99	1540	64	Purging completed
	7.06	1515	65	Measurement while sampling

MW-8				
18				Purging interrupted for recharge
	4.78	709	64	
25	4.72	540	64	Purging completed

007940

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-15				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
110	5.85	547	68	
128	5.87	552	68	
165				Purging completed

MW-16				
17	5.57	582	63	Orange-brown silt
36	6.07	623	64	
62	6.15	640	64	
85	6.18	643	64	
105	6.19	647	64	Purging completed

MW-17				
9	6.89	894	64	
16				Purging interrupted for recharge
17	6.86	930	64	
18	6.85	934	63	Well bailed dry; pale olive purge water

MW-18				
Time (11/21/93)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
1500				Start purging
1515	6.48	491	70	
1525	6.57	492	70	

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-22				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
16	10.54	2480	70	Purging interrupted for recharge
17	10.11	2550	69	Well pumped dry; sample collected

MW-23				
18	7.89	1508	69	Purging interrupted for recharge; clear purge water
20	6.44	1865	65	
21	6.58	1735	65	Purging completed

102				
12	5.51	098	64	Measured while sampling

109				
9	6.02	305	68	
	6.13	316	68	
	6.13	315	68	
	6.09	319	68	
10	6.10	316	68	Purging completed

120				
9	5.11	5500	72	
10	5.05	5900	72	
11	5.09	5970	72	
12	5.07	5950	72	Purging completed

007942

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

123				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
3				Well bailed dry; very silty
5				Well bailed dry: recharge for sampling

124				
3				Well bailed dry; very silty
	5.91	118	65	Measurement while sampling

125				
4	5.86	158	67	
5	5.90	154	67	Pale orange-brown purge water
7	5.94	151	66	
10	5.89	151	67	Purging completed

126				
2	5.95	5350	64	
4	5.94	5230	65	
6	5.96	4660	65	
8	5.96	4700	65	
10	5.93	4300	nm	
16	5.92	4060	63	
18	5.95	4480	66	
20	5.93	4110	65	
21	5.95	4180	66	Purging completed

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

C10				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
183	6.70	1512	67	
191	6.71	1507	67	Clear purge water
201	6.75	1516	67	Purging completed

MW-1				
18	5.50	3730	70	
24	5.60	3690	70	
36	5.71	3740	70	
55	5.68	3660	70	Purging completed

MW-2				
18				Pumping interrupted for recharge
24				Pumping interrupted for recharge
33	5.94	2320	68	
36				Purging completed

MW-3				
24	5.53	1473	69	
27	5.54	1542	69	Clear purge water
36	5.56	1629	69	
38	5.57	1656	69	
50	5.56	1673	69	
57	5.61	1696	69	
64	5.57	1706	69	
73	5.57	1725	69	Clear purge water

007944

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-3 (cont.)				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
82	5.55	1729	69	Clear purge water
88				Purging completed

MW-4				
30	6.16	2600	67	
	6.05	2620		
	6.09	2570		
45	6.10	2620	65	
60	6.12	2590	65	
74	6.11	2610	65	Purging completed; clear purge water

MW-5				
18				Purging interrupted for recharge
22	4.82	1136	nm	Purging interrupted for recharge
27	4.78	1119	65	
	4.77	1123	71	
	4.78	1132	70	
	4.79	1140	72	
	4.80	1180	72	
71	4.83	1137	72	Purging completed

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-9				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
15	5.63	126	64	Purging interrupted for recharge
18				Purging completed
	5.33	100	66	Measurement prior to sampling

MW-10				
20				Purging interrupted for recharge
27	6.46	925	64	
36	6.45	917	65	
	5.69	807	65	Measurement while sampling

MW-11				
8	6.02	132	67	Very pale orange- brown purge water
15	6.05	128	67	
18	6.08	133	68	Purging interrupted for recharge
22				Purging interrupted for recharge
27	5.97	145	68	Purging interrupted for recharge
34	6.31	169	68	
36	5.83	158	67	
37	6.13	158	67	Purging completed

007946

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-12				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
30	4.65	1280	67	
50	4.79	1426	67	
65	4.86	1467	67	
66	4.90	1463	67	
82	4.86	1500	67	
91	4.95	1508	67	
95	4.96	1510	67	
100	4.97	1514	67	Purging completed

MW-13				
22	6.95	984	63	
36	6.93	967	64	
55	6.83	933	64	
73	6.84	931	64	
91	6.79	921	64	
110	6.79	916	64	
128	6.76	909	65	
146	6.70	879	64	Purging completed

MW-14				
119	5.77	1297	68	
128	5.76	1283	68	
137	5.77	1280	68	
160	5.76	1279	68	Purging completed

007947

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

MW-18 (cont.)				
Time (11/21/93)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
1540	6.62	451	70	
1610	6.67	468	70	Staggered pumping/recharge
1645	6.63	489	68	Purging completed; 65 gallons purged

MW-19				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
18	5.73	6610	64	
22	5.85	6730	64	
25				Purging interrupted for recharge
73	5.97	7090	66	
77	6.01	7110	66	
88	6.04	7090	67	
	6.07	6910	67	Measurement while sampling

MW-20				
6				Purging interrupted for recharge
12	7.30	316	63	Purging completed

MW-21				
9	5.31	3690	67	Clear purge water
17				Well pumped dry; sample collected

007948

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

C1				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
55	6.11	2330	66	Clear purge water
73	6.10	2400	67	
91	6.11	2400	67	
93				Purging completed

C2				
22	6.67	754	65	Pumped dry; recharge
27	6.54	735	65	Purging completed
	5.87	658	63	Measurement while sampling

C3				
55	5.41	1313	64	Pale orange-brown purge water
80	5.49	1319	65	
110	5.54	1309	65	
130	5.56	1312	65	Purging completed, clear purge water

C4				
110	5.74	166	64	Purging completed, Clear purge water
	5.80	189	64	Measurements prior to sampling
	5.78	185	64	
	5.82	181	64	

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

C4A				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
23	6.94	543	64	
36	7.07	553	64	
40	7.12	555	65	
50	7.16	555	65	Clear purge water
65	7.15	553	66	Pumping stopped for recharge
95				Purging completed

C5				
45	6.23	340	64	Clear purge water
65	6.23	343	64	Clear purge water
70	6.24	343	64	Clear purge water
110				Purging completed

C5 - Resample 12/7/93				
55	6.20	353	63	Clear purge water
73	6.18	351	63	
91	6.20	353	63	Clear purge water
105				Purging completed

C6				
50	6.04	1572	66	
58	6.03	1588	65	
73	6.04	1587	65	
91	6.02	1519	65	Clear purge water
110	6.07	1582	65	Purging completed

007950

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

C7				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
5	6.47	578	67	
6	6.46	595	67	
9				Purging interrupted for recharge
10	6.56	588	68	Pale olive purge water
11	6.53	583	68	
14	6.55	582	68	
16				Purging interrupted for recharge
18	6.56	583	68	Purging completed; pale olive purge water

C8				
20	6.35	4490	65	
25	6.36	4530	65	
40	6.40	4550	65	
45				Purging completed

C9				
7	6.35	9860	nm	Purging interrupted for recharge
10	6.36	9860	68	Purging completed

007951

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	C1	C2	C3	C3*
Date Purged	12/8/93	11/22/93	11/17/93	12/6/93
Date Sampled	12/8/93	11/23/93	11/18/93	12/6/93
DTW (1)	20.06	3.69	23.19	
WTD (2)	47.02	29.90	62.18	
Water Column (Ft)	26.96	26.21	38.99	
Calculated Well Volume (Gallons)	17.59	17.10	25.45	
5V (3)	87.95	85.50	127.25	
Water Volume Purged (Gallons)	93.0	27.0	130.0	105.0

Well ID	C4	C4A	C5	C5*
Date Purged	11/17/93	12/7/93	11/17/93	12/7/93
Date Sampled	11/18/93	12/7/93	11/18/93	12/7/93
DTW	21.76	21.93	9.44	
WTD	55.40	121.00	39.40	
Water Column (Ft)	33.64	99.07	29.96	
Calculated Well Volume (Gallons)	21.96	64.67	19.56	
5V	109.80	323.35	97.80	
Water Volume Purged (Gallons)	110.0	95.0	110.0	105.0

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	MW-4	MW-5	MW-6	MW-7
Date Purged	12/1/93	12/1/93	12/3/93	11/21/93
Date Sampled	12/1/93	12/1/93	12/3/93	11/22/93
DTW	22.80	21.65	18.92	13.75
WTD	45.30	43.60	47.80	24.50
Water Column (Ft)	22.50	21.95	28.88	10.75
Calculated Well Volume (Gallons)	14.69	14.33	18.85	7.02
5V	73.45	71.65	94.25	35.10
Water Volume Purged (Gallons)	74.0	72.0	30.0	22.0

Well ID	MW-8	MW-9	MW-10	MW-11
Date Purged	11/30/93	11/21/93	11/22/93	11/23/93
Date Sampled	11/30/93	11/22/93	11/23/93	11/23/93
DTW	11.62	9.35	4.80	3.16
WTD	33.60	29.75	36.70	13.20
Water Column (Ft)	21.98	20.40	31.90	10.04
Calculated Well Volume (Gallons)	14.35	13.32	20.82	6.55
5V	71.75	66.60	104.00	32.75
Water Volume Purged (Gallons)	25.0	18.0	21.0	37.0

007953

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	MW-12	MW-13	MW-14	MW-15
Date Purged	11/19/93	11/22/93	11/19/93	12/8/93
Date Sampled	11/19/93	11/23/93	11/19/93	12/8/93
DTW	5.22	4.29	5.92	23.86
WTD	31.20	48.80	53.80	71.80
Water Column (Ft)	25.98	44.51	47.88	47.94
Calculated Well Volume (Gallons)	16.96	29.06	31.26	31.30
5V	84.80	145.30	156.30	156.50
Water Volume Purged (Gallons)	100.0	146.0	160.0	165.0

Well ID	MW-16	MW-17	MW-18	MW-19
Date Purged	11/22/93	11/22/93	11/21/93	11/30/93
Date Sampled	11/23/93	11/23/93	11/22/93	11/30/93
DTW	3.04	7.35	6.00	5.57
WTD	33.70	28.70	33.70	33.75
Water Column (Ft)	30.66	21.35	27.70	28.18
Calculated Well Volume (Gallons)	20.01	13.94	18.08	18.40
5V	100.05	69.70	90.40	92.00
Water Volume Purged (Gallons)	105.0	18.0	65.0	88.0

007954

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	MW-20	MW-21	MW-22	MW-23
Date Purged	11/30/93	12/3/93	12/3/93	12/6/93
Date Sampled	11/30/93	12/3/93	12/3/93	12/7/93
DTW	11.21	24.45	22.80	23.34
WTD	20.00	46.80	43.80	46.80
Water Column (Ft)	8.79	22.35	21.00	23.46
Calculated Well Volume (Gallons)	5.74	14.59	13.71	15.31
5V	28.70	72.95	68.55	76.55
Water Volume Purged (Gallons)	12.0	17.0	17.0	21.0

Well ID	102	109	120	123
Date Purged	11/21/93	12/1/93	11/19/93	12/2/93
Date Sampled	11/22/93	12/2/93	11/19/93	12/3/93
DTW	18.00	22.16	8.90	10.85
WTD	32.72	34.50	27.00	21.10
Water Column (Ft)	14.72	12.34	18.10	10.25
Calculated Well Volume (Gallons)	2.40	2.01	2.95	1.67
5V	12.0	10.05	14.75	8.35
Water Volume Purged (Gallons)	12.0	10.0	12.0	5.0

007955

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	124	125	126	129
Date Purged	12/1/93	12/1/93	12/7/93	11/19/93
Date Sampled	12/2/93	12/1/93	12/8/93	11/19/93
DTW	11.80	21.60	25.20	21.20
WTD	26.00	27.60	39.30	36.70
Water Column (Ft)	14.20	6.00	14.10	15.50
Calculated Well Volume (Gallons)	2.32	0.98	2.30	2.53
5V	11.60	4.90	11.50	12.65
Water Volume Purged (Gallons)	3.0	10.0	21.0	15.0

Well ID	130	AWD-1	AWD-2	AWD-3
Date Purged	11/21/93	11/19/93	12/5/93	12/6/93
Date Sampled	11/22/93	11/19/93	12/6/93	12/6/93
DTW	3.90	6.62	8.10	24.12
WTD	29.60	27.90	29.50	37.40
Water Column (Ft)	25.70	21.28	21.40	13.28
Calculated Well Volume (Gallons)	4.19	13.89	13.97	8.67
5V	20.95	69.50	69.85	43.35
Water Volume Purged (Gallons)	16.0	91.0	70.0	28.0

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

129				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
15	5.57	430	64	Measurements prior to sampling
	5.47	330	64	
	5.45	330	64	
	5.49	330	64	
	5.47	330	64	

130				
10				Bailed dry; recharge
16				Bailed dry; recharge
	6.42	4590	67	Measurement while sampling

AWD-1				
70				Pumped dry; recharge
73	5.96	767	69	
78	5.92	669	69	
82	5.90	663	69	
86	5.90	693	69	
91	5.89	703	69	Purging completed

AWD-2				
	5.09	433	69	
	5.05	559	70	
	5.01	598	70	
	5.05	570	70	

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

AWD-2 (cont.)				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
50				Clear purge water
	5.08	514	70	
	4.90	449	70	
70	4.92	478	70	Purging completed

AWD-3				
17				Pumped dry; recharge
18	5.98	432	66	
21				Pumped dry; recharge
26	5.93	678	68	Pale olive purge water
27	5.97	697	69	
28				Pumped dry; sample

AWD-4				
22				Pumped dry; recharge
45	5.45	683	66	
60	5.56	763	67	
65				Pumped dry; recharge
71	5.26	872	66	
73	5.33	688	66	
82	5.40	559	66	
88	5.41	592	66	
91	5.44	700	66	Purging completed; silty

TABLE X

FIELD PARAMETERS - LHAAP 18 & 24 WELL PURGING AND SAMPLING

EW-1				
Volume (Gallons)	pH	Conductivity (mmhos)	Temp. (°F)	Comments
	5.78	1246	68	Clear purge water
	5.97	1830	68	
	5.93	1552	68	
	5.86	1465	68	
90	5.88	1525	68	Well pumped dry; recharge - chemical odor
110	5.87	1380	67	
114	5.78	1280	68	
120	5.76	1262	68	Purging completed, clear purge water

C3 - Resample 12/6/93				
28	5.56	1411	63	
34	5.54	1409	64	
71	5.53	1406	64	
80	5.55	1408	64	

007959

TABLE X

CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	C6	C7	C8	C9
Date Purged	12/1/93	12/9/93	11/17/93	12/9/93
Date Sampled	12/1/93	12/9/93	11/18/93	12/9/93
DTW	22.40	23.45	18.98	28.82
WTD	54.90	29.20	33.00	42.90
Water Column (Ft)	32.50	5.75	14.02	14.08
Calculated Well Volume (Gallons)	21.22	3.75	9.15	9.19
5V	106.10	18.75	45.75	45.95
Water Volume Purged (Gallons)	110.0	18.0	45.0	10.0

Well ID	C10	MW-1	MW-2	MW-3
Date Purged	12/9/93	12/5/93	12/8/93	12/2/93
Date Sampled	12/9/93	12/6/93	12/8/93	12/2/93
DTW	26.10	23.10	21.60	22.62
WTD	82.80	40.30	43.00	49.60
Water Column (Ft)	56.70	17.20	21.40	26.98
Calculated Well Volume (Gallons)	37.01	11.23	13.96	17.61
5V	185.05	56.15	69.80	88.05
Water Volume Purged (Gallons)	201.0	55.0	36.0	88.0

TABLE X

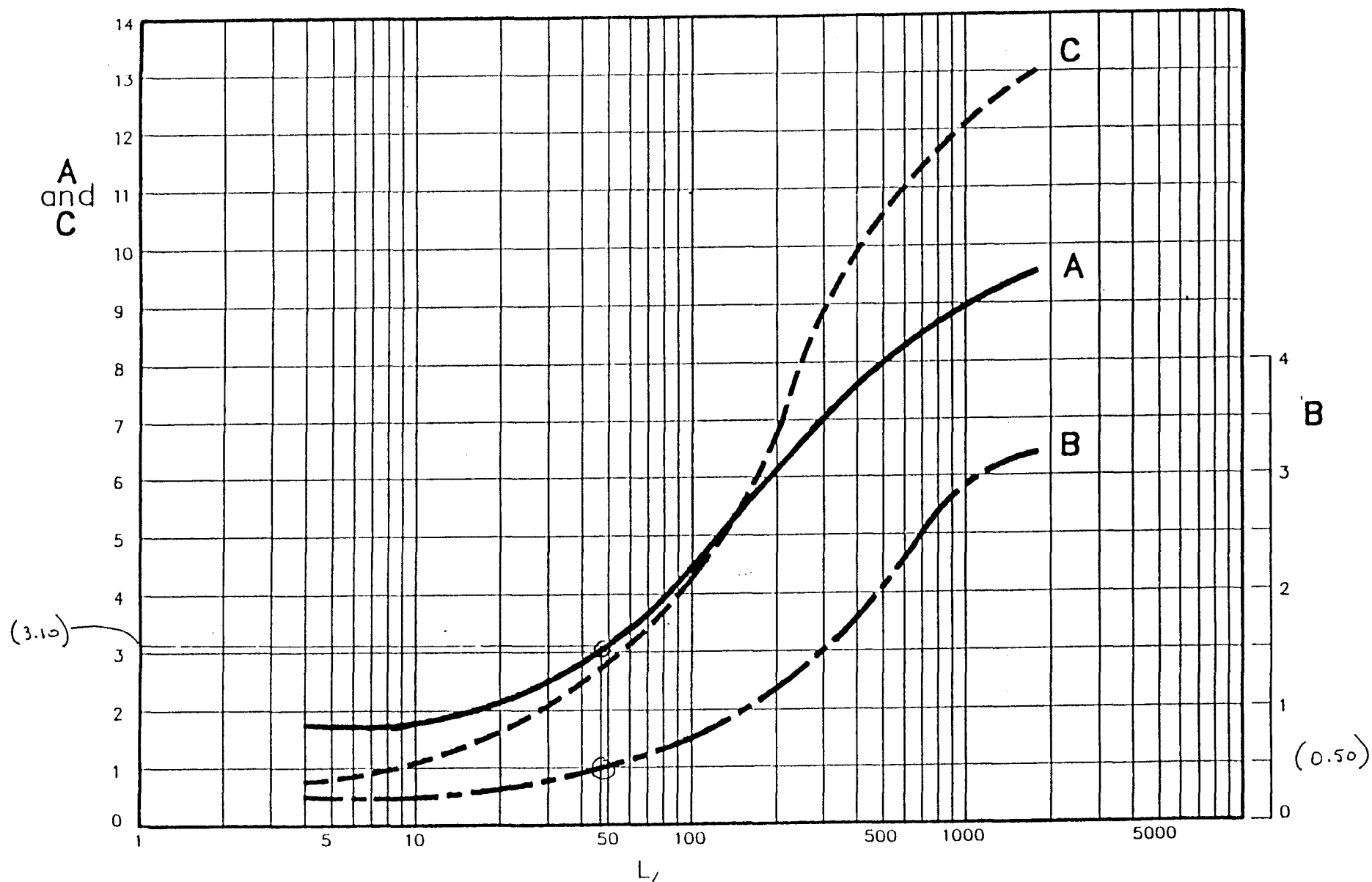
CALCULATED WELL VOLUMES AND PURGE DATA SUMMARY SHEET

Well ID	AWD-4	EW-1		
Date Purged	12/2/93- 12/3/93	12/5/93		
Date Sampled	12/3/93	12/6/93		
DTW	20.15	22.95		
WTD	38.60	39.60		
Water Column (Ft)	18.45	16.65		
Calculated Well Volume (Gallons)	12.04	24.45		
5V	60.20	122.25		
Water Volume Purged (Gallons)	91.0	120.0		

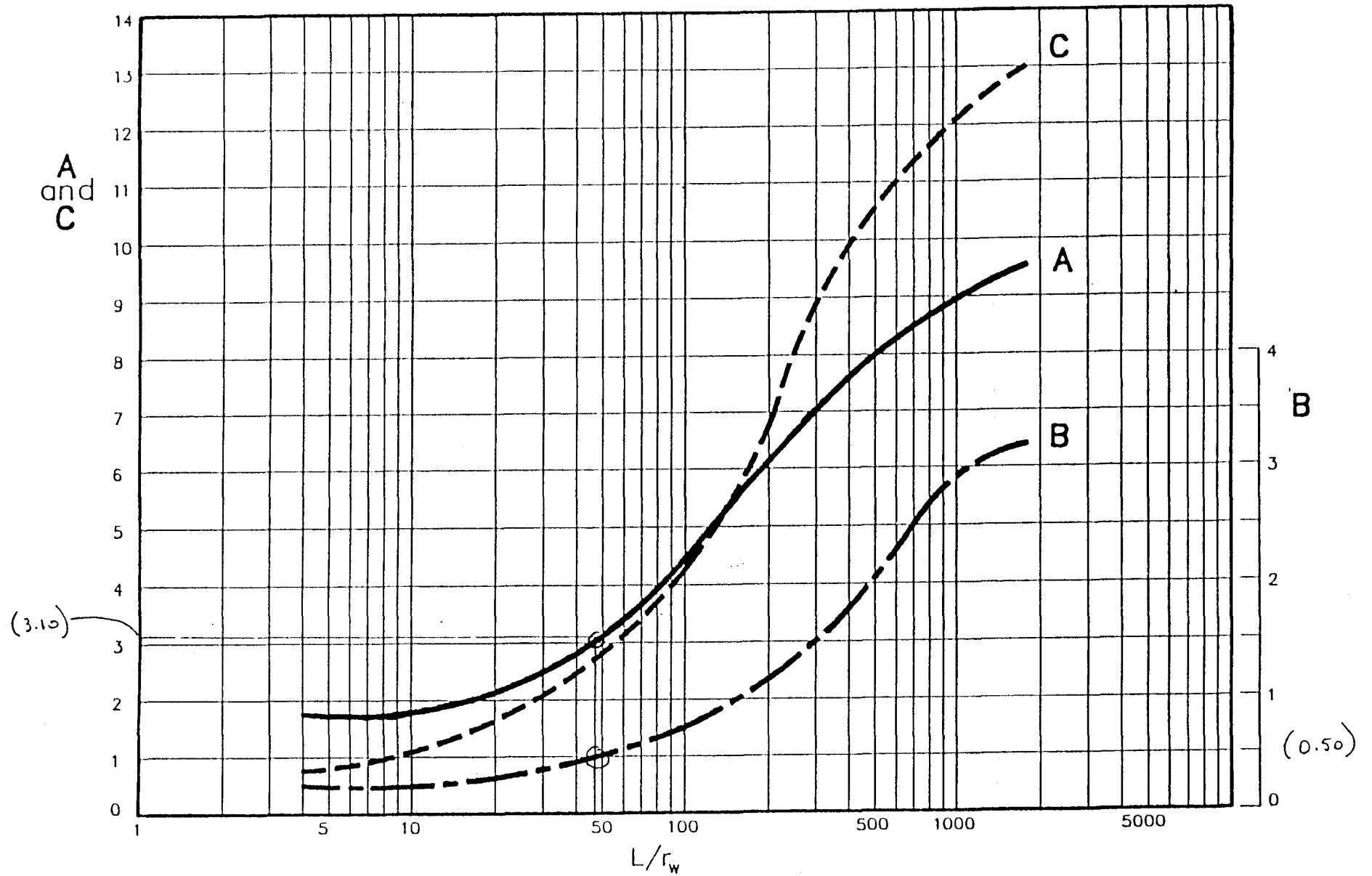
NOTES:

- (*) Well Resampled
- (1) DTW - Depth to Water (Top of Casing) in Feet
- (2) WTD - Well Total Depth (Top of Casing) in Feet
- (3) 5V - 5 X Calculated Well Volumes in Gallons

BOUWER AND RICE SLUG TEST CURVES



DOUWER AND HICE SLUG TEST CURVES

Curves relating coefficient B and C to L/r_w

007963753
AWD - 1

SLUG TEST DATA
TEST PERFORMED
12/4/93
TEST # 0

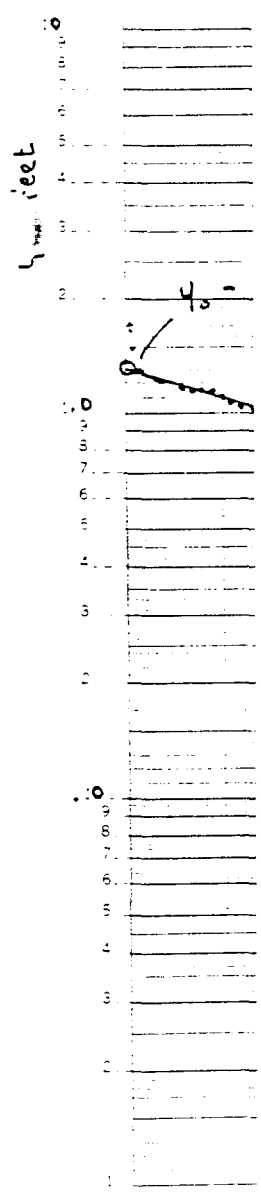
Ready
SE13008
Environmental Logger
12/04 18:00
Unit# 00000 Test# 0
INPUT 1: Level (F) T00
Reference 0.00
Scale factor 20.29
Offset - 0.35
Step# 0 12/04 11:31

Elapsed Time	Value		
0.0000	0.03	1.1447	1.03
0.0033	0.03	1.1500	1.01
0.0066	0.03	1.3333	0.99
0.0099	0.03	1.4166	0.97
0.0133	0.03	1.5000	0.97
0.0166	0.03	1.5833	0.94
0.0200	0.30	1.6667	0.93
0.0233	1.19	1.7500	0.92
0.0266	0.56	1.8333	0.90
0.0300	0.00	1.9167	0.88
0.0333	1.68	2.0000	0.88
0.0500	1.72	2.5000	0.79
0.0666	1.49	3.0000	0.72
0.0833	1.29	3.5000	0.67
0.1000	1.29	4.0000	0.62
0.1166	1.30	4.5000	0.57
0.1333	1.30	5.0000	0.52
0.1500	1.29	5.5000	0.48
0.1666	1.28	6.0000	0.45
0.1833	1.28	6.5000	0.42
0.2000	1.27	7.0000	0.39
0.2166	1.27	7.5000	0.36
0.2333	1.26	8.0000	0.34
0.2500	1.26	8.5000	0.32
0.2666	1.25	9.0000	0.29
0.2833	1.25	9.5000	0.27
0.3000	1.24	10.0000	0.25
0.3166	1.24	12.0000	0.20
0.3333	1.23	14.0000	0.15
0.4167	1.20	16.0000	0.12
0.5000	1.18	18.0000	0.10
0.5833	1.17	20.0000	0.08
0.6667	1.14	22.0000	0.08
0.7500	1.13	24.0000	0.07
0.8333	1.10	26.0000	0.07
0.9167	1.08	28.0000	0.05
1.0000	1.06	30.0000	0.05
1.0833	1.05	32.0000	0.04

END

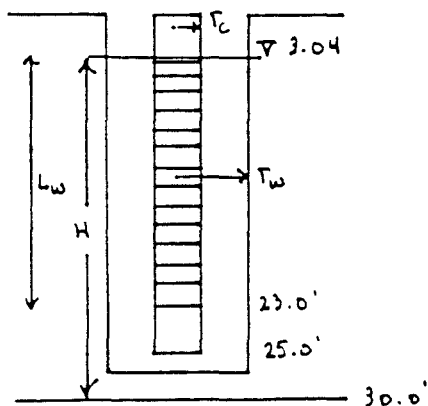
46.6210

KOE SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
REUTEL & FISHER CO. MADE IN U.S.A.



CALCULATION WORKSHEET

CLIENT: CO2	FILE NO.: 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-1 SLUG TEST TEST # 0	CHECKED BY:	DATE: 12/22/93	



B.H. Dia - 0.83' ($r_w = 0.42'$)
 Well I.D. - 0.33' ($r_c = 0.17'$)
 Well TD - 25.0'
 Screen Length (L_e) - 20.0'
 Static w/L - 3.04 BGS

$$L_e / r_w = 20.0 \text{ ft} / 0.42 \text{ ft} = 47.6$$

$$L_w = 19.96 \text{ ft} < H = 26.96 \text{ ft}$$

$$L_w < H$$

* Top of Confining layer
 Assumed to be 30.0 ft-bgs.

{ A from graph - 3.10
 { B from graph - 0.50

$$\begin{aligned}
 \text{Solve for } \ln R_e / r_w &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\
 &= \left[\frac{1.1}{\ln(19.96' / 0.42')} + \frac{3.10 + 0.50 \ln[(26.96 - 19.96) / 0.42]}{47.6} \right]^{-1} \\
 &= (0.285 + 0.0947)^{-1} = \underline{2.63}
 \end{aligned}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln y_0 / y_t$$

From GRAPH - $y_0 = 1.30$; $y_t = 0.88$; $t = 115 \text{ sec}$

$$= \frac{(0.17)^2 (2.63)}{2 (20)} \frac{1}{115} \ln 1.30 / 0.88$$

$$= 6.40 \times 10^{-6} \text{ ft/s}$$

$$= \underline{\underline{1.97 \times 10^{-4} \text{ cm/s}}}$$

AWD-1

007965

SLUG TEST DATA

TEST PERFORMED

12/4/93

TEST #1

File #

1211.03
Environmental Logger
12/04 19:08

Unit# 00000 Test# 1

INPUT 1: Level (F) T00

Reference 0.00
Scale factor 20.29
Offset - 0.75

Step# 0 12/04 14:29

Elapsed Time	Value		
0.0000	3.00	1.1667	1.07
0.0033	3.55	1.2500	1.01
0.0066	1.50	1.3333	1.00
0.0099	- 1.45	1.4166	0.98
0.0133	- 1.71	1.5000	0.96
0.0166	2.22	1.5833	0.95
0.0200	2.20	1.6667	0.94
0.0233	- 1.42	1.7500	0.92
0.0266	0.83	1.8333	0.90
0.0300	7.00	1.9167	0.89
0.0333	- 0.97	2.0000	0.88
0.0366	1.63	2.0833	0.88
0.0400	1.51	2.1667	0.73
0.0433	1.75	2.2500	0.67
0.0466	1.31	2.3333	0.62
0.0500	1.30	2.4167	0.57
0.0533	1.31	2.5000	0.51
0.0566	1.29	2.5833	0.48
0.0600	1.29	2.6667	0.44
0.0633	1.29	2.7500	0.42
0.0666	1.27	2.8333	0.38
0.0700	1.26	2.9167	0.35
0.0733	1.26	3.0000	0.33
0.0766	1.25	3.0833	0.31
0.0800	1.24	3.1667	0.28
0.0833	1.24	3.2500	0.26
0.0866	1.24	3.3333	0.25
0.0900	1.23	3.4167	0.19
0.0933	1.22	3.5000	0.15
0.0966	1.20	3.5833	0.12
0.1000	1.18	3.6667	0.10
0.1033	1.16	3.7500	0.08
0.1066	1.13	3.8333	0.07
0.1100	1.11	3.9167	0.06
0.1133	1.10	4.0000	0.05
0.1166	1.08	4.0833	0.05
0.1200	1.06	4.1667	0.04
0.1233	1.04	4.2500	0.04

END

007966

AWD-1

TEST #1 12/4/93

4.8
et $y_0 = 1.30$ $y_1 = 0.62$ ($t = 240$ sec)K-E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

100

200

300

400

500

600

TEST PERFORMED

12/4/93

TEST #2

the 1990s, the number of people in the world who are under 15 years of age is expected to increase by 1.5 billion, from 1.2 billion in 1990 to 2.7 billion in 2010. The number of people aged 65 and over is expected to increase by 1 billion, from 350 million in 1990 to 1.4 billion in 2010. The number of people aged 15-64 is expected to increase by 1.5 billion, from 2.5 billion in 1990 to 4.0 billion in 2010. The number of people aged 65 and over is expected to increase by 1 billion, from 350 million in 1990 to 1.4 billion in 2010. The number of people aged 15-64 is expected to increase by 1.5 billion, from 2.5 billion in 1990 to 4.0 billion in 2010.

[illegible]

REF ID: A66083

[illegible]

Page# 2 10 02 19:57

Elapsed Time 00:00

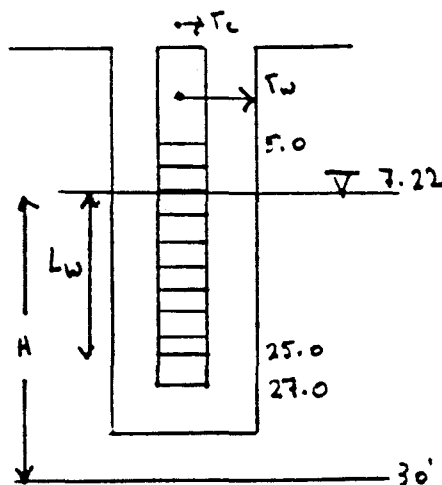
[illegible][illegible]

TEST #2 12/4/93



K-E
KRAFT FOODS COMPANY
CHICAGO, ILL.

CLIENT: USC02	FILE NO.: 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-2 SLUG TEST CALCULATIONS (TEST #2)	CHECKED BY:	DATE: 12/22/93	

BOWSER : RICE SLUG TEST METHOD
AWD-2


B.H. DIA - 0.83' ($r_w = 0.42'$)
 Well ID - 0.33' ($r_c = 0.165'$)
 Well TD - 27.0'
 Screen Length (L_e) - 20.0'
 Static w/L - 7.22 ft-bgs

$$L_e / r_w = 20.0 / 0.42 = 47.6$$

$$L_w = 17.78 \text{ ft} \quad H = 22.78'$$

$$L_w < H$$

A from graph - 3.10 ; B from graph - 0.50

* Assume top of lower
confining layer ~ 30 ft-bgs.

$$\begin{aligned}
 \text{Solve for } \ln R_e / r_w &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\
 &= \left[\frac{1.1}{\ln(17.78' / 0.42')} + \frac{3.10 + 0.50 \ln[(22.78 - 17.78) / 0.42]}{47.6} \right]^{-1} \\
 &= (0.293 + 0.8911)^{-1} = 2.60
 \end{aligned}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln y_0 / y_t$$

From graph $t = 65 \text{ sec}$; $y_0 = 1.08 \text{ ft}$; $y_t = 0.71 \text{ ft}$

$$= \frac{(0.165 \text{ ft})^2 (2.60)}{2 (20.0 \text{ ft})} \frac{1}{65} \ln 1.08 / 0.71$$

$$= 1.14 \times 10^{-5} \text{ ft/s} = \underline{\underline{3.48 \times 10^{-4} \text{ cm/s}}}$$

AWD - 2

TEST PERFORMED
12/4/93

TEST # 3

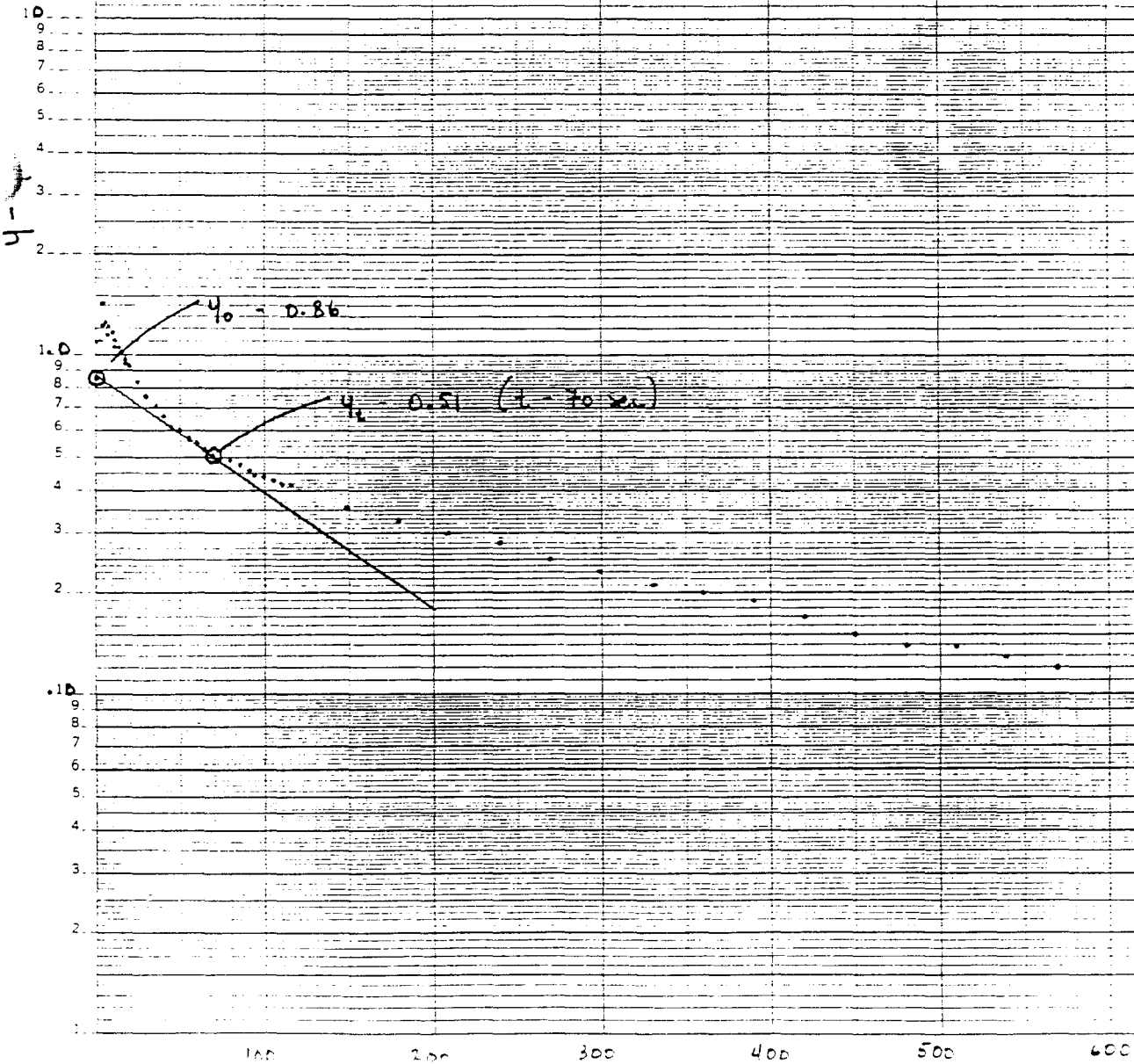
0.0000	0.00
0.0007	0.00
0.0014	0.00
0.0021	0.05
0.0177	1.56
0.0146	1.51
0.0203	1.22
0.0237	3.17
0.0266	1.92
0.0700	0.10
0.0737	3.74
0.0660	1.93
0.0666	1.10
0.0937	1.43
0.1000	1.22
0.1146	1.25
0.1777	1.22
0.1660	1.16
0.1666	1.17
0.1837	1.11
0.1900	1.10
0.2166	1.06
0.2337	1.05
0.2500	1.01
0.2666	1.01
0.2837	0.97
0.7000	0.95
0.5166	0.94
0.7777	0.92
0.7167	0.88

[illegible]

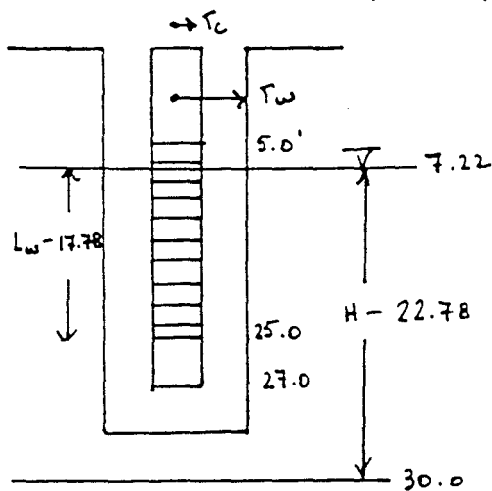
AWD-2
TEST # 3 12/4/93

46 6210

K&S SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



CLIENT: USCOE	FILE NO.: 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-2 SLUG TEST CALCULATION TEST #3	CHECKED BY:	DATE: 12/23/93	



Bouwer & Rice Slug Test Method

B.H. Dia - 0.83' ($r_w = 0.42'$)
Well ID - 0.33' ($r_c = 0.165'$)
Well TD - 27.0'
Screen Length (L_e) - 20.0'
Static w/L - 7.22 ft-bqs.

$$L_e / r_w \Rightarrow 20.0 / 0.42 = 47.6$$

$$L_w = 17.78 \text{ ft} \quad H = 22.78 \text{ ft}$$

$$L_w < H$$

* Assume top of lower
confining layer ~ 30 ft-bqs.

$$\begin{cases} A \text{ from graph} = 3.10 \\ B \text{ from graph} = 0.50 \end{cases}$$

$$\begin{aligned} \text{Solve for } \ln R_e / r_w &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\ &= \left[\frac{1.1}{\ln(17.78 / 0.42)} + \frac{3.10 + 0.50 \ln[(22.78 - 17.78) / 0.42]}{47.6} \right]^{-1} \\ &= (0.293 + 0.0911)^{-1} = \underline{2.60} \end{aligned}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln y_0 / y_t$$

From graph $t = 70$ seconds; $y_0 = 0.86$; $y_t = 0.51$

$$= \frac{(0.165)^2 (2.60)}{2(20.0)} \frac{1}{70} \ln 0.86 / 0.51$$

$$= 1.32 \times 10^{-5} \text{ ft/s}$$

$$= \underline{4.03 \times 10^{-4} \text{ cm/s}}$$

TEST PERFORMED

12 / 7 / 93

TEST #5

Unit# 45550 Test# 5

REF ID: A61550

[illegible]

Page 2 of 2 11:01

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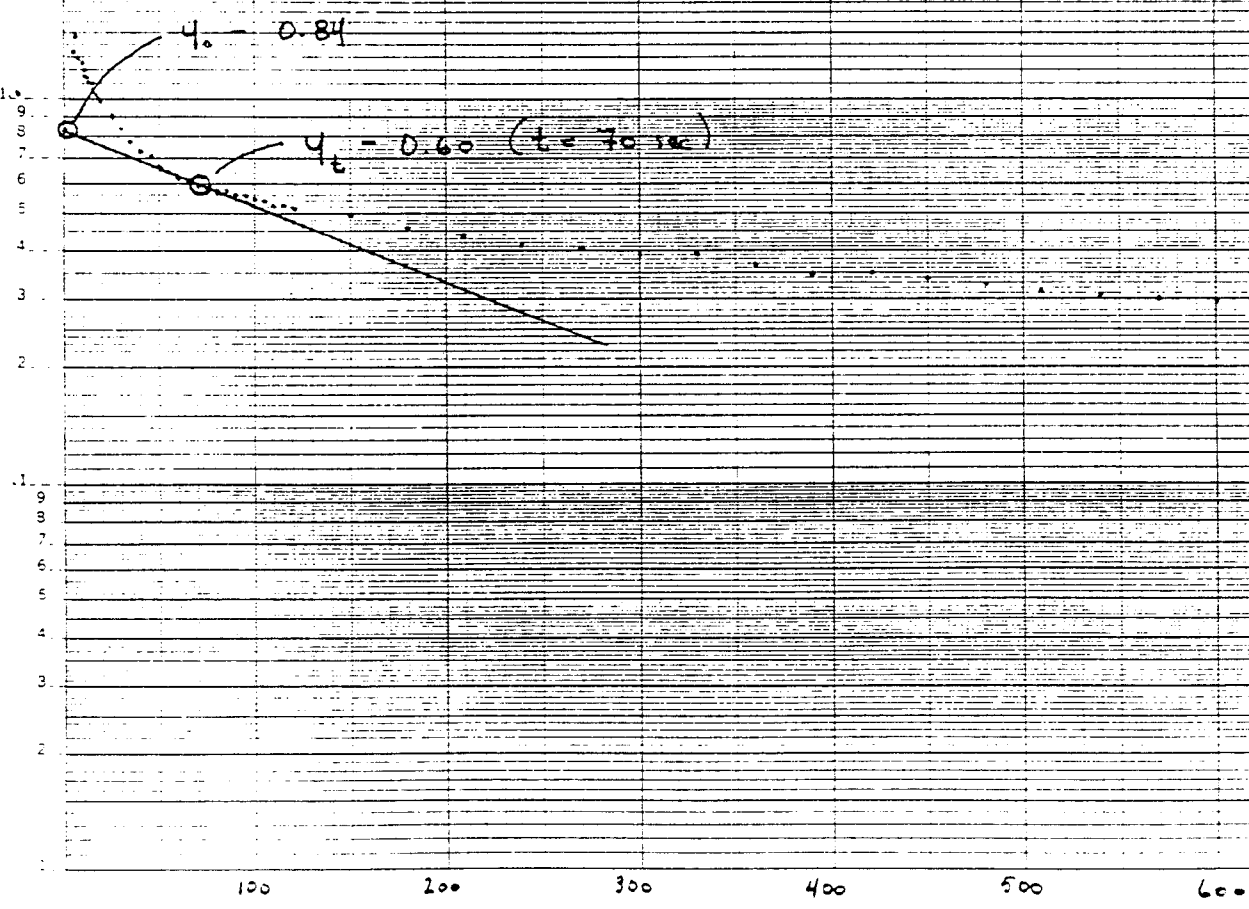
[illegible][illegible]

46 6210

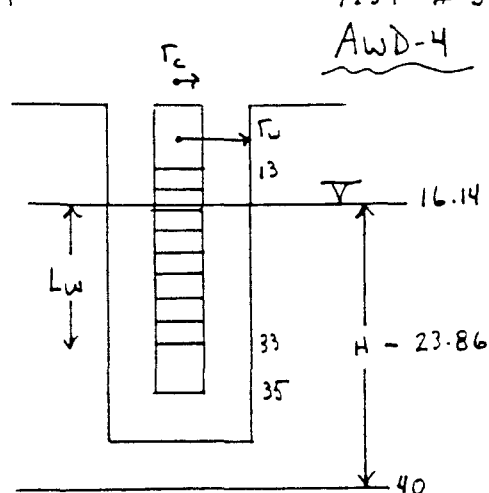
K·E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KLUFFEL & ESSER CO. MADE IN U.S.A.

AWD-4
TEST #5 12/7/93

$\frac{1}{2}$ sec



CLIENT: USC02	FILE NO.: 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-4 SLUG TEST CALCULATION TEST # 5	CHECKED BY:		DATE: 12/27/93



AWD-4

BOWSER & RICE SLUG TEST METHOD

B.H. DIA. - 0.83' ($r_w = 0.42'$)

Well I.D. - 0.33' ($r_c = 0.165'$)

Well TD - 35.0'

Screen Length - 20.0'

Static w/L - 16.14 ft-bgs

$$L_e / r_w = 20.0' / 0.42' = 47.6'$$

$$L_w = 16.86' < H = 23.86'$$

* Assume top of lower
confining layer ~ 40 ft-bgs

$$\begin{cases} A - \text{from graph} = 3.10 \\ B - \text{from graph} = 0.50 \end{cases}$$

$$\begin{aligned} \text{Solve for } \ln R_e / r_w &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\ &= \left[\frac{1.1}{\ln(16.86' / 0.42')} + \frac{3.10 + 0.50 \ln[(23.86 - 16.86) / 0.42]}{47.6'} \right]^{-1} \\ &= (0.30 + 0.095)^{-1} = \underline{\underline{2.53}} \end{aligned}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \cdot \frac{1}{t} \ln y_0 / y_t$$

From graph: $\left\{ \begin{array}{l} y_0 = 0.84' \\ y_t = 0.60' \\ t = 70 \text{ sec.} \end{array} \right.$

$$= \frac{(0.165')^2 (2.53)}{2 (20.0')} \cdot \frac{1}{70 \text{ sec}} \ln 0.84 / 0.60$$

$$= 8.3 \times 10^{-6} \text{ ft/s}$$

$$= \underline{\underline{2.5 \times 10^{-4} \text{ cm/s}}}$$

AWD-4

007976

SLUG TEST DATA

TEST PERFORMED

12/5/93

TEST # 4

0304

0010000

F Environmental Logger
12/05 17:44

Unit# 00000 Test# 4

PLOT 1: Level (F) TDC

Reference 0.00
Scale factor 10.00
Offset -0.5

Rep# 0 12/05 17:09

Elapsed Time Value

0.0000 0.41

0.0000 0.40

0.0000 0.40

0.0000 0.40

0.0000 0.40

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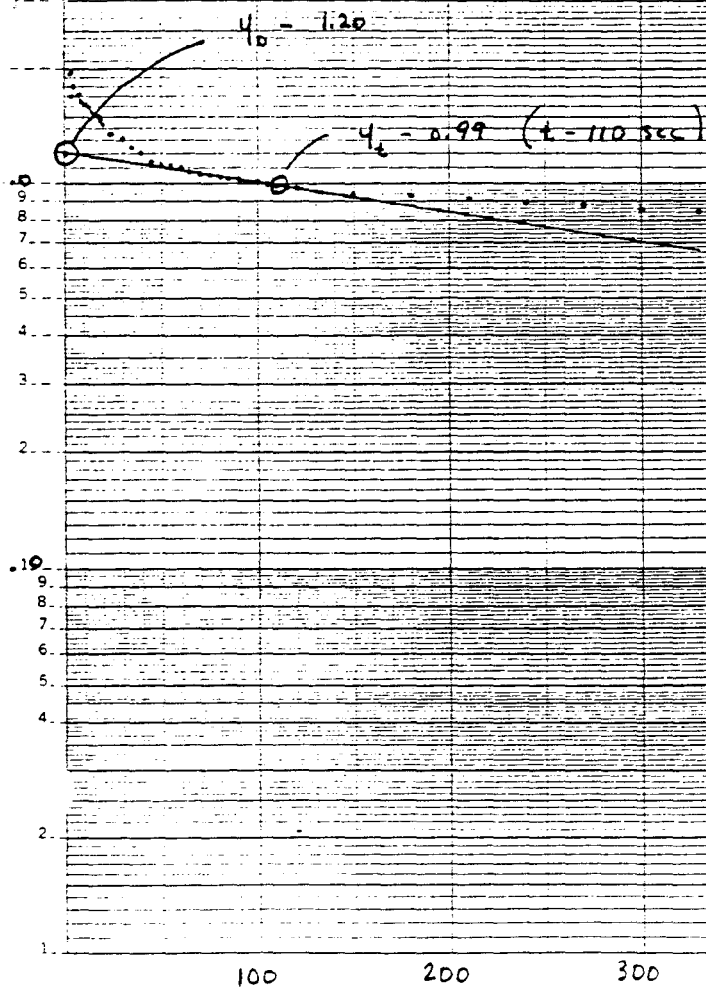
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0.0000 0.40

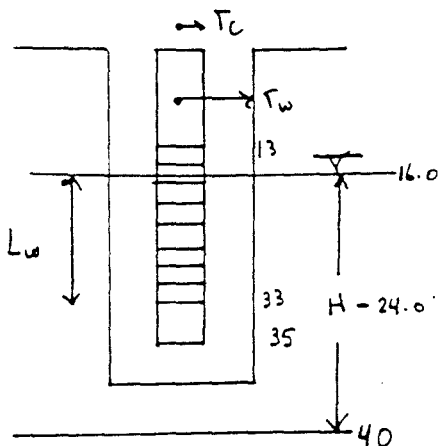
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AWD-4

TEST #4 12/5/93



CLIENT: USC02	FILE NO.: 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-4 SLUG TEST CALCULATION TEST #4	CHECKED BY:	DATE: 12/23/93	



BOUWER & RICE SLUG TEST METHOD

B.H. DIA - 0.83' ($r_w = 0.42'$)
Well ID - 0.33' ($r_c = 0.165'$)
Well TD - 35.0' ft-bqs
Screen Length (L_e) - 20.0' ft
Static w/L - 16.0' ft-bqs

$$L_e / r_w = 20.0 / 0.42' = 47.6$$

$$L_w = 17.0' \text{ ft} \quad H = 24.0' \text{ ft}$$

* Assume top of lower
confining ~ 40' ft-bqs.

{ A from graph - 3.10
{ B from graph - 0.50

$$\text{Solve for } \ln R_e / r_w = \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1}$$

$$= \left[\frac{1.1}{\ln(17.0 / 0.42)} + \frac{3.10 + 0.50 \ln[(24.0 - 17.0) / 0.42]}{47.6} \right]^{-1}$$

$$= (0.29 + 0.0947)^{-1} = \underline{2.60}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln y_0 / y_t$$

From GRAPH:
t - 110 sec
y₀ - 1.20
y_t - 0.99

$$= \frac{(0.165)^2 (2.60)}{2 (20.0)} \frac{1}{110} \ln 1.20 / 0.99$$

$$= 3.1 \times 10^{-6} \text{ ft/s}$$

$$= \underline{\underline{9.43 \times 10^{-5} \text{ cm/s}}}$$

Date: 10/25/2013 Page: 1

217

the β phase of the polymer. The β phase is the more ordered phase and is characterized by a higher density and a higher melting point than the α phase. The β phase is also the more stable phase and is the one that is most commonly observed in nature. The α phase is the less ordered phase and is characterized by a lower density and a lower melting point than the β phase. The α phase is also the less stable phase and is the one that is most commonly observed in nature.

— *Journal of the American Medical Association*, 1997

References

1

AWD-3

SLUG TEST DATA

TEST PERFORMED

12/8/93

TEST # 7

007980

AWD-3

TEST #7 12/8/93

feet

$y_0 = 0.99$
 $y_0 = 0.67 (t = 70 \text{ seconds})$

6-10

100

200

300

400

500

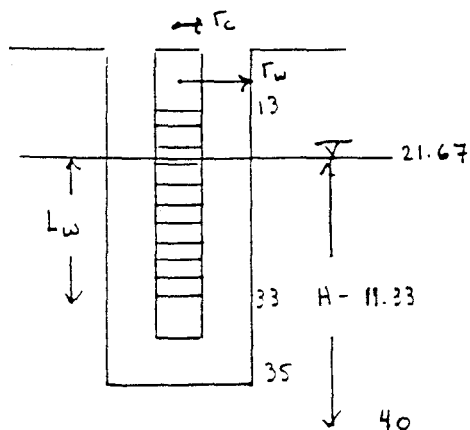
600

CALCULATION WORKSHEET

007981

CLIENT: USCO2	FILE NO.: LITAAP 18:24 2379	BY: DNM	PAGE 1 OF 1
SUBJECT: AWD-3 SLUG TEST CALCULATION TEST # 7	CHECKED BY:	DATE: 12/27/93	

AWD-3



POWELL : RICE SLUG TEST METHOD

B.H. DIA - 0.83' ($r_w = 0.42'$)

Well ID. - 0.33' ($r_c = 0.165'$)

Well TD - 35.0'

Screen Length - 20.0'

Static w/L - 21.67 ft-bgs

$L_e / r_w = 20.0 / 0.42' = 47.6$

$L_w = 11.33' < H = 18.33'$

* Assume top of lower
confining layer ~ 40' ft-bgs.

$\begin{cases} A \text{ from graph} & 3.10 \\ B \text{ from graph} & 0.50 \end{cases}$

$$\begin{aligned} \text{Solve for } \ln R_e / r_w &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\ &= \left[\frac{1.1}{\ln(11.33 / 0.42)} + \frac{3.10 + 0.50 \ln[(18.33 - 11.33) / 0.42]}{47.6} \right]^{-1} \\ &= (0.334 + 0.095)^{-1} = \underline{\underline{2.33}} \end{aligned}$$

Solve for k = $\frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \frac{1}{t} \ln y_0 / y_t$

from graph: $y_0 = 0.99$; $y_t = 0.67$; $t = 70 \text{ sec}$

= $\frac{(0.165)^2 (2.33)}{2(20.0)} \frac{1}{70} \ln 0.99 / 0.67$

= $8.8 \times 10^{-6} \text{ ft/s} = \underline{\underline{2.7 \times 10^{-4} \text{ cm/s}}}$

AWD-3

007982

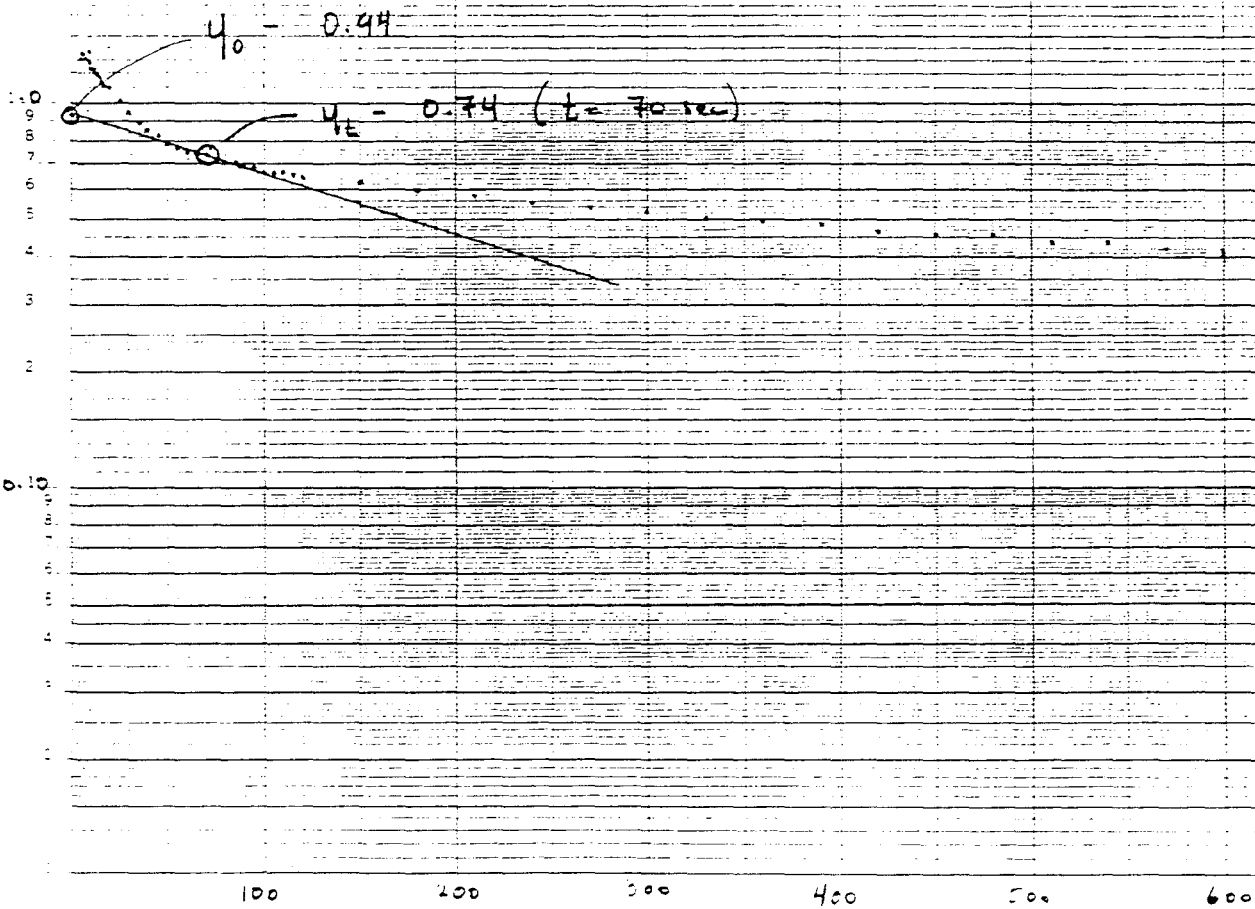
SLUG TEST DATA

TEST PERFORMED
12/7/93

TEST # 6

007983

AWD-3
TEST #6 12/7/93



AWD-3
TEST #6 12/7/93

46 6.10

feet

$y_0 = 0.44$
 $y_e = 0.74 (t = 70 \text{ sec})$

SEALING/ANTHRACITE VEGETATION IN THE FUTURE
KIMBLE & SONS CO. 4400 0000

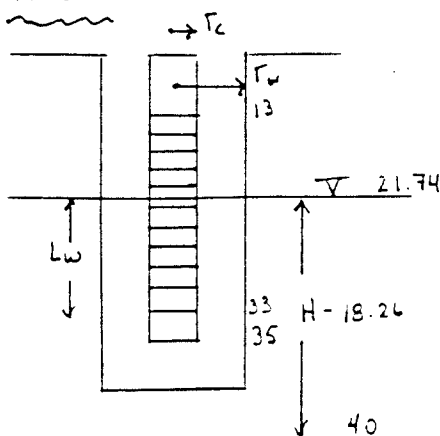
K0Σ

0.10

100 200 300 400 500 600

CLIENT: USCOZ	FILE NO.: LITAAP 18-24 2379	BY: JNM	PAGE 1 OF 1
SUBJECT: AWD-3 Slug TEST CALCULATION TEST #6	CHECKED BY:	DATE: 12/27/93	

AWD-3


Bouwer & Rice Slug Test Method

B.H. Dia. - 0.83' ($r_w = 0.42'$)
 Well ID - 0.33' ($r_c = 0.165'$)
 Well TD - 35.0'
 Screen Length - 20.0'
 Static w/L - 21.74'

$$L_e / r_w = 20.0 / 0.42' = 47.6$$

$$L_w = 11.26' < H = 18.26'$$

* Assume top of lower confining layer ~ 40.0' ft-bas.

{ A from graph - 3.10
 { B from graph - 0.50

$$\begin{aligned}
 \text{Solve for } k &= \left[\frac{1.1}{\ln(L_w / r_w)} + \frac{A + B \ln[(H - L_w) / r_w]}{L_e / r_w} \right]^{-1} \\
 &= \left[\frac{1.1}{\ln(11.26 / 0.42')} + \frac{3.10 + 0.50 \ln[(18.26 - 11.26) / 0.42']}{47.6} \right]^{-1} \\
 &= (0.334 + 0.095)^{-1} = \underline{\underline{2.33}}
 \end{aligned}$$

$$\text{Solve for } k = \frac{r_c^2 \ln(R_e / r_w)}{2 L_e} \cdot \frac{1}{t} \ln \frac{y_0}{y_t}$$

from graph: $y_0 = 0.94$; $y_t = 0.74$; $t = 70 \text{ sec}$

$$= \frac{(0.165')^2 (2.33)}{2(20.0)} \cdot \frac{1}{70 \text{ sec}} \ln \frac{0.94}{0.74}$$

$$= 5.4 \times 10^{-6} \text{ ft/s} = \underline{\underline{1.65 \times 10^{-4} \text{ cm/s}}}$$

Appendix E

INTERIM REMEDIAL ACTION

BURNING GROUND NO.3 AND UNLINED EVAPORATION POND

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

PILOT STUDY REPORT - PHASE II

PREPARED BY

DOW ENVIRONMENTAL, INC.

(FORMERLY A WD TECHNOLOGIES, INC.)

ROCKVILLE, MARYLAND


Dow Environmental

800D REFERENCE FILES
Interim Remedial Action

u20

(12)

**INTERIM REMEDIAL ACTION
BURNING GROUND NO. 3 AND
UNLINED EVAPORATION POND
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS**

PILOT STUDY REPORT - PHASE II

PREPARED FOR

**UNITED STATES ARMY CORPS OF ENGINEERS
TULSA DISTRICT**

PREPARED BY

**DOW ENVIRONMENTAL, INC.
(FORMERLY AWD TECHNOLOGIES, INC.)
ROCKVILLE, MARYLAND**

**MARCH 15, 1995
USACE CONTRACT NUMBER DACA56-93-D-0016
DELIVERY ORDER 0002
MODIFICATION 000203
DEI PROJECT NO. 2379**

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1.0 INTRODUCTION

1.1 General

This report summarizes the results of the Phase II Work for the Interim Remedial Action (IRA) at Burning Ground 3 and the Unlined Evaporation Pond (UEP), also referred to as LHAAP 18 & 24. The site is located within Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. This report is submitted by Dow Environmental Inc. (DEI) formerly, AWD Technologies, Inc. (AWD) in partial fulfillment of the requirements of Contract No. DACA56-93-D-0016, Delivery Order No. 0002 for the U.S. Army Corps of Engineers (USACE), Tulsa District.

1.2 Site Description and Background

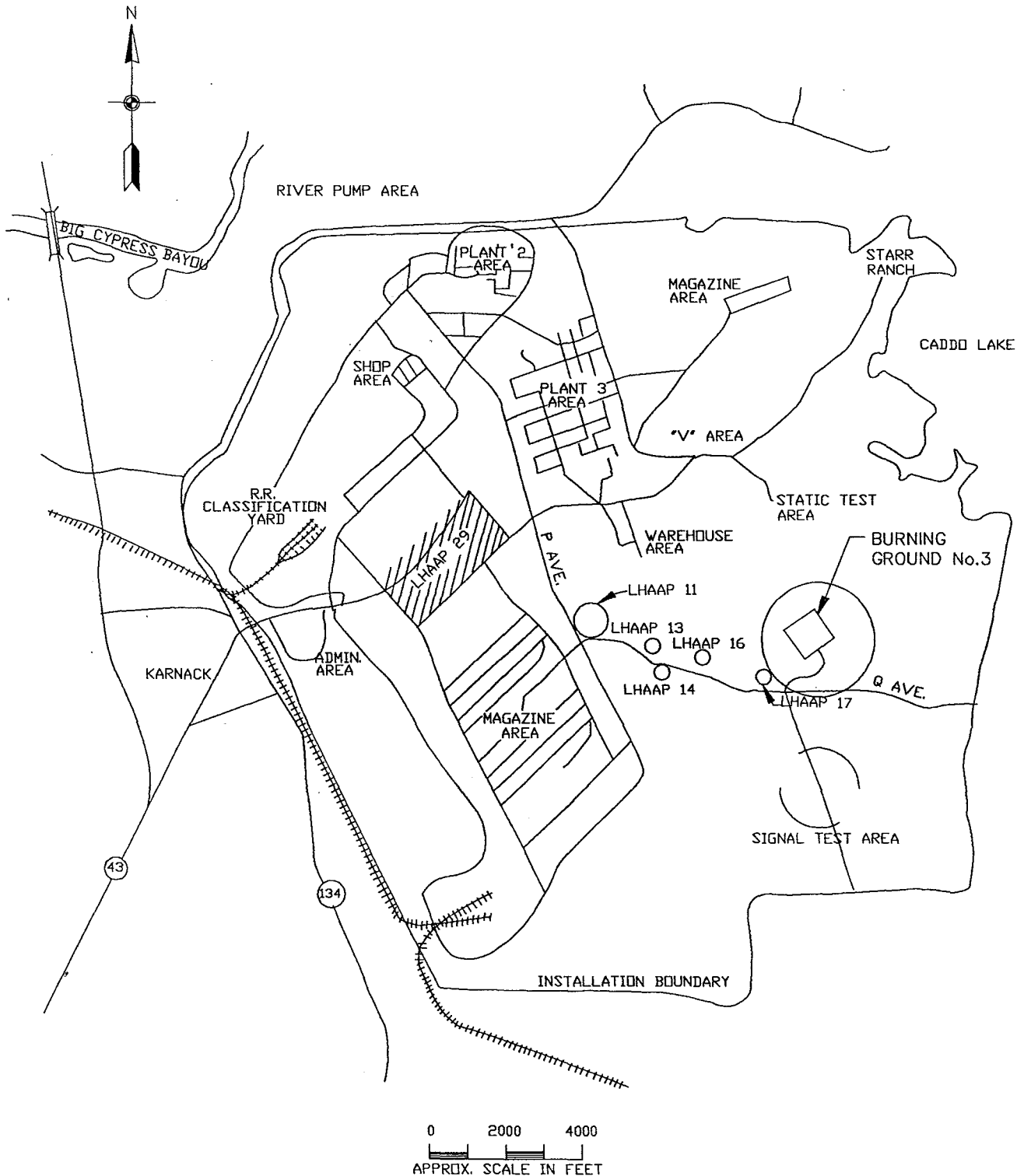
The LHAAP 18 & 24 site is an operable unit of the LHAAP Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site and also a Resource Conservation and Recovery Act (RCRA) site. The site consists of a fenced 34.5-acre secured area located in the southeast quadrant of LHAAP at the end of Avenue Q, as shown on Figure 1-1. This site has been used for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and combustible solvent wastes using open burning pits, the UEP, stockpiles of solvent soaked sawdust, and burial trenches.

In summary, high concentrations of solvents, primarily trichloroethylene and methylene chloride, and heavy metals, such as barium, have been detected within subsurface soils, buried waste and the uppermost water-bearing zone at the site. This contamination is attributed to waste management practices dating back to the early 1950s. Based on previous investigations performed at the site, an IRA is planned for the removal and/or control of contaminants sources within the upper groundwater and unsaturated zone.

DEI conducted Phase I of the IRA between November 8 and December 17, 1993. The Phase I work consisted of confirmation sampling required in order to complete site characterization and of treatment technologies verifications to determine suitable technologies to treat onsite contamination.

1.3 Summary of Activities

The objective of the Phase II work was to determine the effectiveness of different systems for groundwater extraction. The implementation of the Phase II work provided data and information



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APPROX. SCALE IN FEET



US Army Corps
of Engineers
Tulsa District

LOCATION MAP FOR BURNING GROUND No. 3 AND UEP (LHAAP 18 & 24)

LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

FIGURE
NUMBER

1-1

regarding construction methods (i.e. problems/solutions) of the extraction systems, groundwater flow values, and groundwater quality parameters.

The Phase II Work included the following tasks:

- Task 1 - Groundwater sampling and testing of 48 monitoring wells and the vertical extraction well (VEW) designated EW-1 which was installed during the implementation of the Phase I work.
- Task 2 - Construction of the western half of the planned temporary staging and storage area to the south of the burning ground site;
- Task 3 - Construction of two sections of a pilot Interceptor Collection Trench (ICT);
- Task 4 - Installation of a pilot horizontal extraction well (HEW);
- Task 5 - Groundwater flow testing that included two forms of groundwater withdrawal techniques, gravity flow and vacuum enhanced liquid extraction. Testing was performed on the ICT, HEW, and VEW;
- Task 6 - Groundwater sampling and testing of 48 monitoring wells and EW-1 following the completion of the flow tests in July/August and in October/November, 1994.

The field work for the Phase II activities was conducted between March 8 and August 12, 1994. The following sections describe the results of implementing the Phase II tasks.

2.0 RESULTS OF PILOT STUDY

2.1 Task 1 - Groundwater Sampling Prior to initiation of construction

Groundwater sampling was performed at EW-1 and 48 monitoring well locations. The objective of this sampling program was to obtain a "snapshot" of the existing contaminant plume condition prior to implementing the Phase II work. The well locations are shown on Figure 2-1. The analytical testing program for groundwater samples is presented in Table 2-1. Groundwater sampling and testing was performed in accordance with the protocols outlined in the Chemical Data Acquisition Plan (CDAP). The analytical testing was conducted by PDP Analytical Services (PDP) of Spring, Texas.

In general, the groundwater plume, with methylene chloride and trichloroethylene as the main contaminants, was found to have extended beyond what the Fall 1993 sampling event had shown and that concentrations of methylene chloride and/or trichloroethylene had increased in many monitoring wells especially outside the fenced area of Burning Ground 3. Field measurements taken during groundwater sampling are included in Appendix A.1. Detected contaminant concentrations are presented in Tables 2-2 through 2-5. The groundwater levels elevation contours are shown on Figure 2-2. The Methylene Chloride and trichloroethylene isoconcentration contours for this sampling round are presented in Figures 2-3 and 2-4, respectively. The analytical reports are included in Appendix A.2. and the validated analytical data are included in Appendix A.3.

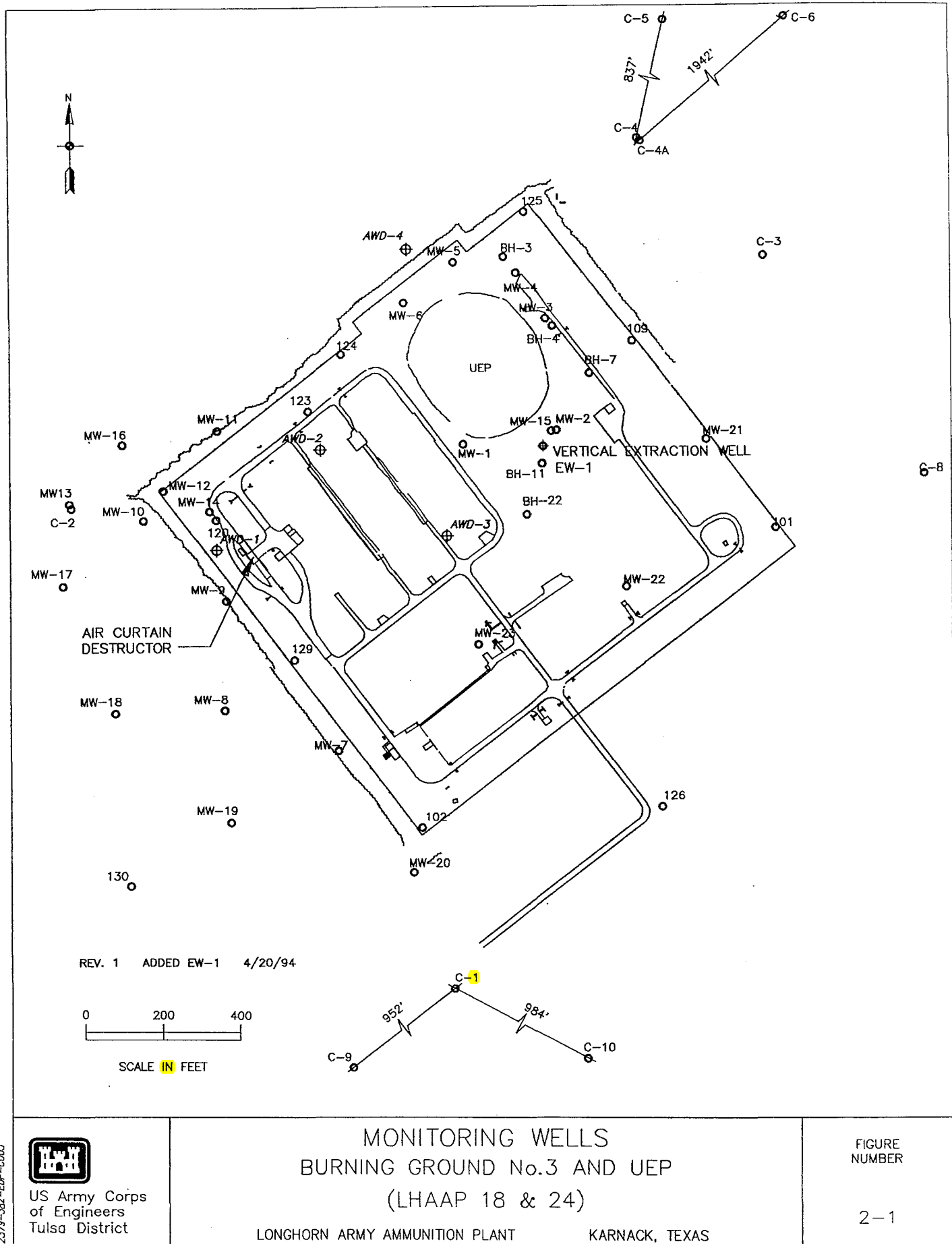
Two rounds of confirmation resampling and testing were conducted at wells C4, C4A, C5, C6, C2, MW10, MW13, and MW16 on May 20, 21, and 22, and on June 7 and 8, 1994. Data from this confirmation testing program are included in Appendix A.4. The additional testing program confirmed that the plume has extended beyond the fenced area of Burning Ground 3; however, concentrations of methylene chloride and trichloroethylene were found to be lower than detected levels for the March/April sampling round as shown in Table 2-6.

2.2 Task 2 - Construction of Temporary Staging and Storage Area

The planned Temporary Staging and Storage Area (TSSA) is to be located outside and to the south of the fenced Burning Ground 3 site as shown on Figure 2-5. Due to limited availability of funds, only about half (western half) of the TSSA, including a contractor staging area, was built during Phase II of the IRA. The construction of the western half of the TSSA included clearing, grubbing, grading, placement of clean fill material, placement of a geotextile layer, and the placement of a six inches thick gravel layer over the geotextile. The construction work was conducted by Palestine Contractors, of Marshall, Texas under subcontract to DEI.

The original ground in the area was very soft and wet during construction which created difficult conditions for maneuvering construction equipment. Several pieces of equipment were stuck in the mud when an attempt was made to remove trees and stumps prior to the grading of the site. Therefore, a decision was made by DEI and the USACE to cut the onsite trees flush with the ground surface and leave the stumps in place. In addition, it was decided to use clean fill material to bridge over and stabilize the soft ground.

The fill placement, which ranged in thickness between three and five feet, proceeded along with the clearing and tree removal operation in order to provide a stable working platform for



**TABLE 2-1
SAMPLING PARAMETERS FOR LHAAP BURNING GROUND 3 AND UEP
PHASE II**

Sampling Matrix	Sampling Location	Chemical Parameters	Physical Parameters
Groundwater	48 Monitoring Wells	pH; conductivity, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), nitrate, nitrite, sulfate, and chloride.	
Groundwater	During Flow Tests as follows: - VEW 5/7/94 to 5/10/94, - HEW 5/31, and - ICT 6/14	alkalinity, hardness, total dissolved solids, total suspended solids, silica, VOCs, SVOCs, explosives, total metals, ammonia, nitrate, nitrite, sulfate, chloride, oil and grease, and total petroleum hydrocarbons.	
Groundwater	During Flow Tests at VEW, HEW, and ICT for all dates not listed above	total suspended solids, silica, VOCs, and total metals.	
Soil	Soil borings along ICT sections and HEW. Also, 2 samples during construction of ICT	VOCs, SVOCs, explosives, antimony, arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, nitrate, sulfate, and chloride	Visual classification, moisture content, gradation, plastic limit, and liquid limit tests
Vapor	During VELE Tests	VOCs	

TABLE 2-2
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, MARCH-APRIL, 1994
VOCs, microgram/liter

WELL No.	VOLATILE ORGANIC COMPOUNDS																	
	MEC	TCE	1,1-DCA	1,1-DCE	1,2-DCA	VC	ACETONE	CF	PCE	1,2-DCE	EBZ	STYRENE	TOLUENE	BENZENE	XYLENES	CTC	1,1,1-TCA	1,1,2-TCA
126	13	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW22	5900	1900	ND	ND	ND	ND	6300	ND	ND	430	ND	ND	ND	ND	ND	ND	ND	ND
MW15	645	ND	ND	ND	ND	ND	7200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW2	10550000	1520000	310	4700	ND	550	3400	1500	ND	8200	ND	ND	ND	ND	ND	ND	ND	183
EW1	87000	9800	ND	ND	ND	ND	9800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW1	444000	171000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW4	80	1100	ND	ND	ND	140	ND	ND	ND	180	ND	ND	ND	ND	ND	ND	ND	ND
MW5	32	126	16	ND	ND	16	ND	ND	ND	31	ND	ND	ND	ND	ND	ND	ND	ND
MW6	22	40	ND	ND	5	8	ND	ND	ND	10	ND	ND	ND	ND	ND	ND	ND	ND
MW21	1270000	8400	ND	ND	ND	ND	160000	ND	ND	500	ND	ND	ND	ND	ND	ND	ND	ND
109	400	250	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
125	600	ND	ND	ND	ND	ND	1100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
123	40	16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD2	28000	11400	ND	ND	620	ND	38	10	ND	20	ND	ND	25	ND	ND	ND	ND	ND
AWD3	175	610	ND	6	4	ND	280	8	5	610	ND	ND	ND	ND	ND	10	ND	ND
MW23	820	980	ND	ND	43	ND	190	3	ND	50	ND	ND	ND	ND	ND	ND	ND	ND
C4A	2000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4	270	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C5	1800	130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C6	300	90	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7	7	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C9	26	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10	690	122	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C3	15	45	ND	ND	ND	ND	ND	ND	ND	20	ND	ND	ND	ND	ND	ND	ND	ND
C8	4	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
102	3	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW7	1700	15000	ND	ND	150	ND	ND	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW8	390	8200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
129	26	1560	28	ND	ND	ND	7	3	ND	15	ND	ND	ND	ND	ND	ND	ND	ND
MW9	950	3600	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD1	19300	69000	44	1100	5	560	ND	15	30	109000	1000	170	40	10	80	370	5	
120	273000	42000	62	310	44	ND	35	70	ND	ND	ND	ND	42	7	ND	27	8	
MW14	2200	12400	34	120	23	ND	ND	4	ND	400	ND	ND	ND	ND	ND	10	3	
MW12	140	4000	ND	19	14	ND	ND	ND	ND	110	ND	ND	ND	ND	ND	ND	ND	ND
130	ND	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW18	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW17	10	32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW13	590	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C2	480	210	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW10	2100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW16	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW11	59	82	ND	ND	6	ND	ND	ND	ND	5	ND	ND	ND	ND	ND	ND	ND	ND
124	31	3	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD4	58	25	ND	ND	ND	ND	ND	ND	ND	6	ND	ND	ND	ND	ND	ND	ND	ND
MW19	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW20	6	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C1	33	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW3	243000	4500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE:

MEC = Methylene Chloride 1,1-DCA = 1,1-Dichloroethane 1,2-DCA = Dichloroethane
TCE = Trichloroethylene 1,1-DCE = 1,1-Dichloroethane CF = Chloroform

PCE = Tetrachloroethylene
1,2-DCE = Total-1,2-Dichloroethane

EBZ = Ethylbenzene
CTC = Carbon tetrachloride

1,1,1-TCA = 1,1,1-Trichloroethane
1,1,2-TCA = 1,1,2-Trichloroethane

TABLE 2--3
 LHAAP 18&24, BURNING GROUND 3 & UEP
 SUMMARY OF GROUNDWATER MONITORING, MARCH--APRIL, 1994
 METALS, mg/l

Well No.	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead
126	0.7100	ND	ND	3.2300	ND	ND	105.0000	ND	0.0160	ND	1.0800	ND
MW22	0.2000	ND	ND	1.9600	ND	ND	99.2000	ND	ND	ND	0.2500	ND
MW15	ND	ND	ND	0.2450	ND	ND	11.2000	ND	ND	ND	2.3000	ND
MW2	ND	ND	ND	3.6800	ND	ND	96.4000	ND	0.0200	ND	0.0000	ND
EW1	ND	ND	ND	0.3290	ND	ND	8.9000	ND	ND	ND	0.1000	ND
MW1	ND	ND	ND	4.5400	ND	ND	122.0000	ND	0.0310	ND	0.0000	ND
MW4	ND	ND	ND	0.1520	ND	ND	54.8000	ND	ND	ND	0.0000	ND
MW5	ND	ND	ND	1.4300	ND	ND	35.3000	ND	ND	ND	0.0000	ND
MW6	ND	ND	ND	0.8850	ND	ND	33.6000	ND	ND	ND	6.3400	ND
MW21	0.3000	ND	ND	6.6000	ND	ND	164.0000	0.0180	0.0520	ND	0.5900	ND
109	0.2200	ND	ND	1.0300	ND	ND	53.7000	ND	ND	ND	0.5200	ND
125	2.6000	ND	ND	0.1880	ND	ND	2.5000	ND	ND	ND	3.6200	ND
123	0.5400	ND	ND	0.1650	ND	ND	16.3000	ND	ND	ND	0.4640	ND
AWD2	3.6200	ND	ND	0.1770	ND	ND	4.3000	0.0180	0.0110	ND	3.7800	ND
AWD3	0.1800	ND	ND	0.2530	ND	ND	36.2000	ND	0.0330	ND	66.5000	ND
MW23	ND	ND	ND	1.7300	ND	ND	52.9000	0.0670	0.0100	ND	2.3700	ND
C4A	ND	ND	ND	0.1010	ND	ND	14.8000	ND	ND	ND	4.1000	ND
C4	ND	ND	ND	0.2060	ND	ND	18.9000	ND	ND	ND	1.4700	ND
C5	ND	ND	ND	0.0780	ND	ND	12.2000	ND	ND	ND	2.4000	ND
C6	ND	ND	ND	1.1000	ND	ND	33.2000	ND	0.0160	ND	32.8000	ND
C7	0.2800	ND	0.0050	0.1260	ND	ND	16.4000	ND	ND	ND	0.2200	ND
C9	ND	ND	ND	0.3200	ND	ND	628.0000	ND	ND	ND	0.0000	ND
C10	ND	ND	ND	0.5920	ND	ND	75.0000	ND	ND	ND	0.3810	ND
C3	0.1300	ND	ND	1.1200	ND	ND	51.9000	ND	ND	ND	93.6000	ND
C8	1.5000	ND	ND	4.4300	ND	ND	202.0000	ND	ND	ND	1.6000	ND
102	0.7800	ND	ND	0.2500	ND	ND	3.9400	ND	ND	ND	0.7400	ND
MW7	ND	ND	ND	0.1280	ND	ND	20.6000	0.2910	ND	ND	0.9500	ND
MW8	ND	ND	ND	0.2220	ND	ND	7.6000	ND	0.0100	ND	0.0000	ND
129	0.1500	ND	ND	0.0600	ND	ND	2.9000	ND	ND	ND	0.2100	ND
MW9	0.6100	ND	ND	0.0450	ND	ND	2.6000	ND	ND	ND	0.5700	ND
AWD1	5.6900	ND	0.0130	0.9150	ND	ND	2.8000	0.0530	ND	ND	5.7000	ND
120	0.9300	ND	ND	0.2700	ND	ND	31.6000	ND	0.1840	ND	3.3400	ND
MW14	ND	ND	ND	1.6500	ND	ND	78.8000	ND	ND	ND	159.0000	ND
MW12	0.2100	ND	ND	0.2440	ND	ND	36.1000	ND	0.0360	ND	65.2000	ND
130	ND	ND	ND	0.2170	ND	ND	64.0000	ND	ND	ND	0.1600	ND
MW18	ND	ND	0.0050	0.2480	ND	ND	7.6000	ND	ND	ND	26.7000	ND
MW17	ND	ND	ND	0.3100	ND	ND	38.1000	0.0160	0.0300	ND	3.9700	ND
MW13	ND	ND	ND	0.3400	ND	ND	28.7000	ND	ND	ND	65.0000	ND
C2	ND	ND	ND	0.3970	ND	ND	19.2000	ND	ND	ND	48.2000	ND
MW10	ND	ND	ND	0.6580	ND	ND	24.7000	ND	ND	ND	54.8000	ND
MW16	ND	ND	ND	0.3360	ND	ND	15.3000	ND	ND	ND	31.3000	ND
MW11	0.1500	ND	ND	0.0860	ND	ND	4.8000	ND	ND	ND	0.2500	ND
124	2.2000	ND	0.0110	0.8150	0.0067	ND	19.8000	ND	0.0450	ND	60.8000	ND
AWD4	0.5300	ND	ND	0.3220	ND	ND	9.6000	0.0460	ND	ND	1.1200	ND
MW19	0.0000	ND	ND	0.0000	ND	ND	142.0000	ND	ND	ND	112.0000	ND
MW20	0.5300	ND	ND	0.2380	ND	ND	21.0000	ND	ND	ND	0.3800	ND
C1	0.3000	ND	ND	0.5460	ND	ND	72.5000	ND	ND	0.0450	0.5500	ND
MW3	ND	ND	ND	1.7100	ND	ND	37.6000	ND	0.0180	ND	ND	ND

TABLE 2-3 (CONTINUE)
 LHAAP 18&24, BURNING GROUND 3 & UEP
 SUMMARY OF GROUNDWATER MONITORING, MARCH-APRIL, 1994
 METALS, mg/l

Well No.	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thalium	Vanadium	Zinc
126	84.3000	0.2350	ND	ND	ND	ND	ND	345.0000	0.0050	ND	0.0540
MW22	40.1000	0.0450	ND	ND	ND	ND	ND	364.0000	ND	ND	ND
MW15	6.7000	0.3450	ND	ND	ND	ND	ND	70.6000	ND	ND	0.0280
MW2	80.8000	0.9660	ND	ND	ND	ND	ND	297.0000	ND	ND	ND
EW1	6.6000	0.3580	ND	ND	ND	ND	ND	102.0000	ND	ND	0.0560
MW1	110.0000	2.1700	ND	ND	ND	ND	ND	384.0000	ND	ND	0.0310
MW4	55.0000	0.2470	ND	ND	ND	ND	ND	461.0000	ND	ND	ND
MW5	37.4000	0.0750	ND	ND	ND	ND	ND	128.0000	ND	ND	0.0300
MW6	25.3000	0.2340	ND	ND	ND	ND	ND	130.0000	ND	ND	0.0250
MW21	131.0000	2.9600	ND	0.0770	ND	ND	ND	458.0000	ND	ND	0.0600
109	40.0000	0.1050	ND	ND	ND	ND	ND	346.0000	ND	ND	0.0410
125	1.9000	0.0430	0.0002	ND	ND	ND	ND	24.4000	ND	0.0100	0.0480
123	9.3000	0.0120	ND	ND	ND	ND	ND	10.2000	ND	ND	0.0830
AWD2	3.6000	0.1400	ND	ND	ND	ND	ND	79.4000	ND	ND	0.0610
AWD3	22.9000	1.8900	ND	0.0660	ND	ND	ND	187.0000	ND	ND	0.2190
MW23	41.6000	0.1940	ND	0.4200	ND	ND	ND	280.0000	ND	ND	0.0290
C4A	2.8000	0.1730	ND	ND	ND	ND	ND	86.8000	ND	ND	0.0790
C4	4.1000	0.2110	ND	ND	ND	ND	ND	19.9000	ND	ND	0.0520
C5	2.9000	0.2000	ND	ND	ND	ND	ND	66.8000	ND	ND	0.0320
C6	21.4000	1.3200	ND	ND	ND	ND	ND	256.0000	ND	ND	0.0330
C7	9.3000	0.0110	ND	ND	ND	ND	ND	112.0000	ND	ND	0.0220
C9	470.0000	0.5600	ND	ND	ND	ND	ND	1590.0000	ND	ND	ND
C10	31.7000	0.2330	ND	ND	ND	ND	ND	250.0000	ND	ND	0.0600
C3	30.5000	1.9900	ND	ND	ND	ND	ND	121.0000	0.0050	ND	0.0780
C8	151.0000	0.1200	ND	ND	ND	ND	ND	819.0000	0.0050	ND	ND
102	2.8000	0.0210	ND	ND	ND	ND	ND	13.6000	ND	ND	0.0330
MW7	15.3000	0.0710	ND	0.2900	ND	ND	ND	332.0000	ND	ND	ND
MW8	6.2000	0.1070	ND	ND	ND	ND	ND	97.3000	ND	ND	ND
129	1.9000	0.0690	ND	ND	ND	ND	ND	52.4000	ND	ND	0.0470
MW9	1.3000	0.0700	ND	ND	ND	ND	ND	15.0000	ND	ND	ND
AWD1	7.5000	0.3580	ND	ND	8.7000	ND	ND	92.4000	ND	0.0110	0.0400
120	44.1000	1.6000	ND	0.0840	ND	ND	ND	1080.0000	ND	ND	0.1650
MW14	46.8000	3.5200	ND	ND	7.6000	ND	ND	407.0000	ND	ND	0.0660
MW12	23.1000	1.8700	ND	0.0740	ND	ND	ND	180.0000	ND	ND	0.2200
130	43.0000	0.5240	ND	ND	ND	ND	ND	927.0000	ND	ND	0.0530
MW18	4.2000	0.4940	ND	ND	ND	ND	ND	66.6000	ND	ND	0.0250
MW17	14.3000	0.5860	ND	0.1600	ND	ND	ND	110.0000	ND	ND	0.0440
MW13	10.5000	1.1400	ND	ND	ND	ND	ND	81.5000	ND	ND	ND
C2	11.8000	1.2100	ND	ND	ND	ND	ND	91.0000	ND	ND	ND
MW10	14.0000	1.2300	ND	ND	ND	ND	ND	106.0000	ND	ND	0.0200
MW16	88.0000	0.5730	ND	ND	ND	ND	ND	60.8000	ND	ND	ND
MW11	2.4000	0.0490	ND	ND	ND	ND	ND	21.1000	ND	ND	0.0300
124	17.2000	1.5000	ND	ND	ND	ND	ND	19.4000	ND	0.0590	0.1300
AWD4	8.3000	0.0770	ND	0.0880	ND	ND	ND	65.1000	ND	ND	0.0280
MW19	80.5000	2.4400	ND	ND	ND	ND	ND	1370.0000	ND	ND	ND
MW20	4.9000	0.0710	ND	0.0610	ND	ND	ND	37.5000	ND	ND	0.0980
C1	54.6000	0.0420	ND	ND	ND	ND	ND	329.0000	ND	ND	0.0490
MW3	35.1000	5.1400	ND	ND	ND	ND	ND	280.0000	ND	ND	ND

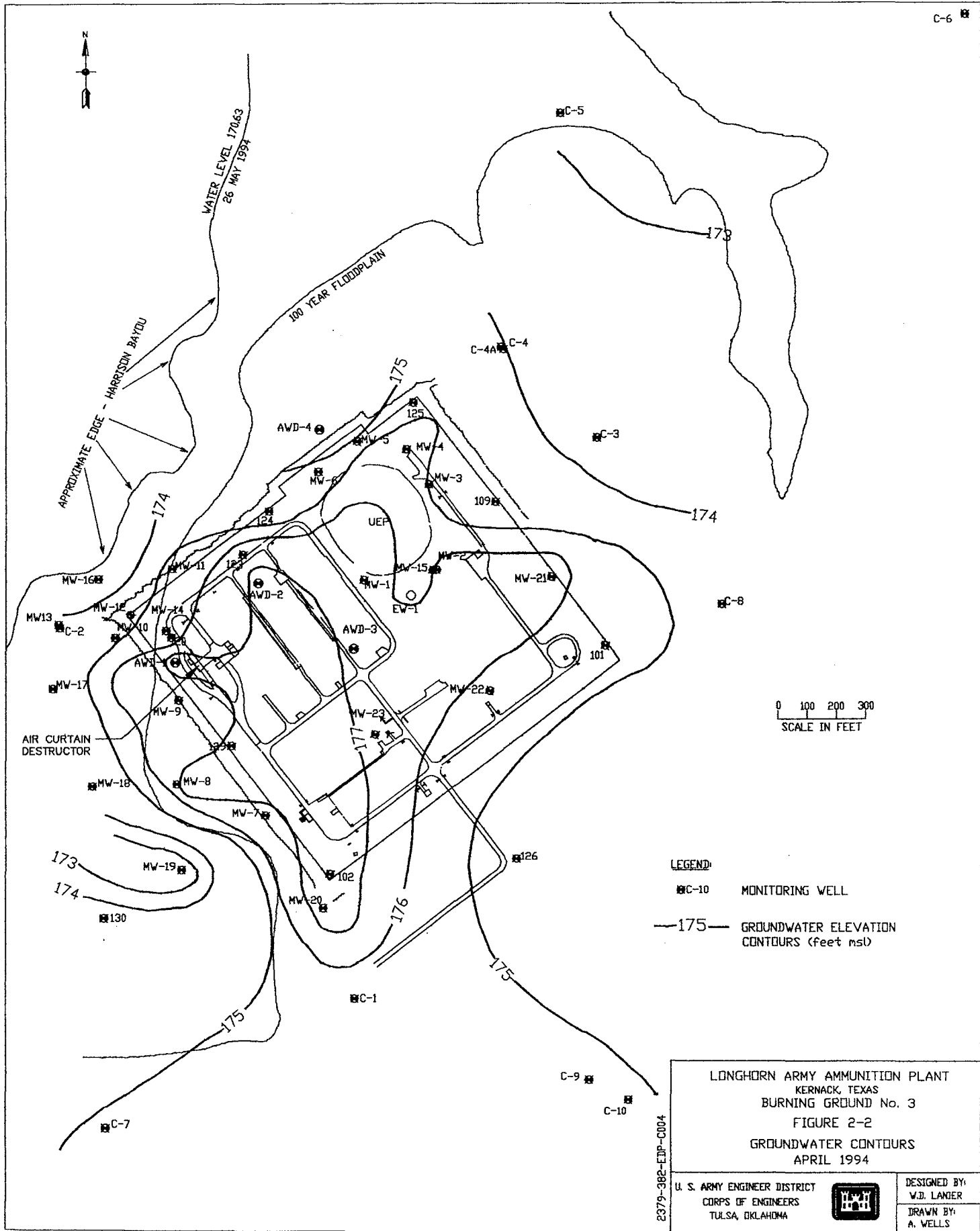
TABLE 2-4
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, MARCH-APRIL, 1994
EXPLOSIVES, micrograms/liter

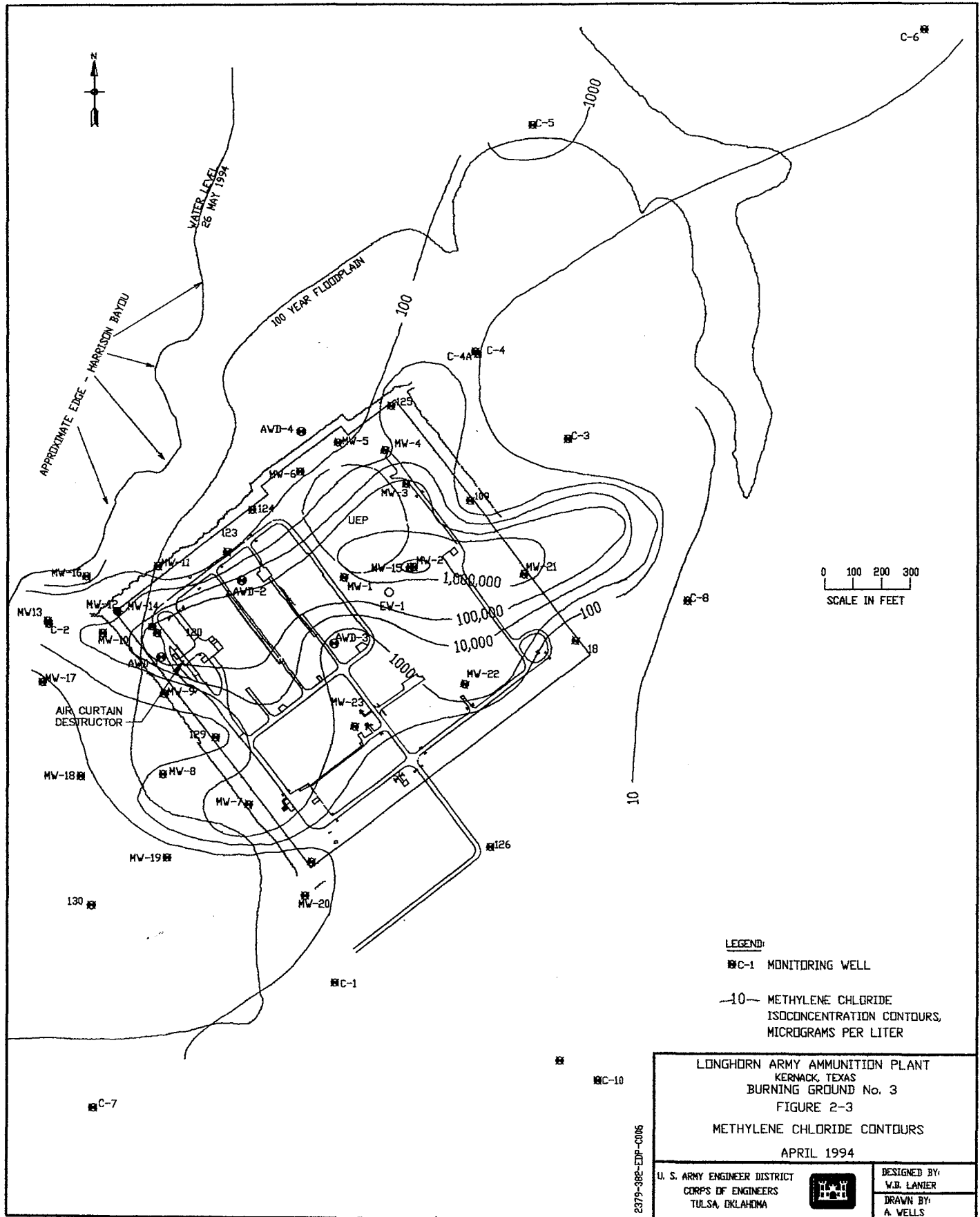
WELL No.	EXPLOSIVES COMPOUND										
	1,3-DNB	2,4-DNT	HMX	NB	2-NT	3-NT	4-NT	RDX	Tetryl	1,3,5-TNB	2,4,6-TNT
126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW2	ND	ND	ND	ND	ND	ND	ND	1.57J	ND	ND	ND
EW1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW21	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
101	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
109	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
123	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD3	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.43J	ND
MW23	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.63J	ND
C9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10	1.39	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
129	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD1	ND	ND	ND	ND	ND	ND	ND	13.0J	ND	0.49J	ND
120	ND	0.21J	ND	0.42J	ND	ND	ND	16.0J	ND	0.52J	4.70J
MW14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
124	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW3	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.39	ND

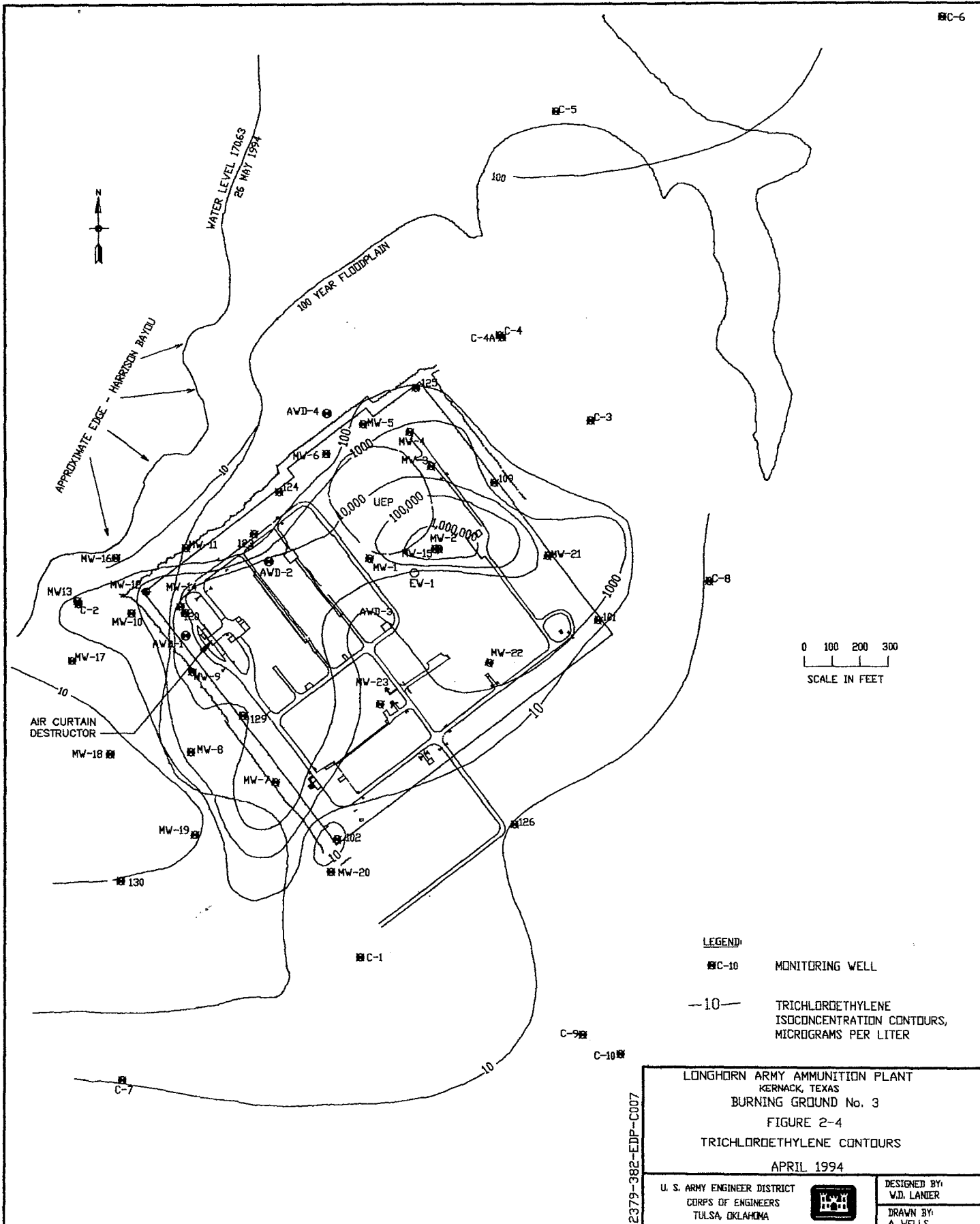
Note: ND = Non-Detect

TABLE 2-5
 LHAAP 18 & 24, Burning Ground 3 & UEP
 Summary of Groundwater Monitoring , March-April, 1994
 Wet Chemistry, mg/l

Well No.	Chloride	Nitrate	Sulfate
126	1090.00	ND	ND
MW22	833.00	ND	11.00
MW15	160.00	ND	8.00
MW2	790.00	16.00	ND
EW1	128.00	10.60	ND
MW1	1420.00	0.20	ND
MW4	753.00	ND	43.00
MW5	363.00	4.10	5.00
MW6	310.00	ND	10.00
MW21	1420.00	ND	6.00
109	931.00	0.50	12.00
125	35.00	1.80	19.00
123	7.00	2.77	9.00
AWD2	99.00	0.45	41.00
AWD3	18.00	0.98	77.00
MW23	594.00	1.20	11.00
C4A	78.00	ND	10.00
C4	53.00	ND	ND
C5	57.00	0.14	16.00
C6	523.00	ND	7.00
C7	80.00	0.76	33.00
C9	4010.00	0.10	176.00
C10	496.00	0.54	8.00
C3	514.00	ND	ND
C8	2280.00	0.20	ND
102	7.00	1.30	69.00
MW7	436.00	3.70	70.00
MW8	167.00	2.00	32.00
129	32.00	1.00	66.00
MW9	14.00	0.24	18.00
AWD1	74.00	1.30	21.00
120	518.00	0.60	55.00
MW14	1140.00	ND	45.00
MW12	528.00	1.70	63.00
130	1390.00	0.70	209.00
MW18	124.00	ND	10.00
MW17	239.00	ND	22.00
MW13	144.00	0.18	8.00
C2	195.00	0.15	7.00
MW10	316.00	0.10	28.00
MW16	186.00	ND	7.00
MW11	18.00	0.20	34.00
124	7.00	0.66	113.00
AWD4	106.00	0.53	19.00
MW19	2450.00	0.18	443.00
MW20	11.00	0.00	24.00
C1	762.00	0.16	20.00
MW3	505.00	0.10	12.00







2379-382-EDP-C007

LONGHORN ARMY AMMUNITION PLANT
KERNACK, TEXAS
BURNING GROUND No. 3

FIGURE 2-4
TRICHLOROETHYLENE CONTOURS

APRIL 1994

U. S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
TULSA, OKLAHOMA



DESIGNED BY:
V.D. LANIER

DRAWN BY:
A. WELLS

TABLE 2-6
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING
CONFIRMATION SAMPLING DATA COMPARISON

VOLATILE ORGANICS COMPOUNDS, microgram/liter

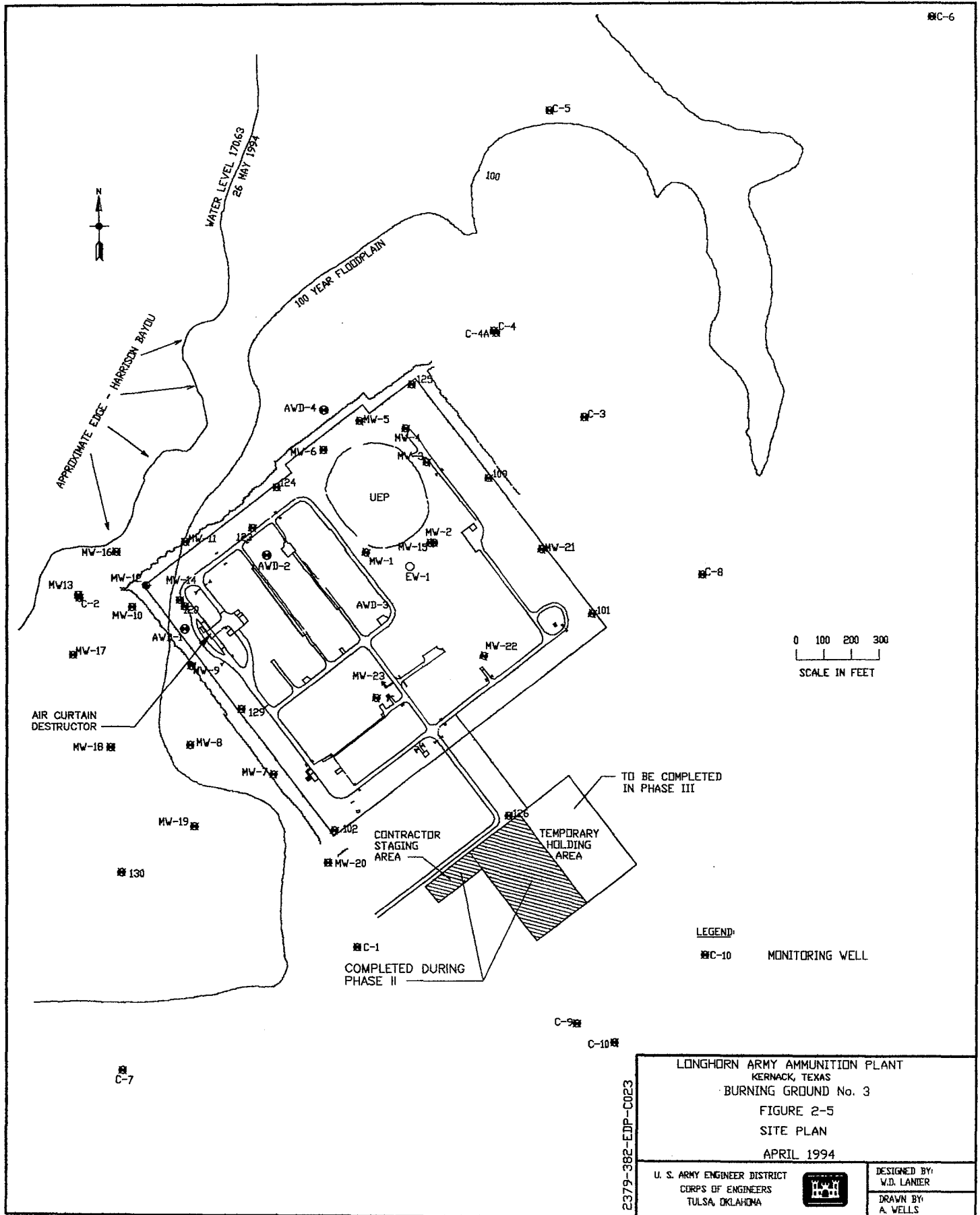
WELL No.	MARCH-APRIL, 1994		MAY, 1994		JUNE, 1994	
	MEC	TCE	MEC	TCE	MEC	TCE
MW2	10550000	1520000			8280000	320000
C4A	2000	ND	5	8	21	ND
C4	270	60	3	6	7	4
C5	1800	130	2	2	5	ND
C6	300	90	30	17	5	8
MW13	590	ND	ND	2	ND	ND
C2	480	210	1	5	4	ND
MW10	2100	ND	1	14	4	10
MW16	5	ND	ND	3	ND	ND

NOTE:

MEC = Methylene Chloride

ND = None Detect

TCE = Trichloroethylene



clearing equipment. The abandonment of tree stumps in place is not expected to cause any structural problems in this area in the future, since the construction of any structure in the area is not planned. This portion of the TSSA will only be used for storage of soil containers and for soil treatment using mobile systems. However, the stumps in the area of the second half of the TSSA will have to be removed, since this area will be occupied by a permanent groundwater treatment plant. The second half of the TSSA will be completed during Phase III of the IRA.

The clean fill was imported from a site in Karnack, Texas outside of LHAAP. Prior to importing this material, representative samples were collected and sent to the firm of Heller, Lewis, and House (HLH) in Longview, Texas for geotechnical testing. The samples were tested for moisture content, Atterbeg Limits, and shrinkage limit. The test results, which are included in Appendix B.1, indicated that the materials at the borrow pit are not expansive (swelling clays) and that they are acceptable for the project. Following this testing program, three representative samples were collected and tested for moisture-density relation by HLH. The laboratory test results which were used in the field to monitor fill placement, are presented in Appendix B.2. Field compaction test results, obtained by HLH, are included in Appendix B.3.

A layer of geotextile fabric, Exxon GTF 300, was placed over the compacted clean fill layer. A six inches gravel layer was placed over the geotextile fabric in a single lift. The material was delivered by trucks from Boorhelm-Fields in Idabel, Oklahoma. Two particle size analyses and one compaction test were performed by HLH on representative samples of the gravel. The test results are included in Appendix B.4. The gravel was spread using a bulldozer and was compacted with a self-propelled vibratory compactor. A 50-foot wide strip along the southern end of the TSSA was not covered with geotextile and gravel due to very wet and soft conditions. This portion of TSSA was topographically high and required little to no fill for grading.

A drainage ditch was cut along the western edge of the TSSA. Sections of 18-inch galvanized corrugated steel pipe were installed at the entrance of the contractor staging area, the entrance of the TSSA, and in between both of these areas in order to convey storm waters away from the site.

2.3 Task 3 - Construction of The Interceptor Collection Trench (ICT).

The ICT consists of two sections ICT-1 and ICT-2. These sections were located east and northeast of the onsite Air Curtain Destructor (ACD) as shown on Drawing II-1. The trench sections extended to the lower semi-confining, retardation layer. The purpose of the trench was to evaluate the effectiveness of such a collection system in dewatering soils of low hydraulic conductivity. The construction of the ICT included the following steps:

2.3.1 Geophysical Survey

An Electromagnetic Terrain (EM) conductivity survey was conducted in the area where the ICT was built by Subsurface Detection Investigations Incorporated (SDII) of Largo, Florida under a subcontract to DEI. The EM survey is a useful remote sensing technique that results in the delineation of the perimeters of buried waste trenches and the detection of buried metal objects (if any) through measurements of subsurface conductivity contrasts. This survey was mainly conducted for health and safety reasons since the area surrounding the proposed ICT location may have been used historically for the burial of facility wastes.

The EM method measures the electrical conductivity of subsurface materials. The conductivity is determined by inducing (from a transmitter) a time-varying magnetic field and measuring (with a receiver) the amplitude and phase shift of an induced secondary magnetic field. The secondary magnetic field is created by subsurface conductive materials behaving as an inductor as the primary magnetic field is passed through them.

SDII findings were documented in a report that is included as Appendix C.1. They indicated the potential presence of several areas with buried metallic debris. The main suspected area was located to the southeast of section ICT-2. No major anomalies were detected along the axes of the ICT. However, the ICT subcontractor and DEI personnel took extra caution during the excavation of the upper few feet of the ground in the areas where buried metals may be present based on this geophysical study. In those areas, excavation of the ICT proceeded very slowly with no personnel allowed within the vicinity of the trench. No metallic debris or buried waste was encountered during the excavation of the ICT sections.

2.3.2 Soil Borings and Temporary Groundwater Monitoring Wells/Piezometers

Soil borings, designated SBT-1 through SBT-7, were drilled along the axes of the ICT sections at about 50 to 75-foot intervals as shown on Drawing II-1, prior to the initiation of trench excavation and construction. The borings were used to define the subsurface conditions including the depth of the semi-confining layer on which the trench will rest, and to collect soil samples for chemical and physical characterization. Each borehole was drilled to the depth of the lower semi-confining layer. This depth was determined by conducting continuous soil sampling throughout the depth of the borehole.

Soil samples for chemical analyses were obtained at five-foot intervals using a three-inch split spoon. In addition, soil samples were obtained for physical testing and characterization. The analytical and geotechnical testing program for collected soil samples is listed in Table 2-1. Table 2-7 presents a summary of the detected chemical concentrations in the tested soil samples. As mentioned above, no buried waste was encountered during the excavation of the ICT sections. Soil contamination based on the collected samples appear to be minimal in the area and is confined to the interface of the semiconfining layer and the overlying shallow aquifer material and may have been caused by the contaminated groundwater in the aquifer. Appendix C.2 contains the results of the chemical analyses. The results of the geotechnical testing program are included in Appendix C.3.

Temporary groundwater monitoring wells (piezometers) were installed in each borehole. These piezometers were used to monitor the static water levels prior to the construction of the ICT sections. The screen section and riser pipe of each of the temporary monitoring wells were two inches in diameter and consisted of schedule 40 PVC. Detailed boring logs are included in Appendix C.4.

Subsurface information collected from the boreholes and the temporary monitoring wells was used to develop two subsurface cross sections shown on Figures 2-6 and 2-7. These cross sections show the potential elevation of the semi-confining retardation layer on which the ICT sections rest. The final design for the ICT sections was presented to the USACE Tulsa District for approval prior to proceeding with its installation. As can be seen from these cross sections, the groundwater level was about 0.5 to 5 feet from ground surface along Section ICT-1 and 3 to 10 feet along Section ICT-2. The shallow groundwater along the western edge of ICT-1

SBT1, SBT2, SBT3 & SBT4 were soil borings installed to design the profile of the Interceptor Collection Trench 1
Locations shown on Figure 2-8

TABLE 2-7
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF SOIL ANALYSES FOR INTERCEPTOR TRENCH
DETECTED CONCENTRATIONS, in milligram/kilogram
MARCH/APRIL 1994

Sample Number Depth (ft)	SBT1 5-7	SBT1 9-11	SBT1 13-15	SBT1 19-21	SBT1 25-27	SBT1 QC 25-27	SBT1 29-31	SBT2 5-7	SBT2 9-11	SBT2 15-17	SBT2 17-19	SBT3 5-7	SBT3 9-11	SBT3 15-17	SBT3 19-21	SBT3 23-25	SBT4 5-7	SBT4 10-12	SBT4 15-17
VOLATILE ORGANICS																			
1,1,1-TCA	ND	0.3	0.04	ND	0.16	0.23	0.018	ND		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-TCA	ND	ND	ND	ND	ND	0.005	0.007	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DCA	ND	0.017	0.17	0.11	0.015	0.018	0.019	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1 DCE	ND	ND	0.13	0.24	0.39	0.45	0.57	ND	0.024	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.006
1,2 DCA	0.005	0.008	0.43	0.99	1.8	2	3	ND	0.1	0.04	0.003	ND	ND	0.016	0.005	0.032	ND	0.005	0.45
2-Butanone	ND	ND	ND	ND	ND	ND	0.036	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	0.007	0.006	ND	0.033	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	0.032	ND	ND	0.12	0.017	ND	0.047	0.036	0.27	0.092	0.049	0.042	0.032	0.033	0.057	0.04	0.027	0.038	0.16
Benzene	ND	ND	ND	ND	ND	ND	0.004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	0.005	0.016	0.018	0.021	0.044	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
Ethylbenzene	ND	ND	ND	ND	0.005	0.006	0.004	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MEC	0.18	0.112	5.18	9.2	9.5	9.5	11.9	0.06	0.4	0.17	0.067	0.055	0.038	0.05	0.034	0.19	0.022	0.03	6.7
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCE	ND	ND	0.011	0.021	0.039	0.053	0.036	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	0.016	0.047	0.023	0.026	0.164	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.023
Total Xylenes	ND	ND	0.006	0.005	0.008	0.006	0.008	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total-1,2-DCE	0.1	ND	7.7	0.004	0.6	0.76	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.013
TCE	0.17	0.073	3.8	6.5	7.5	8.1	8.6	ND	1.4	0.04	ND	ND	ND	0.04	ND	0.01	ND	0.056	2.7
Vinylchloride	ND	0.032	0.19	0.012	0.029	0.032	0.005	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS																			
BEP	1.076	0.842	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.125	ND
DBP	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.471
TOTAL METALS																			
Aluminum	11800	1460	1350	2330	2020	1530	1260	1060	481	844	1040	2530	2570	1950	1170	1520	9210	5650	8070
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.73	1.4	ND	ND	ND	ND
Barium	69.5	72.5	29.4	36.3	27.6	22.5	21.1	67	36.1	33.3	12.3	60.5	45.8	113	73.7	120	63.2	54.3	84.9
Beryllium	0.87	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	170	87.5	111	235	219	219	223	394	124	399	427	790	473	965	956	994	535	373	578
Chromium	9.9	2.3	3.2	3.8	3.4	2.9	4.4	1.6	ND	2.4	4.7	3.7	1.9	2.5	ND	1.2	9.1	8.6	13.5
Cobalt	8.1	2.4	1.5	3.1	3.3	2.9	1.5	4.8	ND	2	1.2	1.4	6.2	2	1.4	4.3	3.4	5.3	6.1
Copper	6.4	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	ND	2.9	3.7	ND	2.6	4.5	5	5.9
Iron	14300	1680	853	3660	2430	1890	1530	417	388	865	598	4820	4790	4600	1840	966	6930	12400	13300
Lead	10.7	4.5	4.4	3	3.1	2.8	2.7	3.7	3.2	4.5	2	3.7	3.8	3.2	3.6	2.5	7.4	13.1	12.2
Magnesium	918	376	231	469	484	450	319	400	206	426	384	788	836	1190	782	990	1070	968	1340
Manganese	117	9.1	8.3	5.1	11.9	10.8	9.7	5.4	6.3	4.5	1.8	6.7	69.8	22.3	16.7	55	17.2	79.6	57.9
Nickel	8.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.3	10	13.7
Potassium	367	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	268	ND	ND	686	ND	770
Sodium	1240	143	89.9	241	89.8	96.8	118	1150	ND	259	333	66	207	1530	1100	109	291	165	298
Vanadium	29.7	3.8	2.8	7.1	5.8	4.4	3.9	1.3	ND	2.8	2.8	8.8	7.1	9.4	3.9	3.3	13.9	16.1	18.1
Zinc	19.2	8.8	8.6	11.9	13.5	11.9	8.5	6.6	4.4	9.5	5.4	4.7	13.5	16.9	12.3	13.4	22.9	27.2	34.5
WET CHEMISTRY																			
Chloride	53	53	35	35	44	35	53	71	18	80	62	ND	27	35	71	89	ND	18	35
Nitrate as N	12.5	12.5	5.5	12	12.8	5.2	2.9	17.5	1.6	12.5	2	2.5	3.3	3.2	24.4	1.3	17	23	6.5
pH	5.42	5.47	4.81	4.52	4.39	4.39	4.4	4.89	5.18	5.16	6.25	6.14	4.97	5.02	7.42	5.23	4.22	5.49	4.97
Sulfate	5400	2550	1030	5990	3540	1920	80	1300	214	506	317	213	216	422	2740	111	4030	4310	5750
EXPLOSIVES: All samples indicated less than detection limits present.																			

max at
30 ft

TABLE 2-7 CONTINUED
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF SOIL ANALYSES FOR INTERCEPTOR TRENCH
DETECTED CONCENTRATIONS, in milligram/kilogram
MARCH/APRIL 1994

Sample Number Depth (ft)	SBT5 5-7	SBT5 9-11	SBT5 QC 9-11	SBT5 14-16	SBT6 5-7	SBT6 10-12	SBT6 15-17	SBT6 19-21	SBT6 23-25	SBT7 5-7	SBT7 10-12	SBT7 15-17	SBT7 19-21	SBT7 QC 19-21	SBT7 25-27	ICT1 16	ICT1 18	ICT2 13	ICT2 23
VOLATILE ORGANICS																			
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.035
1,1,2-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1 DCE	ND	ND	ND	ND	ND	ND	ND	0.008	0.007	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.23
1,2 DCA	ND	ND	ND	ND	ND	ND	ND	0.42	0.19	ND	ND	ND	0.1	0.049	ND	0.007	0.012	0.46	1.8
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	ND	ND	ND	0.053	0.041	0.054	0.047	0.031	0.038	0.056	0.05	0.05	ND	0.05	0.012	ND	ND	0.025	0.12
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	0.003	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.26
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MEC	0.066	0.047	0.038	0.026	0.019	0.028	0.026	0.22	0.028	0.029	0.025	0.014	0.34	0.093	0.023	0.02	0.022	7	29.7
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.013	ND
Total Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total-1,2-DCE	ND	ND	ND	ND	ND	ND	ND	0.007	ND	ND	ND	ND	ND	ND	ND	0.006	0.006	ND	0.89
TCE	0.038	0.14	0.46	ND	ND	ND	ND	1.6	0.88	ND	0.003	ND	0.26	0.18	ND	0.16	0.086	3.9	12.7
Vinylchloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEMI-VOLATILE ORGANICS																			
BEP	ND	1.027	1.164	ND	ND	ND	ND	ND	0.538	ND	ND	ND	ND	ND	ND	1.012	ND	ND	ND
DBP	ND	ND	0.454	ND	0.434	0.582	0.578	0.437	0.518	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TOTAL METALS																			
Aluminum	11600	4700	2990	2490	3830	7040	3990	3500	4050	17700	7100	2860	11000	17100	5720	6350	4860	7250	2890
Arsenic	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	0.92
Barium	84.2	63.3	91.7	18.9	26.1	46.3	21.9	53.8	49.7	90.3	43.8	26.7	124	194	57.1	41.3	35.2	101	37.3
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.64	ND	ND	0.73	0.76	ND	ND	ND	ND	ND
Calcium	331	595	346	652	129	112	713	693	808	324	127	243	1290	1820	539	125	257	703	253
Chromium	10.7	7.6	4.4	3.6	8.6	7.8	3.8	4	5.4	16.4	7.4	3.6	13.1	19	7.7	7.5	14.9	10.7	4.5
Cobalt	3.1	4.2	2.9	7.7	2.9	4.5	4.1	3	9.2	7	4.5	1.6	5.5	7.1	9.4	2.5	2.8	6.8	2.4
Copper	4.3	3.7	3.2	3.5	ND	5.3	3.4	3.4	4.6	8.4	4.4	2.7	6.7	7.7	4	2.8	5.1	4.8	ND
Iron	6190	3530	4770	2880	6490	3810	3580	6990	10600	16800	11300	2560	18700	16900	12000	3920	18500	12700	2960
Lead	11.1	12	8.2	12.3	5.5	7	5.7	6.6	7.5	11.7	8.3	6.5	13.3	5.1	11.6	2.8	5.5	6	3.8
Magnesium	975	967	632	691	309	808	861	777	921	1690	714	363	1820	2690	767	646	571	1610	358
Manganese	11.5	11	20.6	104	36.1	16.4	16.5	22.1	103	62	45.9	8.3	44.2	41.9	176	12.2	18.3	83.8	33.4
Nickel	6.3	5.1	ND	ND	ND	ND	ND	5.6	9.4	14.8	9.8	ND	11.9	16.3	8.5	ND	ND	12.9	ND
Potassium	ND	ND	ND	ND	ND	ND	ND	ND	ND	960	ND	ND	606	935	ND	ND	ND	657	ND
Sodium	204	485	147	500	ND	90	142	179	198	100	72.2	232	223	565	105	161	186	215	114
Vanadium	15.6	12.1	13.4	7.4	12.4	12.1	9.6	11.9	13.9	29	13.5	6.7	20.6	24.7	14.7	10.1	16.3	17.3	6.5
Zinc	17.9	18.2	15.6	12.5	7.9	22.1	15.9	16	23.7	35.6	24.5	8.7	31.6	43.8	19.7	16.4	21.7	40.1	13.5
WET CHEMISTRY																			
Chloride	53	18	35	35	ND	ND	18	89	89	35	ND	27	80	27	80	53	89	64	18
Nitrate as N	12	53	35	55	ND	ND	25	11	11	8	2.9	4.4	56	12	4.1	0.7	1	28	0.51
pH	4.58	6.19	5.94	5.05	4.51	4.51	4.62	4.7	5.07	4.37	4.62	4.67	4.65	4.39	4.98	5.07	4.35	7.49	5.56
Sulfate	2420	6800	7460	12400	125	167	4090	2470	1860	2080	567	731	1800	3330	665	230	299	2140	556
EXPLOSIVES: All samples analyzed indicated non detectable concentrations present.																			

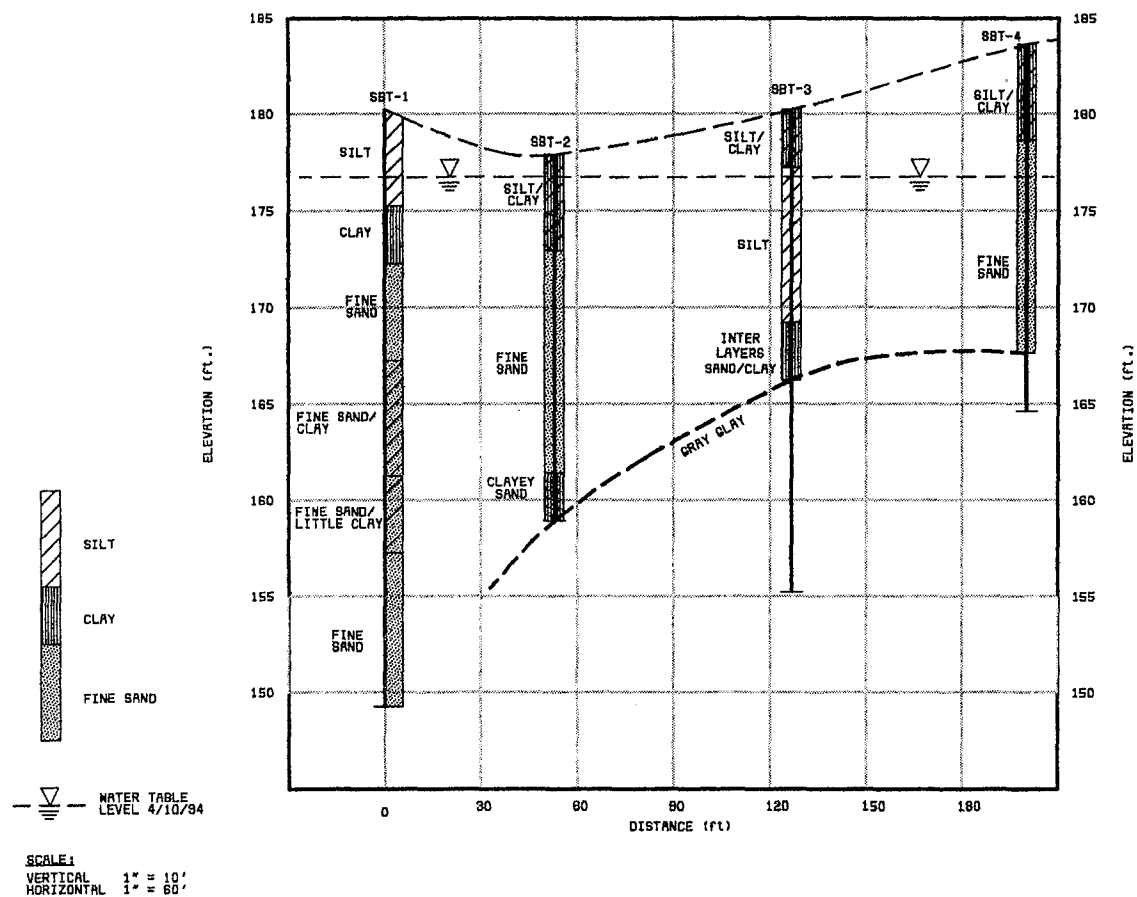
NOTE:

MEC = Methylene Chloride
TCE = Trichloroethene
PCE = Tetrachloroethene

1,1,1-TCA = 1,1,1-Trichloroethane
1,1,2-TCA = 1,1,2-Trichloroethane
1,1-DCA = 1,1-Dichloroethane

1,1-DCE = 1,1-Dichloroethane
1,2-DCA = 1,2-Dichloroethane
BEP = Bis(2-ethylhexyl)phthalate

DBP = Di-n-Butylphthalate
ND = None Detected



LONGHORN ARMY AMMUNITION PLANT

KERNACK, TEXAS

BURNING GROUND No.3

FIGURE 2-6

SECTION ICT - 1

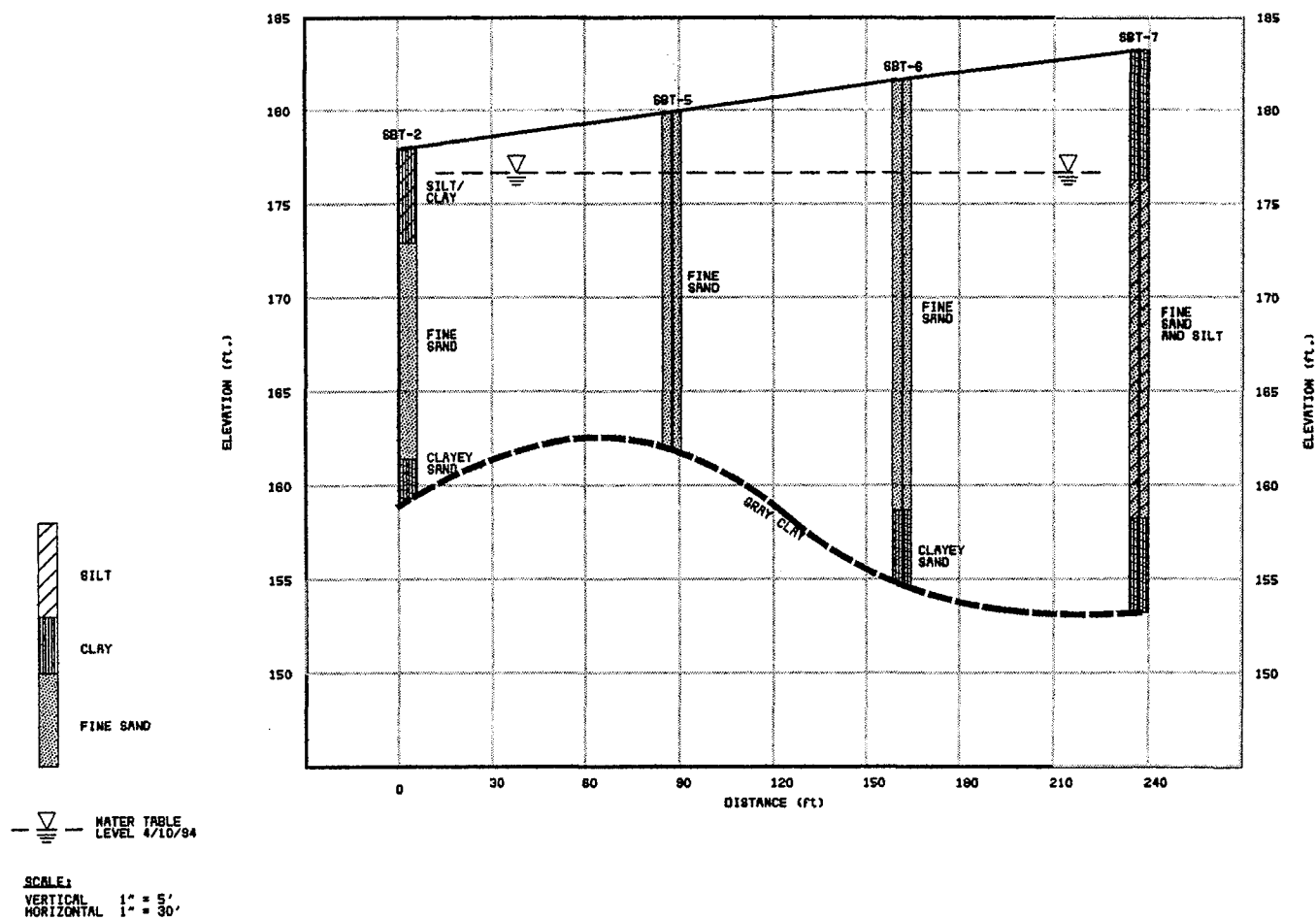
FEBRUARY 1995



Dow Environmental

DESIGNED BY: A. B. ONK

DRAWN BY: E. PIEDRAMARTEL



LONGHORN ARMY AMMUNITION PLANT

KERNACK, TEXAS

BURNING GROUND No.3

FIGURE 2-7

SECTION ICT - 2

FEBRUARY 1995



Dow Environmental

DESIGNED BY: A. B. ONK

DRAWN BY: E. PIEDRAMARTEL

caused ground stability problems during the excavation of this section as described below.

2.3.3 Construction of the ICT

The ICT was constructed by Inquip Associates, Inc. of Fairfax Virginia under subcontract to DEI, using the Bio-Polymer (BP) slurry trench technology. This method of drain construction uses basic slurry trench technology, however, instead of bentonite clay slurry, a guar-gum (or a similar material) based slurry is used to maintain the open trench. This type of slurry breaks down chemically and biologically following the backfilling of the trench with the desired water collection system. This method of drain construction did not require trench entry by workers since once a trench section was dug to the desired depth, the components of the water collection system (i.e. pipe laterals, filter fabric, and gravel) were placed under slurry.

All excavated soil and any liquid or solid waste generated during the construction of the ICT were collected in appropriate containers. These containers consisted of frac tanks for liquid wastes and roll-off boxes with metal covers for solid wastes. The frac tanks have been stored at the burning ground in the vicinity of EW-1 and the roll-off boxes have been stored at the TSSA. Spill control measures were also used to prevent the migration of any generated waste beyond the limits of the excavation.

Two methods were used for the construction of the ICT as follows:

- Section ICT-1 had a geocomposite drainage filter (GUNNET by Gundle) installed vertically in the middle of the trench with a coarse sand backfill on each side of the filter. A groundwater collection pipe (perforated HDPE with a six inches diameter) was wrapped around by the geocomposite filter and placed at the bottom of the trench. Appropriate sumps and clean-out pipes were also placed in the open trench prior to the placement of the sand backfill on both sides of the geocomposite filter. Steel I-beams were used on both sides of the filter material in order to keep it in the middle of the trench. Due to the construction difficulties discussed below, the length of this section was limited to 125 feet instead of 250 feet as planned.
- Section ICT-2 was backfilled with coarse sand having a permeability of $K = 10^{-2}$ cm/sec. A groundwater collection pipe (six inches perforated HDPE) was placed at the bottom of the trench along with appropriate sumps and clean-out pipes prior to the placement of the sand. This section extended 250 feet as planned.

The riser pipes for the groundwater collection system consisted of six-inch diameter HDPE casings and screens. The screens extended from the bottom of the sump to about 12 inches below the top of the ICT drainage material. The riser pipes were placed beside the drain pipe and extended above the ground surface.

A separate three-inch diameter HDPE piping system was installed in each trench section for the distribution of additional vacuum to the trench during the vacuum enhanced groundwater tests. An as built diagram is shown on Figure 2-8.

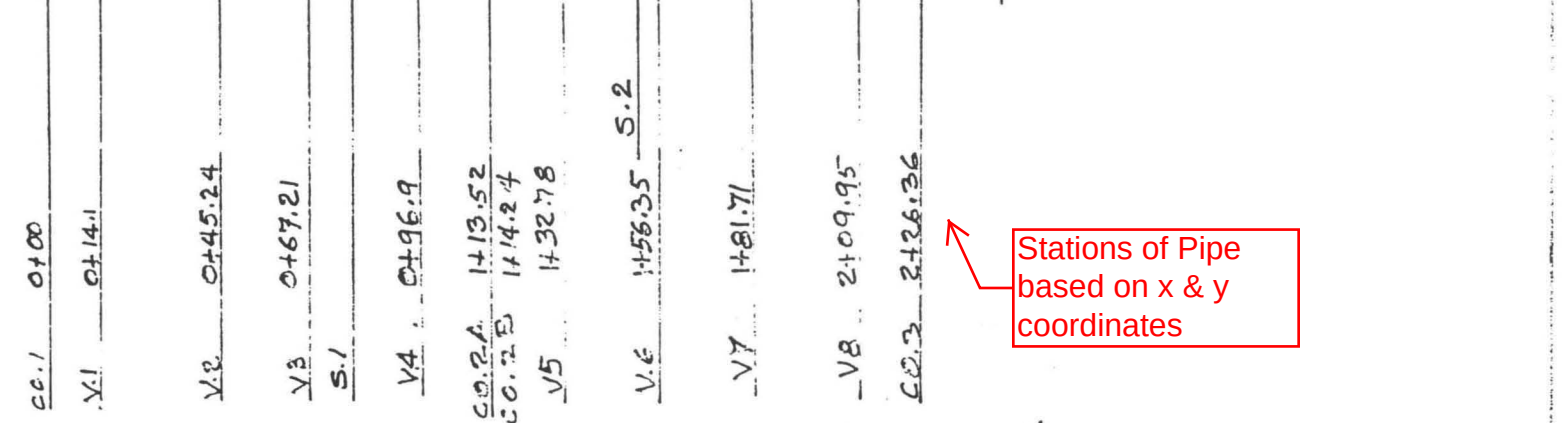
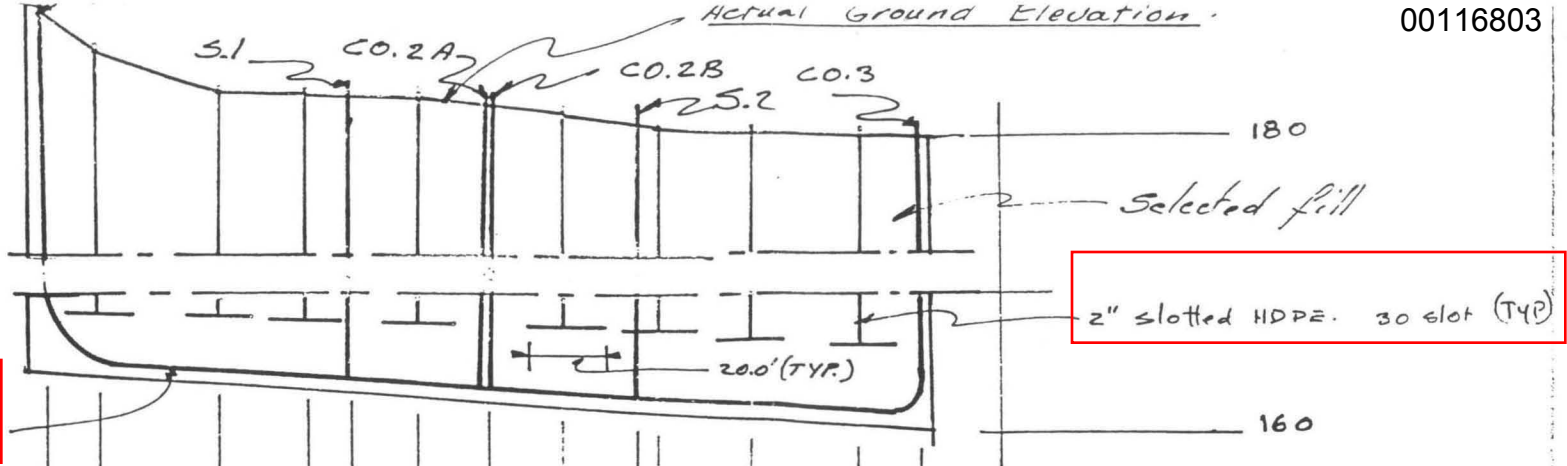
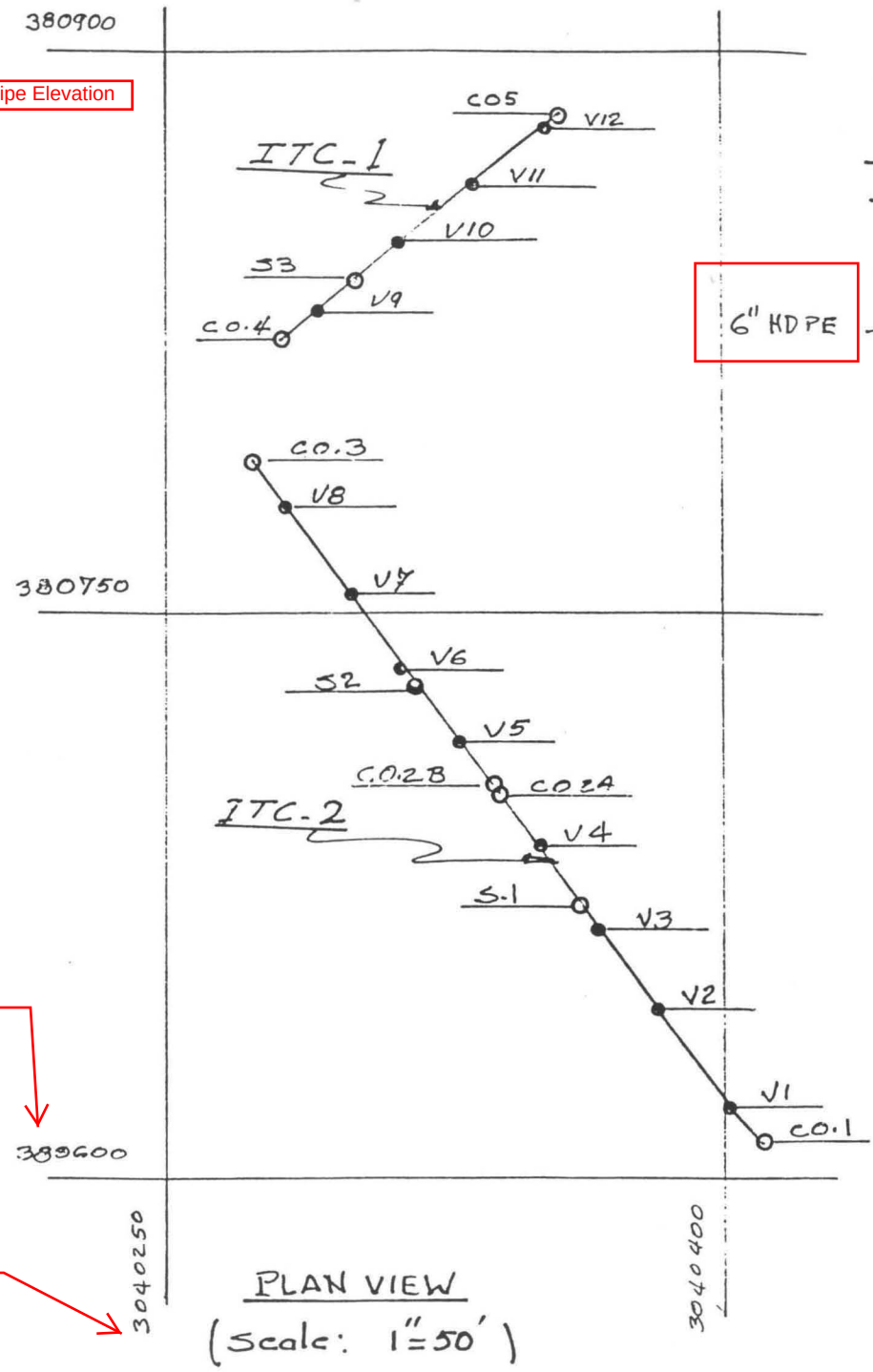
Difficulties encountered during the construction of ICT-1 were as follows:

The shallow groundwater level at the western edge of Section ICT-1, which resulted less

CO= Clean Out Pipe is 6 in HDPE
connected to screened HDPE Pipe
ITC = Interceptor Collection Trench or ICT
V = vacuum Pipe
S = Sump

Bottom of Pipe Elevation

Designation	Station	Ground Elevation	Top of riser pipe Elevation	Invert Pipe Elevation
ITC-01				
CO.04	0+00.00	182.40	184.20	163.20
V.9	0+12.47	182.39	184.39	163.36
S.3	0+24.38	182.49	184.34	163.51
V.10	0+40.56	182.87	184.82	163.72
V.11	0+66.04	183.05	185.10	164.04
V.12	0+90.54	183.45	185.10	164.35
CO.05	0+93.32	183.39	184.79	164.39
ITC-02				
CO.01	0+00.00	186.60	184.42	167.60
V.1	0+14.00	183.15	184.86	167.16
V.2	0+45.24	182.30	183.44	166.20
V.3	0+67.21	182.26	183.80	165.49
S.1	0+78.76	182.35	185.65	165.13
V.4	0+96.90	182.10	184.34	164.56
CO.02A	1+13.52	181.55	182.72	164.04
CO.02B	1+14.24	181.55	182.29	164.02
V.5	1+32.52	181.10	183.70	163.44
S.2	1+52.60	181.06	182.80	162.81
V.6	1+56.35	180.54	182.50	162.70
V.7	1+81.71	180.23	182.05	161.90
V.8	1+89.95	180.14	181.64	161.64
CO.03	2+26.36	180.04	182.29	160.50



Y coordinate

X coordinate

NOTES:

- CO: Clean Out
- V: Vacuum Pipe (horizontal Vacuum pipe is 5.0' above Interceptor Pipe Invert.)
- S: Sump. (Sump pipe riser)

PROVIDE BY: INQUIP ASSOCIATES, INC.	
LONGHORN ARMY AMMUNITION PLANT KERNACK, TEXAS BURNING GROUND No.3	
FIGURE 2-8 INTERCEPTOR COLLECTION TRENCH SECTIONS FEBRUARY 1995	
 Dow Environmental	DESIGNED BY: A. B. ONK DRAWN BY: E. PIEDRAMARTEL

than the desired differential between the water level and slurry level in the trench, created stability problems during the excavation of the trench and resulted in the collapse of about 75 feet of excavation. This portion of ICT-1 was abandoned following its collapse. This action was taken after it was determined that lowering of the water table in the area several feet (6 to 8 feet) is necessary in order to achieve stability of excavation. Such dewatering may have been possible for this short section of trench, however, it would not be practical and/or cost effective to use dewatering for the construction of a site wide ICT system during Phase III of the IRA. Another option to increase stability in this area would have been the construction of a working platform by placing 6 to 8 feet of fill over the area where the trench was to be built. Such a platform would have resulted in a free board above the groundwater level and a stable trench due to a height differential between the groundwater elevation and the slurry level close to the top of the trench. This option was not used in the case of the collapsed portion of ICT-1 due to schedule constraints and due to the fact that such a platform would block the runoff of surface water in the area and create muddy conditions during the flow testing of the ICT sections. However, a thin platform (1 to 3 feet thick) was built along the installed section of ICT-1 in order to level the trench surface and maintain slurry in the trench. The platform was built from the same imported backfill material as the TSSA.

The installation of the geocomposite filter in the eastern portion of ICT-1 necessitated the opening of the entire trench section, 125 feet, in order to lower the drain pipe and filter material in-place. The trench remained open and stable during the installation of the drainage system. This approach may be used for short sections of trench, however, for a trench several hundred feet long, it would not be possible to open the entire trench prior to installing a similar drainage system due to the biodegradable nature of the slurry. Therefore, if the use of a geocomposite filter is required in future ICT sections, such ICT will have to be built of short overlapping trenches about 100 feet long. In addition to trench stability considerations, the installation of the geocomposite filter proceeded slowly and required a large number of I-beams to stretch it and maintain it (to the extent possible) in the middle of the trench. This problem may be avoided by constructing a steel frame per section of ICT at the ground surface, attaching the filter material and piping systems to the frame, and lowering the entire system in one piece into the open trench.

The placement of the wet sand backfill on both sides of the filter material using tremie pipes proceeded very slowly and required the withdrawal and cleanup of pipes several times prior to the completion of the ICT section. Such problems would cause delay during the construction of longer ICT sections during Phase III. A solution to this problem may be the use of pea gravel instead of sand.

Difficulties encountered during the construction of ICT-2 were as follows:

The backfilling of this section of ICT proceeded along with its excavation. However, the excavation activity ahead of the saturated sand backfilling operation applied suction pressures on the sand and caused it to run toward the area being excavated. The running of the sand backfill caused the displacement of the sumps, cleanouts, and vacuum application pipes. This problem was evident during the placement of piping systems and backfill in the southern half of ICT-2. The other half of the trench was backfilled following completion of excavation and minor-to-no problems were encountered during the backfilling of this portion of trench. The displacement of the sand and piping systems caused considerable delay in construction and resulted in a badly damaged sump (sump No. 1). These difficulties

may be avoided in the future by either using coarser material to backfill the trench or by building the trench in short, i.e. 100-foot, overlapping sections. The coarser material such as gravel may allow the hydrostatic forces caused by the saturated conditions and the suction forces of the excavation equipment to dissipate faster than the coarse sand, thus resulting in less running of backfill material and less damage to piping systems. Alternatively, the construction of an ICT using short overlapping sections would allow the backfilling of the trench without any disturbance due to excavation. In addition, rigid pipes such as stainless steel should be used instead of flexible HDPE pipes for riser sumps. As discussed below, the use of separate piping for the application of vacuum was not successful, and its use is not recommended in future ICTs at the site.

A thin platform was also built along the axis of ICT-2 (1 to 4 feet thick) mainly in the area of low original ground surface elevation along the northern third of ICT-2. This platform was necessary to maintain the excavation slurry in the trench and to provide some trench stability, especially in the vicinity of SBT-5 where the groundwater was close to ground surface. The platform was built from the same imported backfill material as the TSSA. The construction of such platform during the installation of the Phase III ICT sections will be necessary if similar conditions are encountered. This will increase the cost of the installation.

The effectiveness of the ICT sections was evaluated based on the results of the gravity flow and the vacuum enhanced liquid extraction testing as discussed in Section 2.5. These results were based on field monitoring of water levels in existing onsite monitoring wells, in some of the SBT1 through SBT7 piezometers installed prior to the construction of the ICT sections, and six new piezometers designated AWD7, AWD8, AWD9, AWD10, AWD16, and AWD17. The new piezometers, which were installed in the vicinity of the ICT following its construction as shown on Drawing II-1, consisted of two-inch, Schedule 40 PVC casings and screens. The piezometer screens extended from the top of the semi-confining layer on which the trench sections rest to about three feet from the existing ground surface. The piezometer riser pipes extended to about two feet above ground surface.

2.4 TASK 4 - Installation of Horizontal Extraction Well (HEW).

The purpose of the HEW was to evaluate the potential extraction of groundwater from a large horizontal area located under the ACD and surrounding support facilities. The construction of the HEW included the following steps:

2.4.1 Soil Borings and Temporary Groundwater Monitoring Wells/Piezometers

Soil borings, designated AWD-11 through AWD-13, were drilled along a direction parallel to the axis of the HEW at the locations shown on Drawing II-1, prior to the initiation of drilling for the horizontal well. The borings were used to define the subsurface conditions including the depth of the semi-confining retardation layer on which the screened portion of the well rests. The borings were also used to collect soil samples for chemical and physical characterization. Each borehole was drilled to the depth of the lower semi-confining layer. This depth was determined by conducting continuous soil sampling throughout the depth of the borehole. The depth of each borehole was verified by the U.S. Army Corps of Engineers, Tulsa District. Any drilled portion of the semi-confining layer was grouted using bentonite grout upon completion of the borehole. Detailed boring logs are included in Appendix D.1.

Soil samples for chemical analyses were obtained at five-foot intervals using a three-inch split spoon. In addition, soil samples were obtained for physical testing and characterization at the same intervals as for chemical analyses. The analytical and geotechnical testing program for collected soil samples is listed in Table 2-1. Appendix D.2 contains the results of the chemical analyses. The results of the geotechnical testing program are included in Appendix C.3. Soil contamination based on the collected samples appears to be minimal in the area and is confined to the interface of the semi-confining layer and the overlying shallow aquifer material and may have been caused by the contaminated groundwater in the aquifer. Table 2-8 presents a summary of the detected chemical concentrations in the tested soil samples.

Temporary groundwater piezometers were installed in each borehole. These piezometers were used to monitor the static water levels prior to proceeding with the installation of the HEW. The screen section and riser pipe of each of the piezometers were two inches in diameter and consisted of schedule 40 PVC. These piezometers were also used to measure water levels during the gravity flow and vacuum enhanced flow testing discussed below.

Subsurface information collected from the boreholes and the temporary monitoring wells was used to develop a subsurface cross section shown on Figure 2-9. This cross section shows the potential elevation of the semi-confining retardation layer on which the HEW rests. The final design for the HEW was presented to the USACE Tulsa District for approval prior to proceeding with its installation.

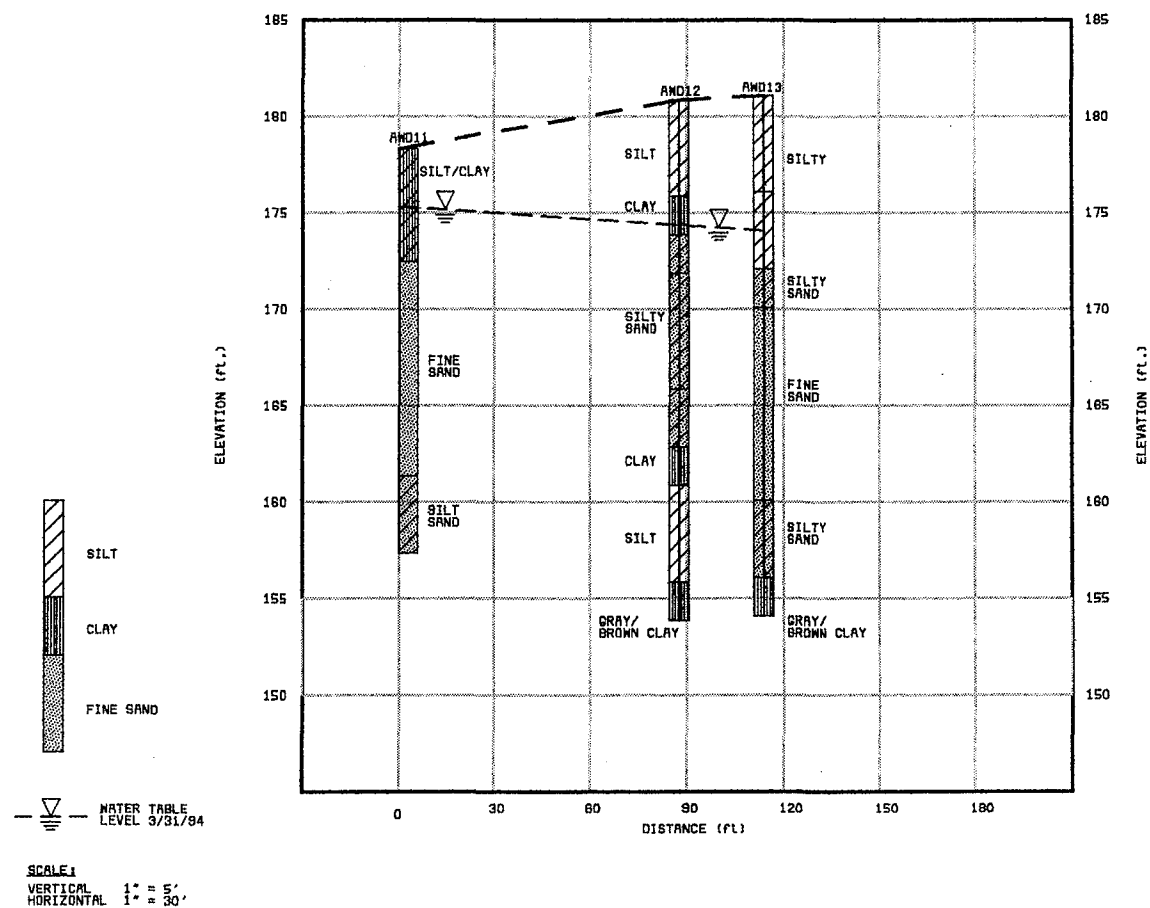
2.4.2 Installation of HEW

The HEW was installed by Eastman Cherington of Houston Texas under subcontract to DEI. The HEW was installed at an approximate depth of 25 feet below the ground surface. It extended about 227 feet including a 120-foot screen section. The HEW head was located to the south of the on-site ACD as shown on Drawing II-1. This location of well head was based on available space to accommodate the large number of equipment required for the installation of the HEW, and on available drilling distances for the drilling equipment to turn to a horizontal level under the ACD. Initial well head locations to the west and north of the ACD were not used due to limitation in space and drilling distance. The well was installed in a northeast direction under the ACD. It consisted of a six-inch HDPE riser pipe and a prepacked six-inch slotted HDPE screen with slot size of 0.01 inch. The screen section extended along the entire length of the horizontal section of the well. As built diagrams of the HEW are included in Appendix D.4.

All generated soil cuttings and any liquid or solid waste generated during the construction of the HEW were collected in appropriate containers. These containers consisted of frac tanks for liquid wastes and roll-off boxes with metal covers for solid wastes. The frac tanks have been stored at the burning ground in the vicinity of EW-1, and the roll-off boxes have been stored at the TSSA. Spill control measures were also used to prevent the migration of any generated waste beyond the limits of the drilling operation.

Difficulties encountered during the installation of the HEW were as follows:

- Ground fracturing occurred along most of the HEW line during drilling operations. The fine subsurface soils collected on the outside of the drilling rods and blocked the circulation of drilling fluid which was being pushed into the hole under pressure. This



LONGHORN ARMY AMMUNITION PLANT
KERNACK, TEXAS
BURNING GROUND No.3
FIGURE 2-9
SUB-SURFACE CROSS-SECTION FROM AWD11 - AWD13
FEBRUARY 1995



Dow Environmental

DESIGNED BY: A. B. ONK

DRAWN BY: E. PIEDRAMARTEL

blockage contributed to the fracturing. The fracturing caused drilling fluids to run up to the ground surface and spill over the area of operation. This spillage was managed at all times in order to prevent contamination to the surrounding environment. About 1,000 bags of sand were used to control the problems caused by fracturing. These bags were placed in a roll-off box following the installation of the HEW and are being handled like all other solid waste generated during Phase II of IRA. It may difficult to avoid this problem in future applications at the site, especially with shallow wells where the overburden is limited and does not provide a balance to the drilling fluid pressures. However, a very slow speed of drilling and the removal and cleaning of drilling rods every few feet of drilling may reduce the amount of drilling fluids blockage and thus the amount of fracturing. This solution will cause an increase in the cost of drilling and will be time consuming.

- The well bore was lost several times during the drilling operations. This problem appears to have been caused by the high speed of drilling over the first two days of the work. It also appears to have been related to the drilling equipment which was difficult to maneuver due to the shallow nature of the well. The drilling contractor is responsible for solving this problem. However, it should be noted that such a problem causes delays and eventually impacts the cost of the project.
- The development of the well proceeded at a very slow rate. The groundwater flow during development was very slow. Eastman Cherrington redeveloped the well on May 27 and 28 and installed a submersible pump in it. The subcontractor attributed this problem to the fine nature of the soils in which the screen was installed and the shallowness of the well. It was also suggested by the subcontractor that a regular well screen be used with a conventional gravel packed instead of the prepacked screen. However, maintaining the borehole open for such an application may be difficult.

The effectiveness of the HEW was evaluated based on the results of the gravity flow and the vacuum enhanced liquid extraction testing as described below in Section 2.5. These results were based on field monitoring of water levels in existing onsite monitoring wells and piezometers, and two new piezometers that were installed in the vicinity of the HEW. The two new piezometers, AWD-14 and AWD-15, were installed at the locations shown on Drawing II-1. They consisted of 2-inch, Schedule 40 PVC casings and screens. The piezometer screens extended from the top of the semi-confining layer on which the HEW rests to about 3 feet from the existing ground surface. The piezometer riser pipes extended to about two feet above ground surface.

2.5 Task 5 - Groundwater Flow Testing

2.5.1 Gravity Flow Testing

A gravity flow test was conducted at the VEW, HEW, and the ICT. The duration of the pumping at each extraction system took into account the effects of delayed yield. The test included the measurements of flow rates, flow volumes, and water level readings in surrounding monitoring wells. The results of the flow tests are to be utilized in the design of a groundwater extraction and treatment system for the IRA.

Water levels in the pumping well and observation wells were recorded using automatic data loggers. Manual water levels were also recorded. The manual measurements were used to supplement the data from the automatic data loggers and were used as a back-up in the event of data logger failure. The manual measurements also allowed the field staff to observe the behavior of the pumping well and aquifer on a continuous basis. The water levels were also monitored after the stoppage of pumping, during aquifer recovery. The pumped groundwater was collected in frac tanks onsite for treatment during Phase III of the IRA. The frac tanks have been stored to the south of the UEP in the vicinity of the VEW. The following is a brief description for the results of flow testing:

2.5.1.1 Vertical Extraction Well Gravity Flow Test

May 13, 1994

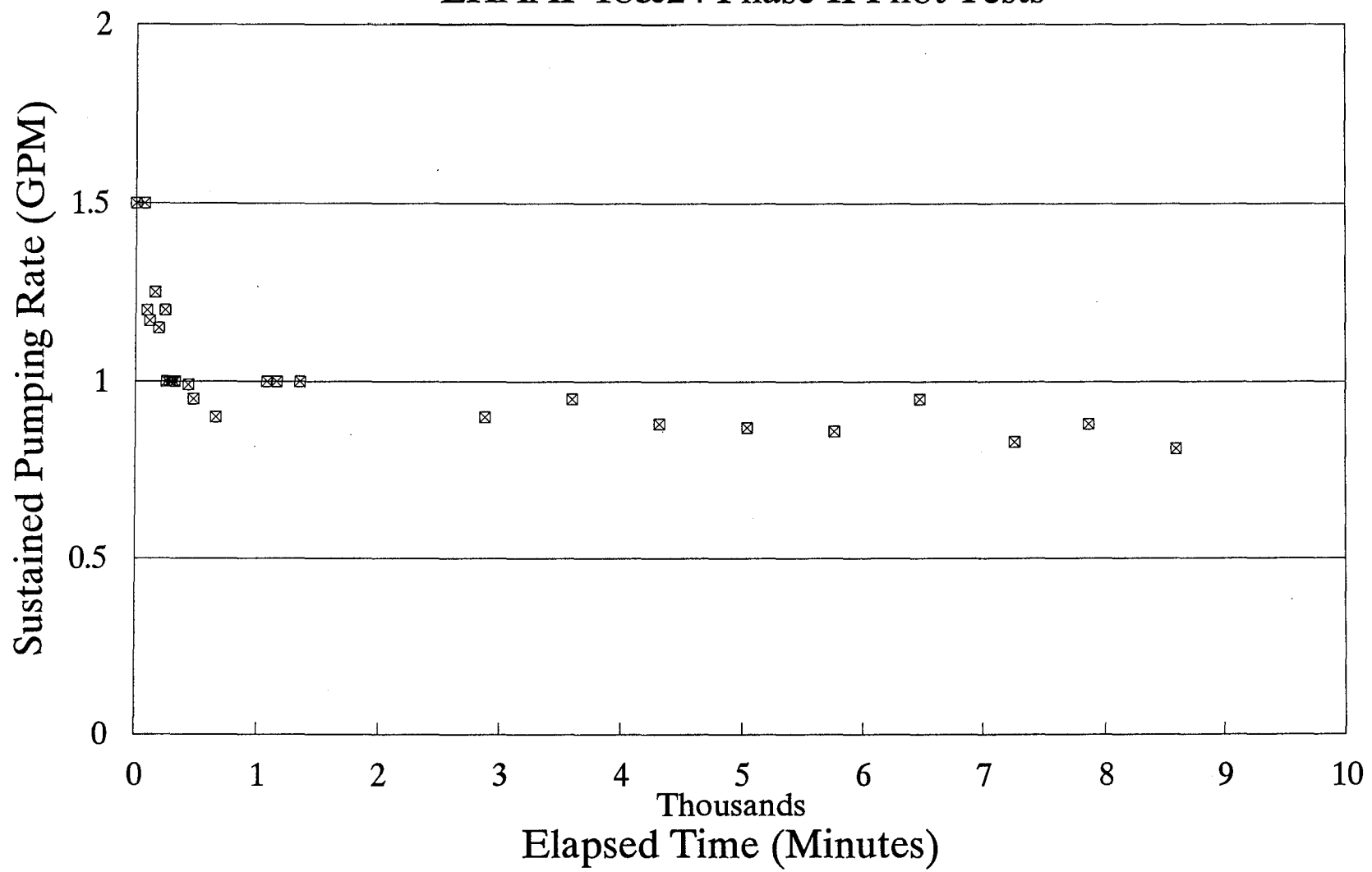
The gravity flow test at the VEW occurred between May 7 and May 13, 1984. The test was preceded on May 6 by a sand free test and a step drawdown test. The sand free test indicated that the well had been properly developed. The step drawdown test resulted in the selection of one gallon per minute (gpm) as the flow rate for the gravity test. The manual water level readings and the data logger readings are included in Appendices D.1 and D.2, respectively. Figure 2-10 shows the sustained pumping rate during the test. The rate started at one gpm and ended at about 0.8 gpm. Figures 2-11 through 2-14 show plots of drawdown versus (vs) distance from pumping well, and drawdown vs time of the pumping well EW-1 and monitoring wells AWD-5 and MW-2, respectively. Piezometers AWD-5 and AWD-6 were installed at the locations shown on Drawing II-1, prior to the start of the flow test in order to better monitor the influence of pumping at the VEW. Figure 2-11 shows the positions of the cone of depression after pumping for 24 hours, 48 hours, 72 hours, and 96 hours. It also shows that the radius of influence due to the withdrawal of water from EW-1 is about 800 feet after 96 hours of pumping. The water level in the pump well and monitoring wells was influenced by the heavy rains that fell during the performance of the flow test as can be seen from the plotted data on Figures 2-12, 2-13, and 2-14. This rain and the fluctuation of the pumping rate influenced the interpretation of data also as shown on these figures. The aquifer transmissivity, T , of 2,030 gallon per day per foot (gpd/ft) and storativity, S , of 2.06×10^{-3} calculated from the distance drawdown graph (Figure 11) may be most representative of site conditions.

One sample of the extracted water was taken each day for laboratory analysis. The samples were analyzed for different parameters as indicated in Table 2-1. Table 2-9 presents a summary of detected parameters. The analytical results are included in Appendix D.3.

2.5.1.2 Horizontal Extraction Well Gravity Flow Test

The gravity flow test at the HEW occurred between May 29 and June 3, 1994. The test was preceded on May 26 through May 28 by the redevelopment of the well by Eastman Cherrington who also conducted a sand free test and a step drawdown test following redevelopment. The sand free test indicated that the well had been properly developed. The step drawdown test resulted in the selection of a 0.7 gpm as the flow rate for the gravity test. However, as can be seen from Figure 2-15, which shows the sustained pumping rate during the test, the flow rate decreased over time and was about 0.3 gpm at the end of the test. Figure 2-16 presents a distance-drawdown plot which reflects the positions of the cone of depression after pumping for 24 hours, 72 hours, and 118 hours. Piezometers AWD-11, AWD-12 and AWD-13 which were installed prior to HEW and located near its axis had maximum drawdowns of 0.51, 0.94, and 0.69 feet, respectively. The manual water level readings and the data logger readings are

Figure 2-10, Pumping Rate vs Time, VEW, Gravity Flow Test
LHAAP 18&24 Phase II Pilot Tests



$$T = \frac{528 Q}{\Delta S}$$

$$= \frac{528 (1.9 \text{ gpm})}{0.26 \text{ ft}}$$

$$= 2,031 \text{ gpd/ft} = 2.9 \times 10^{-4} \text{ m}^3/\text{s}$$

$$S = \frac{0.3 T t}{r_o^2}$$

$$= \frac{0.3 (2,031 \text{ gpd/ft}) (3 \text{ days})}{(940 \text{ ft})^2}$$

$$= 2.07 \times 10^{-3}$$

$$\Delta S = 0.26 \text{ FT}$$

$t = 24 \text{ hrs}$
 $t = 48 \text{ hrs}$
 $t = 96 \text{ hrs}$
 $t = 72 \text{ hrs}$

LONGHORN ARMY AMMUNITION PLANT
 KERNACK, TEXAS
 LHAAP 18 & 24 PHASE II BURNING GROUND No.3

FIGURE 2-11

DISTANCE - DRAWDOWN GRAPH
 GRAVITY FLOW TEST ON
 VERTICAL EXTRACTION WELL

FEBRUARY 1996



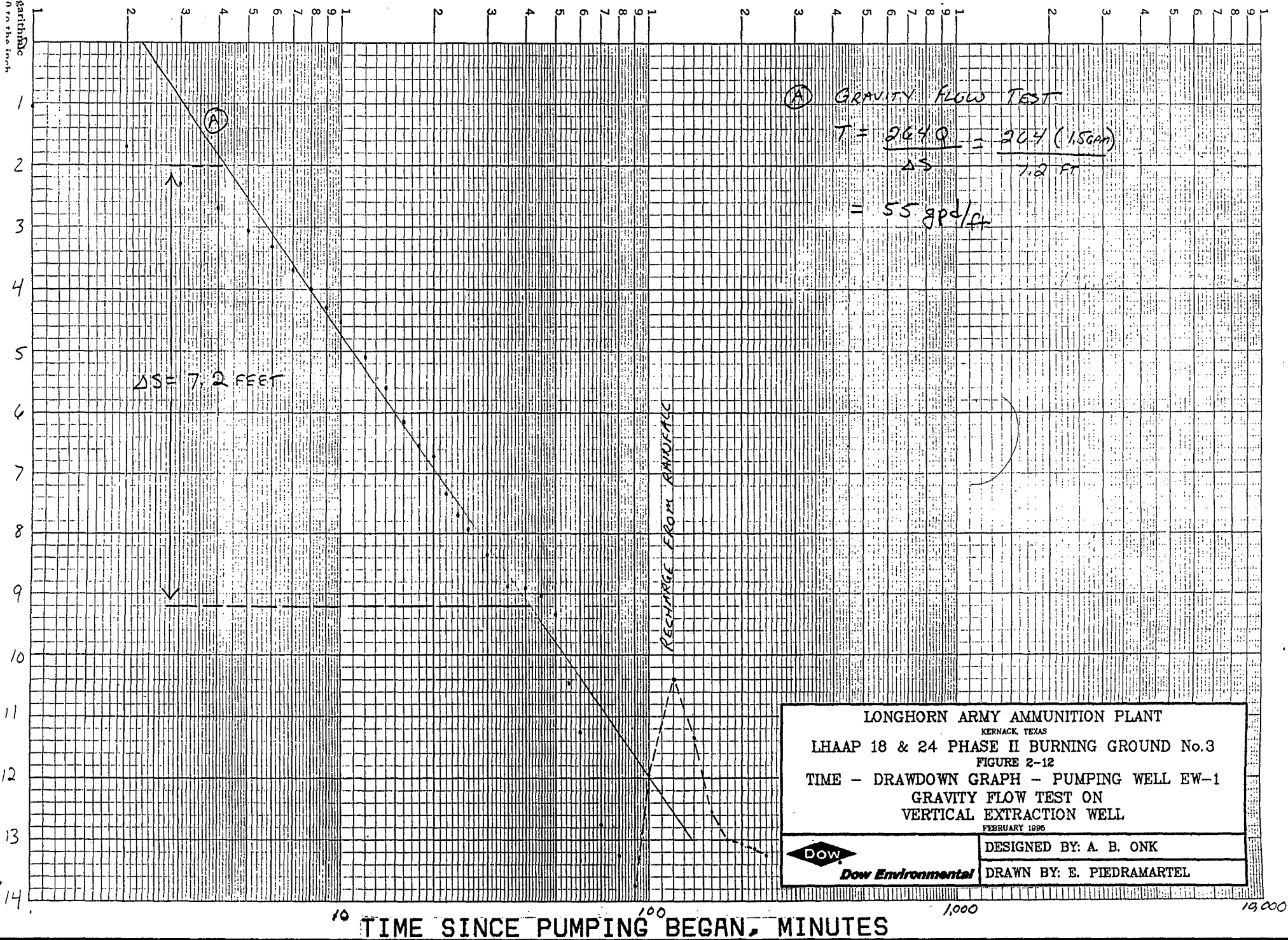
Dow Environmental

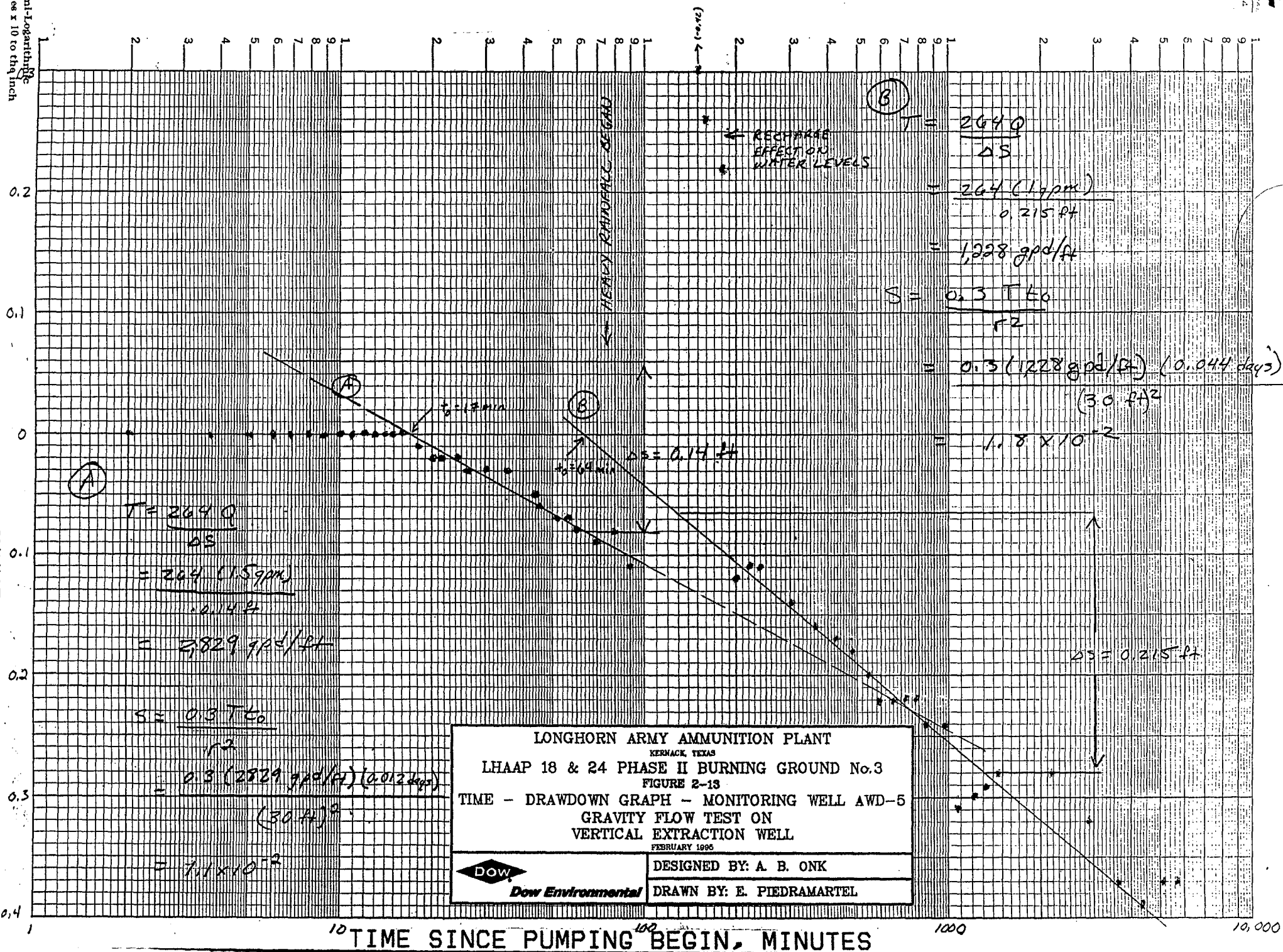
DESIGNED BY: A. B. ONK

DRAWN BY: E. PIEDRAMARTEL

Well I.D.	Distance from Well (ft)	DraWdown (ft)			
		t = 24 hrs	t = 48 hrs	t = 72 hrs	t = 96 hrs
EW-1	9	12.67	13.16	13.44	13.20
AWD5	30	0.28	0.32	0.39	0.37
MW2	54	0.23	0.27	0.33	0.31
AWD6	105	0.14	0.18	0.25	0.23

DISTANCE FROM PUMPED WELL, FEET

Semi-Logarithmic
Scale 1 in. on the inch



LONGHORN ARMY AMMUNITION PLANT
KERMACK, TEXAS
LHAAP 18 & 24 PHASE II BURNING GROUND No.3
FIGURE 2-13
TIME - DRAWDOWN GRAPH - MONITORING WELL AWD-5
GRAVITY FLOW TEST ON
VERTICAL EXTRACTION WELL
FEBRUARY 1995

DESIGNED BY: A. B. ONK
DRAWN BY: E. PIEDRAMARTEL

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Dow Environmental

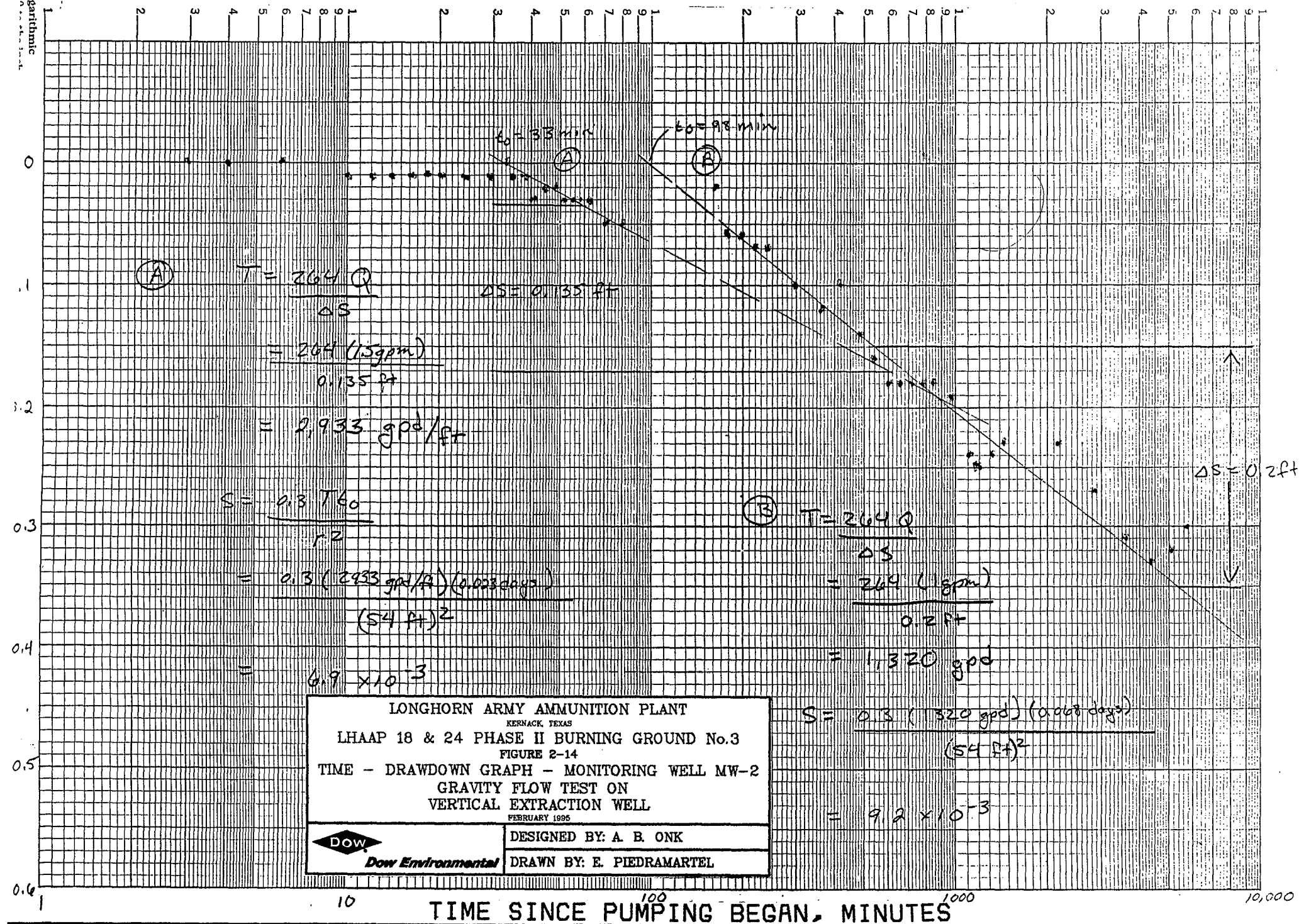


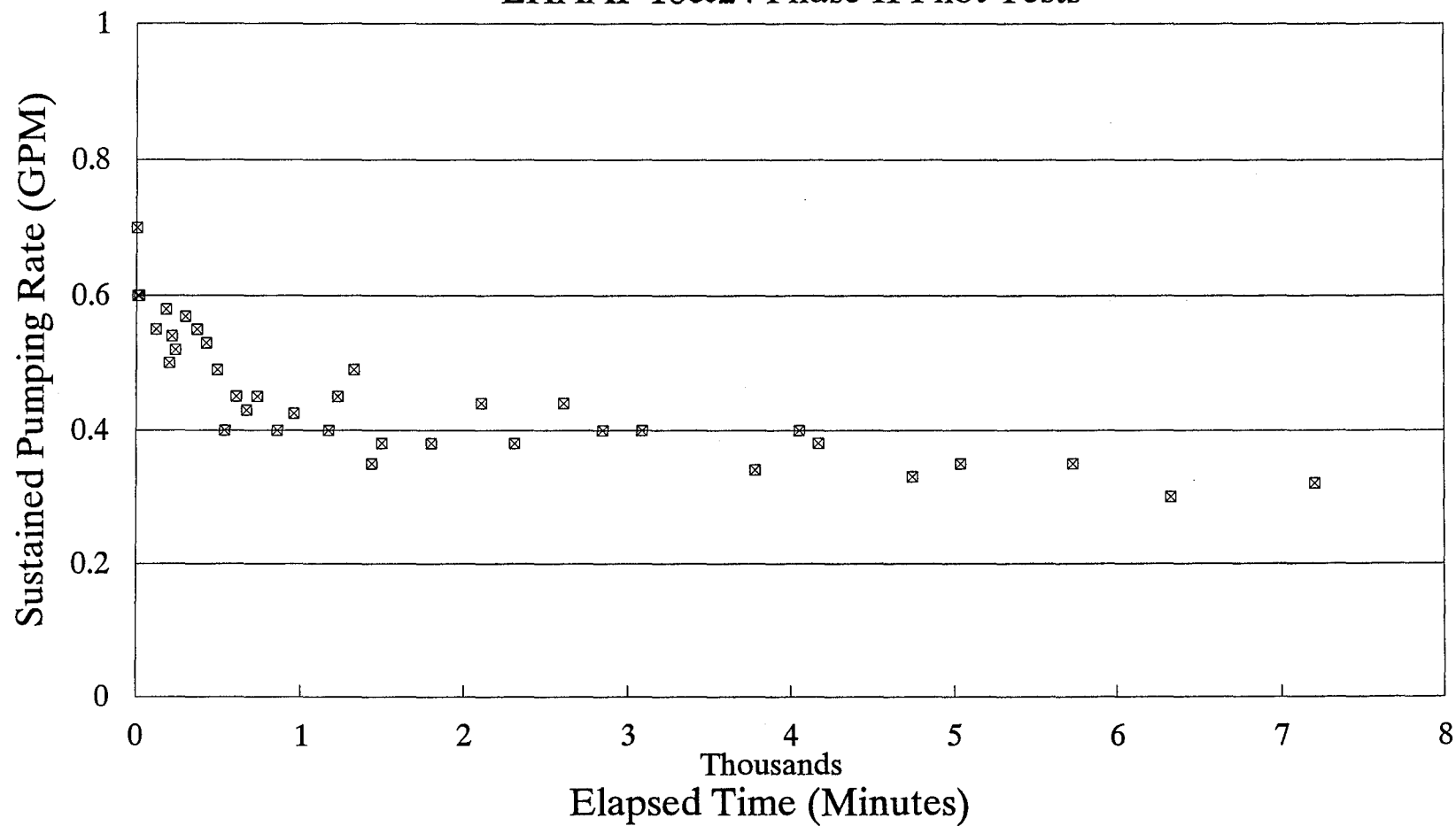
TABLE 2-9
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER ANALYSES DURING FLOW TESTING
DETECTED CONCENTRATIONS AT VEW, in microgram/liter
MAY, 1994

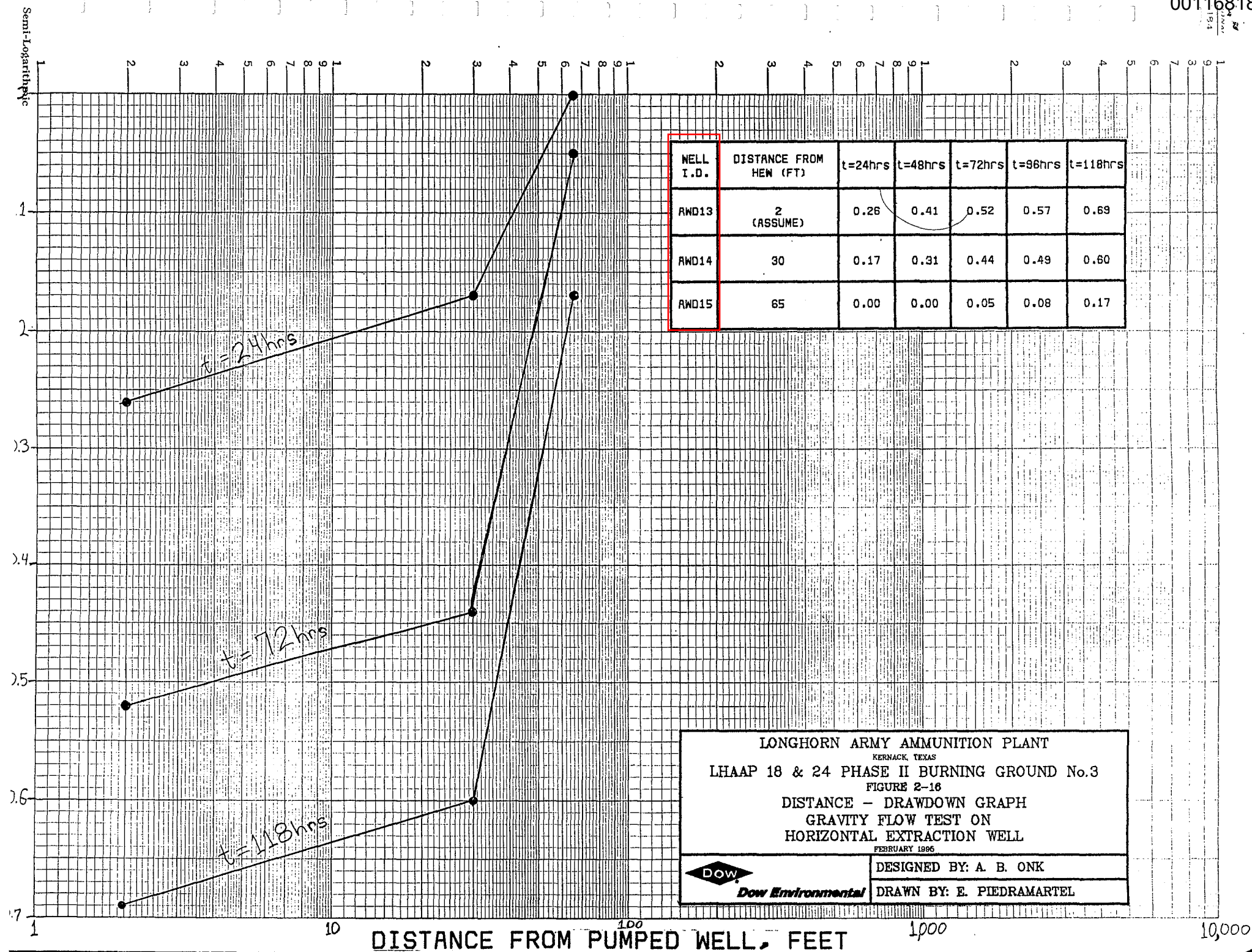
DATE OF SAMPLING	VOLATILE ORGANIC COMPOUND		SEMIVOLATILES					
	METHYLENE CHLORIDE	TRICHLORO-ETHYLENE	2-METHYL-NAPHTHALENE	2-METHYLPHENOL	BENZOIC ACID	BIS (2-ETHYLHEXYL) PHTHALATE	DIMETHYL PHTHALATE	NAPHTHALENE
05/07/94	1020000				149		15	
05/08/94	2150000			8	548		30	
05/09/94	2340000		5	6	458		20	6
05/10/94	4084250	235750			7	24	15	
05/10/94*	2895800	198800	6		392		21	7
05/11/94	3934200	127200						
05/12/94	2332600	109200						
05/13/94	2441000	105800						
05/19/94	1215400							
05/20/94	526000	53000						
05/22/94	1120000	72000						
05/23/94	977000	60000						
05/23/94	919000	42000						
05/24/94	1260000	78750						
05/24/94	1100000*							
05/24/94	1300000	65000						
	*QUALITY CONTROL							

DATE OF SAMPLING	WET CHEMISTRY PARAMETER									
	ALKALINITY	AMMONIA AS N	TOTAL HARDNESS	SILICA	TDS	TSS	CHLORIDE	NITRATE	NITRITE	SULFATE
05/07/94	155000	459	309000	51000	1310000	5000	510000	1100000		44000
05/08/94	118000	328	221000	53000	1060000		300000	190000		3800000
05/09/94	122000	312	250000	53000	1110000		290000	170000		210000
05/10/94	139000	750	251000	50000	1330000	238000	4800	800	30	ND
05/10/94*	153000	1100	352000	50000	1420000	8000	3700	600	ND	ND
05/11/94						ND				
05/12/94						ND				
05/13/94						ND				
05/19/94						190000				
05/20/94						4050000				
05/22/94						5000				
05/23/94						ND				
05/23/94						6000				
05/24/94*						ND				
05/24/94						ND				
	NOTE: ND = NOT DETECTED									

DATE OF SAMPLING	TOTAL METALS			TPH/OIL&GREASE	
	BARIIUM	LEAD	MERCURY	TPH	O&G
05/07/94	688			ND	5430
05/08/94	1410			ND	ND
05/09/94	1600	6		ND	ND
05/10/94	1620	7		ND	5570
05/10/94*				ND	ND
05/11/94	1920	5			
05/12/94	1770	5			
05/13/94	1720	5			
05/19/94	1090	6			
05/20/94	1630	8	0.2		
05/22/94	1280	6			
05/23/94	1270				
05/23/94	1360				
05/24/94*	1370				
05/24/94	1350				
	NOTE: * QUALITY CONTROL			TPH = TOTAL PETROLEUM HYDROCARBON O&G = OIL AND GREASE ND = NOT DETECTED	

Figure 2–15, Pumping Rate vs Time, HEW, Gravity Flow Test
LHAAP 18&24 Phase II Pilot Tests





One sample of the extracted water was taken each day for laboratory analysis. The samples were analyzed for different parameters as indicated in Table 2-1. Table 2-10 presents a summary of detected parameters. The analytical results are included in Appendix E.3

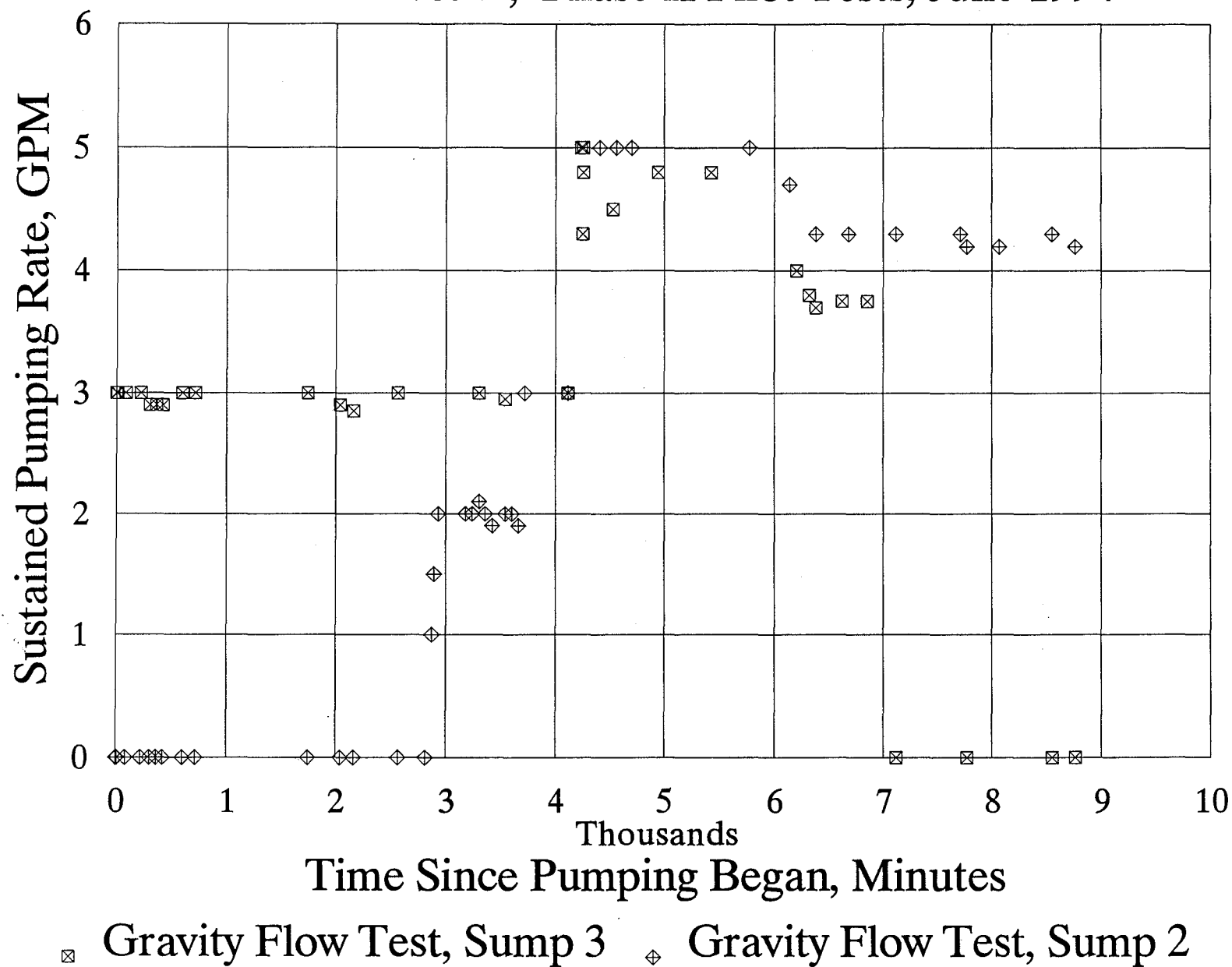
2.5.1.3 Interceptor Collection Trench Gravity Flow Test

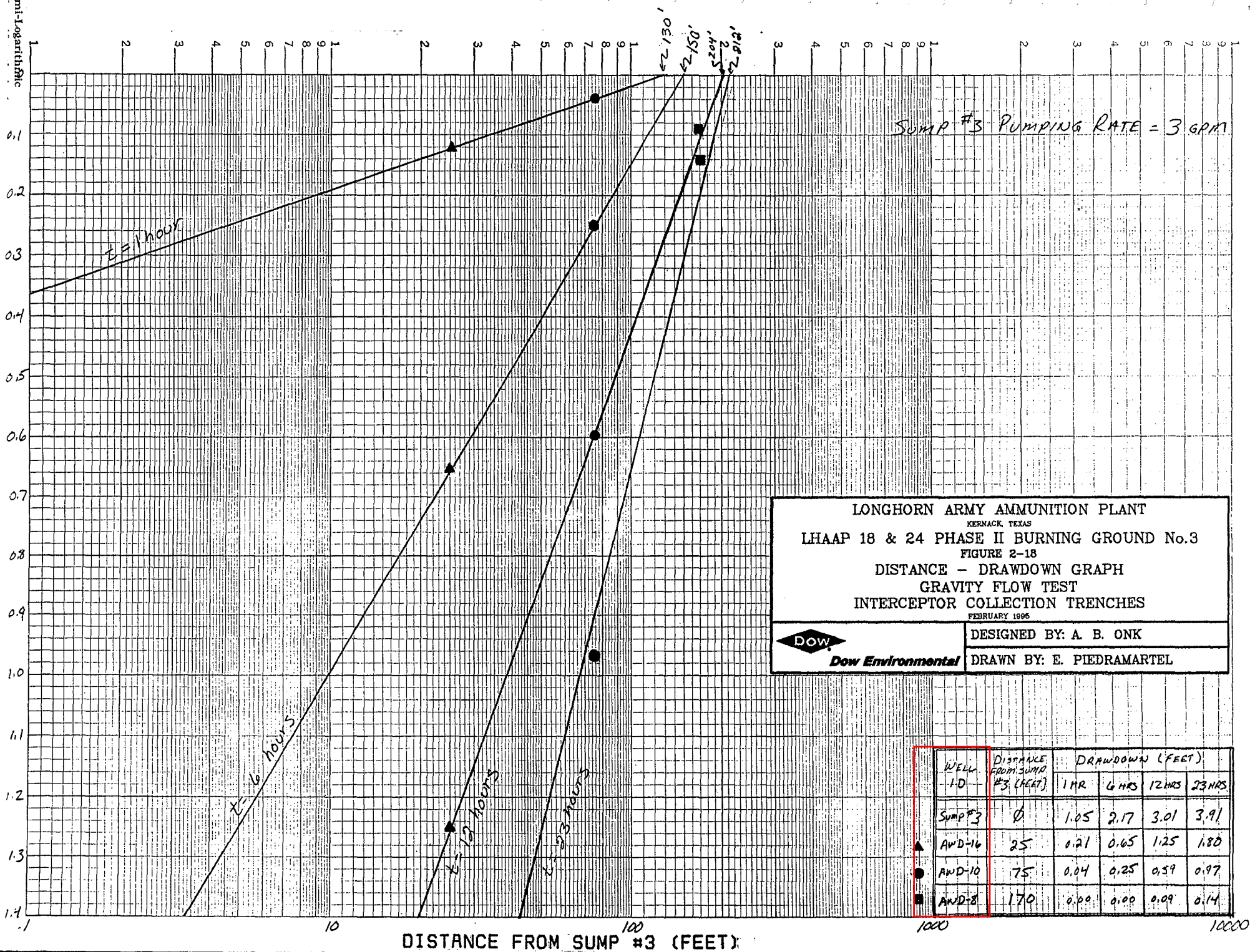
The gravity flow test at the ICT occurred between June 13 and June 20, 1994. The test was preceded on June 11 and 12 with the installation of pumps and site preparation. Also, a sand free test and a step drawdown test were conducted at sumps 1, 2, and 3 on June 12, 1994. The sand free tests indicated that the ICT sections had been properly developed. The step drawdown tests resulted in the selection of 1.5, 2, and 3 gpm as the starter flow rates for the gravity test at sumps 1, 2, and 3, respectively. However, as can be seen from Figure 2-17 which shows the sustained pumping rate during the test at sumps 2 and 3, higher flow rates were achieved at both of these sumps. The last measured flow rates in these sumps were 4.2 gpm and 3.75 gpm, respectively. In order to evaluate the effect of pumping from sump 3 in ICT-1 on the surrounding area including sump 2 in ICT-2 and visa versa, pumping at sump 3 started on June 13 and ended on June 18, and pumping at sump 2 started on June 15 and ended on June 19. The flow rate at sump 1 decreased rapidly and could not be sustained. The pump at sump 1 was turned off on June 16, since little to no flow was being pumped out of it. The riser pipe for sump 1 was damaged during installation due to the difficulties encountered during the installation of ICT-2 as described in Section 2.3.3 above.

Figure 2-18 presents a distance-drawdown plot which reflects the positions of the cone of depression after pumping under a constant rate of 3 gpm at sump 3 for one hour, six hours, 12 hours, and 23 hours. This figure also shows that radius of influence (distance from the sump for zero drawdown) increased with time and was about 212 feet after 23 hours of pumping. However, the increase was minimal after 12 hours. Three time-drawdown graphs, along with transmissivity and storage coefficient calculations, are presented on Figures 2-19, 2-20, and 2-21 for monitoring wells AWD-10, AWD-16, and AWD-17, respectively. These graphs represent monitoring data in these wells, which are located along the north-south axis of sump 3, during the first day of pumping from sump 3 at a rate of 3 gpm. The calculated aquifer transmissivities, with an average of 507 gpd/ft, were smaller than the potential representative transmissivity of 2,031 gpd/ft (see Section 2.5.1.1). This difference could be attributed to the fact that the theory assumes a homogeneous aquifer, which is not the case here due to the presence of coarse material in the trench compared to the fine natural soils at the site. Figure 2-22 also presents a distance-drawdown plot which reflects the positions of the cone of depression after pumping under a constant rate of 4 gpm at sumps 2 and 3 for 24 hours, 48 hours, and 72 hours. As can be seen from this figure, the radius of influence was about 330 feet after 72 hours of pumping from both sumps. The graphs on Figure 2-23 present the measured drawdown using a data logger and transducers at several monitoring wells located near the ICT. The manual water level readings and the data logger readings are included in Appendices F.1 and F.2, respectively.

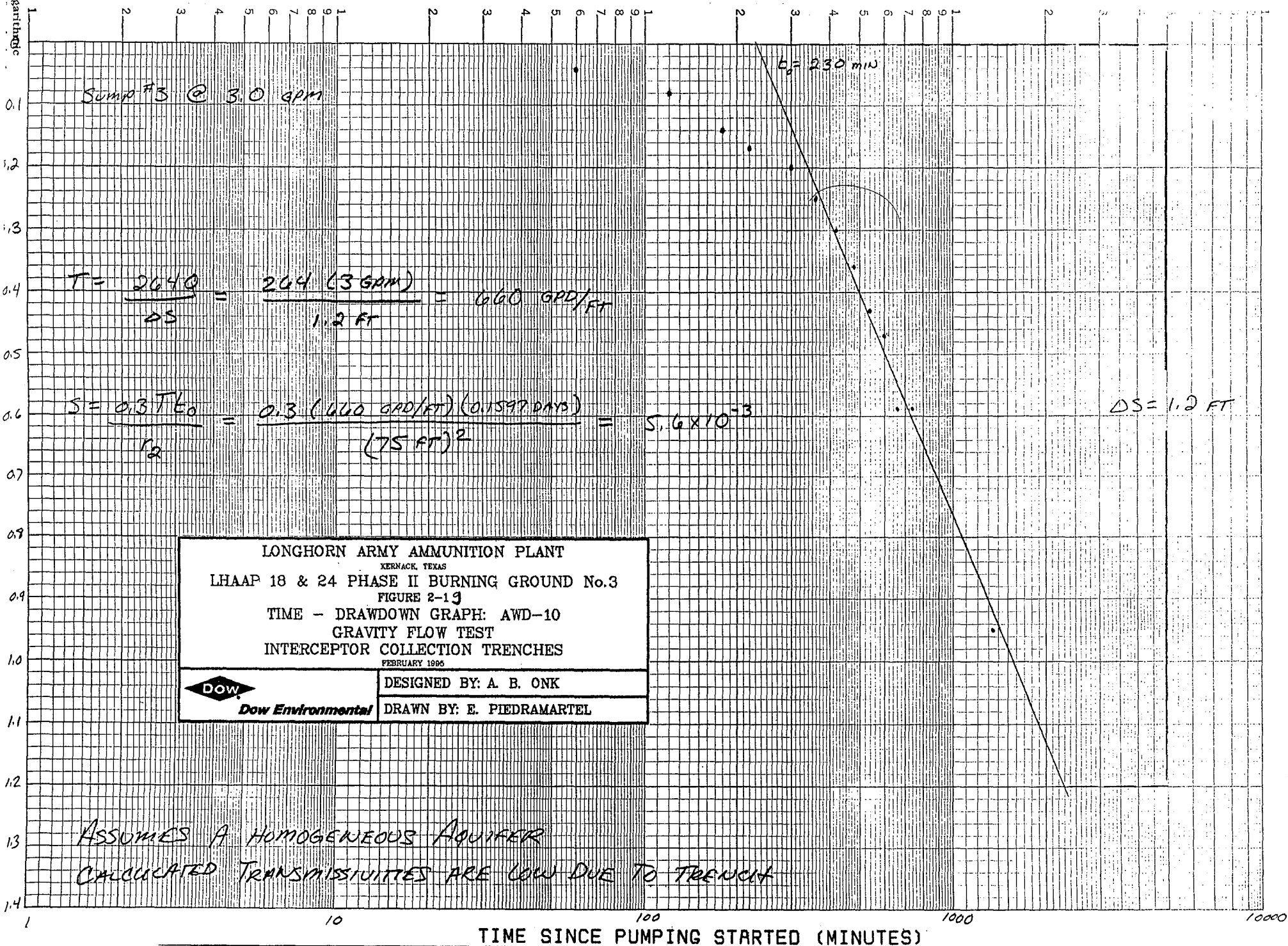
One sample of the extracted water was taken each day for laboratory analysis. The samples were analyzed for different parameters as indicated in Table 2-1. Table 2-11 presents a summary of detected parameters. The analytical results are included in Appendix F.3.

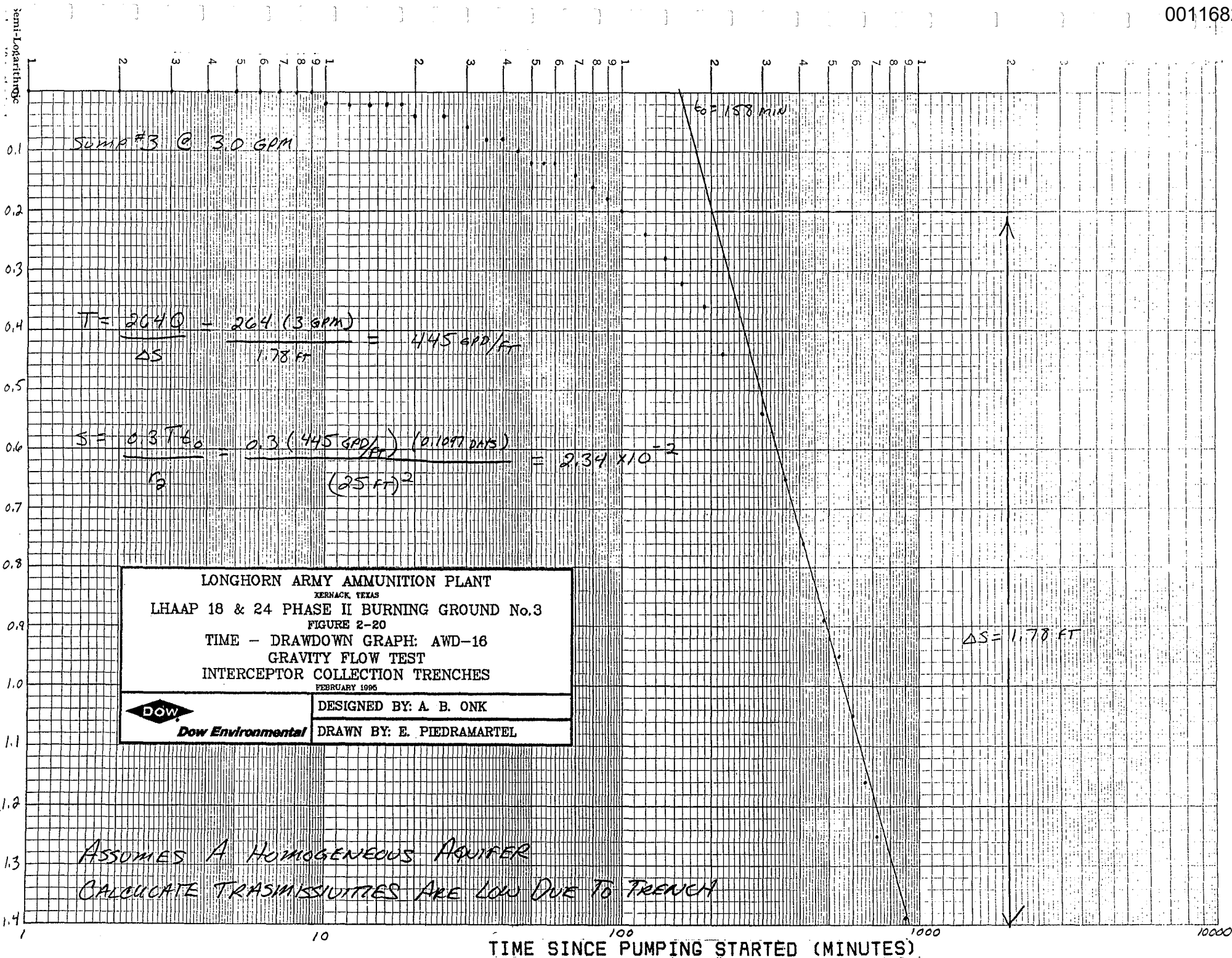
Figure 2-17, Pumping Rate vs Time, ICT, Gravity Flow Tests
LHAAP 18&24, Phase II Pilot Tests, June 1994

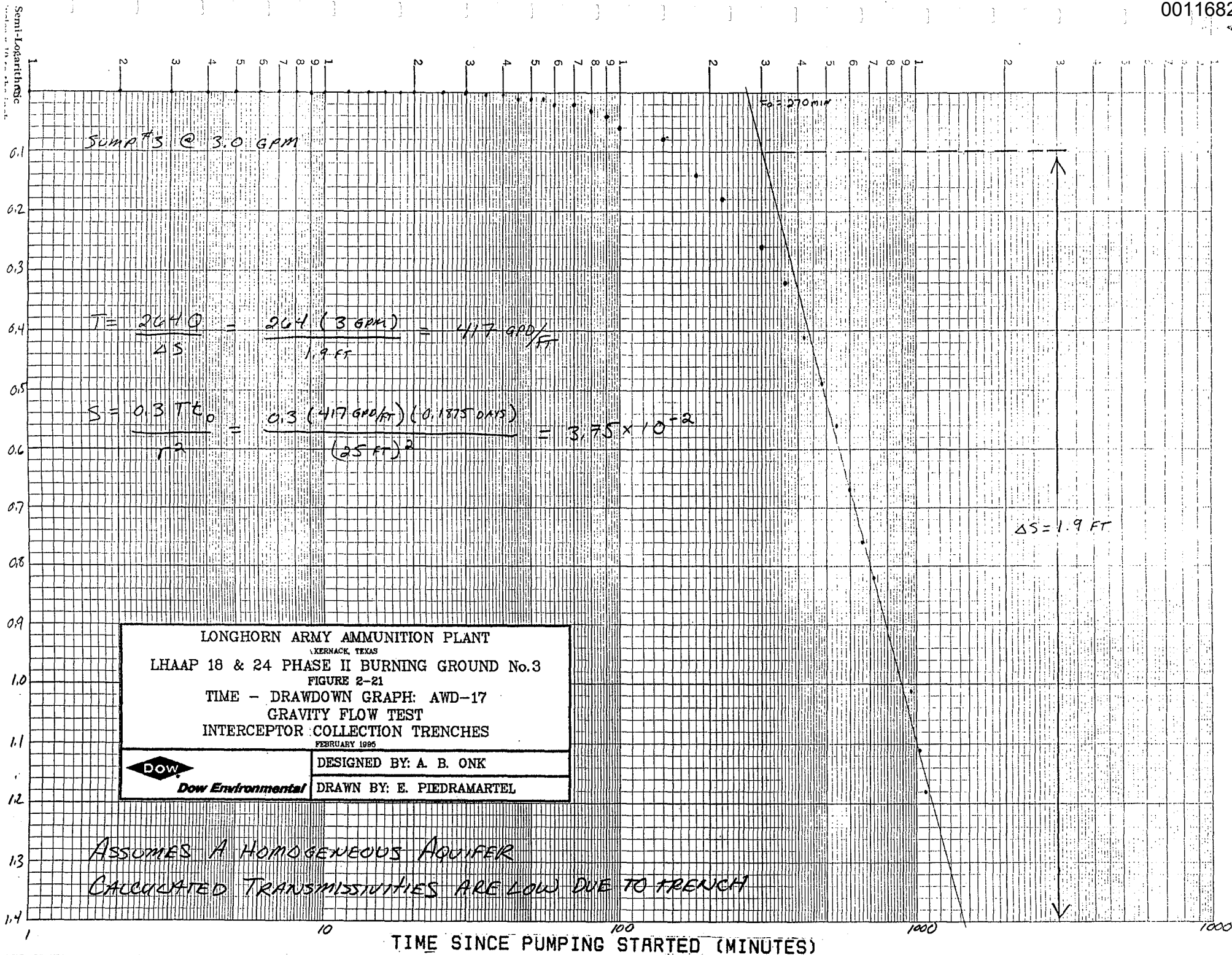




Semi-Logarithmic







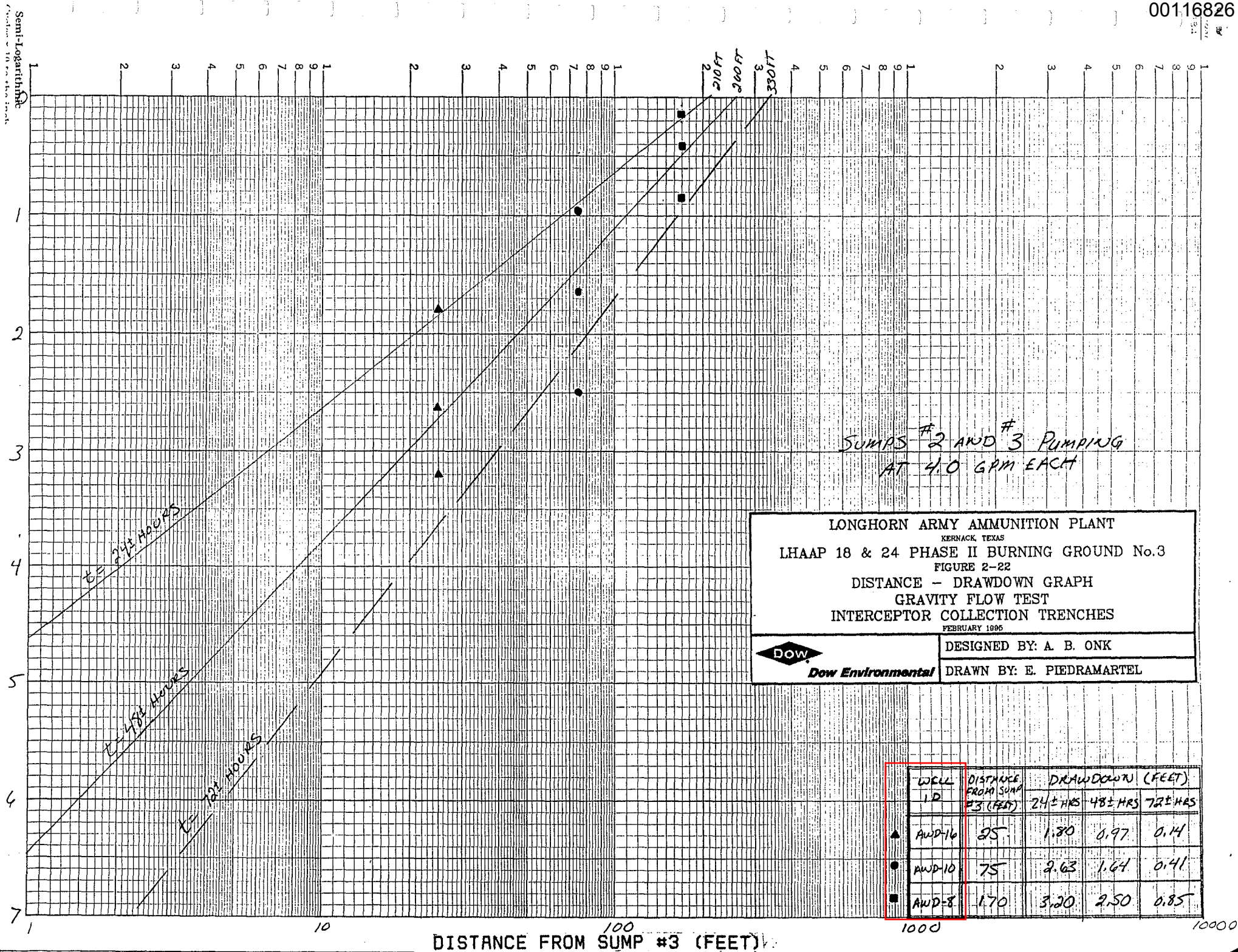


Figure 2-23, Drawdown In Monitoring Wells During Gravity Flow Test at the ICT
LHAAP 18&24, Phase II Pilot Tests, June 1994

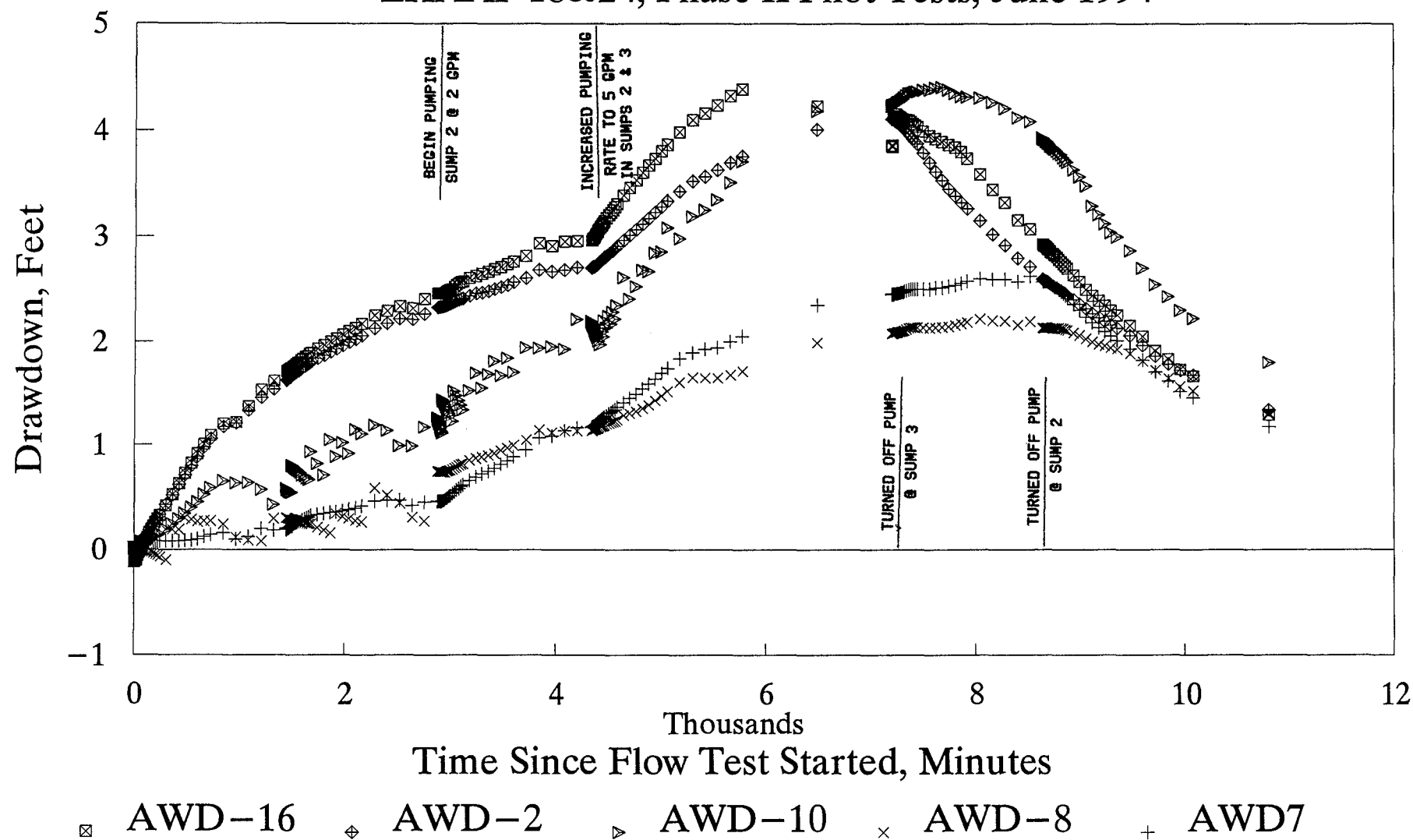


TABLE 2-11
 LHAAP 18 & 25 BURNING GROUND 3 & UEP
 SUMMARY OF GROUNDWATER ANALYSIS DURING FLOW TESTING
 DETECTED CONCENTRATIONS IN THE ICT SUMPS, in micrograms/liter
 June, 1994

DATE OF SAMPLING	SUMP NO.	VOLATILE ORGANIC COMPOUNDS						SEMI-VOLATILES		TOTAL METALS			
		MEC	TCE	1,2-DCA	2-BUTANONE	ACETONE	CF	4-Methyl-phenol	PHENOL	ARSENIC	BARIUM	LEAD	NICKEL
6/14/94	3	1700	640	ND	ND	ND	ND	640	220	ND	1130	10	84
6/15/94	1&3	1977	2379	ND	ND	1035	ND			16	869	16	73
6/16/94	2&3	3896	1753	ND	ND	ND	ND			8	1090	ND	62
6/16/94	2&3 QC									8	110	ND	63
6/17/94	2&3	8785	4485	330	277	750	ND			8	98	6	52
6/18/94	2&3	19452	9220	1416	ND	ND	ND			ND	830	ND	ND
6/19/94	2	47	639	ND	ND	589	ND			14	1220	ND	65
6/24/94	2	ND	840	42	ND	708	15			14	1180	ND	54
6/25/94	2	11162	6680	ND	ND	ND	ND			11	690	7	ND
6/26/94	2&3	13784	7583	ND	ND	ND	ND			ND	564	6	ND
6/27/94	2&3	21511	12140	ND	ND	ND	ND			10	557	ND	ND
6/28/94	2&3	22379	11979	ND	ND	ND	ND			12	623	7	ND
6/28/94	2&3 QC	20675	10844	ND	ND	ND	ND			11	626	7	467

DATE OF SAMPLING	SUMP NO.	WET CHEMISTRY PARAMETERS										
		ALKALINITY	NH4 as N	HARDNESS as CaCO3	SILICA	TDS	TSS	OIL/GREASE	CHLORIDE	NITRATE	NITRITE	SULFATE
6/14/94	3	310000	720	572000	44200	1430000	ND	87400	300000	10000	1000	500000
6/15/94	1&3						ND					
6/16/94	2&3						ND					
6/16/94	2&3 QC						ND					
6/17/94	2&3						ND					
6/18/94	2&3						ND					
6/19/94	2						ND					
6/24/94	2						28000					
6/25/94	2						36000					
6/26/94	2&3						46000					
6/27/94	2&3						32000					
6/28/94	2&3						32000					
6/28/94	2&3						32000					

NOTE: MEC = Methylene Chloride 1,2-DCA = 1,2-Dichloroethane CF = Chloroform
 TCE = Trichloroethene 4-MP = 4-Methylphenol NH4 as N = Ammonia as N
 TDS = Total Dissolved Solids TSS = Total Suspended Solids ND = none detected

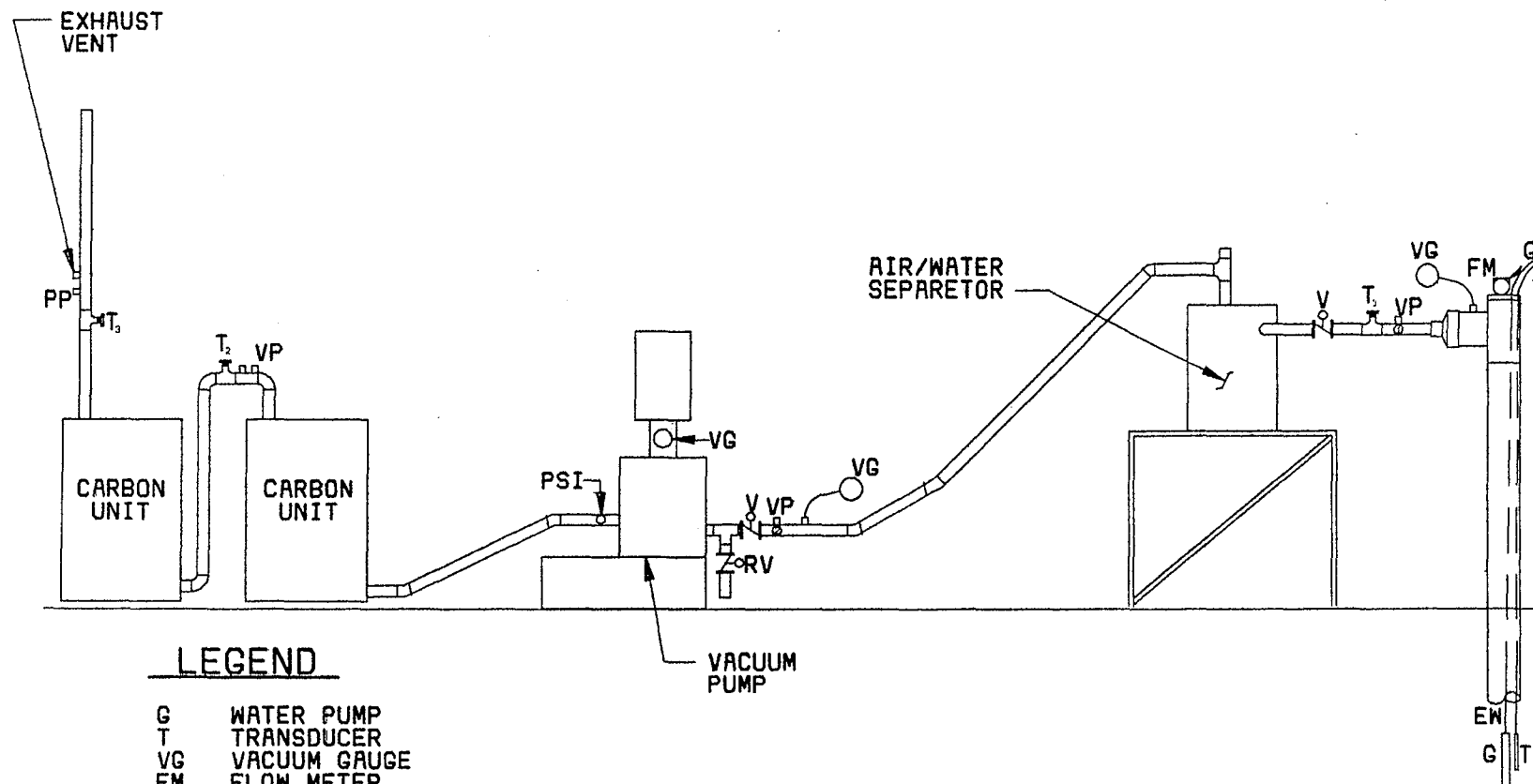
2.5.2 Vacuum Enhanced Liquid Extraction

Vacuum enhanced liquid extraction (VELE) was performed on the VEW, HEW, and ICT following the completion of the gravity flow tests at each of the extraction systems and after the water levels had stabilized for two days. The VELE was conducted on each extraction system separately. The VELE test provided data on the potential of increasing the groundwater flow in the aquifer toward the extraction systems. Groundwater flow and drawdown monitoring were conducted during the VELE tests as discussed in Section 2.5.1 above. In addition Extracted vapor concentrations and obtainable vapor flow rates were collected from this test. However, the radius of influence of the vacuum pressures and soil permeability to air flow could not be calculated since no differential pressure readings were observed in the closest monitoring wells to any of the groundwater extractions systems. This lack of response to the vacuum pressures in the monitoring wells is due to the low permeability (fine) soils of the surface aquifer at the site. It also supports the decision made about not evaluating in situ vapor extraction as a potential technology for source material and soil treatment, during the planning of Phase I of the IRA.

The system for the test included the extraction well(s), observation wells, piping, an air blower, flow meter and controllers, vacuum gauges, sampling ports, an air/water separator, and a vapor treatment system consisting of two 55-gallon activated carbon canisters installed in series. Four canisters were used and then stored at the TSSA. Figure 2-24 shows a schematic of the system used for the VEW which was similar to the ones used later for the HEW and ICT.

2.5.2.1 Vertical Extraction Well VELE Test

The VELE test at the VEW was run under three different vacuum pressures applied at the well head as shown on Figure 2-24. These pressures were 70, 110, and 90 inches of water. In addition to the groundwater flow and drawdown monitoring discussed in Section 2.4.1.2 above, test monitoring included vapor flow rates, temperatures and pressure readings, and vapor sampling for every applied pressure. Figure 2-25 presents the sustainable flow rate with time for all three vacuum pressures. It also compares sustainable flow rates during the gravity with those during the VELE test. As can be seen from Figure 2-25, the flow rate during VELE was higher than during gravity flow testing. The difference was greater when the 70 and then the 110 inches of water vacuum were first applied. However, this difference decreased with time which may imply that in the long term VELE and gravity flow would yield similar flow rates. As can also be seen from Figure 2-25, higher vacuum (110 inch of water) did not result in either higher or stable flow rate after few hours from applying this rate of pressure. A lower vacuum rate, such as 90 inches of water, appeared to generate a more stable flow condition than the 110 inches of water. Figure 2-26 through 2-28 show plots of drawdown vs distance from the pumping well, and drawdown vs time at monitoring wells MW-2 and AWD-5, respectively. Figure 2-26 shows the positions of the cone of depression after pumping 6 hours, 12 hours, 18 hours, and 24 hours under 70 inches of water vacuum. This figure also shows that the radius of influence due to the withdrawal of water from EW-1 was about 205 feet which is 165 feet less than the radius of influence measured during the gravity flow test at the same well and after the same period of pumping. However, the drawdown in adjacent wells (AWD-5, MW-2, and AWD-6) was about twice what it was during the gravity flow test after 24 hours of pumping. Therefore, the data indicates that the influence from VELE was mainly in the vicinity of the well, and that by having a shorter radius of influence, additional wells may be needed to capture the plume and create a hydraulic barrier under VELE. The manual water level readings and the



LEGEND

G	WATER PUMP
T	TRANSDUCER
VG	VACUUM GAUGE
FM	FLOW METER
T ₂	TEMPERATURE
V	VALVE
VP	VACUUM PORT
PP	PRESSURE PORT
RV	RELIEF VALVE

LONGHORN ARMY AMMUNITION PLANT

KERNACK, TEXAS

BURNING GROUND No.3

FIGURE 2-24

VACUUM APPLICATION SCHEMATIC

FEBRUARY 1996

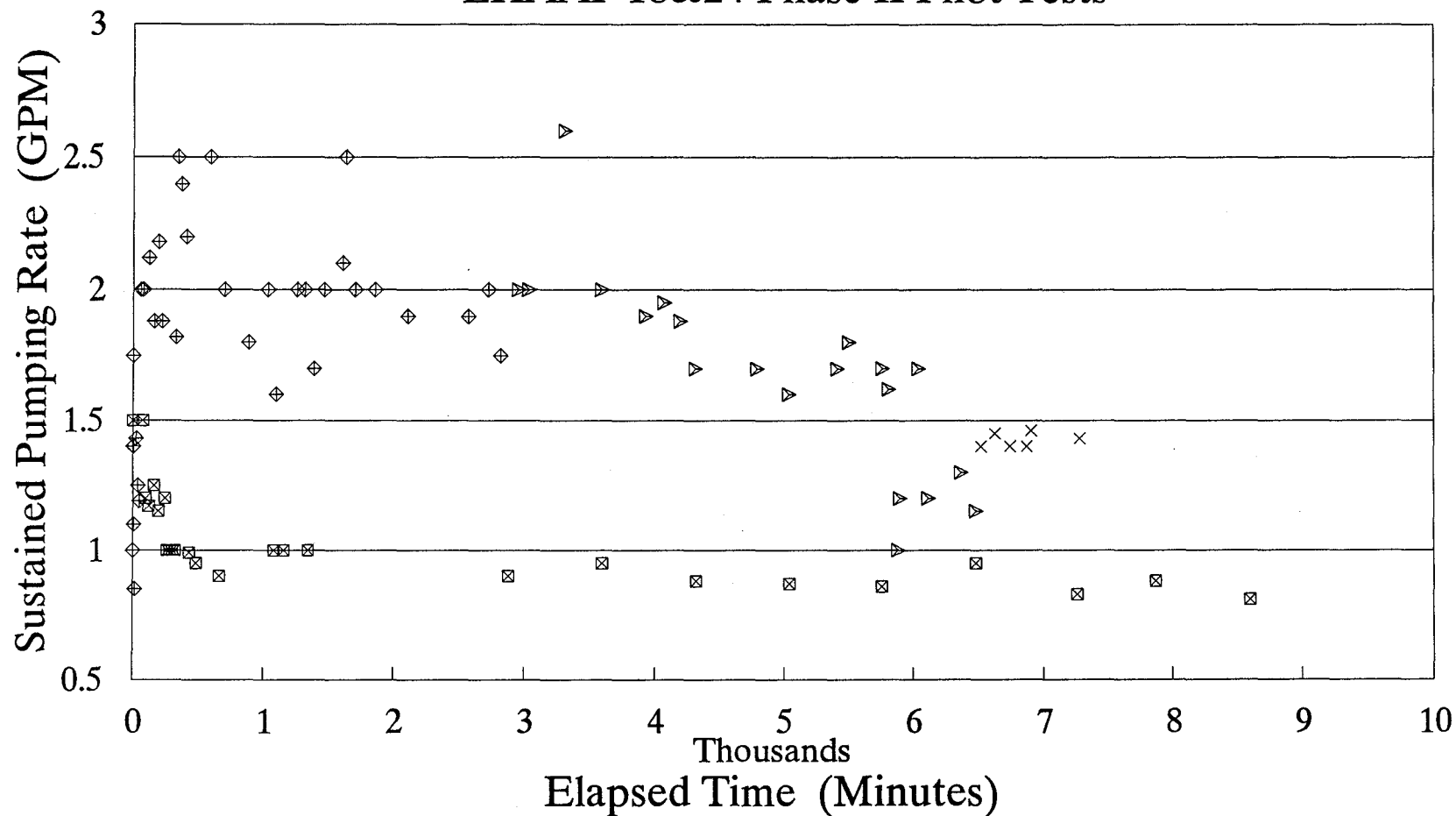


Dow Environmental

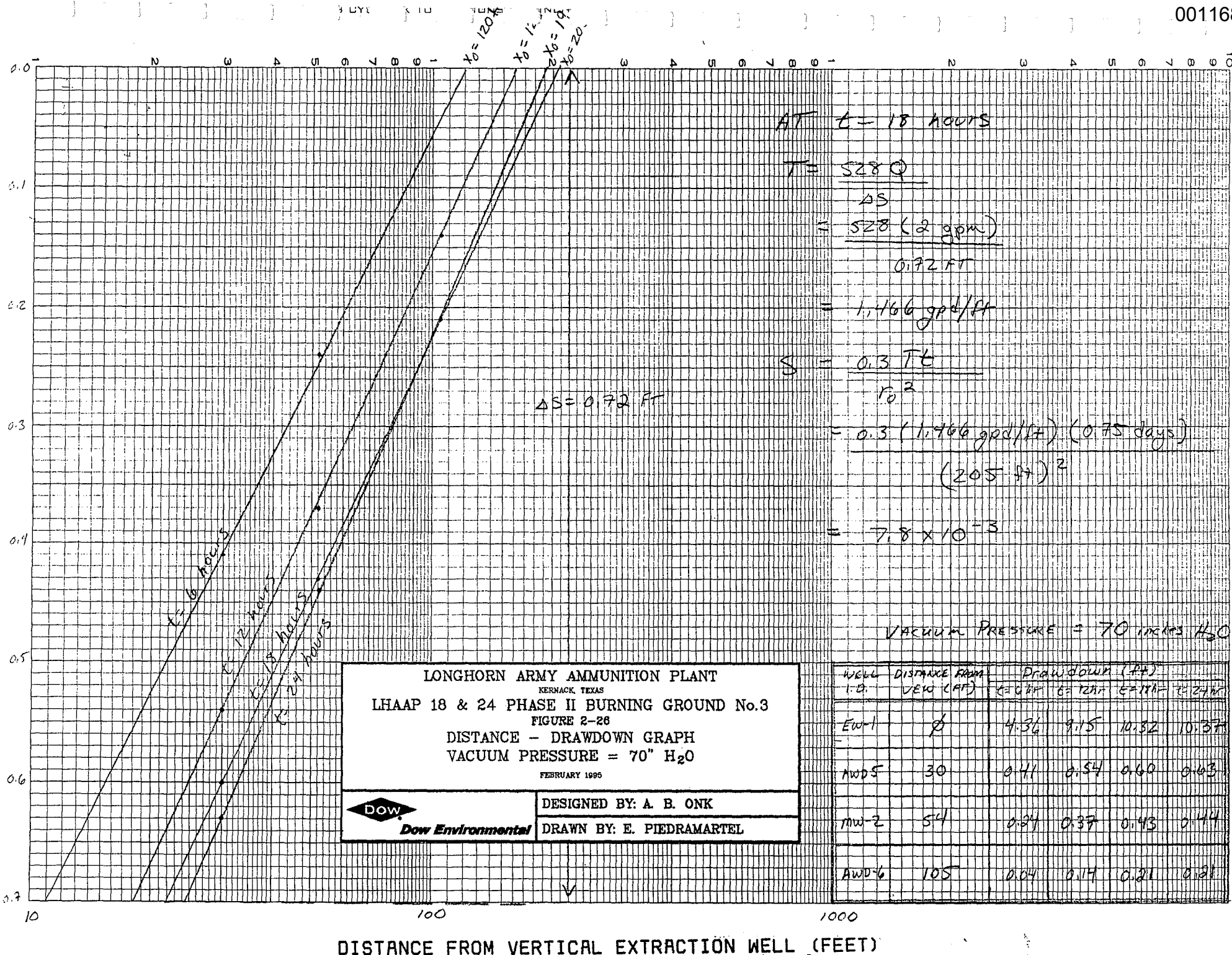
DESIGNED BY: A. B. ONK

DRAWN BY: S. HANLON

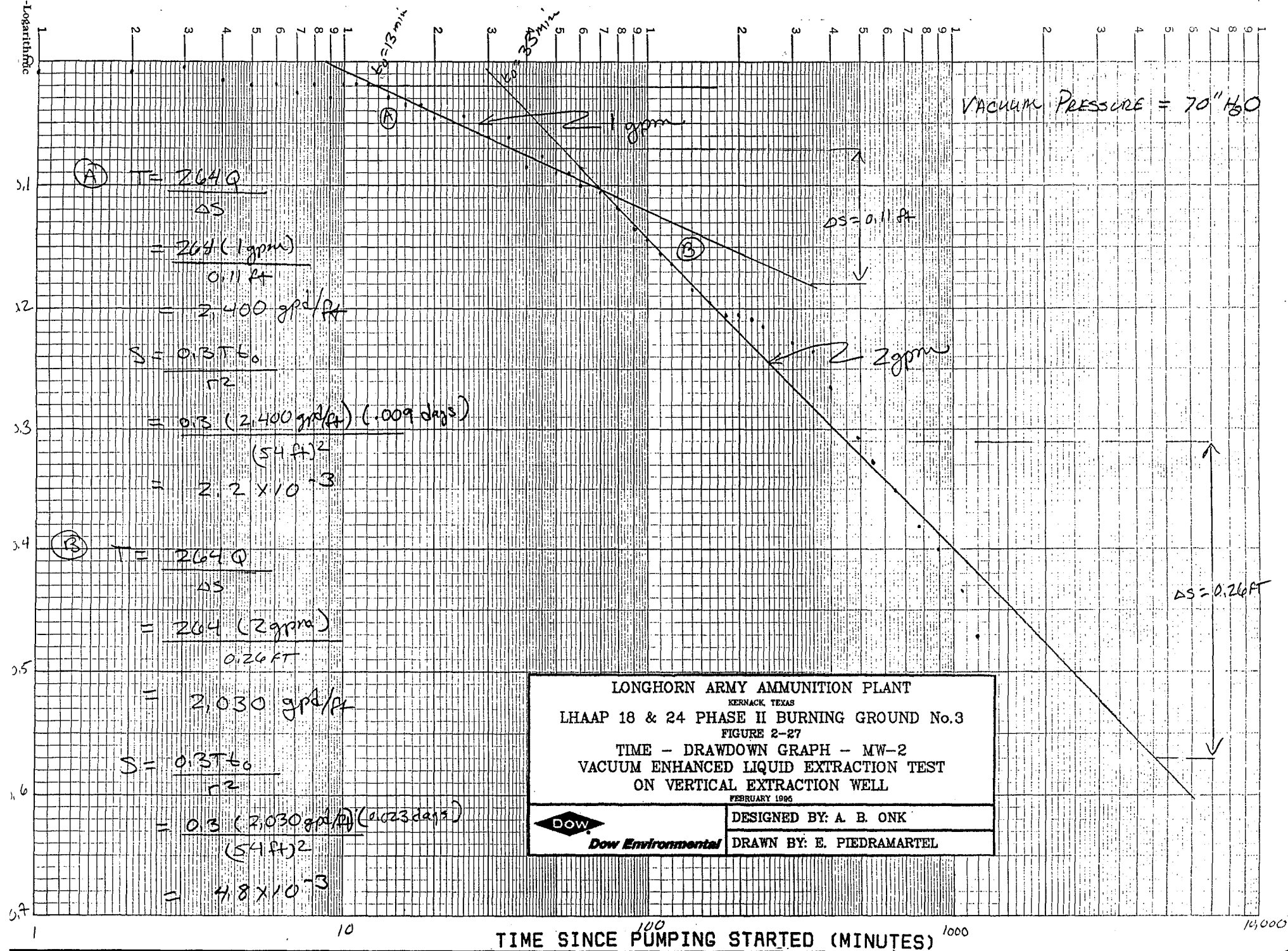
Figure 2-25, Pumping Rate vs. Time, Vertical Extraction Well, EW-1
LHAAP 18&24 Phase II Pilot Tests

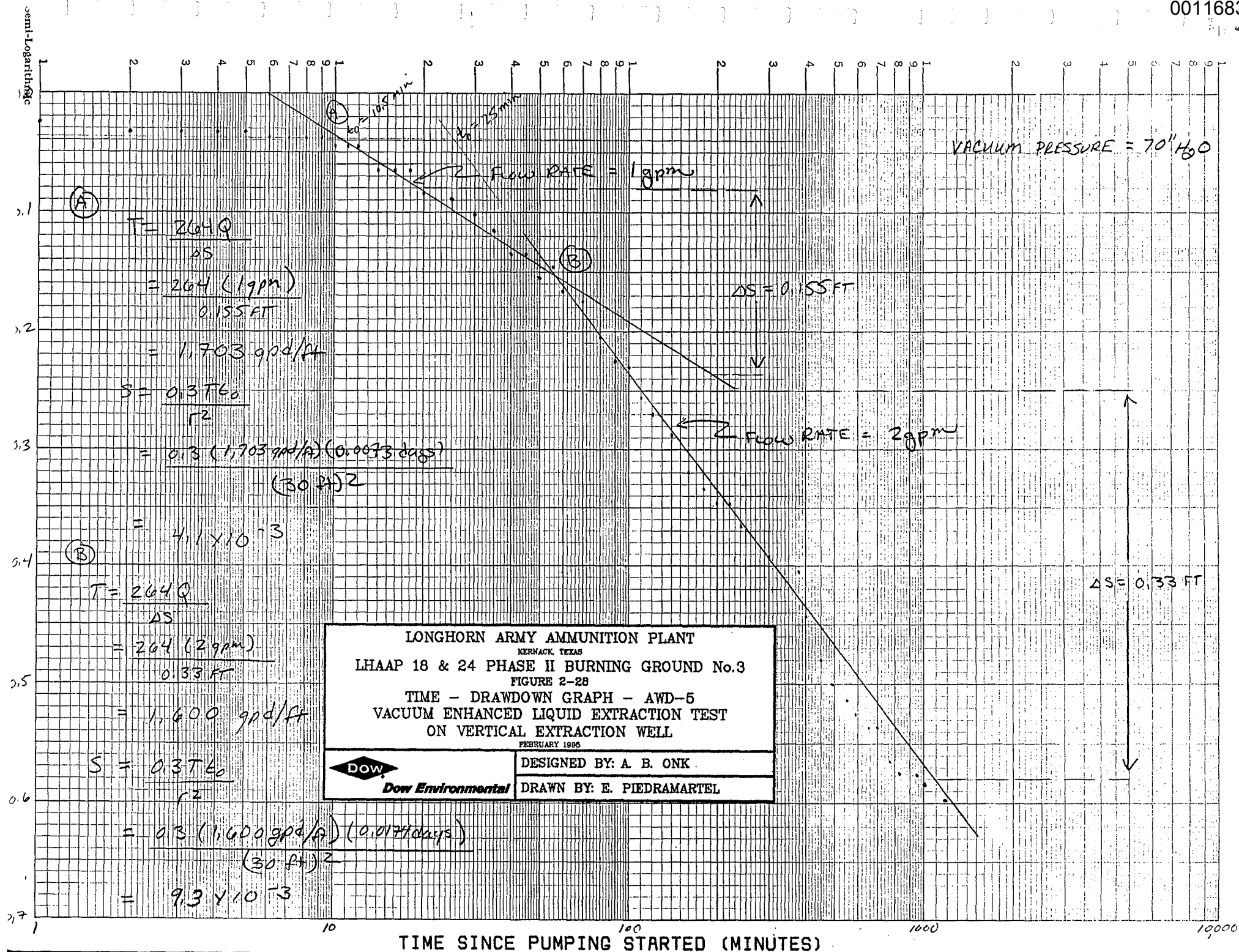


- Gravity Flow Test
- ◇ VELE Test Under 70" of H2O Vacuum
- ▽ VELE Test Under 110" of H2O Vacuum
- × VELE Flow Under 90" of H2O Vacuum



Semi-Logarithmic





data logger readings for this test are included in Appendices G.1 and G.2, respectively.

As during the gravity flow test, one sample of the extracted water was taken each day for laboratory analysis. Detected parameters are listed in Table 2-9. The analytical results for the groundwater samples are included in Appendix G.3.

Air flow and vacuum rates were continuously monitored at the well head using a flow meter and vacuum gauges, respectively. Temperature readings were also made from sensors located at the well head and after each carbon canister. The data for this monitoring is included in Appendix G.4. A vapor/air sample was collected for laboratory analysis from three different sampling ports on a daily basis. The ports were located at the extraction well head and after each carbon unit. One background air sample was taken on May 19, 1994 at a location about 400 feet upwind from the well. The samples were analyzed as listed for VOCs in Table 2-1 by PDP. No VOCs were detected in the background sample. The only detected contaminant from the VEW samples was trichloroethylene in concentrations of 29 ppb and 79 ppb in samples collected at the well head on May 22 and May 24, respectively. The analytical reports are included in Appendix G.5.

2.5.2.2 Horizontal Extraction Well VELE Test

The VELE test at the HEW was not successful due to mechanical and electrical supply problems. Two attempts were made to run VELE at the HEW. The first attempt took place on June 9, 1994. The VELE test was started at 18:00 hours at a vacuum rate of 50 inches of water. However, at 19:00 the system shut down due to a generator problem and failure of the vacuum pump. The groundwater pumping rate during this one hour of VELE application decreased from about one gpm at the beginning of the test to about 0.5 gpm at the system shut down. The generator was fixed by an electrical contractor, and a new vacuum pump was installed on June 10, 1994. The second attempt at applying VELE started at 16:15 hours on June 10, 1994. However, this attempt was interrupted by the failure of the second vacuum pump at 20:40 hours on the same date. The groundwater flow rate at the system shut down was about 0.5 gpm. It was difficult to pin point the reason for the failures of the vacuum pumps, and a decision was made by the USACE Tulsa District onsite representative and DEI to abandon the test at the HEW for the time being and to start the gravity flow test at the ICT. The high flow rates encountered during the testing of the ICT, which showed that an ICT system would be more effective at the site than a series of HEWs under either gravity or VELE flow conditions, and schedule constraints resulted in the elimination of another attempt at applying VELE at the HEW.

The manual water level readings and the data logger readings for this limited test are included in Appendices H.1 and H.2, respectively. Due to the short periods under which this test was run, which were mainly late in the day or at night, air and groundwater samples were not collected for laboratory testing. The equipment set up for this test was similar to the one shown on Figure 2-24.

2.5.2.3 Interceptor Collection Trench VELE Test

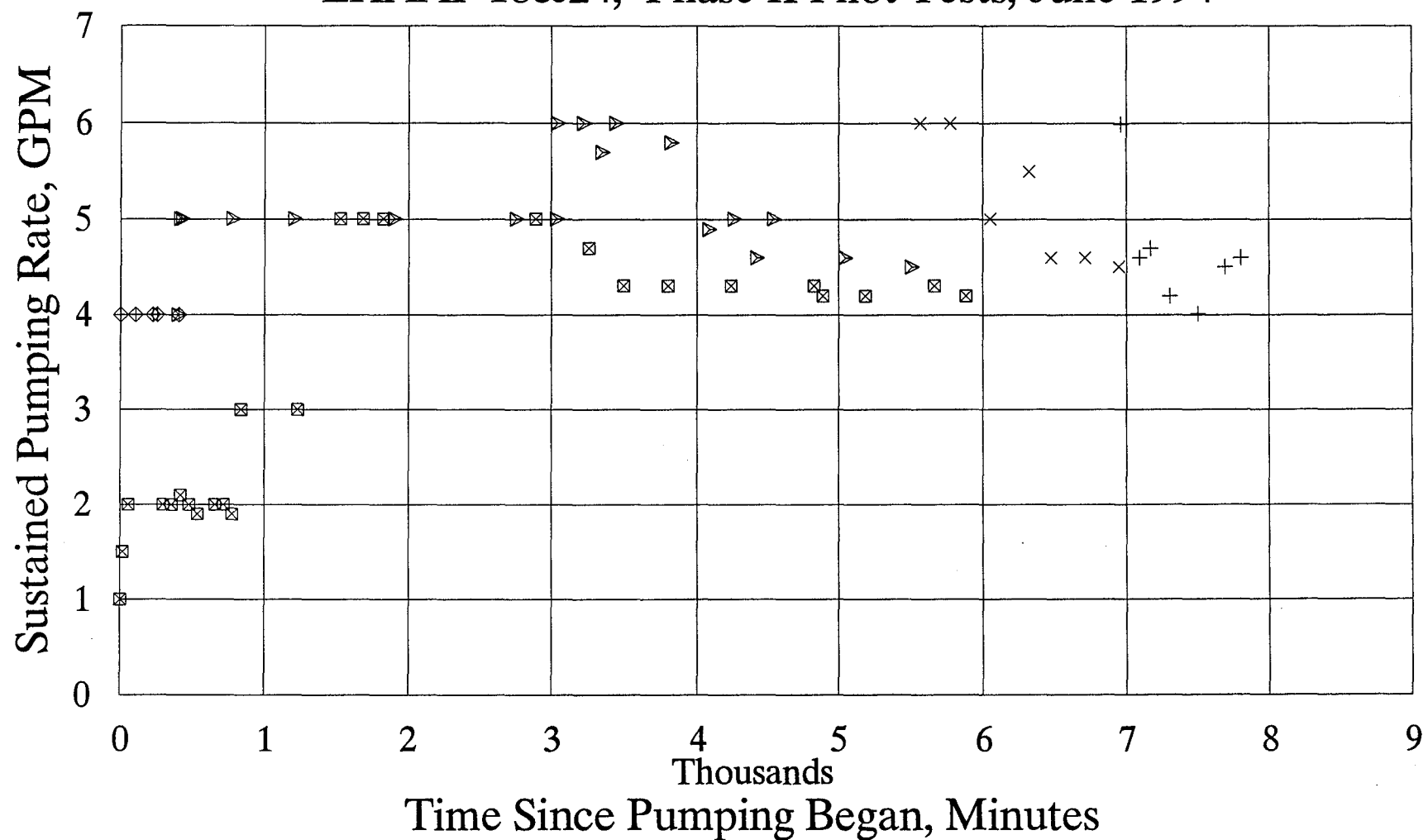
The VELE test at sumps 2 and 3 of the ICT occurred between June 22 and July 1, 1994. Prior to applying any vacuum to either sump, gravity flow pumping at the rate of 4 gpm was used to lower the water level in the trenches and surrounding areas for about 24 hours. This lowering

of the water level, mainly in the two sumps was deemed essential in order to prevent the water from being pulled into the VELE piping system under vacuum.

A vacuum pressure of 50 inches of water was applied at sump 3 located in section ICT-1 on June 23, 1994 at 16:30 in the afternoon. However, by 17:07 hours on the same day the groundwater pump in this sump shutoff. At that time, the vacuum was turned off, and the malfunctioning pump was replaced. Prior to replacing the pump, the sump was redeveloped to sand free conditions, since it was realized by the monitoring geologist that sand may have been pulled into the sump under the vacuum pressures. Groundwater pumping was restarted at sump 3 on June 24, 1994 at 10:49 hours, and 50 inches of vacuum was reapplied at 19:00 hours on the same date. However, the newly installed pump also shut off three hours after reapplying vacuum at sump 3. This problem at sump 3 continued throughout the duration of the VELE test. Groundwater pumping and vacuum applications were discontinued on June 28, 1994 at 12:00 hours. The problems at sump 3 during the VELE may be attributed to the geocomposite that was installed along the center line of the trench section or possibly to a crack in the sump HDPE casing. As discussed above in Section 2.4.3, the HDPE pipe used as the sumps riser in the ICT section was flexible and was difficult to maintain under the slurry pressure and the sand backfill. The presence of the geocomposite, which acted like a conduit for vacuum pressures throughout the trench and possibly contributed to vacuum pressure loss, required the application of the maximum available vacuum pressure at the vacuum pump, about 175 inches of water, in order to achieve a vacuum pressure of 50 to 60 inches of water at the sump. Vacuum was applied at the rate of 50 inches of water to vents 9 and 10, installed at ICT-1, as shown on Figure 2-8, along with sump 3 in order to investigate the possibility of increasing the groundwater flow rate toward sump 3, on June 27, 1994 at 09:25. However, up to 12:05 hours on the same date, the water level available water for pumping in sump 3 did not change which implied that the vacuum at the vents would not improve the outcome of the VELE test at sump 3. Vacuum to vents 9 and 10 was turned off at 12:05. Following this, Vent 9 was opened to the atmosphere in order to investigate the potential for also improving the flow rate toward sump 3. However, this action caused an immediate loss of vacuum in the system due to the presence of the geocomposite in ICT-1 which acted like a conduit in the entire trench section. Vent 9 was immediately closed following the loss of vacuum in the system. Therefore, it was determined that the additional vents placed for the application of vacuum or to open to atmosphere would not be beneficial for trench sections similar to ICT-1.

The test at Sump 2 located in section ICT-2 was run under three different vacuum pressures applied at the sum riser head from June 23 to June 29. These pressures were about 50, 75, and 95 inches of water. No mechanical and or vacuum leakage problems were encountered during the application of vacuum at sump 2. Figure 2-29 presents the sustainable flow rate with time for all three vacuum pressures at sump 2. It also compares sustainable flow rates during the gravity with those during the VELE test. As can be seen from Figure 2-29, the flow rate following the application of a particular vacuum rate was higher than during gravity flow testing. However, this difference decreased with time and became negligible which may imply that in the long term VELE and gravity flow would yield equivalent flow rates in a similar ICT. Figure 2-30 shows plots of drawdown vs distance in monitoring wells adjacent to the ICT sections. These plots, which would consist of straight lines under gravity flow testing conditions, do not reflect a clear trend which may be due to the turbulent conditions created by applying vacuum at the sumps. The manual water level readings and the data logger readings for this test are included in Appendices I.1 and I.2, respectively.

Figure 2-29, Pumping Rate vs Time, ICT, VELE Tests @ Sump 2
LHAAP 18&24, Phase II Pilot Tests, June 1994



- Gravity Flow Test ◇ VELE Under 0" of H2O Vacuum ▷ VELE Under 50" of H2O Vacuum
 × VELE Under 75" of H2O Vacuum + VELE Under 100" of H2O Vacuum

LONGHORN ARMY AMMUNITION PLANT
KERNACK, TEXAS
LHAAP 18 & 24 PHASE II BURNING GROUND No.3
FIGURE 2-30
DISTANCE - DRAWDOWN GRAPH
VACUUM ENHANCED LIQUID EXTRACTION TEST
INTERCEPTOR COLLECTION TRENCHES
FEBRUARY 1996



Dow Environmental

DESIGNED BY: A. B. ONK

DRAWN BY: E. PIEDRAMARTEL

WELL ID	DISTANCE FROM SUMP #3 (FEET)	DRAWDOWN (FEET)		
		24± HRS	48± HRS	72± HRS
▲ AWD-16	25	0.51	0.28	0.47
● AWD-19	75	1.72	1.70	0.84
■ AWD-8	170	2.63	2.43	1.18

DISTANCE FROM SUMP #3 (FEET)

As during the gravity flow test, one sample of the extracted water was taken each day for laboratory analysis. Detected parameters are listed in Table 2-11. The analytical results for the groundwater samples are included in Appendix I.3.

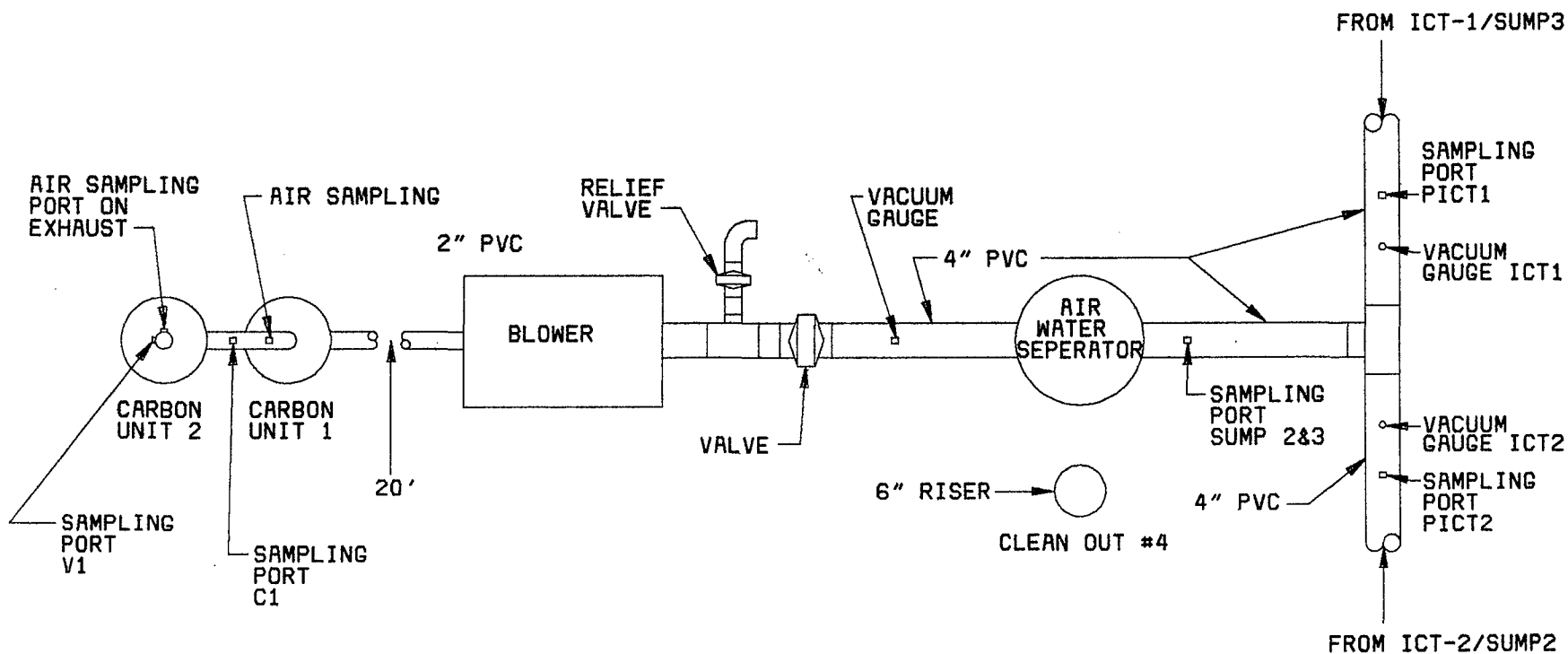
Air flow and vacuum rates were continuously monitored at the sumps head and other sampling ports using a flow meter and vacuum gauges, respectively. Temperature readings were also made from sensors located at the well head and after each carbon canister. The data for this monitoring is included in Appendix I.4. A composite vapor/air sample was collected for laboratory analysis from different sampling ports on a daily basis. The sampling ports locations are shown on Figure 2-31 which shows the equipment set-up for the VELE test at the ICT. One background air sample was taken on June 28, 1994 at a location about 500 feet upwind from the ICT. The samples were analyzed as listed for VOCs in Table 2-1 by PDP. No VOCs were detected in the background sample. Table 2-12 presents detected concentrations from the samples taken at the ICT. The analytical reports are included in Appendix I.5.

2.6 Task 6 - Groundwater Sampling, July-August and October-November 1994

Groundwater sampling was performed at EW-1 and 48 monitoring well locations, following the completion of the flow tests at the VEW, HEW, and ICT in July and August 1994. It was also performed in October-November 1994. The objective of this sampling program was to obtain a "snapshot" of the existing contaminant plume condition following the implementation of the Phase II work, and as part of quarterly sampling program. The well locations are shown on Figure 2-1. The analytical testing program for groundwater samples is presented in Table 2-1. Groundwater sampling and testing were performed in accordance with the protocols outlined in the Phase I Chemical Data Acquisition Plan (CDAP). The analytical testing was conducted by PDP Analytical Services (PDP) of Spring, Texas.

For the July-August sampling round, the groundwater plume, with methylene chloride and trichloroethylene as the main contaminants, was found to have decreased in area, especially outside the Burning Ground No. 3 fence. Field measurements taken during this round of groundwater sampling during this sampling round are included in Appendix J.1. Detected contaminant concentrations are presented in Tables 2-13 and 2-14. The analytical data is included in Appendix J.2, and the validated analytical data is included in Appendix J.3.

For the October-November sampling round, the plume condition was found to be similar to what it was during July-August. Field measurements taken during groundwater sampling are included in Appendix K.1. Detected contaminant concentrations are presented in Tables 2-15 and 2-16. The analytical data is included in Appendix K.2, and the validated analytical data is included in Appendix K.3.



LONGHORN ARMY AMMUNITION PLANT

KERNACK, TEXAS

BURNING GROUND No.3

FIGURE 2-31

DETAIL OF BLOWER SETUP

V.E.L.E. ICT 1 & 2

NOT TO SCALE

MARCH 1995



Dow Environmental

DESIGNED BY: A. B. ONK

DRAWN BY: S. HANLON

TABLE 2-12
 LHAAP 18&24 BURNING GROUND 3 & UEP
 SUMMARY OF AIR/VAPOR MONITORING DURING VECE AT ICT/m
 JUNE 1994
 Detected VOC's in ppb

Sample ID AIR/VAPOR from ICT				
Date Sampled	Acetone	Methylene Chloride	Trichloroethene	COMMENTS
6/24/94	ND	ND	ND	Sump 2 & 3
6/25/94	ND	ND	ND	Sump 2
6/26/94	ND	ND	54	Sump 2 & 3
6/27/94	118	54	259	Sump 2 & 3
6/28/94	ND	ND	17J	Sump 2
Sample ID C1 following first carbon unit				
Date Sampled	Acetone	Methylene Chloride	Trichloroethene	COMMENTS
6/24/94	ND	ND	ND	
6/25/94	ND	ND	ND	
6/26/94	ND	ND	ND	
6/27/94	ND	ND	ND	
6/28/94	ND	ND	21J	
Sample ID V1 following second carbon unit				
Date Sampled	Acetone	Methylene Chloride	Trichloroethene	COMMENTS
6/24/94	ND	ND	ND	
6/25/94	ND	ND	ND	
6/26/94	ND	ND	ND	
6/27/94	ND	ND	ND	
6/28/94	ND	ND	ND	
Sample ID BG Background Air				
Date Sampled	Acetone	Methylene Chloride	Trichloroethene	COMMENTS
6/28/94	ND	ND	ND	
BG Background ND None Detected J Compound Detected Below Method Detection Limits				

TABLE 2-13
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, July 1994
DETECTED VOCs in microgram/liter

WELL No.	VOLATILE ORGANIC COMPOUNDS																
	MEC	TCE	1,1-DCA	1,1-DCE	1,2-DCA	VC	ACETONE	CF	PCE	1,2-DCE	EBZ	STYRENE	TOLUENE	BENZENE	XYLENES	CTC	1,1,1 TCA
126																	
MW22	1936	1490	ND	8	ND	66	ND	6	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW15	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW2	26720000	284900	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EW1	26667	5467	ND	ND	ND	ND	10440	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW1	458250	49950	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW4	12	907	11	ND	ND	141	ND	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW5	6	71	ND	ND	ND	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	23	45	ND	ND	ND	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW21	739600	10500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
101	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
109	ND	333	4	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
125	ND	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
123	20	14	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD2	19953	9693	ND	ND	726	ND	ND	14	ND	ND	ND	ND	16	ND	ND	ND	ND
AWD3	105	1356	ND	ND	ND	ND	ND	ND	ND	23	5	ND	ND	ND	ND	26	ND
MW23	71	654	ND	ND	37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10	ND	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C8																	
102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW7	ND	20046	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW8	ND	7148	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
129	ND	2015	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW9	ND	2543	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD1	54650	87600	43	865	ND	640	ND	14	46	127	1682	295	49	12	49	ND	356
120	190279	25642	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW14	1224	6575	18	58	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	ND
MW12	299	2935	14	20	ND	ND	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
130																	
MW18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW17	ND	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW10	ND	4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW11	ND	165	ND	ND	9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
124	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD4	ND	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW19																	
MW20																	
C1	249	118	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW3	ND	788	9	7	ND	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTE: MEC = Methylene Chloride 1,2-DCA = 1,2-Dichloroethane 1,2-DCE = Total -1,2-Dichloroethene ND = Non-Detect
TCE = Trichloroethene VC = Vinylchloride EBZ = Ethylbenzene
1,1-DCA = 1,1-Dichloroethane CF = Chloroform CTC = Carbon Tetrachloride
1,1-DCE = 1,1-Dichloroethene PCE = Tetrachloroethene 1,1,1 TCA = 1,1,1 Trichloroethane

TABLE 2-14
LHAAP 18&24, BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, July 1994
METALS, mg/l

Well No.	METAL COMPOUND										
	Antimony	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Nickel	Selenium	Silver	Thallium
126											
MW22	ND	ND	1.26	ND	0.03	ND	ND	0.065	ND	ND	ND
MW15	ND	ND	0.245	ND	ND	ND	ND	ND	ND	ND	ND
MW2	ND	ND	3.84	ND	ND	ND	ND	ND	ND	ND	ND
EW1	ND	ND	0.277	ND	0.012	ND	ND	ND	ND	ND	ND
MW1	ND	ND	4.55	ND	ND	ND	ND	ND	ND	ND	ND
MW4	ND	ND	0.158	ND	ND	ND	ND	ND	ND	ND	ND
MW5	ND	ND	1.27	ND	ND	ND	ND	0.044	ND	ND	ND
MW6	ND	0.006	0.918	ND	ND	ND	ND	ND	ND	ND	ND
MW21	ND	ND	5.25	ND	0.026	ND	ND	0.08	ND	ND	ND
101	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
109	ND	ND	0.878	ND	ND	ND	ND	ND	ND	ND	ND
125	ND	ND	0.094	ND	ND	ND	ND	ND	ND	ND	ND
123	ND	ND	0.174	ND	ND	ND	ND	ND	ND	ND	ND
AWD2	ND	ND	0.169	ND	0.018	ND	ND	ND	ND	ND	ND
AWD3	ND	ND	0.15	ND	0.185	ND	ND	0.083	ND	ND	ND
MW23	ND	ND	1.96	ND	0.042	ND	ND	0.2	ND	ND	ND
C4A	ND	ND	0.135	ND	ND	ND	ND	ND	ND	ND	ND
C4	ND	ND	0.176	ND	ND	0.005	ND	ND	ND	ND	ND
C5	ND	ND	0.074	ND	ND	0.006	ND	ND	ND	0.012	ND
C6	ND	ND	1.11	ND	ND	ND	ND	ND	ND	0.016	ND
C7	ND	ND	0.177	ND	ND	ND	ND	ND	ND	ND	ND
C9	ND	ND	0.28	ND	ND	ND	ND	ND	ND	ND	ND
C10	ND	ND	0.481	ND	ND	ND	ND	ND	ND	ND	ND
C3	ND	ND	0.906	ND	ND	ND	ND	ND	ND	0.01	ND
C8											
102	ND	ND	0.066	ND	ND	ND	ND	ND	ND	ND	ND
MW7	ND	ND	0.122	ND	ND	ND	ND	0.072	ND	ND	ND
MW8	ND	ND	0.242	ND	ND	ND	ND	ND	ND	ND	ND
129	ND	ND	0.125	ND	ND	ND	ND	ND	ND	ND	ND
MW9	ND	ND	0.046	ND	0.01	ND	ND	ND	ND	ND	ND
AWD1	ND	0.016	0.977	ND	ND	ND	ND	ND	0.01	ND	ND
120	ND	ND	0.178	ND	ND	ND	ND	ND	ND	ND	ND
MW14	ND	ND	1.17	ND	ND	ND	ND	ND	ND	ND	ND
MW12	ND	ND	0.236	ND	ND	ND	ND	0.057	ND	ND	ND
130											
MW18	ND	ND	0.253	ND	ND	ND	ND	ND	ND	ND	ND
MW17	ND	ND	0.334	ND	0.08	ND	ND	0.11	ND	ND	ND
MW13	ND	ND	0.447	ND	ND	ND	ND	ND	ND	ND	ND
C2	ND	ND	0.379	ND	ND	ND	ND	ND	ND	ND	ND
MW10	ND	ND	0.629	ND	ND	ND	ND	ND	ND	ND	ND
MW16	ND	ND	0.258	ND	ND	ND	ND	ND	ND	ND	ND
MW11	ND	ND	0.076	ND	ND	ND	ND	ND	ND	ND	ND
124	ND	0.008	0.059	ND	ND	ND	ND	ND	ND	ND	ND
AWD4	ND	ND	0.692	ND	0.093	ND	ND	ND	ND	ND	ND
MW19											
MW20											
C1	ND	ND	0.544	ND	ND	ND	ND	ND	ND	ND	ND
MW3	ND	ND	1.68	ND	ND	ND	ND	ND	ND	ND	ND

Note: ND = Non-Detect

TABLE 2-15
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, November 1994
DETECTED VOCs in microgram/liter

WELL No.	VOLATILE ORGANIC COMPOUND																
	MEC	TCE	1,1-DCA	1,1-DCE	1,2-DCA	VC	ACETONE	CF	PCE	1,2-DCE	EBZ	STYRENE	TOLUENE	BENZENE	XYLENES	CTC	1,1,1 TCA
126	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW22	ND	1200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW15	120	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW2	6848000	368800	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
EW1	5497500	193300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW1	362100	21414	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW4	ND	845	ND	ND	ND	119	ND	ND	ND	134	ND	ND	ND	ND	ND	ND	ND
MW5	ND	92	ND	ND	ND	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW6	ND	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW21	615450	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
101	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
109	ND	380	ND	ND	ND	ND	ND	ND	ND	70	ND	ND	ND	ND	ND	ND	ND
125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
123	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD2	3665	6510	ND	ND	460	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD3	689	264	ND	ND	ND	ND	548	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW23	ND	753	ND	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	ND	ND	ND	ND
C4A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW7	17	16250	ND	56	121	ND	ND	74	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW8	ND	7663	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
129	ND	2030	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	45	ND	84	ND
MW9	ND	4621	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD1	1621J	78500	58J	ND	14J	363J	ND	14J	63J	42000	1761J	276J	58J	13J	177J	ND	448J
120	171480	33060	60	241J	38J	ND	ND	73J	ND	503J	ND	ND	44J	8J	ND	ND	ND
MW14	ND	1028	5	15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW12	ND	2520	9	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
130	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW18	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW17	ND	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW13	31	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW11	ND	125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
124	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
AWD4	ND	8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW3	ND	870	ND	ND	ND	ND	ND	ND	ND	53	ND	ND	ND	ND	ND	ND	ND

NOTE: MEC = Methylene Chloride 1,2-DCA = 1,2-Dichloroethane 1,2-DCE = Total - 1,2-Dichloroethene ND = Non-Detect
TCE = Trichloroethene VC = Vinylchloride EBZ = Ethylbenzene
1,1-DCA = 1,1-Dichloroethane CF = Chloroform CTC = Carbon Tetrachloride
1,1-DCE = 1,1-Dichloroethene PCE = Tetrachloroethene 1,1,1 TCA = 1,1,1 Trichloroethane

TABLE 2-16
LHAAP 18&24 BURNING GROUND 3 & UEP
SUMMARY OF GROUNDWATER MONITORING, November 1994
DETECTED CONCENTRATIONS OF METALS in milligrams/liter

Well No.	Arsenic	Barium	Chromium	Lead	Nickel	Selenium
126	ND	5.57	ND	ND	ND	ND
MW22	ND	2.07	0.048	ND	0.057	ND
MW15	0.006	0.226	ND	ND	ND	ND
MW2	ND	3.62	ND	ND	ND	ND
EW1	ND	0.248	0.006	ND	ND	ND
MW1	ND	4.04	ND	ND	ND	ND
MW4	ND	0.172	ND	ND	ND	ND
MW5	ND	1.29	ND	ND	ND	ND
MW6	0.013	0.813	ND	ND	ND	ND
MW21	ND	5.71	ND	ND	ND	ND
101	ND	0.293	ND	ND	ND	ND
109	ND	1.12	ND	ND	ND	ND
125	ND	0.17	ND	ND	ND	ND
123	ND	0.152	ND	ND	ND	ND
AWD2	ND	0.14	0.022	ND	ND	ND
AWD3	ND	0.063	0.021	ND	ND	ND
MW23	ND	2.02	0.026	ND	0.11	ND
C4A	ND	0.162	0.01	ND	ND	ND
C4	ND	0.159	ND	ND	ND	ND
C5	ND	0.084	ND	ND	ND	ND
C6	ND	1.12	ND	ND	ND	ND
C7	ND	0.111	ND	ND	ND	ND
C9	ND	0.27	ND	ND	ND	0.046
C10	ND	0.496	ND	ND	ND	ND
C3	ND	0.857	ND	ND	ND	ND
C8	ND	4.63	ND	ND	ND	ND
102	ND	0.072	ND	ND	ND	ND
MW7	ND	0.126	ND	ND	0.11	ND
MW8	ND	0.257	ND	ND	ND	ND
129	ND	0.12	ND	ND	ND	ND
MW9	ND	0.054	ND	ND	ND	ND
AWD1	0.014	0.898	0.048	ND	0.057	0.007
120	ND	0.182	0.048	ND	0.063	ND
MW14	ND	0.811	0.014	ND	0.042	ND
MW12	ND	0.233	0.048	ND	0.07	ND
130	ND	0.217	ND	ND	ND	ND
MW18	ND	0.245	ND	ND	ND	ND
MW17	ND	0.336	ND	ND	0.084	ND
MW13	ND	0.402	0.026	ND	0.043	ND
C2	ND	0.381	ND	ND	ND	ND
MW10	ND	0.586	ND	ND	ND	ND
MW16	ND	0.333	ND	ND	ND	ND
MW11	ND	0.066	ND	ND	ND	ND
124	0.003	0.063	ND	ND	ND	ND
AWD4	ND	0.6	0.054	ND	0.11	ND
MW19	ND	0.066	ND	ND	ND	0.0076J
MW20	ND	0.29	0.024	0.01	ND	ND
C1	ND	0.493	ND	ND	ND	ND
MW3	ND	1.55	ND	ND	ND	ND

Note: ND = Non-Detect

3.0 CONCLUSION AND RECOMMENDATIONS

The objective of the Phase II work was met by the implementation of the different tasks described above. This work has resulted in the following:

- Three updates to the plume condition in the shallow groundwater aquifer were developed;
- The ICT sections produced the highest groundwater pumping rates under both gravity flow and VELE, followed by the VEW and then the HEW. There was little difference as far as pumping rates between sections ICT-1 and ICT-2. However, section ICT-1 was half as long as and shallower than section ICT-2. ICT-2 was backfilled with sand, while section ICT-1 had a geocomposite drainage layer installed along its center line and throughout its depth along with a sand backfill on both sides of the geocomposite. The construction of section ICT-1 was more complicated than section ICT-2 due to the installation of the geocomposite drainage layer and the very shallow depth of the water table which caused trench stability problems. Some difficulties were also encountered during the construction of section ICT-2 due to the flowing of the sand backfill toward the section under excavation.

The use of ICT sections during Phase III of the IRA is recommended. However, the difficulties encountered during the installation of the pilot ICT sections and the limited depth to which an ICT can be extended must be taken into account during the planning of the Phase III work. Difficulties such as the use of sand as backfill material, the geocomposite drainage layer, and the flexible piping should be considered. In addition, the requirement of building platforms in areas of near surface groundwater in order to maintain trench stability and its potential cost impact should also be evaluated.

The option of using pea gravel to backfill the ICT sections with a geotextile fabric layer placed along the walls and bottom of the trench should be considered as an alternative to backfilling the trench sections with sand and/or sand and geocomposite. In addition, the construction of trench sections by building short (100 to 200 feet) segments in order to maintain trench stability should also be considered. This action is recommended especially if a geocomposite drainage layer is to be used similar to section ICT-1.

The use of stainless steel screen and pipe sections to build the ICT sumps is recommended instead of the HDPE material used during this pilot work. The steel material will be easier to handle during installation and would not get damaged as the HDPE material did during the Phase II work.

- The VEW produced low flow rates under gravity flow conditions. A slightly deeper well may have produced better flow rates. The use of VEW wells during Phase III should be considered, especially in locations where it would be difficult and may be impossible to install an ICT section. However, prior to installing any VEW, it is recommended that an exploratory boring be drilled at the desired location and soil samples be taken for grain size analysis in order to size the well screen and diameter as efficiently as possible. This exploratory work should result in the installation of more efficient vertical extraction wells.

- The HEW produced a relatively low flow rate and difficulties were encountered during its installation. These conditions could be attributed to the shallow depth at which it was installed. The HEW may be pumped during the Phase III work to assist in lowering the water table in the vicinity of the ACD where source materials will be excavated and treated. The use of the HEW, as part of the network of pumping trenches and wells, may be considered based on its production rate while being used to lower the water table during excavation in its vicinity. Additional HEWs are not recommended for the IRA.
- Slightly higher flow rates were measured during the VELE test than during the gravity test at the VEW. However, these rates appeared to decrease with time and the effect of the vacuum pressures appeared to have centered in the immediate area surrounding the well. At the ICT, there was little difference between the flow rates obtained during the VELE and gravity tests. The application of VELE at the HEW was not successful due to mechanical problems. However, the flow rate during the short period at which VELE was used at the HEW appeared to have been very close to the rates obtained during the gravity flow test.

The VELE is not recommended for application at ICT sections during Phase III of the IRA due to the little difference in the measured flow rates during the gravity and VELE tests and difficulties encountered during this pilot work, including the complications at section ICT-1 where the geocomposite acted as a big conduit that required very high rates of vacuum in order to maintain a reasonable vacuum rate at sump 3.

The use of VELE at vertical extraction wells during Phase III may be considered. However, due to the potential spreading of the vertical extraction wells, maintenance of a VELE system will be challenging and may be cost prohibitive. In addition, its difficult to predict the amount of contaminants that will be pulled from the ground and emitted into the atmosphere, especially in highly contaminated areas. Such emissions may not be desired and may complicate the implementation of the Phase III work under the Texas Air Control Board Standard Exemptions listed in 30 Texas Administrative Code (TAC) 116.

Appendix F

Letters, Quality Assurance Reports & Managers Meeting Minutes Used to
Document IRA Construction Field Activities

RATING ELEMENT	(Weighted Percentage)	OUTSTANDING 100	EXCELLENT 99-90	GOOD 89-80	ABOVE SATISFACTORY 79-71	SATISFACTORY OR BELOW 70-0
1. WORK PERFORMANCE	(25%)	100				
2. QUALITY CONTROL	(20%)	98				
3. BUSINESS MANAGEMENT	(20%)	90				
4. TECHNICAL MANAGEMENT	(20%)	100				
5. SAFETY	(15%)	100				
PERCENTAGE RANGE OF AWARD FEE BASED ON SCORE:		100%	97% - 67%	63% - 33%	30% - 3%	0%

NOTES:

Work is approximately 80% complete for the construction of the Soil Handling Dewatering Pad and Concrete Decontamination Pad. Work for the 101 soil borings is approximately 85% complete and development of the installed piezometers at LH 18 and 24 is being performed. Dow Environmental, Inc. personnel are continuing to monitor daily the flow rate for Central Creek and Harrison Bayou. Dow Environmental, Inc. had Engineers in the Houston Office of Dow Chemical Inc. performing technical and cost evaluations of the proposals received for the Ground Water Treatment Plant.

REMARKS

- The work performance on jobsite continues to be exceptional in all aspects. Work being performed is of the highest quality standards and is performed on a timely basis.
- Quality Control for all work being performed continues to be a high priority of Mr. Chris Edgmon and Mr. Amine Bou Onk. These individuals have stressed to all subcontractors the importance of a high quality job and completed in the allowed time schedule.
- The Business Management appears to be of concern regarding cost incurred by Government due to design cost for the GWP. Personnel from Dow, Inc. apparently do not appear to keep the Project Manager abreast of all charges and apparently he does not have "control" over these personnel.
- The technical management by Dow Environmental, Inc. is excellent. Regulators have a respect for the knowledge and honesty displayed by Mr. Amine Bou Onk and are receptive to his ideas and suggestions.
- Mr. Chris Fisher, Site Health and Safety Officer for Dow Environmental, Inc. performs his duties in an exceptional manner. Mr. Fisher has an excellent knowledge of EM-385-1-1 as well as OSHA Regulations and takes steps to properly enforce these regulations at all times. Mr. Fisher is always ready to accept any requests by Corps of Engineers to insure complete safety conditions prevail on the jobsite all time.

Rater's Signature: Oscar Linebaugh, Jr. Date: 21 SEPTEMBER 1995

Concur _____
Do Not Concur _____
Explanation _____

017854

TRC MEETING
6-04-96

ATTENDEES

Ira Nathan	James McPherson
David Tolbert	Bud Jones
Darrell Chinn	Ken Kebbell
Jeff Armstrong	Amine Bou Onk
Oscar Linebaugh	Glen Turney
Frank J. Meleton	Bob Speight
Tom Walker	Jonna Polk
Mary Barrett	Chris Villarreal
Rick Michaels	Ann Montgomery
Sherry McAdoo	

The meeting was called to order by David Tolbert. David welcomed everyone to the quarterly TRC meeting.

James McPherson noted that there were new people in attendance and everyone introduced themselves.

The basic format was followed by going through the Project Status Report, which was distributed to everyone in attendance. The sites were grouped according to number and locations on the map were pointed out to those present.

It was agreed that draft final reports were to be sent to Wilma Subra and Mary Barrett. The SCAPS System was explained to the group.

The need for more monitoring wells was questioned. It was explained that the most important thing is corrective action. Trenches have been dug around Burning Ground #3. Our commitment is to do everything possible to stop contaminant flow to Harrison Bayou. Have to look at it from the taxpayers standpoint to monitor tax dollars and also stop the problem. Will put in necessary piezometer, additional monitoring wells and then see if that is the right fix. Our commitment to the public is to find the fix and whatever it takes we will do. Finished modeling, ready to start looking at where the four clusters will be.

Interim action not stopping studies. Emergency action designed to prevent plume from moving in.

Local contracting is slowing us down somewhat--may be delayed a week or two. Access road will be built first. Extraction wells will be started in July. Additional extraction wells will be put in by the end of September--completed. In order to get the work done, installation has to have approval from State and EPA. This takes a long time. We are in a good position here because this is a Superfund site.

It was mentioned that we had inherited bad data, but everyone was assured that we will not model based on bad data. From the data available, followed Phase I. Phase II designed based on result of Phase 1. Any concerns should be presented as detailed as possible and go forward from there. Technology has changed drastically in the past six years. If anyone wants to add something we will be glad for you to say so now.

017855

It was noted that no interest was shown in setting up a RAB. If you have something to say perhaps it could be put in writing so it could be documented as submitted.

We have started digging trenches, etc. and we want to make everyone aware of what is going on. It was noted that there is no indication of contamination off this plant.

The next meeting was scheduled for September 10.

Meeting adjourned.

PROJECT DESCRIPTION: Burning Ground # 3 - Longhorn Army Ammo. Plant RATING PERIOD: DECEMBER 1996
Karnack, Texas

RATING ELEMENT	(Weighted Percentage)	OUTSTANDING 100	EXCELLENT 99-90	GOOD 89-80	ABOVE SATISFACTORY 79-71	SATISFACTORY OR BELOW 70-0
1. WORK PERFORMANCE	(25%)	100				
2. QUALITY CONTROL	(20%)	100				
3. BUSINESS MANAGEMENT	(20%)		95			
4. TECHNICAL MANAGEMENT	(20%)	100				
5. SAFETY	(15%)	100				
PERCENTAGE RANGE OF AWARD FEE BASED ON SCORE:		100%	97% - 67%	63% - 33%	30% - 3%	0%

DOW ENVIRONMENTAL, INC. personnel did an excellent job in preparing the jobsite for the recent RIBBON CUTTING CEREMONY. NOTES:

The work completed on this Delivery Order for the rating period includes the completion of freeze protection (insulation and heat trace) of the GWTP, removal of one metal building at Louisiana Army Ammunition Plant and re-assembly at the Project site of Longhorn Army Ammunition Plant, and the treatment by GWTP of approximately 50,000 gallons of contaminated water. The final resolution was completed for the Air Monitoring Plan and final comments have been submitted to Corps of Engineers by Dow Environmental, Inc.

REMARKS

- Dow Environmental, Inc. continues to perform all work in an outstanding manner. The construction of buildings has been timely and of the highest quality. The freeze protection work has been accomplished in a timely manner and in a very outstanding fashion.
- The exceptional quality of all work accomplished is certainly noteworthy and has received very high praise and comments from the Using Agency, representatives of higher commands, Corps of Engineer Districts and the public.
- Dow Environmental, Inc. has made definite efforts to bring the Business Management portion of the contract up to standards and it is the opinion of Corps of Engineers representatives that this will be attained very soon.
- The Technical Management by Dow Environmental, Inc.'s Project Manager and personnel of Radian's Austin, Texas office has proven to be very valuable to Corps of Engineers and the installation. The technical assistance regarding the "yellow" water, toxicity tests, air monitoring, and soil treatment.
- This Contractor continue to have an excellent safety record. A recent inspection by the Chief of Safety for Tulsa District Corps of Engineers received very favorable comments regarding Safety. No safety violations have been noted during this rating period.

(SEE ATTACHED SHEETS)

Rater's Signature: Oscar Linebaugh, Jr.Date: 2 JANUARY 1997Concur ☒Do Not Concur ☐

Explanation _____

_____Dudley C. Beene, IIDudley C. Beene, II
Assistant Area Engineer
Eastern Area Office

**Monthly Manager's Meeting
Longhorn Army Ammunition Plant
January 14, 1997
Offices of TNRCC - Austin, TX**

018432

1. The following is a list of participants:

Ira Nathan - LHAAP	David Tolbert - LHAAP
Chris Villarreal - EPA	Diane Poteet - TNRCC
Jonna Polk - Tulsa District, USACE	Frank Meleton - USACE, EAO
Oscar Linebaugh - USACE, EAO	Dave Bockelmann - Sverdrup
Cliff Murray - Tulsa District, USACE	Amine Bou Onk - Dow
Glen Turney - OHM	Jim Bob Owens - Radian
Bob Norris - Eckenfelder	Laura Mahoney - Eckenfelder
Bob Vandegriff - Tulsa District, USACE	

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks and Review and Transmittal of Meeting Minutes: On behalf of LHAAP, Ira Nathan and David Tolbert welcomed all attendees to the Monthly Manager's Meeting held at the TNRCC offices in Austin, TX. The December 1996 meeting minutes were reviewed and accepted without revision or comment.

Sumps Testing and Removal: Glen Turney of OHM reported on the progress of the sumps testing and removal. A summary report was provided. Concrete sampling has been completed. Of the 80 concrete sumps, 29 have been removed and demolished. As approved by TNRCC concrete from sumps was placed on Landfill 16. Two sumps were metal, and were sampled with wipe samples. After receipt of wipe sample results, the sumps were sent to a recovery facility. Based on the total sump sampling results, surrounding soils at 25 of the sump locations will be sampled. The final report is scheduled for submission the first week of March 1997.

Landfill-16 Groundwater Biotoxicity Test: Complete biotoxicity test reports from both Espey Houston and Radian (Louisiana) labs were submitted to and reviewed by TNRCC. TNRCC stated that they will allow treatment and discharge of the Site 16 water (premixed at a 15:1 ratio of burning ground or potable water to Site 16 water) at the Burning Ground Treatment Plant. TNRCC will require toxicity testing again when discharge of the treated water begins, and again at a later date prior to treatment of the Burning Ground water. TNRCC will send a letter detailing the directions.

Scope of Work for Site 16 Remedial Investigation: The Scope of Work (SOW) for the Site 16 Remedial Investigation was reviewed by the LHAAP team. It was noted that surface water samples collected from Harrison Bayou should be included in the Risk Assessment evaluation, and that will be added to the SOW. It was also noted that semivolatile analysis for groundwater should be deleted from Section 3.4.12. This parameter will be deleted.

018433

Site 16 RI Schedule: The schedule for the Site 16 RI was reviewed and discussed. AEC's comment regarding a Risk Assessment Scoping meeting was discussed, and the team agreed to hold that meeting in conjunction with the May 1997 Monthly Manager's Meeting at the offices of EPA in Dallas, TX.

Safety Award Presentation to Dow Environmental: A Safety Award for three years of work without a lost time accident was presented by Tulsa District Safety Officer Bob Vandegriff to Amine Bou Onk, Project Manager, Dow Environmental. Dow was praised for the safe and excellent work which they have done at the Burning Ground in the last three years. Mr. Vandegriff also extended praise from COL. Sanford, Commander, Tulsa District, USACE, to Mr. Oscar Linebaugh, Eastern Area Office, Fort Worth District, for his management of Dow's contract and daily field work over the past three years.

Burning Ground No. 3 Low Temperature Thermal Desorber (LTTD) Proof of Performance (POP) Test: The POP Test is scheduled for 10 February. Eastern Area Office will prepare a letter to send through LHAAP to TNRCC to provide 14 day notice prior to running the POP test.

Regarding the Catalytic Oxidizer for the LTTD, the configuration will be different than previously shown in the 1995 Work Plan due to improvements in technology since that time. The configuration will now consist of two LTTD units with two catalytic oxidizers with one combined stack for the oxidizers. Dow will run 10 hr. treatment days until approval by EPA and TNRCC, then will begin running the LTTDs 24 hr. per day.

Burning Ground No. 3 Groundwater Treatment Plant: An on-site lab will not be used for analysis of water and soil samples, rather, a Radian chemist will be dedicated in Austin, TX specifically to support sample analysis needs for the Burning Ground. Turnaround times will remain as previously committed.

All present at the meeting, as listed above, agreed that the POP test for the groundwater treatment plant should be deferred until the extraction system for the Burning Ground is in place and running, so that water running through the plant will have similar concentrations of VOCs to water which will be processed throughout the operation of the plant. All present also agreed that the IDW water collected during the Pilot Study in May 1994, as well as the IDW water stored in drums at Site 16, could be processed through the plant prior to the POP test.

TNRCC and EPA will provide direction as to whether the Site 16 water can also be treated prior to the POP test.

Monthly Meeting Schedule: The next monthly managers meeting will be held on 11 February at LHAAP at 8:00 a.m. (at the time these minutes were prepared, the meeting schedule had been adjusted to 9:30 a.m.).

PROJECT DESCRIPTION: Burning Ground # 3 - Longhorn Army Ammo. Plant RATING PERIOD: MARCH 1997
Karnack, Texas

RATING ELEMENT	(Weighted Percentage)	OUTSTANDING 100	EXCELLENT 99-90	GOOD 89-80	ABOVE SATISFACTORY 79-71	SATISFACTORY OR BELOW 70-0
1. WORK PERFORMANCE	(25%)		95			
2. QUALITY CONTROL	(20%)		95			
3. BUSINESS MANAGEMENT	(20%)			80 ?	OK	
4. TECHNICAL MANAGEMENT	(20%)			80 ?	OK	
5. SAFETY	(15%)	100				
PERCENTAGE RANGE OF AWARD FEE BASED ON SCORE:		100%	97% - 67%	63% - 33%	30% - 3%	0%

NOTES:

Work completed this period includes excavation of source materials from Burning Ground # 3, treatment of contaminated soils thru the thermal desorber units, hauling and placing the treated soil at Landfill # 12.

REMARKS

- Problems evident due to the small amount of soil being treated by the thermal desorber units.
- Quality Control continues to be excellent. All daily reports are properly completed, documented, and received on time.
- Business Management still needs improvements. Cost and schedule reports do not appear to accurately forecast and report progress, proposed progress and potential cost overruns.
- Technical Management regarding the handling of contaminated soil appears short.
- Safety continues to be outstanding. No safety violations have been noted. Safety appears to be a top priority by all employees of the Radian International, LLC organization.

Rater's Signature:

Oscar Linebaugh, Jr.

Date: 10 APRIL 1997

Concur _____

Do Not Concur _____

Explanation _____

Dudley C. Beene, II
Assistant Area Engineer
Eastern Area Office

018551

TRC Meeting
11 March 1997

The following people were in attendance at the March meeting:

David Tolbert, LHAAP
Cyril Onewokae, HQ, IOC, AMSIO-EQE
Amine BouOnk, Radian Int'l.
Wilma Subra, Uncertain Audubon
Ann Montgomery, LHAAP, OHM
Lynn Muckelrath, LHAAP
Glen Turney, OHM
Jonna Polk, COE, Tulsa
Frank & Frances Gadman, Self
Oscar Linebaugh, COE
H. L. "Bud" Jones, TNRCC

Ira Nathan, LHAAP
Jeff Armstrong, USAEC
Vic Heister, COE, Tulsa
Chris Villarreal, EPA
Diane Poteet, EPA
Bill Corrigan, Radian Int'l.
Dave Bockelman, Sverdrup
Yolane Hartsfield, COE, Tulsa
Frank Meleton, COE
Dudley Beene, COE

Opening Remarks: Ira Nathan opened the meeting in the absence of James McPherson. He welcomed everyone to the meeting and extended a special welcome to Jeff Armstrong. He also personally welcomed Jonna Polk, who will be leaving shortly.

Everyone received a copy of the February minutes.

Landfill 16 water color issue was discussed. Jeff Armstrong wanted to know where we are on that now. The Landfill water has a trace amount of explosives. Diane is now working to get standards.

TNRCC will have Risk Reduction Standards December 98. Review completed.

Proof Of Performance (POP) test results. In mid-February did testing over three days. TNRCC and EPA were here for the tests; tests went very well. On February 15 EPA set interim limits to work under. Now running under conditions EPA set. We will be taking soil to Site 12 today and will run on a 24 hour schedule. EPA set limit of 10 cu. yds. per hour. We are at about 8-1/2 to 9 now, close to the limit. We will have final report in two months. We have some emissions data we will provide to EPA today. Getting between 2 to 5-1/2 lbs. per day. The emission rate is very low.

We had good source material, especially on Saturday. Emissions are quite low. Oxidizers quite low. Will segregate material starting next week.

Site 16 Accelerated RI/FS: Last week finished surface resistivity on Site 16. Preliminary data has not been processed yet. Results will be useful but data not processed. Will be finished late this week or early next week. The initial system looks good.

We may propose some changes in how to figure extraction system or how we place monitoring wells. Looked at four options of transporting water to burning ground. Piping will be the best way; cheapest and fastest.

Accelerated RI: Slight delay in cost estimates and funding. Could effect our schedule. Sverdrup plans to be here in April.

TRC Meeting
11 March 1997

018552

OHM will have decon pad ready _____. We will get updated schedule. April 23 date can slide. If we decide to change position of extraction wells we could be in the field by April 1.

Need to call Diane Poteet when we get workplan for Sverdrup to expedite things.

SUMPS: OHM has basically completed sumps. They are in process of final walk through with Frank Meleton. Started on closure report and are 99% done with field work. Currently work on final report to be submitted by March 31, 1997.

Yolane Hartsfield went through the Status Summary for each project.

Put in site investigation report for EPA for their concurrence or no further action. Also need to provide Chris Villarreal 1993 report on treatability study.

If source material can be used as backfill will reduce the amount of soil taken to the landfill. If amount of soil is reduced at Landfill 16 what kind of impact will that have? If we are not getting that volume of treated soil then Landfill 16 could be designed to accept a lesser amount of soil.

Action for Yolane Hartsfield: Cost to change design.

Caps should be finished by October 98. Need to resolve cost analysis. Will leave schedule as is right now. Will have to readjust if we are not getting soil.

Starting on Landfill 12. To be finished in December 97.

The next Monthly Managers' Meeting is April 8, 1997. To be a teleconference. Tulsa will set up. Time is 9:30.

The next TRC Meeting is June 10, 1997 at 9:30 - same location.

**Technical Review Committee Meeting
Longhorn Army Ammunition Plant
11 March 1997
Longhorn Army Ammunition Plant, Karnack, Texas**

AMENDED

018553

1. The following is a list of participants:

James McPherson - LHAAP
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Cliff Murray - USACE, Tulsa District
Ira Nathan - LHAAP
Earney Funderburg - OHM
Wilma Subra - Uncertain Audubon

Ruth Culver - Uncertain Audubon
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Poteet - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Frank Meleton - USACE, EAO
Jeff Armstrong (by telephone) --AEC

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks, Review and Transmittal of Meeting Minutes: On behalf of LHAAP, Ira Nathan welcomed all attendees to the Technical Review Committee/Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. Nathan extended a special welcome to Mr. Jeff Armstrong. Mr. Nathan introduced Ms. Jonna Polk, outgoing Tulsa District project manager and wished it noted in these minutes that Ms. Polk will be missed by Longhorn Army Ammunition Plant staff and team. The February 1997 meeting minutes were reviewed and accepted with revisions (Revised February 1997 meeting minutes attached).

LTID POP Test Report: The contractor reported that the plant successfully completed the POP Testing 13-15 February 1997. Plant began 24 hour operation schedule 10 March 1997 treating to comply with EPA's 10/cy/hr limit. Plant operating well below EPA emissions' limit. Emissions are averaging between 2 - 5.5 lb/day (EPA emission limit 6 lb/hr or 144 lb/day). Final report from Radian International due in April 1997.

Radian is adding grist mill-like fingers and screening to reduce soil clod size on inflow into soil thermal desorber units. Bud Jones, TNRCC, agreed to provide David Tolbert, LHAAP, information about a similar process in Longview where the use of a grinder vice screening process to enable Mr. Tolbert to compare costs.

Resistivity Study: Sverdrup reported that the resistivity survey was completed on Site 16 as part of the Accelerated RI/FS with Treatability Study. Preliminary data looks useful. Final data should be ready late this week or early next week and will be used to assist in locating planned extraction wells.

018554

TNRCC requested revised schedule to reflect changes due to accelerated work activities. TNRCC noted that they have not concurred on schedule. TNRCC agreed to work to expedite review of work plans and will fax comments and/or conference call comments/resolution through COE.

Sumps: Contractor reported all sumps have been removed and demolished. Pits have been backfilled. Final walk-through with EAO anticipated. Have begun preparation of Closure Report which will be submitted by 31 March 1997. Hazardous waste contaminated soils from 2 sumps and 1 trough sediments were being sent off-site this date for proper disposal.

Executive Summary Review: The executive summary handout was reviewed and questions regarding projects' status were answered. Group 1 schedule for RI and ROD submittal are included herewith. (It was noted that the Public Meeting, scheduled for this summer, would require a transcriptionist.) **Landfill Caps:** query as to whether if we use treated soils from BG3 as backfill into the excavation trenches, what impact to LF16 cap design. COE agreed to have cap designer look at design to see if soil volumes can be minimized without jeopardizing cap integrity. **OHM to provide COE volume of concrete debris delivered to LF16.** Team interested if : 1) redesign possible; 2) total savings expected; and, 3) whether savings would off-set redesign.

OHM personnel reported that they need cost analysis to update schedule based upon soil availability. 1 April they will be clearing and grubbing LF 12/16 and by 15 April they should be placing soil cap. By 28 March soil to LF 12 from GWTP will be completed (currently estimate 8000 cy total to go to LF 12).

Monthly Meeting Schedule and Location: The next monthly meeting will be held on 11 April 1997 by teleconference starting at 0930.

Meeting adjourned.



LHAAP GROUP 2 RI as of 2-27-96

Task Name	Dura	Sched Start	Sched Fin	1994					1995				1996			
				Qtr	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3	Qtr4	Qtr1
LHAAP GROUP 2	1039d	12/16/93	10/19/96													
ASSESSMENT	1039d	12/16/93	10/19/96													
REMEDIAL INVESTIGATION	1039d	12/16/93	10/19/96													
INVESTIGATION/ANALYSIS	813d	12/16/93	03/07/96													
PHASE II WP COM RESOLN	45d	11/27/94	01/10/95													
PHASE II WP APPROVAL	0d	01/10/95	01/10/95													
PHASE II FIELDWORK MOB	20d	01/11/95	01/30/95													
PHASE II FIELDWORK	255d	01/31/95	10/12/95													
PHASE II SAMPLE ANALYSIS	340d	02/03/95	01/08/96													
REVIEW/SUMMARIZE DATA	30d	01/09/96	02/07/96													
SUBMIT DATA RPT AGENCIES	0d	03/07/96	03/07/96													
PHASE II FIELD SUMMARY REPT	221d	02/08/96	09/15/96													
PREP DFT FSR	84d	02/08/96	05/01/96													
SUBMIT DFT FSR	0d	05/01/96	05/01/96													
ARMY REVIEW	30d	05/02/96	05/31/96													
COMMENT RESOLUTION	21d	06/01/96	06/21/96													
PREP DFT FIN FSR	28d	06/22/96	07/19/96													
SUBMIT DF FSR	0d	07/19/96	07/19/96													
AGENCY REVIEW	30d	07/20/96	08/18/96													
COMMENT RESOLUTION	28d	08/19/96	09/15/96													

LHAAP GROUP 2 RI as of 2-27-96

Task Name	Dura	Sched Start	Sched Fin	1994					1995				1996			
				Qtr	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3	Qtr4	Qtr1	Qtr2	Qtr3	Qtr4	Qtr1
FUTURE SCOPE DEVELOPMENT	92d	07/20/96	10/19/96													
REV DATA/DEVLP RECOMM	45d	07/20/96	09/02/96													
SCOPE DVLPMT MTG	4d	09/03/96	09/06/96													
PREP WRITTEN SCOPE DOC	14d	09/07/96	09/20/96													
SUBMIT SCOPE DOC(COMBINED)	0d	09/20/96	09/20/96													
CONCURRENCE REVIEW	28d	09/21/96	10/18/96													
RECOMMENDATION APPROVAL	1d	10/19/96	10/19/96													
INITIATE NEXT PROJECT PHASE	0d	10/19/96	10/19/96													

LHAAP BG No. 3 IRA as of 2-27-95

Task Name	Dura	Sched Start	Sched Fin	1994				1995				1996				1997				199	
				tr	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr2	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr	tr3
IRA AT 18 & 24	1450d	01/09/94	12/28/97																		
INVESTIGATION/ANALYSIS	171d	01/09/94	06/28/94																		
IRA PROP PLAN AND ROD	298d	06/28/94	04/21/95																		
PROPOSED PLAN	105d	06/28/94	10/10/94																		
PREPARE DRAFT PP	30d	06/28/94	07/27/94																		
REVIEW DRAFT PP	30d	07/28/94	08/26/94																		
COMMENT RES/FINAL PP	14d	08/27/94	09/09/94																		
PUBLIC MEETING	1d	09/15/94	09/15/94																		
PUBLIC COMMENT PERIOD	30d	09/11/94	10/10/94																		
RESPONSIVENESS SUMMARY	74d	09/18/94	11/30/94																		
PREPARE DRAFT RESP SUM	30d	09/18/94	10/17/94																		
REVIEW DRAFT RS	30d	10/18/94	11/16/94																		
COMMENT RES/FINAL RS	14d	11/17/94	11/30/94																		
RECORD OF DECISION	215d	09/18/94	04/20/95																		
PREPARE DRAFT ROD	30d	09/18/94	10/17/94																		
SUBMIT DRAFT ROD	0d	10/18/94	10/18/94																		
REVIEW DRAFT ROD	27d	10/19/94	11/14/94																		
COMMENT RESOLUTION MEETI	1d	11/15/94	11/15/94																		
PREP FINAL ROD	112d	11/16/94	03/07/95																		

LHAAP BG No. 3 IRA as of 2-27-95

Task Name	Dura	Sched Start	Sched Fln	1994				1995				1996				1997				199	
				tr	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr2	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr	tr3
SUBMIT FINAL ROD	0d	03/07/95	03/07/95					◇													
ACCEPTANCE REVIEW	14d	03/08/95	03/21/95					I													
SUBMIT ROD FOR SIGNATURES	0d	03/21/95	03/21/95					◇													
OBTAIN ROD SIGNATURES	55d	03/22/95	05/15/95					■													
ROD FINAL	0d	05/15/95	05/15/95					◇													
IRA IMPLEMENTATION	1186d	09/30/94	12/28/97																		
CONTRACT AWARD	0d	09/30/94	09/30/94					◇													
IRA WORKPLAN	202d	05/16/95	12/03/95																		
COMPL DRAFT IRA WP	77d	05/16/95	07/31/95																		
SUBMIT DRAFT IRA WP	0d	07/31/95	07/31/95																		
COMB REV DFT WP	30d	08/01/95	08/30/95																		
PREP COMM RESP	14d	08/31/95	09/13/95																		
SUB MIT COMM RESP	0d	09/13/95	09/13/95																		
COMMENT RESOLUTION	14d	09/14/95	09/27/95																		
PREP FIN IRA WP	30d	09/28/95	10/27/95																		
SUBMIT FINA IRA WP	0d	10/27/95	10/27/95																		
ACCEPTANCE REVIEW	30d	10/28/95	11/26/95																		
IRA WP FINAL	0d	11/26/95	11/26/95																		
PROOF OF PERFORMANCE RE	60d	07/12/96	09/09/96																		

LHAAP BG No. 3 IRA as of 2-27-95

Task Name	Dura	Sched Start	Sched Fin	1994				1995				1996				1997				199	
				tr	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr2	tr3	Qtr4	Qtr1	tr	tr3	Qtr4	Qtr1	tr	tr3
IRA CONSTRUCTION	564d	11/27/95	06/12/97																		
IRA IMPL REPORT	216d	06/13/97	01/14/98																		
PREP DFT IMPL RPT	120d	06/13/97	10/10/97																		
SUBMIT DFT IMPL RPT	0d	10/10/97	10/10/97																		
REV DFT IMPL RPT	45d	10/11/97	11/24/97																		
PREP FIN IMPL RPT	30d	11/25/97	12/24/97																		
SUBMIT FIN IMPL RPT	0d	12/24/97	12/24/97																		
ACCEPTANCE REVIEW	21d	12/25/97	01/14/98																		
IRA IMPL RPT FINAL	0d	01/14/98	01/14/98																		
IRA LONG TRM O&M BEGINS	0d	06/12/97	06/12/97																		

**Monthly Managers' Meeting
Longhorn Army Ammunition Plant
11 March 1997
Longhorn Army Ammunition Plant, Karnack, Texas**

018579

1. The following is a list of participants:

Ruth Culver - Uncertain Audubon
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Jonna Polk - USACE, Tulsa District
Ira Nathan - LHAAP
Frank Meleton - USACE, EAO
Wilma Subra - Uncertain Audubon
Frank and Frances Gadman, Self

Dave Bockelman, Sverdrup Environmental
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Potect - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Lynn Muckelrath, LHAAP
Jeff Armstrong--AEC
Ann Montgomery

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks, Review and Transmittal of Meeting Minutes: On behalf of LHAAP, Ira Nathan welcomed all attendees to the Technical Review Committee/Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. Nathan extended a special welcome to Mr. Jeff Armstrong. Mr. Nathan introduced Ms. Jonna Polk, outgoing Tulsa District project manager and wished it noted in these minutes that Ms. Polk will be missed by Longhorn Army Ammunition Plant staff and team. The February 1997 meeting minutes were reviewed and accepted with revisions. (Revised minutes attached.)

LTDD POP Test Report: The contractor reported that the plant successfully passed the POP Testing 13-15 February 1997. Plant began 24 hour operation schedule 10 March 1997 treating to comply with EPA's 10cy/hr limit. Plant operating well below EPA emissions' limit. Emissions are averaging between 2 - 5.5 lb/day (EPA emission limit 6 lb/hr or 144 lb/day). Final report from Radian International due in April 1997.

Radian is adding grist mill-like fingers and screening to reduce soil clod size on inflow into soil thermal desorber units. Bud Jones, TNRCC, agreed to provide David Tolbert, LHAAP, information about a similar process in Longview where the use of a grinder vice screening process to enable Mr. Tolbert to compare costs.

Resistivity Study: Sverdrup reported that the resistivity survey was completed on Site 16 as part of the Accelerated RI/FS with Treatability Study. Preliminary data looks useful. Final data should be ready late this week or early next week and will be used to assist in locating planned

extraction wells.

018580

TNRCC requested revised schedule to reflect changes due to accelerated work activities. TNRCC noted that they have not concurred on schedule. TNRCC agreed to work to expedite review of work plans and will fax comments and/or conference call comments/resolution through COE. TNRCC noted that they would

Sumps: Contractor reported all sumps have been removed and demolished. Pits have been backfilled. Final walk-through with EAO anticipated. Have begun preparation of Closure Report which will be submitted by 31 March 1997. Hazardous waste contaminated soils from 2 sumps and 1 trough sediments were being sent off-site this date for proper disposal.

Executive Summary Review: The executive summary handout was reviewed and questions regarding projects' status were answered. Group 1 schedule for RI and ROD submittal are included herewith. (It was noted that the Public Meeting, scheduled for this summer, would require a transcriptionist.) Landfill Caps: query as to whether if we use treated soils from BG3 as backfill into the excavation trenches, what impact to LF16 cap design. COE agreed to have cap designer look at design to see if soil volumes can be minimized without jeopardizing cap integrity. OHM to provide COE volume of concrete debris delivered to LF16. Team interested if: 1) redesign possible; 2) total savings expected; and, 3) whether savings would off-set redesign.

OHM personnel reported that they need cost analysis to update schedule based upon soil availability. 1 April they will be clearing and grubbing LF 12/16 and by 15 April they should be placing soil cap. By 28 March soil to LF 12 from GWTP will be completed (currently estimate 8000 cy total to go to LF 12).

Landfill 12 and 16 caps are scheduled for completion October 1998. Landfill 12 cap expected completion date December 1997.

Monthly Meeting Schedule and Location: The next monthly meeting will be held on 8 April 1997 by teleconference starting at 0930.

Meeting adjourned.

**Monthly Managers' Meeting
Longhorn Army Ammunition Plant
11 February 1997
Longhorn Army Ammunition Plant, Karnack, Texas**

018581

Amended

1. The following is a list of participants:

James McPherson - LHAAP	Ruth Culver - Uncertain Audubon
Oscar Linebaugh - USACE, EAO	H. L. "Bud" Jones - TNRCC
Vic Heister - USACE, Tulsa District	David Tolbert - LHAAP
Dudley Beene - USACE, EAO	Yolane Hartsfield - USACE, Tulsa District
Cyril Onewokae - HQ, IOC, AMSIO-EQE	Chris Villarreal - EPA, Region 6
Bill Corrigan - Radian	Diane Poteet - TNRCC
Cliff Murray - USACE, Tulsa District	Amine Bou Onk - Radian
Ira Nathan - LHAAP	Glen Turney - OHM
Earney Funderburg - OHM	Frank Meleton - USACE, EAO
Wilma Subra - Uncertain Audubon	Jeff Armstrong (by telephone) --AEC

2. The following is a list of topics discussed (in order of discussion):

Opening Remarks, Review and Transmittal of Meeting Minutes: On behalf of LHAAP, James McPherson welcomed all attendees to the Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. McPherson introduced Ms. Yolane Hartsfield, Tulsa District COE, as the new project manager. The January 1997 meeting minutes were reviewed and accepted with revisions (Revised January 1997 meeting minutes attached).

Future Land Use: The Army has declared that LHAAP totally excessed to the Army's need and requirements with the intent to divest its interest to the property. The determination as to future land use (i.e. industrial, residential, etc.) is in process. Mr. McPherson outlined the normal process the Army uses to divest its interest in such properties and provided a general overview of the time involved to complete the process. Currently plans are to remediate to industrial use standards, with the Army acknowledging there may be some areas that the Army will retain interest to and ownership thereto. LHAAP has begun process to excess property and will keep regulators fully informed as to progress. COE prepared map is being completed.

Landfill 16 Water Treatment: The disposal plan for produced water was presented. Produced water will be conveyed to the GWTP at BG3, treated and discharged. TNRCC is to provide effluent concentration standards for explosives. Current high flow in Harrison Bayou is optimal for discharge of treated effluent. The addition of a carbon unit to the process was discussed. The carbon unit would be used to remove trace concentrations of high explosives and optimize water color.

Proposed Change in Disposal Method for Landfill Tree Stumps: A change in the disposal

018582

plan for tree stumps at the landfills was presented. Originally the SOW called for chipping the stumps into mulch. The contractor proposes piling the stumps and burning same. This approach will be effective and efficient and save the government $\pm$ \$16,800. Mr. Onewokae requested written documentation of the change. Mr. Nathan to provide.

Sumps Update: The contractor stated that they had demolished 62 of the 80 sumps and were down to the larger sumps. Smaller sumps had been removed whole, moved to the landfill, and demolished on site. The larger sumps will be demolished in-place and then the debris will be moved to the landfill. When sumps were removed, associated trough "leg-outs" were also removed. Discussion of the schedule to remove the remaining troughs was conducted. The consensus reached, with concurrence of the TNRCC, was that these minutes serve as sufficient revision to the work plan (OHM to revise their work plan and distribute) such that the 5 remaining troughs and associated soil will become a part of the Phase III, Group 4, investigation. OHM will place concrete in the trough structures, where to prevent potential releases of fluids from the exposed ends of troughs. A memo will be prepared addressing this change and submitted to the TNRCC (Ms. Hartsfield to prepare).

Mr. McPherson asked for clarification on backfilling the sumps' pits. It was decided to use clean fill or non-contaminated excavated soils (i.e. that soil which meets the Risk Reduction #2 standards). One or 2 sumps' pits will need clean fill according to the contractor. OHM to furnish LHAAP analyses for these 2 sump sites for decision on contaminated soil. No liners will be used in the backfilled pits.

LTDD POP Test Overview: The contractor verified that the plant was ready to go ahead with the POP Testing scheduled for 12 February 1997. Testing to include 3 sets of soil samples from highly contaminated sites, 3 sets from less contaminated sites.

Executive Summary Review: The executive summary handout was reviewed and questions regarding projects' status were answered.

Monthly Meeting Schedule and Location: The next monthly meeting will be held on 11 March 1997 at LHAAP at 0930.

Meeting adjourned.

LONGHORN ARMY AMMUNITION PLANT IRP STATUS SUMMARY

As Of 4 March 1997

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Group #1 (Sites 1, 11, XX, and 27)	Remedial Investigation/ Feasibility Study	Work continues to complete risk assessment and incorporate comments into RI report.	Draft final RI with Risk Assessment is scheduled for submittal 01 May 1997. Funding for this project in FY97 has been received to complete the RI and the ROD for closure of the sites with "no further action". -ROD is now scheduled to be submitted 30 September, 1997.
Group # 2 (Sites 12, 17, 18, 24, 29, and 32)	Remedial Investigation/ Feasibility Study	Scoping of Phase III RI/FS was begun 13 March 1997. Contract negotiated 27 March 1997.	Expected contract award April 1997.
Group # 4 Wastewater Sumps 50 and 60	Remedial Investigation/ Feasibility Study	Scope of work amended to include Sites 50 and 60. Contract negotiated 31 March 1997.	Expected contract award April 1997.
Group # 5 (Sites 52, and 63)	Site Investigation	- Draft Final Site Investigation Report submitted for regulatory review on 3 October. - TNRCC and EPA comments received.	Submittal of Final Site Investigation Report.
Burning Grounds #3 (Group # 2, Sites 18 and 24)	Interim Remedial Action	-AMP and QAPP finalized in January 97. - Groundwater Treatment Plant successfully ran with contaminated water in January 97. - Awaiting effluent standards from TNRCC for explosives and mercury.	- Proof of Performance test for Low Temperature Thermal Desorber units for soil treatment completed February 1997. Currently awaiting Report from Contractor.
Landfill Caps (Group # 2, Sites 12 and 16)	Interim Remedial Action	- Work Plan finalized with revisions in Nov 96. - Work on Landfill 12 Cap underway, completion date scheduled for 12/97. Completion of Landfill 16 Cap scheduled for 10/98.	- Preliminary construction began in August 1996. Capping of both landfills scheduled to be complete in October 1998.

018584

**LONGHORN ARMY AMMUNITION PLANT
IRP STATUS SUMMARY**

As Of 4 March 1997

PROJECT NAME	PROJECT PHASE	PROJECT STATUS	NEXT MAJOR MILESTONE(S)
Landfill Site 16 Accelerated RI	RI/FS	- Quarterly sampling was conducted in Harrison Bayou on 5 February.	- Quarterly sampling has been funded for FY97, and will continue in FY97. Contract for Accelerated RI awaiting award.
DERA SUMPS	Removal Action	- Sump contents have been removed and disposed per TNRCC approval. - Sump removal complete.	- Sump removal final report scheduled to be submitted in March/April 97.

SCHEDULED MEETINGS AND VISITS TO LHAAP		
Date / Time	Purpose of Meeting / Visit	Location
8 April/ 0930	Managers' Meeting	Teleconference
13 May/ 0930	Manager's Meeting/Risk Assessment Planning Meeting	Dallas

018585

**LHAAP, Group 2, Site 16, Accelerated RI/FS with Treatability
Study, as of 01 April 1997**

Task #	Task Name	Duration	Sched Start	Sched Finish	Actual Start	Actual Finish
1	Contract	56d	12/16/96	02/05/97	12/16/97	
2	Workplan Prep	28d	02/05/97	03/02/97		
3	Resistivity Survey Plan Letter	21d	01/22/97	02/10/97		
4	Mobilize/Fieldwork	7d	02/10/97	02/16/97		
5	COE Review Workplan	7d	03/02/97	03/08/97		
6	Comment Resolution	7d	03/08/97	03/15/97		
7	Draft WP Combined Review	30d	03/15/97	04/10/97		
8	Resolve Comments	7d	04/10/97	04/16/97		
9	Revise Workplan	7d	04/17/97	04/23/97		
10	Final Regulatory Review/Approval	7d	04/23/97	04/29/97		
11	Mobilize	7d	04/23/97	04/29/97		
12	Fieldwork	45d	04/29/97	06/08/97		
13	Risk Assessment Planning Mtg	3d	05/13/97	05/13/97		
14	EW Start-up	7d	06/08/97	06/14/97		
15	EW Data Collection	7d	11/21/97	11/27/97		
16	Sampling & Analysis	45d	06/08/97	07/18/97		
17	Data Validation	28d	07/18/97	08/12/97		
18	Data Summary/Validation Report	28d	11/27/97	12/22/97		
19	Combined Review	30d	12/22/97	01/18/98		
20	Data Review Meeting	1d	01/18/98	01/19/98		
21	Modeling/Risk Assessment Scoping Meeting	0d	01/19/98	01/19/98		
22	Modeling Report	150d	01/18/98	05/31/98		
23	COE Review	14d	05/31/98	06/13/98		
24	Comment Resolution	7d	06/13/98	06/19/98		
25	Combined Review	30d	06/19/98	07/16/98		
26	Comment Resolution	14d	07/16/98	07/28/98		

018586

**LHAAP, Group 2, Site 16, Accelerated RI/FS with Treatability
Study, as of 01 April 1997**

27	Draft Risk Assessment Rpt.	180d	01/16/98	06/27/98		
28	COE Review	14d	06/27/98	07/09/98		
29	Comment Resolution	7d	07/09/98	07/16/98		
30	Army Review	30d	07/16/98	08/11/98		
31	Comment Resolution	10d	08/11/98	08/20/98		
32	Revise Risk Assess. Report	7d	08/20/98	08/26/98		
33	Regulatory Review of Risk Assessment	30d	08/26/98	09/22/98		
34	Comment Resolution	14d	09/22/98	10/04/98		
35	Prepare RI/FS Report	90d	10/05/98	12/23/98		
36	Army Review	10d	12/24/98	01/01/99		
37	Comment Resolution	7d	01/01/99	01/08/99		
38	Draft RI/FS	7d	01/08/99	01/14/99		
39	Regulatory Review	30d	01/14/99	02/09/99		
40	Comment Resolution	30d	02/09/99	03/09/99		
41	Revise RI/FS Report	30d	03/09/99	04/08/99		
42	Proposed Plan	55d	04/08/99	05/30/99		

Texas Natural Resource Conservation Commission

INTEROFFICE MEMORANDUM

018588

TO : Diane Poteet
Investigation Unit
Pollution Cleanup Division

DATE: March 17, 1997

Thru *PLV*
3-17-97 Pat Radloff, Team Leader
Industrial Permits Team

FROM : Stephen Ligon
SLM Industrial Permits Team

SUBJECT : Longhorn Army Ammunition

Fax Transmittal Memo

# of Pages 1	
To: POTEET	From: LIGON
Co.:	Co.:
Dept.:	Phone # 4527
Fax # 24469	Fax #

DMFX14

You requested assistance (FAX dated 02/05/97) in establishing effluent guidelines for the discharge of treated groundwater from the above-referenced facility. A list of potential pollutants was provided. Effluent limitations for mercury were sent to you in an earlier memo dated February 19, 1997. Water quality criteria had to be developed by Dr. B.J. Lee, Toxicity Evaluation Team - Water Planning and Assessment Division, for the remaining pollutants. The following effluent limitations were calculated utilizing those criteria:

POLLUTANT	Units are (µg/l)		MAL
	Daily Avg	Dly Max	
Nitrobenzene (CAS 98-95-3)	100	213	10
Antimony (CAS 7440-36-0)	34	72	60
2,3-Dinitrotoluene (CAS 121-14-2)	2.6	5.6	**
2,3-Dinitrotoluene (CAS 602-01-7)	19	39	**
2-Nitrotoluene (CAS 88-72-2)	623	1313	**
3-Nitrotoluene (CAS 99-08-1)	424	898	**
4-Nitrotoluene (CAS 99-99-0)	215	455	**
1,3-Dinitrobenzene (CAS 99-65-0)	21	43	**
1,3,5-Trinitrobenzene (CAS 99-35-4)	10.4	22	**
2,4,6-Trinitrotoluene (CAS 118-96-7)	55	117	**
RDX (CAS 121-82-4)	18.5	39	**
HMX (CAS 2691-41-0)	849	1796	**
(Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetraazocine)			
Tetryl (CAS 479-45-8)	*	*	**
4-Amino-2,6-Dinitrotoluene (CAS 19406-51-0)	74	157	**
2-Amino-4,6-dinitrotoluene (CAS 35572-78-2)	11.3	24	**

* Not classified as a human carcinogen. No toxic criteria available.

** MAL's are not readily available. TNRCC - Houston laboratory is assisting. I will forward this information as soon as it becomes available.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

018596

April 7, 1997

VIA HAND DELIVERY

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plants
Att.: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Early Interim Remedial Action at Burning Ground No. 3
Disposal of Treated Source Material

Dear Mr. McPherson:

This letter is in response to an inquiry made at the March 11, 1996 Technical Review Committee meeting. Specifically, a inquiry was made regarding whether or not source material from Burning Ground No. 3 could be land disposed back to the Burning Ground No. 3 after receiving treatment in the low temperature thermal desorber unit. The Environmental Protection Agency's (EPA) evaluation of this request and position are as follows:

- The May 1995 *Record of Decision for the Interim Remedial Action at Burning Ground No. 3* (ROD) states that "the source material was contaminated with spent halogenated solvents (F002) from nonspecific sources" and that "the source material is regulated under Resource Conservation and Recovery Act (RCRA) 40 CFR 261, Subpart D." Pursuant to 40 CFR §268.30 (c), "the F001-F005 solvent waste which are contaminated soil and debris resulting from a response action taken under section 104 or 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) . . . and the residues from treating these wastes are prohibited from land disposal." However, pursuant to 40 CFR §268.30(d)(1), the above requirement [40 CFR §268.30(c)] does not apply if the wastes meet the standards of Subpart D (Treatment Standards) of this part (See table 1 - enclosed). Pursuant to a conversation with Ms. Terry Sykes, RCRA Team Leader in the Legal Branch of EPA's Enforcement Division, treatment standards must be met for land disposal in a Subtitle C landfill.
- The ROD states that "Metals and other treatment residuals that are hazardous wastes will be managed in accordance with RCRA (40 CFR 261)." Pursuant to 40 CFR §268.7 (Waste analysis and record keeping), "if a generator's waste is listed in 40 CFR part 261, subpart D, the generator must test his waste, or test an extract using test method 1311



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James A McPherson

Page 2

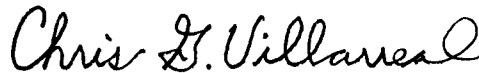
April 7, 1997

018597

(the Toxicity Characteristic Leaching Procedure . . .), or use knowledge of the waste, to determine if the waste is restricted from land disposal under this part." Additionally, "if a generator's waste exhibits one or more of the characteristics set out at 40 CFR part 261, subpart C, the generator must test his waste, or test an extract using test method 1311 (the Toxicity Characteristic Leaching Procedure . . .), or use knowledge of the waste, to determine if the waste is restricted from land disposal under this part." Pursuant to 40 CFR §268.40 (a), "A waste identified in the table 'Treatment Standards for Hazardous Wastes' may be land disposed only if it meets the requirements found in the table."

The EPA has reviewed the results of the waste feed and treated soil samples taken from the Burning Ground No. 3 soil treatment plant between February 12, 1997 and March 8, 1997. Based upon these results, the treated soil is meeting the F002 land disposal treatment standards. However, pursuant to the land disposal restrictions, residuals generated from the treatment of debris contaminated with listed waste are still hazardous waste by virtue of the derived-from rule and would be subject to the hazardous waste management system. Therefore, because the source material from the Burning Ground No. 3 is contaminated with listed waste (F002), residuals generated from the treatment of the source material cannot be land disposed at the Burning Ground No. 3. If you have any questions, please contact me at (214) 665-6758.

Sincerely,



Chris G. Villarreal
Project Manager

Enclosure

cc: Warren Sayes, COE Eastern Area Office (CESWF-AD-E)
Yolane Hartsfield, COE Tulsa District (CESWT-PP-ME)
Diane Poteet, TNRCC (MC-143)

018598

TABLE 1
TREATMENT STANDARDS FOR HAZARDOUS WASTES^A

REGULATED HAZARDOUS CONSTITUENT	NONWASTEWATERS WASTE CODE F002 (mg/kg) ^B	MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC REGULATORY LEVEL (mg/L)
Acetone	160	-----
Arsenic	-----	0.5
Barium	-----	100
Benzene	10	0.5
Cadmium	-----	1.0
Chloroform	-----	6.0
Chromium	-----	5.0
1, 2-Dichloroethane	-----	0.5
1, 1-Dichloroethene (1, 1-Dichloroethylene)	-----	0.7
2, 4-Dinitrotoluene	-----	0.13
Ethylbenzene	10	-----
Lead	-----	5.0
Mercury	-----	0.2
Methylene chloride	30	-----
Selenium	-----	1.0
Silver	-----	5.0
Tetrachloroethylene	6.0	0.7
Toluene	10	-----
1, 1, 1-Trichloroethane	6.0	-----
Trichloroethylene	6.0	0.5
Vinyl chloride	-----	0.2
Xylenes-mixed isomers ^C	30	-----

^A Values taken from 40 CFR §268.40 & 40 CFR §261.24

^B All concentrations standards for nonwastewaters are based on analysis of grab samples.

^C Sum of o-, m-, and p-xylene concentrations.

Meeting with Texas' Trustees
Longhorn Army Ammunition Plant
8 April 1997

018599

Texas Natural Resource Conservation Commission, Austin, Texas

1. The following is a list of participants:

Diane Hyatt, GLO/NRDA
Ira Nathan, LHAAP
David Tolbert, LHAAP
Karen Q. Myers, TPWD
Diane Poteet, TNRCC
Yolane Hartsfield, USACE

Michael Moore, TNRCC/SIS
Ginny King, TNRCC/NRTP
Richard Seiler, TNRCC
Don Pitts, TPWD
Chris Villarreal, EPA

2. The meeting was brought to order by Mr. David Tolbert and general introductions were made.

3. Mr. Tolbert distributed the Executive Summary dated 4 April 1997 to the assembled and using a map of Longhorn AAP discussed the status of the various sites, along with historical information to the Texas' Trustees. Trustees' questions were answered by Mr. Tolbert, Mr. Nathan, Ms. Hartsfield, Diane Poteet, Michael Moore, and Chris Villarreal.

4. Ms. King stated that the Trustees wanted to become more involved in the environmental work on-going at LHAAP. She stated that Longhorn AAP, Lonestar AAP, Air Force Plant #4, and Pantex were the four sites currently within the Trustees' purview. Ms. King stated that the Trustees' interest is in ultimate natural resource losses to the State of Texas and compensation to the State for such lost resources due to an historical spill, leak, or release of hazardous materials into the environment. The Trustees' evaluation is performed after the remedial action is accomplished. With the comprehensive remediation on-going at Longhorn AAP and the Plant's proactive approach, the Trustees' expressed that they do not anticipate any problems. Ms. King stated that she would be the Trustees' single point of contact for the Plant.

5. Trustees stated that they wanted to become members of the Longhorn AAP Team and would be furnishing to the Plant a draft Memorandum of Understanding/Agreement. Longhorn AAP personnel made no commitments of any kind.

6. There being no further discussion, the meeting was adjourned.

Yolane Hartsfield
Project Manager, Tulsa District USACE

RATING ELEMENT	(Weighted Percentage)	OUTSTANDING 100	EXCELLENT 99-90	GOOD 89-80	ABOVE SATISFACTORY 79-71	SATISFACTORY OR BELOW 70-0
1. WORK PERFORMANCE	(25%)	100				
2. QUALITY CONTROL	(20%)	100				
3. BUSINESS MANAGEMENT	(20%)		95			
4. TECHNICAL MANAGEMENT	(20%)	100				
5. SAFETY	(15%)	100				
PERCENTAGE RANGE OF AWARD FEE BASED ON SCORE:		100%	97% - 67%	63% - 33%	30% - 3%	0%

NOTES:

Work performed this period includes construction of Interceptor Collector Trenches, treatment and discharge of contaminated water thru the Ground Water Treatment Plant, excavation, hauling, and treatment of soil source material from Burning Ground # 3 and hauling & disposal of treated soil at Landfill # 16.

REMARKS

- Work performance has greatly improved as evidenced by the large amount of daily production rate of treated soil being run thru the thermal desorber units and the large amount of soil being excavated, hauled, treated, and disposed of. Construction of ICT's is exceptional in quality and quantity.
- Quality control has certainly improved with the addition of Quality Control Inspectors and their daily involvement in the construction work being performed. All Q.C. activities are properly documented and reports are accurate and submitted to Government on time daily.
- The contractor is taking steps to improve the Cost and Schedule Reports and has shown a sincere interest to make improvements in this area. Several persons are daily working on this issue and an accurate cost and schedule report is now being received as required.
- Radian International, LLC has worked to improve the Technical Management at the Site and their dedication to making improvement in this area is starting to show. Technical management is now outstanding in all aspects.
- This Contractor has a very outstanding safety record at this Project. No injuries or lost time accidents have happened in over four (4) years. The entire project management staff is completely dedicated to insuring this jobsite is accident free at all times. Daily Safety Meetings are held by the Contractor and all subcontractors on the jobsite as well as the Radian International, LLC employees are required to attend these meetings. Safety records are well documented and Daily Safety Meeting reports and attendance sheets are submitted each day to the Government.

Rater's Signature: Oscar Linebaugh, Jr. Date: October 15, 1997

Concur ☒

Do Not Concur ☐

Explanation _____

Dudley C. Beene, II
 Dudley C. Beene, II
 Area Engineer
 Eastern Area Office

022162

**COE/Contractor/LHAAP Meeting Minutes
Longhorn AAP
30 October 1997**

1. The participants were:

Ira Nathan, LHAAP
David Tolbert, LHAAP
Oscar Linebaugh, EAO
Bryan Smith, Radian

Chris Edgemon, Radian
Cliff Murray, Tulsa District
Yolane Hartsfield, Tulsa District

2. New carbon units installed and running. Older units have been removed from service, waste carbon analyzed and awaiting results to be disposed properly, with units being returned to vendor.

3. The schedule for the ICT wells is being maintained. The last ICT well has been developed. The wells are scheduled to go on-line in January/February 1998. Under miscellaneous electrical contract for collection system, Radian is relocating and reusing LAAP power poles, transformers, and wiring. Cost savings to be calculated and reported at a later date.

4. Drums. Radian responded that they continue work to process all remaining drums and their contents. Have processed about 240 of the older drums. All 400 (total) will be emptied by the end of this week. Drum cutting/demolition to begin next week for disposal.

5. Monitoring Well 11. Extension in and being installed by this Friday. Then Radian will backfill area around wellhead and rebuild concrete pad.

6. The LTTDs have processed about 29,300 cy of soil (of which 1030 is ICT soils material). Excavation activity completed with remaining soils staged inside tent awaiting treatment. When finished Radian will demobilize, dismantle LTTDs for shipment off-site. Should be gone by Thanksgiving. Radian will remove soils to liner in "dirty" soil tent and treat, and grid and test soils in "clean" soil tent to confirm absence of contamination.

7. Roads at Site 16 are operational. Still need to add gravel to some road surfaces. Large storage tank installed with painters expected this date. Also pumps arrived and electrical work is underway. When contractors' off site, Radian will install fabric on-hand and cover with iron ore gravel. Expect to use 5 or 6 loads of gravel.

8. The biotesting of effluent from the GWTP was successful. The fish lived (at least until the test was completed). Written test results will be hand delivered to regulators at next Monthly Managers' Meeting in Dallas on 12 November.

COE/Contractor/LHAAP Meeting Minutes
Longhorn AAP
16 December 1997

1. The participants were

Ira Nathan, LHAAP
David Tolbert, LHAAP
Dudley Beene, EAO
Oscar Linebaugh, EAO
Chris Edgmon, Radian
Bryan C. Smith, Radian

Bud Jones, TNRCC
Glen Osburn, OWC
Bill Corrigan, CES

2. At the request of the TNRCC, Radian will reseed and fertilize native grasses on the top of the Unlined Evaporation Pond as part of the site restoration activity.

3. Liner debris from the excavation of the soil treatment pad is about 70% complete. This material is being transported to OHM at Site 16 for their disposal during the construction of the landfill cap.

4. The letter from Calgon Carbon Corporation was received by Radian on February 27, 1998. This fax memorandum states that activated carbon will adsorb dioxin. Isotherms for naphthalene and pentachlorophenol were attached to indicate expected adsorption rates.

5. The 7-day Toxicity Testing conducted by Dr. West's office for the water from the Harrison Bayou discharge pipe passed. The final report will be submitted in 21 days.

6. All the ICT wells in the Burning Ground 3 are connected into the header system. Electrical and instrumentation connections are also complete. Calibration of the system and the level controls is currently underway.

7. Approval was given to resume water discharge into Harrison Bayou from Radian's Groundwater Treatment Plant. Radian will sample the water at the discharge point and will have it analyzed for dioxin. Sample will be sent to Southwest Laboratories in Broken Arrow, Oklahoma.

8. The date for the Proof of Performance Testing has been set at March 24, 1998. The testing will be performed at the GWTP prior to the start of the Operation and Maintenance period. EPA and TNRCC will be notified by LHAAP and will be in attendance.

9. Roll of boxes from Baker Tanks have been delivered to Area 29 for Sverdrup's use during the drilling activity.

MONTHLY AWARD FEE EVALUATION CONTRACTOR: Radian International, LLC DELIVERY ORDER NO.: 000200146884
OBJECT DESCRIPTION: Burning Ground # 3 - Longhorn Army Ammo. Plant RATING PERIOD: December 1997
Karnack, Texas

RATING ELEMENT	(Weighted Percentage)	OUTSTANDING 100	EXCELLENT 99-90	GOOD 89-80	ABOVE SATISFACTORY 79-71	SATISFACTORY OR BELOW 70-0
1. WORK PERFORMANCE	(25%)	100				
2. QUALITY CONTROL	(20%)	100				
3. BUSINESS MANAGEMENT	(20%)		98			
4. TECHNICAL MANAGEMENT	(20%)	100				
5. SAFETY	(15%)	100				
PERCENTAGE RANGE OF AWARD FEE BASED ON SCORE:		100%	97% - 67%	63% - 33%	30% - 3%	0%

NOTES:

Work completed this rating period includes the completion of soil treatment by thermal desorption method. Completion of water treatment facility at Site 16 for the treatment of water from the extraction wells at Site 16, and treatment of water from frac tanks and Burning Ground # 3.

REMARKS

1. Work performance continues to be exceptional. All phases of the work is very carefully planned and executed. Proper schedules for receiving and installing materials to be incorporated into the project is always a top priority of the workmen to insure a complete high quality end product upon completion of the project.
2. The Quality Control functions are always exceptional by this Contractor. Daily Quality Control reports are always thorough, accurate and are always submitted on time. The three phase inspection system of Corps of Engineers is always utilized by this Contractor.
3. During this rating period the Contractor has done an excellent job in the management of the Project. The billing vouchers are now accurate and are being submitted on time. The MIS utilization has been brought up to standards required by Corps of Engineers and the cost and schedule reports now appear to be accurate and timely submitted by the Contractor.
4. Technical Management continues to be exceptional as evidenced by the completion of the thermal desorption work without any excess air emissions as required by the Air Monitoring Plans. All water being treated by the Ground Water Treatment Plant has met discharge criteria and the plant continues to function without any problems or "shut downs".
5. The Safety phase of this project has always been exceptional and continues to be very much exceptional as evidenced by the Safety Award presented by Radian International, LLC by the Southwestern Division Commander in Division Headquarters in December 1997 for this firms work performance of 1600 days without a lost time accident. Mr. Chris Edmon, Site Manager for Radian International, LLC is certainly deserving of credit for this worthwhile accomplishment.

Rater's Signature: Oscar Linebaugh, Jr. Date: 9 JANUARY 1998

Concur _____

Do Not Concur _____

Explanation _____

024580



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

August 31, 1999

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plants
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Remedial Action Completion
Early Interim Remedial Action at Burning Ground No. 3 and
Early Interim Remedial Action at Landfills 12 and 16

Dear Mr. McPherson:

This letter is to document that the U.S. Environmental Protection Agency (EPA) finds that the Interim Remedial Actions at the Burning Ground No. 3 and Landfills 12 and 16 are complete. The EPA defines completion of an operable unit remedial action as: conclusion of construction activities, performance of a final inspection, determination that the remedy is operational and functional, and preparation of an operable unit Remedial Action Report.

In regards to the Early Interim Remedial Action at Burning Ground No. 3, major components of the selected remedy included:

- Excavation and treatment of source material using low temperature thermal desorption and catalytic oxidation for the off-gas, and
- Extraction and treatment of contaminated shallow ground water using organic air stripping and off-gas treatment and metals precipitation.

The full-scale source treatment operation occurred from February through December 1997. The *Cost and Performance Report Low Temperature Thermal Desorption at Longhorn Army Ammunition Plant, Burning Ground No. 3* (U.S. Army Corps of Engineers, January 1999), which included all the elements required in a Remedial Action Report, has been reviewed and was approved by EPA on April 19, 1999. The ground water treatment plant has been operational since January 1997 and is continuing to operate.

024581

In regards to the Early Interim Remedial Action at Landfills 12 and 16, the selected remedy consisted of the construction of multilayer caps which included the following components:

- Foundation soil layer,
- Sodium bentonite geocomposite liner,
- Geosynthetic membrane liner,
- Final soil cover, and
- Perimeter berms and drainage swales.

The landfill caps and the final inspections were completed in November 1998. Documentation of the landfill cap construction activities is provided in the *Final Construction Completion Report Interim Remedial Action Landfills 12 and 16 Cap Construction* (OHM Remediation Services Corporation, December 1998).

If you have any questions, feel free to contact Mr. Chris G. Villarreal of my staff at (214) 665-6758.

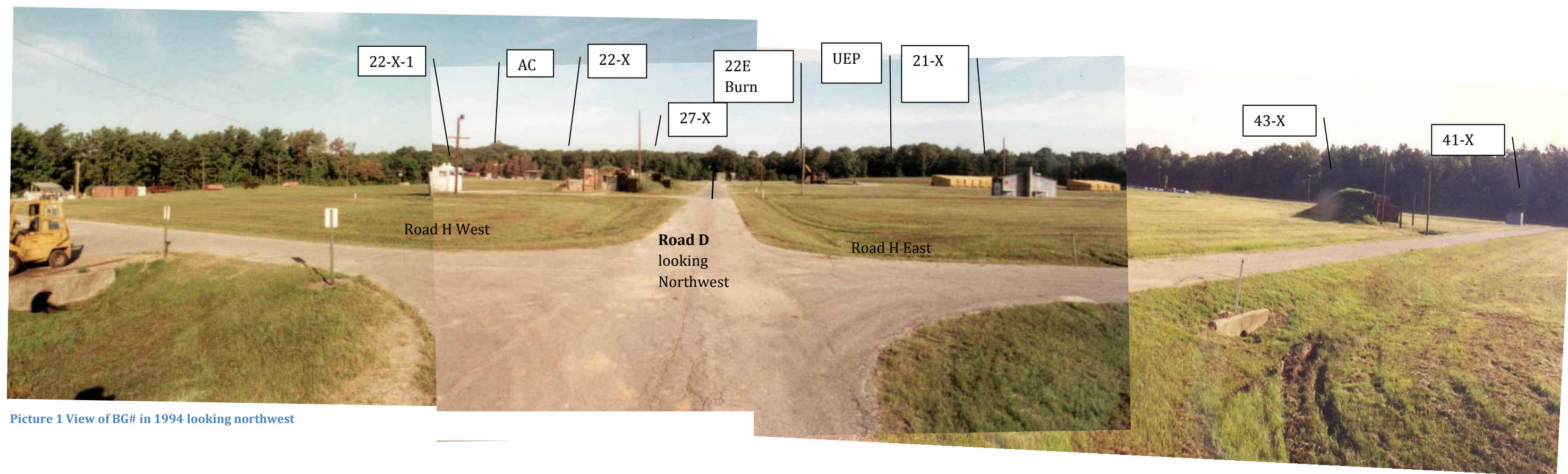
Sincerely,



William K. Honker
Chief, AR/OK/ TX Branch
Superfund Division

Appendix G

Photographs of IRA Construction Field Activities



Picture 1 View of BG# in 1994 looking northwest



Picture 2 Excavation North of ACD

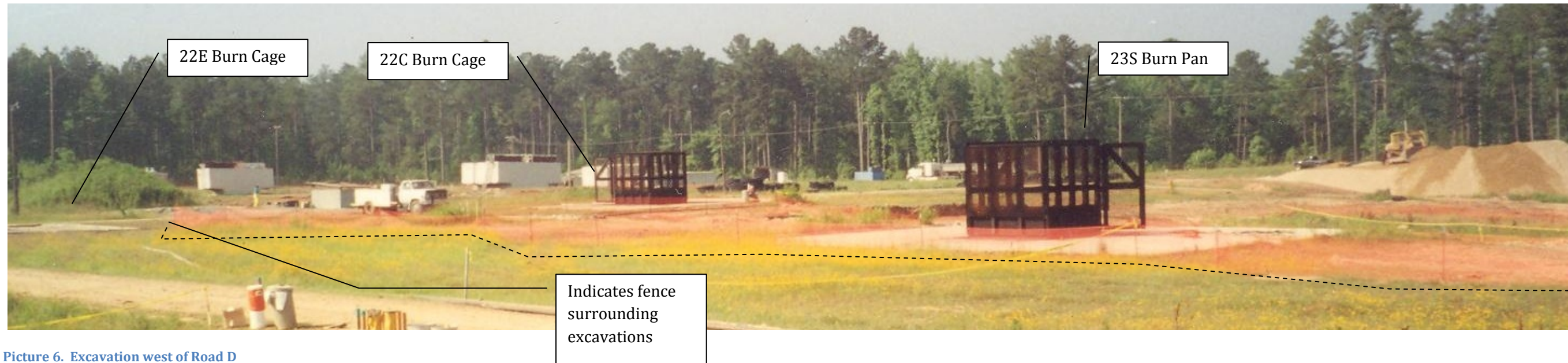


Picture 3. June 10 1997 Excavations West & East of Road D & North of ACD

Picture 4 Along Road D looking North



Picture 5 Along Road D looking South



Picture 6. Excavation west of Road D



Picture 7 More Excavations West Of Road D



Picture 8 Excavations East of ACD



Picture 9 Excavation by Road C with soil screen



Picture 10 East of Rd D Looking South



Picture 11 Road C Looking South



Picture 12 East of Road D Temporary Water Storage in front of BC 23S



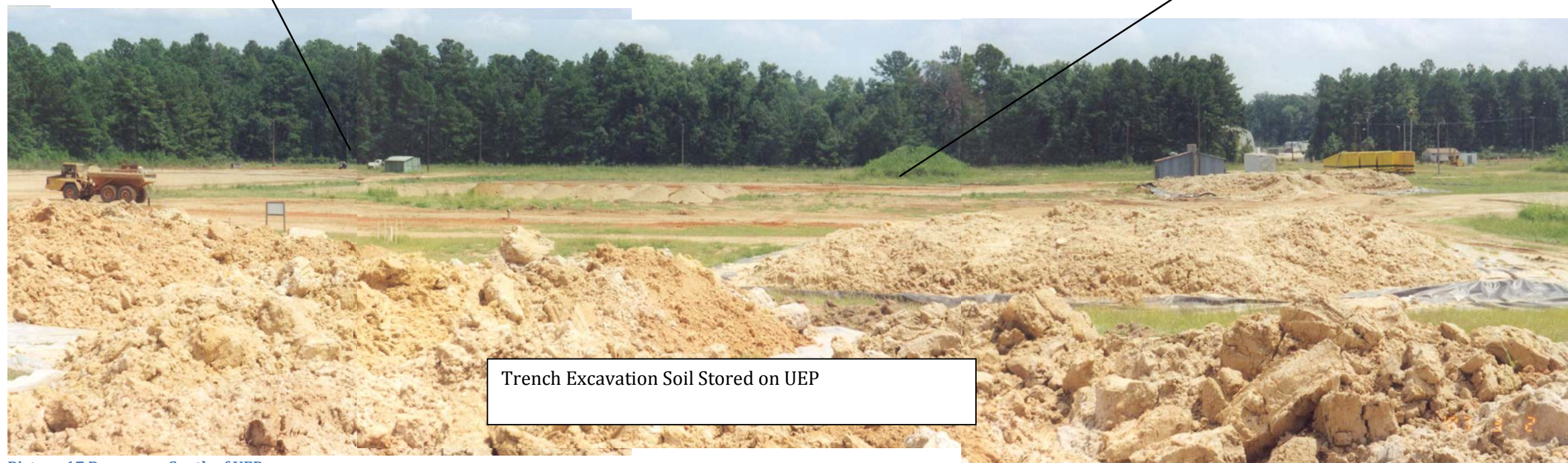
Picture 14 East of ACD & North of HEW



Picture 15 Road C Excavation looking East



Picture 16 Looking South East of ACD



Trench Excavation Soil Stored on UEP

Picture 17 Panorama South of UEP



Picture 19 Munitions Found Near Heavy Propellant Pit



Picture 18 Burn Cage Button Bomb from near 22E



Picture 21 ICT 13 looking West
Shows offset &
Piezometers



Picture 22 Panorama Looking East at ACD Excavation

Appendix H

Table of ICT information Available from Quality Control Reports

IRA ICT QC Notes

ICT Construction/Excavation Length Depth & Volumes from Inquip QC Report

(checked against As-built Drawings)

ICT Summary

ICT 1					
Date	Station	Depth	Width	Vertical Area	Volume
6/13/1997	00+00	17	2		
	00+20	17.5	2	345	690.00
	00+40	18	2	355	710.00
	00+60	19	2	370	740.00
	00+80	18.5	2	375	750.00
	01+00	18.5	2	370	740.00
	01+25	18	2	456.25	912.50
Matches Drawings					4,542.50

Total (ft3) 298,611

Total (yd3) 11,060

Fluff factor multiply

Ordinary (yd3) 13,824.58

Clay (yd3) 15,815.31

Mixed (yd3) 14,819.95

Total Length 5,075

length of ICT (ft) 125

ICT 02					
Date	Station	Depth	Width	Vertical Area	Volume
6/16/1997	00+00	23	2		
	00+25	24	2	587.5	1,175.00
	00+50	25	2	612.5	1,225.00
	00+75	26	2	637.5	1,275.00
	01+00	27	2	662.5	1,325.00
	01+15	28	2	412.5	825.00
	01+25	27.5	2	277.5	555.00
	01+50	27	2	681.25	1,362.50
	01+75	26.5	2	668.75	1,337.50
	02+00	26	2	656.25	1,312.50
	02+25	26	2	650	1,300.00
One extra station 02+25					11,692.50

length of ICT (ft) 125

ICT 03					
Date	Station	Depth	Width	Vertical Area	Volume
6/17/1997	02+00	31	2		
	01+80	31.5	2	625	1,250.00
	01+60	32.5	2	640	1,280.00
	01+40	33.5	2	660	1,320.00
	01+20	34.5	2	680	1,360.00
	01+00	35	2	695	1,390.00
	00+80	34	2	690	1,380.00
6/18/1997	00+60	340	2	680	1,360.00
	00+40	33.5	2	675	1,350.00
	00+20	33.5	2	670	1,340.00
	00+00	33	2	665	1,330.00
Matches Drawings					13,360.00

length of ICT (ft) 200

IRA ICT QC Notes

ICT 04					
Date	Station	Depth	Width	Area	Volume
5/15/1997	00+00	33	2		
	00+25	34	2	837.5	1,675.00
	00+50	35	2	862.5	1,725.00
	00+75	34.5	2	868.8	1,737.60
	01+00	34.5	2	862.5	1,725.00
Matches Drawings					6,862.60

length of ICT (ft) 100

ICT 05					
Date	Station	Depth	Width	Vertical Area	Volume
6/12/1997	00+00	30.5	2		
	00+25	31.5	2	775	1,550.00
	00+50	32.5	2	800	1,600.00
	00+75	33	2	818.75	1,637.50
	01+00	34	2	837.5	1,675.00
Matches Drawings					6,462.50

length of ICT (ft) 100

ICT 06					
Date	Station	Depth	Width	Vertical Area	Volume
6/11/1997	00+00	38.5	2		
	00+25	38.5	2	962.5	1,925.00
	00+50	39	2	968.75	1,937.50
	00+75	38.5	2	968.75	1,937.50
	01+00	38	2	956.25	1,912.50
Matches Drawings					7,712.50

length of ICT (ft) 100

ICT 07					
Date	Station	Depth	Width	Vertical Area	Volume
5/27/1997	00+00	26.5	2		
	00+25	26.5	2	662.5	1,325.00
	00+50	27	2	668.07	1,336.14
	00+75	27	2	675	1,350.00
	01+00	27.5	2	681.3	1,362.60
5/28/1997	01+25	27	2	681.3	1,362.60
	01+50	27	2	675	1,350.00
	01+75	26.5	2	668.8	1,337.60
	02+00	26.5	2	662.5	1,325.00
Matches Drawings					10,748.94

length of ICT (ft) 200

IRA ICT QC Notes

ICT 08					
Date	Station	Depth	Width	Vertical Area	Volume
5/21/1997	02+00	40	2		
	01+75	40	2	1000	2,000.00
5/22/1997	01+50	40.5	2	1006.3	2,012.60
	01+25	40.5	2	1012.5	2,025.00
	01+00	41	2	1018.8	2,037.60
	00+75	40.5	2	1018.8	2,037.60
5/23/1997	00+50	40.5	2	1012.5	2,025.00
	00+25	40	2	1006.3	2,012.60
	00+00	40	2	1000	2,000.00
Matches Drawings					16,150.40

length of ICT (ft) 200

ICT 09					
Date	Station	Depth	Width	Vertical Area	Volume
5/19/1997	02+00	40	2		
	01+75	40.5	2	1006.3	2,012.60
	01+50	41	2	1018.8	2,037.60
5/20/1997	01+25	41.5	2	1031.3	2,062.60
	01+00	42	2	1043.8	2,087.60
	00+75	41.5	2	1043.8	2,087.60
5/21/1997	00+50	41	2	1031.3	2,062.60
	00+25	40.5	2	1018.8	2,037.60
	00+00	40	2	1006.3	2,012.60
Matches Drawings					16,400.80

length of ICT (ft) 200

ICT 10					
Date	Station	Depth	Width	Vertical Area	Volume
5/8/1997	00+00	40.0	2.0		
	00+25	40.5	2.0	1006.3	2,012.60
5/9/1997	00+50	41.0	2.0	1018.8	2,037.60
	00+75	41.5	2.0	1031.3	2,062.60
	01+00	42.0	2.0	1043.8	2,087.60
5/10/1997	01+25	41.5	2.0	1043.8	2,087.60
missing stations 01+25-02+00					10,288.00

length of ICT (ft) 125

IRA ICT QC Notes

ICT 11					
Date	Station	Depth	Width	Vertical Area	Volume
5/16/1997	00+00	38.5	2		
	00+25	39.5	2	975	1,950.00
	00+50	41.5	2	1012.5	2,025.00
	00+75	39.5	2	1012.5	2,025.00
	01+00	38.5	2	975	1,950.00
5/14/1997	01+25	41.5	2		-
	01+50	41	2	1031.3	2,062.60
	01+75	40.5	2	1018.8	2,037.60
	02+00	40	2	1006.3	2,012.60
Exceeds stations in the drawings					14,062.80

length of ICT (ft) 200

ICT 12-1					
Date	Station	Depth	Width	Vertical Area	Volume
7/1/1997	08+00	28	2		
	08+25	28.5	2	706.25	1,412.50
	08+50	29.5	2	725	1,450.00
	08+75	30	2	743.75	1,487.50
	09+00	31	2	762.5	1,525.00
7/2/1997	09+25	30.5	2	768.75	1,537.50
	09+50	30	2	756.25	1,512.50
	09+75	29.5	2	743.75	1,487.50
	10+00	28.5	2	725	1,450.00
Matches Drawings					11,862.50

length of ICT (ft) 200

ICT 12-2					
Date	Station	Depth	Width	Vertical Area	Volume
6/30/1997	06+00	32	2		
	06+25	33	2	812.5	1,625.00
	06+50	33.5	2	831.25	1,662.50
	06+75	33.5	2	837.5	1,675.00
	07+00	33	2	831.25	1,662.50
	07+25	32.5	2	828.75	1,657.50
	07+50	30	2	781.25	1,562.50
	07+75	28.5	2	731.25	1,462.50
	08+00	27	2	693.75	1,387.50
Matches Drawings					12,695.00

length of ICT (ft) 200

called ICT 12C

IRA ICT QC Notes

ICT 12-3					
Date	Station	Depth	Width	Vertical Area	Volume
6/27/1997	04+00	30	2		
	04+25	30	2	750	1,500.00
	04+50	30.5	2	756.25	1,512.50
	04+75	31.5	2	775	1,550.00
	05+00	32	2	793.75	1,587.50
	05+25	32	2	800	1,600.00
6/28/1997	05+50	32	2	800	1,600.00
	05+75	31.5	2	793.75	1,587.50
	06+00	31	2	781.25	1,562.50
Matches Drawings					12,500.00

length of ICT (ft) 200

called ICT 12B

ICT 12-4					
Date	Station	Depth	Width	Vertical Area	Volume
7/8/1997	04+00	32.5	2		
	03+75	32	2	806.25	1,612.50
	03+50	31.5	2	793.75	1,587.50
	03+25	31	2	781.25	1,562.50
	03+00	31	2	775	1,550.00
	02+75	29.5	2	756.25	1,512.50
7/9/1997	02+50	29	2	731.25	1,462.50
	02+25	28.5	2	718.75	1,437.50
	02+00	28	2	706.25	1,412.50
Matches Drawings					12,137.50

length of ICT (ft) 200

called ICT 12A-12B

ICT 12-5					
Date	Station	Depth	Width	Vertical Area	Volume
7/10/1997	02+00	28	2		
	01+75	28.5	2	706.25	1,412.50
	01+50	28.5	2	712.5	1,425.00
	01+25	29	2	718.75	1,437.50
	01+00	29	2	725	1,450.00
7/11/1997	00+75	28.5	2	718.75	1,437.50
	00+50	28	2	706.25	1,412.50
	00+25	26	2	675	1,350.00
	00+00	25	2	637.5	1,275.00
Matches Drawings					11,200.00

length of ICT (ft) 200

called ICT 12A

IRA ICT QC Notes

ICT 13-1					
Date	Station	Depth	Width	Vertical Area	Volume
6/19/1997	12+50	29	2		
	12+25	30	2	737.5	1,475.00
	12+00	29	2	737.5	1,475.00
	11+75	29	2	725	1,450.00
6/20/1997	11+50	28.5	2	718.75	1,437.50
	11+25	28	2	706.25	1,412.50
Matches Drawings					7,250.00

length of ICT (ft) 125

called ICT 13C

ICT 13-2					
Date	Station	Depth	Width	Vertical Area	Volume
7/21/1997	11+25	27	2		
	11+00	27	2	675	1,350.00
	10+75	27.5	2	681.25	1,362.50
	10+50	28	2	693.75	1,387.50
7/22/1997	10+25	28.5	2	706.25	1,412.50
	10+00	28	2	706.25	1,412.50
	09+75	27.5	2	639.75	1,279.50
	09+50	27	2	681.25	1,362.50
	09+25	26	2	662.5	1,325.00
Matches Drawings					10,892.00

length of ICT (ft) 200

called ICT 13C

ICT 13-3					
Date	Station	Depth	Width	Vertical Area	Volume
6/23/1997	09+25	25	2		
	09+00	24.5	2	618.75	1,237.50
	08+75	24.5	2	612.5	1,225.00
	08+50	24.5	2	612.5	1,225.00
	08+25	25	2	618.75	1,237.50
	08+00	24.5	2	618.75	1,237.50
	07+75	23.5	2	600	1,200.00
	07+50	22.5	2	575	1,150.00
	07+25	22	2	556.25	1,112.50
Matches Drawings					9,625.00

length of ICT (ft) 200

called ICT 13C-13B

IRA ICT QC Notes

ICT 13-4					
Date	Station	Depth	Width	Vertical Area	Volume
6/24/1997	07+25	21	2		
	07+00	21.5	2	531.25	1,062.50
6/25/1997	06+75	23	2	556.25	1,112.50
	06+50	23	2	575	1,150.00
	06+25	24	2	587.5	1,175.00
	06+00	23.5	2	593.75	1,187.50
	05+75	23	2	581.25	1,162.50
	05+50	22.5	2	568.75	1,137.50
	05+25	22	2	556.25	1,112.50
Matches Drawings					9,100.00

length of ICT (ft) 200

called ICT 13B

ICT 13-5					
Date	Station	Depth	Width	Vertical Area	Volume
7/18/1997	03+25	22	2		
	03+50	22.5	2	556.25	1,112.50
	03+75	23	2	568.75	1,137.50
	04+00	23.5	2	581.25	1,162.50
	04+25	24.5	2	600	1,200.00
	04+50	24	2	606.25	1,212.50
	04+75	24	2	600	1,200.00
	05+00	23	2	587.5	1,175.00
	05+25	22.5	2	568.75	1,137.50
Matches Drawings					9,337.50

length of ICT (ft) 200

called ICT 13A

ICT 13-6					
Date	Station	Depth	Width	Vertical Area	Volume
7/15/1997	01+25	26	2		
	01+50	26	2	650	1,300.00
	01+75	26.5	2	656.25	1,312.50
	02+00	27	2	668.75	1,337.50
7/16/1997	02+25	28	2	687.5	1,375.00
	02+50	27	2	687.5	1,375.00
	02+75	26.5	2	668.75	1,337.50
	03+00	26.5	2	662.5	1,325.00
	03+25	26	2	656.25	1,312.50
Matches Drawings					10,675.00

length of ICT (ft) 200

called ICT 13A

IRA ICT QC Notes

ICT 13-7					
Date	Station	Depth	Width	Vertical Area	Volume
7/12/1997	00+00	26	2		
	00+25	27	2	662.5	1,325.00
	00+50	27	2	675	1,350.00
7/14/1997	00+75	26	2	662.5	1,325.00
	01+00	26	2	650	1,300.00
	01+25	26	2	650	1,300.00
Matches Drawings					6,600.00

length of ICT (ft) 125

called ICT 13A

ICT 14-1					
Date	Station	Depth	Width	Vertical Area	Volume
5/28/1997	10+00	39	2		
	09+75	39	2	975	1,950.00
5/29/1997	09+50	39.5	2	981.25	1,962.50
	09+25	40	2	993.75	1,987.50
	09+00	41	2	1012.5	2,025.00
	08+75	40	2	1012.5	2,025.00
5/30/1997	08+50	39.5	2	993.75	1,987.50
5/31/1997	08+25	39	2	981.25	1,962.50
	08+00	39	2	975	1,950.00
Matches Drawings					15,850.00

length of ICT (ft) 200

Called ICT 14C

ICT 14-2					
Date	Station	Depth	Width	Vertical Area	Volume
6/2/1997	08+00	40	2		
	07+75	40	2	1000	2,000.00
	07+50	40.5	2	1006.25	2,012.50
	07+25	41	2	1018.75	2,037.50
	07+00	41.5	2	1031.25	2,062.50
	06+75	41	2	1031.3	2,062.60
	06+50	40.5	2	1018.8	2,037.60
6/3/1997	06+25	39	2	993.75	1,987.50
	06+00	39	2	975	1,950.00
Matches Drawings					16,150.20

length of ICT (ft) 200

Called ICT 14C

IRA ICT QC Notes

ICT 14-3					
Date	Station	Depth	Width	Vertical Area	Volume
6/3/1997	06+00	39	2		
	05+75	39.5	2	981.3	1,962.60
6/4/1997	05+50	39.5	2	987.5	1,975.00
	05+25	40	2	993.75	1,987.50
	05+00	40.5	2	1006.25	2,012.50
	04+75	40	2	1006.25	2,012.50
	04+50	39.5	2	993.75	1,987.50
Matches Drawings					11,937.60

length of ICT (ft) 200

ICT 14-4					
Date	Station	Depth	Width	Vertical Area	Volume
6/6/1997	03+50	39.5	2		
	03+25	40	2	993.75	1,987.50
	03+00	40.5	2	1006.25	2,012.50
	02+75	40	2	1006.25	2,012.50
	02+50	39.5	2	993.75	1,987.50
	02+25	39	2	981.25	1,962.50
	02+00	38.5	2	968.75	1,937.50
Matches Drawings					11,900.00

length of ICT (ft) 350

Missing stations 04+50-03+50

ICT 14-5					
Date	Station	Depth	Width	Vertical Area	Volume
6/9/1997	02+00	38.5	2		
	01+75	38.5	2	962.5	1,925.00
	01+50	39	2	968.75	1,937.50
6/10/1997	01+25	39	2	975	1,950.00
	01+00	39	2	975	1,950.00
	00+75	38.5	2	968.75	1,937.50
	00+50	38	2	956.25	1,912.50
	00+35	38	2	570	1,140.00
<i>Missing stations 00+35-00+00</i>					12,752.50

length of ICT (ft) 200

Appendix I

ICT As-Builts Drawings

RADIAN
INTERNATIONAL LLC

To: Mr. Dudley C. Beene, II
Mr. Oscar Linebaugh

From: Bryan Smith
Mike Ryan

Date: 08/25/98

Subject: Project Drawings for
Delivery Order 0002, Interim Remedial Action
Contract No. DACA56-93-D-0016
Burning Ground No. 3, LH 18&24
Longhorn Army Ammn. Plant, Karnack, TX

TRANSMITTAL

Please find enclosed 2 sets of project drawings. A listing of these drawings is attached.

Per verbal direction of Mr. Linebaugh, 2 additional sets of drawings were sent to the following by Federal Express on 08/24/98 (see copy of transmittal form attached):

Mr. Syril Onewokae
INDUSTRIAL OPERATIONS COMMAND
ATTN: AMSIO-IBI-REFT
BUILDING 350, 4TH. FLOOR
ROCK ISLAND, IL 61299-6000

RELEASED BY:

C. M. Ryan
Radian International LLC

DATE:

8/25/98

RECEIVED BY:

Oscar Linebaugh, Jr.
U.S. Army Corps of Engineers

DATE:

8/25/98

COPY

RADIAN
INTERNATIONAL LLC

Longhorn Army Ammunition Plant
P.O. Box 107
Karnack, TX 75661
(903) 679-3448
FAX (903) 679-3357

To: Mr. Cyril Onewokae
Attn: AMSIO-IBI-REFT

From: Bryan Smith, Project Manager, Radian
Mike Ryan, Plant Manager, Radian

Date: 08/24/98

Subject: Project Drawings for
Delivery Order 0002, Interim Remedial Action
Contract No. DACA56-93-D-0016
Burning Ground No. 3, LH 18&24
Longhorn Army Ammn. Plant, Karnack, TX

TRANSMITTAL

Per verbal direction by Mr. Oscar Linebaugh, USACE Fort Worth District, Eastern Area Office
please find enclosed two sets of project drawings.

COPY

List of Enclosed Project Drawings from Radian International LLC relating to Delivery Order No. 0002.
Submitted to U.S. Army Corps of Engineers on 08/25/98.

DWG.#	REV.#	LATEST ISSUE DATE	DRAWING TITLE
2379-C-110	5	08/08/96	Groundwater Treatment Plant Foundation Location Plan
2379-C-201	2	03/11/96	Groundwater Treatment Plant Containment Area Foundation Plan
2379-C-202	0	03/11/96	Groundwater Treatment Plant Foundation for TK-630
2379-C-203	1	04/18/96	Groundwater Treatment Plant Fdn. for TK-640, T-330, & TK-200C
2379-C-204	0	03/11/96	Groundwater Treatment Plant Foundation for TK-100 & TK-380
2379-C-205	1	04/18/96	Groundwater Treatment Plant Foundation for TK-180 & TK-450
2379-C-206	0	03/11/96	Groundwater Treatment Plant Foundation for TK-140
2379-C-207	0	03/11/96	Groundwater Treatment Plant Foundation for TK-240
2379-C-208	1	04/18/97	Groundwater Treatment Plant Foundation for TK-200A & TK-200B
2379-C-209	2	03/12/96	Groundwater Treatment Plant Containment Area Fdn. Sections
2379-C-210	1	04/18/96	Groundwater Treatment Plant Foundation for TK-300 & FL-290
2379-C-211	3	05/22/96	Groundwater Treatment Plant Concrete Details
2379-C-212	0	03/11/96	Groundwater Treatment Plant Containment Area Fdn. Sections
2379-C-213	A	03/19/96	Groundwater Treatment Plant Pump Foundations
2379-C-215	C	05/31/96	Groundwater Treatment Plant Truck Unloading Fdn. Plan
2379-C-216	C	05/31/96	Groundwater Treatment Plant Truck Unloading Fdn. Sections & Details
2379-C-231	1	04/10/96	Groundwater Treatment Plant Catox Foundation Plan
2379-C-232	1	04/10/96	Groundwater Treatment Plant Catox Fdn. Plan, Sections & Details
2379-C-233	1	04/10/96	Groundwater Treatment Plant Catox CB6 Plan, Sections And Details
2379-C-234	0	04/10/96	Groundwater Treatment Plant Pipe Supp't. Fdn. Plan, Sect. And Det's.
2379-C-236	B	08/13/96	Groundwater Treatment Plant Foundation for TK-510A/B & TK-530
2379-C-237	B	08/13/96	Groundwater Treatment Plant Foundation for TK-510A/B & TK-530
2379-C-238	C	08/13/96	Groundwater Treatment Plant Sump Plan, Sections and Details
2379-C-239	B	08/13/96	Groundwater Treatment Plant Sump Sections and Details
2379-E-050	A1	02/06/96	Groundwater Treatment Plant Electrical Grounding Plan
2379-E-060	A1	02/06/96	Groundwater Treatment Plant Electrical Grounding Details
2379-E-110	1	07/03/96	Groundwater Treatment Plant Electrical Grounding Plan
2379-E-111	1	04/26/96	Groundwater Treatment Plant Electrical Grounding Plan
2379-E-112	0	06/27/96	Groundwater Treatment Plant Electrical Grounding Plan

2379-E-120	1	07/12/96	Groundwater Treatment Plant Electrical Lighting & Power
2379-E-130	1	07/08/96	Groundwater Treatment Plant Electrical Equipment Layout Control Building
2379-E-200	3	07/12/96	Electrical One-Line Diagram - MCC-100
2379-E-201	3	07/12/96	Electrical One-Line Diagram - MCC-100
2379-E-202	0	07/03/96	Electrical One-Line Diagram - MCC-100
2379-E-250	1	07/12/96	Electrical Elementary Diagram - LC-500
2379-E-710	0	03/08/96	Groundwater Treatment Plant Electrical Grounding Details
2379-E-720	0	07/12/96	Groundwater Treatment Plant Electrical Power & Raceway Details
2379-E-730	0	07/12/96	Groundwater Treatment Plant Electrical Lighting Details
2379-E-740	0	07/12/96	Groundwater Treatment Plant Electrical Raceway Details
2379-E-800	0	07/12/96	Groundwater Treatment Plant Electrical Schematic Diagram
2379-E-801	0	07/12/96	Groundwater Treatment Plant Electrical Schematic Diagram
2379-E-802	0	07/12/96	Groundwater Treatment Plant Schematic & Wiring Diagram
2379-E-803	0	07/12/96	Groundwater Treatment Plant Schematic & Wiring Diagram
2379-F-100B	2	08/28/97	Piping & Instrument Diagram TK-700 Storage Area
2379-F-105	0	06/18/96	Piping & Instrument Diagram TK-140 Equalization Tank
2379-F-106	0	06/18/96	Piping & Instrument Diagram TK-100 Caustic / TK-280 Polymer Storage
2379-F-107	0	06/18/96	Piping & Instrument Diagram TK-180 Magnesium Hydroxide Storage
2379-F-108	0	06/18/96	Piping & Instrument Diagram TK-300 Stripper Feed Tank
2379-F-109	0	06/18/96	Piping & Instrument Diagram TK-450 Dilute Acid Storage
2379-F-110	0	06/18/96	Piping & Instrument Diagram TK-630 Effluent Storage
2379-F-111	0	06/18/96	Piping & Instrument Diagram TK-510A Thickner & TK-500 Polymer Tote
2379-F-112	0	06/18/96	Piping & Instrument Diagram TK-510B Thickner
2379-F-113	0	06/18/96	Piping & Instrument Diagram TK-530 Devolitizer
2379-F-114	0	06/18/96	Piping & Instrument Diagram FL-560 Filter Press & Sump SP-570
2379-F-115	0	06/18/96	Piping & Instrument Diagram TK-380 Acid Storage
2379-F-116	0	06/18/96	Piping & Instrument Diagram K-700 Air Comp. Pkg. & Vent Header
2379-F-117	0	06/18/96	Piping & Instrument Diagram Potable Water & Fuel Gas Header
2379-F-118	0	06/18/96	Piping & Instrument Diagram TK-330 Stripper Tower
2379-F-119	0	06/18/96	Piping & Instrument Diagram Great Lakes Enviromental In. Pkg.
2379-G-001	1	03/04/96	Groundwater Treatment Plant General Notes
2379-G-101	1	03/04/96	Grid of GWTP, TSSP & SHDP Areas

2379-G-200	0	02/23/96	Staging Area - GWTP, TSSP & SHDP
2379-G-202	A	09/23/96	Soil Treatment Plant Trailer Equipment Site Plan
2379-G-501	1	03/11/96	Groundwater Treatment Plant Site Grading Plan
2379-G-601	0	07/16/97	Site 16 Pipeline Plan, Sections and Details
2379-G-611	0	07/16/97	Site 16 Pipeline Details
2379-G-612	0	07/16/97	Site 16 Pipeline Details
2379-I-100	0	07/12/96	Groundwater Treatment Plant Instrument Key Plan
2379-I-101	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-102	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-103	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-104	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-105	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-106	0	07/12/96	Groundwater Treatment Plant Instrument Location Plan
2379-I-202	0	07/11/96	PLC-100 Marshalling Cabinet details
2379-I-203	0	07/11/96	PLC-100 Marshalling Cabinet Panel Layout
2379-I-204	A	04/01/96	Control Panel CP-100 Details Truck Unloading Station
2379-I-300	0	07/10/96	Instrument 120VAC Junction Box PJB-100
2379-I-301	0	07/10/96	Instrument 120VAC Junction Box PJB-101
2379-I-302	0	07/11/96	PLC-100 Power Distribution Wiring Diagram
2379-I-303	0	07/11/96	PLC-100 Power Distribution Wiring Diagram
2379-I-304	0	07/11/96	PLC-100 Power Distribution Wiring Diagram
2379-I-305	0	07/11/96	PLC-100 Power Distribution Wiring Diagram
2379-I-306	0	07/11/96	PLC-100 Power Distribution Wiring Diagram
2379-I-800	0	07/10/96	CP-100 Control Panel Wiring Schematic
2379-P-100	C	05/10/96	Groundwater Treatment Plant Piping Key Plan
2379-P-200	C	05/10/96	Groundwater Treatment Plant Equipment Location Plan
2379-P-400	0	06/12/96	Groundwater Treatment Plant Piping Plan
2379-P-401	0	06/13/96	Groundwater Treatment Plant Piping Plan
2379-P-402	0	06/14/96	Groundwater Treatment Plant Piping Plan
2379-P-403	0	06/14/96	Groundwater Treatment Plant Piping Plan
2379-P-404	0	06/18/96	Groundwater Treatment Plant Piping Plan
2379-P-405	0	06/18/96	Groundwater Treatment Plant Piping Plan

2379-P-410	B	08/29/97	TK-700 Storage Area Piping Plan
2379-P-502	O	06/18/96	Groundwater Treatment Plant Piping Elevation
2379-S-301	C	05/08/96	Groundwater Treatment Plant Containment Area Pipe Support Plan
2379-S-302	C	05/08/96	Groundwater Treatment Plant Pipe Support Plan
2379-S-401	C	05/08/96	Groundwater Treatment Plant Pipe Supports-Elevations & Details
2379-S-402	C	05/08/96	Groundwater Treatment Plant Pipe Supports-Elevations & Details
2379-S-403	C	05/08/96	Groundwater Treatment Plant Pipe Supports-Elevations
2379-S-404	C	05/08/96	Groundwater Treatment Plant Pipe Support Elevations
2379-S-405	C	05/08/96	Groundwater Treatment Plant Pipe Support Elevations
2379-S-406	C	05/08/96	Groundwater Treatment Plant Pipe Supt.-Elevations PS-46 Thru PS-48
2379-S-407	C	05/08/96	Groundwater Treatment Plant Pipe Supports, Sections and Details
2379-S-501	A	05/15/96	Groundwater Treatment Plant Plan - Catox Stack Structure
2379-S-701	B	03/28/96	Groundwater Treatment Plant Plan & Elev. Stile structure
2379-S-704	C	05/15/96	Groundwater Treatment Plant Steel Details
SK-1	I	07/12/96	Groundwater Treatment Plant MCC-100 layout
GWDP-III-2	B	10/25/95	Groundwater Treatment Plant Piping Effluent Discharge
G-3018	A	10/17/95	Effluent Discharge Detail Proposed Effluent Discharge System
G-3019	A	10/23/95	Endwall & Thrust Block Fdn's. Plan, Sections and Details
P&I -1	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
P&I -2	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
P&I -3	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
P&I -4	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
P&I -5	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
P&I -6	A	04/08/97	Piping & Instrument Diagram Groundwater Extraction System
C-1	A	04/10/97	Miscellaneous Civil Details Groundwater Extraction System
SP-III-1	---	05/17/97	Site Plan Phase III - IRA- Burning Ground No.3
ICT-III-1	---	09/11/96	Plan Layout for Phase III Groundwater Extraction System
ICT-III-2	---	07/26/94	Typical Trench Cross-Section for ICT's with Single or Multiple Sumps May 1995
ICT Sections 1&2	---	08/02/96	Subsurface Cross-Section Intercept Collection Trenches July 1996
ICT Sections 3&4	---	07/29/96	Subsurface Cross-Section Intercept Collection Trenches July 1996
ICT Sections 5&6	---	07/29/96	Subsurface Cross-Section Intercept Collection Trenches July 1996
ICT Sections 7&8	---	07/29/96	Subsurface Cross-Section Intercept Collection Trenches July 1996

ICT Sections 9&10	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 11&12A	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 12B	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 12C	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 13A	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 13B	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 13C	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 14A	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 14B	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996
ICT Sections 14C	---	07/29/96	Subsurface Cross-Section	Intercept Collection Trenches	July 1996

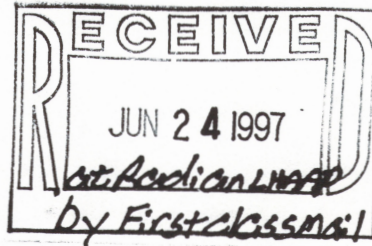
SLURRY WALLS
SEEPAGE BARRIERS
FLEXIBLE LINERS
GROUTING

INQUIP ASSOCIATES, INC.

G E O T E C H N I C A L C O N T R A C T O R

je.ct.97131

Radian International
Longhorn Army Ammunition Plant
P.O. Box 107
Karnack, TX 75661
Attn: Mr. Bryan Smith



June 17, 1997
McLean Office

Re: Longhorn Ammunition Plant, Karnack, Texas
USACE Contract No. DACA56-93-D0016
Solicitation No. 2379-96-ICT-01
Serial Letter No. 8497-12

Dear Mr. Smith:

On May 22nd, Inquip damaged the perforated pipe while removing the chain used to submerge it on ICT-9. The chain had become stuck on a splicer. The splicer was installed at the bend in the pipe and the chain snagged on it. From the appearance of the retrieved section of pipe, the pipe remaining in the trench is twisted nearly closed (see attached sketch).

We have modified our installation methods to avoid a similar mistake.

We have tested the sump by pumping and feel we have a good recovery at the well. The water appears to be clear without sedimentation.

Inquip requests your acceptance of this trench as installed. We believe it will function as intended.

We also propose deducting the quantity of ICT drain installed between sta 1+95 and sta 2+00, for its full depth, from our contract amount.

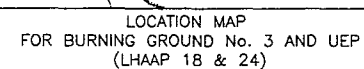
If this is acceptable, please acknowledge. If additional information is required or if you wish to discuss this further, please contact me at (703) 442-0143.

Best regards,

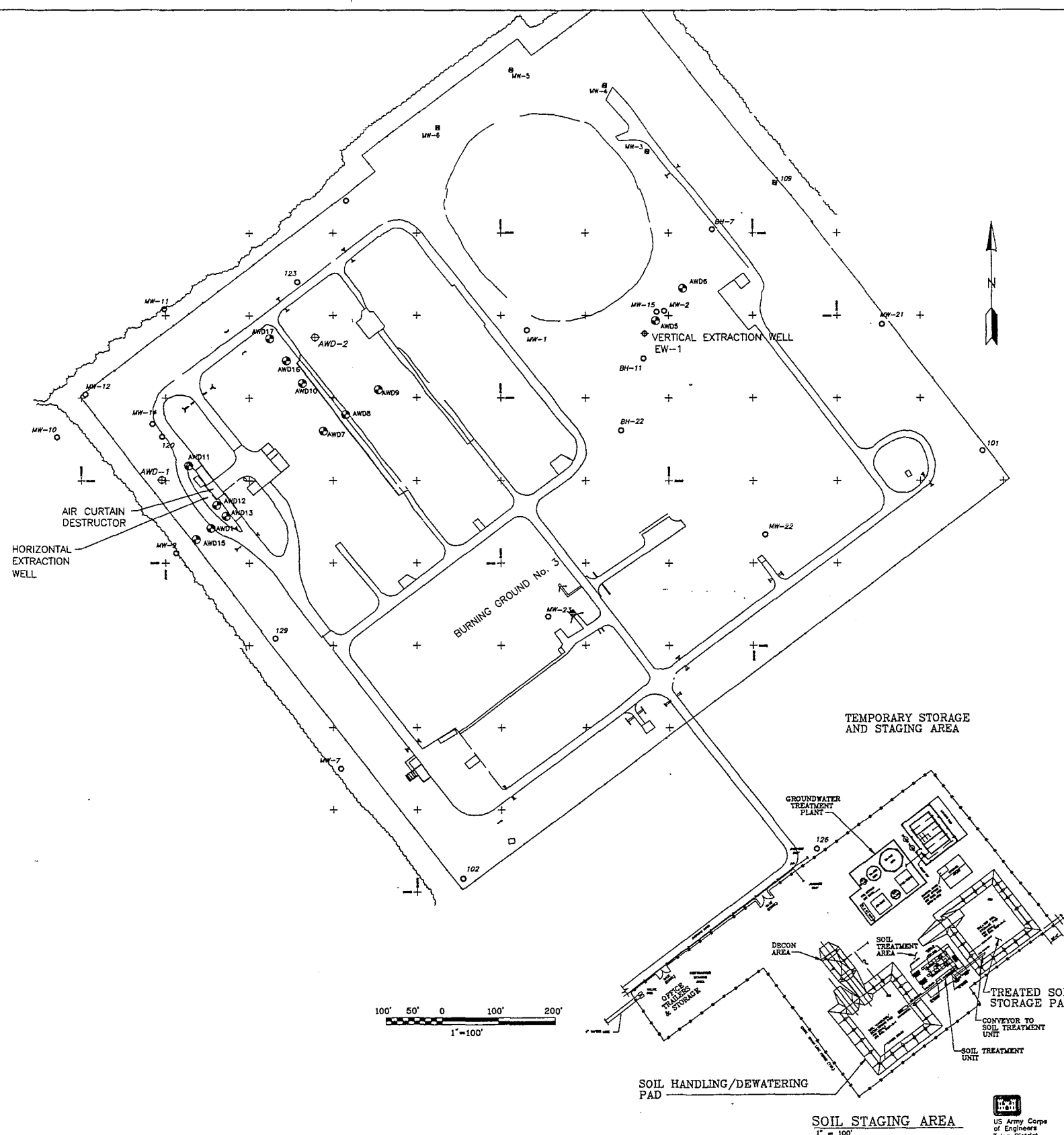
James C. Edwards
Operations Manager
Eastern Region

Response Accepted

7-17-97



LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
BURNING GROUND NO.3

[illegible]

Dow Environmental

SITE PLAN

PHASE III -IRA- BURNING GROUND No.3

CLIENT LHAAP KARNACK, TEXAS

PROJECT NUMBER 2379

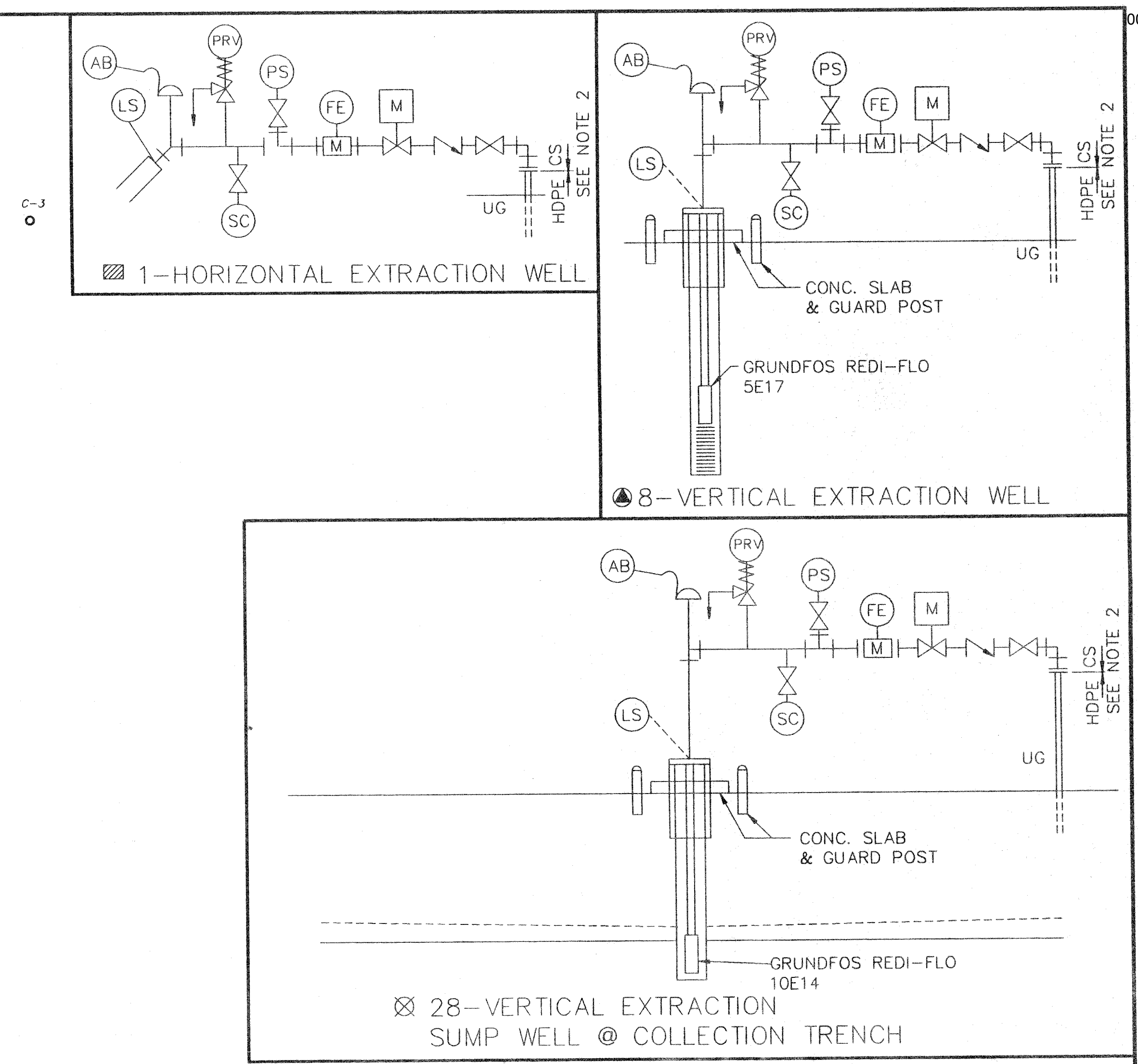
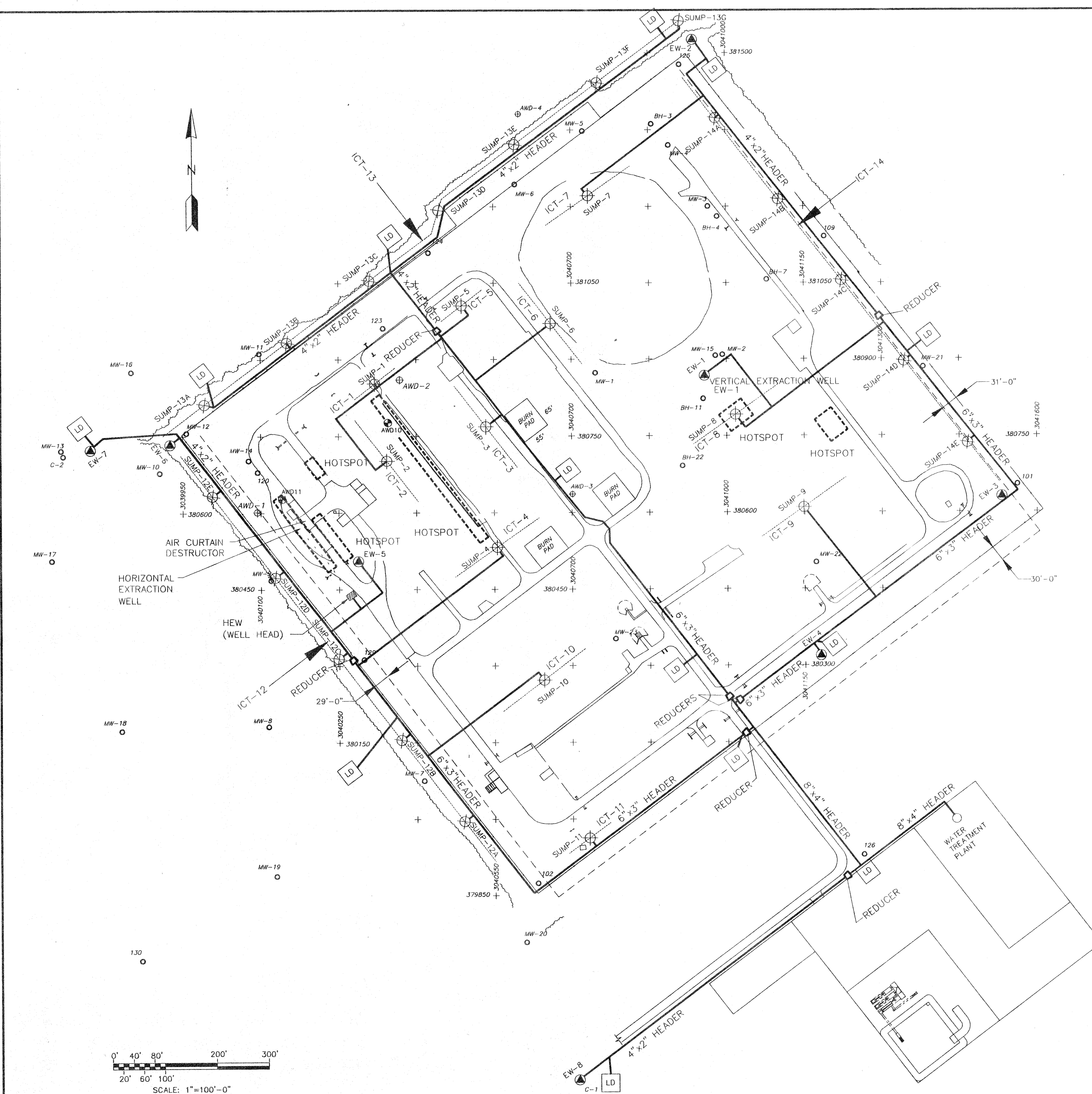
SCALE

DRAWING NUMBER
--

SP-III-1

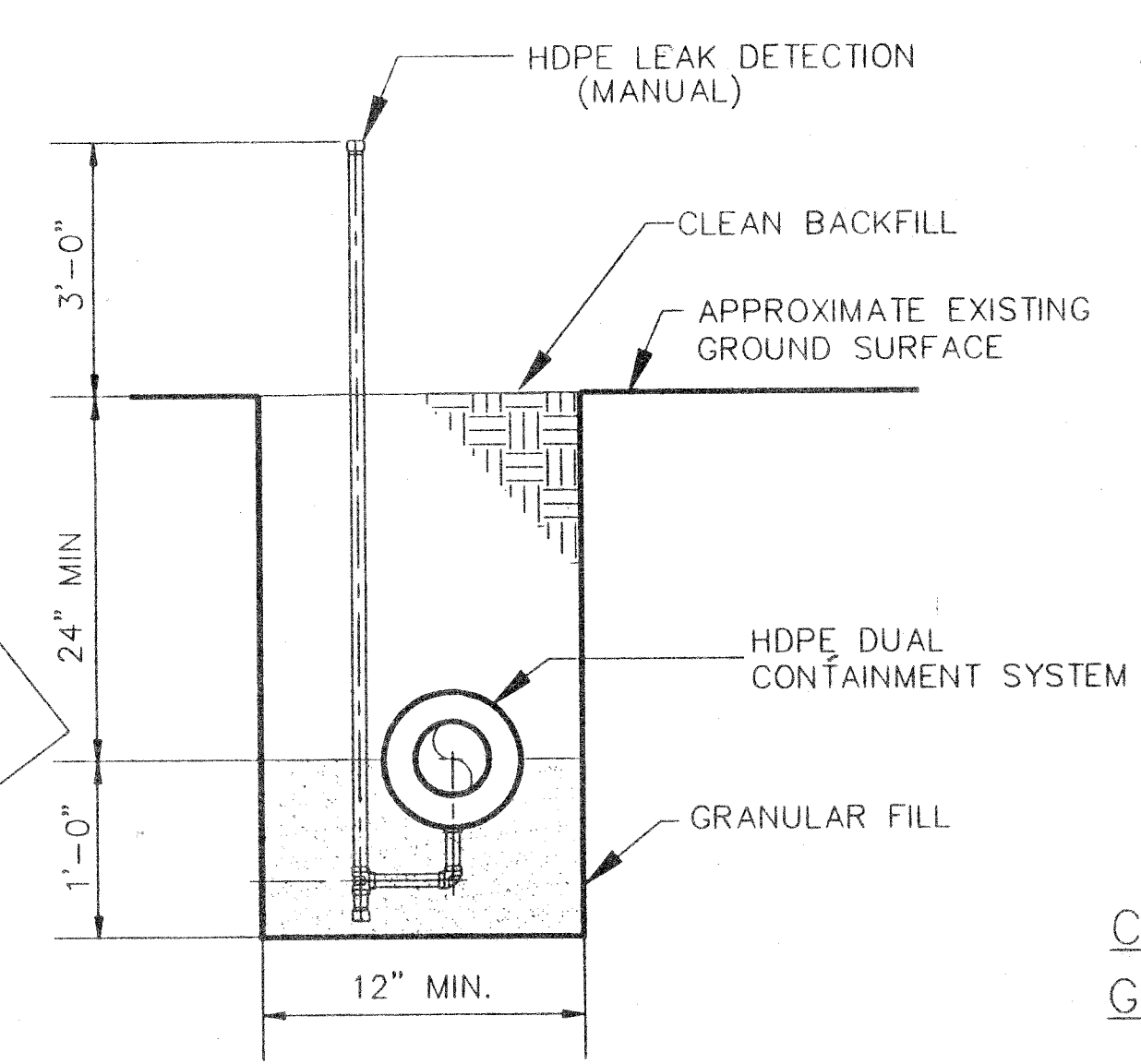
REV

1



- NOTES:
1. DUE TO POSSIBLE GRASS FIRES, ABOVE GROUND PIPING TO BE (CS OR SS)
 2. WHEN LOCATED IN HOT SPOT THIS SPEC BECOMES 316SS.
 3. WELLHEAD AREAS TO HAVE 10' SQ. CONCRETE SLAB WITH GUARD POSTS.
 4. BRANCH CONNECTIONS TO WELLS ARE 4"x2" TYPICAL

- LEGEND:
- POWER POLES
 - LD = LEAK DETECTION
 - 4"x2" HEADER HDPE PIPE SYSTEM DUAL CONTAINMENT INDICATES 4"Ø SECONDARY CONTAINMENT PIPE SDR 21 AND 2"Ø PRIMARY SDR 17 DRISCOPIE 1000 POLYPIPE OR EQUAL
 - PRV PRESSURE RELIEF VALVE
 - PS PRESSURE SWITCH
 - AB AIR BLEED
 - LS LEVEL SWITCH
 - SC SAMPLE CONNECTION
 - FE FLOW ELEMENT
 - M CONTROL VALVE
 - VERTICLE EXTRACTION WELL
 - VERTICLE EXTRACTION SUMP WELL
 - HORIZONTAL EXTRACTION WELL



CONCEPTUAL WELLHEAD AND UNDERGROUND GATHERING SYSTEM PIPING

CONFIDENTIAL - PROPRIETARY!

THIS DRAWING AND ALL INFORMATION CONTAINED HEREIN ARE THE PROPERTY OF DOW ENVIRONMENTAL. REPRODUCTION OR TRANSMITTAL IS PROHIBITED.

FILE.dwg: S:\2379\DEIDWG\CIVIL\GWCPH11.DWG
PLOTTED: 05/18/95 2:00 PM

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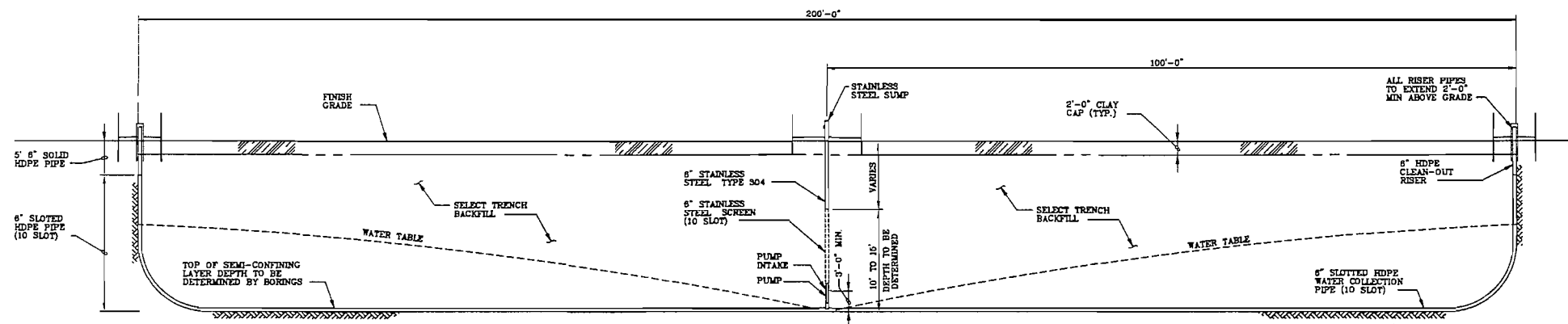
Dow
Dow Environmental

CONCEPTUAL WELLHEAD AND UNDERGROUND GATHERING SYSTEM PIPING & PLOT PLAN

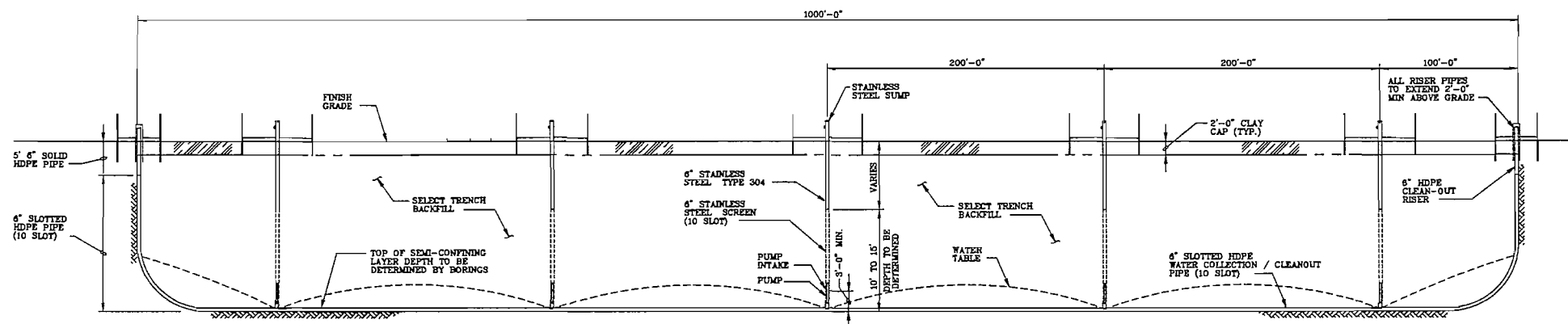
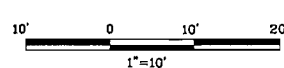
BURNING GROUND No. 3
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

PROJECT: LHAAP 18 & 24 III, IRA PROJECT NO: 2379

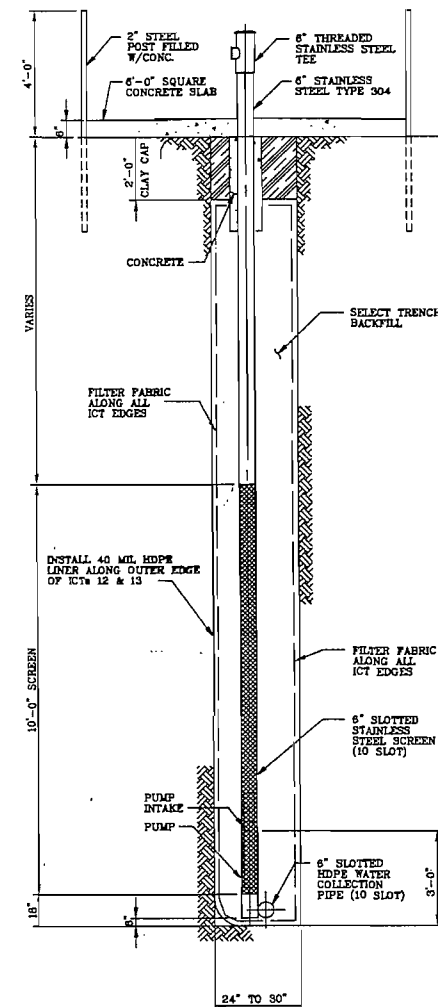
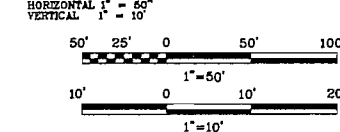
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TYPICAL TRENCH CROSS-SECTION
FOR ICT's WITH ONE SUMP



TYPICAL TRENCH CROSS-SECTION
FOR ICT's WITH MULTIPLE SUMPS



GROUNDWATER EXTRACTION
SUMP

DETAIL 2
3/8" = 1'-0" ICT-2



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Tulsa District



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TYPICAL TRENCH CROSS-SECTION
FOR ICT's WITH SINGLE OR MULTIPLE SUMPS
MAY 1995

CLIENT	LHAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NUMBER	ICT-III-2
REV			

DRAWING NUMBER	DRAWING TITLE	CLIENT APP'D	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVISED	DATE
	REFERENCE DRAWINGS								

ICT 1

ICT 2

E

W

S

N

SBT-4

SBT-3

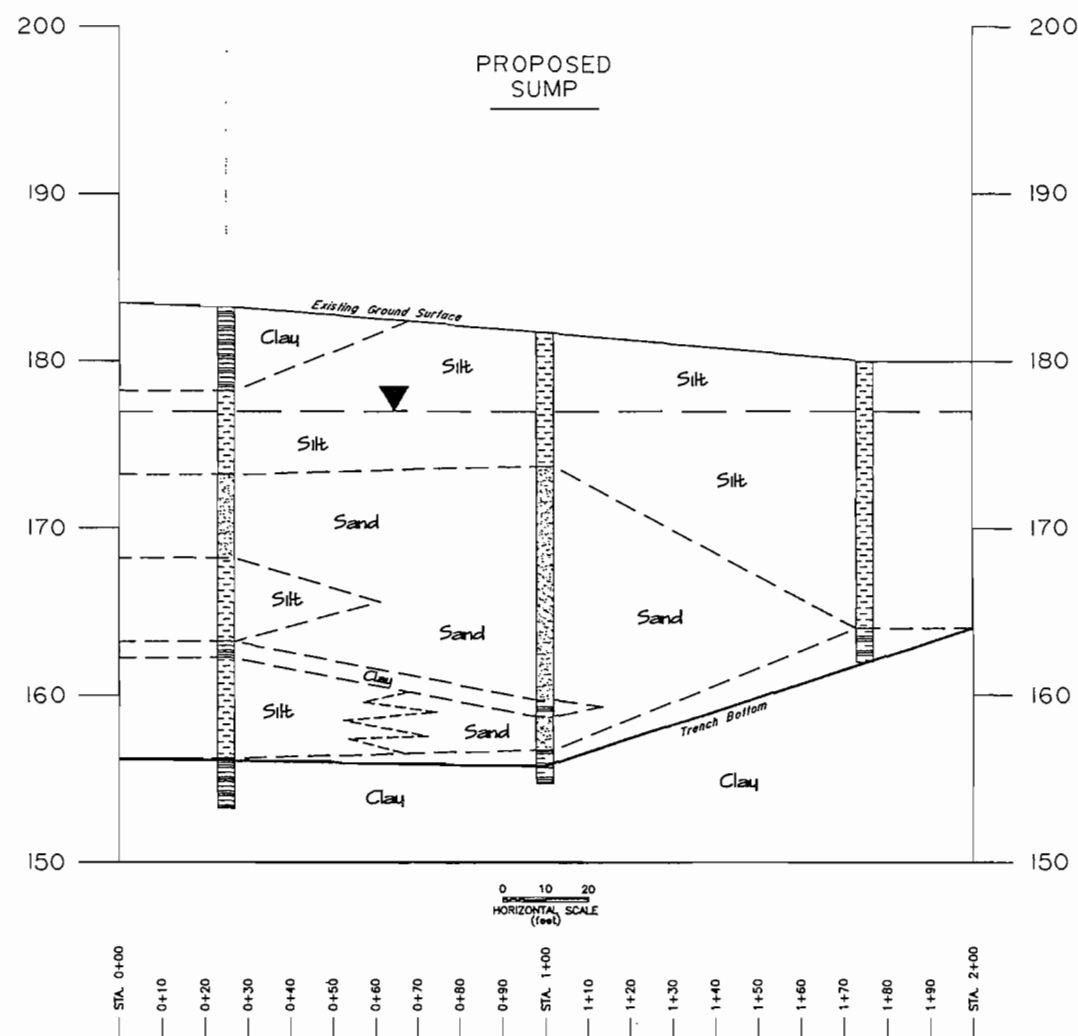
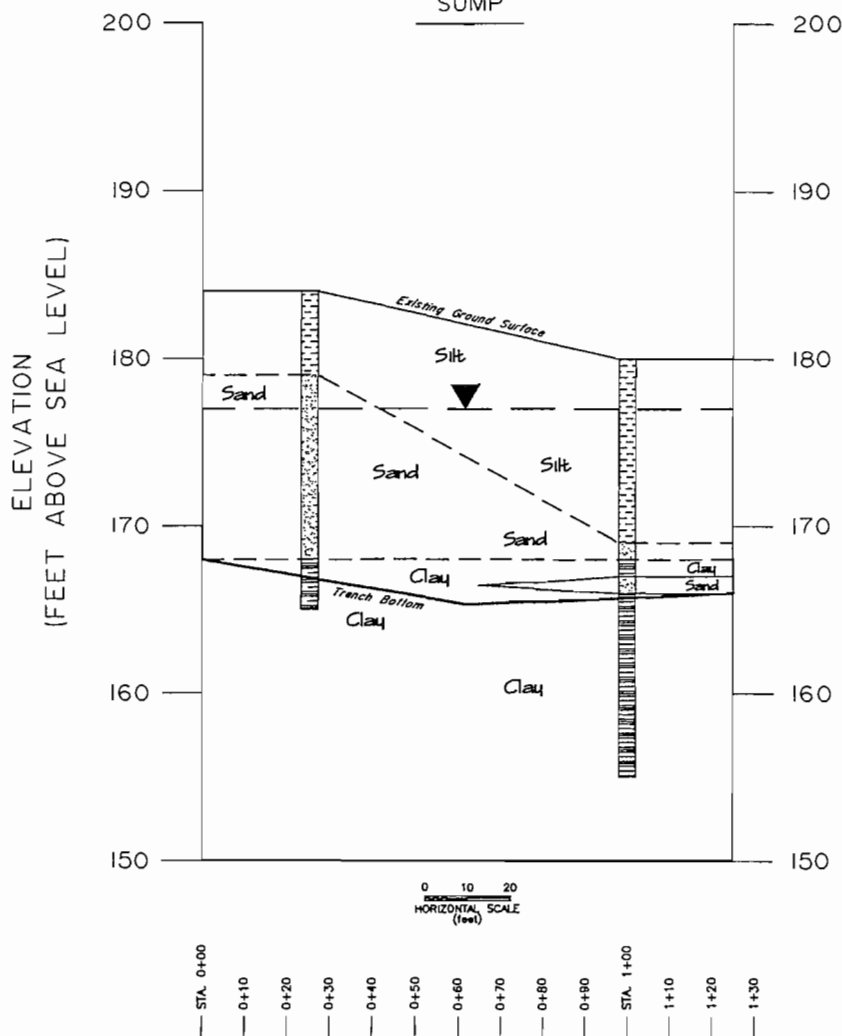
SBT-7

SBT-6

SBT-5

PROPOSED
SUMP

PROPOSED
SUMP



LEGEND

- SAND
- SILT
- CLAY
- WATER LEVEL
- SCREENED INTERVAL
- P = PIEZOMETER WELL
- MW = MONITORING WELL
- EH = SOIL BORING
- SBT = SOIL BORING

- NOTES:
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US Army Corps
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Tulsa District

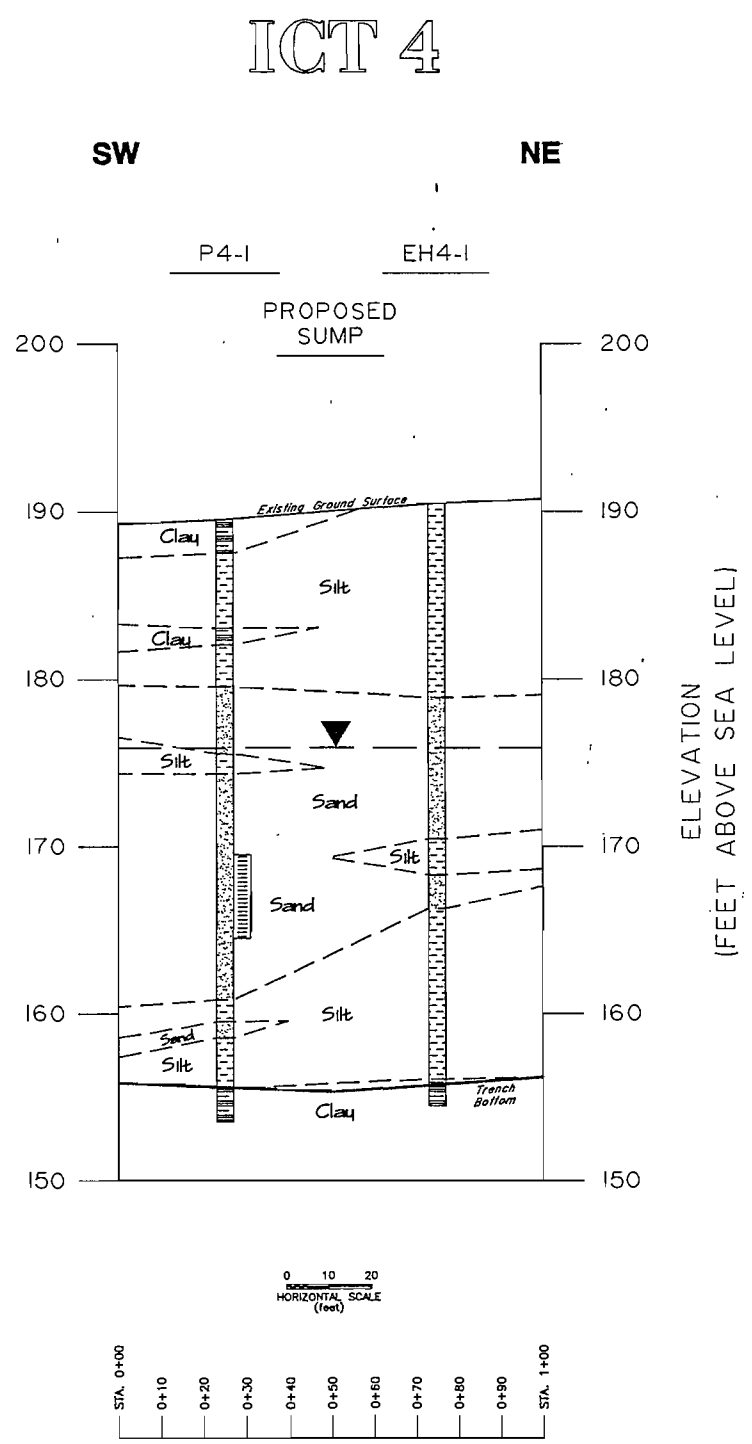
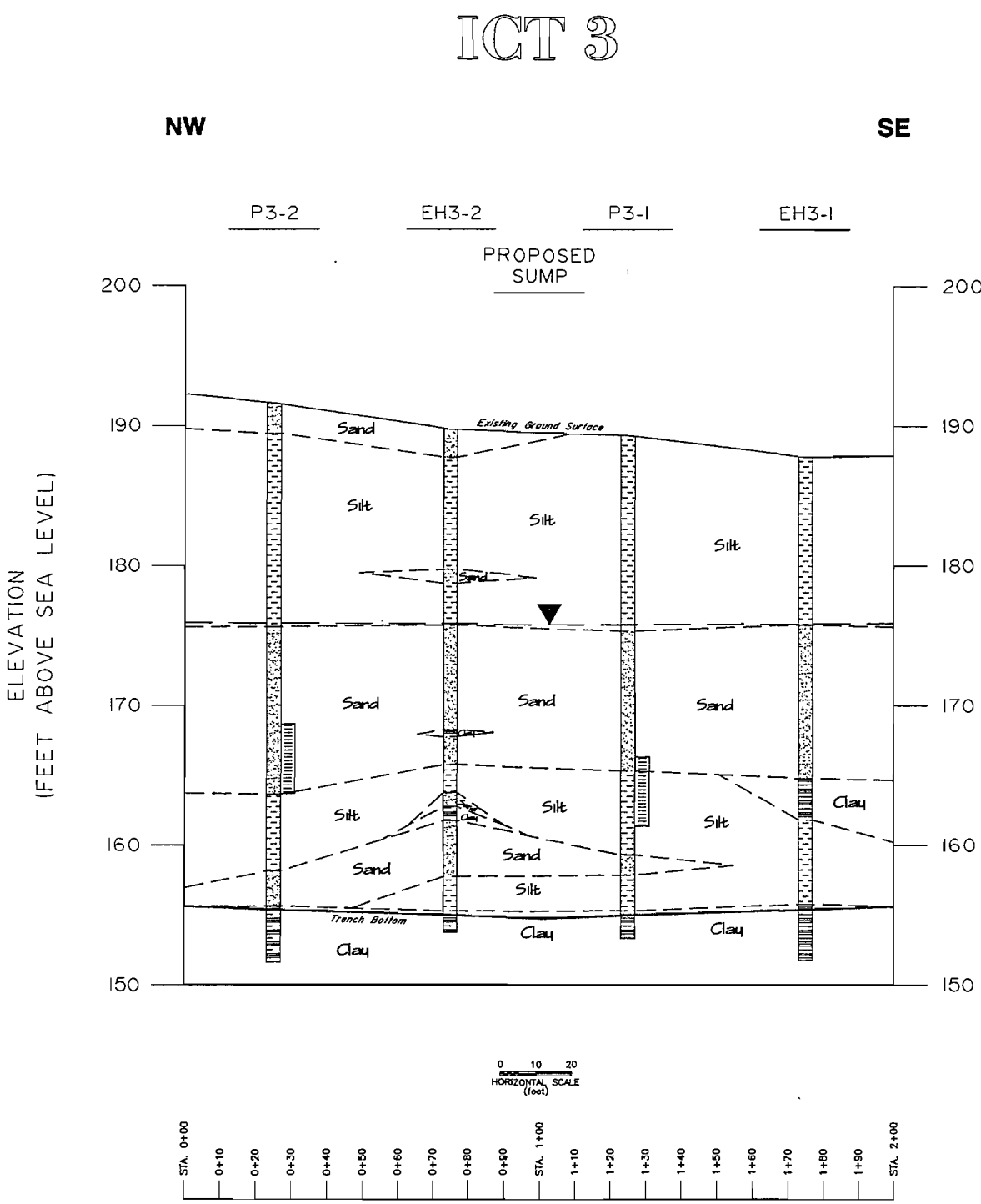
ICT 1		B.Z.H.	J.P.	A.B.S.	---	INITIAL RELEASE		08/02/96
FILE NO.	CLIENT APP'D	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVISED	DATE



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SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTIONS 1 & 2
		SHEET	1 of 14



LEGEND

P = PIEZOMETER WELLMW = MONITORING WELLEH = SOIL BORING

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Dow Environmental

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT LHAAP KARNACK, TEXAS

PROJECT NUMBER 2379

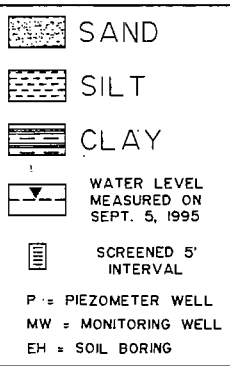
SCALE AS SHOWN

DRAWING NO. ICT SECTIONS 3 & 4

SHEET 2 of 14

ICT 4	BZH	JP	A.B.G.	INITIAL RELEASE	07/29/96			
FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVISED	DATE

LEGEND



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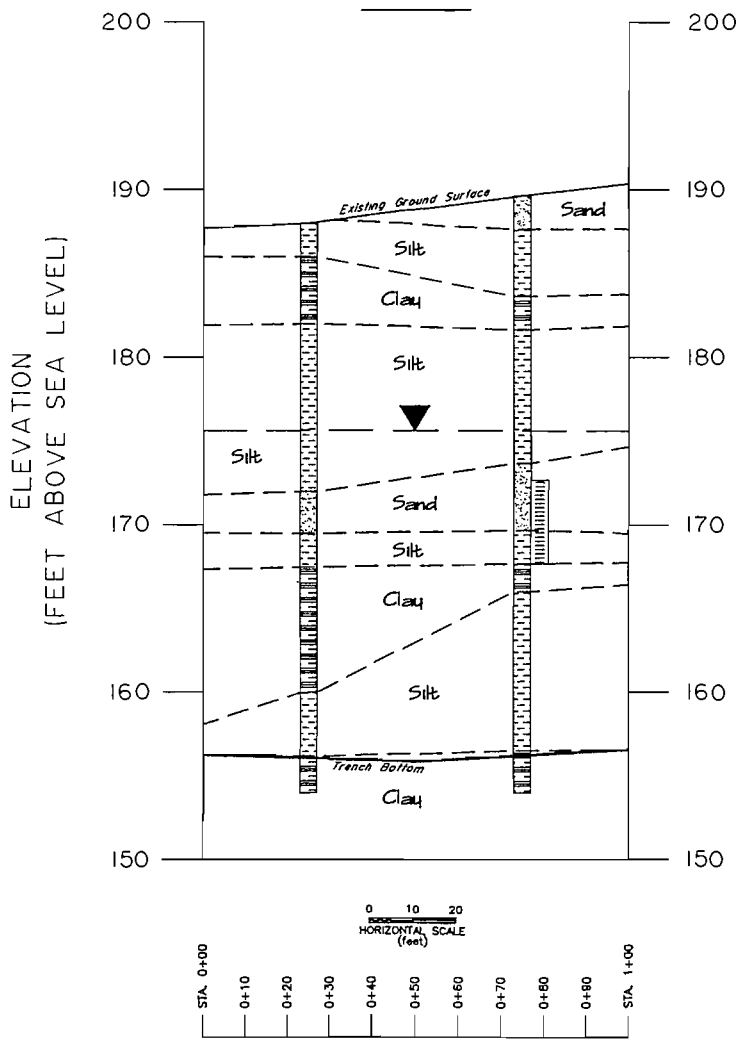
ICT 5

SW

NE

EH5-1 P5-1

PROPOSED SUMP



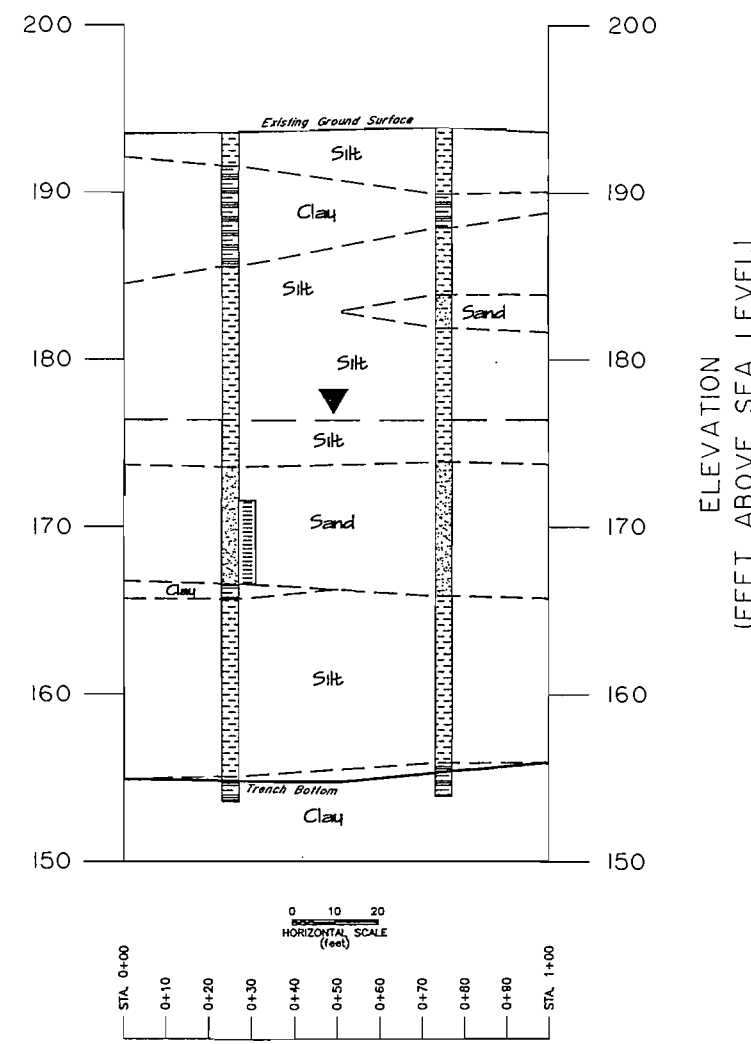
ICT 6

NW

SE

PROPOSED SUMP

P6-2 EH6-2



US Army Corps
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Tulsa District

ICTS #	RZH	J.P.	A.J.G.	INITIAL RELEASE	07/20/96
FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHK'D	ENGR
NO.	APPR	BY	BY	BY	REV
					REVISED
					DATE



Dow Environmental

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTIONS 5 & 6
		SHEET	3 of 14

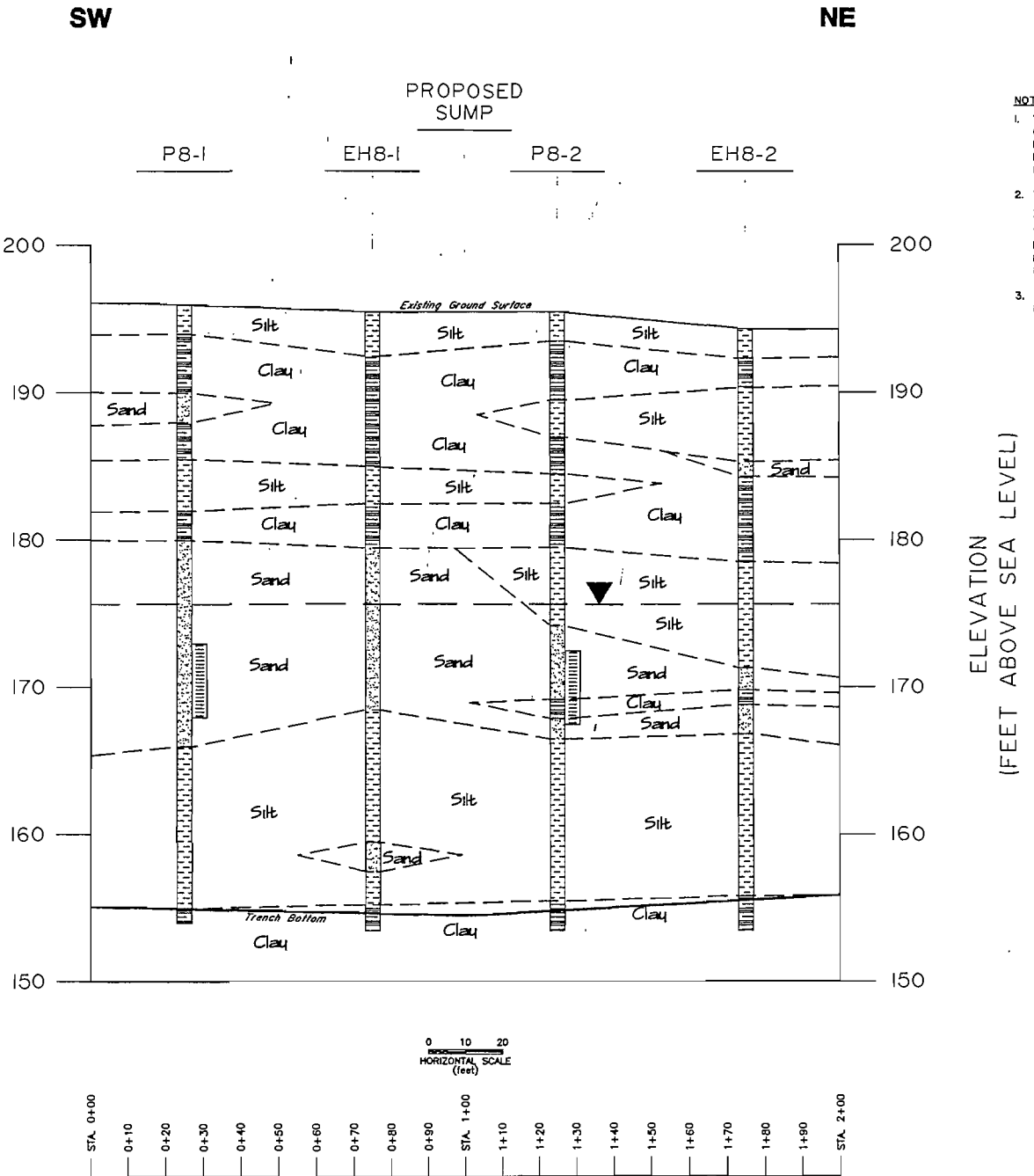
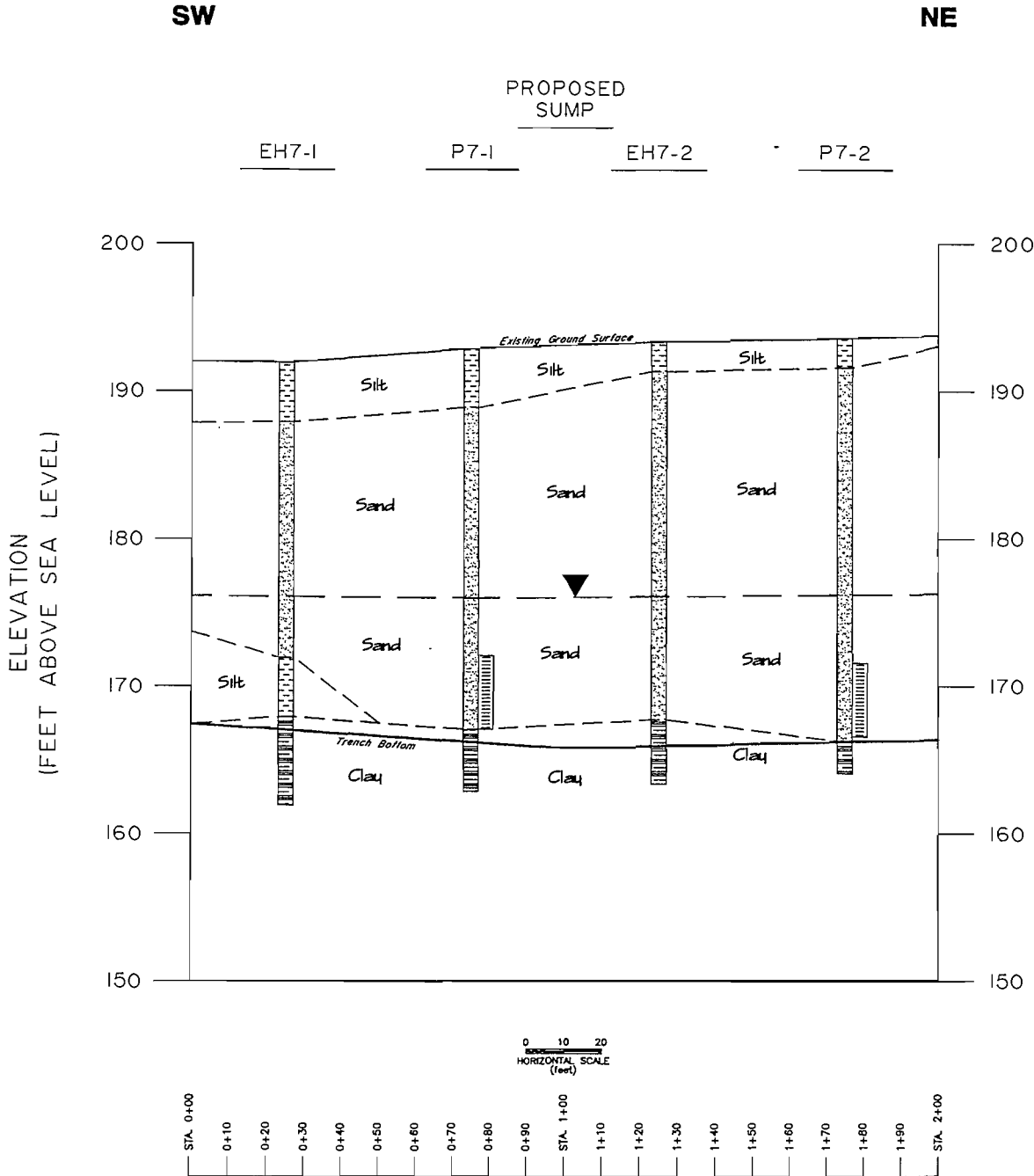
ICT 7

ICT 8

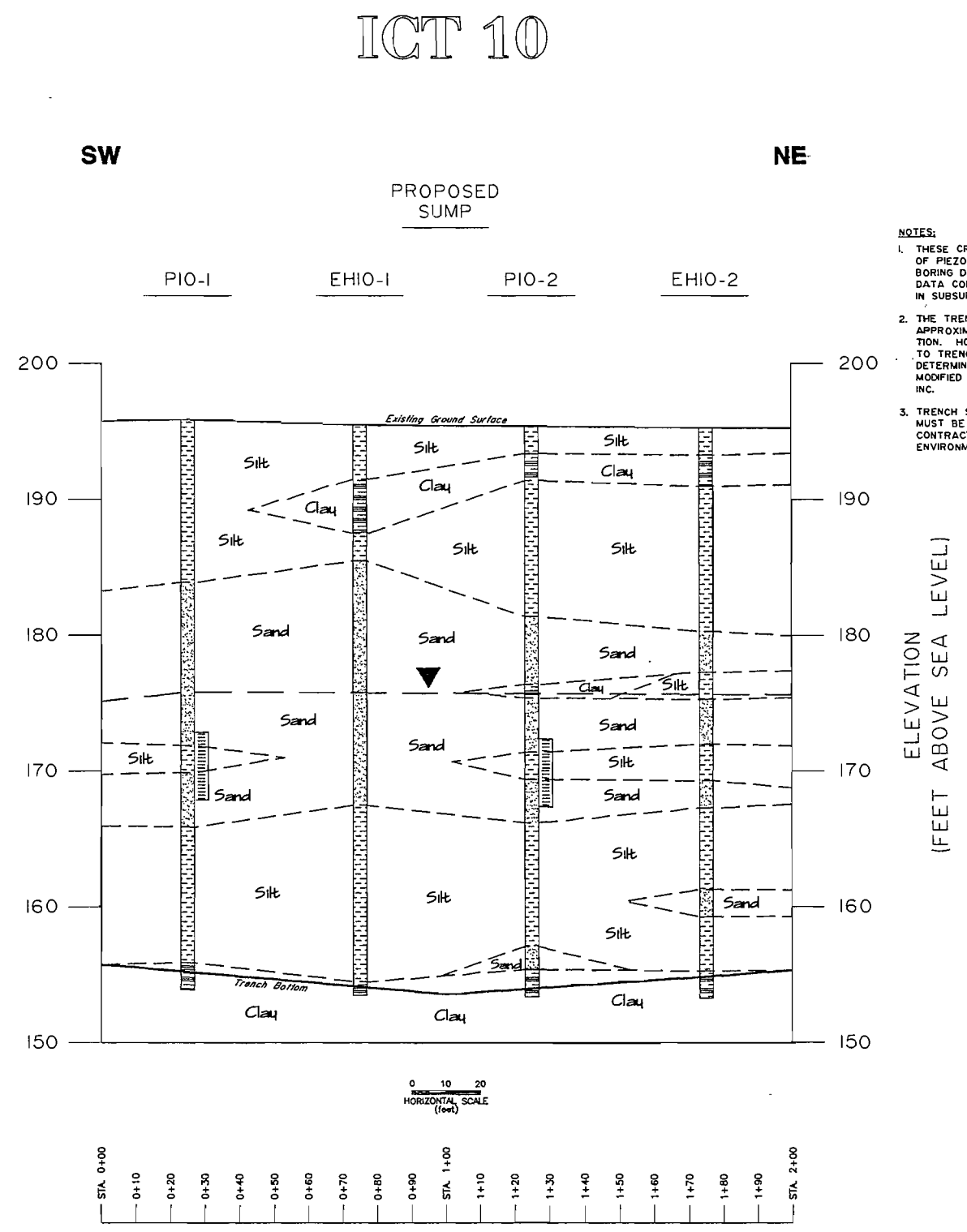
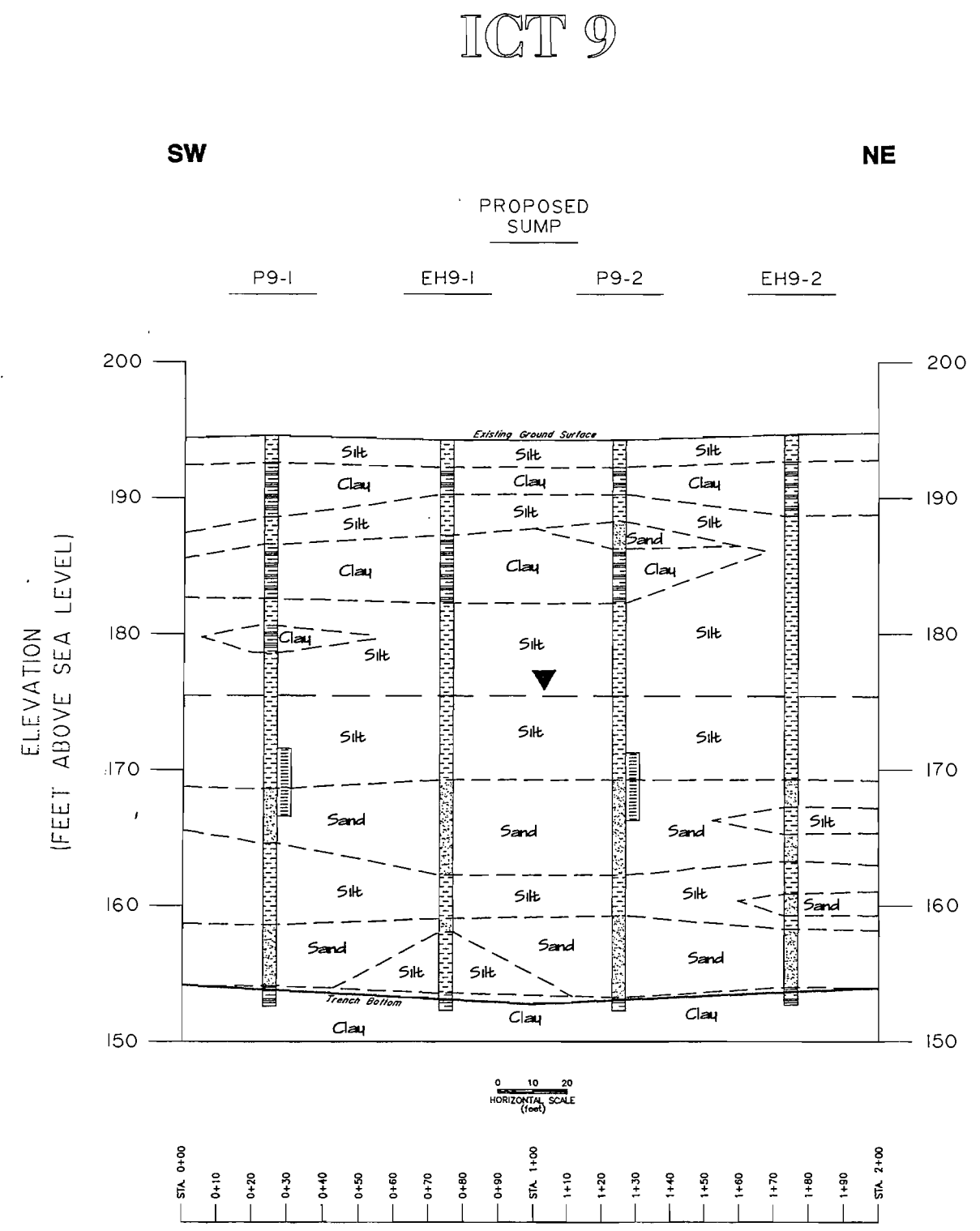
LEGEND

SAND
SILT
CLAY
WATER LEVEL MEASURED ON SEPT. 5, 1995
SCREENED 5' INTERVAL
P = PIEZOMETER WELL
MW = MONITORING WELL
EH = SOIL BORING

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DOW Dow Environmental										SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES JULY 1996			
ICT 8										CLIENT LHAAP KARNACK, TEXAS PROJECT NUMBER 2379			
DATE 07/28/96										DRAWING NO. SHEET			
REVISED										AS SHOWN ICT SECTIONS 7 & 8 4 of 14			



LEGEND

WATER LEVEL MEASURED ON SEPT. 5, 1995

SCREENED 5' INTERVAL

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SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT LHAAP KARNACK, TEXAS	PROJECT NUMBER 2379	SHEET 5 of 14
SCALE AS SHOWN	DRAWING NO. ICT SECTIONS 9 & 10	

ICT# 10	BZH	J.P.	A.B.O.	REVISION	DATE
FILE NO.	CLIENT APP'D	DRAWN BY	DESIGN BY	CHECK'D	ENGR
NO.					REV

REVISION

DATE

ICT 11

ICT 12A

SW

NE

NW

SE

EH11-1

P11-1

PROPOSED
SUMP

P12-1

FHI2-1

P12-2

FHI2-2

P12-3

FH12-3

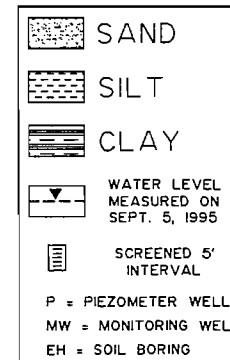
P12-4

PROPOSED
SUMP

MW-21
(Projected)

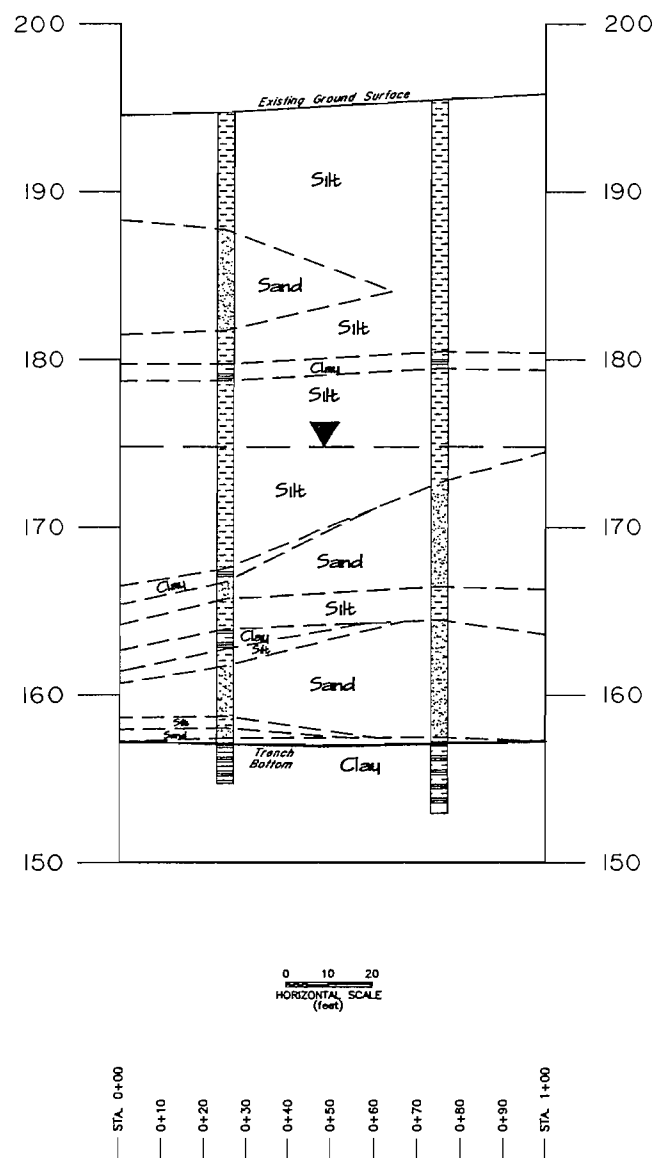
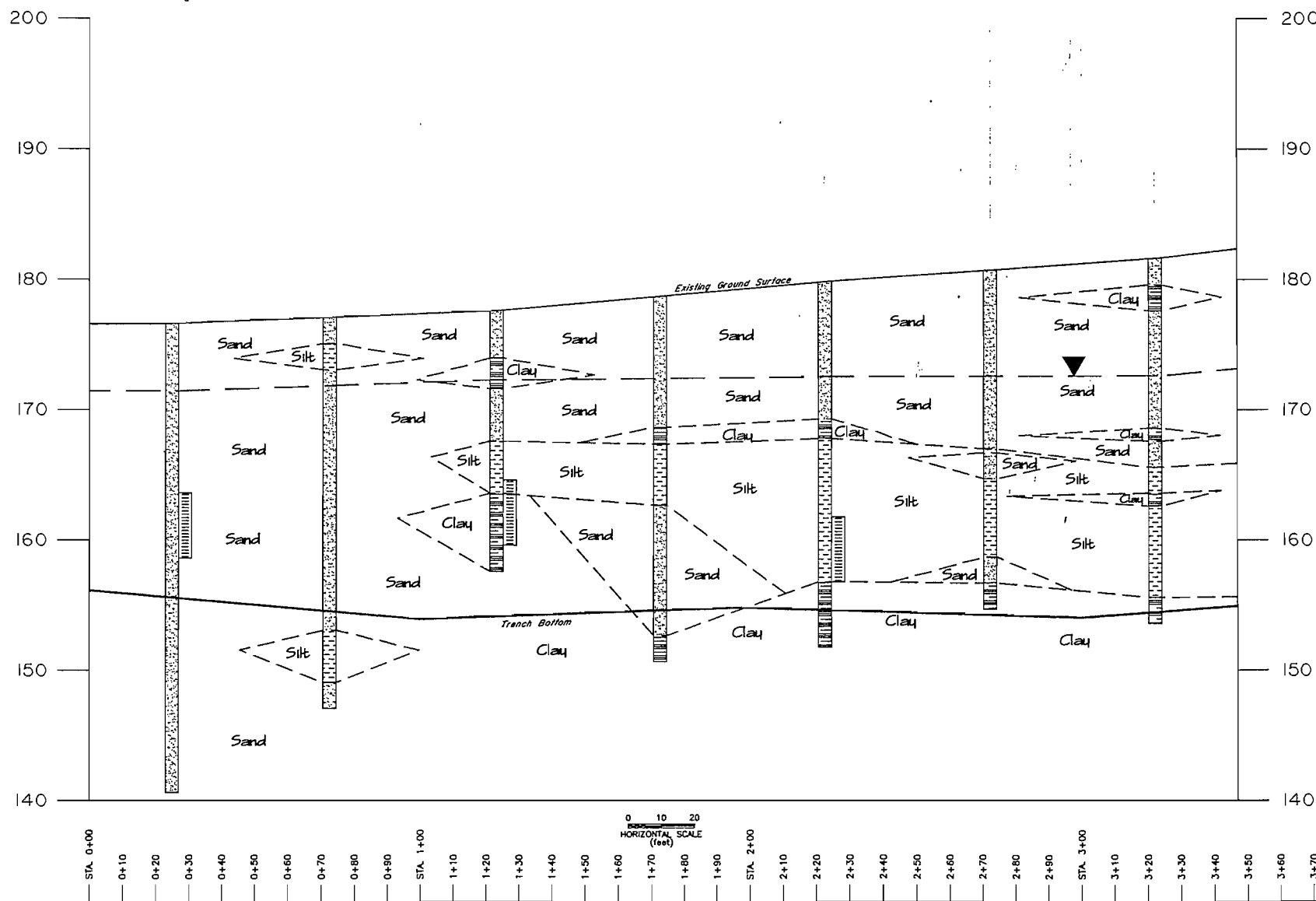
PROPOSED
SUMP

LEGEND



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ELEVATION
(FEET ABOVE SEA LEVEL)ELEVATION
(FEET ABOVE SEA LEVEL)

US Army Corps
of Engineers
Tulsa District

[illegible]

Dow Environmental

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT		PROJECT NUMBER	
LHAAP KARNACK, TEXAS		2379	
SCALE	DRAWING NO.	SHEET	
AS SHOWN	ICT SECTIONS II 8 I2A	6 of 1	

ICT 12B

NW

SE

EH12-4

PI2-5

EH12-5

PI2-6

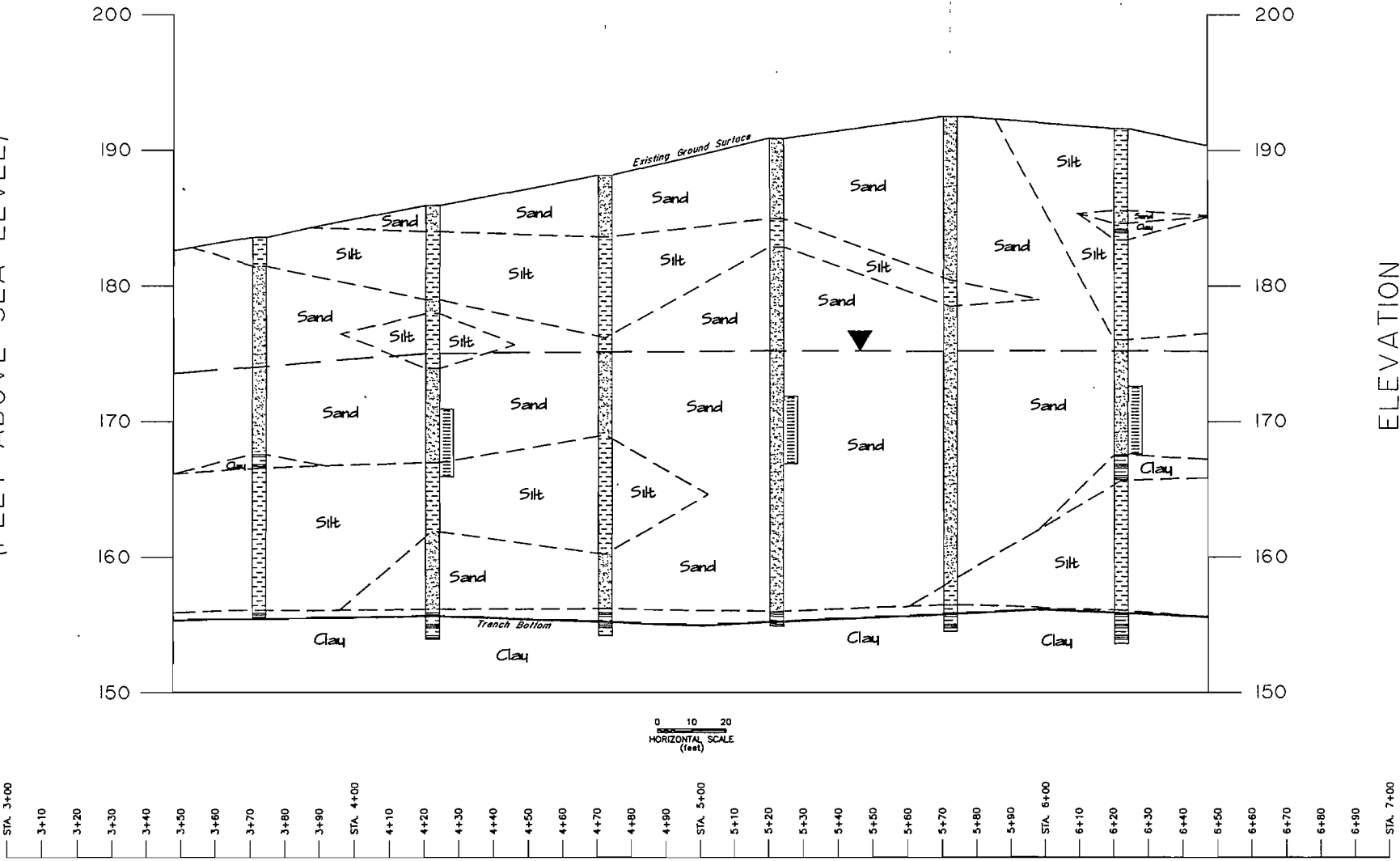
EH12-6

PI2-7

PROPOSED
SUMP

ELEVATION
(FEET ABOVE SEA LEVEL)

ELEVATION
(FEET ABOVE SEA LEVEL)



LEGEND

- SAND
- SILT
- CLAY
- WATER LEVEL MEASURED ON SEPT. 5, 1995
- SCREENED 5' INTERVAL
- P = PIEZOMETER WELL
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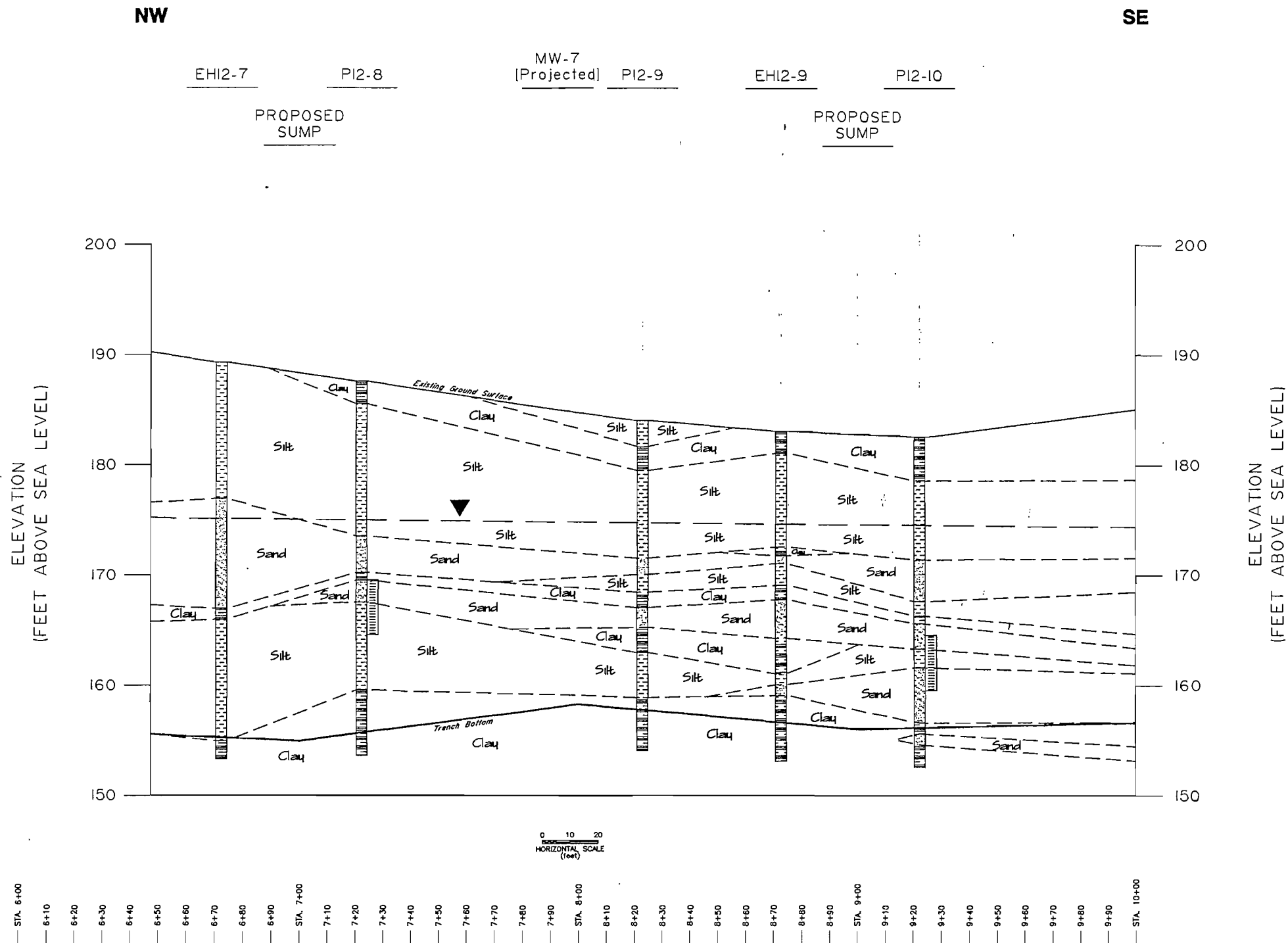
US Army Corps
of Engineers
Tulsa District

FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHECKED BY	ENGR	REV	DATE
ICT2B	B.Z.H.	J.P.	A.B.O.	---	---	---	07/23/96
INITIAL RELEASE							REVISED



SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES JULY 1996			
CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTION 12B
		SHEET	7 of 14

ICT 12C



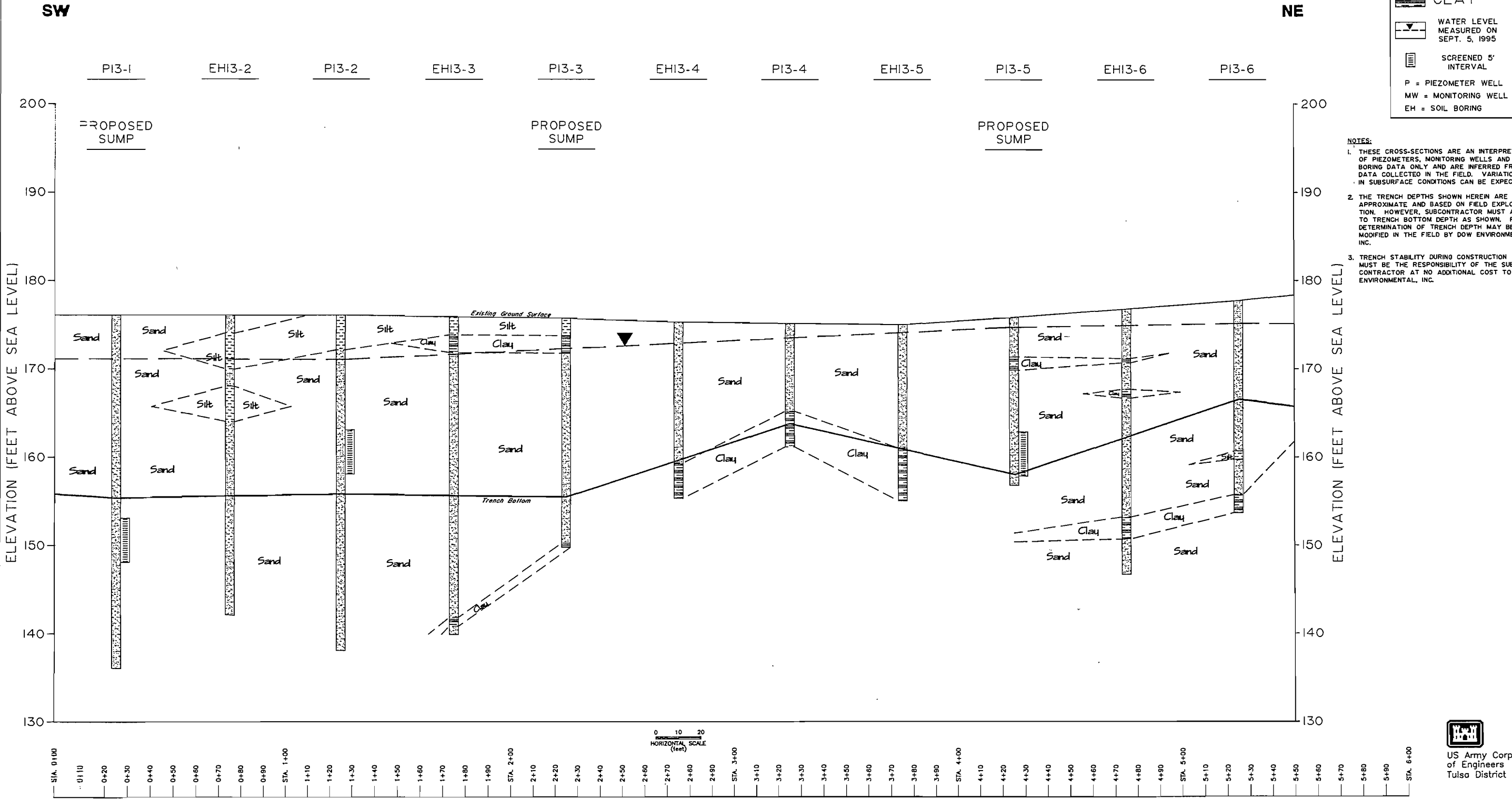
US Army Corps
of Engineers
Tulsa District

FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	INITIAL RELEASE	DATE



SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES JULY 1996		
CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER
SCALE	AS SHOWN	8 of 14

ICT 13A



FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVIS	DATE
ICT13A	LHAAP	BZH	J.P.	A.B.O.				07/25/96

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTION 13A
		SHEET	9 of 14

ICT 13B

LEGEND

 SAND

 SILT

 CLAY

 WATER LEVEL MEASURED ON SEPT. 5, 1995

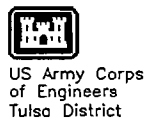
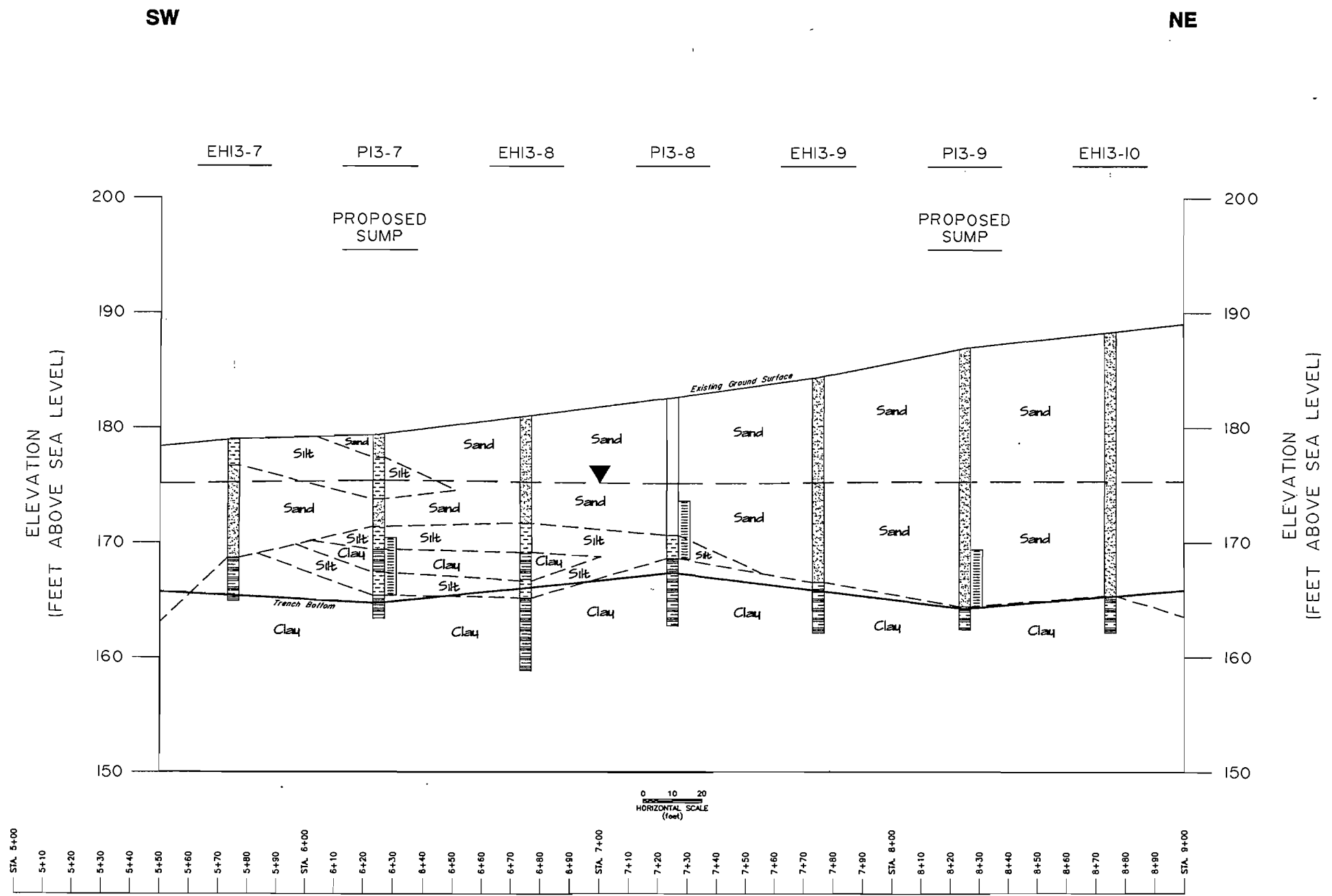
 SCREENED 5' INTERVAL

 P = PIEZOMETER WELL

 MW = MONITORING WELL

 EH = SOIL BORING

- NOTES:**
1. THESE CROSS-SECTIONS ARE AN INTERPRETATION OF PIEZOMETERS, MONITORING WELLS AND SOIL BORING DATA ONLY AND ARE INFERRED FROM DATA COLLECTED IN THE FIELD. VARIATIONS IN SUBSURFACE CONDITIONS CAN BE EXPECTED.
 2. THE TRENCH DEPTHS SHOWN HEREIN ARE APPROXIMATE AND BASED ON FIELD EXPLORATION. HOWEVER, SUBCONTRACTOR MUST ADHERE TO TRENCH BOTTOM DEPTH AS SHOWN. FINAL DETERMINATION OF TRENCH DEPTH MAY BE MODIFIED IN THE FIELD BY DOW ENVIRONMENTAL, INC.
 3. TRENCH STABILITY DURING CONSTRUCTION MUST BE THE RESPONSIBILITY OF THE SUB-CONTRACTOR AT NO ADDITIONAL COST TO DOW ENVIRONMENTAL, INC.



FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHECKED	ENGR	REV	INITIAL RELEASE	DATE
ICT13B	LHAAP	B.J.H.	J.P.	A.B.O.				07/28/96



SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES JULY 1996			
CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTION 13B
		SHEET	10 of 14

ICT 13C

SW

NE

P13-10

EH13-II

P13-11

EH13-12

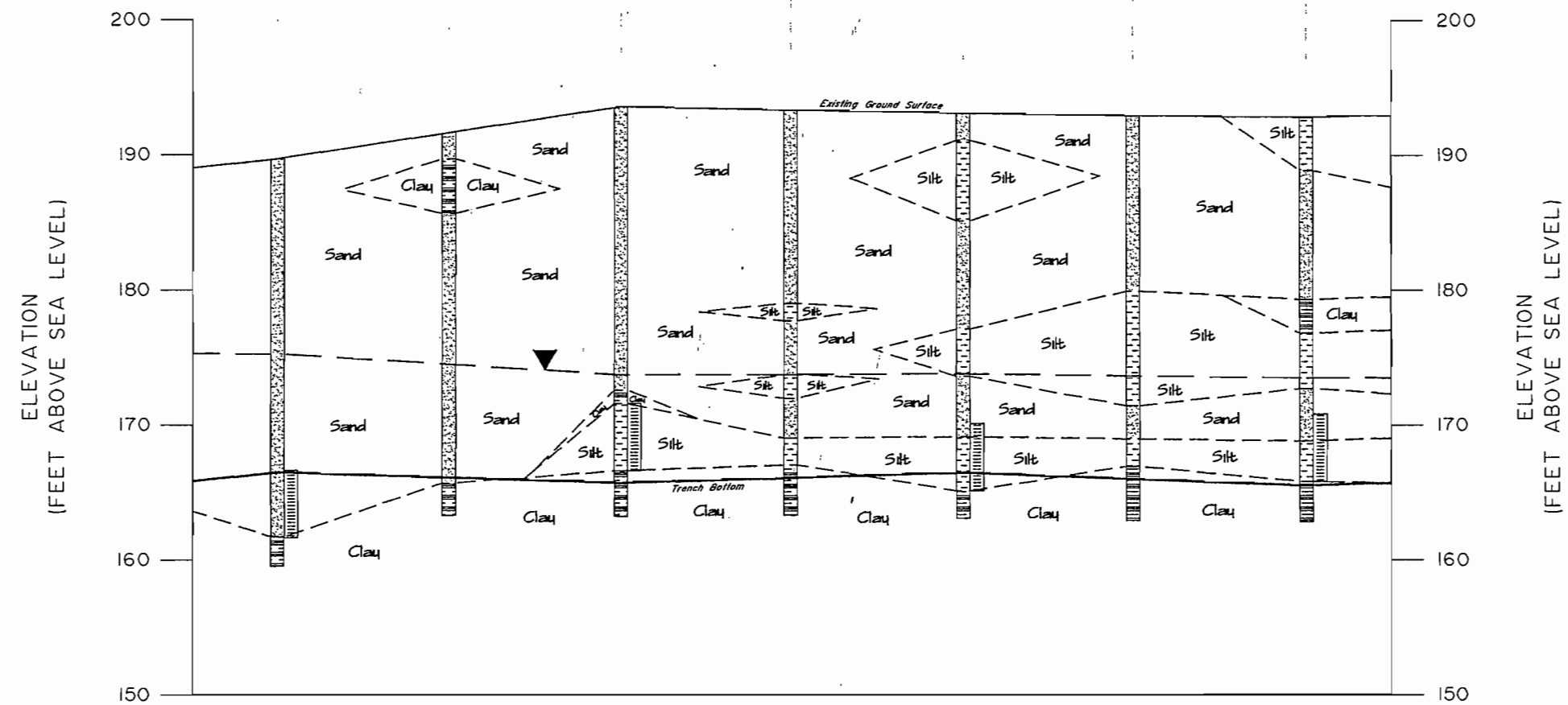
P13-12

EH13-13

P13-13

PROPOSED
SUMP

PROPOSED
SUMP



0 10 20
HORIZONTAL SCALE
(feet)

—	STA. 8+00
—	8+10
—	8+20
—	8+30
—	8+40
—	8+50
—	8+60
—	8+70
—	8+80
—	8+90
—	STA. 9+00
—	9+10
—	9+20
—	9+30
—	9+40
—	9+50
—	9+60
—	9+70
—	9+80
—	9+90
—	STA. 10+00
—	10+10
—	10+20
—	10+30
—	10+40
—	10+50
—	10+60
—	10+70
—	10+80
—	10+90
—	STA. 11+00
—	11+10
—	11+20
—	11+30
—	11+40
—	11+50
—	11+60
—	11+70
—	11+80
—	11+90
—	STA. 12+00
—	12+10
—	12+20
—	12+30
—	12+40
—	12+50
—	12+60
—	12+70
—	12+80
—	12+90
—	STA. 13+00

LEGEND

 SAND
 SILT
 CLAY
 WATER LEVEL MEASURED ON SEPT. 5, 1995
 SCREENED 5' INTERVAL
 P = PIEZOMETER WELL
 MW = MONITORING WELL
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NOTES:

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3. TRENCH STABILITY DURING CONSTRUCTION MUST BE THE RESPONSIBILITY OF THE SUB-CONTRACTOR AT NO ADDITIONAL COST TO DOW ENVIRONMENTAL, INC.



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[illegible]

Dow Environmental

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	SHEET
		ICT SECTION 13C	11 of 14

ICT 14A

NW

SE

EH14-10

PI14-10

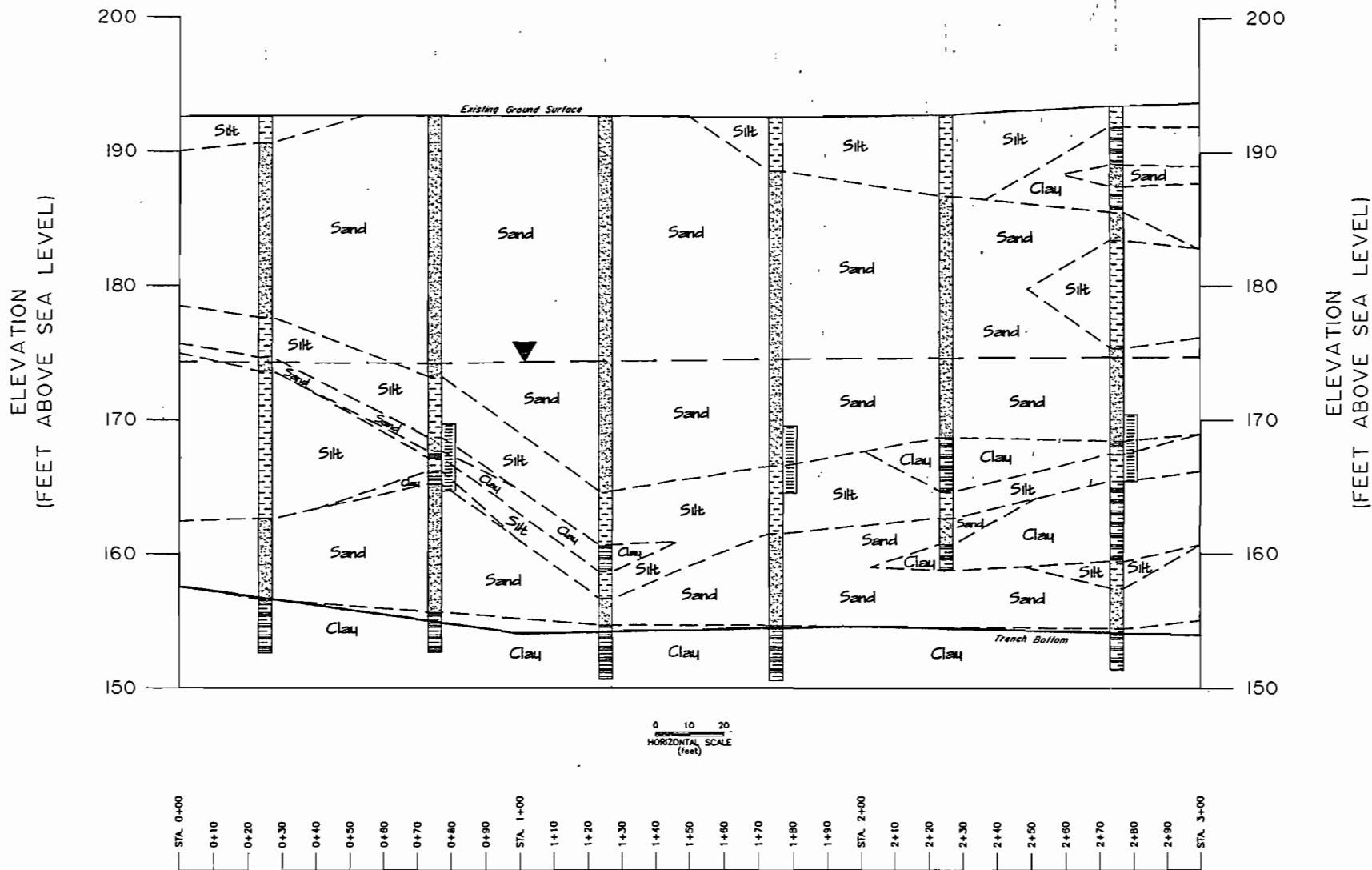
EH14-9

PI14-9

EH14-8

PI14-8

PROPOSED
SUMP



LEGEND

- SAND
- SILT
- CLAY
- WATER LEVEL MEASURED ON SEPT. 5, 1995
- SCREENED 5' INTERVAL
- P = PIEZOMETER WELL
- MW = MONITORING WELL
- EH = SOIL BORING

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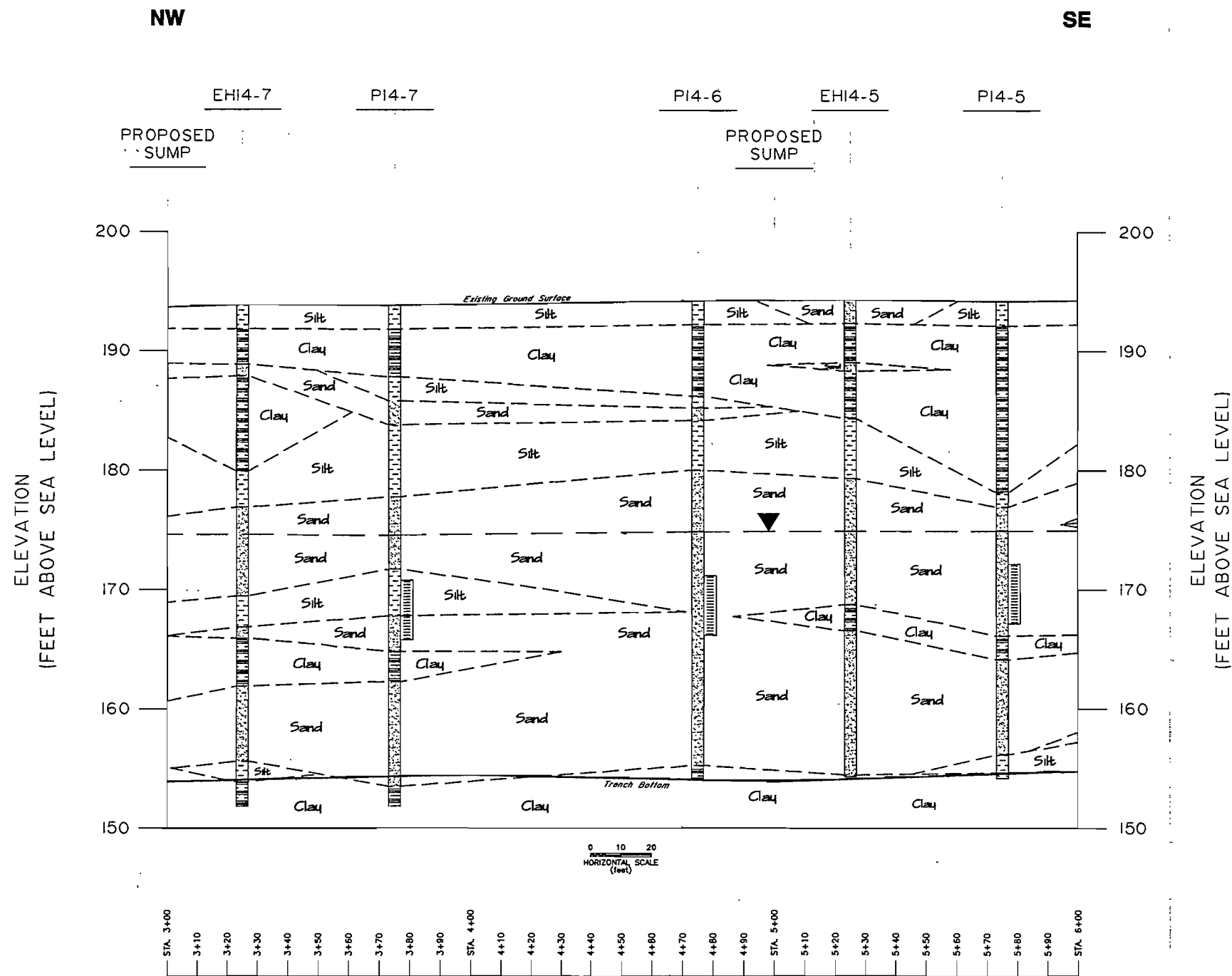
US Army Corps
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Tulsa District

FILE NO.	CLIENT	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVISED	DATE
ICT14A		BZH	JF.		A.R.D.		INITIAL RELEASE	07/28/96



SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES JULY 1996			
CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTION 14A
		SHEET	12 of 14

ICT 14B



LEGEND

- SAND
- SILT
- CLAY
- WATER LEVEL MEASURED ON SEPT. 5, 1995
- SCREENED 5' INTERVAL
- P = PIEZOMETER WELL
- MW = MONITORING WELL
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ICT48		B.Z.H.	J.P.		A.B.D.	—	INITIAL RELEASE	07/28/96
FILE NO.	CLIENT APP'D	DRAWN BY	DESIGN BY	CHK'D	ENGR	REV	REVISED	DATE



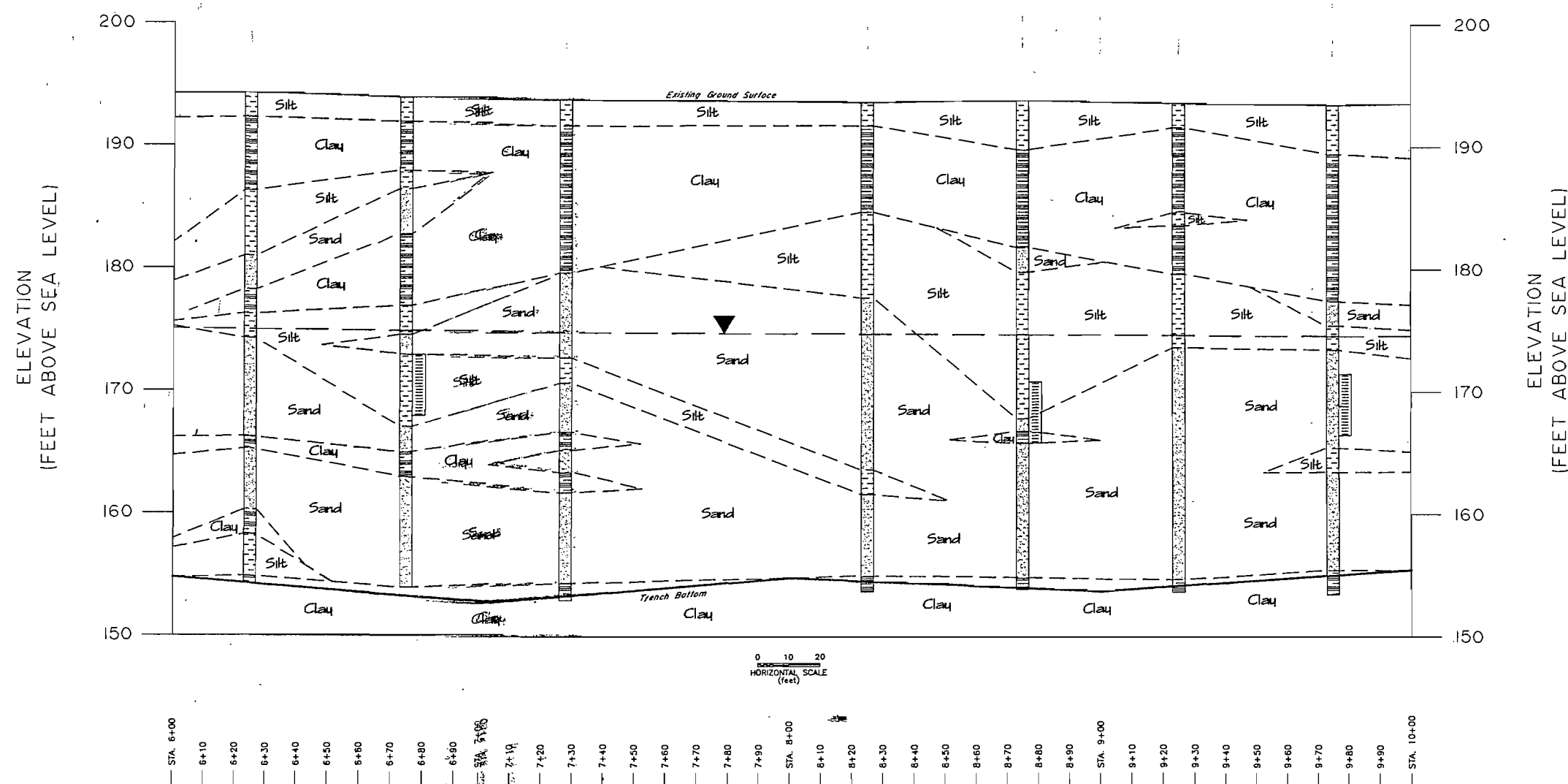
SUBSURFACE CROSS-SECTION INTERCEPT COLLECTION TRENCHES

CLIENT	LHAAP KARNACK, TEXAS	PROJECT NUMBER	2379
SCALE	AS SHOWN	DRAWING NO.	ICT SECTION 14B
		SHEET	13 of 14

SE

PI4-1

PROPOSED
SUMP



SAND

SILT

CLAY

WATER LEVEL
MEASURED ON
SEPT. 5, 1995

SCREENED 5'
INTERVAL

P = PIEZOMETER WELL
MW = MONITORING WELL
EH = SOIL BORING

NOTES:

1. THE CROSS-SECTIONS ARE AN INTERPRETATION OF SEIZOMETERS, MONITORING WELL AND SOIL BORING DATA AND ARE INFERRED FROM DATA COLLECTED IN THE FIELD. VARIATIONS IN SUBSURFACE CONDITIONS CAN BE EXPECTED.
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US Army Corps
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Tulsa District



Dow Environmental

SUBSURFACE CROSS-SECTION
INTERCEPT COLLECTION TRENCHES
JULY 1996

CLIENT		LHAAP KARNACK, TEXAS		PROJECT NUMBER		2379	
SCALE		DRAWING NO.		SHEET			
AS SHOWN		ICT SECTION 14C				14 of	

Appendix J

Table of Source Material Data Available from Quality Control Reports

IRA Information in Quality Control Dailey Reports

Excavations, Treatment & Disposal

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
Summary of all volumes								
Approx Treated	59,425.78	cubic yards						
Total	50,942.75	tons	6,423,024		1,960	24,304	4,154	28,713.50
2/3/1997			117,000					
2/4/1997								
2/5/1997								
2/6/1997								
2/7/1997								
2/8/1997								
2/9/1997								
2/10/1997								
2/11/1997				by ACD & INF cage this week				
2/12/1997								
2/13/1997								50
2/14/1997	50			west of most NW Burn cage 10 loads aprox 55 cy				55
					Total from NW of burn cage			105
2/19/1997			91,440					
2/21/1997	40							
2/22/1997	98.5							
2/24/1997	66.7							
2/25/1997	116.3							
2/26/1997	95.7							
2/27/1997	95.7							
2/28/1997	149.6			along road E			60	
3/1/1997	102.6							
3/3/1997	72.9						75	
3/4/1997	135.1						75	
3/5/1997	97.5		25,000					
3/6/1997	150.9		25,000				135	
3/7/1997	242			along road E			25	60
3/8/1997	142			along road E				85
3/10/1997	180.1			along road E			90	20
3/11/1997	229.8			along road E	105			115.5
3/12/1997	229.8			along road E				55
3/13/1997	175.8		117,737					
3/14/1997	314			along road E	195			82

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
3/15/1997	313			along road E	105			173
3/17/1997	255.6			along road E	240			182
3/18/1997	179.8			along road E				203
3/19/1997	88.1		118,513		270			
				Total for a bng Road E				975.5
3/20/1997	257.5		111,084					
3/21/1997	298				245			
3/22/1997	47.6			UXO				
3/24/1997	190.8			munitions clearing				
3/25/1997	220.7			set -up power screen for UXO				45
3/26/1997	82.4			UXO & metal debris	345			145
3/27/1997	333				110			150
3/28/1997	228.5				225			220
3/29/1997	106.6			Fig 5-2 AMP.. ID #40 and #41	120			275
3/31/1997	276.8			Fig 5-2 AMP.. ID #40 and #41 - PPE escalated to level C respirator				225
4/1/1997	303.5		117,411	Fig 5-2 AMP.. ID #40 and #41				260
4/2/1997	494.7		111,232	Fig 5-2 AMP.. ID #41 and #42			135	270
4/3/1997	340.6			Fig 5-2 AMP.. ID #41 and #42			255	220
4/4/1997	212.9							
4/7/1997	53.3							
4/8/1997	256.4		120,270	Fig 5-2 AMP.. ID #42 and #43			405	120

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
4/9/1997	233.3		105,771	Fig 5-2 AMP.. ID #42 and #43			405	258
4/10/1997	379.4			Fig 5-2 AMP.. ID #42 and #43 screening for uxo			240	296
4/11/1997	243.6			more uxo -soil treatment & excavations shut down			220	
4/14/1997				uxo clearing				
4/15/1997			112,562	uxo clearing				
4/16/1997				uxo clearing				
4/17/1997	139.9		79,572	Fig 5-2 AMP.. ID #42 and #41				135
4/18/1997	358.4			Fig 5-2 AMP.. ID #42 and #43				260
4/19/1997	127.8			Fig 5-2 AMP.. ID #42 and #43				155
4/21/1997	261.2			Fig 5-2 AMP.. ID #42 and #43				462
4/22/1997	136.5							
4/23/1997	447.8			Fig 5-2 AMP.. ID #43 and #44 removed concrete in Rd D & rainwater west of cages & boundary sampling of excavation			438	
4/24/1997	451.7		86,157	Fig 5-2 AMP.. ID #43 and #44			266	195

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
4/25/1997	447.8			Fig 5-2 AMP.. ID #43 and #44			210	135
4/26/1997								
4/27/1997								
4/28/1997	162.1							
4/29/1997	308.5		118,012	Fig 5-2 AMP.. ID #43 and #44			210	110
4/30/1997	258.7			Fig 5-2 AMP.. ID #43 and #44			420	65
5/1/1997	377.6			Fig 5-2 AMP.. ID #43 and #44			112	260
5/2/1997	199.3			Fig 5-2 AMP.. ID #43 and #44 metal debris				48
5/3/1997				Fig 5-2 AMP.. ID #43 and #44				
5/4/1997								
5/5/1997	283.2		121,852	Fig 5-2 AMP.. ID #43 and #44			378	135
5/6/1997	283.2		113,819					metal, concrete & debris
5/7/1997	292.5			boundary sampling of source excavation pits 6B, 6C & 6D IT excavated material treated			294	
5/8/1997	275.8			No info but picture shows between Rd C to Rd D				126

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
5/9/1997	198.1			No info but picture shows between Rd C to Rd D				126
5/10/1997						315		
				Total for area a bng Road D to C				4,696
5/11/1997								
5/12/1997	236.2		77,141	ICT excavated material treated				
5/13/1997	122.7		134,557	ICT excavated material treated				
5/14/1997	47.5			ICT excavated material treated				
5/15/1997	66.3			ICT excavated material treated				0
5/16/1997	137.7			ICT excavated material treated				
5/17/1997								
5/18/1997								
5/19/1997	208.7			ICT excavated material treated				
5/20/1997	193.3			ICT excavated material treated				
5/21/1997	193.3			ICT excavated material treated				

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
5/22/1997	125.1		70,377	ICT excavated material treated				
5/23/1997	159.5			ICT excavated material treated				
5/24/1997								
5/25/1997								
5/26/1997								
5/27/1997	98.1			ICT excavated material treated				
5/28/1997	98.1			ICT excavated material treated				
5/29/1997	162.83		131,273	ICT excavated material treated				
5/30/1997	125.55		37,910	ICT excavated material treated				
5/31/1997								
6/1/1997								
6/2/1997	281.9			ICT excavated material treated				
6/3/1997	433.8		40,136	no location info				375
6/4/1997	340.7			no location info				120
6/5/1997	292.8			no location info		285		48
6/6/1997	363.5			no location info				438

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
				Total for No Location in June 1997				981
6/7/1997	333			North of ACD				333
6/8/1997								
6/9/1997	330.9		49,115	North of ACD		360		126
				Total for North of ACD				459
6/10/1997	423.6							
6/11/1997	176.7			adjacent to ACD		300		210
6/12/1997	332.3			adjacent to ACD		240		180
6/13/1997	51.8					345		
6/14/1997			84,434					
6/15/1997								
6/16/1997	123.4		30,000	adjacent to ACD				432
6/17/1997	262.1		35,000			390		
6/18/1997	287.4			adjacent to ACD		390		120
6/19/1997	274.5			adjacent to ACD		150		84
6/20/1997	222.1			adjacent to ACD				636
6/21/1997								
6/22/1997								
6/23/1997	305.8			adjacent to ACD		105		210
6/24/1997	321.3			adjacent to ACD				75
6/25/1997	230.2			adjacent to ACD		270		180
6/26/1997	211.5			adjacent to ACD		180		126
6/27/1997	278.3			adjacent to ACD				120
6/28/1997								
6/29/1997								
6/30/1997	282.7		100,000			195		
7/1/1997	393.6			adjacent to ACD				275
7/2/1997	393.6					180		

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
7/3/1997	220.4			adjacent to ACD		150		518
7/4/1997								
7/5/1997								
7/6/1997								
7/7/1997	270.2							
7/8/1997	195.2					435		
7/9/1997	333.6		38,000	adjacent to ACD		315		162
7/10/1997	335.4			adjacent to ACD		150		410
7/11/1997	259.5		118,215	adjacent to ACD				282
7/12/1997								
7/13/1997								
7/14/1997	236.2					330		
7/15/1997	152.03			BG 3		285		300
7/16/1997	40.6					210		
7/17/1997	40.6		63,339					
7/18/1997	73.5			BG 3				225
7/19/1997								
7/20/1997								
7/21/1997	210.2			adjacent to ACD				186
7/22/1997	215		47,113			210		
7/23/1997	403.9		40,415			135		
7/24/1997	506.2			adjacent to ACD		195		555
7/25/1997	372.7		29,908	adjacent to ACD		375		342
7/26/1997								
7/27/1997								
7/28/1997	129.4		57,805	adjacent to ACD		330		134
7/29/1997	258.6		101,286			300		
7/30/1997	467.2		70,550	adjacent to ACD		270		450
7/31/1997						240		
8/1/1997	268.3			adjacent to ACD				350
8/2/1997								
8/3/1997								
8/4/1997	198.6							

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
8/5/1997	431.6		66,916	adjacent to ACD		285		345
8/6/1997	469.9		70,000	adjacent to ACD		300		525
8/7/1997	462.7					150		
8/8/1997	166.8		20,000					
8/9/1997								
8/10/1997								
8/11/1997	314.8			adjacent to ACD				600
8/12/1997	485.9		94,103	adjacent to ACD		375		450
8/13/1997	318.1		77,136	adjacent to ACD		345		300
8/14/1997	151.6		71,240	adjacent to ACD		465		525
8/15/1997	307.6		43,980			360		
8/16/1997								
8/17/1997								
8/18/1997	467.1		67,618			270		
8/19/1997	475.7		86,496	adjacent to ACD		240		255
8/20/1997	419.5			adjacent to ACD		330		600
8/21/1997	546.4		56,105	adjacent to ACD		300		600
8/22/1997	246.6		25,157			135		
8/23/1997								
8/24/1997								
8/25/1997	420.7					315		
8/26/1997	501.7		63,029	adjacent to ACD		465		300
8/27/1997	553.8		34,969	adjacent to ACD		210		485
8/28/1997	13		33,888	adjacent to ACD		360		425
8/29/1997	345.2							
8/30/1997								
8/31/1997								
9/1/1997						345		
9/2/1997	403.9		52,059	adjacent to ACD				375

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
9/3/1997	461.8			adjacent to ACD		300		600
9/4/1997	400.5		34,725	adjacent to ACD		720		225
9/5/1997	488.2		35,221			240		
9/6/1997								
9/7/1997								
9/8/1997	411.5		55,797	adjacent to ACD		225		300
9/9/1997	533.6		38,854	adjacent to ACD		255		630
9/10/1997	523.1			adjacent to ACD		480		300
9/11/1997	215.5			adjacent to ACD		285		525
9/12/1997						210		
				total cy adjacent to ACD				14,927
9/13/1997								
9/14/1997								
9/15/1997	236.4					150		
9/16/1997	479.6					255		
9/17/1997	314			No info		270		270
9/18/1997	272.8		56,409	No info		195		570
9/19/1997	416.73		62,308			315		
9/20/1997								
9/21/1997								
9/22/1997	174.14		36,379	No info		345		450
9/23/1997	416.03		36,379					
9/24/1997	417.52							
9/25/1997	204.22		58,984	No info		480		250
9/26/1997	284.6		42,272	No info		495		720
9/27/1997								
9/28/1997								
9/29/1997	158.2		50,130	No info		240		
9/30/1997	395.4		50,130					
10/1/1997	555.8		54,214	No info		180		600
10/2/1997	412.7		45,938	No info		315		350
10/3/1997	445.6		45,938	No info		375		
10/4/1997								
10/5/1997								
10/6/1997	369.3			No info		270		165

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTDD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
10/7/1997	254.9		31,617	No info		255		390
10/8/1997	253.99							
10/9/1997	226.5		78,597	No info		285		525
10/10/1997	226.5		44,184					
10/11/1997								
10/12/1997								
10/13/1997	306.9							
10/14/1997	291.1		49,512	No info		300		
10/15/1997	320		65,376	No info		280		
10/16/1997	364.2		71,708	No info		165		375
10/17/1997	286.7		28,586	No info		210		480
10/18/1997								
10/19/1997								
10/20/1997	278.2		50,209	No info		165		150
10/21/1997	278.2		36,334	No info		195		150
10/22/1997	331.66		46,508					
10/23/1997	63.45		44,115	No info		165		
10/24/1997	237.5		51,389					
10/25/1997								
10/26/1997								
10/27/1997	182.4		77,090	No info		225		210
10/28/1997	277		99,193	No info		255		300
10/29/1997	341.7		34,530	No info		210		615
				Total for No info in September-October 1997				6,570
10/30/1997	298.9		45,474					
10/31/1997	229.3					240		
11/1/1997								
11/2/1997								
11/3/1997	251.7							
11/4/1997	216.2		30,098			225		
11/5/1997	113.2		12,063			225		
11/6/1997	247.8		24,761			225		
11/7/1997	160.7		54,847			210		
11/8/1997								
11/9/1997								
11/10/1997	108.3		27,730					
11/11/1997	111.6		98,087					
11/12/1997	20		41,752					
11/13/1997	74.9		49,200					
11/14/1997	123.8		39,166					
11/15/1997								
11/16/1997								
11/17/1997	30.8					390		

IRA Information in Quality Control Dailey Reports

Date	Material Processed in LTTD (tons)		Discharged Treated Groundwater (gal)	Notes: Pertaining to Excavation Areas	Treated Soil to Landfill 12 (yd3)	Treated Soil to Landfill 16 (yd3)	Treated Soil to BG3 (yd3)	Material Excavated Dailey BG3 (yd3)
11/18/1997	48.6							
11/19/1997	106							
11/20/1997	86.3							
11/21/1997	96.7							
11/22/1997								
11/23/1997								
11/24/1997						300		
11/25/1997	56.7		83,204					
11/26/1997			53,382					
11/27/1997								
11/28/1997								
11/29/1997								
11/30/1997								
12/1/1997								
12/2/1997	111.3							
12/3/1997	101.6							
12/4/1997	68.2							
12/5/1997	105.8		21,772					
12/6/1997								
12/7/1997								
12/8/1997	88		17,520					
12/9/1997	122.8		30,199					
12/10/1997	51.9							
12/11/1997			28,887					
12/12/1997			31,454					
12/13/1997								
12/14/1997								
12/15/1997			21,626					
12/16/1997			88,000					
12/17/1997			40,933					
12/18/1997			30,283					
12/19/1997			52,789					
12/20/1997								
12/21/1997								
12/22/1997								
12/23/1997								
12/24/1997								
12/25/1997								
12/26/1997								
12/27/1997								
12/28/1997								
12/29/1997			28,093					
12/30/1997			47,376					



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

October 1, 2012

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LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

October 1, 2012

Dear LHAAP RAB Member,

The next Restoration Advisory Board (RAB) meeting will be held on Thursday, October 18, 2012, from 6:30 to 8:00 p.m. at the Karnack Community Center, Karnack, Texas. We hope that you can attend. If you have any questions, please do not hesitate to contact me.

AECOM is the contractor supporting the U.S. Army environmental restoration activities at the Longhorn Army Ammunition Plant (LHAAP), and will be coordinating the RAB meeting. A tentative agenda for the meeting is attached. If you have additional items for the agenda, please provide to me at rose.zeiler@us.army.mil.

Regards,

Dr. Rose Zeiler
Department of the Army
Longhorn Army Ammunition Plant
Box 220
Ratcliff, Arkansas 72951

Copy to:
Dawn Orsack, Rick Lowerre; CLI (TAG)
Janetta Coats, Donn Walters; EPA (TAG)



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

AGENDA

DATE: Thursday, October 18, 2012
TIME: 6:30 – 8:00 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:30** Welcome and Introduction
- 06:35** Open items {RMZ}
 - RAB Administrative Issues
 - Minutes
 - Website
 - RAB Tour
- 07:05** Defense Environmental Restoration Program (DERP) Update {AECOM}
 - Introduction of Project Team
 - Overview of Scope and Approach
 - Documents Status/ Environmental Sites
 - Groundwater Treatment Plant (GWTP) Update
- 07:25** Other DERP Environmental Restoration Update {RMZ}
 - Status of Demonstration at Site 37
 - Sitewide LUC Management Plan Update
- 07:30** Military Munitions Response Program (MMRP) {USACE}
- 07:35** Other Environmental Restoration Issues {RMZ}
 - Dispute Resolution
- 07:50** Look Ahead at the Schedule
- 08:00** Adjourn {RMZ}



Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting, Longhorn Army Ammunition Plant (LHAAP)

Location of Meeting: Karnack Community Center, Karnack, Texas

Date of Meeting: October 18, 2012, 6:30 – 08:00 PM

Meeting Participants:

LHAAP/BRAC: Rose M. Zeiler

USACE: John Lambert, Aaron Williams, Wendy Lanier

USAEC: Robin Paul

AECOM: Dave Wacker, Gretchen McDonnell, Marwan Salameh, Rick Cramer

TCEQ: Fay Duke

USEPA Region 6: Rich Mayer, Janetta Coats, Charles Faulty
Kent Becher (USGS Liaison to USEPA)

USFWS: Mark Williams

RAB: **Present:** Paul Fortune, Robert Cargill, Charles Dixon, Carol Fortune, Judith Johnson, Judy Van Deventer, Richard LeTourneau, Nigel Shivers, Tom Walker
Absent: Ken Burkhalter, Lee Guice, Ted Kurz, Jim Lambright, E.V. Wilson, Pickens Winters

Public: Mary Britt, Terry Britt, Terry Echols, B. Mauthe, Vicki Pace, Ray Polk, Tony Thomas (Karnack Independent School District), Jay Webb, Dawn Orsack and George Rice (CLI - TAG)

An agenda for the RAB meeting was distributed prior to the meeting. Paul Fortune called the meeting to order.

Welcome – Rose Zeiler

Rose welcomed attendees to the meeting.

Open Items – Rose Zeiler

Minutes

Rose stated that RAB meeting minutes for all 2011 meetings and the July 2012 meeting had been distributed to the RAB members for review and comment. Judy Vandeventer made a motion to approve all 2011 RAB meeting minutes and the July 2012 RAB meeting minutes. Motion seconded by Judith Johnson.

Website

Robin Paul of USAEC stated that Longhorn has been identified to receive a RAB website as part of a test program. The timetable for having the website up and running was unknown but anticipated to be before the end of the 2013 fiscal year. Dawn Orsack, CLI-TAG noted that CLI has also created a website where meeting materials and some documents have been posted.

RAB Member Attendance

Paul Fortune noted that some RAB members have not been attending meetings regularly. His intent is to check the charter to determine the procedure to remove inactive RAB members to allow selection of new members. His intent is to send a letter to inactive members asking them to participate one final time before moving forward with selection of new members. AECOM will provide a record of meeting attendance for the last two years to assist the RAB in their evaluation.

RAB Tour

The last RAB tour of the facility was two years ago. Judith Vandeventer suggested waiting to conduct the next tour until new RAB members have been added. Rose suggested and the group agreed to tentatively plan for a tour in conjunction with the March 2013 RAB meeting.

Community Involvement Plan (CIP) Update Status

Ms. Paul informed the group that a draft of the revised CIP is being prepared now that all required data has been collected and interviews conducted. RAB members will each receive a copy of the new CIP.

Defense Environmental Restoration Program (DERP) Update – AECOM (Dave Wacker)

Introduction of Project Team

AECOM Project Manager Dave Wacker introduced other members of the AECOM team attending the meeting. Gretchen McDonnell was introduced as the Deputy Project Manager assisting Dave. Marwan Salameh was introduced as the task leader for the LHAAP 18/24 site and the Groundwater Treatment Plant (GWTP). Rick Cramer was introduced as the lead on the Conceptual Site Model work for LHAAP-18/24.

In addition to AECOM staff, a limited number of subcontractors will be assisting AECOM with LHAAP operations. Specifically, World Environmental has hired the two long-time LHAAP GWTP technicians and another local individual to support daily operations. Additionally, Eagle Environmental Services of Shreveport will be utilized to provide supplemental technical staff as needed for field efforts.

Judith Johnson requested that AECOM provide a more detailed organizational chart showing AECOM project staff for the next RAB meeting.

Overview of Scope and Approach

AECOM's contract period of performance ends September 20, 2017. Dave summarized that AECOM's ultimate goal is to achieve either "Remedy in Place" or "Operating Properly and Successfully" status for all LHAAP sites under their contract before that date. At the next RAB meeting, AECOM will present a slide describing the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA) process to help in understanding where each of the sites are on the path to closure. Dave presented a slide showing the names and locations of the LHAAP sites included in AECOM's contract.

Document Status/Environmental Sites

Status reviews were presented for sites with significant activities upcoming in the near-term.

LHAAP-04. Soil impacts have been addressed. Perchlorate in groundwater is the remaining contaminant to be addressed.

LHAAP-47. Soil and groundwater remedies will be completed for this site. AECOM showed a slide depicting extent of soil and groundwater impacts at this site.

LHAAP-46. Remedial Design is complete. AECOM is preparing the Remedial Action Work Plan to implement the design to address impacted groundwater.

LHAAP-67. Remedial Design is complete. AECOM is preparing the Remedial Action Work Plan to implement the design to address impacted groundwater.

LHAAP-18/24. A historical data review is being conducted and the Conceptual Site Model (CSM) for the site is being updated. AECOM is preparing a Post-Screening Investigation (PSI) work plan to collect information to fill data gaps. USACE was asked to prepare an "activity/source map" of LHAAP-18/24 showing the locations of all disposal areas and activities.

Compliance Sampling. Completed in September for LHAAP-18/24 and the 6 perimeter wells.

Five-Year Review. A kick-off meeting has been held for this work. The draft Five-Year Review Report is planned to be delivered to the Army for review by the end of February. Public notice of the Five-Year Review activities will be published in the Marshall paper. AECOM was asked to prepare a slide showing the sites that will be included in the Five-Year Review.

Groundwater Treatment Plant (GWTP) Update

The GWTP began treating water on September 6, 2012 to continue containment of the plume at LHAAP-18/24. Operations had halted on May 21, 2012 when a bearing on the scrubber blower shattered causing hot gases from the catalytic oxidation unit to enter the scrubber stack which resulted in warping of the stack. Since the GWTP was restarted, 512,722 gallons of water have been treated and returned to the site through the sprinkler system. Because the catalytic oxidation unit and damaged air scrubber are off-line, monitoring of untreated gas emissions is being conducted as an interim solution to allow plant operation until a long-term plan for the GWTP treatment train is developed.

Paul Fortune asked what happens when the GWTP wears out, since it looks like there's no end in sight for its operations. Dave Wacker stated that everything has a lifespan, but that AECOM has proposed to refurbish the GWTP and evaluate the plant to determine the best long-term

operation plan. The GWTP is very efficient at removing contaminants and controlling the plume, but AECOM is evaluating whether there is a better final remedy that should be proposed. Rose stated that AECOM must ensure the GWTP continues to work until a final remedy is decided upon; the ultimate goal is to more aggressively clean-up LHAAP-18/24 and shut the GWTP down. However, there are no solid dates on when the GWTP might be able to shut down and the plant needs to continue to operate until then.

Paul asked how many GWTP operators AECOM is using. Dave replied that there are two full-time operators (the same individuals who have been running the GWTP for years under previous contractors) and one part-time local employee who focuses more on mowing and maintenance. Currently, AECOM also has another GWTP operator from their San Antonio office at Longhorn to assist in the refurbishing of the facility.

Upcoming Field Work

LHAAP-18/24. The PSI work plan will be executed to collect additional field data relating to geology and groundwater.

LHAAP-46 and LHAAP-67. Remedial Action Work Plans will be executed, including monitoring well installation and groundwater sampling.

Proposed Plan Public Meeting

December 11, 2012 is the tentative date of public meetings associated with the Proposed Plans for LHAAP-04 and LHAAP-47. A public notice will be published in the Marshall Messenger. Notice of the meeting will also be sent to RAB members and the “interested parties” list. Judith Johnson requested that the public notice sent to the newspaper be emailed to the RAB who will further distribute to help get the word out.

Military Munitions Response Program (MMRP) – USACE

Recent Groundwater Monitoring

Rich Mayer, USEPA stated that results have been received for groundwater monitoring conducted in August for ten wells at the two munitions sites. USEPA redeveloped the wells prior to the sampling event. Perchlorate levels were lower than the last groundwater sampling event. Groundwater elevations were lower.

Other DERP Environmental Restoration Update – Rose Zeiler

LHAAP-37 Bioplug Demonstration Project

Rose informed the group that the bio-plug system has been installed, and inoculation with aerobic microbes, air and nutrients began in September. A presentation on initial results is anticipated to happen this spring.

Sitewide Land Use Controls (LUC) Management Plan Update

Rose stated that the plan will contain a list of all LUC signs required for each site. The document will be kept current and authentic through annual “recertification” updates that will be done even if no changes to the plan are needed. All the LUC plans will be in one tabbed document for consolidated reference.

Other Environmental Restoration Issues – Rose Zeiler

Dispute Resolution

Dispute resolution continues. Nothing specific to update since last RAB meeting.

Look Ahead at the Schedule

The public meeting for LHAAP-04 and LHAAP-47 Proposed Plans is scheduled for December 11, 2012. Notice of the meeting will be provided to RAB members.

The next RAB meeting was tentatively scheduled for January 31, 2013 at the Karnack Community Center.

New Items/Question and Answer

A question was asked if the “perimeter wells” recently sampled are for the perimeter of the entire plant or just one site? Rose replied that the perimeter wells are for the entire plant. A question was asked if there is any change in the amount of sampling AECOM will be doing as compared to Shaw. Rose replied that sampling requirements are set by regulatory agreement.

Paul Fortune inquired on the condition of the INF Pond liner. Rose provided background information that INF Pond was first constructed to support the Rocket Motor Burn-Out area, but it was never used. The only water routed to the Pond is treated water from the GWTP, and that only occurs when the bayou is dry. (When the bayou is dry, treated water cannot be discharged to the bayou, and must be held until it can be discharged) While the current volume of treated water is being handled by returning directly to the site by the sprinkler system (water is not routed to the Pond), the Pond is available to provide additional treated water storage capacity if needed. As for current status of the liner, Rose stated that the liner issue from last year where there were trees growing up through the edge of the liner has been resolved. There is currently a small amount of erosion of the soil cover along one edge that is being taken care of by AECOM.

A member of the public asked why the water can’t be released to the dry bayou if the water is treated. Rose responded that the chloride and sulfate (salts) in the water require stream flow to meet discharge criteria.

A member of the public stated there was a health risk study done in 2003, and inquired what information there is before that regarding the impacts to the health of citizens and their offspring. Rose stated that USEPA is waiting to receive a list of specific health risk questions from Mr. Winters, and those questions will be addressed.

A member of the public asked who pays for fixing the GWTP equipment. Rose stated that operation and repair of the GWTP is part AECOM’s responsibility. The gentleman then asked why the Army allowed the Catalytic Oxidation (CATOX) unit to be offline since May. John Lambert explained that there were two options when the CATOX unit failed; either repair the CATOX or run the GWTP without the CATOX. To repair the CATOX, the repair parts (blower bearing) would take 6-8 weeks to obtain. To run the GWTP temporarily without the CATOX unit, Army received regulatory approval as a short term measure while assessing the system. AECOM is now collecting data on the air emissions to determine whether the CATOX unit should be part of the long-term solution and identified that the air data to date met all health screening levels.

George Rice, CLI asked which sites will be included in the upcoming Five-Year Review. Rose stated that only sites with a remedy in place are included. Rose requested that George request a list of the Five-Year Review sites by email.

Paul Fortune asked for additional information regarding the revision of the CIP. Janetta Coats introduced herself as the USEPA's community involvement coordinator working with Army. Army has the lead on the CIP. USEPA did not participate in the CIP interviews but has received the list of questions asked. Paul asked when the new CIP would be received. Rose stated that USAEC has the contract to do the work. Robin Paul of USAEC stated they did not yet have a date for completion of the CIP. Paul asked how people were selected to be interviewed. Robin stated that input was received from the RAB, USEPA, CLI, local businesses, public officials and other interested parties. While the actual names of those interviewed are not disclosed, they were selected to provide input from a broad spectrum of the community.

The next RAB meeting was tentatively scheduled for January 31, 2013 at the Karnack Community Center and will be followed up by notification letters to the RAB.

A motion to adjourn was made by Judith Johnson and seconded by Judy Van Deventer.

Adjourn

October Meeting Attachments and Handouts:

- *Meeting Agenda*
- *Minutes from July meeting*
- *LHAAP-04 Alternatives Analysis Fact Sheet*
- *LHAAP-47 Alternatives Analysis Fact Sheet*

Acronyms

AECOM	AECOM Technical Services, Inc.
CATOX	Catalytic Oxidation
CERCLA	Comprehensive, Environmental Response, Compensation, and Liability Act
CIP	Community Involvement Plan
CLI	Caddo Lake Institute
CSM	Conceptual Site Model
DERP	Defense Environment Response Program
GWTP	Groundwater Treatment Plant
INF	Intermediate-Range Nuclear Forces
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Controls
PSI	Post-Screening Investigation
RAB	Restoration Advisory Board
TAG	Technical Assistance Grant
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting



Location	Karnack Community Center		
Date	18-Oct-2012	6:30 PM	page 1 of __

Please sign in the space provided or add your name and address on next page if your name does not appear below.

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
RAB Members				
Paul Fortune	<i>Paul Fortune</i>	RAB Co-Chair	903 679 3949	plfortune@hotmail.com
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Richard LeTourneau	<i>Richard LeTourneau</i>	RAB Board Member		richardoi@aol.com
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E. V. Wilson		RAB Board Member		evw1@valornet.com
Pickens Winters		RAB Board Member		NA
Longhorn Team Members and Community				
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Aaron Williams	<i>Aaron Williams</i>	USACE, Tulsa	(918) 669-4915	aaron.k.williams@usace.army.mil
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Fay Duke	<i>Fay Duke</i>	TCEQ, Austin	(512) 239-2443	fduke@tceq.state.tx.us
Dale Vodak		TCEQ	(903) 535-5147	dvodak@tceq.state.tx.us
Paul Bruckwicki		USFWS	(903) 679-4536	paul.bruckwicki@fws.gov
Barry Forsythe		USFWS	(214) 665-8467	forsythe.barry@epa.gov
Mark Williams	<i>Mark Williams</i>	USFWS	(903) 679-9144	mark_williams@fws.gov
Mamman Salameh		AECOM	712 735 7063	
Janetta Coats	<i>Janetta Coats</i>	USEPA, Dallas	214 665 1308	Coats.janetta@epa.gov

[illegible]



Prepared by
Tulsa District Corps of Engineers

Subject: Minutes, Quarterly Restoration Advisory Board (RAB)
Meeting, Longhorn Army Ammunition Plant (LHAAP)

Location of Meeting: Caddo State Park Recreation Hall, Karnack, Texas

Date of Meeting: July 19, 2012, 6:30 – 08:30 PM

Meeting Participants:

LHAAP/BRAC: Rose M. Zeiler

USACE: John Lambert, Aaron Williams, Wendy Lanier

USAEC: Marilyn Plitnik

AECOM: Dave Wacker, Manish Joshi

TCEQ: Fay Duke

USEPA Region 6: Steve Tzhone, Terry Burton, Rich Mayer, Paul Torcoletti,
Janetta Coats, Barry Forsythe (USFWS Liason to EPA),
Kent Becher (USGS Liason to EPA)

RAB: **Present:** Paul Fortune, Carol Fortune, Judith Johnson, Ted Kurz,
Judy Van Deventer, Richard LeTourneau
Absent: Ken Burkhalter, Lee Guice, Robert Cargill, Charles
Dixon, Jim Lambright, Nigel Shivers, E.V. Wilson, Pickens
Winters

Public: Lee Thomas, William Techels, William Hatfield (Harrison Co.
Commissioner), Dawn Orsak (CLI - TAG), Bryan Hughes
(Texas House Representative)

An agenda for the RAB meeting was distributed prior to the meeting. Paul Fortune called the meeting to order.

Welcome – Rose Zeiler

Dave Wacker and Manish Joshi were introduced as the new contractors (AECOM) conducting environmental restoration at Longhorn. They were asked where they were located. They responded that they will perform the contract from offices in San Antonio, Dallas, Austin, and

Houston Texas. Ted Kurz asked what the deliverables are on the contract. Since AECOM had just received notice that stop work had been rescinded on Monday there was no time to put together a presentation. A discussion of deliverables will be included at the next meeting.

William Hatfield was introduced as the Harrison County Commissioner-elect. Bryan Hughes was introduced as the Texas State Representative-elect.

The previous RAB meeting minutes were distributed as handouts and the RAB was informed that if they had any revisions for the meeting minutes to submit comments for inclusion prior to uploading the minutes to the Administrative Record. Ted Kurz made a motion that the January 2012 minutes be approved and Judith Johnson seconded the motion. Rose Zeiler noted that in the future RAB minutes will be sent to RAB members for review so that approval can take place at the next meeting. Any comments or edits can be sent to Paul Fortune who will send them on to Army. Judy Vandeventer asked about previous meeting minutes. Rose Zeiler responded that they were available in the administrative record. Because the minutes for meetings held in 2011 were inadvertently not presented to the RAB for review, comments on the minutes will be accepted through the next RAB meeting. The 2011 meeting minutes will be emailed to the RAB for review.

Open Items – Rose Zeiler

Charter Approval Status

Rose informed the group that the RAB charter had been approved and the signed copies were emailed to the group and provided as handouts at the RAB.

Community Involvement Plan (CIP) Update Status

Rose informed the group that the Community Involvement Plan was being revised, not merely updated as previously indicated. Marilyn Plitnik with AEC reported that the funds to support new interviews and a revised CIP are in the works. It was determined that new interviews should be conducted since the last interviews were conducted in 2002. Steve Thzone stated that Janetta Coats with the EPA would also be involved in supporting the effort of updating the CIP.

Wooden Cover on way to Fire Station

Rose informed Paul Fortune that she would discuss the matter with him after the RAB meeting.

Contract Status - USACE

John Lambert informed the group that the stop work order on the new contract was rescinded on Monday and that the post-protest process was completed. AECOM was introduced as the new contractor. Ted Kurz asked about the length of the contract. AECOM responded that the contract covered 5.75 years.

April 2012 Minutes

The April 2012 minutes were provided as a handout and the minutes will be emailed to the RAB group again since the RAB members reported they did not receive the original email.

Groundwater Treatment Plant (GWTP) Update

Aaron Williams informed the group that Groundwater Treatment Plant operations halted on May 21st when a bearing on the scrubber blower shattered causing hot gases from the catalytic oxidation unit to enter the scrubber stack which resulted in warping of the stack. The Groundwater Treatment Plant had been operating in recirculation mode to keep the bacteria in the Fluidized Bed Reactor alive up until recently when the PLC programming went down. AECOM is assessing the GWTP status. An interim measure to allow untreated gas emissions from the air stripper is being considered to get the GWTP up and operational in the near-term while more permanent long-term solutions are reviewed. The Groundwater Treatment Plant has been down before for periods of weeks and months in the past.

Wendy Lanier presented historical information leading to the Interim Remedial Action (IRA) at LHAAP-18/24. The Army considers LHAAP-18/24 to be the most contaminated site at Longhorn. Wendy was involved in the Corp's initial design of the IRA. The GWTP was constructed in the 96/98 timeframe. Construction photos were shared in a binder at the meeting for those who were interested in seeing the level of effort that went into it. It was pointed out that the GWTP as part of the IRA has outlived its estimated life going on almost 10 years. The timeline from beginning operations at the Burning Ground to GWTP operations was presented. Details of operations at LHAAP 18/24 were presented including washing out of rocket motors at the Unlined Evaporation Pond and use of the Air Curtain Destructor and washout pads. Wendy explained why the IRA was implemented. From comparing the Methylene chloride (MEC) and Trichloroethylene (TCE) 1992 plumes to the 1993 plumes it was clear that the plume was migrating in the shallow groundwater. Wendy presented the findings to the Longhorn Installation Commander. The Commander subsequently requested funds to implement an IRA to remove source material at the site which include the highly contaminated soil and shallow groundwater. The Army provided the U.S. Army Corps of Engineers Tulsa District with \$15 million to begin the design/construction process to address the source material that was contributing to plume migration, ASAP. Wendy pointed out that the timeline from conceptual design of the IRA to construction and operation was extremely fast due to the Army's and regulator's commitment to working together by such means as agreeing to quick reviews and use of a Cost Plus Contract. Wendy discussed some of the technical aspects of the IRA (i.e. Interceptor Collection Trenches, use of an organic slurry (guar gum) to hold trenches open during construction, treatment of at least 30,000 cubic yards of contaminated soil in a low temperature thermal treatment plant and extracting and treating groundwater). A comparison of the 1993 sampling results to the 2009 sampling results at LHAAP-18/24 were displayed to show that the Interim Remedial Action has been effective controlling the MEC/TCE plume migration and bringing the concentrations in the shallow groundwater down significantly.

Perimeter Well/Surface Water Sampling (Creek) Results and Update

Aaron Williams informed the group that handouts for the recent creek sampling have been provided but that there is nothing new to report since the creeks were dry during the June sampling event.

Other DERP Environmental Restoration Update – Rose Zeiler -LHAAP-37 – Bioplug Demonstration Project

Rose informed the group that the demonstration consists of bioplug wells offset by 10 feet and inoculated with aerobic microbes, air and nutrients. Project will last 2 years. To date 81 out of

the 300 bioplugs have been installed. Plan to start operation in late August. Monitoring wells were sampled during the week to establish baseline.

Other Environmental Restoration Issues – Rose Zeiler, Steve Tzhone, Fay Duke -Four RODs

Army and Regulators re-iterated to the RAB that they are currently in dispute resolution over 8 issues arising from four RODs and 1 dispute over stipulated penalties. In the last month the Army and Regulators have come close to resolution on 7 issues. Based on those discussions, Army prepared redline RODs for regulator review. TCEQ comments have been received on the redline RODs addressing the 7 issues. EPA comments are pending. For the remaining issue regarding perchlorate cleanup concentration, Army and TCEQ disagree with EPA. The perchlorate issue will most likely go to the next level for resolution, the SEC, as will the stipulated penalties issue. Steve Tzhone explained that if the SEC cannot resolve the issue that it would then go to the EPA regional administrator for resolution. The Army and TCEQ would at that time have the opportunity to issue a written notice elevating the dispute to the Administrator in Washington D.C.. The details for the dispute issues are included in the Administrative Record. Judy Vandeventer asked whether the Administrative Record could be accessed online. The answer was no, but that the CD was located at the Marshall Public Library for public access and that folks certainly could burn a CD from the one in the Marshall Public Library for their own copy. There followed some discussion about access to the Administrative Record CD.

EPA Sampling of MMRP Sites' wells

EPA informed the group that they were going to be sampling the 10 monitoring wells at the MMRP sites the week of August 13th.

EPA Research Project - Phytoforensics study update – Rich Mayer

Rich Mayer discussed the phytoforensics research effort conducted at Longhorn. The study included sampling of 200 trees throughout LHAAP-16, -17, and -18/24 including background trees and monitoring wells in and around the sites. One-third of the samples had TCE and perchlorate detections. This was the first time perchlorate had been analyzed for in a phytoforensics study. Rich displayed the grids for the sampling activities at the sites and provided a demonstration of how a tree coring is collected. Ted Kurz asked if there were any signs of stress to the trees. The answer was that there was no visual stress to the trees and it was added that trees have been used in studies to help remediate groundwater contamination.

Look Ahead at the Schedule

Presentation provided: Upcoming Field Work includes groundwater monitoring in September at LHAAP-18/24 and creek sampling quarterly.

New Items/Question and Answer

A member of the public asked why it is taking so long to cleanup, is it because the cleanup standards keep changing? Response was that sometimes standards change but that the reason for lengthy cleanup times was due to the nature of the contaminant and the media, with its lenses of clay which takes a long time to cleanup with current technology. The question was asked whether the site would be cleaned up during the life of one's grandchildren. The response was no for Site 18/24, but most likely yes for some of the smaller plumes, like Site

67. It was also pointed out that the lengthy cleanup being discussed was for groundwater and that soil cleanup is being done more quickly. The land will be available for refuge activities (e.g. bird watching) sooner.

Ted Kurz wanted to know whether funding would be available in 50 years. The response was that budgets are shrinking but the Army will get funding since it is a NPL site and there is a FFA. Each year Army prepares a 30-year environmental liability projection for the annual report to Congress. It was also pointed out that DERA funds are “fenced money” that is the funds must be used for environmental remediation.

The next RAB meeting was tentatively scheduled for October 18, 2012. The group had one objection to meeting at the Caddo State Park Recreation Hall for future meetings. Paul Fortune will discuss with other absent RAB members to reach a consensus on location for the next meeting. (Note: Immediately after adjournment, Judith announced that a decision was reached among the RAB members present that the next meeting will be held in the Karnack Community Center.)

A motion was made by Carol Fortune to adjourn and seconded by Ted Kurz.

Adjourn

July Meeting Attachments and Handouts:

- *Meeting Agenda*
- *Meeting Minutes from April meeting*
- *Surface Water Sampling Results*
- *Signed RAB Charter*
- *IRA Presentation*
- *Phytoforensics Presentation*
- *Look Ahead*

Acronyms

<i>CIP</i>	<i>Community Involvement Plan</i>
<i>DERP</i>	<i>Defense Environment Response Program</i>
<i>FFA</i>	<i>Federal Facilities Agreement</i>
<i>GWTP</i>	<i>Groundwater Treatment Plant</i>
<i>IRA</i>	<i>Interim Remedial Action</i>
<i>MMRP</i>	<i>military munitions response program</i>
<i>PBC</i>	<i>Performance Based Contract</i>
<i>PLC</i>	<i>Programmable Logic Controller</i>
<i>ROD</i>	<i>Record of Decision</i>
<i>SEC</i>	<i>Senior Executive Committee</i>
<i>TCE</i>	<i>Trichlorethene</i>
<i>USGS</i>	<i>United States Geological Survey</i>

LHAAP-04

Former Pilot Wastewater Treatment Plant

Site History

The Former Pilot Wastewater Treatment Plant at LHAAP-04 began industrial wastewater treatment operations in 1984 and historical operations resulted in environmental impacts to soil and groundwater. Demolition of the Former Pilot Wastewater Treatment Facility structures, tanks, and piping, and the disposal of associated wastes were completed in the summer of 1997 as part of Resource Conservation and Recovery Act (RCRA) closure of the plant. Numerous sampling events were conducted from 1993 through 2008 to identify contamination from past operations and its impact to soil. Soil contaminated with perchlorate and mercury was removed in 2009, eliminating the principle threat at the site.

Site Characteristics

LHAAP-04, the Former Pilot Wastewater Treatment Plant, is located in the central portion of LHAAP at the northwest corner of 6th and 60th Streets near the former fire station and covers approximately 0.5 acre. LHAAP-04 is surrounded by light duty roads. The LHAAP-04 site is situated on an outcrop of the Wilcox Group which generally consists of a few feet of residually derived soils overlying interbedded silts and clays. Based on the potentiometric surface map for LHAAP -04, the groundwater flow direction in the shallow saturated zone is to the northeast.

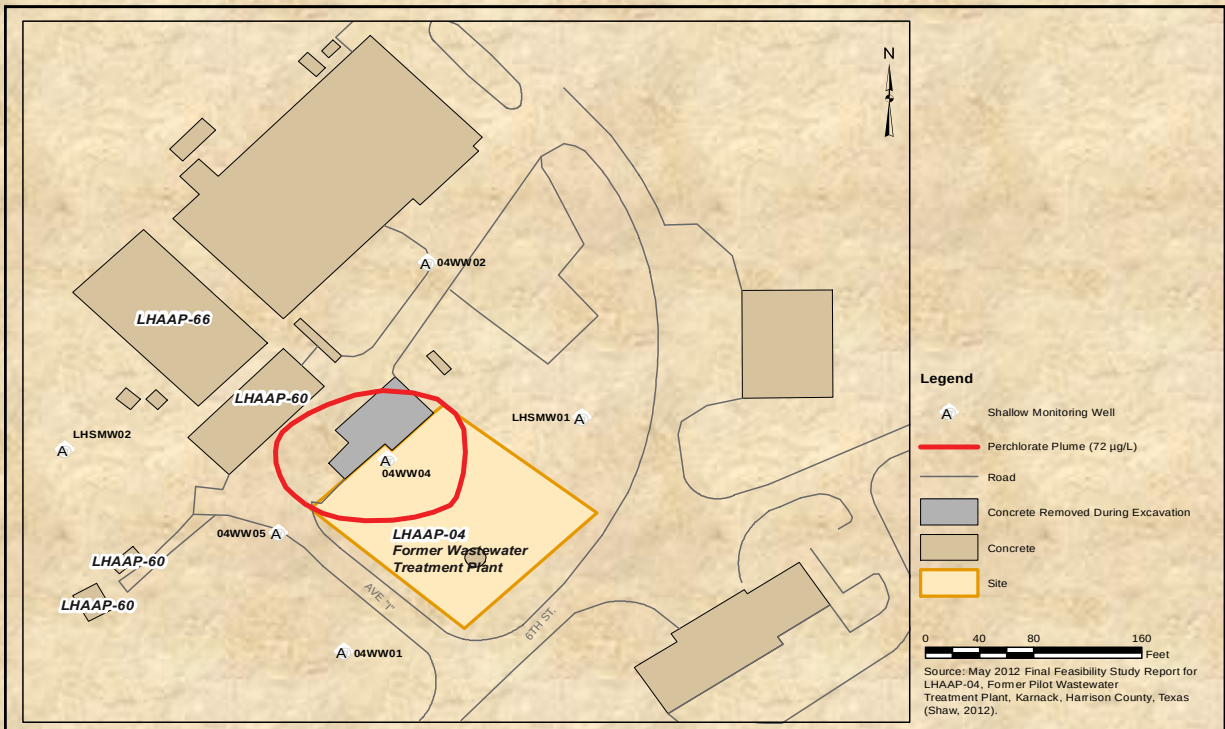
Risk Assessment

Baseline human health risk assessment (BHHRA) and baseline ecological risk assessment (BERA) studies were conducted for LHAAP-04 to determine current and future effects of contaminants on human health and the environment. Additional soil and groundwater data was collected and analyzed after completion of the risk assessments.

The baseline ecological risk assessment (BERA) concluded that no unacceptable risk was present in the Industrial Sub-Area of which LHAAP-04 is a part, and therefore, no further action is needed at LHAAP-04 for protection of ecological receptors (Shaw, 2007).

Soil samples collected after the BHHRA were observed to contain perchlorate and mercury concentrations posing unacceptable risk or hazards to human health. These soils with high perchlorate and mercury concentrations were removed and sent to an off-site landfill in 2009. Soil remaining after completion of the removal activity does not pose unacceptable risk or hazard to human health based on exposure pathway for a future maintenance worker in an industrial scenario.

Groundwater data collected after the risk assessment indicated that perchlorate concentrations in the groundwater exceed acceptable concentrations, so are presumed to pose an unacceptable risk to human health and require remediation.



Chemicals of Concern

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess contamination from past operations and its impact to the soil and/or groundwater. The chemical of concern (COC) for LHAAP-04 is perchlorate, which was found at concentrations exceeding acceptable levels in the shallow groundwater zone.

Remedial Alternatives for LHAAP-04

The RAOs for LHAAP-04, which address contamination associated with the media at the site and takes into account the future uses of LHAAP streams, land, and groundwater include:

- 1) Protect human health by preventing exposure to groundwater contaminated with perchlorate.
- 2) Protect human health and the environment by preventing groundwater contaminated with perchlorate from migrating into nearby surface water.
- 3) Return groundwater to its potential beneficial use, wherever practicable, within a reasonable time period given the particular site circumstances.

Alternative 1

No Action

Estimated Present
Worth: \$0

Alternative 2

Monitored
Natural
Attenuation
and Land Use
Controls

Estimated Present
Worth: \$565,000

Alternative 3

In-situ
Bioremediation
and
Land Use Controls

Estimated Present
Worth: \$638,000

Alternative 4

Groundwater
Extraction,
On-Site Treatment,
and Land Use
Controls

Estimated Present
Worth: \$730,000

Alternative 5

Interceptor
Collection Trenches,
Groundwater
Extraction and
Treatment, Long-
Term Operation and
Land Use Controls
Estimated Present
Worth: \$783,000

The five remedial alternatives will be evaluated using nine required criteria to select a remedy.

- 1) Overall protection of human health and the environment***
- 2) Compliance with ARARs***
- 3) Long-term effectiveness and permanence***
- 4) Reduction of toxicity, mobility, or volume through treatment***
- 5) Short-term effectiveness***
- 6) Implementability***
- 7) Cost***
- 8) State/support agency acceptance***
- 9) Community acceptance***

LHAAP-47, PLANT AREA 3

SOLID ROCKET MOTOR FUEL PRODUCTION

Site History

LHAAP-47, historically known as Plant 3, is located in the north-central portion of the former Longhorn Army Ammunition Plant, covering an area of approximately 275 acres. Plant 3 produced rocket motors from 1954 until the early 1980s when operations were converted to produce pyrotechnic and illumination devices. Production activities continued through 1997. Industrial solid wastes and possibly hazardous wastes such as parts cleaners and spent solvents may have been generated by these activities. Fifty waste process sumps and three waste rack sumps were located within the LHAAP-47 site. The soil, groundwater, surface water, and sediment at the LHAAP-47 site have been the subject of numerous investigations to identify potential contamination. Jacobs Engineering conducted Phase I, Phase II, and Phase III remedial investigations in 1993, 1995, and 1998, respectively, and additional remedial investigations from 1996 through 2001. In 1999, the Army installed plastic liner material around Building 25-C over perchlorate-contaminated soils to prevent migration of perchlorate to Goose Prairie Creek.

Site Characteristics

The surface features at the LHAAP-47 site are a mixture of asphalt-paved roads, parking areas, remnants of building foundations, old buildings, and areas covered with dense vegetation. The topography in this area is relatively flat with surface water drainage flowing into tributaries of Goose Prairie Creek, which eventually enters Caddo Lake.

The soil at the LHAAP-47 site consists of layers of silty clay, underlain by silty sand to clayey sand. Below this are rocks of the Wilcox Group, generally consisting of interbedded silts and clays.

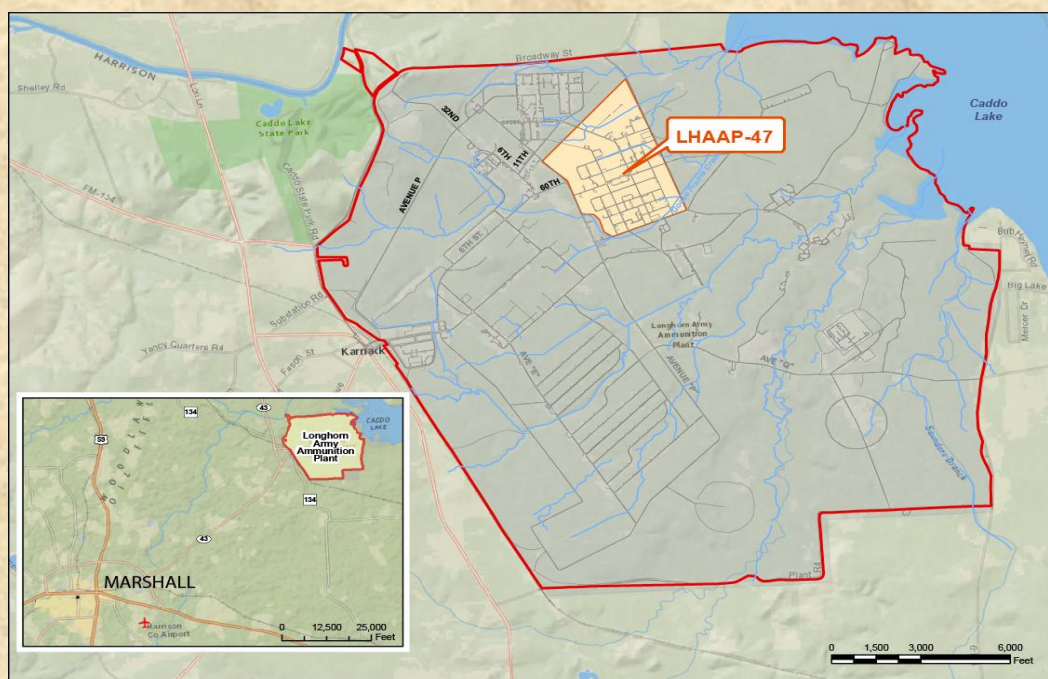
Groundwater at the site is divided into four zones: shallow, shallow/intermediate, intermediate and deep. The shallow and intermediate groundwater zones are interconnected over much of the site except in the east-central portion of the site where they are separated by a clay layer. The groundwater flow direction in the shallow and intermediate saturated zones is to the northeast, with groundwater in the deep zone flowing to the north-northeast.

Risk Assessment

Baseline human health risk assessment (BHHRA) and screening level ecological risk assessment (SLERA) studies were conducted for LHAAP-47 in 2003 to determine current and future effects of contaminants on human health and the environment and determine whether further ecological risk assessment was needed. In 2007, a baseline ecological risk assessment (BERA) was conducted to further assess potential risks to the environment.

The BERA concluded contaminant levels at the site posed no unacceptable ecological risk. The BHHRA concluded the concentrations of contaminants in soil at the site did not pose a cancer risk or non-cancer hazard to the hypothetical future maintenance worker under an industrial scenario. However, groundwater posed unacceptable cancer risk and non-cancer hazard, requiring remediation for the protection of the hypothetical future maintenance worker.

Surface water impacts resulting from leaching of perchlorate-contaminated soils were addressed in 1999 with a temporary measure where plastic liner was installed over perchlorate-contaminated soils at Building 25-C, to prevent leaching of perchlorate.



Chemicals of Concern

Investigations conducted at LHAAP-47 have identified perchlorate in soil near Building 25C as a potential source for groundwater perchlorate contamination. Chemicals of concern (COCs) identified in shallow, shallow/intermediate, and intermediate groundwater zones include perchlorate, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and 2,4,6-trinitrotoluene (TNT).

Remedial Alternatives for LHAAP-47

The RAOs for LHAAP-47, which address contamination associated with the media at the site and takes into account the future uses of LHAAP streams, land, and groundwater include:

- 1) Protection of human health by preventing human exposure to the contaminated groundwater.
- 2) Protection of human health by preventing further potential degradation of groundwater and surface water.
- 3) Protection of human health by preventing degradation of surface water from groundwater contaminated with COCs.
- 4) Return of groundwater to its potential beneficial use as drinking water, wherever practicable.

Alternative 1

No Action

Estimated Present Worth:
\$0

Alternative 2

Excavation, In-situ
Bioremediation,
Monitored Natural
Attenuation and Land Use
Controls

Estimated Present Worth:
\$5.09 million

Alternative 3

Excavation, Recirculating
Bioremediation,
Monitored Natural
Attenuation and Land Use
Controls

Estimated Present Worth:
\$7.62 million

Alternative 4

Excavation,
Groundwater Pump and
Treat, In-situ
Bioremediation,
Monitored Natural
Attenuation, and Land
Use Controls

Estimated Present
Worth:
\$7.90 million

The four remedial alternatives will be evaluated using nine required criteria to select a remedy.

- 1) *Overall protection of human health and the environment*
- 2) *Compliance with ARARs*
- 3) *Long-term effectiveness and permanence*
- 4) *Reduction of toxicity, mobility, or volume through treatment*
- 5) *Short-term effectiveness*
- 6) *Implementability*
- 7) *Cost*
- 8) *State/support agency acceptance*
- 9) *Community acceptance*

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE: October 19, 2012
TIME: 8:00 a.m.
PLACE: Hampton Inn, Marshall TX

Welcome

RMZ

Action Items

AECOM

- GWTP Longer-Term Plan Update
- INF Pond – Evaluate Exposed Liner for Corrective Action
- Submit GWTP air analytical data from 19 September sampling to Mr. Williams
- “Path Forward for LHAAP-03”
- Provide the RTC matrix documents in Word format by email to reviewers.
- Examine ICT-13 for proper function.
- Decide location for October 19th Monthly Managers' Meeting

Army

- Distribute GWTP air analytical data from 19 September sampling (Mr. Williams)
- Forward electronic copies of documents to AEC for review since AEC does not have SharePoint access
- Provide Memo For Record for Site 18/24 Historical Research including providing scanned copies of all drawings/documents which are not currently in the Admin Record
- Provide supplemental BERA schedule to EPA and TCEQ
- Provide scanned copies of all drawings/documents which are not currently in the AR
- USACE will provide spreadsheets for MMRP groundwater split sample data collected at the October Managers' Meeting.
- Mr. Williams will resend to EPA the 16/17/18/24 area historical ground water data dump previously provided, or provide update on how the data can be accessed.

EPA

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September.
- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide response to Army's question regarding CERCLA process and the use of an EECA – Pending submittal of new path forward
- EPA will provide spreadsheets for site 37 MMRP groundwater split sample data collected at the October Managers' Meeting.
- Mr. Becher will put the draft phytoforensics study report out to an FTP site for everyone to access.
- Provide comment for the revised LHAAP-03 EE/CA.

TCEQ

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September.
- Provide list of site 18/24 historic documents for the Admin Record – future action pending Army submittal of MFR
- Provide input wells planned for sampling at LHAAP-18/24 as part of compliance sampling event
- Provide comment for the revised LHAAP-03 EE/CA.

AEC

- Provide LHAAP-37 Pilot Demonstration data at October Managers' Meeting

Defense Environmental Restoration Program (DERP) PBR Update**AECOM**

- Upcoming document submissions to regulators see Document status table
- Upcoming field work
- Monthly data submission
- Quarterly reports - status
 - Surface water monitoring
 - Groundwater Treatment Plant
 - Report
 - UIC
 - Perimeter Well Sampling and Reporting
- Status of Groundwater Treatment Plant
 - Air monitoring
 - Return to Sprinkler System
 - Other
- Status of regulator comments on LHAAP-18/24 PSI Work Plan
Regulators schedule extension request (**RMZ**)

Other DERA Program Update**Army**

- LHAAP-37 Pilot Demonstration update
- Status of Supplemental BERA
- Decision Document for multiple sites
- Five Year Review Report
- Sitewide LUC Management Plan – annual update

MMRP Update**Army**

- Update status of EPA Groundwater Sampling

Other Environmental Restoration**Army**

- CRP/CIP Update
- Site 19 Decision Document update

Programmatic Issues**RMZ/RM/FD**

- Status of Dispute

USFWS Update**RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

EPA – Non-CERCLA

- Update on Phytoforensics Study

RM**Adjourn****ACRONYM LIST**

DERP-	Defense Environmental Restoration Program
EPA-	Environmental Protection Agency
FS-	Feasibility Study
IRP-	Installation Restoration Program
ITS-	Intertek Testing Services
LHAAP-	Longhorn Army Ammunition Plant
MMRP-	Military Munitions Response Program
MNA-	Monitored Natural Attenuation
PB-	Paul Bruckwicki
PBC-	Performance Based Contract
PS-	Praveen Srivastav
QA-	Quality Assurance
QC-	Quality Control
RMZ-	Rose M. Zeiler
RD-	Remedial Design
ROD-	Record of Decision
SAP-	Sampling and Analysis Plan
TCEQ-	Texas Commission on Environmental Quality
USFWS-	United States Fish and Wildlife Service

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

MINUTES

DATE: October 19, 2012
TIME: 8:00 a.m.
PLACE: Hampton Inn, Marshall TX

Welcome

RMZ

Army requested that future minutes avoid the use of bullets.

Action Items
AECOM

- GWTP Longer-Term Plan Update

TCEQ is concerned that the Army should emphasize that current operation of the GWTP is a “stop-gap measure” because there are differences in the current operation versus the typical operating configuration. AECOM will prepare the GWTP path forward for the next monthly managers’ meeting so all can review and be on the same page before the next RAB meeting. Discussion continued on how to best prepare for RAB meetings to ensure all managers’ are on board with all messages and before presentations are made before the public.

AECOM advised that CATOX quotes have been obtained but as air datasets have been received and evaluated, all results meet Texas Permit by Rule standards and the option to not treat the air has also been evaluated along side repair and replacement of volatiles treating equipment. The cost to have the unit evaluated by the manufacturer is \$6,000 so that action is being held until more discussion is complete on the long-term plan for the GWTP. AECOM will continue to collect air data to support current GWTP operations. Air samples have been meeting all TCEQ standards. Samples taken at the GWTP door and at the off-site receptor location meet the exposure requirements.

- INF Pond – Evaluate Exposed Liner for Corrective Action

AECOM has a path forward to make the repair. Topsoil will be applied to exposed liner areas and covered with erosion control matting, this action is planned for December.

AECOM asked if the pond could be kept drained. Army stated Shaw was given that opportunity and draining/mowing is an option for AECOM to pursue.

- Submit GWTP air analytical data from 19 September sampling to Mr. Williams – COMPLETE and sent to regulators
- “Path Forward for LHAAP-03” – Will be discussed later in meeting
- Provide the RTC matrix documents in Word format by email to reviewers. – This process has been started.
- Examine ICT-13 for proper function.

ICT-13 was examined as part of the overall placement of the pumps. The system was shut down for so long that iron build-up will force replacement of some equipment. AECOM is evaluating the pumps on a case by case basis for repair and replacement.

- Decide location for October 19th Monthly Managers' Meeting - COMPLETE

Ms. Zeiler stated that GWTP staff are going to begin locking gates at all times to prohibit entry by unauthorized persons. Road improvements being made by USFWS are going to increase traffic in the area, and the areas are going to be permitted soon as well, so everything that can be done must be done to help keep unauthorized personnel out of the GWTP area. The locking well caps will be evaluated on all the wells to ensure they are secure as well.

Mr. Bruckwicki said USFWS is also putting in additional security measures to help keep people out of unauthorized areas.

Ms. Zeiler stated that AECOM must begin locking the metering shed at the transformer, as well as the LHAAP-16 shed. The LHAAP-16 gate also needs a better solution.

Mr. Bruckwicki asked that anything AECOM/Army can do to coordinate with USFWS on access would be appreciated as game wardens sometimes need access to the LHAAP-16 areas. Access through LHAAP-16 for USFWS was discussed.

Army

- Distribute GWTP air analytical data from 19 September sampling (Mr. Williams) - COMPLETE
- Forward electronic copies of documents to AEC for review since AEC does not have SharePoint access – COMPLETE. Minutes should read from Army viewpoint as AECOM is speaking for Army on these documents.
- Provide Memo For Record for Site 18/24 Historical Research including providing scanned copies of all drawings/documents which are not currently in the Admin Record – Ms. Lanier will be distributing MFRs to the group electronically to allow drawings to be in full resolution.
- Provide supplemental BERA schedule to USEPA and TCEQ - COMPLETE
- Provide scanned copies of all drawings/documents which are not currently in the AR

Army will be sending this information to regulators, at which time TCEQ and USEPA will have to decide what they want in the record as a part of the update supporting 18/24 work. Ms. Lanier found some additional USATHAMA reports that have more information but are not in the AR. Anything that was used in the decision for remedy selection should be part of the AR. Need to gather it all up with the next update and put it all in as a group. Ms. Lanier will prepare a separate MFR on just historical reports that were found so they can be entered into the AR under that as a group. Mr. Becher will provide a list he has developed of documents he has seen referenced in various reports but are not in the AR to see if Army can find them for addition to the AR. AECOM plans to copy out all AR documents into site-specific folders for faster reference. The group concurred there would be great value to that effort.

- USACE will provide spreadsheets for MMRP sites groundwater split sample data recently collected.

Mr. Williams provided copies of the spreadsheet (attached) for the meeting and will also email it to the group. Mr. Mayer will be emailing the USEPA's data set summary to the group. Mr. Mayer provided a CD containing the phytoforensics tree coring report CD to USACE. Mr. Becher will put the report on an FTP site for AECOM to access as well.

- Mr. Williams will resend to USEPA the 16/17/18/24 area historical ground water data dump previously provided, or provide update on how the data can be accessed. – COMPLETE

Mr. Becher notes that dates on the samples were shown as 1/1/1950 for a several samples. Mr. Williams thought there might be a data conversion error and will check on that.

USEPA

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September. - COMPLETE
- Provide list of site LHAAP-18/24 historic documents for the Admin Record – future action pending Army submittal of MFR - COMPLETE
- Provide response to Army's question regarding CERCLA process and the use of an EECA – Pending submittal of new path forward – Will cover this during today's LHAAP-03 discussion.
- USEPA will provide spreadsheets for LHAAP-27 groundwater split sample data collected in time for the October Managers' Meeting. - COMPLETE
- Mr. Becher will put the draft phytoforensics study report out to an FTP site for the group to access. - COMPLETE
- Provide comment for the revised LHAAP-03 EE/CA. – Will cover this during today's LHAAP-03 discussion.

TCEQ

- Provide list of 2012 dispute-related (letterhead) documents to Army for September AR update by 21 September. - COMPLETE
- Provide list of site LHAAP-18/24 historic documents for the Admin Record pending Army submittal of MFR - COMPLETE
- Provide input wells planned for sampling at LHAAP-18/24 as part of compliance sampling event - COMPLETE
- Provide comment for the revised LHAAP-03 EE/CA. - COMPLETE

AEC

- Provide LHAAP-37 Pilot Demonstration data at October Managers' Meeting

Mr. Fabian is still validating this baseline data set, which will be submitted next week. The plan is to send data to TCEQ and USEPA as soon as the data is validated. Baseline data will have chemical concentrations and the bio data (initial nutrient data) which was resampled due to an interference problem. Four three-well clusters align up with the arrays. Mr. Bruckwicki thinks the LHAAP-37 demonstration team is eager to show what they have accomplished in the field. Ms. Zeiler wants to include the area in a RAB tour when scheduled and would also like Mr. Fabian to make a presentation at the next RAB.

Defense Environmental Restoration Program (DERP) PBR Update

AECOM

See Document and Issue Tracking table for upcoming document submissions to regulators.

- Item 1: LHAAP-04 Proposed Plan – Both Mr. Mayer and Mr. Becher are reviewing this with consolidated comments to be provided on Monday. The question was asked if baseline risk assessment data is considered valid? Mr. Williams said the issue with the BERA should not impact LHAAP-04 as only the explosives required supplementation. TCEQ will provide comments next week. Deadline for regulator comments to maintain schedule is 30 October 2012.

- USEPA suggested the Fire Station well should be tested. Army agrees. Mr. Torcoletti with USEPA found data showing the well is screened from 58-128' screened interval, but lithology was apparently provided to 460 feet. Need to check total depth for the well.
- Item 2: LHAAP-47 Proposed Plan – AECOM will be providing a revised version for Army legal review. Document should be submitted for regulatory review by end of the month. Army legal is gone next week so AECOM needs to get this in to Ms. Zeiler ASAP.
- Items 1 and 2: LHAAP-04 and LHAAP-47 Proposed Plan Public Meetings were discussed. Schedule requires that the public meeting for LHAAP-04 PP must be in December...December 11th is the tentative proposed date. The LHAAP-47 PP has a later deadline, so the public meeting could be delayed until January if both LHAAP-04 and LHAAP-47 cannot be completed together. Mr. Faultry advised that we should keep the PP public meetings separate from the requested public health discussion meeting, which Mr. Thomas, KISD requested for the first week of December. Ms. Coats suggested the group get input from the RAB to determine whether they want to do combined meetings for two PPs, two PPs plus public health, etc. Mr. Thomas was to provide a list of questions to USEPA in advance of scheduling a public health meeting, as no questions were asked during the previous meeting held on this topic.
- Item 3: LHAAP-18/24 PSI WP/CSM
 - A proposed schedule for LHAAP-18/24 (attached) was provided to the group for discussion.
 - The history of LHAAP-18/24 submittals and the schedule was discussed. The draft LHAAP-18/24 FS was submitted to the regulators long ago. Regulatory review comments returned on the draft required more data be incorporated and developed. Army has discovered a significant amount of additional data stored at the site. Army decided to have the new contractor, AECOM, handle finalizing the FS. Current schedule deadlines are listed as:
 - Draft FS February 2009
 - Draft Final FS March 2013
 - Final April 2013
 - AECOM's review of existing data indicated that more field work was needed, resulting in the development of the PSI WP, which must be executed prior to submittal of the next version of the FS in order to provide all information needed to bring the FS to Final. However, before the PSI WP can be finalized, AECOM needed to update the CSM to ensure the PSI WP focused on obtaining the correct data. AECOM has incorporated a large amount of additional historical data into the CSM. With the time required to unearth and assimilate all the additional data found at the site, and now the need for the PSI WP to be executed, Army is in a schedule crunch to meet existing deadlines.
 - Although it has taken time, getting the historical information incorporated was part of providing an appropriate response to regulator comments on the Draft FS. As well, Ms. Zeiler stated that LHAAP-18/24 is a major site for the Army and they want to be aggressive as possible and do everything right, but still reduce out-year costs where possible, which requires that we take into consideration all information we can before moving forward. Mr. Lambert reiterated that the gathering of all this data is under the umbrella of providing a comment response for the Draft FS, so it would not be completely incorrect to call the next iteration of the document a Draft Final FS.
 - Ms. Zeiler asked how the next version of the FS should be named. Discussion wrapped up to indicate the document will be titled "Revised Draft".

- Ms. Zeiler said Army thinks our understanding of the site is now in good shape but regulators haven't had the benefit of looking at all the data yet. Mr. Faultry said that he feels strongly that everyone needs a solid opportunity to look at all the data supporting the FS to make the final decision, instead of trying to process information coming in piece meal. Others reviewing the information at higher regulatory levels need to see all the data so they can understand the recommendations proposed.
- Mr. Becher stated that we've been waiting years to have this data compiled into something meaningful and it only makes sense that we take a reasonable amount of time to assess it. Mr. Becher felt the PSI WP comment turn-around was too fast, especially because the PSI WP was submitted before the revised CSM was presented to the group. Mr. Lambert stated that Army's push to get the PSI WP approved quickly and into the field is all schedule-driven, with the Army trying to work to meet required FFA deadlines. Ms. Zeiler stated that Army would like to hear regulators tell Army the schedule is unrealistic so we can all have an opportunity to fully review all of this information (historical and new).
- Mr. Wacker stated that AECOM has made an effort to identify what the well data is really telling us so we can eliminate wells as appropriate. AECOM is identifying wells that are in poor condition for repair, redevelopment and upgrade. Mr. Becher stated that USUSEPA did a well inventory in 2007 and they will send those results to USACE to assist in AECOM's efforts to get wells properly numbered. Discussion continued on current well conditions and conflicting well labeling observed during the September compliance event. Mr. Becher stated that AECOM took detailed notes of pad condition and photos during the September event, and are on top of it. Ms. Zeiler stated that AECOM has plans to work over the next 3-6 months to do this well maintenance.
- Ms. Zeiler restated Mr. Becher's concern is that we need to look closely at the condition and naming of existing wells before incorporating them into the PSI work to make sure we're getting the best data possible into the FS.
- Mr. Lambert stated that Mr. Becher worked with Shaw to prescribe the list of wells for compliance events. Mr. Becher stated that the plan for September was to sample the same 24 wells being completed by Shaw. AECOM data gap investigation wells were also added to the mix unexpectedly. Mr. Wacker stated that there are some growing pains in coordination, but we hope we're on the right path.
- Mr. Wacker explained that the proposed schedule for LHAAP-18/24 (attached) was put together to meet the March 2013 DF FS deadline. This is a starting point to discuss how the schedule needs to be adjusted to be realistic. Ms. Duke is concerned that TCEQ have time to review and understand the CSM updates, particularly the two-zone groundwater model. Ms. Paul summarized that it appears that the volume and importance of the data being added rises to the level where it warrants a complete overhaul of the schedule for this site. Mr. Faultry asked that a schedule revised for realism be submitted to the group for review. Army will take a look at the schedule and provide a letter with a revised schedule that can realistically allow everyone the opportunity to get comfortable with the data.
- Ms. Lanier at USACE will be issuing two MFRs, one on the LHAAP-18/24 IRA and another for other historical records. Regulators will take 30 days to review from the time the MFRs and the PSI WP is received. The PSI WP should be received soon.
- AECOM needs to do an analysis of the wells that will be used in the CSM. Mr. Becher will provide well condition information on the wells he feels are critical to the CSM by Wednesday. AECOM confirmed Mr. Becher could contact Mr. Beesinger directly to discuss well condition issues.

- There should be a continual exchange of information/comments within the 30-day comment period, but the final set of comments will be submitted at the end of the 30 days.
- The group discussed what the revised 18/24 PSI WP submittal should be called. The group decided the document will be called a Revised Draft, with the version after that incorporating regulatory comments incorporated will be called the Draft Final
- Items 4 and 5: LHAAP-46 & LHAAP-67 RAWPs will be submitted for regulatory comment by 31 October 2012. These are both MNA sites with solvent contamination.
- Item 6: LHAAP-03 Path Forward – AECOM has put together a path forward and supporting white paper which was submitted to TCEQ and USEPA. Regulators stated they don't agree with conclusions and formal comments are pending. Ms. Zeiler stated that the path for this site has changed and is convoluted at this point. If the regulators do not feel there is a NFA there, we are back on track to a RI. Mr. Wacker suggested a meeting/teleconference between Army and regulators to come to a final agreement on the path forward. Deadline is 31 October for Ms. Zeiler to send the schedule modification request letter, so she needs to know immediately what the path forward is, one way or another, so she can do the letter and get it submitted. Ms. Duke stated TCEQ disagrees with the way the background data was interpreted in AECOM's white paper (disagree that the outlier data is generally within the background data set) and stated TCEQ would not support a NFA on the groundwater arsenic contamination. AECOM must advise Ms. Zeiler on what their approach will be based on this regulatory decision on the arsenic issue. USEPA will send their comments on the LHAAP-03 white paper on Monday. A teleconference with the regulators was tentatively planned for Thursday.
- Item 7: GWTP O&M / Air Monitoring – AECOM has started winterizing the plant. There is a need to replace the post-FBR effluent tank and some valves. There are two extra people working at the GWTP right now to assist with these activities. Mr. Bruckwicki stated that he observed someone from AECOM GWTP speeding in the LHAAP-37 area one morning last week. AECOM will get in emphasize compliance with posted speed limits at the morning tailgate safety meetings. Mr. Bruckwicki said there's a lot of activity going on with loggers, concrete reclamation contractors, road construction contractors. Mr. Faultry asked that safety is stressed because whether accidents occur on the USFWS areas or at the actual environmental sites, the perception is that it's all Longhorn. Mr. Becher stated he observed that AECOM was very serious about safety.
- Items 9-13 are placeholders for upcoming items.

Upcoming field work – LHAAP-18/24 work schedule is being pushed out based upon additional review times.

- Monthly data submission – a list of data submitted this month will be appended to the end of these minutes.
 - Perimeter Well Sampling and Reporting – has been conducted and report is pending
- Status of Groundwater Treatment Plant
 - Air monitoring continues
 - Returning treated water to the site through the sprinkler system because there is no flow to the Bayou
- Status of regulator comments on LHAAP-18/24 PSI WP
 - Regulators requested schedule extension to review new data. Discussed at length earlier in the meeting.

Other DERA Program Update

- LHAAP-37 Pilot Demonstration update – Would like a presentation for the RAB meeting in January or will push it out to the next RAB whenever data is available.
- Status of Supplemental BERA – Separate soil and sediment/surface water documents have been generated. Regulators should be receiving that in November.
- Decision Document for multiple TCEQ Non-NPL sites is being reviewed by Ms. Zeiler and will be forwarded to AECOM.
- Five-Year Review Report – An internal Army kick-off meeting was completed. This is the third Five-Year Review with the report due as a final signed document by 02 October 2013. AECOM owes Army a list to ensure all the right sites are being included in the review. Army will also be doing a programmatic review of selected sites at the same time. Mr. Faultry commented that USEPA is looking closely at Five-Year Review report recommendations to ensure they are implemented and that an implementation schedule is provided. USEPA will no longer sign Five-Year Review reports where the same issues are described as in previous reviews and are not being addressed. The Army stated that all recommendations from the second Five-Year Review report were implemented.
- Sitewide LUC Management Plan – Mr. Williams added all the sites in as part of the annual plan update. The document control process requires that the recertification page be signed by all parties in the first quarter of the year to maintain the document status as ‘current’.

MMRP Update

- Update status of USEPA Groundwater Sampling – Ms. Zeiler reported that a logger has run over multiple signs. Mr. Bruckwicki stated that USFWS will address this issue as the logger’s contract requires them to fix damages. Long Branch Road will also be repaired.

Other Environmental Restoration

- CRP/CIP Update – As soon as the draft update is available, Ms. Zeiler will let Ms. Coats know. Ms. Coats received questions and list of names, but not the hand-written notes. Ms. Zeiler will provide those notes to Ms. Coats.
- LHAAP-19 (non-NPL) Decision Document update is pending Ms. Zeiler’s review. Should be submitted for TCEQ review soon.

Programmatic Issues

- Status of Dispute – Mr. Faultry stated that USEPA is in process of getting all remaining issues to the Regional Administrator for review. A Decision Document on things that have not been resolved will be reviewed by the RA and then goes to Lisa Jackson for signature. The new RA who was previously the acting RA has been transitioned and briefed on this situation. There will be no addition round of discussion at the current level.

USFWS Update

- Environmental Restoration Issues with Transfer Schedule Impact None
- USFWS Comments on Documents - None

USEPA – Non-CERCLA

- Update on Phytoforensics Study – Mr. Becher will post the study for the group to access. Mr. Mayer stated that the method worked fairly good in areas of high perchlorate concentrations. Ms. Zeiler asked if it appeared the method might be any help at LHAAP-16 and Mr. Becher is going to look at that. Mr. Mayer commented that it didn’t look like there was anything going across Harrison Bayou in the shallow groundwater based on tree coring

results. The report doesn't have any conclusions, just presents the results. USEPA will have to look at the data to take it to the next level.

- Discussion of screening standards for 1,4-dioxane as an emerging contaminant that USEPA and TCEQ want examined at LHAAP. Ms. Zeiler asked USEPA to make a request for Army to examine it. Mr. Mayer stated he would provide the request to Army.
- Mr. Becher provided a review of the September compliance sampling event. He expressed concern with SOPs not covering the YSI and some instances where SOPs were not being followed precisely. Mr. Lambert stated that USEPA had an opportunity to comment on the SOPs in the site-wide plan when it was generated. USEPA stated that the sampling crews ran into bumps due to being unfamiliar with some equipment. AECOM commented that AECOM had scheduled a training session at the start of the event for the crews to be trained in use of all the equipment, but that training session was pre-empted by Mr. Becher directing the group to move to the field before the training could be completed. Discussion continued with the summary being that although the site-wide plan was approved, the SOPs appear to have some deficiencies, and AECOM is encouraged to develop their own for future sampling. AECOM noted Mr. Becher's specific concerns expressed during the discussion so they could be evaluated when the SOPs are revisited and the next event should run more smoothly.

Adjourn

Attachments

August 2012 LHAAP-27 and 54 USACE Split Sampling Event Analytical Results Table

Proposed Schedule for LHAAP-18/24

October 18, 2012 Document and Issue Tracking Table

October AECOM Data Submittals

ACRONYM LIST

AEC	United States Army Environmental Command
AR	Administrative Record
BERA	Baseline Environmental Risk Assessment
CATOX	Catalytic Oxidizer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRP/CIP	Community Relations Plan / Community Involvement Plan
COE	Center of Excellence
CSM	Conceptual Site Model
DERP-	Defense Environmental Restoration Program
DF	Draft Final
EE/CA	Engineering Evaluation / Cost Analysis
FBR	Fluidized Bed Reactor
FS	Feasibility Study
FTP	File Transfer Protocol
GWTP	Ground Water Treatment Plant
ICT	Interceptor Collector Trench
INF	Infiltration
IRA	Interim Remedial Action
KISD	Karnack Independent School District
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Controls

MFR	Memorandum for the Record
MMRP-	Military Munitions Response Program
MNA	Monitored Natural Attenuation
NFA	No Further Action
NPL	National Priorities List
PP	Proposed Plan
PSI WP	Post-Screening Investigation Work Plan
RAB	Restoration Advisory Board
RAWP	Remedial Action Work Plan
SOP	Standard Operating Procedure
TCEQ	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

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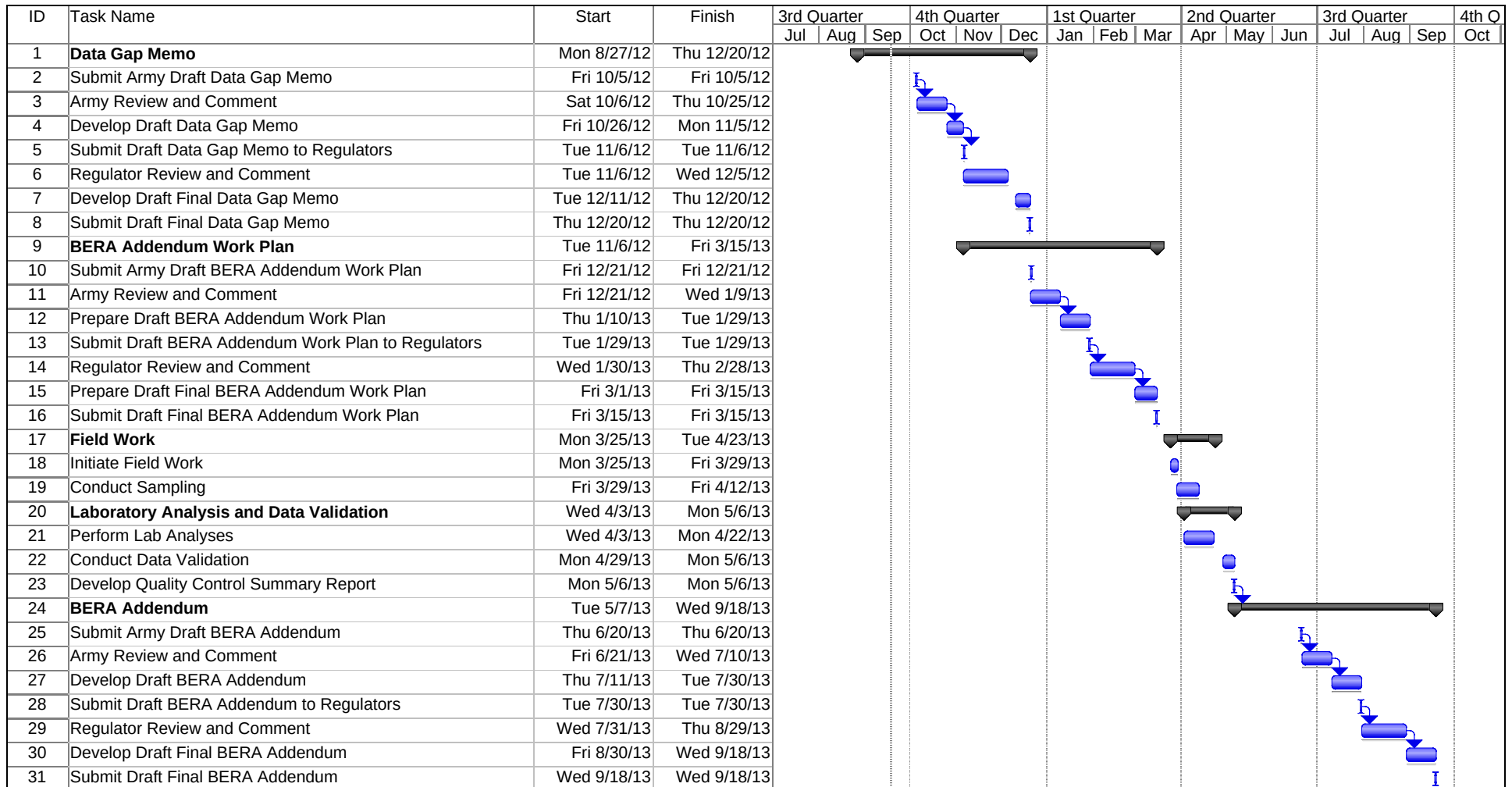
Proposed Schedule for LHAAP-18/24	
AECOM Submit Redlined PSI WP	10/22/2012
TCEQ/EPA Review and Provide Input on PSI WP	10/29/2012
Teleconference to Resolve Comments	10/30/2012
Final PSI WP to TCEQ/EPA	10/31/2012
CPT/MIP	11/12/2012 - 11/20/2012
Well Install and Sample	11/26/2012 - 12/07/2012
Lab Analysis	12/01/2012 - 12/31/2012
Data Validation	12/26/2012 - 1/15/2013
Army Draft Data Gap Report/Revised Draft FS	1/7/2013 - 1/18/2013
Army Comment Incorporation and Develop Draft	1/19/2013 - 1/31/2013
Draft Data Gap Report and Revised Draft FS to EPA/TCEQ	1/31/2013
EPA/TCEQ Review	02/01/13 - 03/02/13
AECOM RTC and Army Approval	3/15/2013
Teleconference to Resolve Comments	3/22/2013
Draft Final FS/Draft Final Data Gap Report	3/29/2013

**Document and Issue Tracking
Longhorn Army Ammunition Plant
October 18, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
1	LHAAP-04 Proposed Plan	EPA/TCEQ Comment	10/29/12	Submitted 09/28/12	Due to EPA/TCEQ as DF 11/30
2	LHAAP-47 Proposed Plan	AECOM RTC and Draft for Army Legal	10/19/12		Due to EPA/TCEQ 10/31
3	LHAAP-18/24 PSI WP and CSM	AECOM Provide Red-lined version for EPA/TCEQ Review	10/21/12		Due to EPA/TCEQ as DF/F
4	LHAAP-46 RAWP	Army provide comments on Army Draft	10/24/12	In-progress	Due to EPA/TCEQ 10/31
5	LHAAP-67 RAWP	Army Provide comments on Army Draft	10/24/12	In-progress	Due to EPA/TCEQ 10/31
6	LHAAP-03Path Forward	EPA/TCEQ Provide Comments	TBD	Submitted to Army 09/28	Obtain EPA and TCEQ Concurrence
7	GWTP O&M/Air Monitoring	AECOM submits Monthly and interim Report	10/31/12	Continue air monitoring	
8	ICT-13 and INF Pond soil cover	AECOM evaluate and plan repairs	10/31/12	In-progress	
9	5 Year Review	AECOM Submit Questions and Site List	10/31/12	In-progress	Return comments/questions/list of appropriate documents to Army for vector check 10/31/12

Document and Issue Tracking
Longhorn Army Ammunition Plant
October 18, 2012

Item	Description	Next Action	Due Date	Status	Remarks
10	Admin Record Update/Information Repository	AECOM finalize draft	10/31/12	In-progress	
11	LHAAP-16 RD WP	AECOM Submit Army Draft	11/16/12	In-progress	
12	LHAAP-17 RD WP	AECOM Submit Army Draft	11/16/12	In-progress	
13	LHAAP-29 PSI WP	AECOM submits draft	T11/30/12	In-progress	Soil and groundwater sampling, aquifer testing planned similar to 18/24



Project: LHAAP BERA Project2
Date: Tue 9/18/12

Task

Split

Progress

Milestone



Summary



Project Summary



External Tasks



External Milestone



Deadline



**GWTP Ambient Air Data
September 19 to October 29,
2012**

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - September 19, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status	Downwind Ambient Air Concentrations (2)		Status
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U	PASS	0.68	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U	PASS	0.68	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U	PASS	0.68	U	PASS
Acetone	67-64-1	5900	NA	6.9	U	PASS	6.8	U	PASS
Benzene	71-43-2	170	575	0.69	U	PASS	0.68	U	PASS
Carbon disulfide	75-15-0	30	NA	0.69	U	PASS	6.8	U	PASS
Chloroform	67-66-3	100	98	0.69	U	PASS	0.68	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	7.4		PASS	0.68	U	PASS
Methylene chloride	75-09-2	3600	12158	1.2		PASS	0.73		PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U	PASS	0.68	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U	PASS	0.68	U	PASS
Trichloroethene	79-01-6	540	537	12		PASS	0.68	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U	PASS	0.68	U	PASS
n-Hexane	110-54-3	5300	6336	1.1		PASS	0.68	U	PASS
Styrene	100-42-5	110	21725	1.1		PASS	0.8		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	1.2		NA	1		NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.6		PASS	2.6		PASS
Ethanol	64-17-5	18800	NA	6.9	U	PASS	6.8	U	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.3		PASS	1.3		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	30		PASS	3.6		PASS
alpha-Pinene	80-56-8	60	3499	6.8		PASS	6.2		PASS
d-Limonene	5989-27-5	1100	NA	1.3		PASS	1.3		PASS

(1) Sample collected over an-hour period on September 19, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on September 19, 2012 at 8:05 AM and ending on September 20, 2012 at 8:05 AM.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - September 24, 2012

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status (3)	Downwind Ambient Air Concentrations (2)		Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.7	U	PASS	0.69	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.7	U	PASS	0.69	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.7	U	PASS	0.69	U	PASS
Acetone	67-64-1	5900	NA	10		PASS	19		PASS
Benzene	71-43-2	170	575	0.81		PASS	1.2		PASS
Carbon disulfide	75-15-0	30	NA	7	U	PASS	6.9	U	PASS
Chloroform	67-66-3	100	98	0.7	U	PASS	0.69	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	11		PASS	0.69	U	PASS
Methylene chloride	75-09-2	3600	12158	1.5		PASS	0.77		PASS
Tetrachloroethene	127-18-4	2000	6782	0.7	U	PASS	0.69	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.7	U	PASS	0.69	U	PASS
Trichloroethene	79-01-6	540	537	24		PASS	0.69	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.7	U	PASS	0.69	U	PASS
n-Hexane	110-54-3	5300	6336	0.98		PASS	2.1		PASS
Styrene	100-42-5	110	21725	1.8		PASS	4		PASS
Toluene	108-88-3	640	15074	0.84		PASS	1.6		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.7	U	NA	0.82		NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3		PASS	2.6		PASS
Ethanol	64-17-5	18800	NA	7	U	PASS	190		PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.2		PASS	1.8		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	53		PASS	0.69	U	PASS
alpha-Pinene	80-56-8	60	3499	10		PASS	68		PASS
d-Limonene	5989-27-5	1100	NA	4.1		PASS	17		PASS

(1) Sample collected over an-hour period on September 24, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on September 24, 2012 at 8:05 AM and ending on September 25, 2012 at 8:05 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 1, 2012

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status (3)	Downwind Ambient Air Concentrations (2)		Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U	PASS	0.65	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U	PASS	0.65	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U	PASS	0.65	U	PASS
Acetone	67-64-1	5900	NA	130		PASS	8.7		PASS
Benzene	71-43-2	170	575	0.69	U	PASS	0.65	U	PASS
Carbon disulfide	75-15-0	30	NA	6.9	U	PASS	6.5	U	PASS
Chloroform	67-66-3	100	98	0.69	U	PASS	0.65	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	1.2		PASS	0.65	U	PASS
Methylene chloride	75-09-2	3600	12158	0.69	U	PASS	0.65	U	PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U	PASS	0.65	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U	PASS	0.65	U	PASS
Trichloroethene	79-01-6	540	537	2.5		PASS	0.65	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U	PASS	0.65	U	PASS
n-Hexane	110-54-3	5300	6336	0.69	U	PASS	0.65	U	PASS
Styrene	100-42-5	110	21725	1.4		PASS	0.99		PASS
Toluene	108-88-3	640	15074	0.69	U	PASS	0.82		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.69	U	NA	0.65	U	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.2		PASS	2.4		PASS
Ethanol	64-17-5	18800	NA	6.9	U	PASS	8.4		PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1		PASS	1.2		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	5.6		PASS	1.5		PASS
alpha-Pinene	80-56-8	60	3499	1.5		PASS	26		PASS
d-Limonene	5989-27-5	1100	NA	0.69	U	PASS	6		PASS

(1) Sample collected over an 8-hour period on October 1, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on October 1, 2012 at 8:05 AM and ending on October 2, 2012 at 8:05 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 8, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.67	U PASS	0.65	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.67	U PASS	0.65	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.67	U PASS	0.65	U PASS
Acetone	67-64-1	5900	NA	7.1	PASS	6.5	U PASS
Benzene	71-43-2	170	575	0.67	U PASS	0.65	U PASS
Carbon disulfide	75-15-0	30	NA	6.7	U PASS	6.5	U PASS
Chloroform	67-66-3	100	98	0.67	U PASS	0.65	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	7.2	PASS	0.65	U PASS
Methylene chloride	75-09-2	3600	12158	0.67	U PASS	0.65	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.67	U PASS	0.65	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.67	U PASS	0.65	U PASS
Trichloroethene	79-01-6	540	537	18	PASS	0.99	PASS
Vinyl chloride	75-01-4	20000	66460	0.67	U PASS	0.65	U PASS
n-Hexane	110-54-3	5300	6336	0.67	U PASS	0.65	U PASS
Styrene	100-42-5	110	21725	0.67	U PASS	0.65	U PASS
Toluene	108-88-3	640	15074	0.67	U PASS	0.65	U PASS
Ethylbenzene	100-41-4	740	86844	0.81	PASS	1.3	PASS
m,p-Xylenes	179601-23-1	180	7382	3.8	PASS	5.7	PASS
o-Xylene	95-47-6	1600	7382	1.5	PASS	1.9	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.92	PASS	0.65	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.67	U NA	1	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.1	PASS	2.1	PASS
Ethanol	64-17-5	18800	NA	6.7	U PASS	1600	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	1.1	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	33	PASS	2.2	PASS
alpha-Pinene	80-56-8	60	3499	0.67	U PASS	4.2	PASS
d-Limonene	5989-27-5	1100	NA	0.67	U PASS	1.7	PASS

(1) Sample collected over an 8-hour period on October 8, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 8, 2012 at 6:15 AM and ending on October 9, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 15, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.73	U PASS	6.1	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.73	U PASS	6.1	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.73	U PASS	6.1	U PASS
Acetone	67-64-1	5900	NA	11	PASS	61	U PASS
Benzene	71-43-2	170	575	1.1	PASS	6.1	U PASS
Carbon disulfide	75-15-0	30	NA	7.3	U PASS	61	U PASS
Chloroform	67-66-3	100	98	0.73	U PASS	6.1	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	5.7	PASS	6.1	U PASS
Methylene chloride	75-09-2	3600	12158	0.73	U PASS	6.1	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.73	U PASS	6.1	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.73	U PASS	6.1	U PASS
Trichloroethene	79-01-6	540	537	14	PASS	6.1	U PASS
Vinyl chloride	75-01-4	20000	66460	0.73	U PASS	6.1	U PASS
n-Hexane	110-54-3	5300	6336	1.6	PASS	6.1	U PASS
Styrene	100-42-5	110	21725	0.89	PASS	6.1	U PASS
Toluene	108-88-3	640	15074	2.3	PASS	6.1	U PASS
Ethylbenzene	100-41-4	740	86844	27	PASS	36	PASS
m,p-Xylenes	179601-23-1	180	7382	100	PASS	160	PASS
o-Xylene	95-47-6	1600	7382	33	PASS	62	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.73	U PASS	6.1	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.88	NA	6.1	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3	PASS	6.1	U PASS
Ethanol	64-17-5	18800	NA	48	PASS	3700	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	6.1	U PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	19	PASS	6.1	U PASS
alpha-Pinene	80-56-8	60	3499	3.7	PASS	22	PASS
d-Limonene	5989-27-5	1100	NA	1.3	PASS	21	PASS

(1) Sample collected over an 8-hour period on October 15, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 15, 2012 at 6:20 AM and ending on October 16, 2012 at 6:20 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 22, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U PASS	0.81	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U PASS	0.81	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U PASS	0.81	U PASS
Acetone	67-64-1	5900	NA	12	PASS	35	PASS
Benzene	71-43-2	170	575	1.1	PASS	0.91	PASS
Carbon disulfide	75-15-0	30	NA	6.9	U PASS	8.1	U PASS
Chloroform	67-66-3	100	98	0.69	U PASS	0.81	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	14	PASS	0.81	U PASS
Methylene chloride	75-09-2	3600	12158	0.95	PASS	0.81	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U PASS	0.81	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U PASS	0.81	U PASS
Trichloroethene	79-01-6	540	537	40	PASS	0.81	U PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U PASS	0.81	U PASS
n-Hexane	110-54-3	5300	6336	1.3	PASS	2.3	PASS
Styrene	100-42-5	110	21725	0.69	U PASS	2.3	PASS
Toluene	108-88-3	640	15074	2.1	PASS	3	PASS
Ethylbenzene	100-41-4	740	86844	2.1	PASS	6.4	PASS
m,p-Xylenes	179601-23-1	180	7382	10	PASS	29	PASS
o-Xylene	95-47-6	1600	7382	4.2	PASS	12	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.69	U PASS	0.81	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	1.2	NA	33	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.2	PASS	2.3	PASS
Ethanol	64-17-5	18800	NA	86	PASS	15000	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	1.7	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	61	PASS	3.7	PASS
alpha-Pinene	80-56-8	60	3499	2.2	PASS	7.9	PASS
d-Limonene	5989-27-5	1100	NA	1	PASS	5.9	PASS

(1) Sample collected over an 8-hour period on October 22, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 22, 2012 at 6:15 AM and ending on October 23, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 29, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.67	U PASS	0.75	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.67	U PASS	0.75	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.67	U PASS	0.75	U PASS
Acetone	67-64-1	5900	NA	6.7	U PASS	7.5	U PASS
Benzene	71-43-2	170	575	1.4	PASS	0.86	PASS
Carbon disulfide	75-15-0	30	NA	6.7	U PASS	7.5	U Pass
Chloroform	67-66-3	100	98	0.67	U PASS	0.75	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	3.8	PASS	0.75	U PASS
Methylene chloride	75-09-2	3600	12158	0.67	U PASS	0.75	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.67	U PASS	0.75	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.67	U PASS	0.75	U PASS
Trichloroethene	79-01-6	540	537	11	PASS	0.75	U PASS
Vinyl chloride	75-01-4	20000	66460	0.67	U PASS	0.75	U PASS
n-Hexane	110-54-3	5300	6336	1.4	PASS	0.87	PASS
Styrene	100-42-5	110	21725	0.67	U PASS	0.75	U PASS
Toluene	108-88-3	640	15074	0.96	PASS	0.75	U PASS
Ethylbenzene	100-41-4	740	86844	0.67	U PASS	0.75	U PASS
m,p-Xylenes	179601-23-1	180	7382	1.9	PASS	1.5	U PASS
o-Xylene	95-47-6	1600	7382	0.83	PASS	0.75	U PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.67	U PASS	0.75	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.86	NA	0.75	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3	PASS	2.3	PASS
Ethanol	64-17-5	18800	NA	42	PASS	35	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.3	PASS	1.1	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	17	PASS	0.81	PASS
alpha-Pinene	80-56-8	60	3499	13	PASS	16	PASS
d-Limonene	5989-27-5	1100	NA	2.3	PASS	2.5	PASS

(1) Sample collected over an 8-hour period on October 29, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 29, 2012 at 6:20 AM and ending on October 30, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Emission Stack Air Data
September 19 to October 29,
2012**

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - September 19, 2012

		Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)		Status			Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off- site Receptor ⁽⁵⁾⁽⁶⁾ (E) = L/K	Status	
Pollutant	CAS	μg/m ³		lb/hr		tpy		tpy			TLV (L) mg/m ³	TLV Reference	Compliance section	ft			
1,1-Dichloroethane	75-34-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	210		3.14E-03		1.37E-02		5	PASS		20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	100		1.49E-03		6.54E-03		5	PASS		40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	905	U	6.76E-03	U	2.96E-02	U	5	PASS		590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	905	U	6.76E-03	U	2.96E-02	U	5	PASS		31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	12000		1.79E-01		7.85E-01		5	PASS		793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1600		2.39E-02		1.05E-01		5	PASS		26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	80		1.20E-03		5.23E-03		5	PASS		33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	18000		2.69E-01		1.18E+00		5	PASS		135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	245		3.66E-03		1.60E-02		5	PASS		2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Propene (C3 H6)	115-07-1	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		(4)		30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	905	U	6.76E-03	U	2.96E-02	U	5	PASS		1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	19500		2.91E-01		1.28E+00		5	PASS		7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				0.801	U												

(1) Sample collected on September 19, 2012 at 2:00 PM

(2) Based on a blower flow rate of 4,000 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) No TLVs for these chemicals

(5) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(6) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - September 24, 2012**

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ⁽⁶⁾⁽⁷⁾ (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	305	4.39E-03	1.92E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	175 U	1.26E-03 U	5.51E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	175 U	1.26E-03 U	5.51E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	16500	2.37E-01	1.04E+00	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1400	2.01E-02	8.82E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	190	2.73E-03	1.20E-02	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	175 U	1.26E-03 U	5.51E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	25000	3.59E-01	1.57E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	230	3.31E-03	1.45E-02	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	175 U	1.26E-03 U	5.51E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Propene (C3 H6)	115-07-1	175 U	1.26E-03 U	5.51E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	175 U	1.26E-03 U	5.51E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	175 U	1.26E-03 U	5.51E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	26500	3.81E-01	1.67E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	175 U	1.26E-03 U	5.51E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	175 U	1.26E-03 U	5.51E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			1.062 U										

(1) Sample collected on September 24, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 1, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	270	3.83E-03	1.68E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	135 U	9.58E-04 U	4.20E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1350 U	9.58E-03 U	4.20E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	135 U	9.58E-04 U	4.20E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1350 U	9.58E-03 U	4.20E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	15500	2.20E-01	9.63E-01	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1600	2.27E-02	9.95E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	135 U	9.58E-04 U	4.20E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	135 U	9.58E-04 U	4.20E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	24000	3.41E-01	1.49E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	135	1.92E-03	8.39E-03	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	135 U	9.58E-04 U	4.20E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Propene (C3 H6)	115-07-1	135 U	9.58E-04 U	4.20E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	135 U	9.58E-04 U	4.20E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1400 U	9.93E-03 U	4.35E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	135 U	9.58E-04 U	4.20E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	21500	3.05E-01	1.34E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	135 U	9.58E-04 U	4.20E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	135 U	9.58E-04 U	4.20E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			0.937 U										

(1) Sample collected on October 1, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,800 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3800 cfm

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 8, 2012**

		Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)	Status (4)				Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K	
Pollutant	CAS	µg/m ³		lb/hr		tpy		tpy		TLV (L)	TLV Reference	Compliance section	ft		lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	205		2.95E-03		1.29E-02		5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	160	U	1.15E-03	U	5.04E-03	U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	160	U	1.15E-03	U	5.04E-03	U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	15000		2.16E-01		9.45E-01		5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	210		3.02E-03		1.32E-02		5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	160	U	1.15E-03	U	5.04E-03	U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	24000		3.45E-01		1.51E+00		5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	160	U	1.15E-03	U	5.04E-03	U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	330	U	2.37E-03	U	1.04E-02	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	160	U	1.15E-03	U	5.04E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	160	U	1.15E-03	U	5.04E-03	U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	160	U	1.15E-03	U	5.04E-03	U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	160	U	1.15E-03	U	5.04E-03	U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	19500		2.80E-01		1.23E+00		5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	160	U	1.15E-03	U	5.04E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
δ-Limonene	5989-27-5	160	U	1.15E-03	U	5.04E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				0.905	U											

(1) Sample collected on October 8, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 15, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	240	3.45E-03	1.51E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	180 U	1.29E-03 U	5.67E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1600 U	1.15E-02 U	5.04E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	180 U	1.29E-03 U	5.67E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1800 U	1.29E-02 U	5.67E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	16500	2.37E-01	1.04E+00	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	580	8.34E-03	3.65E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	180 U	1.29E-03 U	5.67E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	29500	4.24E-01	1.86E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	180 U	1.29E-03 U	5.67E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	360 U	2.59E-03 U	1.13E-02 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	180 U	1.29E-03 U	5.67E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	180 U	1.29E-03 U	5.67E-03 U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	180 U	1.29E-03 U	5.67E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	180 U	1.29E-03 U	5.67E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1800 U	1.29E-02 U	5.67E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	18500	2.66E-01	1.17E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	180 U	1.29E-03 U	5.67E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	180 U	1.29E-03 U	5.67E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			1.002	U									

(1) Sample collected on October 15, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 22, 2012**

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	140	2.01E-03	8.82E-03	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	140	2.01E-03	8.82E-03	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	135 U	9.71E-04 U	4.25E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	9950	1.43E-01	6.27E-01	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	245	3.52E-03	1.54E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	135 U	9.71E-04 U	4.25E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	18500	2.66E-01	1.17E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	135 U	9.71E-04 U	4.25E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	275 U	1.98E-03 U	8.66E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	135 U	9.71E-04 U	4.25E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	135 U	9.71E-04 U	4.25E-03 U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	135 U	9.71E-04 U	4.25E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	135 U	9.71E-04 U	4.25E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	11000	1.58E-01	6.93E-01	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	135 U	9.71E-04 U	4.25E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	135 U	9.71E-04 U	4.25E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			0.622 U										

(1) Sample collected on October 22, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 29, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)	Status (4)	TLV (L)	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ⁽⁶⁾⁽⁷⁾ (E) = L/K	Status (8)
		µg/m ³		lb/hr		tpy		tpy		mg/m ³			ft		lb/hr	
1,1-Dichloroethane	75-34-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	195		2.88E-03		1.26E-02		5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	130		1.92E-03		8.40E-03		5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	10500		1.55E-01		6.78E-01		5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	130		1.92E-03		8.40E-03		5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	21500		3.17E-01		1.39E+00		5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	180	U	1.33E-03	U	5.82E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	15000		2.21E-01		9.69E-01		5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL						0.745	U									

(1) Sample collected on October 29, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,950 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3950 cfm

CESWT-EC-ER

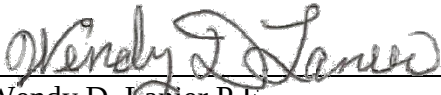
20 October 2012

MEMORANDUM FOR RECORD

SUBJECT: Additional Records that are pertinent to Remedial Action (RA) at LHAAP 18/24, (Burning Ground 3) Longhorn Army Ammunition Plant Karnack, Texas, U.S. Army Corps Of Engineers, Tulsa District

1. The Purpose of this Memorandum For Record (MFR) is to provide documentation to members of the Remedial Managers Group that I found over the course of my search for documentation of the IRA field activities at Burning Ground 3 (BG3).
2. The reports attached include:
 - a. First Five-Year Review Report for Longhorn Army Ammunition Plant • Sites 18 & 24 (Burning Ground 3) • Site 16 (Old Landfill) • Site 12 (Sanitary Landfill) Karnack Harrison County, Texas August 2002, prepared by *Complete Environmental Service* Contract No. DACA56-00-C-20J4.
 - b. Groundwater Quality Assessment Longhorn Army Ammunition Plant Marshall, Texas Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond, CDM Contract No. DAC87-830-C-0091, March 15, 1985.
 - c. Addendum To Groundwater Quality Assessment Longhorn Army Ammunition Plant Marshall, Texas Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond, CDM Contract No. DAC87-830-C-0091, May 8, 1986
 - d. Phase 2, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-Detonation Grounds Evaluation, Longhorn Army Ammunition Plant, Marshall, Texas, 31 July - 3 August 1981
 - e. Land Disposal Study No. 38-26-0104-81, Longhorn Army Ammunition Plant, Marshall. TX. 23 January - 8 February 1980
 - f. Installation Assessment of LHAAP, Report No. 150, February 1980

6 Encls
First Five Year Review
Groundwater Quality Assessment
Addendum Groundwater Quality Assessment
Phase 2, Hazardous Waste Management Special Study
Land Disposal Study No. 38-26-0104-81
Installation Assessment of LHAAP


Wendy D. Lanier P.E.
Environmental Engineer
Environmental Engineering Branch

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

DRAFT MONTHLY MANAGERS' MEETING

AGENDA

DATE: November 14, 2012

TIME: 1:00 p.m.

PLACE: Teleconference

Welcome

RMZ

Action Items

AECOM

- GWTP Longer-Term Plan Update
- GWTP Repairs and Maintenance (see DERP update)
- Submit GWTP air analytical data – All data through Oct 29 has been submitted (7 sets)
- “Path Forward for LHAAP-03” – Draft RI/FFS in progress for submittal to agencies by December 31, path forward memo submitted based upon follow-on teleconference
- Check total depth of fire station well.
- Submit RTC and redline LHAAP-18/24 PSI WP to regulators.

Army

- Advise Ms. Coats when draft CRP/CIP update comes in. Provide hand-written notes to Ms. Coats.
- Distribute a LHAAP-18/24 Historical Records MFR to the group.
- Distribute a LHAAP-18/24 IRA Records MFR to the group.
- Provide spreadsheets for August MMRP groundwater split sample data.
- Check 16/14/18/24 area historical ground water data dump for data conversion error, where sampling date was 1/1/1950 for several samples.
- Provide supplemental BERA schedule to EPA and TCEQ - Complete
- Mr. Williams will resend to EPA the 16/17/18/24 area historical ground water data dump previously provided, or provide update on how the data can be accessed.

EPA

- USGS (Becher) will provide the list of documents developed as referenced in various reports, but not found in the AR.
- Provide August MMRP groundwater split sample data collected.
- USGS to provide phytoforensics (tree coring) report on FTP site for AECOM to access.
- Provide comments on Draft LHAAP-04 Proposed Plan.
- USGS to provide copy of USEPA 2007 Longhorn well inventory.
- USGS to provide well condition information on wells they feel are critical by Wednesday, 23 October.
- Provide comments on AECOM's LHAAP-03/58 groundwater arsenic whitepaper.
- Provide Army with a request to examine 1,4-dioxane at LHAAP.

TCEQ

- Determine what TCEQ documents should be in the AR as part of the update supporting LHAAP-18/24 work.
- Provide comments on Draft LHAAP-04 Proposed Plan.
- Provide comment for the revised LHAAP-03 EE/CA – pending review of revised path forward.

AEC

- Provide LHAAP-37 Pilot Demonstration data when available

Defense Environmental Restoration Program (DERP) PBR Update**AECOM**

- Upcoming document submissions to regulators (see Document status table)
- Upcoming field work
- Monthly data submission
- Quarterly reports - status
 - Surface water monitoring
 - Groundwater Treatment Plant
 - Report
 - UIC
 - LHAAP-12 LHAAP-16, and SW Sampling and Reporting
 - Compliance Sampling Data for LHAAP-18/24 and Perimeter Wells
- Status of Groundwater Treatment Plant
 - Air monitoring
 - Return to Sprinkler System
 - INF Topsoil and erosion control planned for December
 - 7 pump sets being replaced at LHAAP-18/24, 4 at LHAAP-16
 - Winterization continues
 - PLC repaired at LHAAP-16 and water is being treated from 4 operable wells
 - FBR effluent tank replacement
 - Misc

Other DERA Program Update**Army**

- LHAAP-37 Pilot Demonstration update
- Status of Supplemental BERA
- Decision Document for multiple sites
- Five Year Review Report – Draft in-progress for sites with previous 5YR
- Sitewide LUC Management Plan – annual update

MMRP Update**Army**

- Update status of EPA Groundwater Sampling

Other Environmental Restoration**Army**

- CRP/CIP Update
- Site 19 Decision Document update

Programmatic Issues**RMZ/RM/FD**

- Status of Dispute

USFWS Update**RMZ/PB**

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

EPA – Non-CERCLA

- Update on Phytoforensics Study

RM**Adjourn****ACRONYM LIST**

DERP-	Defense Environmental Restoration Program
EPA-	Environmental Protection Agency
FS-	Feasibility Study
IRP-	Installation Restoration Program
ITS-	Intertek Testing Services
LHAAP-	Longhorn Army Ammunition Plant
MMRP-	Military Munitions Response Program
MNA-	Monitored Natural Attenuation
PB-	Paul Bruckwicki
PBC-	Performance Based Contract
PS-	Praveen Srivastav
QA-	Quality Assurance
QC-	Quality Control
RMZ-	Rose M. Zeiler
RD-	Remedial Design
ROD-	Record of Decision
SAP-	Sampling and Analysis Plan
TCEQ-	Texas Commission on Environmental Quality
USFWS-	United States Fish and Wildlife Service

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

FINAL MONTHLY MANAGERS' MEETING

MINUTES

DATE: November 14, 2012
TIME: 1:00 p.m.
PLACE: **Teleconference** – Call 866-203-6896, 1759304791 courtesy of AECOM

Welcome

RMZ

Attendees:

LHAAP/BRAC: Rose Zeiler
 USEPA: Rich Mayer, Paul Torcoletti, Kent Becher (USGS)
 TCEQ: Fay Duke
 USACE: Wendy Lanier, Aaron Williams
 AECOM: Dave Wacker, Gretchen McDonnell
 USFWS: Paul Bruckwicki

Mr. Bruckwicki had not received notice of the meeting. AECOM will ensure Paul Bruckwicki, USFWS is on the distribution list for the Monthly Managers' Meeting.

Action Items

AECOM

- “Path Forward for LHAAP-03” – Draft RI/FFS in progress for submittal to agencies by December 31, path forward memo submitted based upon follow-on teleconference - COMPLETE
- Set up a teleconference for discussion of LHAAP-03 path forward - COMPLETE
- Provide Sampling SOPs and training documentation – AECOM will submit revised SOPs with the Installation-Wide Work Plan update planned for submitted to Army review at the end of November. **AECOM will share a YSI SOP with the group** as soon as possible because a sampling event is planned for December. Field QA split sampling report containing comments from Mr. Becher will not be ready until after the upcoming December sampling is done.
- Submit GWTP air analytical data – All data through this week has been submitted (8 sets) – COMPLETE.

Army

- Submit schedule change request letter to regulators for LHAAP-03 - COMPLETE
- Submit schedule change request letter to regulators for LHAAP-18/24 - COMPLETE
- Transmit CIP hand written interview notes to EPA and advise when draft CRP/CIP update comes in. – Draft CRP/CIP is in EPAs hands. Ms. Coats has not received the password for the site. **Ms. Zeiler will email Ms. Paul to get a password for Ms. Coats sent to her.**
- Distribute a LHAAP-18/24 Historical Records MFR to the group. - COMPLETE
- Distribute a LHAAP-18/24 IRA Records MFR to the group. – COMPLETE - IRA is just on the IRA information 1993-1998. The Historical Records MFR were other documents not necessarily related to IRA and were not in the AR but had good information about 18/24 and other sites.
- Provide spreadsheets for August MMRP groundwater split sample data. - COMPLETE
- Check 16/17/18/24 area historical ground water data dump for data conversion error, where sampling date was 1/1/1950 for several samples. – COMPLETE. These dates were an error

in Shaw's original database. Mr. Williams has contacted Shaw and requested that Shaw correct this error. For now, all parties will note this issue.

EPA

- Mr. Becher will provide the list of documents developed as referenced in various reports, but not found in the AR. – PENDING
- Provide August MMRP groundwater split sample data collected. - COMPLETE
- Provide phytoforensics (tree coring) report on FTP site for AECOM to access. – COMPLETE. Was provided to AECOM as a CD.
- Provide copy of USEPA 2007 Longhorn well inventory. - PENDING
- Provide well condition information on wells they feel are critical by Wednesday, 23 October. – COMPLETED. To be provided with PSI WP comments.
- Provide comments on AECOM's LHAAP-03/58 groundwater arsenic whitepaper. – COMPLETED. Revised and sent to agencies today for review as plan forward document. Groundwater arsenic portion was removed due to disputes on background data.
- Provide Army with a request to examine 1,4-dioxane at LHAAP. – EPA emailed an Air Force abstract relating to 1,4-dioxane, but has not done an actual request yet. Ms. Duke feels a data evaluation needs to be done, and TCEQ was supposed to provide an action level for 1,4-dioxane for Army reference. Mr. Mayer says EPA has a 6.1ppb screening level for 1,4-dioxane. Mr. Becher says he checked LHAAP database and there is no data for 1,4-dioxane, but he did find some with 1,1,1-TCA at LHAAP-18/24 which might suggest the presence of 1,4-dioxane. (1,4-dioxane was a solvent stabilizer so would likely be found in association with a solvent.) **Army will check the LHAAP database for 1,1,1-TCA and 1,4-dioxane sampling results in groundwater to determine whether it has been evaluated.**
- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA – PENDING. Army provided Shaw RTCs that require regulator comment on 30 OCT 2012.
- Determine what EPA documents should be in the AR as part of the update supporting LHAAP-18/24 work. – PENDING.

TCEQ

- Determine what TCEQ documents should be in the AR as part of the update supporting LHAAP-18/24 work. – PENDING.
- Provide comments on Draft LHAAP-04 Proposed Plan. – COMPLETE.
- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA. - PENDING. Army provided Shaw RTCs that require regulator comment on 30 OCT 2012.

AEC

- Provide LHAAP-37 Pilot Demonstration data when available – COMPLETE. Data sent was baseline. Mr. Fabian is hoping to make a presentation with first set of data to the April RAB.

Defense Environmental Restoration Program (DERP) PBR Update

AECOM

- Upcoming document submissions to regulators (see Document status table)
 - Item 1 – LHAAP-04 PP. Schedule conflicts with public meeting tentatively scheduled for 11 December 2012 were discussed. Meeting rescheduled to 18 December 2012. **AECOM will provide public notice and any meeting materials to EPA and TCEQ for review after Army comments are incorporated.** Elements of the meeting will be posters/visuals, hard copies of key reports (1 or 2

- copies for people to thumb through), fact sheet hand outs public can take with them, sign-in sheet, and AECOM presentation on the PP.
- On a public health meeting to be potentially held in December, there has been no response from Mr. Thomas to Mr. Mayer's contacts. No public health meeting will be scheduled until the list of specific questions are provided. Mr. Mayer will try to contact Mr. Thomas again. AECOM had sent a request to Mr. Thomas asking to use the school as a venue for the public meeting. No response has been received so AECOM will attempt to reserve the Karnack Community Center.
 - Items 2 – 5. All of these were submitted to regulators at the end of October. Comments are due 03 December. AECOM invited discussion about comments as necessary before formal comments are due. There's also potential to do a couple of hours of a working session prior to the 18 December LHAAP-04 PP Public Meeting to discuss these documents, and to tentatively plan a LHAAP-47 PP Public Meeting (in January around the night of the RAB meeting). **AECOM will email the RAB to determine whether there is a preference to have the LHAAP-47 PP public meeting and the RAB meeting on separate nights during the same week, separate nights during separate weeks, or on the same night.**
 - Document Distribution Discussion: AECOM forwarded copies of drafts of items 1-5 to Mr. Bruckwicki during the meeting as he had not been on the original distribution for these documents. **AECOM will follow-up with Ms. Duke on tracking numbers for TCEQ hard copies as she has not received them. AECOM must update PMP table with respect to submittals of DRAFTS – add one hard copy each to USFWS, EPA and TCEQ, with copy of electronic transmittal. AECOM will add Mr. Torcoletti and Mr. Becher to the distribution for electronic documents, along with ensuring Mr. Bruckwicki is included on the distribution.**
 - Item 6. AECOM sent this memo to regulators today. Memo puts forth AECOM's understanding of the agreed path forward for LHAAP-03. 31 December is the RI/FS deadline so confirmation of the path forward presented in the memo is requested ASAP.
 - Item 7. GWTP O&M / Air Monitoring – See Below
 - Item 8. 5-Year Review – See Below
- Upcoming field work –LHAAP-12 and LHAAP-16 groundwater sampling, and site-wide surface water sampling is planned for the first week of December. **AECOM must either send September compliance sampling results (perimeter wells and surface water) to the RAB or prepare to present to the RAB during the next meeting, with quarterly submittals of data to the RAB being the goal going forward.** Mr. Torcoletti wanted to ensure water levels for all 8 wells would be taken at LHAAP-12, which AECOM confirmed. **AECOM will update the master sampling schedule to add LHAAP-12 to be done late in the first quarter to try to capture seasonal water level changes.**
 - Monthly data submissions - Caught up on transfer of air data to regulators through this week. 8 separate sets of results were submitted. These data submittals will be appended to the October Monthly Meeting Minutes.
 - Quarterly reports – AECOM plans to submit the next quarterly GWTP report by the end of November, to include September sampling. **AECOM will provide information to EPA and TCEQ on which wells were bailed vs. pumped for the September LHAAP-18/24 monitoring event.**
 - Groundwater Treatment Plant
 - Air Monitoring - Caught up on transfer of data to regulators through this week. 8 separate sets of results were submitted.

- Return to Sprinkler System – continues as there is no flow in the Bayou
- INF Pond Topsoil and erosion control planned for December
- Repairs and replacements – These items are taking priority over INF Pond since erosion there is relatively minor. This week, AECOM is replacing pumps at LHAAP-18/24. LHAAP-16 has been evaluated for what needs to be repaired/replaced and have placed order for that equipment. All should be completed in the next 2-3 weeks, then will shift back to INF Pond work. After that, replacement of the FBR effluent tank will take us through activities until the end of the year. Two extra staff still working at GWTP full-time to assist with repairs.
- GWTP Longer-Term Plan. Volatiles treatment - TCE has been consistently 3-4 times lower than air emission criteria and this is the closest to any limit the air has come to date, so TCEQ Permit By Rule requirements are being met. **AECOM will compile and submit to TCEQ information needed to establish the GWTP is operating in compliance with PBR requirements so TCEQ's Air Quality group can review it.**

Other DERA Program Update

Army

- LHAAP-37 Pilot Demonstration update – Inoculation began in September. Mr. Fabian plans to host a RAB visit and share initial treatment data in April.
- Status of Supplemental BERA – Data gap memos were sent to regulators by Mr. Williams on 05 November with due date of 05 December.
- Decision Document for multiple sites – PENDING. USACE is working this document.
- Five Year Review Report Update – Draft in-progress for sites with previous 5YRR – AECOM's schedule is to submit draft in March 2013. Site inspections are scheduled to happen on 17 December @ 2PM with the group meeting at Army trailer.
- Sitewide LUC Management Plan – annual update. PENDING – USACE is working the revision at this time. Army wants to do the update and sign the log in the first quarter of each year. Mr. Williams will likely return the document to Ms. Zeiler tomorrow.

MMRP Update

Army

- Update status – EPA and USACE provided their groundwater monitoring split sampling data.

Other Environmental Restoration

Army

- CRP/CIP Update - Ms. Zeiler will be working to get a website password sent to Ms. Coats.
- Site 19 Decision Document update – PENDING. Ms. Zeiler working this document.

Programmatic Issues

RMZ/RM/FD

- Status of Dispute – No Update.

USFWS Update

RMZ/PB

- Environmental Restoration Issues with Transfer Schedule Impact – None.
- USFWS Comments on Documents – AECOM sent Mr. Bruckwicki copies of Items 1-5 by email during the meeting as he was not on the original distribution. A hard copy will also be sent to Mr. Bruckwicki. **TCEQ requested and AECOM will upload draft documents to SharePoint, and maintain that site as a repository for reference.**

EPA – Non-CERCLA

- Update on Phytoforensics Study – COMPLETE. Item will be removed from future agendas.

Next Managers' Meeting scheduled as a teleconference at 1000 on 11 December 2012. **AECOM will provide an invite.**

Adjourn

Attachments

LHAAP-37 Pilot Demonstration Baseline Sampling Results

November 12, 2012 Document and Issue Tracking Table

GWTP air analytical data from 24 September through 5 November sampling

ACRONYM LIST

1,1,1-TCA	1,1,1-Trichloroethane
5YRR	Five-Year Review Report
AEC	United States Army Environmental Command
AR	Administrative Record
BERA	Baseline Environmental Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRP/CIP	Community Relations Plan / Community Involvement Plan
DERP	Defense Environmental Restoration Program
DF	Draft Final
EE/CA	Engineering Evaluation / Cost Analysis
FBR	Fluidized Bed Reactor
FS	Feasibility Study
FFS	Focused Feasibility Study
FTP	File Transfer Protocol
GWTP	Ground Water Treatment Plant
INF	Intermediate-Range Nuclear Forces
IRA	Interim Remedial Action
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Controls
MFR	Memorandum for the Record
MMRP	Military Munitions Response Program
O&M	Operation & Maintenance
PBR	Permit By Rule
PP	Proposed Plan
PSI WP	Post-Screening Investigation Work Plan
QA	Quality Assurance
RAB	Restoration Advisory Board
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RMZ	Rose M. Zeiler
RTC	Response to Comments
SOP	Standard Operating Procedure
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USATHAMA	United States Army Toxic and Hazardous Materials Agency
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

LEGEND

 EXISTING MONITORING WELLS

 BIO PLUG LOCATIONS

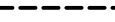
 GROUNDWATER ELEVATION CONTOUR DEC 2007

 PCE CONCENTRATION CONTOUR

 INFERRED PCE CONTOUR

 TCE CONCENTRATION CONTOUR

 INFERRED TCE CONCENTRATION

 ACCESS ROAD

 STONE PAD

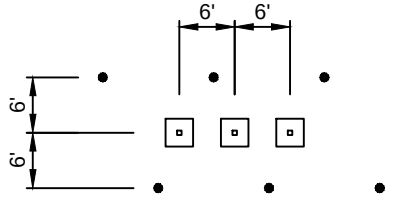
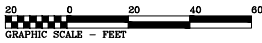
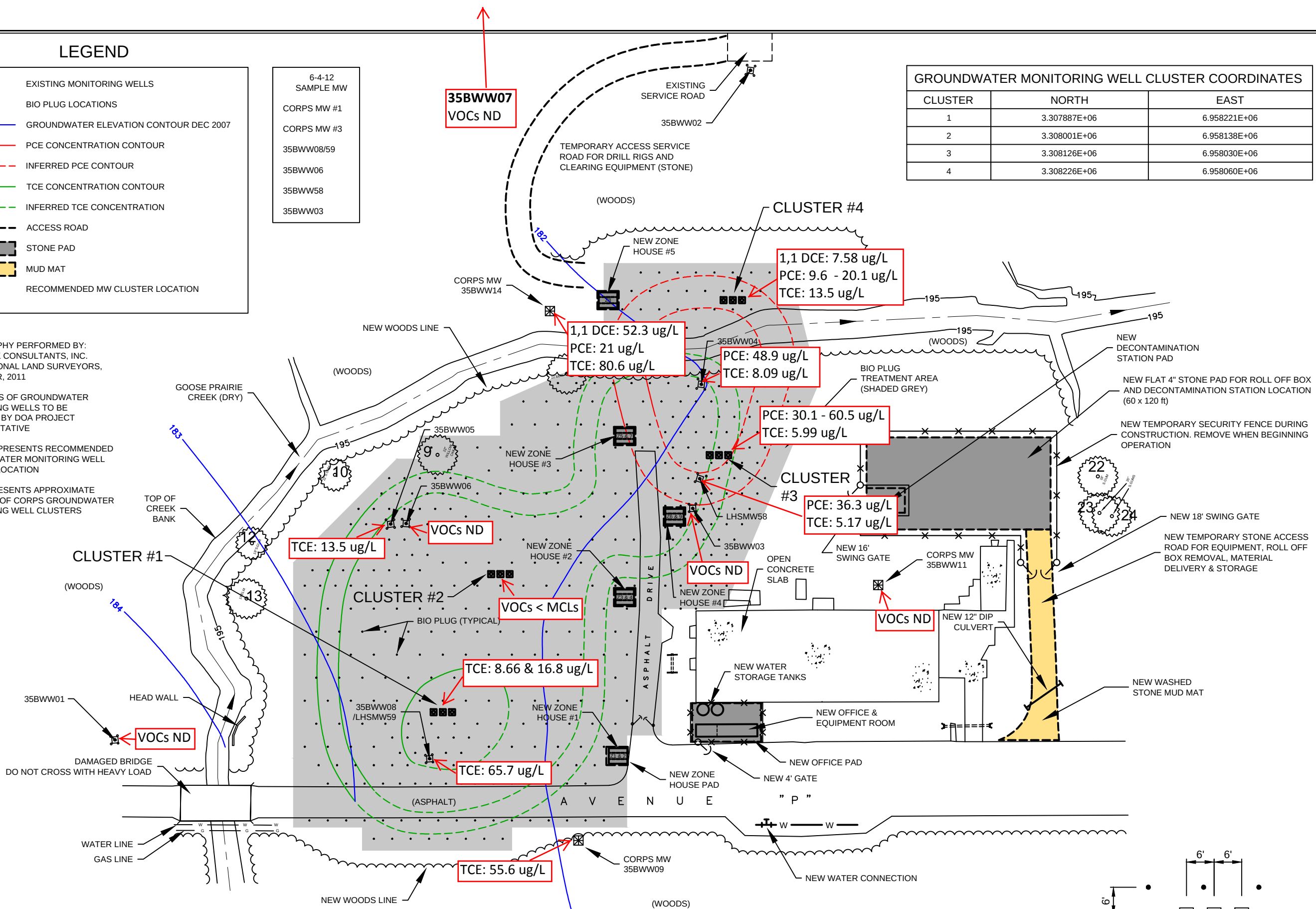
 MUD MAT

 RECOMMENDED MW CLUSTER LOCATION

- 6-4-12
SAMPLE MW
- CORPS MW #1
 - CORPS MW #3
 - 35BWW08/59
 - 35BWW06
 - 35BWW58
 - 35BWW03

- NOTE:
1. TOPOGRAPHY PERFORMED BY: LANDMARK CONSULTANTS, INC. PROFESSIONAL LAND SURVEYORS, NOVEMBER, 2011
 2. LOCATIONS OF GROUNDWATER MONITORING WELLS TO BE SELECTED BY DOA PROJECT REPRESENTATIVE
 3.  REPRESENTS RECOMMENDED GROUNDWATER MONITORING WELL CLUSTER LOCATION
 4.  REPRESENTS APPROXIMATE LOCATION OF CORPS GROUNDWATER MONITORING WELL CLUSTERS

GROUNDWATER MONITORING WELL CLUSTER COORDINATES		
CLUSTER	NORTH	EAST
1	3.307887E+06	6.958221E+06
2	3.308001E+06	6.958138E+06
3	3.308126E+06	6.958030E+06
4	3.308226E+06	6.958060E+06

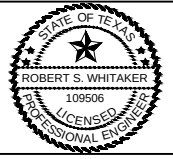


GROUNDWATER MONITORING WELL POSITIONS

**ABS**
ADVANCED
BIOSYSTEMS, LLC

TMD
ENGINEERING, LLC
F-13937

121 VENTURE BLVD, SUITE B
SPARTANBURG, SC 29306
PHONE: 864.595.0103
FAX: 864.595.1952



APPROVALS	
PROJECT ENG.	RSW
DESIGNED BY	N/A
DRAWN BY	BAH
CHECKED BY	RSW
APPROVED	RSW

REVISIONS	
NO.	DESCRIPTION
1	AGENCY REVIEW
2	ISSUED FOR QUOTES
3	MW LOCATION
4	ISSUED FOR CONSTRUCTION

PROJECT NO.: 381-02

LHAAP-38B(37)
BIO PLUG PILOT PROJECT

FOR
UNITED STATES
DEPARTMENT OF THE ARMY

TEXAS

SHEET TITLE:
**NEW SHORT TERM
GROUNDWATER
MONITORING WELL
LOCATIONS PLAN**

SCALE: AS SHOWN

DATE: 12-06-2011

**Document and Issue Tracking
Longhorn Army Ammunition Plant
November 12, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
1	LHAAP-04 Proposed Plan	EPA/TCEQ Telecon or Comment Back check	11/16/12	Scheduling venue and ad	Due to EPA/TCEQ as DF 11/30
2	LHAAP-47 Proposed Plan	EPA/TCEQ provide comments or concurrence	12/03/12	In-progress	Due to EPA/TCEQ as DF 12/31
3	LHAAP-18/24 PSI WP and CSM	EPA/TCEQ provide comments or concurrence	12/03/12	In-progress	
4	LHAAP-46 RAWP	EPA/TCEQ provide comments or concurrence	12/03/12	In-progress	Due to EPA/TCEQ as DF 12/31
5	LHAAP-67 RAWP	EPA/TCEQ provide comments or concurrence	12/03/12	In-progress	Due to EPA/TCEQ as DF 12/31
6	LHAAP-03RI/FS	AECOM develop Army Draft	11/30/12	In-progress	Obtain EPA and TCEQ Concurrence or Comments
7	GWTP O&M/Air Monitoring	AECOM submits Monthly and interim Report	11/15/12	Continued air monitoring in progress and repairs documented in weekly summary	INF Pond Additional soil cover and erosion control matting planned
8	5 Year Review	Schedule site visit and ad publication	11/21/12	Develop draft	5 Year Review

**Document and Issue Tracking
Longhorn Army Ammunition Plant
November 12, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
9	Admin Record Update/Information Repository	Publish Quarterly Update	11/21/12	Complete	
10	LHAAP-16 RD WP	AECOM Submit Army Draft	11/15/12	In-progress	
11	LHAAP-17 RD WP	AECOM Submit Army Draft	11/16/12	In-progress	
12	LHAAP-29 PSI WP	AECOM submits draft	12/14/12	In-progress	Soil and groundwater sampling, aquifer testing planned similar to 18/24
13	LTM Plan Memo LHAAP-12, LTM Plan Memo LHAAP-16/LHAAP-001-R-01	AECOM Submits Draft	11/13/12	In-progress	
14	RAB and MMM	Army Review minutes	11/21/12	In-progress	
15	CIP	EPA/TCEQ Comment	11/26/2012	Submitted 10/25/2012	DF Due to EPA/TCEQ 12/26/2012
16	BERA Data Gap Memo	EPA/TCEQ Comment	12/5/2012	Submitted 11/5/2012	DF Due to EPA/TCEQ 1/7/2013
17	BERA Addendum Work Plan	Submit Army Draft	12/21/2012		
18	BERA Field Work	Initiate Field Work	3/25/2013		

**Document and Issue Tracking
Longhorn Army Ammunition Plant
November 12, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
19	BERA Addendum	Submit Army Draft	6/20/2013		

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

- Operation of GWTP began on September 6, 2012 at 8:00 AM after the system had been idle since May 24, 2012.
- Treatment began with groundwater that was stored in TK-140 (influent tank) since May 24, 2012. The tank which has a capacity of 300,000 gallons, and was approximately 72% full.
- Treatment occurred at the usual 200 gallons per minute (gpm) flow rate. Simultaneously, groundwater extraction began with an average extraction flowrate of 15 gpm. This flow rate is dictated primarily by groundwater levels in the Interceptor Collection Trenches (ICTs) and extraction wells.
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level.
- The treated groundwater was then discharged to TK-630 which has a capacity of 120,000 gallons and had 26% of its capacity full of previously treated groundwater.
- The water from this tank was pumped into the fluidized bed reactor (FBR) and the FBR-treated groundwater was recirculated to TK-630. This was done to allow the FBR to be revived slowly and to allow a long residence time for groundwater containing perchlorate to be treated.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene. The PID was then used to collect ambient air and stripper stack air concentrations.
- At 2:00 PM (after continuous operation for 6 hours), an ambient air sample was measured using the PID near the GWTP office building. The PID registered zero. The PID continued to register zero for nearly 20 minutes while work was being conducted outdoors within the GWTP.
- A Summa® canister ambient air sample was collected from the same location just outside the GWTP office building where the PID measurement was taken.
- At 2:10 PM, a sample from the air stripper stack was collected. First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 19.8 parts per million by volume (ppmv) and then began to decline to a steady state concentration of 6.8 ppmv. At this time, the line was deemed purged, and an air sample using a Summa® canister was collected.
- At 2:30 PM, an ambient air sample from downwind Army-retained property boundary was collected (this location is to the north of the GWTP as the prevailing wind was from the south). The temperature was 95° F and the wind was light (3-5 miles per hour (mph)).
- The air analytical results were received on September 10, 2012.

- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health as shown in the "September 6, 2012 Air Data-rev1" file. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr). These rates were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹.
- The total emission rate of 0.64 lb/hr is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - September 6, 2012

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status	Downwind Ambient Air Concentrations (2)	Status
	CAS	µg/m ³	ppbv	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	1000	4047	0.62	U PASS	0.64	U PASS
1,1-Dichloroethene	75-35-4	210	180	714	0.62	U PASS	0.64	U PASS
1,2-Dichloroethane	107-06-2	160	40	162	0.62	U PASS	0.64	U PASS
Acetone	67-64-1	5900	NA	NA	11	PASS	18	PASS
Benzene	71-43-2	170	180	575	0.62	U PASS	0.64	U PASS
Carbon disulfide	75-15-0	30	NA	NA	0.62	U PASS	6.4	U PASS
Chloroform	67-66-3	100	20	98	0.62	U PASS	0.64	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	NA	0.62	U PASS	0.64	U PASS
Methylene chloride	75-09-2	3600	3500	12158	0.62	U PASS	0.64	U PASS
Tetrachloroethene	127-18-4	2000	1000	6782	0.62	U PASS	0.64	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	NA	0.62	U PASS	0.64	U PASS
Trichloroethene	79-01-6	540	100	537	0.62	U PASS	0.64	U PASS
Vinyl chloride	75-01-4	20000	26000	66460	0.62	U PASS	0.64	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	Asphyxiant	0.69	NA	0.64	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	10000	49452	1.6	PASS	2.3	PASS
Ethanol	64-17-5	18800	NA	NA	7.4	PASS	6.4	U PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	10000	56184	0.94	PASS	1.2	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	NA	1.2	PASS	0.64	U PASS

(1) Sample collected on September 6, 2012 at 2:00 PM

(2) Sample collected on September 6, 2012 at 2:30 PM

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - September 6, 2012**

Pollutant		Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)	Air Stripper Emission Rates	TLV (L)	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off- site Receptor ⁽⁴⁾⁽⁵⁾ (E) = L/K	Status
	CAS	µg/m ³		lb/hr	tpy	mg/m ³			ft		lb/hr	
1,1-Dichloroethane	75-34-3	75	U	5.60E-04	2.45E-03	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	93		1.39E-03	6.08E-03	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	80		1.20E-03	5.23E-03	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	750	U	5.60E-03	2.45E-02	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	75	U	5.60E-04	2.45E-03	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	750	U	5.60E-03	2.45E-02	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	75	U	5.60E-04	2.45E-03	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	8300		1.24E-01	5.43E-01	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	13000		1.94E-01	8.51E-01	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	75	U	5.60E-04	2.45E-03	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	75	U	5.60E-04	2.45E-03	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	10000		1.49E-01	6.54E-01	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	400		5.98E-03	2.62E-02	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
Propene (C3 H6)	115-07-1	75	U	5.60E-04	2.45E-03	(3)		30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	75	U	5.60E-04	2.45E-03	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	750	U	5.60E-03	2.45E-02	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	75	U	5.60E-04	2.45E-03	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	9400		1.40E-01	6.15E-01	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				0.638								

(1) Sample collected on September 6, 2012 at 2:10 PM

(2) Based on a blower flow rate of 4,000 cfm.

(3) No TLVs for these chemicals

(4) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(5) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: <u>9/6/2012</u>	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: <u>Ray Castillo</u>

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time: <u>1020</u>	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: <u>RC to Zero</u>	Value:	
Second Point Calibration	Vapor conc. (ppm)	<u>100ppm</u> (isobutylene)	<u>06/15/2016</u>	<u>GAM-248-100-8</u>	Initials: <u>RC</u>	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – September 19, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on September 19, 2012 at 7:00 AM and lasted for 9.5 hours. The last operation of GWTP was on September 6, 2012.
- Treatment began for groundwater that was stored in TK-140 (influent tank).
- Treatment occurred at the usual 200 gallons per minute (gpm) flow rate. Simultaneously, groundwater extraction began with an average extraction flowrate of 15 gpm.
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level.
- The treated groundwater was then discharged to TK-630 which has a capacity of 120,000 gallons.
- The water from this tank was pumped into the fluidized bed reactor (FBR) and the FBR-treated groundwater was recirculated to TK-630. This was done to make sure FBR has sufficient residence time for groundwater containing perchlorate to be treated.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene. The PID was then used to collect ambient air and stripper stack air concentrations. Ambient air PID data was collected at the GWTP at 8:00 AM and downwind at 8:05 AM. At the same time, sampling via Summa canisters began with an 8-hr composite sample for the ambient air at the GWTP and 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.1 ppm and the PID downwind registered 0.0 ppm.
- At 2:00 PM (after continuous operation for 7 hours), a PID reading was collected from the air stripper stack. First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 34.9 parts per million by volume (ppmv) and then began to decline to a steady state concentration of 22.3 ppmv. At this time, the line was deemed purged, and an air sample using a Summa® canister was collected.
- The air analytical results were received on October 2, 2012.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health as shown in the "September 19, 2012 Air Data" file. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.

- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr). These rates were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹.
- The total stack emission rate of 0.801 lb/hr is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - September 19, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status	Downwind Ambient Air Concentrations (2)		Status
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U	PASS	0.68	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U	PASS	0.68	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U	PASS	0.68	U	PASS
Acetone	67-64-1	5900	NA	6.9	U	PASS	6.8	U	PASS
Benzene	71-43-2	170	575	0.69	U	PASS	0.68	U	PASS
Carbon disulfide	75-15-0	30	NA	0.69	U	PASS	6.8	U	PASS
Chloroform	67-66-3	100	98	0.69	U	PASS	0.68	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	7.4		PASS	0.68	U	PASS
Methylene chloride	75-09-2	3600	12158	1.2		PASS	0.73		PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U	PASS	0.68	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U	PASS	0.68	U	PASS
Trichloroethene	79-01-6	540	537	12		PASS	0.68	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U	PASS	0.68	U	PASS
n-Hexane	110-54-3	5300	6336	1.1		PASS	0.68	U	PASS
Styrene	100-42-5	110	21725	1.1		PASS	0.8		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	1.2		NA	1		NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.6		PASS	2.6		PASS
Ethanol	64-17-5	18800	NA	6.9	U	PASS	6.8	U	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.3		PASS	1.3		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	30		PASS	3.6		PASS
alpha-Pinene	80-56-8	60	3499	6.8		PASS	6.2		PASS
d-Limonene	5989-27-5	1100	NA	1.3		PASS	1.3		PASS

(1) Sample collected over an-hour period on September 19, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on September 19, 2012 at 8:05 AM and ending on September 20, 2012 at 8:05 AM.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - September 19, 2012

		Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)		Status			Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off- site Receptor ⁽⁵⁾⁽⁶⁾ (E) = L/K	Status	
Pollutant	CAS	μg/m ³		lb/hr		tpy		tpy			TLV (L) mg/m ³	TLV Reference	Compliance section	ft			
1,1-Dichloroethane	75-34-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	210		3.14E-03		1.37E-02		5	PASS		20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	100		1.49E-03		6.54E-03		5	PASS		40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	905	U	6.76E-03	U	2.96E-02	U	5	PASS		590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	905	U	6.76E-03	U	2.96E-02	U	5	PASS		31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	12000		1.79E-01		7.85E-01		5	PASS		793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1600		2.39E-02		1.05E-01		5	PASS		26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	80		1.20E-03		5.23E-03		5	PASS		33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	18000		2.69E-01		1.18E+00		5	PASS		135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	245		3.66E-03		1.60E-02		5	PASS		2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Propene (C3 H6)	115-07-1	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		(4)		30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	905	U	6.76E-03	U	2.96E-02	U	5	PASS		1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	19500		2.91E-01		1.28E+00		5	PASS		7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	90.5	U	6.76E-04	U	2.96E-03	U	5	PASS		557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				0.801	U												

(1) Sample collected on September 19, 2012 at 2:00 PM

(2) Based on a blower flow rate of 4,000 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) No TLVs for these chemicals

(5) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(6) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

**Air Analytical Results -
September 19, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01518

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 0.010 Liter(s)
 0.0070 Liter(s)

Initial Pressure (psig): -1.67 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.41

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	71	ND	41	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	71	ND	14	
74-87-3	Chloromethane	ND	71	ND	34	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	71	ND	10	
75-01-4	Vinyl Chloride	250	71	97	28	
106-99-0	1,3-Butadiene	ND	71	ND	32	
74-83-9	Bromomethane	ND	71	ND	18	
75-00-3	Chloroethane	ND	71	ND	27	
64-17-5	Ethanol	ND	710	ND	370	
75-05-8	Acetonitrile	ND	71	ND	42	
107-02-8	Acrolein	ND	280	ND	120	
67-64-1	Acetone	ND	710	ND	300	
75-69-4	Trichlorofluoromethane	ND	71	ND	13	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	710	ND	290	
107-13-1	Acrylonitrile	ND	71	ND	32	
75-35-4	1,1-Dichloroethene	210	71	53	18	
75-09-2	Methylene Chloride	1,600	71	450	20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	71	ND	23	
76-13-1	Trichlorotrifluoroethane	20,000	100	2,600	13	D
75-15-0	Carbon Disulfide	ND	710	ND	230	
156-60-5	trans-1,2-Dichloroethene	ND	71	ND	18	
75-34-3	1,1-Dichloroethane	ND	71	ND	17	
1634-04-4	Methyl tert-Butyl Ether	ND	71	ND	20	
108-05-4	Vinyl Acetate	ND	710	ND	200	
78-93-3	2-Butanone (MEK)	ND	710	ND	240	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01518

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 0.010 Liter(s)
 0.0070 Liter(s)

Initial Pressure (psig): -1.67 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.41

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	12,000	71	3,000	18	
141-78-6	Ethyl Acetate	ND	140	ND	39	
110-54-3	n-Hexane	ND	71	ND	20	
67-66-3	Chloroform	ND	71	ND	14	
109-99-9	Tetrahydrofuran (THF)	ND	71	ND	24	
107-06-2	1,2-Dichloroethane	100	71	25	17	
71-55-6	1,1,1-Trichloroethane	ND	71	ND	13	
71-43-2	Benzene	ND	71	ND	22	
56-23-5	Carbon Tetrachloride	ND	71	ND	11	
110-82-7	Cyclohexane	ND	140	ND	41	
78-87-5	1,2-Dichloropropane	ND	71	ND	15	
75-27-4	Bromodichloromethane	ND	71	ND	11	
79-01-6	Trichloroethene	18,000	100	3,400	19	D
123-91-1	1,4-Dioxane	ND	71	ND	20	
80-62-6	Methyl Methacrylate	ND	140	ND	34	
142-82-5	n-Heptane	ND	71	ND	17	
10061-01-5	cis-1,3-Dichloropropene	ND	71	ND	16	
108-10-1	4-Methyl-2-pentanone	ND	71	ND	17	
10061-02-6	trans-1,3-Dichloropropene	ND	71	ND	16	
79-00-5	1,1,2-Trichloroethane	ND	71	ND	13	
108-88-3	Toluene	ND	71	ND	19	
591-78-6	2-Hexanone	ND	71	ND	17	
124-48-1	Dibromochloromethane	ND	71	ND	8.3	
106-93-4	1,2-Dibromoethane	ND	71	ND	9.2	
123-86-4	n-Butyl Acetate	ND	71	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01518

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 0.010 Liter(s)
 0.0070 Liter(s)

Initial Pressure (psig): -1.67 Final Pressure (psig): 3.67

Canister Dilution Factor: 1.41

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	71	ND	15	
127-18-4	Tetrachloroethene	80	71	12	10	
108-90-7	Chlorobenzene	ND	71	ND	15	
100-41-4	Ethylbenzene	ND	71	ND	16	
179601-23-1	m,p-Xylenes	ND	140	ND	32	
75-25-2	Bromoform	ND	71	ND	6.8	
100-42-5	Styrene	ND	71	ND	17	
95-47-6	o-Xylene	ND	71	ND	16	
111-84-2	n-Nonane	ND	71	ND	13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	71	ND	10	
98-82-8	Cumene	ND	71	ND	14	
80-56-8	alpha-Pinene	ND	71	ND	13	
103-65-1	n-Propylbenzene	ND	71	ND	14	
622-96-8	4-Ethyltoluene	ND	71	ND	14	
108-67-8	1,3,5-Trimethylbenzene	ND	71	ND	14	
95-63-6	1,2,4-Trimethylbenzene	ND	71	ND	14	
100-44-7	Benzyl Chloride	ND	71	ND	14	
541-73-1	1,3-Dichlorobenzene	ND	71	ND	12	
106-46-7	1,4-Dichlorobenzene	ND	71	ND	12	
95-50-1	1,2-Dichlorobenzene	ND	71	ND	12	
5989-27-5	d-Limonene	ND	71	ND	13	
96-12-8	1,2-Dibromo-3-chloropropane	ND	71	ND	7.3	
120-82-1	1,2,4-Trichlorobenzene	ND	71	ND	9.5	
91-20-3	Naphthalene	ND	71	ND	13	
87-68-3	Hexachlorobutadiene	ND	71	ND	6.6	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper-DUP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00240

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/27/12
 Volume(s) Analyzed: 0.0060 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	110	ND	64	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	110	ND	22	
74-87-3	Chloromethane	ND	110	ND	53	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	110	ND	16	
75-01-4	Vinyl Chloride	240	110	95	43	
106-99-0	1,3-Butadiene	ND	110	ND	50	
74-83-9	Bromomethane	ND	110	ND	28	
75-00-3	Chloroethane	ND	110	ND	42	
64-17-5	Ethanol	ND	1,100	ND	580	
75-05-8	Acetonitrile	ND	110	ND	66	
107-02-8	Acrolein	ND	440	ND	190	
67-64-1	Acetone	ND	1,100	ND	460	
75-69-4	Trichlorofluoromethane	ND	110	ND	20	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,100	ND	450	
107-13-1	Acrylonitrile	ND	110	ND	51	
75-35-4	1,1-Dichloroethene	210	110	53	28	
75-09-2	Methylene Chloride	1,600	110	450	32	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	110	ND	35	
76-13-1	Trichlorotrifluoroethane	19,000	110	2,500	14	
75-15-0	Carbon Disulfide	ND	1,100	ND	350	
156-60-5	trans-1,2-Dichloroethene	ND	110	ND	28	
75-34-3	1,1-Dichloroethane	ND	110	ND	27	
1634-04-4	Methyl tert-Butyl Ether	ND	110	ND	31	
108-05-4	Vinyl Acetate	ND	1,100	ND	310	
78-93-3	2-Butanone (MEK)	ND	1,100	ND	370	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper-DUP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00240

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/27/12
 Volume(s) Analyzed: 0.0060 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	12,000	110	3,000	28	
141-78-6	Ethyl Acetate	ND	220	ND	61	
110-54-3	n-Hexane	ND	110	ND	31	
67-66-3	Chloroform	ND	110	ND	23	
109-99-9	Tetrahydrofuran (THF)	ND	110	ND	37	
107-06-2	1,2-Dichloroethane	ND	110	ND	27	
71-55-6	1,1,1-Trichloroethane	ND	110	ND	20	
71-43-2	Benzene	ND	110	ND	34	
56-23-5	Carbon Tetrachloride	ND	110	ND	17	
110-82-7	Cyclohexane	ND	220	ND	64	
78-87-5	1,2-Dichloropropane	ND	110	ND	24	
75-27-4	Bromodichloromethane	ND	110	ND	16	
79-01-6	Trichloroethene	18,000	110	3,300	20	
123-91-1	1,4-Dioxane	ND	110	ND	31	
80-62-6	Methyl Methacrylate	ND	220	ND	54	
142-82-5	n-Heptane	ND	110	ND	27	
10061-01-5	cis-1,3-Dichloropropene	ND	110	ND	24	
108-10-1	4-Methyl-2-pentanone	ND	110	ND	27	
10061-02-6	trans-1,3-Dichloropropene	ND	110	ND	24	
79-00-5	1,1,2-Trichloroethane	ND	110	ND	20	
108-88-3	Toluene	ND	110	ND	29	
591-78-6	2-Hexanone	ND	110	ND	27	
124-48-1	Dibromochloromethane	ND	110	ND	13	
106-93-4	1,2-Dibromoethane	ND	110	ND	14	
123-86-4	n-Butyl Acetate	ND	110	ND	23	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Stripper-DUP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00240

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/27/12
 Volume(s) Analyzed: 0.0060 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	110	ND	24	
127-18-4	Tetrachloroethene	ND	110	ND	16	
108-90-7	Chlorobenzene	ND	110	ND	24	
100-41-4	Ethylbenzene	ND	110	ND	25	
179601-23-1	m,p-Xylenes	ND	220	ND	51	
75-25-2	Bromoform	ND	110	ND	11	
100-42-5	Styrene	ND	110	ND	26	
95-47-6	o-Xylene	ND	110	ND	25	
111-84-2	n-Nonane	ND	110	ND	21	
79-34-5	1,1,2,2-Tetrachloroethane	ND	110	ND	16	
98-82-8	Cumene	ND	110	ND	22	
80-56-8	alpha-Pinene	ND	110	ND	20	
103-65-1	n-Propylbenzene	ND	110	ND	22	
622-96-8	4-Ethyltoluene	ND	110	ND	22	
108-67-8	1,3,5-Trimethylbenzene	ND	110	ND	22	
95-63-6	1,2,4-Trimethylbenzene	ND	110	ND	22	
100-44-7	Benzyl Chloride	ND	110	ND	21	
541-73-1	1,3-Dichlorobenzene	ND	110	ND	18	
106-46-7	1,4-Dichlorobenzene	ND	110	ND	18	
95-50-1	1,2-Dichlorobenzene	ND	110	ND	18	
5989-27-5	d-Limonene	ND	110	ND	20	
96-12-8	1,2-Dibromo-3-chloropropane	ND	110	ND	11	
120-82-1	1,2,4-Trichlorobenzene	ND	110	ND	15	
91-20-3	Naphthalene	ND	110	ND	21	
87-68-3	Hexachlorobutadiene	ND	110	ND	10	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-GWTP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00130

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.52 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.38

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	1.2	0.69	0.69	0.40	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.6	0.69	0.52	0.14	
74-87-3	Chloromethane	ND	0.69	ND	0.33	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.69	ND	0.099	
75-01-4	Vinyl Chloride	ND	0.69	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.69	ND	0.31	
74-83-9	Bromomethane	ND	0.69	ND	0.18	
75-00-3	Chloroethane	ND	0.69	ND	0.26	
64-17-5	Ethanol	ND	6.9	ND	3.7	
75-05-8	Acetonitrile	ND	0.69	ND	0.41	
107-02-8	Acrolein	ND	2.8	ND	1.2	
67-64-1	Acetone	ND	6.9	ND	2.9	
75-69-4	Trichlorofluoromethane	1.3	0.69	0.24	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.9	ND	2.8	
107-13-1	Acrylonitrile	ND	0.69	ND	0.32	
75-35-4	1,1-Dichloroethene	ND	0.69	ND	0.17	
75-09-2	Methylene Chloride	1.2	0.69	0.36	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.69	ND	0.22	
76-13-1	Trichlorotrifluoroethane	30	0.69	3.9	0.090	
75-15-0	Carbon Disulfide	ND	6.9	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.69	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.69	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.69	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.9	ND	2.0	
78-93-3	2-Butanone (MEK)	ND	6.9	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-GWTP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00130

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.52 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	7.4	0.69	1.9	0.17	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.38	
110-54-3	n-Hexane	1.1	0.69	0.31	0.20	
67-66-3	Chloroform	ND	0.69	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.69	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.69	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.69	ND	0.13	
71-43-2	Benzene	ND	0.69	ND	0.22	
56-23-5	Carbon Tetrachloride	ND	0.69	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.40	
78-87-5	1,2-Dichloropropane	ND	0.69	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.69	ND	0.10	
79-01-6	Trichloroethene	12	0.69	2.3	0.13	
123-91-1	1,4-Dioxane	ND	0.69	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.34	
142-82-5	n-Heptane	ND	0.69	ND	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.69	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.69	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.69	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.69	ND	0.13	
108-88-3	Toluene	ND	0.69	ND	0.18	
591-78-6	2-Hexanone	ND	0.69	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.69	ND	0.081	
106-93-4	1,2-Dibromoethane	ND	0.69	ND	0.090	
123-86-4	n-Butyl Acetate	ND	0.69	ND	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-GWTP
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00130

Date Collected: 9/19/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.52 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.69	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.69	ND	0.10	
108-90-7	Chlorobenzene	ND	0.69	ND	0.15	
100-41-4	Ethylbenzene	ND	0.69	ND	0.16	
179601-23-1	m,p-Xylenes	ND	1.4	ND	0.32	
75-25-2	Bromoform	ND	0.69	ND	0.067	
100-42-5	Styrene	1.1	0.69	0.25	0.16	
95-47-6	o-Xylene	ND	0.69	ND	0.16	
111-84-2	n-Nonane	ND	0.69	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.69	ND	0.10	
98-82-8	Cumene	ND	0.69	ND	0.14	
80-56-8	alpha-Pinene	6.8	0.69	1.2	0.12	
103-65-1	n-Propylbenzene	ND	0.69	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.69	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.69	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.69	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.69	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.69	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.69	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.69	ND	0.11	
5989-27-5	d-Limonene	1.3	0.69	0.24	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.69	ND	0.071	
120-82-1	1,2,4-Trichlorobenzene	ND	0.69	ND	0.093	
91-20-3	Naphthalene	ND	0.69	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.69	ND	0.065	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Downwind
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00182

Date Collected: 9/20/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.25 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.36

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	1.0	0.68	0.60	0.40	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.6	0.68	0.52	0.14	
74-87-3	Chloromethane	ND	0.68	ND	0.33	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.68	ND	0.097	
75-01-4	Vinyl Chloride	ND	0.68	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.68	ND	0.31	
74-83-9	Bromomethane	ND	0.68	ND	0.18	
75-00-3	Chloroethane	ND	0.68	ND	0.26	
64-17-5	Ethanol	ND	6.8	ND	3.6	
75-05-8	Acetonitrile	ND	0.68	ND	0.41	
107-02-8	Acrolein	ND	2.7	ND	1.2	
67-64-1	Acetone	ND	6.8	ND	2.9	
75-69-4	Trichlorofluoromethane	1.3	0.68	0.23	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.8	ND	2.8	
107-13-1	Acrylonitrile	ND	0.68	ND	0.31	
75-35-4	1,1-Dichloroethene	ND	0.68	ND	0.17	
75-09-2	Methylene Chloride	0.73	0.68	0.21	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.68	ND	0.22	
76-13-1	Trichlorotrifluoroethane	3.6	0.68	0.47	0.089	
75-15-0	Carbon Disulfide	ND	6.8	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.68	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.68	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.68	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.8	ND	1.9	
78-93-3	2-Butanone (MEK)	ND	6.8	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Downwind
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00182

Date Collected: 9/20/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.25 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.36

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.68	ND	0.17	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.38	
110-54-3	n-Hexane	ND	0.68	ND	0.19	
67-66-3	Chloroform	ND	0.68	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.68	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.68	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.68	ND	0.12	
71-43-2	Benzene	ND	0.68	ND	0.21	
56-23-5	Carbon Tetrachloride	ND	0.68	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.40	
78-87-5	1,2-Dichloropropane	ND	0.68	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.68	ND	0.10	
79-01-6	Trichloroethene	ND	0.68	ND	0.13	
123-91-1	1,4-Dioxane	ND	0.68	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.33	
142-82-5	n-Heptane	ND	0.68	ND	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.68	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.68	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.68	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.68	ND	0.12	
108-88-3	Toluene	ND	0.68	ND	0.18	
591-78-6	2-Hexanone	ND	0.68	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.68	ND	0.080	
106-93-4	1,2-Dibromoethane	ND	0.68	ND	0.089	
123-86-4	n-Butyl Acetate	ND	0.68	ND	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5005-Downwind
Client Project ID: GWTP / 60256135.0004AA

CAS Project ID: P1203874
 CAS Sample ID: P1203874-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS8
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00182

Date Collected: 9/20/12
 Date Received: 9/21/12
 Date Analyzed: 9/26/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.25 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.36

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.68	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.68	ND	0.10	
108-90-7	Chlorobenzene	ND	0.68	ND	0.15	
100-41-4	Ethylbenzene	ND	0.68	ND	0.16	
179601-23-1	m,p-Xylenes	ND	1.4	ND	0.31	
75-25-2	Bromoform	ND	0.68	ND	0.066	
100-42-5	Styrene	0.80	0.68	0.19	0.16	
95-47-6	o-Xylene	ND	0.68	ND	0.16	
111-84-2	n-Nonane	ND	0.68	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.68	ND	0.099	
98-82-8	Cumene	ND	0.68	ND	0.14	
80-56-8	alpha-Pinene	6.2	0.68	1.1	0.12	
103-65-1	n-Propylbenzene	ND	0.68	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.68	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.68	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.68	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.68	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.68	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.68	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.68	ND	0.11	
5989-27-5	d-Limonene	1.3	0.68	0.24	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.68	ND	0.070	
120-82-1	1,2,4-Trichlorobenzene	ND	0.68	ND	0.092	
91-20-3	Naphthalene	ND	0.68	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.68	ND	0.064	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – September 19, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
9/19/2012	8:00	Outside GWTP Office	3950 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 53 degrees
9/19/2012	8:05	Downwind	3950 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 53 degrees
9/19/2012	2:00	Stipper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 34.9 ppm Steady State 22.3 ppm	Clear 80 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: <u>9/19/12</u>	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: <u>Scott Beesinger</u>

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time: 0545	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB TO ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100ppm (isobutylene)	6/15/2016	GAM-248- 100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O2 (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7			Value:	Value:	
	Turbidity (NTU)	100			Value:	Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – September 24, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on September 24, 2012 for 9.5 hours. The previous operation of GWTP was on September 19, 2012.
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while recovery will continue to occur continuously.
- 101,924 gallons of water were processed from TK-140 (influent tank) and a total of 75,486 gallons through the irrigation system were transferred to the Burning Grounds No. 3.
- The treatment flow rate averaged approximately 179 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level.
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was pumped into the fluidized bed reactor (FBR) for treatment for perchlorate. The treated groundwater through the FBR was then transferred to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was clear and the temperature was 68°F.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.1 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 2:00 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 20.2 ppmv and then began to decline to a steady state concentration of 7.0 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.
- At 2:15 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:30 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.0 ppmv and the PID downwind registered 0.0 ppmv.

- The air analytical results were received on October 4, 2012.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 1.06 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - September 24, 2012

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status (3)	Downwind Ambient Air Concentrations (2)		Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.7	U	PASS	0.69	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.7	U	PASS	0.69	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.7	U	PASS	0.69	U	PASS
Acetone	67-64-1	5900	NA	10		PASS	19		PASS
Benzene	71-43-2	170	575	0.81		PASS	1.2		PASS
Carbon disulfide	75-15-0	30	NA	7	U	PASS	6.9	U	PASS
Chloroform	67-66-3	100	98	0.7	U	PASS	0.69	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	11		PASS	0.69	U	PASS
Methylene chloride	75-09-2	3600	12158	1.5		PASS	0.77		PASS
Tetrachloroethene	127-18-4	2000	6782	0.7	U	PASS	0.69	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.7	U	PASS	0.69	U	PASS
Trichloroethene	79-01-6	540	537	24		PASS	0.69	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.7	U	PASS	0.69	U	PASS
n-Hexane	110-54-3	5300	6336	0.98		PASS	2.1		PASS
Styrene	100-42-5	110	21725	1.8		PASS	4		PASS
Toluene	108-88-3	640	15074	0.84		PASS	1.6		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.7	U	NA	0.82		NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3		PASS	2.6		PASS
Ethanol	64-17-5	18800	NA	7	U	PASS	190		PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.2		PASS	1.8		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	53		PASS	0.69	U	PASS
alpha-Pinene	80-56-8	60	3499	10		PASS	68		PASS
d-Limonene	5989-27-5	1100	NA	4.1		PASS	17		PASS

(1) Sample collected over an-hour period on September 24, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on September 24, 2012 at 8:05 AM and ending on September 25, 2012 at 8:05 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - September 24, 2012**

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ⁽⁶⁾⁽⁷⁾ (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	305	4.39E-03	1.92E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	175 U	1.26E-03 U	5.51E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	175 U	1.26E-03 U	5.51E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	16500	2.37E-01	1.04E+00	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1400	2.01E-02	8.82E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	190	2.73E-03	1.20E-02	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	175 U	1.26E-03 U	5.51E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	25000	3.59E-01	1.57E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	230	3.31E-03	1.45E-02	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	175 U	1.26E-03 U	5.51E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	175 U	1.26E-03 U	5.51E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Propene (C3 H6)	115-07-1	175 U	1.26E-03 U	5.51E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	175 U	1.26E-03 U	5.51E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1750 U	1.26E-02 U	5.51E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	175 U	1.26E-03 U	5.51E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	26500	3.81E-01	1.67E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	175 U	1.26E-03 U	5.51E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	175 U	1.26E-03 U	5.51E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			1.062 U										

(1) Sample collected on September 24, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

**Air Analytical Results -
September 24, 2012**

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-GWTP**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00537

Date Collected: 9/24/12

Date Received: 9/26/12

Date Analyzed: 10/1/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.66 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.40

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.70	ND	0.41	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.3	0.70	0.47	0.14	
74-87-3	Chloromethane	ND	0.70	ND	0.34	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.70	ND	0.10	
75-01-4	Vinyl Chloride	ND	0.70	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.70	ND	0.32	
74-83-9	Bromomethane	ND	0.70	ND	0.18	
75-00-3	Chloroethane	ND	0.70	ND	0.27	
64-17-5	Ethanol	ND	7.0	ND	3.7	
75-05-8	Acetonitrile	ND	0.70	ND	0.42	
107-02-8	Acrolein	ND	2.8	ND	1.2	
67-64-1	Acetone	10	7.0	4.2	2.9	
75-69-4	Trichlorofluoromethane	1.2	0.70	0.21	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	7.0	ND	2.8	
107-13-1	Acrylonitrile	ND	0.70	ND	0.32	
75-35-4	1,1-Dichloroethene	ND	0.70	ND	0.18	
75-09-2	Methylene Chloride	1.5	0.70	0.42	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.70	ND	0.22	
76-13-1	Trichlorotrifluoroethane	53	0.70	7.0	0.091	
75-15-0	Carbon Disulfide	ND	7.0	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.70	ND	0.18	
75-34-3	1,1-Dichloroethane	ND	0.70	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.70	ND	0.19	
108-05-4	Vinyl Acetate	ND	7.0	ND	2.0	
78-93-3	2-Butanone (MEK)	ND	7.0	ND	2.4	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-GWTP**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00537

Date Collected: 9/24/12

Date Received: 9/26/12

Date Analyzed: 10/1/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.66 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.40

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	11	0.70	2.7	0.18	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.39	
110-54-3	n-Hexane	0.98	0.70	0.28	0.20	
67-66-3	Chloroform	ND	0.70	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.70	ND	0.24	
107-06-2	1,2-Dichloroethane	ND	0.70	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.70	ND	0.13	
71-43-2	Benzene	0.81	0.70	0.25	0.22	
56-23-5	Carbon Tetrachloride	ND	0.70	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.41	
78-87-5	1,2-Dichloropropane	ND	0.70	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.70	ND	0.10	
79-01-6	Trichloroethene	24	0.70	4.4	0.13	
123-91-1	1,4-Dioxane	ND	0.70	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.34	
142-82-5	n-Heptane	ND	0.70	ND	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.70	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.70	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.70	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.70	ND	0.13	
108-88-3	Toluene	0.84	0.70	0.22	0.19	
591-78-6	2-Hexanone	ND	0.70	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.70	ND	0.082	
106-93-4	1,2-Dibromoethane	ND	0.70	ND	0.091	
123-86-4	n-Butyl Acetate	ND	0.70	ND	0.15	

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Verified By: _____ Date: _____

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-GWTP
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
 CAS Sample ID: P1203955-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC00537

Date Collected: 9/24/12
 Date Received: 9/26/12
 Date Analyzed: 10/1/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.66 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.40

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.70	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.70	ND	0.10	
108-90-7	Chlorobenzene	ND	0.70	ND	0.15	
100-41-4	Ethylbenzene	ND	0.70	ND	0.16	
179601-23-1	m,p-Xylenes	ND	1.4	ND	0.32	
75-25-2	Bromoform	ND	0.70	ND	0.068	
100-42-5	Styrene	1.8	0.70	0.43	0.16	
95-47-6	o-Xylene	ND	0.70	ND	0.16	
111-84-2	n-Nonane	ND	0.70	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.70	ND	0.10	
98-82-8	Cumene	ND	0.70	ND	0.14	
80-56-8	alpha-Pinene	10	0.70	1.9	0.13	
103-65-1	n-Propylbenzene	ND	0.70	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.70	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.70	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.70	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.70	ND	0.14	
541-73-1	1,3-Dichlorobenzene	ND	0.70	ND	0.12	
106-46-7	1,4-Dichlorobenzene	ND	0.70	ND	0.12	
95-50-1	1,2-Dichlorobenzene	ND	0.70	ND	0.12	
5989-27-5	d-Limonene	4.1	0.70	0.73	0.13	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.70	ND	0.072	
120-82-1	1,2,4-Trichlorobenzene	ND	0.70	ND	0.094	
91-20-3	Naphthalene	ND	0.70	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.70	ND	0.066	

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Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-Downwind**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01213

Date Collected: 9/25/12

Date Received: 9/26/12

Date Analyzed: 10/1/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.51 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	0.82	0.69	0.48	0.40	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.6	0.69	0.52	0.14	
74-87-3	Chloromethane	ND	0.69	ND	0.33	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.69	ND	0.099	
75-01-4	Vinyl Chloride	ND	0.69	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.69	ND	0.31	
74-83-9	Bromomethane	ND	0.69	ND	0.18	
75-00-3	Chloroethane	ND	0.69	ND	0.26	
64-17-5	Ethanol	190	6.9	100	3.7	
75-05-8	Acetonitrile	ND	0.69	ND	0.41	
107-02-8	Acrolein	ND	2.8	ND	1.2	
67-64-1	Acetone	19	6.9	8.0	2.9	
75-69-4	Trichlorofluoromethane	1.8	0.69	0.32	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.9	ND	2.8	
107-13-1	Acrylonitrile	ND	0.69	ND	0.32	
75-35-4	1,1-Dichloroethene	ND	0.69	ND	0.17	
75-09-2	Methylene Chloride	0.77	0.69	0.22	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.69	ND	0.22	
76-13-1	Trichlorotrifluoroethane	ND	0.69	ND	0.090	
75-15-0	Carbon Disulfide	ND	6.9	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.69	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.69	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.69	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.9	ND	2.0	
78-93-3	2-Butanone (MEK)	ND	6.9	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-Downwind**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-004

Test Code: EPA TO-15

Date Collected: 9/25/12

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Date Received: 9/26/12

Analyst: Simon Cao

Date Analyzed: 10/1/12

Sampling Media: 6.0 L Summa Canister

Volume(s) Analyzed: 1.00 Liter(s)

Test Notes:

Container ID: AC01213

Initial Pressure (psig): -1.51 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.69	ND	0.17	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.38	
110-54-3	n-Hexane	2.1	0.69	0.59	0.20	
67-66-3	Chloroform	ND	0.69	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	1.6	0.69	0.55	0.23	
107-06-2	1,2-Dichloroethane	ND	0.69	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.69	ND	0.13	
71-43-2	Benzene	1.2	0.69	0.37	0.22	
56-23-5	Carbon Tetrachloride	ND	0.69	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.40	
78-87-5	1,2-Dichloropropane	ND	0.69	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.69	ND	0.10	
79-01-6	Trichloroethene	ND	0.69	ND	0.13	
123-91-1	1,4-Dioxane	ND	0.69	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.34	
142-82-5	n-Heptane	0.69	0.69	0.17	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.69	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.69	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.69	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.69	ND	0.13	
108-88-3	Toluene	1.6	0.69	0.44	0.18	
591-78-6	2-Hexanone	ND	0.69	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.69	ND	0.081	
106-93-4	1,2-Dibromoethane	ND	0.69	ND	0.090	
123-86-4	n-Butyl Acetate	ND	0.69	ND	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-Downwind
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
 CAS Sample ID: P1203955-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01213

Date Collected: 9/25/12
 Date Received: 9/26/12
 Date Analyzed: 10/1/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.51 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.69	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.69	ND	0.10	
108-90-7	Chlorobenzene	ND	0.69	ND	0.15	
100-41-4	Ethylbenzene	ND	0.69	ND	0.16	
179601-23-1	m,p-Xylenes	1.7	1.4	0.39	0.32	
75-25-2	Bromoform	ND	0.69	ND	0.067	
100-42-5	Styrene	4.0	0.69	0.94	0.16	
95-47-6	o-Xylene	ND	0.69	ND	0.16	
111-84-2	n-Nonane	1.0	0.69	0.20	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.69	ND	0.10	
98-82-8	Cumene	ND	0.69	ND	0.14	
80-56-8	alpha-Pinene	68	0.69	12	0.12	
103-65-1	n-Propylbenzene	ND	0.69	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.69	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.69	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.69	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.69	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.69	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.69	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.69	ND	0.11	
5989-27-5	d-Limonene	17	0.69	3.1	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.69	ND	0.071	
120-82-1	1,2,4-Trichlorobenzene	ND	0.69	ND	0.093	
91-20-3	Naphthalene	ND	0.69	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.69	ND	0.065	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-Stripper**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-002

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC01701

Date Collected: 9/24/12

Date Received: 9/26/12

Date Analyzed: 10/1/12

Volume(s) Analyzed: 0.0050 Liter(s)

0.0025 Liter(s)

Initial Pressure (psig): -0.52 Final Pressure (psig): 3.72

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	130	ND	76	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	130	ND	26	
74-87-3	Chloromethane	ND	130	ND	63	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	130	ND	19	
75-01-4	Vinyl Chloride	240	130	92	51	
106-99-0	1,3-Butadiene	ND	130	ND	59	
74-83-9	Bromomethane	ND	130	ND	33	
75-00-3	Chloroethane	ND	130	ND	49	
64-17-5	Ethanol	ND	1,300	ND	690	
75-05-8	Acetonitrile	ND	130	ND	77	
107-02-8	Acrolein	ND	520	ND	230	
67-64-1	Acetone	ND	1,300	ND	550	
75-69-4	Trichlorofluoromethane	ND	130	ND	23	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,300	ND	530	
107-13-1	Acrylonitrile	ND	130	ND	60	
75-35-4	1,1-Dichloroethene	330	130	83	33	
75-09-2	Methylene Chloride	1,500	130	440	37	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	130	ND	42	
76-13-1	Trichlorotrifluoroethane	28,000	260	3,700	34	D
75-15-0	Carbon Disulfide	ND	1,300	ND	420	
156-60-5	trans-1,2-Dichloroethene	ND	130	ND	33	
75-34-3	1,1-Dichloroethane	ND	130	ND	32	
1634-04-4	Methyl tert-Butyl Ether	ND	130	ND	36	
108-05-4	Vinyl Acetate	ND	1,300	ND	370	
78-93-3	2-Butanone (MEK)	ND	1,300	ND	440	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5007-Stripper**Client Project ID:** GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955

CAS Sample ID: P1203955-002

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC01701

Date Collected: 9/24/12

Date Received: 9/26/12

Date Analyzed: 10/1/12

Volume(s) Analyzed: 0.0050 Liter(s)

0.0025 Liter(s)

Initial Pressure (psig): -0.52 Final Pressure (psig): 3.72

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	17,000	130	4,400	33	
141-78-6	Ethyl Acetate	ND	260	ND	72	
110-54-3	n-Hexane	ND	130	ND	37	
67-66-3	Chloroform	ND	130	ND	27	
109-99-9	Tetrahydrofuran (THF)	ND	130	ND	44	
107-06-2	1,2-Dichloroethane	ND	130	ND	32	
71-55-6	1,1,1-Trichloroethane	ND	130	ND	24	
71-43-2	Benzene	ND	130	ND	41	
56-23-5	Carbon Tetrachloride	ND	130	ND	21	
110-82-7	Cyclohexane	ND	260	ND	76	
78-87-5	1,2-Dichloropropane	ND	130	ND	28	
75-27-4	Bromodichloromethane	ND	130	ND	19	
79-01-6	Trichloroethene	26,000	260	4,900	48	D
123-91-1	1,4-Dioxane	ND	130	ND	36	
80-62-6	Methyl Methacrylate	ND	260	ND	64	
142-82-5	n-Heptane	ND	130	ND	32	
10061-01-5	cis-1,3-Dichloropropene	ND	130	ND	29	
108-10-1	4-Methyl-2-pentanone	ND	130	ND	32	
10061-02-6	trans-1,3-Dichloropropene	ND	130	ND	29	
79-00-5	1,1,2-Trichloroethane	ND	130	ND	24	
108-88-3	Toluene	ND	130	ND	35	
591-78-6	2-Hexanone	ND	130	ND	32	
124-48-1	Dibromochloromethane	ND	130	ND	15	
106-93-4	1,2-Dibromoethane	ND	130	ND	17	
123-86-4	n-Butyl Acetate	ND	130	ND	27	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-Stripper
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
CAS Sample ID: P1203955-002

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Simon Cao
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: SC01701

Date Collected: 9/24/12
Date Received: 9/26/12
Date Analyzed: 10/1/12
Volume(s) Analyzed: 0.0050 Liter(s)
0.0025 Liter(s)

Initial Pressure (psig): -0.52 Final Pressure (psig): 3.72

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	130	ND	28	
127-18-4	Tetrachloroethene	140	130	21	19	
108-90-7	Chlorobenzene	ND	130	ND	28	
100-41-4	Ethylbenzene	ND	130	ND	30	
179601-23-1	m,p-Xylenes	ND	260	ND	60	
75-25-2	Bromoform	ND	130	ND	13	
100-42-5	Styrene	ND	130	ND	31	
95-47-6	o-Xylene	ND	130	ND	30	
111-84-2	n-Nonane	ND	130	ND	25	
79-34-5	1,1,2,2-Tetrachloroethane	ND	130	ND	19	
98-82-8	Cumene	ND	130	ND	26	
80-56-8	alpha-Pinene	ND	130	ND	23	
103-65-1	n-Propylbenzene	ND	130	ND	26	
622-96-8	4-Ethyltoluene	ND	130	ND	26	
108-67-8	1,3,5-Trimethylbenzene	ND	130	ND	26	
95-63-6	1,2,4-Trimethylbenzene	ND	130	ND	26	
100-44-7	Benzyl Chloride	ND	130	ND	25	
541-73-1	1,3-Dichlorobenzene	ND	130	ND	22	
106-46-7	1,4-Dichlorobenzene	ND	130	ND	22	
95-50-1	1,2-Dichlorobenzene	ND	130	ND	22	
5989-27-5	d-Limonene	ND	130	ND	23	
96-12-8	1,2-Dibromo-3-chloropropane	ND	130	ND	13	
120-82-1	1,2,4-Trichlorobenzene	ND	130	ND	18	
91-20-3	Naphthalene	ND	130	ND	25	
87-68-3	Hexachlorobutadiene	ND	130	ND	12	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-Stripper-DUP
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
 CAS Sample ID: P1203955-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01057

Date Collected: 9/24/12
 Date Received: 9/26/12
 Date Analyzed: 10/1/12
 Volume(s) Analyzed: 0.0030 Liter(s)

Initial Pressure (psig): -0.77 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	220	ND	130	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	220	ND	44	
74-87-3	Chloromethane	ND	220	ND	110	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	220	ND	31	
75-01-4	Vinyl Chloride	ND	220	ND	85	
106-99-0	1,3-Butadiene	ND	220	ND	99	
74-83-9	Bromomethane	ND	220	ND	56	
75-00-3	Chloroethane	ND	220	ND	83	
64-17-5	Ethanol	ND	2,200	ND	1,200	
75-05-8	Acetonitrile	ND	220	ND	130	
107-02-8	Acrolein	ND	870	ND	380	
67-64-1	Acetone	ND	2,200	ND	920	
75-69-4	Trichlorofluoromethane	ND	220	ND	39	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	2,200	ND	890	
107-13-1	Acrylonitrile	ND	220	ND	100	
75-35-4	1,1-Dichloroethene	280	220	72	55	
75-09-2	Methylene Chloride	1,300	220	380	63	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	220	ND	70	
76-13-1	Trichlorotrifluoroethane	25,000	220	3,300	29	
75-15-0	Carbon Disulfide	ND	2,200	ND	700	
156-60-5	trans-1,2-Dichloroethene	ND	220	ND	55	
75-34-3	1,1-Dichloroethane	ND	220	ND	54	
1634-04-4	Methyl tert-Butyl Ether	ND	220	ND	61	
108-05-4	Vinyl Acetate	ND	2,200	ND	620	
78-93-3	2-Butanone (MEK)	ND	2,200	ND	740	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-Stripper-DUP
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
 CAS Sample ID: P1203955-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01057

Date Collected: 9/24/12
 Date Received: 9/26/12
 Date Analyzed: 10/1/12
 Volume(s) Analyzed: 0.0030 Liter(s)

Initial Pressure (psig): -0.77 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	16,000	220	3,900	55	
141-78-6	Ethyl Acetate	ND	440	ND	120	
110-54-3	n-Hexane	ND	220	ND	62	
67-66-3	Chloroform	ND	220	ND	45	
109-99-9	Tetrahydrofuran (THF)	ND	220	ND	74	
107-06-2	1,2-Dichloroethane	ND	220	ND	54	
71-55-6	1,1,1-Trichloroethane	ND	220	ND	40	
71-43-2	Benzene	ND	220	ND	68	
56-23-5	Carbon Tetrachloride	ND	220	ND	35	
110-82-7	Cyclohexane	ND	440	ND	130	
78-87-5	1,2-Dichloropropane	ND	220	ND	47	
75-27-4	Bromodichloromethane	ND	220	ND	33	
79-01-6	Trichloroethene	24,000	220	4,400	41	
123-91-1	1,4-Dioxane	ND	220	ND	61	
80-62-6	Methyl Methacrylate	ND	440	ND	110	
142-82-5	n-Heptane	ND	220	ND	53	
10061-01-5	cis-1,3-Dichloropropene	ND	220	ND	48	
108-10-1	4-Methyl-2-pentanone	ND	220	ND	53	
10061-02-6	trans-1,3-Dichloropropene	ND	220	ND	48	
79-00-5	1,1,2-Trichloroethane	ND	220	ND	40	
108-88-3	Toluene	ND	220	ND	58	
591-78-6	2-Hexanone	ND	220	ND	53	
124-48-1	Dibromochloromethane	ND	220	ND	26	
106-93-4	1,2-Dibromoethane	ND	220	ND	28	
123-86-4	n-Butyl Acetate	ND	220	ND	46	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5007-Stripper-DUP
Client Project ID: GWTP Longhorn / 60256135-0004AA

CAS Project ID: P1203955
CAS Sample ID: P1203955-001

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Simon Cao
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: SC01057

Date Collected: 9/24/12
Date Received: 9/26/12
Date Analyzed: 10/1/12
Volume(s) Analyzed: 0.0030 Liter(s)

Initial Pressure (psig): -0.77 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	220	ND	47	
127-18-4	Tetrachloroethene	240	220	35	32	
108-90-7	Chlorobenzene	ND	220	ND	47	
100-41-4	Ethylbenzene	ND	220	ND	50	
179601-23-1	m,p-Xylenes	ND	440	ND	100	
75-25-2	Bromoform	ND	220	ND	21	
100-42-5	Styrene	ND	220	ND	51	
95-47-6	o-Xylene	ND	220	ND	50	
111-84-2	n-Nonane	ND	220	ND	42	
79-34-5	1,1,2,2-Tetrachloroethane	ND	220	ND	32	
98-82-8	Cumene	ND	220	ND	44	
80-56-8	alpha-Pinene	ND	220	ND	39	
103-65-1	n-Propylbenzene	ND	220	ND	44	
622-96-8	4-Ethyltoluene	ND	220	ND	44	
108-67-8	1,3,5-Trimethylbenzene	ND	220	ND	44	
95-63-6	1,2,4-Trimethylbenzene	ND	220	ND	44	
100-44-7	Benzyl Chloride	ND	220	ND	42	
541-73-1	1,3-Dichlorobenzene	ND	220	ND	36	
106-46-7	1,4-Dichlorobenzene	ND	220	ND	36	
95-50-1	1,2-Dichlorobenzene	ND	220	ND	36	
5989-27-5	d-Limonene	ND	220	ND	39	
96-12-8	1,2-Dibromo-3-chloropropane	ND	220	ND	23	
120-82-1	1,2,4-Trichlorobenzene	ND	220	ND	29	
91-20-3	Naphthalene	ND	220	ND	42	
87-68-3	Hexachlorobutadiene	ND	220	ND	20	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – September 24, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
9/24/2012	8:00	Outside GWTP Office	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 68 degrees
9/24/2012	8:05	Downwind	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 68 degrees
9/24/2012	2:00	Stripper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 20.2ppm Steady State 7.0 ppm	Clear 90 degrees
9/24/2012	2:15	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 90 degrees
9/24/2012	2:30	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 90 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: 9/24/12	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: Scott Beesinger

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB TO ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100ppm (isobutylene)	6/15/2016	GAM-248 - 100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – October 1, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on October 1, 2012 for 9.25 hours. The previous operation of GWTP was on September 27, 2012 (Thursday).
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while recovery will continue to occur continuously.
- 104,926 gallons of water were processed from TK-140 (influent tank) and a total of 79,634 gallons were transferred to the Burning Grounds No. 3 through the irrigation system.
- The treatment flow rate averaged approximately 189 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The blower flow rate was 3,800 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was pumped into the fluidized bed reactor (FBR) for treatment for perchlorate. The treated groundwater through the FBR was then transferred to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was cloudy and the temperature was 65°F.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.1 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 2:00 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 20.62 ppmv and then began to decline to a steady state concentration of 15.7 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.
- At 2:15 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:20 PM, a PID reading was collected from the downwind location.

- The PID at the GWTP registered 0.2 ppmv and the PID downwind registered 0.0 ppmv.
- The air analytical results were received on October 10, 2012.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 0.937 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 1, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	270	3.83E-03	1.68E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	135 U	9.58E-04 U	4.20E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1350 U	9.58E-03 U	4.20E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	135 U	9.58E-04 U	4.20E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1350 U	9.58E-03 U	4.20E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	15500	2.20E-01	9.63E-01	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	1600	2.27E-02	9.95E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	135 U	9.58E-04 U	4.20E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	135 U	9.58E-04 U	4.20E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	24000	3.41E-01	1.49E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	135	1.92E-03	8.39E-03	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	135 U	9.58E-04 U	4.20E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	135 U	9.58E-04 U	4.20E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Propene (C3 H6)	115-07-1	135 U	9.58E-04 U	4.20E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	135 U	9.58E-04 U	4.20E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1400 U	9.93E-03 U	4.35E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	135 U	9.58E-04 U	4.20E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	21500	3.05E-01	1.34E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	135 U	9.58E-04 U	4.20E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	135 U	9.58E-04 U	4.20E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			0.937 U										

(1) Sample collected on October 1, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,800 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3800 cfm

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 1, 2012

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)		Status (3)	Downwind Ambient Air Concentrations (2)		Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³			µg/m ³		
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U	PASS	0.65	U	PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U	PASS	0.65	U	PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U	PASS	0.65	U	PASS
Acetone	67-64-1	5900	NA	130		PASS	8.7		PASS
Benzene	71-43-2	170	575	0.69	U	PASS	0.65	U	PASS
Carbon disulfide	75-15-0	30	NA	6.9	U	PASS	6.5	U	PASS
Chloroform	67-66-3	100	98	0.69	U	PASS	0.65	U	PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	1.2		PASS	0.65	U	PASS
Methylene chloride	75-09-2	3600	12158	0.69	U	PASS	0.65	U	PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U	PASS	0.65	U	PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U	PASS	0.65	U	PASS
Trichloroethene	79-01-6	540	537	2.5		PASS	0.65	U	PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U	PASS	0.65	U	PASS
n-Hexane	110-54-3	5300	6336	0.69	U	PASS	0.65	U	PASS
Styrene	100-42-5	110	21725	1.4		PASS	0.99		PASS
Toluene	108-88-3	640	15074	0.69	U	PASS	0.82		PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.69	U	NA	0.65	U	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.2		PASS	2.4		PASS
Ethanol	64-17-5	18800	NA	6.9	U	PASS	8.4		PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1		PASS	1.2		PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	5.6		PASS	1.5		PASS
alpha-Pinene	80-56-8	60	3499	1.5		PASS	26		PASS
d-Limonene	5989-27-5	1100	NA	0.69	U	PASS	6		PASS

(1) Sample collected over an 8-hour period on October 1, 2012 between 8:00 AM and 4:00 PM

(2) Sample collected over a 24-hour period beginning on October 1, 2012 at 8:05 AM and ending on October 2, 2012 at 8:05 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Air Analytical Results –
October 1, 2012**

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-STRIPPER**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00129

Date Collected: 10/1/12

Date Received: 10/3/12

Date Analyzed: 10/5/12

Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.88 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.44

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	140	ND	84	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	140	ND	29	
74-87-3	Chloromethane	ND	140	ND	70	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	140	ND	21	
75-01-4	Vinyl Chloride	ND	140	ND	56	
106-99-0	1,3-Butadiene	ND	140	ND	65	
74-83-9	Bromomethane	ND	140	ND	37	
75-00-3	Chloroethane	ND	140	ND	55	
64-17-5	Ethanol	ND	1,400	ND	760	
75-05-8	Acetonitrile	ND	140	ND	86	
107-02-8	Acrolein	ND	580	ND	250	
67-64-1	Acetone	ND	1,400	ND	610	
75-69-4	Trichlorofluoromethane	ND	140	ND	26	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,400	ND	590	
107-13-1	Acrylonitrile	ND	140	ND	66	
75-35-4	1,1-Dichloroethene	270	140	69	36	
75-09-2	Methylene Chloride	1,600	140	470	41	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	140	ND	46	
76-13-1	Trichlorotrifluoroethane	22,000	140	2,900	19	
75-15-0	Carbon Disulfide	ND	1,400	ND	460	
156-60-5	trans-1,2-Dichloroethene	ND	140	ND	36	
75-34-3	1,1-Dichloroethane	ND	140	ND	36	
1634-04-4	Methyl tert-Butyl Ether	ND	140	ND	40	
108-05-4	Vinyl Acetate	ND	1,400	ND	410	
78-93-3	2-Butanone (MEK)	ND	1,400	ND	490	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-STRIPPER**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00129

Date Collected: 10/1/12

Date Received: 10/3/12

Date Analyzed: 10/5/12

Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.88 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.44

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	16,000	140	4,000	36	
141-78-6	Ethyl Acetate	ND	290	ND	80	
110-54-3	n-Hexane	ND	140	ND	41	
67-66-3	Chloroform	ND	140	ND	29	
109-99-9	Tetrahydrofuran (THF)	ND	140	ND	49	
107-06-2	1,2-Dichloroethane	ND	140	ND	36	
71-55-6	1,1,1-Trichloroethane	ND	140	ND	26	
71-43-2	Benzene	ND	140	ND	45	
56-23-5	Carbon Tetrachloride	ND	140	ND	23	
110-82-7	Cyclohexane	ND	290	ND	84	
78-87-5	1,2-Dichloropropane	ND	140	ND	31	
75-27-4	Bromodichloromethane	ND	140	ND	22	
79-01-6	Trichloroethene	24,000	140	4,500	27	
123-91-1	1,4-Dioxane	ND	140	ND	40	
80-62-6	Methyl Methacrylate	ND	290	ND	70	
142-82-5	n-Heptane	ND	140	ND	35	
10061-01-5	cis-1,3-Dichloropropene	ND	140	ND	32	
108-10-1	4-Methyl-2-pentanone	ND	140	ND	35	
10061-02-6	trans-1,3-Dichloropropene	ND	140	ND	32	
79-00-5	1,1,2-Trichloroethane	ND	140	ND	26	
108-88-3	Toluene	ND	140	ND	38	
591-78-6	2-Hexanone	ND	140	ND	35	
124-48-1	Dibromochloromethane	ND	140	ND	17	
106-93-4	1,2-Dibromoethane	ND	140	ND	19	
123-86-4	n-Butyl Acetate	ND	140	ND	30	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-STRIPPER
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
CAS Sample ID: P1204063-001

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Simon Cao
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: SC00129

Date Collected: 10/1/12
Date Received: 10/3/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.88 Final Pressure (psig): 3.76

Canister Dilution Factor: 1.44

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	140	ND	31	
127-18-4	Tetrachloroethene	ND	140	ND	21	
108-90-7	Chlorobenzene	ND	140	ND	31	
100-41-4	Ethylbenzene	ND	140	ND	33	
179601-23-1	m,p-Xylenes	ND	290	ND	66	
75-25-2	Bromoform	ND	140	ND	14	
100-42-5	Styrene	ND	140	ND	34	
95-47-6	o-Xylene	ND	140	ND	33	
111-84-2	n-Nonane	ND	140	ND	27	
79-34-5	1,1,2,2-Tetrachloroethane	ND	140	ND	21	
98-82-8	Cumene	ND	140	ND	29	
80-56-8	alpha-Pinene	ND	140	ND	26	
103-65-1	n-Propylbenzene	ND	140	ND	29	
622-96-8	4-Ethyltoluene	ND	140	ND	29	
108-67-8	1,3,5-Trimethylbenzene	ND	140	ND	29	
95-63-6	1,2,4-Trimethylbenzene	ND	140	ND	29	
100-44-7	Benzyl Chloride	ND	140	ND	28	
541-73-1	1,3-Dichlorobenzene	ND	140	ND	24	
106-46-7	1,4-Dichlorobenzene	ND	140	ND	24	
95-50-1	1,2-Dichlorobenzene	ND	140	ND	24	
5989-27-5	d-Limonene	ND	140	ND	26	
96-12-8	1,2-Dibromo-3-chloropropane	ND	140	ND	15	
120-82-1	1,2,4-Trichlorobenzene	ND	140	ND	19	
91-20-3	Naphthalene	ND	140	ND	27	
87-68-3	Hexachlorobutadiene	ND	140	ND	14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-STRIPPER-Dup**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-002

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC01674

Date Collected: 10/1/12

Date Received: 10/3/12

Date Analyzed: 10/5/12

Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -0.54 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	130	ND	75	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	130	ND	26	
74-87-3	Chloromethane	ND	130	ND	62	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	130	ND	18	
75-01-4	Vinyl Chloride	130	130	52	50	
106-99-0	1,3-Butadiene	ND	130	ND	58	
74-83-9	Bromomethane	ND	130	ND	33	
75-00-3	Chloroethane	ND	130	ND	49	
64-17-5	Ethanol	ND	1,300	ND	680	
75-05-8	Acetonitrile	ND	130	ND	77	
107-02-8	Acrolein	ND	520	ND	230	
67-64-1	Acetone	ND	1,300	ND	540	
75-69-4	Trichlorofluoromethane	ND	130	ND	23	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,300	ND	530	
107-13-1	Acrylonitrile	ND	130	ND	59	
75-35-4	1,1-Dichloroethene	270	130	68	33	
75-09-2	Methylene Chloride	1,600	130	450	37	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	130	ND	41	
76-13-1	Trichlorotrifluoroethane	21,000	130	2,800	17	
75-15-0	Carbon Disulfide	ND	1,300	ND	410	
156-60-5	trans-1,2-Dichloroethene	ND	130	ND	33	
75-34-3	1,1-Dichloroethane	ND	130	ND	32	
1634-04-4	Methyl tert-Butyl Ether	ND	130	ND	36	
108-05-4	Vinyl Acetate	ND	1,300	ND	370	
78-93-3	2-Butanone (MEK)	ND	1,300	ND	440	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-STRIPPER-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
CAS Sample ID: P1204063-002

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Simon Cao
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: SC01674

Date Collected: 10/1/12
Date Received: 10/3/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -0.54 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	15,000	130	3,800	33	
141-78-6	Ethyl Acetate	ND	260	ND	72	
110-54-3	n-Hexane	ND	130	ND	37	
67-66-3	Chloroform	ND	130	ND	26	
109-99-9	Tetrahydrofuran (THF)	ND	130	ND	44	
107-06-2	1,2-Dichloroethane	ND	130	ND	32	
71-55-6	1,1,1-Trichloroethane	ND	130	ND	24	
71-43-2	Benzene	ND	130	ND	40	
56-23-5	Carbon Tetrachloride	ND	130	ND	21	
110-82-7	Cyclohexane	ND	260	ND	75	
78-87-5	1,2-Dichloropropane	ND	130	ND	28	
75-27-4	Bromodichloromethane	ND	130	ND	19	
79-01-6	Trichloroethene	24,000	130	4,400	24	
123-91-1	1,4-Dioxane	ND	130	ND	36	
80-62-6	Methyl Methacrylate	ND	260	ND	63	
142-82-5	n-Heptane	ND	130	ND	31	
10061-01-5	cis-1,3-Dichloropropene	ND	130	ND	28	
108-10-1	4-Methyl-2-pentanone	ND	130	ND	31	
10061-02-6	trans-1,3-Dichloropropene	ND	130	ND	28	
79-00-5	1,1,2-Trichloroethane	ND	130	ND	24	
108-88-3	Toluene	ND	130	ND	34	
591-78-6	2-Hexanone	ND	130	ND	32	
124-48-1	Dibromochloromethane	ND	130	ND	15	
106-93-4	1,2-Dibromoethane	ND	130	ND	17	
123-86-4	n-Butyl Acetate	ND	130	ND	27	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-STRIPPER-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
 CAS Sample ID: P1204063-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC01674

Date Collected: 10/1/12
 Date Received: 10/3/12
 Date Analyzed: 10/5/12
 Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -0.54 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	130	ND	28	
127-18-4	Tetrachloroethene	ND	130	ND	19	
108-90-7	Chlorobenzene	ND	130	ND	28	
100-41-4	Ethylbenzene	ND	130	ND	30	
179601-23-1	m,p-Xylenes	ND	260	ND	59	
75-25-2	Bromoform	ND	130	ND	12	
100-42-5	Styrene	ND	130	ND	30	
95-47-6	o-Xylene	ND	130	ND	30	
111-84-2	n-Nonane	ND	130	ND	25	
79-34-5	1,1,2,2-Tetrachloroethane	ND	130	ND	19	
98-82-8	Cumene	ND	130	ND	26	
80-56-8	alpha-Pinene	ND	130	ND	23	
103-65-1	n-Propylbenzene	ND	130	ND	26	
622-96-8	4-Ethyltoluene	ND	130	ND	26	
108-67-8	1,3,5-Trimethylbenzene	ND	130	ND	26	
95-63-6	1,2,4-Trimethylbenzene	ND	130	ND	26	
100-44-7	Benzyl Chloride	ND	130	ND	25	
541-73-1	1,3-Dichlorobenzene	ND	130	ND	21	
106-46-7	1,4-Dichlorobenzene	ND	130	ND	21	
95-50-1	1,2-Dichlorobenzene	ND	130	ND	21	
5989-27-5	d-Limonene	ND	130	ND	23	
96-12-8	1,2-Dibromo-3-chloropropane	ND	130	ND	13	
120-82-1	1,2,4-Trichlorobenzene	ND	130	ND	17	
91-20-3	Naphthalene	ND	130	ND	25	
87-68-3	Hexachlorobutadiene	ND	130	ND	12	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00869

Date Collected: 10/1/12

Date Received: 10/3/12

Date Analyzed: 10/8/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.35 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.37

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.69	ND	0.40	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.2	0.69	0.45	0.14	
74-87-3	Chloromethane	ND	0.69	ND	0.33	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.69	ND	0.098	
75-01-4	Vinyl Chloride	ND	0.69	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.69	ND	0.31	
74-83-9	Bromomethane	ND	0.69	ND	0.18	
75-00-3	Chloroethane	ND	0.69	ND	0.26	
64-17-5	Ethanol	ND	6.9	ND	3.6	
75-05-8	Acetonitrile	ND	0.69	ND	0.41	
107-02-8	Acrolein	ND	2.7	ND	1.2	
67-64-1	Acetone	130	6.9	53	2.9	
75-69-4	Trichlorofluoromethane	1.1	0.69	0.20	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.9	ND	2.8	
107-13-1	Acrylonitrile	ND	0.69	ND	0.32	
75-35-4	1,1-Dichloroethene	ND	0.69	ND	0.17	
75-09-2	Methylene Chloride	ND	0.69	ND	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.69	ND	0.22	
76-13-1	Trichlorotrifluoroethane	5.6	0.69	0.74	0.089	
75-15-0	Carbon Disulfide	ND	6.9	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.69	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.69	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.69	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.9	ND	1.9	
78-93-3	2-Butanone (MEK)	ND	6.9	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00869

Date Collected: 10/1/12

Date Received: 10/3/12

Date Analyzed: 10/8/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.35 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.37

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	1.2	0.69	0.29	0.17	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.38	
110-54-3	n-Hexane	ND	0.69	ND	0.19	
67-66-3	Chloroform	ND	0.69	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.69	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.69	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.69	ND	0.13	
71-43-2	Benzene	ND	0.69	ND	0.21	
56-23-5	Carbon Tetrachloride	ND	0.69	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.40	
78-87-5	1,2-Dichloropropane	ND	0.69	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.69	ND	0.10	
79-01-6	Trichloroethene	2.5	0.69	0.47	0.13	
123-91-1	1,4-Dioxane	ND	0.69	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.33	
142-82-5	n-Heptane	ND	0.69	ND	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.69	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.69	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.69	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.69	ND	0.13	
108-88-3	Toluene	ND	0.69	ND	0.18	
591-78-6	2-Hexanone	ND	0.69	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.69	ND	0.080	
106-93-4	1,2-Dibromoethane	ND	0.69	ND	0.089	
123-86-4	n-Butyl Acetate	1.1	0.69	0.22	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
 CAS Sample ID: P1204063-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC00869

Date Collected: 10/1/12
 Date Received: 10/3/12
 Date Analyzed: 10/8/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.35 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.37

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.69	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.69	ND	0.10	
108-90-7	Chlorobenzene	ND	0.69	ND	0.15	
100-41-4	Ethylbenzene	ND	0.69	ND	0.16	
179601-23-1	m,p-Xylenes	1.8	1.4	0.42	0.32	
75-25-2	Bromoform	ND	0.69	ND	0.066	
100-42-5	Styrene	1.4	0.69	0.32	0.16	
95-47-6	o-Xylene	ND	0.69	ND	0.16	
111-84-2	n-Nonane	ND	0.69	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.69	ND	0.10	
98-82-8	Cumene	ND	0.69	ND	0.14	
80-56-8	alpha-Pinene	1.5	0.69	0.27	0.12	
103-65-1	n-Propylbenzene	ND	0.69	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.69	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.69	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.69	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.69	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.69	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.69	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.69	ND	0.11	
5989-27-5	d-Limonene	ND	0.69	ND	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.69	ND	0.071	
120-82-1	1,2,4-Trichlorobenzene	ND	0.69	ND	0.092	
91-20-3	Naphthalene	ND	0.69	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.69	ND	0.064	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
 CAS Sample ID: P1204063-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01466

Date Collected: 10/2/12
 Date Received: 10/3/12
 Date Analyzed: 10/5/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.47 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.65	ND	0.37	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.4	0.65	0.49	0.13	
74-87-3	Chloromethane	0.66	0.65	0.32	0.31	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.65	ND	0.092	
75-01-4	Vinyl Chloride	ND	0.65	ND	0.25	
106-99-0	1,3-Butadiene	ND	0.65	ND	0.29	
74-83-9	Bromomethane	ND	0.65	ND	0.17	
75-00-3	Chloroethane	ND	0.65	ND	0.24	
64-17-5	Ethanol	8.4	6.5	4.5	3.4	
75-05-8	Acetonitrile	ND	0.65	ND	0.38	
107-02-8	Acrolein	ND	2.6	ND	1.1	
67-64-1	Acetone	8.7	6.5	3.6	2.7	
75-69-4	Trichlorofluoromethane	1.2	0.65	0.21	0.11	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.5	ND	2.6	
107-13-1	Acrylonitrile	ND	0.65	ND	0.30	
75-35-4	1,1-Dichloroethene	ND	0.65	ND	0.16	
75-09-2	Methylene Chloride	ND	0.65	ND	0.19	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.65	ND	0.21	
76-13-1	Trichlorotrifluoroethane	1.5	0.65	0.20	0.084	
75-15-0	Carbon Disulfide	ND	6.5	ND	2.1	
156-60-5	trans-1,2-Dichloroethene	ND	0.65	ND	0.16	
75-34-3	1,1-Dichloroethane	ND	0.65	ND	0.16	
1634-04-4	Methyl tert-Butyl Ether	ND	0.65	ND	0.18	
108-05-4	Vinyl Acetate	ND	6.5	ND	1.8	
78-93-3	2-Butanone (MEK)	ND	6.5	ND	2.2	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5011-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063

CAS Sample ID: P1204063-004

Test Code: EPA TO-15

Date Collected: 10/2/12

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Date Received: 10/3/12

Analyst: Simon Cao

Date Analyzed: 10/5/12

Sampling Media: 6.0 L Summa Canister

Volume(s) Analyzed: 1.00 Liter(s)

Test Notes:

Container ID: AC01466

Initial Pressure (psig): -0.47 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.65	ND	0.16	
141-78-6	Ethyl Acetate	ND	1.3	ND	0.36	
110-54-3	n-Hexane	ND	0.65	ND	0.18	
67-66-3	Chloroform	ND	0.65	ND	0.13	
109-99-9	Tetrahydrofuran (THF)	ND	0.65	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.65	ND	0.16	
71-55-6	1,1,1-Trichloroethane	ND	0.65	ND	0.12	
71-43-2	Benzene	ND	0.65	ND	0.20	
56-23-5	Carbon Tetrachloride	ND	0.65	ND	0.10	
110-82-7	Cyclohexane	ND	1.3	ND	0.37	
78-87-5	1,2-Dichloropropane	ND	0.65	ND	0.14	
75-27-4	Bromodichloromethane	ND	0.65	ND	0.096	
79-01-6	Trichloroethene	ND	0.65	ND	0.12	
123-91-1	1,4-Dioxane	ND	0.65	ND	0.18	
80-62-6	Methyl Methacrylate	ND	1.3	ND	0.32	
142-82-5	n-Heptane	ND	0.65	ND	0.16	
10061-01-5	cis-1,3-Dichloropropene	ND	0.65	ND	0.14	
108-10-1	4-Methyl-2-pentanone	ND	0.65	ND	0.16	
10061-02-6	trans-1,3-Dichloropropene	ND	0.65	ND	0.14	
79-00-5	1,1,2-Trichloroethane	ND	0.65	ND	0.12	
108-88-3	Toluene	0.82	0.65	0.22	0.17	
591-78-6	2-Hexanone	ND	0.65	ND	0.16	
124-48-1	Dibromochloromethane	ND	0.65	ND	0.076	
106-93-4	1,2-Dibromoethane	ND	0.65	ND	0.084	
123-86-4	n-Butyl Acetate	ND	0.65	ND	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5011-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204063
CAS Sample ID: P1204063-004

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Simon Cao
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: AC01466

Date Collected: 10/2/12
Date Received: 10/3/12
Date Analyzed: 10/5/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.47 Final Pressure (psig): 3.71

Canister Dilution Factor: 1.29

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.65	ND	0.14	
127-18-4	Tetrachloroethene	ND	0.65	ND	0.095	
108-90-7	Chlorobenzene	ND	0.65	ND	0.14	
100-41-4	Ethylbenzene	ND	0.65	ND	0.15	
179601-23-1	m,p-Xylenes	ND	1.3	ND	0.30	
75-25-2	Bromoform	ND	0.65	ND	0.062	
100-42-5	Styrene	0.99	0.65	0.23	0.15	
95-47-6	o-Xylene	ND	0.65	ND	0.15	
111-84-2	n-Nonane	ND	0.65	ND	0.12	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.65	ND	0.094	
98-82-8	Cumene	ND	0.65	ND	0.13	
80-56-8	alpha-Pinene	26	0.65	4.7	0.12	
103-65-1	n-Propylbenzene	ND	0.65	ND	0.13	
622-96-8	4-Ethyltoluene	ND	0.65	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.65	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	ND	0.65	ND	0.13	
100-44-7	Benzyl Chloride	ND	0.65	ND	0.12	
541-73-1	1,3-Dichlorobenzene	ND	0.65	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.65	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.65	ND	0.11	
5989-27-5	d-Limonene	6.0	0.65	1.1	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.65	ND	0.067	
120-82-1	1,2,4-Trichlorobenzene	ND	0.65	ND	0.087	
91-20-3	Naphthalene	ND	0.65	ND	0.12	
87-68-3	Hexachlorobutadiene	ND	0.65	ND	0.060	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – October 1, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
10/1/2012	8:00	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Cloudy 65 degrees
10/1/2012	8:05	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Cloudy 65 degrees
10/1/2012	2:00	Stripper	3750 ACFM	MiniRAE 3000	Scott Beesinger	Max. 20.6 ppm Steady State 15.7 ppm	Clear 80 degrees
10/1/2012	2:15	Outside GWTP Office	3750 ACFM	MiniRAE 3000	Scott Beesinger	0.2 ppm	Clear 80 degrees
10/1/2012	2:20	Downwind	3750 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 80 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: 10/1/12

Project Name: GWTP Operations.

60256135 .0004aa

Recorded By: Scott Beesinger

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB To ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100 ppm (isobutylene)	6/15/2016	6Am-248 -100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O2 (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Plant Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Plant Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7			Value:	Value:	
	Turbidity (NTU)	100			Value:	Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – October 8, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on October 8, 2012 for 9.00 hours. The previous operation of GWTP occurred on October 4, 2012 (Thursday).
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while groundwater extraction will continue to occur continuously.
- 99,811 gallons of water were processed from TK-140 (influent tank) and a total of 69,494 gallons were returned to the Burning Grounds No. 3 through the irrigation system.
- The metals precipitation and air stripping treatment flow rate averaged approximately 185 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The blower flow rate was 3,850 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was treated in the fluidized bed reactor (FBR) for perchlorate. The treated groundwater through the FBR was then returned to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was clear and the temperature was 50°F.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.0 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 1:55 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 22.2 ppmv and then began to decline to a steady state concentration of 15.7 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.

- At 1: 50 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:10 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.0 ppmv and the PID downwind registered 0.0 ppmv.
- The air analytical results were received on October 10, 2012.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 0.905 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds. The average measured emission rate from the air stripper stack since September 6, 2012 is estimated at 0.90 lb/hr.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 8, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.67	U PASS	0.65	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.67	U PASS	0.65	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.67	U PASS	0.65	U PASS
Acetone	67-64-1	5900	NA	7.1	PASS	6.5	U PASS
Benzene	71-43-2	170	575	0.67	U PASS	0.65	U PASS
Carbon disulfide	75-15-0	30	NA	6.7	U PASS	6.5	U PASS
Chloroform	67-66-3	100	98	0.67	U PASS	0.65	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	7.2	PASS	0.65	U PASS
Methylene chloride	75-09-2	3600	12158	0.67	U PASS	0.65	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.67	U PASS	0.65	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.67	U PASS	0.65	U PASS
Trichloroethene	79-01-6	540	537	18	PASS	0.99	PASS
Vinyl chloride	75-01-4	20000	66460	0.67	U PASS	0.65	U PASS
n-Hexane	110-54-3	5300	6336	0.67	U PASS	0.65	U PASS
Styrene	100-42-5	110	21725	0.67	U PASS	0.65	U PASS
Toluene	108-88-3	640	15074	0.67	U PASS	0.65	U PASS
Ethylbenzene	100-41-4	740	86844	0.81	PASS	1.3	PASS
m,p-Xylenes	179601-23-1	180	7382	3.8	PASS	5.7	PASS
o-Xylene	95-47-6	1600	7382	1.5	PASS	1.9	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.92	PASS	0.65	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.67	U NA	1	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.1	PASS	2.1	PASS
Ethanol	64-17-5	18800	NA	6.7	U PASS	1600	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	1.1	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	33	PASS	2.2	PASS
alpha-Pinene	80-56-8	60	3499	0.67	U PASS	4.2	PASS
d-Limonene	5989-27-5	1100	NA	0.67	U PASS	1.7	PASS

(1) Sample collected over an 8-hour period on October 8, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 8, 2012 at 6:15 AM and ending on October 9, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 8, 2012

		Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)	Status (4)				Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K	Status (8)
Pollutant	CAS	µg/m ³		lb/hr		tpy		tpy		TLV (L)	TLV Reference	Compliance section	ft			
1,1-Dichloroethane	75-34-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
1,1-Dichloroethene	75-35-4	205		2.95E-03		1.29E-02		5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		1.4
1,2-Dichloroethane	107-06-2	160	U	1.15E-03	U	5.04E-03	U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		2.9
Acetone	67-64-1	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Benzene	71-43-2	160	U	1.15E-03	U	5.04E-03	U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		0.21
Carbon disulfide	75-15-0	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		2.2
Chloroform	67-66-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		0.71
cis-1,2-Dichloroethene	540-59-0	15000		2.16E-01		9.45E-01		5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Methylene chloride	75-09-2	210		3.02E-03		1.32E-02		5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		1.9
Tetrachloroethene	127-18-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		2.4
trans-1,2-Dichloroethene	540-59-0	160	U	1.15E-03	U	5.04E-03	U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Trichloroethene	79-01-6	24000		3.45E-01		1.51E+00		5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		6.0
Vinyl chloride	75-01-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		0.14
n-Hexane	110-54-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Styrene	100-42-5	160	U	1.15E-03	U	5.04E-03	U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14		1.5
Toluene	108-88-3	160	U	1.15E-03	U	5.04E-03	U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		6.0
Ethylbenzene	100-41-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
m,p-Xylenes	179601-23-1	330	U	2.37E-03	U	1.04E-02	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
o-Xylene	95-47-6	160	U	1.15E-03	U	5.04E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
1,3-Dichlorobenzene	541-73-1	160	U	1.15E-03	U	5.04E-03	U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		4.3
Propene (C3 H6)	115-07-1	160	U	1.15E-03	U	5.04E-03	U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	160	U	1.15E-03	U	5.04E-03	U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Ethanol	64-17-5	1600	U	1.15E-02	U	5.04E-02	U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Trichlorofluoromethane (CCl3F)	75-69-4	160	U	1.15E-03	U	5.04E-03	U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	19500		2.80E-01		1.23E+00		5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
alpha-Pinene	80-56-8	160	U	1.15E-03	U	5.04E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
δ-Limonene	5989-27-5	160	U	1.15E-03	U	5.04E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14		1.0
TOTAL				0.905	U											

(1) Sample collected on October 8, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

**Air Analytical Results –
October 8, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00091

Date Collected: 10/8/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.53

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	160	ND	94	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	160	ND	33	
74-87-3	Chloromethane	ND	160	ND	79	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	160	ND	23	
75-01-4	Vinyl Chloride	ND	160	ND	64	
106-99-0	1,3-Butadiene	ND	160	ND	73	
74-83-9	Bromomethane	ND	160	ND	42	
75-00-3	Chloroethane	ND	160	ND	62	
64-17-5	Ethanol	ND	1,600	ND	860	
75-05-8	Acetonitrile	ND	160	ND	97	
107-02-8	Acrolein	ND	650	ND	280	
67-64-1	Acetone	ND	1,600	ND	680	
75-69-4	Trichlorofluoromethane	ND	160	ND	29	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,600	ND	660	
107-13-1	Acrylonitrile	ND	160	ND	75	
75-35-4	1,1-Dichloroethene	210	160	52	41	
75-09-2	Methylene Chloride	210	160	60	47	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	160	ND	52	
76-13-1	Trichlorotrifluoroethane	20,000	160	2,600	21	
75-15-0	Carbon Disulfide	ND	1,600	ND	520	
156-60-5	trans-1,2-Dichloroethene	ND	160	ND	41	
75-34-3	1,1-Dichloroethane	ND	160	ND	40	
1634-04-4	Methyl tert-Butyl Ether	ND	160	ND	45	
108-05-4	Vinyl Acetate	ND	1,600	ND	460	
78-93-3	2-Butanone (MEK)	ND	1,600	ND	550	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5012-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172

CAS Sample ID: P1204172-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00091

Date Collected: 10/8/12

Date Received: 10/10/12

Date Analyzed: 10/11/12

Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.53

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	15,000	160	3,800	41	
141-78-6	Ethyl Acetate	ND	330	ND	90	
110-54-3	n-Hexane	ND	160	ND	46	
67-66-3	Chloroform	ND	160	ND	33	
109-99-9	Tetrahydrofuran (THF)	ND	160	ND	55	
107-06-2	1,2-Dichloroethane	ND	160	ND	40	
71-55-6	1,1,1-Trichloroethane	ND	160	ND	30	
71-43-2	Benzene	ND	160	ND	51	
56-23-5	Carbon Tetrachloride	ND	160	ND	26	
110-82-7	Cyclohexane	ND	330	ND	94	
78-87-5	1,2-Dichloropropane	ND	160	ND	35	
75-27-4	Bromodichloromethane	ND	160	ND	24	
79-01-6	Trichloroethene	24,000	160	4,500	30	
123-91-1	1,4-Dioxane	ND	160	ND	45	
80-62-6	Methyl Methacrylate	ND	330	ND	79	
142-82-5	n-Heptane	ND	160	ND	40	
10061-01-5	cis-1,3-Dichloropropene	ND	160	ND	36	
108-10-1	4-Methyl-2-pentanone	ND	160	ND	40	
10061-02-6	trans-1,3-Dichloropropene	ND	160	ND	36	
79-00-5	1,1,2-Trichloroethane	ND	160	ND	30	
108-88-3	Toluene	ND	160	ND	43	
591-78-6	2-Hexanone	ND	160	ND	40	
124-48-1	Dibromochloromethane	ND	160	ND	19	
106-93-4	1,2-Dibromoethane	ND	160	ND	21	
123-86-4	n-Butyl Acetate	ND	160	ND	34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00091

Date Collected: 10/8/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.53

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	160	ND	35	
127-18-4	Tetrachloroethene	ND	160	ND	24	
108-90-7	Chlorobenzene	ND	160	ND	35	
100-41-4	Ethylbenzene	ND	160	ND	37	
179601-23-1	m,p-Xylenes	ND	330	ND	75	
75-25-2	Bromoform	ND	160	ND	16	
100-42-5	Styrene	ND	160	ND	38	
95-47-6	o-Xylene	ND	160	ND	37	
111-84-2	n-Nonane	ND	160	ND	31	
79-34-5	1,1,2,2-Tetrachloroethane	ND	160	ND	24	
98-82-8	Cumene	ND	160	ND	33	
80-56-8	alpha-Pinene	ND	160	ND	29	
103-65-1	n-Propylbenzene	ND	160	ND	33	
622-96-8	4-Ethyltoluene	ND	160	ND	33	
108-67-8	1,3,5-Trimethylbenzene	ND	160	ND	33	
95-63-6	1,2,4-Trimethylbenzene	ND	160	ND	33	
100-44-7	Benzyl Chloride	ND	160	ND	31	
541-73-1	1,3-Dichlorobenzene	ND	160	ND	27	
106-46-7	1,4-Dichlorobenzene	ND	160	ND	27	
95-50-1	1,2-Dichlorobenzene	ND	160	ND	27	
5989-27-5	d-Limonene	ND	160	ND	29	
96-12-8	1,2-Dibromo-3-chloropropane	ND	160	ND	17	
120-82-1	1,2,4-Trichlorobenzene	ND	160	ND	22	
91-20-3	Naphthalene	ND	160	ND	31	
87-68-3	Hexachlorobutadiene	ND	160	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00638

Date Collected: 10/8/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.69 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	160	ND	94	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	160	ND	33	
74-87-3	Chloromethane	ND	160	ND	79	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	160	ND	23	
75-01-4	Vinyl Chloride	ND	160	ND	64	
106-99-0	1,3-Butadiene	ND	160	ND	73	
74-83-9	Bromomethane	ND	160	ND	42	
75-00-3	Chloroethane	ND	160	ND	62	
64-17-5	Ethanol	ND	1,600	ND	860	
75-05-8	Acetonitrile	ND	160	ND	97	
107-02-8	Acrolein	ND	650	ND	280	
67-64-1	Acetone	ND	1,600	ND	680	
75-69-4	Trichlorofluoromethane	ND	160	ND	29	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,600	ND	660	
107-13-1	Acrylonitrile	ND	160	ND	75	
75-35-4	1,1-Dichloroethene	200	160	50	41	
75-09-2	Methylene Chloride	210	160	59	47	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	160	ND	52	
76-13-1	Trichlorotrifluoroethane	19,000	160	2,500	21	
75-15-0	Carbon Disulfide	ND	1,600	ND	520	
156-60-5	trans-1,2-Dichloroethene	ND	160	ND	41	
75-34-3	1,1-Dichloroethane	ND	160	ND	40	
1634-04-4	Methyl tert-Butyl Ether	ND	160	ND	45	
108-05-4	Vinyl Acetate	ND	1,600	ND	460	
78-93-3	2-Butanone (MEK)	ND	1,600	ND	550	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00638

Date Collected: 10/8/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.69 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	15,000	160	3,700	41	
141-78-6	Ethyl Acetate	ND	330	ND	90	
110-54-3	n-Hexane	ND	160	ND	46	
67-66-3	Chloroform	ND	160	ND	33	
109-99-9	Tetrahydrofuran (THF)	ND	160	ND	55	
107-06-2	1,2-Dichloroethane	ND	160	ND	40	
71-55-6	1,1,1-Trichloroethane	ND	160	ND	30	
71-43-2	Benzene	ND	160	ND	51	
56-23-5	Carbon Tetrachloride	ND	160	ND	26	
110-82-7	Cyclohexane	ND	330	ND	94	
78-87-5	1,2-Dichloropropane	ND	160	ND	35	
75-27-4	Bromodichloromethane	ND	160	ND	24	
79-01-6	Trichloroethene	24,000	160	4,400	30	
123-91-1	1,4-Dioxane	ND	160	ND	45	
80-62-6	Methyl Methacrylate	ND	330	ND	79	
142-82-5	n-Heptane	ND	160	ND	40	
10061-01-5	cis-1,3-Dichloropropene	ND	160	ND	36	
108-10-1	4-Methyl-2-pentanone	ND	160	ND	40	
10061-02-6	trans-1,3-Dichloropropene	ND	160	ND	36	
79-00-5	1,1,2-Trichloroethane	ND	160	ND	30	
108-88-3	Toluene	ND	160	ND	43	
591-78-6	2-Hexanone	ND	160	ND	40	
124-48-1	Dibromochloromethane	ND	160	ND	19	
106-93-4	1,2-Dibromoethane	ND	160	ND	21	
123-86-4	n-Butyl Acetate	ND	160	ND	34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00638

Date Collected: 10/8/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.69 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	160	ND	35	
127-18-4	Tetrachloroethene	ND	160	ND	24	
108-90-7	Chlorobenzene	ND	160	ND	35	
100-41-4	Ethylbenzene	ND	160	ND	37	
179601-23-1	m,p-Xylenes	ND	330	ND	75	
75-25-2	Bromoform	ND	160	ND	16	
100-42-5	Styrene	ND	160	ND	38	
95-47-6	o-Xylene	ND	160	ND	37	
111-84-2	n-Nonane	ND	160	ND	31	
79-34-5	1,1,2,2-Tetrachloroethane	ND	160	ND	24	
98-82-8	Cumene	ND	160	ND	33	
80-56-8	alpha-Pinene	ND	160	ND	29	
103-65-1	n-Propylbenzene	ND	160	ND	33	
622-96-8	4-Ethyltoluene	ND	160	ND	33	
108-67-8	1,3,5-Trimethylbenzene	ND	160	ND	33	
95-63-6	1,2,4-Trimethylbenzene	ND	160	ND	33	
100-44-7	Benzyl Chloride	ND	160	ND	31	
541-73-1	1,3-Dichlorobenzene	ND	160	ND	27	
106-46-7	1,4-Dichlorobenzene	ND	160	ND	27	
95-50-1	1,2-Dichlorobenzene	ND	160	ND	27	
5989-27-5	d-Limonene	ND	160	ND	29	
96-12-8	1,2-Dibromo-3-chloropropane	ND	160	ND	17	
120-82-1	1,2,4-Trichlorobenzene	ND	160	ND	22	
91-20-3	Naphthalene	ND	160	ND	31	
87-68-3	Hexachlorobutadiene	ND	160	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5012-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172

CAS Sample ID: P1204172-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01887

Date Collected: 10/8/12

Date Received: 10/10/12

Date Analyzed: 10/11/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.07 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.67	ND	0.39	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.1	0.67	0.43	0.14	
74-87-3	Chloromethane	ND	0.67	ND	0.32	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.67	ND	0.096	
75-01-4	Vinyl Chloride	ND	0.67	ND	0.26	
106-99-0	1,3-Butadiene	ND	0.67	ND	0.30	
74-83-9	Bromomethane	ND	0.67	ND	0.17	
75-00-3	Chloroethane	ND	0.67	ND	0.25	
64-17-5	Ethanol	ND	6.7	ND	3.6	
75-05-8	Acetonitrile	ND	0.67	ND	0.40	
107-02-8	Acrolein	ND	2.7	ND	1.2	
67-64-1	Acetone	7.1	6.7	3.0	2.8	
75-69-4	Trichlorofluoromethane	1.1	0.67	0.19	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.7	ND	2.7	
107-13-1	Acrylonitrile	ND	0.67	ND	0.31	
75-35-4	1,1-Dichloroethene	ND	0.67	ND	0.17	
75-09-2	Methylene Chloride	ND	0.67	ND	0.19	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.67	ND	0.21	
76-13-1	Trichlorotrifluoroethane	33	0.67	4.4	0.087	
75-15-0	Carbon Disulfide	ND	6.7	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.67	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.67	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.67	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.7	ND	1.9	
78-93-3	2-Butanone (MEK)	ND	6.7	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5012-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172

CAS Sample ID: P1204172-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01887

Date Collected: 10/8/12

Date Received: 10/10/12

Date Analyzed: 10/11/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.07 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	7.2	0.67	1.8	0.17	
141-78-6	Ethyl Acetate	ND	1.3	ND	0.37	
110-54-3	n-Hexane	ND	0.67	ND	0.19	
67-66-3	Chloroform	ND	0.67	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.67	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.67	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.67	ND	0.12	
71-43-2	Benzene	ND	0.67	ND	0.21	
56-23-5	Carbon Tetrachloride	ND	0.67	ND	0.11	
110-82-7	Cyclohexane	ND	1.3	ND	0.39	
78-87-5	1,2-Dichloropropane	ND	0.67	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.67	ND	0.10	
79-01-6	Trichloroethene	18	0.67	3.4	0.12	
123-91-1	1,4-Dioxane	ND	0.67	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.3	ND	0.33	
142-82-5	n-Heptane	ND	0.67	ND	0.16	
10061-01-5	cis-1,3-Dichloropropene	ND	0.67	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.67	ND	0.16	
10061-02-6	trans-1,3-Dichloropropene	ND	0.67	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.67	ND	0.12	
108-88-3	Toluene	ND	0.67	ND	0.18	
591-78-6	2-Hexanone	ND	0.67	ND	0.16	
124-48-1	Dibromochloromethane	ND	0.67	ND	0.079	
106-93-4	1,2-Dibromoethane	ND	0.67	ND	0.087	
123-86-4	n-Butyl Acetate	2.4	0.67	0.50	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
CAS Sample ID: P1204172-003

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
Analyst: Chris Cornett
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: AC01887

Date Collected: 10/8/12
Date Received: 10/10/12
Date Analyzed: 10/11/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.07 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.67	ND	0.14	
127-18-4	Tetrachloroethene	ND	0.67	ND	0.099	
108-90-7	Chlorobenzene	ND	0.67	ND	0.15	
100-41-4	Ethylbenzene	0.81	0.67	0.19	0.15	
179601-23-1	m,p-Xylenes	3.8	1.3	0.87	0.31	
75-25-2	Bromoform	ND	0.67	ND	0.065	
100-42-5	Styrene	ND	0.67	ND	0.16	
95-47-6	o-Xylene	1.5	0.67	0.33	0.15	
111-84-2	n-Nonane	ND	0.67	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.67	ND	0.098	
98-82-8	Cumene	ND	0.67	ND	0.14	
80-56-8	alpha-Pinene	ND	0.67	ND	0.12	
103-65-1	n-Propylbenzene	ND	0.67	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.67	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.67	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.67	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.67	ND	0.13	
541-73-1	1,3-Dichlorobenzene	0.92	0.67	0.15	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.67	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.67	ND	0.11	
5989-27-5	d-Limonene	ND	0.67	ND	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.67	ND	0.069	
120-82-1	1,2,4-Trichlorobenzene	ND	0.67	ND	0.090	
91-20-3	Naphthalene	ND	0.67	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.67	ND	0.063	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5012-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172

CAS Sample ID: P1204172-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AS00194

Date Collected: 10/9/12

Date Received: 10/10/12

Date Analyzed: 10/11/12

Volume(s) Analyzed: 1.00 Liter(s)

0.10 Liter(s)

Initial Pressure (psig): -0.70 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	1.0	0.65	0.60	0.38	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.1	0.65	0.43	0.13	
74-87-3	Chloromethane	ND	0.65	ND	0.31	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.65	ND	0.093	
75-01-4	Vinyl Chloride	ND	0.65	ND	0.25	
106-99-0	1,3-Butadiene	ND	0.65	ND	0.29	
74-83-9	Bromomethane	ND	0.65	ND	0.17	
75-00-3	Chloroethane	ND	0.65	ND	0.25	
64-17-5	Ethanol	1,600	65	860	35	D
75-05-8	Acetonitrile	ND	0.65	ND	0.39	
107-02-8	Acrolein	ND	2.6	ND	1.1	
67-64-1	Acetone	ND	6.5	ND	2.7	
75-69-4	Trichlorofluoromethane	1.1	0.65	0.19	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.5	ND	2.6	
107-13-1	Acrylonitrile	ND	0.65	ND	0.30	
75-35-4	1,1-Dichloroethene	ND	0.65	ND	0.16	
75-09-2	Methylene Chloride	ND	0.65	ND	0.19	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.65	ND	0.21	
76-13-1	Trichlorotrifluoroethane	2.2	0.65	0.29	0.085	
75-15-0	Carbon Disulfide	ND	6.5	ND	2.1	
156-60-5	trans-1,2-Dichloroethene	ND	0.65	ND	0.16	
75-34-3	1,1-Dichloroethane	ND	0.65	ND	0.16	
1634-04-4	Methyl tert-Butyl Ether	ND	0.65	ND	0.18	
108-05-4	Vinyl Acetate	ND	6.5	ND	1.8	
78-93-3	2-Butanone (MEK)	ND	6.5	ND	2.2	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5012-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172

CAS Sample ID: P1204172-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AS00194

Date Collected: 10/9/12

Date Received: 10/10/12

Date Analyzed: 10/11/12

Volume(s) Analyzed: 1.00 Liter(s)

0.10 Liter(s)

Initial Pressure (psig): -0.70 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.65	ND	0.16	
141-78-6	Ethyl Acetate	ND	1.3	ND	0.36	
110-54-3	n-Hexane	ND	0.65	ND	0.18	
67-66-3	Chloroform	ND	0.65	ND	0.13	
109-99-9	Tetrahydrofuran (THF)	ND	0.65	ND	0.22	
107-06-2	1,2-Dichloroethane	ND	0.65	ND	0.16	
71-55-6	1,1,1-Trichloroethane	ND	0.65	ND	0.12	
71-43-2	Benzene	ND	0.65	ND	0.20	
56-23-5	Carbon Tetrachloride	ND	0.65	ND	0.10	
110-82-7	Cyclohexane	ND	1.3	ND	0.38	
78-87-5	1,2-Dichloropropane	ND	0.65	ND	0.14	
75-27-4	Bromodichloromethane	ND	0.65	ND	0.097	
79-01-6	Trichloroethene	0.99	0.65	0.18	0.12	
123-91-1	1,4-Dioxane	ND	0.65	ND	0.18	
80-62-6	Methyl Methacrylate	ND	1.3	ND	0.32	
142-82-5	n-Heptane	ND	0.65	ND	0.16	
10061-01-5	cis-1,3-Dichloropropene	ND	0.65	ND	0.14	
108-10-1	4-Methyl-2-pentanone	ND	0.65	ND	0.16	
10061-02-6	trans-1,3-Dichloropropene	ND	0.65	ND	0.14	
79-00-5	1,1,2-Trichloroethane	ND	0.65	ND	0.12	
108-88-3	Toluene	ND	0.65	ND	0.17	
591-78-6	2-Hexanone	ND	0.65	ND	0.16	
124-48-1	Dibromochloromethane	ND	0.65	ND	0.076	
106-93-4	1,2-Dibromoethane	ND	0.65	ND	0.085	
123-86-4	n-Butyl Acetate	ND	0.65	ND	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5012-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204172
 CAS Sample ID: P1204172-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AS00194

Date Collected: 10/9/12
 Date Received: 10/10/12
 Date Analyzed: 10/11/12
 Volume(s) Analyzed: 1.00 Liter(s)
 0.10 Liter(s)

Initial Pressure (psig): -0.70 Final Pressure (psig): 3.52

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.65	ND	0.14	
127-18-4	Tetrachloroethene	ND	0.65	ND	0.096	
108-90-7	Chlorobenzene	ND	0.65	ND	0.14	
100-41-4	Ethylbenzene	1.3	0.65	0.31	0.15	
179601-23-1	m,p-Xylenes	5.7	1.3	1.3	0.30	
75-25-2	Bromoform	ND	0.65	ND	0.063	
100-42-5	Styrene	ND	0.65	ND	0.15	
95-47-6	o-Xylene	1.9	0.65	0.43	0.15	
111-84-2	n-Nonane	ND	0.65	ND	0.12	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.65	ND	0.095	
98-82-8	Cumene	ND	0.65	ND	0.13	
80-56-8	alpha-Pinene	4.2	0.65	0.76	0.12	
103-65-1	n-Propylbenzene	ND	0.65	ND	0.13	
622-96-8	4-Ethyltoluene	ND	0.65	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.65	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	ND	0.65	ND	0.13	
100-44-7	Benzyl Chloride	ND	0.65	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.65	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.65	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.65	ND	0.11	
5989-27-5	d-Limonene	1.7	0.65	0.31	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.65	ND	0.067	
120-82-1	1,2,4-Trichlorobenzene	ND	0.65	ND	0.088	
91-20-3	Naphthalene	ND	0.65	ND	0.12	
87-68-3	Hexachlorobutadiene	ND	0.65	ND	0.061	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – October 8, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
10/8/2012	8:00	Outside GWTP Office	3950 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 50 degrees
10/8/2012	8:00	Downwind	3950 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 50 degrees
10/8/2012	13:55	Stripper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 22.2 ppm Steady State 15.7 ppm	Clear 65 degrees
10/8/2012	13:50	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 65 degrees
10/8/2012	14:10	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 65 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: <u>10/08/12</u>	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: <u>Scott Beesinger</u>

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB TO ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100ppm (isobutylene)	6/15/2016	6mm-248 -100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O2 (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Plant Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Plant Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7			Value:	Value:	
	Turbidity (NTU)	100			Value:	Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – October 15, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on October 15, 2012 for 9.00 hours. The previous operation of GWTP occurred on October 11, 2012 (Thursday).
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while groundwater extraction will continue to occur continuously.
- 104,729 gallons of water were processed from TK-140 (influent tank) and a total of 70,337 gallons were returned to the Burning Grounds No. 3 through the irrigation system.
- The metals precipitation and air stripping treatment flow rate averaged approximately 194 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The blower flow rate was 3,850 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was treated in the fluidized bed reactor (FBR) for perchlorate. The treated groundwater through the FBR was then returned to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was clear and the temperature was 60°F.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.1 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 1:55 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 26.3 ppmv and then began to decline to a steady state concentration of 20.0 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.

- At 1: 50 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:10 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.1 ppmv and the PID downwind registered 0.0 ppmv. The weather was clear and the temperature was 80°F.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 1.00 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds. The average measured emission rate from the air stripper stack since September 6, 2012 is estimated at 0.91 lb/hr.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 15, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.73	U PASS	6.1	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.73	U PASS	6.1	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.73	U PASS	6.1	U PASS
Acetone	67-64-1	5900	NA	11	PASS	61	U PASS
Benzene	71-43-2	170	575	1.1	PASS	6.1	U PASS
Carbon disulfide	75-15-0	30	NA	7.3	U PASS	61	U PASS
Chloroform	67-66-3	100	98	0.73	U PASS	6.1	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	5.7	PASS	6.1	U PASS
Methylene chloride	75-09-2	3600	12158	0.73	U PASS	6.1	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.73	U PASS	6.1	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.73	U PASS	6.1	U PASS
Trichloroethene	79-01-6	540	537	14	PASS	6.1	U PASS
Vinyl chloride	75-01-4	20000	66460	0.73	U PASS	6.1	U PASS
n-Hexane	110-54-3	5300	6336	1.6	PASS	6.1	U PASS
Styrene	100-42-5	110	21725	0.89	PASS	6.1	U PASS
Toluene	108-88-3	640	15074	2.3	PASS	6.1	U PASS
Ethylbenzene	100-41-4	740	86844	27	PASS	36	PASS
m,p-Xylenes	179601-23-1	180	7382	100	PASS	160	PASS
o-Xylene	95-47-6	1600	7382	33	PASS	62	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.73	U PASS	6.1	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.88	NA	6.1	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3	PASS	6.1	U PASS
Ethanol	64-17-5	18800	NA	48	PASS	3700	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	6.1	U PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	19	PASS	6.1	U PASS
alpha-Pinene	80-56-8	60	3499	3.7	PASS	22	PASS
d-Limonene	5989-27-5	1100	NA	1.3	PASS	21	PASS

(1) Sample collected over an 8-hour period on October 15, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 15, 2012 at 6:20 AM and ending on October 16, 2012 at 6:20 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 15, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) μg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K	Status (8)
1,1-Dichloroethane	75-34-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	240	3.45E-03	1.51E-02	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	180 U	1.29E-03 U	5.67E-03 U	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1600 U	1.15E-02 U	5.04E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	180 U	1.29E-03 U	5.67E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1800 U	1.29E-02 U	5.67E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	16500	2.37E-01	1.04E+00	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	580	8.34E-03	3.65E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	180 U	1.29E-03 U	5.67E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	29500	4.24E-01	1.86E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	180 U	1.29E-03 U	5.67E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	180 U	1.29E-03 U	5.67E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	360 U	2.59E-03 U	1.13E-02 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	180 U	1.29E-03 U	5.67E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	180 U	1.29E-03 U	5.67E-03 U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	180 U	1.29E-03 U	5.67E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	180 U	1.29E-03 U	5.67E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1800 U	1.29E-02 U	5.67E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	180 U	1.29E-03 U	5.67E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	18500	2.66E-01	1.17E+00	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	180 U	1.29E-03 U	5.67E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	180 U	1.29E-03 U	5.67E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			1.002	U									

(1) Sample collected on October 15, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

**Air Analytical Results –
October 15, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00206

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -1.06 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	170	ND	97	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	170	ND	34	
74-87-3	Chloromethane	ND	170	ND	81	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	170	ND	24	
75-01-4	Vinyl Chloride	ND	170	ND	66	
106-99-0	1,3-Butadiene	ND	170	ND	76	
74-83-9	Bromomethane	ND	170	ND	43	
75-00-3	Chloroethane	ND	170	ND	64	
64-17-5	Ethanol	ND	1,700	ND	890	
75-05-8	Acetonitrile	ND	170	ND	100	
107-02-8	Acrolein	ND	670	ND	290	
67-64-1	Acetone	ND	1,700	ND	710	
75-69-4	Trichlorofluoromethane	ND	170	ND	30	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,700	ND	680	
107-13-1	Acrylonitrile	ND	170	ND	77	
75-35-4	1,1-Dichloroethene	250	170	63	42	
75-09-2	Methylene Chloride	580	170	170	48	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	170	ND	54	
76-13-1	Trichlorotrifluoroethane	19,000	170	2,500	22	
75-15-0	Carbon Disulfide	ND	1,700	ND	540	
156-60-5	trans-1,2-Dichloroethene	ND	170	ND	42	
75-34-3	1,1-Dichloroethane	ND	170	ND	41	
1634-04-4	Methyl tert-Butyl Ether	ND	170	ND	46	
108-05-4	Vinyl Acetate	ND	1,700	ND	480	
78-93-3	2-Butanone (MEK)	ND	1,700	ND	570	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5014-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276

CAS Sample ID: P1204276-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00206

Date Collected: 10/15/12

Date Received: 10/17/12

Date Analyzed: 10/22/12

Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -1.06 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	16,000	170	4,000	42	
141-78-6	Ethyl Acetate	ND	340	ND	93	
110-54-3	n-Hexane	ND	170	ND	48	
67-66-3	Chloroform	ND	170	ND	34	
109-99-9	Tetrahydrofuran (THF)	ND	170	ND	57	
107-06-2	1,2-Dichloroethane	ND	170	ND	41	
71-55-6	1,1,1-Trichloroethane	ND	170	ND	31	
71-43-2	Benzene	ND	170	ND	52	
56-23-5	Carbon Tetrachloride	ND	170	ND	27	
110-82-7	Cyclohexane	ND	340	ND	97	
78-87-5	1,2-Dichloropropane	ND	170	ND	36	
75-27-4	Bromodichloromethane	ND	170	ND	25	
79-01-6	Trichloroethene	30,000	170	5,600	31	
123-91-1	1,4-Dioxane	ND	170	ND	46	
80-62-6	Methyl Methacrylate	ND	340	ND	82	
142-82-5	n-Heptane	ND	170	ND	41	
10061-01-5	cis-1,3-Dichloropropene	ND	170	ND	37	
108-10-1	4-Methyl-2-pentanone	ND	170	ND	41	
10061-02-6	trans-1,3-Dichloropropene	ND	170	ND	37	
79-00-5	1,1,2-Trichloroethane	ND	170	ND	31	
108-88-3	Toluene	ND	170	ND	44	
591-78-6	2-Hexanone	ND	170	ND	41	
124-48-1	Dibromochloromethane	ND	170	ND	20	
106-93-4	1,2-Dibromoethane	ND	170	ND	22	
123-86-4	n-Butyl Acetate	ND	170	ND	35	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00206

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -1.06 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	170	ND	36	
127-18-4	Tetrachloroethene	ND	170	ND	25	
108-90-7	Chlorobenzene	ND	170	ND	36	
100-41-4	Ethylbenzene	ND	170	ND	39	
179601-23-1	m,p-Xylenes	ND	340	ND	77	
75-25-2	Bromoform	ND	170	ND	16	
100-42-5	Styrene	ND	170	ND	39	
95-47-6	o-Xylene	ND	170	ND	39	
111-84-2	n-Nonane	ND	170	ND	32	
79-34-5	1,1,2,2-Tetrachloroethane	ND	170	ND	24	
98-82-8	Cumene	ND	170	ND	34	
80-56-8	alpha-Pinene	ND	170	ND	30	
103-65-1	n-Propylbenzene	ND	170	ND	34	
622-96-8	4-Ethyltoluene	ND	170	ND	34	
108-67-8	1,3,5-Trimethylbenzene	ND	170	ND	34	
95-63-6	1,2,4-Trimethylbenzene	ND	170	ND	34	
100-44-7	Benzyl Chloride	ND	170	ND	32	
541-73-1	1,3-Dichlorobenzene	ND	170	ND	28	
106-46-7	1,4-Dichlorobenzene	ND	170	ND	28	
95-50-1	1,2-Dichlorobenzene	ND	170	ND	28	
5989-27-5	d-Limonene	ND	170	ND	30	
96-12-8	1,2-Dibromo-3-chloropropane	ND	170	ND	17	
120-82-1	1,2,4-Trichlorobenzene	ND	170	ND	23	
91-20-3	Naphthalene	ND	170	ND	32	
87-68-3	Hexachlorobutadiene	ND	170	ND	16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00653

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.0035 Liter(s)

Initial Pressure (psig): -0.82 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	190	ND	110	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	190	ND	38	
74-87-3	Chloromethane	ND	190	ND	91	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	190	ND	27	
75-01-4	Vinyl Chloride	ND	190	ND	74	
106-99-0	1,3-Butadiene	ND	190	ND	85	
74-83-9	Bromomethane	ND	190	ND	49	
75-00-3	Chloroethane	ND	190	ND	71	
64-17-5	Ethanol	ND	1,900	ND	1,000	
75-05-8	Acetonitrile	ND	190	ND	110	
107-02-8	Acrolein	ND	750	ND	330	
67-64-1	Acetone	ND	1,900	ND	790	
75-69-4	Trichlorofluoromethane	ND	190	ND	34	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,900	ND	770	
107-13-1	Acrylonitrile	ND	190	ND	87	
75-35-4	1,1-Dichloroethene	230	190	58	48	
75-09-2	Methylene Chloride	580	190	170	54	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	190	ND	60	
76-13-1	Trichlorotrifluoroethane	18,000	190	2,400	25	
75-15-0	Carbon Disulfide	ND	1,900	ND	610	
156-60-5	trans-1,2-Dichloroethene	ND	190	ND	48	
75-34-3	1,1-Dichloroethane	ND	190	ND	47	
1634-04-4	Methyl tert-Butyl Ether	ND	190	ND	52	
108-05-4	Vinyl Acetate	ND	1,900	ND	540	
78-93-3	2-Butanone (MEK)	ND	1,900	ND	640	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00653

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.0035 Liter(s)

Initial Pressure (psig): -0.82 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	15,000	190	3,900	48	
141-78-6	Ethyl Acetate	ND	380	ND	100	
110-54-3	n-Hexane	ND	190	ND	54	
67-66-3	Chloroform	ND	190	ND	39	
109-99-9	Tetrahydrofuran (THF)	ND	190	ND	64	
107-06-2	1,2-Dichloroethane	ND	190	ND	47	
71-55-6	1,1,1-Trichloroethane	ND	190	ND	35	
71-43-2	Benzene	ND	190	ND	59	
56-23-5	Carbon Tetrachloride	ND	190	ND	30	
110-82-7	Cyclohexane	ND	380	ND	110	
78-87-5	1,2-Dichloropropane	ND	190	ND	41	
75-27-4	Bromodichloromethane	ND	190	ND	28	
79-01-6	Trichloroethene	29,000	190	5,400	35	
123-91-1	1,4-Dioxane	ND	190	ND	52	
80-62-6	Methyl Methacrylate	ND	380	ND	92	
142-82-5	n-Heptane	ND	190	ND	46	
10061-01-5	cis-1,3-Dichloropropene	ND	190	ND	42	
108-10-1	4-Methyl-2-pentanone	ND	190	ND	46	
10061-02-6	trans-1,3-Dichloropropene	ND	190	ND	42	
79-00-5	1,1,2-Trichloroethane	ND	190	ND	35	
108-88-3	Toluene	ND	190	ND	50	
591-78-6	2-Hexanone	ND	190	ND	46	
124-48-1	Dibromochloromethane	ND	190	ND	22	
106-93-4	1,2-Dibromoethane	ND	190	ND	25	
123-86-4	n-Butyl Acetate	ND	190	ND	40	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00653

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.0035 Liter(s)

Initial Pressure (psig): -0.82 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.32

CAS #	Compound	Result $\mu\text{g}/\text{m}^3$	MRL $\mu\text{g}/\text{m}^3$	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	190	ND	40	
127-18-4	Tetrachloroethene	ND	190	ND	28	
108-90-7	Chlorobenzene	ND	190	ND	41	
100-41-4	Ethylbenzene	ND	190	ND	43	
179601-23-1	m,p-Xylenes	ND	380	ND	87	
75-25-2	Bromoform	ND	190	ND	18	
100-42-5	Styrene	ND	190	ND	44	
95-47-6	o-Xylene	ND	190	ND	43	
111-84-2	n-Nonane	ND	190	ND	36	
79-34-5	1,1,2,2-Tetrachloroethane	ND	190	ND	27	
98-82-8	Cumene	ND	190	ND	38	
80-56-8	alpha-Pinene	ND	190	ND	34	
103-65-1	n-Propylbenzene	ND	190	ND	38	
622-96-8	4-Ethyltoluene	ND	190	ND	38	
108-67-8	1,3,5-Trimethylbenzene	ND	190	ND	38	
95-63-6	1,2,4-Trimethylbenzene	ND	190	ND	38	
100-44-7	Benzyl Chloride	ND	190	ND	36	
541-73-1	1,3-Dichlorobenzene	ND	190	ND	31	
106-46-7	1,4-Dichlorobenzene	ND	190	ND	31	
95-50-1	1,2-Dichlorobenzene	ND	190	ND	31	
5989-27-5	d-Limonene	ND	190	ND	34	
96-12-8	1,2-Dibromo-3-chloropropane	ND	190	ND	20	
120-82-1	1,2,4-Trichlorobenzene	ND	190	ND	25	
91-20-3	Naphthalene	ND	190	ND	36	
87-68-3	Hexachlorobutadiene	ND	190	ND	18	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01863

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.06 Final Pressure (psig): 3.66

Canister Dilution Factor: 1.45

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	0.88	0.73	0.51	0.42	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.3	0.73	0.47	0.15	
74-87-3	Chloromethane	0.80	0.73	0.39	0.35	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.73	ND	0.10	
75-01-4	Vinyl Chloride	ND	0.73	ND	0.28	
106-99-0	1,3-Butadiene	ND	0.73	ND	0.33	
74-83-9	Bromomethane	ND	0.73	ND	0.19	
75-00-3	Chloroethane	ND	0.73	ND	0.27	
64-17-5	Ethanol	48	7.3	25	3.8	
75-05-8	Acetonitrile	ND	0.73	ND	0.43	
107-02-8	Acrolein	ND	2.9	ND	1.3	
67-64-1	Acetone	11	7.3	4.6	3.1	
75-69-4	Trichlorofluoromethane	1.1	0.73	0.20	0.13	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	7.3	ND	3.0	
107-13-1	Acrylonitrile	ND	0.73	ND	0.33	
75-35-4	1,1-Dichloroethene	ND	0.73	ND	0.18	
75-09-2	Methylene Chloride	ND	0.73	ND	0.21	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.73	ND	0.23	
76-13-1	Trichlorotrifluoroethane	19	0.73	2.5	0.095	
75-15-0	Carbon Disulfide	ND	7.3	ND	2.3	
156-60-5	trans-1,2-Dichloroethene	ND	0.73	ND	0.18	
75-34-3	1,1-Dichloroethane	ND	0.73	ND	0.18	
1634-04-4	Methyl tert-Butyl Ether	ND	0.73	ND	0.20	
108-05-4	Vinyl Acetate	ND	7.3	ND	2.1	
78-93-3	2-Butanone (MEK)	ND	7.3	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01863

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.06 Final Pressure (psig): 3.66

Canister Dilution Factor: 1.45

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	5.7	0.73	1.4	0.18	
141-78-6	Ethyl Acetate	1.7	1.5	0.47	0.40	
110-54-3	n-Hexane	1.6	0.73	0.44	0.21	
67-66-3	Chloroform	ND	0.73	ND	0.15	
109-99-9	Tetrahydrofuran (THF)	ND	0.73	ND	0.25	
107-06-2	1,2-Dichloroethane	ND	0.73	ND	0.18	
71-55-6	1,1,1-Trichloroethane	ND	0.73	ND	0.13	
71-43-2	Benzene	1.1	0.73	0.35	0.23	
56-23-5	Carbon Tetrachloride	ND	0.73	ND	0.12	
110-82-7	Cyclohexane	ND	1.5	ND	0.42	
78-87-5	1,2-Dichloropropane	ND	0.73	ND	0.16	
75-27-4	Bromodichloromethane	ND	0.73	ND	0.11	
79-01-6	Trichloroethene	14	0.73	2.7	0.13	
123-91-1	1,4-Dioxane	ND	0.73	ND	0.20	
80-62-6	Methyl Methacrylate	ND	1.5	ND	0.35	
142-82-5	n-Heptane	0.83	0.73	0.20	0.18	
10061-01-5	cis-1,3-Dichloropropene	ND	0.73	ND	0.16	
108-10-1	4-Methyl-2-pentanone	ND	0.73	ND	0.18	
10061-02-6	trans-1,3-Dichloropropene	ND	0.73	ND	0.16	
79-00-5	1,1,2-Trichloroethane	ND	0.73	ND	0.13	
108-88-3	Toluene	2.3	0.73	0.61	0.19	
591-78-6	2-Hexanone	ND	0.73	ND	0.18	
124-48-1	Dibromochloromethane	ND	0.73	ND	0.085	
106-93-4	1,2-Dibromoethane	ND	0.73	ND	0.094	
123-86-4	n-Butyl Acetate	ND	0.73	ND	0.15	

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Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01863

Date Collected: 10/15/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.06 Final Pressure (psig): 3.66

Canister Dilution Factor: 1.45

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.73	ND	0.16	
127-18-4	Tetrachloroethene	ND	0.73	ND	0.11	
108-90-7	Chlorobenzene	ND	0.73	ND	0.16	
100-41-4	Ethylbenzene	27	0.73	6.3	0.17	
179601-23-1	m,p-Xylenes	100	1.5	24	0.33	
75-25-2	Bromoform	ND	0.73	ND	0.070	
100-42-5	Styrene	0.89	0.73	0.21	0.17	
95-47-6	o-Xylene	33	0.73	7.6	0.17	
111-84-2	n-Nonane	0.90	0.73	0.17	0.14	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.73	ND	0.11	
98-82-8	Cumene	ND	0.73	ND	0.15	
80-56-8	alpha-Pinene	3.7	0.73	0.67	0.13	
103-65-1	n-Propylbenzene	ND	0.73	ND	0.15	
622-96-8	4-Ethyltoluene	ND	0.73	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.73	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	ND	0.73	ND	0.15	
100-44-7	Benzyl Chloride	ND	0.73	ND	0.14	
541-73-1	1,3-Dichlorobenzene	ND	0.73	ND	0.12	
106-46-7	1,4-Dichlorobenzene	ND	0.73	ND	0.12	
95-50-1	1,2-Dichlorobenzene	ND	0.73	ND	0.12	
5989-27-5	d-Limonene	1.3	0.73	0.23	0.13	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.73	ND	0.075	
120-82-1	1,2,4-Trichlorobenzene	ND	0.73	ND	0.098	
91-20-3	Naphthalene	ND	0.73	ND	0.14	
87-68-3	Hexachlorobutadiene	ND	0.73	ND	0.068	

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5014-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276

CAS Sample ID: P1204276-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Simon Cao

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00656

Date Collected: 10/16/12

Date Received: 10/17/12

Date Analyzed: 10/22/12

Volume(s) Analyzed: 0.10 Liter(s)

Initial Pressure (psig): 0.49 Final Pressure (psig): 3.79

Canister Dilution Factor: 1.22

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	6.1	ND	3.5	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	6.1	ND	1.2	
74-87-3	Chloromethane	ND	6.1	ND	3.0	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	6.1	ND	0.87	
75-01-4	Vinyl Chloride	ND	6.1	ND	2.4	
106-99-0	1,3-Butadiene	ND	6.1	ND	2.8	
74-83-9	Bromomethane	ND	6.1	ND	1.6	
75-00-3	Chloroethane	ND	6.1	ND	2.3	
64-17-5	Ethanol	3,700	61	2,000	32	
75-05-8	Acetonitrile	ND	6.1	ND	3.6	
107-02-8	Acrolein	ND	24	ND	11	
67-64-1	Acetone	ND	61	ND	26	
75-69-4	Trichlorofluoromethane	ND	6.1	ND	1.1	
67-63-0	2-Propanol (Isopropyl Alcohol)	160	61	65	25	
107-13-1	Acrylonitrile	ND	6.1	ND	2.8	
75-35-4	1,1-Dichloroethene	ND	6.1	ND	1.5	
75-09-2	Methylene Chloride	ND	6.1	ND	1.8	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	6.1	ND	1.9	
76-13-1	Trichlorotrifluoroethane	ND	6.1	ND	0.80	
75-15-0	Carbon Disulfide	ND	61	ND	20	
156-60-5	trans-1,2-Dichloroethene	ND	6.1	ND	1.5	
75-34-3	1,1-Dichloroethane	ND	6.1	ND	1.5	
1634-04-4	Methyl tert-Butyl Ether	ND	6.1	ND	1.7	
108-05-4	Vinyl Acetate	ND	61	ND	17	
78-93-3	2-Butanone (MEK)	ND	61	ND	21	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5014-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276

CAS Sample ID: P1204276-004

Test Code: EPA TO-15

Date Collected: 10/16/12

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Date Received: 10/17/12

Analyst: Simon Cao

Date Analyzed: 10/22/12

Sampling Media: 6.0 L Summa Canister

Volume(s) Analyzed: 0.10 Liter(s)

Test Notes:

Container ID: AC00656

Initial Pressure (psig): 0.49 Final Pressure (psig): 3.79

Canister Dilution Factor: 1.22

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	6.1	ND	1.5	
141-78-6	Ethyl Acetate	ND	12	ND	3.4	
110-54-3	n-Hexane	ND	6.1	ND	1.7	
67-66-3	Chloroform	ND	6.1	ND	1.2	
109-99-9	Tetrahydrofuran (THF)	ND	6.1	ND	2.1	
107-06-2	1,2-Dichloroethane	ND	6.1	ND	1.5	
71-55-6	1,1,1-Trichloroethane	ND	6.1	ND	1.1	
71-43-2	Benzene	ND	6.1	ND	1.9	
56-23-5	Carbon Tetrachloride	ND	6.1	ND	0.97	
110-82-7	Cyclohexane	ND	12	ND	3.5	
78-87-5	1,2-Dichloropropane	ND	6.1	ND	1.3	
75-27-4	Bromodichloromethane	ND	6.1	ND	0.91	
79-01-6	Trichloroethene	ND	6.1	ND	1.1	
123-91-1	1,4-Dioxane	ND	6.1	ND	1.7	
80-62-6	Methyl Methacrylate	ND	12	ND	3.0	
142-82-5	n-Heptane	ND	6.1	ND	1.5	
10061-01-5	cis-1,3-Dichloropropene	ND	6.1	ND	1.3	
108-10-1	4-Methyl-2-pentanone	ND	6.1	ND	1.5	
10061-02-6	trans-1,3-Dichloropropene	ND	6.1	ND	1.3	
79-00-5	1,1,2-Trichloroethane	ND	6.1	ND	1.1	
108-88-3	Toluene	ND	6.1	ND	1.6	
591-78-6	2-Hexanone	ND	6.1	ND	1.5	
124-48-1	Dibromochloromethane	ND	6.1	ND	0.72	
106-93-4	1,2-Dibromoethane	ND	6.1	ND	0.79	
123-86-4	n-Butyl Acetate	ND	6.1	ND	1.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5014-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204276
 CAS Sample ID: P1204276-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Simon Cao
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC00656

Date Collected: 10/16/12
 Date Received: 10/17/12
 Date Analyzed: 10/22/12
 Volume(s) Analyzed: 0.10 Liter(s)

Initial Pressure (psig): 0.49 Final Pressure (psig): 3.79

Canister Dilution Factor: 1.22

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	6.1	ND	1.3	
127-18-4	Tetrachloroethene	ND	6.1	ND	0.90	
108-90-7	Chlorobenzene	ND	6.1	ND	1.3	
100-41-4	Ethylbenzene	36	6.1	8.4	1.4	
179601-23-1	m,p-Xylenes	160	12	37	2.8	
75-25-2	Bromoform	ND	6.1	ND	0.59	
100-42-5	Styrene	ND	6.1	ND	1.4	
95-47-6	o-Xylene	62	6.1	14	1.4	
111-84-2	n-Nonane	ND	6.1	ND	1.2	
79-34-5	1,1,2,2-Tetrachloroethane	ND	6.1	ND	0.89	
98-82-8	Cumene	ND	6.1	ND	1.2	
80-56-8	alpha-Pinene	22	6.1	4.0	1.1	
103-65-1	n-Propylbenzene	ND	6.1	ND	1.2	
622-96-8	4-Ethyltoluene	ND	6.1	ND	1.2	
108-67-8	1,3,5-Trimethylbenzene	ND	6.1	ND	1.2	
95-63-6	1,2,4-Trimethylbenzene	ND	6.1	ND	1.2	
100-44-7	Benzyl Chloride	ND	6.1	ND	1.2	
541-73-1	1,3-Dichlorobenzene	ND	6.1	ND	1.0	
106-46-7	1,4-Dichlorobenzene	ND	6.1	ND	1.0	
95-50-1	1,2-Dichlorobenzene	ND	6.1	ND	1.0	
5989-27-5	d-Limonene	21	6.1	3.7	1.1	
96-12-8	1,2-Dibromo-3-chloropropane	ND	6.1	ND	0.63	
120-82-1	1,2,4-Trichlorobenzene	ND	6.1	ND	0.82	
91-20-3	Naphthalene	ND	6.1	ND	1.2	
87-68-3	Hexachlorobutadiene	ND	6.1	ND	0.57	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – October 15, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
10/15/2012	8:00	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 60 degrees
10/15/2012	8:00	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 60 degrees
10/15/2012	13:55	Stripper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 26.3 ppm Steady State 20.0 ppm	Clear 80 degrees
10/15/2012	13:50	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 80 degrees
10/15/2012	14:10	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 80 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: <u>10/15/12</u>	Project Name: <u>GWTP Operations.</u>
60256135 .0004aa	Recorded By: <u>Scott Beesinger</u>

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: <u>SB</u> <u>TO ZERO</u>	Value:	
Second Point Calibration	Vapor conc. (ppm)	<u>100 ppm</u> (isobutylene)	<u>6/15/2016</u>	<u>6AM-24R-100-8</u>	Initials: <u>SB</u>	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7			Value:	Value:	
	Turbidity (NTU)	100			Value:	Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – October 22, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on October 22, 2012 for 9.00 hours. The previous operation of GWTP occurred on October 18, 2012 (Thursday).
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while groundwater extraction will continue to occur continuously.
- 100,883 gallons of water were processed from TK-140 (influent tank) and a total of 67,543 gallons were returned to the Burning Grounds No. 3 through the irrigation system.
- The metals precipitation and air stripping treatment flow rate averaged approximately 187 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The blower flow rate was 3,850 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was treated in the fluidized bed reactor (FBR) for perchlorate. The treated groundwater through the FBR was then returned to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was clear, the temperature was 69°F, and the wind was southerly.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.1 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 1:55 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 19.5 ppmv and then began to decline to a steady state concentration of 13.0 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.

- At 1: 50 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:10 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.1 ppmv and the PID downwind registered 0.0 ppmv. The weather was clear and the temperature was 82°F.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 0.622 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds. The average measured emission rate from the air stripper stack since September 6, 2012 is estimated at 0.89 lb/hr.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 22, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.69	U PASS	0.81	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.69	U PASS	0.81	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.69	U PASS	0.81	U PASS
Acetone	67-64-1	5900	NA	12	PASS	35	PASS
Benzene	71-43-2	170	575	1.1	PASS	0.91	PASS
Carbon disulfide	75-15-0	30	NA	6.9	U PASS	8.1	U PASS
Chloroform	67-66-3	100	98	0.69	U PASS	0.81	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	14	PASS	0.81	U PASS
Methylene chloride	75-09-2	3600	12158	0.95	PASS	0.81	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.69	U PASS	0.81	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.69	U PASS	0.81	U PASS
Trichloroethene	79-01-6	540	537	40	PASS	0.81	U PASS
Vinyl chloride	75-01-4	20000	66460	0.69	U PASS	0.81	U PASS
n-Hexane	110-54-3	5300	6336	1.3	PASS	2.3	PASS
Styrene	100-42-5	110	21725	0.69	U PASS	2.3	PASS
Toluene	108-88-3	640	15074	2.1	PASS	3	PASS
Ethylbenzene	100-41-4	740	86844	2.1	PASS	6.4	PASS
m,p-Xylenes	179601-23-1	180	7382	10	PASS	29	PASS
o-Xylene	95-47-6	1600	7382	4.2	PASS	12	PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.69	U PASS	0.81	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	1.2	NA	33	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.2	PASS	2.3	PASS
Ethanol	64-17-5	18800	NA	86	PASS	15000	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.1	PASS	1.7	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	61	PASS	3.7	PASS
alpha-Pinene	80-56-8	60	3499	2.2	PASS	7.9	PASS
d-Limonene	5989-27-5	1100	NA	1	PASS	5.9	PASS

(1) Sample collected over an 8-hour period on October 22, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 22, 2012 at 6:15 AM and ending on October 23, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 22, 2012**

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1) µg/m ³	Air Stripper Emission Rates (2) lb/hr	Air Stripper Emission Rates tpy	Allowable Annual Emission (3) tpy	Status (4)	TLV (L) mg/m ³	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D) ft	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ^{(6)/(7)} (E) = L/K lb/hr	Status (8)
1,1-Dichloroethane	75-34-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	140	2.01E-03	8.82E-03	5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	140	2.01E-03	8.82E-03	5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	135 U	9.71E-04 U	4.25E-03 U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	9950	1.43E-01	6.27E-01	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	245	3.52E-03	1.54E-02	5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	135 U	9.71E-04 U	4.25E-03 U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	18500	2.66E-01	1.17E+00	5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	135 U	9.71E-04 U	4.25E-03 U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	135 U	9.71E-04 U	4.25E-03 U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	275 U	1.98E-03 U	8.66E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	135 U	9.71E-04 U	4.25E-03 U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	135 U	9.71E-04 U	4.25E-03 U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	135 U	9.71E-04 U	4.25E-03 U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	135 U	9.71E-04 U	4.25E-03 U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1350 U	9.71E-03 U	4.25E-02 U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	135 U	9.71E-04 U	4.25E-03 U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	11000	1.58E-01	6.93E-01	5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	135 U	9.71E-04 U	4.25E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	135 U	9.71E-04 U	4.25E-03 U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL			0.622 U										

(1) Sample collected on October 22, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,850 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3850 cfm

**Air Analytical Results –
October 22, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5017-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376

CAS Sample ID: P1204376-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00121

Date Collected: 10/22/12

Date Received: 10/24/12

Date Analyzed: 10/25/12

Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.03 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	130	ND	78	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	130	ND	27	
74-87-3	Chloromethane	ND	130	ND	65	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	130	ND	19	
75-01-4	Vinyl Chloride	ND	130	ND	52	
106-99-0	1,3-Butadiene	ND	130	ND	61	
74-83-9	Bromomethane	ND	130	ND	35	
75-00-3	Chloroethane	ND	130	ND	51	
64-17-5	Ethanol	ND	1,300	ND	710	
75-05-8	Acetonitrile	ND	130	ND	80	
107-02-8	Acrolein	ND	540	ND	230	
67-64-1	Acetone	ND	1,300	ND	560	
75-69-4	Trichlorofluoromethane	ND	130	ND	24	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,300	ND	550	
107-13-1	Acrylonitrile	ND	130	ND	62	
75-35-4	1,1-Dichloroethene	140	130	36	34	
75-09-2	Methylene Chloride	250	130	72	39	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	130	ND	43	
76-13-1	Trichlorotrifluoroethane	11,000	130	1,400	17	
75-15-0	Carbon Disulfide	ND	1,300	ND	430	
156-60-5	trans-1,2-Dichloroethene	ND	130	ND	34	
75-34-3	1,1-Dichloroethane	ND	130	ND	33	
1634-04-4	Methyl tert-Butyl Ether	ND	130	ND	37	
108-05-4	Vinyl Acetate	ND	1,300	ND	380	
78-93-3	2-Butanone (MEK)	ND	1,300	ND	450	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5017-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376

CAS Sample ID: P1204376-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00121

Date Collected: 10/22/12

Date Received: 10/24/12

Date Analyzed: 10/25/12

Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.03 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	9,900	130	2,500	34	
141-78-6	Ethyl Acetate	ND	270	ND	74	
110-54-3	n-Hexane	ND	130	ND	38	
67-66-3	Chloroform	ND	130	ND	27	
109-99-9	Tetrahydrofuran (THF)	ND	130	ND	45	
107-06-2	1,2-Dichloroethane	140	130	34	33	
71-55-6	1,1,1-Trichloroethane	ND	130	ND	25	
71-43-2	Benzene	ND	130	ND	42	
56-23-5	Carbon Tetrachloride	ND	130	ND	21	
110-82-7	Cyclohexane	ND	270	ND	78	
78-87-5	1,2-Dichloropropane	ND	130	ND	29	
75-27-4	Bromodichloromethane	ND	130	ND	20	
79-01-6	Trichloroethene	18,000	130	3,400	25	
123-91-1	1,4-Dioxane	ND	130	ND	37	
80-62-6	Methyl Methacrylate	ND	270	ND	65	
142-82-5	n-Heptane	ND	130	ND	33	
10061-01-5	cis-1,3-Dichloropropene	ND	130	ND	30	
108-10-1	4-Methyl-2-pentanone	ND	130	ND	33	
10061-02-6	trans-1,3-Dichloropropene	ND	130	ND	30	
79-00-5	1,1,2-Trichloroethane	ND	130	ND	25	
108-88-3	Toluene	ND	130	ND	36	
591-78-6	2-Hexanone	ND	130	ND	33	
124-48-1	Dibromochloromethane	ND	130	ND	16	
106-93-4	1,2-Dibromoethane	ND	130	ND	17	
123-86-4	n-Butyl Acetate	ND	130	ND	28	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
CAS Sample ID: P1204376-001

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
Analyst: Chris Cornett
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: SC00121

Date Collected: 10/22/12
Date Received: 10/24/12
Date Analyzed: 10/25/12
Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.03 Final Pressure (psig): 3.58

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	130	ND	29	
127-18-4	Tetrachloroethene	ND	130	ND	20	
108-90-7	Chlorobenzene	ND	130	ND	29	
100-41-4	Ethylbenzene	ND	130	ND	31	
179601-23-1	m,p-Xylenes	ND	270	ND	62	
75-25-2	Bromoform	ND	130	ND	13	
100-42-5	Styrene	ND	130	ND	31	
95-47-6	o-Xylene	ND	130	ND	31	
111-84-2	n-Nonane	ND	130	ND	26	
79-34-5	1,1,2,2-Tetrachloroethane	ND	130	ND	20	
98-82-8	Cumene	ND	130	ND	27	
80-56-8	alpha-Pinene	ND	130	ND	24	
103-65-1	n-Propylbenzene	ND	130	ND	27	
622-96-8	4-Ethyltoluene	ND	130	ND	27	
108-67-8	1,3,5-Trimethylbenzene	ND	130	ND	27	
95-63-6	1,2,4-Trimethylbenzene	ND	130	ND	27	
100-44-7	Benzyl Chloride	ND	130	ND	26	
541-73-1	1,3-Dichlorobenzene	ND	130	ND	22	
106-46-7	1,4-Dichlorobenzene	ND	130	ND	22	
95-50-1	1,2-Dichlorobenzene	ND	130	ND	22	
5989-27-5	d-Limonene	ND	130	ND	24	
96-12-8	1,2-Dibromo-3-chloropropane	ND	130	ND	14	
120-82-1	1,2,4-Trichlorobenzene	ND	130	ND	18	
91-20-3	Naphthalene	ND	130	ND	26	
87-68-3	Hexachlorobutadiene	ND	130	ND	13	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
 CAS Sample ID: P1204376-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00519

Date Collected: 10/22/12
 Date Received: 10/24/12
 Date Analyzed: 10/25/12
 Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.48 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	140	ND	80	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	140	ND	28	
74-87-3	Chloromethane	ND	140	ND	67	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	140	ND	20	
75-01-4	Vinyl Chloride	ND	140	ND	54	
106-99-0	1,3-Butadiene	ND	140	ND	62	
74-83-9	Bromomethane	ND	140	ND	36	
75-00-3	Chloroethane	ND	140	ND	52	
64-17-5	Ethanol	ND	1,400	ND	730	
75-05-8	Acetonitrile	ND	140	ND	82	
107-02-8	Acrolein	ND	550	ND	240	
67-64-1	Acetone	ND	1,400	ND	580	
75-69-4	Trichlorofluoromethane	ND	140	ND	25	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,400	ND	560	
107-13-1	Acrylonitrile	ND	140	ND	64	
75-35-4	1,1-Dichloroethene	140	140	35	35	
75-09-2	Methylene Chloride	240	140	70	40	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	140	ND	44	
76-13-1	Trichlorotrifluoroethane	11,000	140	1,400	18	
75-15-0	Carbon Disulfide	ND	1,400	ND	440	
156-60-5	trans-1,2-Dichloroethene	ND	140	ND	35	
75-34-3	1,1-Dichloroethane	ND	140	ND	34	
1634-04-4	Methyl tert-Butyl Ether	ND	140	ND	38	
108-05-4	Vinyl Acetate	ND	1,400	ND	390	
78-93-3	2-Butanone (MEK)	ND	1,400	ND	470	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
 CAS Sample ID: P1204376-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00519

Date Collected: 10/22/12
 Date Received: 10/24/12
 Date Analyzed: 10/25/12
 Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.48 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	10,000	140	2,500	35	
141-78-6	Ethyl Acetate	ND	280	ND	77	
110-54-3	n-Hexane	ND	140	ND	39	
67-66-3	Chloroform	ND	140	ND	28	
109-99-9	Tetrahydrofuran (THF)	ND	140	ND	47	
107-06-2	1,2-Dichloroethane	ND	140	ND	34	
71-55-6	1,1,1-Trichloroethane	ND	140	ND	25	
71-43-2	Benzene	ND	140	ND	43	
56-23-5	Carbon Tetrachloride	ND	140	ND	22	
110-82-7	Cyclohexane	ND	280	ND	80	
78-87-5	1,2-Dichloropropane	ND	140	ND	30	
75-27-4	Bromodichloromethane	ND	140	ND	21	
79-01-6	Trichloroethene	19,000	140	3,500	26	
123-91-1	1,4-Dioxane	ND	140	ND	38	
80-62-6	Methyl Methacrylate	ND	280	ND	67	
142-82-5	n-Heptane	ND	140	ND	34	
10061-01-5	cis-1,3-Dichloropropene	ND	140	ND	30	
108-10-1	4-Methyl-2-pentanone	ND	140	ND	34	
10061-02-6	trans-1,3-Dichloropropene	ND	140	ND	30	
79-00-5	1,1,2-Trichloroethane	ND	140	ND	25	
108-88-3	Toluene	ND	140	ND	37	
591-78-6	2-Hexanone	ND	140	ND	34	
124-48-1	Dibromochloromethane	ND	140	ND	16	
106-93-4	1,2-Dibromoethane	ND	140	ND	18	
123-86-4	n-Butyl Acetate	ND	140	ND	29	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
 CAS Sample ID: P1204376-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00519

Date Collected: 10/22/12
 Date Received: 10/24/12
 Date Analyzed: 10/25/12
 Volume(s) Analyzed: 0.0050 Liter(s)

Initial Pressure (psig): -1.48 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	140	ND	30	
127-18-4	Tetrachloroethene	ND	140	ND	20	
108-90-7	Chlorobenzene	ND	140	ND	30	
100-41-4	Ethylbenzene	ND	140	ND	32	
179601-23-1	m,p-Xylenes	ND	280	ND	64	
75-25-2	Bromoform	ND	140	ND	13	
100-42-5	Styrene	ND	140	ND	32	
95-47-6	o-Xylene	ND	140	ND	32	
111-84-2	n-Nonane	ND	140	ND	26	
79-34-5	1,1,2,2-Tetrachloroethane	ND	140	ND	20	
98-82-8	Cumene	ND	140	ND	28	
80-56-8	alpha-Pinene	ND	140	ND	25	
103-65-1	n-Propylbenzene	ND	140	ND	28	
622-96-8	4-Ethyltoluene	ND	140	ND	28	
108-67-8	1,3,5-Trimethylbenzene	ND	140	ND	28	
95-63-6	1,2,4-Trimethylbenzene	ND	140	ND	28	
100-44-7	Benzyl Chloride	ND	140	ND	27	
541-73-1	1,3-Dichlorobenzene	ND	140	ND	23	
106-46-7	1,4-Dichlorobenzene	ND	140	ND	23	
95-50-1	1,2-Dichlorobenzene	ND	140	ND	23	
5989-27-5	d-Limonene	ND	140	ND	25	
96-12-8	1,2-Dibromo-3-chloropropane	ND	140	ND	14	
120-82-1	1,2,4-Trichlorobenzene	ND	140	ND	19	
91-20-3	Naphthalene	ND	140	ND	26	
87-68-3	Hexachlorobutadiene	ND	140	ND	13	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5017-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376

CAS Sample ID: P1204376-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00999

Date Collected: 10/22/12

Date Received: 10/24/12

Date Analyzed: 10/25/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.46 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	1.2	0.69	0.72	0.40	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.2	0.69	0.45	0.14	
74-87-3	Chloromethane	ND	0.69	ND	0.33	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.69	ND	0.099	
75-01-4	Vinyl Chloride	ND	0.69	ND	0.27	
106-99-0	1,3-Butadiene	ND	0.69	ND	0.31	
74-83-9	Bromomethane	ND	0.69	ND	0.18	
75-00-3	Chloroethane	ND	0.69	ND	0.26	
64-17-5	Ethanol	86	6.9	46	3.7	
75-05-8	Acetonitrile	ND	0.69	ND	0.41	
107-02-8	Acrolein	ND	2.8	ND	1.2	
67-64-1	Acetone	12	6.9	5.0	2.9	
75-69-4	Trichlorofluoromethane	1.1	0.69	0.19	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.9	ND	2.8	
107-13-1	Acrylonitrile	ND	0.69	ND	0.32	
75-35-4	1,1-Dichloroethene	ND	0.69	ND	0.17	
75-09-2	Methylene Chloride	0.95	0.69	0.27	0.20	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.69	ND	0.22	
76-13-1	Trichlorotrifluoroethane	61	0.69	8.0	0.090	
75-15-0	Carbon Disulfide	ND	6.9	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.69	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.69	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.69	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.9	ND	2.0	
78-93-3	2-Butanone (MEK)	ND	6.9	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5017-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376

CAS Sample ID: P1204376-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC00999

Date Collected: 10/22/12

Date Received: 10/24/12

Date Analyzed: 10/25/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.46 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	14	0.69	3.4	0.17	
141-78-6	Ethyl Acetate	ND	1.4	ND	0.38	
110-54-3	n-Hexane	1.3	0.69	0.37	0.20	
67-66-3	Chloroform	ND	0.69	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.69	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.69	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.69	ND	0.13	
71-43-2	Benzene	1.1	0.69	0.35	0.22	
56-23-5	Carbon Tetrachloride	ND	0.69	ND	0.11	
110-82-7	Cyclohexane	ND	1.4	ND	0.40	
78-87-5	1,2-Dichloropropane	ND	0.69	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.69	ND	0.10	
79-01-6	Trichloroethene	40	0.69	7.4	0.13	
123-91-1	1,4-Dioxane	ND	0.69	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.4	ND	0.34	
142-82-5	n-Heptane	0.86	0.69	0.21	0.17	
10061-01-5	cis-1,3-Dichloropropene	ND	0.69	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.69	ND	0.17	
10061-02-6	trans-1,3-Dichloropropene	ND	0.69	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.69	ND	0.13	
108-88-3	Toluene	2.1	0.69	0.56	0.18	
591-78-6	2-Hexanone	ND	0.69	ND	0.17	
124-48-1	Dibromochloromethane	ND	0.69	ND	0.081	
106-93-4	1,2-Dibromoethane	ND	0.69	ND	0.090	
123-86-4	n-Butyl Acetate	ND	0.69	ND	0.15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
CAS Sample ID: P1204376-003

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
Analyst: Chris Cornett
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: AC00999

Date Collected: 10/22/12
Date Received: 10/24/12
Date Analyzed: 10/25/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -1.46 Final Pressure (psig): 3.62

Canister Dilution Factor: 1.38

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.69	ND	0.15	
127-18-4	Tetrachloroethene	ND	0.69	ND	0.10	
108-90-7	Chlorobenzene	ND	0.69	ND	0.15	
100-41-4	Ethylbenzene	2.1	0.69	0.49	0.16	
179601-23-1	m,p-Xylenes	10	1.4	2.3	0.32	
75-25-2	Bromoform	ND	0.69	ND	0.067	
100-42-5	Styrene	ND	0.69	ND	0.16	
95-47-6	o-Xylene	4.2	0.69	0.97	0.16	
111-84-2	n-Nonane	1.0	0.69	0.19	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.69	ND	0.10	
98-82-8	Cumene	ND	0.69	ND	0.14	
80-56-8	alpha-Pinene	2.2	0.69	0.39	0.12	
103-65-1	n-Propylbenzene	ND	0.69	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.69	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.69	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	0.85	0.69	0.17	0.14	
100-44-7	Benzyl Chloride	ND	0.69	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.69	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.69	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.69	ND	0.11	
5989-27-5	d-Limonene	1.0	0.69	0.18	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.69	ND	0.071	
120-82-1	1,2,4-Trichlorobenzene	ND	0.69	ND	0.093	
91-20-3	Naphthalene	ND	0.69	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.69	ND	0.065	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5017-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376

CAS Sample ID: P1204376-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13

Analyst: Chris Cornett

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01210

Date Collected: 10/23/12

Date Received: 10/24/12

Date Analyzed: 10/25 - 10/26/12

Volume(s) Analyzed: 1.00 Liter(s)

0.050 Liter(s)

Initial Pressure (psig): -3.38 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.61

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	33	0.81	19	0.47	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.3	0.81	0.46	0.16	
74-87-3	Chloromethane	ND	0.81	ND	0.39	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.81	ND	0.12	
75-01-4	Vinyl Chloride	ND	0.81	ND	0.32	
106-99-0	1,3-Butadiene	ND	0.81	ND	0.36	
74-83-9	Bromomethane	ND	0.81	ND	0.21	
75-00-3	Chloroethane	ND	0.81	ND	0.31	
64-17-5	Ethanol	15,000	160	7,800	85	D
75-05-8	Acetonitrile	ND	0.81	ND	0.48	
107-02-8	Acrolein	ND	3.2	ND	1.4	
67-64-1	Acetone	35	8.1	15	3.4	
75-69-4	Trichlorofluoromethane	1.7	0.81	0.30	0.14	
67-63-0	2-Propanol (Isopropyl Alcohol)	130	8.1	55	3.3	
107-13-1	Acrylonitrile	ND	0.81	ND	0.37	
75-35-4	1,1-Dichloroethene	ND	0.81	ND	0.20	
75-09-2	Methylene Chloride	ND	0.81	ND	0.23	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.81	ND	0.26	
76-13-1	Trichlorotrifluoroethane	3.7	0.81	0.48	0.11	
75-15-0	Carbon Disulfide	ND	8.1	ND	2.6	
156-60-5	trans-1,2-Dichloroethene	ND	0.81	ND	0.20	
75-34-3	1,1-Dichloroethane	ND	0.81	ND	0.20	
1634-04-4	Methyl tert-Butyl Ether	ND	0.81	ND	0.22	
108-05-4	Vinyl Acetate	ND	8.1	ND	2.3	
78-93-3	2-Butanone (MEK)	ND	8.1	ND	2.7	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
 CAS Sample ID: P1204376-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01210

Date Collected: 10/23/12
 Date Received: 10/24/12
 Date Analyzed: 10/25 - 10/26/12
 Volume(s) Analyzed: 1.00 Liter(s)
 0.050 Liter(s)

Initial Pressure (psig): -3.38 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.61

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.81	ND	0.20	
141-78-6	Ethyl Acetate	11	1.6	3.1	0.45	
110-54-3	n-Hexane	2.3	0.81	0.66	0.23	
67-66-3	Chloroform	ND	0.81	ND	0.16	
109-99-9	Tetrahydrofuran (THF)	1.4	0.81	0.48	0.27	
107-06-2	1,2-Dichloroethane	ND	0.81	ND	0.20	
71-55-6	1,1,1-Trichloroethane	ND	0.81	ND	0.15	
71-43-2	Benzene	0.91	0.81	0.29	0.25	
56-23-5	Carbon Tetrachloride	ND	0.81	ND	0.13	
110-82-7	Cyclohexane	ND	1.6	ND	0.47	
78-87-5	1,2-Dichloropropane	ND	0.81	ND	0.17	
75-27-4	Bromodichloromethane	ND	0.81	ND	0.12	
79-01-6	Trichloroethene	ND	0.81	ND	0.15	
123-91-1	1,4-Dioxane	ND	0.81	ND	0.22	
80-62-6	Methyl Methacrylate	ND	1.6	ND	0.39	
142-82-5	n-Heptane	ND	0.81	ND	0.20	
10061-01-5	cis-1,3-Dichloropropene	ND	0.81	ND	0.18	
108-10-1	4-Methyl-2-pentanone	ND	0.81	ND	0.20	
10061-02-6	trans-1,3-Dichloropropene	ND	0.81	ND	0.18	
79-00-5	1,1,2-Trichloroethane	ND	0.81	ND	0.15	
108-88-3	Toluene	3.0	0.81	0.80	0.21	
591-78-6	2-Hexanone	ND	0.81	ND	0.20	
124-48-1	Dibromochloromethane	ND	0.81	ND	0.095	
106-93-4	1,2-Dibromoethane	ND	0.81	ND	0.10	
123-86-4	n-Butyl Acetate	1.3	0.81	0.28	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5017-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204376
 CAS Sample ID: P1204376-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5975Binert/6890N/MS13
 Analyst: Chris Cornett
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01210

Date Collected: 10/23/12
 Date Received: 10/24/12
 Date Analyzed: 10/25 - 10/26/12
 Volume(s) Analyzed: 1.00 Liter(s)
 0.050 Liter(s)

Initial Pressure (psig): -3.38 Final Pressure (psig): 3.56

Canister Dilution Factor: 1.61

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.81	ND	0.17	
127-18-4	Tetrachloroethene	ND	0.81	ND	0.12	
108-90-7	Chlorobenzene	ND	0.81	ND	0.17	
100-41-4	Ethylbenzene	6.4	0.81	1.5	0.19	
179601-23-1	m,p-Xylenes	29	1.6	6.7	0.37	
75-25-2	Bromoform	ND	0.81	ND	0.078	
100-42-5	Styrene	2.3	0.81	0.54	0.19	
95-47-6	o-Xylene	12	0.81	2.7	0.19	
111-84-2	n-Nonane	3.6	0.81	0.69	0.15	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.81	ND	0.12	
98-82-8	Cumene	ND	0.81	ND	0.16	
80-56-8	alpha-Pinene	7.9	0.81	1.4	0.14	
103-65-1	n-Propylbenzene	ND	0.81	ND	0.16	
622-96-8	4-Ethyltoluene	ND	0.81	ND	0.16	
108-67-8	1,3,5-Trimethylbenzene	ND	0.81	ND	0.16	
95-63-6	1,2,4-Trimethylbenzene	1.7	0.81	0.34	0.16	
100-44-7	Benzyl Chloride	ND	0.81	ND	0.16	
541-73-1	1,3-Dichlorobenzene	ND	0.81	ND	0.13	
106-46-7	1,4-Dichlorobenzene	ND	0.81	ND	0.13	
95-50-1	1,2-Dichlorobenzene	ND	0.81	ND	0.13	
5989-27-5	d-Limonene	5.9	0.81	1.1	0.14	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.81	ND	0.083	
120-82-1	1,2,4-Trichlorobenzene	ND	0.81	ND	0.11	
91-20-3	Naphthalene	ND	0.81	ND	0.15	
87-68-3	Hexachlorobutadiene	ND	0.81	ND	0.075	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – October 22, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
10/22/2012	8:00	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 69 degrees
10/22/2012	8:05	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 69 degrees
10/22/2012	13:55	Stripper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 19.5 ppm Steady State 13.0 ppm	Clear 82 degrees
10/22/2012	13:50	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Clear 82 degrees
10/22/2012	14:10	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 82 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: 10/22/12

Project Name: GWTP Operations.

60256135 .0004aa

Recorded By:

SCOTT BEESINGER

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB To ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100 ppm (isobutylene)	6/15/2016	GAM-248 - 100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – October 29, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on October 29, 2012 for 10.5 hours. The previous operation of GWTP occurred on October 22, 2012 (Monday). No operation occurred on Thursday (October 25, 2012) because of insufficient volume of water in TK-140.
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while groundwater extraction will continue to occur continuously.
- 122,612 gallons of water were processed from TK-140 (influent tank) and a total of 40,333 gallons were returned to the Burning Grounds No. 3 through the irrigation system.
- The metals precipitation and air stripping treatment flow rate averaged approximately 195 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The average blower flow rate was 3,950 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was treated in the fluidized bed reactor (FBR) for perchlorate. The treated groundwater through the FBR was then returned to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was clear, the temperature was 40°F, and the wind was northerly.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.0 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 1:55 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 21.1 ppmv and then began to decline to a steady state concentration of 12.6 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.

- At 1: 50 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:10 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.0 ppmv and the PID downwind registered 0.0 ppmv. The weather was clear and the temperature was 60°F.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 0.745 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds. The average measured emission rate from the air stripper stack since September 6, 2012 is estimated at 0.86 lb/hr.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - October 29, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.67	U PASS	0.75	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.67	U PASS	0.75	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.67	U PASS	0.75	U PASS
Acetone	67-64-1	5900	NA	6.7	U PASS	7.5	U PASS
Benzene	71-43-2	170	575	1.4	PASS	0.86	PASS
Carbon disulfide	75-15-0	30	NA	6.7	U PASS	7.5	U Pass
Chloroform	67-66-3	100	98	0.67	U PASS	0.75	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	3.8	PASS	0.75	U PASS
Methylene chloride	75-09-2	3600	12158	0.67	U PASS	0.75	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.67	U PASS	0.75	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.67	U PASS	0.75	U PASS
Trichloroethene	79-01-6	540	537	11	PASS	0.75	U PASS
Vinyl chloride	75-01-4	20000	66460	0.67	U PASS	0.75	U PASS
n-Hexane	110-54-3	5300	6336	1.4	PASS	0.87	PASS
Styrene	100-42-5	110	21725	0.67	U PASS	0.75	U PASS
Toluene	108-88-3	640	15074	0.96	PASS	0.75	U PASS
Ethylbenzene	100-41-4	740	86844	0.67	U PASS	0.75	U PASS
m,p-Xylenes	179601-23-1	180	7382	1.9	PASS	1.5	U PASS
o-Xylene	95-47-6	1600	7382	0.83	PASS	0.75	U PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.67	U PASS	0.75	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.86	NA	0.75	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.3	PASS	2.3	PASS
Ethanol	64-17-5	18800	NA	42	PASS	35	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.3	PASS	1.1	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	17	PASS	0.81	PASS
alpha-Pinene	80-56-8	60	3499	13	PASS	16	PASS
d-Limonene	5989-27-5	1100	NA	2.3	PASS	2.5	PASS

(1) Sample collected over an 8-hour period on October 29, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on October 29, 2012 at 6:20 AM and ending on October 30, 2012 at 6:15 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - October 29, 2012

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)	Status (4)	TLV (L)	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ⁽⁶⁾⁽⁷⁾ (E) = L/K	Status (8)
		µg/m ³		lb/hr		tpy		tpy		mg/m ³			ft		lb/hr	
1,1-Dichloroethane	75-34-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	195		2.88E-03		1.26E-02		5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	130		1.92E-03		8.40E-03		5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	10500		1.55E-01		6.78E-01		5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	130		1.92E-03		8.40E-03		5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	21500		3.17E-01		1.39E+00		5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	180	U	1.33E-03	U	5.82E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1255	U	9.26E-03	U	4.05E-02	U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	15000		2.21E-01		9.69E-01		5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	125.5	U	9.26E-04	U	4.05E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				0.745	U											

(1) Sample collected on October 29, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,950 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3950 cfm

**Air Analytical Results –
October 29, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5019-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485

CAS Sample ID: P1204485-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Elsa Moctezuma

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: SC00069

Date Collected: 10/29/12

Date Received: 10/31/12

Date Analyzed: 11/2/12

Volume(s) Analyzed: 0.0070 Liter(s)

0.0050 Liter(s)

Initial Pressure (psig): -0.34 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.27

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	91	ND	53	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	91	ND	18	
74-87-3	Chloromethane	ND	91	ND	44	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	91	ND	13	
75-01-4	Vinyl Chloride	ND	91	ND	36	
106-99-0	1,3-Butadiene	ND	91	ND	41	
74-83-9	Bromomethane	ND	91	ND	23	
75-00-3	Chloroethane	ND	91	ND	34	
64-17-5	Ethanol	ND	910	ND	480	
75-05-8	Acetonitrile	ND	91	ND	54	
107-02-8	Acrolein	ND	360	ND	160	
67-64-1	Acetone	ND	910	ND	380	
75-69-4	Trichlorofluoromethane	ND	91	ND	16	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	910	ND	370	
107-13-1	Acrylonitrile	ND	91	ND	42	
75-35-4	1,1-Dichloroethene	200	91	51	23	
75-09-2	Methylene Chloride	130	91	36	26	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	91	ND	29	
76-13-1	Trichlorotrifluoroethane	15,000	91	2,000	12	
75-15-0	Carbon Disulfide	ND	910	ND	290	
156-60-5	trans-1,2-Dichloroethene	ND	91	ND	23	
75-34-3	1,1-Dichloroethane	ND	91	ND	22	
1634-04-4	Methyl tert-Butyl Ether	ND	91	ND	25	
108-05-4	Vinyl Acetate	ND	910	ND	260	
78-93-3	2-Butanone (MEK)	ND	910	ND	310	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00069

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 0.0070 Liter(s)
 0.0050 Liter(s)

Initial Pressure (psig): -0.34 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.27

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	11,000	91	2,700	23	
141-78-6	Ethyl Acetate	ND	180	ND	50	
110-54-3	n-Hexane	ND	91	ND	26	
67-66-3	Chloroform	ND	91	ND	19	
109-99-9	Tetrahydrofuran (THF)	ND	91	ND	31	
107-06-2	1,2-Dichloroethane	130	91	33	22	
71-55-6	1,1,1-Trichloroethane	ND	91	ND	17	
71-43-2	Benzene	ND	91	ND	28	
56-23-5	Carbon Tetrachloride	ND	91	ND	14	
110-82-7	Cyclohexane	ND	180	ND	53	
78-87-5	1,2-Dichloropropane	ND	91	ND	20	
75-27-4	Bromodichloromethane	ND	91	ND	14	
79-01-6	Trichloroethene	22,000	130	4,000	24	D
123-91-1	1,4-Dioxane	ND	91	ND	25	
80-62-6	Methyl Methacrylate	ND	180	ND	44	
142-82-5	n-Heptane	ND	91	ND	22	
10061-01-5	cis-1,3-Dichloropropene	ND	91	ND	20	
108-10-1	4-Methyl-2-pentanone	ND	91	ND	22	
10061-02-6	trans-1,3-Dichloropropene	ND	91	ND	20	
79-00-5	1,1,2-Trichloroethane	ND	91	ND	17	
108-88-3	Toluene	ND	91	ND	24	
591-78-6	2-Hexanone	ND	91	ND	22	
124-48-1	Dibromochloromethane	ND	91	ND	11	
106-93-4	1,2-Dibromoethane	ND	91	ND	12	
123-86-4	n-Butyl Acetate	ND	91	ND	19	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

D = The reported result is from a dilution.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00069

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 0.0070 Liter(s)
 0.0050 Liter(s)

Initial Pressure (psig): -0.34 Final Pressure (psig): 3.55

Canister Dilution Factor: 1.27

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	91	ND	19	
127-18-4	Tetrachloroethene	ND	91	ND	13	
108-90-7	Chlorobenzene	ND	91	ND	20	
100-41-4	Ethylbenzene	ND	91	ND	21	
179601-23-1	m,p-Xylenes	ND	180	ND	42	
75-25-2	Bromoform	ND	91	ND	8.8	
100-42-5	Styrene	ND	91	ND	21	
95-47-6	o-Xylene	ND	91	ND	21	
111-84-2	n-Nonane	ND	91	ND	17	
79-34-5	1,1,2,2-Tetrachloroethane	ND	91	ND	13	
98-82-8	Cumene	ND	91	ND	18	
80-56-8	alpha-Pinene	ND	91	ND	16	
103-65-1	n-Propylbenzene	ND	91	ND	18	
622-96-8	4-Ethyltoluene	ND	91	ND	18	
108-67-8	1,3,5-Trimethylbenzene	ND	91	ND	18	
95-63-6	1,2,4-Trimethylbenzene	ND	91	ND	18	
100-44-7	Benzyl Chloride	ND	91	ND	18	
541-73-1	1,3-Dichlorobenzene	ND	91	ND	15	
106-46-7	1,4-Dichlorobenzene	ND	91	ND	15	
95-50-1	1,2-Dichlorobenzene	ND	91	ND	15	
5989-27-5	d-Limonene	ND	91	ND	16	
96-12-8	1,2-Dibromo-3-chloropropane	ND	91	ND	9.4	
120-82-1	1,2,4-Trichlorobenzene	ND	91	ND	12	
91-20-3	Naphthalene	ND	91	ND	17	
87-68-3	Hexachlorobutadiene	ND	91	ND	8.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00823

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	160	ND	95	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	160	ND	33	
74-87-3	Chloromethane	ND	160	ND	79	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	160	ND	23	
75-01-4	Vinyl Chloride	ND	160	ND	64	
106-99-0	1,3-Butadiene	ND	160	ND	74	
74-83-9	Bromomethane	ND	160	ND	42	
75-00-3	Chloroethane	ND	160	ND	62	
64-17-5	Ethanol	ND	1,600	ND	870	
75-05-8	Acetonitrile	ND	160	ND	98	
107-02-8	Acrolein	ND	660	ND	290	
67-64-1	Acetone	ND	1,600	ND	690	
75-69-4	Trichlorofluoromethane	ND	160	ND	29	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,600	ND	670	
107-13-1	Acrylonitrile	ND	160	ND	75	
75-35-4	1,1-Dichloroethene	190	160	48	41	
75-09-2	Methylene Chloride	ND	160	ND	47	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	160	ND	52	
76-13-1	Trichlorotrifluoroethane	15,000	160	1,900	21	
75-15-0	Carbon Disulfide	ND	1,600	ND	530	
156-60-5	trans-1,2-Dichloroethene	ND	160	ND	41	
75-34-3	1,1-Dichloroethane	ND	160	ND	40	
1634-04-4	Methyl tert-Butyl Ether	ND	160	ND	45	
108-05-4	Vinyl Acetate	ND	1,600	ND	470	
78-93-3	2-Butanone (MEK)	ND	1,600	ND	560	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00823

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	10,000	160	2,600	41	
141-78-6	Ethyl Acetate	ND	330	ND	91	
110-54-3	n-Hexane	ND	160	ND	46	
67-66-3	Chloroform	ND	160	ND	34	
109-99-9	Tetrahydrofuran (THF)	ND	160	ND	56	
107-06-2	1,2-Dichloroethane	ND	160	ND	40	
71-55-6	1,1,1-Trichloroethane	ND	160	ND	30	
71-43-2	Benzene	ND	160	ND	51	
56-23-5	Carbon Tetrachloride	ND	160	ND	26	
110-82-7	Cyclohexane	ND	330	ND	95	
78-87-5	1,2-Dichloropropane	ND	160	ND	35	
75-27-4	Bromodichloromethane	ND	160	ND	24	
79-01-6	Trichloroethene	21,000	160	3,900	30	
123-91-1	1,4-Dioxane	ND	160	ND	45	
80-62-6	Methyl Methacrylate	ND	330	ND	80	
142-82-5	n-Heptane	ND	160	ND	40	
10061-01-5	cis-1,3-Dichloropropene	ND	160	ND	36	
108-10-1	4-Methyl-2-pentanone	ND	160	ND	40	
10061-02-6	trans-1,3-Dichloropropene	ND	160	ND	36	
79-00-5	1,1,2-Trichloroethane	ND	160	ND	30	
108-88-3	Toluene	ND	160	ND	43	
591-78-6	2-Hexanone	ND	160	ND	40	
124-48-1	Dibromochloromethane	ND	160	ND	19	
106-93-4	1,2-Dibromoethane	ND	160	ND	21	
123-86-4	n-Butyl Acetate	ND	160	ND	34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

Now Part of the ALS Group

RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Stripper-Dup
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00823

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.85 Final Pressure (psig): 3.50

Canister Dilution Factor: 1.31

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	160	ND	35	
127-18-4	Tetrachloroethene	ND	160	ND	24	
108-90-7	Chlorobenzene	ND	160	ND	36	
100-41-4	Ethylbenzene	ND	160	ND	38	
179601-23-1	m,p-Xylenes	ND	330	ND	75	
75-25-2	Bromoform	ND	160	ND	16	
100-42-5	Styrene	ND	160	ND	38	
95-47-6	o-Xylene	ND	160	ND	38	
111-84-2	n-Nonane	ND	160	ND	31	
79-34-5	1,1,2,2-Tetrachloroethane	ND	160	ND	24	
98-82-8	Cumene	ND	160	ND	33	
80-56-8	alpha-Pinene	ND	160	ND	29	
103-65-1	n-Propylbenzene	ND	160	ND	33	
622-96-8	4-Ethyltoluene	ND	160	ND	33	
108-67-8	1,3,5-Trimethylbenzene	ND	160	ND	33	
95-63-6	1,2,4-Trimethylbenzene	ND	160	ND	33	
100-44-7	Benzyl Chloride	ND	160	ND	32	
541-73-1	1,3-Dichlorobenzene	ND	160	ND	27	
106-46-7	1,4-Dichlorobenzene	ND	160	ND	27	
95-50-1	1,2-Dichlorobenzene	ND	160	ND	27	
5989-27-5	d-Limonene	ND	160	ND	29	
96-12-8	1,2-Dibromo-3-chloropropane	ND	160	ND	17	
120-82-1	1,2,4-Trichlorobenzene	ND	160	ND	22	
91-20-3	Naphthalene	ND	160	ND	31	
87-68-3	Hexachlorobutadiene	ND	160	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5019-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485

CAS Sample ID: P1204485-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Elsa Moctezuma

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01940

Date Collected: 10/29/12

Date Received: 10/31/12

Date Analyzed: 11/2/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.99 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	0.86	0.67	0.50	0.39	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.3	0.67	0.47	0.14	
74-87-3	Chloromethane	ND	0.67	ND	0.32	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.67	ND	0.096	
75-01-4	Vinyl Chloride	ND	0.67	ND	0.26	
106-99-0	1,3-Butadiene	ND	0.67	ND	0.30	
74-83-9	Bromomethane	ND	0.67	ND	0.17	
75-00-3	Chloroethane	ND	0.67	ND	0.25	
64-17-5	Ethanol	42	6.7	22	3.6	
75-05-8	Acetonitrile	ND	0.67	ND	0.40	
107-02-8	Acrolein	ND	2.7	ND	1.2	
67-64-1	Acetone	ND	6.7	ND	2.8	
75-69-4	Trichlorofluoromethane	1.3	0.67	0.23	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.7	ND	2.7	
107-13-1	Acrylonitrile	ND	0.67	ND	0.31	
75-35-4	1,1-Dichloroethene	ND	0.67	ND	0.17	
75-09-2	Methylene Chloride	ND	0.67	ND	0.19	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.67	ND	0.21	
76-13-1	Trichlorotrifluoroethane	17	0.67	2.2	0.087	
75-15-0	Carbon Disulfide	ND	6.7	ND	2.2	
156-60-5	trans-1,2-Dichloroethene	ND	0.67	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.67	ND	0.17	
1634-04-4	Methyl tert-Butyl Ether	ND	0.67	ND	0.19	
108-05-4	Vinyl Acetate	ND	6.7	ND	1.9	
78-93-3	2-Butanone (MEK)	ND	6.7	ND	2.3	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01940

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.99 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	3.8	0.67	0.95	0.17	
141-78-6	Ethyl Acetate	ND	1.3	ND	0.37	
110-54-3	n-Hexane	1.4	0.67	0.39	0.19	
67-66-3	Chloroform	ND	0.67	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	ND	0.67	ND	0.23	
107-06-2	1,2-Dichloroethane	ND	0.67	ND	0.17	
71-55-6	1,1,1-Trichloroethane	ND	0.67	ND	0.12	
71-43-2	Benzene	1.4	0.67	0.43	0.21	
56-23-5	Carbon Tetrachloride	ND	0.67	ND	0.11	
110-82-7	Cyclohexane	ND	1.3	ND	0.39	
78-87-5	1,2-Dichloropropane	ND	0.67	ND	0.15	
75-27-4	Bromodichloromethane	ND	0.67	ND	0.10	
79-01-6	Trichloroethene	11	0.67	2.0	0.12	
123-91-1	1,4-Dioxane	ND	0.67	ND	0.19	
80-62-6	Methyl Methacrylate	ND	1.3	ND	0.33	
142-82-5	n-Heptane	0.69	0.67	0.17	0.16	
10061-01-5	cis-1,3-Dichloropropene	ND	0.67	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.67	ND	0.16	
10061-02-6	trans-1,3-Dichloropropene	ND	0.67	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.67	ND	0.12	
108-88-3	Toluene	0.96	0.67	0.26	0.18	
591-78-6	2-Hexanone	ND	0.67	ND	0.16	
124-48-1	Dibromochloromethane	ND	0.67	ND	0.079	
106-93-4	1,2-Dibromoethane	ND	0.67	ND	0.087	
123-86-4	n-Butyl Acetate	ND	0.67	ND	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 3 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01940

Date Collected: 10/29/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.99 Final Pressure (psig): 3.61

Canister Dilution Factor: 1.34

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.67	ND	0.14	
127-18-4	Tetrachloroethene	ND	0.67	ND	0.099	
108-90-7	Chlorobenzene	ND	0.67	ND	0.15	
100-41-4	Ethylbenzene	ND	0.67	ND	0.15	
179601-23-1	m,p-Xylenes	1.9	1.3	0.43	0.31	
75-25-2	Bromoform	ND	0.67	ND	0.065	
100-42-5	Styrene	ND	0.67	ND	0.16	
95-47-6	o-Xylene	0.83	0.67	0.19	0.15	
111-84-2	n-Nonane	ND	0.67	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.67	ND	0.098	
98-82-8	Cumene	ND	0.67	ND	0.14	
80-56-8	alpha-Pinene	13	0.67	2.3	0.12	
103-65-1	n-Propylbenzene	ND	0.67	ND	0.14	
622-96-8	4-Ethyltoluene	ND	0.67	ND	0.14	
108-67-8	1,3,5-Trimethylbenzene	ND	0.67	ND	0.14	
95-63-6	1,2,4-Trimethylbenzene	ND	0.67	ND	0.14	
100-44-7	Benzyl Chloride	ND	0.67	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.67	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.67	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.67	ND	0.11	
5989-27-5	d-Limonene	2.3	0.67	0.42	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.67	ND	0.069	
120-82-1	1,2,4-Trichlorobenzene	ND	0.67	ND	0.090	
91-20-3	Naphthalene	ND	0.67	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.67	ND	0.063	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5019-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485

CAS Sample ID: P1204485-004

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3

Analyst: Elsa Moctezuma

Sampling Media: 6.0 L Summa Canister

Test Notes:

Container ID: AC01945

Date Collected: 10/30/12

Date Received: 10/31/12

Date Analyzed: 11/2/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.52 Final Pressure (psig): 3.57

Canister Dilution Factor: 1.50

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.75	ND	0.44	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.3	0.75	0.46	0.15	
74-87-3	Chloromethane	ND	0.75	ND	0.36	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.75	ND	0.11	
75-01-4	Vinyl Chloride	ND	0.75	ND	0.29	
106-99-0	1,3-Butadiene	ND	0.75	ND	0.34	
74-83-9	Bromomethane	ND	0.75	ND	0.19	
75-00-3	Chloroethane	ND	0.75	ND	0.28	
64-17-5	Ethanol	35	7.5	19	4.0	
75-05-8	Acetonitrile	ND	0.75	ND	0.45	
107-02-8	Acrolein	ND	3.0	ND	1.3	
67-64-1	Acetone	ND	7.5	ND	3.2	
75-69-4	Trichlorofluoromethane	1.1	0.75	0.20	0.13	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	7.5	ND	3.1	
107-13-1	Acrylonitrile	ND	0.75	ND	0.35	
75-35-4	1,1-Dichloroethene	ND	0.75	ND	0.19	
75-09-2	Methylene Chloride	ND	0.75	ND	0.22	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.75	ND	0.24	
76-13-1	Trichlorotrifluoroethane	0.81	0.75	0.11	0.098	
75-15-0	Carbon Disulfide	ND	7.5	ND	2.4	
156-60-5	trans-1,2-Dichloroethene	ND	0.75	ND	0.19	
75-34-3	1,1-Dichloroethane	ND	0.75	ND	0.19	
1634-04-4	Methyl tert-Butyl Ether	ND	0.75	ND	0.21	
108-05-4	Vinyl Acetate	ND	7.5	ND	2.1	
78-93-3	2-Butanone (MEK)	ND	7.5	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

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Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
 CAS Sample ID: P1204485-004

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
 Analyst: Elsa Moctezuma
 Sampling Media: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01945

Date Collected: 10/30/12
 Date Received: 10/31/12
 Date Analyzed: 11/2/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.52 Final Pressure (psig): 3.57

Canister Dilution Factor: 1.50

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.75	ND	0.19	
141-78-6	Ethyl Acetate	ND	1.5	ND	0.42	
110-54-3	n-Hexane	0.87	0.75	0.25	0.21	
67-66-3	Chloroform	ND	0.75	ND	0.15	
109-99-9	Tetrahydrofuran (THF)	ND	0.75	ND	0.25	
107-06-2	1,2-Dichloroethane	ND	0.75	ND	0.19	
71-55-6	1,1,1-Trichloroethane	ND	0.75	ND	0.14	
71-43-2	Benzene	0.86	0.75	0.27	0.23	
56-23-5	Carbon Tetrachloride	ND	0.75	ND	0.12	
110-82-7	Cyclohexane	ND	1.5	ND	0.44	
78-87-5	1,2-Dichloropropane	ND	0.75	ND	0.16	
75-27-4	Bromodichloromethane	ND	0.75	ND	0.11	
79-01-6	Trichloroethene	ND	0.75	ND	0.14	
123-91-1	1,4-Dioxane	ND	0.75	ND	0.21	
80-62-6	Methyl Methacrylate	ND	1.5	ND	0.37	
142-82-5	n-Heptane	ND	0.75	ND	0.18	
10061-01-5	cis-1,3-Dichloropropene	ND	0.75	ND	0.17	
108-10-1	4-Methyl-2-pentanone	ND	0.75	ND	0.18	
10061-02-6	trans-1,3-Dichloropropene	ND	0.75	ND	0.17	
79-00-5	1,1,2-Trichloroethane	ND	0.75	ND	0.14	
108-88-3	Toluene	ND	0.75	ND	0.20	
591-78-6	2-Hexanone	ND	0.75	ND	0.18	
124-48-1	Dibromochloromethane	ND	0.75	ND	0.088	
106-93-4	1,2-Dibromoethane	ND	0.75	ND	0.098	
123-86-4	n-Butyl Acetate	ND	0.75	ND	0.16	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5019-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204485
CAS Sample ID: P1204485-004

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/HP5973/HP6890/MS3
Analyst: Elsa Moctezuma
Sampling Media: 6.0 L Summa Canister
Test Notes:
Container ID: AC01945

Date Collected: 10/30/12
Date Received: 10/31/12
Date Analyzed: 11/2/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -2.52 Final Pressure (psig): 3.57

Canister Dilution Factor: 1.50

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.75	ND	0.16	
127-18-4	Tetrachloroethene	ND	0.75	ND	0.11	
108-90-7	Chlorobenzene	ND	0.75	ND	0.16	
100-41-4	Ethylbenzene	ND	0.75	ND	0.17	
179601-23-1	m,p-Xylenes	ND	1.5	ND	0.35	
75-25-2	Bromoform	ND	0.75	ND	0.073	
100-42-5	Styrene	ND	0.75	ND	0.18	
95-47-6	o-Xylene	ND	0.75	ND	0.17	
111-84-2	n-Nonane	ND	0.75	ND	0.14	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.75	ND	0.11	
98-82-8	Cumene	ND	0.75	ND	0.15	
80-56-8	alpha-Pinene	16	0.75	2.9	0.13	
103-65-1	n-Propylbenzene	ND	0.75	ND	0.15	
622-96-8	4-Ethyltoluene	ND	0.75	ND	0.15	
108-67-8	1,3,5-Trimethylbenzene	ND	0.75	ND	0.15	
95-63-6	1,2,4-Trimethylbenzene	ND	0.75	ND	0.15	
100-44-7	Benzyl Chloride	ND	0.75	ND	0.14	
541-73-1	1,3-Dichlorobenzene	ND	0.75	ND	0.12	
106-46-7	1,4-Dichlorobenzene	ND	0.75	ND	0.12	
95-50-1	1,2-Dichlorobenzene	ND	0.75	ND	0.12	
5989-27-5	d-Limonene	2.5	0.75	0.46	0.13	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.75	ND	0.078	
120-82-1	1,2,4-Trichlorobenzene	ND	0.75	ND	0.10	
91-20-3	Naphthalene	ND	0.75	ND	0.14	
87-68-3	Hexachlorobutadiene	ND	0.75	ND	0.070	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – October 29, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
10/29/2012	8:00	Outside GWTP Office	4000 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 40 degrees
10/29/2012	8:05	Downwind	4000 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 40 degrees
10/29/2012	13:55	Stripper	3900 ACFM	MiniRAE 3000	Scott Beesinger	Max. 21.1 ppm Steady State 12.6 ppm	Clear 60 degrees
10/29/2012	13:50	Outside GWTP Office	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 60 degrees
10/29/2012	14:10	Downwind	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Clear 60 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: 10/29/12	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: Scott Beesinger

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: SB TO ZERO	Value:	
Second Point Calibration	Vapor conc. (ppm)	100 ppm (isobutylene)	6/15/2016	GAM-248 - 100-8	Initials: SB	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	

Additional Remarks:

Longhorn Army Ammunition Plant (LHAAP)
Groundwater Treatment Plant
Operating Air Results – November 5, 2012

The following information provides a discussion of the groundwater treatment plant (GWTP) operating conditions, air sampling, air analytical results, and presents a brief discussion of the results.

Groundwater extraction at LHAAP-18/24 has been operational since September 19, 2012.

- Operation of GWTP occurred on November 5, 2012 for 10.25 hours. The previous operation of GWTP occurred on October 29, 2012 (Monday). No operation occurred on Thursday (November 1, 2012) because of insufficient volume of water in TK-140.
- Operation of the GWTP will continue to occur on Monday and Thursday of every week while groundwater extraction will continue to occur continuously.
- 121,807 gallons of water were processed from TK-140 (influent tank) and a total of 42,857 gallons were returned to the Burning Grounds No. 3 through the irrigation system.
- The metals precipitation and air stripping treatment flow rate averaged approximately 198 gallons per minute (gpm).
- Groundwater from TK-140 was treated for metals and for the VOCs via the air stripper. The air was vented using vents available on the fiber glass line connecting the stripper to the Catox unit. The approximate elevation of the emission point is 20 feet above ground level. The average blower flow rate was 3,875 ambient cubic feet per minute (acfm).
- The treated groundwater was then collected in tank TK-630 which has a capacity of 120,000 gallons.
- The water from TK-630 was treated in the fluidized bed reactor (FBR) for perchlorate. The treated groundwater through the FBR was then returned to the Burning Grounds No. 3 via the sprinkler system.
- A photoionization detector (PID) equipped with an 11.7 electron volt (eV) lamp was calibrated using 100 part per million (ppm) isobutylene.
- PID readings were collected at 8:00 AM outside the GWTP office and at 8:05 AM downwind. The weather was cloudy, the temperature was 56°F, and the wind was southerly.
- At the same time, sampling via Summa canisters began for collection of an 8-hr composite sample for the ambient air at the GWTP and a 24-hour composite sample for the ambient air downwind of the GWTP at the closest downwind property boundary.
- The PID at the GWTP registered 0.0 parts per million by volume (ppmv) and the PID downwind registered 0.0 ppmv.
- A PID reading was collected from the stripper stack air at 1:55 PM.
- First, the air line was purged using the PID pump. The PID concentration began to increase immediately and peaked at 38.6 ppmv and then began to decline to a steady state concentration of 29.8 ppmv. At this time, the line was deemed purged, and a duplicate grab air sample using Summa® canisters was collected.

- At 1: 50 PM, a PID reading was collected from outside the GWTP office (while the treatment plant was operational) and at 2:10 PM, a PID reading was collected from the downwind location.
- The PID at the GWTP registered 0.1 ppmv and the PID downwind registered 0.0 ppmv. The weather was cloudy and the temperature was 72°F.
- The ambient air data at the GWTP and downwind, were compared to the Air Monitoring Comparison Values (AMCVs) protective of human health. For chemicals with no published AMCVs, the short term Effects Screening Levels (ESLs) were used for comparison. All ambient air concentrations were lower than the AMCVs or ESLs.
- The stripper stack sample concentrations were used to calculate emission rates in pounds per hour (lbs/hr) and tons per year (tpy). The calculated emission rates in lbs/hr were then compared to the allowable emission rates per 30 TAC 106.533(f)(1). All emission rates were lower than the allowable emission rates to the conservatively-selected off-site receptor¹. The distance used to the downwind receptor was 2,000 feet. The calculated emission rate in tpy was compared to the allowable limit of 5 tpy per chemical. All emission rates were lower than the allowable emission rates.
- The total stack emission rate was determined to be 1.144 lb/hr, which is in line with the result reported by Shaw in September/October 2010 of 0.64 lb/hr based on average chemical concentrations or 0.988 lb/hr based on maximum potential to emit for concentrations in TK-300 (feed tank to air stripper), which assumed complete volatilization of volatile organic compounds. The average measured emission rate from the air stripper stack since September 6, 2012 is estimated at 0.9 lb/hr.

¹ Off-site receptor--Any recreational area, residence, commercial/industrial facility, or other normally occupied structures not used solely by the owner or operator of the facilities or the owner of the site upon which the facilities are located. Measurements of distances to determine compliance with this distance restriction must be taken toward structures that are in use as of the date that a notification is filed with the commission.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Ambient Air Data - November 5, 2012**

Pollutant		Short Term ESL March 2012	AMCVs (ST Health)	GWTP Ambient Air Concentrations (1)	Status (3)	Downwind Ambient Air Concentrations (2)	Status (3)
	CAS	µg/m ³	µg/m ³	µg/m ³		µg/m ³	
1,1-Dichloroethane	75-34-3	4000	4047	0.66	U PASS	0.83	U PASS
1,1-Dichloroethene	75-35-4	210	714	0.66	U PASS	0.83	U PASS
1,2-Dichloroethane	107-06-2	160	162	0.66	U PASS	0.83	U PASS
Acetone	67-64-1	5900	NA	7.1	PASS	11	PASS
Benzene	71-43-2	170	575	0.82	PASS	0.83	U PASS
Carbon disulfide	75-15-0	30	NA	6.6	U PASS	8.3	U Pass
Chloroform	67-66-3	100	98	0.66	U PASS	0.83	U PASS
cis-1,2-Dichloroethene	540-59-0	7900	NA	3.5	PASS	0.83	U PASS
Methylene chloride	75-09-2	3600	12158	0.66	U PASS	0.83	U PASS
Tetrachloroethene	127-18-4	2000	6782	0.66	U PASS	0.83	U PASS
trans-1,2-Dichloroethene	540-59-0	7900	NA	0.66	U PASS	0.83	U PASS
Trichloroethene	79-01-6	540	537	9	PASS	0.83	U PASS
Vinyl chloride	75-01-4	20000	66460	0.66	U PASS	0.83	U PASS
n-Hexane	110-54-3	5300	6336	0.93	PASS	0.83	U PASS
Styrene	100-42-5	110	21725	0.66	U PASS	0.83	U PASS
Toluene	108-88-3	640	15074	0.67	PASS	0.83	U PASS
Ethylbenzene	100-41-4	740	86844	0.66	U PASS	0.83	U PASS
m,p-Xylenes	179601-23-1	180	7382	2.5	PASS	1.7	U PASS
o-Xylene	95-47-6	1600	7382	0.88	PASS	0.83	U PASS
1,3-Dichlorobenzene	541-73-1	720	NA	0.66	U PASS	0.83	U PASS
Propene (C3 H6)	115-07-1	Asphyxiant	Asphyxiant	0.66	U NA	0.83	U NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	50000	49452	2.4	PASS	2.4	PASS
Ethanol	64-17-5	18800	NA	54	PASS	56	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	28000	56184	1.2	PASS	1.2	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	38000	NA	17	PASS	7	PASS
alpha-Pinene	80-56-8	60	3499	2.3	PASS	7	PASS
d-Limonene	5989-27-5	1100	NA	0.83	PASS	1.3	PASS

(1) Sample collected over an 8-hour period on November 5, 2012 between 6:15 AM and 2:15 PM

(2) Sample collected over a 24-hour period beginning on November 5, 2012 at 6:20 AM and ending on November 6, 2012 at 6:20 AM.

(3) Status based on comparison of air sample result to Air Monitoring Comparison Values (AMCVs). When there is no AMCV value for a chemical, the air sample concentration is compared to the short-term ESL.

**Longhorn Army Ammunition Plant
Groundwater Treatment Plant
Emission Stack Air Data - November 5, 2012**

Pollutant	CAS	Measured Air Stripper Stack Concentrations (1)		Air Stripper Emission Rates (2)		Air Stripper Emission Rates		Allowable Annual Emission (3)	Status (4)	TLV (L)	TLV Reference	Compliance section	Distance Downwind to nearest off-site Receptor (D)	(K) value	Allowable Maximum Hourly Emission Limit at Nearest off-site Receptor ⁽⁶⁾⁽⁷⁾ (E) = L/K	Status (8)
		μg/m ³		lb/hr		tpy		tpy		mg/m ³			ft		lb/hr	
1,1-Dichloroethane	75-34-3	160	U	1.16E-03	U	5.07E-03	U	5	PASS	405	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,1-Dichloroethene	75-35-4	335		4.85E-03		2.12E-02		5	PASS	20	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.4	PASS
1,2-Dichloroethane	107-06-2	165		2.39E-03		1.05E-02		5	PASS	40	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.9	PASS
Acetone	67-64-1	1600	U	1.16E-02	U	5.07E-02	U	5	PASS	590	106.262 List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Benzene	71-43-2	160	U	1.16E-03	U	5.07E-03	U	5	PASS	3	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.21	PASS
Carbon disulfide	75-15-0	1600	U	1.16E-02	U	5.07E-02	U	5	PASS	31	ACGIH List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.2	PASS
Chloroform	67-66-3	160	U	1.16E-03	U	5.07E-03	U	5	PASS	10	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.71	PASS
cis-1,2-Dichloroethene	540-59-0	17000		2.46E-01		1.08E+00		5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Methylene chloride	75-09-2	160		2.32E-03		1.01E-02		5	PASS	26	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.9	PASS
Tetrachloroethene	127-18-4	160	U	1.16E-03	U	5.07E-03	U	5	PASS	33.5	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	2.4	PASS
trans-1,2-Dichloroethene	540-59-0	160	U	1.16E-03	U	5.07E-03	U	5	PASS	793	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichloroethene	79-01-6	31000		4.49E-01		1.96E+00		5	PASS	135	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	6.0	PASS
Vinyl chloride	75-01-4	160	U	1.16E-03	U	5.07E-03	U	5	PASS	2	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	0.14	PASS
n-Hexane	110-54-3	160	U	1.16E-03	U	5.07E-03	U	5	PASS	1800	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Styrene	100-42-5	160	U	1.16E-03	U	5.07E-03	U	5	PASS	21	106.262 List	30 TAC 106.533(f)(1)(A)(ii)	2000	14	1.5	PASS
Toluene	108-88-3	160	U	1.16E-03	U	5.07E-03	U	5	PASS	188	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	6.0	PASS
Ethylbenzene	100-41-4	160	U	1.16E-03	U	5.07E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
m,p-Xylenes	179601-23-1	325	U	2.35E-03	U	1.03E-02	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
o-Xylene	95-47-6	160	U	1.16E-03	U	5.07E-03	U	5	PASS	434	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
1,3-Dichlorobenzene	541-73-1	160	U	1.16E-03	U	5.07E-03	U	5	PASS	60	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	4.3	PASS
Propene (C3 H6)	115-07-1	160	U	1.16E-03	U	5.07E-03	U	5	PASS	(5)	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	NA	NA
Dichlorodifluoromethane (CCl2F2)	75-71-8	160	U	1.16E-03	U	5.07E-03	U	5	PASS	4950	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Ethanol	64-17-5	1600	U	1.16E-02	U	5.07E-02	U	5	PASS	1880	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorofluoromethane (CCl3F)	75-69-4	160	U	1.16E-03	U	5.07E-03	U	5	PASS	5620	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
Trichlorotrifluoroethane (C2Cl3F3)	76-13-1	26500		3.83E-01		1.68E+00		5	PASS	7670	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
alpha-Pinene	80-56-8	160	U	1.16E-03	U	5.07E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
d-Limonene	5989-27-5	160	U	1.16E-03	U	5.07E-03	U	5	PASS	557	ACGIH List	30 TAC 106.533(f)(1)(A)(i)	2000	14	1.0	PASS
TOTAL				1.144	U											

(1) Sample collected on November 5, 2012 at 2:00 PM

(2) Based on a blower flow rate of 3,875 cfm.

(3) Per 30TAC 106.533(f)(1)(B)

(4) Based on comparing the calculated air stripper stack sample emission rate in tons per year (tpy) to the allowable annual emission limit per chemical of 5 tpy.

(5) No TLVs for these chemicals

(6) The maximum hourly limit allowed by 30 TAC 106.262, per pollutant, is 6 lbs/hr per "Figure 1: 30 TAC 106.262(a)". The E value was overridden with 6 lb/hr when the calculated E was higher.

(7) The maximum hourly emission rate allowed by 30 TAC 106.261(a)(3) for chemicals with an limit value (L) greater than 200 mg/m³ is 1 lb/hr.

(8) Based on comparing the calculated air stripper stack sample emission rate in pounds per hour (lb/hr) to the allowable maximum emission limit per chemical based on distance downwind to nearest off-site receptor.

Blower flowrate = 3875 cfm

**Air Analytical Results –
November 5, 2012**

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
 CAS Sample ID: P1204578-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
 Analyst: Wida Ang
 Sample Type: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00916

Date Collected: 11/5/12
 Date Received: 11/7/12
 Date Analyzed: 11/8/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.44 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.28

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	160	ND	93	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	160	ND	32	
74-87-3	Chloromethane	ND	160	ND	78	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	160	ND	23	
75-01-4	xane	ND	160	ND	63	
106-99-0	1,3-Butadiene	ND	160	ND	72	
74-83-9	Bromomethane	ND	160	ND	41	
75-00-3	Chloroethane	ND	160	ND	61	
64-17-5	Ethanol	ND	1,600	ND	850	
75-05-8	Acetonitrile	ND	160	ND	95	
107-02-8	Acrolein	ND	640	ND	280	
67-64-1	Acetone	ND	1,600	ND	670	
75-69-4	Trichlorofluoromethane	ND	160	ND	28	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,600	ND	650	
107-13-1	Acrylonitrile	ND	160	ND	74	
75-35-4	1,1-Dichloroethene	350	160	88	40	
75-09-2	Methylene Chloride	ND	160	ND	46	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	160	ND	51	
76-13-1	Trichlorotrifluoroethane	27,000	160	3,500	21	
75-15-0	Carbon Disulfide	ND	1,600	ND	510	
156-60-5	trans-1,2-Dichloroethene	ND	160	ND	40	
75-34-3	1,1-Dichloroethane	ND	160	ND	40	
1634-04-4	Methyl tert-Butyl Ether	ND	160	ND	44	
108-05-4	Vinyl Acetate	ND	1,600	ND	450	L
78-93-3	2-Butanone (MEK)	ND	1,600	ND	540	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5021-Stripper**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578

CAS Sample ID: P1204578-001

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9

Analyst: Wida Ang

Sample Type: 6.0 L Summa Canister

Test Notes:

Container ID: SC00916

Date Collected: 11/5/12

Date Received: 11/7/12

Date Analyzed: 11/8/12

Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.44 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.28

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	17,000	160	4,400	40	
141-78-6	Ethyl Acetate	ND	320	ND	89	
110-54-3	n-Hexane	ND	160	ND	45	
67-66-3	Chloroform	ND	160	ND	33	
109-99-9	Tetrahydrofuran (THF)	ND	160	ND	54	
107-06-2	1,2-Dichloroethane	170	160	42	40	
71-55-6	1,1,1-Trichloroethane	ND	160	ND	29	
71-43-2	Benzene	ND	160	ND	50	
56-23-5	Carbon Tetrachloride	ND	160	ND	25	
110-82-7	Cyclohexane	ND	320	ND	93	
78-87-5	1,2-Dichloropropane	ND	160	ND	35	
75-27-4	Bromodichloromethane	ND	160	ND	24	
79-01-6	Trichloroethene	32,000	160	5,900	30	
123-91-1	1,4-Dioxane	ND	160	ND	44	
80-62-6	Methyl Methacrylate	ND	320	ND	78	
142-82-5	n-Heptane	ND	160	ND	39	
10061-01-5	cis-1,3-Dichloropropene	ND	160	ND	35	
108-10-1	4-Methyl-2-pentanone	ND	160	ND	39	
10061-02-6	trans-1,3-Dichloropropene	ND	160	ND	35	
79-00-5	1,1,2-Trichloroethane	ND	160	ND	29	
108-88-3	Toluene	ND	160	ND	42	
591-78-6	2-Hexanone	ND	160	ND	39	
124-48-1	Dibromochloromethane	ND	160	ND	19	
106-93-4	1,2-Dibromoethane	ND	160	ND	21	
123-86-4	n-Butyl Acetate	ND	160	ND	34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Stripper
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
 CAS Sample ID: P1204578-001

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
 Analyst: Wida Ang
 Sample Type: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00916

Date Collected: 11/5/12
 Date Received: 11/7/12
 Date Analyzed: 11/8/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.44 Final Pressure (psig): 3.60

Canister Dilution Factor: 1.28

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	160	ND	34	
127-18-4	Tetrachloroethene	ND	160	ND	24	
108-90-7	Chlorobenzene	ND	160	ND	35	
100-41-4	Ethylbenzene	ND	160	ND	37	
179601-23-1	m,p-Xylenes	ND	320	ND	74	
75-25-2	Bromoform	ND	160	ND	15	
100-42-5	Styrene	ND	160	ND	38	
95-47-6	o-Xylene	ND	160	ND	37	
111-84-2	n-Nonane	ND	160	ND	31	
79-34-5	1,1,2,2-Tetrachloroethane	ND	160	ND	23	
98-82-8	Cumene	ND	160	ND	33	
80-56-8	alpha-Pinene	ND	160	ND	29	
103-65-1	n-Propylbenzene	ND	160	ND	33	
622-96-8	4-Ethyltoluene	ND	160	ND	33	
108-67-8	1,3,5-Trimethylbenzene	ND	160	ND	33	
95-63-6	1,2,4-Trimethylbenzene	ND	160	ND	33	
100-44-7	Benzyl Chloride	ND	160	ND	31	
541-73-1	1,3-Dichlorobenzene	ND	160	ND	27	
106-46-7	1,4-Dichlorobenzene	ND	160	ND	27	
95-50-1	1,2-Dichlorobenzene	ND	160	ND	27	
5989-27-5	d-Limonene	ND	160	ND	29	
96-12-8	1,2-Dibromo-3-chloropropane	ND	160	ND	17	L
120-82-1	1,2,4-Trichlorobenzene	ND	160	ND	22	
91-20-3	Naphthalene	ND	160	ND	31	
87-68-3	Hexachlorobutadiene	ND	160	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
 CAS Sample ID: P1204578-002

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
 Analyst: Wida Ang
 Sample Type: 6.0 L Summa Canister
 Test Notes:
 Container ID: SC00773

Date Collected: 11/5/12
 Date Received: 11/7/12
 Date Analyzed: 11/8/12
 Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.54

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	160	ND	94	
75-71-8	Dichlorodifluoromethane (CFC 12)	ND	160	ND	33	
74-87-3	Chloromethane	ND	160	ND	79	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	160	ND	23	
75-01-4	Vinyl Chloride	ND	160	ND	64	
106-99-0	1,3-Butadiene	ND	160	ND	73	
74-83-9	Bromomethane	ND	160	ND	42	
75-00-3	Chloroethane	ND	160	ND	62	
64-17-5	Ethanol	ND	1,600	ND	860	
75-05-8	Acetonitrile	ND	160	ND	97	
107-02-8	Acrolein	ND	650	ND	280	
67-64-1	Acetone	ND	1,600	ND	680	
75-69-4	Trichlorofluoromethane	ND	160	ND	29	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	1,600	ND	660	
107-13-1	Acrylonitrile	ND	160	ND	75	
75-35-4	1,1-Dichloroethene	320	160	80	41	
75-09-2	Methylene Chloride	ND	160	ND	47	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	160	ND	52	
76-13-1	Trichlorotrifluoroethane	26,000	160	3,400	21	
75-15-0	Carbon Disulfide	ND	1,600	ND	520	
156-60-5	trans-1,2-Dichloroethene	ND	160	ND	41	
75-34-3	1,1-Dichloroethane	ND	160	ND	40	
1634-04-4	Methyl tert-Butyl Ether	ND	160	ND	45	
108-05-4	Vinyl Acetate	ND	1,600	ND	460	L
78-93-3	2-Butanone (MEK)	ND	1,600	ND	550	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
CAS Sample ID: P1204578-002

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister
Test Notes:
Container ID: SC00773

Date Collected: 11/5/12
Date Received: 11/7/12
Date Analyzed: 11/8/12
Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.54

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	17,000	160	4,300	41	
141-78-6	Ethyl Acetate	ND	330	ND	90	
110-54-3	n-Hexane	ND	160	ND	46	
67-66-3	Chloroform	ND	160	ND	33	
109-99-9	Tetrahydrofuran (THF)	ND	160	ND	55	
107-06-2	1,2-Dichloroethane	160	160	40	40	
71-55-6	1,1,1-Trichloroethane	ND	160	ND	30	
71-43-2	Benzene	ND	160	ND	51	
56-23-5	Carbon Tetrachloride	ND	160	ND	26	
110-82-7	Cyclohexane	ND	330	ND	94	
78-87-5	1,2-Dichloropropane	ND	160	ND	35	
75-27-4	Bromodichloromethane	ND	160	ND	24	
79-01-6	Trichloroethene	30,000	160	5,700	30	
123-91-1	1,4-Dioxane	ND	160	ND	45	
80-62-6	Methyl Methacrylate	ND	330	ND	79	
142-82-5	n-Heptane	ND	160	ND	40	
10061-01-5	cis-1,3-Dichloropropene	ND	160	ND	36	
108-10-1	4-Methyl-2-pentanone	ND	160	ND	40	
10061-02-6	trans-1,3-Dichloropropene	ND	160	ND	36	
79-00-5	1,1,2-Trichloroethane	ND	160	ND	30	
108-88-3	Toluene	ND	160	ND	43	
591-78-6	2-Hexanone	ND	160	ND	40	
124-48-1	Dibromochloromethane	ND	160	ND	19	
106-93-4	1,2-Dibromoethane	ND	160	ND	21	
123-86-4	n-Butyl Acetate	ND	160	ND	34	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Stripper-DUP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
CAS Sample ID: P1204578-002

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister
Test Notes:
Container ID: SC00773

Date Collected: 11/5/12
Date Received: 11/7/12
Date Analyzed: 11/8/12
Volume(s) Analyzed: 0.0040 Liter(s)

Initial Pressure (psig): -0.66 Final Pressure (psig): 3.54

Canister Dilution Factor: 1.30

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	160	ND	35	
127-18-4	Tetrachloroethene	ND	160	ND	24	
108-90-7	Chlorobenzene	ND	160	ND	35	
100-41-4	Ethylbenzene	ND	160	ND	37	
179601-23-1	m,p-Xylenes	ND	330	ND	75	
75-25-2	Bromoform	ND	160	ND	16	
100-42-5	Styrene	ND	160	ND	38	
95-47-6	o-Xylene	ND	160	ND	37	
111-84-2	n-Nonane	ND	160	ND	31	
79-34-5	1,1,2,2-Tetrachloroethane	ND	160	ND	24	
98-82-8	Cumene	ND	160	ND	33	
80-56-8	alpha-Pinene	ND	160	ND	29	
103-65-1	n-Propylbenzene	ND	160	ND	33	
622-96-8	4-Ethyltoluene	ND	160	ND	33	
108-67-8	1,3,5-Trimethylbenzene	ND	160	ND	33	
95-63-6	1,2,4-Trimethylbenzene	ND	160	ND	33	
100-44-7	Benzyl Chloride	ND	160	ND	31	
541-73-1	1,3-Dichlorobenzene	ND	160	ND	27	
106-46-7	1,4-Dichlorobenzene	ND	160	ND	27	
95-50-1	1,2-Dichlorobenzene	ND	160	ND	27	
5989-27-5	d-Limonene	ND	160	ND	29	
96-12-8	1,2-Dibromo-3-chloropropane	ND	160	ND	17	L
120-82-1	1,2,4-Trichlorobenzene	ND	160	ND	22	
91-20-3	Naphthalene	ND	160	ND	31	
87-68-3	Hexachlorobutadiene	ND	160	ND	15	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5021-GWTP**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578

CAS Sample ID: P1204578-003

Test Code: EPA TO-15

Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9

Analyst: Wida Ang

Sample Type: 6.0 L Summa Canister

Test Notes:

Container ID: AC01181

Date Collected: 11/5/12

Date Received: 11/7/12

Date Analyzed: 11/8/12

Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.96 Final Pressure (psig): 3.49

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.66	ND	0.38	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.4	0.66	0.49	0.13	
74-87-3	Chloromethane	ND	0.66	ND	0.32	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.66	ND	0.094	
75-01-4	Vinyl Chloride	ND	0.66	ND	0.26	
106-99-0	1,3-Butadiene	ND	0.66	ND	0.30	
74-83-9	Bromomethane	ND	0.66	ND	0.17	
75-00-3	Chloroethane	ND	0.66	ND	0.25	
64-17-5	Ethanol	54	6.6	29	3.5	
75-05-8	Acetonitrile	ND	0.66	ND	0.39	
107-02-8	Acrolein	ND	2.6	ND	1.2	
67-64-1	Acetone	7.1	6.6	3.0	2.8	
75-69-4	Trichlorofluoromethane	1.2	0.66	0.22	0.12	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	6.6	ND	2.7	
107-13-1	Acrylonitrile	ND	0.66	ND	0.30	
75-35-4	1,1-Dichloroethene	ND	0.66	ND	0.17	
75-09-2	Methylene Chloride	ND	0.66	ND	0.19	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.66	ND	0.21	
76-13-1	Trichlorotrifluoroethane	17	0.66	2.2	0.086	
75-15-0	Carbon Disulfide	ND	6.6	ND	2.1	
156-60-5	trans-1,2-Dichloroethene	ND	0.66	ND	0.17	
75-34-3	1,1-Dichloroethane	ND	0.66	ND	0.16	
1634-04-4	Methyl tert-Butyl Ether	ND	0.66	ND	0.18	
108-05-4	Vinyl Acetate	ND	6.6	ND	1.9	L
78-93-3	2-Butanone (MEK)	ND	6.6	ND	2.2	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
 CAS Sample ID: P1204578-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
 Analyst: Wida Ang
 Sample Type: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01181

Date Collected: 11/5/12
 Date Received: 11/7/12
 Date Analyzed: 11/8/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.96 Final Pressure (psig): 3.49

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	3.5	0.66	0.88	0.17	
141-78-6	Ethyl Acetate	ND	1.3	ND	0.37	
110-54-3	Ethyl Acetate	0.93	0.66	0.26	0.19	
67-66-3	Chloroform	ND	0.66	ND	0.14	
109-99-9	Tetrahydrofuran (THF)	0.75	0.66	0.25	0.22	
107-06-2	1,2-Dichloroethane	ND	0.66	ND	0.16	
71-55-6	1,1,1-Trichloroethane	ND	0.66	ND	0.12	
71-43-2	Benzene	0.82	0.66	0.26	0.21	
56-23-5	Carbon Tetrachloride	ND	0.66	ND	0.10	
110-82-7	Cyclohexane	ND	1.3	ND	0.38	
78-87-5	1,2-Dichloropropane	ND	0.66	ND	0.14	
75-27-4	Bromodichloromethane	ND	0.66	ND	0.099	
79-01-6	Trichloroethene	9.0	0.66	1.7	0.12	
123-91-1	1,4-Dioxane	ND	0.66	ND	0.18	
80-62-6	Methyl Methacrylate	ND	1.3	ND	0.32	
142-82-5	n-Heptane	ND	0.66	ND	0.16	
10061-01-5	cis-1,3-Dichloropropene	ND	0.66	ND	0.15	
108-10-1	4-Methyl-2-pentanone	ND	0.66	ND	0.16	
10061-02-6	trans-1,3-Dichloropropene	ND	0.66	ND	0.15	
79-00-5	1,1,2-Trichloroethane	ND	0.66	ND	0.12	
108-88-3	Toluene	0.67	0.66	0.18	0.18	
591-78-6	2-Hexanone	ND	0.66	ND	0.16	
124-48-1	Dibromochloromethane	ND	0.66	ND	0.078	
106-93-4	1,2-Dibromoethane	ND	0.66	ND	0.086	
123-86-4	n-Butyl Acetate	ND	0.66	ND	0.14	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-GWTP
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
 CAS Sample ID: P1204578-003

Test Code: EPA TO-15
 Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
 Analyst: Wida Ang
 Sample Type: 6.0 L Summa Canister
 Test Notes:
 Container ID: AC01181

Date Collected: 11/5/12
 Date Received: 11/7/12
 Date Analyzed: 11/8/12
 Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -0.96 Final Pressure (psig): 3.49

Canister Dilution Factor: 1.32

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.66	ND	0.14	
127-18-4	Tetrachloroethene	ND	0.66	ND	0.097	
108-90-7	Chlorobenzene	ND	0.66	ND	0.14	
100-41-4	Ethylbenzene	ND	0.66	ND	0.15	
179601-23-1	m,p-Xylenes	2.5	1.3	0.57	0.30	
75-25-2	Bromoform	ND	0.66	ND	0.064	
100-42-5	Styrene	ND	0.66	ND	0.16	
95-47-6	o-Xylene	0.88	0.66	0.20	0.15	
111-84-2	n-Nonane	ND	0.66	ND	0.13	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.66	ND	0.096	
98-82-8	Cumene	ND	0.66	ND	0.13	
80-56-8	alpha-Pinene	2.3	0.66	0.42	0.12	
103-65-1	n-Propylbenzene	ND	0.66	ND	0.13	
622-96-8	4-Ethyltoluene	ND	0.66	ND	0.13	
108-67-8	1,3,5-Trimethylbenzene	ND	0.66	ND	0.13	
95-63-6	1,2,4-Trimethylbenzene	ND	0.66	ND	0.13	
100-44-7	Benzyl Chloride	ND	0.66	ND	0.13	
541-73-1	1,3-Dichlorobenzene	ND	0.66	ND	0.11	
106-46-7	1,4-Dichlorobenzene	ND	0.66	ND	0.11	
95-50-1	1,2-Dichlorobenzene	ND	0.66	ND	0.11	
5989-27-5	d-Limonene	0.83	0.66	0.15	0.12	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.66	ND	0.068	L
120-82-1	1,2,4-Trichlorobenzene	ND	0.66	ND	0.089	
91-20-3	Naphthalene	ND	0.66	ND	0.13	
87-68-3	Hexachlorobutadiene	ND	0.66	ND	0.062	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 1 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5021-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578

CAS Sample ID: P1204578-004

Test Code: EPA TO-15

Date Collected: 11/6/12

Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9

Date Received: 11/7/12

Analyst: Wida Ang

Date Analyzed: 11/8/12

Sample Type: 6.0 L Summa Canister

Volume(s) Analyzed: 1.00 Liter(s)

Test Notes:

Container ID: AC00714

Initial Pressure (psig): -3.63 Final Pressure (psig): 3.64

Canister Dilution Factor: 1.66

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
115-07-1	Propene	ND	0.83	ND	0.48	
75-71-8	Dichlorodifluoromethane (CFC 12)	2.4	0.83	0.49	0.17	
74-87-3	Chloromethane	ND	0.83	ND	0.40	
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane (CFC 114)	ND	0.83	ND	0.12	
75-01-4	Vinyl Chloride	ND	0.83	ND	0.32	
106-99-0	1,3-Butadiene	ND	0.83	ND	0.38	
74-83-9	Bromomethane	ND	0.83	ND	0.21	
75-00-3	Chloroethane	ND	0.83	ND	0.31	
64-17-5	Ethanol	56	8.3	30	4.4	
75-05-8	Acetonitrile	ND	0.83	ND	0.49	
107-02-8	Acrolein	ND	3.3	ND	1.4	
67-64-1	Acetone	11	8.3	4.7	3.5	
75-69-4	Trichlorofluoromethane	1.2	0.83	0.21	0.15	
67-63-0	2-Propanol (Isopropyl Alcohol)	ND	8.3	ND	3.4	
107-13-1	Acrylonitrile	ND	0.83	ND	0.38	
75-35-4	1,1-Dichloroethene	ND	0.83	ND	0.21	
75-09-2	Methylene Chloride	ND	0.83	ND	0.24	
107-05-1	3-Chloro-1-propene (Allyl Chloride)	ND	0.83	ND	0.27	
76-13-1	Trichlorotrifluoroethane	7.0	0.83	0.91	0.11	
75-15-0	Carbon Disulfide	ND	8.3	ND	2.7	
156-60-5	trans-1,2-Dichloroethene	ND	0.83	ND	0.21	
75-34-3	1,1-Dichloroethane	ND	0.83	ND	0.21	
1634-04-4	Methyl tert-Butyl Ether	ND	0.83	ND	0.23	
108-05-4	Vinyl Acetate	ND	8.3	ND	2.4	L
78-93-3	2-Butanone (MEK)	ND	8.3	ND	2.8	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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RESULTS OF ANALYSIS

Page 2 of 3

Client: Microbac Laboratories**Client Sample ID:** LH18/24-Air-5021-Downwind**Client Project ID:** Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578

CAS Sample ID: P1204578-004

Test Code: EPA TO-15

Date Collected: 11/6/12

Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9

Date Received: 11/7/12

Analyst: Wida Ang

Date Analyzed: 11/8/12

Sample Type: 6.0 L Summa Canister

Volume(s) Analyzed: 1.00 Liter(s)

Test Notes:

Container ID: AC00714

Initial Pressure (psig): -3.63 Final Pressure (psig): 3.64

Canister Dilution Factor: 1.66

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
156-59-2	cis-1,2-Dichloroethene	ND	0.83	ND	0.21	
141-78-6	Ethyl Acetate	ND	1.7	ND	0.46	
110-54-3	n-Hexane	ND	0.83	ND	0.24	
67-66-3	Chloroform	ND	0.83	ND	0.17	
109-99-9	Tetrahydrofuran (THF)	ND	0.83	ND	0.28	
107-06-2	1,2-Dichloroethane	ND	0.83	ND	0.21	
71-55-6	1,1,1-Trichloroethane	ND	0.83	ND	0.15	
71-43-2	Benzene	ND	0.83	ND	0.26	
56-23-5	Carbon Tetrachloride	ND	0.83	ND	0.13	
110-82-7	Cyclohexane	ND	1.7	ND	0.48	
78-87-5	1,2-Dichloropropane	ND	0.83	ND	0.18	
75-27-4	Bromodichloromethane	ND	0.83	ND	0.12	
79-01-6	Trichloroethene	ND	0.83	ND	0.15	
123-91-1	1,4-Dioxane	ND	0.83	ND	0.23	
80-62-6	Methyl Methacrylate	ND	1.7	ND	0.41	
142-82-5	n-Heptane	ND	0.83	ND	0.20	
10061-01-5	cis-1,3-Dichloropropene	ND	0.83	ND	0.18	
108-10-1	4-Methyl-2-pentanone	ND	0.83	ND	0.20	
10061-02-6	trans-1,3-Dichloropropene	ND	0.83	ND	0.18	
79-00-5	1,1,2-Trichloroethane	ND	0.83	ND	0.15	
108-88-3	Toluene	ND	0.83	ND	0.22	
591-78-6	2-Hexanone	ND	0.83	ND	0.20	
124-48-1	Dibromochloromethane	ND	0.83	ND	0.097	
106-93-4	1,2-Dibromoethane	ND	0.83	ND	0.11	
123-86-4	n-Butyl Acetate	ND	0.83	ND	0.17	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: _____ Date: _____

COLUMBIA ANALYTICAL SERVICES, INC.

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Client: Microbac Laboratories
Client Sample ID: LH18/24-Air-5021-Downwind
Client Project ID: Longhorn GWTP / 60256135.0004AA

CAS Project ID: P1204578
CAS Sample ID: P1204578-004

Test Code: EPA TO-15
Instrument ID: Tekmar AUTOCAN/Agilent 5973inert/6890N/MS9
Analyst: Wida Ang
Sample Type: 6.0 L Summa Canister
Test Notes:
Container ID: AC00714

Date Collected: 11/6/12
Date Received: 11/7/12
Date Analyzed: 11/8/12
Volume(s) Analyzed: 1.00 Liter(s)

Initial Pressure (psig): -3.63 Final Pressure (psig): 3.64

Canister Dilution Factor: 1.66

CAS #	Compound	Result µg/m ³	MRL µg/m ³	Result ppbV	MRL ppbV	Data Qualifier
111-65-9	n-Octane	ND	0.83	ND	0.18	
127-18-4	Tetrachloroethene	ND	0.83	ND	0.12	
108-90-7	Chlorobenzene	ND	0.83	ND	0.18	
100-41-4	Ethylbenzene	ND	0.83	ND	0.19	
179601-23-1	m,p-Xylenes	ND	1.7	ND	0.38	
75-25-2	Bromoform	ND	0.83	ND	0.080	
100-42-5	Styrene	ND	0.83	ND	0.20	
95-47-6	o-Xylene	ND	0.83	ND	0.19	
111-84-2	n-Nonane	ND	0.83	ND	0.16	
79-34-5	1,1,2,2-Tetrachloroethane	ND	0.83	ND	0.12	
98-82-8	Cumene	ND	0.83	ND	0.17	
80-56-8	alpha-Pinene	7.0	0.83	1.3	0.15	
103-65-1	n-Propylbenzene	ND	0.83	ND	0.17	
622-96-8	4-Ethyltoluene	ND	0.83	ND	0.17	
108-67-8	1,3,5-Trimethylbenzene	ND	0.83	ND	0.17	
95-63-6	1,2,4-Trimethylbenzene	ND	0.83	ND	0.17	
100-44-7	Benzyl Chloride	ND	0.83	ND	0.16	
541-73-1	1,3-Dichlorobenzene	ND	0.83	ND	0.14	
106-46-7	1,4-Dichlorobenzene	ND	0.83	ND	0.14	
95-50-1	1,2-Dichlorobenzene	ND	0.83	ND	0.14	
5989-27-5	d-Limonene	1.3	0.83	0.23	0.15	
96-12-8	1,2-Dibromo-3-chloropropane	ND	0.83	ND	0.086	L
120-82-1	1,2,4-Trichlorobenzene	ND	0.83	ND	0.11	
91-20-3	Naphthalene	ND	0.83	ND	0.16	
87-68-3	Hexachlorobutadiene	ND	0.83	ND	0.078	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

L = Laboratory control sample recovery outside the specified limits, results may be biased high.

Verified By: _____ Date: _____

**PID Readings and Calibration
Log – November 5, 2012**

<u>Date</u>	<u>Time</u>	<u>Location</u>	<u>Air Flow Rate at Blower</u>	<u>Instrument ID</u>	<u>Person Collecting</u>	<u>PID Reading</u>	<u>Weather Conditions</u>
11/5/2012	8:00	Outside GWTP Office	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Cloudy 56 degrees
11/5/2012	8:05	Downwind	3900 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Cloudy 56 degrees
11/5/2012	13:55	Stripper	3850 ACFM	MiniRAE 3000	Scott Beesinger	Max. 38.6 ppm Steady State 29.8 ppm	Cloudy 72 degrees
11/5/2012	13:50	Outside GWTP Office	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.1 ppm	Cloudy 72 degrees
11/5/2012	14:10	Downwind	3850 ACFM	MiniRAE 3000	Scott Beesinger	0.0 ppm	Cloudy 72 degrees

Longhorn Army Ammunition Plant.

EQUIPMENT CALIBRATION DAILY LOG

Date: <u>11/5/12</u>	Project Name: GWTP Operations.
60256135 .0004aa	Recorded By: <u>SCOTT BESSINKER</u>

PID	Model: Mini-Rae 2000		Bulb: 11.5 meV		Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	Vapor conc. (ppm)	0.0 (ambient air)	NA	NA	Initials: <u>SB</u> <u>TO ZERO</u>	Value:	
Second Point Calibration	Vapor conc. (ppm)	<u>100 ppm</u> (isobutylene)	<u>6/15/2016</u>	<u>64m-248</u> <u>-100-8</u>	Initials: <u>SB</u>	Value:	

COMB. GAS/O ₂ METER	Model:				Morning Calibration	Evening Check	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration	O ₂ (%)				Initials:	Value:	
	% LEL Pentane				Initials:	Value:	

WATER QUALITY METER	Model: YSI Water Quality				Morning Calibration/Check	Evening Check (one point only)	Additional Calib./Check (if necessary)
	Equipment ID #:						
	Parameter	Standard	Exp. Date	Lot #	Time:	Time:	Time:
First Point Calibration (Auto)	pH	4.00			Initials:	Value:	
	Conductivity (mS/cm)	4.49				Value:	
	Turbidity (NTU)	0				Value:	
	DO (mg/L)	8.9-9.1 (ambient air)	NA	NA		Value:	
Second Point Calibration	pH	7.00			Initials:	Value:	
	Conductivity (mS/cm)	53.7				Value:	
	Turbidity (NTU)	100				Value:	
Third Point Calibration	pH	10.00			Value:	Value:	
	Conductivity (mS/cm)	53.7			Value:	Value:	
	Turbidity (NTU)	100			Value:	Value:	

Additional Remarks:



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

November 16, 2012

Ms. Rose Zeiler, Ph.D
Longhorn AAP Site Manager
Department of Army
P.O. Box 220
Ratcliff, AR 72951

RE: Approval of Schedule Extension Request for LHAAP-18/24

Dear Ms. Zeiler:

The U.S. Environmental Protection Agency (EPA) has reviewed your letter dated October 31, 2012 requesting a schedule extension for Longhorn Site 18/24 and hereby approves the schedule included in the letter. Please submit a revised schedule to EPA which includes the dates identified in your letter. If you have any further questions, please contact me by email at mayer.richard@epa.gov or call me at (214) 665-7442.

Sincerely yours,

A handwritten signature in black ink, which appears to read "Rich Mayer", is written over the typed name.

Rich Mayer, P.G.
Longhorn AAP Project Manager

cc: Ms. Fay Duke, TCEQ



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202

November 16, 2012

Ms. Rose Zeiler, Ph.D
Longhorn AAP Site Manager
Department of Army
P.O. Box 220
Ratcliff, AR 72951

RE: Approval of Schedule Extension Request for LHAAP-03

Dear Ms. Zeiler:

The U.S. Environmental Protection Agency (EPA) has reviewed your letter dated October 31, 2012 requesting a schedule extension for Longhorn Site 3 and hereby approves the schedule included in the letter. Please submit a revised schedule to EPA which includes the dates identified in your letter. If you have any further questions, please contact me by email at mayer.richard@epa.gov or call me at (214) 665-7442.

Sincerely yours,

A handwritten signature in black ink, which appears to read "Rich Mayer", is written over a circular stamp.

Rich Mayer, P.G.
Longhorn AAP Project Manager

cc: Ms. Fay Duke, TCEQ

**FINAL
PROPOSED PLAN
FOR LHAAP-04
FORMER PILOT WASTEWATER TREATMENT PLANT
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS**

Prepared For:



U.S. Army Corps of Engineers

Prepared By:



AECOM Technical Services

December 2012

**THE U.S ARMY ANNOUNCES THE PROPOSED PLAN FOR
LONGHORN ARMY AMMUNITION PLANT LHAAP-04
(FORMER PILOT WASTEWATER TREATMENT PLANT)**

1.0 INTRODUCTION

The U.S Army is issuing this Proposed Plan for public comment and participation in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, and Sections 300.430(f)(2) and (f)(3) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300).

The primary purpose of the Proposed Plan is to facilitate public involvement in the remedy selection process for environmentally impacted sites. It provides the public with basic background about Longhorn Army Ammunition Plant (LHAAP) and site LHAAP-04, the rationale for selecting the Preferred Alternative, and summaries of other alternatives considered for protecting human health and the environment from the chemical of concern, perchlorate, detected in groundwater. The Preferred Alternative for the LHAAP-04 site is Alternative 3: In-situ bioremediation and land use controls (LUCs).

The U.S. Army, the lead agency for environmental response actions at LHAAP, is acting in partnership with United States Environmental Protection Agency (USEPA) Region 6 and Texas Commission on Environmental Quality (TCEQ). As the lead agency, the U.S. Army is charged with planning and implementing remedial actions at the LHAAP. Regulatory agencies assist the U.S. Army by providing technical support, project review, project comment, and oversight in accordance with the CERCLA and Superfund Amendments and Reauthorization Act (SARA) and the LHAAP Federal Facilities Agreement (FFA).

DATES TO REMEMBER

PUBLIC COMMENT PERIOD:

January 1, 2013 to January 31, 2013

The U.S. Army invites you to participate during the public comment period by submitting comments on the LHAAP-04 Proposed Plan. The U.S. Army will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: The U.S. Army will hold a public meeting to explain the Proposed Plan for LHAAP-04. Oral and written comments will be accepted at the meeting. The meeting will be held on January 9, 2013 from 6:00 p.m. to 7:00 p.m. at Karnack Community Center.

For more information, see the Administrative Record at the following location:

Marshall Public Library

300 S. Alamo

Marshall, Texas 75670

Business Hours: Monday – Thursday (10.00 a.m. – 8.00 p.m.)

Friday – Saturday (10.00 a.m. – 5.00 p.m.)

For further information on LHAAP-04, please contact:

Dr. Rose M. Zeiler

Site Manager

Longhorn Army Ammunition Plant

P.O. Box 220

Ratcliff, Arkansas 72951

Phone No.: 479-635-0110

E-mail address: rose.zeiler@us.army.mil

Contaminated soil at the LHAAP-04 site was removed in 2009 under CERCLA removal authority, eliminating the principal threat at the site. This Plan addresses groundwater contamination and is the planned final remedy for contamination at the LHAAP-04 site.

The U.S. Army, in consultation with USEPA Region 6 and TCEQ, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. The U.S. Army may modify the Preferred Alternative or select another response action presented in the Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives presented in the Proposed Plan.

This Proposed Plan summarizes LHAAP-04 site information contained in the Administrative Record file for LHAAP-04. Relevant information in this Proposed Plan is presented in the following sections:

- 1.0 Introduction
- 2.0 Site Background
- 3.0 Site Characteristics
- 4.0 Scope and Role
- 5.0 Risk Summary
- 6.0 Remedial Action Objectives
- 6.0 Summary of Remedial Alternatives
- 8.0 Evaluation of Alternatives
- 9.0 Summary of the Preferred Alternative
- 10.0 Community Participation
- 11.0 References

2.0 SITE BACKGROUND

The LHAAP is located in central-east Texas in the northeastern corner of Harrison County (**Figure 1**). The installation occupies approximately 1,400 of its former 8,416 acres between State Highway 43 at Karnack, Texas, and the western shore of Caddo Lake. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport,

Louisiana, approximately 40 miles to the southeast.

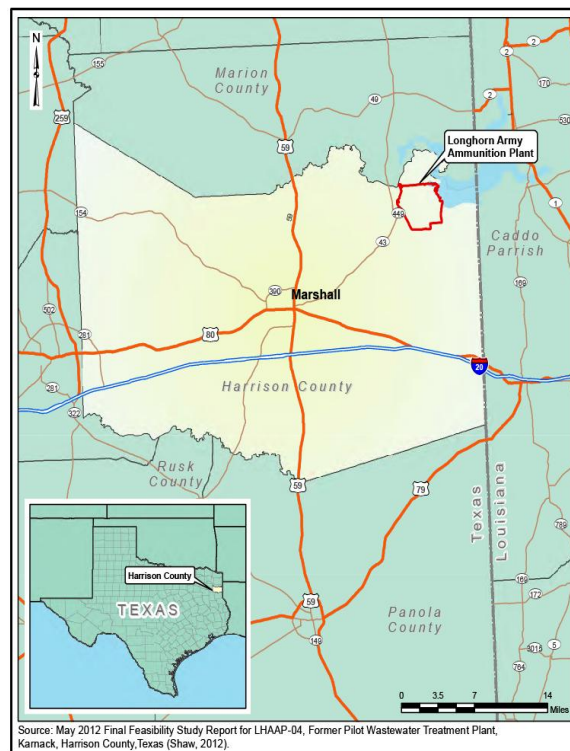


Figure 1 – LHAAP Location

Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border, bounds LHAAP to the north and east.

The U.S. Army has transferred nearly 7,000 acres to the U.S. Fish and Wildlife Service (USFWS) for management as Caddo Lake National Wildlife Refuge. The property transfer process is continuing as response is completed at individual sites. The Longhorn Restoration Advisory Board has been kept informed of investigations and progress at Longhorn and site LHAAP-04 through regular quarterly meetings. Additionally, the Administrative Record is updated at least twice per year and is available at the Marshall Public Library.

Due to releases of chemicals from operations at the facility, LHAAP was placed on the Superfund National Priorities List (NPL) on August 9, 1990. Activities to remediate contamination associated with the listing of LHAAP as a NPL site began in 1990. The U.S. Army, the USEPA, and the Texas Water Commission (currently known as TCEQ) have

entered into a CERCLA Section 120 FFA since that time for remedial activities at LHAAP. The FFA became effective December 30, 1991.

LHAAP operated until 1997 when it was placed on inactive status and classified by the U.S. Army Armament, Munitions, and Chemical Command as excess property.

A site description of LHAAP-04, site characteristics, and a summary of site risks are provided below followed by a discussion of remedial alternatives and the Preferred Alternative recommendation.

LHAAP-04

LHAAP-04, known as Site 04 or the former pilot wastewater treatment plant, is approximately 0.5 acres and is located in the central portion of LHAAP at the northwest corner of 6th and 60th Streets near the former fire station (**Figure 2**). Industrial wastewater treatment operations began at LHAAP-04 in 1984. Industrial wastewater from sumps throughout LHAAP was trucked to the plant for treatment. After the wastewater settled, it was transferred to one of

two storage tanks, and then was pumped through a heat exchanger to an evaporation tower. Solids were shipped offsite for disposal. Sludge from the settling tanks was dewatered and drummed weekly, then burned at Burning Ground No. 3 (LHAAP-18/24) (Plexus, 2005).

The demolition of the former pilot wastewater treatment facility structures, tanks, and piping, and the disposal of associated wastes were completed in the summer of 1997 as part of Resource Conservation and Recovery Act (RCRA) closure of the plant.

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess contamination from past operations and its impact to the soil and/or groundwater (Shaw, 2012). A Remedial Investigation (RI) for the LHAAP-04 was completed in 2002 (Jacobs, 2002). Following RCRA closure of LHAAP-04, soil sampling was conducted and LHAAP-04 was approved for closure according to 30 Texas Administrative Code 335 Subchapter S, Risk Reduction Rule Standard 2 in 1998 with the stipulation that the remaining soil contamination

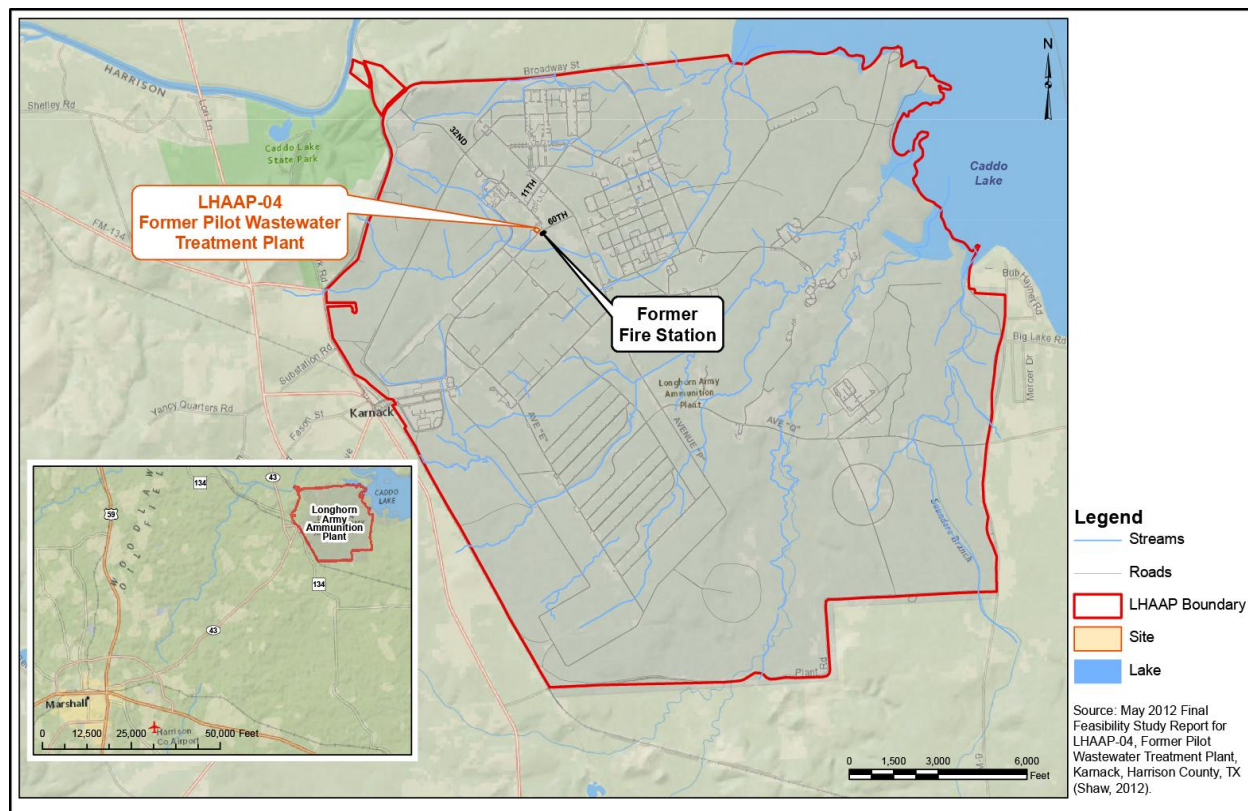


Figure 2 - LHAAP-04 Site Location

be addressed under CERCLA (Shaw, 2009a). Within the perchlorate contaminated soil area at LHAAP-04 there was an isolated area of mercury contamination that was above the soil medium specific concentration (MSC) for industrial use based on inhalation, ingestion, and dermal contact (TCEQ, 2006).

An Engineering Evaluation/Cost Analysis and an Action Memorandum were prepared for the LHAAP-04 site (Shaw, 2009b). The removal of soil contaminated with perchlorate and mercury was conducted in 2009 under CERCLA removal authority eliminating the principal threat at the site. The contaminated soil was excavated in 2009 along the southern edge of the slab, which formerly housed storage tanks for the former pilot wastewater treatment facility. A total of approximately 3,406 cubic yards of contaminated soil was removed and disposed off-site (Shaw, 2011). The perchlorate contaminated soil clean-up was based on the TCEQ MSC for the protection of industrial groundwater standard. Removal of the perchlorate and mercury contaminated soil eliminated the risk of soil migration to groundwater pathway.

Because of the inflow of groundwater into the

excavation, soil confirmation samples from the floor of two confirmation grids (FL09 and FL11) could not be collected to document clean closure of the site. Perchlorate levels were unconfirmed within these grids.

In summary, the industrial wastewater treatment plant was demolished in 1997 and soil contaminated with perchlorate and mercury was removed in 2009. A Feasibility Study (FS) to address groundwater contaminated with perchlorate was completed in 2012 (Shaw, 2012).

3.0 SITE CHARACTERISTICS

The LHAAP-04 site is situated on the outcrop of Wilcox Group which generally consists of a few feet of residually derived soils overlying interbedded silts and clays (Shaw, 2012). Shallow groundwater at LHAAP-04 has been assessed via seven monitoring wells installed near LHAAP-04 to depths of approximately 20 feet below ground surface. Based on the potentiometric surface map for LHAAP -04, the groundwater flow direction in the shallow saturated zone is to the northeast (**Figure 3**).

The former pilot wastewater treatment plant was

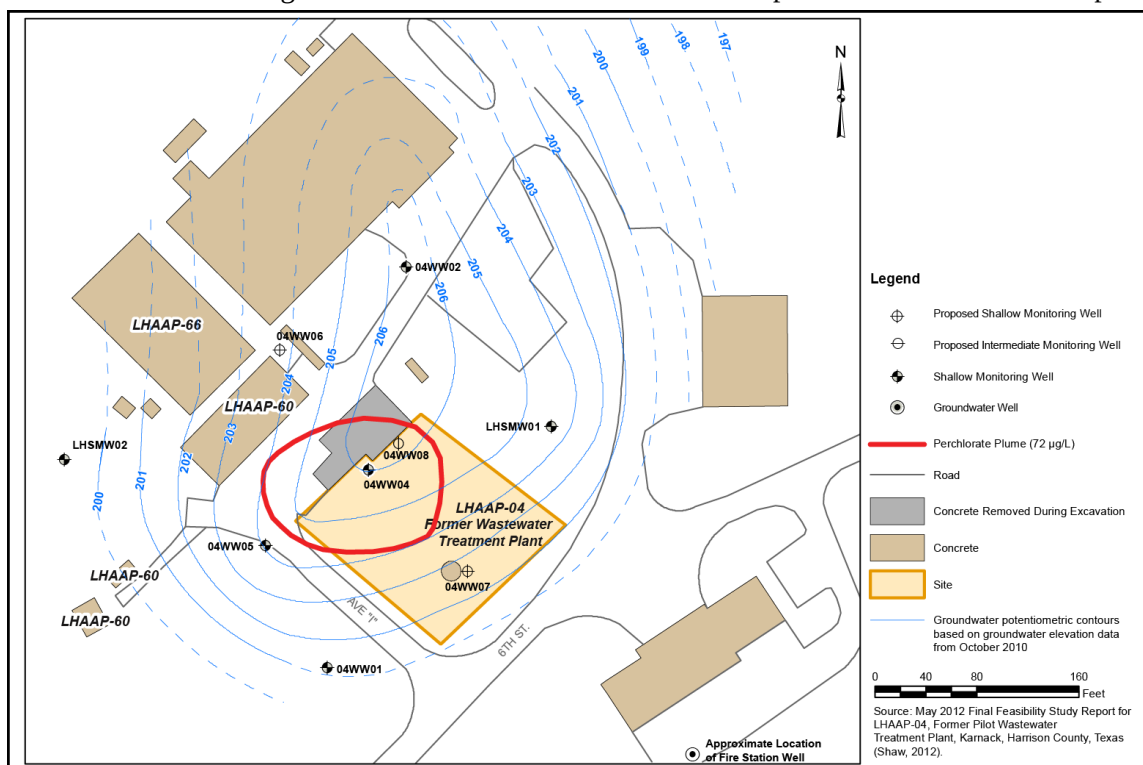


Figure 3 – LHAAP-04 Perchlorate Plume in Groundwater

the most likely source of contaminants that were released into the environment. Perchlorate was likely released into the environment via overflows, spills, and discharges to soil.

The perchlorate impacts in shallow groundwater are limited to an area in the vicinity of well 04WW04, located closest to the former pilot wastewater treatment plant (**Figure 3**). Although contaminated soil was confirmed removed to levels at or below the TCEQ soil MSC for protection of groundwater based on industrial use of 7.2 milligrams per kilogram (mg/kg) in all except two grids (FL09 and FL11), residual perchlorate levels in these two areas are unconfirmed. The well with the highest perchlorate detection is situated at the location of these two grids (Shaw, 2011).

Goose Prairie Creek is located approximately 700 feet to the south of the LHAAP-04 site. It is not expected that the LHAAP-04 site will contribute to surface water perchlorate contamination since the perchlorate contaminated soil has been removed (Shaw, 2012).

4.0 SCOPE AND ROLE OF THE PROPOSED REMEDY

This is the second and final planned Remedial Action for the LHAAP-04 site. The groundwater COC is perchlorate. The Preferred Alternative of completing In-situ Bioremediation with LUCs will reduce the level of perchlorate in groundwater toward the Remedial Action Objectives (RAOs), prevent migration of the plume, and reduce or eliminate exposure to contaminated groundwater. LUCs may be terminated when groundwater COC concentrations are reduced to levels to that allow for unlimited use and unrestricted exposure.

5.0 SUMMARY OF LHAAP-04 SITE RISKS

A Baseline Human Health and Screening Ecological Risk Assessment were performed for LHAAP-04 in 2003 (Jacobs, 2003), and presented the human health risks and hazards to a hypothetical future maintenance worker under an industrial scenario for soil and groundwater

and a screening level ecological risk assessment. Subsequently, a baseline ecological risk assessment was also conducted and concluded that there is no impact to ecological receptors (Shaw, 2007). For the human health risk assessment, soil and groundwater data were used to calculate the aggregate risk values, which were then compared to the USEPA target risk range of 1×10^{-4} to 1×10^{-6} for the excess lifetime cancer risk and a hazard index (HI) of 1. The risks were:

Soil

For the hypothetical future maintenance worker exposure to soil at LHAAP-04, the carcinogenic risk and non-carcinogenic hazard were 1.2×10^{-6} with HI below 1 (0.28).

Groundwater

For the hypothetical future maintenance worker exposure to the groundwater at LHAAP-04 the carcinogenic risk and non-carcinogenic hazard were 4.5×10^{-5} with HI below 1 (0.19).

Since the completion of risk assessments, additional soil and groundwater data has been collected and analyzed. Soil samples collected after the risk assessment contained perchlorate and mercury concentrations that posed unacceptable risk or hazards to human health. These soils with high perchlorate and mercury concentrations were removed and sent to an off-site landfill in 2009 (Shaw, 2011). The remaining soil after completion of the removal activity does not pose unacceptable risk or hazard to human health based on exposure pathway for an industrial worker (Shaw, 2012).

Additional groundwater data collected after the risk assessment indicated that well 04WW04 had perchlorate concentrations exceeding the groundwater MSC for industrial use (GW-Ind) level of 72 micrograms per liter ($\mu\text{g/L}$). The perchlorate concentrations in the groundwater exceed the GW-Ind value, so are presumed to pose an unacceptable risk to human health.

The baseline ecological risk assessment concluded that no unacceptable risk was present in the Industrial Sub-Area which LHAAP-04 is a part of, and therefore, no further action is needed at LHAAP-04 for protection of ecological receptors (Shaw, 2007).

LHAAP-04 is not expected to contribute to surface water contamination since the contaminated soil has been removed (Shaw, 2011). Groundwater modeling also concluded that there was no impact to surface water from groundwater (Shaw, 2007). The modeling report considered a perchlorate concentration in groundwater (78,200 µg/L) more than ten times the highest measured groundwater concentration at LHAAP-04 (5,410 µg/L). The only pathway considered complete for remediation is the future industrial groundwater use and the GW-Ind value for perchlorate (72 µg/L) is the proposed cleanup level for perchlorate in groundwater.

Based on the groundwater risk, the U.S. Army's current judgment is that the Preferred Alternative identified in this Proposed Plan or one of the other active measures considered, is necessary to protect public health, welfare, or the environment from actual or threatened impacts from perchlorate in groundwater.

6.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are established to protect human health and the environment while also meeting Applicable or Relevant and Appropriate Requirements (ARARs). The identification of RAOs must consider the environmental issues at the site and the receptors that are affected. As identified in the conceptual site model (CSM), the primary environmental issue at LHAAP-04 is groundwater that exceeds the GW-Ind value for perchlorate and has the potential to adversely impact human health. Ecological risk is not a concern at LHAAP-04. Based on these considerations, the RAOs for LHAAP-04 are as follows:

- Protect human health by preventing ingestion of groundwater contaminated with perchlorate;
- Return groundwater to its potential beneficial use, wherever practicable, within a reasonable time period given the particular site circumstances;

- Prevent groundwater contaminated with perchlorate from migrating into nearby surface water.

7.0 SUMMARY OF REMEDIAL ALTERNATIVES

LUCs, long-term monitoring (LTM), and Five-Year Reviews are common elements for all the action alternatives. These common elements are described below.

Land Use Controls

LUCs are any restriction or control, arising from the need to protect human health and the environment, that limits the use of and/or exposure to any portion of that property, including water resources.

Proposed LUCs as part of the action alternatives are:

- LUC to restrict land use to non-residential use until it is demonstrated that the COCs in soil and groundwater are at levels that allow for unlimited use and unrestricted exposure.
- LUC prohibiting potable use of groundwater above cleanup levels until it is demonstrated that the COCs are at levels that allow for unlimited use and unrestricted exposure.

Long Term Monitoring

LTM is the monitoring conducted after a remedy is selected and implemented, and is used to evaluate the degree to which the remedial measure achieves its objectives. Alternatives 2 through 5 at the LHAAP-04 site include long-term groundwater monitoring activities. LTM would include monitoring of a select number of groundwater wells to evaluate contaminant migration, ensure that the groundwater COC plume continues to degrade and verify that COC levels do not exceed the cleanup levels.

The LTM would be continued as required to demonstrate effectiveness of the remedy, and compliance with ARARs, until RAOs are achieved.

Five-Year Reviews

Five-Year Reviews are intended to evaluate whether the response action remains protective of human health and the environment, is functioning as designed, and necessary operation and maintenance is being performed. For the LHAAP-04 site, the Five-Year Review would focus on effectiveness of the remedial action and achievement of specific performance levels established in the Record of Decision (ROD). Five-Year Reviews would include document reviews, review of cleanup standards, inspections, technology reviews, and preparation of a report summarizing the findings and recommendations. Five-Year Reviews would be performed until site conditions allow for unlimited use and unrestricted exposure.

The unique elements of each remedial alternative are identified below.

Alternative 1 – No Action

The No Action Alternative is required by CERCLA and serves as a baseline for comparison to other alternatives. Under this alternative, contaminated groundwater would remain in place without implementation of any contaminant removal, treatment, containment, or monitoring. The No Action Alternative would not eliminate risks or achieve RAOs. The No Action alternative is required to be listed for baseline comparison purposes, but will not be considered as a realistic alternative.

There are no costs associated with the No Action alternative.

Estimated Total Present Worth (PW) Cost: \$0

Alternative 2 – Monitored Natural Attenuation (MNA), LUCs

This Alternative relies on monitoring the natural attenuation of contaminant concentrations in groundwater under an MNA program, combined with maintenance of LUCs as described in the common elements above. Groundwater monitoring would be performed to monitor whether the perchlorate concentrations in groundwater remain stable and continue to degrade via naturally occurring processes. The estimated cleanup time is

12 years and is based on a half life of 1.9 years using limited data from other LHAAP monitoring wells with similar perchlorate concentrations. Actual cleanup time could be higher or lower than this estimate.

The estimated PW costs for this Alternative were based on LTM of five wells for 15 years and use a 30-year evaluation period.

Estimated Total Direct Capital Cost: \$121,000

Estimated Total Operation and Maintenance (O&M) Cost: \$444,000

Estimated Total PW Cost: \$565,000

Alternative 3 – In-situ Bioremediation, LUCs

This is the Preferred Alternative and is designed to reduce contamination in the area of highest perchlorate concentrations in the groundwater plume. It relies on In-situ Bioremediation using bioaugmentation, to reduce concentrations to acceptable values in a shorter time than MNA. LUCs would be maintained as described in the common elements above.

ISB is a technology that encourages growth and reproduction of indigenous microorganisms to enhance biodegradation of organic constituents such as perchlorate in the saturated groundwater zone. A substrate will be injected into the target treatment area via injection points/wells. Bioaugmentation will be performed if necessary to introduce the appropriate kind of microbial culture into the subsurface environment. A groundwater monitoring program includes the installation of additional groundwater monitoring wells in addition to sampling of the well located at the Fire Station. Groundwater sampling of these wells will be implemented as necessary to monitor the effectiveness and progress of in-situ bioremediation in reducing perchlorate concentrations in groundwater.

The estimated PW costs for this Alternative were based on LTM for 8 years and use a 30-year evaluation period.

Estimated Total Direct Capital Cost: \$233,000

Estimated Total O&M Cost: \$405,000

Estimated Total PW Cost: \$638,000

Alternative 4 – Extraction and Treatment, LUCs

This alternative is designed to reduce perchlorate contamination in the area of highest concentrations in the groundwater plume via extraction (using extraction wells) and treatment of groundwater to achieve the cleanup level. Plume areas outside the extraction system are also expected to attain the cleanup level in a shorter duration after the highest perchlorate concentrations are removed. It is estimated that the perchlorate cleanup level in the groundwater would be achieved in approximately 15 months of treatment, provided extraction and treatment results are favorable. A trailer mounted treatment system will be used to remove perchlorate from the extracted groundwater using ion exchange resin technology. The treated effluent would be re-injected via four temporary wells back into the shallow zone at the site.

LUCs would be maintained as described in the common elements above.

It is estimated that the extraction and treatment of perchlorate contaminated groundwater will be performed for a period of 15 months and LTM would continue for 5 years and include costs associated with maintenance of LUCs for that period.

Estimated Total Direct Capital Cost: \$312,000

Estimated Total O&M Cost: \$418,000

Estimated Total PW Cost: \$730,000

Alternative 5 – Interceptor Collection Trenches, Extraction and Treatment, MNA, LUCs

This alternative is designed to reduce perchlorate contamination in the area of highest concentrations in the groundwater plume via extraction using interceptor collection trenches followed by treatment of the extracted groundwater to achieve the perchlorate cleanup level. The extracted water will be treated using an ion exchange resin technology and the treated groundwater will be re-injected into the shallow zone at the site. Because the groundwater in the area with highest perchlorate concentration is removed and treated, perchlorate in portion of the plume located outside the influence of the

extraction system is also expected to naturally attain the clean up level in a shorter duration (Shaw, 2012).

LUCs will be maintained as described in the common elements above.

The extraction and treatment portion of this alternative is estimated to take approximately six months. The LTM would continue for 5 years and include costs associated with maintenance of LUCs for that period.

Estimated Total Direct Capital Cost: \$389,000

Estimated Total O&M Cost: \$394,000

Estimated Total PW Cost: \$783,000

8.0 EVALUATION OF ALTERNATIVES

Nine criteria identified in the NCP, 300.430(f)(1)(i), are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. The evaluation includes threshold criteria (requirements that must be met) and balancing criteria (used to weigh trade-offs). The modifying criteria (anticipated agency and public acceptance) will be evaluated based on comments received on this Proposed Plan.

1. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the primary objective of a Remedial Action. The No Action Alternative does not achieve the RAOs and provides no reduction in risks to the human health or the environment. The other four alternatives achieve the RAOs. Alternative 2 relies most heavily on LUCs combined with MNA and does not provide contaminant removal or treatment in groundwater other than from natural processes. Alternatives 3, 4, and 5 also provide overall protection of human health and the environment and the ARARs for these alternatives are expected to be achieved in a shorter time frame due to active treatment components.

2. Compliance with ARARs

ARARs are environmental laws that are identified on a site-specific basis. Alternative 1 does not comply with chemical-specific ARARs as no remedial action would be implemented. The action-specific ARAR does not apply to Alternative 1 since no remedial activities would be conducted. Alternatives 2, 3, 4, and 5 are expected to comply with chemical-specific ARARs and action-specific ARARs. There are no location-specific ARARs.

3. Long-Term Effectiveness and Permanence

Alternative 1 would be least effective and permanent because no contaminant removal or treatment would take place and no active measures would be implemented to control exposure risks posed by contaminated site. Alternative 2 offers long-term effectiveness through implementation of MNA with LUCs, which would minimize the hazard posed by contaminated groundwater, albeit in a longer time than Alternatives 3, 4 and 5. Alternatives 3, 4, and 5 will provide long-term effectiveness and permanence and in addition, they are designed to reduce groundwater contaminant concentrations and achieve clean up levels in a shorter duration. LUCs associated with Alternatives 2, 3, 4, and 5 will be in place until levels that allow for unlimited use and unrestricted exposure are achieved.

4. Reduction in Toxicity, Mobility, or Volume Through Treatment

Alternative 1 does not include a remedy, so there is no documentation of reduction in toxicity, mobility or volume. Alternative 2 does not employ active treatment and will rely on naturally occurring processes to achieve reduction in toxicity, mobility, and volume as contaminants are reduced to concentrations below risk criteria. Alternative 3 provides a reduction in toxicity, mobility, and volume via bioremediation of perchlorate. Alternatives 4 and 5 will reduce the volume of contamination via extraction of impacted groundwater and will provide reduction in toxicity and mobility via treatment of impacted groundwater. The degree

of reduction in toxicity and mobility will depend upon the treatment processes.

5. Short-Term Effectiveness

Short-term effectiveness is used to evaluate the length of time needed to implement an alternative for a risk to on-site workers and the nearby community during remedial action implementation.

Alternative 1 does not involve any remedial actions, so no short-term risk to workers, the community or the environment would exist.

The implementation of Alternative 3, 4, or 5 would require more time than alternative 2 due to requirement for pre-design activities. LUCs associated with Alternatives 2, 3, 4, and 5 will be in place until levels that allow for unlimited use and unrestricted exposure are achieved.

Alternatives 4 and 5 are also operation and maintenance (O&M) intensive, with greater potential for short-term physical safety risks to on-site workers, and refuge visitors.

6. Implementability

Under alternative 1, no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation. Alternatives 2, 3, 4, and 5 can be easily implemented from a technical standpoint as all equipment, materials, and services required are readily available. Alternative 3 would be slightly more difficult to implement than Alternative 2 from a technical standpoint due to the specialized expertise required to design and construct the In-situ Bioremediation treatment elements. Administratively, all of the alternatives are implementable.

7. Cost

Cost Estimates are used in the CERCLA FS process to eliminate those remedial alternatives that are significantly more expensive than competing alternatives without offering commensurate increases in performance or overall protection of human health or the environment. For each alternative addressed in the comparative analysis, a total PW cost was developed including both capital and long-term

O&M costs. These costs are estimates with an intended accuracy range of +50% to -30% of the estimates. Of the action alternatives, Alternative 2 is the least expensive, followed by Alternative 3, Alternative 4, and Alternative 5, which is the most expensive Alternative.

Alternative 1 Total PW Cost:	\$0
Alternative 2 Total PW Cost:	\$565,000
Alternative 3 (Preferred Alternative)	
Total PW Cost:	\$638,000
Alternative 4 Total PW Cost:	\$730,000
Alternative 5 Total PW Cost:	\$783,000

8. State/Support Agency Acceptance

The TCEQ and the EPA concur with the Preferred Alternative.

9. Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated based on comments received during the public comment period for this Proposed Plan. A Responsiveness Summary will be included in the LHAAP-04 Decision Document (DD).

9.0 SUMMARY OF THE PREFERRED ALTERNATIVE

Based on the evaluation of alternatives, Alternative 3 (In-situ Bioremediation, LUCs) is the Preferred Alternative for the LHAAP-04 because it:

- Is protective of human health and the environment;
- Complies with ARARs;
- Is expected to achieve RAOs;
- Has been shown to be both efficient and effective at other sites with similar contamination;
- Is easy to implement with no adverse short-term impacts;
- Is more cost-effective than Alternatives 4 and 5.

The Preferred Alternative involves In-situ Bioremediation to reduce perchlorate concentrations in groundwater to achieve the

cleanup level, and maintenance of LUCs until it is demonstrated that the COCs are at levels that allow for unlimited use and unrestricted exposure. Groundwater in the hot spot area in the vicinity of monitor well 04WW04 will be targeted by In-situ Bioremediation. Additional site investigation is proposed to better define the area of treatment, and delineate perchlorate extent and obtain geochemistry information. In-situ Bioremediation would be performed in the target treatment area using a substrate which would be injected via direct push technology injection points.

Introduction of the appropriate microbial culture via bioaugmentation will be performed to assist in In-situ Bioremediation. It is anticipated that the substrate would be injected in the first year, and that the injection would occur in the shallow zone, at no deeper than 25 feet bgs. Performance monitoring will be performed to monitor the effectiveness of this Preferred Alternative. Additional applications may be needed based on in situ effectiveness of the In-situ Bioremediation technology. Performance monitoring would be performed on a quarterly basis for a period of two years and will include analysis of perchlorate and other geochemical parameters. LTM would begin in year 3 after treatment and would be conducted semiannually for 3 years (through Year 5), then annually for years 6 through 8.

The U.S. Army will implement LUCs under this alternative through the Remedial Design.

The Preferred Alternative can change in response to public comments or new information.

Based on information currently available, the U.S. Army believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives with respect to the balancing and modifying criteria. The U.S. Army expects the Preferred Alternative to satisfy the following requirements of CERCLA Section 121(b):

- be protective of human health and the environment;
- comply with ARARs; and
- be cost effective.

10.0 COMMUNITY PARTICIPATION

The U.S. Army, USEPA, and TCEQ provide information regarding LHAAP-04 through public meetings and the Administrative Record file for the facility. The public is encouraged to gain a more comprehensive understanding of the sites.

The public comment period for this Proposed Plan offers the public an opportunity to provide input to the LHAAP-04 remedial action planning process. The Proposed Plan is available in the Administrative Record (see “Dates to Remember” on page 1 of this Proposed Plan for location). The public comment period will begin on January 1, 2013 and end on January 31, 2013.

After the public has had an opportunity to review this Proposed Plan during the public comment period and the U.S. Army reviews the public comments received on it, the U.S. Army will publish the selected remedy for the LHAAP-04, the basis for its selection, the associated RAOs, and any contingency planning in a DD. The U.S. Army will also incorporate a Responsiveness Summary addressing public comments in the DD.

11.0 REFERENCES

Jacobs, 2002, *Remedial Investigation Report Addendum for the Group 4 Sites, Remedial Investigation Report, Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, Tennessee*, February.

Jacobs, 2003, *Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 4 Sites (Sites 04, 08, 35A, 35B, 35C, 46, 47, 48, 50, 60, 67, Goose Prairie Creek, Saunders Branch, Central Creek, and Caddo Lake), Longhorn Army Ammunition Plant, Karnack, Texas, Final, Oak Ridge, Tennessee*, June.

Plexus, 2005, *Environmental Site Assessment, Phase I and II Report, Final, Production Areas, Longhorn Army Ammunition Plant, Karnack, Texas*, February.

Shaw, 2007, *Final Modeling Report, Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment, Revision 1, Longhorn Army Ammunition Plant, Karnack, Texas*, February.

Shaw, 2009a, *Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Karnack, Harrison County, Texas*, July.

Shaw, 2009b, *Final Engineering Evaluation/Cost Analysis, LHAAP-04, Former Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Texas*, March.

Shaw, 2011, *Final Completion Report Non-Time-Critical Removal Action, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas*, August.

Shaw, 2012, *Final Feasibility Study Report for LHAAP-04, Former Pilot Wastewater Treatment Plant, Karnack, Harrison County, Texas*, May.

Texas Commission on Environmental Quality (TCEQ), 2006, *Updated Examples of Standard No. 2, Appendix II, Medium-Specific Concentrations*, March 31.

GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below:

Administrative Record File: A file which is maintained and contains all information used to make a decision on the selection of a response action under CERCLA.

Applicable or Relevant and Appropriate Requirements (ARARs): The federal and state environmental laws and regulations that must be complied with when undertaking a selected remedy. These requirements may vary among sites and alternatives.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): A law that establishes a program to identify hazardous waste sites and procedures for cleaning up sites to be protective of human health and the environment, and evaluate damages to natural resources.

Conceptual Site Models (CSMs): a description of a site and its environment that is based on existing knowledge and is updated regularly

Decision Document (DD): A public document that identifies the selected remedy, the final remedial action objectives (RAOs), measures to achieve RAOs, the basis for the decision, remedial action performance expectations, and metrics to assess remedial progress. The DD is based on the information and technical analysis generated during the remedial investigation/feasibility study, consideration of ARARs, and consideration of public comments. All information used to make a final remedy decision must be documented in the site Administrative Record.

Feasibility Study (FS): An investigation stage in the CERCLA clean-up process to identify the alternatives available to address contamination at a site, including an analysis of cost and how each alternative will protect human health and the environment

Five-year Review: A process that evaluates the protectiveness of the remedy and determines whether conditions remain protective of human health and the environment. CERCLA Section 121(c) and the National Contingency Plan at 40 CFR Section 300.430(f)(4)(ii) require that remedial actions that result in hazardous substances, pollutants, or contaminants remaining at a site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment.

National Oil and Hazardous Substances Pollution Contingency Plan (NCP): Also referred to as the National Contingency Plan, it is a plan required by CERCLA and codified at 40 CFR Section 300 that provides a framework for responding to releases or threats of release of hazardous substances and oil discharges.

Present Worth (PW) Analysis: A method to evaluate expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared. When calculating present worth costs for Superfund sites, capital as well as operation & maintenance costs are included.

Proposed Plan: A public participation requirement of CERCLA Section 117 in which the lead federal agency summarizes the preferred cleanup strategy, the rationale for the preference, the alternatives evaluated in the remedial investigation/feasibility study, and any ARAR waivers proposed for site cleanup. The Proposed Plan is issued to the public to solicit public review and comment on all alternatives under consideration.

Public Comment Period: A prescribed period during which the public may comment on the Proposed Plan.

Remedial Action: The means selected to achieve RAOs; also, the construction or implementation phase that follows the remedial design of the selected cleanup alternative at an NPL site.

Remedial Action Objective (RAO): The goals established for a remedy that ensure protection of human health and the environment.

Remedial Investigation (RI): An investigation stage in the CERCLA clean-up process in which the nature and extent of contamination (types of chemicals and how far they have travelled vertically and horizontally) is determined

Resource Conservation and Recovery Act (RCRA): The Resource Conservation and Recovery Act (RCRA), enacted in 1976, is the principal Federal law in the United States governing the disposal of solid waste and hazardous waste

Risk Assessment: An Analysis of the potential adverse health effects (current and future) caused by hazardous substances. The assessment contributes to decisions regarding appropriate response alternatives.

ACRONYMS

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
DD	Decision Document
FFA	Federal Facilities Agreement
FS	Feasibility Study
GW-Ind	Groundwater Medium Specific Concentration for Industrial Use
HI	Hazard Index
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Control
LTM	Long-term Monitoring
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation
MSC	medium specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
PW	present worth
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
TCEQ	Texas Commission on Environmental Quality
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

Agenda

DATE: December 11, 2012
TIME: 10:00 a.m.
PLACE: **Teleconference** – Call 866-203-6896, 1759304791 courtesy of AECOM

Welcome

RMZ

Action Items

AECOM

- Share a groundwater quality meter SOP with the group in advance of December 2012 sampling event. **Completed**
- Provide LHAAP-04 Proposed Plan public notice and any meeting materials to EPA and TCEQ for review after Army comments are incorporated. **Completed**
- Email the RAB to determine whether there is a preference to have the LHAAP-47 PP public meeting and the RAB meeting on separate nights during the same week, separate nights during separate weeks, or on the same night. **Interim discussion held with RAB members identified Jan 8 and 9 for RAB and Public Meeting, Completed**
- Provide Ms. Duke with tracking numbers for TCEQ hard copies as she has not received them. **Completed**
- Update PMP table with respect to submittals of DRAFTS – add one hard copy each to USFWS, EPA and TCEQ, with a hard copy of electronic transmittal included. **A revised table has been developed and will be added to the upcoming PMP update, Completed**
- Add Mr. Torcoletti and Mr. Becher to the distribution for electronic documents, along with ensuring Mr. Bruckwicki is included on the distribution. **Completed**
- Send surface water sampling results to RAB or be prepared to present to the RAB during the next meeting.
- Update the master sampling schedule to add LHAAP-12 to be done late in the first quarter to try to capture seasonal water level changes.
- Provide information to EPA on which wells were bailed vs. pumped for the September LHAAP-18/24 monitoring event. **Completed**
- Compile and submit GWTP volatiles emission data for review by the PBR group.
- Upload draft documents to SharePoint, and maintain that site as a repository for manager reference.

Army

- Arrange for Ms. Coats, EPA to receive a password for the CRP/CIP website. **Completed**
- Army will check the LHAAP database for 1,1,1-TCA and 1,4-dioxane sampling results in both groundwater and soils to determine whether it has been evaluated. **Completed**

EPA

- Mr. Becher will provide the list of documents developed as referenced in various reports, but not found in the AR.
- Provide copy of USEPA 2007 Longhorn well inventory.

- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA.
- Determine what documents should be in the AR as part of the update supporting LHAAP-18/24 work.

TCEQ

- Determine what documents should be in the AR as part of the update supporting LHAAP-18/24 work.
- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA

AEC

- None

Defense Environmental Restoration Program (DERP) PBR Update

AECOM

- Upcoming document submissions to regulators (see Document and Issue Tracking table)
- Upcoming field work
- Monthly data
- Quarterly reports
- Groundwater Treatment Plant
 - Air Monitoring
 - INF Pond Topsoil and erosion control status
 - Repairs and replacements
 - GWTP Longer-Term Plan

Other DERA Program Update

Army

- Status of Supplemental BERA
- Decision Document for multiple sites
- Five Year Review Report Update
- Sitewide LUC Management Plan – annual update

MMRP Update

Army

- Update

Other Environmental Restoration

Army

- CRP/CIP Update
- Site 19 Decision Document update

Programmatic Issues

RMZ/RM/FD

- Status of Dispute

USFWS Update

RMZ/PB

- Environmental Restoration Issues with Transfer Schedule Impact
- USFWS Comments on Documents

Schedule Next Managers' Meeting

Adjourn

ACRONYM LIST

1,1,1-TCA	1,1,1-Trichloroethane
AEC	United States Army Environmental Command
AR	Administrative Record
BERA	Baseline Environmental Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRP/CIP	Community Relations Plan / Community Involvement Plan
DERA	Defense Environmental Restoration Act
DERP	Defense Environmental Restoration Program
EE/CA	Engineering Evaluation / Cost Analysis
EPA	United States Environmental Protection Agency
FD	Fay Duke
GWTP	Ground Water Treatment Plant
INF	Intermediate-Range Nuclear Forces
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Controls
MMRP	Military Munitions Response Program
PB	Paul Bruckwicki
PBR	Permit By Rule
PMP	Project Management Plan
RAB	Restoration Advisory Board
RM	Rich Mayer
RMZ	Rose M. Zeiler
RTC	Response to Comments
SOP	Standard Operating Procedure
TCEQ	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

LONGHORN ARMY AMMUNITION PLANT
Karnack, Texas

MONTHLY MANAGERS' MEETING

Minutes

DATE: December 11, 2012
TIME: 10:00 a.m.
PLACE: **Teleconference** – Call 866-203-6896, 1759304791 courtesy of AECOM

Welcome

RMZ

Attendees:

USEPA: Rich Mayer, Kent Becher (USGS)
TCEQ: Fay Duke, April Palmie
USACE: John Lambert, Wendy Lanier, Aaron Williams
AEC: Marilyn Plitnik, Robin Paul
AECOM: Dave Wacker, Gretchen McDonnell

Action Items

AECOM

- Share a groundwater quality meter SOP with the group in advance of December 2012 sampling event. **Completed**
- Provide LHAAP-04 Proposed Plan public notice and any meeting materials to EPA and TCEQ for review after Army comments are incorporated. **Completed**
- Email the RAB to determine whether there is a preference to have the LHAAP-47 PP public meeting and the RAB meeting on separate nights during the same week, separate nights during separate weeks, or on the same night. **Interim discussion held with RAB members identified Jan 8 and 9 for RAB and Public Meeting, Completed**
- Provide Ms. Duke with tracking numbers for TCEQ hard copies as she has not received them. **Completed**
- Update PMP table with respect to submittals of DRAFTS – add one hard copy each to USFWS, EPA and TCEQ, with a hard copy of electronic transmittal included. **A revised table has been developed and will be added to the upcoming PMP update, Completed**
- Add Mr. Torcoletti and Mr. Becher to the distribution for electronic documents, along with ensuring Mr. Bruckwicki is included on the distribution. **Completed**
- Send surface water sampling results to RAB or be prepared to present to the RAB during the next meeting. **Completed.** AECOM will be prepared to present data not previously presented at the next RAB. TCEQ reminded the group that all data must be reviewed by regulators before it goes to the RAB.
- Update the master sampling schedule to add LHAAP-12 to be done late in the first quarter to try to capture seasonal water level changes. **In progress.**
- Provide information to EPA on which wells were bailed vs. pumped for the September LHAAP-18/24 monitoring event. **Completed**
- Compile and submit GWTP volatiles emission data for review by the Air Quality permit-by-rule group. **In Progress**
- Upload draft documents to SharePoint, and maintain that site as a repository for manager reference. **In Progress**
- **Add April Palmie, TCEQ to all distribution lists that Fay Duke is on.**
- **Give April Palmie, TCEQ to SharePoint access.**

- Provide RAB Meeting minutes for the 08 January meeting to the MMM group before the meeting for input.

Army

- Arrange for Ms. Coats, EPA to receive a password for the CRP/CIP website. **Completed**
- Army will check the LHAAP database for 1,1,1-TCA and 1,4-dioxane sampling results in both groundwater and soils to determine whether it has been evaluated. **Completed**
- Army will prepare an email outlining the categories of documents within the MFRS and providing a recommendation on whether they should be added to the AR and why. **Completed**

EPA

- Mr. Becher will provide the list of documents developed as referenced in various reports, but not found in the AR. **In Progress**
- Provide copy of USEPA 2007 Longhorn well inventory. **In Progress**
- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA. **Completed**
- Determine what documents from the recent Army MFRs should be in the AR as part of the update supporting LHAAP-18/24 work. **In Progress, waiting on advisory email from Army.**

TCEQ

- Determine what documents from the recent Army MFRs should be in the AR as part of the update supporting LHAAP-18/24 work. **In Progress, waiting on advisory email from Army.**
- Provide comment/concurrence for the RTCs for the revised LHAAP-03 EE/CA. **In Progress, TCEQ will concur with USEPA Comments and provide response today.**

AEC

- None

Defense Environmental Restoration Program (DERP) PBR Update

AECOM

- Upcoming document submissions to regulators (see Document and Issue Tracking table)

-Item 1 LHAAP-04 Proposed Plan. Public meeting date changed to 09 January based on comments from the RAB. PP and public notice have been modified to reflect the meeting date change and public notice will be republished with the new meeting date.

-Item 2 LHAAP-47 Proposed Plan. Agency RTCs are with the Army for review and agencies will receive for RTC review in the next few days. The current thought is to hold the LHAAP-47 PP public meeting on 09 January, immediately after the LHAAP-04 PP public meeting.

-Item 3 LHAAP-18/24 PSI WP and CSM – AECOM is waiting on TCEQ comments on the PSI WP. EPA comments were received and AECOM will submit responses to EPA comments for Army review soon. TCEQ will submit an extension request letter to cover the delay in their comments.

-Items 4 and 5 LHAAP-46 RAWP and LHAAP-67 RAWP – EPA comments received. TCEQ stated that they will provide comments, primarily related to how some Shaw DPT

data is planned for use. AECOM stated that the DPT data was used qualitatively to assist in placing new wells and will address the comment in the RTC.

-Item 6 LHAAP-03 RI/FS – AECOM sending draft document to Army for review today. The document is planned for submittal to the agencies for comment before the end of the month.

-Item 7 – GWTP O&M/Air Monitoring - Air monitoring continues. All pumps are now operating at LHAAP-16 so more water being treated from that site. Replaced 7 pumps at LHAAP-18/24 and performed other repair work there to improve operation of that system.

Required INF Pond repairs were evaluated with the decision being to upgrade the entire margin of the pond instead of just patchwork on current areas of erosion. The plan is to regrade the clay on the sides and top of the slope, add topsoil and hydroseed. This work is planned to occur in December.

GWTP yesterday lost power due to tree damage to electric pole at northeast edge of LHAAP-29 (18th and Avenue D). The pole and cross-arms were replaced as well as a cross-arm on the adjacent pole. Stringing new wire today, so power should be restored by 1PM today. Generators have been used to keep certain GWTP components warm and circulate the FBR while power was out.

The GWTP groundwater monitoring report will be in AECOM final review this week, then to Army, and finally to agencies.

-Item 8 – 5 Year Review – AECOM is developing the report draft and will be completing site visits the week of 17 December. EPA will contact Ms. Zeiler regarding a possible showing of an EPA video about 5-year reviews at the RAB meeting.

-Items 9 thru 12 – Placeholders for AECOM items in the works. No major comments on these.

Item 13 – RAB and MMM - RAB meeting now scheduled for the evening of 08 January. Meeting minutes will be provided to group before the meeting for input. Next MMM scheduled for 07 January at 1000, by teleconference. AECOM will send an invitation.

Item 14 – CIP - Army received EPAs comments. TCEQ stated they will not comment and will provide Army with a “no comment” statement. Ms. Paul needs to clarify one item with Ms. Zeiler and then the draft CIP should be ready to go back to EPA for review.

Items 15 – BERA Data Gap Memo – Mr. Williams stated that comments on surface water and sediments were received, but inquired whether any comments would be provided on soil. Mr. Mayer will check on the status of EPA comments for this document.

Items 16-18 – Nothing additional on these items.

- Upcoming field work
 - Compliance sampling for LHAAP-12, LHAAP-16 and surface water were completed in December.
 - AECOM 5-Year Review site visits will take place the week of 17 December 2012.

- Joint Army/Regulator/AECOM 5-Year Review site inspections will be conducted 08-09 January 2013. Plan is to meet at 2PM on 08 January at Army trailer and begin by completing the site visits for the full 5-Year Review sites (18/24, 12, 16, 49 and Pistol Range). On 09 January, we would meet in the morning to complete the full 5-Year Review sites and conduct drive-bys for the remainder of the sites.
- Monthly data – Additional data attached to the minutes. Data collected by AECOM to date includes compliance sampling at LHAAP-18/24 and perimeter wells, compliance sampling for LHAAP-12 and LHAAP-16, and GWTP water and air monitoring sampling.
- Quarterly reports
- Groundwater Treatment Plant – See discussion under Item 7 of Document and Issue Tracking document.
 - Air Monitoring
 - INF Pond Topsoil and erosion control status
 - Repairs and replacements
 - GWTP Longer-Term Plan

Other DERA Program Update

Army

- Status of Supplemental BERA
- Decision Document for multiple sites – In internal Army review
- Five-Year Review Report Update – field work planned for week of 17 December ; drafting of document is on-going
- Sitewide LUC Management Plan – annual update – In internal Army review

MMRP Update

Army

- Update – Cannot move forward until resolution of the final ROD. EPA will provide updates as developments occur.

Other Environmental Restoration

Army

- CRP/CIP Update – Army responses to EPA comments will be returned to EPA soon.
- Site 19 Decision Document update - In Army internal review.

Programmatic Issues

RMZ/RM/FD

- Status of Dispute – No updates

USFWS Update

RMZ/PB

- Environmental Restoration Issues with Transfer Schedule Impact – No USFWS representative on the call
- USFWS Comments on Documents – No USFWS representative on the call

Next Managers' Meeting scheduled as a teleconference at 1000 on 07 January 2013. **AECOM will provide an invite.**

Adjourn

Attachments

December 10, 2012 Document and Issue Tracking Table

ACRONYM LIST

1,1,1-TCA	1,1,1-Trichloroethane
AEC	United States Army Environmental Command
AR	Administrative Record
BERA	Baseline Environmental Risk Assessment
CRP/CIP	Community Relations Plan / Community Involvement Plan
CSM	Conceptual Site Model
DERA	Defense Environmental Restoration Act
DERP	Defense Environmental Restoration Program
DPT	Direct Push Technology
EE/CA	Engineering Evaluation / Cost Analysis
EPA	United States Environmental Protection Agency
FBR	Fluidized Bed Reactor
FD	Fay Duke
GWTP	Ground Water Treatment Plant
INF	Intermediate-Range Nuclear Forces
LHAAP	Longhorn Army Ammunition Plant
LUC	Land Use Controls
O&M	Operation & Maintenance
MFR	Memorandum for the Record
MMM	Monthly Managers' Meeting
MMRP	Military Munitions Response Program
PB	Paul Bruckwicki
PBR	Performance-Based Remediation
PMP	Project Management Plan
PP	Proposed Plan
PSI WP	Post-Screening Investigation Work Plan
RAB	Restoration Advisory Board
RM	Rich Mayer
RMZ	Rose M. Zeiler
ROD	Record of Decision
RTC	Response to Comments
SOP	Standard Operating Procedure
TCEQ	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

**Document and Issue Tracking
Longhorn Army Ammunition Plant
December 10, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
1	LHAAP-04 Proposed Plan	Re-schedule Meeting date and ad	12/11/12	Finalize Dec 11	Due to EPA/TCEQ as F 12/31
2	LHAAP-47 Proposed Plan	Army review RTC for EPA and TCEQ comments	12/03/12	Looking to schedule in conjunction with LHAAP-04 January Meeting	Due to EPA/TCEQ as DF 12/31
3	LHAAP-18/24 PSI WP and CSM	AECOM responding to EPA comments, awaiting TCEQ comments	12/03/12	Expecting comments or concurrence from TCEQ	
4	LHAAP-46 RAWP	AECOM responding to EPA comments, awaiting TCEQ comments	12/03/12	Expecting comments or concurrence from TCEQ	Due to EPA/TCEQ as DF 12/31
5	LHAAP-67 RAWP	AECOM responding to EPA comments, awaiting TCEQ comments	12/03/12	In-progress	Due to EPA/TCEQ as DF 12/31
6	LHAAP-03RI/FS	AECOM develop Army Draft	12/10/12	In-progress, Army submittal 12/10	
7	GWTP O&M/Air Monitoring	AECOM submits Monthly and interim Report	Continued	Continued air monitoring in progress and repairs documented in weekly summary	INF Pond Additional soil cover and erosion control matting planned for December
8	5 Year Review	Complete Site Visit	12/20/12	Develop Army draft	5 Year Review

**Document and Issue Tracking
Longhorn Army Ammunition Plant
December 10, 2012**

Item	Description	Next Action	Due Date	Status	Remarks
9	LHAAP-16 RD WP	AECOM Submit Army Draft	January	In-progress	
10	LHAAP-17 RD WP	AECOM Submit Army Draft	January	In-progress	
11	LHAAP-29 PSI WP	AECOM submits draft	January	In-progress	Soil and groundwater sampling, aquifer testing planned similar to 18/24
12	LTM Plan Memo LHAAP-12, LTM Plan Memo LHAAP-16/LHAAP-001-R-01	AECOM Submits Draft	January	In-progress	
13	RAB and MMM	Army review and AECOM submits to regulators	12/07/12	Complete	
14	CIP	EPA/TCEQ Comment	11/26/2012	Submitted 10/25/2012	DF Due to EPA/TCEQ 12/26/2012
15	BERA Data Gap Memo	EPA/TCEQ Comment	12/5/2012	Submitted 11/5/2012	DF Due to EPA/TCEQ 1/7/2013
16	BERA Addendum Work Plan	Submit Army Draft	12/21/2012		
17	BERA Field Work	Initiate Field Work	3/25/2013		
18	BERA Addendum	Submit Army Draft	6/20/2013		