LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

ADMINISTRATIVE RECORD

VOLUME 12 of 13

1994

Bate Stamp Numbers
011562 - 011687

Prepared for:

Department of the Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671-1059

1995

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
ADMINISTRATIVE RECORD - CHRONOLOGICAL INDEX

VOLUME 12 of 13

1994

A.
Title: Letter - Subject: EPA's Comments On Schedule
Group(s): 1, 2 & 4
Site(s): LHAAP-1 Inert Burning Grounds
LHAAP-11 Suspected TNT Burial Site At Avenues P & Q
LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
LHAAP-17 Burning Ground No. 2 / Flashing Area
LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
LHAAP-27 South Test Area
LHAAP-29 Former TNT Production Area
LHAAP-32 Former TNT Disposal Area
LHAAP-35 Process Wastewater Sumps
LHAAP-54 & LHAAP-XX Ground Signal Test Area
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Environmental Protection Agency
Author(s): Ms. Lisa Marie Price, Environmental Protection Agency
Recipient: Mr David Tolbert, Longhorn Army Ammunition Plant
Date: September 20, 1994
Bate Stamp: 011562 - 011564

B.
Title: Newspaper Article - Explosive Issue, Army, environmentalists debate cleanup of munitions plant
Group(s): All
Site(s): General
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: The Dallas Morning News
Author(s): Randy Lee Loftis
Recipient: U.S. Public
Date: September 26, 1994
Bate Stamp: 011565 - 011566

C.
Title: Letter - Subject: TNRCC's Comments On Interim Risk Assessment For Burning Ground No. 3 and Unlined Evaporation Pond (Sites 18 & 24)
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Mr Michael Moore, Superfund Investigation Section Pollution Cleanup Division
Recipient: Mr David Tolbert, Longhorn Army Ammunition Plant

VOLUME 12 of 13 (Continued)

1994

Date: September 27, 1994
Bate Stamp: 011567

D. Title: Letter - Subject: TNRCC's Comments On Draft Field Investigation Summary Report For Group No. 2 Sites
Group(s): 2
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
LHAAP-17 No. 2 Flashing Area / Burning Ground
LHAAP-18 & LHAAP 24 Burning Ground / Washout Pond & Evaporation Pond
LHAAP-29 Former TNT Production Area
LHAAP-32 Formal TNT Waste Disposal Plant
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Michael A. Moore, Superfund Investigation Section
Recipient: David Tolbert, Longhorn Army Ammunition Plant
Date: October 5, 1994
Bate Stamp: 011568 - 011570

E. Title: Letter - Subject: Army Requested Establishment Of Effluent Standards For Treated Ground Water From Interim Remedial Action At Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa Lieutenant Colonel, U.S. Army Commanding Officer
Recipient: Mr. Michael Moore, Superfund Investigation Section
Date: October 6, 1994
Bate Stamp: 011571 - 011572

F. Title: Letter - Subject: Draft Record Of Decision Document For Interim Remedial Action For Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa Lieutenant Colonel, U.S. Army Commanding Officer
Recipient: Ms. Lisa Price, Environmental Protection Agency

1994

Date: October 13, 1994
Bate Stamp: 011573

G. Title: Letter - Subject: TNRCC's Comments On Phase I Investigations For 125 Waste Rack Sumps And 20 Waste Rack Sum,ps, And Approval Of Phase II - Workplans Of 125 Waste Process Sumps And 20 Waste Rack Sumps
Group(s): 4
Site(s): LHAAP-35 Process Wastewater Sumps - Various
LHAAP-36 Explosive Waste Pads
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Mr Michael Moore, Superfund Investigation Section Pollution Cleanup Division
Recipient: Mr David Tolbert, Longhorn Army Ammunition Plant
Date: October 17, 1994
Bate Stamp: 011574

H. Title: Letter - Subject: TNRCC's Comments On Remedial Design Investigation For Landfills
Group(s): 2 (Partial)
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Michael A. Moore, Superfund Investigation Section
Recipient: Mr. David Tolbert, Longhorn Army Ammunition Plant
Date: October 18, 1994
Bate Stamp: 011575 - 011576

I. Title: Letter - Subject: Draft Phase II Group No. 2 Work Plans
Group(s): 2
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
LHAAP-17 No. 2 Flashing Area / Burning Ground
LHAAP-18 & LHAAP 24 Burning Ground / Washout Pond & Evaporation Pond
LHAAP-29 Former TNT Production Area
LHAAP-32 Formal TNT Waste Disposal Plant
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa Lieutenant Colonel, U.S. Army Commanding Officer
Recipient: Ms. Lisa Marie Price, Environmental Protection Agency
Date: October 24, 1994
Bate Stamp: 011577

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J. Title: Letter - Subject: Request For Clarification Regarding A TNRCC Comment on Draft RI / FS For Sites #13 & #14
Group(s): 3
Site(s): LHAAP-13 Suspected TNT Burial Between Active Landfill And Old Landfill
LHAAP-14 Area 54 Burial Ground
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa, Lieutenant Colonel, U.S. Army
Recipient: Mr. Michael Moore, Superfund Investigation Section
Date: October 31, 1994
Bate Stamp: 011578

K. Title: Letter - Subject: Army's Response To A TNRCC Comment Will Cause Delay In Finalization Of RI / FS For Sites #13 & #14
Group(s): 3
Site(s): LHAAP-13 Suspected TNT Burial Between Active Landfill And Old Landfill
LHAAP-14 Area 54 Burial Ground
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa, Lieutenant Colonel, U.S. Army
Recipient: Ms. Lisa Marie Price, Environmental Protection Agency
Date: October 31, 1994
Bate Stamp: 011579 - 011580

L. Title: Letter - Subject: TNRCC's Response to Army's Request For Clarification On Comments Regarding RI / FS For Sites #13 & #14
Group(s): 3
Site(s): LHAAP-13 Suspected TNT Burial Between Active Landfill And Old Landfill
LHAAP-14 Area 54 Burial Ground
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Mr Michael Moore, Superfund Investigation Section Pollution Cleanup Division
Recipient: Mr David Tolbert, Longhorn Army Ammunition Plant
Date: November 1, 1994
Bate Stamp: 011581 - 011582

M. Title: Letter - Subject: Submission Of The Draft Responsiveness Summary of Public Comments On The Longhorn Army Ammunition Plant Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning ground / Washout Pond & Unlined Evaporation Pond

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1994

Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa Lieutenant Colonel, U.S. Army Commanding Officer
Recipient: Ms. Lisa Price, Environmental Protection Agency
Date: November 1, 1994
Bate Stamp: 011583

N. Title: Letter - Subject: EPA's Response To Delay In RI / FS For Sites 13 & 14p
Group(s): 3
Site(s): LHAAP-13 Suspected TNT Burial Between Active Landfill And Old Landfill
LHAAP-14 Area 54 Burial Ground
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Environmental Protection Agency
Author(s): Ms. Lisa Marie Price, Environmental Protection Agency
Recipient: Mr David Tolbert, Longhorn Army Ammunition Plant
Date: November 3, 1994
Bate Stamp: 011584 - 011585

O. Title: Letter - Subject:Draft Proposed Plan For Interim Action At Landfills
Group(s): 2 (Partial)
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa Lieutenant Colonel, U.S. Army Commanding Officer
Recipient: Ms. Lisa Price, Environmental Protection Agency
Date: November 28, 1994
Bate Stamp: 011586

P. Title: Letter - Subject:EPA's Comments On Work Plan For Interim Action At Landfills Phase II Group 2
Group(s): 2 (Partial)
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Environmental Protection Agency
Author(s): Ms. Lisa Price, Environmental Protection Agency
Recipient: Me David Tolbert Longhorn Army Ammunition Plant
Date: November 28, 1994
Bate Stamp: 011587 - 011591

VOLUME 12 of 13 (Continued)

1994

Q. **Title:** Letter - Subject:TNRCC's Comments On Work Plan For RI / FS Phase II Group #2
Group(s): 2
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
LHAAP-17 No. 2 Flashing Area / Burning Ground
LHAAP-18 & LHAAP 24 Burning Ground / Washout Pond & Evaporation Pond
LHAAP-29 Former TNT Production Area
LHAAP-32 Formal TNT Waste Disposal Plant
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Michael A. Moore Superfund Investigation Unit
Recipient: David Tolbert, Project Manager Longhorn Army Ammunition Plant
Date: November 29, 1994
Bate Stamp: 011592 - 011593

R. **Title:** Final Workplan - Phase 2 Workplan For The Remedial Investigation (RI)
Group(s): 2
Site(s): LHAAP-12 Active Landfill
LHAAP-16 Old Landfill
LHAAP-17 No. 2 Flashing Area / Burning Ground
LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Evaporation Pond
LHAAP-29 Former TNT Production Area
LHAAP-32 Former TNT Waste Disposal Plant
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: Sverdrup Environmental, Inc.
Author(s): Sverdrup Environmental, Inc.
Recipient: U.S. Army Corps of Engineers, Tulsa District
Date: December, 1994
Bate Stamp: 011594 - 011687

011562

SEP 2 0 1994

CERTIFIED MAIL: RETURN RECEIPT REQUESTED P104 195 165

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Updated Schedule for
Primary and Secondary Documents for
Longhorn Army Ammunition Plant

Dear David:

Pursuant to the Federal Facility Agreement for the Longhorn Army Ammunition Plant, EPA is submitting comments on the Updated Schedule for Primary and Secondary Documents for Longhorn Army Ammunition Plant. EPA originally submitted comments on January 19, 1994 on the last requested update to the schedule (Army letter dated December 2, 1993). However, because of the continuation of unresolved issues, EPA is submitting the following comments:

#1 *EPA agreed with the Army's request to project the updated schedule only through the completion and finalization of the Remedial Investigation (RI) for Group #1, #2, and #4 sites. EPA has expressed during our monthly meetings, however, that as soon as the Site Characterization Summary has been completed for the groups of sites an addendum to this schedule or new updated schedule must be submitted for the Feasibility Study (FS), the Record of Decision (ROD) activities, the Remedial Design/Remedial Action (RD/RA), and all associated secondary documents.*

Furthermore, as there are many activities for the associated with the actual FS (i.e., treatability studies, detailed analysis of alternatives), EPA hopes that the Army has taken into consideration EPA's January 19, 1994, comments regarding the parallel tracks for the studies and report preparation.

#2 *EPA continues to object to the time required to complete the RI for the Group #1 sites. The schedule for the completion of the RI only shortened 30 days (from February 21, 1996 to January 21, 1996) based on EPA's January 19, 1994, comments. Because the schedule is not carried beyond the completion and finalization of the RI, EPA assumes the overall RI/FS and ROD process has not been affected by EPA's January 19, 1994, comments. Therefore, EPA objections stand on the time required to resolve the Group #1 sites.*

#3 *From the draft December 1993 update to this August 1994 update, the completion and finalization of the RI has been EXTENDED four (4) months! EPA finds this not only puzzling but objectionable.*

#4 *As was discussed in the August 30, 1994, project coordinators meeting, the issue concerning the removal of the TNT pipeline is in question, therefore, EPA will not comment on the proposed schedule for this activity.*

#5 *For the Group #5 sites, the schedule should not reflect a finalization period of 14 days for the Field Summary Report. It is a secondary document, therefore does not require formal finalization. See EPA's January 19, 1994, comments.*

#6 *The schedule for the Hydrogeologic Assessment is misleading. According to EPA's records, the Hydrogeologic Assessment itself will be submitted to EPA in January 1995, not the work plan for the assessment.*

#7 *As it is critical to determine work in progress and work planned, EPA requests that "work break down" schedules as well as monthly status updates of site activities be provided to EPA.*

#8 *Although the DERPMIS Resolution Document cannot be considered a primary document, pursuant to the Federal Facility Agreement for the Longhorn Army Ammunition Plant, EPA requests that a schedule be established for the ultimate resolution of this document.*

If you have any questions about EPA's comments or any other matter, please contact me at (214) 665-6744.

Sincerely,

Lisa Marie Price
Remedial Project Manager
Superfund Texas Enforcement

cc: Lieutenant Colonel Lawrence J. Sowa
Commanding Officer, U.S. Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671-1059

Tulsa District Corps of Engineers
P.O. Box 61
Attn: Mr. Ross Nguyen
CESWT-PP-E
Tulsa, OK 74121-0061

011564

Mike Moore, Superfund
Texas Natural Resource Conservation Commission
P.O. Box 13087
Capital Station
1700 N. Congress Avenue
Austin, TX 78711-3087

'S STUDY WHAT HAPPENS AS WE AGE. DISCOVERIES, PAGE 6D.

Dallas Morning News

94, The Dallas Morning News · Dallas, Texas, Monday, September 26, 1994 · 5 Sections · H · ····· 25 Cents

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Gov. Pete Wilson, who backs the proposition, cites the high cost of social services for undocumented immigrants. Challenger Kathleen Brown opposes the measure.

TIONS '94

highlights. 10A

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rored by others among the 60 people who recently attended the Human Relations Commission forum in this seaside town just north of the U.S.-Mexican border.

Comments afterward suggested that the battle remains to be won on the proposal that immigration critics forced onto the Nov. 8 California

Please see IMMIGRATION on Page 10A.

EXPLOSIVE ISSUE

Army, environmentalists debate cleanup of munitions plant

By Randy Lee Loftis
Environmental Writer of The Dallas Morning News

■ A look at the plant. 8A

KARNACK, Texas — The things that workers made at the Longhorn Army Ammunition Plant here have blown up all over the world.

Now, however, decades of standard operating practice at the bomb factory seem to be blowing up in the Army's face. Here in farthest East Texas, by the shores of quiet Caddo Lake, Longhorn is a tale of the toxic consequences of arming for war.

For 52 years, Longhorn manufactured explosives, artillery shells, fire-starting devices, smoke bombs, flash-and-bang training simulators and other dangerous goods for the Army.

That job is done; the last manufacturing task officially ends Oct. 13. Longhorn isn't officially closing. But it's left with nearly empty buildings and weed-choked back lots strung along almost deserted roads that slice the woods.

It's also left with a $127 million environmental cleanup bill from decades of practices that are sloppy by today's standards. Longhorn is on the federal Superfund list of toxic sites.

And it has stockpiles of unneeded or outdated explosives, factory rejects and discontinued items to get rid of.

The Army's plan for the leftovers: simply burn them under the wide East Texas sky, a half-mile from the only natural lake in Texas.

The company that runs the plant for the Army, Thiokol Corp., is also left with virtually nothing to do here. Thiokol has found one new job so far: scrapping 2,000 old rockets for the U.S. Energy Department. Thiokol would tie them down and fire their motors, sending tons of pollution skyward. After the six-month

Please see ARMY on Page 8A.

Cities in Haiti

011565

Army, environmentalists debate n

011566

Continued from Page 1A.

rocket job ends, it's anybody's guess what other work Thiokol might find here.

The Army says the plans would do no noticeable harm. But with buried toxic ooze, and the prospect of blasting rockets and smoke rising over hallowed Caddo Lake, some landowners, officials and environmentalists say they've had enough.

Fearing pollution of the lake — a rare Texas symbol of unspoiled nature — and the ruin of its natural beauty, they have formed a coalition to oppose Longhorn's plans. It's a level of opposition unseen here since the Army opened shop early in World War II.

"The main reason is that Caddo Lake is the crown jewel of lakes in Texas," said Richard Lowerre, a lawyer from Austin who represents environmentalists, property owners and others opposed to Longhorn's plans. "It's one of those crown jewels that you want to make sure future generations can enjoy, too."

Caddo Lake, which straddles the Texas-Louisiana line, has been declared a wetland of international significance under a global environmental treaty. It recently survived unrelated Army plans to dig a new channel, Daingerfield Reach, to boost navigation. Opponents mustered enough public ire to kill the plan.

The fight against Daingerfield Reach cemented the same coalition that now opposes Longhorn's plans. It could be months before the state rules on the permits.

"Caddo Lake cannot speak for itself," said environmentalist Sybil Walker of nearby Shreveport, La., "but we can."

Downplaying fears

Ira Nathan, the Army's chief engineer at Longhorn, said the fears are exaggerated. There's no evidence that the lake has suffered from a half-century of making, testing and disposing of explosives, he said.

Anybody worried about today's drastically reduced activities should have been here about 30 going on, and materials were being burned that were much more hazardous," Mr. Nathan said during a stroll across the 36-acre area where the open burning takes place. "Our activities today are virtually nothing by comparison."

Longhorn helped arm the Allies a half-century ago, but the team spirit of those days has worn thin. At a recent state environmental permit hearing in nearby Marshall, people trooped to the microphone to denounce Longhorn as a threat to nature and people.

Longhorn's managers "champion the dollar over the health of people," said Harrison County environmentalist Carroll Campbell. "What next — a commercial hazardous waste facility?" demanded Bill Wiener of Don't Ditch Caddo, a group from Shreveport.

Only a couple of people rose to defend the facility that, in its now-hazy heyday, employed 3,000 people. One was Hal Cornish, a former Thiokol employee and former president of the Marshall Chamber of Commerce.

"I have no concern whatsoever," Mr. Cornish said. "They've been doing it a long, long time, and they're the technical experts."

Dig and dump

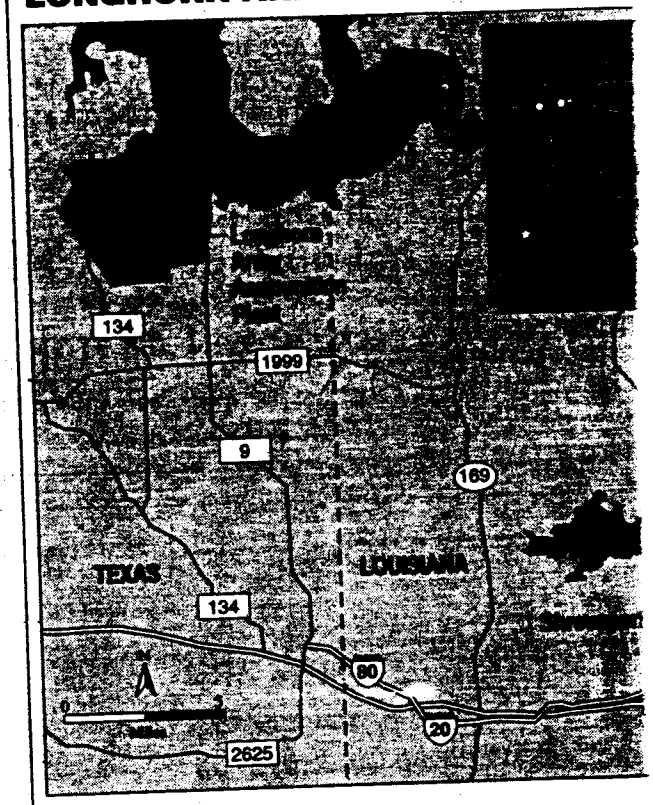
In fact, the Army has been doing it so long at Longhorn that the plant predates modern notions of health and safety. Lynn Muckelrath, an Army environmental engineer, explained the plant's original hazardous-waste management system during a recent plant tour.

"They dug a big pit, and they dumped it in," Mr. Muckelrath said, indicating a low mound now covered with grass. The Army has a preliminary plan to pump out the ground water there and remove the trichloroethylene and methylene chloride. The job will cost taxpayers more than $16 million.

Mr. Nathan said the plant is committed to protecting the environment and has been for a long time.

"The colonel's name is on the permit," he said, referring to the plant's commander, Lt. Col. Lawrence J. Sowa. "If anything goes wrong, it's on the colonel's head. The Army just isn't going to let that happen."

LONGHORN ARMY AMMUNITION P



Location: Karnack, Texas (Harrison County)
Size: 8,500 acres
Founded: 1942
Owner: U.S. Army
Manager: Thiokol Corp. (under Army contract)

Mission: To manufacture explosives, incendiary devices and other munitions for the Army. The plant also has played a role in disarmament; motors from 921 Pershing missiles were fired and crushed into scrap there under a U.S.-Soviet treaty from 1988-91.

Status: Army work for Thiokol ends Oct. 13. After that, Thiokol is responsible for finding new work on its own. Thiokol will continue to use the plant's facilities, rent-free. The Army says the arrangement will keep the plant r the government nee up quickly.

Environmenta plant is listed as a f Superfund toxic-cle Total cleanup costs at $127 million, but complete. A prelimi plan at one contam cost about $16 milli

In addition, the Arm state authorization standing practice o hazardous materia burn cages.

Also, Thiokol is see approval of a plan t from 2,000 small rc contract it won fron Department of Ene

SOURCE: U.S. Army

to "insignificant" amounts.

The plant's state permit allows no more than 100.2 tons of carbon monoxide per year. By comparison, pollution sources in the Dallas-Fort Worth area emit an estimated 4,000 tons in a single day.

Longhorn's open burning can emit up to 2.4 tons a year of volatile organic compounds, a common type

every day.

Longhorn's ni limit is 600 pounc Dallas-Fort Wort tons a day.

Emissions fro Energy Departme also be insignific said. According the entire job wo

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

011567

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

September 27, 1994

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Interim Risk Assessment for Burning Ground 3 and
Unlined Evaporation Pond (Sites 18 & 24)

Dear Mr. Tolbert:

As I understand from our discussions earlier this year, the U. S. Army, U. S. Environmental Protection Agency, and Texas Natural Resource Conservation Commission agreed that the draft Interim Risk Assessment which was submitted in January, 1994, would be held in abeyance until further remedial investigation has been completed. Since our toxicologist had reviewed the document and submitted her comments to me, I am forwarding those comments to you now so that they may be considered as the Army continues its development of the risk assessment document.

If you have any additional questions or comments, please contact me at (512) 239-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

Enclosure

cc: Capt. Ross Nguyen, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action
Alvie Nichols, WASTE/PC - Superfund Engineering

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

011568

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

October 5, 1994

CERTIFIED MAIL

RETURN RECEIPT REQUESTED

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Draft Field Investigation Summary Report for Group 2 Sites

Dear Mr. Tolbert:

The Texas Natural Resource Conservation Commission (TNRCC) staff have completed our review of the "Draft Field Investigation Summary Report" for the "Group 2" sites, dated February 1994. We concur with the comments presented by the Environmental Protection Agency in its letter dated April 19, 1994. Our specific comments are enclosed.

If you have any questions regarding our comments, please contact me at (512) 239-2483.

Sincerely yours,.

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

cc: Capt. Ross Nguyen, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action

TNRCC Comments
on
Longhorn Army Ammunition Plant
Draft Field Investigation Summary Report
for Group 2 Sites

Section	Page	Comment
General		We agree with EPA's recommendation that stratigraphic descriptions in boring logs be compared to the geotechnical information in Appendix II in order to resolve apparent discrepancies in soil classifications; and that the cross-sections then be reinterpreted to provide a more accurate visual representation of the geology of the sites.
General		Data summary tables for organic compounds should include all detected organic compounds (including those coded as estimated concentrations and tentatively identified compounds). Tables for inorganic compounds should include all inorganic compounds detected above established background concentrations (include all "hits" if background is not yet established). Once preliminary remediation goals are established (see Risk Assessment Guidance for Superfund: Volume 1 (Part B)), they may be used as a basis for comparison and reduction of analytical data.
3.2.4	3-8	According to the cross-sections on pages 3-3 and 3-4, wells 12WW05 and 12WW07 were not completed in an aquitard or confining layer. Also, well 12WW07 was screened through an aquitard or confining layer which occurs at approximately 180' - 176' to interconnect two saturated zones. In order to adequately investigate the ground water at the site, particularly if the presence of DNAPL's is a possibility, wells should be screened into a confining (or retarding) layer, and not connect two saturated zones. Additionally, the thickness of the "clay aquitard/clay confining layer" encountered at approximately 173' needs to be determined.

Section	Page	Comment
5.3.2	5-8	None of the wells at this site extend to the bottom of the saturated zone which was encountered at 8' - 15' below the surface; the thickness of this zone needs to be determined, and wells need to be screened into the underlying confining layer to investigate the possible presence of DNAPL's.
Fig. 5-4	5-11	The side bar elevations do not appear to be correct.
6.1.3	6-6	Please provide a reference for (or a copy of) the March 1986 TNRCC "certification" cited in the second paragraph.
6.1.3	6-10	In case there is still any question as to whether "source" materials are still present at the Burning Ground No. 3/Unlined Evaporation Pond site, the investigation discussed in the last paragraph (which appears to be from the 1989 Phase I & II RFI Report) seems to confirm that contaminated source material still exists at this site.
6.2.2	6-13	Has the revised report cited in this section been submitted to TNRCC?
6.4.3	6-26	The EP-toxicity test has been replaced by the Toxicity Characteristic Leaching Procedure (TCLP). Both tests were primarily developed to determine the regulatory requirements which apply to a solid waste under RCRA. Although TCLP may provide an indication of the mobility of hazardous constituents present in waste, its application to the present investigation is questionable, and should be proposed for discussion before being used as a basis for determining site characteristics. Also, please note that if leachate concentrations are eventually going to be used in the determination of remediation goals, the TNRCC Risk Reduction Standards require the use of EPA's SW-846 Method 1312 (Synthetic Precipitation Leaching Procedure) (see 30 TAC §335.559 (f) (2)).
6.5	6-35	What were the results of the solute transport modeling for this site?

011571

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO ATTENTION OF

6 October 1994

SMCLO-EN

Mr. Michael Moore
Superfund Investigation Section
Texas Natural Resource Conservation Commission
P. O. Box 13087
Austin, Texas 78711-3087

Dear Sir:

Longhorn Army Ammunition Plant is pursuing implementation of an Early Interim Remedial Action for remediation of source material at Burning Ground No. 3. A Proposed Plan prepared in accordance with CERCLA was submitted for public review and comment on September 9, 1994. The public comment period will end on October 11, 1994. The preferred alternatives were presented to the public on September 15, 1994. The preferred alternatives identified will discharge treated groundwater to surface water, place treated waste in a landfill which will be capped, and use treated soil for backfill material on the site.

Pursuant to the Federal Facilities Agreement, we are requesting that TNRCC establish standards for air emissions from the treatment units and discharge standards for the treated groundwater. All standards will be incorporated into the Draft Record of Decision (ROD). A list of contaminants of concern is attached. We request an expeditious reply in order to include this information in the ROD. The Army verbally requested this information during the June Technical Review Committee meeting.

The purpose of this letter is to emphasize the potential impact to the project schedule. If these standards are not provided for incorporation into the Draft ROD due for review on 18 October a possibility of lost project funds exists.

Please contact David Tolbert at (903) 679-2728 for additional information which may be required for determination of these standards.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U.S. Army
Commanding Officer

011572

ANALYTES OF CONCERN

VOLATILE ORGANIC COMPOUNDS	METALS	EXPLOSIVES
Trichloroethene	Arsenic	HMX
Methylene chloride	Lead	RDX
Vinyl chloride	Thallium	1,2,5-TNB
Trichlorofluoromethane	Barium	1,3-DNB
1,1-Dichloroethene	Chromium	TETRYL
1,1-Dichloroethane	Nickel	2,3,5-TNT
1,2-Dichloroethane	Selenium	2,4-DNT
Tetrachloroethene	Nitrate	2-AM-4,6-DNT
Toluene	Chloride	TNT
Ethylbenzene	Magnesium	4-AM-2,6-DNT
Total Xylenes	Cadmium	
Acetone	Manganese	
Cis-1,2-Dichloroethene	Sodium	
Carbon Disulfide		
Chloroform		
1,1,2-Trichloro 1,2,2-Trifluoroethane		
Benzene		
Carbon Tetrachloride		
Chlorobenzene		
1,2-Dichloroethene		
2-Chloroethyl Vinyl Ether		
1,1,2-Trichloroethene		
1,2-(trans) Dichloroethene		
1,1,1-Trichloroethane		
Diethylphtbalate		
1,2-Dichloroethene		
Styrene		
Benzene		
Total-1,2-Dichloroethene		
Hexachlorobenzene		
(bis)2-Ethylhexylphthalate		

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

011573

REPLY TO
ATTENTION OF

October 13, 1994

Ms. Lisa Price
Superfund Enforcement
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202

Dear Ms. Price:

Please find enclosed the Draft Record of Decision Document for the Interim Remedial Action for Burning Ground No. 3 (Areas 18 and 24). The text is provided without specific standards for discharge water, soil and air emissions as negotiation of these parameters is pending. Additionally, consistent with schedule assumptions provided August 16, 1994, the public comment responsiveness summary has not been completed. A significant number of public comments were received on October 11, 1994. While many of the comments and questions are straightforward, some will require decisions on future policy prior to responding. Accordingly, submission of the responsiveness summary will be delayed until 28 Oct 94. The Record of Decision Document will also be revised to incorporate the responsiveness summary.

The document is being provided in this form to facilitate the earliest possible review of the text and allow initiation of the revision process. Mr. David Tolbert can be reached at 903-679-2728.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U. S. Army
Commanding Officer

Enclosure

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

011574

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

October 17, 1994

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

CERTIFIED MAIL
P 111 120 785
RETURN RECEIPT REQUESTED

Re: Longhorn Army Ammunition Plant
125 Waste Process Sumps and 20 Waste Rack Sumps
Phase I Investigation Report and Phase II Workplan

Dear Mr. Tolbert:

Texas Natural Resource Conservation Commission staff have reviewed the "Draft Final Report Phase I Investigations of 125 Waste Process Sumps and 20 Waste Rack Sumps", dated February 17, 1994. We have also reviewed the U. S. Environmental Protection Agency's (EPA) comments dated April 19, 1994. We concur with EPA's comments, as discussed during the March 10 and April 6-7, 1994 project managers' meetings.

We have also reviewed the "Draft Final Phase II Workplan", which we received on July 13, 1994, and the "Final Phase II Workplan", which we received on September 15, 1994. We have also reviewed EPA's comments on those documents, dated August 10, 1994 and September 26, 1994, respectively. We concur with the "Final Workplan", as modified by EPA's August 10, 1994 comments.

If you have any additional questions or comments, please contact me at (512) 239-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

cc: Capt. Ross Nguyen, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action
Alvie Nichols, WASTE/PC - Superfund Engineering

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

011575

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

October 18, 1994

CERTIFIED MAIL
P 111 120 786
RETURN RECEIPT REQUESTED

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Active Landfill (LHAAP-12) and Old Landfill (LHAAP-16)

Dear Mr. Tolbert:

Texas Natural Resource Conservation Commission staff have reviewed the "Landfill Caps Remedial Design Investigations" -- "Draft Final Work Plan", dated June 16, 1994, "Final Work Plan", dated August 16 1994, and "Final Work Plan" (revised), dated September 21, 1994. We have also reviewed the U. S. Environmental Protection Agency (EPA) comments dated July 13, 1994.

We concur with EPA's comments, which were discussed during the August 31, 1994 project managers' meeting. Our additional specific comments are enclosed.

If you have any additional questions or comments, please contact me at (512) 239-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

Enclosure

cc: Capt. Ross Nguyen, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action
Alvie Nichols, WASTE/PC - Superfund Engineering

011576

TNRCC Comments
on
Longhorn Army Ammunition Plant
Landfill Caps Remedial Design Investigations
Final Work Plan
LHAAP-12 and LHAAP-16
Active Landfill and Old Landfill

1) Section 3.0 - specific test methods should be cited (e.g. ASTM method numbers) for geophysical tests.

2) Section 3.0 - a copy of the "TNRCC Technical Guideline for Landfills" was sent to Mr. Wade Anderson, U. S. Army Corps of Engineers Tulsa Region, on September 21, 1994. This guideline should be considered (action specific ARAR, applicable and relevant) during the landfill cap design.

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO ATTENTION OF

24 October 1994

011577

SMCLO-EN

Ms. Lisa Price
Superfund Enforcement
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

Dear Ms. Price:

Enclosed are two copies of the Draft Final Phase II Group II Work Plans for Longhorn Army Ammunition Plant in Karnack, Texas.

Please review and send your comments back to us by November 28, 1994. If comments are not received by this date, a "no response" is assumed.

If there are any questions, please contact Mr. David Tolbert at 903/679-2728.

Sincerely,

for David Tolbert
Lawrence J. Sowa
Lieutenant Colonel, U.S. Army
Commanding Officer

Enclosures

10-24-1994 04:52PM FROM TO 56509427191866972235 P.04

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

October 31, 1994

011578

Mr. Michael Moore
Superfund Investigation Section
Texas Natural Resource Conservation Commission
P.O. Box 13087
Austin, TX 78711-3087

SUBJECT: Comments to Draft Final Remedial Investigation/ Feasibility Study Report, Sites 13 and 14, Longhorn Army Ammunition Plant

Dear Mr. Moore:

The comments submitted by the Texas Natural Resource Conservation Commission (TNRCC) regarding the subject document have been reviewed. We request clarification of comment number 13, General comment to the Baseline Risk Assessment.

The comment as it is currently understood by the Army will require development of a risk assessment for quantification of human health risk using a much more rigorous approach than used for the baseline risk assessment previously submitted. Further, the risk evaluation must be revised using statistically valid background concentrations which have been accepted by TNRCC and EPA. Compliance with this comment as it is currently understood will require submission of the revised Draft Final RI/FS Report at the time of regulatory approval of the Background Study. Currently, regulatory approval of the Background Study is scheduled for January 30, 1995.

We request expeditious clarification of this comment due to the project schedule impacts identified above. In order to minimize impacts to the project, we are proceeding based upon current understanding of the comment.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U.S. Army
Commanding Officer

Enclosure 1

011579

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

October 31, 1994

Ms. Lisa Price
Superfund Enforcement
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

SUBJECT: Submission of the Final Remedial Investigation/ Feasibility Study (RI/FS) Report for Sites 13 and 14 (Group 3), Longhorn Army Ammunition Plant (LHAAP)

Dear Ms. Price:

Please reference comments on the subject document provided by the Texas Natural Resource Conservation Commission (TNRCC) dated September 19, 1994. The Army is requesting written clarification (see enclosure 1) of the TNRCC general comment on Baseline Risk Assessment (copy attached). The Army believes compliance with this comment requires finalization of the LHAAP Soils Background Concentrations Report prior to submission of the Final RI/FS Report for Group 3. Accordingly, the Final RI/FS Report can be submitted when the Background Report is finalized, currently scheduled for January 30, 1995. The Army will accelerate this schedule in the event that clarification is provided by TNRCC allowing an earlier submission of the RI/FS Report or if the Soils Background Report is finalized ahead of the current schedule.

The delayed submission of the Group 3 RI/FS Report and the potential delay to Group 3 activities are necessary to insure regulatory comments are adequately addressed. Please direct any questions to Mr. David Tolbert at 903-679-2728.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U.S. Army
Commanding Officer

Attachment
Enclosure

Section	Page	Comment
5.6	5-7	It is appropriate to compare parameter concentrations or levels to regulatory standards (such as MCL's and MCLG's), and to established background concentrations, but not to other sites being investigated.
5.6	5-7 thru 5-13	"Groundwater grab samples" are not ground water samples, cannot be presented as providing data that are representative of ground water conditions at the sites, and are not an accepted remedial investigation technique; therefore, any discussion of "groundwater grab samples" and the data thus obtained should be segregated from the rest of the report.
6	6-1 thru 6-14	Same comments as for Chapter 5, where applicable.
6.6	6-14	It is not clear why the last sentence above the table is there. Most of the section seems to discuss results of the ground water investigation. It would probably be easier to understand if ground water and surface water are discussed in separate paragraphs or sections.
7	7-1	The last sentence of this section should read more like the last sentence of section 8.1 on the following page.
Baseline Risk Assessment	General	It is noted that metals exceeded "site background" concentrations in a substantial number of samples. This situation seems to contradict the conclusion that the sites are not contaminated, and would indicate the need for quantification of human health risk in order to justify no further remedial action. It is recommended that comparisons of metals in soils be revised using statistically valid background concentrations as determined in the soils background study, after that study has been completed and accepted by EPA and TNRCC.

Attachment

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

011581

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

November 1, 1994

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Remedial Investigation/Feasibility Study (RI/FS) Report
Sites 13 and 14

Dear Mr. Tolbert:

This letter is in response to Col. Sowa's letter, dated October 31, 1994. The letter requested clarification of the Texas Natural Resource Conservation Commission's (TNRCC's) September 19, 1994 comment regarding the Baseline Risk Assessment portion of the subject draft report.

According to Appendix D (Baseline Risk Assessment) of the draft RI/FS Report, " . . . analytical results indicate the site is not contaminated by reported past disposal actions, and, therefore, is not a risk to human health or the environment . . . ". This conclusion was based, in part, on the statement that " . . . results show that metals concentrations in surface soil were generally near background levels . . . " as indicated in Table 1 [for each of the two sites investigated]. The results in Table 1 indicate that "background" was exceeded in at least 50% of the samples from each site for barium, chromium, mercury, selenium, sulfate, nitrate/nitrite, and conductivity; and also for nickel at site 14. These results do not support the stated conclusion that the sites are not contaminated by past disposal actions; therefore, risk calculations should be included in the risk assessment to support the conclusion that the sites do not pose a risk to human health or the environment.

During previous discussions regarding the validity of the "background" concentrations which were derived during the Phase I RI at sites 13 and 14, as well as other sites at the facility, it was concluded that further sampling was needed to develop statistically valid background data to be used for risk assessment purposes. A work plan for such a study was proposed by the Army, and concurred with by TNRCC and the U. S. Environmental Protection Agency (EPA). As discussed during our teleconference on

October 27, 1994, the Army has recently completed its soils background study, and the report is pending review by the Army, EPA, and TNRCC. It is requested that a preliminary draft report of the background study be provided to EPA and TNRCC for an expedited concurrent review. It is also requested that the revised draft RI/FS report for sites 13 and 14 (to include resolution of EPA's comments dated September 12, 1994) be submitted to EPA and TNRCC for review. If EPA's comments are adequately addressed, and the statistically valid background data for the inorganic constituents detected at sites 13 and 14 confirm the Army's conclusions that the hazardous inorganic constituents (*i.e.* the metals) are within the acceptable range of background concentrations, the risk assessment can be revised to reflect these findings and TNRCC will concur that no further remedial action is warranted at these two sites. If the hazardous constituents are found to be present at greater than background concentrations, risk calculations should be performed to determine whether the sites pose a risk (*i.e.* greater than 1×10^{-6}) to human health or the environment.

If the preliminary draft report of the background study and revised draft RI/FS report be provided to EPA and TNRCC within the next two weeks, the scheduled delivery date for the Record of Decision for these two sites should still be achievable. If you have any additional questions or comments, please contact me at (512) 239-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

Enclosure

cc: Capt. Ross Nguyen, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action
Alvie Nichols, WASTE/PC - Superfund Engineering

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

November 1, 1994

011583

Ms. Lisa Price
Superfund Enforcement
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

SUBJECT: Submission of the Draft Responsiveness Summary to Public Comments on the Longhorn Army Ammunition Plant (LHAAP) Burning Ground No. 3 Interim Action Proposed Plan

Dear Ms. Price:

The subject document was submitted to you under separate cover on October 28, 1994. The Responsiveness Summary will constitute Appendix A of the Record of Decision (ROD). A comment resolution meeting for the Draft ROD has been tentatively scheduled for November 15, 1994 in Aberdeen, Maryland. Please refer any questions to Mr. David Tolbert at 903-679-2728.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U.S. Army
Commanding Officer

011584

NOV 0 3 1994

CERTIFIED MAIL: RETURN RECEIPT REQUESTED

P773283271

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Army's October 31, 1994, Letter Regarding
Remedial Investigation/Feasibility Study for Sites 13 and 14
Longhorn Army Ammunition Plant

Dear David:

EPA received by fax at the close of business October 31, 1994, the Army's letter requesting a delay in the submission of the Remedial Investigation/Feasibility Study (RI/FS) for the Sites 13 and 14 (Group #3) from October 31, 1994, until January 30, 1995, and a copy of the letter sent to the Texas Natural Resource Conservation Commission (TNRCC) by the Army requesting clarification of a comment submitted by the TNRCC regarding the draft RI/FS for Group #3.

Regarding the request for the delay of the submission of the Final RI/FS Report until January 30, 1995, EPA finds this problematic. According the Army's schedule for the Group #3 sites, public comment on the Proposed Plan is to begin January 6, 1995. Therefore, the Army's request for a delay in the RI/FS Report has a significant impact on the overall schedule for the Group #3 sites.

The draft Final Soil Background Concentration Report is due to be submitted to EPA and TNRCC on December 17, 1994. The information contained within the Soil Background Concentration Report is what is at issue with TNRCC's comment. Therefore, EPA requests that the revised draft Final RI/FS Report and Soil Background Concentration Report be submitted concurrently on December 17, 1994. According to the schedule, the Soil Background Concentration Report was released for Army review on October 29, 1994. This scenario would have less impact on the schedule, resolve TNRCC's comment, and allow EPA and TNRCC to review and comment on the document (i.e., RI/FS) in conjunction with the supporting data (i.e., Soil Background Concentration Report).

If you have any questions about this matter, please contact me at (214) 665-6744.

Sincerely,

Lisa Marie Price
Remedial Project Manager
Superfund Texas Enforcement

cc: Lieutenant Colonel Lawrence J. Sowa
Commanding Officer, U.S. Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671-1059

Tulsa District Corps of Engineers
P.O. Box 61
Attn: Mr. Kevin DaVee
CESWT-PP-E
Tulsa, OK 74121-0061

Mike Moore, Superfund
Texas Natural Resource Conservation Commission
P.O. Box 13087
Capital Station
1700 N. Congress Avenue
Austin, TX 78711-3087

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO ATTENTION OF

RECEIVED
EPA REGION VI
DEC 12 1994
SUPERFUND BRANCH

November 28, 1994

011586

SMCLO-EN

Ms. Lisa Price
Superfund Enforcement
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, Texas 75202

Dear Ms. Price:

In accordance with the Landfill Caps schedule dated August 9, 1994, the subject document enclosed for your review and comment. I request that you provide written comments by December 28, 1994.

Please refer any questions to the Installation Restoration Program Manager, Mr. David Tolbert at 903-679-2728.

Sincerely,

LAWRENCE J. SOWA
Lieutenant Colonel, U.S.Army
Commanding Officer

Enclosure

011587

NOV 28 1994

CERTIFIED MAIL: RETURN RECEIPT REQUESTED

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Work Plan for Remedial Investigation/Feasibility Study
Phase II for Group #2 Sites
Longhorn Army Ammunition Plant

Dear David:

Pursuant to the Federal Facility Agreement for the Longhorn Army Ammunition Plant, EPA is submitting comments on the Draft Work Plan for the Remedial Investigation/Feasibility Study Phase II for the Group #2 Sites. EPA's comments are included as an enclosure to this letter.

If you have any questions about the comments or any other matter, please contact me at (214) 665-6744.

Sincerely,

Lisa Marie Price
Remedial Project Manager
Superfund Texas Enforcement

Enclosure

cc: Lieutenant Colonel Lawrence J. Sowa
Commanding Officer, U.S. Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671-1059

Tulsa District Corps of Engineers
P.O. Box 61
Attn: Mr. Kevin DaVee
CESWT-PP-E
Tulsa, OK 74121-0061

Mike Moore, Superfund
Texas Natural Resource Conservation Commission
P.O. Box 13087
Capital Station
1700 N. Congress Avenue
Austin, TX 78711-3087

Comment #1

General comment: EPA has on several occasions requested that one facility-wide Chemical Data Acquisition Plan (CDAP) as well as one Health and Safety Plan (HSP) be drafted for all Phase II field investigations (i.e., August 1994 monthly Project Coordinators meeting; EPA's comments on the draft Sump Phase II Work Plan dated August 10, 1994; October 25, 1994, meeting with COE, Army and EPA; and October 1994 monthly Project Coordinators meeting). EPA, however, has received and commented on two (2) Phase II CDAPs to date (July 29, 1994, for the Group #1 Phase II RI; August 10, 1994, for Sumps Phase II RI). EPA has not received any HSPs for Phase II RI activities at the facility.

Because of the delay in the drafting and submission of a facility-wide Phase II CDAP and HSP, EPA's request is irrelevant. EPA does, however, believe that a facility-wide CDAP (to include an Investigation Derived Waste Management Plan) and HSP are paramount to the consistency, effectiveness, and continuity of an investigation. To piecemeal these important documents results in the duplication of effort, perpetuation of mistakes, and inconsistent although continued reviews.

Therefore, prior to the undertaking of any new or additional studies, a NEW facility-wide CDAP and HSP must be submitted to EPA and TNRCC for review and comment.

Comment #2

General comment: EPA in several letters to the Army (June 7, 1994; July 13, 1994; July 29, 1994) has requested the development of a protocol to address the installation, construction, and sampling materials and techniques to be used for monitoring wells on the facility in known or suspected DNAPL-contaminated environments. To date, EPA's request has been ignored. An attempt to address the issue of drilling and of construction of monitoring wells in DNAPL-contaminated areas is included in the draft CDAP for Phase II for Group #2. EPA, however, does not believe that the issue has been thoroughly addressed. The proper installation, construction, and sampling materials and techniques are paramount when conducting an investigation into an area known or suspected to have DNAPL or DNAPL-type contaminants. To ignore the importance of precaution and preventative techniques could result is severe and possible irreparable harm to the environment.

EPA's Comments
Phase II RI Work Plan
11/28/94

Comment #3 — General comment: For clarity, refer to all Phase II documents as Phase II documents, not addendums. Given the number of documents associated with this project, "addendum to what?" may be difficult to trace. For all phases of work, refer to the current phase for which the work or amendment is associated.

Comment #4 — Phase II Work Plan, List of Acronyms/Abbreviations, page iv: MCL is Maximum Contaminant Level, not Maximum Concentration Limit.

Comment #5 — Phase II Work Plan, Section 4.6: During the March 23, 1994, scoping meeting for the Group #2 sites, EPA and TNRCC requested that Geoprobe ground water samples be collected from various locations throughout the site. The samples were to be analyzed for explosives, toluene, and metals. Based on the results of the Geoprobe sampling and analysis, EPA, TNRCC and the Army were to decide if ground water monitoring wells were needed. In order to satisfy EPA's and TNRCC's request, Geoprobe sampling must be conducted in the area of the Former TNT Waste Disposal Plant site (LHAAP 32) in addition to the work identified in the work plan.

Comment #6 — CDAP, Section 2, Figure 2-1, page 2: Is the organizational chart correct? Isn't Kevin DaVee the Project Manager? Hasn't Scott Henderson left the position of A-E Manager? Update the chart.

Comment #7 — CDAP, Section 4.0, page 1: "... *the USACE RI/FS Work Plan, Volume 1 and the Preliminary Draft Work Plan Addendum for Group No. 2 sites, developed by Sverdrup in August, 1994.*" What documents are these? The basis for selecting the general locations, types of samples to be collected, and the analytical parameters at each of the seven LHAAP areas were developed by the Army, EPA and TNRCC in the March 23, 1994, scoping meeting.

Comment #8 — CDAP, Section 4, Tables 4-1 and 4-2: Require update based on EPA's Comment #5.

Comment #9 — CDAP, Section 4.1: Care must be taken during Phase II that the deep stratigraphic borings are actually drilled down to the Midway.

Comment #10 — CDAP, Section 4.1, page 17: Hollow stem auger is the only method that is acceptable for the drilling of borings/monitoring wells.

EPA's Comments
Phase II RI Work Plan
11/28/94

Comment #11 — CDAP, Section 4.1, page 20 and Section 4.1.2, page 21: Insufficient attention has been paid to the reality of the presence of DNAPL at the UEP/Burning Ground No.3 sites (LHAAP 18 & 24) and the high potential for presence of DNAPL at the two landfill sites (LHAAP 12 &16). Refer to EPA's Comment #2. Therefore, Section 4.1.2, page 21, should read "*All water-bearing zones will be cased off with the casing thoroughly seated into the lower permeability materials beneath prior to the advancement of boring.*"

Comment #12 — CDAP, Section 4.1.2, page 22: How long will the grout be allowed to set before the boring will be advanced? I believe the minimum recommended set time is 24 hours. Identify the appropriate set time in the CDAP.

Comment #13 — CDAP Section 4.1.4, page 23: Again, identify the setup time on grouting.

Comment #14 — CDAP Section 4.2.1.1, page 24: How will the potentiometric surface be determined?

Comment #15 — CDAP Section 4.2.5, page 28: What kind of grout will be used when abandoning a well. EPA requests that the clay bentonite material described in Section 4.1.2 be used and that Section 4.1.2 be referenced in this section.

Comment #16 — CDAP Section 4.4, page 29: Why are no hydraulic studies being conducted on the new monitoring wells? Given the lack of hydraulic information regarding these sites, EPA requests that hydraulic testing be conducted on the new monitoring wells.

Comment #17 — CDAP Section 4.5.1.1, page 31: Refer to EPA Comment #2 regarding the need for establishment of procedures for the sampling of wells in DNAPL contaminated environments.

Comment #18 — CDAP Section 4.5.1.1.4, page 33: "*Immiscible liquid layers are not expected be encountered...*" This statement is inaccurate and inappropriate. Given the delicate nature of investigation into DNAPL-contaminated environments, knowledge and preparedness are paramount.

EPA's Comments
Phase II RI Work Plan
11/28/94

Comment #19 CDAP Section 4.5.1.3: Are the polyethylene tubing and silicon tubing to be used in sampling compatible with the contaminants expected to be encountered during the sampling?

Comment #20 CDAP Section 4.5.1.3: It was EPA's understanding that the direct push technology selected by the Army (i.e., Geoprobe) would also provide stratigraphic information.

Comment #21 CDAP Section 4.5.2, page 36: Given the site contaminants, is the use of Teflon-lined lids on the glass jars acceptable?

Comment #22 CDAP Section 4.7.1, page 39: What is the purpose of checking the headspace of a sample? If a determination of the presence of volatiles in the headspace of sample is desired, a flame-ionization detector should be used, not a photo-ionization detector (PID).

Comment #23 CDAP Section 4.7.3, page 39: Refer to EPA's Comment #1. Furthermore, the use of a PID for monitoring ambient air is unacceptable. Unless the ionization potential of every possible contaminant is known, the PID is useless for the purpose of protecting a worker. A PID along with several other SCREENING tools are acceptable for SCREENING, not MONITORING!

Comment #24 CDAP Section 4.10, page 43: Refer to EPA's comment #1 regarding the issue of the IDW Management Plan. However, in January 1994 monthly Project Coordinators meeting, EPA and TNRCC were told that a revised IDW Management Plan was to be submitted for review. To date, no such revision has been received by EPA for review.

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Dan Pearson, *Executive Director*

011592

DEC -2 PM 2:47

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

November 29, 1994

CERTIFIED MAIL
P 111 120 787
RETURN RECEIPT REQUESTED

David Tolbert, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Draft Phase II RI/FS Work Plan for Group 2 Sites

Dear Mr. Tolbert:

Texas Natural Resource Conservation Commission staff have reviewed the subject Work Plan and associated Chemical Data Acquisition Plan, which were transmitted by letter dated October 24, 1994. Our comments are enclosed.

If you have any additional questions or comments, please contact me at (512) 239-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

Enclosure

cc: Kevin DaVee, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Bud Jones, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action
Alvie Nichols, WASTE/PC - Superfund Engineering

TNRCC Comments
on
Longhorn Army Ammunition Plant
Draft Phase II RI/FS Work Plan
for
Group 2 Sites

1) Section 4.0 of the Work Plan (General Comment) -- When investigating for the presence of DNAPL's, the screened interval of the monitoring well should penetrate the underlying confining layer so that a thin layer of DNAPL cannot pass beneath the well without being detected.

2) Section 4.0 of the Work Plan (General Comment) -- If chemical analyses are not performed on soil samples from well borings, how will a determination be made as to whether the cuttings are contaminated and/or hazardous wastes?

3) Section 4.4 of the Work Plan, first line on page 17 of 26 -- Sentence should begin "If no *deeper* clay layer is observed . . . ".

4) Paragraph 4.1.2 on page C-37 of the CDAP (IDW Management Plan) -- the first step in determining if a waste is a hazardous waste is to determine whether it is (or contains) a <u>listed</u> hazardous waste (*i.e.* an F-listed solvent). If the waste is not a hazardous waste for this reason, the second step is to test the waste for the hazardous waste characteristics.

011594

FINAL

PHASE 2 WORK PLAN

for the

REMEDIAL INVESTIGATION
GROUP NO. 2 SITES

at

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Submitted to:

U.S. ARMY CORPS OF ENGINEERS
Tulsa District

DECEMBER 1994

Prepared by:

SVERDRUP ENVIRONMENTAL, INC.
ST. LOUIS, MISSOURI

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011593

LIST OF ACRONYMS/ABBREVIATIONS

ACD	Air Curtain Destructor
AMCCOM	U.S. Army Armament, Munitions, and Chemical Command
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
DCA	dichloroethane
DCE	dichloroethene
DEHP	bis(2-ethylhexyl)phthalate
DNB	dinitrobenzene
DNT	dinitrotoluene
EPA	U.S. Environmental Protection Agency
EPS	Environmental Protection Systems, Inc.
FFA	Federal Facility Agreement
GG	groundwater grab
GOCO	government-owned, contractor-operated
INF	Intermediate-Range Nuclear Forces
LHAAP	Longhorn Army Ammunition Plant
MCL	Maximum Contaminant Level
MEC	methylene chloride
MEK	methyl ethyl ketone, 2-butanone
MW	monitoring well
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
NT	nitrotoluene
PCB	polychlorinated biphenyls
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
SB	soil boring
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Concentration Limit
SS	shallow soil
SSHP	Site Safety and Health Plan
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TCA	trichloroethane
TCE	trichloroethene, trichloroethylene
TNB	trinitrobenzene
TNRCC	Texas Natural Resources Conservation Commission
TOX	total organic halides
TWC	Texas Water Commission
UEP	Unlined Evaporation Pond
USACE	United States Army Corps of Engineers
USAEHA	United States Army Environmental Hygiene Agency
VOC	volatile organic compound
WL	waste line
WW	monitoring well

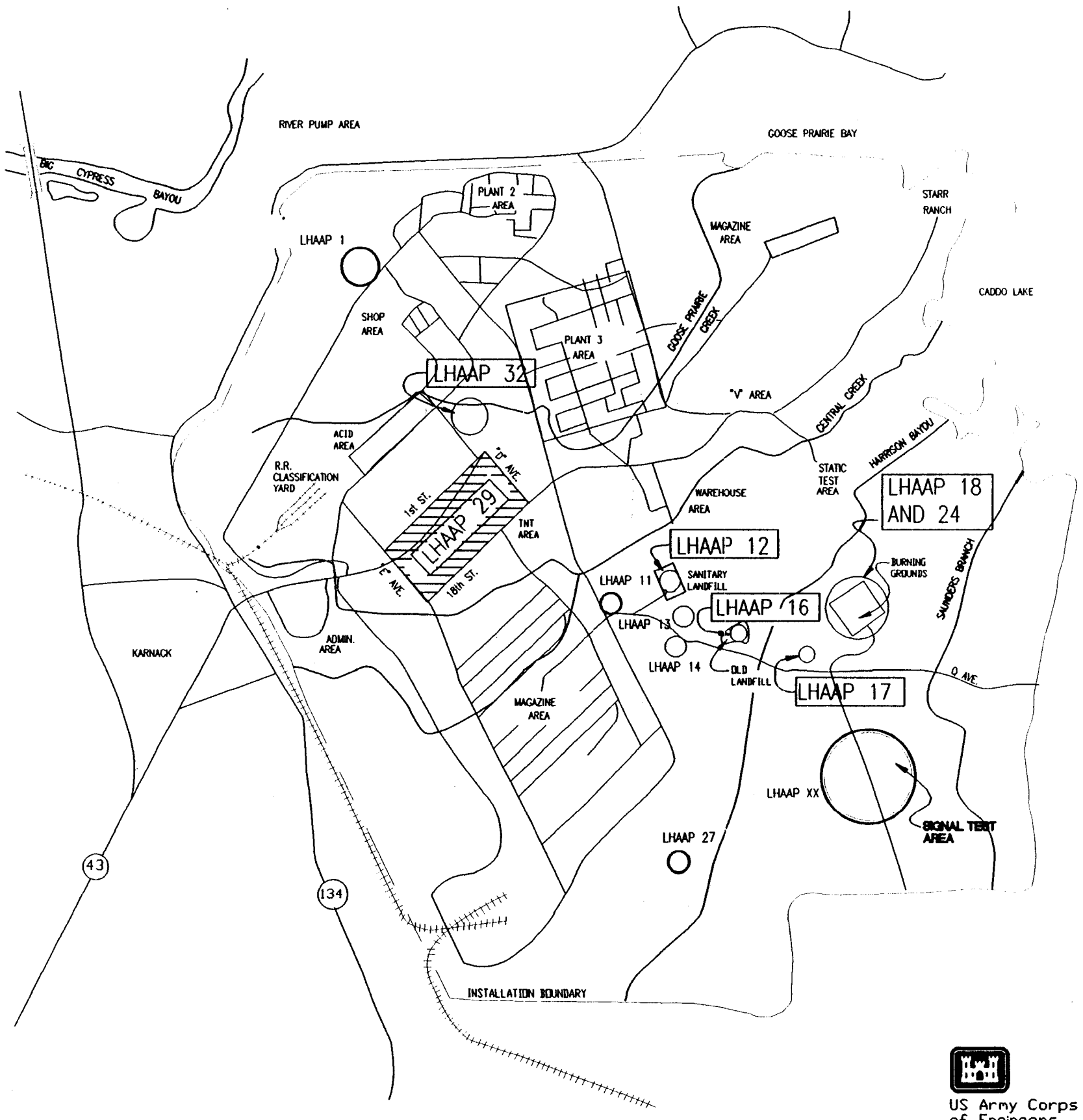
SECTION 1.0

INTRODUCTION

1.1 Introduction

This Phase 2 Work Plan describes the remedial activities necessary to conduct a Phase 2 Remedial Investigation (RI) at the Group 2 sites for Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. It provides modifications to the RI/FS Work Plan Volume I - General, U.S. Army Corps of Engineers, June 1992. These modifications address the activities required to perform a Phase 2 RI at seven (7) LHAAP sites, as listed in Table 1-1. The site locations within LHAAP are shown on Figure 1-1.

011600



GROUP 2 SITES IN THIS INVESTIGATION

LHAAP 12
LHAAP 16
LHAAP 17
LHAAP 18/24
LHAAP 29
LHAAP 32

N

3000 0 3000 6000

SCALE IN FEET

US Army Corps of Engineers Tulsa District

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

SITE LOCATION MAP

Sverdrup Environmental

FIGURE 1-1

TABLE 1-1

Group 2 Sites for Phase 2 Remedial Investigation Activities at LHAAP

LHAAP NO.	AREA NAME
12	Active Landfill
16*	Old Landfill
17*	Burning Ground No. 2/ Flashing Area
18*	Burning Ground No.3/Unlined Evaporation Pond
29*	Former TNT Production Area
32	Former TNT Waste Disposal Plant

* Indicates a SWMU listed in the RCRA Permit

1.2 Purpose and Scope

The purpose of this Phase 2 Work Plan is to ensure that environmental impacts associated with past and present activities at the LHAAP are thoroughly investigated in the Phase 2 RI at the Group 2 Sites, so that, if necessary, an appropriate remedial action is selected to protect the public health, welfare, and the environment. The proposed investigations presented herein are intended to satisfy the data requirements to complete the RI and the risk assessment.

The scope of this Phase 2 Work Plan is to present the rationale and step-by-step plan of action for each field activity included in the Phase 2 RI at the Group 2 Sites.

1.3 Regulatory Background

LHAAP was placed on the National Priorities List (NPL) on August 30, 1990. After being listed on the NPL, LHAAP, the U.S. Environmental Protection Agency (EPA), and the Texas Natural Resources Conservation Commission (TRNCC), formerly the Texas Water Commission (TWC), entered into a CERCLA Section 120 Agreement for remedial activities at LHAAP. The CERCLA Section 120 Agreement, referred to as the Federal Facility Agreement (FFA), became effective on December 30, 1991. The FFA specified that remedial activities would be conducted at 13 areas on LHAAP following CERCLA guidelines.

LHAAP was issued a Resource Conservation and Recovery Act (RCRA) Part B permit, Permit No. HW-50195, by the TNRCC in February 1992. Areas listed as Solid Waste Management Units (SWMUs) in the Part B permit are followed by an asterisk in Table 1-1.

1.4 Work Plan Organization

The Phase 2 Work Plan describes general information about the facility, previous investigations, and the proposed plan for the Phase 2 RI. This work plan is designed to complement the LHAAP RI/FS Work Plan prepared in June, 1992. Companion documents include the Phase 2 Chemical Data Acquisition Plan (CDAP) and the RI/FS Site Safety and Health Plan (SSHP). The Phase 2 CDAP incorporates

modifications to the RI/FS CDAP dated June 1992. The original RI/FS SSHP has been implemented without change for completion of the Phase 2 RI.

The Phase 2 Work Plan has been divided into four sections. Section 1.0 introduces the sites to be investigated, the regulatory background, and the organization of the Work Plan.

Section 2.0 provides general information about the facility. It describes the location, background, and other features of the facility.

Section 3.0 gives site specific information about each of the seven areas included in the Phase 2 RI. A detailed description is provided for each site. A discussion of previous investigations and a summary of the results are provided. The potential contaminants, migration pathways, and potential receptors of contaminants are also provided in the section.

Section 4.0 presents the data requirements needed for site characterization and the plan of investigations for each of the seven sites. The number of samples, type of samples (soil, groundwater, sediment, or surface water), and parameters to be analyzed are presented. The field procedures for obtaining the samples and lab procedures for analysis are described in the Phase 2 CDAP.

1.5 Project Management

Remedial activities at LHAAP will be performed by the U.S. Army with review and direction from the EPA Region VI and the TNRCC. The Army will use the U. S. Army Corps of Engineers (USACE) and the Corps' contractors to perform the remedial activities at LHAAP. The USACE will conduct operations under the direction of the Army's Project Manager for LHAAP, Mr. Dave Tolbert, Longhorn Army Ammunition Plant, ATTN: SMCLO-EV, Marshall, Texas 75671-1059.

SECTION 2.0

FACILITY BACKGROUND

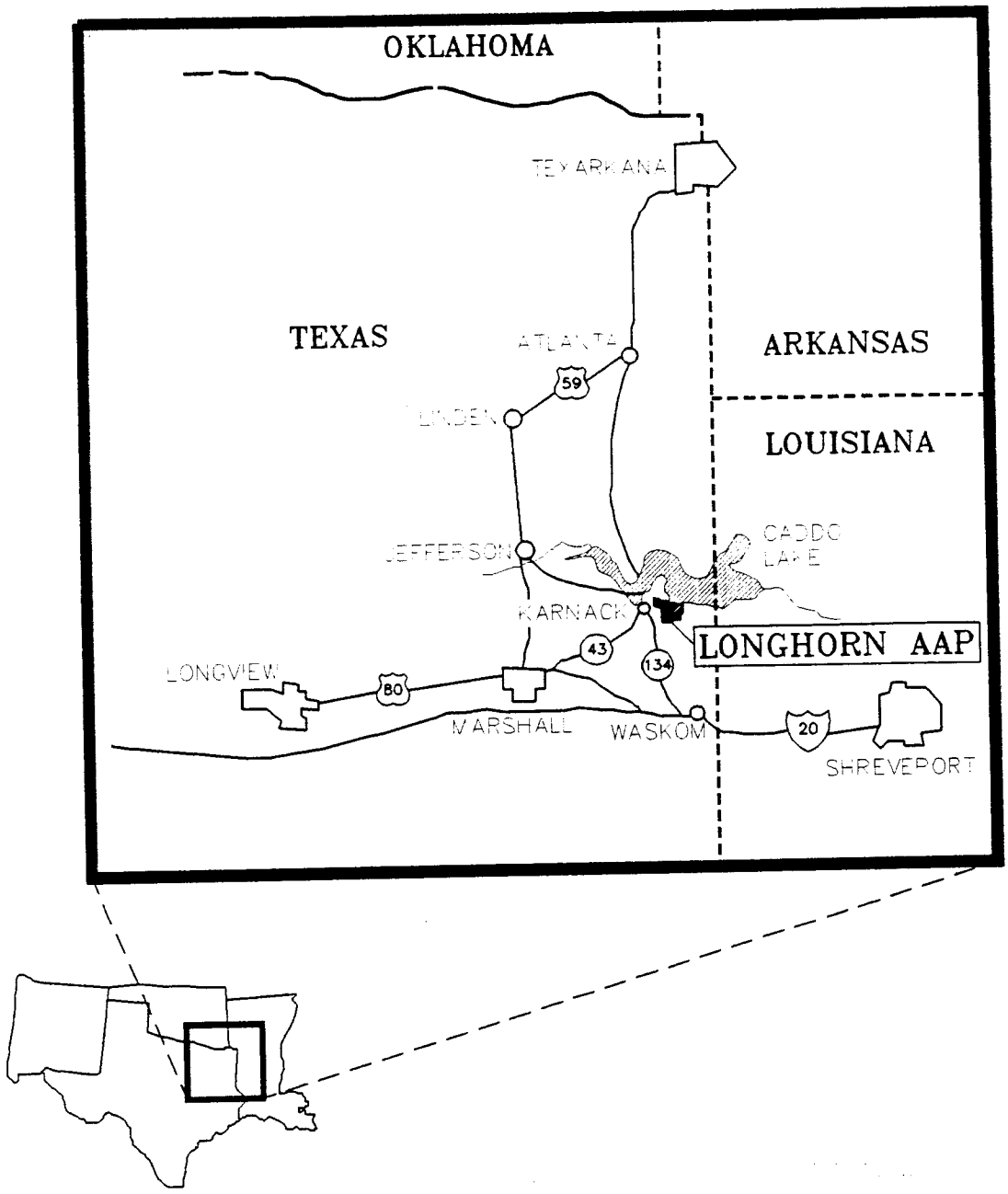
2.1 Location

Longhorn Army Ammunition Plant (LHAAP) is located in central east Texas in the northeast corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and approximately 40 miles west of Shreveport, Louisiana. The installation occupies 8,493 acres between State Highway 43 and the western shore of Caddo Lake. State Highways 43 and 134 access the installation. A location map is shown on Figure 2-1.

2.2 Boundary Features

Longhorn Army Ammunition Plant is bounded to the north and east by Caddo Lake, a large fresh water lake lying on the Texas-Louisiana state line. The eastern fence of the installation is 3-1/2 miles from the state border. The small incorporated city of Uncertain, Texas, and the non-incorporated community of Karnack, Texas, are located immediately north and west of the installation boundary, respectively. The remaining surrounding area is sparsely populated and is regionally known as the Pineywoods of east Texas.

011606



CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

SITE VICINITY MAP

Sverdrup Environmental

FIGURE 2-1

000086-5\LH5-02

2.3 Facility Background

Longhorn Army Ammunition Plant is a government-owned, contractor-operated (GOCO) industrial facility under the jurisdiction of the U.S. Army Armament, Munitions, and Chemical Command (AMCCOM). Its primary mission is to load, assemble, and pack (LAP) pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The Longhorn Division of Thiokol Corporation is the current operating contractor.

Longhorn Army Ammunition Plant was established in October 1942 with the primary mission of producing 2,4,6-trinitrotoluene (2,4,6-TNT) flake in the TNT Production Area. Monsanto Chemical Company was the first contract operator of the plant. Production of TNT continued through World War II until August 1945 when Monsanto's role ceased. The plant was placed on standby status until February 1952. From 1952 until 1956, Universal Match Corporation was the operating contractor, producing pyrotechnic ammunition such as photoflash bombs, simulators, hand signals, and 40 mm tracers.

In November 1955, Thiokol Corporation began operation of the Plant 3 area rocket motor facility. Thiokol assumed responsibility for total operation of the plant with the departure of Universal Match Corporation in 1956. Production of rocket motors continued to be the primary mission of LHAAP until 1965, when the production of pyrotechnic and illuminating ammunition was reestablished.

Current operations consist of compounding pyrotechnic and propellant mixtures, LAP activities, accommodating receipt and shipment of containerized cargo, and the maintenance and/or layaway of standby facilities and equipment for mobilization planning. The installation has also been responsible for the static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force (INF) Treaty in effect between the United States and the former U.S.S.R.

2.4 Climate

Longhorn Army Ammunition Plant is located in a moist, subhumid to humid, mild climate. The average annual rainfall is 46 inches. Precipitation is fairly evenly distributed throughout the year, although summer and fall are frequently drought seasons, and December through May are often the wettest months. Precipitation almost always occurs as rain, with snow a rare occurrence.

2.5 Additional Information

Additional background information about the Longhorn Army Ammunition Plant facility, including topography and drainage, geology and soils, regional hydrogeology, surface water and groundwater usage, surrounding land use, ecologic conditions, and cultural resources may be referenced in Section 2.0, Facility Background of the RI/FS Work Plan, Volume I - General.

SECTION 3.0

NATURE AND EXTENT OF CONTAMINATION

3.1 LHAAP 12 : Active Landfill

3.1.1 Site History. The Active Landfill was started in 1963 and used intermittently for the disposal of industrial solid wastes, and possibly hazardous waste, generated at LHAAP. Since 1978, the site has apparently been in continuous use for the disposal of industrial solid wastes generated at LHAAP. The landfill was used for disposal of non-hazardous industrial solid waste, under TNRCC Registration No. 30990. The landfill was closed in April, 1994.

Much of the history of the site is revealed by aerial photographs taken in May 1954, April 1963, and December 1978. Photos from 1954 reveal a ditch excavated through a low ridge between Central Creek and one of its principal tributaries that collects surface runoff from the southern part of the Magazine Area. The low ridge segment of the ditch and part of the borrow area were subsequently filled with waste and soil to form the nucleus of the current Active Landfill site. Aerial photos from 1963 show that waste materials had just begun to be disposed in the ditch about 350 ft downstream from its confluence with the diverted tributary stream. By 1978, photographs showed that a considerable volume of additional waste had been disposed in the ditch.

During the early 1980's, a large area alongside the southeast margin of the former diversion ditch was cleared for future waste disposal. This area received waste which consisted of nonhazardous combustible and non-combustible wastes having no scrap value.

3.1.2 Site Description. The Active Landfill is located in the central portion of LHAAP. The center of the site is about 1,700 feet east northeast of the intersection of Avenue P and Q. The entrance to the site's graveled access road is on Avenue Q about 0.2 mile east of Avenue P. The site contains an area of approximately 7 acres. A detailed map of the Active Landfill showing current site conditions is provided as Figure 3-1.

General soil and geologic maps indicate that the site is situated on the outcrop of the Wilcox Group. The Wilcox materials at the site generally consist of a few feet of residually-derived soils overlying silty and clayey sands, and sandy silts and clays. Excavations at the site removed some of the residual soils and exposed the underlying sands, silts, and clays. Most of the excavated materials were later replaced with waste and soil fill materials.

Surficial soils generally range in thickness from 0 to 3.5 ft, and consist of brown and gray clayey silt grading into a brown sandy clay. Below the surficial soils, a moist, brown to reddish brown sandy clay ranging from

011611

APPROXIMATE LIMITS OF ACTIVE LANDFILL

BH-17 (P)

BORROW AREA

12SW01

12SD01

12-103

12WW02

BH-18 (P)

HEAVY TIMBER

A'

12WW01

BG

12SW02

12SD02

BH-19 (P)

12WW04A

12WW04

APPROXIMATE ℄ OF BURIED DIVERSION DITCH

LANDFILL

12SB01

12SB02

3917

12WW03

12-121

12WW06

12WW07

A

BG

12SD03

3795
3796
3797
3798
3806
3807

12WW05

BH-20 (P)

12SW03

HEAVY TIMBER

APPROXIMATE LIMITS OF 1954 EXCAVATION FOR DIVERSION DITCH AND BORROW AREA

TO CENTRAL CREEK APPROX. 800'

TO CENTRAL CREEK APPROX. 600'

LEGEND

- ◆ SURFACE SEDIMENT SAMPLE (RI PHASE 1)
- ⊕ SURFACE WATER SAMPLE (RI PHASE 1)
- ◉ SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- ■ SURFACE SOIL SAMPLE (RI PHASE 1)
- ▣ SURFACE SOIL SAMPLE (PREVIOUS)
- ◆ SHALLOW MONITORING WELL (RI PHASE 1)
- ◉ MONITORING WELL (PREVIOUS)
- ● SOIL BORING (RI PHASE 1)
- ◉ SOIL BORING (PREVIOUS)

BG BACKGROUND SAMPLE LOCATION
(P) MONITORING WELL PLUGGED DURING RI PHASE 1
← SURFACE WATER FLOW DIRECTION
APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
A A' SOIL PROFILE LOCATION

N

100 0 100 200

SCALE: 1"=100'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 12
ACTIVE LANDFILL
SITE LAYOUT
AND SAMPLE LOCATIONS

Sverdrup Environmental

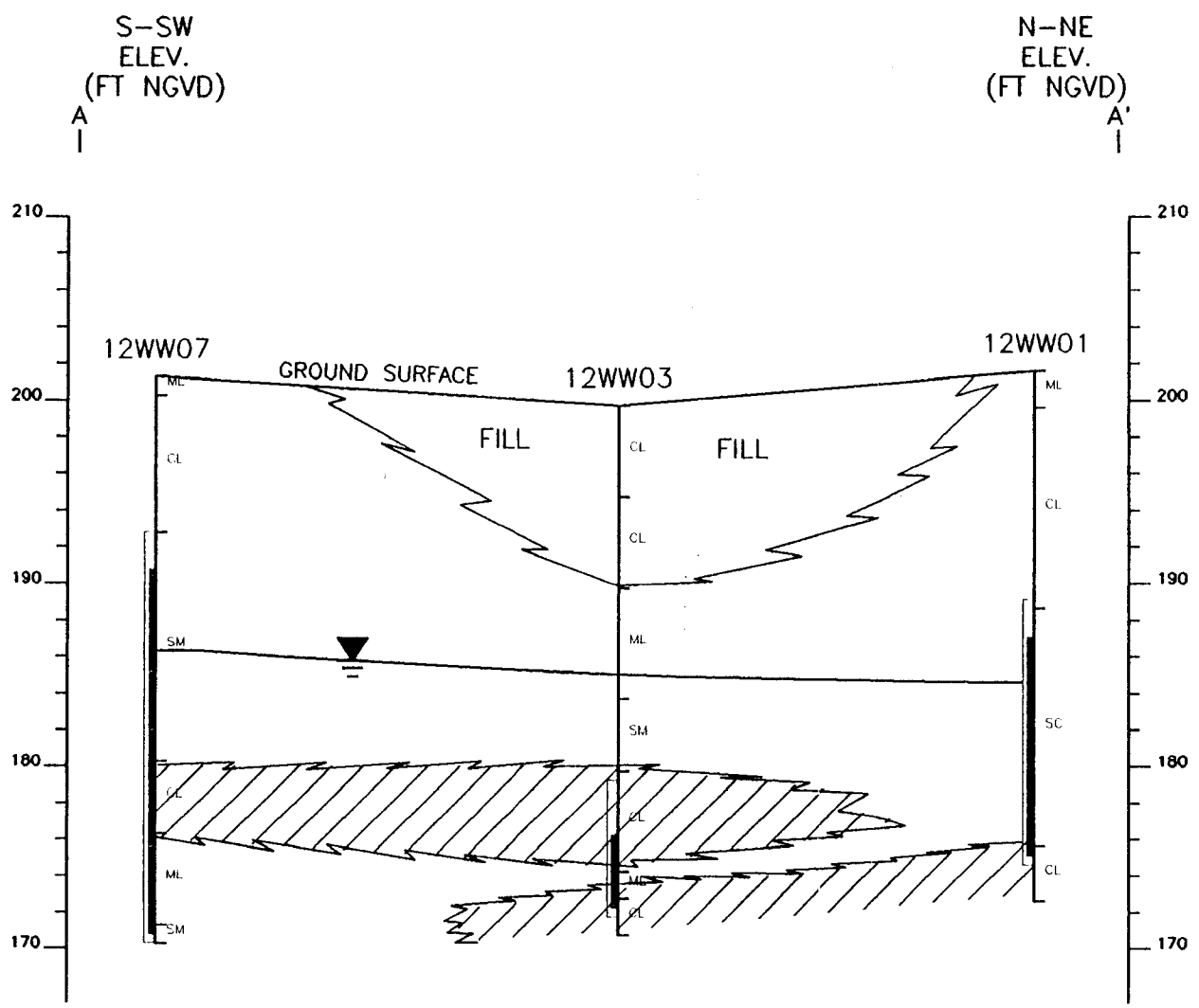
FIGURE 3-1

000086-5\LH5-03

3 to 10 ft thick is typically encountered across LHAAP 12. Extending below this zone to depths ranging from 6 to 17.5 ft below ground surface is a saturated silty, sometimes clayey, brown and gray sand. A clay layer, which may locally act as an aquitard to groundwater movement, was encountered within the suspected boundary of the landfill at approximately El. 172 to 180 ft NGVD. This clay layer was not encountered in borings 12-WW-05 and 12-WW-07, however. Figure 3-2 depicts a generalized soil profile across LHAAP 12.

Fill material, consisting of debris mixed with gray, clayey sandy silt, was encountered in borings 12-WW-03 and 12-WW-04. The fill material ranged in thickness from 5 to 10 ft in 12-WW-03 and from 10 to 18 ft in 12-WW-04. These borings were located near the suspected centerline of the landfill. Seven groundwater monitoring wells (12-WW-01 through 12-WW-07) were drilled and installed during the Phase 1 RI, and information from these wells, coupled with information from two previously installed monitoring wells, were utilized to investigate the shallow aquifer of LHAAP 12.

3.1.3 Previous Investigations. The Active Landfill was included in a contamination survey conducted under contract by Environmental Protection Systems, Inc. (EPS), as documented in June 1984. EPS installed two monitoring wells (103 and 121); groundwater samples were analyzed for explosives, selected metals, and selected anions.



LEGEND

CL — UNIFIED SOIL CLASSIFICATION SYMBOL

MONITORING WELL SCREEN INTERVAL

MONITORING WELL FILTER SAND INTERVAL

LOCALLY CONFINING LAYER

GROUNDWATER POTENTIOMETRIC SURFACE

SCALE: HOR. 1"=100'
VER. 1"=10'

100 0 100 200

NOTE: SOIL CONTACTS AND GROUNDWATER SURFACE ARE INTERPRETED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 12
ACTIVE LANDFILL
SOIL PROFILE A–A'

Sverdrup Environmental

FIGURE 3–2

000085-5\LH5-48

During the Phase 1 Remedial Investigation conducted by Sverdrup in 1993, groundwater, surface water, sediment, and soil samples were collected and analyzed for volatiles, semi-volatiles, explosives, metals, and anions. Three surface water samples (12-SW-01 through 12-SW-03) and three sediment samples (12-SD-01 through 12-SD-03) were collected at the locations outside the perimeter of the site to determine if contamination is moving offsite through surface drainage. Four soil borings, completed as wells 12-WW-01, -02, -05, and -07, were located outside the suspected boundary of the landfill to investigate whether water moving through potentially contaminated fill material and soil may be leaching contaminants and carrying them into underlying soils and pose a threat to groundwater. Three soil borings, completed as wells 12-WW-03, -04, and -06, were drilled within areas suspected to contain landfilled materials. Overall, nine groundwater samples were collected from site monitoring wells.

3.1.4 Assessment of Existing Data. Previous investigations by EPS indicated elevated concentrations of metals and anions in many surface water samples; copper, iron, and magnesium in several sediment samples; and chloride, cadmium, manganese, and traces of 1,3-DNB in groundwater samples. Groundwater samples also contained methylene chloride at 45 µg/l, exceeding the Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) of 5 µg/l.

The Phase 1 Remedial Investigation detected no significant contamination in the three surface water and sediment samples, with the exception of sediment sample 12-SD-03 (located at the north edge of the site), which contained concentrations of barium (384 µg/kg), chromium (24.7 µg/kg), lead (10.7 µg/kg), nickel (11.4 µg/kg), thallium (4.11 µg/kg), chloride (137 µg/kg), and sulfate (88.6 µg/kg) elevated above background levels at location 12-SD-02.

Analyses of soil samples from background boring 12-WW-07 detected bis(2-ethylhexyl) phthalate (DEHP) ranging in concentration from 660 to 5000 µg/kg from 5 to 17 feet in depth. Trace concentrations of acetone, toluene, ethylbenzene, and xylene were detected within borings 12-WW-03 and 12-WW-04 within the debris materials from 5 to 16 ft.

Groundwater contamination approaching or in excess of MCLs was detected in 5 of 9 wells. Detected contaminants included trichloroethene (TCE) in wells 12-WW-01 (27 µg/l) and 12-WW-03 (16 µg/l), 1,1,1-trichloroethane in Well 103 (66 µg/l), methyl ethyl ketone (MEK) in Well 121 (11 µg/l), and DEHP in well 12-WW-01 (15 µg/l). Well 12-WW-03 contained elevated concentrations greater than MCLs for lead, chromium, and nickel at 58, 162, and 207 µg/l, respectively. Barium was detected approaching the MCL in well 12-WW-03 at 979 µg/l (MCL=2000 µg/l). The explosive 1,3,5-trinitrobenzene (TNB) was detected in Well 121 at 17 µg/l. Well 121 also

contained trace concentrations of other explosives, including 2,4,6-TNT at 2.5 µg/l, 4-am-2,6-DNT at 0.78 µg/l, 2-am-4,6-DNT at 0.34 µg/l, and 2-nitrotoluene at 1.4 µg/l. 2-am-4,6-DNT was also detected in wells 12-WW-04 and 12-WW-06 at 0.16 µg/l and 0.56 µg/l, respectively.

3.1.5 Potential Contaminants and Migration Pathways. The primary sources of potential contamination at this site are industrial solid wastes generated at LHAAP and disclosed intermittently at the site since 1963. Soil samples taken from landfill materials contained trace concentrations of VOCs, primarily acetone, toluene, ethylbenzene, and xylene. Contaminants detected in groundwater included high concentrations of lead, chromium, and nickel exceeding MCLs in monitoring well 12-WW-03. Other groundwater contaminants included TCE in wells 12-W-01 and 12-WW-03 and 1,1,1-TCA in Well 103.

Migration pathways for contaminants include surface water, sediment, soil, and groundwater. Rainfall runoff from surficial fill materials and soils could transport contaminants to collection ditches and streams. Erosion of contaminated fill materials and soils during heavy rainfall could produce contaminated sediment that would be carried downstream. Water percolating downward through contaminated fill materials and soils appears to have leached contaminants and carried them into underlying soils and groundwater.

Groundwater is encountered at a relatively shallow depth at the site and is an important pathway for contaminant migration. Contaminant transport within the shallow aquifer was estimated using slug test data from the site monitoring wells, which indicated a mean hydraulic conductivity (K) of 8E-04 ft per min, and a resultant groundwater velocity (v=Ki/n) of 0.03 ft per day, calculated using average hydraulic gradient (i) = 0.004 to the east-northeast, and an aquifer porosity (n) = 0.15. Contaminated groundwater could discharge to surface water. All surface drainage would eventually enter Caddo Lake via Central Creek. The total flow distance from the site to the lake is 2.1 miles.

3.1.6 Identification of Potential Receptors. The general public does not have ready access to the site because it is located within the confines of LHAAP. Also, installation personnel and authorized visitors do not have ready access to the site, since the entrance road is closed with a locked access gate. Occasionally, hunters visit the site and adjoining areas.

A potential threat to public health and safety posed by contaminated groundwater originating at this site could be its emergence into the surface water flow regime of Central Creek and its tributaries. The nearest public water supply well, Well 902, is approximately 2.3 miles southwest, and hydraulically upgradient, of the site. There are no public water supply wells located in the directions of expected groundwater flow

downgradient from the site and none are expected to be installed. Groundwater generally flows from the site in a general east-northeasterly direction toward Caddo Lake. During wet periods, however, portions of groundwater flow may be more influenced by local surface topography to flow towards the north-northwest or south-southeast.

3.2 LHAAP 16 : Old Landfill

3.2.1 Site History. The Old Landfill was originally used from 1942 to 1944 for the disposal of TNT red water ash generated from the TNT Waste Disposal Plant (LHAAP 32). In the mid-to-late 1950s, three rocket motor casings were reportedly burned and possibly buried on the eastern side of the site. During this time, a large bermed depression encompassing the central section of the site was reportedly used for the disposal of a variety of materials such as substandard TNT, barrels of chemicals, oil, paint, scrap iron, and wood. This area was eventually filled in, and landfilling operations continued moving eastward, eventually raising the ground surface to its current elevation approximately 15 ft above the original grade. Burn pits and waste storage were common waste disposal activities conducted at the site during the history of its operation, but little is known about the nature of the wastes. The site continued to be used for a variety of waste disposal and treatment activities into the 1980s, when the disposal of inert solid wastes was moved to the Active Landfill (LHAAP 12).

3.2.2 Site Description. LHAAP 16 is located in the south-central portion of LHAAP, just north of Avenue Q and adjacent to the active retail sales area. The site encompasses approximately 20 acres and is composed of an open, grassy area bounded on the western and northern edges by a gravel road and by wooded areas along the eastern and southern edges. A rectangular paved area, known as the former retail sales area, is located at the western edge of the site. A tributary of the Harrison Bayou runs along the eastern edge. A detailed map of the Old Landfill showing current site conditions is provided as Figure 3-3.

Geologic maps indicate that the landfill is situated on Wilcox materials with the toe along the eastern edge of the area extending onto alluvial materials of the Harrison Bayou floodplain. Surficial soils at LHAAP 16 consist of medium plastic silts and clays. Dry to moist, silty fine sand containing silt and clay lenses is encountered at depths of 5-15 ft; it generally becomes saturated below 15-20 ft depth. Medium to highly plastic silts and clays exist below the sand and range in thickness from 10-30 ft. A second, saturated, fine to medium silty sand exists at depths of 30-50 ft. The deeper sand layer is generally less silty than the upper sand layer, and contains lenses of silt and clay throughout. A hard, silty clay is encountered below the second sand at depths of 40 to 80 ft. Groundwater is first encountered in the shallow silty sand aquifer at

16SB01(S)
BH-14 (P)
16WW04
A
16WW03
16SB02
16SW01
16SD01
16WW01
16WW02
BH-15 (P)
BG
16SB03(S)
BH-16 (P)
16WW05
(BG)
16WW06
16SB04
16SB05
16WW11
16SB06
16WW07
16WW08
16WW09
16WW10
A'
BH-13
BH-12
16SW02
16SD02
16SB07(S)
16SD03
16SW03
16SW04
16SD04
16SW05
16SD05
(BG)
200' SOUTH
HEAVY TIMBER
GRAVEL ROAD
AVE. Q
30' WIDE
20' WIDE
ASPHALT
RETAIL SALES AREA
BULK STORAGE
EXCAVATION AREA
APPROXIMATE LIMITS OF INACTIVE LANDFILL SITE

LEGEND

- SURFACE SEDIMENT SAMPLE (RI PHASE 1)
- SURFACE WATER SAMPLE (RI PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- SHALLOW MONITORING WELL (RI PHASE 1)
- INTERMEDIATE MONITORING WELL (RI PHASE 1)
- MONITORING WELL (PREVIOUS)
- SOIL BORING (RI PHASE 1)
- SOIL BORING (PREVIOUS)
- (S) STRATIGRAPHIC BORING (RI PHASE 1)
- BG BACKGROUND SAMPLE LOCATION
- (P) MONITORING WELL PLUGGED DURING RI PHASE 1
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- APPROXIMATE LIMITS OF DISPOSAL SITES
- A-A' SOIL PROFILE LOCATION

N

150 0 150 300

SCALE: 1"=150'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 16
OLD LANDFILL
SITE LAYOUT
AND SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 3-3

000086-5\LH5-05

depths of 5 to 20 ft below the surface of the landfill. The intervening clay aquitard between the shallow aquifer and deeper groundwater appears to be thicker and more consistent at LHAAP 16 than at LHAAP 12, averaging 15 to 20 ft thick. Figure 3-4 depicts a generalized soil profile across LHAAP 16.

3.2.3 Previous Investigations. The Old Landfill was investigated by EPS for USATHAMA and Morton Thiokol, Inc., as presented in reports published in June 1984 and May 1988, respectively. Ten surface soil samples were taken to a depth of 6 inches each along the eastern toe of the landfill; deeper soil samples were taken from a total of 20 soil borings within the limits of the landfill. All samples were analyzed for explosives, selected metals and anions.

During the Phase 1 Remedial Investigation conducted by Sverdrup in 1993, groundwater, surface water, sediment, and soil samples were collected and analyzed for volatile, semi-volatile, explosives, metals, and anions. Four soil borings (16-SB-02, -04, -05, and -06) were located within the suspected limits of the former waste disposal activity. Three of the borings (16-SB-04, -05, and -06) were located along the east-west centerline of the landfill in an effort to profile the depth of landfilled materials. The fourth boring (16-SB-02) was located in the northern end of the landfill within one of the former burn pit locations. Three deep

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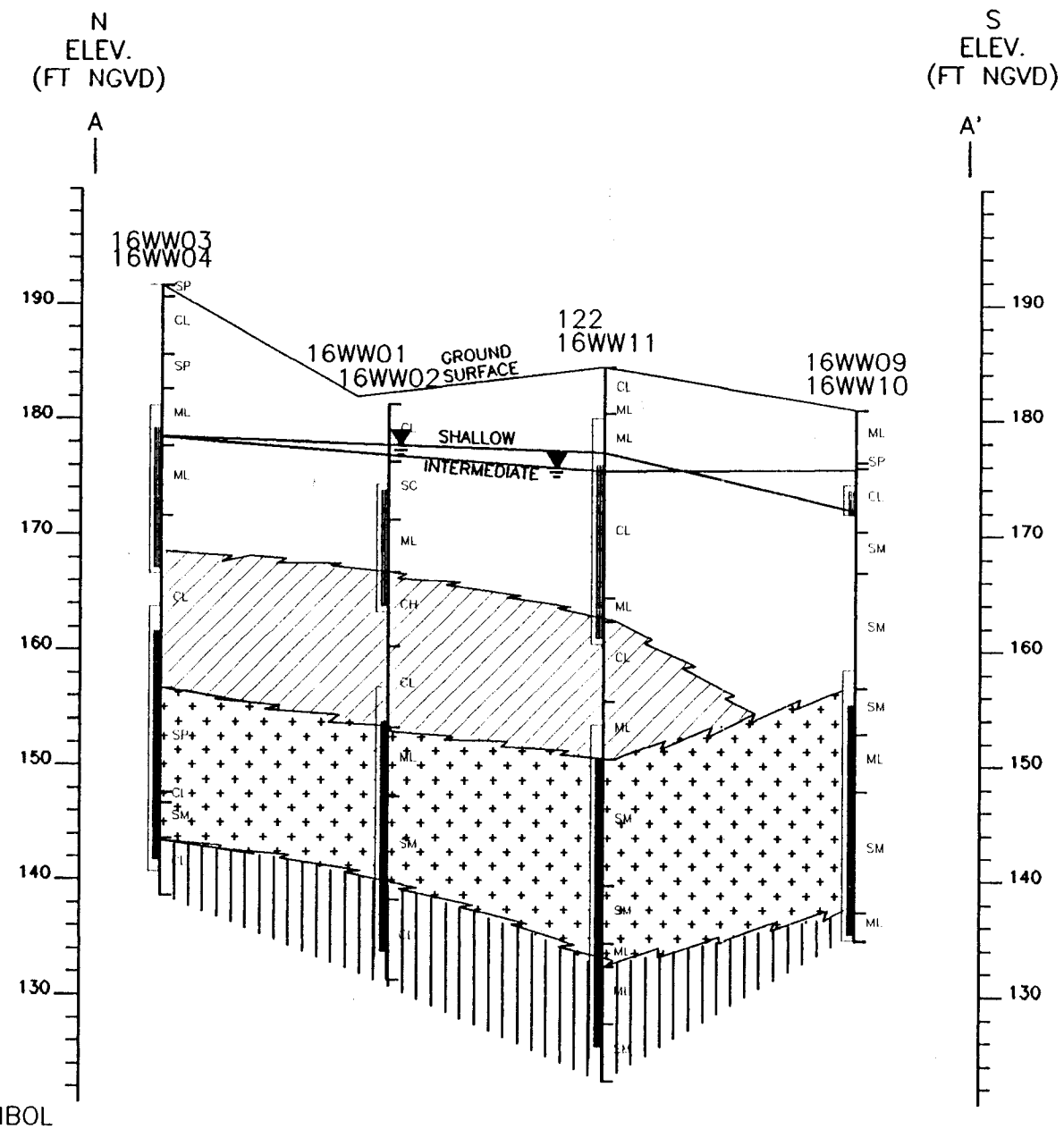

LEGEND

- CL — UNIFIED SOIL CLASSIFICATION SYMBOL
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL FILTER SAND INTERVAL
- LOCALLY CONFINING LAYER
- INTERMEDIATE AQUIFER
- DENSE GRAY SANDY CLAYEY SILT
- GROUNDWATER POTENTIOMETRIC SURFACE

SCALE: HOR. 1"=150'
VER. 1"=15'

150 0 150 300

NOTE: 1) SOIL CONTACTS AND GROUNDWATER SURFACE ARE INTERPRETED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 16
OLD LANDFILL
SOIL PROFILE A–A'

Sverdrup Environmental

FIGURE 3–4

borings (16-SB-01, -03, -07) were drilled to further define the geologic stratigraphy beneath the site. These borings were constructed outside of the boundary of the landfill to reduce the potential for cross contamination of water-bearing zones.

Five surface water samples (16-SW-01 through 16-SW-05) and five sediment samples (SD-01 through 16-SD-05) were also collected. Four of the samples targeted the surface water drainage paths leading from the site to determine if contaminants are migrating towards Harrison Bayou. Monitoring wells 16-WW-01 through 16-WW-11 were installed onsite at locations along the perimeter of the landfill area.

3.2.4 Assessment of Existing Data. Previous investigations by EPS indicated low concentrations of explosives and organic compounds in the soils at depths within the landfill, in the surface soils of the landfill, and the groundwater downgradient of the landfill. Contaminants 2,6-DNT and vinyl chloride were noted at concentrations of 8.6 µg/l and 10.5 µg/l, respectively, in groundwater. 2,6-DNT was also detected in soil samples as high as 73 µg/kg. Previous samplings of monitoring well 122 exceeded the MCL of 5 µg/l for cadmium with concentrations of 6.84 and 10 µg/l, obtained in 1984 and 1988, respectively.

The Phase 1 Remedial Investigation analyses detected no contamination in the five surface water and sediment samples. Contaminants detected in soil samples taken within landfilled materials included TCE in borings 16-SB-02 (7 - 10,000 µg/kg) and 16-SB-04 (130 - 3,100 µg/kg), cis-1,2-DCE in borings 16-SB-02 (6.5 - 2,600 µg/kg) and 16-SB-04 (180 - 630 µg/kg), and methylene chloride in boring 16-SB-02 (940 - 1,400 µg/kg). Concentrations of di-n-butyl phthalate reached up to 2600 µg/kg and 3100 µg/kg in borings 16-SB-02 and 16-SB-04, respectively.

Groundwater contamination was detected in 6 of 11 new wells. Contaminants exceeding MCLs included TCE at 6,400 µg/l (MCL=5 µg/l), methylene chloride at 520 µg/l (MCL=5 µg/l), and nickel at 142 µg/l (MCL=100 µg/l) in well 16-WW-03. Arsenic and cadmium were detected in Well 122 at 17 µg/l and 5.45 µg/l, respectively, exceeding the MCLs of 5 µg/l. Selenium was detected as high as 15.6 µg/l in well 16-WW-04. Other contaminants detected in groundwater included acetone (17 µg/l), cis-1,2-DCE (52 µg/l), nitrobenzene (1.5 µg/l), and lead (3.67 µg/l). Ten of twelve monitoring wells sampled exceeded the SDWA SMCLs of 250 mg/l for chlorides and sulfates. Wells 16-WW-05 and 16-WW-06 contained concentrations of chloride above the SMCL. Sulfate concentrations were particularly elevated in well 16-WW-02 at 1,850 µg/l, well 16-WW-03 at 4,926 µg/l, and well 16-WW-04 at 7,266 µg/l.

3.2.5 Potential Contaminants and Migration Pathways. The suspected sources of contamination are primarily buried explosive and solvent wastes. Materials deposited in the landfill are potential sources for contamination of the soil, surface water, and groundwater. Soil samples taken within landfilled materials detected notable concentrations of TCE, methylene chloride, cis-1,2-DCE, and vinyl chloride. Groundwater contaminants, detected in 6 of 11 new wells, included TCE, methylene chloride, cis-1,2-DCE, nitrobenzene, nickel, and cadmium.

The potential for surface water contamination exists due to run off across surface soils contaminated with explosives and from possible discharge of contaminated groundwater to surface water drainage. Erosion of contaminated soils during heavy rainfall and flooding could produce contaminated sediment that would be carried by surface water runoff into the tributary of Harrison Bayou adjacent to the site. Contaminated fill material and soils at the surface to depths of at least 15 feet create the potential for contaminating surface runoff from the site and for leaching contaminants down to groundwater beneath the site.

Groundwater within the shallow and intermediate aquifers is a significant pathway for contaminant migration from the site. Wells completed in the shallow aquifer, 16-WW-01 and 16-WW-03, contained levels of TCE exceeding the MCL, with cis-1,2-DCE approaching the MCL. Well 16-WW-03 also

contained concentrations of methylene chloride well above the MCL. Wells 16-WW-04 and 16-WW-11, completed in the intermediate aquifer beneath the first clay aquitard, contained TCE contamination at levels exceeding the MCL. Contaminant transport within the silty sand shallow aquifer and intermediate aquifer was estimated using slug test data from the site monitoring wells, which indicated a mean hydraulic conductivity (K) of 4E-04 ft per minute for the shallow aquifer and 1E-03 ft per minute for the intermediate aquifer, and resultant groundwater velocities (v=Ki/n) of 0.02 ft per day and 0.12 ft per day, respectively, calculated using an average hydraulic gradient (i) of 0.005 and an aquifer porosity (n) of 0.15. Contaminated groundwater could discharge to the tributary of Harrison Bayou. The total flow distance from the site to Caddo Lake is over 2.0 miles.

3.2.6 Identification of Potential Receptors. The general public does not have ready access to the Old Landfill site because it is confined within secured LHAAP boundaries. Access is further restricted by a locked gate on the entrance road to the site. The population having direct use of the site is primarily limited to the occasional hunter. There are no public supply wells in the direction of regional groundwater flow towards Caddo Lake. The horizontal distance that contaminants must travel to the nearest public supply well, Well 902, is approximately 2.2 miles southwest and upgradient of the site.

3.3 LHAAP 17: Burning Ground No.2/Flashing Area

3.3.1 Site History. Burning Ground No. 2/Flashing Area was used for burning bulk TNT, photo flash powder, and reject material when LHAAP was operated by Universal Match Corporation. In 1959, all of the materials removed from the TNT Production Area (LHAAP 29) and the TNT Waste Disposal Plant (LHAAP 32) during razing were burned and/or flashed at this site. The site was then used until 1980 as a flashing area to decontaminate recoverable metal by-products. Burning trenches were located around the inside perimeter of the previously fenced area and within the open area on the western side of the site. As each trench filled with ash, the trench was covered and a new trench was dug. The waste residues were reportedly removed in 1984 and the site was allowed to revegetate. The site is presently inactive.

3.3.2 Site Description. LHAAP 17 is located in the southeastern quadrant of LHAAP at the intersection of Long Point Road and Avenue Q and immediately southwest of LHAAP 18. The site is located within a heavily wooded section of LHAAP. The site has two 185 x 305 ft cleared areas separated by a gravel entrance road. The site is relatively flat and is covered with grass and scattered brush. A detailed map of the site showing current site conditions is provided as Figure 3-5.

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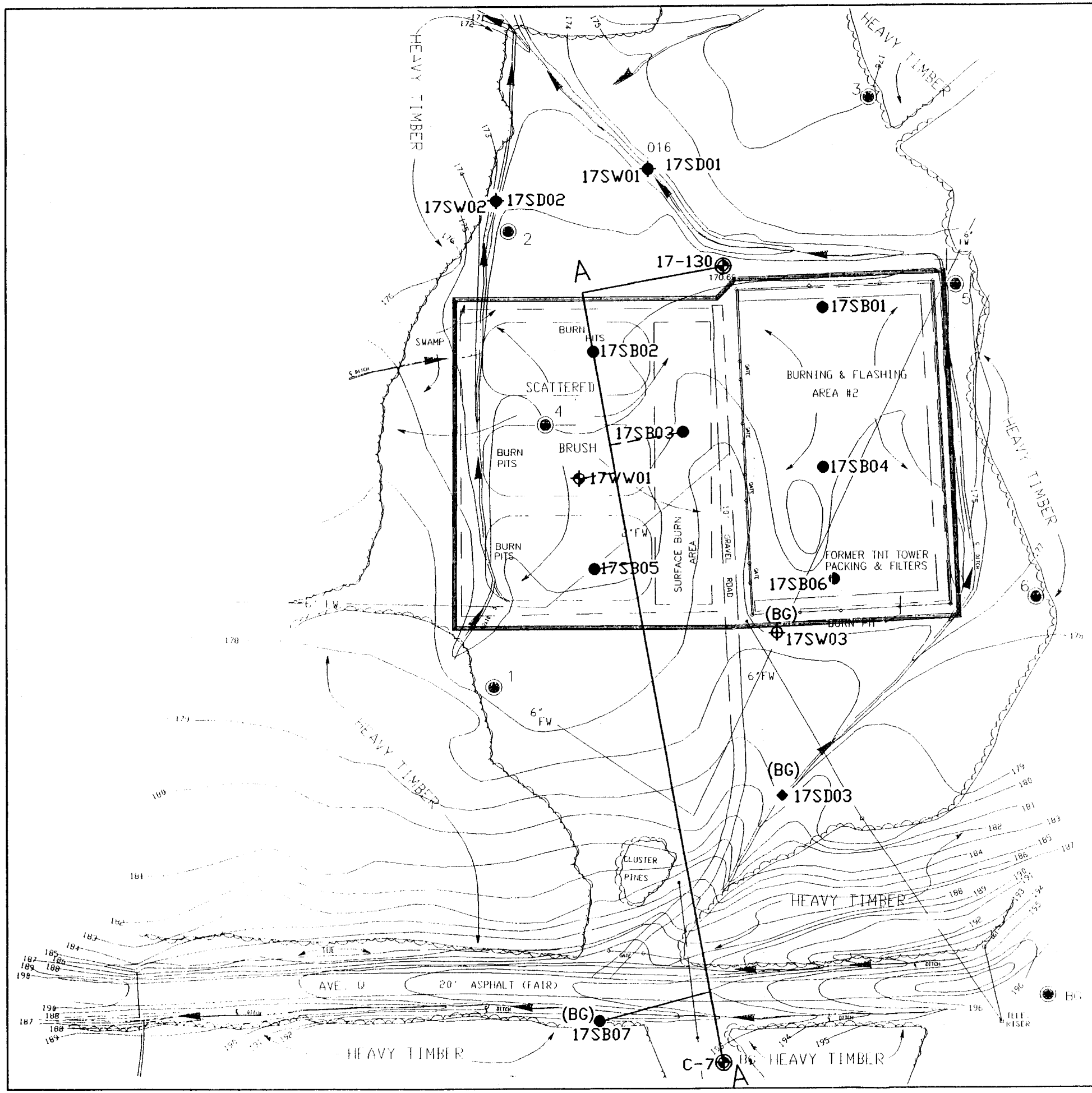

LEGEND

- SURFACE SEDIMENT SAMPLE (RI PHASE 1)
- SURFACE WATER SAMPLE (RI PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SHALLOW MONITORING WELL (RI PHASE 1)
- MONITORING WELL (PREVIOUS)
- SOIL BORING (RI PHASE 1)
- SOIL BORING (PREVIOUS)
- BG BACKGROUND SAMPLE LOCATION
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- APPROX. LIMITS OF BURN PITS/TRENCHES
- A A' SOIL PROFILE LOCATION

N

100 0 100 200

SCALE: 1"=100'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 17
BURNING GROUND NO. 2
FLASHING AREA
SITE LAYOUT & SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 3-5

LHAAP 17 is situated on alluvial materials overlying Wilcox Group materials. Surficial soils consist of medium plastic silts and clays containing thin sand lenses. Some borings encountered soft clay which may represent backfill of former disposal trenches or burn pits. An apparently consistent clay layer was noted from 5-8 ft depth. Saturated silty fine to medium sand was encountered beneath the clay layer from 8 to 15 ft depth. Figure 3-6 depicts a generalized soil profile across LHAAP 17.

Harrison Bayou flows approximately 1,200 ft northwest of the site. Surface drainage from LHAAP 17 flows to ditches along the eastern and western edges of the site, which lead to Harrison Bayou. The entire site is within the 100-year floodplain of the bayou.

3.3.3 Previous Investigations. The site was originally investigated as a potentially contaminated site by EPS for USATHAMA and Morton Thiokol, Inc., as documented in reports dated June 1984 and May 1988. The investigations included seven 5 ft deep soil borings and several surface soil samples. All samples were analyzed for explosives, VOCs, and selected (total) metals.

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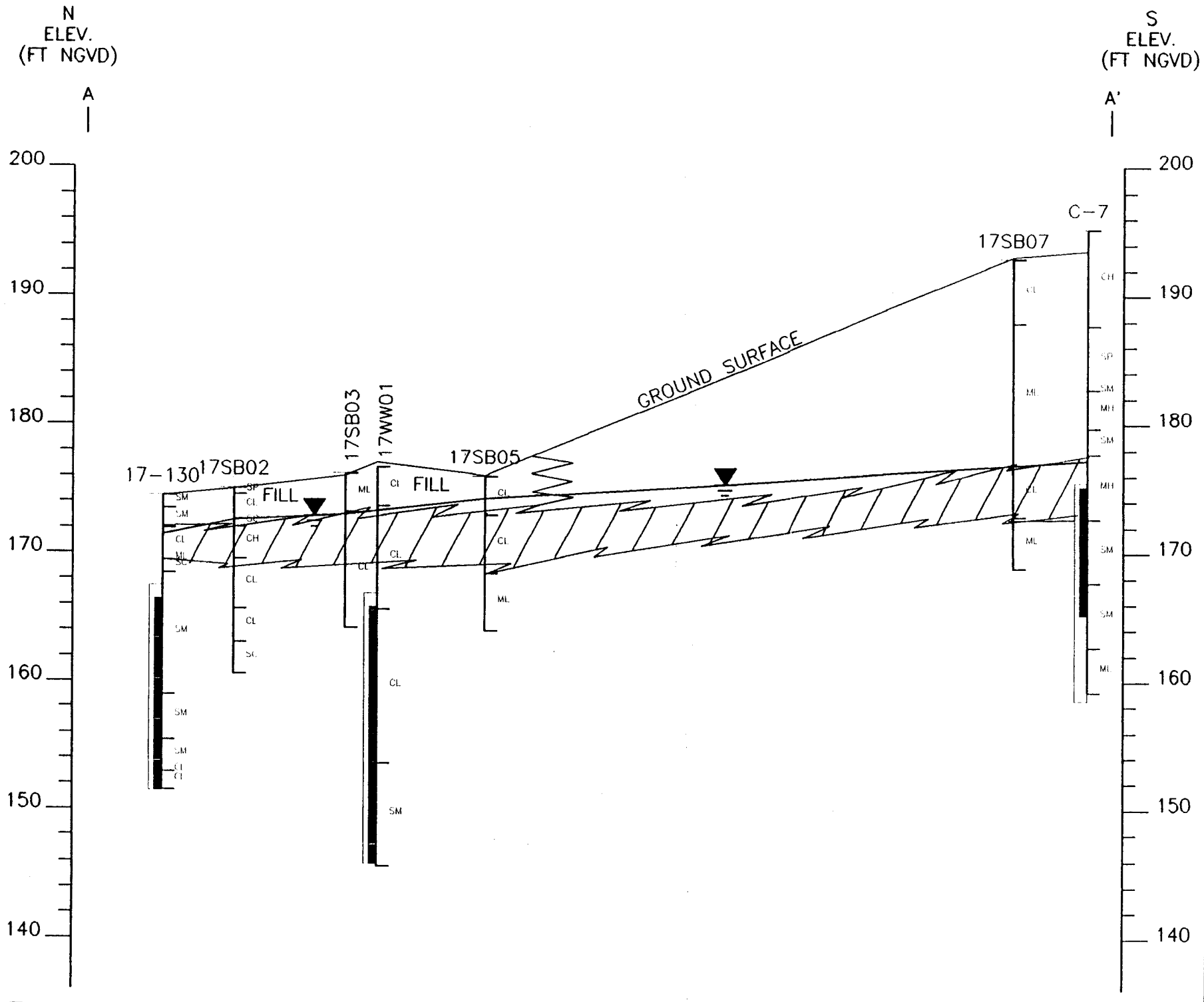


LEGEND

CL — UNIFIED SOIL CLASSIFICATION SYMBOL

MONITORING WELL SCREEN INTERVAL

MONITORING WELL FILTER SAND INTERVAL

LOCALLY CONFINING LAYER

GROUNDWATER POTENTIOMETRIC SURFACE

NOTE: SOIL CONTACTS AND GROUNDWATER SURFACE ARE INTERPRETED.

SCALE: HOR. 1"=100'
VER. 1"=10'

100 0 100 200

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 17
BURNING GROUND NO. 2
FLASHING AREA
SOIL PROFILE A-A'

Sverdrup Environmental

FIGURE 3-6

000080-0105.6A

During the Phase 1 Remedial Investigation conducted by Sverdrup in 1993, groundwater, surface water, sediment, and soil samples were collected and analyzed for volatile, semi-volatile, explosives, metals, and anions. Seven soil borings (17-SB-01 through 17-SB-06 and 17-WW-01) were drilled approximately 2 ft into groundwater in the suspected burn trench locations within the previously fenced flashing area, the center of the previously fenced flashing areas, and the suspected burn pit or trench locations on the western half of the site. Background boring 17-SB-07 was drilled along Avenue Q to the south of LHAAP 17. Three surface water (17-SW-01, -02, and -03) and three sediment samples (17-SD-01, -02, and -03) were collected at locations downgradient from the burnpit trench area, upgradient of the site, and from the flashing area on the eastern side of the site. One monitoring well, 17-WW-01, was installed, and groundwater grab samples were obtained from the seven soil boring locations (17-SB-01 through 17-SB-07).

3.3.4 Assessment of Existing Data. Previous investigations by EPS and Thiokol indicated concentrations of explosives and chlorinated organic compounds in soils down to a depth of 5 feet. Results from groundwater, surface water, and sediment sampling indicated no contamination of these media.

The Phase 1 Remedial Investigation provided soil samples containing trace concentrations of volatile organics, explosives, and/or heavy metals from all borings except 17-SB-05. Concentrations of explosives were detected in 6 of the 8 borings (17-WW-01, 17-SB-01, -02, -03, -04, -06) from the ground surface to depths of 5-7 ft, with the concentrations generally being the highest in the shallowest samples and decreasing with increasing depth. Detected explosives included 2,4,6-TNT ranging from 0.43 to 82 µg/g; 2,4-DNT ranging from 0.51 to 4000 µg/g; 2,6-DNT ranging from 0.75 to 500 µg/g; and 1,3,5-TNB ranging from 2.0 to 360 µg/g. Trace concentrations of volatiles, including methylene chloride, acetone, 1,1-DCE, 1,1-DCA, 1,2-DCA, 2-butanone, TCE, and PCE, were detected in soil samples from 17-WW-01. Elevated concentrations of acetone were detected in borings 17-SB-02, -03, -04, and -06. Metal concentrations in site soils were notably elevated above levels in background boring 17-SB-07, including barium in borings 17-SB-01, -03, and -04; chromium and silver in 17-SB-03 and -04; and lead in 17-SB-01 and -04.

Analyses of the three sediment samples detected no notable contamination. Surface water samples 17-SW-02 and 17-SW-03 contained lead at concentrations of 55.0 µg/l and 38.8 µg/l, respectively. Thallium was also detected at 10.3 µg/l. Contaminants detected in groundwater exceeding

MCLs included 1,2-DCA at 29 µg/l, 1,1-DCE at 51 µg/l, and TCE at 4000 µg/l in monitoring well 17-WW-01.

3.3.5 Potential Contaminants and Migration Pathways. Potential sources of contaminants at this site are explosive residues and ash resulting from burning and flashing operations in pits and trenches. Contamination is widespread within the shallow soils and present within the groundwater beneath the site. Low concentrations of explosives and chlorinated organic compounds have been identified in the soils down to a depth of 5 feet at a location suspected to be in the center of the western burn pit area at the site. Explosives were detected in soil samples from 6 of 8 borings. Groundwater samples from monitoring well 17-WW-01 contained concentrations of TCE, 1,2-DCA, and 1,1-DCE that exceeded MCLs. Borehole groundwater samples 17-GG-02 and 17-GG-06 also contained significant contamination with explosives.

Runoff across surface soils contaminated with explosive compounds and VOCs would follow surface drainage paths into Harrison Bayou and eventually into Caddo Lake. A high potential for the erosion of contaminated surface soils during flooding or heavy rainfall exists due to the site's location within the floodplain. Therefore, contaminated sediment could be carried

by surface water runoff into the surface drainage pathways leaving the site where it could be deposited or carried off to Harrison Bayou. Contaminants in subsurface soils appear to have migrated downward to the shallow groundwater beneath the site, and could eventually discharge to Harrison Bayou. Contaminant transport within the shallow aquifer was evaluated using slug test data onsite monitoring wells, which indicated a mean hydraulic conductivity (K) of 2E-04 ft per min and a groundwater velocity (v=Ki/n) of 0.006 ft per day, using average hydraulic gradient (i) = 0.003 and aquifer porosity = 0.15. The total flow distance from the site to Caddo Lake is 1.5 miles.

3.3.6 Identification of Potential Receptors. The general public does not have ready access to the Burning Ground No.2/Flashing Area because the site is located within the confines of LHAAP boundaries. Access is further restricted by a locked gate on the entrance road to the site. Because the site is no longer active, installation personnel have little opportunity to visit the site. The population having direct use of the site is primarily limited to the occasional hunter.

Because groundwater occurs under unconfined conditions, discharge of contaminated groundwater to Harrison Bayou poses a potential threat. The

horizontal distance that contaminants must travel to the nearest public supply well, Well 902, is approximately 2.4 miles southwest of the site and upgradient of LHAAP 17. There are no public supply wells in the direction of regional groundwater flow towards Caddo Lake.

3.4 LHAAP 18/24: Burning Ground No.3/Unlined Evaporation Pond

3.4.1 Site History. Burning Ground No. 3 has been in operation since 1955. The area has been used for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and combustible solvent wastes by open burning, incineration, evaporation, and burial. Historical waste management units include open burning pits, an unlined evaporation pond (UEP), stockpiles of solvent soaked sawdust, and suspected waste burial pits. The UEP, constructed at the burning ground in 1963, was originally utilized as a holding pond to store explosive wastes resulting from the washout of rocket motor casings, which was performed at the northern corner of the pond.

In 1973, the pond also began receiving wash water containing solvent residues and solids collected from LHAAP operations involving pyrotechnic material preparation and mixing. The washwater commonly contained metallic

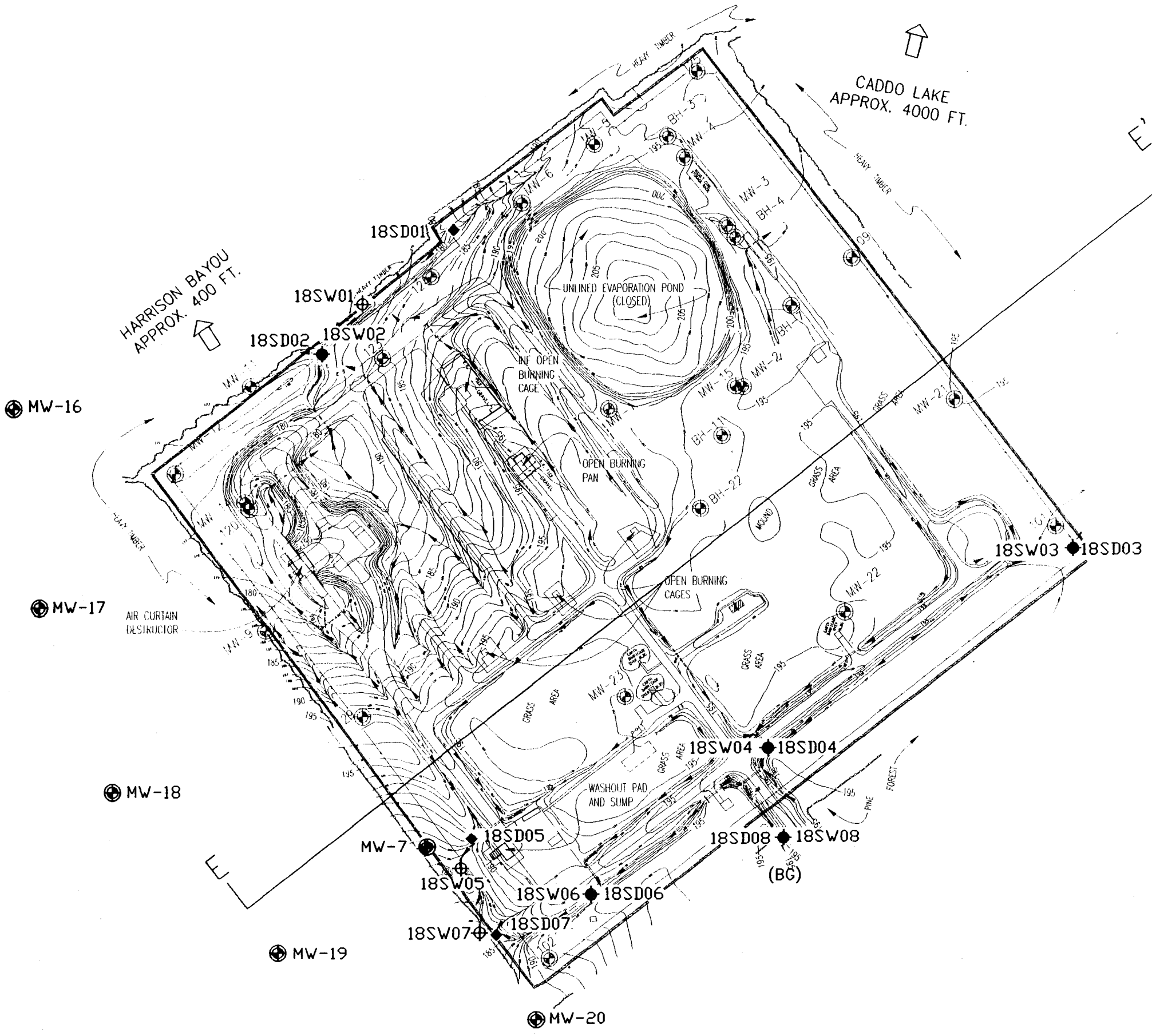
cations, nonmetallic anions, and organic solvents. Sawdust, soaked with methylene chloride and other solvents used to clean and scour mixers used for mixing illuminants, was stockpiled along the southern berm of the pond and was burned in trenches in the western portion of the burning ground. Use of the UEP was discontinued in 1984. The UEP was closed as a RCRA interim status surface impoundment in 1986 by removing all waste and capping the impoundment. Current operations at LHAAP 18/24 now include treatment of explosives and explosives-contaminated wastes by burning in the Air Curtain Destructor (ACD), three open burning cages, one open burning pan, and a burn cage for Perching II motor elimination.

3.4.2 Site Description. Burning Ground No. 3 is a fenced 34.5-acre secured area located in the southeastern quadrant of LHAAP at the end of Avenue Q. The Unlined Evaporation Pond/Rocket Motor Washout Facility (UEP) site is located within the northern corner of the burning ground. Harrison Bayou flows within 1,000 feet of the western edge and within 500 feet of the northern edge of the burning ground site. A detailed map of the site showing current site conditions is provided as Figure 3-7.

The site is a cleared area within a heavily wooded section of LHAAP. The area is generally vegetated with grass and weeds and is dissected with

LEGEND

- SURFACE SEDIMENT SAMPLE (RI PHASE 1)
- SURFACE WATER SAMPLE (RI PHASE 1)
- MONITORING WELL (PREVIOUS)
- BG BACKGROUND SAMPLE LOCATION
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- E E' SOIL PROFILE LOCATION



CORPS OF ENGINEERS, TULSA DISTRICT	
LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS RI PHASE 2 WORK PLAN	
LHAAP 18 AND 24 BURNING GROUND NO. 3 AND UNLINED EVAPORATION POND SITE LAYOUT & SAMPLE LOCATIONS	
Sverdrup Environmental	FIGURE 3-7

asphalt-paved roads. Topography of the site has been greatly altered by operations over the past 35 years. The burning ground is now mostly level with more relief near the western corner containing the ACD and near the northern corner containing the mounded surface of the former UEP site. Most of the fenced area of Burning Ground No. 3 is situated on an outcrop of the Wilcox Group, with a contact between the primary materials of the Wilcox and Recent alluvium located along the western corner of the site.

Surficial soils consist of a sandy/silty clay underlain by a sandy/silty stratum. A clay layer, varying from 5-15 ft thick, occurs from approximately El. 150 - 160 ft NGVD to El. 140 - 150 ft NGVD across the site. Depending on the particular location, the site is underlain by two or three possibly interlinked aquifers above the top of the Midway Formation. Figure 3-8 depicts a generalized soil profile across LHAAP 18/24.

3.4.3 Previous Investigations. USAEHA performed an investigation of the site in 1980 and installed 13 monitoring wells to monitor the UEP. The site was again investigated by EPS for USATHAMA , and a report was published in June of 1984. EPS installed nine monitoring wells within and around

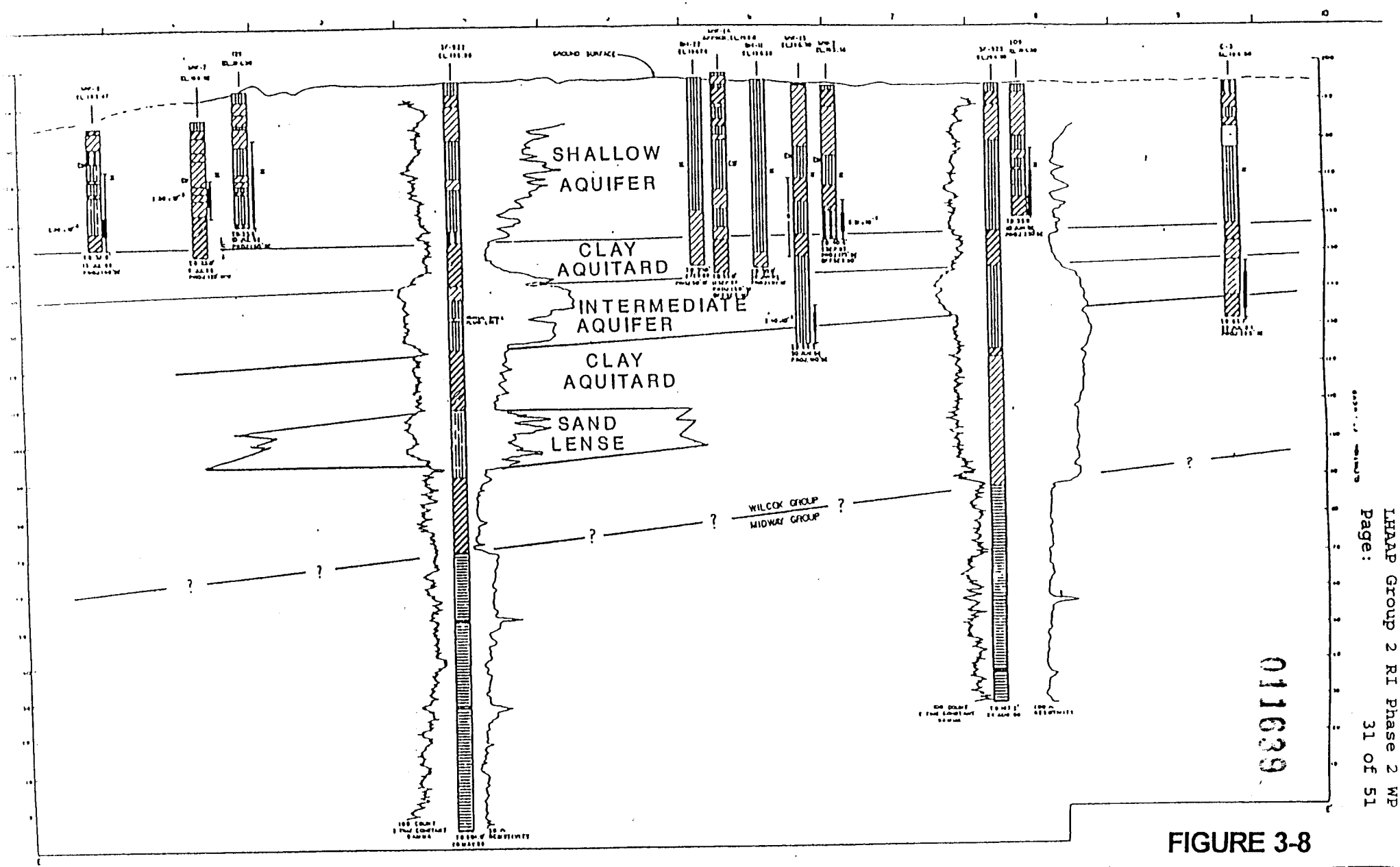


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FIGURE 3-8

NOTES

1. LOG SHOWN FOR MW-2 WAS FROM ORIGINALLY DRILLED LOCATION APPROXIMATELY 10 SE OF LOCATION SHOWN. WELL WAS CONSTRUCTED IN NEW BORING WHERE T.D. WAS 33.0'.
2. FOR LEGEND, STRATIGRAPHIC SYMBOLS, AND GENERAL NOTES, SEE SHEET 10.
3. FOR BORING LOCATIONS, SEE SHEET 11.
4. Soil Contacts Are Interpreted.

HORIZONTAL SCALE IN FEET

VERTICAL SCALE IN FEET

LOUISIANA ARMY AMMUNITION PLANT
RCRA FACILITY INVESTIGATION
ABG AND LEP SITES
PHASE I
SUBSURFACE PROFILE E - E'

ROBERT E. REIM

Burning Ground No. 3, and sampled them and the existing 13 USAEHA wells for explosives, metals, selected anions, and organic compounds. Results indicated nitrate, barium, cadmium, and chromium present in at least one of the monitoring wells at concentrations greater than the SDWA MCLs and SMCLs. Explosives were detected in many of the wells, including 1,3,5-TNB at 51 µg/l and 2,5,6-TNT at 5.6 µg/l. The USACE performed investigations for the Phase 1 RI in which they analyzed soil and groundwater for chlorides, nitrates, TOX, explosive compounds, VOCs, and metals. Concurrent with the investigations being performed for the Phase 1 RI, Morton Thiokol, Inc. contracted with EPS to sample three existing monitoring wells at Burning Ground No. 3 and analyze the samples for explosives as part of a study to identify TNT burial sites at LHAAP.

Due to the extensive investigations of LHAAP since 1981, the Phase 1 Remedial Investigation conducted by Sverdrup in 1993 was limited to surface water and sediment sampling. Eight surface water (18-SW-01 through -08) and eight sediment (18-SD-01 through -08) samples were collected for the purpose of determining if contaminated runoff is being generated and leaving the area. Four of these samples targeted surface drainage pathways, three isolated the source of any contaminants that may be migrating from a given area, and one was used to determine background

concentrations. The samples were analyzed for VOCs, SVOCs, explosives, total metals, nitrates, chlorides, and sulfates.

3.4.4 Assessment of Existing Data. Previous investigations by the USACE indicated extensive contamination beneath large portions of the site, including concentrations of methylene chloride (MEC) and trichloroethene (TCE) as great as 17,800,800 µg/l and 251,000 µg/l, respectively. In association with these contaminants were elevated concentrations of vinyl chloride at 25 µg/l (MCL=2 µg/l), trichlorofluoromethane at 46,300 µg/l, and 1,2-dichloroethane at 180 µg/l (MCL=5 µg/l). Concentrations of 1,3,5-TNB and 4-am-DNT were detected in monitoring well MW-2 at elevated levels. Chromium, lead, and nickel concentrations exceeded MCLs in scattered monitoring wells.

Elevated concentrations of volatile organic compounds were detected in a number of soil samples taken from former waste disposal trenches in the vicinity of the ACD. Particularly high concentrations of methylene chloride, TCE, 1,2-DCE, and styrene were also noted. Scattered soil samples from the drilling of site monitoring wells detected concentrations of volatile organic compounds.

The Phase 1 Remedial Investigation detected 17 µg/l of trichloroethene and 19 µg/l of cis-1,2-dichloroethene in surface water sample 18-SW-02, and elevated concentrations of barium, chromium, lead, and nickel in 18-SW-05.

3.4.5 Potential Contaminants and Migration Pathways. Sources identified as contributing to groundwater contamination existing beneath the burning grounds area include the contaminated groundwater resulting from past operation of the UEP, remnants of trenches containing solvent soaked sawdust around the ACD, and contaminated soil from various burn pits and trenches. Contaminants identified in the groundwater are various VOCs, including very high concentrations of chlorinated solvents, metals, total nitrates, and chloride, all of which are consistent with the past waste management activities performed at the sites and the nature of the wastes treated and disposed there.

The potential for surface water contamination exists from runoff across any contaminated surface soils remaining at the site. Intermittent surface water flow along these drainage pathways leading from past open burning sites within the burning ground could continue to carry these contaminated solids and redeposit them further away from the site. Remaining contaminated soils and fills near the ACD and UEP appear to continue to be

leaching and contaminating the underlying groundwater. Groundwater contaminated with organic and inorganic compounds forms a single plume beneath Burning Ground No. 3 that appears to be migrating very slowly to the west towards Harrison Bayou and to the north towards Caddo Lake. The potential exists for contaminants to migrate along this pathway and eventually impact the surface water regime.

3.4.6 Identification of Potential Receptors. The general public does not have ready access to Burning Ground No. 3 and the UEP because the sites are confined within secured LHAAP boundaries. Access to both sites is further restricted by a locked gate on the entrance road and tall fencing around the burning ground area. The population having direct use of the immediate area is primarily limited to installation personnel conducting burning operations.

Because groundwater occurs under unconfined conditions, discharge of contaminated groundwater to the surface waters of Harrison Bayou poses a potential threat. The horizontal distance that contaminants must travel to the nearest public supply well, Well 902, is approximately 2.6 miles southwest of the site area and upgradient of the site. There are no public supply wells in the direction of regional groundwater flow toward Caddo Lake. It is not anticipated that groundwater downgradient of the site will be developed for future use.

3.5 LHAAP 29: Former TNT Production Area

3.5.1 Site History. A TNT plant, consisting of six production lines, was operated in the former TNT Production Area from October 1942 until August 1945. The plant produced over 180 million kilograms of flake TNT from five regular production lines and one standby line. Each production line was essentially the same and consisted of four main elements: an unloading area where acids and toluene were unloaded and held in tanks until ready for use; a nitrating area where TNT flakes were produced by nitrating toluene with nitric acid; a wash area where the TNT flakes were washed to remove impurities and then dried; and a loading area where the cardboard-boxed TNT was loaded onto trucks.

A "yellow liquor" wastewater generated by the production plant and a "red liquor" generated at each of the wash areas was pumped through a 12-in underground wood stave pipeline to the TNT Waste Disposal Plant (LHAAP 32). Both the red and yellow wastewaters likely contained low concentrations of metals derived from the source water and picked up during the TNT purification and wastewater treatment processes.

The TNT production plant was inactive from August 1945 until 1959 when most of its buildings and above ground storage tanks were removed. There have been only limited activities at the site since World War II.

3.5.2 Site Description. LHAAP 29 is a heavily wooded site located in the western central portion of the LHAAP 29. The site is bounded by Avenue E on the southwest, 1st Street on the northwest, 18th Street on the southeast, and Avenue D on the northeast. A portion of LHAAP, the Bulk Toluene Storage Area, is located in a wooded area across Avenue D from the production area. A detailed map of LHAAP 29 showing current site conditions is provided as Figure 3-9.

Surficial soils typically consist of predominantly medium plasticity clays with some high plasticity zones to depths of 15-20 ft. Below this and extending to depths in excess of 25 ft, the soils are typically low plasticity silts or silty clayey sands and contain some medium to high plasticity clay zones within a very dense dark gray sand and silt layer. Groundwater is generally found confined within thin sand lenses within thicker silt layers. Figures 3-10 and 3-11 depict generalized soil profiles across LHAAP 29.

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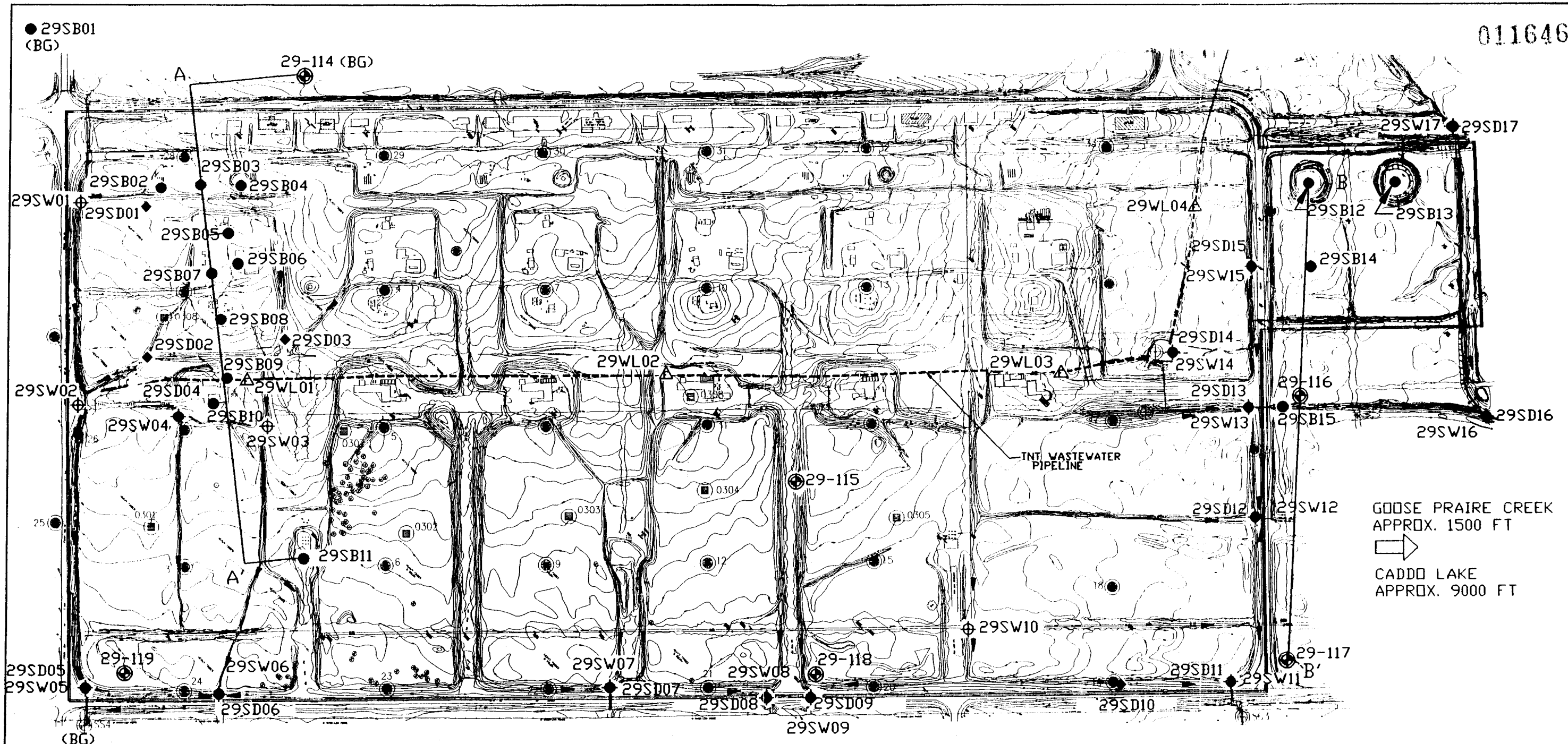


LEGEND

- SURFACE SEDIMENT SAMPLE (RI PHASE 1)
- SURFACE WATER SAMPLE (RI PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- MONITORING WELL (PREVIOUS)
- SOIL BORING (RI PHASE 1)
- SOIL BORING (PREVIOUS)
- WASTEWATER LINE SAMPLE (RI PHASE 1)
- (BG) BACKGROUND SAMPLE LOCATION
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE SITE LIMITS
- A A' SOIL PROFILE LOCATION

N

300 0 300 600

SCALE: 1"=300'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

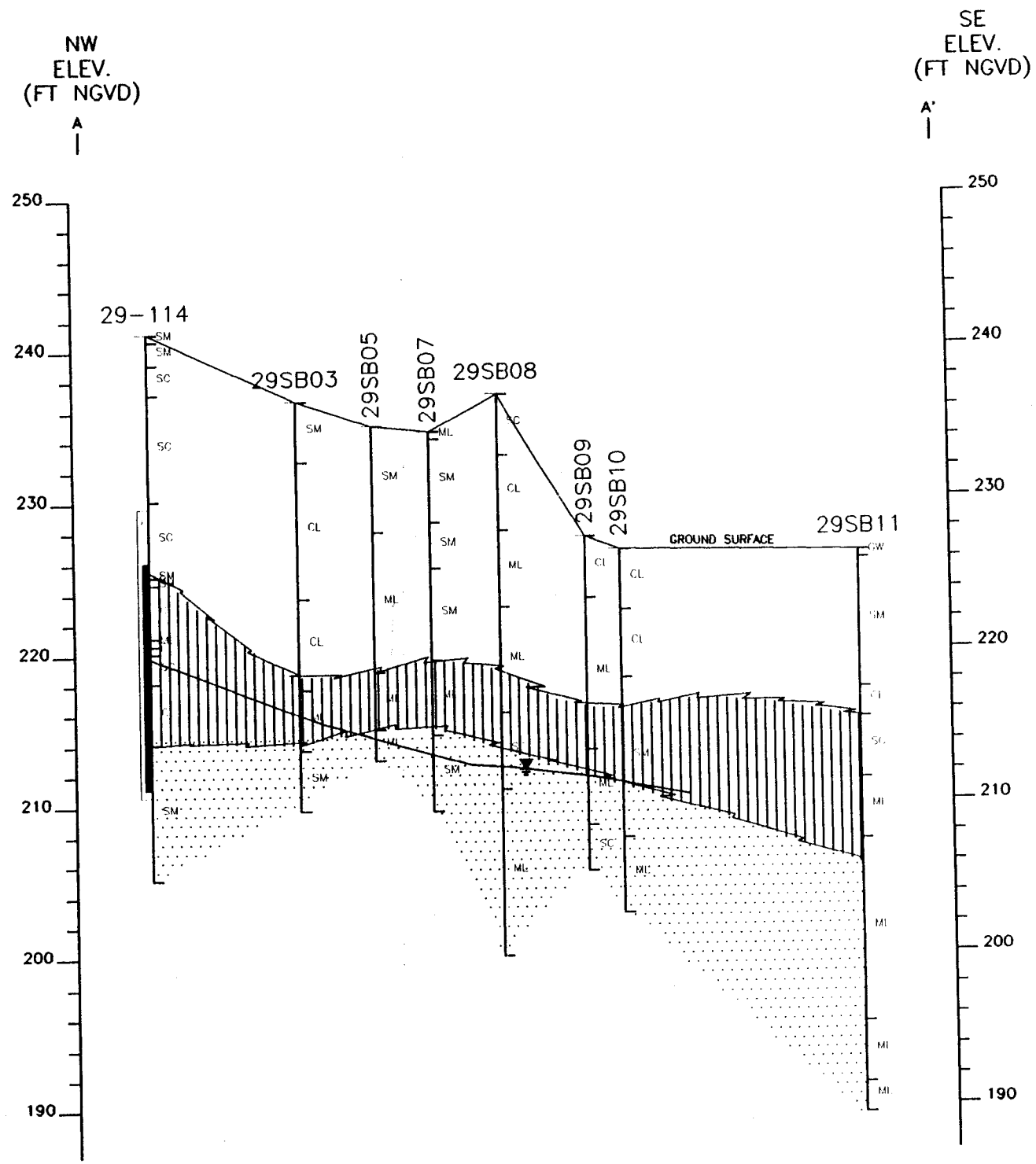
LHAAP 29
FORMER TNT PRODUCTION AREA
SITE LAYOUT
AND SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 3-9

000086-5\fs5-10

011647



LEGEND

- CL — UNIFIED SOIL CLASSIFICATION SYMBOL
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL FILTER SAND INTERVAL
- LOCALLY CONFINING LAYER
- DENSE GRAY SAND AND SILT
- GROUNDWATER POTENTIOMETRIC SURFACE

SCALE: HOR. 1"=300'
VER. 1"=10'

300 0 300 600

NOTE: SOIL CONTACTS AND GROUNDWATER SURFACE ARE INTERPRETED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

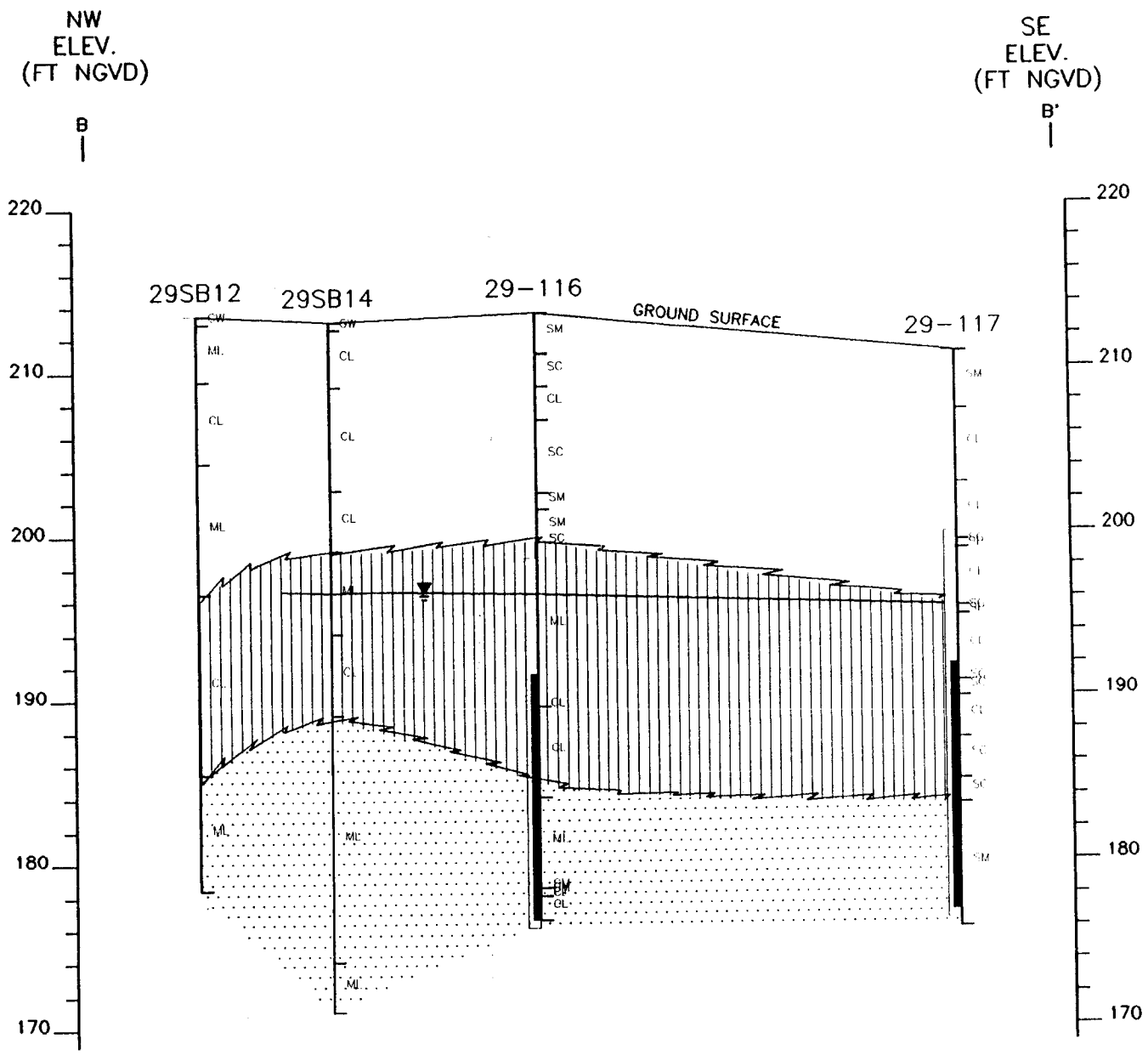
LHAAP 29
FORMER TNT PRODUCTION AREA
SOIL PROFILE A-A'

Sverdrup Environmental

FIGURE 3-10

000086-5\th5-8b

011648



LEGEND

- CL — UNIFIED SOIL CLASSIFICATION SYMBOL
- MONITORING WELL SCREEN INTERVAL
- MONITORING WELL FILTER SAND INTERVAL
- LOCALLY CONFINING LAYER
- DENSE GRAY SAND AND SILT
- GROUNDWATER POTENTIOMETRIC SURFACE

SCALE: HOR. 1"=300'
VER. 1"=10'

300 0 300 600

NOTE: SOIL CONTACTS AND GROUNDWATER SURFACE ARE INTERPRETED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 29
FORMER TNT PRODUCTION AREA
SOIL PROFILE B-B'

Sverdrup Environmental

FIGURE 3-11

000086 5\th5 8

3.5.3 Previous Investigations. The Former TNT Production Area was investigated as a potentially contaminated site by EPS for USATHAMA, as documented in reports dated June 1984 and May 1988. Six monitoring wells were installed to sample the groundwater for explosive compounds and VOCs. All surface water, sediment, and soil analyzed for explosive compounds.

During the Phase 1 Remedial Investigation conducted by Sverdrup in 1993, sources, groundwater, surface water, sediment, and soil samples were analyzed for volatiles, semi-volatiles, explosives, metals, and anions. Trenches were excavated to expose the red and yellow liquor wastewater pipeline at four locations designated 29-WL-01 through 29-WL-04. Sixteen of the seventeen surface water (29-SW-01 through -17) and sediment samples (29-SD-01 through -17) were collected within ditches that collect surface water runoff. Samples 29-SW-14 and 29-SD-14 were collected in the pond at the discharge point of the former TNT production wastewater pipeline. Fifteen soil borings were drilled to approximately 2 ft below the water table in TNT Production Line A to represent conditions within all six production lines. Groundwater grab samples were obtained from the 15 soil borings.

3.5.4 Assessment of Existing Data. Previous investigations by EPS confirmed 2,4,6-TNT in surface soils at the site and in surface water and sediments leaving the site. The highest concentration of 2,4,6-TNT identified in soils was 2,057 µg/kg. Surface water samples SS1 and SS2 contained 2,4,6-TNT at concentrations of 11 µg/l and 116 µg/l, respectively. Groundwater samples from the monitoring wells 114 and 118 revealed 1.4 µg/l of 1,3,5-TNB.

The Phase 1 Remedial Investigation detected elevated concentrations of metals in sediment samples, including chromium, ranging from 12.5-63.3 mg/kg; lead, ranging from 10.5-88.2 mg/kg; and mercury at 0.22 mg/kg. The background sediment sample LH29-SD-13 also contained notable concentrations of 2,4,6-TNT, 4-am-DNT, and 2-am-DNT. Other contaminants detected in sediment included acetone (112 µg/kg), toluene (31 µg/kg), di-n-butyl phthalate (11,000 µg/kg), and 2,4,6-TNT (51 µg/kg). Surface water analyses detected bis(2-ethylhexyl)phthalate (DEHP) at 45 µg/l in LH29-SW-13. Soil contamination was limited to explosives and DEHP. 2,4,6-TNT was detected at 110 µg/g and DEHP was detected in the range of 3,000-4,000 µg/kg. Soil samples taken from the surrounding soil beneath the pipeline detected no contamination with VOCs or explosives. Groundwater sampling of the existing monitoring well network detected contamination with 2,6-

dinitrotoluene (2,6-DNT) and 2-nitrotoluene (2-NT) in well 29-116. The groundwater sample from Well 29-118 contained mercury and selenium above MCLs at 3.0 and 162 µg/l, respectively. Cadmium was detected above the MCL in Well 29-119. Low concentrations of barium, chromium, lead, and nickel were also observed.

3.5.5 Potential Contaminants and Migration Pathways. The potential source of contaminants are the residues of explosive compounds and explosives manufacturing wastes scattered over the site and possibly concentrated in some of the lower lying portions of the site. Groundwater sampling of the monitoring well network detected contamination with 2,6-DNT, 2-NT, and mercury, selenium, and cadmium above MCLs. Borehole water data indicated potential groundwater contamination with 1,3,5-trinitrobenzene (1,3,5-TNB), 2,4,6-trinitrotoluene (2,4,6-TNT), 2,4-DNT, 2-NT, and 4-NT.

Migration pathways include the surface water, groundwater, sediment, and soil. The potential for surface water contamination exists from runoff across contaminated surface soils. Erosion of contaminated surface soils during heavy rainfall could produce contaminated sediment that would be carried by surface water runoff into the ditches on the site where it could deposit in these ditches or in the pond at the former pumphouse

location. Contaminated surface soils could contaminate surface water runoff. Water percolating downward through contaminated soils could also eventually leach explosives or organic contaminants into the groundwater, which occurs about 20 ft beneath the site.

Contaminant transport within the shallow aquifer was estimated using slug test data from the site monitoring wells, which indicated a mean hydraulic conductivity (K) of 7E-05 ft per min and a resultant groundwater flow velocity of 0.005 ft per day for the western portion of the site and 0.0015 ft per day for the eastern portion, using average hydraulic gradients (i) of 0.007 and 0.002, respectively, and an aquifer porosity of 0.15. Contaminated groundwater could be discharged to surface water flow downstream from the site.

3.5.6 Identification of Potential Receptors. The general public does not have ready access to the Former TNT Production Area because the site is confined within secured LHAAP boundaries. Access to the site is not restricted except by one locked gate on the main entrance road to the site. The site is no longer active. Therefore, installation personnel have little opportunity to visit the site. The population having direct use of the site is primarily limited to the occasional hunter.

Because groundwater occurs under unconfined conditions over much of the installation, discharge of contaminated groundwater to the many surface water channels bisecting the installation poses a much greater threat. There are no public supply wells in the direction of regional ground flow towards Caddo Lake. The horizontal distance that contaminants must travel to the nearest public supply well, Well 504, is approximately 0.9 mile west and upgradient of the site.

3.6 LHAAP 32: Former TNT Disposal Plant

3.6.1 Site History. The former TNT Waste Disposal Plant was constructed in 1942 to treat and dispose of wastewaters generated at the nearby former TNT Production Area (LHAAP 29). Wastewater resulting from the production of 180 million kilograms of TNT was disposed of through the plant. The wastewaters were transferred to the disposal area through a 6-in wooden pipeline and stored in holding tanks until treatment. During operation of the disposal plant, leakage from its many tanks and pipelines was reportedly a constant problem. Because of the large volumes of wastes that were handled, there were probably occasional spills resulting from the overflow of tanks and manual handling of wastes.

Wastewaters were pumped to the Settling Tanks then piped to the Evaporator Building where pH was increased by mixing in sodium hydroxide from the Caustic Soda Storage Tanks. The mixture was returned to the Evaporator Building for water content reduction. Condensate was collected and stored in the Condensate Storage Tank, and eventually released via the blue water ditch to Goose Prairie Creek.

A blue water ditch, which appears to have had its upstream terminus at the detention pond, carried acidic cooling water from the disposal plant to the Neutralization Plant located next to the Bulk Toluene Storage Area in LHAAP 29. The plant was not operated after 1945. In 1959, most of the buildings and tanks used in the disposal process were removed and the debris burned at LHAAP 17.

3.6.2 Site Description. LHAAP 32 is located in the west central portion of LHAAP. The site entrance is on Avenue C about 0.2 miles northwest of its intersection with 1st Street. The site covers approximately 9 acres and is covered extensively with trees and brush that have grown over the site since the 1940s. A detailed map of LHAAP 32 showing current site conditions is provided as Figure 3-12.

011655

CADDO LAKE
APPROX. 8000 FT

LEGEND

- SEDIMENT SAMPLE (RI PHASE 1)
- SURFACE WATER SAMPLE (RI PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- MONITORING WELL (PREVIOUS)
- SOIL BORING (RI PHASE 1)
- SURFACE WATER FLOW DIRECTION
- WASTEWATER LINE SAMPLE (RI PHASE 1)
- BG BACKGROUND SAMPLE LOCATION

32SW01
32SD01
32SB01
32SB02
32SW02
32SD02
32SB04
32SB06
32SW07
32SD07
113
32SB03
32SB05
32SB07
32SB12
32SB10
32SB08
32SB09
32SW05
32SD05
32SW06
"RED AND YELLOW LIQUOR" WASTEWATER PIPELINE
32SB11
32SD06
32WL01
32SW03
32SD03
(BG)
32SB13
32SD04
(BG)
32WL02
(BG)
32SW04

N

150 0 150 300
SCALE: 1"=150'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 32
FORMER TNT WASTE DISPOSAL SITE
SITE LAYOUT
AND SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 3-12

000086-5\In5-09

General soil and geologic maps indicate that the site is located on an outcrop of the Wilcox Group of sediments. These sediments appear to be overlain by a few feet of residually-derived soils or fill materials. The fill materials are restricted to a few scattered small areas and resulted from grading operations during construction of the disposal plant. Yellowish brown, medium plastic, and silty clay is encountered to a depth of 10 to 15 ft. Gray, low plasticity silt is encountered from 5 to 15 ft depth. Underlying the low plasticity silt is very dense, dark gray sand, and silt, occasionally containing lignite lenses. Groundwater is generally observed within the very dense and silt below a depth of 25 to 30 ft in depth.

3.6.3 Previous Investigations. The site was investigated by EPS for USATHAMA, as presented in a report published in June 1984. EPS installed one monitoring well 113; groundwater samples were analyzed for explosives. Surface water, sediment, and shallow soil samples were collected in Goose Prairie Creek and analyzed for explosives.

During the Phase 1 Remedial Investigation conducted by Sverdrup in 1993, surface water, groundwater, sediment, and soil samples were analyzed for VOCs, SVOCs, explosives, metals, nitrates, and sulfates. Seven surface

water (32-SW-01 through -07) and seven sediment (32-SD-01 through -07) samples were collected from the detection pond, former settling tank locations, and surface water runoff collection ditches. Trenches were excavated to expose the red and yellow liquor wastewater pipeline at two locations designated 32-WL-01 and 32-WL-02. The pipeline contents were analyzed for explosives and VOCs. Thirteen soil borings were drilled and designated 32-SB-01 through 32-SB-13. Five of these borings were taken to a depth of 5 ft to characterize suspected shallow soil contamination. Groundwater grab samples were obtained from each of the eight deeper soil borings.

3.6.4 Assessment of Existing Data. Results from previous investigations by EPS indicated that, with the exception of 2,4,6-TNT found in surface water sample 3919 at 7.6 µg/l, explosives were below detection limits. Surface water analyses indicated concentrations of aluminum, chromium, lead manganese, and nickel above local background levels.

The Phase 1 Remedial Investigation indicated no contamination of the pipeline contents and surrounding soil with explosives or volatile organic compounds. Surface water sample 32-SW-06 contained a lead concentration of 252 µg/l. Sediment samples LH32-SD-06 and LH32-SD-07, taken within the

blue water ditch, contained lead concentrations at 62 and 324 mg/kg, respectively. Sample 32-SD-07 contained mercury at 0.36 mg/kg. Arsenic, chromium, and nickel were detected in 32-SD-02 and 32-SD-03 at concentrations greater than background concentrations (32-SD-04).

Soil samples from boring 32-SB-10 detected notable concentrations of metals including silver at 8.78 mg/kg and mercury at 0.19 mg/kg. Other metals detected included barium, chromium, and nickel. Elevated chloride concentrations greater than 500 mg/kg were detected in samples from borings 32-SB-03 and 32-SB-07.

Analyses of a groundwater sample from existing Well 113 detected concentrations of chromium at 58.8 µg/l (MCL=100 µg/l), lead at 18.6 µg/l (MCL=15 µg/l), and nickel at 75 µg/l (MCL=100 µg/l). No organics, explosives, pesticides, herbicides, or PCBs were detected, however.

3.6.5 Potential Contaminants and Migration Pathways. The primary sources of potential contamination at this site are the explosive compounds and residues contained in the red and yellow liquor wastewaters and sludges that were treated and disposed at the site and the ashes resulting from incineration of the sludges produced by evaporating the wastewaters.

Analyses of the pipeline contents and surrounding soil revealed no contamination with explosives or volatile organic compounds. Surface water and sediment within the blue water ditch contained elevated lead concentrations. Groundwater sampling in Well 113 detected a lead concentration in excess of the SDWA MCL.

Migration pathways include surface water, sediment, soil, and groundwater. Runoff from surficial soils and fill materials could transport contaminants to collection ditches or streams. These ditches and streams would then carry the contaminated surface water into Goose Prairie Creek and Caddo Lake. Erosion of contaminated soils and fill materials during heavy rainfall could produce contaminated sediment that would be carried by surface water runoff to receiving ditches and streams. Water percolating downward through contaminated soils may leach contaminants and carry them into underlying soils where they could eventually reach groundwater.

Groundwater is a significant pathway for contaminant migration due to the relative shallowness of the water table and its expected seasonal fluctuation. Contaminant transport within the shallow aquifer was evaluated using slug test data from the aquifer, which indicated a mean

hydraulic conductivity (K) of 8E-06 ft per min, and a resultant groundwater velocity (v=Ki/n) of 0.004 ft per day, using an average hydraulic gradient (i) = 0.005 and an aquifer porosity = 0.15. Contaminated groundwater could discharge to surface drainage, where all drainage would eventually enter Caddo Lake via Goose Prairie Creek. The total flow distance from the site to Caddo Lake is about 2.3 miles.

3.6.6 Identification of Potential Receptors. The general public does not have ready access to the site because it is located within the confines of LHAAP. Also, installation personnel and authorized visitors do not have ready access to the site, and adjoining areas are enclosed by a fence with a locked access gate. The site is seldom visited because it is not being used for anything except occasional hunting.

A potential threat to public health and the environment posed by contaminated groundwater originating at this site appears to be its possible emergence into the surface water flow regime. There are no public water supply wells located in the direction of expected groundwater flow from the site, and none are expected to be installed. The nearest public water supply well, Well 504, is approximately 1.4 miles southwest of and hydraulically upgradient of the site.

SECTION 4.0

PLAN OF INVESTIGATIONS

Each plan of investigation described below is designed to obtain site-specific data to best characterize both the physical and chemical characteristics for the location being investigated based on the data presented for each site in Section 3.0. Unless otherwise stated, the following parameters will be analyzed for all soil, sediment, surface water, and groundwater samples: pH; specific conductance; volatile organic compounds (VOCs); high explosives; antimony; arsenic; barium; cadmium; chromium; lead; mercury; nickel; selenium; silver; and thallium. All physical analyses for soil boring samples will include, at a minimum, visual classification, moisture content, gradation, plastic limit, and liquid limit tests. All sampling and analyses described in each plan of investigation will be performed in accordance with the procedures outlined in the Chemical Data Acquisition Plan (CDAP) and the Site Safety and Health Plan (SSHP).

4.1 LHAAP 12: Active Landfill

Site LHAAP 12 began operation in 1963 and used intermittently for the disposal of industrial solid wastes, and possibly hazardous waste, generated at LHAAP. The landfill was used for disposal of nonhazardous industrial solid waste until it was closed in April, 1994.

Previous investigations by EPS in 1984 included the installation of two monitoring wells (103 and 121) to monitor shallow groundwater. Groundwater analysis indicated the presence of cadmium and elevated levels of manganese. The only explosive detected was a trace of 1,3-DNB. The groundwater samples also contained methylene chloride at 45 µg/l, exceeding the SDWA MCL of 5 µg/l.

The 1993 Phase 1 Remedial Investigation conducted by Sverdrup detected contaminants in groundwater, including concentrations exceeding SDWA MCLs for lead, chromium, and nickel in well 12-WW-03 and TCE in wells 12-WW-01 and -03. Varying concentrations of bis(2-ethylhexyl) phthalate (DEHP) as high as 5,000 µg/kg were detected in soil samples collected from 5 to 17 feet in depth in boring 12-WW-07. Soil samples taken from landfill materials detected trace concentrations of VOCs, primarily acetone, toluene, ethylbenzene, and xylene.

To further investigate observed groundwater contamination with VOCs, explosives, and metals, the Phase 2 RI includes the following: collection of eighteen (18) Geoprobe samples of the shallow groundwater to evaluate the potential TCE plume detected within the shallow aquifer; drilling and geotechnical sampling of one stratigraphic boring being approximately 200 ft deep; installation of three (3) shallow (<40 ft), downgradient monitoring wells outside of the plume perimeter; installation of one (1) deep (>100 ft) monitoring well clustered with a shallow

well downgradient of the plume; installation of two piezometers near the old diversion ditch to evaluate groundwater flow gradient within the landfill; confirmation groundwater sampling of nine existing wells (12-WW-01, 12-WW-02, 12-WW-03, 12-WW-04, 12-WW-05, 12-WW-06, 12-WW-07, 103, and 121) and four (4) new wells; and plugging of five (5) existing monitoring wells (12-WW-03, 12-WW-04, 12-WW-07, 103, and 121). Eleven (11) surface water and sediment samples will be taken at locations representing drainage pathways from the site toward Central Creek to the north and the unnamed creek to the south. Proposed sampling locations are shown on Figure 4-1. Five (5) additional sediment and surface water sampling locations in Harrison Bayou are shown in Figure 4-7.

After completion of the Geoprobe sampling, a brief, site-specific sampling plan will be prepared that presents the results of the Geoprobe sampling and provides recommendations for placement of shallow and deep monitoring wells outside of the perimeter of any identified plume.

Groundwater is anticipated to be encountered at depths of 15-25 ft. In order to detect the presence of any DNAPLs, all wells (shallow, intermediate, or deep) will be placed at the bottom of the water-bearing stratum, such that the bottom

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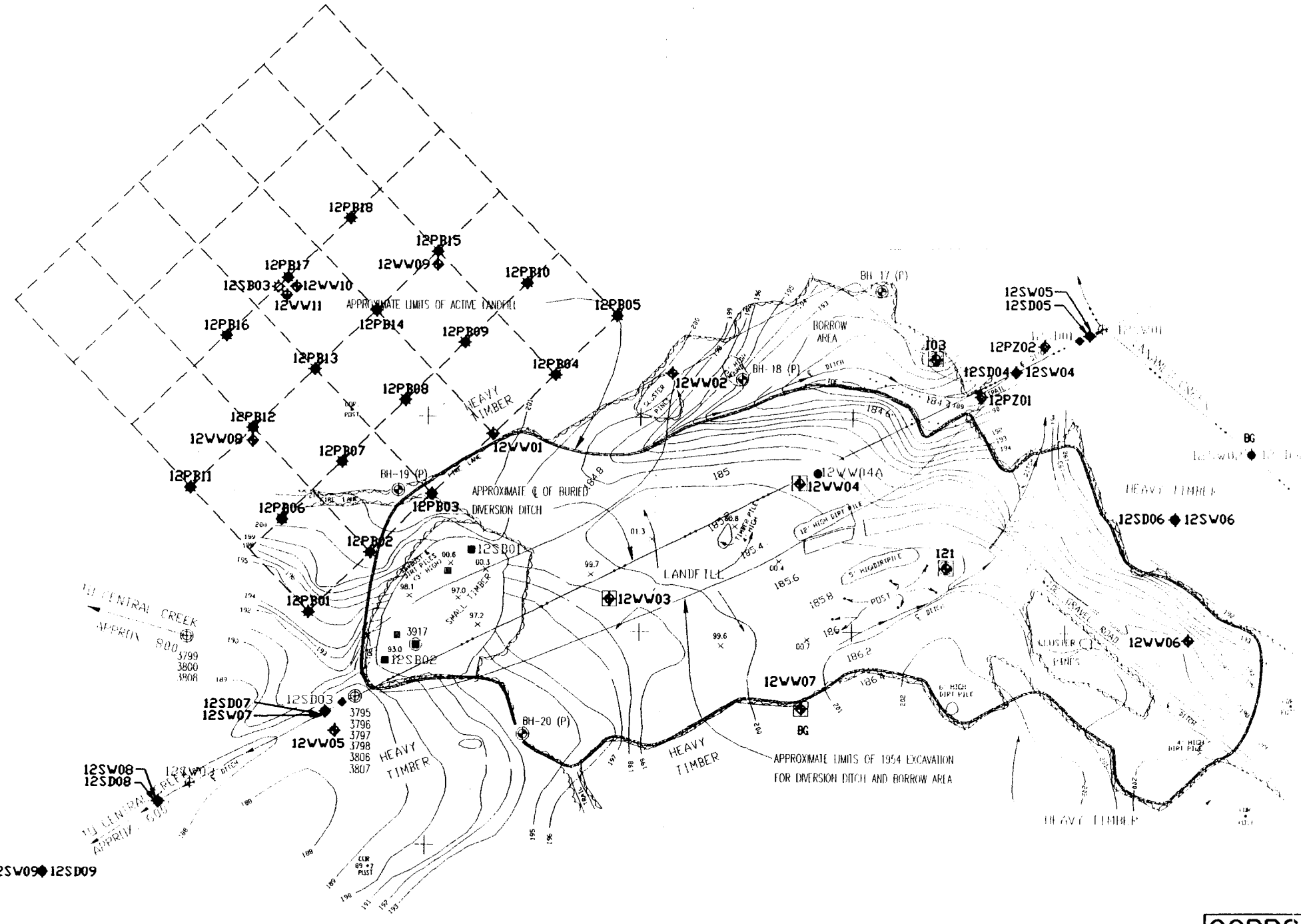

LEGEND

- SURFACE SEDIMENT SAMPLE (PHASE 1)
- SURFACE WATER SAMPLE (PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PHASE 1)
- SURFACE SOIL SAMPLE (PREVIOUS)
- SHALLOW MONITORING WELL (PHASE 1)
- MONITORING WELL (EXISTING)
- SOIL BORING (PHASE 1)
- SOIL BORING (PREVIOUS)
- BG BACKGROUND SAMPLE LOCATION
- (P) MONITORING WELL PLUGGED DURING RI
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- 186 GROUNDWATER ELEVATION CONTOUR

RI PHASE 2 LEGEND

- PROBE BORING (18)
- SHALLOW MONITORING WELL (3)
- DEEP MONITORING WELL (1)
- DEEP STRATIGRAPHIC BORING (1)
- PIEZOMETER (2)
- SEDIMENT/SURFACE WATER SAMPLE (6)
- MONITORING WELL TO BE PLUGGED DURING PHASE 2 (5)

NOTE: CONTOURS ARE STRICTLY INTERPOLATED.

N

150' 0' 150' 300'

SCALE: 1"=150'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 12
ACTIVE LANDFILL
SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-1

000086-5\LH5-11

4 to 6 inches of slotted screen is installed below the observed top of the low permeability (clay) confining layer. Such a clay layer must be confirmed to have a minimum thickness of two (2) ft, such that it separates the shallow aquifer from deeper aquifers. The deep stratigraphic boring will be drilled to identify the depth to the top of the Midway Formation, which represents the base of fresh groundwater beneath the site. The deep well will be installed with its screen placed immediately above the top of the Midway Formation. Well screen lengths will not exceed ten (10) ft.

One groundwater sample will be collected from each Geoprobe boring, new well, and existing well scheduled for confirmation sampling, and analyzed for volatiles, explosives, and metals. Sediment and surface water samples will be analyzed for volatiles, explosives, and metals. Three of the surface water samples obtained from Central Creek will also be analyzed for total hardness. Soil samples will be collected for physical analysis from approximately every 5 ft depth of the deep stratigraphic boring and the new well borings. Physical analyses consist of moisture content, Atterberg limits, and combined washed sieve and hydrometer gradation analysis. Chemical analyses will not be performed on soil samples.

4.2 LHAAP 16: Old Landfill

Site LHAAP 16 was originally used from 1942 to 1944 for the disposal of TNT red water ash generated from the TNT Waste Disposal Plant (LHAAP 32). Burn pits and waste storage were common waste disposal activities conducted at the site during the history of its operation. The site continued to be used for a variety of waste disposal and treatment activities into the 1980s.

Previous investigations by EPS in 1984 confirmed low concentrations of explosives and organic compounds in the surface soils of the landfill, in the soils at depth within the landfill, and the groundwater downgradient of the landfill. Contaminants 2,6-DNT and vinyl chloride were detected at concentrations of 8.6 µg/l and 10.5 µg/l, respectively, in groundwater. 2,6-DNT was also detected in soil samples as high as 73 µg/kg.

The 1993 Phase 1 Remedial Investigation conducted by Sverdrup detected no contamination in the five surface water and sediment samples. Soil samples taken within landfilled materials detected notable concentrations of TCE, methylene chloride, cis-1,2-DCE, and vinyl chloride. Groundwater contaminants, detected in 6 of the 11 new wells, included TCE, methylene chloride, cis-1,2-DCE, nitrobenzene, nickel, and cadmium.

To further investigate potential contamination with VOCs, explosives, and metals, the Phase 2 RI includes the following: collection of fifteen (15) Geoprobe samples of the shallow groundwater to evaluate the volatile contaminants detected within the shallow aquifer; drilling and geotechnical sampling of one stratigraphic boring approximately 200 feet deep; installation of three (3) shallow (<40 ft), downgradient monitoring wells outside of the plume perimeter; installation of one (1) deep (>100 ft) monitoring well clustered with a shallow well downgradient of the plume; confirmation groundwater sampling of twelve (12) existing wells (16-WW-01, 16-WW-02, 16-WW-03, 16-WW-04, 16-WW-05, 16-WW-06, 16-WW-07, 16-WW-08, 16-WW-09, 16-WW-10, 16-WW-11, and 122) and four (4) new wells; and collection of fifteen (15) surface water and sediment samples. Proposed sampling locations are shown in Figure 4-2. Nine (9) additional sediment and surface water sampling locations in Harrison Bayou are shown in Figure 4-7.

After completion of the Geoprobe sampling, a brief, site-specific sampling plan will be prepared that presents the results of the Geoprobe sampling and provides recommendations for placement of shallow and deep monitoring wells outside of the perimeter of any identified plume.

Groundwater is anticipated to be encountered at depths of 0-10 ft. In order to detect the presence of any DNAPLs, all wells (shallow, intermediate, or deep)

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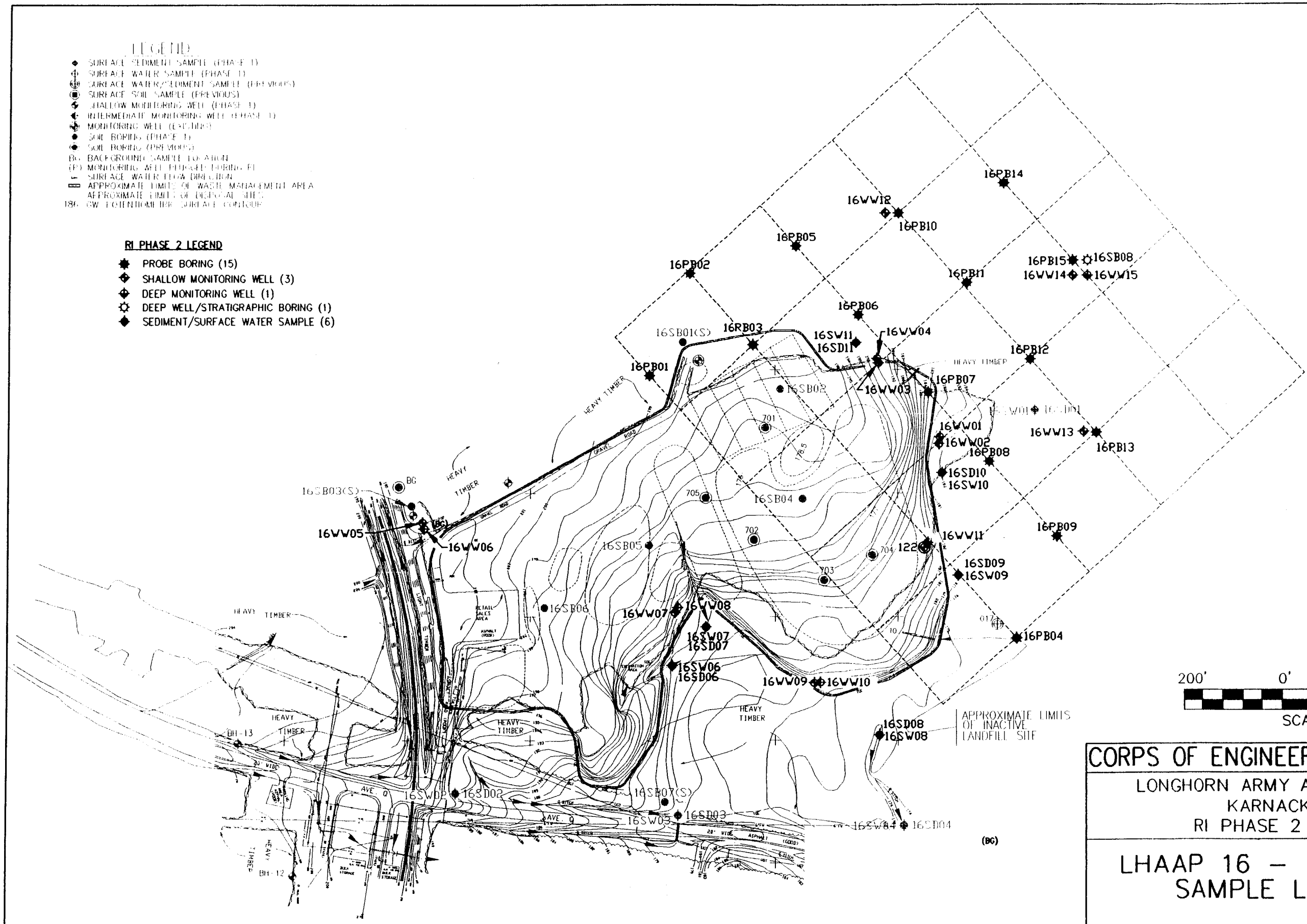
LEGEND

- SURFACE SEDIMENT SAMPLE (PHASE 1)
- SURFACE WATER SAMPLE (PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- SHALLOW MONITORING WELL (PHASE 1)
- INTERMEDIATE MONITORING WELL (PHASE 1)
- MONITORING WELL (EXISTING)
- SOIL BORING (PHASE 1)
- SOIL BORING (PREVIOUS)
- BG BACKGROUND SAMPLE LOCATION
- (P) MONITORING WELL PLUGGED DURING P1
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- APPROXIMATE LIMITS OF DISPOSAL SITE
- 186 GW POTENTIOMETER SURFACE CONTOUR

RI PHASE 2 LEGEND

- PROBE BORING (15)
- SHALLOW MONITORING WELL (3)
- DEEP MONITORING WELL (1)
- DEEP WELL/STRATIGRAPHIC BORING (1)
- SEDIMENT/SURFACE WATER SAMPLE (6)



NOTE:
CONTOURS ARE STRICTLY INTERPOLATED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 16 – OLD LANDFILL SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4–2

000086-5\LH5-12

will be placed at the bottom of the water-bearing stratum, such that the bottom 4 to 6 inches of slotted screen is installed below the observed top of the low permeability (clay) confining layer. Such a clay layer must be confirmed to have a minimum thickness of two (2) ft, such that it separates the shallow aquifer from deeper aquifers. The deep stratigraphic boring will be drilled to identify the depth to the top of the Midway Formation, which represents the base of fresh groundwater beneath the site. The deep well will be installed with its screen placed immediately above the top of the Midway Formation. Well screen lengths should not exceed ten (10) ft.

One groundwater sample will be collected from each Geoprobe boring, new well, and existing well scheduled for confirmation sampling and analyzed for volatiles, explosives, and metals. Sediment and surface water samples will be analyzed for volatiles, explosives, and metals. Soil samples will be collected for physical analysis from approximately every 5 ft depth of the deep stratigraphic boring and the new well borings. Physical analyses consist of moisture content, Atterberg limits, and combined washed sieve and hydrometer gradation analysis. Chemical analyses will not be performed on soil samples.

4.3 LHAAP 17: Burning Ground No.2

Site LHAAP 17 was used for burning bulk TNT, photo flash powder, and reject material when LHAAP was operated by Universal Match Corporation. In 1959, all of the materials removed from the TNT Production Area (LHAAP 29) and the TNT Waste Disposal Plant (LHAAP 32) during razing were reportedly burned and/or flashed at this site. The site was then used until 1980's as a flashing area to decontaminate recoverable metal by-products. The site is presently inactive.

Previous investigations by EPS in 1984 included seven 5 feet deep soil borings and several surface soil samples. Analytical results indicated concentrations of explosives and chlorinated organic compounds. Analytical results from groundwater, surface water, and sediment sampling indicated no contamination of these media.

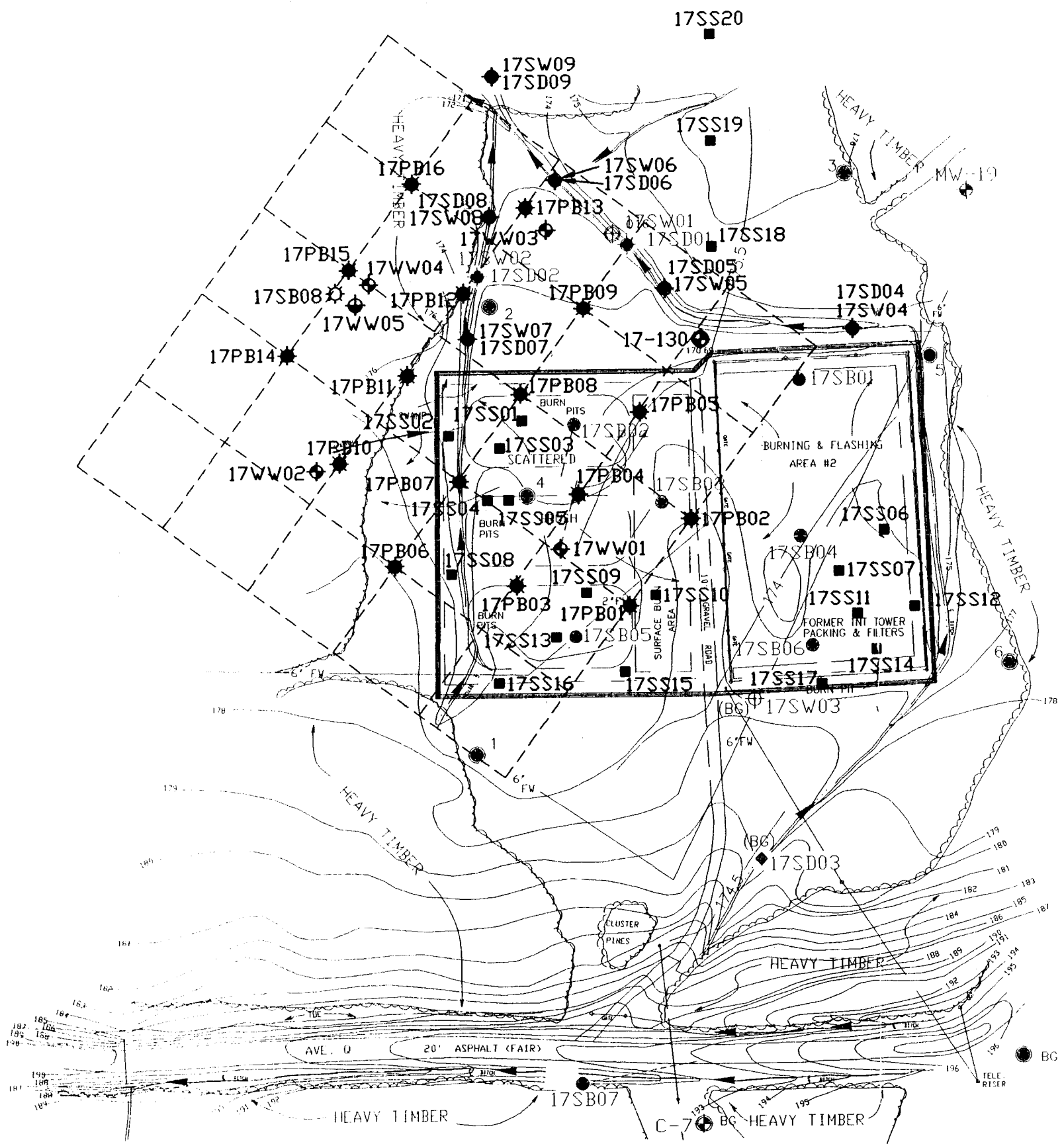
The 1993 Phase 1 Remedial Investigation detected trace concentrations of volatile organics, explosives, and/or heavy metals from all borings except 17-SB-05. Explosives compounds were detected in soil samples collected from 6 of 8 borings, with the highest concentrations generally occurring in the surficial samples (0-2 ft) and decreasing with increasing depth. Concentrations of TCE, 1,1-DCE, and 1,2-dichloroethane (1,2-DCA) exceeding MCLs were detected in well 17-WW-01.

To further investigate potential contamination with VOCs, explosives, and metals, the Phase 2 RI includes the following: collection of sixteen (16) Geoprobe samples of the shallow groundwater to evaluate volatile organics detected within the shallow aquifer; drilling and geotechnical sampling of one (1) stratigraphic boring approximately 200 feet deep; installation of three (3) shallow (<40 ft), downgradient monitoring wells outside of the plume perimeter; installation of one (1) deep (>100 ft) monitoring well clustered with the shallow well downgradient of the plume; confirmation groundwater sampling of two (2) existing wells (17-WW-01 and 130) and four (4) new wells; and collection of six (6) surface water and sediment samples. Twenty (20) surface (<6 inches) soil samples will be taken at random locations, including three samples at 100, 200, and 300 foot intervals downwind of the site. Proposed sampling locations are shown on Figure 4-3.

After completion of the Geoprobe sampling, a brief, site-specific sampling plan will be prepared that presents the results of the Geoprobe sampling and provides recommendations for placement of shallow and deep monitoring wells outside of the perimeter of any identified plume.

Groundwater is anticipated to be encountered at depths of 0-10 ft. In order to detect the presence of any DNAPLs, all wells (shallow, intermediate, or deep) will be placed at the bottom of the water-bearing stratum, such that the bottom

011672



LEGEND

- SURFACE SEDIMENT SAMPLE (PHASE 1)
- SURFACE WATER SAMPLE (PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- SHALLOW MONITORING WELL (PHASE 1)
- MONITORING WELL (EXISTING)
- SOIL BORING (PHASE 1)
- SOIL BORING (PREVIOUS)
- BG BACKGROUND SAMPLE LOCATION
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE LIMITS OF WASTE MANAGEMENT AREA
- APPROXIMATE LIMITS OF BURN PITS/TRENCHES

RI PHASE 2 LEGEND

- PROBE BORING (16)
- SHALLOW MONITORING WELL (3)
- DEEP MONITORING WELL (1)
- DEEP STRATIGRAPHIC BORING (1)
- SEDIMENT/SURFACE WATER SAMPLE (6)
- SURFACE SOIL SAMPLE (20)

N

120' 0' 120' 240'

SCALE: 1"=120'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 17
BURNING GROUND NO. 2
SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-3

000086-5\LH5-13

4 to 6 inches of slotted screen is installed below the observed top of the low permeability (clay) confining layer. Such a clay layer must be confirmed to have a minimum thickness of two (2) ft, such that it separates the shallow aquifer from deeper aquifers. The deep stratigraphic boring will be drilled to identify the depth to the top of the Midway Formation, which represents the base of fresh groundwater beneath the site. The deep well will be installed with its screen placed immediately above the top of the Midway Formation. Well screen lengths should not exceed ten (10) ft.

One groundwater sample will be collected from each Geoprobe boring, new well, and existing well scheduled for confirmation sampling and analyzed for volatiles, explosives, and metals. Groundwater samples from new wells will also be analyzed for the anions chloride, nitrate, and sulfate. Sediment and surface water samples will be analyzed for volatiles, explosives, metals, and anions. Surface soil samples will be analyzed for volatiles, explosives, and metals. Soil samples will be collected for physical analysis from approximately every 5 ft depth of the deep stratigraphic boring and the new well borings. Physical analyses consist of moisture content, Atterberg limits, and combined washed sieve and hydrometer gradation analysis. Chemical analyses will not be performed on soil samples obtained from borings.

4.4 LHAAP 18/24: Burning Ground No.3/Unlined Evaporation Pond

Burning Ground No. 3 has been in operation since 1955. The area has been used for treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and combustible solvent wastes by open burning, incineration, evaporation, and burial. The Unlined Evaporation Pond (UEP) was constructed at the burning ground in 1963 and utilized as a holding pond to store explosive wastes resulting from the washout of rocket motor casings. Current operations at LHAAP 18/24 now include treatment of explosives and explosive-contaminated wastes by burning in the Air Curtain Destructor (ACD), three open burning cages, one open burning pan, and a burn cage for Perching II motor elimination.

Previous investigations by USAEHA and EPS included the installation of 13 and 9 monitoring wells, respectively, to monitor the site. Results from the November 1992 sampling indicated extensive contamination beneath large portions of the site including concentrations of methylene chloride (MEC) and trichloroethene (TCE) as great as 17,800,800 µg/l and 251,000 µg/l, respectively. In association with these contaminants were elevated concentrations of vinyl chloride, trichlorofluoromethane, and 1,2-DCA that exceeded MCLs. Chromium, lead, and nickel concentrations exceed MCLs in a number of monitoring wells scattered across the site. Elevated concentrations of explosives compounds were detected in monitoring well MW-2.

To further investigate potential contamination with VOCs and metals, the Phase 2 RI includes the following: collection of twenty-five (25) surface (<6 inches) soil samples at random locations - fifteen (15) samples shall be analyzed for volatile organics and all 25 samples shall be analyzed for metals; collection of a minimum of thirty (30) Geoprobe groundwater samples; drilling and geotechnical sampling of five (5) stratigraphic borings; installation of five (5) deep monitoring wells with screens immediately above the top of the Midway; installation of eight (8) monitoring wells in the shallow aquifer; installation of six (6) monitoring wells in the intermediate aquifer; and collection of eighteen (18) surface water and sediment samples. Proposed sampling locations are indicated on Figures 4-4A and 4-4B. Ten (10) of the eighteen (18) sediment and surface water sampling locations proposed to be collected in LHAAP 18/24 are shown in Figure 4-7. These samples are to be collected in Harrison Bayou and Saunder's Branch.

It should be noted that only the first line of Geoprobe sampling locations is shown in the figure. These locations are approximate and will be adjusted based on field results. After completion of the Geoprobe sampling, a brief, site-specific sampling plan will be prepared that presents the results of the Geoprobe

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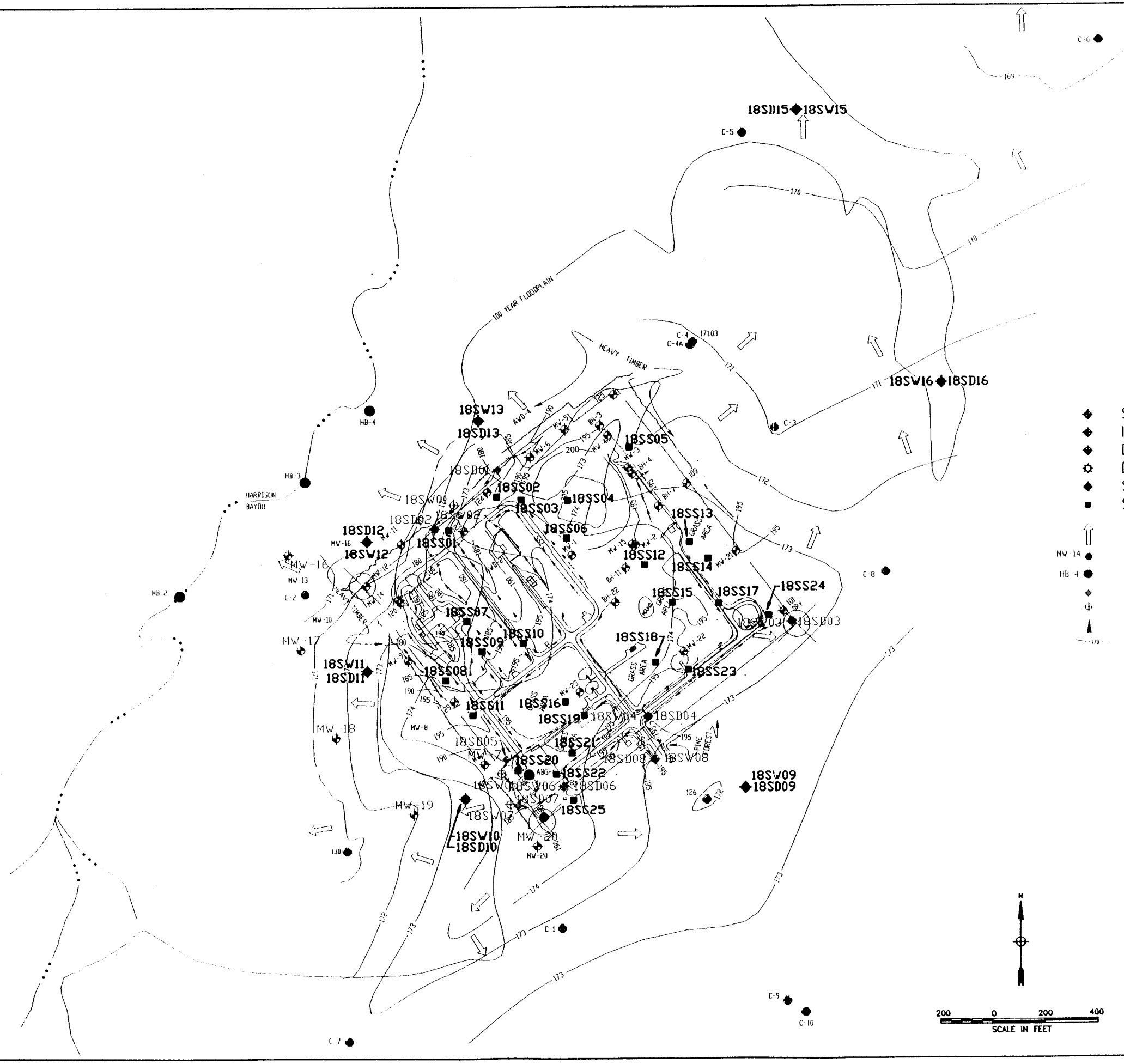


LEGEND

- SHALLOW MONITORING WELL (8)
- INTERMEDIATE MONITORING WELL (6)
- DEEP MONITORING WELL (5)
- DEEP STRATIGRAPHIC BORING (5)
- SEDIMENT/SURFACE WATER SAMPLE (8)
- SURFACE SOIL SAMPLE (25)
- GROUND WATER FLOW DIRECTION
- MW 14 MONITOR WELL NUMBER AND GROUNDWATER ELEVATION (EXISTING)
- HB-4 SURFACE WATER/SEDIMENT SAMPLE AND NUMBER (EXISTING)
- SEDIMENT SAMPLE (PHASE I)
- SURFACE WATER SAMPLE (PHASE I)
- SURFACE WATER FLOW DIRECTION
- 170 GROUNDWATER SURFACE ELEVATION

N

200 0 200 400
SCALE IN FEET

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

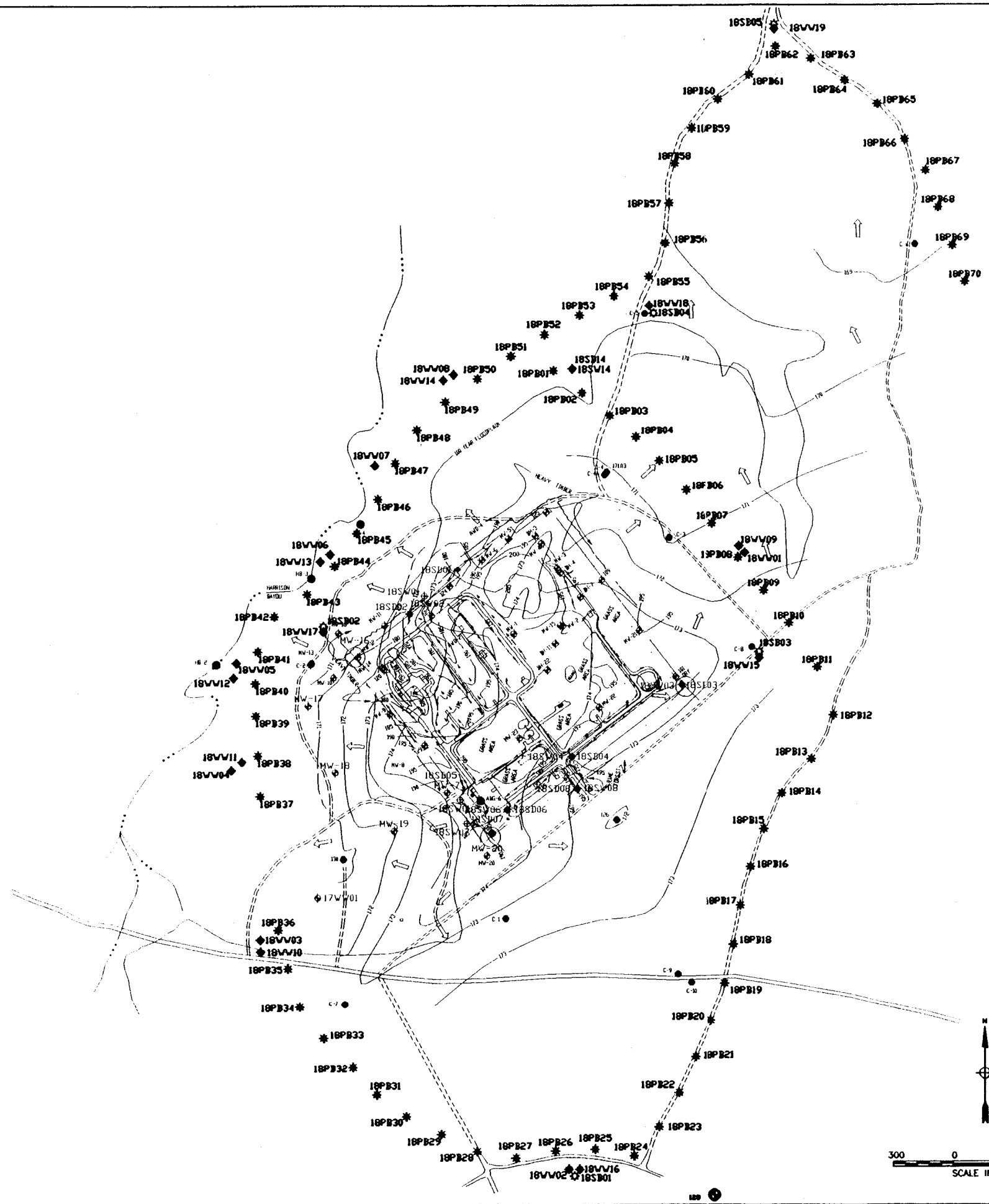
LHAAP 18 AND 24
BURNING GROUND NO. 3 AND UNLINED EVAPORATION POND SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-4A

000086-5\LH5-14A

011677



LEGEND

- PROBE BORING (70)
- SHALLOW MONITORING WELL (8)
- INTERMEDIATE MONITORING WELL (6)
- DEEP MONITORING WELL (5)
- DEEP STRATIGRAPHIC BORING (5)
- SEDIMENT/SURFACE WATER SAMPLE (8)
- SURFACE SOIL SAMPLE (25)
- GROUND WATER FLOW DIRECTION
- MONITOR WELL NUMBER AND GROUNDWATER ELEVATION (EXISTING)
- SURFACE WATER/SEDIMENT SAMPLE AND NUMBER (EXISTING)
- SEDIMENT SAMPLE (PROPOSED)
- SURFACE WATER SAMPLE (PROPOSED)
- SURFACE WATER FLOW DIRECTION
- GROUND WATER SURFACE ELEVATION

NOTE:
ADDITIONAL PROBE BORINGS WILL BE LOCATED AS NECESSARY TO DEFINE ANY GROUNDWATER CONTAMINATION DETECTED IN THE FIRST LINE OF PROBE BORINGS.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 18 AND 24
BURNING GROUND NO. 3 AND UNLINED EVAPORATION POND GEOPROBE BORINGS AND WELLS

Sverdrup Environmental

FIGURE 4-4B

000086-5\LH5-14

sampling and provides recommendations for placement of shallow and deep monitoring wells outside of the perimeter of any identified plume.

Groundwater is anticipated to be encountered at depths of 0-10 ft. In order to detect the presence of any DNAPLs, all wells (shallow, intermediate, or deep) will be placed at the bottom of the water-bearing stratum, such that the bottom 4 to 6 inches of slotted screen is installed below the observed top of the low permeability (clay) confining layer. Such a clay layer must be confirmed to have a minimum thickness of two (2) ft, such that it separates the shallow aquifer from deeper aquifers. Intermediate wells will be installed at locations clustered with a shallow well. Deep stratigraphic borings will be drilled to identify the depth to the top of the Midway Formation, which represents the base of fresh groundwater beneath the site. Deep wells will be installed with screens placed immediately above the top of the Midway Formation. Well screen lengths should not exceed ten (10) ft.

One groundwater sample will be collected from each Geoprobe boring and analyzed for volatiles. One groundwater sample will be collected from each new well and analyzed for volatiles and metals. Sediment and surface water samples will be analyzed for volatiles and metals. Three (3) surface water samples obtained from Harrison Bayou, and three from Saunder's Branch, will also be analyzed for total

hardness. Surface soil samples will be analyzed for metals, and fifteen (15) samples will also be analyzed for volatiles.

Soil samples will be collected for physical analysis from approximately every 5 ft depth of the deep stratigraphic boring and the new well borings. Physical analyses consist of moisture content, Atterberg limits, and combined washed sieve and hydrometer gradation analysis. Chemical analyses will not be performed on soil samples obtained from borings.

4.5 LHAAP 29: Former TNT Production Area

Site LHAAP 29 was operated in the former TNT Production Area from October 1942 until August 1945. The plant produced over 180 million kilograms of flake TNT from five regular production lines and one standby line. The TNT "red liquor" generated at each of the wash areas and the "yellow liquor" wastewater generated by the production plant was pumped through a 12-in underground wood stave pipeline to the TNT Waste Disposal Plant (LHAAP 32). The TNT production plant was inactive from August 1945 until 1959 when most of its building and above ground storage tanks were removed. There have been only limited activities at the site since World War II.

Previous investigations by EPS included the installation of six monitoring wells to sample the groundwater for explosives compounds and VOCs. Results detected 2,4,6-TNT in surface soils, surface water, and sediments.

The 1993 Phase 1 Remedial Investigation conducted by Sverdrup detected no contamination with volatile organic or explosives compounds in soil samples taken from the surrounding soil beneath the pipeline. Groundwater sampling of the existing monitoring well network detected contamination with 2,6-dinitrotoluene (2,6-DNT) and 2-nitrotoluene (2-NT) in excess of the SDWA MCLs in Well 116, which is located within 50 ft of the former cooling water ditch and directly downgradient from the central portion of the site. The groundwater sample from Well 118 contained mercury and selenium above the MCL. The groundwater sample from Well 119 contained cadmium above the MCL. Borehole water data indicated potential groundwater contamination with 1,3,5-trinitrobenzene (1,3,5-TNB), 2,4,6-trinitrotoluene (2,4,6-TNT), 2,4-DNT, 2-NT, and 4-NT at LHAAP 29.

To further investigate potential contamination with explosives and metals, the Phase 2 RI includes the following: collection of twenty-four (24) surface (<6 inches) soil samples at random locations - four samples shall be taken at each of the six production line areas; 24 soil samples at a depth of 4-5 feet taken at the same locations as the surface soil samples; confirmation groundwater

sampling of three (3) existing monitoring wells (116, 118, and 119); collection of sixteen (16) Geoprobe groundwater samples in the Line A Production Area; drilling and geotechnical sampling of one (1) stratigraphic boring being approximately 200 ft deep in the Line A Production Area; installation of three (3) shallow, downgradient monitoring wells in the shallow aquifer in the Line A Production Area; installation of one (1) monitoring well (>100 feet) in the deeper aquifer in the Line A Production area; collection of seventeen (17) Geoprobe groundwater samples in the cooling water ditch area; drilling and geotechnical sampling of one stratigraphic boring being approximately 200 feet deep in the cooling water ditch area; installation of three (3) downgradient monitoring wells in the shallow aquifer in the cooling water ditch area; installation of one (1) monitoring well (>100 feet) in the deeper aquifer in the cooling water ditch area; and collection of six (6) Geoprobe groundwater samples in the area of the Bulk Toluene Storage Tanks. Proposed sampling locations are included on Figure 4-5. Three (3) additional sediment and surface water sampling locations in Central Creek are shown in Figure 4-7.

After completion of the Geoprobe sampling in each area (Line A Production Area, the cooling water ditch, and the Bulk Toluene Tanks), a brief, area-specific sampling plan will be prepared that presents the results of the Geoprobe sampling and provides recommendations for placement of shallow and deep monitoring wells outside of the perimeter of any identified plume.

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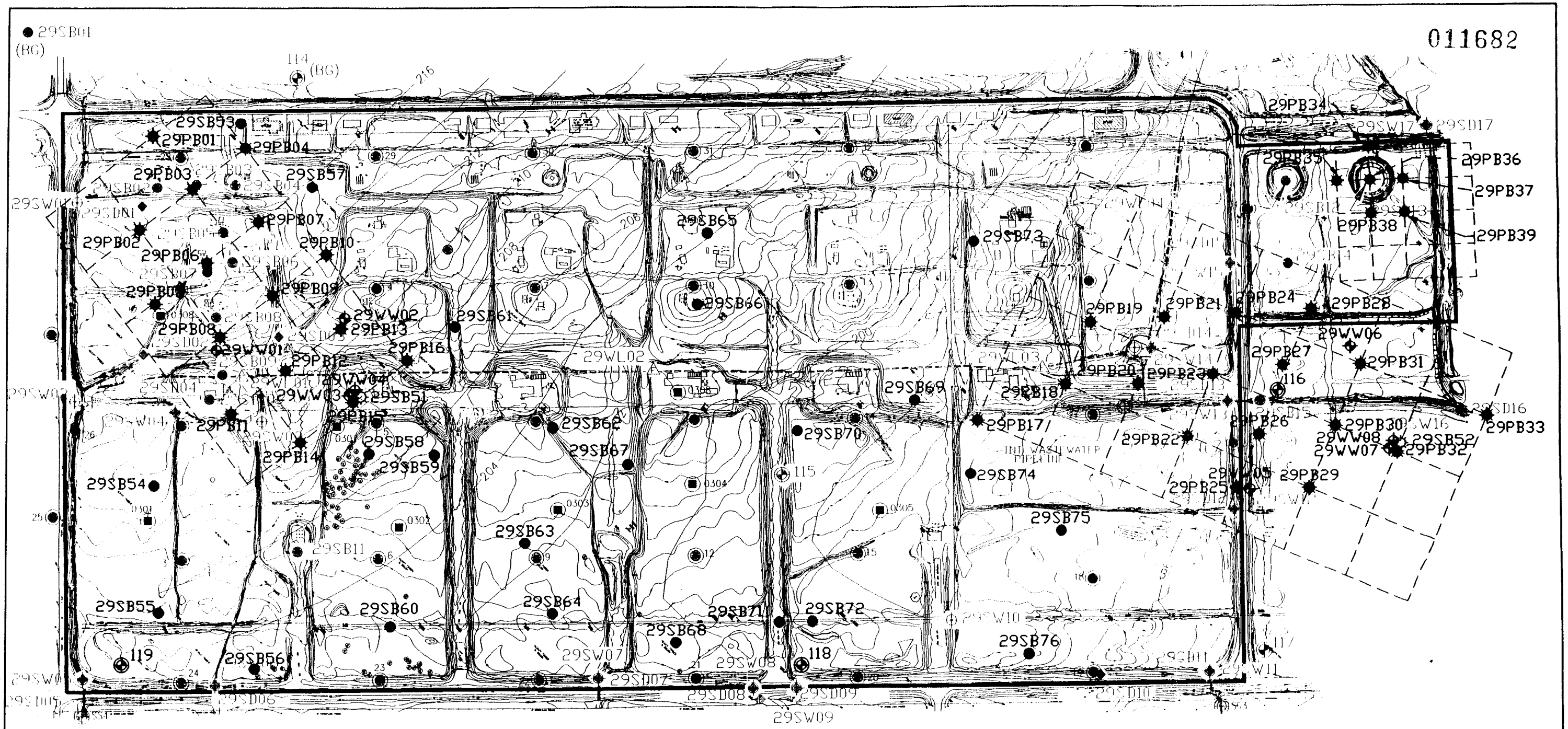


LEGEND

- SURFACE SEDIMENT SAMPLE (PHASE 1)
- SURFACE WATER SAMPLE (PHASE 1)
- SURFACE WATER-SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- MONITORING WELL (EXISTING)
- SOIL BORING (PHASE 1)
- SOIL BORING (PREVIOUS)
- WASTEWATER LINE SAMPLE (PHASE 1)
- BG BACKGROUND SAMPLE LOCATION
- SURFACE WATER FLOW DIRECTION
- APPROXIMATE SITE LIMITS
- 186 GW POTENTIOMETRIC SURFACE CONTOUR

NOTE: GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS ARE INTERPERTED.

RI PHASE 2 LEGEND

- PROBE BORING (39)
- SHALLOW MONITORING WELL (6)
- DEEP MONITORING WELL (2)
- DEEP STRATIGRAPHIC BORING (2)
- 5' SOIL BORING (24)

N

300' 0 300' 600'

SCALE: 1"=300'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

LHAAP 29
FORMER TNT PRODUCTION AREA SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-5

000086-5\LH5-15

Groundwater is anticipated to be encountered at depths of 20-40 ft. In order to detect the presence of any DNAPLs, all wells (shallow, intermediate, or deep) will be placed at the bottom of the water-bearing stratum, such that the bottom 4 to 6 inches of slotted screen is installed below the observed top of the low permeability (clay) confining layer. Deep stratigraphic borings will be drilled to identify the depth to the top of the Midway Formation, which represents the base of fresh groundwater beneath the site. Deep wells will be installed with their screens placed immediately above the top of the Midway Formation. Well screen lengths should not exceed ten (10) ft.

One groundwater sample will be collected from each Geoprobe/Hydropunch boring and new well and analyzed for explosives and metals. Geoprobe/Hydropunch groundwater samples collected from the Bulk Toluene Storage Tanks area will also be analyzed for toluene. Groundwater samples from existing Well 116 will be analyzed for explosives, Well 118 for selenium and mercury, and Well 119 for cadmium. Sediment and surface water samples will be analyzed for explosives and metals. In addition, three (3) surface water samples obtained from Central Creek will be analyzed for total hardness. The twenty-four (24) surface soil samples and soil samples from 4-5 ft depth will be analyzed for explosives and metals.

Soil samples will be collected for physical analysis from approximately every 5

ft depth of the deep stratigraphic boring and the new well borings. Physical analyses consist of moisture content, Atterberg limits, and combined washed sieve and hydrometer gradation analysis. Chemical analyses will not be performed on soil samples obtained from borings.

4.6 LHAAP 32: Former TNT Waste Disposal Plant

Site LHAAP 32 was constructed in 1942 to treat and dispose of wastewaters generated at the nearby former TNT Production Area (LHAAP 29). Wastewater resulting from the production of 180 million kilograms of TNT was disposed of through the plant. Because of the large volumes of wastes that were handled, there were probably occasional spills resulting from the overflow of tanks and manual handling of wastes. The plant was not operated after 1945. In 1959, most of the buildings and tanks used in the disposal process were removed and the debris burned at LHAAP 17.

Previous investigations by EPS included sampling of surface soils, surface water, sediment; and the installation of one monitoring well (113). Results indicated that, with the exception of 2,4,6-TNT found in surface water sample No. 3919 at 7.6 μg/l, explosives concentrations were below detection limits.

The 1993 Phase 1 Remedial Investigation conducted by Sverdrup detected no contamination of the pipeline contents and surrounding soils with explosives or volatile organic compounds. Surface water and sediment within the blue water ditch contained elevated lead concentrations. Groundwater sampling in Well 113 contained a lead concentration in excess of the MCL.

To further investigate potential contamination with explosives and metals, the Phase 2 RI includes the following: collection of nine (9) surface water and sediment samples - three (3) locations in Goose Prairie Creek and six (6) locations representing drainage pathways toward Goose Prairie Creek. Proposed sampling locations are included on Figures 4-6 and 4-7. Sediment and surface water samples will be analyzed for explosives and metals. In addition, the three (3) surface water samples obtained from Goose Prairie Creek will be analyzed for total hardness.

CADDO LAKE
APPROX. 8000 FT

LEGEND

- SURFACE SEDIMENT SAMPLE (PHASE 1)
- SURFACE WATER SAMPLE (PHASE 1)
- SURFACE WATER/SEDIMENT SAMPLE (PREVIOUS)
- SURFACE SOIL SAMPLE (PREVIOUS)
- MONITORING WELL (EXIST)
- 186 GW. POTENTIOMETRIC SURFACE CONTOUR (EL. FT.)
- SOIL BORING (PHASE 1)
- SOIL BORING (PREVIOUS)
- WASTEWATER LINE SAMPLE
- BG BACKGROUND SAMPLE LOCATION

RI PHASE 2 LEGEND

- SEDIMENT/SURFACE WATER SAMPLE (6)

32SW10 32SD10
32SW11
32SD01
32SB01
32SB02
32SW02 32SD02
32SW09 32SD09
32SW08 32SD08
32SB04
32SB06
32SB05
32SB07
32SB12
32SB08
32SB09
32SB10
32SD11
32SW11
32SW05 32SD05
32SW06
32SD06
32WL01
32SB11
32SD12
32SW12
32SW03 32SD03
(BG) 32SB13
32SD04
(BG)
(BG) 32SW04
32SW13
32SD13
32SW07 32SD07
RED AND YELLOW LIQUOR WASTEWATER PIPELINE
32WL02
200
202

N

150' 0 150' 300'
SCALE: 1"=150'

NOTE: GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS ARE INTERPERTED.

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

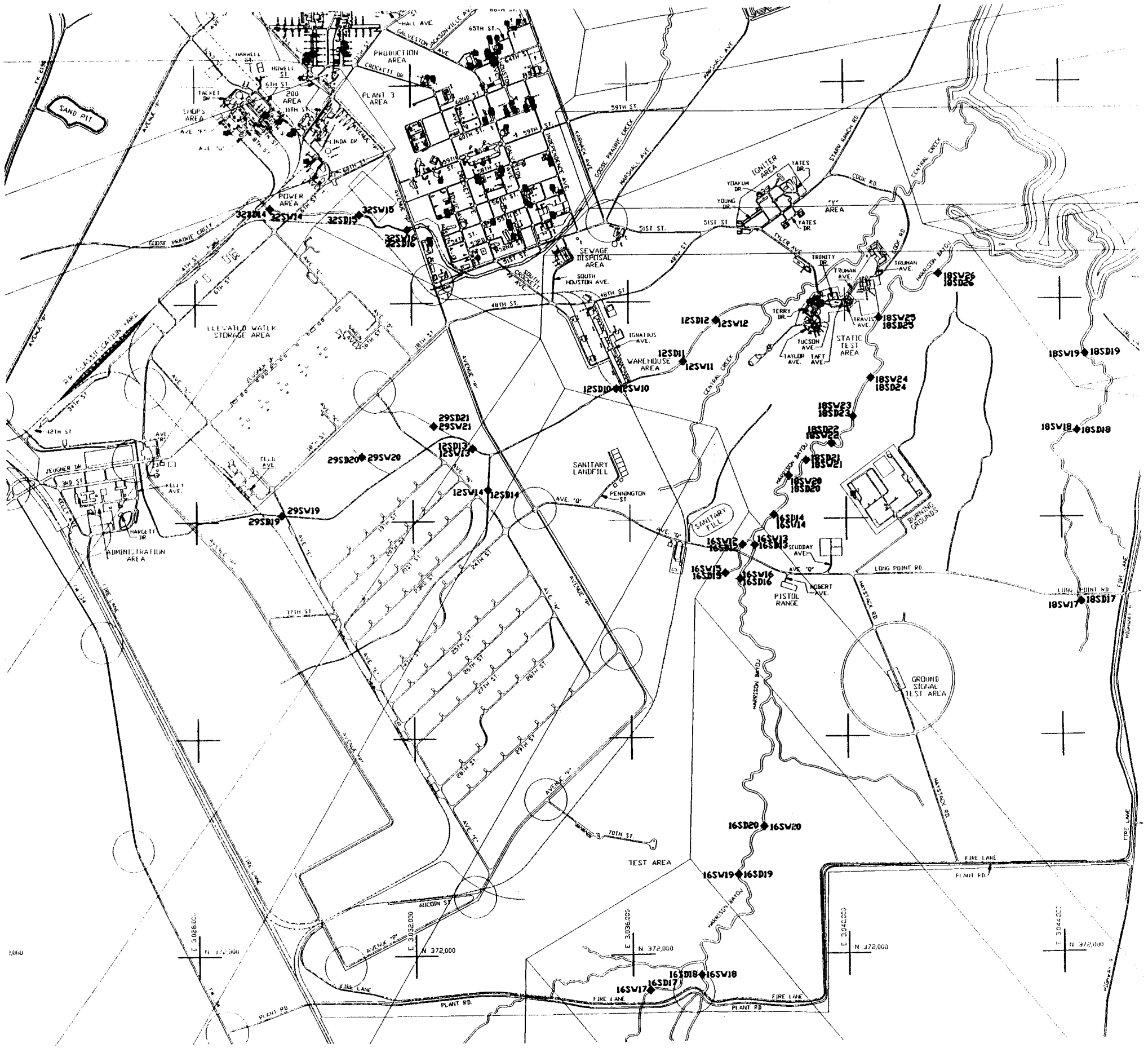
LHAAP 32
FORMER WASTE DISPOSAL PLANT
SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-6

000086 5\LH5-16

011687



RI PHASE 2 LEGEND

◆ SEDIMENT\SURFACE WATER SAMPLE (30)

N

2000 0 2000 4000

SCALE: 1"=2000'

CORPS OF ENGINEERS, TULSA DISTRICT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI PHASE 2 WORK PLAN

GROUP 2 SITES ADDITIONAL SEDIMENT\SURFACE WATER SAMPLE LOCATIONS

Sverdrup Environmental

FIGURE 4-7

000086 5\185 17