# LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

# ADMINISTRATIVE RECORD

**Volume 13 of 13**

**2009**

**Bate Stamp Numbers**
**00082173 – 00082430**

**Prepared for**

**Department of the Army**
**Longhorn Army Ammunition Plant**

**1976 – 2009**

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

VOLUME 13 of 13

2009

A. Title: Report (Continued) – Final Feasibility Study, LHAAP-35A(58), Shops Area, Group 4, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: December 21, 2009
Bate Stamp: 00082173 – 00082348

***NOTE: Letter B of Volume 13, YEAR 2009, is listed OUT OF DATE SEQUENCE and should have been inserted in the YEAR 2008 update to the ADMINISTRATIVE RECORD***

B. Title: Letter and Enclosures – Revised MNA Modeling Results for Time to MCL, LHAAP-37 and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): LHAAP Site Manager, Rose M. Zeiler, United States Army
Recipient: TCEQ Remediation Division Project Manager, Fay Duke
Date: June 9, 2008
Bate Stamp: 00082349 – 00082384

***NOTE: Letter C of Volume 13, YEAR 2009, is listed OUT OF DATE SEQUENCE and should have been inserted in the YEAR 1998 update to the ADMINISTRATIVE RECORD***

C. Title: Report – Final Construction Completion Report Interim Remedial Action Landfills 12 and 16 Cap Construction, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): OHM Remediation Services Corporation, Houston, Texas
Recipient: TCEQ Remediation Division Project Manager, Fay Duke
Date: December 2, 1998
Bate Stamp: 00082385 – 00082430

# 2.2.3 Metals CVAA Data (Mercury)

# 2.2.3.1 Summary Data

# LABORATORY REPORT

00082175

**L08110782**

**12/09/08 09:06**

**Submitted By**

**Microbac Laboratories Inc.**
**158 Starlite Drive**
**Marietta , OH 45750**
**( 740 ) 373 - 4071**

**For**

**Account Name:** Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
**Attention:** Jennifer Hoang

**Project Number:** 2773.025
**Project:** Longhorn AAP
**Site:** LONGHORN AAP KARNACK TX

**P.O. Number:** 389869/ 390836(GWTP)

## Sample Analysis Summary

| Client ID | Lab ID | Method | Dilution | Date Received |
|---|---|---|---|---|
| 35AWW01-111908 | L08110782-01 | 7470A | 1 | 25-NOV-08 |
| LHSMW06-111908 | L08110782-02 | 7470A | 1 | 25-NOV-08 |
| LHSMW03-111908 | L08110782-03 | 7470A | 1 | 25-NOV-08 |
| LHSMW07-111908 | L08110782-04 | 7470A | 1 | 25-NOV-08 |
| 35AWW05-112108 | L08110782-05 | 7470A | 1 | 25-NOV-08 |
| 03SB11-(10-11) | L08110782-06 | 7471A | 1 | 25-NOV-08 |
| 03SB11-(BOTTOM) | L08110782-07 | 7471A | 1 | 25-NOV-08 |

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082176

Sample Number: **L08110782-01**
Client ID: **35AWW01-111908**
Matrix: **Water**
Workgroup Number: **WG289327**
Collect Date: **11/19/2008 15:15**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **METHOD**
Analytical Method: **7470A**
Analyst: **ADC**
Dilution: **1**
Units: **mg/L**

Instrument: **HYDRA**
Prep Date: **12/01/2008 14:22**
Cal Date: **12/01/2008 15:12**
Run Date: **12/01/2008 15:25**
File ID: **HY.120108.152502**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury | 7439-97-6 | | U | 0.000200 | 0.000100 |

**U** Not detected at or above adjusted sample detection limit

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082177

Sample Number: **L08110782-02**
Client ID: **LHSMW06-111908**
Matrix: **Water**
Workgroup Number: **WG289327**
Collect Date: **11/19/2008 12:40**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **METHOD**
Analytical Method: **7470A**
Analyst: **ADC**
Dilution: **1**
Units: **mg/L**

Instrument: **HYDRA**
Prep Date: **12/01/2008 14:22**
Cal Date: **12/01/2008 15:12**
Run Date: **12/01/2008 15:28**
File ID: **HY.120108.152852**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury | 7439-97-6 | | U | 0.000200 | 0.000100 |

**U Not detected at or above adjusted sample detection limit**

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082178

Sample Number: **L08110782-03**
Client ID: **LHSMW03-111908**
Matrix: **Water**
Workgroup Number: **WG289327**
Collect Date: **11/19/2008 09:45**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **METHOD**
Analytical Method: **7470A**
Analyst: **ADC**
Dilution: **1**
Units: **mg/L**

Instrument: **HYDRA**
Prep Date: **12/01/2008 14:22**
Cal Date: **12/01/2008 15:12**
Run Date: **12/01/2008 15:31**
File ID: **HY.120108.153126**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury | 7439-97-6 | | U | 0.000200 | 0.000100 |

**U** Not detected at or above adjusted sample detection limit

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082179

| | | | | | |
|---|---|---|---|---|---|
| Sample Number: | L08110782-04 | PrePrep Method: | NONE | Instrument: | HYDRA |
| Client ID: | LHSMW07-111908 | Prep Method: | METHOD | Prep Date: | 12/01/2008 14:22 |
| Matrix: | Water | Analytical Method: | 7470A | Cal Date: | 12/01/2008 15:12 |
| Workgroup Number: | WG289327 | Analyst: | ADC | Run Date: | 12/01/2008 15:33 |
| Collect Date: | 11/21/2008 13:05 | Dilution: | 1 | File ID: | HY.120108.153322 |
| Sample Tag: | 01 | Units: | mg/L | | |

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury | 7439-97-6 | | U | 0.000200 | 0.000100 |

**U** Not detected at or above adjusted sample detection limit

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082180

Sample Number: **L08110782-05**
Client ID: **35AWW05-112108**
Matrix: **Water**
Workgroup Number: **WG289327**
Collect Date: **11/21/2008 17:30**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **METHOD**
Analytical Method: **7470A**
Analyst: **ADC**
Dilution: **1**
Units: **mg/L**

Instrument: **HYDRA**
Prep Date: **12/01/2008 14:22**
Cal Date: **12/01/2008 15:12**
Run Date: **12/01/2008 15:35**
File ID: **HY.120108.153515**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury | 7439-97-6 | | U | 0.000200 | 0.000100 |

**U** Not detected at or above adjusted sample detection limit

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082181

| | | | | | |
|---|---|---|---|---|---|
| Sample Number: | L08110782-06 | PrePrep Method: | NONE | Instrument: | HYDRA |
| Client ID: | 03SB11-(10-11) | Prep Method: | 7471A | Prep Date: | 12/01/2008 10:05 |
| Matrix: | Soil | Analytical Method: | 7471A | Cal Date: | 12/01/2008 14:25 |
| Workgroup Number: | WG289319 | Analyst: | ADC | Run Date: | 12/01/2008 14:38 |
| Collect Date: | 11/18/2008 09:45 | Dilution: | 1 | File ID: | HY.120108.143811 |
| Sample Tag: | 01 | Units: | mg/kg | Percent Solid: | 89.3 |

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury, Total | 7439-97-6 | | U | 0.279 | 0.0112 |

**U** Not detected at or above adjusted sample detection limit

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082182

| | | | | | |
|---|---|---|---|---|---|
| Sample Number: | L08110782-07 | PrePrep Method: | NONE | Instrument: | HYDRA |
| Client ID: | 03SB11-(BOTTOM) | Prep Method: | 7471A | Prep Date: | 12/01/2008 10:10 |
| Matrix: | Soil | Analytical Method: | 7471A | Cal Date: | 12/01/2008 14:25 |
| Workgroup Number: | WG289319 | Analyst: | ADC | Run Date: | 12/01/2008 14:45 |
| Collect Date: | 11/18/2008 10:15 | Dilution: | 1 | File ID: | HY.120108.144551 |
| Sample Tag: | 01 | Units: | mg/kg | Percent Solid: | 84.9 |

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| Mercury, Total | 7439-97-6 | 0.406 | | 0.294 | 0.0118 |

# 2.2.3.2 QC Summary Data

**Example Cold Vapor Mercury Calculations**
**Hydra AA Mercury Analyzer**

**1.0 Initial Calibration (ICAL) Parameters**
The system performs linear regression from data consisting of a blank and five standards.

**2.0 Calculating the concentration (C) of an element in water using data from run log and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):**

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

| Where: | **Example:** |
|---|---|
| $Cs$ = Concentration computed by the data system (ug/L) | 0.1 |
| $Vf$ = Diluted to Volume (mL) | 40 |
| $Vi$ = Aliquot Volume (mL) | 40 |
| $D$ = Manual dilution factor, if required (10X = 10) | 1 |
| | |
| $Cx$ = Concentration of element in ppb (ug/L) | 0.1 |

**3.0 Calculating the concentration (C) of an element in soil using data from prep log and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):**

$$Cx = Cs \times \frac{Vf}{Ws} \times D$$

| Where: | **Example:** |
|---|---|
| $Cs$ = Concentration computed by the data system (ug/L) | 0.1 |
| $Vf$ = Diluted to volume (mL) | 40 |
| $Ws$ = Aliquot weight (g) | 0.6 |
| $D$ = Manual dilution factor | 1 |
| | |
| $Cx$ = Concentration of element in ug/kg | 6.67 |

**4.0 Adjusting the concentration to dry weight:**

$$Cdry = \frac{Cx \times 100}{Px}$$

| | |
|---|---|
| 1 $Cx$ = Concentration calculated as received (wet basis) | 6.67 |
| $Px$ = Percent solids of sample (%wt) | 80 |
| | |
| $Cdry$ = Concentration calculated as dry weight (ug/kg) | 8.33 |

**8.33 ug/kg = 0.00833 mg/kg**

Microbac Laboratories Inc.
Metals Digest Log

00082185

Workgroup: WG289276
Analyst: PDM
Spike Analyst: VC
Method: 7471A
Run Date: 12/01/2008 10:10
Hotblock Start Temp: 92.4 @ 10:25
Hotblock End Temp: 92.9 @ 10:55

SOP: ME405 Revison 8
Spike Solution: STD30092
Spike Witness: SDL
HNO3 Lot #: COA13530
hcl Lot #: COA13324
KMnO4 1:1 Lot #: RGT13349
HG SOIL STD 10PPM Lot #: STD30099
HG SOILS ICV Lot #: STD30100
Digest tubes Lot #: COA13407

| | SAMPLE # | Type | Matrix | Initial Amount | Final Volume | Spike Amount | Due Date |
|---|---|---|---|---|---|---|---|
| 1 | WG289276-02 | BLANK | 7 | .6 g | 40 mL | | |
| 2 | WG289276-03 | LCS | 7 | .6 g | 40 mL | 4 mL | |
| 3 | WG289276-01 | REF | 7 | .602 g | 40 mL | | |
| 4 | L08110782-06 | SAMP | 7 | .602 g | 40 mL | | 12/05/08 |
| 5 | L08110782-07 | SAMP | 7 | .601 g | 40 mL | | 12/05/08 |
| 6 | WG289276-04 | MS | 7 | .602 g | 40 mL | 4 mL | |
| 7 | WG289276-05 | MSD | 7 | .602 g | 40 mL | 4 mL | |

Analyst: Pierce Morris

Reviewer: Vicki Collins

BLOCK_DIG - Modified 07/22/2008
PDF ID: 1263269
Report generated: 12/01/2008 11:31

# Microbac Laboratories Inc.
## Metals Digest Log

Workgroup: WG289304
Analyst: ED
Spike Analyst: ED
Method: METHOD
Run Date: 12/01/2008 14:22
Hotblock Start Temp: 92.9 @ 12:00
Hotblock End Temp: 93.5 @ 14:00

SOP: 7040 Revison 11
Spike Solution: STD30101
Spike Witness: VC
HNO3 Lot #: COA13530
KMnO4 1:1 Lot #: RGT13349
H2SO4 Lot #: COA13254
K2S2O8 1:1 Lot #: RGT13338
HG H2O STDS 10PPM Lot #: STD30109

| | SAMPLE # | Type | Matrix | Initial Amount | Final Volume | Spike Amount | Due Date |
|---|---|---|---|---|---|---|---|
| 1 | WG289304-02 | BLANK | 1 | 40 mL | 40 mL | | |
| 2 | WG289304-03 | LCS | 1 | 40 mL | 40 mL | 4 mL | |
| 3 | L08110782-01 | SAMP | 1 | 40 mL | 40 mL | | 12/05/08 |
| 4 | L08110782-02 | SAMP | 1 | 40 mL | 40 mL | | 12/05/08 |
| 5 | L08110782-03 | SAMP | 1 | 40 mL | 40 mL | | 12/05/08 |
| 6 | L08110782-04 | SAMP | 1 | 40 mL | 40 mL | | 12/05/08 |
| 7 | WG289304-01 | REF | 1 | 40 mL | 40 mL | | |
| 8 | L08110782-05 | SAMP | 1 | 40 mL | 40 mL | | 12/05/08 |
| 9 | WG289304-04 | MS | 1 | 36 mL | 40 mL | 4 mL | |
| 10 | WG289304-05 | MSD | 1 | 36 mL | 40 mL | 4 mL | |

Analyst: Kimberly Decker

Reviewer: Vicki Collins

BLOCK_DIG - Modified 07/22/2008
PDF ID: 1263566
Report generated: 12/03/2008 11:18

**Microbac Laboratories Inc.**

Instrument Run Log

Instrument: HYDRA  Dataset: 120108A.PRN
Analyst1: ADC  Analyst2: N/A
Method: 7471A  SOP: 405  Rev: 8
Maintenance Log ID: 26797

Calibration Std: STD30099  ICV/CCV Std: STD30100  Post Spike: STD30099
ICSA: N/A  ICSAB: N/A

Workgroups: 289319

Comments:

| Seq. | File ID | Sample | ID | Prep | Dil | Reference | Date/Time |
|---|---|---|---|---|---|---|---|
| 1 | HY.120108.141543 | WG289437-01 | Calibration Point | | 1 | | 12/01/08 14:15 |
| 2 | HY.120108.141735 | WG289437-02 | Calibration Point | | 1 | | 12/01/08 14:17 |
| 3 | HY.120108.141922 | WG289437-03 | Calibration Point | | 1 | | 12/01/08 14:19 |
| 4 | HY.120108.142115 | WG289437-04 | Calibration Point | | 1 | | 12/01/08 14:21 |
| 5 | HY.120108.142300 | WG289437-05 | Calibration Point | | 1 | | 12/01/08 14:23 |
| 6 | HY.120108.142505 | WG289437-06 | Calibration Point | | 1 | | 12/01/08 14:25 |
| 7 | HY.120108.142700 | WG289437-07 | Initial Calibration Verification | | 1 | | 12/01/08 14:27 |
| 8 | HY.120108.142851 | WG289437-08 | Initial Calib Blank | | 1 | | 12/01/08 14:28 |
| 9 | HY.120108.143047 | WG289437-09 | CCV | | 1 | | 12/01/08 14:30 |
| 10 | HY.120108.143254 | WG289437-10 | CCB | | 1 | | 12/01/08 14:32 |
| 11 | HY.120108.143445 | WG289276-02 | Method/Prep Blank | .6/40 | 1 | | 12/01/08 14:34 |
| 12 | HY.120108.143628 | WG289276-03 | Laboratory Control S | .6/40 | 1 | | 12/01/08 14:36 |
| 13 | HY.120108.143811 | L08110782-06 | 03SB11-(10-11) | .602/40 | 1 | | 12/01/08 14:38 |
| 14 | HY.120108.144018 | WG289319-01 | Post Digestion Spike | | 1 | L08110782-06 | 12/01/08 14:40 |
| 15 | HY.120108.144358 | WG289319-01 | Post Digestion Spike | | 1 | L08110782-06 | 12/01/08 14:43 |
| 16 | HY.120108.144551 | L08110782-07 | 03SB11-(BOTTOM) | .601/40 | 1 | WG289244-01 | 12/01/08 14:45 |
| 17 | HY.120108.144735 | WG289276-04 | Matrix Spike | .602/40 | 1 | L08110782-06 | 12/01/08 14:47 |
| 18 | HY.120108.144932 | WG289276-05 | Matrix Spike Duplica | .602/40 | 1 | L08110782-06 | 12/01/08 14:49 |
| 19 | HY.120108.145127 | WG289319-02 | Serial Dilution | | 1 | | 12/01/08 14:51 |
| 20 | HY.120108.145321 | WG289437-11 | CCV | | 1 | | 12/01/08 14:53 |
| 21 | HY.120108.145508 | WG289437-12 | CCB | | 1 | | 12/01/08 14:55 |

**Comments**

| Seq. | Rerun | Dil. | Reason | Analytes |
|---|---|---|---|---|
| 14 | X | | marginal post spike failure | HG |

Page: 1  Approved: December 05, 2008

Maren Berry

Microbac

**Microbac Laboratories Inc.**

Instrument Run Log

Instrument: HYDRA  Dataset: 120108B.PRN
Analyst1: ADC  Analyst2: N/A
Method: 7470A  SOP: 404  Rev: 11
Maintenance Log ID: 26797

Calibration Std: STD30109  ICV/CCV Std: STD30103  Post Spike: STD30109
ICSA: N/A  ICSAB: N/A

Workgroups: 289327

Comments:

| Seq. | File ID | Sample | ID | Prep | Dil | Reference | Date/Time |
|---|---|---|---|---|---|---|---|
| 1 | HY.120108.150300 | WG289505-01 | Calibration Point | | 1 | | 12/01/08 15:03 |
| 2 | HY.120108.150453 | WG289505-02 | Calibration Point | | 1 | | 12/01/08 15:04 |
| 3 | HY.120108.150635 | WG289505-03 | Calibration Point | | 1 | | 12/01/08 15:06 |
| 4 | HY.120108.150818 | WG289505-04 | Calibration Point | | 1 | | 12/01/08 15:08 |
| 5 | HY.120108.151002 | WG289505-05 | Calibration Point | | 1 | | 12/01/08 15:10 |
| 6 | HY.120108.151236 | WG289505-06 | Calibration Point | | 1 | | 12/01/08 15:12 |
| 7 | HY.120108.151422 | WG289505-07 | Initial Calibration Verification | | 1 | | 12/01/08 15:14 |
| 8 | HY.120108.151625 | WG289505-08 | Initial Calib Blank | | 1 | | 12/01/08 15:16 |
| 9 | HY.120108.151808 | WG289505-09 | CCV | | 1 | | 12/01/08 15:18 |
| 10 | HY.120108.151952 | WG289505-10 | CCB | | 1 | | 12/01/08 15:19 |
| 11 | HY.120108.152135 | WG289304-02 | Method/Prep Blank | 40/40 | 1 | | 12/01/08 15:21 |
| 12 | HY.120108.152319 | WG289304-03 | Laboratory Control S | 40/40 | 1 | | 12/01/08 15:23 |
| 13 | HY.120108.152502 | L08110782-01 | 35AWW01-111908 | 40/40 | 1 | | 12/01/08 15:25 |
| 14 | HY.120108.152648 | WG289327-01 | Post Digestion Spike | | 1 | L08110782-01 | 12/01/08 15:26 |
| 15 | HY.120108.152852 | L08110782-02 | LHSMW06-111908 | 40/40 | 1 | | 12/01/08 15:28 |
| 16 | HY.120108.153126 | L08110782-03 | LHSMW03-111908 | 40/40 | 1 | | 12/01/08 15:31 |
| 17 | HY.120108.153322 | L08110782-04 | LHSMW07-111908 | 40/40 | 1 | | 12/01/08 15:33 |
| 18 | HY.120108.153515 | L08110782-05 | 35AWW05-112108 | 40/40 | 1 | WG289304-01 | 12/01/08 15:35 |
| 19 | HY.120108.153658 | WG289304-04 | Matrix Spike | 36/40 | 1 | L08110782-05 | 12/01/08 15:36 |
| 20 | HY.120108.153851 | WG289304-05 | Matrix Spike Duplica | 36/40 | 1 | L08110782-05 | 12/01/08 15:38 |
| 21 | HY.120108.154036 | WG289505-11 | CCV | | 1 | | 12/01/08 15:40 |
| 22 | HY.120108.154223 | WG289505-12 | CCB | | 1 | | 12/01/08 15:42 |


Approved: December 05, 2008
Maren Berry

Microbac Laboratories Inc.

Data Checklist

Date: 01-DEC-2008
Analyst: ADC
Analyst: NA
Method: 7471A
Instrument: HYDRA
Curve Workgroup: 289437
Runlog ID: 25502
Analytical Workgroups: 289319

| | |
|---|---|
| Calibration/Linearity | X |
| ICV/CCV | X |
| ICB/CCB | X |
| ICSA/ICSAB | |
| CRI | |
| Blank/LCS | X |
| MS/MSD | X |
| Post Spike/Serial Dilution | X |
| Upload Results | X |
| Data Qualifiers | |
| Generate PDF Instrument Data | X |
| Sign/Annotate PDF Data | X |
| Upload Curve Data | X |
| Workgroup Forms | X |
| Case Narrative | 0782 |
| Client Forms | X |
| Level X | |
| Level 3 | 0782 |
| Level 4 | |
| Check for compliance with method and project specific requirements | X |
| Check the completeness of reported information | X |
| Check the information for the report narrative | X |
| Primary Reviewer | ADC |
| Secondary Reviewer | MMB |
| | |
| Comments | |

Primary Reviewer:
02-DEC-2008

Secondary Reviewer:
05-DEC-2008

CHECKLIST1 - Modified 03/05/2008
Generated: DEC-05-2008 14:25:11

Microbac Laboratories Inc.

Data Checklist

Date: 01-DEC-2008
Analyst: ADC
Analyst: NA
Method: 7470A
Instrument: HYDRA
Curve Workgroup: 289505
Runlog ID: 25507
Analytical Workgroups: 289327

| | |
|---|---|
| Calibration/Linearity | X |
| ICV/CCV | X |
| ICB/CCB | X |
| ICSA/ICSAB | |
| CRI | |
| Blank/LCS | X |
| MS/MSD | X |
| Post Spike/Serial Dilution | X |
| Upload Results | X |
| Data Qualifiers | |
| Generate PDF Instrument Data | X |
| Sign/Annotate PDF Data | X |
| Upload Curve Data | X |
| Workgroup Forms | X |
| Case Narrative | 0782 |
| Client Forms | X |
| Level X | |
| Level 3 | 0782 |
| Level 4 | |
| Check for compliance with method and project specific requirements | X |
| Check the completeness of reported information | X |
| Check the information for the report narrative | X |
| Primary Reviewer | ADC |
| Secondary Reviewer | MMB |
| | |
| Comments | |

Primary Reviewer:
03-DEC-2008

Secondary Reviewer:
05-DEC-2008

CHECKLIST1 - Modified 03/05/2008
Generated: DEC-05-2008 14:15:48

Microbac Laboratories Inc.

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

00082191

Analytical Method: 7471A AAB#: WG289319

Login Number: L08110782

| Client ID | Date Collected | Date Received | Date Extracted | Max Hold Time Ext. | Time Held Ext. | Date Analyzed | Max Hold Time Anal | Time Held Anal. | Q |
|---|---|---|---|---|---|---|---|---|---|
| 03SB11-(BOTTOM) | 11/18/08 | 11/25/08 | 12/01/08 | 28 | 13.0 | 12/01/08 | 28 | 0.191 | |
| 03SB11-(10-11) | 11/18/08 | 11/25/08 | 12/01/08 | 28 | 13.0 | 12/01/08 | 28 | 0.189 | |

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1265151
Report generated 12/08/2008 16:40

Microbac®

Microbac Laboratories Inc.

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

00082192

Analytical Method: 7470A AAB#: WG289327

Login Number: L08110782

| Client ID | Date Collected | Date Received | Date Extracted | Max Hold Time Ext. | Time Held Ext. | Date Analyzed | Max Hold Time Anal | Time Held Anal. | Q |
|---|---|---|---|---|---|---|---|---|---|
| 35AWW01-111908 | 11/19/08 | 11/25/08 | 12/01/08 | 28 | 12.0 | 12/01/08 | 28 | 0.0433 | |
| 35AWW05-112108 | 11/21/08 | 11/25/08 | 12/01/08 | 28 | 9.87 | 12/01/08 | 28 | 0.0504 | |
| LHSMW06-111908 | 11/19/08 | 11/25/08 | 12/01/08 | 28 | 12.1 | 12/01/08 | 28 | 0.0459 | |
| LHSMW03-111908 | 11/19/08 | 11/25/08 | 12/01/08 | 28 | 12.2 | 12/01/08 | 28 | 0.0477 | |
| LHSMW07-111908 | 11/21/08 | 11/25/08 | 12/01/08 | 28 | 10.1 | 12/01/08 | 28 | 0.0491 | |

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1265151
Report generated 12/08/2008 16:40

Microbac®

# METHOD BLANK SUMMARY

| | | | |
|---|---|---|---|
| Login Number: | L08110782 | Work Group: | WG289319 |
| Blank File ID: | HY.120108.143445 | Blank Sample ID: | WG289276-02 |
| Prep Date: | 12/01/08 10:10 | Instrument ID: | HYDRA |
| Analyzed Date: | 12/01/08 14:34 | Method: | 7471A |
| Analyst: | ADC | | |

This Method Blank Applies To The Following Samples:

| Client ID | Lab Sample ID | Lab File ID | Time Analyzed | TAG |
|---|---|---|---|---|
| LCS | WG289276-03 | HY.120108.143628 | 12/01/08 14:36 | 01 |
| 03SB11-(10-11) | L08110782-06 | HY.120108.143811 | 12/01/08 14:38 | 01 |
| 03SB11-(BOTTOM) | L08110782-07 | HY.120108.144551 | 12/01/08 14:45 | 01 |

Report Name: BLANK_SUMMARY
PDF File ID: 1265152
Report generated 12/08/2008 16:40

# METHOD BLANK SUMMARY

Login Number: L08110782
Work Group: WG289327
Blank File ID: HY.120108.152135
Blank Sample ID: WG289304-02
Prep Date: 12/01/08 14:22
Instrument ID: HYDRA
Analyzed Date: 12/01/08 15:21
Method: 7470A
Analyst: ADC

This Method Blank Applies To The Following Samples:

| Client ID | Lab Sample ID | Lab File ID | Time Analyzed | TAG |
|---|---|---|---|---|
| LCS | WG289304-03 | HY.120108.152319 | 12/01/08 15:23 | 01 |
| 35AWW01-111908 | L08110782-01 | HY.120108.152502 | 12/01/08 15:25 | 01 |
| LHSMW06-111908 | L08110782-02 | HY.120108.152852 | 12/01/08 15:28 | 01 |
| LHSMW03-111908 | L08110782-03 | HY.120108.153126 | 12/01/08 15:31 | 01 |
| LHSMW07-111908 | L08110782-04 | HY.120108.153322 | 12/01/08 15:33 | 01 |
| 35AWW05-112108 | L08110782-05 | HY.120108.153515 | 12/01/08 15:35 | 01 |

Report Name: BLANK_SUMMARY
PDF File ID: 1265152
Report generated 12/08/2008 16:40

Microbac Laboratories Inc.

METHOD BLANK REPORT

00082195

Login Number: L08110782 Prep Date: 12/01/08 10:10 Sample ID: WG289276-02
Instrument ID: HYDRA Run Date: 12/01/08 14:34 Prep Method: 7471A
File ID: HY.120108.143445 Analyst: ADC Method: 7471A
Workgroup (AAB#): WG289319 Matrix: Soil Units: mg/kg
Contract #: DACA56-94-D-0020 Cal ID: HYDRA-01-DEC-08

| Analytes | SDL | PQL | Concentration | Dilution | Qualifier |
|---|---|---|---|---|---|
| Mercury, Total | 0.0100 | 0.250 | 0.0100 | 1 | U |

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name:BLANK
PDF ID: 1265153
08-DEC-2008 16:40

Microbac Laboratories Inc.

METHOD BLANK REPORT

00082196

Login Number: L08110782 Prep Date: 12/01/08 14:22 Sample ID: WG289304-02
Instrument ID: HYDRA Run Date: 12/01/08 15:21 Prep Method: METHOD
File ID: HY.120108.152135 Analyst: ADC Method: 7470A
Workgroup (AAB#): WG289327 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: HYDRA-01-DEC-08

| Analytes | SDL | PQL | Concentration | Dilution | Qualifier |
|---|---|---|---|---|---|
| Mercury | 0.000100 | 0.000200 | 0.000100 | 1 | U |

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name:BLANK
PDF ID: 1265153
08-DEC-2008 16:40

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

00082197

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289276-03
Instrument ID: HYDRA Run Time: 14:36 Prep Method: 7471A
File ID: HY.120108.143628 Analyst: ADC Method: 7471A
Workgroup (AAB#): WG289319 Matrix: Soil Units: mg/kg
QC Key: STD Lot#: STD30092 Cal ID: HYDRA-01-DEC-08

| Analytes | Expected | Found | % Rec | LCS Limits | Q |
|---|---|---|---|---|---|
| Mercury, Total | 0.267 | 0.260 | 97.5 | 80 - 120 | |

LCS - Modified 03/06/2008
PDF File ID: 1265154
Report generated: 12/08/2008 16:40

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

00082198

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289304-03
Instrument ID: HYDRA Run Time: 15:23 Prep Method: METHOD
File ID: HY.120108.152319 Analyst: ADC Method: 7470A
Workgroup (AAB#): WG289327 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD30101 Cal ID: HYDRA-01-DEC-08

| Analytes | Expected | Found | % Rec | LCS Limits | Q |
|---|---|---|---|---|---|
| Mercury | 0.00400 | 0.00423 | 106 | 85 - 115 | |

LCS - Modified 03/06/2008
PDF File ID: 1265154
Report generated: 12/08/2008 16:40

Microbac Laboratories Inc.

MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

00082199

Loginnum:L08110782 Cal ID:HYDRA- Worknum:WG289319

Instrument ID:HYDRA Contract #:DACA56-94-D-0020 Method:7471A

Parent ID:WG289276-01 File ID:HY.120108.143811 Dil:1 Matrix:SOLID

Sample ID:WG289276-04 MS File ID:HY.120108.144735 Dil:1 Units:mg/kg

Sample ID:WG289276-05 MSD File ID:HY.120108.144932 Dil:1 Percent Solid:89.3

| Analyte | Parent | MS Spiked | MS Found | MS %Rec | MSD Spiked | MSD Found | MSD %Rec | %RPD | %Rec Limits | RPD Limit | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury, Total | ND | 0.298 | 0.303 | 102 | 0.298 | 0.302 | 102 | 0.246 | 75 - 125 | 25 | |

* FAILS %REC LIMIT

# FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008

PDF File ID: 1265155

Report generated 12/08/2008 16:40

Microbac Laboratories Inc.

MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

00082200

Loginnum:L08110782 Cal ID:HYDRA- Worknum:WG289327
Instrument ID:HYDRA Contract #:DACA56-94-D-0020 Method:7470A
Parent ID:WG289304-01 File ID:HY.120108.153515 Dil:1 Matrix:WATER
Sample ID:WG289304-04 MS File ID:HY.120108.153658 Dil:1 Units:mg/L
Sample ID:WG289304-05 MSD File ID:HY.120108.153851 Dil:1

| Analyte | Parent | MS Spiked | MS Found | MS %Rec | MSD Spiked | MSD Found | MSD %Rec | %RPD | %Rec Limits | RPD Limit | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | ND | 0.00444 | 0.00456 | 103 | 0.00444 | 0.00464 | 105 | 1.93 | 85 - 115 | 20 | |

* FAILS %REC LIMIT

# FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008
PDF File ID: 1265155
Report generated 12/08/2008 16:40

**Microbac Laboratories Inc.**
Serial Dilution Report

**Login:** L08110782 **Worknum:** WG289319
**Instrument:** HYDRA **Method:** 7471A
**Serial Dil:** WG289319-02 **File ID:** HY.120108.145127 **Dil:** 5 **Units:** ug/L
**Sample:** L08110782-07 **File ID:** HY.120108.144551 **Dil:** 1

| Analyte | Sample | Qual | Serial Dil | Qual | % Diff | Q |
|---|---|---|---|---|---|---|
| Mercury | 5.18 | | 5 | F | 3.47 | |

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 25 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 25 times the MDL.

**SERIAL_DIL - Modified 09/22/2008**
**PDF File ID: 1269158**
**12/08/2008 16:40**

**Sample Login ID:** L08110782 **Worknum:** WG289319
**Instrument ID:** HYDRA **Method:** 7471A
**Post Spike ID:** WG289319-01 **File ID:** HY.120108.144358 **Dil:** 1 **Units:** ug/L
**Sample ID:** L08110782-06 **File ID:** HY.120108.143811 **Dil:** 1 **Matrix:** Soil

| Analyte | Post Spike Result | C | Sample Result | C | Spike Added(SA) | % R | Control Limit %R | Q |
|---|---|---|---|---|---|---|---|---|
| MERCURY | 1.14 | F | 0 | .15 | 1 | 114.0 | 85 - 115 | |

**N = % Recovery exceeds control limits**
**F = Result is between MDL and RL**
**U = Sample result is below MDL. A value of zero is used in the calculation**

**POST_SPIKE - Modified 03/06/2008**
**PDF File ID: 1265150**
**Report generated: 12/08/2008 16:40**

**Sample Login ID:** L08110782 **Worknum:** WG289327
**Instrument ID:** HYDRA **Method:** 7470A
**Post Spike ID:** WG289327-01 **File ID:** HY.120108.152648 **Dil:** 1 **Units:** ug/L
**Sample ID:** L08110782-01 **File ID:** HY.120108.152502 **Dil:** 1 **Matrix:** Water

| Analyte | Post Spike Result | C | Sample Result | C | Spike Added(SA) | % R | Control Limit %R | Q |
|---|---|---|---|---|---|---|---|---|
| MERCURY | 0.930 | | 0 | .1 | 1 | 93.0 | 85 - 115 | |

**N = % Recovery exceeds control limits**
**F = Result is between MDL and RL**
**U = Sample result is below MDL. A value of zero is used in the calculation**

**POST_SPIKE - Modified 03/06/2008**
**PDF File ID: 1265150**
**Report generated: 12/08/2008 16:40**

Microbac Laboratories Inc.

INITIAL CALIBRATION SUMMARY

00082204

Login Number: L08110782
Analytical Method: 7471A
ICAL Worknum: WG289437

Workgroup (AAB#): WG289319
Instrument ID: HYDRA
Initial Calibration Date: 12/01/2008 14:25

| Analyte | WG289437-01 | | WG289437-02 | | WG289437-03 | | WG289437-04 | | WG289437-05 | | WG289437-06 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | STD | INT | STD | INT | STD | INT | STD | INT | STD | INT | STD | INT |
| Mercury | 0 | 2362 | 0.200 | 12728 | 1.00 | 60329 | 2.00 | 121354 | 5.00 | 309866 | 10.0 | 603237 |

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
* = Out of Compliance; R < 0.995

INT_CAL_HG_FU - Modified 03/06/2008
PDF File ID: 1265156
Report generated 12/08/2008 16:40

Microbac Laboratories Inc.

INITIAL CALIBRATION SUMMARY

00082205

Login Number: L08110782
Analytical Method: 7471A
ICAL Worknum: WG289437

Workgroup (AAB#): WG289319
Instrument ID: HYDRA
Initial Calibration Date: 12/01/2008 14:25

| Analyte | R | Q |
|---|---|---|
| Mercury | 1.000 | |

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
* = Out of Compliance; R < 0.995

INT_CAL_HG_FU - Modified 03/06/2008
PDF File ID: 1265156
Report generated 12/08/2008 16:40

Microbac Laboratories Inc.

INITIAL CALIBRATION SUMMARY

00082206

Login Number: L08110782
Analytical Method: 7470A
ICAL Worknum: WG289505

Workgroup (AAB#): WG289327
Instrument ID: HYDRA
Initial Calibration Date: 12/01/2008 15:12

| Analyte | WG289505-01 | | WG289505-02 | | WG289505-03 | | WG289505-04 | | WG289505-05 | | WG289505-06 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | STD | INT | STD | INT | STD | INT | STD | INT | STD | INT | STD | INT |
| Mercury | 0 | 2690 | 0.200 | 12405 | 1.00 | 55240 | 2.00 | 111155 | 5.00 | 275583 | 10.0 | 548566 |

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
* = Out of Compliance; R < 0.995

INT_CAL_HG_FU - Modified 03/06/2008
PDF File ID: 1265156
Report generated 12/08/2008 16:40

Microbac Laboratories Inc.

INITIAL CALIBRATION SUMMARY

00082207

Login Number: L08110782
Analytical Method: 7470A
ICAL Worknum: WG289505

Workgroup (AAB#): WG289327
Instrument ID: HYDRA
Initial Calibration Date: 12/01/2008 15:12

| Analyte | R | Q |
|---|---|---|
| Mercury | 1.000 | |

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
* = Out of Compliance; R < 0.995

INT_CAL_HG_FU - Modified 03/06/2008
PDF File ID: 1265156
Report generated 12/08/2008 16:40

Microbac Laboratories Inc.
INITIAL CALIBRATION BLANK (ICB)

00082208

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-08
Instrument ID: HYDRA Run Time: 14:28 Method: 7471
File ID: HY.120108.142851 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08
Matrix: SOIL

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| MERCURY | .15 | 3.75 | .15 | U |

ICB - Modified 03/06/2008
PDF File ID: 1265158
Report generated 12/08/2008 16:41

Microbac Laboratories Inc.
INITIAL CALIBRATION BLANK (ICB)

00082209

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-08
Instrument ID: HYDRA Run Time: 15:16 Method: 7471
File ID: HY.120108.151625 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08
Matrix: WATER

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| MERCURY | .1 | .2 | .1 | U |

ICB - Modified 03/06/2008
PDF File ID: 1265158
Report generated 12/08/2008 16:41

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00082210

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-10
Instrument ID: HYDRA Run Time: 14:32 Method: 7471A
File ID: HY.120108.143254 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08
Matrix: SOIL

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| Mercury | 0.150 | 3.75 | 0.150 | U |

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1265161
Report generated 12/08/2008 16:41

Microbac

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00082211

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-12
Instrument ID: HYDRA Run Time: 14:55 Method: 7471A
File ID: HY.120108.145508 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08
Matrix: SOIL

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| Mercury | 0.150 | 3.75 | 0.150 | U |

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1265161
Report generated 12/08/2008 16:41

Microbac

Microbac Laboratories Inc.

CONTINUING CALIBRATION BLANK (CCB)

00082212

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-10

Instrument ID: HYDRA Run Time: 15:19 Method: 7470A

File ID: HY.120108.151952 Analyst: ADC Units: ug/L

Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08

Matrix: WATER

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| Mercury | 0.100 | 0.200 | 0.100 | U |

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008

PDF File ID: 1265161

Report generated 12/08/2008 16:41

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00082213

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-12
Instrument ID: HYDRA Run Time: 15:42 Method: 7470A
File ID: HY.120108.154223 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08
Matrix: WATER

| Analytes | MDL | RDL | Concentration | Qualifier |
|---|---|---|---|---|
| Mercury | 0.100 | 0.200 | 0.100 | U |

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1265161
Report generated 12/08/2008 16:41

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

00082214

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-07
Instrument ID: HYDRA Run Time: 14:27 Method: 7471A
File ID: HY.120108.142700 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08
QC Key: STD

| Analyte | Expected | Found | %REC | LIMITS | Q |
|---|---|---|---|---|---|
| Mercury | 2 | 2.21 | 111 | 90 - 110 | * |

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1265157
Report generated 12/08/2008 16:41

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

00082215

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-07
Instrument ID: HYDRA Run Time: 15:14 Method: 7470A
File ID: HY.120108.151422 Analyst: ADC Units: ug/L
Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08
QC Key: STD

| Analyte | | Expected | Found | %REC | LIMITS | Q |
|---|---|---|---|---|---|---|
| Mercury | | 2 | 2.01 | 101 | 90 - 110 | |

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1265157
Report generated 12/08/2008 16:41

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Microbac Laboratories Inc.

CONTINUING CALIBRATION VERIFICATION (CCV)

00082216

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-09

Instrument ID: HYDRA Run Time: 14:30 Method: 7471A

File ID: HY.120108.143047 Analyst: ADC QC Key: STD

Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08

Matrix: SOIL

| Analyte | | Expected | Found | UNITS | %REC | LIMITS | | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury, Total | | 0.00200 | 0.00215 | mg/L | 108 | 80 - 120 | | |

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008

PDF File ID: 1265159

Report generated 12/08/2008 16:41

Microbac Laboratories Inc.

CONTINUING CALIBRATION VERIFICATION (CCV)

00082217

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289437-11

Instrument ID: HYDRA Run Time: 14:53 Method: 7471A

File ID: HY.120108.145321 Analyst: ADC QC Key: STD

Workgroup (AAB#): WG289319 Cal ID: HYDRA - 01-DEC-08

Matrix: SOIL

| Analyte | | Expected | Found | UNITS | %REC | LIMITS | | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury, Total | | 0.00200 | 0.00219 | mg/L | 110 | 80 - 120 | | |

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008

PDF File ID: 1265159

Report generated 12/08/2008 16:41

Microbac Laboratories Inc.

CONTINUING CALIBRATION VERIFICATION (CCV)

00082218

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-09

Instrument ID: HYDRA Run Time: 15:18 Method: 7470A

File ID: HY.120108.151808 Analyst: ADC QC Key: STD

Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08

Matrix: WATER

| Analyte | | Expected | Found | UNITS | %REC | LIMITS | | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury, Total | | 0.00200 | 0.00210 | mg/L | 105 | 80 - 120 | | |

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008

PDF File ID: 1265159

Report generated 12/08/2008 16:41

Microbac Laboratories Inc.

CONTINUING CALIBRATION VERIFICATION (CCV)

00082219

Login Number: L08110782 Run Date: 12/01/2008 Sample ID: WG289505-11

Instrument ID: HYDRA Run Time: 15:40 Method: 7470A

File ID: HY.120108.154036 Analyst: ADC QC Key: STD

Workgroup (AAB#): WG289327 Cal ID: HYDRA - 01-DEC-08

Matrix: WATER

| Analyte | | Expected | Found | UNITS | %REC | LIMITS | | Q |
|---|---|---|---|---|---|---|---|---|
| Mercury, Total | | 0.00200 | 0.00196 | mg/L | 98.0 | 80 - 120 | | |

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008

PDF File ID: 1265159

Report generated 12/08/2008 16:41

# 2.3 General Chemistry Data

# 2.3.1 Percent Solids Data

# 2.3.1.1 Raw Data

# LABORATORY REPORT

00082223

**L08110782**

**12/09/08 09:06**

**Submitted By**

**Microbac Laboratories Inc.**
**158 Starlite Drive**
**Marietta , OH 45750**
**( 740 ) 373 - 4071**

**For**

**Account Name:** Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
**Attention:** Jennifer Hoang

**Project Number:** 2773.025
**Project:** Longhorn AAP
**Site:** LONGHORN AAP KARNACK TX

**P.O. Number:** 389869/ 390836(GWTP)

## Sample Analysis Summary

| Client ID | Lab ID | Method | Dilution | Date Received |
|---|---|---|---|---|
| 03SB11-(10-11) | L08110782-06 | D2216-90 | 1 | 25-NOV-08 |
| 03SB11-(BOTTOM) | L08110782-07 | D2216-90 | 1 | 25-NOV-08 |

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082224

Sample Number: **L08110782-06**
Client ID: **03SB11-(10-11)**
Matrix: **Soil**
Workgroup Number: **WG289169**
Collect Date: **11/18/2008 09:45**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **D2216-90**
Analytical Method: **D2216-90**
Analyst: **JDH**
Dilution: **1**
Units: **weight %**

Instrument: **BAL001**
Prep Date: **12/01/2008 09:29**
Cal Date:
Run Date: **12/01/2008 09:29**
File ID: **B1.289169-0149**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| **Percent Solids** | **10-02-6** | **89.3** | | **1.00** | **1.00** |



Microbac®

Report Number: **L08110782**
Report Date : **December 9, 2008**

00082225

Sample Number: **L08110782-07**
Client ID: **03SB11-(BOTTOM)**
Matrix: **Soil**
Workgroup Number: **WG289169**
Collect Date: **11/18/2008 10:15**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **D2216-90**
Analytical Method: **D2216-90**
Analyst: **JDH**
Dilution: **1**
Units: **weight %**

Instrument: **BAL001**
Prep Date: **12/01/2008 09:29**
Cal Date:
Run Date: **12/01/2008 09:29**
File ID: **B1.289169-0150**

| Analyte | CAS. Number | Result | Qual | PQL | SDL |
|---|---|---|---|---|---|
| **Percent Solids** | **10-02-6** | **84.9** | | **1.00** | **1.00** |

**Example Percent Solids Calculations**

**1.0 Calculating the percent solids of a sample.**

$$\%Solids = \frac{WT3 - WT1}{WT2 - WT1} \times F$$

| Where: | |
|---|---|
| WT1 = Weight, in grams, of the empty container | 1.30 g |
| WT2 = Weight, in grams, of the container and wet sample | 21.274 g |
| WT3 = Weight, in grams, of the container and dried sample | 5.21 g |
| F = Factor to get units as percent weight | 100 |
| %Solids = Percent solids present in sample. | 19.58% |

**2.0 Calculating the percent moisture of a sample.**

**% Moisture = 100 - % Solids from 1.0 calculation**

PERCENT SOLIDS

00082227

Workgroup (AAB#):WG289169 Analyst:JDH ADT(on):11/26/2008 15:47
Method:D2216-90 Instrument:BAL001 ADT(off):12/01/2008 09:29
SOP:K0003 Rev:9

| SAMPLE NUMBER | EMPTY PAN WT 1 | WET WT 2 | DRY WT 3A | DRY WT 3B | DRY WT 3C | PERCENT SOLID | PERCENT MOISTURE |
|---|---|---|---|---|---|---|---|
| L08110548-01 | 1.32 | 26.24 | 25.85 | | | 98.43 | |
| L08110548-02 | 1.31 | 32.29 | 31.87 | | | 98.64 | |
| L08110548-03 | 1.32 | 19.52 | 19.5 | | | 99.89 | |
| L08110548-04 | 1.27 | 28.93 | 28.56 | | | 98.66 | |
| L08110548-05 | 1.28 | 31.06 | 30.65 | | | 98.62 | |
| L08110548-06 | 1.3 | 38.82 | 38.27 | | | 98.53 | |
| L08110548-07 | 1.29 | 30.24 | 29.92 | | | 98.89 | |
| L08110548-08 | 1.28 | 31.87 | 31.47 | | | 98.69 | |
| L08110548-09 | 1.28 | 31.87 | 31.47 | | | 98.69 | |
| L08110548-10 | 1.28 | 31.87 | 31.47 | | | 98.69 | |
| L08110548-11 | 1.31 | 25.08 | 24.74 | | | 98.57 | |
| L08110548-12 | 1.29 | 28.86 | 28.58 | | | 98.98 | |
| L08110548-13 | 1.29 | 34.94 | 34.5 | | | 98.69 | |
| L08110548-14 | 1.29 | 34.49 | 34.13 | | | 98.92 | |
| L08110548-15 | 1.27 | 38.72 | 38.4 | | | 99.15 | |
| L08110548-16 | 1.29 | 21.5 | 21.28 | | | 98.91 | |
| L08110548-17 | 1.29 | 27.14 | 26.88 | | | 98.99 | |
| L08110548-18 | 1.3 | 29.61 | 29.18 | | | 98.48 | |
| L08110548-19 | 1.3 | 28.9 | 28.44 | | | 98.33 | |
| L08110548-20 | 1.3 | 27.93 | 27.47 | | | 98.27 | |
| L08110548-21 | 1.29 | 24.41 | 24.17 | | | 98.96 | |
| L08110548-22 | 1.3 | 26.67 | 26.59 | | | 99.68 | |
| L08110548-23 | 1.29 | 31.89 | 31.4 | | | 98.40 | |
| L08110548-24 | 1.29 | 33.49 | 33 | | | 98.48 | |
| L08110550-01 | 1.29 | 28.98 | 28.51 | | | 98.30 | |
| L08110550-02 | 1.3 | 33.63 | 33.16 | | | 98.55 | |
| L08110550-03 | 1.3 | 33.63 | 33.16 | | | 98.55 | |
| L08110550-04 | 1.3 | 33.63 | 33.16 | | | 98.55 | |
| L08110550-05 | 1.29 | 26.74 | 26.38 | | | 98.59 | |
| L08110550-06 | 1.29 | 26.2 | 25.82 | | | 98.47 | |
| L08110550-07 | 1.29 | 30.55 | 30.26 | | | 99.01 | |
| L08110550-08 | 1.3 | 31.34 | 30.91 | | | 98.57 | |
| L08110550-09 | 1.28 | 28.66 | 28.11 | | | 97.99 | |
| L08110550-10 | 1.3 | 25.84 | 25.21 | | | 97.43 | |
| L08110550-11 | 1.29 | 33.47 | 33.1 | | | 98.85 | |
| L08110550-12 | 1.29 | 26.37 | 26.01 | | | 98.56 | |
| L08110550-13 | 1.31 | 24.45 | 24.01 | | | 98.10 | |
| L08110550-14 | 1.29 | 22.77 | 22.44 | | | 98.46 | |
| L08110550-15 | 1.31 | 31.2 | 30.65 | | | 98.16 | |
| L08110550-16 | 1.32 | 28.88 | 28.43 | | | 98.37 | |
| L08110550-17 | 1.31 | 32.51 | 31.96 | | | 98.24 | |
| L08110550-18 | 1.32 | 28.62 | 28.3 | | | 98.83 | |

PERCENT_SOLIDS - Modified 04/24/2008
PDF ID: 1262277
Report generated: 12/01/2008 09:40

Microbac Laboratories Inc.

PERCENT SOLIDS

00082228

Workgroup (AAB#):WG289169 Analyst:JDH ADT(on):11/26/2008 15:47

Method:D2216-90 Instrument:BAL001 ADT(off):12/01/2008 09:29

SOP:K0003 Rev:9

| SAMPLE NUMBER | EMPTY PAN WT 1 | WET WT 2 | DRY WT 3A | DRY WT 3B | DRY WT 3C | PERCENT SOLID | PERCENT MOISTURE |
|---|---|---|---|---|---|---|---|
| L08110550-19 | 1.33 | 24.99 | 24.64 | | | 98.52 | |
| L08110550-20 | 1.3 | 32.49 | 32.11 | | | 98.78 | |
| L08110550-21 | 1.32 | 30.65 | 30.05 | | | 97.95 | |
| L08110550-22 | 1.31 | 20.69 | 20.44 | | | 98.71 | |
| L08110550-23 | 1.31 | 34.07 | 33.66 | | | 98.75 | |
| L08110550-25 | 1.3 | 32.85 | 32.27 | | | 98.16 | |
| L08110747-01 | 1.3 | 35.12 | 25.05 | | | 70.22 | |
| L08110747-02 | 1.32 | 30.25 | 21.61 | | | 70.13 | |
| L08110782-06 | 1.29 | 28.73 | 25.8 | | | 89.32 | |
| L08110782-07 | 1.3 | 24.03 | 20.59 | | | 84.87 | |
| WG289169-01 | 1.3 | 32.49 | 32.11 | | | 98.78 | 1.218 |
| WG289169-02 | 1.29 | 28.86 | 28.58 | | | 98.98 | 1.016 |
| WG289169-03 | 1.3 | 35.12 | 25.05 | | | 70.22 | 29.78 |
| WG289169-04 | 1.28 | 22.69 | 22.49 | | | 99.07 | 0.9341 |
| WG289169-05 | 1.28 | 32.73 | 32.42 | | | 99.01 | 0.9857 |
| WG289169-06 | 1.28 | 29.53 | 20.89 | | | 69.42 | 30.58 |

Analyst: Justin Hesson

PERCENT_SOLIDS - Modified 04/24/2008

PDF ID: 1262277

Report generated: 12/01/2008 09:40

# 3.0 Attachments

**Microbac Laboratories Inc.**
**Analyst Listing**
**December 9, 2008**

---

| | | |
|---|---|---|
| ADC – ANTHONY D. CANTER | AJF – AMANDA J. FICKIESEN | ALB – ANNIE L. BROWN |
| AM – ALISON J. MILLER | AML – ANTHONY M. LONG | BRG – BRENDA R. GREGORY |
| CAA – CASSIE A. AUGENSTEIN | CAF – CHERYL A. FLOWERS | CAH – CHARLES A. HALL |
| CEB – CHAD E. BARNES | CLC – CHRYS L. CRAWFORD | CLW – CHARISSA L. WINTERS |
| CMS – CRYSTAL M. STEPHENS | CPD – CHAD P. DAVIS | CSH – CHRIS S. HILL |
| CTB – CHRIS T. BUCINA | DDE – DEBRA D. ELLIOTT | DEL – DON E. LIGHTFRITZ |
| DEV – DAVID E. VANDENBERG | DGB – DOUGLAS G. BUTCHER | DIH – DEANNA I. HESSON |
| DLB – DAVID L. BUMGARNER | DLP – DOROTHY L. PAYNE | DLR – DIANNA L. RAUCH |
| DR – DEANNA ROBERTS | DSF – DEBRA S. FREDERICK | EAB – EDDIE A. BYERS |
| ECL – ERIC C. LAWSON | ED – EMILY E. DECKER | EDA – ERIN D. AGEE |
| EDH – ETHAN D. MORRIS | ERP – ERIN R. PORTER | FJB – FRANCES J. BOLDEN |
| HAV – HEMA VILASAGAR | HJR – HOLLY J. REED | JBK – JEREMY B. KINNEY |
| JC – JOHN L. CONLEY | JDH – JUSTIN D. HESSON | JKP – JACQUELINE K. PARSONS |
| JKT – JANE K. THOMPSON | JWR – JOHN W. RICHARDS | JWS – JACK W. SHEAVES |
| JYH – JI Y. HU | KEB – KATHRYN E. BARNES | KHR – KIM H. RHODES |
| KJW – KATIE J. WIEFERICH | KRA – KATHY R. ALBERTSON | LHT – LANCE H. THOMPSON |
| LKN – LINDA K. NEDEFF | LSB – LESLIE S. BUCINA | MDA – MIKE D. ALBERTSON |
| MDC – MICHAEL D. COCHRAN | MES – MARY E. SCHILLING | MMB – MAREN M. BEERY |
| MRT – MICHELLE R. TAYLOR | MSW – MATT S. WILSON | NPM – NATHANIEL P. MILLER |
| PDM – PIERCE D. MORRIS | RAH – ROY A. HALSTEAD | RB – ROBERT BUCHANAN |
| REK – ROBERT E. KYER | RLK – ROBIN L. KLINGER | RWC – RODNEY W. CAMPBELL |
| SAV – SARAH A. VANDENBERG | SDH – SHANA D. HINYARD | SDL – SHELLY D. LENT |
| SLM – STEPHANIE L. MOSSBURG | SLP – SHERI L. PFALZGRAF | SMH – SHAUNA M. HYDE |
| TDH – TRICIA D. HUCK | TIP – TAE I. PARRISH | TMB – TIFFANY M. BAILEY |
| TMM – TAMMY M. MORRIS | VC – VICKI COLLIER | WTD – WADE T. DELONG |

Microbac Laboratories Inc.
List of Valid Qualifiers
December 09, 2008

00082231

Qualkey: STD

| Qualifier | Description |
|---|---|
| * | Surrogate or spike compound out of range |
| + | Correlation coefficient for the MSA is less than 0.995 |
| < | Result is less than the associated numerical value. |
| > | Result is greater than the associated numerical value. |
| A | See the report narrative |
| B | Analyte present in method blank |
| B3 | Target analyte detected in calibration blank at or above the method reporting limit |
| C | Confirmed by GC/MS |
| CG | Confluent growth |
| D1 | Sample required dilution due to matrix. |
| D2 | Sample required dilution due to high concenration of target analyte. |
| DL | Surrogate or spike compound was diluted out |
| E | Estimated concentration due to sample matrix interference |
| E1 | Concentration estimated. Analyte exceeded calibration range. Insufficient sample for reanalysis. |
| E2 | Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to matrix. |
| E3 | Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements |
| EDL | Elevated sample reporting limits, presence of non-target analytes |
| EMPC | Estimated Maximum Possible Concentration |
| F, S | Estimated result below quantitation limit; method of standard additions(MSA) |
| FL | Free Liquid |
| H1 | Sample analysis performed past holding time. |
| I | Semiquantitative result (out of instrument calibration range) |
| J | The analyte was positively identified, but the quantitation was below the RL |
| J,B | Analyte detected in both the method blank and sample above the MDL. |
| J,P | Estimate; columns don't agree to within 40% |
| J,S | Estimated concentration; analyzed by method of standard addition (MSA) |
| L | Sample reporting limits elevated due to matrix interference |
| L1 | The associated blank spike (LCS) recovery was above the laboratory acceptance limits. |
| L2 | The associated blank spike (LCS) recovery was below the laboratory acceptance limits. |
| M | Matrix effect; the concentration is an estimate due to matrix effect. |
| M1 | Matrix spike recovery was high; the assocated blank spike recovery was acceptable. |
| M2 | Matrix spike recovery was low; the assocated blank spike recovery was acceptable. |
| M3 | The spike recovery value is unusable since the analyte concentration is disproportionate to the spike level. |
| N | Tentatively identified compound(TIC) |
| NA | Not applicable |
| ND | Not detected at or above the reporting limit |
| ND, L | Not detected; sample reporting limit (RL) elevated due to interference |
| ND, S | Not detected; analyzed by method of standard addition (MSA) |
| NF | Not found by library search |
| NFL | No free liquid |
| NI | Non-ignitable |
| NR | Analyte is not required to be analyzed |
| NS | Not spiked |
| P | Concentrations >40% difference between the two GC columns |
| Q | One or more quality control criteria fail. See narrative. |
| Q1 | Sample integraity was not maintained. See report narrative. |
| QNS | Quantity of sample not sufficient to perform analysis |
| R1 | Duplicate RPD/RSD exceeded the method acceptance limit. |
| R2 | Duplicate RPD/RSD exceeded the laboratory acceptance limit. |
| RA | Reanalysis confirms reported results |
| RE | Reanalysis confirms sample matrix interference |
| S | Analyzed by method of standard addition (MSA) |
| SMI | Sample matrix interference on surrogate |
| SP | Reported results are for spike compounds only |
| TIC | Library Search Compound |
| TNTC | Too numerous to count |
| U | Undetected; the concentration is below the reported MDL. |
| UJ | Undetected; the MDL and RL are estimated due to quality control discrepancies. |
| V1 | CCV recovery was above method acceptance limits. This target analyte was not detected in the sample. |
| V2 | CCV recovery was above method acceptance limits. Insufficient volume for sample reanalysis. |
| W | Post-digestion spike for furnace AA out of control limits |
| X | Exceeds regulatory limit |
| X, S | Exceeds regulatory limit; method of standard additions (MSA) |
| Z | Cannot be resolved from isomer - see below |

*****Special Notes for Organic Analytes**

Microbac®

Qualkey: STD

1. Acrolein and acrylonitrile by method 624 are semi-quantitative screens only.
2. 1,2-Diphenylhydrazine is unstable and is reported as azobenzene.
3. N-nitrosodiphenylamine cannot be separated from diphenylamine.
4. 3-Methylphenol and 4-Methylphenol are unresolvable compounds.
5. m-Xylene and p-Xylene are unresolvable compounds.
6. The reporting limits for Appendix II/IX compounds by method 8270 are based on EPA estimated PQLs referenced in 40 CFR Part 264, Appendix IX. They are not always achievable for every compound an are matrix dependent.

00082233

NO. 5725

# Chain of Custody

Shaw® Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 400
Houston, TX 77042
(713) 996-4400

Laboratory Name: MICROBAC LABS Address: 158 Starlite Drive Marietta, Ohio Contact: Stephanie Morsburg

Project Name: Longhorn - AAP Project Location: Karnack, Texas

Project No.: 117591.63500000 Project Contact: Allen Willmore Project Telephone No.: 713 247 9292

Point of Contact: Jennifer Hoang Telephone No.: 713 996 4408

Project Manager/Supervisor: Praveen Srivastav

Analysis and Method Desired (Indicate separate containers)

| Item No. | Sample Number | Date | Time | Comp | Grab | Matrix | Sample Description, Location | Number of Containers | VOCs | TAL Metals | Perchlorate | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 04PZ01-112108 | 11/21/08 | 10:05 | | ✓ | W | SITE 04 | 1 | | | ✓ | | | | | |
| 2 | 04PZ02-112008 | 11/20/08 | 15:00 | | ✓ | W | SITE 04 | 1 | | | ✓ | | | | | |
| 3 | 04PZ03-112008 | 11/20/08 | 12:30 | | ✓ | W | SITE 04 | 1 | | | ✓ | | | | | |
| 4 | 04PZ04-112008 | 11/20/08 | 09:15 | | ✓ | W | SITE 04 | 1 | | | ✓ | | | | | |
| 5 | 35AMW01-111908 | 11/19/08 | 15:15 | | ✓ | W | SITE 35A | 4 | ✓ | ✓ | | | | | | |
| 6 | LHSAMW06-111908 | 11/19/08 | 12:46 | | ✓ | W | SITE 35A | 4 | ✓ | ✓ | | | | | | |
| 7 | LHSAMW03-111908 | 11/19/08 | 09:45 | | ✓ | W | SITE 35A | 4 | ✓ | ✓ | | | | | | |
| 8 | LHSAMW07-112108 | 11/21/08 | 13:05 | | ✓ | W | SITE 35A | 4 | ✓ | ✓ | | | | | | |
| 9 | ~~LHSAMW05~~ 35AWW05 112108 | 11/21/08 | 17:50 | | ✓ | W | SITE 35A | 4 | ✓ | ✓ | | | | | | |
| 10 | 03SB11-(10-11) | 11/18/08 | 09:45 | | ✓ | S | SITE 03 | 2 | | ✓ | | | | | | Please hold for SPLP later |
| 11 | 03SB11-(bottom of water) | 11/18/08 | 10:15 | | ✓ | S | SITE 03 | 2 | | ✓ | | | | | | |

| Transfers Relinquished By (signature) | Date/Time | Transfers Accepted By (signature) | Date/Time | Special Instructions |
|---|---|---|---|---|
| M. Miller | 11/24/08 17:30 | | | 7-day TAT |
| | | | | FedEx Airbill No.: |
| | | Laboratory | 11-25-08 940 | Sampler's Signature M. Miller |

TAT: ____ Standard ____ Rush Date ____ Seals Intact? ____ Y ____ N Received Good Condition ____ Y ____ N ____ Cold

White - Lab Copy Canary - Field Copy Pink - File Copy



Form Number: 433_2
Rev. 10-19-07

Microbac Laboratories, Inc. **SAMPLE RECEIPT FORM** 00082234

158 Starlite Drive
Marietta, OH 45750
(740) 373-4071

| | |
|---|---|
| **Client:** | (RK) ~~Microbac~~ Shaw - Texas |
| **Workorder Number:** | B |
| **Date Received:** | 11-25-08 |
| **Delivered by:** | ( ) Fedx (✓) UPS ( ) Client ( ) Courier **Time:** 940 |
| **Opened by:** | RLK |
| **IR Temp Gun:** | (✓) D ( ) G |
| **Logged by:** | RLK L 0811 0782 |

**Cooler information**

| Cooler ID | Temp C | Airbill# | COC# | Other |
|---|---|---|---|---|
| 3156 | 1 | 1Z 401 663 22 1005 5885 | 5725 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

| **Inspection Checklist** | **Y** | **N** | **NA** | **Discrepancy ID** |
|---|---|---|---|---|
| Were shipping coolers sealed? | ✓ | | | |
| Were custody seals intact? | ✓ | | | |
| Were cooler temperatures in range of 0 - 6? | ✓ | | | |
| Was ice present? | ✓ | | | |
| Were COC's received/ information complete/signed and dated? | ✓ | | | |
| Were sample containers and labels intact and match COC? | ~~✓~~ | ✓ | | (1) |
| Were the correct containers and volumes received? | ✓ | | | |
| Were correct preservatives used? (water only) | ✓ | | | |
| Were pH ranges acceptable? (voa's excluded) | ✓ | | | |
| Were VOA samples free of headspace (< 6mm)? | ✓ | | | |
| Were samples received within EPA hold times? | ✓ | | | |

**Discrepancy/Comments/Other Problems**

(1) Sample LHSMW03 - 111908 (3 VOAs) time on sample is 12:40 - time on COC is 945.

Added (2) Trip Blanks - Received but not on COC.

**Distribution**

| | |
|---|---|
| Name of Microbac representative: | |
| Client/Company: | |
| Person Contacted: | |
| Date contacted: | |

**Resolution/other comments:**

Microbac Laboratories Inc.

Internal Chain of Custody Report

**Login:** L08110782
**Account:** 2773
**Project:** 2773.025
**Samples:** 8
**Due Date:** 05-DEC-2008

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-01** | 531241 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:01 | TMB | ERE |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:01 | TMB | ERE |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-04** | 531247 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-05** | 531249 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

Internal Chain of Custody Report

**Login:** L08110782
**Account:** 2773
**Project:** 2773.025
**Samples:** 8
**Due Date:** 05-DEC-2008

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-08** | 531251 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 29-NOV-2008 11:23 | AM | RLK |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 29-NOV-2008 11:23 | AM | RLK |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-01** | 531242 | AG-MS AL AS-MS BA-MS BE-AX CA CD-MS CO-AX CR-M |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:09 | RLK | |
| 2 | PREP | W1 | DIG | 01-DEC-2008 06:45 | VC | ERE |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 09:49 | | VC |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-02** | 531244 | AG-MS AL AS-MS BA-MS BE-AX CA CD-MS CO-AX CR-M |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:09 | RLK | |
| 2 | PREP | W1 | DIG | 01-DEC-2008 06:45 | VC | ERE |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 09:49 | | VC |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-05** | 531250 | AG-MS AL AS-MS BA-MS BE-AX CA CD-MS CO-AX CR-M |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:09 | RLK | |
| 2 | PREP | W1 | DIG | 01-DEC-2008 06:45 | VC | ERE |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 09:49 | | VC |

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

Internal Chain of Custody Report

**Login:** L08110782
**Account:** 2773
**Project:** 2773.025
**Samples:** 8
**Due Date:** 05-DEC-2008

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-03** | 531245 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:02 | TMB | ERE |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-03** | 531246 | AG-MS AL AS-MS BA-MS BE-AX CA CD-MS CO-AX CR-M |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:09 | RLK | |
| 2 | PREP | W1 | DIG | 01-DEC-2008 06:45 | VC | ERE |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 09:49 | | VC |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-04** | 531248 | AG-MS AL AS-MS BA-MS BE-AX CA CD-MS CO-AX CR-M |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:09 | RLK | |
| 2 | PREP | W1 | DIG | 01-DEC-2008 06:45 | VC | ERE |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 09:49 | | VC |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-06** | 531252 | AG AL AS-MS BA BE CA CD CO CR CU DIG-ICP FE HG |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:15 | RLK | |
| 2 | ANALYZ | W1 | WET | 26-NOV-2008 15:33 | JDH | RLK |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 08:31 | | PDM |

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

Internal Chain of Custody Report

**Login:** L08110782
**Account:** 2773
**Project:** 2773.025
**Samples:** 8
**Due Date:** 05-DEC-2008

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-02** | 531243 | 826-LOW |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:01 | TMB | ERE |

Bottle: 2

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | V1 | 26-NOV-2008 15:09 | RLK | |
| 2 | ANALYZ | V1 | ORG4 | 28-NOV-2008 17:01 | TMB | ERE |

| Samplenum | Container ID | Products |
|---|---|---|
| **L08110782-07** | 531253 | AG AL AS-MS BA BE CA CD CO CR CU DIG-ICP FE HG |

Bottle: 1

| Seq. | Purpose | From | To | Date/Time | Accept | Relinquish |
|---|---|---|---|---|---|---|
| 1 | LOGIN | COOLER | W1 | 26-NOV-2008 15:15 | RLK | |
| 2 | ANALYZ | W1 | WET | 26-NOV-2008 15:33 | JDH | RLK |
| 3 | EXTRACT | DIG | METALS | 01-DEC-2008 08:31 | | PDM |

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

# Shallow Zone Wells

# 2007 and 2008

# Field Documentation

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# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

03WC001

Operable Unit/Site ID: LHAAP-63 | Sampling location ID: 03WC01
Project Name/#: 117591 / Longhorn | Sample ID: 03WC001
Weather: Cloudy 50's | Collection Time/Date: 12/24/08 17:05

## Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist
Installation date/beginning time: 12/24/08 16:20
PID/FID reading (well head/background): 0.0
Installation date/completion time: 12/24/08 16:30
Casing diameter (inches): 4"
Screen Interval (ft. BTOC): 23 to 33
Total well Depth (ft. BTOC): 33.15
Pump intake depth (ft BTOC): 28
Initial (pre-installation) DTW/time: 25.34
Post-installation DTW/time: 25.34
Final (after pump priming) DTW/time:
Max. sustainable pump rate (mL/min): 100
Free product (circle): LNAPL / DNAPL
Appearance of product: None
Volume of water removed during priming (mL):
Discharge tube diameter (3/8" or 1/4"): 1/4"
Discharge tube length (ft.): 36
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = MR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | NA | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore / A. Gilchrist
PID/FID reading (well head/background): 0.0
Purge date/beginning time: 12.03.08
Purge date/completion time: 12/24/08
Initial (pre-purging) DTW (ft. BTOC): 25.71
Final (post-purging) DTW (ft BTOC): 25.71
Calculated tubing + pump volume: NA
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | NA | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 16:30 | 25.62 | 100 | 0.5 | 19.68 | 3.81 | 5.78 | -7.2 | 1.18 | 15.2 |
| 16:35 | 25.62 | 100 | 1.0 | 19.69 | 3.950 | 5.37 | -7.3 | 1.18 | 15.6 |
| 16:40 | 25.62 | 100 | 1.5 | 16.81 | 3.801 | 5.80 | 6.3 | 2.06 | 16.4 |
| 16:45 | 25.62 | 100 | 2.0 | 19.69 | 3.742 | 5.87 | 6.2 | 2.01 | 16.0 |
| 16:55 | 25.62 | 100 | 2.5 | 19.70 | 3.669 | 5.80 | 6.7 | 2.01 | 9.9 |
| 17:00 | 25.62 | 100 | 2.0 | 19.68 | 3.697 | 5.78 | 7.6 | 2.02 | 4.4 |
| | | | | | | | | | |
| | | | | | | | | | |

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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

03WW01

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
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12/3/08

## Sampling

Sampling beginning time: 17:05 Sampling completion time: 17:15

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 17:00 | 25.62 | 100 | 5.0 | 19.69 | 3.697 | 5.78 | 7.6 | 2.01 | 3.8 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 03WW01-122408 Sample collection date/time: 12-24-08 17:05

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: NA

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOCs | 8260 | 3-30mL VOA Vials | | | |
| TAL METALS | 6020 | 1-HDPE | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Comments: Purged & Sampled w/ peristaltic pump
No filter used.

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

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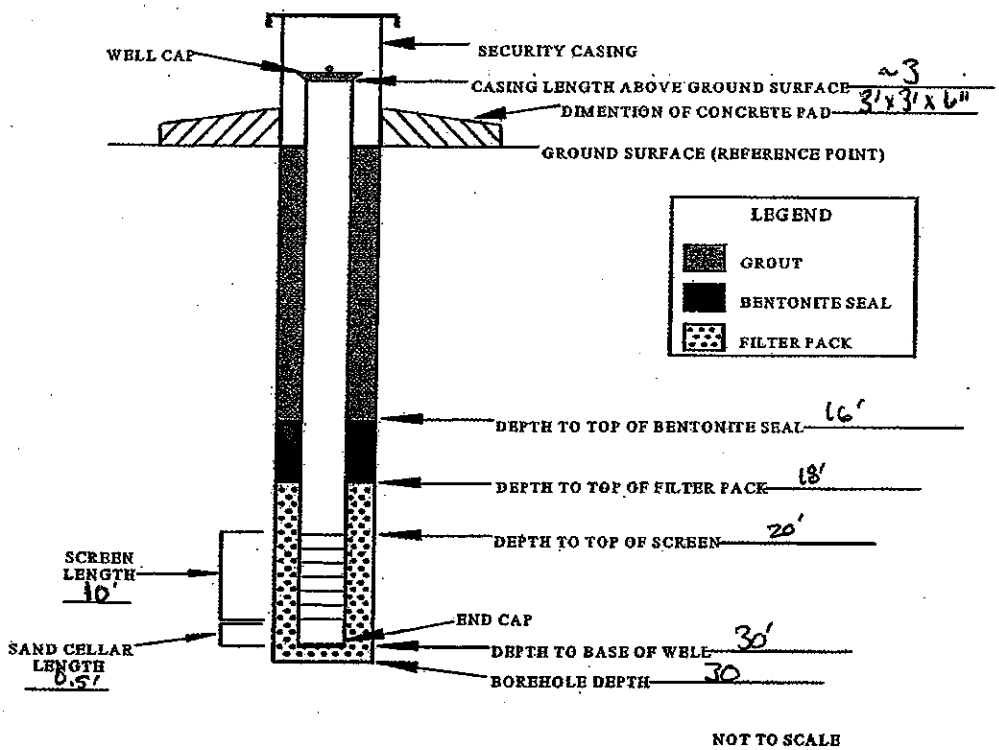
03WW01

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: Allen Willmore
DRILLING CONTRACTOR: ETT
DRILLING TECHNIQUE: H.S.A.
AUGER SIZE AND TYPE: 8" I.D.
BOREHOLE IDENTIFICATION: 03WW01
BOREHOLE DIAMETER: 8"
WELL IDENTIFICATION: 03WW01
WELL CONSTRUCTION START DATE: 11/18/08
WELL CONSTRUCTION COMPLETE DATE: 11/18/08
SCREEN MATERIAL: Sch. 40 PVC
SCREEN DIAMETER: 4"
STRATUM-SCREENED INTERVAL (FT): 10'
CASING MATERIAL: Sch. 40 PVC
CASING DIAMETER: 4"

TYPE OF FILTER PACK: Silica Sand
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 9-bags 50lbs
TYPE OF BENTONITE: pellets
AMOUNT BENTONITE USED: 1- 50lb bucket
TYPE OF CEMENT: Portland cement
AMOUNT CEMENT USED: NR
GROUT MATERIALS USED: Bent.
DIMENSIONS OF SECURITY CASING: 8" x 8" x ~3'
TYPE OF WELL CAP: plugging cap
TYPE OF END CAP: Sch. 40 PVC
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




NOT TO SCALE

INSTALLED BY: Doug Hinds/Billy Rogers INSTALLATION OBSERVED BY: Allen Willmore
DISCREPANCIES: none

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HOLE NO. 03WW101

**DRILLING LOG** | DIVISION: FEDERAL | INSTALLATION: Longhorn | SHEET 1 OF 3 SHEETS

| | |
|---|---|
| 1. PROJECT: LHAAP | 10. SIZE AND TYPE OF BIT: 8" I.D. HSA |
| 2. LOCATION (Coordinates or Station): Karnack, Texas | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL |
| 3. DRILLING AGENCY: ETTL | 12. MANUFACTURER'S DESIGNATION OF DRILL: 5500 CME |
| 4. HOLE NO. (As shown on drawing title and file number): 03WW01 | 13. OVERBURDEN SAMPLES: DISTURBED / UNDISTURBED ✓ |
| 5. NAME OF DRILLER: Doug Hinds | 14. TOTAL NUMBER CORE BOXES: NR |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 0° DEG. FROM VERT. | 15. ELEVATION GROUND WATER: |
| 7. THICKNESS OF OVERBURDEN: 30' | 16. DATE HOLE: STARTED 11/18/08 COMPLETED 11/18/08 |
| 8. DEPTH DRILLED INTO ROCK: 0' | 17. ELEVATION TOP OF HOLE: NR |
| 9. TOTAL DEPTH OF HOLE: 30' | 18. TOTAL CORE RECOVERY FOR BORING: NR % |
| | ALLEN WILLMORE — INSPECTOR |

| ELEVATION PID (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 0.0 | 5 | CL | CLAY, SANDY, LOW TO NO PLASTICITY, BROWN, MOIST, NO ODOR, STIFF, IRON STAINING | 90% | | |
| 0.0 | | | - BECOMES DRY | | | |
| 0.0 | | | - BECOMES HARD | 100% | | |
| 0.0 | | | - BECOMES MORE SANDY | | | |
| 0.0 | 10 | SM | SAND, SILTY, BROWNISH-GRAY, MOIST | 100% | X | - SAMPLE COLLECTED FROM 10'-11' BGS |
| 0.0 | | | | | | |
| 0.0 | | | | | | |

**DRILLING LOG (Cont Sheet)**

ELEVATION TOP OF HOLE: NR

Hole No. 63WW01

PROJECT: LHAAP - MARC

INSTALLATION: LHAAP

SHEET 2 OF 3 SHEETS

| ELEVATION (Ft) a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| 6.0 | | SM | Same as above | | | |
| | 15 | | | 90% | | -Sample collected 14'-15' bgs (bottom of vadose) (AC) |
| 0.0 | | SC | Sand, clayey, wet, dense, brown, poorly-sorted, no odor | | | |
| 0.0 | | | clay, sandy, dark gray to gray, very stiff, low plasticity, moist (KC) 11/18/08 | | | |
| 0.0 | 20 | | | 95% | | |
| 0.0 | | | - becomes more moist | | | |
| 0.0 | | CL | CLAY, SANDY, dark gray to gray, very stiff, low plasticity, moist | | | |
| | 25 | | | 85% | | |
| 0.0 | | | | | | |
| 0.0 | | | | 100% | | |

ENG FORM 1836—PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

**DRILLING LOG (Cont Sheet)** | ELEVATION TOP OF HOLE: NR | Hole No. 03WW01

PROJECT: LHAAP-MARC | INSTALLATION: LHAAP | SHEET 3 OF 3 SHEETS

| ELEVATION Pid (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| | | CL | SAME AS ABOVE | 100% | | |
| | 30 | | End of boring @ 30' bgl | | | |

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# GROUNDWATER SAMPLING FORM

Sheet 1 of 8

Operable Unit/Site ID: LHAAP-35A
Project Name/#: 117591
Weather: clear, 60s
Sampling location ID: ~~LHSMW03~~ 35AMW03
Sample ID: NA
Collection Time/Date: DRY

## Pump Installation

Pump installation crew: A. Willmon
PID/FID reading (well head/background): 0.0
Casing diameter (inches):
Total well Depth (ft. BTOC):
Initial (pre-installation) DTW/time:
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): DRY
Discharge tube length (ft.): DRY
Installation date/beginning time:
Installation date/completion time:
Screen Interval (ft. BTOC): DRY to
Pump intake depth (ft BTOC):
Post-installation DTW/time:
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"): 1/4" NA
Inlet reducer used (Y/N):

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmon
Purge date/beginning time: 11-18-08
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background):
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AWW03

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
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DRY

10-20

## Sampling

Sampling beginning time: NA

Sampling completion time: NA

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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DRY

## Sample Information

Sample ID:

Duplicate sample collected (Y/N): DRY

Split sample collected (Y/N): DRY

COC No(s):

Sample collection date/time: DRY

Duplicate sample ID:

Split sample ID:

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| | | | | | |
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DRY

Comments:

DRY

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

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# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

35AWW04

Operable Unit/Site ID: 35A
Project Name/#: DRY
Weather:

Sampling location ID:
Sample ID: DRY
Collection Time/Date:

## Pump Installation

Pump installation crew:
PID/FID reading (well head/background):
Casing diameter (inches):
Total well Depth (ft. BTOC):
Initial (pre-installation) DTW/time:
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):

Installation date/beginning time:
Installation date/completion time:
Screen Interval (ft. BTOC): to
Pump intake depth (ft BTOC):
Post-installation DTW/time:
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
Inlet reducer used (Y/N):

DRY

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

DRY

## Purging

Purging/sampling crew:
Purge date/beginning time:
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA

PID/FID reading (well head/background):
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

DRY

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

DRY

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AW004

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
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DRY

## Sampling

Sampling beginning time:_____ Sampling completion time:_____

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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| | | | | | DRY | | | | |
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## Sample Information

Sample ID:_____ Sample collection date/time:_____

Duplicate sample collected (Y/N):_____ Duplicate sample ID:_____

Split sample collected (Y/N):_____ Split sample ID:_____

COC No(s):_____

DRY DRY

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| | | | | | |
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DRY

**Comments:**

11-24-08

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082250

HOLE NO. 35AWW06

# DRILLING LOG

DIVISION: FEDERAL

INSTALLATION: Longhorn AAP

SHEET 1 OF 2 SHEETS

1. PROJECT: Longhorn MARC
2. LOCATION (Coordinates or Station): Karnack, Tx
3. DRILLING AGENCY: ETTL
4. HOLE NO. (As shown on drawing title and file number): 35AWW06
5. NAME OF DRILLER: Billy Ragan
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED 0° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 28'
8. DEPTH DRILLED INTO ROCK: 0'
9. TOTAL DEPTH OF HOLE: 28'
10. SIZE AND TYPE OF BIT: 10" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Foremost 5500
13. OVERBURDEN SAMPLES: DISTURBED ✓ UNDISTURBED
14. TOTAL NUMBER CORE BOXES: NR
15. ELEVATION GROUND WATER: NR
16. DATE HOLE: STARTED 11/10/08 COMPLETED 11/14/08
17. ELEVATION TOP OF HOLE: NR
18. TOTAL CORE RECOVERY FOR BORING: NR %

INSPECTOR: Allen Willmore

| ELEVATION-PID (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 0.0 | | | TOPSOIL, CLAY, MOIST, SOFT, DISTURBED | | | |
| | | | CLAY, SILTY, HARD, NO PLASTICITY, DRY GRAY, IRON STAINING, NO ODOR | 60% | | |
| 0.0 | | | | | | |
| 0.0 | | CL | | | | |
| 0.0 | 5 | | | 100% | | |
| 0.0 | | | | | | |
| 0.0 | | | | | | |
| 0.0 | 10 | | | 100% | | |
| 0.0 | | | | | | |
| 0.0 | | | - BECOMES SOFTER, MORE SAND CONTENT | | | |

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**DRILLING LOG (Cont Sheet)**

ELEVATION TOP OF HOLE

Hole No. 35AWW06

PROJECT: Longhorn MARC

INSTALLATION: Longhorn AAP

SHEET 2 OF 2 SHEETS

| ELEVATION MSL (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 8.0 | | | Same as above | | | |
| 0.0 | 15 | SC-SP | SAND, very clayey, gray, moist, dense, poorly-sorted, no odor @ 14'6" | 100% | | |
| 0.0 | | CL | | | | |
| 0.0 | | | | | | |
| 0.0 | 20 | SC-SP | SAND, very clayey, gray, moist, dense, poorly-sorted, no odor | 100% | | |
| 0.0 | | | | | | |
| 0.0 | | | | | | |
| 0.2 | 25 | | | 100% | | |
| 0.0 | | CL | CLAY, SILTY, GRAY, HARD, NO PLASTICITY DRY TO DAMP, NO ODOR. | | | |
| | | | END OF BORING @ 28' bgs | | | |

ENG FORM 1836—PREVIOUS EDITIONS ARE OBSOLETE. MAR 71



PROJECT: Longhorn MARC

HOLE NO. 35AWW06

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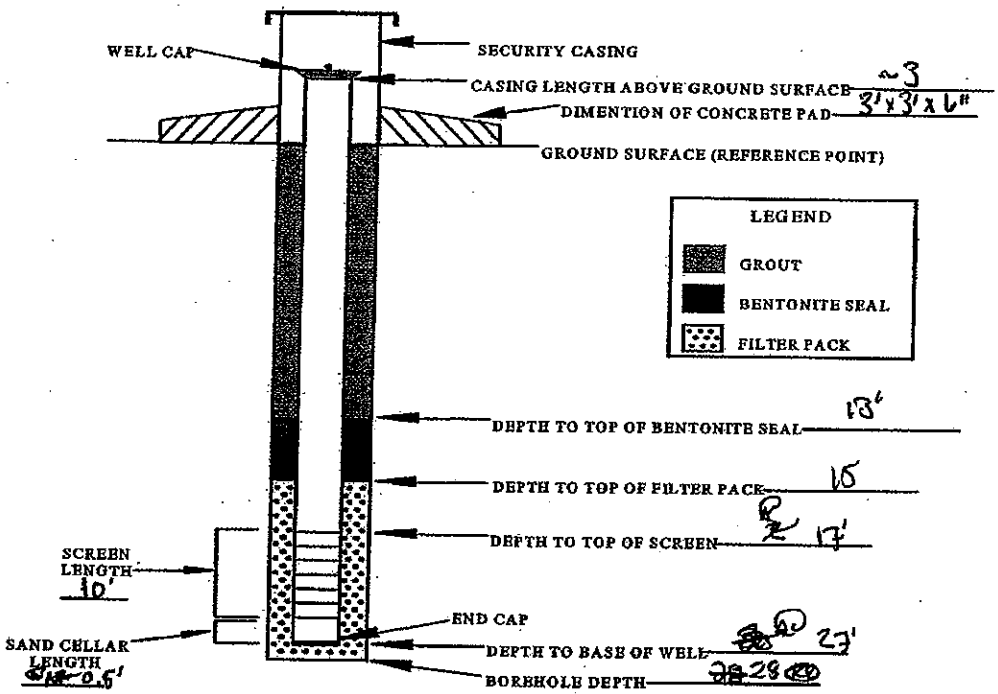
35AWW06

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: Allen Willmore
DRILLING CONTRACTOR: ETIC
DRILLING TECHNIQUE: H.S.A.
AUGER SIZE AND TYPE: 8" I.D.
BOREHOLE IDENTIFICATION: 35A WW06
BOREHOLE DIAMETER: 8"
WELL IDENTIFICATION: 35AWW06
WELL CONSTRUCTION START DATE: 11/14/08
WELL CONSTRUCTION COMPLETE DATE: 11/19/08
SCREEN MATERIAL: Sch. 40 PVC
SCREEN DIAMETER: 4"
STRATUM-SCREENED INTERVAL (FT):
CASING MATERIAL: Sch. 40 PVC
CASING DIAMETER: 4"

TYPE OF FILTER PACK: Silica Sand
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 9-bags 50lbs
TYPE OF BENTONITE: pellets
AMOUNT BENTONITE USED: 1-50lb bucket
TYPE OF CEMENT: Portland cement
AMOUNT CEMENT USED: NR
GROUT MATERIALS USED: Bent.
DIMENSIONS OF SECURITY CASING: 8"x8"x~3'
TYPE OF WELL CAP: plugging cap
TYPE OF END CAP: Sch. 40 PVC
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




INSTALLED BY: Doug Hinds/Billy Rogers INSTALLATION OBSERVED BY: Allen Willmore
DISCREPANCIES: none

00082253

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-35A
Project Name/#: Longhorn / 117591
Weather: Cloudy, 60s

Sampling location ID: 35AWW06
Sample ID: 35AWW06-120308
Collection Time/Date: 14:25 / 12.03.08

## Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 32'
Initial (pre-installation) DTW/time: 20.57
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 31'

Installation date/beginning time: 12.03.08 13:45
Installation date/completion time: 12.03.08 13:50
Screen Interval (ft. BTOC): 22 to 32
Pump intake depth (ft BTOC): 27
Post-installation DTW/time: 20.57
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore / A. Gilchrist
Purge date/beginning time: 12.03.08 13:56
Initial (pre-purging) DTW (ft. BTOC): 20.57
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 12.03.08
Final (post-purging) DTW (ft. BTOC): 20.85
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 14:01 | 20.85 | 100 | 0.5 | 19.21 | 7.361 | 6.46 | 21.3 | 4.37 | 27.4 |
| 14:06 | 20.85 | 100 | 1.0 | 19.11 | 7.361 | 6.45 | 20.8 | 4.24 | 21.3 |
| 14:11 | 20.85 | 100 | 1.5 | 18.97 | 7.381 | 6.45 | 19.8 | 4.21 | 16.2 |
| 14:16 | 20.85 | 100 | 2.0 | 19.04 | 7.375 | 6.45 | 18.5 | 4.17 | 7.3 |
| 14:21 | 20.85 | 100 | 2.5 | 18.96 | 7.378 | 6.45 | 17.4 | 4.14 | 5.3 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

00082254

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AWW06

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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12/03/08

## Sampling

Sampling beginning time: 14:25 Sampling completion time: 14:38

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 14:36 | 26.85 | 100 | 4.0 | 18.99 | 7.380 | 6.45 | 17.3 | 4.15 | 3.2 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 35AWW06-120308

Sample collection date/time: 12-03-08 14:25

Duplicate sample collected (Y/N): N

Duplicate sample ID: NA

Split sample collected (Y/N): N

Split sample ID: NA

COC No(s): NR

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL METALS | 6020 | ~~PAE Metals~~ 1-500mL HDPE | | | |
| VOCs | 8260 | 3-40mL VOA vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Comments: Purged & Sampled w/ peristaltic pump. No filter used!

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082255

HOLE NO. 35AWW07

**DRILLING LOG**

DIVISION: FEDERAL

INSTALLATION: Longhorn AAP

SHEET 1 OF 3 SHEETS

1. PROJECT: Longhorn MARC
2. LOCATION (Coordinates or Station): KARNACK, TX
3. DRILLING AGENCY: ETEL
4. HOLE NO. (As shown on drawing title and file number): 35AWW07
5. NAME OF DRILLER: Billy Ragon
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED 0° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: —
8. DEPTH DRILLED INTO ROCK: NA
9. TOTAL DEPTH OF HOLE: 30'
10. SIZE AND TYPE OF BIT: HSA 10"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: FOREMOST 5500
13. OVERBURDEN SAMPLES: DISTURBED ✓ UNDISTURBED
14. TOTAL NUMBER CORE BOXES: NR
15. ELEVATION GROUND WATER: NR
16. DATE HOLE: STARTED 11/13/08 COMPLETED 11/14/08
17. ELEVATION TOP OF HOLE: NR
18. TOTAL CORE RECOVERY FOR BORING: NR %

ALLEN WILLMORE — INSPECTOR

| ELEVATION PID (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 0.0 | | | TOP SOIL | | | |
| | | | CLAY, SILTY, LOW TO NO PLASTICITY BROWN, SOFT, NO ODOR | 65% | | |
| 0.0 | | | | | | |
| | | | -BECOMES SANDY, STIFF, MOIST | | | |
| 0.0 | 5 | | | | | |
| | | | | 100% | | |
| 0.0 | | | | | | |
| | | | SAND, SILTY, DENSE, BROWN, IRON STAINING TO GRAY MOIST, NO ODOR | | | |
| 0.0 | 10 | | | 60% | | |
| 0.0 | | | | | | |

**DRILLING LOG (Cont Sheet)**

ELEVATION TOP OF HOLE: NA

Hole No. 35AWW07

PROJECT: Longhorn MARC

INSTALLATION: Longhorn AAP

SHEET 2 OF 3 SHEETS

| ELEVATION (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 0.0 | 15 | CL | SAME AS ABOVE<br>CLAY, SILTY, BROWN, SLIGHT PLASTICITY, MOIST, SOFT, NO ODOR | 70% | | |
| 0.0 | | | SAND, SILTY, MOIST, GRAY, IRON STAINING, MOTTLING, NO ODOR, MODERATELY DENSE | | | |
| 0.0 | 20 | | - MORE IRON, MORE ORGANICS | 100% | | |
| 0.0 | | CL | CLAY, SILTY, STIFF, MOIST, HIGH PLASTICITY, NO ODOR | | | |
| 0.0 | 25 | | | 100% | | |
| 0.0 | | MLS | SILT, SANDY, MOIST, IRON STAING, GRAY, DENSE | | | |
| 0.0 | | | | 100% | | |

ENG FORM 1836—PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT

HOLE NO.

00082257

**DRILLING LOG (Cont Sheet)**

ELEVATION TOP OF HOLE: NA

Hole No. 35AWW07

PROJECT: Longhorn MARC

INSTALLATION: Longhorn AAP

SHEET 3 OF 3 SHEETS

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| 0.0 | 30 | | -BECOMES MORE CLAYE<br>END OF BORING @ 30' bgs | 100% | | |

ENG FORM 1836—APREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT

HOLE NO.

00082258

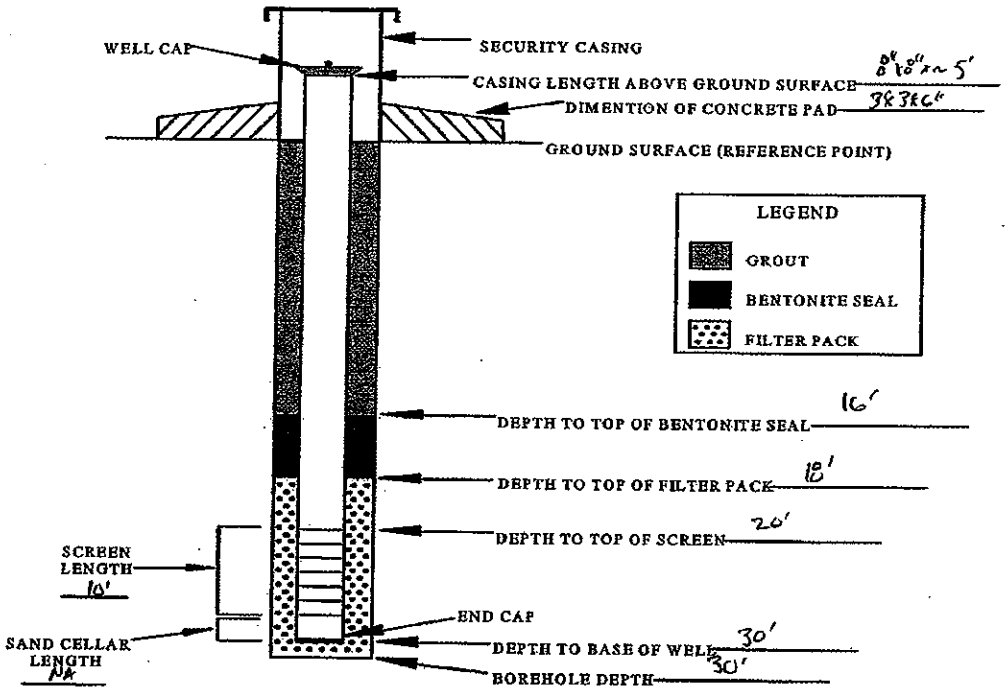
35AWW07

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: Allen Willmore
DRILLING CONTRACTOR: ETC
DRILLING TECHNIQUE: HSA
AUGER SIZE AND TYPE: 10"
BOREHOLE IDENTIFICATION: 35AWW07
BOREHOLE DIAMETER: 10"
WELL IDENTIFICATION: 35AWW07
WELL CONSTRUCTION START DATE: 11/13/08
WELL CONSTRUCTION COMPLETE DATE: 11/14/08
SCREEN MATERIAL: sch. 40 PVC
SCREEN DIAMETER: 4"
STRATUM-SCREENED INTERVAL (FT): 10'
CASING MATERIAL: sch. 40 PVC
CASING DIAMETER: 4"

TYPE OF FILTER PACK: silica sand
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 18 bags (50 lbs)
TYPE OF BENTONITE: pellet
AMOUNT BENTONITE USED: 1 - 50 lb bucket
TYPE OF CEMENT: portland cement
AMOUNT CEMENT USED: NA
GROUT MATERIALS USED: bentonite slurry
DIMENSIONS OF SECURITY CASING: 8" x 8" x ~3'
TYPE OF WELL CAP: plastic cap
TYPE OF END CAP: sch. 40 PVC
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




NOT TO SCALE

INSTALLED BY: Billy Ragon
INSTALLATION OBSERVED BY: Allen Willmore
DISCREPANCIES: none

00082259

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

35AWW07

Operable Unit/Site ID: Site
Project Name/#: Longhorn AAP/ 117591
Weather:

Sampling location ID: 35AWW07
Sample ID: 35AWW07
Collection Time/Date: 09:50 11/24/08

## Pump Installation

Pump installation crew: A. Willmore
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 32.43
Initial (pre-installation) DTW/time: 22.77
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 30'

Installation date/beginning time: 11/24/08 09:45
Installation date/completion time: 11/24/08 09:47
Screen Interval (ft. BTOC): 22.0 to 32.0
Pump intake depth (ft BTOC): ~27'
Post-installation DTW/time: 22.77
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | NA | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore
Purge date/beginning time: 11/24/08
Initial (pre-purging) DTW (ft. BTOC): 22.77
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/24/08
Final (post-purging) DTW (ft. BTOC): 22.94
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | NA | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 09:30 | 22.94 | 100 | 0.5 | 16.94 | 0.386 | 6.63 | -81.2 | 1.017 | 7.3 |
| 09:36 | 22.94 | 100 | 1.0 | 16.98 | 0.382 | 6.63 | -83.4 | 1.018 | 6.2 |
| 09:42 | 22.94 | 100 | 1.5 | 16.94 | 0.381 | 6.64 | -82.6 | 1.014 | 4.1 |
| 09:46 | 22.94 | 100 | 2.0 | 16.98 | 0.380 | 6.64 | -84.1 | 1.013 | 3.2 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

00082260

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AMW07

**Water Quality Parameter Measurements (continued)**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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| | | | | | | | | | |

11/24/08

10/20

## Sampling

Sampling beginning time: 09:50 Sampling completion time: ~~09:~~ 10:00

**Water Quality Parameter Measurements**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:05 | 22.94 | 100 | 4.0 | 17.01 | 6.394 | 6.44 | -86.1 | 1.012 | 2.4 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 35AMW07-112408 Sample collection date/time: 09:50 11-24-08

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: NA

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| Metals (TAL) | 6020 | ~~1-500 mL~~ 1-500 mL HDPE | | | |
| VOCs | 8260 | 3-40 mL VOA vial | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Purged & Sample w/ peristaltic pump
No filter used.

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082261

HOLE NO. 35AWW08

| DRILLING LOG | DIVISION FEDERAL | INSTALLATION Longhorn | SHEET 1 OF 1 SHEETS |
|---|---|---|---|
| 1. PROJECT LHAAP | | 10. SIZE AND TYPE OF BIT 8" I.D. HSA | |
| 2. LOCATION (Coordinates or Station) Karnack, Texas | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL | |
| 3. DRILLING AGENCY ETTL | | 12. MANUFACTURER'S DESIGNATION OF DRILL 5500 CME | |
| 4. HOLE NO. (As shown on drawing title and file number) 35AWW08 | | 13. OVERBURDEN SAMPLES | DISTURBED / UNDISTURBED ✓ |
| 5. NAME OF DRILLER Doug Hinds | | 14. TOTAL NUMBER CORE BOXES NR | |
| 6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED 0° DEG. FROM VERT. | | 15. ELEVATION GROUND WATER NR | |
| 7. THICKNESS OF OVERBURDEN 30' | | 16. DATE HOLE STARTED 11/18/08 | COMPLETED 11/18/08 |
| 8. DEPTH DRILLED INTO ROCK 0' | | 17. ELEVATION TOP OF HOLE NR | |
| 9. TOTAL DEPTH OF HOLE 30' | | 18. TOTAL CORE RECOVERY FOR BORING NR % | |
| | | ALLEN WILLMORE | INSPECTOR |

| ELEVATION PID (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| NR | | | Same lithology as 35AWW01. See boring log ~~35AWW01~~ LHSMW05 for lithologic decription. This boring ends @ 30' bgs | | | Well completed to replace well LHSMW05; however this well was completed @ a deeper depth. |
| | 30' | | END OF BORING | | | |
| | 5 | | | | | |
| | 10 | | | | | |

00082262

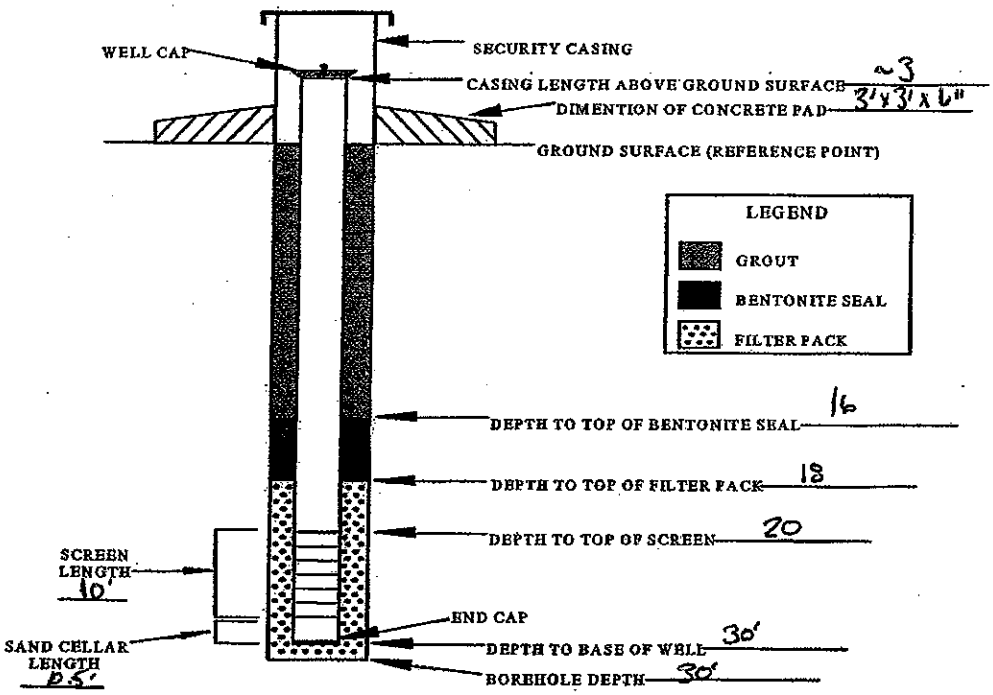
35AWW08

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: Allen Willmore
DRILLING CONTRACTOR: ETL
DRILLING TECHNIQUE: H.S.A.
AUGER SIZE AND TYPE: 8" I.D.
BOREHOLE IDENTIFICATION: 35A WW08
BOREHOLE DIAMETER: 8"
WELL IDENTIFICATION: 35AWW08
WELL CONSTRUCTION START DATE: 11/18/08
WELL CONSTRUCTION COMPLETE DATE: 11/18/08
SCREEN MATERIAL: sch. 40 pvc
SCREEN DIAMETER: 4"
STRATUM-SCREENED INTERVAL (FT): 10'
CASING MATERIAL: sch. 40 pvc
CASING DIAMETER: 4"

TYPE OF FILTER PACK: Silica Sand
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 9- bags 50lbs
TYPE OF BENTONITE: pellets
AMOUNT BENTONITE USED: 1- 50lb bucket
TYPE OF CEMENT: portland cement
AMOUNT CEMENT USED: NR
GROUT MATERIALS USED: bent.
DIMENSIONS OF SECURITY CASING: 8"x8"x~3'
TYPE OF WELL CAP: plugging cap
TYPE OF END CAP: sch. 40 pvc
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




NOT TO SCALE

INSTALLED BY: Doug Hinds/Billy Rogers INSTALLATION OBSERVED BY: Allen Willmore
DISCREPANCIES: none

00082263

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

35A WW08

Operable Unit/Site ID: Site
Project Name/#: Longhorn AAP/ 117591
Weather: Clear, cool

Sampling location ID: 35AWW08
Sample ID: 35AWW08-112408
Collection Time/Date: 12:25 11/24/08

## Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist
PID/FID reading (well head/background): 0.1
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~33
Initial (pre-installation) DTW/time: 26.03
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 31

Installation date/beginning time: 11/24/08 11:56
Installation date/completion time: 11/24/08 11:58
Screen Interval (ft. BTOC): 23 to 33
Pump intake depth (ft BTOC): 28
Post-installation DTW/time: 26.03
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore / A. Gilchrist
Purge date/beginning time: 11/24/08
Initial (pre-purging) DTW (ft. BTOC): 26.03
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.1
Purge date/completion time: 11/24/08
Final (post-purging) DTW (ft. BTOC): 26.15
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | NA | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 12:05 | 26.15 | 100 | 0.5 | 18.01 | 8.109 | 6.38 | -52.1 | 4.006 | 11.3 |
| 12:10 | 26.15 | 100 | 1.0 | 18.24 | 7.942 | 6.34 | -48.1 | 3.121 | 5.1 |
| 12:15 | 26.15 | 100 | 1.5 | 18.36 | 7.918 | 6.34 | -44.2 | 3.122 | 4.9 |
| 12:20 | 26.15 | 100 | 2.0 | 18.72 | 7.918 | 6.34 | -43.9 | 3.121 | 3.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AMW08

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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| | | | | | | | | | |

11/24/08

## Sampling

Sampling beginning time: 12:25 Sampling completion time: 12:30

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 12:35 | 26.15 | 100 | 3.5 | 18.61 | 7.919 | 6.33 | -44.1 | 3.123 | 1.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 35AWW08-112408

Sample collection date/time: 12:25 11.24.08

Duplicate sample collected (Y/N): N

Duplicate sample ID: NA

Split sample collected (Y/N): N

Split sample ID: NA

COC No(s): NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL Metals | 6020 | 1-500mL HDPE | | | |
| VOCs | 8260 | 3-40mL VOA vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Purged & Sampled w/ peristaltic pump
No filter use

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

## LHAAP-35A(58)
## Notes on DPT Drilling and Sampling

| Location ID | Date Started | Date Completed | Date Sampled | Total Depth (ft bgs) | Drilling Notes | Gauging Date | Static Water Level (ft bgs) | Screen Interval (ft bgs) | Well Notes |
|---|---|---|---|---|---|---|---|---|---|
| 58DPT01 | 10/1/2008 | 10/1/2008 | 10/2/2008 | 18.2 | water in hole after 24 hours-13.55 ft bgs | 10/13/2008 | 14.76 | 8.2-18.2 | temporary well; probably some sloughing when tubing inserted. |
| 58DPT02 | 9/30/2008 | 10/3/2008 | 10/15/2008 | 28 | partially collapsed; redrilled 10/3/08 and inserted screen | 10/13/2008 | 19.31 | 10-20 | temporary well; sloughing in hole when tubing inserted |
| 58DPT03 | 10/1/2008 | 10/3/2008 | 10/15/2008 | 28 | no water in well after 24 hours-rods pulled; redrilled 10/3/08 | 10/17/2008 | 16.48 | 10-20 | temporary well |
| 58DPT04 | 9/30/2008 | 9/30/2008 | 10/1/2008 | 28 | water encountered 26.7 ft bgs; refusal at 28 ft bgs; | 10/13/2008 | 23.52 | 18-28 | temporary well |
| 58DPT05 | 10/2/2008 | 10/2/2008 | 10/2/2008 | 28 | moist 10-26.5 ft bgs | 10/13/2008 | 21.52 | 18-28 | temporary well |
| 58DPT06 | 10/1/2008 | 10/3/2008 | 10/15/2008 | 30 | no water observed during drilling; refusal at 20 ft bgs on 10/1/08; redrilled on 10/3/08 and refusal at 30 ft bgs | 10/17/2008 | 18.14 | 20-30 | temporary well; probably some sloughing when tubing inserted. |
| 58DPT07 | 10/1/2008 | 10/1/2008 | 10/2/2008 | 26 | water encountered at 19.1 ft bgs | 10/13/2008 | 21.70 | 16-26 | temporary well |
| 58DPT08 | 10/2/2008 | 10/2/2008 | 10/2/2008 | 28 | water encountered at 21.61 ft bgs | 10/13/2008 | 23.12 | 18-28 | temporary well |
| | | | | | | | | | |
| ft bgs - feet below ground surface | | | | | | | | | |
| | | | | | | | | | |

00082265

00082266

58DPT04 HOLE NO. 04

| DRILLING LOG | DIVISION: SHAW E-I | INSTALLATION: LONGHORN AAP | SHEET 3 ↓ OF SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): - | |
| 3. DRILLING AGENCY: Strata Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-04 | | 13. OVERBURDEN SAMPLES: DISTURBED - | UNDISTURBED → |
| 5. NAME OF DRILLER: Strata-Core-Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: - | | 16. DATE HOLE: STARTED 9/30/08 | COMPLETED 9/30/08 |
| 8. DEPTH DRILLED INTO ROCK: - | | 17. ELEVATION TOP OF HOLE: - | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 90 % | |
| | | Andy Gilchriest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| 0.0 | 1–3 | | Sand dry loose fine grain 10YR 5/4 yellowish brown | | | |
| 0.0 | 3–5 | | ~~sandy clay~~ clayey sand some iron mottling loose dry 10YR 5/3 brown | | | |
| 0.0 | 5–7 | | Sandy clay iron mottling low plasticity 10YR 4/2 dark grayish brown | | | |
| 0.0 | 9–11 | | Sand Moist fine grain loose 10YR 7/2 light gray | | | |
| 0.2 | 11–12 | | | | | |

00082267

58DPT04 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 2 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): – | |
| 3. DRILLING AGENCY: STRATA CORE | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT04 | | 13. OVERBURDEN SAMPLES: DISTURBED – | UNDISTURBED – |
| 5. NAME OF DRILLER: Shane | | 14. TOTAL NUMBER CORE BOXES: – | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: – | | 16. DATE HOLE: STARTED 9/30/08 | COMPLETED 9/30/08 |
| 8. DEPTH DRILLED INTO ROCK: – | | 17. ELEVATION TOP OF HOLE: – | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 90 % | |
| | | Andy Gilcriest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 13 | | SAA 10YR 6/6 brownish yellow | | | |
| | 14 | | SAA | | | |
| | 15 | | | | | |
| | 16 | | Sandy clay 10YR 5/6 fine grain Yellowish Matrix brown low plasticity iron mottling | | | |
| | 17 | | | | | |
| | 18 | | | | | |
| | 19 | | SAA | | | |
| | 20 | | | | | |
| | 21 | | EOB core | | | |
| | 22 | | | | | |
| | 23 | | | | | |
| | 24 | | | | | |

00082268

58DPT04 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 3 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: STRA | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58 DPT-04 | | 13. OVERBURDEN SAMPLES: DISTURBED — | UNDISTURBED — |
| 5. NAME OF DRILLER: STRATA CORE | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 9/30/08 | COMPLETED 9/30/08 |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 90% | |
| | | Andy Gilcrist INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 25 | | sandy clay | | | |
| | 26 | | silty clay wet moist | | | |
| | 27 | | soft 10YR 5/2 low plasticity grayish brown | | | |
| | 28 | | EOB refusal @ 28' water in hole | | | |

00082269

58DPT 05 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E-I | INSTALLATION: LONGHORN AAP | SHEET 1 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC-LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-05 | | 13. OVERBURDEN SAMPLES: DISTURBED — | UNDISTURBED — |
| 5. NAME OF DRILLER: Strata Core Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| | | 16. DATE HOLE: STARTED 10/2/08 | COMPLETED 10/2/08 |
| 7. THICKNESS OF OVERBURDEN: — | | 17. ELEVATION TOP OF HOLE: — | |
| 8. DEPTH DRILLED INTO ROCK: — | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| 9. TOTAL DEPTH OF HOLE: 28' | | Andy Gilcrist INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 0–6 | | Sand dk loose fine grain 10YR 5/6 yellowish brown organics | | | |
| | 6–10 | | Clay stiff OH 10YR 6/6 brownish yellow | | | |
| | 10–12 | | Sand moist loose fine grain 10YR 7/4 very pale brown | | | |

00082270

58 DPT 05 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E+I | INSTALLATION: LONGHORN AAP | SHEET 2 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): – | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-05 | | 13. OVERBURDEN SAMPLES: DISTURBED – | UNDISTURBED – |
| 5. NAME OF DRILLER: Strata Core Shane | | 14. TOTAL NUMBER CORE BOXES: – | |
| 6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: – | | 16. DATE HOLE: STARTED 10/2/08 | COMPLETED 10/2/08 |
| 8. DEPTH DRILLED INTO ROCK: – | | 17. ELEVATION TOP OF HOLE: – | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | Andy Gilcriest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 13 | | Sand | | | |
| | 14 | | | | | |
| | 15 | | | | | |
| | 16 | | Sandy clay | | | |
| | 17 | | moist | | | |
| | 18 | | low plasticity | | | |
| | 19 | | fine grain | | | |
| | 20 | | | | | |
| | 21 | | | | | |
| | 22 | | | | | |
| | 23 | | Sand | | | |
| | 24 | | moist | | | |

00082271

58DPT05 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 3 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-05 | | 13. OVERBURDEN SAMPLES: DISTURBED — UNDISTURBED — | |
| 5. NAME OF DRILLER: Stratacore Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 10/2/08 COMPLETED 10/2/08 | |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | Andy Gilcriest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 25 | ▽ wet | Sand | | | |
| | 26 | | | | | |
| | 27 | | clay moist stiff 10YR 7/6 yellow | | | |
| | 28 | | EOB | | | |

00082272

58DPT07 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E-I | INSTALLATION: LONGHORN AAP | SHEET 1 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): – | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-07 | | 13. OVERBURDEN SAMPLES: DISTURBED – | UNDISTURBED – |
| 5. NAME OF DRILLER: Strata Core – Shane | | 14. TOTAL NUMBER CORE BOXES: – | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 22.5 | |
| 7. THICKNESS OF OVERBURDEN: – | | 16. DATE HOLE: STARTED 10/1/08 | COMPLETED 10/1/08 |
| 8. DEPTH DRILLED INTO ROCK: – | | 17. ELEVATION TOP OF HOLE: – | |
| 9. TOTAL DEPTH OF HOLE: 26' | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | Andy Gilcrest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 1 | | Sand<br>loose<br>dry<br>organics<br>fine grain<br>10YR 6/6<br>brownish yellow | | | |
| | 2 | | | | | |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | Sandy<br>clay<br>moist<br>med. hardness<br>10YR 5/4<br>yellowish brown | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |
| | 11 | | Sand<br>loose<br>moist<br>fine grain<br>10YR 7/4 | | | |
| | 12 | | | | | |

00082273

58DPT07 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E+I | INSTALLATION: LONGHORN AAP | SHEET 2 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-07 | | 13. OVERBURDEN SAMPLES: DISTURBED — | UNDISTURBED — |
| 5. NAME OF DRILLER: Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 22.5 | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 10/1/08 | COMPLETED 10/1/08 |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE: 26 | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | Andy Gilcrest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 13 | | SAA | | | |
| | 14 | | | | | |
| | 15 | | | | | |
| | 16 | | | | | |
| | 17 | | ~~Clayey~~ sandy clay moist — 10YR 7/6 yellow | | | |
| | 18 | | | | | |
| | 19 | | | | | |
| | 20 | | Sand moist loose fine grain — 10YR 6/3 pale brown | | | |
| | 21 | | | | | |
| | 22 | | | | | |
| | 23 | | water | | | |
| | 24 | | clay | | | |

00082274

58DPT07 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 3 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-07 | | 13. OVERBURDEN SAMPLES: DISTURBED — UNDISTURBED — | |
| 5. NAME OF DRILLER: Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 22.5 | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 10/1/08 COMPLETED 10/1/08 | |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: | |
| 9. TOTAL DEPTH OF HOLE: 26' | | 18. TOTAL CORE RECOVERY FOR BORING: % | |
| | | Andy Gilcriest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 25 | | clay | | | |
| | 26 | | EOB<br>Very hard refusal | | | |

58DPT08 HOLE NO.

| DRILLING LOG | DIVISION SHAW E-I | INSTALLATION LONGHORN AAP | SHEET 1 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT MARC Longhorn | | 10. SIZE AND TYPE OF BIT Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station) Site58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) — | |
| 3. DRILLING AGENCY Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number) 58DPT-08 | | 13. OVERBURDEN SAMPLES: DISTURBED — | UNDISTURBED — |
| 5. NAME OF DRILLER Shane | | 14. TOTAL NUMBER CORE BOXES — | |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER 24.5 | |
| | | 16. DATE HOLE STARTED 10/2/08 | COMPLETED 10/2/08 |
| 7. THICKNESS OF OVERBURDEN — | | 17. ELEVATION TOP OF HOLE — | |
| 8. DEPTH DRILLED INTO ROCK — | | 18. TOTAL CORE RECOVERY FOR BORING 100 % | |
| 9. TOTAL DEPTH OF HOLE 28' | | Andy Gilcrest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 0–4 | | Sand loose dry organics 10YR 6/4 light yellowish brown | | | |
| | 4–10 | | Sandy clay low plasticity med. hardness 10YR 5/4 yellowish brown | | | |
| | 10–12 | | sand loose moist fine grain 10YR 6/6 brownish yellow | | | |

00082276

58DPT08 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 2 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Site 58 | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Strata-Core | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-08 | | 13. OVERBURDEN SAMPLES: DISTURBED — UNDISTURBED — | |
| 5. NAME OF DRILLER: Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5' | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 10/2/08 COMPLETED 10/2/08 | |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | ANDY GILCRIEST INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 13 | | SAA | | | |
| | 14 | | | | | |
| | 15 | | | | | |
| | 16 | | | | | |
| | 17 | | clay 10YR 7/6 yellow<br>stiff<br>moist<br>low plasticity | | | |
| | 18 | | | | | |
| | 19 | | | | | |
| | 20 | | | | | |
| | 21 | | | | | |
| | 22 | | | | | |
| | 23 | | sand<br>fine grain 10YR 5/3 brown<br>moist | | | |
| | 24 | | | | | |

00082277

58DPT08 HOLE NO.

| DRILLING LOG | DIVISION: SHAW E&I | INSTALLATION: LONGHORN AAP | SHEET 3 OF 3 SHEETS |
|---|---|---|---|
| 1. PROJECT: MARC LHAAP | | 10. SIZE AND TYPE OF BIT: Geoprobe Macro-Core | |
| 2. LOCATION (Coordinates or Station): Strata Core | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL): — | |
| 3. DRILLING AGENCY: Site 58 | | 12. MANUFACTURER'S DESIGNATION OF DRILL: Geoprobe 6610 | |
| 4. HOLE NO. (As shown on drawing title and file number): 58DPT-08 | | 13. OVERBURDEN SAMPLES: DISTURBED — | UNDISTURBED — |
| 5. NAME OF DRILLER: Shane | | 14. TOTAL NUMBER CORE BOXES: — | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: 24.5 | |
| 7. THICKNESS OF OVERBURDEN: — | | 16. DATE HOLE: STARTED 10/2/08 | COMPLETED 10/2/08 |
| 8. DEPTH DRILLED INTO ROCK: — | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE: 28' | | 18. TOTAL CORE RECOVERY FOR BORING: 100 % | |
| | | Andy Gilcrest INSPECTOR | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 25 | ▽ wet | silt | | | |
| | 26 | | | | | |
| | 27 | | clay very stiff | | | |
| | 28 | | EOB | | | |

9/29/08 A. Gilchrist

0730 - Leave for LHAAP
0840 - arrive, sign in
0850 - go with A. Willmore to supervise ETTC rigs
1000 - talk to Stratacore - share about 1½ hours out
1200 - stratacore arrives lunch
1300 - safety meeting + site discussion
1340 - @ LHAAP-49 49WW02 to drill temp well
1355 begin drilling
1520 - reach 28' water from 24-27' set well
1535 - complete temp well return to treatment plant
1610 - drillers offsite close treatment plant
1640 - offsite
1730 - @ hotel

9/29/08



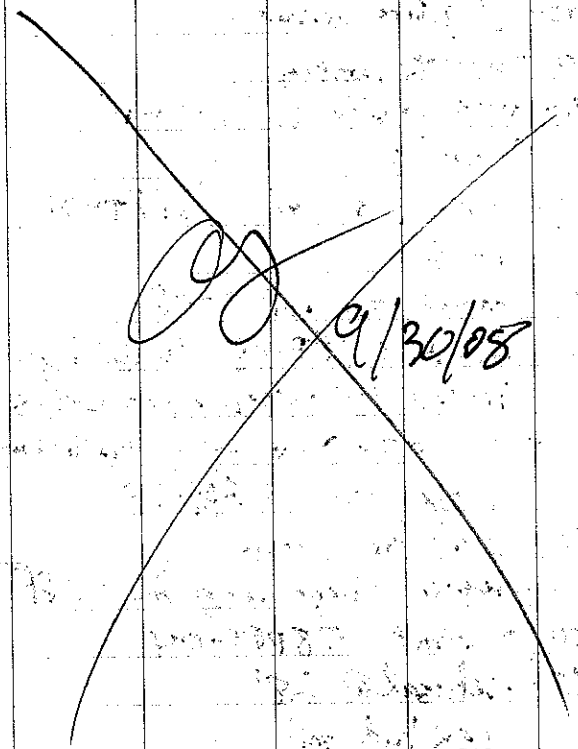
9/30/08 A. Gilchrist

0700 - leave hotel
0740 - @ base plant
0800 drillers arrive
0810 - safety meeting
0830 - move to site 16 to install 2 wells
0900 - install first well 16DPT-01 to 12'
0940 move to 16DPT-02
1015 finish 16DPT-02 to 12' bgs install 10' screen both wells
1040 - return to plant, repair trailer fan (j)
1100 - move to LHAAP-58
1140 - break for lunch
1240 - return - begin setup for 58DPT-04
1250 - start 58DPT-04
1400 - refusal @ 28' very hard soil water in hole ~26' set case to get level
1435 - return to treatment plant to clean rods
1540 - move to 49 to sample temp well
1610 - stop sampling for day



00082278

1620- offsite
1710- @ hotel






10/1/08
0700- leave hotel
0745- on site, move to temp well to sample now
0815- meet drillers, move to 58 to continue drilling
830- start on 58PPT-02
0920- reach 29' - retract rods to expose screen of hydropunch
0945- no water in hole move to 58DPT-04 to check water
0950- 58DPT-04 water level 23.17 ft bgs
955 sample 58PPT-04 3 x 40mL VOAs
1010 - complete sampling
1020- complete 49DPT-01 sample 3 x 250mL
1045- return to 58PPT-06 to 28' bgs - no water pull rods, move to 58DPT-03
1120- reach 28' pull to expose screen - no immediate water



00082279

10/1/08

1130 going to leave rods over lunch to see if water comes in

230- return to 58DPT-03 to try for water - no water pull rods.

1315 move to 58DPT-01, begin pushing

1345- refusal @ 18' bgs, pull out of hole

410- water in 58DPT-01, temp well installed to be sampled later

1420 move to 58DPT-07 get to 16' bgs and rig hammer starts acting up Shane calls to see about troubleshooting

1550- fix rig and finish boring to 26' bgs leave overnight

1630 - move rig to 58DPT-05

1645 - off site

1710 - @ motel

10/1/08



10/2/08

0730- leave hotel

0800 @ site

0815 meet drillers - begin DPT-05 check 58DPT-07 water @ 19.10'

0915 - sample 58DPT-08 7@ DUP-01 taken here

0930 - move to 58DPT-08 58DPT-05 completed to 28' bgs

0935 - start 58DPT-08 move to 58DPT-01 to check temp well water @ 13.55 bgs TD 18.2ft

945 - sample DPT-01 3x 40mL VOA's

955 - finish 58DPT-08 to 28' bgs move back to 16 to install temp well 16DPT-03 calibrate PID 100ppm-100 ppm

1155- complete 16DPT-03 to 28' bgs take lunch

1230- move to 58DPT-05 water @ 26.11' bgs



00082280

10/02/08

1245- Sample 58DPT-07
3x40mL VOA's
1255- move to 58DPT-08
water @ 21.61' bgs
1330- sample 58DPT-08
3x40mL VOA's
1345- complete
meet drillers @ treatment plant
and move to 18/24
1415- start 18/24DPT-A @ 32'
1520- complete A to ~~25~~ bgs
1525 start 18/24DPT-B
1620- complete to 32' bgs
going to repunch
58DPT-02, 06, & 03
tomorrow and reset
wells and set sand in
holes for ground water
levels
1630- offsite
1740- @ hotel

10/2/08

24

10/3/08

0705- check out at hotel
0800- @ site, get sand for wells
0820- meet drillers, set up on
58DPT-02 push 28' bgs
910- set temp well - hole partially
collapsed - only allowing for
20' of pipe in ground
920- move to DPT-06 to redrill
950- complete 58DPT-06 to 30' (refusal)
move to 03
1015 refusal @ 20' set well
1030- sand and bentonite wells
for ground water levels
1100- drillers offsite
1200 finish wells, caps
1230- offsite

10/3/08

00082281

10/15/08 Well Development @ 29

08:30 - Arrived @ site. Began loading truck.

10:10 - Sampled 58-DPT-02 for VOCs. (temp well)

10:35 - Sampled 58-DPT-03 for VOCs (temp well)

11:10 - Sampled 58-DPT-06 for VOCs (temp well).

13:00 - Continued developing wells. See Well Development Records for details.

17:45 - Left Site.

M. Allen

10/15/08

10/16/08 Well Development @ 29

Shaw staff - Allen Willmon

Developed wells @ LHAAP-29; see well development records for details.

M. Allen

10/16/08

00082282

00082283

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Site 35A
Project Name/#: Longhorn AAP/ 117591
Weather: Clear, 50s

Sampling location ID: ~~KB~~ LHSMW03
Sample ID: ~~KB~~ LHSMW03-111908
Collection Time/Date: 09:45 11/19/08

## Pump Installation

Pump installation crew: A. Willmore
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~35'
Initial (pre-installation) DTW/time: 27.02
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 33'

Installation date/beginning time: 11/19/08 0846
Installation date/completion time: 11/19/08 0841
Screen Interval (ft. BTOC): 25 to 35
Pump intake depth (ft BTOC): 30
Post-installation DTW/time: 27.02
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore
Purge date/beginning time: 11/19/08 08:50
Initial (pre-purging) DTW (ft. BTOC): 27.02
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/19/08 10:00
Final (post-purging) DTW (ft. BTOC): 27.18
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | NA | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 08:56 | 27.14 | 100 | 0.5 | 19.66 | 1.001 | 6.32 | -52.1 | | 200.8 |
| 09:00 | 27.18 | 100 | 1.0 | 19.61 | 1.002 | 6.41 | -48.9 | | 192.4 |
| 09:05 | 27.18 | 100 | 1.5 | 19.41 | 1.008 | 6.38 | -44.1 | | 191.3 |
| 09:10 | 27.19 | 100 | 2.0 | 19.23 | 1.011 | 6.34 | -29.8 | | 181.1 |
| 09:20 | 27.18 | 100 | 3.0 | 19.20 | 1.012 | 6.32 | -26.1 | | 152.6 |
| 09:30 | 27.18 | 100 | 4.0 | 19.18 | 1.014 | 6.32 | -23.4 | | 141.1 |
| 09:40 | ~~27.18~~ | 100 | 5.0 | 19.11 | 1.018 | 6.32 | -20.6 | | 140.3 |
| | | | | | | | | | |

00082284

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW03

**Water Quality Parameter Measurements (continued)**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | Electrical Conductivity (uMhos/cm) ±3% | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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11/19/08

## Sampling

Sampling beginning time: 09:45 Sampling completion time: 09:55

**Water Quality Parameter Measurements**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:00 | 27.18 | 100 | 7.6 | 19.11 | 1.017 | 6.31 | -19.9 | | 62.1 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: LHSMW03-111908 Sample collection date/time: 11-19-08 09:45

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: N/A

COC No(s): NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL Metals | 6020 | 1-500 mL HDPE | | | |
| VOCs | 8260 | 3-40 mL VOA vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Purged & Sampled w/ peristaltic pump
Used 10 µ filter

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082285

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# *Sample Collection Log*



## 117591 · Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

**RFA / COC Number:** 10948

*Location Code:* LHSMW04
*Sample Number:* LHSMW04-Feb 2007
*Sample Name:* LHSMW04-GW-LHSMW04- -REG
*Sampling Method:* SP
*Sample Type:* GW *Sample Purpose:* REG
*Sampling Equip:* _____

*Task:* MNA_EVENT_FEB07
*Collection Date:* 2-20-07
*Collection Time:* 1530
*Start Depth:* 23.97'
*End Depth:* 24.1
*Sample Matrix:* WATER

**QC Partners:**
(TB) _____ (ER) _____ (FB) _____

*Sample Team:* Willemore/McAdoo

**Containers**

| Analytical Suite | Flt | Frtn | Qty | Size | Units | Type |
|---|---|---|---|---|---|---|
| VOC-FULL | N | A | 3 | 40 | mL | VOA VIAL |
| ANIONS | N | B | 1 | 500 | mL | HDPE |
| PERC | N | C | 1 | 500 | mL | HDPE |
| GASES | N | D | 2 | 40 | mL | VOA Vial |
| ALKALINITY | N | E | 1 | 100 | mL | HDPE |
| TOC_415 | N | F | 1 | 100 | mL | HDPE |
| DHC | N | G | 1 | 1 | L | Amb. Glass |

**ERPIMS Values:**
*Sacode:* _____
*Lot Control#:* _____

**Groundwater Information:**
**Measured Well Depth:** 30.80' **Depth To Water:** 23.97'

**Comments:** _____

**Sketch Location:**

*Logged BY / Date:* Berry McAdoo 2-20-07 *Reviewed BY / Date:* _____

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# *Sample Collection Log*



## 117591 - Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

*Location Code:* **LHSMW04**

*Sample Number:* **LHSMW04-Feb2007**

***PURGE RECORD:***

| Initial | Time(24hr) | DepthtoWater (ft) | Eh (mV) | pH (SU) | Conductivity (mS/cm) | Turbidity (NTU) | DissOxygen (ppm) | Temperature (C) | Purge Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| Sample: | 1530 | 24.1 | 237.5 | 5.80 | 5.291 | 3.4 | 0.92 | 18.58 | 100 |

*Logged BY / Date:* SBerry McAdoo 2-20-07 *Reviewed BY / Date:* _____

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LAAAP, Site 35A
Project Name/#: Longhorn AAP
Weather: Cloudy

Sampling location ID: LHSMW04
Sample ID: LHSMW04-Feb2007
Collection Time/Date: 2-20-07/1530

## Pump Installation

Pump installation crew: Willemore/McAdoo
PID/FID reading (well head/background): 0.0/0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 30.80'
Initial (pre-installation) DTW/time: 23.97'
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 29'

Installation date/beginning time: 2-20-07/1440
Installation date/completion time: 2-20-07/1455
Screen Interval (ft. BTOC): 20.80 to 30.80
Pump intake depth (ft BTOC): 26'
Post-installation DTW/time: 23.78'
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N):

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Willemore/McAdoo
Purge date/beginning time: 2-20-07/1455
Initial (pre-purging) DTW (ft. BTOC): 23.78'
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0/0%
Purge date/completion time: 2-20-07
Final (post-purging) DTW (ft. BTOC): 24.1
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 16 | 16 | 16 | 16 | | | | | |
| Refill Setting | 10 | 10 | 10 | 10 | | | | | |
| Discharge Setting | 5 | 5 | 5 | 5 | | | | | |
| Flow rate (mL/min) | 100 | 100 | 100 | 106 | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1515 | 24.1 | 100 | 0.5 @ 5' | 18.42 | 5.123 | 5.86 | 239.9 | 1.16 | 4.4 |
| 1520 | 24.1 | 100 | ~~2.0~~ 1.8 @ 10' | 18.43 | 5.145 | 5.84 | 239.5 | 1.11 | 4.1 |
| 1525 | 24.1 | 100 | ~~3.5~~ 3.5 @ 15' | 18.45 | 5.154 | 5.84 | 239.1 | 1.08 | 3.7 |
| 1530 | 24.1 | 100 | ~~5.0~~ 5.2 @ 20' | 18.49 | 5.224 | 5.81 | 236.6 | 1.01 | 3.6 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

00082288

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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S.M.S.

## Sampling

Sampling beginning time: 1530 Sampling completion time: 1530

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1530 | 24.1 | 100 | 4.20 | 18.49 | 5.224 | 5.81 | 236.6 | 1.01 | 3.6 |
| 1605 | 24.1 | 100 | 5.25 | 18.58 | 5.291 | 5.80 | 237.5 | 0.92 | 3.4 |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: LHSMW04-Feb2007 Sample collection date/time: 2-20-07 1530

Duplicate sample collected (Y/N): N Duplicate sample ID: N

Split sample collected (Y/N): N Split sample ID: N

COC No(s): 10948

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOC | 8260B | 3 | Alkalinity | 310.1 | 1 |
| Anions | 300.0 | 1 | TOC | 415.1 | 3 |
| Sulfides | 376.2 | 1 | | | |
| Perchlorate | 314.0 | 1 | | | |
| GASES-CO2 | SOP125 | 3 | | | |

**Comments:**

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Shaw®

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009B830
Weather: SUNNY 50°F

Sampling location ID: SITE 58
Sample ID: LHSMW04-013008
Collection Time/Date: 2:00 1/30/08

## Pump Installation

Pump installation crew: B. Singer
PID/FID reading (well head/background): 0.0/ppm
Casing diameter (inches):
Total well Depth (ft. BTOC): 30.75
Initial (pre-installation) DTW/time: 25.33
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = psi

Installation date/beginning time: 01/30/08 12:40
Installation date/completion time: 1/30/08 12:55
Screen Interval (ft. BTOC): 20.75 to 30.75
Pump intake depth (ft BTOC): 27.75
Post-installation DTW/time: 25.20
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
Inlet reducer used (Y/N):

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: B. Singer
Purge date/beginning time: 1/30/08 12:55
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = psi

PID/FID reading (well head/background): 0.0/ppm
Purge date/completion time: 1/30/08 2:00
Final (post-purging) DTW (ft. BTOC): 25.62
No. of tubing + pump volumes purged:

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 18 | | | | | | | | |
| Refill Setting | 18 | | | | | | | | |
| Discharge Setting | 16 | | | | | | | | |
| Flow rate (mL/min) | 100 | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1:05 | 25.50 | 100 | 500 | 18.46 | 5.816 | 5.51 | 55.5 | 1.01 | 38.4 |
| 1:10 | 25.53 | 100 | 1000 | 18.40 | 5.879 | 5.51 | 55.4 | 0.93 | 35.0 |
| 1:15 | 25.55 | 100 | 1500 | 18.86 | 5.860 | 5.52 | 55.3 | 0.81 | 28.1 |
| 1:20 | 25.57 | 100 | 2000 | 18.97 | 5.827 | 5.56 | 54.9 | 0.74 | 22.7 |
| 1:25 | 25.59 | 100 | 2500 | 19.10 | 5.768 | 5.58 | 55.0 | 0.70 | 20.0 |
| 1:30 | 25.60 | 100 | 3000 | 19.20 | 5.730 | 5.60 | 55.1 | 0.66 | 18.5 |
| 1:35 | 25.60 | 100 | 3500 | 19.25 | 5.718 | 5.60 | 55.3 | 0.64 | 17.3 |
| 1:40 | 25.60 | 100 | 4000 | 19.14 | 5.690 | 5.60 | 55.8 | 0.60 | 13.5 |

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
| 1:45 | 25.62 | 100 | 4500 | 19.26 | 5.564 | 5.66 | 61.3 | 0.53 | 9.9 |
| 1:50 | 25.62 | 100 | 5000 | 19.21 | 5.560 | 5.67 | 62.8 | 0.57 | 7.7 |
| 1:55 | 25.62 | 100 | 5500 | 19.22 | 5.557 | 5.67 | 63.0 | 0.50 | 6.7 |
| 2:00 | 25.62 | 100 | 6000 | 19.22 | 5.555 | 5.67 | 63.1 | 0.48 | 5.0 |
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## Sampling

Sampling beginning time: 2:00 Sampling completion time: 2:02

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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## Sample Information

Sample ID: LHSMW04-013008 Sample collection date/time: 1/30/08 2:00

Duplicate sample collected (Y/N): Duplicate sample ID:

Split sample collected (Y/N): Split sample ID:

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOCs | | 3-40ml glass | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:**

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082291

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

LHSMW04

Operable Unit/Site ID: LHMMP-35A
Project Name/#: Longhorn / 117691
Weather: clear, Hi 60s

Sampling location ID: ~~35AW0404~~
Sample ID: LHSMW04-112508
Collection Time/Date: 12:45 11-25-08

## Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 30.78
Initial (pre-installation) DTW/time: 25.15
Final (after pump priming) DTW/time: NR
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 38'

Installation date/beginning time: 11.26.08 10:32
Installation date/completion time: 11.26.08 10:34
Screen Interval (ft. BTOC): 20.5 to 30.5
Pump intake depth (ft BTOC): 25
Post-installation DTW/time: 25.15
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore / A. Gilchrist
Purge date/beginning time: 11.25.08 10:43
Initial (pre-purging) DTW (ft. BTOC): 26.15
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 11.25.08 11:50
Final (post-purging) DTW (ft. BTOC): 26.21
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:43 | 26.21 | 100 | 0.5 | 19.46 | 5.201 | 5.81 | 32.1 | 0.94 | 50.1 |
| 10:48 | 26.23 | 100 | 1.0 | 19.44 | 5.128 | 5.82 | 48.2 | 0.81 | 41.1 |
| 10:53 | 26.24 | 100 | 1.5 | 19.41 | 5.119 | 5.83 | 54.1 | 0.82 | 32.1 |
| 10:58 | 26.24 | 100 | 2.0 | 19.38 | 5.118 | 5.83 | 63.6 | 0.82 | 33.4 |
| 11:03 | 26.24 | 100 | 3.0 | 19.32 | 5.118 | 5.83 | 64.1 | 0.81 | 32.1 |
| 11:18 | 26.24 | 100 | 4.0 | 19.32 | 5.116 | 5.83 | 64.9 | 0.84 | 26.1 |
| | | | | | | | | | |
| | | | | | | | | | |

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# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

LHSMW04
35A000004

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
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11/25/08

## Sampling

Sampling beginning time: 11:25 Sampling completion time: 11:35

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 11:20 | 26.24 | 100 | 5.5 | 19.31 | 5.117 | 5.83 | 65.1 | 0.85 | 23.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: LHSMW04-112508
Duplicate sample collected (Y/N): N
Split sample collected (Y/N): N
COC No(s): NA

Sample collection date/time: 11-25-08 11:45
Duplicate sample ID: NA
Split sample ID: NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOCs | 8260 | 3- 40mL voa vial | | | |
| TAL Metals | 6020 | 1- 500 mL HDPE | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Comments: Purged & Sampled w/ peristaltic pump
Filter Used!

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

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# *Sample Collection Log*



## 117591 · Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

**RFA / COC Number:** _____

*Location Code:* **LHSMW05**
*Sample Number:* **LHSMW05-**
*Sample Name:* **LHSMW05-GW-LHSMW05- -REG**
*Sampling Method:* **SP**
*Sample Type:* **GW** *Sample Purpose:* **REG**
*Sampling Equip:* _____

*Task:* **MNA_EVENT_FEB07**
*Collection Date:* _____
*Collection Time:* _____
*Start Depth:* _____
*End Depth:* _____
*Sample Matrix:* **WATER**

**QC Partners:**
(TB) _____ (ER) _____ (FB) _____

*Sample Team:* _____

**Containers**

| Analytical Suite | Flt | Frtn | Qty | Size | Units | Type |
|---|---|---|---|---|---|---|
| VOC-FULL | N | A | 3 | 40 | mL | VOA VIAL |
| ANIONS | N | B | 1 | 500 | mL | HDPE |
| PERC | N | C | 1 | 500 | mL | HDPE |
| GASES | N | D | 2 | 40 | mL | VOA Vial |
| ALKALINITY | N | E | 1 | 100 | mL | HDPE |
| TOC_415 | N | F | 1 | 100 | mL | HDPE |
| DHC | N | G | 1 | 1 | L | Amb. Glass |

**ERPIMS Values:**
*Sacode:* _____
*Lot Control#:* _____

**Groundwater Information:** 24.35
**Measured Well Depth:** ~~28.73~~ **Depth To Water:** 23.73

**Comments:** Only @ 0.6' of water in column, bailed dry @ 16:00 2/20/04.
No Sample taken - not enough water

**Sketch Location:**

*Logged BY / Date:* Sherry McRae 2-21-07 *Reviewed BY / Date:* _____

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# *Sample Collection Log*



**117591 - Longhorn Army Ammunition Plant**
**Manager:** Praveen Srivastav

*Location Code:* **LHSMW05**
*Sample Number:* **LHSMW05-**

***PURGE RECORD:***

| Initial | Time(24hr) | DepthtoWater (ft) | Eh (mV) | pH (SU) | Conductivity (mS/cm) | Turbidity (NTU) | DissOxygen (ppm) | Temperature (C) | Purge Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Sample: | | | | | | | | | |

Not Sampled - SKMC

*Logged BY / Date:* Sherry McAloon 2-21-07 *Reviewed BY / Date:* _____

00082295

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Longhorn, Site 35A
Project Name/#: Longhorn AAP
Weather: Sunny 60/70
Sampling location ID: 35A
Sample ID: LHSMW05 - FEB2007
Collection Time/Date:

## Pump Installation

Pump installation crew: Willmore / McAdoo
PID/FID reading (well head/background): 0.0 / 0.
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 24.35
Initial (pre-installation) DTW/time: 23.79
Final (after pump priming) DTW/time: NR
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NR
Discharge tube length (ft.): NA
Installation date/beginning time: NA
Installation date/completion time: NA
Screen Interval (ft. BTOC): NA to NA
Pump intake depth (ft BTOC): NA
Post-installation DTW/time: NA
Max. sustainable pump rate (mL/min): NA
Appearance of product: NA
Discharge tube diameter (3/8" or 1/4"): NA
Inlet reducer used (Y/N): NA

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

Slow

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | SKIP | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Willemore/McAdoo
Purge date/beginning time:
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background):
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

Bailed Dry 2-21-07

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | SKIP | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | SKIP | | | | | |
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Bailed Dry!!

00082296

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
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10/20

SKIP

## Sampling

Sampling beginning time:_____ Sampling completion time:_____

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | No Sample | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID:_____ Sample collection date/time:_____

Duplicate sample collected (Y/N):_____ Duplicate sample ID:_____

Split sample collected (Y/N):_____ Split sample ID:_____

COC No(s):_____

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| | | | | | |
| No Sample | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Well does not generate suffiient water. Bailed dry 2/20/07

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

Not Sampled - not enough water,

00082297

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

LHSMW05

Operable Unit/Site ID: 35K
Project Name/#: DRY
Weather:
Sampling location ID:
Sample ID: DRY
Collection Time/Date:

## Pump Installation

Pump installation crew:
PID/FID reading (well head/background):
Casing diameter (inches):
Total well Depth (ft. BTOC): DRY
Initial (pre-installation) DTW/time:
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Installation date/beginning time: ~~11:25~~
Installation date/completion time:
Screen Interval (ft. BTOC): _____ to _____
Pump intake depth (ft BTOC):
Post-installation DTW/time:
Max. sustainable pump rate (mL/min): DRY
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
Inlet reducer used (Y/N):

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | DRY | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew:
Purge date/beginning time: DRY
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background):
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC): DRY
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | DRY | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | DRY | | | | | |
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00082298

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW05

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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DRY

## Sampling

Sampling beginning time:_____ Sampling completion time:_____

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
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DRY

## Sample Information

Sample ID:_____ Sample collection date/time:_____

Duplicate sample collected (Y/N):_____ Duplicate sample ID:_____

Split sample collected (Y/N):_____ Split sample ID:_____

COC No(s):_____

DRY DRY

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

DRY

Comments:

11.25.08

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082299

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# *Sample Collection Log*



## 117591 - Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

**RFA / COC Number:** 10497

*Location Code:* LHSMW06
*Sample Number:* LHSMW06- Feb 2007
*Sample Name:* LHSMW06-GW-LHSMW06- -REG
*Sampling Method:* SP
*Sample Type:* GW *Sample Purpose:* REG
*Sampling Equip:* Stainless Steel Bladder Pump

*Task:* MNA_EVENT_FEB07
*Collection Date:* 2-21-07
*Collection Time:*
*Start Depth:* SKmc 20' ~~15.65~~ ~~23.56~~
*End Depth:* 20'
*Sample Matrix:* WATER

**QC Partners:**
(TB) (ER) (FB)

*Sample Team:* Willmore/McFadden

**Containers**

| Analytical Suite | Flt | Frtn | Qty | Size | Units | Type |
|---|---|---|---|---|---|---|
| VOC-FULL | N | A | 3 | 40 | mL | VOA VIAL |
| ANIONS | N | B | 1 | 500 | mL | HDPE |
| PERC | N | C | 1 | 500 | mL | HDPE |
| GASES | N | D | 2 | 40 | mL | VOA Vial |
| ALKALINITY | N | E | 1 | 100 | mL | HDPE |
| TOC_415 | N | F | 1 | 100 | mL | HDPE |
| DHC | N | G | 1 | 1 | L | Amb. Glass |

**ERPIMS Values:**
*Sacode:*
*Lot Control#:*

SKmc
**Groundwater Information:** 23.56
**Measured Well Depth:** ~~17.65~~ **Depth To Water:** 17.76

**Comments:**

**Sketch Location:**

*Logged BY / Date:* Berry McFadden 2-21-07 *Reviewed BY / Date:*

Shaw E & I, Inc.

# *Sample Collection Log*



## 117591 - Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

*Location Code:* **LHSMW06**

*Sample Number:* **LHSMW06-Feb2007**

***PURGE RECORD:***

| Initial | Time(24hr) | DepthtoWater (ft) | Eh (mV) | pH (SU) | Conductivity (mS/cm) | Turbidity (NTU) | DissOxygen (ppm) | Temperature (C) | Purge Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | SKMS | | | | |
| | 1115 | 17.70 | 211-1 | 6.25 | 3.630 | 0.0 | 0.96 | 24.05 | 100 |
| Sample: | ~~1545~~ | ~~28.92~~ | ~~302~~ | ~~6.44~~ | ~~4.635~~ | ~~1.2~~ | ~~0.94~~ | ~~20.63~~ | ~~105~~ SKMS |

*Logged BY / Date:* Sherry McBee 2-21-07 *Reviewed BY / Date:* _____

00082301

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-Site 35A
Project Name/#: Longhorn AAP
Weather: Sunny 60°

Sampling location ID: LHSMW06
Sample ID: LHSmw06-Feb 2007
Collection Time/Date: 2-21-07/1020

## Pump Installation

Pump installation crew: Willemsee/Mc.Adoo
PID/FID reading (well head/background): 0.0/0 %
Casing diameter (inches): 4
Total well Depth (ft. BTOC): 23.56
Initial (pre-installation) DTW/time: 17.68
Final (after pump priming) DTW/time: 17.76
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): _____
Discharge tube length (ft.): 23'

Installation date/beginning time: 2-21-07 0935
Installation date/completion time: 2-21-07 0950
Screen Interval (ft. BTOC): _____ to _____
Pump intake depth (ft BTOC): 20'
Post-installation DTW/time: 17.76
Max. sustainable pump rate (mL/min): _____
Appearance of product: _____
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): _____

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | SKIP | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Willemsee/Mc.Adoo
Purge date/beginning time: 2-21-07/1000
Initial (pre-purging) DTW (ft. BTOC): 17.76
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0/0 %
Purge date/completion time: 2-21-07/1020
Final (post-purging) DTW (ft. BTOC): 17.76
No. of tubing + pump volumes purged: _____

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 20 | 20 | 20 | 20 | | | | | |
| Refill Setting | 10 | 10 | 10 | 10 | | | | | |
| Discharge Setting | 5 | 5 | 5 | 5 | | | | | |
| Flow rate (mL/min) | 100 | 100 | 100 | 100 | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1000 | 17.76 | 100 | 0.5 | 20.08 | 3.744 | 6.29 | 211.5 | 1.33 | 3.4 |
| 1005 | 17.76 | 100 | 1.0 | 19.94 | 3.689 | 6.28 | 186.2 | .72 | 2.4 |
| 1010 | 17.76 | 100 | 1.5 | 19.92 | 3.662 | 6.28 | 178.3 | .57 | 2.6 |
| 1015 | 17.76 | 100 | 2.0 | 19.99 | 3.641 | 6.28 | 176.1 | .53 | 2.2 |
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00082302

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
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## Sampling

Sampling beginning time: 1020 Sampling completion time: 1020

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 11:15 | 17.70 | 100 | ~~27.5~~ 28 | 24.05 | 3.680 | 6.25 | 211.1 | 0.96 | 0.0 |
| | | | | | | | | | |
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## Sample Information

Sample ID: UHSMW06-Feb2007 Sample collection date/time: 2-21-07

Duplicate sample collected (Y/N): N Duplicate sample ID: N

Split sample collected (Y/N): N Split sample ID: N

COC No(s): 10497

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOC | 8260B | 3 | Alkalinity | 310.1 | 1 |
| Anions | 300.0 | 1 | TOC | 415.1 | 3 |
| Sulfides | 376.2 | 1 | | | |
| Perchlorate | 314.0 | 1 | | | |
| Bases-CO2 | SOP 175 | 3 | | | |

**Comments:**

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082303

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-36B
Project Name/#: Longhorn / 117594
Weather: ptly cloudy 60's - 50's

Sampling location ID: ~~LHSMW06~~ 117594 (LHSMW06)
Sample ID: LHSMW06-117594
Collection Time/Date: 09:45 11.19.08

## Pump Installation

Pump installation crew: A. Williams / A. Gilchrist
PID/FID reading (well head/background): 0.1
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~25'
Initial (pre-installation) DTW/time: 18.91
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 28'

Installation date/beginning time: 11.19.08 08:40
Installation date/completion time: 11.19.08 09:22
Screen Interval (ft. BTOC): 15 to 25
Pump intake depth (ft BTOC): 22
Post-installation DTW/time: 18.91
Max. sustainable pump rate (mL/min): 100
Appearance of product: NA
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NA psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Williams / A. Gilchrist
Purge date/beginning time: 11.19.08
Initial (pre-purging) DTW (ft. BTOC): 18.91
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.1
Purge date/completion time: 11.19.08 10:00
Final (post-purging) DTW (ft. BTOC): 19.01
No. of tubing + pump volumes purged: N/A

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NA psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 08:32 | 18.99 | 100 | 0.5 | 18.96 | 3.311 | 6.41 | 22.4 | 2.11 | 101.4 |
| 08:52 | 19.01 | 100 | 2.5 | 18.03 | 3.301 | 6.41 | 27.6 | 2.01 | 100.1 |
| 09:02 | 19.01 | 100 | 3.0 | 17.91 | 3.294 | 6.46 | 28.1 | 1.96 | 78.1 |
| 09:07 | 19.01 | 100 | 3.5 | 17.82 | 3.291 | 6.41 | 33.4 | 1.94 | 62.6 |
| 09:17 | 19.01 | 100 | 4.5 | 17.62 | 3.272 | 6.46 | 33.1 | 1.93 | 61.0 |
| 09:27 | 19.01 | 100 | 5.5 | 18.03 | 3.296 | 6.47 | 32.9 | 1.91 | 64.3 |
| 09:37 | 19.01 | 100 | 6.5 | 18.17 | 3.291 | 6.48 | 33.4 | 1.92 | 64.9 |
| | | | | | | | | | |

00082304

# GROUNDWATER SAMPLING FORM

Sheet 2 of 7

LHSmw06

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
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11-19-08

10-20

## Sampling

Sampling beginning time: 09:45 Sampling completion time: 09:55

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:00 | 19.01 | 100 | | ~~20.05~~ 18.15 | 3.273 | 6.48 | 33.9 | 1.95 | 65.6 |
| | | | | | | | | | |
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## Sample Information

Sample ID: LHSmw06-111908 Sample collection date/time: 11.19.08

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: NA

COC No(s): NR

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOCs | 6020 | 1-500mL HDPE | | | |
| TAL Metals | 8260 | 3-40mL VOA vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Comments: Purged & Sampled w/ peristaltic pump
Filter used !! (10µ)

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082305

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# *Sample Collection Log*



## 117591 - Longhorn Army Ammunition Plant

**Manager:** Praveen Srivastav

**RFA / COC Number:** 10496

*Location Code:* **LHSMW07**
*Sample Number:* **LHSMW07-Feb2007**
*Sample Name:* **LHSMW07-GW-LHSMW07- -REG**
*Sampling Method:* **SP**
*Sample Type:* **GW** *Sample Purpose:* **REG**
*Sampling Equip:* Stainless Steel Bladder Pump
**QC Partners:**
(TB) _____ (ER) _____ (FB) _____

*Task:* **MNA_EVENT_FEB07**
*Collection Date:* 2-21-07
*Collection Time:* 1315
*Start Depth:* 30.40
*End Depth:* 30.40
*Sample Matrix:* **WATER**
*Sample Team:* Willemore/McAdoo

**ERPIMS Values:**
*Sacode:* _____
*Lot Control#:* _____

**Containers**

| Analytical Suite | Flt | Frtn | Qty | Size | Units | Type |
|---|---|---|---|---|---|---|
| VOC-FULL | N | A | 3 | 40 | mL | VOA VIAL |
| ANIONS | N | B | 1 | 500 | mL | HDPE |
| PERC | N | C | 1 | 500 | mL | HDPE |
| GASES | N | D | 2 | 40 | mL | VOA Vial |
| ALKALINITY | N | E | 1 | 100 | mL | HDPE |
| TOC_415 | N | F | 1 | 100 | mL | HDPE |
| DHC | N | G | 1 | 1 | L | Amb. Glass |

**Groundwater Information:**

**Measured Well Depth:** 30.40 **Depth To Water:** 18.49

**Comments:**

**Sketch Location:**

*Logged BY / Date:* SBerry McAdoo 2-21-07

*Reviewed BY / Date:* _____

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# *Sample Collection Log*



**117591 - Longhorn Army Ammunition Plant**
**Manager:** Praveen Srivastav

*Location Code:* **LHSMW07**
*Sample Number:* **LHSMW07-Feb2007**

***PURGE RECORD:***

| Initial | Time(24hr) | DepthtoWater (ft) | Eh (mV) | pH (SU) | Conductivity (mS/cm) | Turbidity (NTU) | DissOxygen (ppm) | Temperature (C) | Purge Volume (gal) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| Sample: | 1345 | 18.45 | 282.0 | 6.46 | 9.122 | 3.8 | 2.48 | 22.94 | 100 |

Skms.

*Logged BY / Date:* Sherry McAdoo 2-21-07

*Reviewed BY / Date:* _____

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP Site 35A
Project Name/#: Longhorn AAP
Weather: Sunny 75°

Sampling location ID: Site35A
Sample ID: LHSMW07-Feb2007
Collection Time/Date: 2-21-07 / 1315

## Pump Installation

Pump installation crew: Willemore / McAdoo
PID/FID reading (well head/background): 0.0 / 0 ppm
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 30.60
Initial (pre-installation) DTW/time: 18.49/1230
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 28'

Installation date/beginning time: 2-21-07 / 1230
Installation date/completion time: 2-21-07 / 1240
Screen Interval (ft. BTOC): to
Pump intake depth (ft BTOC): 25'
Post-installation DTW/time: 18.45 / 1245
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N):

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = _____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | SLSMS | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Willemore / McAdoo
Purge date/beginning time: 2-21-07 / 1245
Initial (pre-purging) DTW (ft. BTOC): 18.45
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0 / 0 ppm
Purge date/completion time: 2-21-07 / 1345
Final (post-purging) DTW (ft. BTOC): 18.45
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 20 | 20 | 20 | 20 | | | | | |
| Refill Setting | 10 | 10 | 10 | 11 | | | | | |
| Discharge Setting | 5 | 5 | 5 | 5 | | | | | |
| Flow rate (mL/min) | 100 | 100 | 100 | 100 | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1300 | 18.45 | 100 | ~~1.0~~ 0.5 | 21.06 | 11.72 | 6.32 | 285.6 | 0.68 | 18.4 |
| 1305 | 18.45 | 100 | ~~2.0~~ 1.0 | 20.67 | 11.74 | 6.32 | 280.1 | 0.54 | 13.2 |
| 1310 | 18.45 | 100 | ~~3.0~~ 1.5 | 20.58 | 11.73 | 6.33 | 275.3 | 0.46 | 10.6 |
| 1315 | 18.45 | 100 | ~~4.0~~ 2.0 | 20.28 | 11.74 | 6.33 | 270.1 | 0.42 | 7.8 |
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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
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SKMC

## Sampling

Sampling beginning time: 1315 Sampling completion time: 1315

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1345 | 18.45 | 100 | 5.0 | 22.94 | 9,122 | 6.46 | 282.0 | 2.48 | 3.8 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 4HSmw07-Feb2007 Sample collection date/time: 2-21-07

Duplicate sample collected (Y/N): N Duplicate sample ID: N

Split sample collected (Y/N): N Split sample ID: N

COC No(s): 10496

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOC | 8260B | 3 | Perchlorate | 314 | 1 |
| TOC | 415.1 | 3 | Alkalinity | 310 | 1 |
| Gases-CO2 | SOP175 | 3 | | | |
| Anions | 300.0 | 1 | | | |
| Sulfides | 376.2 | 1 | | | |

**Comments:**

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082309

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Site
Project Name/#: Longhorn AAP/ 117591
Weather: cloudy, ~50° F

Sampling location ID: WBL LHSMW07
Sample ID: WBL LHSMW07-112408
Collection Time/Date: 11/24/08

## Pump Installation

Pump installation crew: A. Willmore/ A. Gilchwist
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~30
Initial (pre-installation) DTW/time: 19.14
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 30'

Installation date/beginning time: 11/24/08 12:32
Installation date/completion time: 11/24/08 12:35
Screen Interval (ft. BTOC): 20 to 30
Pump intake depth (ft BTOC): 25
Post-installation DTW/time: 19.14 12:57
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore
Purge date/beginning time: 11/24/08 12:40
Initial (pre-purging) DTW (ft. BTOC): 19.14
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/24/08 13:15
Final (post-purging) DTW (ft. BTOC): 19.24
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) Switched | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 12:45 | 19.21 | 100 | 19.31 | 0.5 | 1.132 | 6.95 | -0.32 | 2.20 | 46.1 |
| 12:50 | 19.24 | 100 | 19.84 | 1.0 | 1.141 | 6.98 | -0.11 | 2.18 | 10.1 |
| 12:55 | 19.24 | 100 | 19.42 | 1.5 | 1.122 | 6.94 | -0.14 | 2.13 | 9.4 |
| 13:00 | 19.24 | 100 | 19.43 | 2.0 | 1.163 | 6.94 | -0.18 | 2.06 | 9.3 |
| | | | | | | | | | |
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00082310

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW07-112408

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
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11/24/08

## Sampling

Sampling beginning time: 13:05 Sampling completion time: 13:10

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 13:15 | 19.74 | 108 | 4.18 | 19.47 | 1.114 | 6.93 | -0.19 | 2.10 | 9.6 |
| | | | | | | | | | |
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## Sample Information

Sample ID: LHSMW07-112408 Sample collection date/time: 11.24.08 13:05

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: N/A

COC No(s): NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL METALS | 6020 | 500mL HDPE | | | |
| VOCs | 8260 | 40mL VOA vials | | | |
| | | | | | |
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**Comments:** Purged & Sampled w/ peristaltic pump. No filter used.

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082311

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009BB30
Weather: Sunny 72°F
Sampling location ID: Site 46
Sample ID: LHSMW09-031508
Collection Time/Date: 11:30 3/15/08

## Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background):
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 26.25
Initial (pre-installation) DTW/time: 19.30
Final (after pump priming) DTW/time: 19.64
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): —
Discharge tube length (ft.):
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = ____ psi

Installation date/beginning time: 3/15/08 9:50
Installation date/completion time: 3/15/08 10:05
Screen Interval (ft. BTOC): 16.25 to 26.25
Pump intake depth (ft BTOC): 23.00
Post-installation DTW/time: 19.20
Max. sustainable pump rate (mL/min): 100
Appearance of product: N/A
Discharge tube diameter (3/8" or 1/4"): NA
Inlet reducer used (Y/N): N

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Beesinger
Purge date/beginning time: 3/15/08 10:05
Initial (pre-purging) DTW (ft. BTOC): 19.20
Calculated tubing + pump volume: NA
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = ____ psi

PID/FID reading (well head/background):
Purge date/completion time: 3/15/08 11:30
Final (post-purging) DTW (ft. BTOC): 19.64
No. of tubing + pump volumes purged:

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 15 | | | | | | | | |
| Refill Setting | 12 | | | | | | | | |
| Discharge Setting | 15 | | | | | | | | |
| Flow rate (mL/min) | 100 | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:10 | 19.45 | 100 | .500 | 18.79 | 0.092 | 5.81 | 188.1 | 7.45 | 35.4 |
| 10:15 | 19.48 | 100 | 1000 | 18.87 | 0.147 | 5.67 | 187.6 | 5.69 | 29.2 |
| 10:20 | 19.53 | 100 | 1500 | 19.16 | 0.146 | 5.64 | 190.0 | 5.88 | 21.4 |
| 10:25 | 19.57 | 100 | 2000 | 19.24 | 0.146 | 5.64 | 190.7 | 6.07 | 18.5 |
| 10:30 | 19.60 | 100 | 2500 | 19.36 | 0.146 | 5.61 | 193.7 | 4.84 | 17.4 |
| 10:35 | 19.62 | 100 | 3000 | 19.52 | 0.145 | 5.63 | 194.8 | 4.13 | 16.3 |
| 10:40 | 19.62 | 100 | 3500 | 19.48 | 0.145 | 5.62 | 196.8 | 4.03 | 16.5 |
| 10:45 | 19.63 | 100 | 4000 | 19.44 | 0.145 | 5.60 | 199.2 | 4.02 | 17.2 |

00082312

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW09

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
| 10:50 | 19.63 | 100 | 4500 | 19.20 | 0.144 | 5.54 | 201.5 | 4.39 | 16.0 |
| 10:55 | 19.63 | 100 | 5000 | 19.10 | 0.144 | 5.58 | 203.7 | 4.06 | 15.5 |
| 11:00 | 19.64 | 100 | 5500 | 19.00 | 0.144 | 5.57 | 205.4 | 3.96 | 16.1 |
| 11:05 | 19.64 | 100 | 6000 | 18.97 | 0.144 | 5.56 | 207.2 | 3.54 | 15.0 |
| 11:10 | 19.64 | 100 | 6500 | 18.86 | 0.144 | 5.56 | 208.6 | 3.82 | 14.0 |
| 11:15 | 19.64 | 100 | 7000 | 18.83 | 0.144 | 5.55 | 210.1 | 4.06 | 13.1 |
| 11:20 | 19.64 | 100 | 7500 | 18.87 | 0.144 | 5.55 | 211.5 | 4.05 | 11.9 |
| 11:25 | 19.64 | 100 | 8000 | 18.88 | 0.144 | 5.54 | 212.3 | 4.03 | 10.0 |
| 11:30 | 19.64 | 100 | 8500 | 18.87 | 0.143 | 5.54 | 213.6 | 4.04 | 9.7 |

## Sampling

Sampling beginning time: 11:30 Sampling completion time: 11:32

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 11:32 | 19.64 | 100 | 8700 | 18.87 | 0.143 | 5.54 | 214.0 | 4.05 | 8.8 |

## Sample Information

Sample ID: LHSMW09-031508 Sample collection date/time: 3/15/08 11:30

Duplicate sample collected (Y/N): Duplicate sample ID:

Split sample collected (Y/N): Split sample ID:

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOA | | 2-40ml glass | | | |

Comments:

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082313

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009.BB30
Weather: Sunny 85°F
Sampling location ID: Site 46
Sample ID: LHSMW10-031408
Collection Time/Date:

## Pump Installation

Pump installation crew: Resuga
PID/FID reading (well head/background):
Casing diameter (inches): 4.11
Total well Depth (ft. BTOC): 22.80
Initial (pre-installation) DTW/time: DRY
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = _____ psi

Installation date/beginning time: 3/14/08 3:10
Installation date/completion time:
Screen Interval (ft. BTOC): _____ to _____
Pump intake depth (ft BTOC):
Post-installation DTW/time:
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/6" or 1/4"):
Inlet reducer used (Y/N):

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew:
Purge date/beginning time:
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = _____ psi

PID/FID reading (well head/background):
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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NM DRY

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
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10-20

## Sampling

Sampling beginning time:_____ Sampling completion time:_____

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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## Sample Information

Sample ID: No Sample well is DRY

Duplicate sample collected (Y/N):

Split sample collected (Y/N):

COC No(s):

Sample collection date/time:

Duplicate sample ID:

Split sample ID:

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
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Comments:

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHSmw11 Site 46
Project Name/#: 117591
Weather: Sunny / 85°F
Sampling location ID: Site 46
Sample ID: LHSMW11
Collection Time/Date: 9/7/07 12:20

## Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background): ____
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 27.75
Initial (pre-installation) DTW/time: 22.75
Final (after pump priming) DTW/time: ____
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): —
Discharge tube length (ft.): —
Installation date/beginning time: 9/7/07 10:35
Installation date/completion time: 9/7/07 10:50
Screen Interval (ft. BTOC): 17.75 to 27.75
Pump intake depth (ft BTOC): 25.25
Post-installation DTW/time: 22.63
Max. sustainable pump rate (mL/min): 100
Appearance of product: N
Discharge tube diameter (3/8" or 1/4"): —
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = ____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Beesinger
Purge date/beginning time: ~~10:50~~ 9/7/07 10:50
Initial (pre-purging) DTW (ft. BTOC): ____
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): —
Purge date/completion time: 9/7/07 12:20
Final (post-purging) DTW (ft. BTOC): 23.55
No. of tubing + pump volumes purged: —

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = ____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 30 | | | | | | | | |
| Refill Setting | 30 | | | | | | | | |
| Discharge Setting | 25 | | | | | | | | |
| Flow rate (mL/min) | 100 | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 11:00 | 22.83 | ~~100~~ | ~~0.0~~ | 24.24 | 5.36 | 6.26 | 14.9 | 3.27 | 240.8 |
| 11:05 | 22.95 | 100 | ~~0.0~~ 0.5 | 23.23 | 5.36 | 6.25 | 12.8 | 1.00 | 184.9 |
| 11:10 | ~~23.07~~ 23.07 | 100 | ~~0.0~~ 1.0 | 22.91 | 5.36 | 6.28 | 19.3 | .71 | 137.3 |
| 11:15 | 23.15 | 100 | ~~0.0~~ 1.5 | 22.89 | 5.37 | 6.29 | 22.6 | .70 | 123.2 |
| 11:20 | 23.21 | 100 | ~~0.0~~ 2.0 | 22.84 | 5.36 | 6.29 | 25.0 | .73 | 83.1 |
| 11:25 | 23.28 | 100 | ~~0.0~~ 2.5 | 22.52 | 5.37 | 6.30 | 27.2 | .75 | 80.6 |
| 11:30 | 23.30 | 100 | ~~0.0~~ 3.0 | 22.70 | 5.36 | 6.30 | 26.9 | .87 | 75.2 |
| 11:35 | 23.33 | 100 | ~~0.0~~ 3.5 | 22.90 | 5.37 | 6.33 | 25.4 | .93 | 72.1 |

00082316

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW 11

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
| 11:40 | 23.35 | 100 | ~~900~~ 11.0 | ~~23.10~~ | 5.40 | 6.34 | 24.2 | 1.63 | 70.5 |
| 11:45 | 23.38 | 100 | ~~1000~~ 11.5 | 23.21 | 5.42 | 6.36 | 23.9 | 2.06 | 68.3 |
| 11:50 | 23.40 | 100 | ~~1100~~ 12.0 | 23.25 | 5.41 | 6.33 | 19.9 | 2.15 | 65.2 |
| 11:55 | 23.42 | 100 | ~~1200~~ 12.5 | 23.28 | 5.41 | 6.32 | 19.4 | 2.69 | 40.3 |
| 12:00 | 23.45 | 100 | ~~1300~~ 13.0 | 23.28 | 5.40 | 6.32 | 19.8 | 2.74 | 35.6 |
| 12:05 | 23.47 | 100 | ~~1400~~ 13.5 | 23.30 | 5.39 | 6.32 | 21.1 | 2.66 | 17.6 |
| 12:10 | 23.49 | 100 | ~~1500~~ 14.0 | 23.32 | 5.39 | 6.31 | 21.7 | 2.64 | 17.5 |
| 12:15 | 23.53 | 100 | ~~1600~~ 14.5 | 23.33 | 5.40 | 6.31 | 21.5 | 2.67 | 17.1 |
| 12:20 | 23.55 | 100 | ~~1700~~ 15.0 | 23.33 | 5.41 | 6.31 | 21.8 | 2.69 | 17.0 |
| | | | (15) | | | | | | |
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## Sampling

Sampling beginning time: 12:20 Sampling completion time: 12:40

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 1220 | 23.53 | 100 | | 23.33 | 5.41 | 6.31 | 21.8 | 2.69 | 17.0 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: LHSmw11-090709 Sample collection date/time: 9/7/07 12:20

Duplicate sample collected (Y/N): N Duplicate sample ID: —

Split sample collected (Y/N): N Split sample ID: —

COC No(s): _____

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL metals filtered | | 1-500 ml plastic | | | |
| TAL metals unfiltered | | " " " | | | |
| Total Dissolved Solids | | " " " | | | |
| Total Suspended Solids | | " " " | | | |
| | | | | | |

**Comments:**

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082317

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009B830
Weather: Clear 65°F
Sampling location ID: Site 46
Sample ID: LHSMW11-031508
Collection Time/Date: 9:30 3/15/08

## Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background):
Casing diameter (inches): 4+1
Total well Depth (ft. BTOC): 26.90
Initial (pre-installation) DTW/time: 23.35
Final (after pump priming) DTW/time: 23.72
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = _____ psi

Installation date/beginning time: 3/15/08 7:50
Installation date/completion time: 3/15/08 8:00
Screen Interval (ft. BTOC): 16.90 to 26.90
Pump intake depth (ft BTOC): 23.00
Post-installation DTW/time: 23.20
Max. sustainable pump rate (mL/min): 100
Appearance of product: NA
Discharge tube diameter (3/8" or 1/4"):
Inlet reducer used (Y/N): N

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Beesinger
Purge date/beginning time: 3/15/08 8:00
Initial (pre-purging) DTW (ft. BTOC): 23.20
Calculated tubing + pump volume: NA
Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = _____ psi

PID/FID reading (well head/background):
Purge date/completion time: 3/15/08 9:30
Final (post-purging) DTW (ft. BTOC): 23.72
No. of tubing + pump volumes purged:

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 18 | | | | | | | | |
| Refill Setting | 15 | | | | | | | | |
| Discharge Setting | 18 | | | | | | | | |
| Flow rate (mL/min) | 100 | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 8:10 | 23.50 | 100 | 1000 | 18.46 | 5.297 | 6.40 | 129.2 | 0.01 | 90.7 |
| 8:15 | 23.55 | 100 | 1500 | 18.35 | 5.321 | 6.37 | 133.4 | 0.04 | 74.7 |
| 8:20 | 23.60 | 100 | 2000 | 18.27 | 5.334 | 6.35 | 133.7 | 0.23 | 63.2 |
| 8:25 | 23.65 | 100 | 2500 | 18.24 | 5.338 | 6.34 | 128.5 | 0.65 | 63.7 |
| 8:30 | 23.68 | 100 | 3000 | 18.24 | 5.339 | 6.33 | 124.4 | 0.86 | 58.5 |
| 8:35 | 23.70 | 100 | 3500 | 18.24 | 5.339 | 6.33 | 121.2 | 0.99 | 53.1 |
| 8:40 | 23.71 | 100 | 4000 | 18.20 | 5.341 | 6.33 | 119.4 | 0.98 | 48.5 |
| 8:45 | 23.72 | 100 | 4500 | 18.20 | 5.341 | 6.32 | 119.8 | 0.98 | 47.1 |

00082318

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW11

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity ±3% (uMhos/cm) | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
| 8:50 | 23.72 | 100 | 5000 | 18.18 | 5.341 | 6.32 | 121.6 | 1.03 | 43.7 |
| 8:55 | 23.72 | 100 | 5500 | 18.18 | 5.340 | 6.32 | 124.1 | 1.04 | 41.1 |
| 9:00 | 23.72 | 100 | 6000 | 18.20 | 5.341 | 6.31 | 127.4 | 1.09 | 38.5 |
| 9:05 | 23.72 | 100 | 6500 | 18.22 | 5.342 | 6.31 | 129.8 | 1.10 | 35.3 |
| 9:10 | 23.72 | 100 | 7000 | 18.23 | 5.342 | 6.31 | 131.2 | 1.11 | 33.9 |
| 9:15 | 23.72 | 100 | 7500 | 18.26 | 5.342 | 6.31 | 131.4 | 1.12 | 26.7 |
| 9:20 | 23.72 | 100 | 8000 | 18.27 | 5.343 | 6.31 | 131.2 | 1.13 | 20.1 |
| 9:25 | 23.72 | 100 | 8500 | 18.27 | 5.341 | 6.31 | 131.3 | 1.14 | 17.0 |
| 9:30 | 23.72 | 100 | 9000 | 18.28 | 5.342 | 6.32 | 132.6 | 1.13 | 12.3 |
| | | | | | | | | | |
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20

## Sampling

Sampling beginning time: 9:30 Sampling completion time: 9:32

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 9:32 | 23.72 | 100 | 9200 | 18.28 | 5.342 | 6.32 | 132.0 | 1.13 | 11.5 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: LHSMW11-031508 Sample collection date/time: 3/15/08 9:30

Duplicate sample collected (Y/N): Duplicate sample ID:

Split sample collected (Y/N): Split sample ID:

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOA | | 2-40 ml glass | | | |
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| | | | | | |

Comments:

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082319

# WELL DEVELOPMENT RECORD

LHAAP-46

WELL/PIEZOMETER ID LHSMW11

SHEET 1 of 1

PROJECT NAME: Longhorn PROJECT NO.: 117591 DATE: 10/18/08

LOCATION: Karnack, Tx DATE INSTALLED: Redevelopment

TOTAL DEPTH (FTOC) 26.90 CASING DIAMETER 4"

METHODS OF DEVELOPMENT

☐ Swabbing ☒ Bailing ☐ Pumping ☐ Describe

Equipment decontaminated prior to development ☐ Yes ☐ NO

Describe 3-part rinse; potable water, alconox + $H_2O$, DI water

EQUIPMENT NUMBERS:

pH Meter YSI 6280 EC Meter YSI 6280 Turbidity Meter YSI 6280 Thermometer YSI 6280

CASING VOLUME INFORMATION:

| Casing ID (inch) | 1.0 | 1.5 | 2.0 | 2.2 | 3.0 | 4.0 | 4.3 | 5.0 | 6.0 | 7.0 | 8.0 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Unit Casing Volume (A) (gal/ft) | 0.04 | 0.09 | 0.16 | 0.2 | 0.37 | 0.65 | 0.75 | 1.0 | 1.5 | 2.0 | 2.6 |

PURGING INFORMATION:

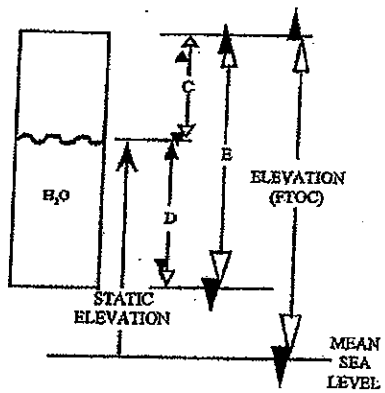
Measured Well Depth (B) 26.90 ft.

Measured Water Level Depth (C) 23.97 ft.

Length of Static Water Column (D) 26.90 (B) - 23.97 (C) = 2.93 ft.

Casing Water Volume (E) = 0.65 (A) x 2.93 (D) = 1.90 gal

Total Purge Volume = 3.4 (gal)




| Date | Time | Water Level (FTOC) | Volume Removed (gal) | pH | EC | Temperature F or C | Turbidity/ Sand (ppm) | Comments |
|---|---|---|---|---|---|---|---|---|
| 10/18/08 | 13:30 | MR | 2.4 | 6.31 | 5.251 | 18.17 | 308.1 | murky |

10/18/08

FIGURE 5

00082320

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

LHSMW-11

Operable Unit/Site ID: LHAAP-46
Project Name/#: Longhorn
Weather: clear, 40s
Sampling location ID: ~~LHMW~~ LHSMW-11
Sample ID: LHSMW11 - 102708
Collection Time/Date: 12:15 10-27-08

## Pump Installation

Pump installation crew: A. Willmore / R. Wagner
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~~29~~26.90
Initial (pre-installation) DTW/time: 23.93
Final (after pump priming) DTW/time: NA
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 28'
Installation date/beginning time: 10-27-08 11:00
Installation date/completion time: 10-27-08 11:07
Screen Interval (ft. BTOC): 16.5 ~~+25~~ to ~~295~~ 265
Pump intake depth (ft BTOC): 25'
Post-installation DTW/time: 23.93
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore / R. Wagner
Purge date/beginning time: 10-27-08 11:07
Initial (pre-purging) DTW (ft. BTOC): 23.93
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 10-27-08
Final (post-purging) DTW (ft. BTOC): 23.65
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NA psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | NA | | | | | | | | NA |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | 100 | | | | | | | | 100 |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 11:12 | 23.65 | 100 | 0.5 | 18.20 | 5.204 | 6.30 | 20.9 | 4.14 | 246.7 |
| 11:17 | | 100 | 1.0 | 18.53 | 5.235 | 6.28 | 56.7 | 4.48 | 167.6 |
| 11:22 | | 100 | 1.5 | 18.74 | 5.247 | 6.28 | 82.2 | 4.44 | 153.7 |
| 11:27 | | 100 | 2.0 | 17.86 | 5.249 | 6.30 | 117.6 | 6.82 | 135.9 |
| 11:32 | | 100 | 3.0 | 17.11 | 5.250 | 6.24 | 121.2 | 6.66 | 116.2 |
| 11:47 | | 100 | 4.0 | 16.34 | 5.251 5.252 | 6.32 | 118.9 | 7.88 | 96.9 |
| 11:57 | | 100 | 5.0 | 15.87 | ~~5.252~~ | 6.32 | 115.6 | 7.76 | 84.8 |
| 12:07 | | 100 | 6.0 | 15.51 | 5.253 | 6.32 | 111.3 | 7.76 | 75.3 |

00082321

# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

LHSMW-11

**Water Quality Parameter Measurements (continued)**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
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10/27/08

10-<20

## Sampling

Sampling beginning time: 12:15 Sampling completion time: 12:25

**Water Quality Parameter Measurements**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 12:32 | 23.65 | 100 | 8.5 | 15.49 | 5.253 | 6.32 | 110.8 | 7.76 | 65.3 |
| | | | | | | | | | |
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## Sample Information

Sample ID: LHSMW11-102708

Sample collection date/time: 10.27.08 12:15

Duplicate sample collected (Y/N): N

Duplicate sample ID: NA

Split sample collected (Y/N): N

Split sample ID: NA

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL METALS | | 1-500 mL HDPE | | | |
| | | | | | |
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Comments: Purged & Sampled w/ peristaltic pump
Used Filter (10 µ) to sample

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

# Intermediate Zone Wells

# 2007 and 2008

# Field Documentation

00082323

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009B830
Weather: SUNNY 51°F

Sampling location ID: SITE 58
Sample ID: 35AWW001-020608
Collection Time/Date: 4:30 02/06/08

## Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background):
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 72.22
Initial (pre-installation) DTW/time: 38.22
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):

Installation date/beginning time: 2/6/08 2:45
Installation date/completion time: 2/6/08 3:00
Screen Interval (ft. BTOC): 62.22 to 72.22
Pump intake depth (ft BTOC): 67.00
Post-installation DTW/time: 38.11
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
Inlet reducer used (Y/N):

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = ____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Beesinger
Purge date/beginning time: 2/6/08 3:00
Initial (pre-purging) DTW (ft. BTOC): 38.10
Calculated tubing + pump volume: NA

PID/FID reading (well head/background):
Purge date/completion time: 2/6/08 4:30
Final (post-purging) DTW (ft. BTOC): 38.40
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**

Initial air pressure = H (ft.) X 0.43 = ____ psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 4.5 | | | | | | | | |
| Refill Setting | 4.5 | | | | | | | | |
| Discharge Setting | 40 | | | | | | | | |
| Flow rate (mL/min) | 150 | | | | | | | | |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 3:05 | 38.35 | 150 | .750 | 18.81 | 0.867 | 6.64 | -29.3 | 1.15 | 214.9 |
| 3:10 | 38.38 | 150 | 1.500 | 18.94 | 0.815 | 6.65 | -25.3 | 0.66 | 210.1 |
| 3:15 | 38.40 | 150 | 2.250 | 18.97 | 0.804 | 6.68 | -22.4 | 0.50 | 249.1 |
| 3:20 | 38.40 | 150 | 3.000 | 18.96 | 0.802 | 6.69 | -23.7 | 0.43 | 256.9 |
| 3:25 | 38.40 | 150 | 3.750 | 18.85 | 0.801 | 6.69 | -23.2 | 0.39 | 274 |
| 3:30 | 38.40 | 150 | 4.500 | 18.71 | 0.801 | 6.68 | -23.3 | 0.37 | 248.0 |
| 3:35 | 38.40 | 150 | 5.250 | 18.43 | 0.801 | 6.67 | -23.0 | 0.35 | 226.8 |
| 3:40 | 38.40 | 150 | 6.000 | 18.41 | 0.800 | 6.66 | -22.1 | 0.36 | 217.0 |

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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
| 3:45 | 38.40 | 150 | 6,750 | 18.36 | 0.800 | 6.64 | -21.2 | 0.38 | 188.7 |
| 3:50 | 38.40 | 150 | 7,500 | 18.34 | 0.800 | 6.63 | -21.0 | 0.39 | 187.0 |
| 3:55 | 38.40 | 150 | 8250 | 18.23 | 0.800 | 6.63 | -21.5 | 0.42 | 160.3 |
| 4:00 | 38.40 | 150 | 9000 | 18.19 | 0.800 | 6.62 | -21.8 | 0.45 | 129.1 |
| 4:05 | 38.40 | 150 | 9750 | 18.17 | 0.800 | 6.62 | -21.4 | 0.47 | 86.3 |
| 4:10 | 38.40 | 150 | 10,500 | 18.11 | 0.800 | 6.60 | -20.7 | 0.47 | 50.1 |
| 4:15 | 38.40 | 150 | 11,250 | 18.12 | 0.800 | 6.60 | -20.5 | 0.44 | 32.3 |
| 4:20 | 38.40 | 150 | 12,000 | 18.12 | 0.800 | 6.60 | -20.1 | 0.48 | 25.2 |
| 4:25 | 38.40 | 150 | 12,750 | 18.13 | 0.800 | 6.60 | -20.3 | 0.48 | 21.1 |
| 4:30 | 38.40 | 150 | 13,500 | 18.13 | 0.800 | 6.60 | -20.5 | 0.48 | 19.8 |
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## Sampling

Sampling beginning time: 4:30 Sampling completion time: 4:32

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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## Sample Information

Sample ID: 35AWW01-020608 Sample collection date/time: 2/6/08 4:30

Duplicate sample collected (Y/N): Duplicate sample ID:

Split sample collected (Y/N): Split sample ID:

COC No(s):

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOC | | 3-40ml glass | | | |
| | | | | | |
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Comments:

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00082325

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Site 36A
Project Name/#: Longhorn AAP/ 117591
Weather: ~~Sunny~~ clear, Cool

Sampling location ID: 36AWW01
Sample ID: 36AWW01-111908
Collection Time/Date: 15:15 11/19/08

## Pump Installation

Pump installation crew: A. Willmore
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 72.45
Initial (pre-installation) DTW/time: 38.98
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): ~~approx~~ 71

Installation date/beginning time: 11/19/08 14:41
Installation date/completion time: 11/19/08 15:45
Screen Interval (ft. BTOC): 62 to 72
Pump intake depth (ft BTOC): 68
Post-installation DTW/time: 38.98
Max. sustainable pump rate (mL/min): 100
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | NA | | | | | |
| Refill Setting | | | | | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore
Purge date/beginning time: 11/19/08 14:46
Initial (pre-purging) DTW (ft. BTOC): 28.91
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/19/08
Final (post-purging) DTW (ft. BTOC): 39.31
No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 54 | | | | | | | | 54 |
| Refill Setting | 10 | | | | | | | | 10 |
| Discharge Setting | 6 | | | | | | | | 5 |
| Flow rate (mL/min) | 100 | | | | | | | | 100 |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH (switch) | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 14:51 | 38.99 | 100 | 0.5 | 20.05 | 0.946 | -19.1 | 6.70 | 0.98 | 9.2 |
| 14:56 | 39.31 | 100 | 1.0 | 20.07 | 0.932 | -23.4 | 6.71 | 0.92 | 7.8 |
| 15:01 | 39.31 | 100 | 1.5 | 20.09 | 0.911 | -21.1 | 6.71 | 0.91 | 5.2 |
| 15:06 | 39.31 | 100 | 2.0 | 20.04 | 0.912 | -20.3 | 6.76 | 0.89 | 4.1 |
| | | | | | | | | | |
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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AWW01

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% 10/20 |
|---|---|---|---|---|---|---|---|---|---|
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11/19/08

## Sampling

Sampling beginning time: 15:15 Sampling completion time: 15:25

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 15:30 | 39.31 | 600 | 4.0 | 20.03 | 0.901 | 6.77 | -19.2 | 0.88 | 3.4 |
| | | | | | | | | | |
| | | | | | | | | | |
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## Sample Information

Sample ID: 35AWW01-111908
Duplicate sample collected (Y/N): N
Split sample collected (Y/N): N
COC No(s): N/A

Sample collection date/time: 11/19/08 16:15
Duplicate sample ID: NA
Split sample ID: NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL Metals | 6020 | 1-500 mL HDPE | | | |
| VOCs | 8260 | 3-40mL vog vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Purged & sampled w/ bladder pump.
No filter used

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

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# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Site 35 | Sampling location ID: 35AWW05
Project Name/#: Longhorn AAP/ 117591 | Sample ID: 35AWW05-112108
Weather: ptly cloudy, cool, good | Collection Time/Date: 17:30 11/21/08

## Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist | Installation date/beginning time: 11/21/08 16:45
PID/FID reading (well head/background): 0.0 | Installation date/completion time: 11/21/08 14:46
Casing diameter (inches): 4" | Screen Interval (ft. BTOC): 61 to 71
Total well Depth (ft. BTOC): 71.85 | Pump intake depth (ft BTOC): 66
Initial (pre-installation) DTW/time: 41.98 | Post-installation DTW/time: 41.76 16:50
Final (after pump priming) DTW/time: NA | Max. sustainable pump rate (mL/min): 100
Free product (circle): LNAPL / DNAPL | Appearance of product: None
Volume of water removed during priming (mL): NA | Discharge tube diameter (3/8" or 1/4"): 1/4"
Discharge tube length (ft.): 69 | Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NA | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: A. Willmore | PID/FID reading (well head/background): 0.0
Purge date/beginning time: 11/21/08 | Purge date/completion time: 11/21/08
Initial (pre-purging) DTW (ft. BTOC): 41.74 | Final (post-purging) DTW (ft. BTOC): 42.01
Calculated tubing + pump volume: NA | No. of tubing + pump volumes purged: NA

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 74 | | | | | | | | 74 |
| Refill Setting | 10 | | | | | | | | 10 |
| Discharge Setting | 6 | | | | | | | | 5 |
| Flow rate (mL/min) | 100 | | | | | | | | 100 |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 17:07 | 42.01 | 100 | 0.5 | 21.38 | 2.818 | 7.19 | -168.3 | 1.01 | 10.1 |
| 17:10 | 42.01 | 100 | 1.0 | 21.21 | 2.814 | 7.18 | -121.5 | 0.81 | 10.3 |
| 17:15 | 42.01 | 100 | 1.5 | 21.18 | 2.814 | 7.15 | -121.4 | 0.78 | 9.1 |
| 17:20 | 42.01 | 100 | 2.0 | 21.08 | 2.814 | 7.15 | -120.1 | 0.76 | 8.2 |
| 17:40 | | | | | | | | | |
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# GROUNDWATER SAMPLING FORM

Sheet 2 of 2

35AWW05

**Water Quality Parameter Measurements (continued)**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ± 10% | ±3% Electrical Conductivity (uMhos/cm) | pH ± 0.1 | Eh (mv) ± 10 | DO (mg/L) ± 10% | Turbidity (NTU) ± 10% |
|---|---|---|---|---|---|---|---|---|---|
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10/20

12/21/08

## Sampling

Sampling beginning time: 17:30 Sampling completion time: 17:35

**Water Quality Parameter Measurements**

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 17:40 | 42.01 | 100 | ~~3.0~~ 3.5 | 21.03 | 2.818 | 7.14 | -119.4 | 0.73 | 2.1 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 35AWW05 -112108 Sample collection date/time: 11.21.08 17:38

Duplicate sample collected (Y/N): N Duplicate sample ID: NA

Split sample collected (Y/N): N Split sample ID: NA

COC No(s): NA

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| TAL METALS | | 1-500mL HDPE | | | |
| VOC | | 3-40 mL VOA vials | | | |
| | | | | | |
| | | | | | |
| | | | | | |

**Comments:** Purged & Sampled w/ bladder pump. No filter used.

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

# Deep Zone Well

# 2007 and 2008

# Field Documentation

00082330

# GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-36A
Project Name/#: Longhorn AAP
Weather: cloudy, 40s

Sampling location ID: 35AWW02
Sample ID: 35AWW02-112608
Collection Time/Date: 09:35 11.26.08

## Pump Installation

Pump installation crew: A. Willmon / A. Gilchrist
PID/FID reading (well head/background): 0.2
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~148
Initial (pre-installation) DTW/time: 46.67
Final (after pump priming) DTW/time: N/A
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): N/A
Discharge tube length (ft.): 138'

Installation date/beginning time: 11/26/08 9:00
Installation date/completion time: 11/26/08 9:04
Screen Interval (ft. BTOC): 136 to 146
Pump intake depth (ft BTOC): 135'
Post-installation DTW/time: 46.31
Max. sustainable pump rate (mL/min): 200
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4
Inlet reducer used (Y/N): N

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | | | | | | | | | |
| Refill Setting | | | | NR | | | | | |
| Discharge Setting | | | | | | | | | |
| Flow rate (mL/min) | | | | | | | | | |

## Purging

Purging/sampling crew: Allen Willmon / A. Gilchrist
Purge date/beginning time: 11/26/08 09:05
Initial (pre-purging) DTW (ft. BTOC): 46.31
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 6.0
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC): 47.16
No. of tubing + pump volumes purged:

**Pneumatic Controller Tuning:**
Initial air pressure = H (ft.) X 0.43 = NR psi

| | Initial | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Final |
|---|---|---|---|---|---|---|---|---|---|
| Pressure (psi) | 87 | | | | | | | | 87 |
| Refill Setting | 10 | | | | | | | | 10 |
| Discharge Setting | 5 | | | | | | | | 5 |
| Flow rate (mL/min) | 100 | | | | | | | | 100 |

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 09:10 | 46.82 | 100 | 0.5 | 17.60 | 1.208 | 8.30 | -86.2 | 1.58 | 4.3 |
| 09:15 | 47.14 | 100 | 1.0 | 17.90 | 1.128 | 8.77 | -115.2 | 1.08 | 1.5 |
| 09:20 | 47.16 | 100 | 1.5 | 18.19 | 1.115 | 8.98 | -135.6 | 0.86 | 0.0 |
| 09:25 | 47.16 | 100 | 2.0 | 18.19 | 1.113 | 8.99 | -138.3 | 0.81 | 0.0 |
| 09:30 | 47.16 | 100 | 2.5 | 18.20 | 1.112 | 9.0 | -138.3 | 0.81 | 0.0 |
| ~~09:35~~ | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

00082331

# GROUNDWATER SAMPLING FORM

Sheet 2 of 3

35AWW02

## Water Quality Parameter Measurements (continued)

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) ±10% | Electrical Conductivity (uMhos/cm) ±3% | pH ±0.1 | Eh (mv) ±10 | DO (mg/L) ±10% | Turbidity (NTU) ±10% |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
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| | | | | | | | | | |
| | | | | | | | | | |

11/26/09

10-20

## Sampling

Sampling beginning time: 09:35 Sampling completion time: 09:55

### Water Quality Parameter Measurements

| Time | DTW (ft. BTOC) | Purge Rate (mL/min) | Cumulative Volume Purged (L) | Temp. (degree C) | Electrical Conductivity (uMhos/cm) | pH | Eh (mv) | DO (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|---|
| 10:00 | 47.16 | 100 | 5.5 | 18.25 | 1.112 | 9.1 | -141.2 | 0.81 | 0.0 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## Sample Information

Sample ID: 35AWW02-112608 Sample collection date/time: 11-26-08 09:35

Duplicate sample collected (Y/N): Y Duplicate sample ID: 35AWW02-112608-FD

Split sample collected (Y/N): N Split sample ID: NA

COC No(s): NR

| Requested Analysis | Method | Containers | Requested Analysis | Method | Containers |
|---|---|---|---|---|---|
| VOCs | | 6-40 mL Voa Vials | | | |
| TAL Metals | | 2-500mL HDPE | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Comments: Sampled & Purged w/ 1.5" SS Bladder pump.

Took Field Duplicate

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

# *Appendix C*

# *Basis of Estimate for LHAAP-35A(58) Remediation*

# Alternative 2, MNA with LUCs
# Present Value

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **COMPANY NAME:** | | **SHAW E & I** | | | | | | | |
| | | | **PROJECT LOCATION:** | | **KARNACK, TEXAS** | | | | **DATE:** | **JUNE 2009** | | |
| | | | | | | | | | | | | |
| Year | **FY** | | **Capital Costs** | | **O & M Costs** | | | | | **Present Value (NPV)** | | |
| | | | | | | | | | | **Discount Rate** | **Capital** | **O & M** |
| | | | | | **MNA** | **LTM** | | **Total** | | 2.8% | | |
| | | | | | | | | | | **NPV** | **60,514** | **432,342** |
| 1 | 2009 | | 60,513 | | 50,350 | | | 50,350 | | | | |
| 2 | 2010 | | 0 | | 50,350 | | | 50,350 | | | **Total NPV** | |
| 3 | 2011 | | 0 | | | 24,555 | | 24,555 | | | **492,856** | |
| 4 | 2012 | | 0 | | | 24,555 | | 24,555 | | | | |
| 5 | 2013 | | 0 | | | 67,080 | | 67,080 | | | | |
| 6 | 2014 | | 0 | | | 15,549 | | 15,549 | | | | |
| 7 | 2015 | | 0 | | | 15,549 | | 15,549 | | | | |
| 8 | 2016 | | 0 | | | 15,549 | | 15,549 | | | | |
| 9 | 2017 | | 0 | | | 15,549 | | 15,549 | | | | |
| 10 | 2018 | | 0 | | | 58,071 | | 58,071 | | | | |
| 11 | | | | | | | | 0 | | | | |
| 12 | | | | | | | | 0 | | | | |
| 13 | | | | | | | | 0 | | | | |
| 14 | | | | | | | | 0 | | | | |
| 15 | | | | | | 58,071 | | 58,071 | | | | |
| 16 | | | | | | | | 0 | | | | |
| 17 | | | | | | | | 0 | | | | |
| 18 | | | | | | | | 0 | | | | |
| 19 | | | | | | | | 0 | | | | |
| 20 | | | | | | 58,071 | | 58,071 | | | | |
| 21 | | | | | | | | 0 | | | | |
| 22 | | | | | | | | 0 | | | | |
| 23 | | | | | | | | 0 | | | | |
| 24 | | | | | | | | 0 | | | | |
| 25 | | | | | | 58,071 | | 58,071 | | | | |
| 26 | | | | | | | | 0 | | | | |
| 27 | | | | | | | | 0 | | | | |
| 28 | | | | | | | | 0 | | | | |
| 29 | | | | | | | | 0 | | | | |
| 30 | | | | | | 58,071 | | 58,071 | | | | |
| | | | | | | | | | | | | |
| | | | 60,513 | | 100,701 | 468,740 | 0 | 569,441 | | | | |

# Alternative 2
# MNA with LUCs

| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | DATE: | JUNE 2009 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | | | | |
| Item | | | | | | LABOR | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | **Year 1** | | | | | | | | | | | | | | |
| | **Capitol costs** | | | | | | | | | | | | | | |
| 1 | Allowance for Legal Fees, Administration Controls, and Documentation | 1 | lot | | | | | | | | | | 15,000 | 15,000 | 15,000 |
| 2 | Establish initial database, licenses, work plans | 1 | ea | 300 | 300 | eng | 81.60 | 24,480 | 5,000 | 5,000 | | | 5,000 | 5,000 | 34,480 |
| | **Capital Costs Subtotal** | | | | | | | **24,480** | | **5,000** | | **0** | | **20,000** | **49,480** |
| | Taxes @ 6.5 % | | | | | | | | | 325 | | | | | 325 |
| | **Subtotal** | | | | | | | | | | | | | | **49,805** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 10,708 |
| | **Year 1 total Capital costs** | | | | | | | | | | | | | | **$ 60,513** |
| | **Year 1 MNA Monitoring (under O&M costs)** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples quarterly (GW) | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 2 | Sample analysis (VOCs, MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| | **Subtotal** | | | | | | | **22,780** | | **3,670** | | **1,152** | | **13,600** | **41,202** |
| | Taxes @ 6.5 % | | | | | | | | | 239 | | | | | 239 |
| | **Subtotal** | | | | | | | | | | | | | | **41,441** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,910 |
| | **Year 1 total O&M** | | | | | | | | | | | | | | **$ 50,350** |
| | **Year 2 MNA** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples quarterly | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 2 | Sample analysis (VOCs, MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| | **Subtotal** | | | | | | | **22,780** | | **3,670** | | **1,152** | | **13,600** | **41,202** |
| | Taxes @ 6.5 % | | | | | | | | | 239 | | | | | 239 |
| | **Subtotal** | | | | | | | | | | | | | | **41,441** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,910 |
| | **Year 2 total O&M** | | | | | | | | | | | | | | **$ 50,350** |

# Alternative 2
# MNA with LUCs

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMPANY NAME: | | | SHAW E & I | | | | | | | | | |
| | | | | PROJECT LOCATION: | | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | | | LABOR | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | | TOTAL ($) |
| | **Years 3 and 4** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | | 22,232 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | | 7,200 |
| 3 | Annual report | 2 | ea | 64 | 128 | eng | 81.60 | 10,440 | 150 | 300 | | | | | | 10,740 |
| | **Subtotal** | | | | | | | **28,000** | | **3,820** | | **1,152** | | **7,200** | | **40,172** |
| | Taxes @ 6.5 % | | | | | | | | | 248 | | | | | | 248 |
| | **Subtotal** | | | | | | | | | | | | | | | **40,420** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | | 8,690 |
| | **Years 3 and 4 total O&M** | | | | | | | | | | | | | | | **49,111** |
| | **Annual Total** | | | | | | | | | | | | | | **$** | **24,555** |
| | **Year 5** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 16 | ea | 16 | 256 | tech | 34.30 | 8,780 | 110 | 1,760 | 36 | 576 | | | | 11,116 |
| 2 | Sample analysis (VOCs) | 16 | ea | | | | | | | | | | 225 | 3,600 | | 3,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | | 5,370 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | | 35,000 |
| | **Subtotal** | | | | | | | **14,000** | | **1,910** | | **576** | | **3,600** | | **55,086** |
| | Taxes @ 6.5 % | | | | | | | | | 124 | | | | | | 124 |
| | **Subtotal** | | | | | | | | | | | | | | | **55,210** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | | 11,870 |
| | **Year 5 total O&M** | | | | | | | | | | | | | | **$** | **67,080** |
| | **Years 6 thru 9** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | | 22,232 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | | 7,200 |
| 3 | Annual report/inpection | 4 | ea | 64 | 256 | eng | 81.60 | 20,890 | 150 | 600 | | | | | | 21,490 |
| | **Subtotal** | | | | | | | **38,450** | | **4,120** | | **1,152** | | **7,200** | | **50,922** |
| | Taxes @ 6.5 % | | | | | | | | | 268 | | | | | | 268 |
| | **Subtotal** | | | | | | | | | | | | | | | **51,189** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | | 11,006 |
| | **Years 6 through 9 total O&M** | | | | | | | | | | | | | | | **62,195** |
| | **Annual Total** | | | | | | | | | | | | | | **$** | **15,549** |

# Alternative 2
# MNA with LUCs

| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | DATE: | JUNE 2009 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | | | | | |
| Item | | | | | LABOR | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) | |
| | **Year 10** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples annually | 8 | ea | 16 | 128 | tech | 34.30 | 4,390 | 110 | 880 | 36 | 288 | | | 5,558 | |
| 2 | Sample analysis (VOCs) | 8 | ea | | | | | | | | | | 225 | 1,800 | 1,800 | |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 | |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 | |
| | **Subtotal** | | | | | | | **9,610** | | **1,030** | | **288** | | **1,800** | **47,728** | |
| | Taxes @ 6.5 % | | | | | | | | | 67 | | | | | 67 | |
| | **Subtotal** | | | | | | | | | | | | | | **47,795** | |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 10,276 | |
| | **Year 10 total O&M** | | | | | | | | | | | | | | **$ 58,071** | |
| | **Years 15, 20, 25, and 30 LTM** | | | | | | | | | | | | | | | |
| | Cost for one event | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples once every 5 yrs | 8 | ea | 16 | 128 | tech | 34.30 | 4,390 | 110 | 880 | 36 | 288 | | | 5,558 | |
| 2 | Sample analysis (VOCs) | 8 | ea | | | | | | | | | | 225 | 1,800 | 1,800 | |
| 3 | Event report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 | |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 | |
| | **Subtotal** | | | | | | | **9,610** | | **1,030** | | **288** | | **1,800** | **47,728** | |
| | Taxes @ 6.5 % | | | | | | | | | 67 | | | | | 67 | |
| | **Subtotal** | | | | | | | | | | | | | | **47,795** | |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 10,276 | |
| | **One Event Total** | | | | | | | | | | | | | | **$ 58,071** | |
| | **Years 15, 20, 25, and 30 total O&M** | | | | | | | | | | | | | | **290,354** | |

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM
# Present Value

**COMPANY NAME:** SHAW E & I
**PROJECT LOCATION:** KARNACK, TEXAS **DATE:** JUNE 2009

| Year | FY | Capital Costs | O & M Costs | | | | Present Value (NPV) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Discount Rate | Capital | O & M |
| | | | L T Monitor | Bioremed | | Total | 2.6% | | |
| 1 | 2009 | 860,090 | 118,108 | | | 118,108 | NPV | 860,091 | 483,077 |
| 2 | 2010 | 0 | 50,352 | 113,412 | | 163,765 | | | |
| 3 | 2011 | 0 | 24,556 | | | 24,556 | | NPV Total | |
| 4 | 2012 | 0 | 24,556 | | | 24,556 | | 1,343,168 | |
| 5 | 2013 | 0 | 67,081 | | | 67,081 | | | |
| 6 | 2014 | 0 | 15,549 | | | 15,549 | | | |
| 7 | 2015 | 0 | 15,549 | | | 15,549 | | | |
| 8 | 2016 | 0 | 15,549 | | | 15,549 | | | |
| 9 | 2017 | 0 | 15,549 | | | 15,549 | | | |
| 10 | 2018 | 0 | 58,071 | | | 58,071 | | | |
| 11 | 2019 | | | | | | | | |
| 12 | 2020 | | | | | | | | |
| 13 | 2021 | | | | | | | | |
| 14 | 2022 | | | | | | | | |
| 15 | 2023 | | | | | | | | |
| 16 | 2024 | | | | | | | | |
| 17 | 2025 | | | | | | | | |
| 18 | 2026 | | | | | | | | |
| 19 | 2027 | | | | | | | | |
| 20 | 2028 | | | | | | | | |
| 21 | 2029 | | | | | | | | |
| 22 | 2030 | | | | | | | | |
| 23 | 2031 | | | | | | | | |
| 24 | 2032 | | | | | | | | |
| 25 | 2033 | | | | | | | | |
| 26 | 2034 | | | | | | | | |
| 27 | 2035 | | | | | | | | |
| 28 | 2036 | | | | | | | | |
| 29 | 2037 | | | | | | | | |
| 30 | 2038 | | | | | | | | |
| | | | | | | | | | |
| | | 860,090 | 404,923 | 113,412 | 0 | 518,335 | | | |

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM
## In Situ Bioremediation

**COMPANY NAME:** SHAW E & I
**PROJECT LOCATION:** KARNACK, TEXAS
**DATE:** JUNE 2009

| Item | | | | LABOR | | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | **Field Work** | | | | | | | | | | | | | | |
| | **YEAR 1** | | | | | | | | | | | | | | |
| 1 | Work plans, safety plans | 1 | ea | 240 | 240 | eng | 81.60 | 19,584 | 200 | 200 | | | | | 19,784 |
| 2 | UIC Permit and Design | 1 | ea | 160 | 160 | eng/geol | 91.50 | 14,640 | 200 | 200 | | | | | 14,840 |
| 3 | Treatability Study | 1 | ea | 120 | 120 | eng | 81.60 | 9,792 | 200 | 200 | | | | | 9,992 |
| 3 | Treatability Sample Collection | 1 | hr | 50 | 50 | eng/geol | 91.50 | 4,575 | | | | | | | 4,575 |
| 3 | Driller for Treatability Sampling | 2 | wells | | | | | | | | | | 4000 | 8,000 | 8,000 |
| 3 | Per Diem and Travel Costs | 4 | days | | | | | | 50 | 200 | 80 | 320 | 109 | 436 | 956 |
| 3 | Mob / Demob | 1 | ea | 40 | 40 | eng | 81.60 | 3,264 | 1,200 | 1,200 | 1,000 | 1,000 | | | 5,464 |
| 4 | Field H&S | 1 | hr | 160 | 160 | h/s | 55.70 | 8,912 | 50 | 50 | 160 | 160 | | | 9,122 |
| 5 | Field Super/Geolog | 1 | hr | 160 | 160 | super | 72.30 | 11,568 | | | 2,825 | 2,825 | | | 14,393 |
| 6 | Vehicles | 45 | day | | | | | | 10 | 450 | 80 | 3,600 | | | 4,050 |
| 7 | Per Diem | 90 | day | | | | | | | | | | 99 | 8,910 | 8,910 |
| 8 | Driller Mob/Demob | 1 | ea | | | | | | | | | | 1200 | 1,200 | 1,200 |
| 9 | Install injection wells, 30' dpt, 2" dia. (10 fixed /60 p | 70 | ea | | | | | | | | | | 3,150 | 220,500 | 220,500 |
| 10 | Well survey | 1 | ea | | | | | | | | | | 3,000 | 3,000 | 3,000 |
| 11 | Well drill waste disposal | 20 | drum | | | | | | | | | | 250 | 5,000 | 5,000 |
| 12 | Collect & prepare well waste drum samples | 20 | ea | 12 | 240 | tech | 34.30 | 8,232 | 60 | 1,200 | 36 | 720 | | | 10,152 |
| 13 | Sample analysis (Waste Char) | 20 | ea | | | | | | | | | | 1,500 | 30,000 | 30,000 |
| 14 | Bioaugmentation materials | 14 | ea | | | | | | 12,000 | 168,000 | 10,000 | 140,000 | | | 308,000 |
| 15 | Collect and prepare samples (2 times) | 20 | ea | 16 | 320 | tech | 34.30 | 10,976 | 122 | 2,440 | 36 | 720 | | | 14,136 |
| 16 | Sample analysis (VOCs) | 20 | ea | | | | | | | | | | 225 | 4,500 | 4,500 |
| | | | | | | | | | | | | | | | |
| | **Subtotal** | | | | | | | **91,543** | | **174,140** | | **149,345** | | **281,546** | **696,574** |
| | Taxes @ 6.5 % | | | | | | | | | 11,319 | | | | | 11,319 |
| | **Subtotal** | | | | | | | | | | | | | | **707,893** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 152,197 |
| | | | | | | | | | | | | | | | |
| | **Total** | | | | | | | | | | | | | | **860,090** |

**** T O T A L **** **$ 860,090**

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM

## In Situ Bioremediation O&M

**COMPANY NAME:** SHAW E & I
**PROJECT LOCATION:** KARNACK, TEXAS
**DATE:** JUNE 2009

| Item NO | DESCRIPTION | QTY | UNIT | LABOR | | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | |
| | **Bioremediation O&M Annual costs** | | | | | | | | | | | | | | |
| | **Year 2** | | | | | | | | | | | | | | |
| 1 | Update safety, training ,waste, and | 1 | ea | 80 | 80 | eng | 81.60 | 6,528 | 80 | 80 | | | | | 6,608 |
| | health , plans, etc. | | | | | | | | | | | | | | |
| 2 | Field Engineer | 1 | hr | 170 | 170 | h/s | 55.70 | 9,469 | 50 | 50 | 160 | 160 | | | 9,679 |
| 3 | Field Engineer | 1 | hr | 120 | 120 | spr/tech/hs | 89.90 | 10,788 | | | 2,825 | 2,825 | | | 13,613 |
| 4 | Inject nutrients 1 time per year into each | 2 | ea | 60 | 120 | eng tech | 65.70 | 7,884 | 12,000 | 24,000 | | | | | 31,884 |
| | injection well | | | | | | | | | | | | | | |
| 5 | Abandon wells | 10 | ea | 5 | 50 | eng tech | 65.70 | 3,285 | 80 | 800 | 80 | 800 | 1,000 | 10,000 | 14,885 |
| 6 | Mob / Demob | 1 | ea | 40 | 40 | eng | 81.60 | 3,264 | 1,200 | 1,200 | 1,000 | 1,000 | | | 5,464 |
| 7 | Vehicles | 40 | day | | | | | | 10 | 400 | 80 | 3,200 | | | 3,600 |
| 8 | Per Diem | 54 | day | | | | | | | | | | 109 | 5,886 | 5,886 |
| | **Subtotal** | | | | | | | **41,218** | | **26,530** | | **7,985** | | **15,886** | **91,619** |
| | | | | | | | | | | | | | | | |
| | Taxes @ 6.5 % | | | | | | | | | 1,724 | | | | | 1,724 |
| | | | | | | | | | | | | | | | |
| | **Subtotal** | | | | | | | | | | | | | | **93,343** |
| | | | | | | | | | | | | | | | |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 20,069 |
| | | | | | | | | | | | | | | | |
| | **O&M FOR 1 YEAR** | | | | | | | | | | | | | | **$ 113,412** |

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM Monitoring/LUCs

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | | |
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | | LABOR | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | | | | | | Monitoring of 8 wells | | | | | | | | | |
| | **Year 1** | | | | | | | | | | | | | | |
| 1 | Establish initial database, licenses, coordinate well characterization & other well info, develop work plans, etc | 1 | ea | 300 | 300 | eng | 81.60 | 24,480 | 5,000 | 5,000 | | | 5,000 | 5,000 | 34,480 |
| 2 | Geoprobe install 2 additional monitoring wells | 2 | ea | 40 | 80 | geol | 71.20 | 5,696 | 1,500 | 3,000 | 36 | 72 | 6000 | 12,000 | 20,768 |
| 3 | Collect and prepare samples quarterly (GW) | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 4 | Sample analysis (VOCs and MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 5 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| | **Subtotal** | | | | | | | **52,956** | | **11,670** | | **1,224** | | **30,600** | **96,450** |
| | Taxes @ 6.5 % | | | | | | | | | 759 | | | | | 759 |
| | **Subtotal** | | | | | | | | | | | | | | **97,209** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 20,900 |
| | **Year 1 total** | | | | | | | | | | | | | | **$ 118,108** |
| | **Year 2** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples quarterly | 32 | ea | 16 | 512 | tech | 34.30 | 17,562 | 110 | 3,520 | 36 | 1,152 | | | 22,234 |
| 2 | Sample analysis (VOCs and MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| | **Subtotal** | | | | | | | **22,782** | | **3,670** | | **1,152** | | **13,600** | **41,204** |
| | Taxes @ 6.5 % | | | | | | | | | 239 | | | | | 239 |
| | **Subtotal** | | | | | | | | | | | | | | **41,442** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,910 |
| | **Year 2 Total** | | | | | | | | | | | | | | **$ 50,352** |

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM Monitoring/LUCs

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | | |
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | | LABOR | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | **Years 3 and 4** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,562 | 110 | 3,520 | 36 | 1,152 | | | 22,234 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | 7,200 |
| 3 | Annual report | 2 | ea | 64 | 128 | eng | 81.60 | 10,440 | 150 | 300 | | | | | 10,740 |
| | **Subtotal** | | | | | | | **28,002** | | **3,820** | | **1,152** | | **7,200** | **40,174** |
| | Taxes @ 6.5 % | | | | | | | | | 248 | | | | | 248 |
| | **Subtotal** | | | | | | | | | | | | | | **40,422** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,691 |
| | **Total for Years 3 and 4** | | | | | | | | | | | | | | **49,113** |
| | **Annual Total** | | | | | | | | | | | | | | **$ 24,556** |
| | **Year 5** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 16 | ea | 16 | 256 | tech | 34.30 | 8,781 | 110 | 1,760 | 36 | 576 | | | 11,117 |
| 2 | Sample analysis (VOCs) | 16 | ea | | | | | | | | | | 225 | 3,600 | 3,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 |
| | **Subtotal** | | | | | | | **14,001** | | **1,910** | | **576** | | **3,600** | **55,087** |
| | Taxes @ 6.5 % | | | | | | | | | 124 | | | | | 124 |
| | **Subtotal** | | | | | | | | | | | | | | **55,211** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 11,870 |
| | **Year 5 Total** | | | | | | | | | | | | | | **$ 67,081** |

# Alternative 3, In Situ Bioremediation with Short Term LUCs and LTM Monitoring/LUCs

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | | |
| | | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | | | LABOR | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | | TOTAL ($) |
| | **Years 6 thru 9** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,562 | 110 | 3,520 | 36 | 1,152 | | | | 22,234 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | | 7,200 |
| 3 | Annual report/inpection | 4 | ea | 64 | 256 | eng | 81.60 | 20,890 | 150 | 600 | | | | | | 21,490 |
| | **Subtotal** | | | | | | | **38,451** | | **4,120** | | **1,152** | | **7,200** | | **50,923** |
| | Taxes @ 6.5 % | | | | | | | | | 268 | | | | | | 268 |
| | **Subtotal** | | | | | | | | | | | | | | | **51,191** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | | 11,006 |
| | **Total for Years 6 through 9** | | | | | | | | | | | | | | | **62,197** |
| | **Annual Total** | | | | | | | | | | | | | | **$** | **15,549** |
| | **Year 10** | | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples annually | 8 | ea | 16 | 128 | tech | 34.30 | 4,390 | 110 | 880 | 36 | 288 | | | | 5,558 |
| 2 | Sample analysis (Suite 2) | 8 | ea | | | | | | | | | | 225 | 1,800 | | 1,800 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | | 5,370 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35000 | 35,000 | | 35,000 |
| | **Subtotal** | | | | | | | **9,610** | | **1,030** | | **288** | | **36,800** | | **47,728** |
| | Taxes @ 6.5 % | | | | | | | | | 67 | | | | | | 67 |
| | **Subtotal** | | | | | | | | | | | | | | | **47,795** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | | 10,276 |
| | **Year 10 Total** | | | | | | | | | | | | | | **$** | **58,071** |

**** T O T A L **** **$404,923**

# Alternative 4
# In Situ Bio for Eastern Plume, MNA LUCs; MNA LUCs for Western Plume
# Present Value

**COMPANY NAME:** **SHAW E & I**
**PROJECT LOCATION:** **KARNACK, TEXAS** **DATE:** **JUNE 2009**

| Year | FY | Capital Costs | O & M Costs | | | | Present Value (NPV) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Discount Rate | Capital | O & M |
| | | | L T Monitor | Bioremed | | Total | 2.8% | | |
| 1 | 2009 | 190,712 | 118,108 | | | 118,108 | NPV | 190,712 | 593,996 |
| 2 | 2010 | 0 | 50,353 | 101,397 | | 151,750 | | | |
| 3 | 2011 | 0 | 24,558 | | | 24,558 | | NPV Total | |
| 4 | 2012 | 0 | 24,558 | | | 24,558 | | 784,708 | |
| 5 | 2013 | 0 | 67,083 | | | 67,083 | | | |
| 6 | 2014 | 0 | 17,135 | | | 17,135 | | | |
| 7 | 2015 | 0 | 17,135 | | | 17,135 | | | |
| 8 | 2016 | 0 | 17,135 | | | 17,135 | | | |
| 9 | 2017 | 0 | 17,135 | | | 17,135 | | | |
| 10 | 2018 | 0 | 58,074 | | | 58,074 | | | |
| 11 | 2019 | | | | | 0 | | | |
| 12 | 2020 | | | | | 0 | | | |
| 13 | 2021 | | | | | 0 | | | |
| 14 | 2022 | | | | | 0 | | | |
| 15 | 2023 | | 53,572 | | | 53,572 | | | |
| 16 | 2024 | | | | | 0 | | | |
| 17 | 2025 | | | | | 0 | | | |
| 18 | 2026 | | | | | 0 | | | |
| 19 | 2027 | | | | | 0 | | | |
| 20 | 2028 | | 53,572 | | | 53,572 | | | |
| 21 | 2029 | | | | | 0 | | | |
| 22 | 2030 | | | | | 0 | | | |
| 23 | 2031 | | | | | 0 | | | |
| 24 | 2032 | | | | | 0 | | | |
| 25 | 2033 | | 53,572 | | | 53,572 | | | |
| 26 | 2034 | | | | | 0 | | | |
| 27 | 2035 | | | | | 0 | | | |
| 28 | 2036 | | | | | 0 | | | |
| 29 | 2037 | | | | | 0 | | | |
| 30 | 2038 | | 53,572 | | | 53,572 | | | |
| | | 190,712 | 625,564 | 101,397 | | 726,961 | | | |

# Alternative 4
# In Situ Bio for Eastern Plume, MNA LUCs; MNA LUCs for Western Plume
# In Situ Bioremediation

**COMPANY NAME:** SHAW E & I
**PROJECT LOCATION:** KARNACK, TEXAS
**DATE:** JUNE 2009

| Item NO | DESCRIPTION | QTY | UNIT | LABOR | | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | |
| | **Field Work** | | | | | | | | | | | | | | |
| | YEAR 1 | | | | | | | | | | | | | | |
| 1 | Work plans, safety plans | 1 | ea | 240 | 240 | eng | 81.60 | 19,584 | 200 | 200 | | | | | 19,784 |
| 2 | UIC Permit and Design | 1 | ea | 160 | 160 | spr/tech/hs | 89.90 | 14,384 | 200 | 200 | | | | | 14,584 |
| 3 | Treatability Study | 1 | ea | 80 | 80 | eng | 81.60 | 6,528 | 200 | 200 | | | | | 6,728 |
| 3 | Treatability Sample Collection | 1 | hr | 25 | 25 | spr/tech/hs | 89.90 | 2,248 | | | | | | | 2,248 |
| 3 | Driller for Treatability Sampling | 2 | wells | | | | | | | | | | 4000 | 8,000 | 8,000 |
| 3 | Per Diem and Travel Costs | 4 | days | | | | | | 50 | 200 | 80 | 320 | 109 | 436 | 956 |
| 3 | Mob / Demob | 1 | ea | 40 | 40 | eng | 81.60 | 3,264 | 1,200 | 1,200 | 1,000 | 1,000 | | | 5,464 |
| 4 | Field H&S | 1 | hr | 80 | 80 | h/s | 55.70 | 4,456 | 50 | 50 | 160 | 160 | | | 4,666 |
| 5 | Field Super/Geolog | 1 | hr | 80 | 80 | super | 72.30 | 5,784 | | | 2,825 | 2,825 | | | 8,609 |
| 6 | Vehicles | 26 | day | | | | | | 10 | 260 | 80 | 2,080 | | | 2,340 |
| 7 | Per Diem | 39 | day | | | | | | | | | | 109 | 4,251 | 4,251 |
| 8 | Driller Mob/Demob | 1 | ea | | | | | | | | | | 1200 | 1,200 | 1,200 |
| 9 | Install injection wells, 30' dpt, 2" dia. | 10 | ea | | | | | | | | | | 3,150 | 31,500 | 31,500 |
| 10 | Well survey | 1 | ea | | | | | | | | | | 3,000 | 3,000 | 3,000 |
| 11 | Well drill waste disposal | 5 | drum | | | | | | | | | | 250 | 1,250 | 1,250 |
| 12 | Collect & prepare well waste drum samples | 5 | ea | 12 | 60 | tech | 34.30 | 2,058 | 60 | 300 | 36 | 180 | | | 2,538 |
| 13 | Sample analysis (Waste Char) | 5 | ea | | | | | | | | | | 1,500 | 7,500 | 7,500 |
| 14 | Bioaugmentation materials | 1 | ea | | | | | | 12,000 | 12,000 | 10,000 | 10,000 | | | 22,000 |
| 15 | Collect and prepare samples (2 times) | 10 | ea | 16 | 160 | tech | 34.30 | 5,488 | 122 | 1,220 | 36 | 360 | | | 7,068 |
| 16 | Sample analysis (VOCs) | 10 | ea | | | | | | | | | | 225 | 2,250 | 2,250 |
| | | | | | | | | | | | | | | | |
| | **Subtotal** | | | | | | | **63,794** | | **15,830** | | **16,925** | | **59,387** | **155,936** |
| | Taxes @ 6.5 % | | | | | | | | | 1,029 | | | | | 1,029 |
| | **Subtotal** | | | | | | | | | | | | | | **156,964** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 33,747 |
| | **Total** | | | | | | | | | | | | | | **$ 190,712** |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | **** T O T A L **** | **$ 190,712** |

# Alternative 4
# In Situ Bio for Eastern Plume, MNA & LUCs; MNA & LUCs for Western Plume
# In Situ Bioremediation O&M

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | | |
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | LABOR | | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | **Bioremediation O&M Annual costs** | | | | | | | | | | | | | | |
| | **Year 2** | | | | | | | | | | | | | | |
| 1 | Update safety, training ,waste, and | 1 | ea | 80 | 80 | eng | 81.60 | 6,528 | 80 | 80 | | | | | 6,608 |
| | health , plans, etc. | | | | | | | | | | | | | | |
| 2 | Field Engineer | 1 | hr | 170 | 170 | h/s | 81.00 | 13,770 | 50 | 50 | 160 | 160 | | | 13,980 |
| 3 | Field Engineer | 1 | hr | 120 | 120 | spr/tech/hs | 89.90 | 10,788 | | | 2,825 | 2,825 | | | 13,613 |
| 4 | Inject nutrients 1 time per year into each | 1 | ea | 60 | 60 | eng tech | 65.70 | 3,942 | 12,000 | 12,000 | 10,000 | 10,000 | | | 25,942 |
| | injection well | | | | | | | | | | | | | | |
| 5 | Abandon wells | 5 | ea | 5 | 25 | eng tech | 65.70 | 1,643 | 80 | 400 | 80 | 400 | 1,000 | 5,000 | 7,443 |
| 6 | Mob / Demob | 1 | ea | 40 | 40 | eng | 81.60 | 3,264 | 1,200 | 1,200 | 1,000 | 1,000 | | | 5,464 |
| 7 | Vehicles | 40 | day | | | | | | 10 | 400 | 80 | 3,200 | | | 3,600 |
| 8 | Per Diem | 54 | day | | | | | | | | | | 109 | 5,886 | 5,886 |
| | | | | | | | | | | | | | | | |
| | **Subtotal** | | | | | | | **39,935** | | **14,130** | | **17,585** | | **10,886** | **82,536** |
| | Taxes @ 6.5 % | | | | | | | | | 918 | | | | | 918 |
| | **Subtotal** | | | | | | | | | | | | | | **83,454** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 17,943 |
| | **O &M FOR 1 YEAR** | | | | | | | | | | | | | | **$ 101,397** |

# Alternative 4
# In Situ Bio for Eastern Plume, MNA LUCs; MNA LUCs for Western Plume
# MNA/LUCs

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | |
| | | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | DATE: | | JUNE 2009 | |
| Item | | | | | | LABOR | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| | **Monitoring of 8 wells** | | | | | | | | | | | | | | |
| | **Year 1** | | | | | | | | | | | | | | |
| 1 | Establish initial database, licenses, coordinate well characterization & other well info, develop work plans, etc | 1 | ea | 300 | 300 | eng | 81.60 | 24,480 | 5,000 | 5,000 | | | 5,000 | 5,000 | 34,480 |
| 2 | Geoprobe install two additional monitoring wells | 2 | ea | 40 | 80 | geol | 71.20 | 5,696 | 1,500 | 3,000 | 36 | 72 | 6000 | 12,000 | 20,768 |
| 3 | Collect and prepare samples quarterly (GW) | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 4 | Sample analysis (VOCs and MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 5 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| | **Subtotal** | | | | | | | **52,956** | | **11,670** | | **1,224** | | **30,600** | **96,450** |
| | Taxes @ 6.5 % | | | | | | | | | 759 | | | | | 759 |
| | **Subtotal** | | | | | | | | | | | | | | **97,209** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 20,900 |
| | **Year 1 total** | | | | | | | | | | | | | | **$ 118,108** |
| | **Year 2** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples quarterly | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 2 | Sample analysis (VOCs and MNA) | 32 | ea | | | | | | | | | | 425 | 13,600 | 13,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,222 | 150 | 150 | | | | | 5,372 |
| | **Subtotal** | | | | | | | **22,782** | | **3,670** | | **1,152** | | **13,600** | **41,204** |
| | Taxes @ 6.5 % | | | | | | | | | 239 | | | | | 239 |
| | **Subtotal** | | | | | | | | | | | | | | **41,443** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,910 |
| | **Year 2 Total** | | | | | | | | | | | | | | **$ 50,353** |

# Alternative 4
# In Situ Bio for Eastern Plume, MNA LUCs; MNA LUCs for Western Plume
# MNA/LUCs

**COMPANY NAME:** SHAW E & I
**PROJECT LOCATION:** KARNACK, TEXAS
**DATE:** JUNE 2009

| Item NO | DESCRIPTION | QTY | UNIT | LABOR UNIT MH | LABOR TOTAL MH | LABOR CRAFT | LABOR $/MH | LABOR $ VALUE | MATERIAL $/UNIT | MATERIAL $ VALUE | EQUIPMENT $/UNIT | EQUIPMENT $ VALUE | SUBCONTRACT $/UNIT | SUBCONTRACT $ VALUE | TOTAL ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Years 3 and 4** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | 7,200 |
| 3 | Annual report | 2 | ea | 64 | 128 | eng | 81.60 | 10,445 | 150 | 300 | | | | | 10,745 |
| | **Subtotal** | | | | | | | **28,005** | | **3,820** | | **1,152** | | **7,200** | **40,177** |
| | Taxes @ 6.5 % | | | | | | | | | 248 | | | | | 248 |
| | **Subtotal** | | | | | | | | | | | | | | **40,425** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 8,691 |
| | **Years 3 and 4 Total** | | | | | | | | | | | | | | **49,116** |
| | **Annual Total** | | | | | | | | | | | | | **$** | **24,558** |
| | **Year 5** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples semi-annually | 16 | ea | 16 | 256 | tech | 34.30 | 8,780 | 110 | 1,760 | 36 | 576 | | | 11,116 |
| 2 | Sample analysis (VOCs) | 16 | ea | | | | | | | | | | 225 | 3,600 | 3,600 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,222 | 150 | 150 | | | | | 5,372 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 |
| | **Subtotal** | | | | | | | **14,002** | | **1,910** | | **576** | | **3,600** | **55,088** |
| | Taxes @ 6.5 % | | | | | | | | | 124 | | | | | 124 |
| | **Subtotal** | | | | | | | | | | | | | | **55,213** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 11,871 |
| | **Year 5 Total** | | | | | | | | | | | | | **$** | **67,083** |
| | **Years 6 thru 9** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples annually | 32 | ea | 16 | 512 | tech | 34.30 | 17,560 | 110 | 3,520 | 36 | 1,152 | | | 22,232 |
| 2 | Sample analysis (VOCs) | 32 | ea | | | | | | | | | | 225 | 7,200 | 7,200 |
| 3 | Annual report/inpection | 4 | ea | 80 | 320 | eng | 81.60 | 26,112 | 150 | 600 | | | | | 26,712 |
| | **Subtotal** | | | | | | | **43,672** | | **4,120** | | **1,152** | | **7,200** | **56,144** |
| | Taxes @ 6.5 % | | | | | | | | | 268 | | | | | 268 |
| | **Subtotal** | | | | | | | | | | | | | | **56,412** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 12,129 |
| | **Years 6 through 9 Total** | | | | | | | | | | | | | | **68,540** |
| | **Annual Total** | | | | | | | | | | | | | **$** | **17,135** |
| | **Year 10** | | | | | | | | | | | | | | |

# Alternative 4
# In Situ Bio for Eastern Plume, MNA LUCs; MNA LUCs for Western Plume
# MNA/LUCs

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COMPANY NAME: | | SHAW E & I | | | | | | | | | |
| | | | | PROJECT LOCATION: | | KARNACK, TEXAS | | | | | | DATE: | | JUNE 2009 | |
| Item | | | | LABOR | | | | MATERIAL | | EQUIPMENT | | SUBCONTRACT | | | |
| NO | DESCRIPTION | QTY | UNIT | UNIT MH | TOTAL MH | CRAFT | $/MH | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | $/UNIT | $ VALUE | TOTAL ($) |
| 1 | Collect and prepare samples annually | 8 | ea | 16 | 128 | tech | 34.30 | 4,390 | 110 | 880 | 36 | 288 | | | 5,558 |
| 2 | Sample analysis (VOCs) | 8 | ea | | | | | | | | | | 225 | 1,800 | 1,800 |
| 3 | Annual report | 1 | ea | 64 | 64 | eng | 81.60 | 5,222 | 150 | 150 | | | | | 5,372 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 |
| | **Subtotal** | | | | | | | **9,612** | | **1,030** | | **288** | | **1,800** | **47,730** |
| | Taxes @ 6.5 % | | | | | | | | | 67 | | | | | 67 |
| | **Subtotal** | | | | | | | | | | | | | | **47,797** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 10,276 |
| | **Year 10 Total** | | | | | | | | | | | | | | **$ 58,074** |
| | | | | | | **Monitoring of 4 wells** | | | | | | | | | |
| | **Years 15, 20, 25 and 30 - Cost for 1 Event** | | | | | | | | | | | | | | |
| 1 | Collect and prepare samples once every 5 yrs | 4 | ea | 16 | 64 | tech | 34.30 | 2,200 | 110 | 440 | 36 | 144 | | | 2,784 |
| 2 | Sample analysis (VOCs) | 4 | ea | | | | | | | | | | 225 | 900 | 900 |
| 3 | Event Report | 1 | ea | 64 | 64 | eng | 81.60 | 5,220 | 150 | 150 | | | | | 5,370 |
| 4 | Five Year Review | 1 | ea | | | | | | | | | | 35,000 | 35,000 | 35,000 |
| | **Subtotal** | | | | | | | **7,420** | | **590** | | **144** | | **900** | **44,054** |
| | Taxes @ 6.5 % | | | | | | | | | 38 | | | | | 38 |
| | **Subtotal** | | | | | | | | | | | | | | **44,092** |
| | Indirects @ 21.5% | | | | | | | | | | | | | | 9,480 |
| | **Event Total** | | | | | | | | | | | | | | **$ 53,572** |
| | **Years 15, 20, 25 and 30 Total** | | | | | | | | | | | | | | **214,289** |

**** T O T A L **** **$625,564**

**DEPARTMENT OF THE ARMY**
**LONGHORN ARMY AMMUNITION PLANT**
**POST OFFICE BOX 220**
**RATCLIFF, AR 72951**

June 9, 2008

DAIM-BD-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
Environmental Cleanup Section II (MC-136)
12100 Park 35 Circle
Austin, TX 78753

Re: Revised MNA Modeling Results for Time to MCL, LHAAP-35B (37) and LHAAP-67
Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Duke,

The Results of Modeling for Natural Attenuation of Chlorinated Solvents in Groundwater at LHAAP-35B (37) and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas was finalized and submitted in July 2007. One of the comments TCEQ made on the Draft Final document concerned the use of literature-based degradation rates and the very short times to MCL. In particular TCEQ was skeptical of the results and pointed out that given the dates used, MCLs should already have been achieved at Site 67, but were not. Army's response was that estimates were conservative because both zero degradation rates and 10 times the literature rates were also used to generate a range of times to MCL. That report did not incorporate new information that was obtained in the field during and after the production of the report. This new information derived from aquifer test results, boring logs and groundwater samples, drives some changes in modeling parameters that result in more realistic time frames for meeting MCLs.

Field data was collected at Sites 37 and 67 in December 2007 to evaluate whether the water-bearing units at the sites fit the Class 3 groundwater resource equivalent criteria. A cyclic discharge test method was used at both sites to estimate sustainable yield. The results of the field work were provided to Army in the attached Memorandum (Enclosure1). Other important field data was acquired with the installation of new wells at Site 37 in late 2006 and 2007. These wells revealed a more complete picture of the hydrostratigraphy and redefined the extent of the plume. The well logs and completion details for some of these wells are attached (Enclosure 2).

Site 67

Data collected from three wells during testing indicate that the water bearing unit is equivalent to a Class 3 groundwater resource, producing an average of 143 gallons per day. For the purposes of MNA modeling, an estimate of a representative site specific hydraulic conductivity for the site was approximated from this testing. The result was a change in the value of hydraulic conductivity used in the initial modeling effort by about one order of magnitude, decreasing from $5.21 \times 10^{-3}$ centimeters per second (cm/s) to $4.6 \times 10^{-4}$ cm/s. Considering that the original model calculated times that would have MCLs already met, this lower value may well represent a more realistic value. A Memorandum documenting the process used to achieve this estimate of

hydraulic conductivity (Enclosure 3) and the new model results for times to MCL (Table 3) (Enclosure 4) are attached.

Site 37

Data collected during the sustainable yield testing at Site 37 did not support a Class 3 groundwater resource equivalent classification. However, it is noted that well log data indicates that the sand units bearing contaminated water at Site 37 are not laterally continuous (see logs of 35BWW07 and 47WW52). Short term tests such as those run during the December 2007 testing would not reveal this boundary flow condition. Well data, however, supports changes in other modeling parameters. Groundwater samples in the new wells indicate that the extent of the plume is greater than originally defined (35BWW04 and 35BWW05) and that the sand unit is thicker in some areas (35BWW02 and 35BWW05). Because the plume source area is modeled after plume extent, the size was increased from 200 x 350 feet to 300 x 350 feet. Additionally, the thickness of the modeled interval was increased from 13.5 to 16.8 feet. These changes result in increased times to MCL. The new modeling results are attached as Table 2 (Enclosure 4).

Although there has been no definitive field test at Site 37 on which to base a change in the value of hydraulic conductivity used for modeling, it is noteworthy that the sand units reflect a fluvial type of depositional environment, are known not to be laterally continuous in the downgradient direction, and are interbedded with and encased in clay. The change in hydraulic conductivity from a sand to a clay would have a large effect on time to achieve MCL, raising it by as much as an order of magnitude over the revised estimate. Considering the uncertainty inherent in the modeling representative formation conditions, a range of times is appropriate.

Based on the revised modeling using new information, the times to MCL have been changed in the Proposed Plan. This information is provided as documentation for the Administrative Record. If you would like to discuss these changes, please identify the elements for discussion by 7 July, prior to the end of the planned proposed public review period.

Point of contact for this action is the undersigned. I may be contacted at 479-635-0110, or by email at rose.zeiler@us.army.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Enclosures:

1. Groundwater Resource Classification Memorandum, January 2008
2. Well Logs and Completion Details
3. Hydraulic Conductivity Estimation Methodology, June 6, 2008
4. Table 2 and Table 3, Revised Results for Natural Attenuation of PCE, TCE, and 11-DCE at LHAAP-37 and LHAAP-67, June 2008

Copies furnished:
Steve Tzhone, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
John R. Lambert, COE – Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project file)

**ENCLOSURE 1**

Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 400
Houston, Texas 77042
(713) 996-4400
(713) 996-4436 Fax

Shaw The Shaw Group Inc.™

# Memorandum

**Date:** **January 8, 2008**

**To:** **Cliff Murray – U.S. Army Corps of Engineers, Tulsa District**

**From:** **Allen Willmore – Shaw Environmental, Inc.**
**William A. Foss, P.G. – Shaw Environmental, Inc.**

**RE:** **Groundwater Resource Classification**
**Longhorn Army Ammunition Plant Sites LHAAP-35B(37) and LHAAP-67**

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The purpose of this memorandum is to discuss the recent activities performed by Shaw Environmental, Inc. (Shaw) to determine the groundwater resource classification of the uppermost groundwater-bearing unit (GWBU) at the Chemical Laboratory site (LHAAP-35B(37)) and the Above Ground Storage Tank Farm site (LHAAP-67). The text below discusses the results of the testing performed by Shaw to classify the uppermost GWBU at the two sites.

The TCEQ's *Groundwater Classification* Regulatory Guidance Document (TRRP-8) provides guidance for classifying GWBUs according to water quality, current use, and sustainable yield. GWBUs with TDS concentrations less than 10,000 parts per millions (ppm) and a sustainable yield of at least 150 gallons per day (gpd) from a 4-inch diameter well are considered to be Class 2 groundwater resources, while those GWBUs with TDS concentrations greater than 10,000 ppm or those yielding less than 150 gpd are Class 3 groundwater resources. The aquifer yield testing described in this memorandum was performed December 12, 2007 through December 14, 2007. The testing effort also included sampling of six wells for total dissolved solids (TDS) analysis.

## Well Selection and Methodology

At LHAAP-35B(37), there are seven wells screened in the shallow GWBU (35BWW01, 35BWW02, 35BWW04, 35BWW05, 35BWW07, 35BWW08, and LHSMW58). Monitoring well locations at LHAAP-35B(37) are shown in **Figure 1**. Of the seven shallow wells at LHAAP-35B(37), 35BWW05 is the only well that does not fully penetrate the uppermost GWBU. At LHAAP-67, there are six wells that are screened in the shallow GWBU (67WW01, 67WW02, 67WW03, 67WW04, 67WW05, and 67WW07). Monitoring well locations at LHAAP-67 are shown in **Figure 2**. Of the six shallow wells at LHAAP-67, 67WW07 is the only well that does not fully penetrate the uppermost GWBU. Shaw selected wells LHSMWM-58, 35BWW04, and 35BWW08 at LHAAP-35B(37), and 67WW01, 67WW02, and 67WW05 at LHAAP-67 as representative wells for aquifer yield testing. The well construction details for the shallow wells at each site are shown in **Table 1**.

TRRP-8 recommends several methods by which the sustainable yield of a GWBU may be calculated. The method used to test the yield of the uppermost GWBUs at LHAAP-35B(37) and LHAAP-67 was *Method 2a: Well Yield by Cyclic Discharge*, described in Section 2.7.2.2 of TRRP-8. The Cyclic Discharge procedure is described in TRRP-8 as follows:

1. **Well Construction**: Test well must be *fully-penetrating*, have a minimum diameter of 2 inches, and be completed with construction details consistent with requirements of 16 TAC § 76.1000 - §76.1009.

**Table 1**
**Monitoring Well Construction Information**
**LHAAP-35B(37) and LHAAP-67**

| Well ID | Well Diameter (inches) | Surface Elevation (ft AMSL) | Top of Casing Elevation (ft AMSL) | Total Borehole Depth (ft bgs) | Screened Interval (ft bgs) | Saturated Interval (ft bgs) | Fully Penetrating? |
|---|---|---|---|---|---|---|---|
| LHAAP-35B(37) | | | | | | | |
| 35BWW01 | 4 | 200.24 | 202.88 | 19 | 9 - 19 | 10 - 18 | Yes |
| 35BWW02 | 4 | 201.06 | 203.95 | 43 | 9 - 14 | 12 - 14 | Yes[1] |
| 35BWW04 | 4 | 199.3 | 202.11 | 30 | 20 - 30 | 19.5 - 29 | Yes[2] |
| 35BWW05 | 2 | 200 | 202.57 | 36 | 26 - 36 | 20 - 35 | No |
| 35BWW07 | 2 | 200.86 | 203.53 | 28.5 | 18 - 28 | 19 - 20 | Yes |
| 35BWW08 | 2 | 201.4 | 204.12 | 32.5 | 22 - 32 | 21 - 31 | Yes[2] |
| LHSMW-58 | 4 | 200.2 | 203.5 | 34 | 21.4 - 31.4 | 17 - 33 | Yes[2] |
| LHAAP-67 | | | | | | | |
| 67WW01 | 4 | 198.29 | 201.07 | 23 | 12 - 22 | 14 - 19.5 | Yes |
| 67WW02 | 4 | 196.73 | 199.79 | 26 | 15 - 25 | 13.5 - 24 | Yes[2] |
| 67WW03 | 4 | 197.32 | 200.32 | 24 | 14 - 24 | 13 - 22.5 | Yes[2] |
| 67WW04 | 4 | 200.05 | 203.76 | 23 | 11 - 21 | 13 - 20 | Yes |
| 67WW05 | 4 | 197.48 | 201.00 | 27 | 16 - 26 | 14 - 26 | Yes[2] |
| 67WW07 | 4 | 197.04 | 200.84 | 24 | 14 - 24 | 14 - 48.5 | No |

Notes:

1 - The screened interval fully penetrates a small saturated silty sand lens perched above a 1 foot clay layer that overlies another saturated silty sand layer that extends to the bottom of the borehole

2 - The filter pack for the well encompasses the entire saturated interval, so the well is considered to be fully penetrating.

AMSL - above mean level

ft bgs - feet below ground surface

2. **Initial Water Level**: Measure static water level in well.
3. **Water-Level Bail-Down**: Use bailer, pump, or other device to effectively evacuate *all* water from the well. Contain all discharged water and measure total volume ($V_1$). Measure static water level in well immediately upon completion of water removal.
4. **Time for Water-Level Recovery**: Monitor static water level in well and measure elapsed time ($t_1$) from completion of water removal until static water level in well recovers to the *same specified level, up to, but not greater than 90%* of height to initial static water level.
5. **Repeat Bail-Down and Recovery**: Repeat Steps 2 and 3 above twice. *This procedure requires a minimum of three bail-down/recovery cycles*. Record total volume of water ($V_1 \ldots V_n$) removed from well during each successive bail-down and the elapsed time ($t_1 \ldots t_n$) from completion of water removal until water level in well recovers to the same specified level used in prior cycle(s) (*i.e., up to, but not greater than 90%* of height to initial static water level).

   The maximum well yield corresponds to the total bailed water volume divided by the combined recovery time measured during the (*minimum of*) three bail-down/recovery cycles.

Shaw used a submersible stainless steel monsoon pump at LHAAP-35B(37) and a disposable HDPE 3.5-inch diameter disposable hand bailer at LHAAP-67 to evacuate the water from the wells. The water was containerized in drums onsite. Upon completion of testing, the water was disposed of at the Groundwater Treatment Plant at LHAAP-18/24 which has the capacity to treat the wastewater previously characterized at LHAAP-35B(37) and LHAAP-67. Test duration times ranged from approximately 1 to 3.5 hours depending upon the rate of recovery in each well. The Cyclic Discharge Field Forms, which show test duration times and recovery volumes, are provided as **Attachment 1**.

**Aquifer Testing Results**

LHAAP-35B(37)

Three wells at LHAAP-35B(37) were tested using the cyclic discharge method described in TRRP-8 (35BWW04, 35BWW08, and LHSMW58). **Table 2** shows the cumulative yield for three cycles of pumping at each well along with the cumulative elapsed time for the recovery. The yield over the recovery time is shown in gallons per minute (gpm) and gallons per day (gpd). The value at the bottom of the table is the geometric mean of the three values expressed in gpd. The measured yields at LHAAP-35B(37) ranged from 1894 to 2010 gpd.

**Table 2**
**LHAAP-35B(37) Aquifer Testing Results**

| Well ID | Cumulative Volume Removed (gallons) | Cumulative Recovery Time (minutes) | Calculated Yield (gpm) | Calculated Yield (gpd) |
|---|---|---|---|---|
| 35BWW04 | 74 | 53 | 1.396 | 2010 |
| 35BWW08 | 71 | 54 | 1.315 | 1894 |
| LHSMW58 | 67 | 49 | 1.367 | 1968 |
| | | | **Geometric Mean (gpd)** | **1957** |

LHAAP-67

Three wells at LHAAP-67 were tested using the cyclic discharge method described in TRRP-8 (67WW01, 67WW02, and 67WW05). **Table 3** shows the cumulative yield and cumulative recovery time for each well along with the calculated yield in gpm and gpd. The measured yields at LHAAP-67 ranged from 125 to 170 gpd.

**Table 3**
**LHAAP-67 Aquifer Testing Results**

| Well ID | Cumulative Volume Removed (gallons) | Cumulative Recovery Time (minutes) | Calculated Yield (gpm) | Calculated Yield (gpd) |
|---|---|---|---|---|
| 67WW01 | 9 | 94 | 0.096 | 138 |
| 67WW02 | 10 | 115 | 0.087 | 125 |
| 67WW05 | 17 | 144 | 0.118 | 170 |
| | | | **Geometric Mean (gpd)** | **143** |

### Total Dissolved Solids Analytical Results

Samples were collected for TDS analysis from each well where aquifer testing was performed. The samples were submitted to Kemron Environmental Services in Marietta, Ohio for TDS analysis by Method 160.1. The TDS concentrations at LHAAP-35B(37) ranged from 200 ppm to 592 ppm with a geometric mean of 356 ppm. The TDS concentrations at LHAAP-67 ranged from 1,570 ppm to 2,070 ppm with a geometric mean of 1843 ppm.

### Conclusions

The testing at LHAAP-35B(37) and LHAAP-67 was conducted to collect representative hydrogeologic data for the uppermost GWBU at each site. The TDS concentrations at LHAAP-35B(37) and LHAAP-67 did not exceed 10,000 ppm in any sample. Therefore, the classification of the uppermost GWBU at each site depends on the calculated yield from the aquifer testing. Based on the geometric mean of the measured yields at LHAAP-35B(37) (1,957 gpd), the yield for the uppermost GWBU at LHAAP-35B(37) exceeds the 150 gpd threshold and is likely to be a Class 2 groundwater resource. Based on the geometric mean of the measured yields at LHAAP-67 (143 gpd), the yield for the uppermost GWBU at LHAAP-67 is below the 150 gpd threshold and is likely to be a Class 3 groundwater resource.

00082357

| OFFICE | DRAWN BY | CHECKED BY |
|---|---|---|
| Cincinnati | GWT | N. Olson |
| | 1/04/08 | 1/04/08 |

| APPROVED BY | FILE PATH |
|---|---|
| W. Foss | T:\GIS\Longhorn\MXD\ST35B67\LHAAP35B_GW_Dec07_B.mxd |
| 1/04/08 | |

LHAAP-05

LHAAP-29

LHAAP-47

LHAAP-35B(37)

Goose Prairie Creek

35BWW01
184.64

35BWW05
182.22

35BWW08
182.53

35BWW04
182.04

LHSMW58
181.15

35BWW02
DRY

35BWW07
180.69

184

183

182

181

## Legend

- Upper Shallow Zone Monitoring Well
- Groundwater Elevation Contours (1 Ft)
- Stream
- Road
- Former Building or Concrete Slab
- Site

0 75 150 300 Feet

Shaw®

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

Figure 1
Shallow Groundwater Wells at LHAAP-35B

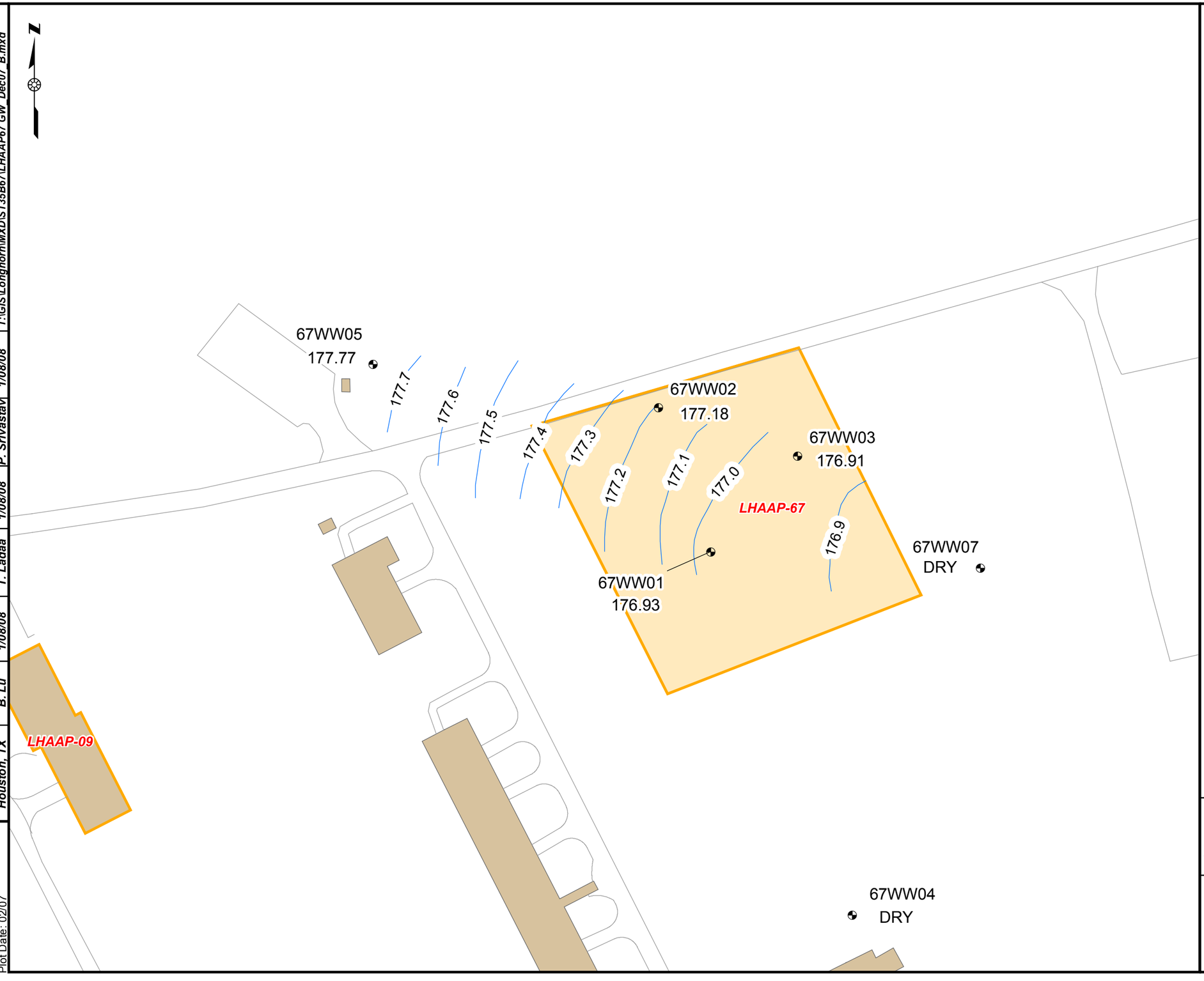
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00082358

| FILE PATH | |
|---|---|
| T:\GIS\Longhorn\MXD\ST35B67\LHAAP67 GW_Dec07_B.mxd | |

| OFFICE | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|
| Houston, TX | B. Lu 1/08/08 | T. Ladaa 1/08/08 | P. Srivastav 1/08/08 |

Plot Date: 02/07




**Legend**

- Shallow Monitoring Well
- Groundwater Elevation Contours (0.1ft)
- Stream
- Road
- Former Building or Concrete Slab
- Site

0 50 100 200 Feet

Shaw®

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

Figure 2
Shallow Groundwater Wells at LHAAP-67

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

**ATTACHMENT I**

00082360

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. LHSMW58 Date: 12/13/07 Name: ALLEN WILLMORE DTW = 21.31

| Water Pumped DTW | Trial | DTWi (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) | 5-gallon bucket tally |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25.97 | 1 | 21.31 | 36.00 | 14.69 | 07:32 | NA | ~~34.53~~ 34.53 | NA① | 28.66 | NA① | 22.78 | 00:03:12 | 30 | 30 | |
| 25.97 | 2 | 21.31 | 36.00 | 14.69 | 07:49 | NA | 34.53 | NA① | 28.66 | NA① | 22.79 | 00:03:42 | 18 | 48 | |
| 25 | 3 | 21.31 | 36.00 | 14.69 | 08:21 | NA | 34.53 | NA① | 28.66 | NA① | 22.78 | 00:03:19 | 19 | 67 | |

① Could not purge below water level, needed for 50% and 10% recovery

Water level stabilized @ 25.97 Sampled @ 08:25

Used Stainless Steel Monsoon pump

Shaw Group, Inc.
Longhorn Army Ammunition Plant

00082361

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. 35BWW04 Date: 12/13/07 Name: ALLEN WILLMORE

| Trial | DTWi (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft-btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft-btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26.16 1 | 19.94 | 34.00 | 14.06 | 11:03 | NA | NA | NA | 26.97 | NR | 21.35 | 00:04:12 | 25 | 25 |
| 26.64 2 | 19.94 | 34.00 | 14.06 | 11:31 | NA | NA | NA | 26.97 | NR | 21.35 | 00:05:03 | 24 | 49 |
| 26.16 3 | 19.94 | 34.00 | 14.06 | 11:56 | NA | NA | N | 26.97 | NR | 21.35 | 00:04:53 | 25 | 74 |
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Used Stainless Steel Monsoon Pump

Sampled for TDS @ 12:00

NR- Not Recorded

00082362

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. 35BWW08 Date: 12/13/07 Name: Allen Willmore DTW = 21.69

| Trial | DTWi (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21.69 | 33.75 | 12.06 | ~~09:30~~ 09:04 | NR | 32.54 | NR | 27.72 | ~~00:05:01~~ 00:00:55 | 22.87 | 00:06:30 | 23 | 23 | 1111 |
| 2 | ~~21.69~~ | 33.75 | 12.06 | 09:31 | NR | 32.54 | NR | 27.72 | 00:01:30 | 22.87 | 00:07:25 | 24 | 47 | 1111 |
| 3 | 21.69 | 33.75 | 12.06 | 09:58 | NR | 32.54 | NR | 27.72 | 00:01:23 | 22.87 | 00:07:15 | 24 | 71 | 1111 |

Water Purged Dry
Pumped Dry
Pumped Dry
Pumped Dry

5 gallon bucket tall

Notes: Heavy Rain on 12/12/07

Used Monsoon Pump

NR- Not Recorded

Sampled @ 10:00 for TDS

Shaw Group, Inc.
Longhorn Army Ammunition Plant

00082363

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. 67WW01 Date: 12/12/07 Name: Allen Willmore

| Trial | DTWi (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft-btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 24.02 | 26.69 | 2.67 | 10:15 | 10:18 | NR | NR | 25.6 | 00:28:03 | NA | NA | 3 | 3 |
| 2 | ~~24.02~~ 25.6 | 26.69 | 2.67 | 10:58 | 11:01 | NR | NR | 25.6 | 00:35:06 | NA | NA | 3 | 6 |
| 3 | ~~24.02~~ 25.6 | 26.69 | 2.67 | 11:47 | 11:52 | NR | NR | 25.6 | 00:31:41 | NA | NA | 3 | 9 |
| | | ? | | | | | | | | | | | |

Only allowed well to recharge to 50%.

Purged dry w/ bailer.

Sampled: 11:47 for TDS

Shaw Group, Inc.
Longhorn Army Ammunition Plant

00082364

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. 67WW02 Date: 12/12/07 Name: ALLEN WILLMORE

| Trial | DTWI (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 22.63 | 27.50 | 4.87 | 13:12 | 13:14 | NR | NR | 25.07 | 00:38:07 | NA | NA | 4 | 4 |
| 2 | 22.63 | ~~27.50~~ 25.10 | 4.87 | 14:11 | 14:16 | NR | NR | 25.07 | 00:40:57 | NA | NA | 3 | 7 |
| 3 | 22.63 | ~~27.50~~ 25.10 | 4.87 | 15:06 | 15:09 | NR | NR | 25.07 | 00:37:21 | NA | NA | 3 | 10 |

Well Only Recharged to 50%. Used 67WW02 because of minimal water in 67WW03

Purged dry w/ bailer

DTW = 23.33 for 67WW03
TD = 24.61
Sampled: 15:08 for TDS

Shaw Group, Inc.
Longhorn Army Ammunition Plant

00082365

# WELL YIELD BY CYCLIC DISCHARGE FIELD FORM

Well ID. 67WW05 Date: 12/14/07 Name: ALLEN WILLMORE

| Trial | DTWi (ft-btoc) | Total Depth (ft-btoc) | Length of Water Column (ft) | Time Began Pumping/Bailing | Time Well Went Dry | 10% Recovery (ft btoc) | 10% Time Elapsed (hh:mm:ss) | 50% Recovery (ft-btoc) | 50% Time Elapsed (hh:mm:ss) | 90% Recovery (ft-btoc) | 90% Time Elapsed (hh:mm:ss) | Volume Removed per Trial (gallons) | Cumulative Volume Removed (gallons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRY 1 | 23.25 | 30.45 | 7.20 | 09:17 | 09:24 | NR | NR | 26.75 | 00:50:42 | 83.97 | NA | 5 | 5 |
| DRY 2 | 23.25 | 30.45 | 7.20 | 10:35 | 10:40 | NR | NR | 26.75 | 00:48:09 | 83.97 | NA | 6 | 11 |
| DRY 3 | 23.25 | 30.45 | 7.20 | 11:41 | 11:48 | NR | NR | 26.75 | 01:51:13 | 83.97 | NA | 6 | 17 |

Allowed well to recover to 50%.

Sampled: 11:45

**ENCLOSURE 2**

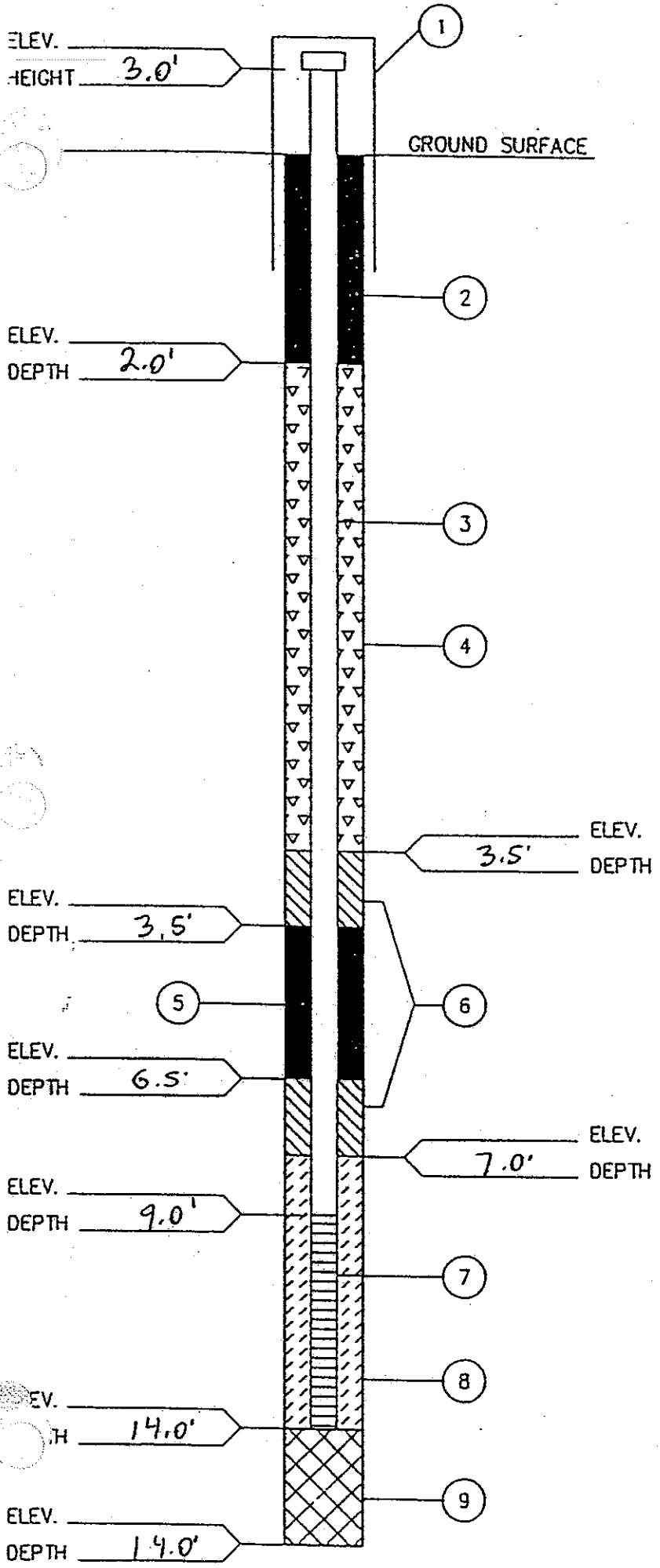
HOLE NO. LHS-MW52

| DRILLING LOG | DIVISION SOUTHWEST | INSTALLATION LHAAP | SHEET 1 OF 1 SHEETS |
|---|---|---|---|
| 1. PROJECT LHAAP-WASTE SUMPS | | 10. SIZE AND TYPE OF BIT 8" AUGER | |
| 2. LOCATION (Coordinates or Station) 6958449.80 | 3308619.60 | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) | MSL |
| 3. DRILLING AGENCY TULSA DISTRICT COE | | 12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500 | |
| 4. HOLE NO. (As shown on drawing title and file number) | LHS-MW52 | 13. OVERBURDEN SAMPLES DISTURBED 8 | UNDISTURBED 0 |
| 5. NAME OF DRILLER RAY VOILS | | 14. TOTAL NUMBER CORE BOXES | 0 |
| 6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER | NOT DETERMINED |
| | | 16. DATE HOLE STARTED 09/00/1994 | COMPLETED 09/00/1994 |
| 7. THICKNESS OF OVERBURDEN | 22.0 | 17. ELEVATION TOP OF HOLE | 202.5 |
| 8. DEPTH DRILLED INTO ROCK | 0.0 | 18. TOTAL CORE RECOVERY FOR BORING | 0.0 % |
| 9. TOTAL DEPTH OF HOLE | 22.0 | R. PETERSON | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| 200.5 | | | LEAN CLAY (CL) (0.0 – 2.0) CL-ML, SANDY SILTY CLAY, BROWN, WET. | | J-1 | TYPE AUGER ZONE 0.0– 22.0<br>SAMPLE DEPTH<br>J-1 0.0– 2.0<br>J-2 2.0– 4.0<br>J-3 4.0– 7.5<br>J-4 7.5– 10.5<br>J-5 10.5– 13.0<br>J-6 13.0– 17.0<br>J-7 17.0– 20.5<br>J-8 20.5– 22.0 |
| 198.5 | 3 | | LEAN CLAY (CL) (2.0 – 4.0) WITH SAND, REDDISH BROWN, MOIST. | | J-2 | |
| 195.0 | 6 | | FAT CLAY (CH) (4.0 – 7.5) WITH SAND, REDDISH BROWN, MOIST | | J-3 | |
| 192.0 | 9 | | LEAN CLAY (CL) (7.5 – 10.5) SANDY, REDDISH BROWN, MOIST. | | J-4 | |
| 182.0 | 12 15 18 | | LEAN CLAY (CL) (10.5 – 20.5) WITH SAND, BROWN TO YELLOWISH BROWN, MOIST. | | J-5 J-6 J-7 | 11.7-21.7<br>180.8-190.8 |
| 180.5 | 21 | | FAT CLAY (CH) (20.5 – 22.0) YELLOWISH BROWN, MOIST. | | J-8 | |
| | 24 27 30 | | | | | |

PROJECT LHAAP-WASTE SUMPS | HOLE NO. LHS-MW52

00082368




MONITORING WELL CONSTRUCTION INFORMATION

JOB. NO. 000187

BORING/WELL NO. 35BWW02(S)

DATE 8-31-98

CHIEF/UNIT BB / CME-75

1. PROTECTIVE CASING YES NO

   LOCKING YES NO

2. TYPE OF SURFACE SEAL (IF INSTALLED)
   Cement

3. SOLID PIPE TYPE Stainless steel

   SOLID PIPE LENGTH 12.0' ft.

   JOINT TYPE SLIP/GLUED/THREADED

4. TYPE OF BACKFILL Cement

   HOW INSTALLED - TREMIE Pipe

   FROM SURFACE

5. TYPE OF LOWER SEAL (IF INSTALLED)
   Bentonite (hydrated)

6. TYPE OF SECONDARY FILTER PACK
   Sand (30-70)

7. SCREEN TYPE Stainless steel

   SCREEN LENGTH 5.0 ft.

   SLOT SIZE #10 Machine in.

   SCREEN DIAMETER 4 in. (I.D

8. TYPE OF PRIMARY FILTER PACK
   Primary Sand (16-30)

9. TYPE OF BACKFILL Primary Sand

10. DRILLING METHOD HSA

WATER LEVEL _____ DATE _____

*ALL DEPTHS MEASURED FROM GROUND SURFACE

**Sverdrup**
ENVIRONMENTAL

Hole No. 35BWW02(3)

00082369

| DRILLING LOG | DIVISION: USACE Tulsa | INSTALLATION: LHAAP Karnack, TX | SHEET 1 OF 2 SHEETS |
|---|---|---|---|
| 1. PROJECT: LHAAP Site 35 B | | 10. SIZE AND TYPE OF BIT: Hole Boring | |
| 2. LOCATION (Coordinates or Station) | | 11. DATUM FOR ELEVATION SHOWN (TBM or MSL) | |
| 3. DRILLING AGENCY: GPI, Inc Hurst, TX | | 12. MANUFACTURER'S DESIGNATION OF DRILL: CME-75 3¼" ID 3"OD HSA / 3" Conv Sampler / 11" OD HSA | |
| 4. HOLE NO. (As shown on drawing title or file number): 35BWW02 | | 13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED — | |
| 5. NAME OF DRILLER: José Landros | | 14. TOTAL NUMBER CORE BOXES: N/A | |
| 6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT. | | 15. ELEVATION GROUND WATER: — | |
| 7. THICKNESS OF OVERBURDEN | | 16. DATE HOLE: STARTED 8-31-98; COMPLETED 8-31-98 | |
| 8. DEPTH DRILLED INTO ROCK | | 17. ELEVATION TOP OF HOLE: — | |
| 9. TOTAL DEPTH OF HOLE | | 18. TOTAL CORE RECOVERY FOR BORING: N/A % | |
| | | 19. SIGNATURE OF INSPECTOR: B B | |

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 1 | CL | silty clay - dark brown grading dk yellowish brown (mottled), stiff to very stiff (Dry) | 3.5' of 4.0' | SS#1 0.0' to 4.0' | Commenced 1325 Hour Reading |
| | 2 | | | | | |
| | 3 | | silty clay - light to dk brown w/ some orange staining (mottled) (still cohesive) (Dry) | | | Sampler = 0 ppm |
| | 4 | CL | | | | |
| | 5 | | silty sand - light gray sand w/ high silt content low plasticity soft and friable throughout (Dry) high silt content from 7' to 8' fine micaceous sand from 8' down to 9' grades into CL at 10.5' | 5.6' of 5.0' | SS#2 4.0' to 9.0' | Sampler = |
| | 6 | SM | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |
| | 11 | CL | silty clay - gray to light gray w/ orange staining (mottled) moderate plasticity (moist) | 5.0' of 5.0' | SS#3 9.0' to 14.0' | Sampler = 4 ppm |
| | 12 | | | | | |
| | 13 | SM | silty sand/sandy silt - gray to dark gray silt present, no plasticity soft to very soft (free water) grades into CL around 14 to 14.1' | | | |
| | 14 | | | | | |
| | 15 | CL | silty sandy clay - med gray to light w/ orange staining (moist) thin layers of hard shale like clay about 2" thick | 2.5' of 5.0' | SS#4 14.0' to 19.0' | |
| | 16 | SP | poorly sorted sand - light gray to gray sand w/ some silt no plasticity, very soft + some orange staining. (free water) | | | |
| | 17 | | | | | |
| | 18 | | | | | |
| | 19 | | | 2.0' of 5.0' | SS#5 (G.D' 4021') | |

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT | HOLE NO.

00082370

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE | Hole No. 35Blw002

PROJECT | INSTALLATION | SHEET 2 OF 2 SHEETS

| ELEVATION a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOV-ERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | 20 | SM | Silty sand - olive-gray-brown to lt gray mottled silty sand w/some gravel around 20.2' (soft to stiff) no plasticity (wet) | 2.0' of 2.0' | SS#5 19.0' to 21.0' | |
| | 21 | SM/SC | silty clayey sand - lt gray to olive brown - sand with lots of fines (some plasticity) soft to very soft (free water) | 2.0' to 2.0' | SS#6 21.0' to 23.0' | |
| | 23 | SM | silty sand - lt gray to lt brown silty sand no plasticity very soft (free wat | 5.0' of 2.0' | SS#7 23.0 to 25.0 | |
| | 25 | SM | as above | 2.0' of 2.0' | SS#8 25.0 to 27.0 | |
| | 27 | | | 2.0' of 2.0' | SS#9 27.0 to 29.0 | |
| | 28 | SM | As above | | | |
| | 29 | | | | | |
| | 30 | | | | | |
| | 31 | | | 5.0' of 5.0' | SS#10 29.0' to 34.0' | |
| | 32 | | | | | |
| | 33 | SM/SC | silty clayey sand - lt gray to lt brown w/a purple tint soft (free wat) | | | Clayey sands - gravel. Appreciable amount of sandy silt and clayey "shale" Dark brown to gray (wet) stiff but friable SP -68 |
| | 34 | | | | | |
| | 35 | SM | silty sand lt brown n. sand w/some fines, increase towards bottom (soft freewat) | 5.0' of 5.0' | SS#11 34.0' to 39.0' | |
| | 36 | | | | | |
| | 37 | | | | | |
| | 38 | | | | | |
| | 39 | SM | As above | | | |
| | 40 | | freewater | 5.0' of 5.0' | SS#12 39.0' 44.0 | |
| | 41 | | | | | |
| | 42 | CL | lt-m clay loam (mod stiff to stiff) lt gray clay (wet) | | | |
| | 43 | SM | 1" lt gray silty sand - soft + free wat w/o plasticity | | | |

ENG FORM 1836-A (ER 1110-1-1801) GPO 1980 OF-928-003 | PROJECT | HOLE NO.

# Drilling Log

00082371

Monitoring Well **35BWW04**



Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *845714*

Surface Elev. *199.3 ft.* Total Hole Depth *30.0 ft.* North *6958058.09 ft* East *3308166.14 ft.*

Top of Casing *202.11 ft.* Water Level Initial ▽ *14.0 ft.* Static ▼ *19.5 ft.* Diameter *8 in.*

Screen: Dia *4 in.* Length *10 ft.* Type/Size *Sch. 40 PVC/.01 in.*

Casing: Dia *4 in.* Length *23 ft.* Type *Sch. 40 PVC*

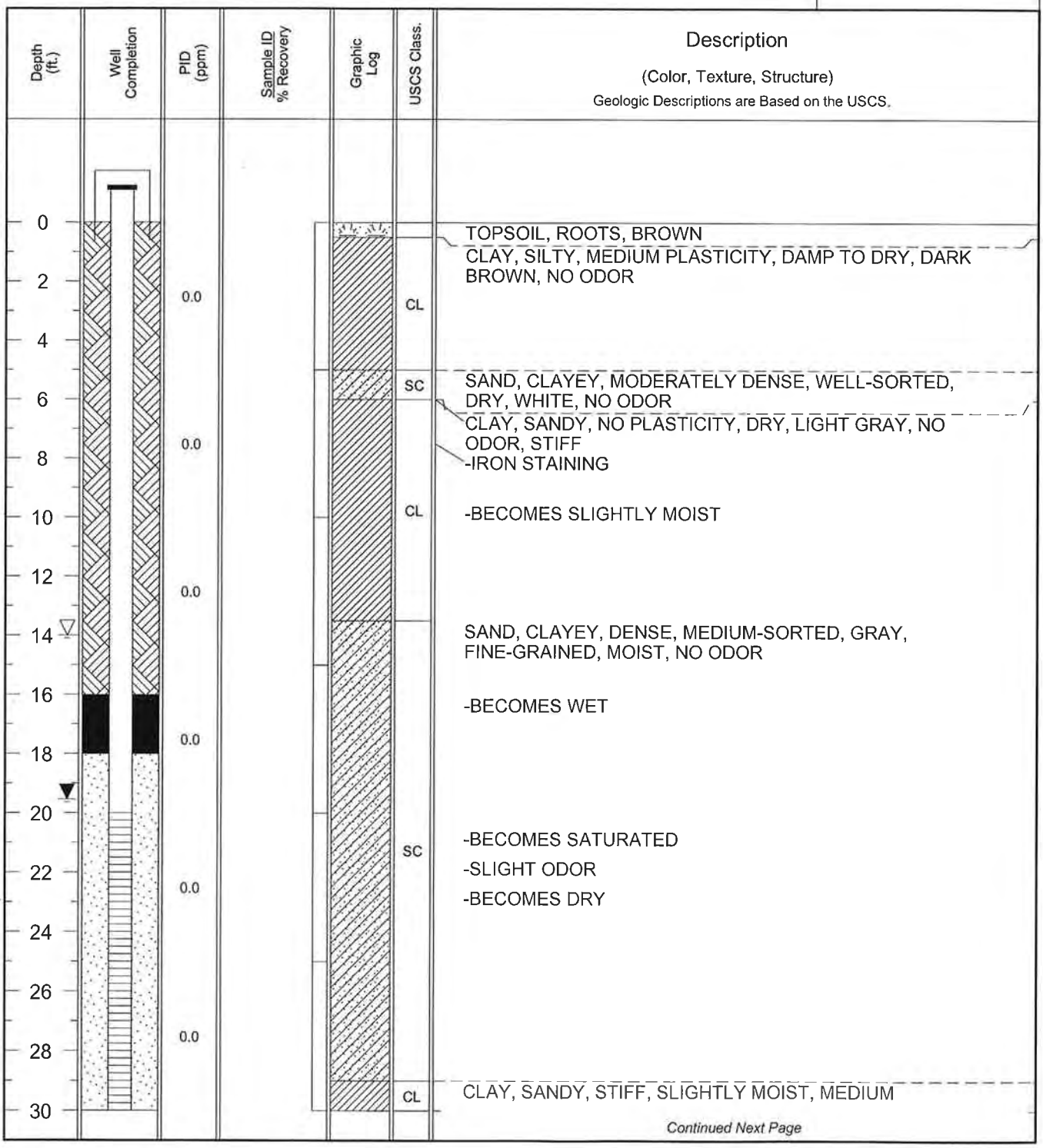
Fill Material *20/40 silica sand* Rig/Core *B-61*

Drill Co. *JEDI* Method *Hollow Stem Auger*

Driller *Joe Medrano* Log By *A. Willmore* Date *12/6/06* Driller # *4603*

Checked By *K. Everett* License No. *Texas 379*

*COMMENTS*
*Hand augered 0 to 5 feet bgs.*




*Continued Next Page*

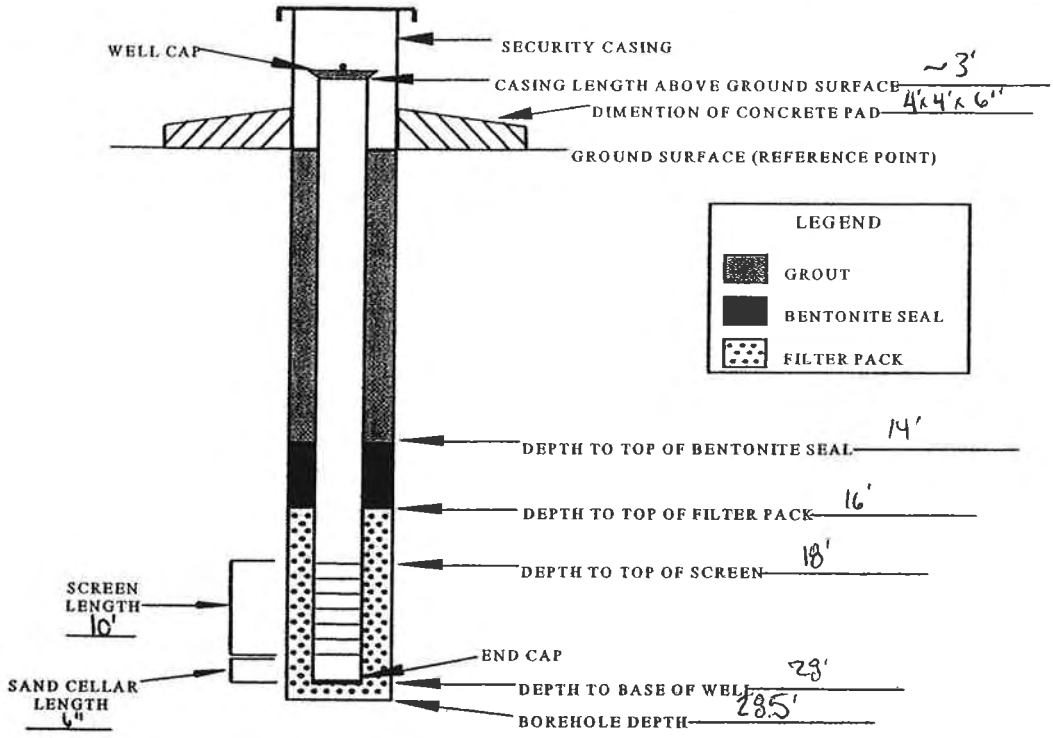
00082372

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: A. Willmore
DRILLING CONTRACTOR: JEDI
DRILLING TECHNIQUE: HSA
AUGER SIZE AND TYPE: 8" Auger
BOREHOLE IDENTIFICATION: 35B WW07
BOREHOLE DIAMETER: 8"
WELL IDENTIFICATION: 35BWW07
WELL CONSTRUCTION START DATE: 9/8/07
WELL CONSTRUCTION COMPLETE DATE: 9/8/07
SCREEN MATERIAL: SCH 40 PVC
SCREEN DIAMETER: 2"
STRATUM-SCREENED INTERVAL (FT): 10'
CASING MATERIAL: SCH 40 PVC
CASING DIAMETER: 2"

TYPE OF FILTER PACK: 20/40 SILICA SAND
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 5-50lb bags
TYPE OF BENTONITE: pellets
AMOUNT BENTONITE USED: ~12.5 lbs
TYPE OF CEMENT: PORTLAND - CEMENT
AMOUNT CEMENT USED: 6-94 lb bags
GROUT MATERIALS USED: slurry
DIMENSIONS OF SECURITY CASING: 6" x 6"
TYPE OF WELL CAP: 2" well plugging cap
TYPE OF END CAP: SCH 40 PVC
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




NOT TO SCALE

INSTALLED BY: Oscar Garcia - JEDI INSTALLATION OBSERVED BY: Allen Willmore - SHAW

DISCREPANCIES:

SITE 35B(37)
HOLE NO. 35BWW07 00082373

# BORING LOG

DIVISION TERC — HOUSTON FEDERAL

INSTALLATION: LHAAP

SHEET 1 OF SHEETS

1. PROJECT: LHAAP
2. LOCATION: KARNACK, TEXAS
3. DRILLING AGENCY: VEDI DRILLING
4. HOLE NO. (As shown on drawing title and file number): 35BWW07
5. NAME OF DRILLER: OSCAR GARCIA
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 0° DEG. FROM VERT.
7. TOTAL DEPTH OF HOLE: 28'
8. SIZE AND TYPE OF BIT: 8" O.D., HSA, 2" SPLIT SPOON
9. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
10. MANUFACTURER'S DESIGNATION OF DRILL: CME 75
11. OVERBURDEN SAMPLES: DISTURBED YES; UNDISTURBED
12. TOTAL NUMBER CORE BOXES: NA
13. ELEVATION GROUND WATER
14. DATE HOLE: STARTED 9/8/07; COMPLETED 9/8/07
15. ELEVATION TOP OF HOLE: NOT ORIGINALLY RECORDED, SEE SURVEY
16. TOTAL CORE RECOVERY FOR BORING: ____ %
17. LOGGED BY: A. Willmore; QC

| PID (ppm) a | DEPTH b | USCS c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | SAMPLE f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| 0.0 | 0 | CL | CLAY, SANDY, NO PLASTICITY, STIFF, DRY, BROWN, NO ODOR | 100% | | |
| 0.0 | 5 | SM | SAND, SILTY, ~~CLAY~~ SLIGHTLY DENSE, MODERATELY TO WELL SORTED, GRAY, MOIST, NO ODOR | 75% | | |
| 0.0 | | ML | SILT, CLAYEY, DENSE, NO PLASTICITY, POORLY SORTED, MOIST, GRAY, NO ODOR | 100% | | |
| 0.0 | 10 | CL | CLAY, SANDY, LOW PLASTICITY, SOFT TO STIFF, MOIST, GRAY, NO ODOR | 100% | | |

00082374

**DRILLING LOG (Cont Sheet)** | ELEVATION TOP OF HOLE | Hole No. 35BKMW07

PROJECT: LHAAP-TERC | INSTALLATION: LHAAP | SHEET 2 OF SHEETS

| PID ELEVATION (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| 0.0 | | CL | SAME AS ABOVE | 100% | | |
| | 15 | | -BECOMES SILTY, STIFF | | | |
| 0.0 | | | | 100% | | |
| 0.0 | | SC | SAND, CLAYEY, LOOSE TO MOD DENSE, POORLY-SORTED SATURATED, NO ODOR | 100% | | |
| | 20 | CL | CLAY, SILTY, LOW PLASTICITY, SOFT, MOIST, NO ODOR, GRAY | | | |
| 0.0 | | | -BECOMES HARD TO STIFF | | | |
| | | | -BECOMES DRY | 0.0 | | |
| | 25 | | END OF BORING @ 28' BGS | | | |

ENG FORM 1836—APREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

00082375

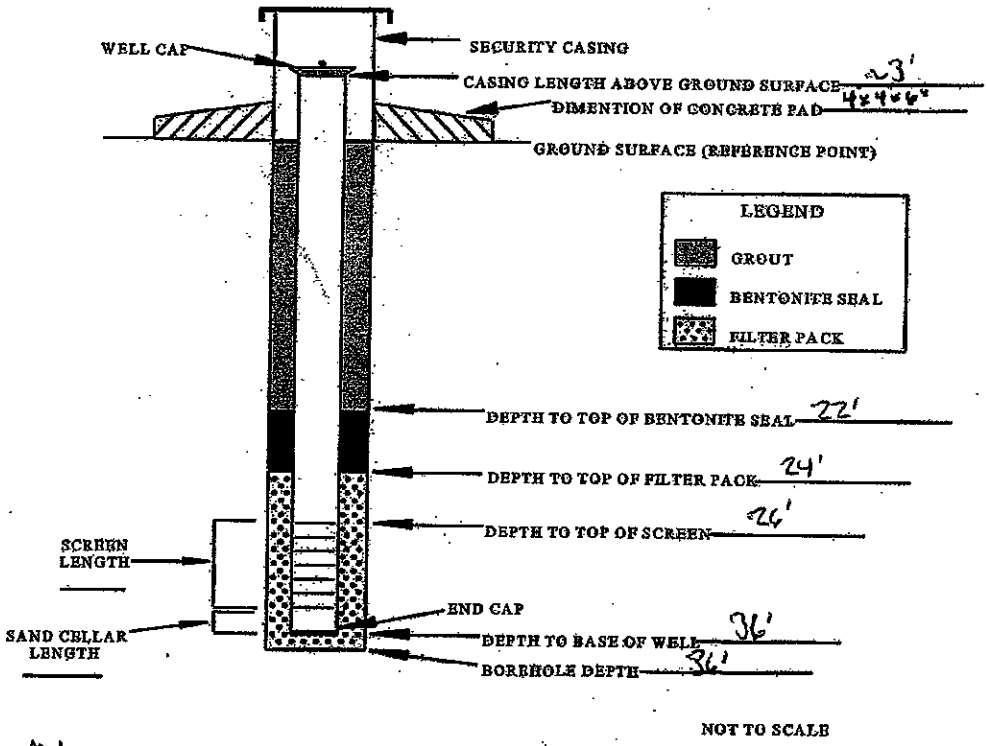
358WW05

# WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: A. Willmore
DRILLING CONTRACTOR: Jedi
DRILLING TECHNIQUE: HSA
AUGER SIZE AND TYPE: 8"
BOREHOLE IDENTIFICATION: 358TW01/358WW05
BOREHOLE DIAMETER: 8
WELL IDENTIFICATION: 358TW01/358WW05
WELL CONSTRUCTION START DATE: 12/6/06
WELL CONSTRUCTION COMPLETE DATE: 12/6/06
SCREEN MATERIAL: Sch. 40 PVC
SCREEN DIAMETER: 2"
STRATUM-SCREENED INTERVAL (FT): 10'
CASING MATERIAL: Sch 40 PVC
CASING DIAMETER: 2"

TYPE OF FILTER PACK: Silica Sand
GRADIATION: 20/40
AMOUNT OF FILTER PACK USED: 5-bags (25-lb)
TYPE OF BENTONITE: 3/8" Hole Plug
AMOUNT BENTONITE USED: 1-50 lb bags
TYPE OF CEMENT: Portland cement
AMOUNT CEMENT USED: 2+ bags
GROUT MATERIALS USED: NR
DIMENSIONS OF SECURITY CASING: 8" x 8"
TYPE OF WELL CAP: Plug in cap
TYPE OF END CAP: PVC cone sump
COMMENTS:

SPECIAL CONDITIONS
(describe and draw)




NOT TO SCALE

INSTALLED BY: Joe Medrano
INSTALLATION OBSERVED BY:
DISCREPANCIES:

00082376

35BTW01
HOLE NO. 35BW1005

**DRILLING LOG**

DIVISION: FEDERAL TERR
INSTALLATION: Longhorn Army Ammunition Plant
SHEET 1 OF SHEETS

1. PROJECT: LHAAP
2. LOCATION (Coordinates or Station): Karnack, TX
3. DRILLING AGENCY: JEAI
4. HOLE NO. (As shown on drawing title and file number): 35BTW01 / 35BW1005
5. NAME OF DRILLER: Joe Mennano
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED 0° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: NA
8. DEPTH DRILLED INTO ROCK: NA
9. TOTAL DEPTH OF HOLE: 30'
10. SIZE AND TYPE OF BIT: 8" HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL
12. MANUFACTURER'S DESIGNATION OF DRILL: Hot HSA RD B-61
13. OVERBURDEN SAMPLES: DISTURBED No; UNDISTURBED Yes
14. TOTAL NUMBER CORE BOXES: NR
15. ELEVATION GROUND WATER: NR
16. DATE HOLE: STARTED 12/6/06; COMPLETED 12/6/06
17. ELEVATION TOP OF HOLE: NR
18. TOTAL CORE RECOVERY FOR BORING: NR %
INSPECTOR: Allen Willmore

| ELEVATION (ft) a | DEPTH b | LEGEND c | CLASSIFICATION OF MATERIALS (Description) d | % CORE RECOVERY e | BOX OR SAMPLE NO. f | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g |
|---|---|---|---|---|---|---|
| | | | TOPSOIL & ROOTING | | | |
| | | | CLAY, SILTY, NO PLASTICITY, SOFT, DARK BROWN, SLIGHTLY MOIST, NO ODOR | 100% | | |
| 0.0 | | CL | -BECOMES SANDY, DRY, LIGHT BROWN, SOME IRON STAINING | 100% | | |
| | 5 | | | 100% | | |
| 6.0 | | SC | SAND, CLAYEY, DENSE, SLIGHTLY MOIST, IRON STAINING, BROWNISH GRAY | 100% | | |
| | 10 | CL | CLAY, SANDY, NO PLASTICITY, VERY STIFF, BROWNISH-GRAY, IRON STAINING | 100% | | |
| 0.0 | | | -6" moist sand seam | 100% | | |
| | | SC | SAND, CLAYEY, DENSE, WET, IRON STAINING, GRAY, WELL-SORTED | 100% | | |

00082377

**DRILLING LOG (Cont Sheet)** | ELEVATION TOP OF HOLE | Hole No. 36B TW01 / 36B005

PROJECT 845714 | INSTALLATION CHAMP | SHEET 2 OF SHEETS

| ELEVATION (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| | | | -BECOMES FILTY, SATURATED, LOOSE | 100% | | |
| | 5 | SM | | 100% | | |
| | | | | 100% | | |
| | 10 | | | 100% | | |
| | | | | NR | | |
| | 15 | SM | -BECOMES MORE DENSE | 100% | | |
| | 20 | | -BECOMES LESS DENSE, BROWN | 100% | | |
| | 25 | | | 100% | | |
| | | | | 100% | | |

ENG FORM 1836—APREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

**DRILLING LOG (Cont Sheet)** | ELEVATION TOP OF HOLE | Hole No. 358TW01 / 358TW05

PROJECT 84574 | INSTALLATION LHAAP | SHEET 3 OF SHEETS

| ELEVATION PID (a) | DEPTH (b) | LEGEND (c) | CLASSIFICATION OF MATERIALS (Description) (d) | % CORE RECOVERY (e) | BOX OR SAMPLE NO. (f) | REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g) |
|---|---|---|---|---|---|---|
| | 30 | SM | | 100% | | |
| | | | | 100% | | |
| | | | - BECOMES VERY SATURATED | 100% | | |
| | 35 | CL | CLAY, SILTY, SOFT, NO PLASTICITY, VERY SL. MOIST; NO ODORS REDDISH-BRN. | 100% | | |
| | | | END OF BORING @ 36' BGS | | | |

ENG FORM 1836—APREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT | HOLE NO.

**ENCLOSURE 3**

Shaw Environmental & Infrastructure, Inc.

3010 Briarpark Drive, Suite 400
Houston, Texas 77042
(713) 996-4400
(713) 996-4436 Fax

Shaw The Shaw Group Inc.™

# Memorandum

**Date:** **June 6, 2008**

**To:** **John Elliott and Nicole Olson, Shaw Environmental, Inc**

**From:** **William A. Foss, P.G. – Shaw Environmental, Inc.**

**RE:** **Hydraulic Conductivity Estimation Methodology**
**Longhorn Army Ammunition Plant Site LHAAP-67**

---

The purpose of this memorandum is to describe the methodology used to estimate the hydraulic conductivity (K) of the shallow aquifer at LHAAP-67 based on the results of the cyclic discharge aquifer tests reported in a January 8, 2008 technical memorandum to Cliff Murray (USACE-Tulsa). There is no way to directly calculate a K value from the data collected during a cyclic discharge well test. However, the method described in the next paragraph provides a conservative estimate that is likely biased towards higher values. The K value estimated using the method described below ($4.6x10^{-4}$ cm/s) was lower than the literature derived value used in previous modeling at LHAAP-67. However, as explained below, the new site-specific estimate is likely to still be more conservative (higher) than the actual value.

The hydraulic conductivity (K) for LHAAP-67 was estimated as a flow velocity calculated from the volume removed from each well over the time of pumping divided by the saturated surface area of the borehole that was discharging water to each well. For each well, a cyclic discharge test was performed where the well was pumped until it ran dry. Then the well was allowed to recharge until 90% recovery was reached. Three pumping and recovery cycles were performed for each well. The total volume pumped divided by the recovery time was determined to represent the estimated aquifer yield. For the purposes of calculating a K value, the yield value was converted from gallons per day into units of cubic centimeters per second, then divided by the saturated surface area of the borehole in square centimeters, leaving a value in centimeters per second (cm/s) that represents a flow velocity into the well.

**Aquifer Yield** ($cm^3/s$) **/ Saturated Surface Area** ($cm^2$) **= Flow Velocity** (cm/s)

The flow velocity is typically calculated as shown below:

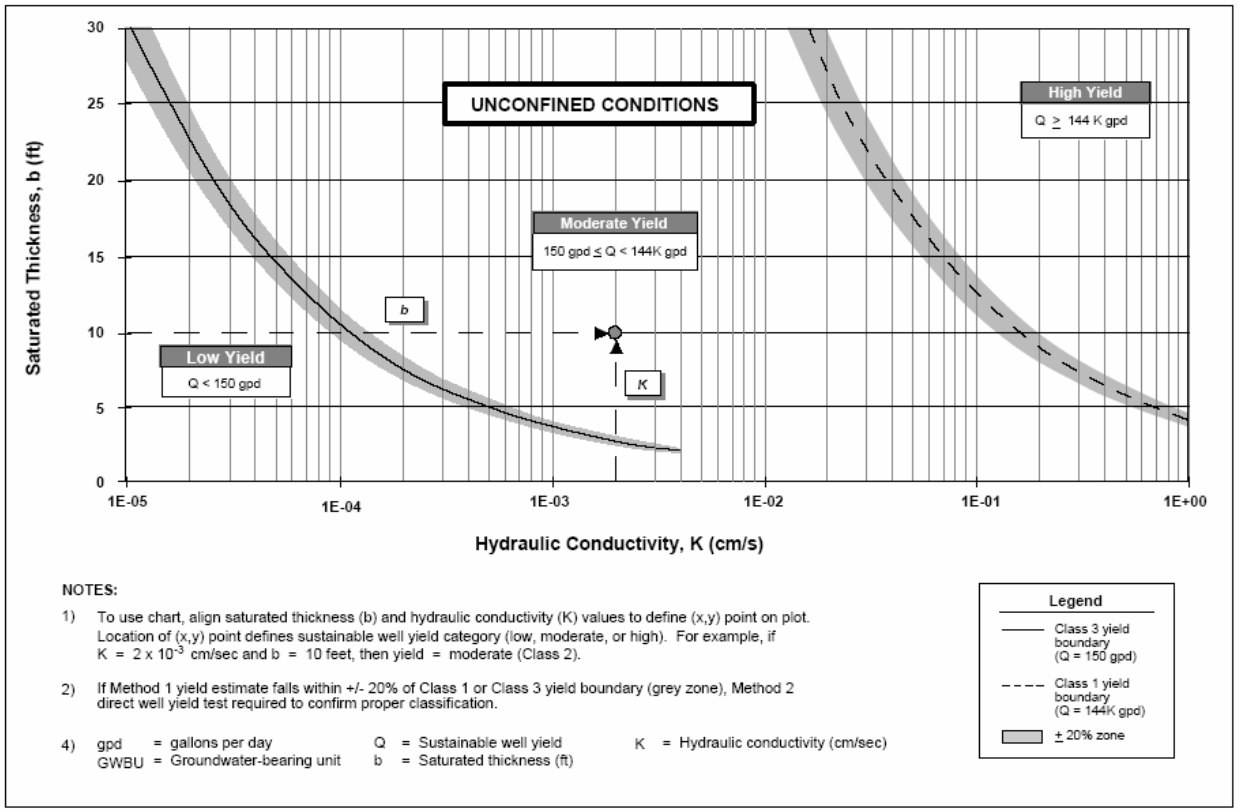
**Flow velocity** (cm/s) **= Hydraulic Conductivity** (cm/s) **x Hydraulic Gradient** (cm/cm)

In the case of the flow velocity of the groundwater at the edge of the borehole, the gradient will be variable depending on the amount of drawdown in the well as well as the slope of the cone of depression in the surrounding saturated material. Since no additional wells were measured for water levels during pumping, it is impossible to know what the slope of the cone of depression was. Since the wells were pumped dry, and only allowed to recover 90%, it is safe to assume that more than half of the recharge occurred when the well drawdown was greater than 50% of the saturated thickness. Based on the short duration of pumping to achieve full drawdown (10-12 minutes on average), the gradient at 50% drawdown would be likely be greater than 1/1, or 1, which would result in the flow velocity equaling or exceeding the hydraulic gradient. Therefore, in the case of these tests, the average flow velocity is likely to be a relatively conservative estimate of the K value for the aquifer as a whole.

The estimated K values for the wells tested at LHAAP-67 ranged from $2.7x10^{-4}$ cm/s to $7.8x10^{-4}$ cm/s, with aquifer yields ranging from 125 to 170 gallons per day. The left hand black curve on the figure below

**MEMORANDUM**

(reproduced from page A-8 of the TCEQ's TRRP-8 *Groundwater Classification* guidance document) represents an aquifer yield of 150 gallons per day. With a 10 foot saturated thickness, the 150 gallons per day yield equates to a K value of slightly over $1x10^{-4}$ cm/s. Since the average yield calculated from the testing at LHAAP-67 was 143 gallons per day, this figure confirms that the method described above to estimate K values at LHAAP-67 is likely to produce a reasonable estimate of the actual K value for use in the LHAAP-67 modeling, with a slight bias towards higher or more conservative values.




(Figure from Page A-8, TCEQ TRRP-8 *Groundwater Classification* guidance document)

**ENCLOSURE 4**

**Table 2**
**Estimated Time for PCE, TCE and 1,1,DCE Concentrations at the Source to be Reduced to MCLs by Natural Attenuationfor LHAAP- 35B (37)**

| | Current (Recent) Maximum Concentration at the Source (µg/L) | Attenuation Period Assuming an Instantaneous Source (years) | Attenuation Period Assuming a Continuous Source for 10 years (years) |
|---|---|---|---|
| | Tetrachloroethene (PCE), MCL = 5.0 µg/L | | |
| No Degradation | 34 | 26.4 (37.2) | 32 (45.6) |
| Half-life = 20 years | 34 | 22.2 (27.6) | 27.6 (37.7) |
| Half-life = 2 years | 34 | 8.5 (10.3) | 14.5 (17.5) |
| | Trichloroethene (TCE), MCL = 5.0 µg/L | | |
| No Degradation | 330 | 32.6 (41.9) | 39 (47) |
| Half-life = 45 years | 330 | 30.5 (38.5) | 37 (43.3) |
| Half-life = 4.5 years | 330 | 19.3 (19.8) | 25.6 (26.2) |
| | 1,1-dichloroethene (1,1-DCE), MCL = 7.0 µg/L | | |
| No Degradation | 58 | 20.4 (25.4) | 26.5 (29.9) |
| Half-life = 3.62 years | 58 | 11.8 (16) | 18 (21.2) |
| Half-life = 0.362 years | 58 | 2 (3.6) | 10.2 (11.1) |

Notes:
µg/L micrograms per liter
MCL maximum contaminant level
Values in Red are based on larger size of plume (350 ft x 300 ft x 16.8 ft)

**Table 3**
**Estimated Time for TCE, 1,1-DCE, 1,2-DCA, 1,1,1-TCA, and 1,1,2-TCA Concentrations at the Source to be Reduced to MCLs By Natural Attenuation for LHAAP-67**

| | Current (Recent) Maximum Concentration at the Source (µg/L) | Attenuation Period Assuming an Instantaneous Source (years) | Attenuation Period Assuming a Continuous Source for 10 years (years) |
|---|---|---|---|
| | Trichloroethene (TCE), MCL = 5.0 µg/L | | |
| No Degradation | 6.3 | 2.1 (21.7) | 13.8 (122.8) |
| Half-life = 45 years | 6.3 | 1.97 (16.6) | 13.3 (66.2) |
| Half-life = 4.5 years | 6.3 | 1.6 (6) | 11.4 (19.4) |
| | 1,1-dichloroethene (1,1-DCE), MCL = 7.0 µg/L | | |
| No Degradation | 380 | 15 (165.1) | 33.9 (352.4) |
| Half-life = 3.62 years | 380 | 8.2 (20.1) | 20.1 (34.3) |
| Half-life = 0.362 years | 380 | 2 (2.6) | 11.3 (11.7) |
| | 1,2-dichloroethane (1,2-DCA), MCL = 5.0 µg/L | | |
| No Degradation | 27 | 5.3 (57.5) | 19 (178.2) |
| Half-life =10 years | 27 | 4.4 (21.0) | 16.3 (43.4) |
| Half-life = 1 year | 27 | 2.1 (3.9) | 11.4 (13.2) |
| | 1,1,1-Triichloroethane (1,1,1-TCA), MCL = 200 µg/L | | |
| No Degradation | 1800 | 8.4 | 26.9 |
| Half-life = 15 years | 1800 | 7.1 | 22 |
| Half-life = 1.5 years | 1800 | 3.2 | 12.9 |
| | 1,1,2-Trichloroethane (1,1,2-TCA), MCL = 5 µg/L | | |
| No Degradation | 33 | 6.4 | 22 |
| Half-life = 20 years | 33 | 5.8 | 19.6 |
| Half-life = 2 years | 33 | 3.2 | 13.1 |

Notes:

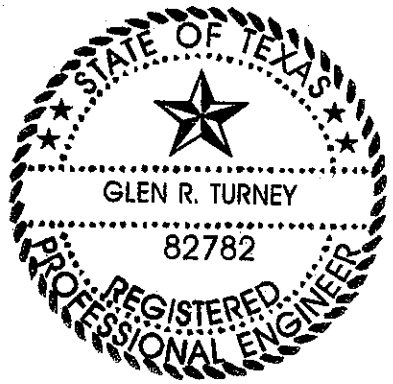
µg/L micrograms per liter

MCL maximum contaminant level

Values in Red are based on an average hydraulic conductivity of $4.6 \times 10^{-4}$ cm/s.

**FINAL**

# CONSTRUCTION COMPLETION REPORT
# INTERIM REMEDIAL ACTION
# LANDFILLS 12 AND 16 CAP CONSTRUCTION
# LONGHORN ARMY AMMUNITION PLANT (LHAAP)
# KARNACK, TEXAS




Glen R. Turney 12/2/98

**Glen R. Turney, P.E**

**Texas No. 82782**

**December 1998**

**OHM Remediation Services Corporation**
**13111 NW Freeway, Ste. 600**
**Houston, Texas 77040**

# CONSTRUCTION COMPLETION REPORT
# INTERIM REMEDIAL ACTION
# LANDFILLS 12 AND 16 CAP CONSTRUCTION
# LONGHORN ARMY AMMUNITION PLANT (LHAAP)
# KARNACK, TEXAS

## TABLE OF CONTENTS


Page

**1.0 INTRODUCTION** ..... 1

**2.0 SITE INFORMATION** ..... 1

**3.0 PROJECT SCOPE** ..... 2
- 3.1 Regulatory Requirements ..... 2
- 3.2 Landfill Cap Design Features ..... 2

**4.0 CONSTRUCTION WORK TASKS** ..... 6
- 4.1 Task 1 – Mobilization ..... 6
- 4.2 Task 2 – Construction of Access Roads ..... 6
- 4.3 Task 3 – Preparation of Borrow Source ..... 6
- 4.4 Task 4 – Installation of Stormwater Controls ..... 6
- 4.5 Task 5 – Preliminary Site Survey ..... 7
- 4.6 Task 6 – Construction and Operation of LF 12 & LF 16 Stockpiles ..... 7
  - 4.6.1 Sub-Task 6.1 – Clear Stockpile Area ..... 7
  - 4.6.2 Sub-Task 6.2 – Construction of Stormwater Diversion Berms at Stockpile 7
  - 4.6.3 Sub-Task 6.3 – Handling the Treated Contaminates Soil Stockpile ..... 7
- 4.7 Task 7 – Perform Air Monitoring ..... 8
- 4.8 Task 8 – Construction of LF 12 and LF 16 Cap ..... 8
  - 4.8.1 Sub-Task 8.1 – Clear and Proofroll ..... 8
  - 4.8.2 Sub-Task 8.2 – Place Grading Layer ..... 8
  - 4.8.3 Sub-Task 8.3 – Installation of GCL/FML ..... 9
  - 4.8.4 Sub-Task 8.4 – Placement of Cover Layer ..... 9
  - 4.8.5 Sub-Task 8.5 – Placement of Topsoil ..... 10
  - 4.8.6 Sub-Task 8.6 – Construction of Landfill Drainage ..... 10
  - 4.8.7 Sub-Task 8.7 – Vegetation of the Landfill Cap Surface ..... 11
- 4.9 Task 9 – Demobilization ..... 11
- 4.10 Task 10 – Plugging and Abandonment of Groundwater Wells ..... 11
- 4.11 Task 11 – Demolition of Existing Features ..... 11

**5.0 PROJECT VARIANCES AND AMENDMENTS** ..... 12

## TABLE OF CONTENTS
**(Continued)**

**FIGURES:**

**Page**

Figure 3-1 - Cap Liner Configuration ..... 5

**TABLES**

Table 5-1 ..... 13

**APPENDICES:**

APPENDIX A - Construction As-Built Drawings

## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| EPA | Environmental Protection Agency (US) |
| FML | Flexible Membrane Liner |
| GCL | Geocomposite Clay Liner |
| LF | Landfill |
| LHAAP | Longhorn Army Ammunition Plant |
| LLDPE | Linear Low-Density Polyethylene |
| NCP | National [Oil and Hazardous Substances Pollution] Contingency Plan |
| OHM | OHM Remediation Services Corporation |
| RCRA | Resource Conservation and Recovery Act |
| ROD | Record of Decision |
| SARA | Superfund Amendments and Reauthorization Act |
| SCP | Stormwater Control Plan |
| TERC | Total Environmental Restoration Contract |
| USACE | United States Army Corps of Engineers |

# CONSTRUCTION COMPLETION REPORT
# INTERIM REMEDIAL ACTION LANDFILLS 12 AND 16 CAP CONSTRUCTION
# LONGHORN ARMY AMMUNITION PLANT (LHAAP)
# KARNACK, TEXAS

## 1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted OHM Remediation Services Corp. (OHM) to cap existing Landfills 12 and 16 at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. The project included construction of access roads, preparation of temporary stockpiles for waste treated by others, stormwater controls, and construction of geocomposite landfill caps.

## 2.0 SITE INFORMATION

LHAAP is located in central east Texas in the northeast corner of Harrison County 40 miles west of Shreveport, Louisiana, and approximately 14 miles northeast of Marshall, Texas, as shown on **Drawing C-01** in **Appendix H** of the **Work Plan**. The installation occupies 8,493 acres between State Highways 43 and 134 (western and northern boundaries, respectively) and the western shore of Caddo Lake.

The LHAAP 12 and 16 Landfills are in a remote location of the plant. LHAAP 12 Landfill is an open area, encompassing approximately seven acres of grass bounded by heavy timber. A tributary of Central Creek flows along the eastern, northeastern, and northern edges of the landfill.

LHAAP 16 landfill is a sloped, open area encompassing approximately 16 acres of grass bounded along the west and north by a gravel road and along the east and south by heavy timber. Harrison Bayou borders the landfill along the east and southeast. The southeastern edge of the landfill is in the 100-year flood plain.

## 3.0 PROJECT SCOPE

### 3.1 Regulatory Requirements

This project was required by the Record of Decision (ROD) made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This ROD is documented in the Administrative Record for this site.

The ROD for LHAAP 12 and 16 Landfills addressed an Early Interim Remedial Action which is necessary to mitigate potential risks posed by buried source material at the landfills. The source material includes industrial solid wastes, possibly containing hazardous constituents, generated at LHAAP. The potential risks, in general, include the infiltration of water into the landfills and contaminant transport. The selected remedy includes a multi-layer cap and cover system over each landfill to minimize both water infiltration and contaminant transport.

The cap and cover system for each landfill consists of the following components:

- A grading layer placed on the landfills to provide proper grading for drainage.
- A low permeability sodium bentonite geocomposite, geosynthetic membrane liner.
- A final soil cover with adequate slopes and vegetation.
- Perimeter berms and drainage swales to control surface runoff.

### 3.2 Landfill Cap Design Features

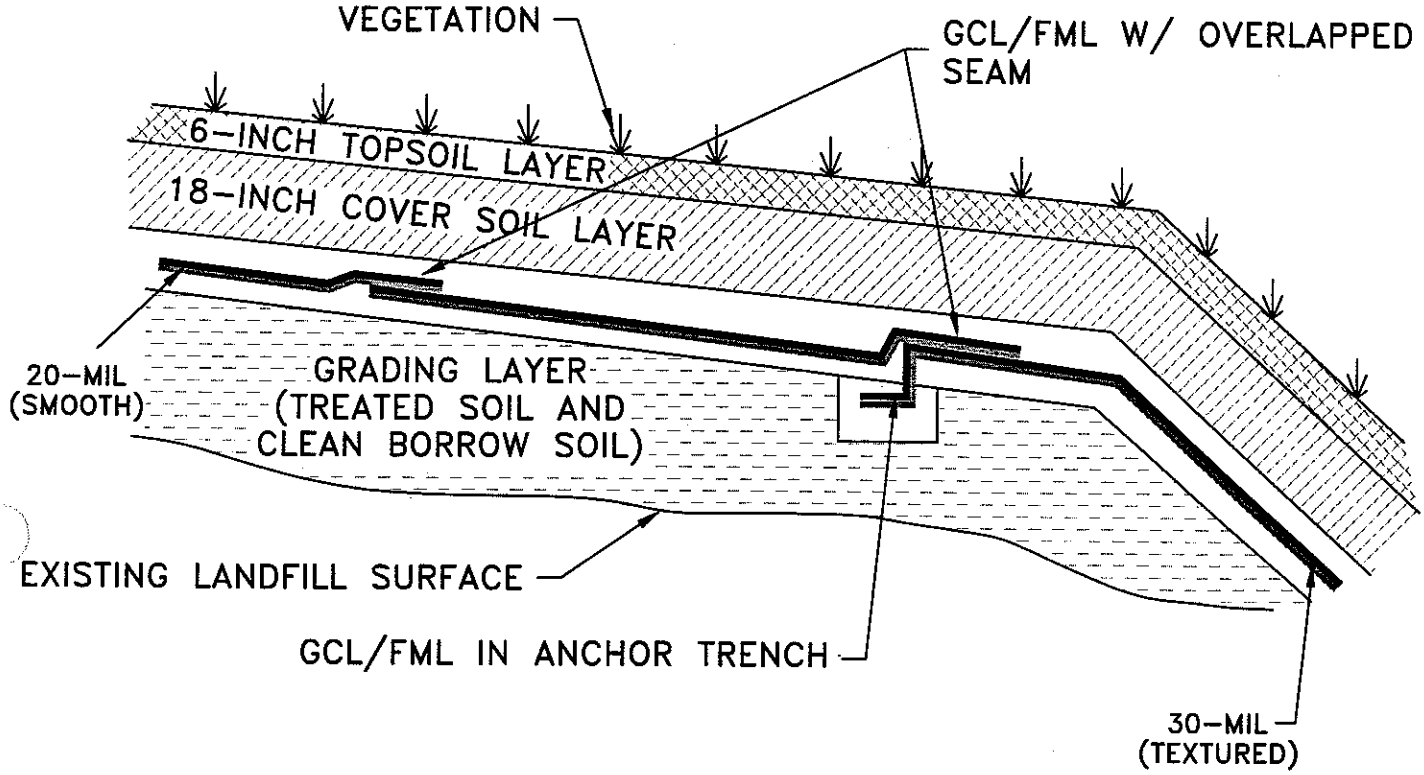
The grading layer primarily consisted of treated contaminated soil material from the Burning Ground No. 3 remediation project adjacent to the landfills. This material was spread and compacted in lifts

to make a firm foundation for the cap liner layers. Additional subgrade material consisting of impermeable clay was also placed and compacted along with the treated soil to make up the required grade. The approximate quantity of treated soils used in the subgrade was 37,840 cubic yards. The total design volume capacity of the two landfills was maximized to the extent practical. The two landfills were designed with a reasonable overage of the volume to accommodate treated soil materials plus a buffer volume of clean fill soil which was taken from the LHAAP borrow source. Demolition debris, consisting of stormwater culverts, pavement, concrete, signage and power/light poles found in the vicinity of Landfills 12 and 16 were placed in the lower lifts of the grading layer and covered with compacted soil material. Debris were placed at a minimum of 18 inches beneath the subgrade soil surface. Section 4.11 includes a list of items demolished and placed in the subgrade.

A combination of low-permeability sodium bentonite geocomposite liner (GCL) and a 20-mil flexible membrane liner (FML) was used as a composite layer over the subgrade as shown on **Figure 3-1**. A 30-mil textured FML layer was used on all 4:1 slopes. The GCL and FML are bonded together at the manufacturer's plant before delivery to the site in rolls. The composite GCL/FML were deployed with the GCL side of the composite facing downward and the FML facing upward. Seams were overlapped and anchored according to the design specification except where noted otherwise in **Table 5-1** or on as-built drawings. FML welding was not necessary since there was GCL between the two pieces of FML at the overlap. The GCL acts as a seal between the two pieces of FML.

The final soil cover consisted of an 18-inch layer of cover soil and a 6-inch layer of topsoil. The cover soil was placed on the FML liner and compacted carefully to prevent damage to the GCL and FML liners. Material for the cover soil layer was taken from the LHAAP borrow source. Topsoil (which met the design specifications) came from either the borrow source or the LHAAP magazine area. The topsoil was placed, spread, and lightly compacted to receive vegetation. The landfill areas' disturbed ground surface and the topsoil layer were revegetated to protect the cap from erosion by wind and water.

Perimeter drainage features, such as berms and swales, were constructed around each landfill to control long-term erosion and sedimentation.




# COMPOSITE GCL/FML LAYER

(TYPICAL) FOR BOTH LANDFILLS

| | | |
|---|---|---|
| OHM Remediation Services Corp. Houston, Texas A Subsidiary of OHM Corp. | | |
| DRAWN BY: | MHE | 11/25/98 |
| CHECKED BY: | GRT | 11/30/98 |
| FILE | 917852-A1 | |
| REV 1 | SHEET 1 | PROJECT 917852 |

U.S. ARMY CORPS OF ENGINEERS

TULSA DISTRICT

TERC CONTRACT DACA 56-94-D-0020 DELIVERY ORDER NO. 0012

LANDFILL 12 AND LANDFILL 16 CAPS LHAAP, KARNACK, TEXAS

FIGURE 3-1

LANDFILL CAP LINER CONFIGURATION

## 4.0 CONSTRUCTION WORK TASKS

The construction work included the following tasks.

### 4.1 Task 1 - Mobilization

OHM mobilized key personnel and equipment from the Houston, Texas office in July 1996 and constructed a temporary support facility east of the entrance to Landfill 16.

### 4.2 Task 2 – Construction of Access Roads

OHM constructed temporary access roads at the borrow pit and at both landfills.

### 4.3 Task 3 – Preparation of Borrow Source

An area of approximately 8.5 acres was selected as the borrow source. Approximately one foot of the topsoil at the borrow source was stripped prior to using underlying soil for the cap. The brush and grubbed material was stockpiled and burned. The borrow source was cleared and grubbed in increments as material was required in order to minimize the area exposed to wind and rain.

### 4.4 Task 4 – Installation of Stormwater Controls

A silt fence was erected around the borrow source and each landfill to control silt migration caused by stormwater. Silt fencing was also used in the ditches along the borrow source access road to minimize sedimentation.

### 4.5 Task 5 - Preliminary Site Survey

A land surveyor licensed in the State of Texas performed the following work:

- Set up control points
- Set grade stakes at the landfills
- Prepared drawings showing the locations and elevations of the control points

OHM personnel used the control points to replace grade stakes as the work progressed.

### 4.6 Task 6 - Construction and Operation of LF 12 & LF 16 Stockpiles

#### 4.6.1 Sub-task 6.1 - Clear Stockpile Area

OHM cleared areas at Landfill 12 and Landfill 16 to receive treated soil. The tree stumps and brush were stockpiled and burned as discussed previously regarding the borrow source.

#### 4.6.2 Sub-task 6.2 – Construction of Stormwater Diversion Berms At Stockpile

OHM installed berms at the stockpiles to divert stormwater run-on around the treated contaminated materials. A silt fence was constructed at each stockpile to control sediments from the disturbed area. Plastic sheets were used to cover the stockpiles. Soil was excavated at the borrow pit using an excavator and hauled to the stockpiles by dump truck.

#### 4.6.3 Sub-task 6.3 - Handling the Treated Contaminated Soil Stockpile

Radian International stockpiled treated contaminated soil delivered to each landfill. OHM decontaminated equipment on a temporary decon pad before leaving the stockpile. A bulldozer was utilized to build a stockpile of treated material with sloping sides.

### 4.7 Task 7 - Air Monitoring

OHM performed perimeter air monitoring to ensure employees were properly protected when handling the treated stockpiles.

### 4.8 Task 8 – Construction of LF 12 and LF 16 Cap

#### 4.8.1 Sub-task 8.1 - Clear and Proofroll

OHM cleared and proofrolled the landfill cap areas as required in the **Work Plan** Specification Section 02110 - Clearing and Grubbing. The tree stumps and brush were removed and stockpiled outside the landfill boundary and burned. A water truck was used to proofroll the surface. The landfill surface was cleared and grubbed in increments as the work progressed, in order to minimize the disturbed area exposed to wind and rain.

#### 4.8.2 Sub-task 8.2 - Place Grading Layer

The grading layer consisted of treated soils, supplemented by clean fill soils (clay) from the borrow source as required to achieve the lines and grades in the final landfill design drawings and Specification Section 02444 - Subgrade Layer.

OHM placed and compacted treated soils from the stockpile. Treated soils from the stockpile were spread over the landfill area to the lines and grades shown on the as-built drawings (**Appendix A**). The first 8-inch loose lift was compacted by 5 passes of the compactor. Subsequent lifts were placed in 8-inch loose lifts at a moisture content within 3 percent of optimum and compacted to 90 percent Standard Proctor density by ASTM D 698. Field density tests were performed on each of the compacted layers to verify the degree of compaction. The tests were performed at a rate of 1 per 10,000 square feet per lift (at a minimum). The in-place density tests were confirmed by ASTM D 2922. Compacted lifts were scarified at least 6 inches prior to placing the next lift. Debris from demolition of existing pavement and other features were spread in the lower lifts. Debris were

not placed in the top 18 inches of the grading layer. Large debris were placed at least 3 feet below the top of the grading layer.

In **LF 12**, approximately 2,000 cubic yards of treated soil and 34,496 cubic yards of borrow source clay were placed in the grading layer (subgrade). The finished subgrade is shown on **Drawing LF-12-1** in **Appendix A**.

In **LF 16**, approximately 35,840 cubic yards of treated soil and 10,581 cubic yards of imported clay were placed in the grading layer. The finished subgrade is shown on **Drawing LF-12913-16** in **Appendix A**.

The final surface was smooth-rolled, inspected, and approved by USACE representatives prior to placing GCL liner.

### 4.8.3 Sub-task 8.3 – Installation of GCL/FML

The GCL and FML liners were installed to the limits shown on the design drawings and as required in Specification Sections 02271 and 02442. Storage of materials on-site, placement, overlaps, placement in anchor trenches, ballasting to prevent uplift by wind, and repairs were inspected by USACE representative. Special care was taken when the surface conditions were wet to avoid damage to the GCL.

The panel layouts of the liners for **LF-12** and **LF-16** are shown on drawings in **Appendix A.**

### 4.8.4 Sub-task 8.4 – Placement of Cover Layer

Soils at the borrow pit were mixed as necessary during excavation and loading to reduce the likelihood of using high-plasticity clays in the cover soil. This procedure was rarely necessary. An excavator loaded dump trucks at the borrow pit. The trucks dumped the soil on the working surface of the landfill cap. A motor grader, bulldozer, compactor, and water truck spread and compacted

the soil over the landfill cap to the lines and grades shown on the design drawings. The cover layer material was placed in 12-inch loose lifts at a moisture content within 3 percent of optimum and compacted to 90 percent Standard Proctor density as required in Specification Section 02221-Coversoil and Topsoil. Field density tests were performed on each of the compacted layers at the specified frequency to verify the degree of compaction. The first lift was walked in using the bulldozer (not the compactor) to avoid damaging the underlying GCL/FML .

In **LF 12**, approximately 19,080 cubic yards of soil were placed in the cover layer. The finished cover layer is shown on **Drawing "Cover"** in **Appendix A**.

In **LF 16**, approximately 36,972 cubic yards of soil were placed in the cover layer. The finished cover layer is shown on **Drawing 12913-16** in **Appendix A**.

### 4.8.5 Sub-task 8.5 – Placement of Topsoil

The topsoil was placed and lightly compact in one lift over the cover layers to the lines and grades shown on the design drawings and as required in Specification Section 02221-Coversoil and Topsoil.

In **LF 12**, approximately 7,632 cubic yards of soil were placed in the topsoil. The finished cap is shown on **Drawing FINIS2** in **Appendix A**.

In **LF 16**, approximately 14,292 cubic yards of soil were placed in the topsoil. The finished cap is shown on **Drawing FINIS2** in **Appendix A**.

### 4.8.6 Sub-task 8.6 – Construction of Landfill Drainage

Drainage swales were constructed around the landfills to the lines and grades shown on the design drawings with some exceptions noted on the drawings. Soil excavated to construct the swales was spread over disturbed areas in the immediate vicinity of the work.

### 4.8.7 Sub-task 8.7 - Vegetation of the Landfill Cap Surface

Both landfill caps were revegetated as described in Specification Section 02930 - Establishment of Turf. The grass seed mix used was appropriate to the region and planting season. Turf establishment is complete at **LF 12**, while summer seeding will take place at **LF 16** next spring.

## 4.9 Task 9 - Demobilization

All equipment including trailers were demobilized in October 1998. Housekeeping was performed to leave the Site(s) free of debris.

## 4.10 Task 10 - Plugging and Abandonment of Groundwater Wells

A well driller licensed in the State of Texas plugged and abandoned the existing monitoring wells within the limits of the new landfill caps as required in Specification Section 02671 - Ground-Water Monitoring Wells. Debris were disposed of in accordance with the **Waste Management Plan**. Well locations are shown in the construction drawings included as **Appendix A (Drawing C)**. All abandonment documentation was submitted to the Texas Department of Water Resources as per their requirements.

## 4.11 Task 11 – Demolition of Existing Features

OHM demolished existing stormwater culverts, pavement, signage and power/light poles in the vicinity of Landfills 12 and 16 as required in Specification Section 02050 - Demolition.

Debris disposed of in the landfills included:

- Metal fence and gate
- Corrugated metal pipe culverts
- Concrete debris stacked on Landfill 12

- Concrete, bentonite and PVC pipe from abandoned monitoring wells
- Lighting / power poles
- Electric Cable
- Asphalt paving from Landfill 16
- Road signs and posts
- Gravel from on-site roads.

Debris were disposed of in the landfill in accordance with the **Waste Management Plan**. This is shown on **Drawings C07** and **C14**.

## 5.0 PROJECT VARIANCES AND AMENDMENTS

During the construction of the landfills, the design and construction details were subjected to variances and amendments to adapt to the changing field conditions in accordance with good engineering practices. The variances and amendments made are listed in **Table 5-1**. The original design drawings were revised to include these changes and are included under separate cover "Variances and Amendments" in **Appendix A**.

| TABLE 5-1 | |
|---|---|
| **Sheet Reference Numbers** | **Discrepancies** |
| C-07 | Piezometer Well #PZ 12-01 does not appear on drawings to be demolished. LF-12. |
| C-08 | There is no definite toe grades set for sub-grade at Station 1+50 nor 14+00. Had to field fit sub-grade toes. LF-12 |
| C-08 | AL-1 points to a monument that does not exist, should point to PI #1, elevation should be 202.62 instead of 199.60. LF-12 |
| C-08 | 2-95 points to a monument that does not exist. Should point to Station 0+00 elevation 199.04. LF-12 |
| C-08 | Curve Data, Delta is wrong, should be 46 degrees, 33 minutes, 17 seconds instead of 48 degrees, 00 minutes, 28 seconds. LF-12 |
| C-08 | Vertical alignment, finished elevation is wrong. Add .5 (tenths) to finish elevation because of Drawing C-11 stating only 12 inch total coversoil and 6 inch topsoil originally. LF-12 |
| C-08 | The major discrepancies occur between the plan view drawing (C-8) of the landfill and the various cross sections of the landfill at various stations along the baseline. The discrepancies occurs between the scaled distance from the baseline to the toe at sub-grade on the plan view as compared to this distance as shown at the various cross sections. LF-12 |
| C-11 | Incorrect amount of coversoil (18" coversoil) LF-12 & LF-16. |
| C-11 | Anchor Trench detail #2 does not reflect trench to be excavated at true toe as detail #1 does. LF-12 & LF-16. Anchor Trench was excavated using detail #2. |
| C-08 | Treated soil placed from Station 8+00 to Station 12+50 east side of baseline approximately 100 feet. LF-12 |
| C-09 | Concrete from north end of LF-12 (existing) moved to low area of LF-12 Station 4+50 – 5+00, approximately 175 feet east of baseline. LF-12 |
| C-09 | Bridge lift of approximately 3 feet of borrow clay placed west side of baseline LF-12 approximately 75 feet West from Station 12+50 to 14+00. LF-12 |
| C-08 | No information was given on the cross sections for elevations for radius at Station 1+43 and Radius at Station 14+05, both radius elevations were placed by contour elevations & percent fall of known elevations adjacent to radius. LF-12 |
| C-09 | Elevations from Station 7+00, 100 feet East of Baseline to Station 8+00, 100 feet East of Baseline changed, also elevations from Station 7+00 to Station 8+00 on Crown (East Side) changed. These changes were made due to elevation errors on the cross sections. LF-12 |
| C-09 | Piezometer well PZ.12-01 removed at Station 6+50, |

| TABLE 5-1 | |
|---|---|
| **Sheet Reference Numbers** | **Discrepancies** |
| | approximately 75 feet East of the Baseline. LF-12 |
| C-09 | PPE placed at Station 13+50, 50 feet West of the Baseline, PPE consists of sarans & tyvex used from sump concrete sampling phase. LF-12 |
| C-08 | Modifications to anchor trench from Station 4+30, West toe to Station 4+82, West toe. Modifications were made to insure complete coverage of Landfill 12. LF-12 |
| C-09 | Cover material placed from Station 1+43, 150 feet to 250 feet East of the Baseline to Station 6+50, 150 feet to 250 feet East of the Baseline. This area of placement is flood prone low area. LF-12 |
| C-09 | Berm placed from Station 6+50, 150 feet East of the Baseline to 175 feet East of the Baseline to Station 11+50, 50 feet East of the Baseline. LF-12 |
| C-14 | Iron ore road placed on Landfill 16 – West to East. |
| C-14 | Monitor Wells #16-7, 16-8, 16-9, 16-10, 16-11, 122, 16-1, 16-2, 16-3, and 16-4 were abandoned and removed. LF-16 |
| C-14 | Concrete from sump demolition & monitor well abandonment was placed at Station 5+50, 150 feet North to 250 feet North of the Baseline to Station 7+00, 150 feet North to 250 feet North of the Baseline. LF-16 |
| C-16 | Treated material placed from Station 3+50, 100 feet North to 165 feet North of the Baseline to Station 8+00, 200 feet North to 265 feet North of the Baseline. Also treated material placed from Station 4+00 Baseline to 60 feet North of the Baseline to Station 7+00, 100 feet North to 160 feet North of the Baseline. LF-16 |
| C-16 | Concrete placement from Radian was placed from Station 6+50, 50 feet North of the Baseline to 150 feet South of Baseline to station 8+50, 50' feet North of Baseline to 250 feet South of Baseline. LF-16 |
| C-18 | Detail #1 40 mil geomembrane liner is changed to 20 mil geomembrane liner. Also cover soil on Detail #1 shows 12 inches of coversoil – changed to 18 inches of cover soil. |
| C-16 | Asphalt placed from Station 3+00 to Station 5+00, 100' to 200' South of Baseline. Asphalt was from asphalt pad at station 1+00, 100' South of Baseline. LF-16 |
| C-16 | Bricks from Radian International placed at Station 6+50, 100' North of Baseline, Station 7+50, 150' South of Baseline, Station 5+50, 100' South of Baseline, and Station 7+00, 100' North of Baseline 16. |
| C-17 | Liner material from Radian International was placed at Station 5+25, 150' South of the Baseline in Grid #35. LF-16 |

| TABLE 5-1 | |
|---|---|
| **Sheet Reference Numbers** | **Discrepancies** |
| C-17 | 55-gallon drums filled with grout from Radian International were placed at Station 4+75, 175' South of Baseline in Grid #27. LF-16 |
| C-16 | Berm placed from Station 6+25, from South toe to 250' North on East side of LF-16 (See detail on Sheet C-16) |
| C-17 | Placement of 30 mil liner, to be used as 20 mil – Panels P-252, P-263 |
| C-10 | Perimeter fence placement LF-12 |
| C-17 | Perimeter fence placement F-16 |
| C-20 | Perimeter ditches at LF-12 & LF-16 were excavated with a minimum excavation to best meet the existing topography. |
| C-17 | Subgrade at stations 3+00, 100' North to Station 5+00 approximately 200' North was raised 3 to 4 tenths because of existing evidence of contamination. |
| C-15 & C-16 | MW 16-8 not shown on drawing raised 8' to accept fill in the area. |
| C-16 | New toe and crown, office fence left in place. |
| C-16 | Baseline used for LF construction. |
| C-16, C-17 | EZY Bag and woven fabric placed. |
| C-17 | Silt fencing placed to reduce water flow to swale area. |

# APPENDIX A

## CONSTRUCTION AS-BUILT DRAWINGS

## LIST OF DRAWINGS

| LANDFILL 12 AS-BUILTS | REVISED CONSTRUCTION DRAWINGS LF-12 |
|---|---|
| PLAN VIEW CONTOURS TOP SOIL | DEMOLITION PLAN |
| PLAN VIEW CONTOURS COVER SOIL | CONTROL PLAN |
| PLAN VIEW CONTOURS SUBGRADE | SUBGRADE GRADING PLAN |
| LINER PANEL LAYOUT | FINAL GRADING PLAN |
| | TYPICAL SECTION |
| | CROSS SECTION I |
| | CROSS SECTION II |

| LANDFILL 16 AS-BUILTS | REVISED CONSTRUCTION DRAWINGS LF-16 |
|---|---|
| PLAN VIEW CONTOURS TOP SOIL | EXISTING SITE PLAN |
| POINT NOS. AND ELEVATIONS | DEMOLITION PLAN |
| PLAN VIEW CONTOURS COVER SOIL | SUBGRADE PLAN |
| PLAN VIEW CONTOURS SUBGRADE | FINAL GRADING PLAN |
| PLAN VIEW ELEVATIONS FINISHED GRADE | TYPICAL SECTION |
| PLAN VIEW ELEVATIONS COVER GRADE | CROSS SECTIONS |
| PLAN VIEW ELEVATIONS SUBGRADE | TYPICAL SECTION AND DETAIL |
| LINER PANEL LAYOUT | |

| LANDFILL 12 AS-BUILTS | |
|---|---|
| DRAWING DESCRIPTION | DRAWING NAME/NUMBER |
| 1. Plan View Contours Top Soil | TOP SOIL |
| 2. Plan View Contours Cover Soil | COVER |
| 3. Plan View Contours Subgrade | LF-12-1 |
| 4. Liner Panel Layout | 12PNL |

CURVE DATA

| C-1 | C-2 |
|---|---|
| △ = 46°33'17" | △ = 23°18'52" |
| R = 422.2960' | R = 425.0865' |
| T = 181.6722' | T = 87.6999' |
| L = 343.1306' | L = 172.9729' |
| C = 333.7680' | C = 171.7830' |




GRAPHIC SCALE

50 0 25 50 100 200

( IN FEET )
1 inch = 50 ft.

Data Acquired:
OCTOBER 17, 1997

Sheet 1 of 1

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

LHAAP - LANDFILL 12 TOPO

PLAN VIEW --- --- TOP SOIL

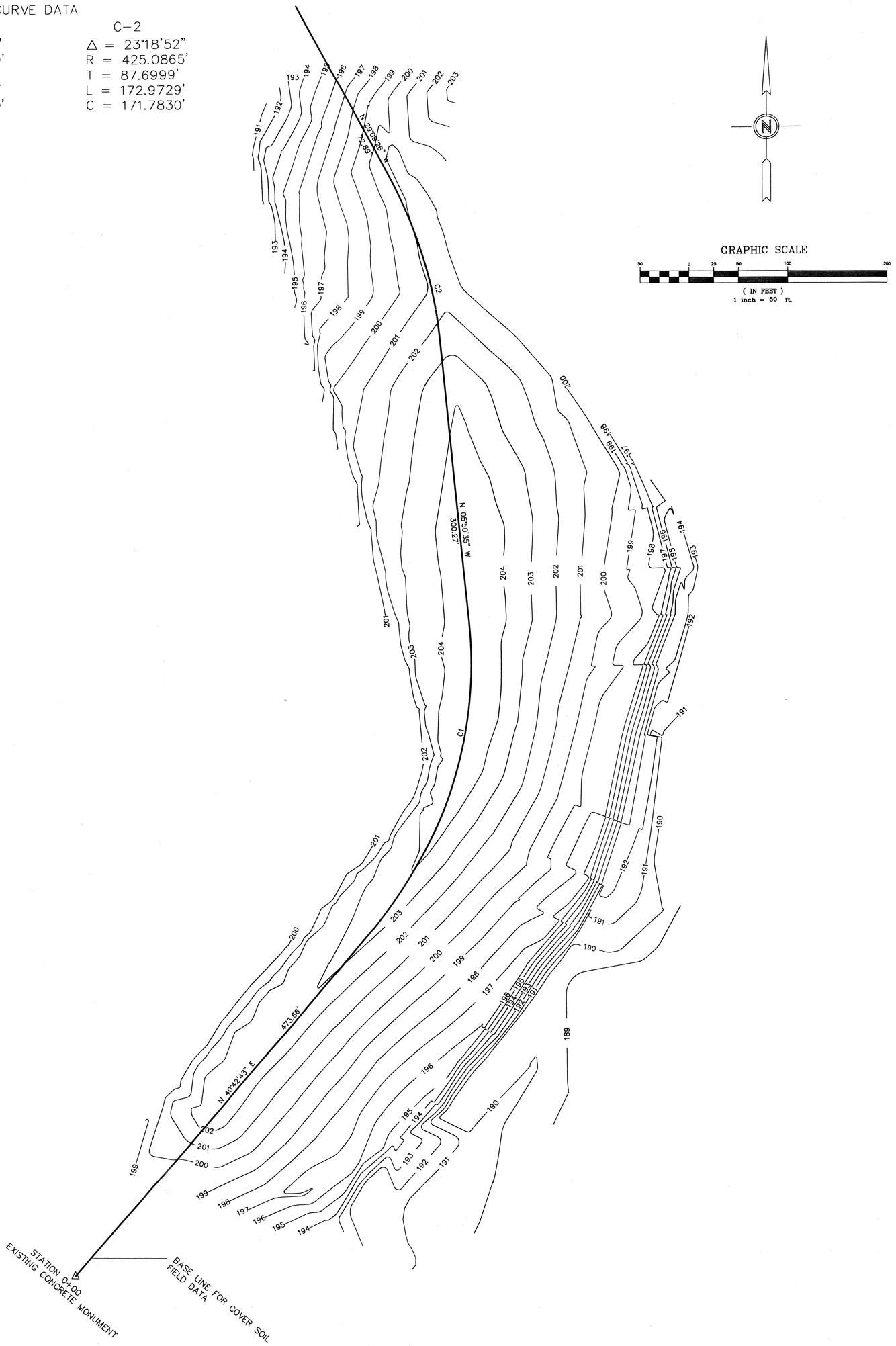

PREPARED BY
WINN ENVIRONMENTAL SERVICES, INC.
P.O. Box 7351 1900 SE LOOP 281 LONGVIEW, TX. 75607
DATE: 10/21/97 FAX\758-2701 903-758-1171


| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| L.W.D. | 1"=50' | 97-2008 | TOPSOIL.DWG |

00082407

CURVE DATA

| C-1 | C-2 |
|---|---|
| △ = 46°33'17" | △ = 23°18'52" |
| R = 422.2960' | R = 425.0865' |
| T = 181.6722' | T = 87.6999' |
| L = 343.1306' | L = 172.9729' |
| C = 333.7680' | C = 171.7830' |




Data Acquired:
SEPTEMBER 26, 1997

Sheet 1 of 1

| NO. | DATE | DESCRIPTION | BY |
|---|---|---|---|
| | | | |

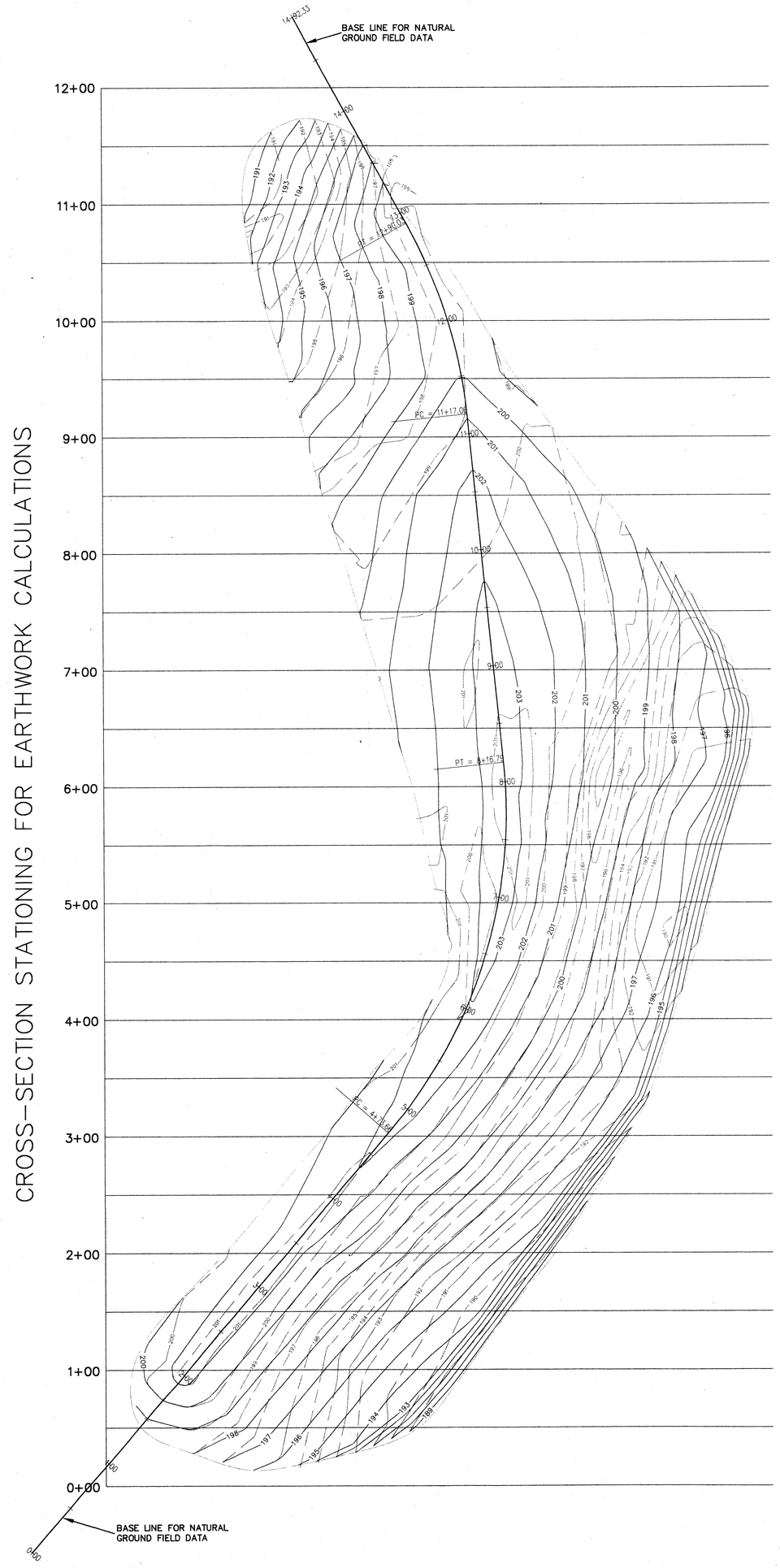
**LHAAP - LANDFILL 12 TOPO**

**PLAN VIEW --- --- COVER SOIL**


PREPARED BY
WINN ENVIRONMENTAL SERVICES, INC.
P.O. Box 7351 1900 SE LOOP 281 LONGVIEW, TX. 75607
DATE: 10/21/97 FAX 758-2701 903-758-1171


| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| L.W.D. | 1"=50' | 97-2008 | COVER.DWG |

000824O8




TOTAL FILL = 20,573 CU YD
(fill volume represents bank yardage with no shrinkage factor applied)

NOTE
There are two independent sets of stationing shown on this plan. The Base Line stations were used to gather natural ground field data. The Cross-Section stations were used for volume calculations, and correspond to those shown on sheets 2, 3, and 4. Volume calculations were done using the Average End Area method, applying sections at 2 ft intervals (e.g. 2+02, 2+04, 2+06, etc) over the entire site. For illustrative purposes, only the 50 ft station intervals are shown.

REVISIONS
August 8, 1997

Data Acquired:
July 17 & 21, 1997

Sheet 1 of 4

LHAAP – LANDFILL 12
**PLAN VIEW**

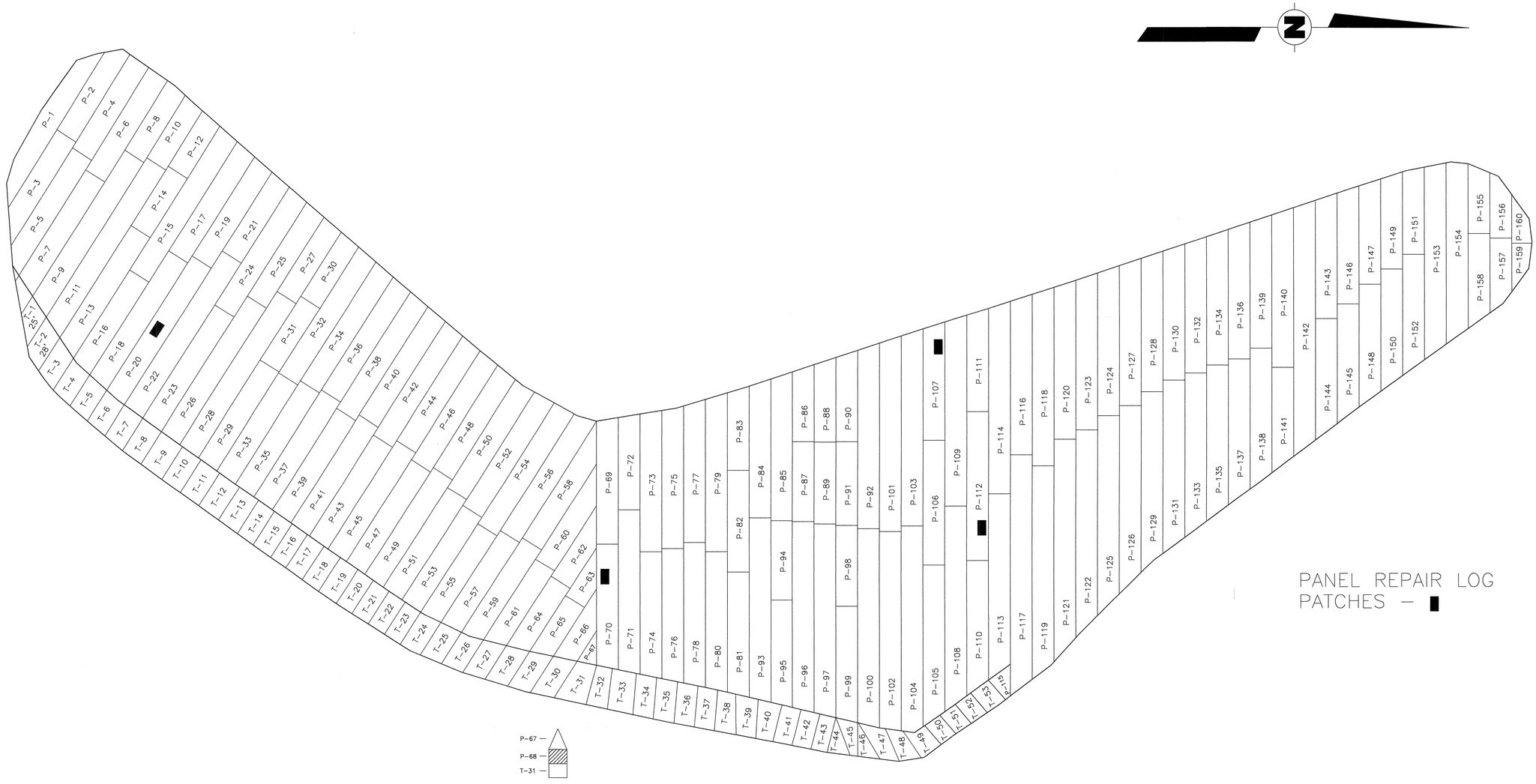
PREPARED BY
*HART ENGINEERING CO.*
CONSULTING ENGINEERS
AND SURVEYORS
P.O. Box 2804 415 N. CENTER ST. LONGVIEW, TX. 75606
DATE: 1 Aug 97 FAX\758-2402 903-758-0166

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| DLB | 1" = 50' | 12,913 | LF-12-1.DWG |

G:\ENG\12900\12913\LF-12-1 Wed Aug 13 09:37:40 1997

0008240

00082410




PANEL REPAIR LOG
PATCHES — ■

NOTE: P-68 IS LOCATED BETWEEN P-67 AND T-31

GENERAL NOTES:

1. ROLLS USED FOR THIS PROJECT WERE 17.5'x200' FOR 20 MIL, AND 17.5'x170' 30 MIL TEXTURED.
2. TEXTURED 30 MIL WAS USED ON ALL SLOPES WHERE INDICATED IN THE DRAWING.
3. PANEL BREAKS ARE ACTUAL.

SCALE
0 40 80

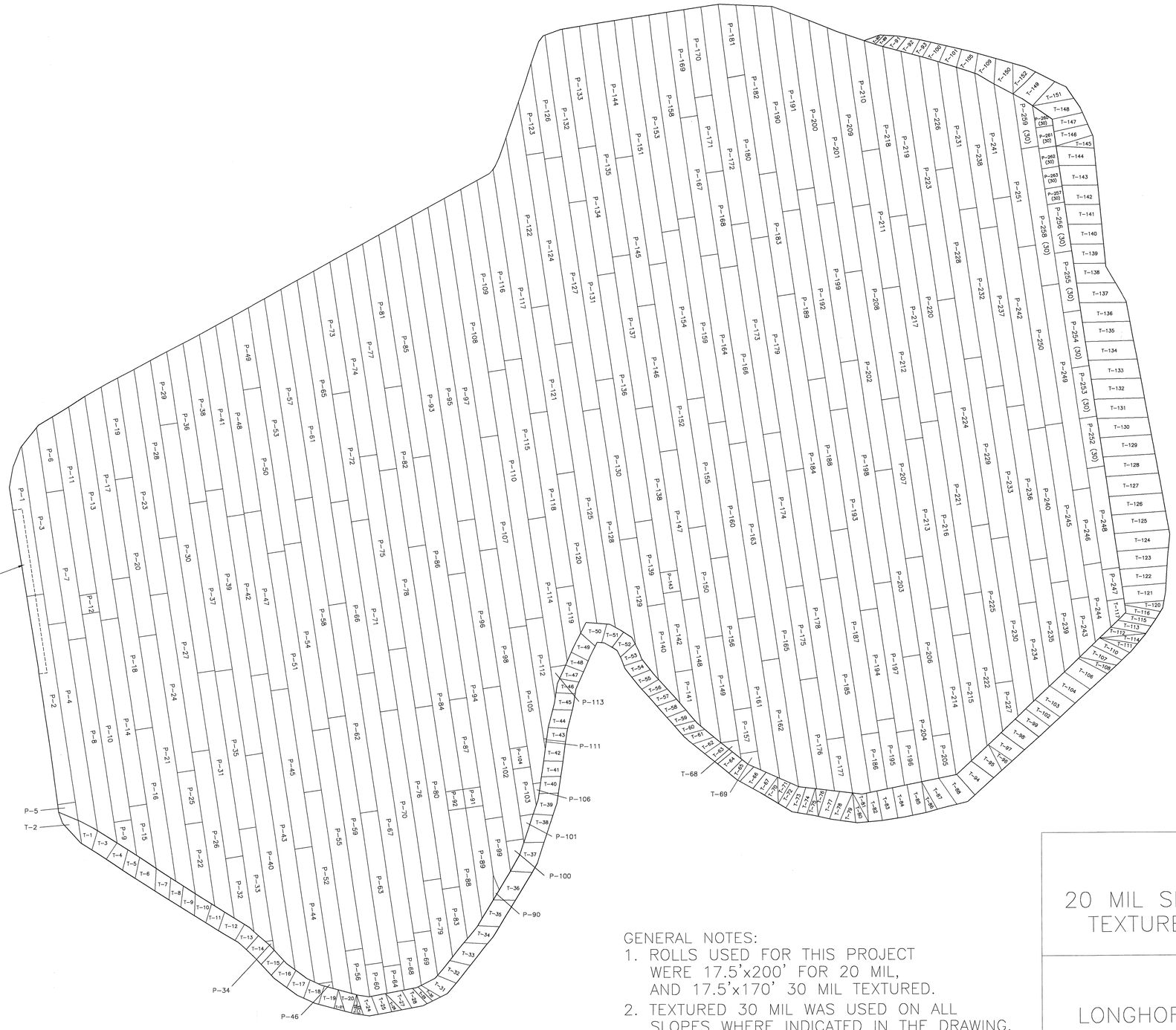
# LANDFILL 12
## 20 MIL SMOOTH GUNSEAL AND 30 MIL TEXTURED GUNSEAL PANEL LAYOUT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

REVISED BY: OHM
DATE: NOVEMBER 1998

12PNL.DWG

00082411




NOTE:
A PIECE OF 20 MIL LINER 17.5'x70' WAS CUT TO 8.75'x140' IN LENGTH. THIS WAS PLACED BECAUSE OF ROUGH EDGES ON THE ANCHOR TRENCH.

0 25 50 100 150
SCALE: 1" = 50'

GENERAL NOTES:

1. ROLLS USED FOR THIS PROJECT WERE 17.5'x200' FOR 20 MIL, AND 17.5'x170' 30 MIL TEXTURED.
2. TEXTURED 30 MIL WAS USED ON ALL SLOPES WHERE INDICATED IN THE DRAWING.
3. PANEL BREAKS ARE ACTUAL.
4. 30 MIL PLACEMENT FOR 20 MIL FROM P-252 – P-263

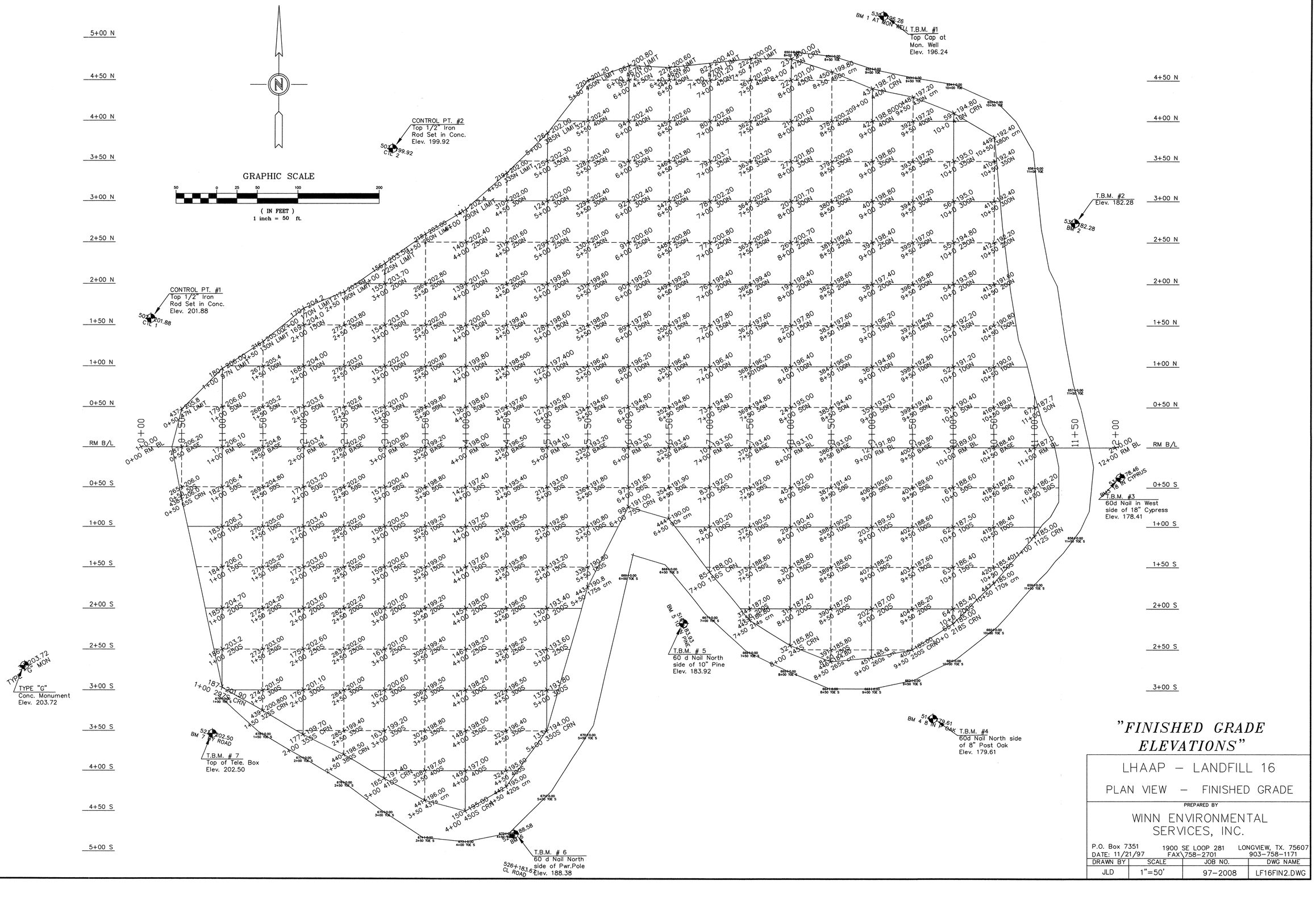
# LANDFILL 16

## 20 MIL SMOOTH GUNSEAL AND 30 MIL TEXTURED GUNSEAL PANEL LAYOUT

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

REVISED BY: OHM
DATE: NOVEMBER 1998

16PNL.DWG




"*FINISHED GRADE ELEVATIONS*"

# LHAAP – LANDFILL 16

## PLAN VIEW – FINISHED GRADE

PREPARED BY

WINN ENVIRONMENTAL SERVICES, INC.

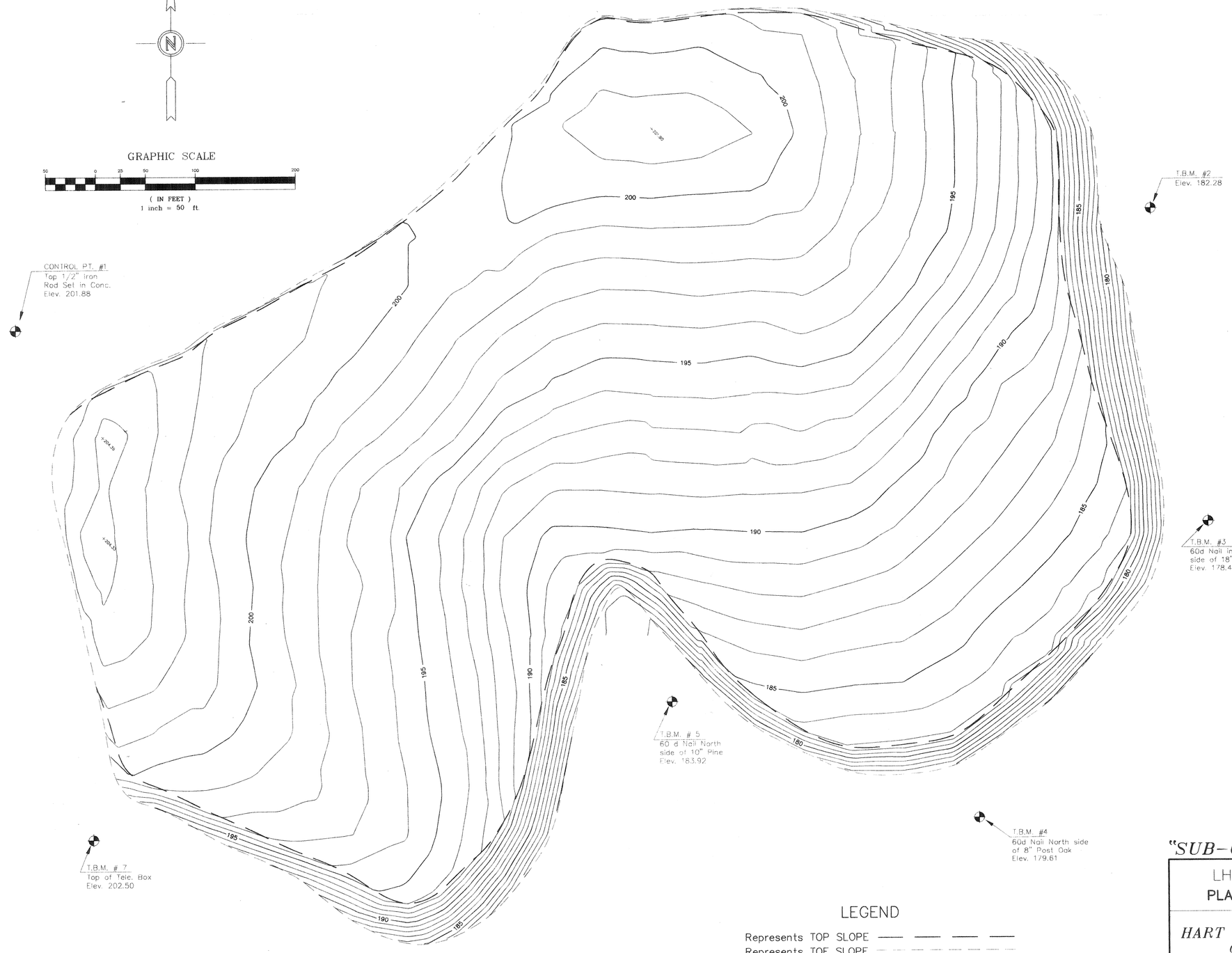
P.O. Box 7351 1900 SE LOOP 281 LONGVIEW, TX. 75607
DATE: 11/21/97 FAX 758-2701 903-758-1171

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JLD | 1"=50' | 97-2008 | LF16FIN2.DWG |

GRAPHIC SCALE

50 0 25 50 100 200

( IN FEET )
1 inch = 50 ft.




LEGEND

Represents TOP SLOPE ——— ——— ——— ———

Represents TOE SLOPE - - - - - - - - - - - - - - - - - -

"*SUB-GRADE ELEVATIONS*"

LHAAP – LANDFILL 16

**PLAN VIEW -- SUBGRADE**

PREPARED BY
*HART ENGINEERING COMPANY*
*CONSULTING ENGINEERS*
*AND SURVEYORS*
P.O. Box 2084 415 No. Center St. Longview, TX. 75606
DATE: 05/22/98 FAX\758-2402 903-758-0166

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JWH | 1"=50' | 12913-3 | 12913-16.DWG |

G:\ENG\12900\12913\12913-16 Fri May 22 15:05:40 1998

GPS BASE POINT

T.B.M. #1
Top Cap at Mon. Well
Elev. 196.24

GRAPHIC SCALE
50 0 25 50 100 200
( IN FEET )
1 inch = 50 ft.

CONTROL PT. #1
Top 1/2" Iron Rod Set in Conc.
Elev. 201.88

T.B.M. #2
Elev. 182.28

T.B.M. #3
60d Nail in West side of 15" Cypress
Elev. 177.41

T.B.M. # 5
60 d Nail North side of 10" Pine
Elev. 183.92

T.B.M. #4
60d Nail North side of 8" Post Oak
Elev. 179.61

TYPE "G"
Conc. Monument
Elev. 203.72

T.B.M. # 7
Top of Tele. Box
Elev. 202.50

T.B.M. # 6
60 d Nail North side of Pwr.Pole
Elev. 188.38

TYPE "G"
Conc. Monument
Elev. 178.37

805 178.37
ACTUAL PLOT IS OFF PAPER
(Mon. on south side road between two creeks)

Plotted: 08–13–98
Contoured: 08–12–98

*"COVER SOIL CONTOURS"*

# LHAAP – LANDFILL 16
## PLAN VIEW – COVER SOIL

PREPARED BY
*HART ENGINEERING COMPANY*
*CONSULTING ENGINEERS AND SURVEYORS*
P.O. Box 2084 415 No. Center St. Longview, TX. 75606
DATE: 08/13/98 FAX\758–2402 903–758–0166

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JWH | 1"=50' | 12913–3 | 12913–16.DWG |

\ENG\12900\12913\12913-16 Thu Aug 13 10:43:38 1998

GRAPHIC SCALE

50 0 25 50 100 200

( IN FEET )
1 inch = 50 ft.

GPS BASE POINT
1+200.42

T.B.M. #1
Top Cap at Mon. Well
Elev. 196.24

T.B.M. #2
Elev. 182.28

T.B.M. #3
60d Nail in West side of 18" Cypress
Elev. 178.41

T.B.M. #4
60d Nail North side of 8" Post Oak
Elev. 179.61

T.B.M. # 5
60 d Nail North Side of 10" Pine
Elev. 183.92

T.B.M. # 6
60 d Nail North side of Pwr.Pole
Elev. 188.38

T.B.M. # 7
Top of Tele. Box
Elev. 202.50

CONTROL PT. #1
Top of Marker
Rod Set in Conc
Elev. 201.68

TYPE "G"
Conc. Monument
Elev. 203.72

TYPE "G"
Conc. Monument
Elev. 178.37

805+178.37
ACTUAL PLOT IS OFF PAPER
(Mon. on south side road between two creeks)

NOTE:

Points numbered 1800 through 2203 were generated 9-02-98.

"TOP SOIL ELEVATIONS"

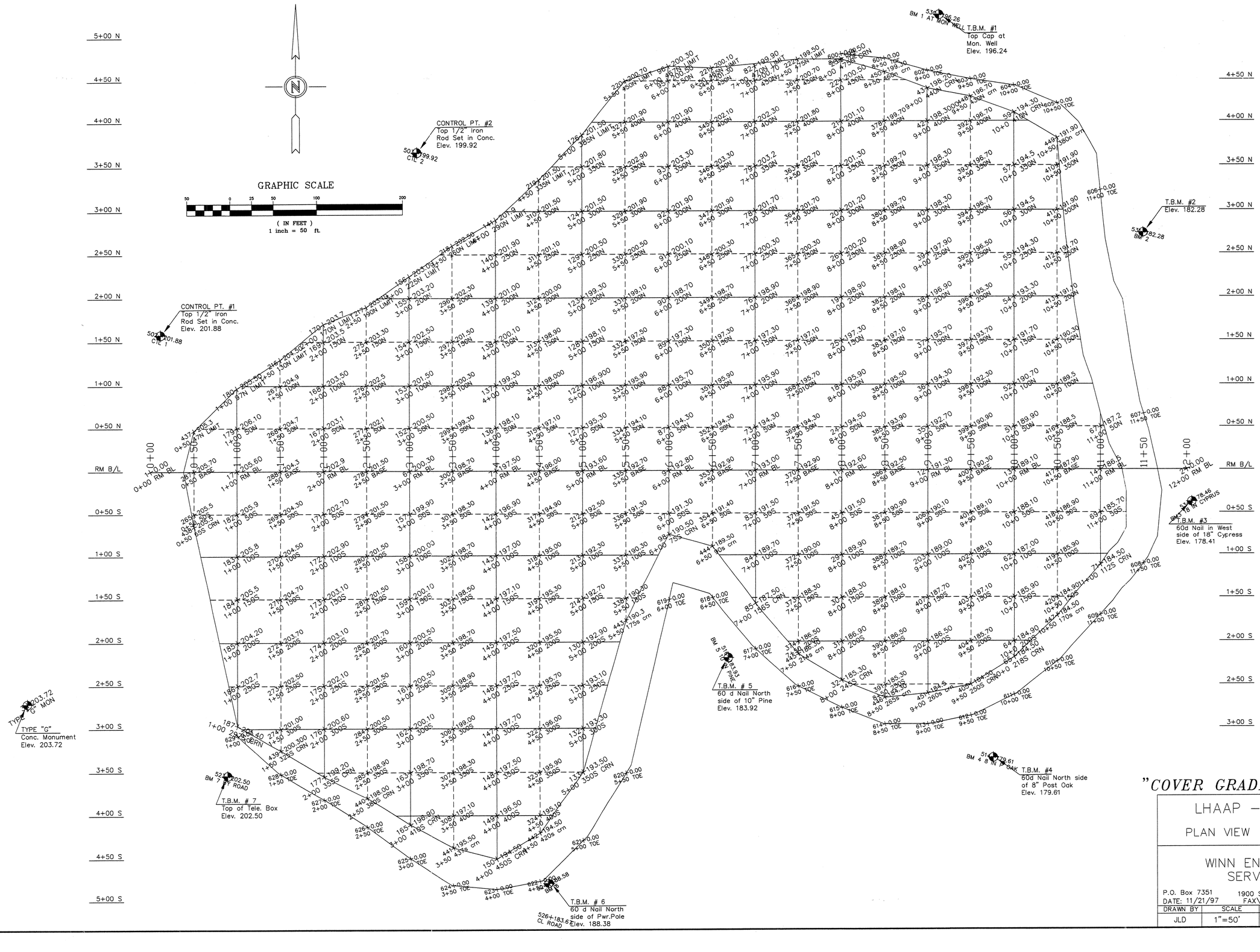
# LHAAP – LANDFILL 16
## POINT NOS. AND ELEVATIONS

PREPARED BY
*HART ENGINEERING COMPANY*
*CONSULTING ENGINEERS AND SURVEYORS*

P.O. Box 2084 415 No. Center St. Longview, TX. 75606
DATE: 09/12/98 FAX\758-2402 903-758-0166

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JWH | 1"=50' | 12913-5 | FINIS2.DWG |

G:\ENV\12900\12913\FINIS2 Sat Sep 12 11:27:48 1998




"COVER GRADE ELEVATIONS"

# LHAAP – LANDFILL 16

## PLAN VIEW – COVER GRADE

PREPARED BY
WINN ENVIRONMENTAL SERVICES, INC.
P.O. Box 7351 1900 SE LOOP 281 LONGVIEW, TX. 75607
DATE: 11/21/97 FAX\758-2701 903-758-1171

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JLD | 1"=50' | 97-2008 | LF16COV2.DWG |

N

N 3313602.310
E 6953558.529

N 3313418.890
E 6953471.410

N 3313167.160
E 6953368.410

LANDFILL BOUNDARY

OL-2
5/8" I.P. W/ALUM. CAP
N 6953377.10
E 3313845.82
ELEV 195.91

N 3314107.680
E 6953468.840

MW-16-8

ARROWS INDICTE PLACEMENT OF TREATED SOIL

TREATED SOIL PILE TO BE CUT DOWN TO SUBGRADE ELEVATON (NO TEST ROUIRED)

TREATED SOIL 65'X450'

TREATED SOIL 60'X320'

TREATED SOIL PILE TO BE CUT DOWN TO SUBGRADE ELEVATON (NO TEST ROUIRED)

BRICK PLACEMENT BY RADIAN

CONCRETE PLACEMENT

CONCRETE AREA

BRICK PLACEMENT BY RADIAN

BRICK PLACEMENT BY RADIAN

4400 EZY BAGS PLACED FOR EROSION CONTROL SEE DETAIL "B"

ASPHALT PLACEMENT

(FROM ASPHALT PAD AT ST. 1+00 100' SOUTH OF BASELINE)

N 3312994.930
E 6953051.960

OL-1
5/8" I.P. W/ ALUM. CAP
N 6952967.39
E 3313134.34
ELEV 201.25

C-19-2
TYPE "G" MONUMENT
N 6952844.320
E 3312839.019
ELEV 203.72

N 3312988.530
E 6952859.660

N 3313602.310
E 6952943.090

N 3313914.130
E 6952800.870

N 3314154.360
E 6953004.360

EXISTING POWER POLE

NEW TOE

NEW CROWN

EXISTING POWER POLE

NEW TOE

6' CHAIN LINK FENCE LEFT IN PACE

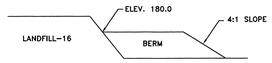
20' ROLL GATE

PAVEMENT EDGE

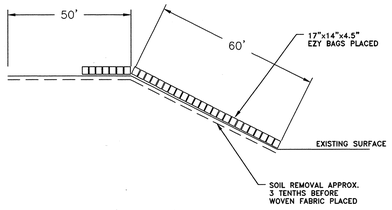
N 3313486.410
E 6952658.560

BERM 4:1 SLOPE

DETAIL "A"
BERM KEY-IN ON EAST & SOUTH SLOPE AT ELEVATION 180.00 – BERM SLOPE 4:1




DETAIL "B"




3-95 (NOT SHOWN)
TYPE "G" MONUMENT
N 6952411.298
E 3314136.438
ELEV 178.39

LEGEND

- DITCH
- CENTERLINE OF 16' WIDE ROAD
- EXISTING CONTOURS
- FINAL CONTOURS

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.

COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE. (4202)

COMBINED SCALE FACTOR: 0.99988410

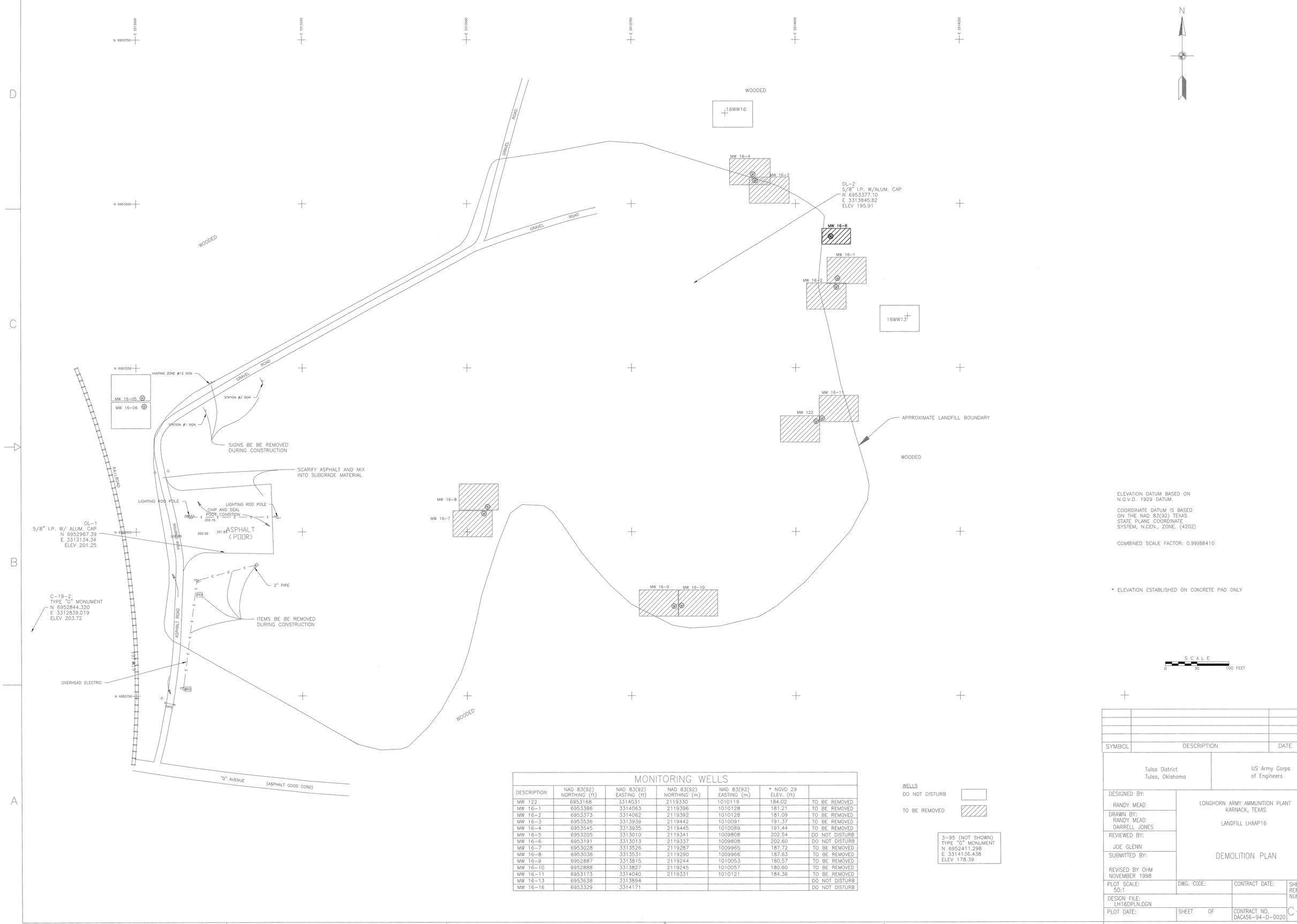
SCALE
0 50 100 FEET

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps of Engineers

| | | | |
|---|---|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS | | |
| DRAWN BY: RANDY MEAD | LANDFILL LHAAP16 | | |
| REVIEWED BY: JOE GLENN | | | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | SUBGRADE PLAN | | |
| PLOT SCALE: AS SHOWN | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER C16 |
| DESIGN FILE: LH16SGPL.DGN | | INVITATION NO. DACA56- -B- | |
| PLOT DATE: DECEMBER 1995 | SHEET OF | CONTRACT NO. DACA56-94-D-0020 | |




| MONITORING WELLS | | | | | | |
|---|---|---|---|---|---|---|
| DESCRIPTION | NAD 83(92) NORTHING (ft) | NAD 83(92) EASTING (ft) | NAD 83(92) NORTHING (m) | NAD 83(92) EASTING (m) | * NGVD 29 ELEV. (ft) | |
| MW 122 | 6953168 | 3314031 | 2119330 | 1010119 | 184.02 | TO BE REMOVED |
| MW 16-1 | 6953386 | 3314063 | 2119396 | 1010128 | 181.21 | TO BE REMOVED |
| MW 16-2 | 6953373 | 3314062 | 2119392 | 1010128 | 181.09 | TO BE REMOVED |
| MW 16-3 | 6953536 | 3313939 | 2119442 | 1010091 | 191.37 | TO BE REMOVED |
| MW 16-4 | 6953545 | 3313935 | 2119445 | 1010089 | 191.44 | TO BE REMOVED |
| MW 16-5 | 6953205 | 3313010 | 2119341 | 1009808 | 202.54 | DO NOT DISTURB |
| MW 16-6 | 6953191 | 3313013 | 2119337 | 1009808 | 202.60 | DO NOT DISTURB |
| MW 16-7 | 6953028 | 3313526 | 2119287 | 1009965 | 187.72 | TO BE REMOVED |
| MW 16-8 | 6953038 | 3313531 | 2119290 | 1009966 | 187.63 | TO BE REMOVED |
| MW 16-9 | 6952887 | 3313815 | 2119244 | 1010053 | 180.57 | TO BE REMOVED |
| MW 16-10 | 6952888 | 3313827 | 2119245 | 1010057 | 180.60 | TO BE REMOVED |
| MW 16-11 | 6953173 | 3314040 | 2119331 | 1010121 | 184.36 | TO BE REMOVED |
| MW 16-13 | 6953638 | 3313894 | | | | DO NOT DISTURB |
| MW 16-16 | 6953329 | 3314171 | | | | DO NOT DISTURB |

WELLS
DO NOT DISTURB
TO BE REMOVED

3-95 (NOT SHOWN)
TYPE "G" MONUMENT
N 6952411.298
E 3314136.438
ELEV 178.39

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.

COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE. (4202)

COMBINED SCALE FACTOR: 0.99988410

* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY

SCALE
0 50 100 FEET

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |
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| | | | |

| | |
|---|---|
| Tulsa District<br>Tulsa, Oklahoma | US Army Corps<br>of Engineers |

| | | | |
|---|---|---|---|
| DESIGNED BY:<br>RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT<br>KARNACK, TEXAS<br><br>LANDFILL LHAAP16<br><br>DEMOLITION PLAN | | |
| DRAWN BY:<br>RANDY MEAD<br>DARRELL JONES | | | |
| REVIEWED BY:<br>JOE GLENN | | | |
| SUBMITTED BY:<br>REVISED BY OHM<br>NOVEMBER 1998 | | | |
| PLOT SCALE:<br>50:1 | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE:<br>LH16DPLN.DGN | | | C-15 |
| PLOT DATE: | SHEET OF | CONTRACT NO.<br>DACA56-94-D-0020 | |




ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.

COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE. (4202)

FIELD DATA RECORDED IN ELECTRONIC DATA COLLECTOR.

COMBINED SCALE FACTOR: 0.99988410

* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY

SCALE
0 50 100 FEET

## MONITORING WELLS

| DESCRIPTION | NAD 83(92) NORTHING (ft) | NAD 83(92) EASTING (ft) | NAD 83(92) NORTHING (m) | NAD 83(92) EASTING (m) | * NGVD 29 ELEV. (ft) |
|---|---|---|---|---|---|
| MW 122 | 6953168 | 3314031 | 2119330 | 1010119 | 184.02 |
| MW 16-1 | 6953386 | 3314063 | 2119396 | 1010128 | 181.21 |
| MW 16-2 | 6953373 | 3314062 | 2119392 | 1010128 | 181.09 |
| MW 16-3 | 6953536 | 3313939 | 2119442 | 1010091 | 191.37 |
| MW 16-4 | 6953545 | 3313935 | 2119445 | 1010089 | 191.44 |
| MW 16-5 | 6953205 | 3313010 | 2119341 | 1009808 | 202.54 |
| MW 16-6 | 6953191 | 3313013 | 2119337 | 1009808 | 202.60 |
| MW 16-7 | 6953028 | 3313526 | 2119287 | 1009965 | 187.72 |
| MW 16-8 | 6953038 | 3313531 | 2119290 | 1009966 | 187.63 |
| MW 16-9 | 6952887 | 3313815 | 2119244 | 1010053 | 180.57 |
| MW 16-10 | 6952888 | 3313827 | 2119245 | 1010057 | 180.60 |
| MW 16-11 | 6953173 | 3314040 | 2119331 | 1010121 | 184.36 |

3-95 (NOT SHOWN)
TYPE "G" MONUMENT
N 6952411.298
E 3314136.438
ELEV 178.39

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps of Engineers

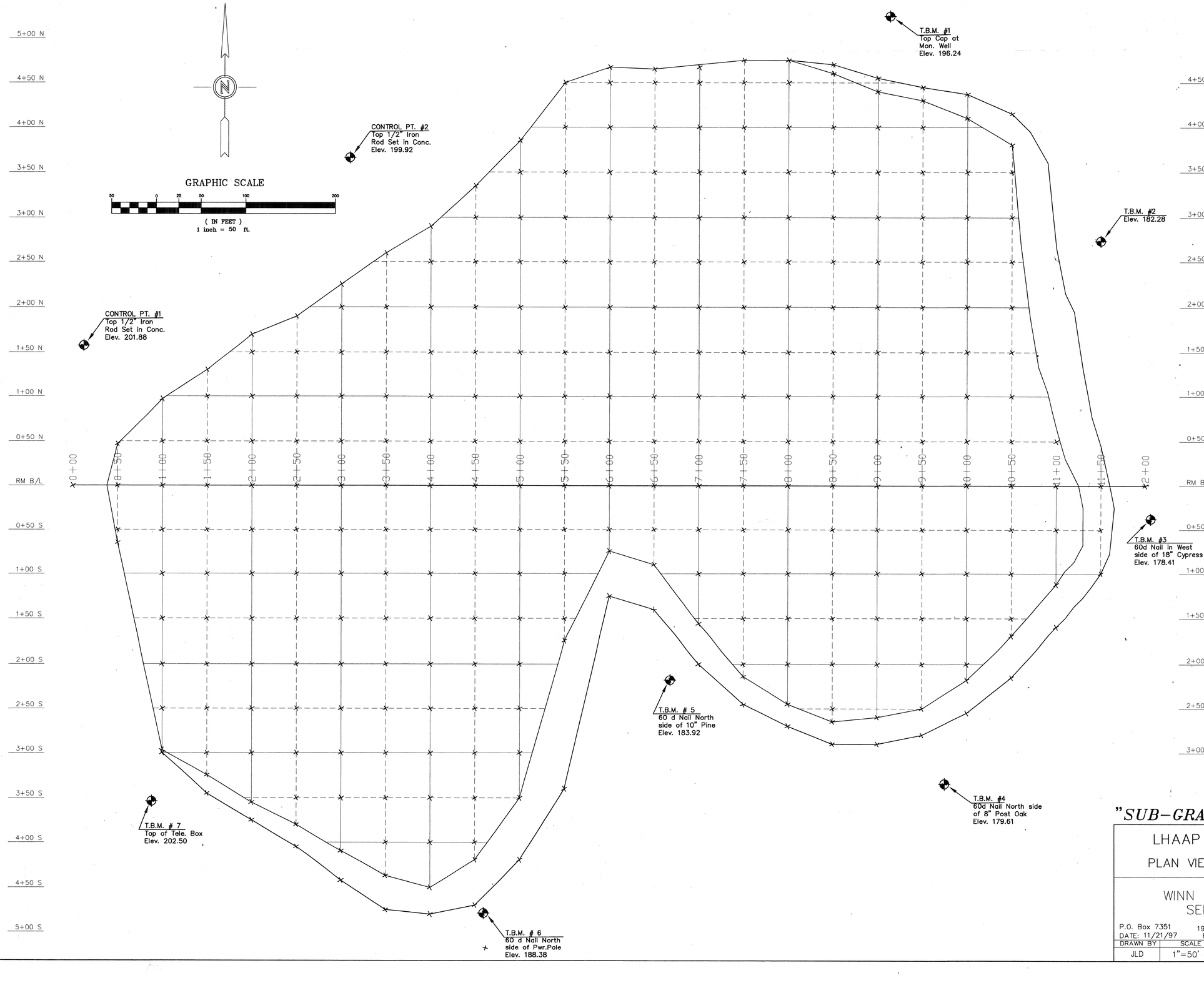
DESIGNED BY: RANDY MEAD
DRAWN BY: LORI KRUSE
REVIEWED BY: JOE GLENN
SUBMITTED BY: REVISED BY OHM NOVEMBER 1998

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

LANDFILL LHAAP16

EXISTING SITE PLAN

PLOT SCALE: AS SHOWN
DWG. CODE:
CONTRACT DATE:
SHEET REFERENCE NUMBER: C14
DESIGN FILE: LH16EPLN.DGN
INVITATION NO. DACA56- -B-
PLOT DATE: DECEMBER 1995
SHEET OF
CONTRACT NO. DACA56-94-D-0020




## *"SUB-GRADE ELEVATIONS"*

# LHAAP – LANDFILL 16

## PLAN VIEW -- SUBGRADE

PREPARED BY

WINN ENVIRONMENTAL
SERVICES, INC.

P.O. Box 7351 1900 SE LOOP 281 LONGVIEW, TX. 75607
DATE: 11/21/97 FAX\758-2701 903-758-1171

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JLD | 1"=50' | 97-2008 | LF16ESIZE.DWG |




N

NOTE

FIELD-LOCATED BERM IS OMMITED FOR CLARITY OF COVER SOIL GRADING

LEGEND

- DITCH
- CENTERLINE OF 16' WIDE ROAD
- EXISTING CONTOURS
- FINAL CONTOURS
- 100-YEAR FLOORPLAIN CONTOUR

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.

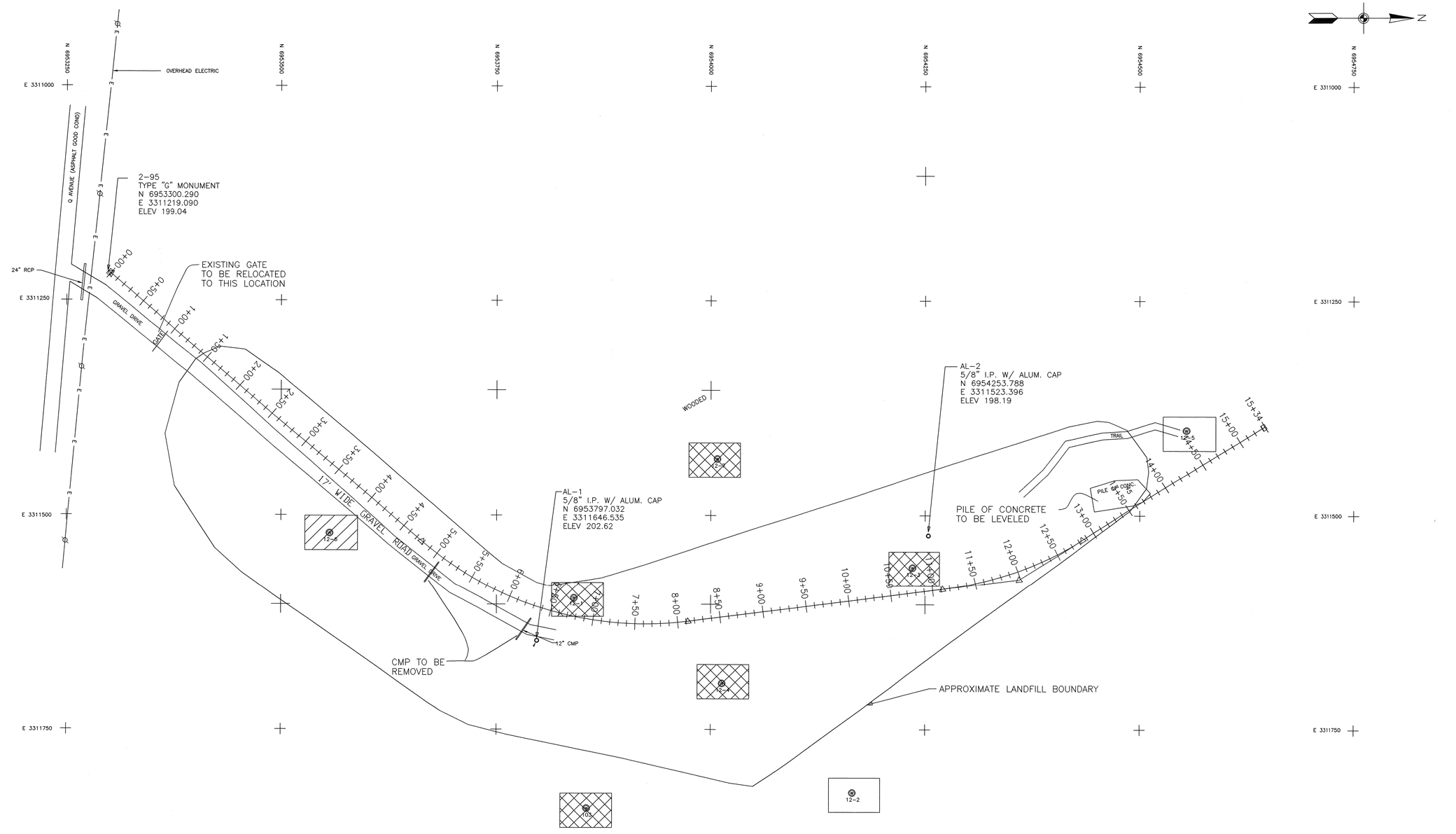
COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE. (4202)

SCALE
0 50 100 FEET

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
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| | |
|---|---|
| Tulsa District<br>Tulsa, Oklahoma | US Army Corps<br>of Engineers |

| | | | |
|---|---|---|---|
| DESIGNED BY:<br>RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT<br>KARNACK, TEXAS<br><br>LANDILL LHAAP16 | | |
| DRAWN BY:<br>LORI KRUSE | | | |
| REVIEWED BY:<br>JOE GLENN | | | |
| SUBMITTED BY:<br>REVISED BY OHM<br>NOVEMBER 1998 | FINAL GRADING PLAN | | |
| PLOT SCALE:<br>AS SHOWN | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE:<br>LH16FGPL.DGN | | INVITATION NO.<br>DACA56- -B- | C17 |
| PLOT DATE:<br>DECEMBER 1995 | SHEET OF | CONTRACT NO.<br>DACA56-94-D-0020 | |




△
C-19-1
TYPE "G" MONUMENT
N 6953171.960
E 3311890.494
ELEV 201.42

## MONITORING WELLS

| DESCRIPTION | NAD 83(92) NORTHING (ft) | NAD 83(92) EASTING (ft) | NAD 83(92) NORTHING (m) | NAD 83(92) EASTING (m) | * NGVD 29 ELEV. (ft) | STATUS OF WELL |
|---|---|---|---|---|---|---|
| MW 103 | 6953855 | 3311842 | 2119539.2 | 1009451.4 | 192.78 | C |
| MW 12-1 | 6953840 | 3311597 | 2119534.7 | 1009376.7 | 200.20 | C |
| MW 12-2 | 6954164 | 3311824 | 2119633.6 | 1009446.0 | 200.28 | A |
| MW 12-3 | 6954235 | 3311561 | 2119655.2 | 1009365.8 | 199.75 | C |
| MW 12-4 | 6954013 | 3311696 | 2119587.5 | 1009407.0 | 200.81 | C |
| MW 12-5 | 6954555 | 3311400 | 2119752.5 | 1009316.8 | 188.46 | A |
| MW 12-6 | 6953555 | 3311521 | 2119447.9 | 1009353.6 | 198.39 | B |
| MW 12-7 | 6954008 | 3311434 | 2119585.8 | 1009327.1 | 201.34 | C |

* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY

A = DO NOT DISTURB

B = TO BE REMOVED

C = REMOVED BY PREVIOUS CONTRACTOR

ELEVATION DATUM BASED ON
N.G.V.D. 1929 DATUM.
O ELEVATION ESTABLISHED ON CONCRETE PAD ONLY
COORDINATE DATUM IS BASED
ON THE NAD 83(92) TEXAS
STATE PLANE COORDINATE
SYSTEM, N.CEN. ZONE. (4202)
STATE PLANE COORDINATESED
FIELD DATA RECORDED IN ELECTRONIC
DATA COLLECTOR.

SCALE
0 50 100 FEET

1-95 (NOT SHOWN)
TYPE "G" MONUMENT
N 6953336.621
E 3310185.015
ELEV 203.93

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps
of Engineers

DESIGNED BY: RANDY MEAD
DRAWN BY: DARRELL JONES
REVIEWED BY: JOE GLENN
SUBMITTED BY: REVISED BY OHM NOVEMBER 1998

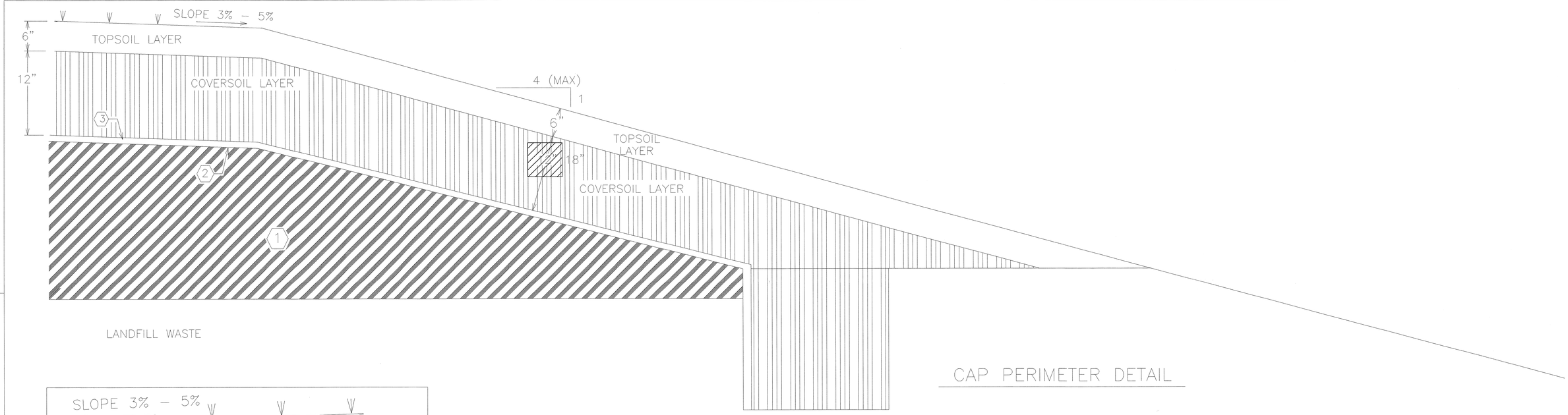
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

LANDFILL LHAAP 12

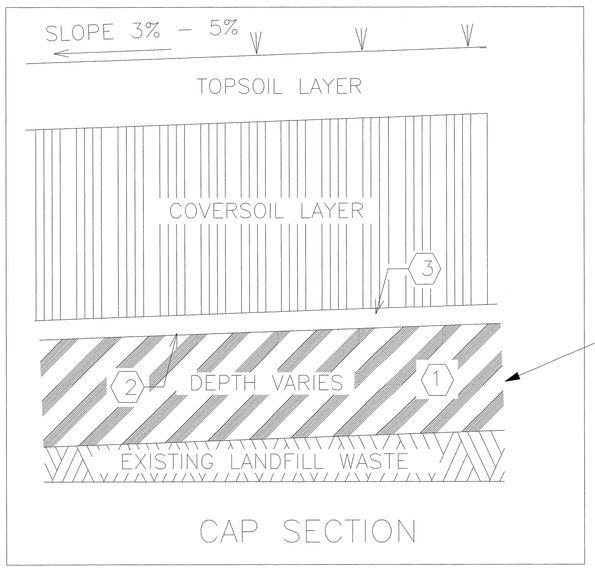
# DEMOLITION PLAN

| | | | |
|---|---|---|---|
| PLOT SCALE: 50:1 | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: LH12DPLN.DGN | | INVITATION NO. DACA56- -B- | |
| PLOT DATE: | SHEET OF | CONTRACT NO. DACA56-94-D-0020 | C-07 |

00082423




CAP PERIMETER DETAIL




CAP SECTION

NOTE: NO LARGE DEBRIS WILL BE PLACED WITHIN 3' OF 2 ⬡




TOE OF SLOPE DETAIL

## LEGEND

⬡1 – SUBGRADE LAYER (PLACED BY OHM)

⬡2 – GEOCOMPOSITE CLAY LINER

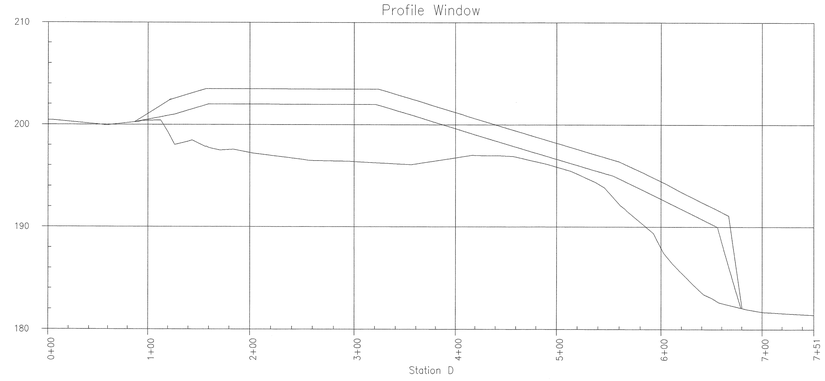
⬡3 – 40 mil / 20 mil GEOMEMBRANE

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

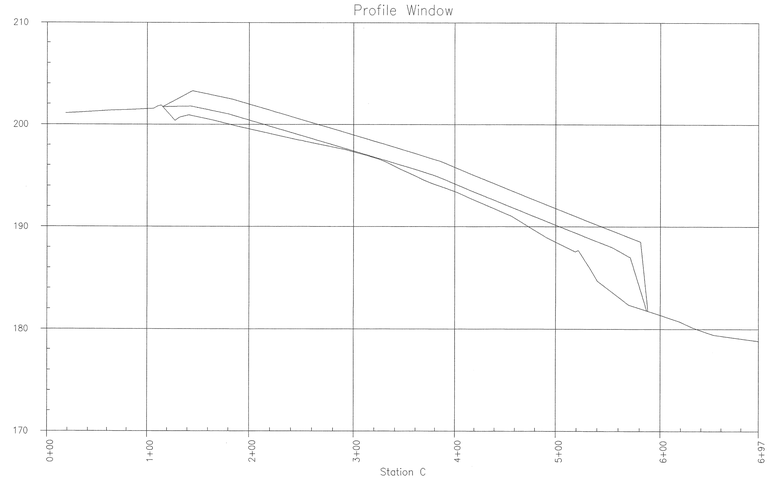
Tulsa District, Tulsa, Oklahoma — US Army Corps of Engineers

| | | | |
|---|---|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS | | |
| DRAWN BY: DARRELL JONES | LANDFILL LHAAP 12 AND 16 | | |
| REVIEWED BY: JOE GLENN | TYPICAL SECTION AND DETAIL | | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | | | |
| PLOT SCALE: | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: 12DETAIL.DGN | | | C–20 |
| PLOT DATE: DECEMBER 1995 | SHEET OF | CONTRACT NO. DACA56–94–D–0020 | |

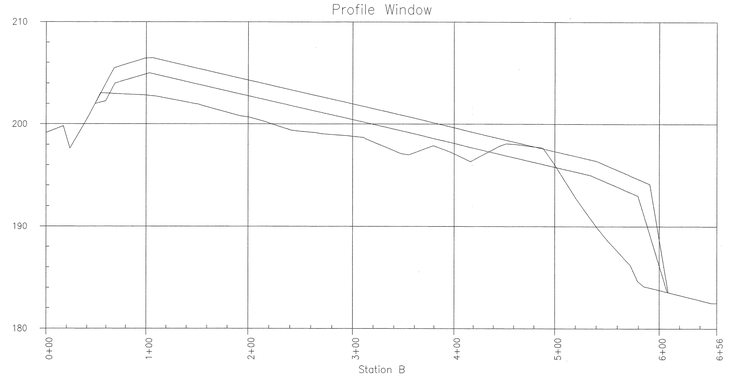
Profile Window



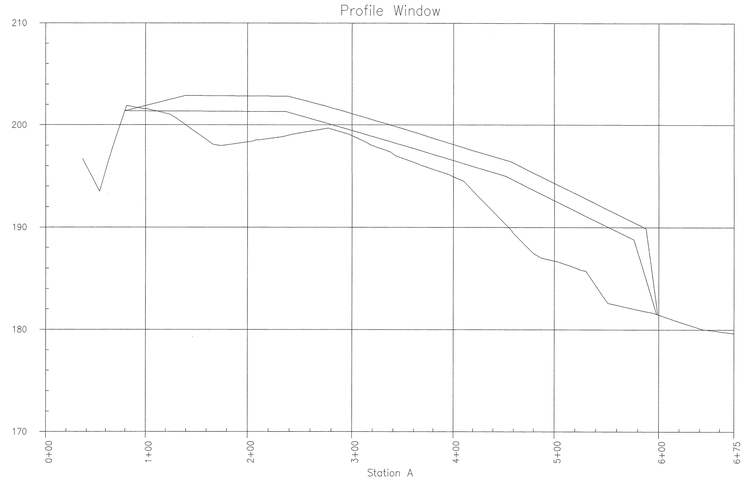

Profile Window



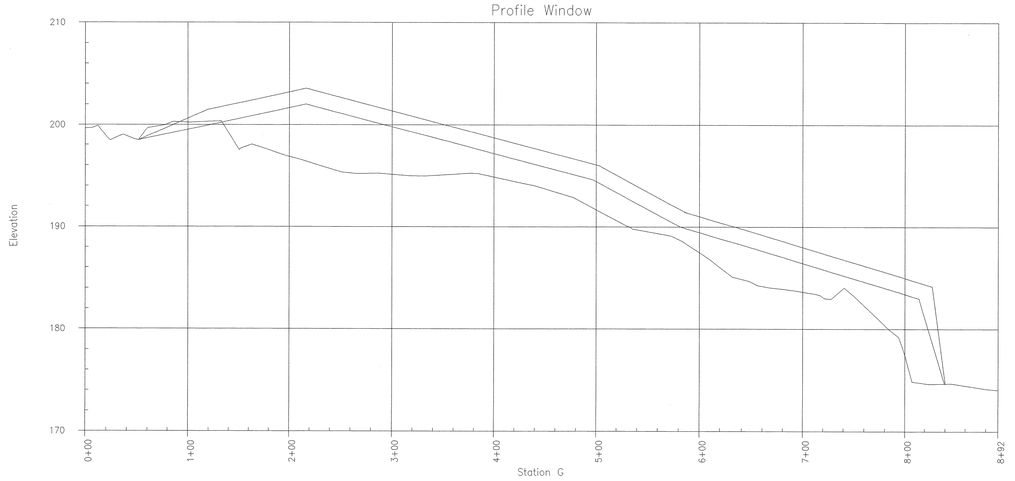

Profile Window



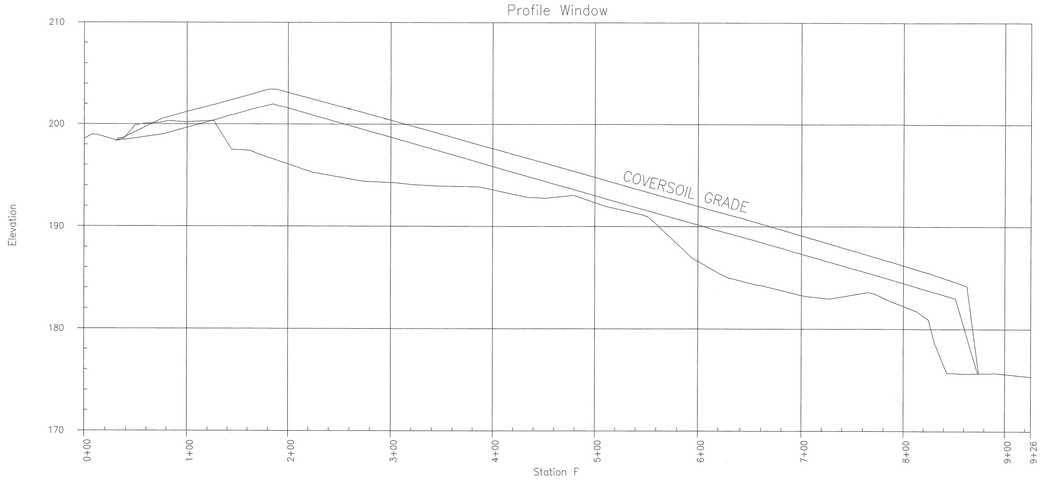

Profile Window



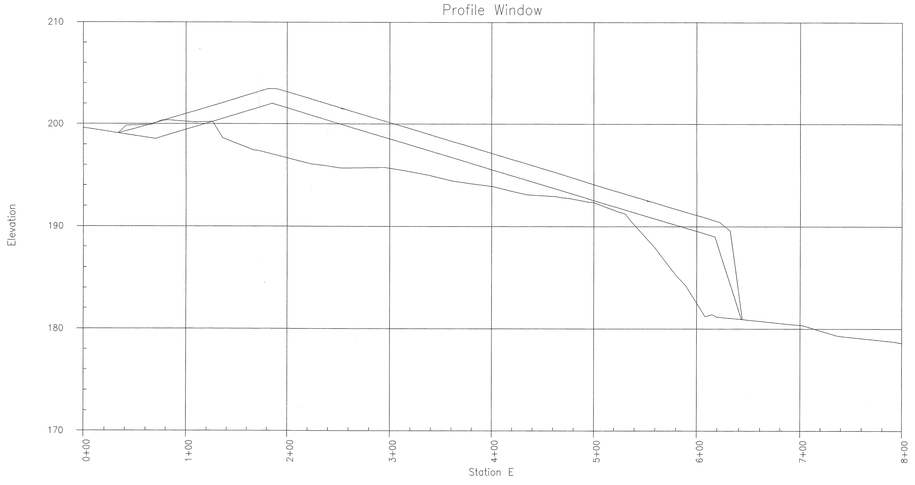

Profile Window




Profile Window




Profile Window




| LINE | SURFACE | OFFSET |
|---|---|---|
| | ORIG16 | 0.00 |
| | subgrade1 | 0.00 |
| Scaled 10.00 Times Ver. Scaled 1.00 Times Hor. | | |

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps
of Engineers

DESIGNED BY:
RANDY MEAD

DRAWN BY:
RANDY MEAD
DARRELL JONES

REVIEWED BY:
JOE GLENN

SUBMITTED BY:

REVISED BY OHM
NOVEMBER 1998

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

LANDFILL LHAAP 16

CROSS SECTIONS

PLOT SCALE:

DWG. CODE:

CONTRACT DATE:

SHEET REFERENCE NUMBER

DESIGN FILE:
16SECT.DGN

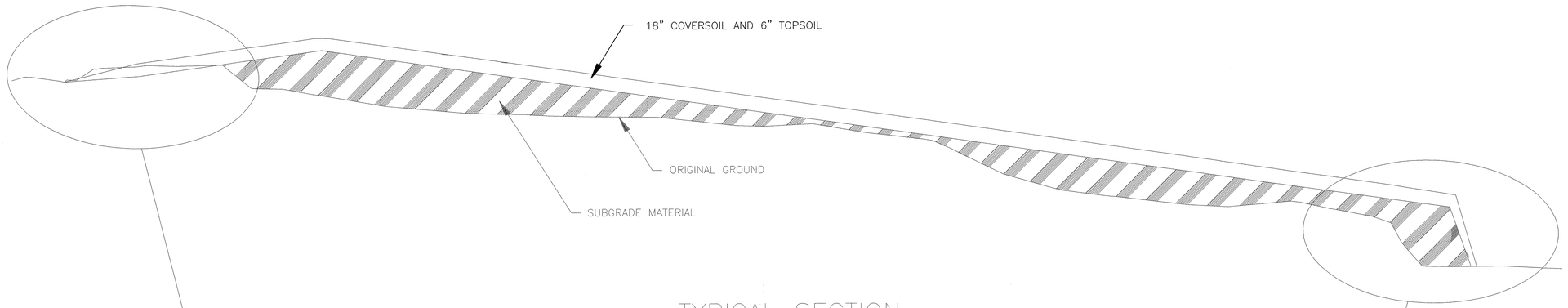
PLOT DATE:

SHEET OF

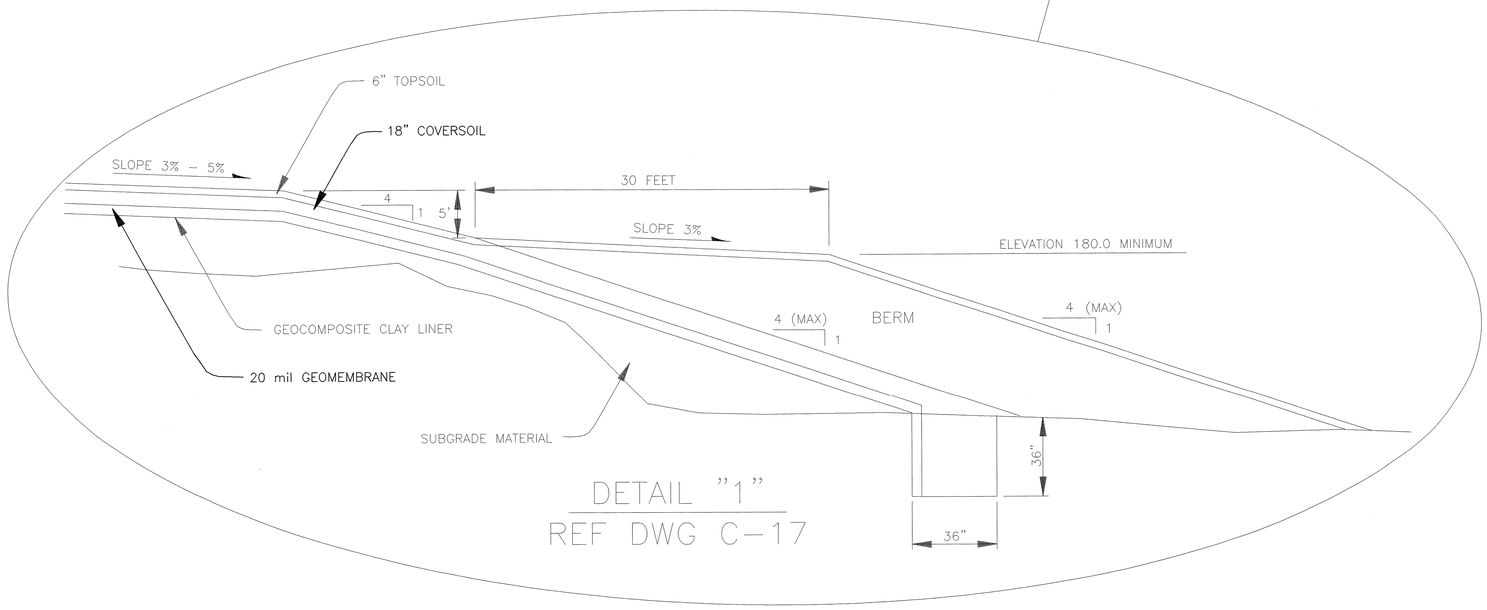
CONTRACT NO.
DACA56-94-D-0020

C-19

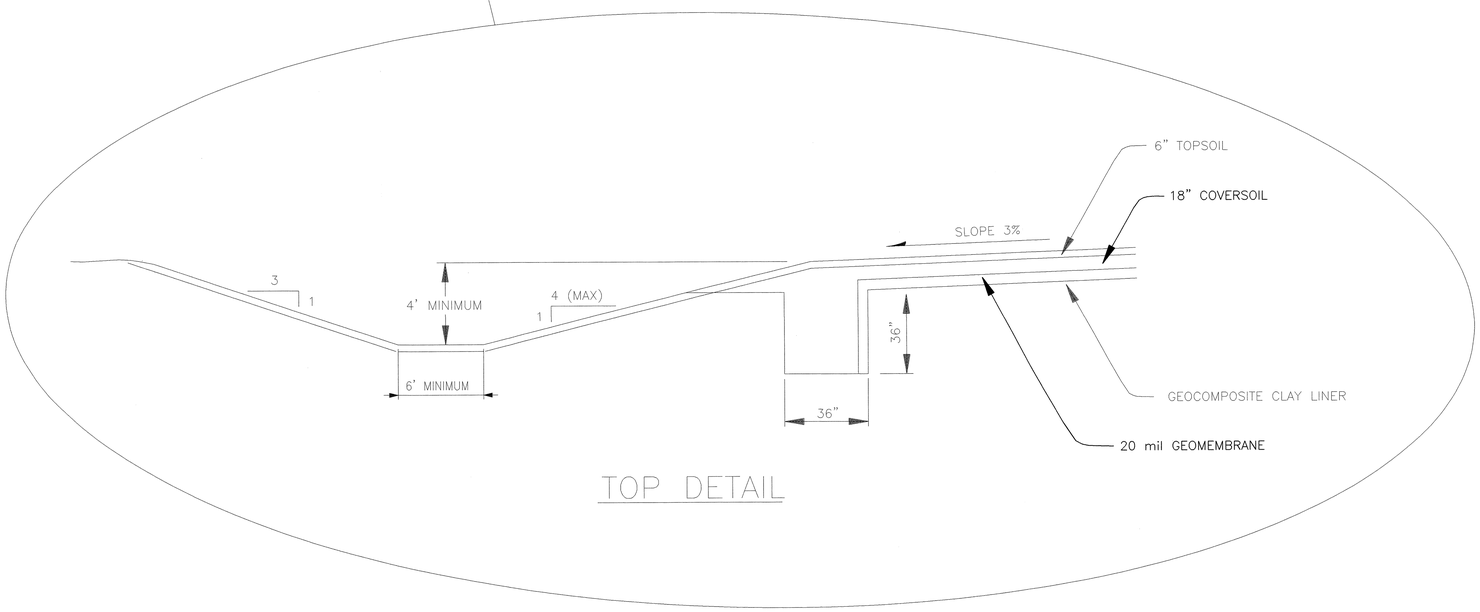
00082425




# TYPICAL SECTION




DETAIL "1"
REF DWG C-17



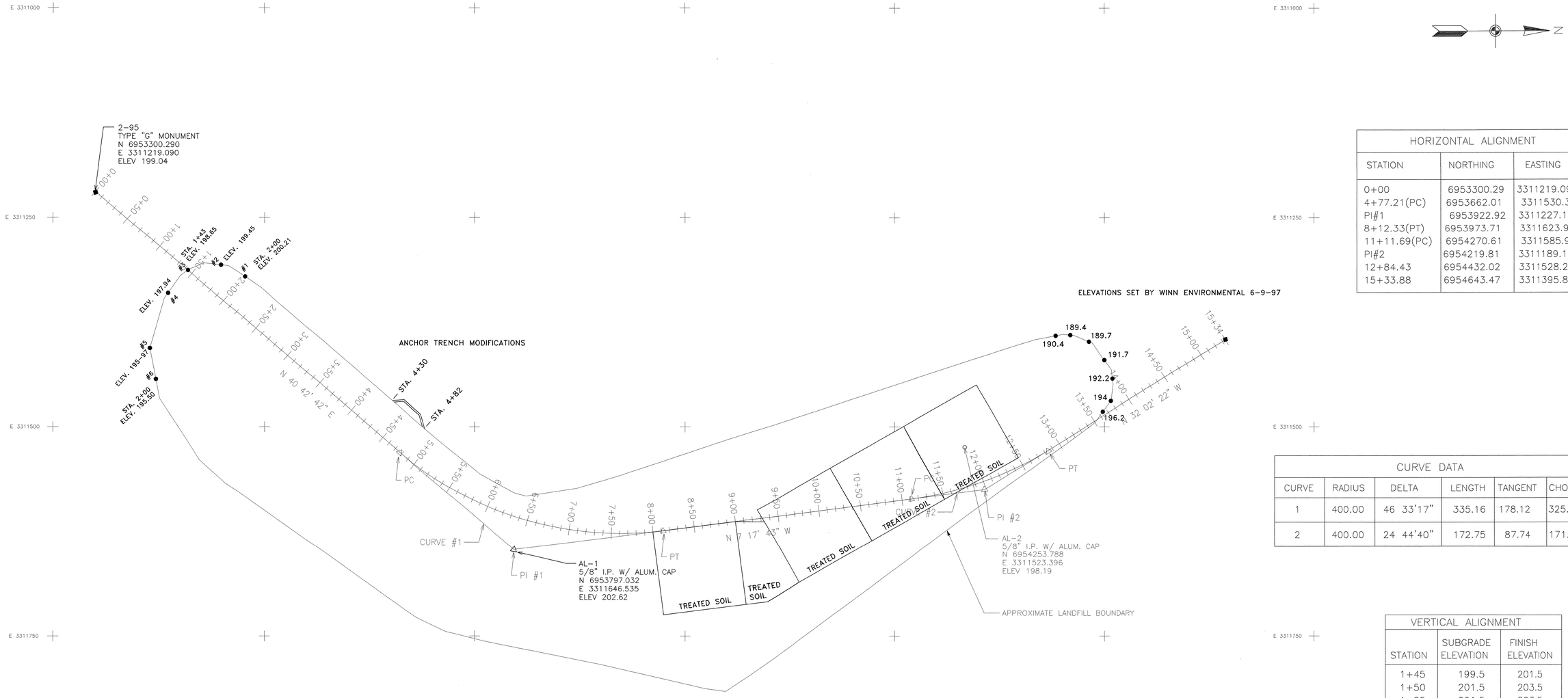

TOP DETAIL

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps
of Engineers

| | | | |
|---|---|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT<br>KARNACK, TEXAS<br>LANDFILL LHAAP 16 | | |
| DRAWN BY: DARRELL JONES | | | |
| REVIEWED BY: JOE GLENN | | | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | TYPICAL SECTION | | |
| PLOT SCALE: NTS | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: 16TYPE.DGN | | | |
| PLOT DATE: | SHEET OF | CONTRACT NO. DACA56-94-D-0020 | C-18 |



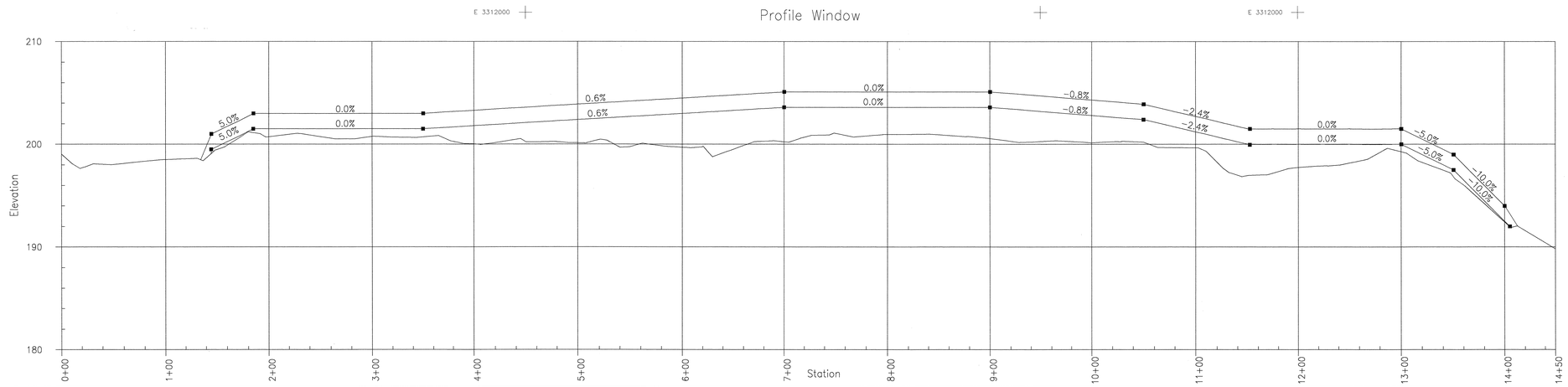

| HORIZONTAL ALIGNMENT | | |
|---|---|---|
| STATION | NORTHING | EASTING |
| 0+00 | 6953300.29 | 3311219.09 |
| 4+77.21(PC) | 6953662.01 | 3311530.35 |
| PI#1 | 6953922.92 | 3311227.15 |
| 8+12.33(PT) | 6953973.71 | 3311623.91 |
| 11+11.69(PC) | 6954270.61 | 3311585.90 |
| PI#2 | 6954219.81 | 3311189.14 |
| 12+84.43 | 6954432.02 | 3311528.21 |
| 15+33.88 | 6954643.47 | 3311395.88 |

| CURVE DATA | | | | | |
|---|---|---|---|---|---|
| CURVE | RADIUS | DELTA | LENGTH | TANGENT | CHORD |
| 1 | 400.00 | 46 33'17" | 335.16 | 178.12 | 325.44 |
| 2 | 400.00 | 24 44'40" | 172.75 | 87.74 | 171.41 |

△
C-19-1
TYPE "G" MONUMENT
N 6953171.960
E 3311890.494
ELEV 201.42

1-95 (NOT SHOWN)
TYPE "G" MONUMENT
N 6953336.621
E 3310185.015
ELEV 203.93

| VERTICAL ALIGNMENT | | |
|---|---|---|
| STATION | SUBGRADE ELEVATION | FINISH ELEVATION |
| 1+45 | 199.5 | 201.5 |
| 1+50 | 201.5 | 203.5 |
| 1+85 | 201.5 | 203.5 |
| 3+50 | 201.5 | 203.5 |
| 7+00 | 203.6 | 205.6 |
| 9+00 | 203.6 | 205.6 |
| 10+50 | 202.4 | 204.4 |
| 11+50 | 200.0 | 202.0 |
| 13+00 | 204.0 | 202.0 |
| 13+50 | 197.5 | 199.5 |
| 14+05 | 192.0 | 194.0 |




SCALE
0 50 100 FEET

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps
of Engineers

DESIGNED BY: RANDY MEAD
DRAWN BY: LORI KRUSE
REVIEWED BY: JOE GLENN
SUBMITTED BY: REVISED BY OHM NOVEMBER 1998

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

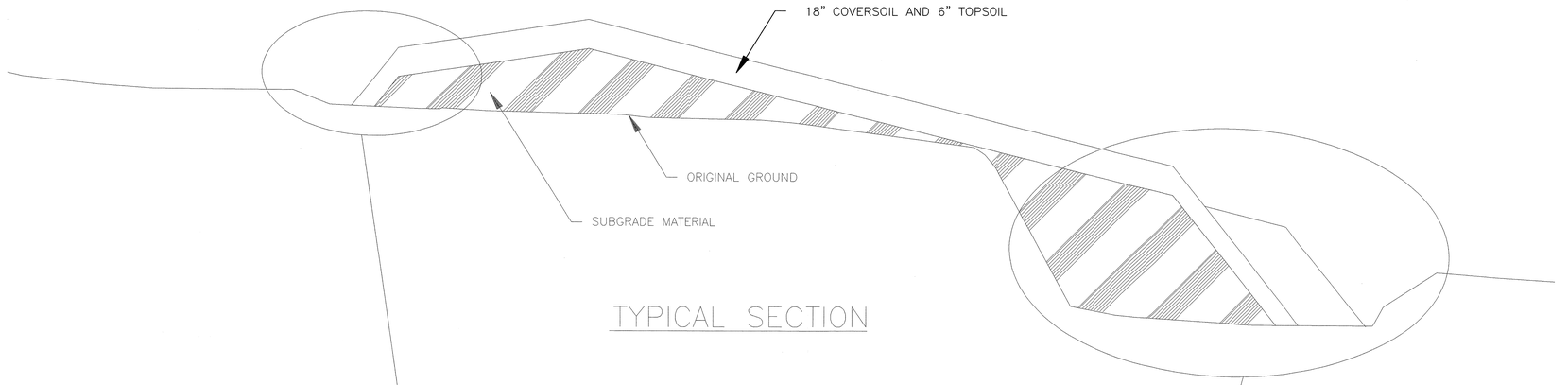
LANDFILL LHAAP12

CONTROL PLAN

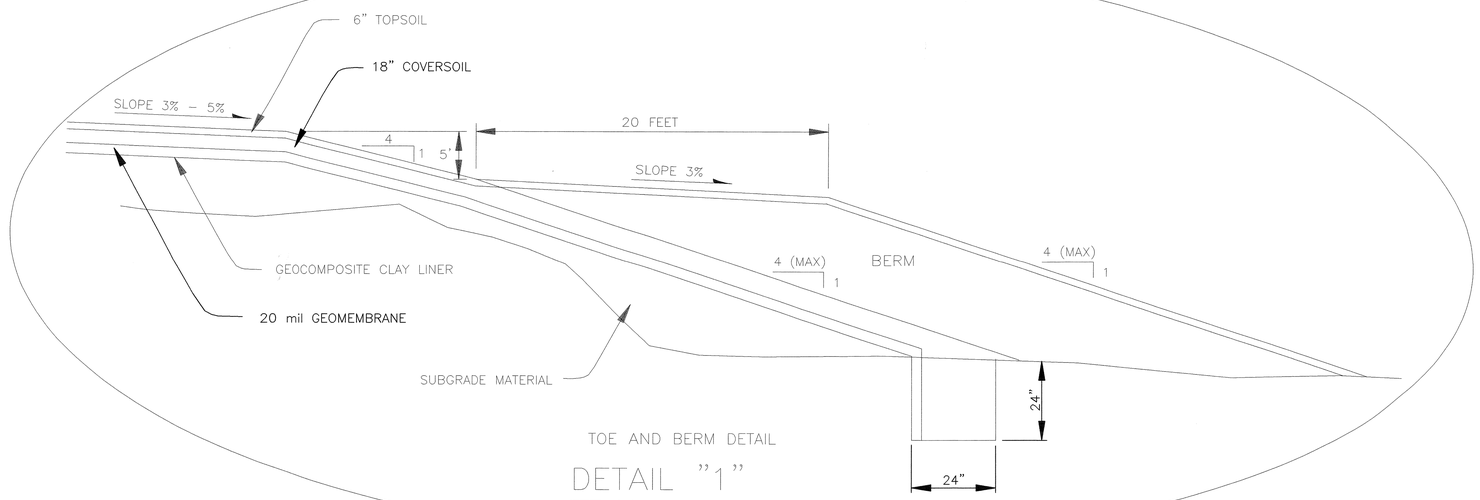
PLOT SCALE: AS SHOWN
DESIGN FILE: LH12CPLN.DGN
PLOT DATE: JANUARY 1996
DWG. CODE:
SHEET OF
CONTRACT DATE:
INVITATION NO. DACA56- -B-
CONTRACT NO. DACA56-94-D-0020

SHEET REFERENCE NUMBER
C08

00082427



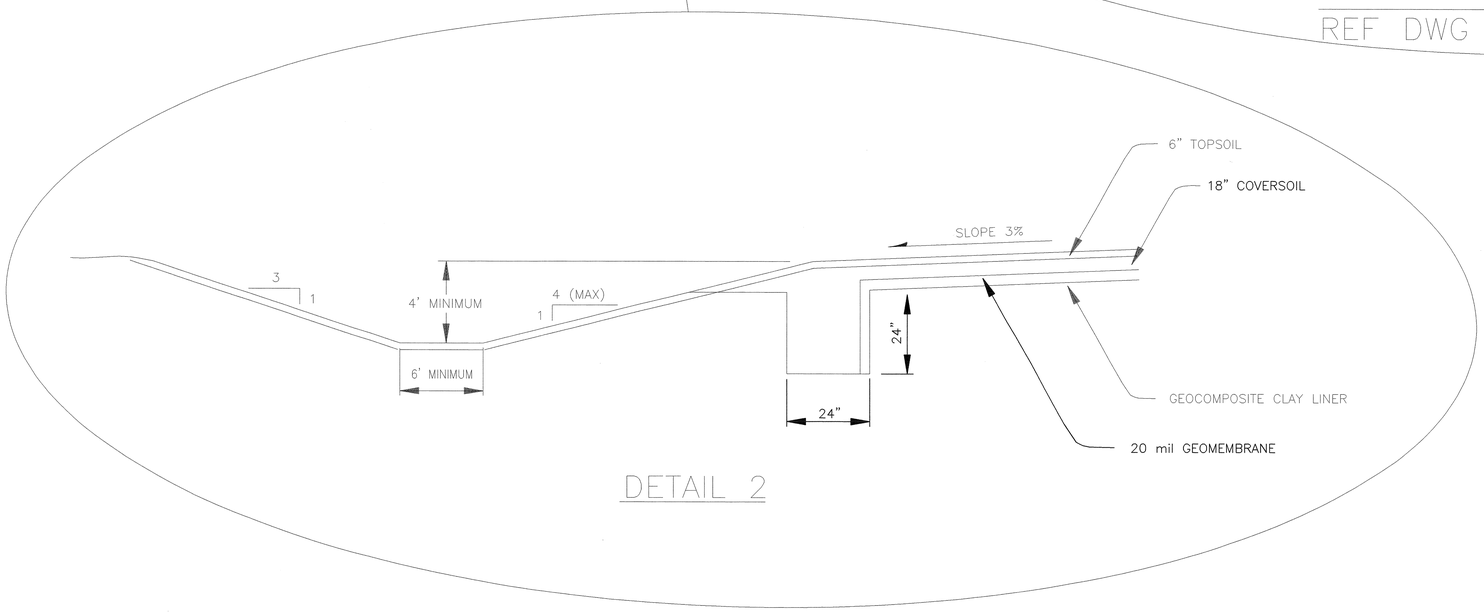

TYPICAL SECTION




TOE AND BERM DETAIL

DETAIL "1"

REF DWG C–10




DETAIL 2

NOTE:

BERM LIMITS:
STATION 2+40 TO STATION 8+90.
TRANSITION FROM STATION 1+90
TO STATION 2+40 AND FROM
STATION 8+90 TO STATION 9+40.
SEE PLAN DRAWING C10.

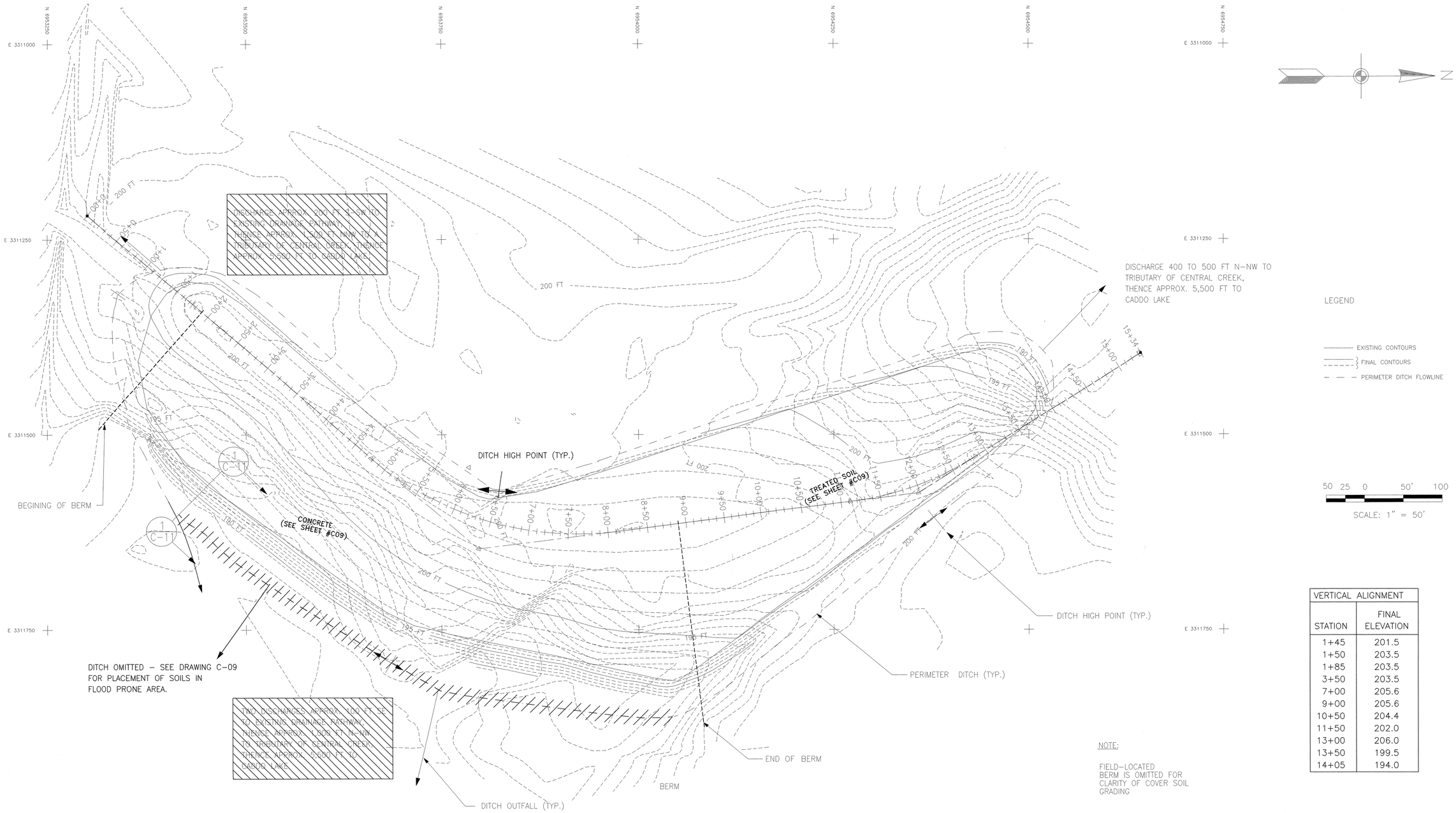
| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps
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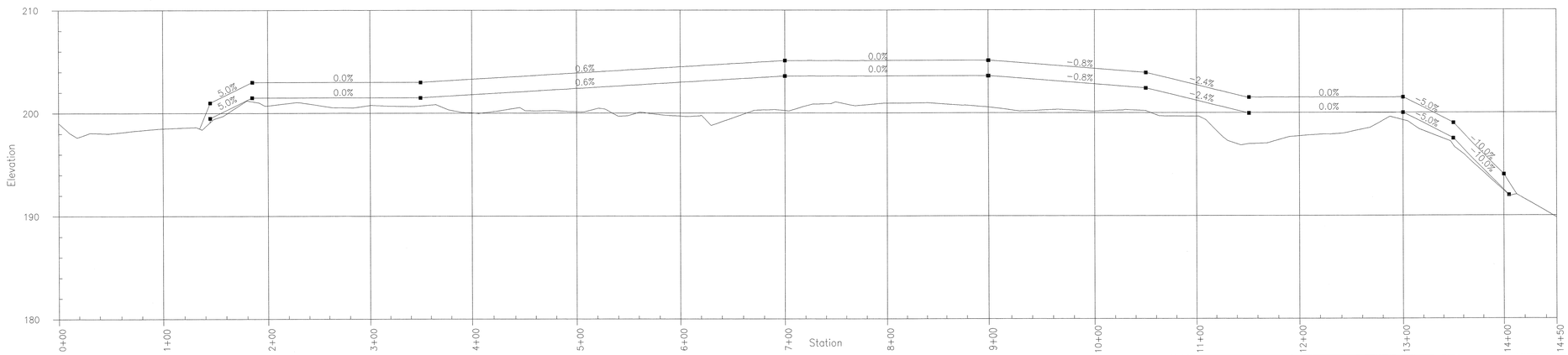
| | |
|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT<br>KARNACK, TEXAS<br>LANDFILL LHAAP 12<br>TYPICAL SECTION |
| DRAWN BY: DARRELL JONES | |
| REVIEWED BY: JOE GLENN | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | |

| | | | |
|---|---|---|---|
| PLOT SCALE: NTS | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: 12TYPE.DGN | | | C–11 |
| PLOT DATE: | SHEET OF | CONTRACT NO. DACA56–94–D–0020 | |




| VERTICAL ALIGNMENT | |
|---|---|
| STATION | FINAL ELEVATION |
| 1+45 | 201.5 |
| 1+50 | 203.5 |
| 1+85 | 203.5 |
| 3+50 | 203.5 |
| 7+00 | 205.6 |
| 9+00 | 205.6 |
| 10+50 | 204.4 |
| 11+50 | 202.0 |
| 13+00 | 206.0 |
| 13+50 | 199.5 |
| 14+05 | 194.0 |

Profile Window




| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps of Engineers

| | |
|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS |
| DRAWN BY: LORI KRUSE | LANDFILL LHAAP 12 |
| REVIEWED BY: JOE GLENN | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | FINAL GRADING PLAN |

| | | | |
|---|---|---|---|
| PLOT SCALE: 50:1 | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: LH12FGPL.DGN | | INVITATION NO. DACA56- -B- | C10 |
| PLOT DATE: JANUARY 1996 | SHEET OF | CONTRACT NO. DACA56-94-D-0020 | |

N 6953250 N 6953500 N 6953750 N 6954000 N 6954250 N 6954500 N 6954750

E 3311000 E 3311250 E 3311500 E 3311750 E 3312000

N

LEGEND

- CENTERLINE OF 16' WIDE ROAD
- EXISTING CONTOURS
- FINAL CONTOURS
- LANDFILL BOUNDARY

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.

COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE. (4202)

ELEVATIONS FOR RADIUS

189.4
189.7
190.4
191.7
192.2
194
196.2

BRIDGE LIFT

ELEVATION OF PIER

CONCRETE

FLOOD PRONE LOW AREA – ADDITIONAL SOIL ADDED SEE FINAL GRADE

PIEZOMETER WELL REMOVED

ELEV. 200.1
ELEV. 200.6
ELEV. 201.1

NOTE: ELEVATIONS FROM STA. 7+00.100' EAST OF BASELINE CHANGED TO THESE ELEVATIONS

ELEV. 197.4
ELEV. 197.6
ELEV. 197.8

NOTE: ELEVATIONS FROM STA. 7+00 TO STA. 8+00 ON CROWN, EAST OF BASELINE, CHANGED TO THESE ELEVATIONS.

BERM AREA

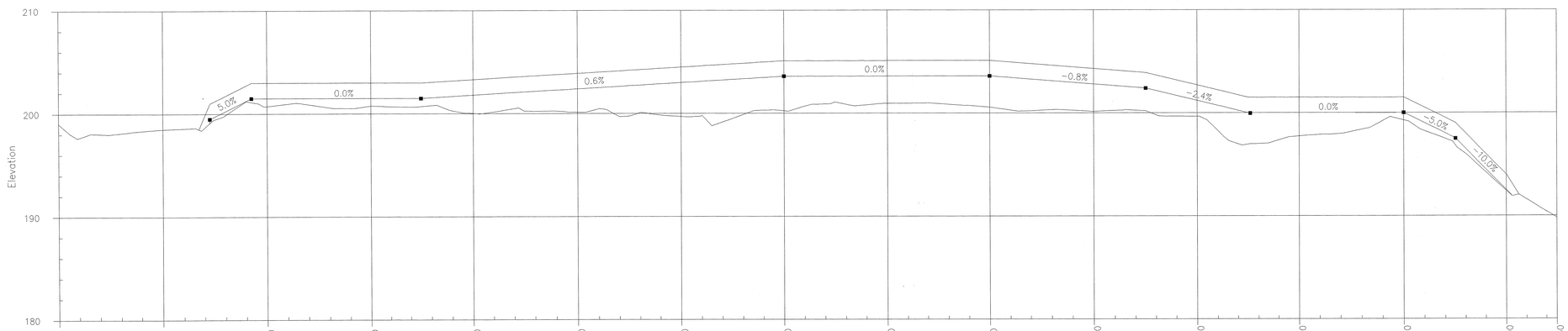
DITCH

APPROXIMATE LANDFILL BOUNDARY

200 FT
195 FT
190 FT

0+00 0+50 1+00 1+50 2+00 2+50 3+00 3+50 4+00 4+50 5+00 5+50 6+00 6+50 7+00 7+50 8+00 8+50 9+00 9+50 10+00 10+50 11+00 11+50 12+00 12+50 13+00 13+50 14+00 14+50 15+00 15+34

## Profile Window




50 25 0 50' 100

SCALE: 1" = 50'

| SYMBOL | DESCRIPTION | DATE | APPR |
|---|---|---|---|
| | | | |

Tulsa District
Tulsa, Oklahoma

US Army Corps of Engineers

| | |
|---|---|
| DESIGNED BY: RANDY MEAD | LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS |
| DRAWN BY: LORI KRUSE | LANDFILL LHAAP 12 |
| REVIEWED BY: JOE GLENN | |
| SUBMITTED BY: REVISED BY OHM NOVEMBER 1998 | SUBGRADE GRADING PLAN |

| | | | |
|---|---|---|---|
| PLOT SCALE: 50:1 | DWG. CODE: | CONTRACT DATE: | SHEET REFERENCE NUMBER |
| DESIGN FILE: LH12BGPL.DGN | | INVITATION NO. DACA56- -B- | C09 |
| PLOT DATE: JANUARY 1996 | SHEET OF | CONTRACT NO. DACA56-94-D-0020 | |

GPS BASE POINT

T.B.M. #1
Top Cap at Mon. Well
Elev. 196.24

GRAPHIC SCALE
50 0 25 50 100 200
( IN FEET )
1 inch = 50 ft.

T.B.M. #2
Elev. 182.28

CONTROL PT. #1
Top 1/2" Iron Rod Set in Conc.
Elev. 201.88

T.B.M. #3
60d Nail in West side of 18" Cypress
Elev. 178.41

T.B.M. # 5
60 d Nail North side of 10" Pine
Elev. 183.92

TYPE "C"
Conc. Monument
Elev. 203.72

T.B.M. #4
60d Nail North side of 8" Post Oak
Elev. 179.61

T.B.M. # 7
Top of Tele. Box
Elev. 202.50

TYPE "G"
Conc. Monument
Elev. 178.37

T.B.M. # 6
60 d Nail North side of Pwr.Pole
Elev. 188.38

Plotted: 09-12-98
Contoured: 09-12-98

ACTUAL PLOT IS OFF PAPER
(Mon. on south side road between two creeks)

*"TOP SOIL CONTOURS"*

# LHAAP – LANDFILL 16
## PLAN VIEW – TOP SOIL

PREPARED BY
*HART ENGINEERING COMPANY*
*CONSULTING ENGINEERS AND SURVEYORS*
P.O. Box 2084 415 No. Center St. Longview, TX. 75606
DATE: 09/12/98 FAX\758-2402 903-758-0166

| DRAWN BY | SCALE | JOB NO. | DWG NAME |
|---|---|---|---|
| JWH | 1"=50' | 12913-5 | FINIS2.DWG |

G:\ENG\12900\12913\FINIS2 Sat Sep 12 10:58:59 1998