# TOLUNAY-WONG ENGINEERS, INC.

| Boring No. | Sample No. | Sample Depth (feet) | Elevation (feet) | Pocket Pen. (tsf) | Soil Description | USCS | Water Content (%) | Liquid Limit | Plastic Limit | Plasticity Index | Finer than No. 200 (%) | Unit Dry Weight (pcf) | Dev./Compr. Stress (tsf) | Failure Strain (%) | Confining Pressure (psi) | Failure Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 14-16 | 40.15 | 3.25 | Gray and tan FAT CLAY | CH | 20.6 | | | | | | | | | |
| | 9 | 16-18 | 38.15 | 4.50 | Gray and tan FAT CLAY | CH | 19.5 | | | | | | | | | |
| | 10 | 18-20 | 36.15 | 3.00 | Gray and reddish-brown FAT CLAY | CH | 22.8 | | | | | | | | | |
| | 11 | 20-22 | 34.15 | 4.00 | Gray and reddish-brown FAT CLAY | CH | 19.3 | | | | | | | | | |
| | 12 | 22-24 | 32.15 | 3.25 | Gray and tan FAT CLAY | CH | 19.8 | | | | | | | | | |
| | 13 | 24-25 | 31.15 | 4.50 | Gray and reddish-brown FAT CLAY; calcareous nodules | CH | 20.6 | | | | | | | | | |
| 07-33 | N 13842900.96, E 3155618.63 | | | | | | | | | | | | | | | |
| | 1 | 0-2 | | 4.50 | Gray and reddish-brown FAT CLAY | CH | 19.7 | | | | | | | | | |
| | 2 | 2-4 | | 4.50 | Reddish-brown and gray FAT CLAY | CH | 21.2 | | | | | | | | | |
| | 3 | 4-6 | | 3.75 | Reddish-brown and gray FAT CLAY | CH | 26.8 | | | | | | | | | |
| | 4 | 6-8 | | 1.75 | Reddish-brown and gray FAT CLAY | CH | 32.6 | | | | | | | | | |
| | 5 | 8-10 | | 1.50 | Reddish-brown and gray FAT CLAY | CH | 39.8 | 96 | 29 | 67 | | 79.1 | 1.18 | 1.6 | | Slickensided |
| | 6 | 10-12 | | 2.00 | Dark gray FAT CLAY | CH | 24.6 | | | | | | | | | |
| | 7 | 12-14 | | 2.50 | Tan and gray FAT CLAY | CH | 28.0 | | | | | | | | | |
| | 8 | 14-16 | | 3.75 | Gray and tan FAT CLAY | CH | 19.8 | | | | | | | | | |
| | 9 | 16-18 | | 3.50 | Reddish-brown and gray FAT CLAY | CH | 32.0 | | | | | | | | | |
| | 10 | 18-20 | | 2.25 | Dark gray and tan FAT CLAY | CH | 23.3 | | | | | | | | | |
| | 11 | 20-22 | | 2.75 | Gray and reddish-brown FAT CLAY | CH | 22.8 | | | | | | | | | |
| | 12 | 22-24 | | 2.50 | Tan and gray FAT CLAY | CH | 20.1 | | | | | | | | | |
| | 13 | 24-26 | | 4.50 | Dark gray and reddish-brown FAT CLAY | CH | 19.6 | | | | | | | | | |
| | 14 | 26-28 | | 3.00 | Reddish-brown and gray FAT CLAY | CH | 29.4 | | | | | | | | | |
| | 15 | 28-30 | | 2.75 | Dark gray abnd tan FAT CLAY; rotten roots | CH | 29.0 | | | | | | | | | |
| | 16 | 30-32 | | 2.50 | Reddish-brown and gray FAT CLAY | CH | 30.2 | | | | | | | | | |
| | 17 | 32-34 | | 2.75 | Gray and reddish-brown FAT CLAY | CH | 24.7 | 80 | 23 | 57 | | 98.2 | 1.90 | 2.4 | | Vertical shear |
| | 18 | 34-36 | | 2.00 | Tan and gray FAT CLAY; calcareous deposits | CH | 26.1 | | | | | | | | | |
| | 19 | 36-38 | | 2.00 | Tan and gray FAT CLAY; calcareous nodules | CH | 27.9 | | | | | | | | | |
| | 20 | 38-40 | | 3.25 | Reddish-brown and gray FAT CLAY | CH | 23.3 | | | | | | | | | |
| 07-39 | N 13839159.80, E 3155103.19 | | 57.61 | | | | | | | | | | | | | |
| | 2 | 2.5-4 | 53.61 | | Tan SAND with SILT | SP-SM | | | | | 8.0 | | | | | |
| | 3 | 4.5-6 | 51.61 | | Tan and gray SILTY SAND; organics | SM | | | | | 13.9 | | | | | |
| 07-40 | N 13839514.76, E 3155031.32 | | 53.46 | | | | | | | | | | | | | |
| | 1 | 0-2 | 51.46 | | Tan SAND with SILT | SP-SM | | | | | 8.9 | | | | | |
| | 2 | 2.5-4 | 49.46 | | Dark gray SILTY SAND; organics | SM | | | | | 19.1 | | | | | |
| | 3 | 4.5-6 | 47.46 | | Tan and gray SANDY LEAN CLAY | CL | | | | | 64.4 | | | | | |
| 07-41 | N 13839120.75, E 3154939.15 | | 55.50 | | | | | | | | | | | | | |
| | 1 | 0-2 | 53.50 | | Tan and gray SILTY SAND; grass roots | SM | | | | | 12.8 | | | | | |
| | 2 | 2.5-4 | 51.50 | | Tan and gray SILTY SAND | SM | | | | | 15.6 | | | | | |
| | 3 | 4.5-6 | 49.50 | | Tan and gray SILTY SAND | SM | | | | | 14.2 | | | | | |
| 07-42 | N 13839419.10, E 3154899.16 | | 53.54 | | | | | | | | | | | | | |
| | 1 | 0-2 | 51.54 | | Dark gray SILTY SAND; rotten grass roots | SM | | | | | 17.8 | | | | | |
| | 2 | 2.5-4 | 49.54 | | Gray and tan SANDY LEAN CLAY; organics | CL | | | | | 68.4 | | | | | |
| 07-43 | N 13838731.74, E 3154300.47 | | 58.72 | | | | | | | | | | | | | |
| | 1 | 0-2 | 56.72 | | Tan and gray SAND with SILT; shell fragments | SP-SM | | | | | 11.0 | | | | | |
| | 2 | 2.5-4 | 54.72 | | Tan and gray SILTY SAND; shell fragments | SM | | | | | 14.5 | | | | | |
| | 3 | 4.5-6 | 52.72 | | Tan and gray SANDY SILT | ML | | | | | 57.9 | | | | | |
| 07-44 | N 13838909.79, E 3154179.82 | | 56.46 | | | | | | | | | | | | | |
| | 1 | 0-2 | 54.46 | | Tan SAND with SILT | SP-SM | | | | | 7.6 | | | | | |
| | 2 | 2.5-4 | 52.46 | | Tan and gray SILTY SAND | SM | | | | | 18.4 | | | | | |
| | 3 | 4.5-6 | 50.46 | | Tan and gray SILTY SAND | SM | | | | | 13.7 | | | | | |
| 07-45 | N 13838950.20, E 3154511.58 | | 55.37 | | | | | | | | | | | | | |
| | 1 | 0-2 | 53.37 | | Tan SAND with SILT | SP-SM | | | | | 9.3 | | | | | |
| | 2 | 2.5-4 | 51.37 | | Gray and tan SILTY SAND; organics | SM | | | | | 16.7 | | | | | |
| | 3 | 4.5-6 | 49.37 | | Tan and gray SILTY SAND | SM | | | | | 21.4 | | | | | |
| 07-46 | N 13839041.98, E 3154756.69 | | 54.77 | | | | | | | | | | | | | |
| | 1 | 0-2 | 52.77 | | Gray and tan SILTY SAND; grass roots | SM | | | | | 15.0 | | | | | |
| | 2 | 2.5-4 | 50.77 | | Dark gray SILTY SAND; organics | SM | | | | | 34.3 | | | | | |

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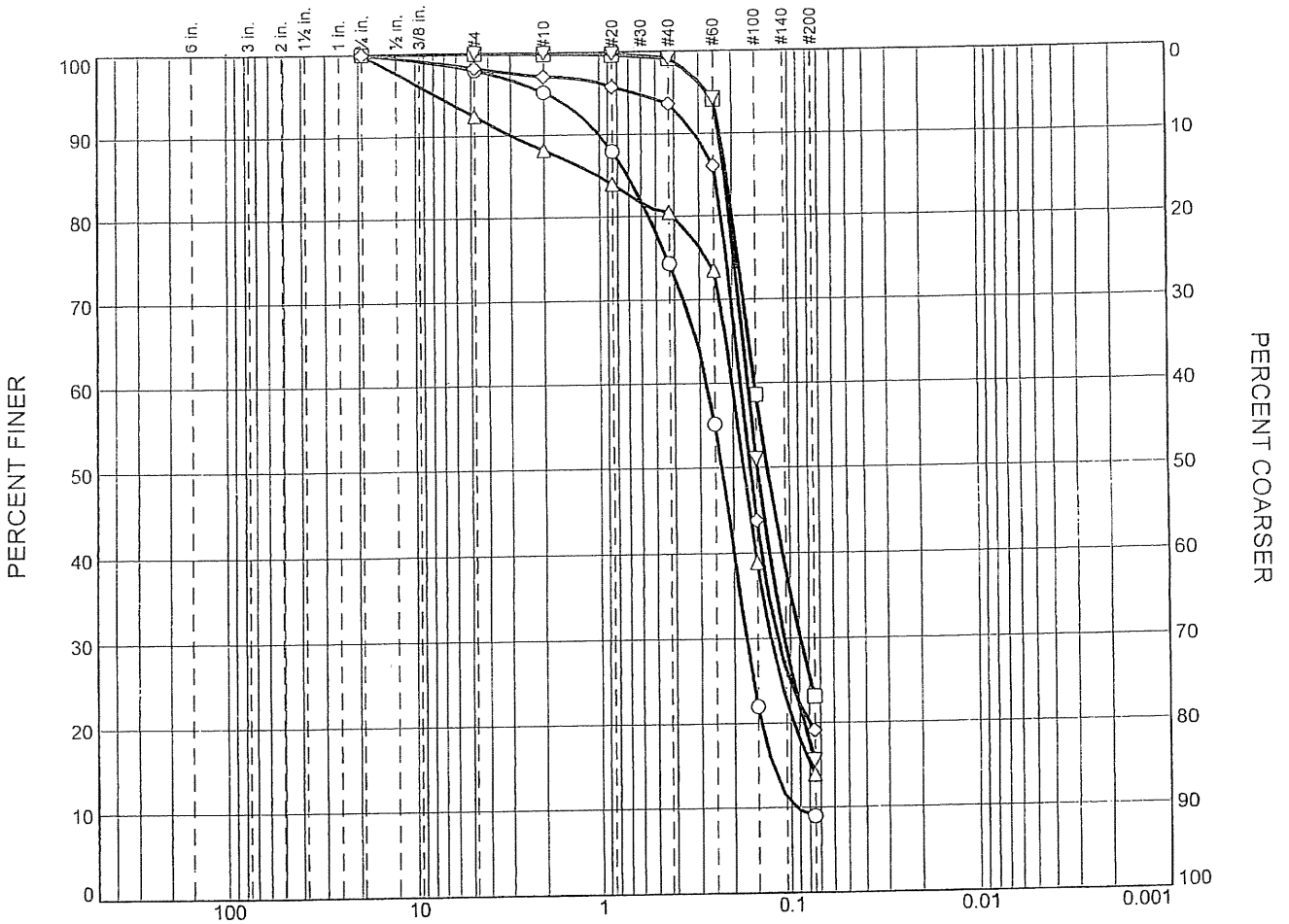
# Grain Size Analysis - ASTM D 422




| | % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 0.0 | 2.0 | 2.8 | 20.9 | 65.3 | 9.0 | |
| □ | 0.0 | 0.0 | 0.1 | 0.1 | 0.7 | 75.9 | 23.2 | |
| △ | 0.0 | 0.0 | 7.6 | 4.2 | 7.7 | 66.6 | 13.9 | |
| ◇ | 0.0 | 0.0 | 1.8 | 1.0 | 3.5 | 74.6 | 19.1 | |
| ▽ | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 83.6 | 15.6 | |

## SOIL DATA

| SYMBOL | SOURCE | SAMPLE NO. | DEPTH (ft.) | Material Description | USCS |
|---|---|---|---|---|---|
| ○ | 07-05 | 7 | 12.5-14 | Gray and tan Well graded SAND with SILT | SW-SM |
| □ | 07-11 | 3 | 4.5-6 | Gray and tan SILTY SAND | SM |
| △ | 07-39 | 3 | 4.5-6 | Tan and gray SILTY SAND; organics | SM |
| ◇ | 07-40 | 2 | 2.5-4 | Dark gray SILTY SAND; organics | SM |
| ▽ | 07-41 | 2 | 2.5-4 | Tan and gray SILTY SAND | SM |

**Tolunay-Wong Engineers, Inc.**
**Houston, Texas**

**Client:** U. S. Army Corps of Engineers
**Project:** House Tract Placement Area
Contract No. DACW64-03-D-0008, Task Order 0067
**Project No.:** 07.18.922

Hole No. 07-40

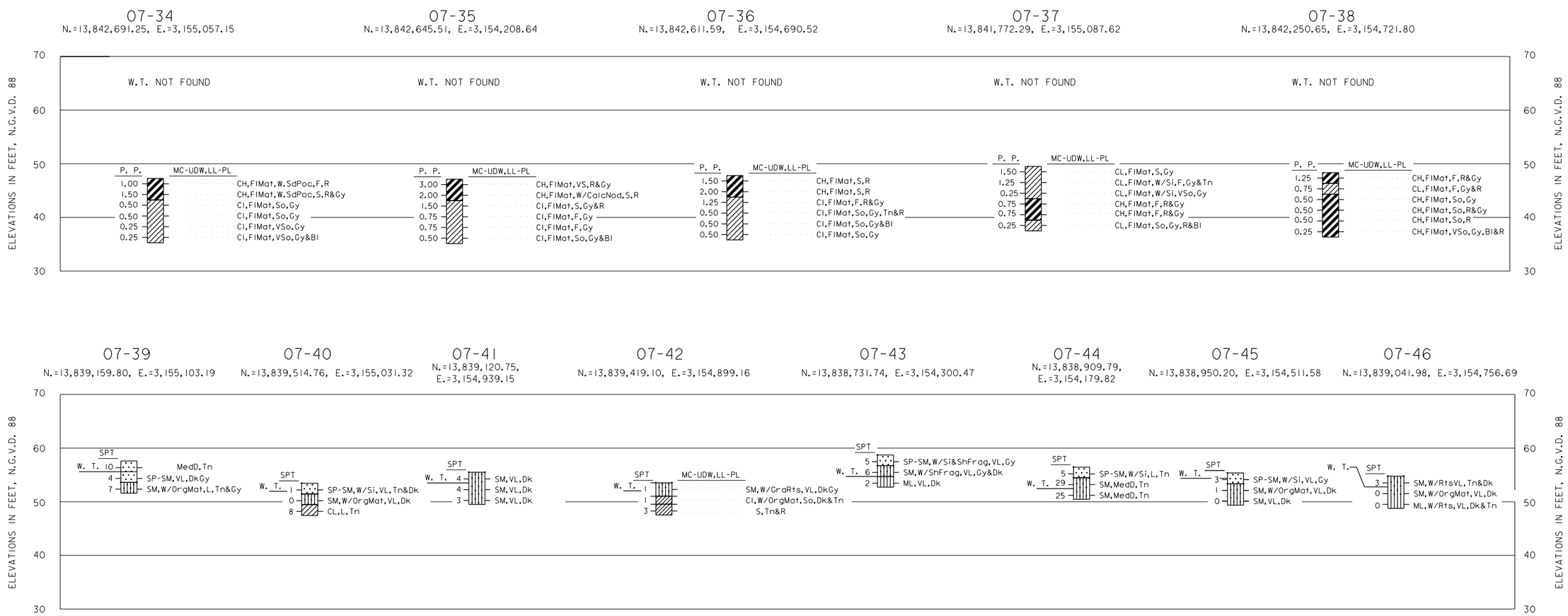
| BORING LOG | DISTRICT | INSTALLATION | SHEET 1 OF 1 SHEETS |
|---|---|---|---|

| | |
|---|---|
| 1. PROJECT<br>House Tract Placement Area | 7. ELEVATION OF HOLE<br>47.12 ft |
| 2. LOCATION (Coordinates or Station)<br>N=13839514.76 E=3155031.32 | 8. DATUM FOR ELEVATION |
| 3. DRILLING AGENCY<br>T.R.I. | 9. ELEVATION OF GROUNDWATER<br>▽ TOD: 45.62 ft ▼ 24-HR: |
| 4. LABORATORY TESTING AGENCY<br>Tolunay-Wong Engineers, Inc. | 10. DRILLING DATE and TIME<br>STARTED: 4/20/07 COMPLETED: 4/20/07 |
| 5. DEPTH OF WATER<br>▽ TOD: 1.5 ft ▼ 24-HR: | 11. CLASSIFICATION REFERENCE |
| 6. DEPTH OF HOLE<br>6 ft | 12. ENGINEER |

| DEPTH (ft) | ELEVATION (ft) | GRAPHIC LOG | MATERIAL DESCRIPTION | SAMPLE TYPE | NUMBER | RECOVERY (%) | SPT (N) | PENETROMETER (tsf) | DRY UNIT WT. (pcf) | MOISTURE CONTENT (%) | LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | FINES CONTENT (% <200) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ▽ 45.1 | | **POORLY GRADED SAND w/ SILT(SP-SM)**, very loose to loose, dark gray & tan | X | 1 | | 1 | | | | | | | 8.9 |
| | 43.1 | | **SILTY SAND(SM)**, very loose, dark gray, w/ organics | X | 2 | | 0 | | | | | | | 19.1 |
| 5 | 41.1 | | **SANDY LEAN CLAY(CL)**, firm, tan & gray, w/ interbedded clay layers | X | 3 | | 8 | | | | | | | 64.4 |
| | | | Boring terminated at 6 ft. | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | |

SWG 1836 BOR 03.14.859-057.GPJ TOLUNAY-WONG ENGINEERS.GDT 3/4/08

ENG FORM: SWG 1836 BOR







NOTES;

1. SOILS HAVE BEEN CLASSIFIED IN ACCORDANCE WITH ASTM 2487-06 "CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES (UNIFIED SOILS CLASSIFICATION SYSTEM)". CONSISTENCY OF SOILS SUCH AS SOFT, MEDIUM, HARD, LOOSE, DENSE, ETC., ARE RELATIVE TERMS BASED ON ESTIMATED UNDISTURBED SHEAR STRENGTH OF THE MATERIAL AS DETERMINED BY VISUAL CLASSIFICATION, POCKET PENETROMETER TESTS AND PENETRATION RESISTANCE DURING SAMPLING.
2. FIGURES TO THE RIGHT OF BORING LOGS ARE WATER CONTENTS IN PERCENT OF THE DRY WEIGHT, DRY DENSITY, LIQUID LIMIT, PLASTIC LIMIT, AND BAR LINEAR SHRINKAGE. (MC-UDW),(LL-PL),(B.L.S.)* FIGURES TO THE LEFT OF BORING LOGS ARE BLOWS PER FOOT OF PENETRATION FROM STANDARD PENETRATION TESTING.
3. BORINGS WERE DRILLED USING WET ROTARY DRILLING TECHNIQUES AND UNDISTURBED SAMPLES WERE RECOVERED WITH A 3-INCH DIAMETER THIN WALL SAMPLER WHERE COHESIVE MATERIALS WERE ENCOUNTERED.WHERE COHESIONLESS MATERIALS WERE ENCOUNTERED, DISTURBED SAMPLES WERE TAKEN WITH A SPLIT SPOON SAMPLER DURING PERFORMANCE OF STANDARD PENETRATION TESTING.
4. WATER TABLE LEVELS SHOWN ON BORING LOGS WERE DETERMINED AFTER DRILLING BORINGS BY MEASURING THE TOP OF FLUID LEVELS IN THE BORINGS. INASMUCH AS WET ROTARY DRILLING TECHNIQUES AND DRILLING MUD WERE USED TO DRILL THE HOLES, THE LEVEL OF DRILLING FLUIDS IN THE BORE HOLES MAY NOT HAVE STABLILIZED TO THE LEVEL OF THE ACTUAL WATER TABLE. ADDITIONALLY, WATER TABLES IN THE FIELD ARE LIKELY TO FLUCTUATE DEPENDING ON WEATHER CONDITIONS. THEREFORE, SOME VARIATION SHOULD BE ANTICIPATED BETWEEN WATER TABLES INDICATED AND WATER TABLES ENCOUNTERED IN THE FIELD.
5. THE HORIZONTAL DATUM IS NAD 83. THE VERTICAL DATUM IS NAVD 88.

VISUAL CLASSIFICATIONS:

| | | | |
|---|---|---|---|
| Bl Black | El Elastic | Nod Nodules | Si Silty |
| Ba Ball(s) | F Firm | Org Organic | Slks Slicken Sides |
| Bn Brown(ish) | Frag Fragment(s) | Or Orange | Sms Seams |
| Calc Calcareous | Gy Gray(ish) | Poc Pocket(s) | So Soft |
| Cl Clay(ey) | H Hard | R Red(dish) | Tn Tan(nish) |
| Conc Concrete | Hcbn Hydrocarben | Rts Root(s) | V Very |
| D Dense | L Loose | S Stiff | W.T. Water Table |
| Dep Deposit(s) | Med Medium | Sd Sand(y) | W With |
| Dk Dark | N. Rec. No Record | Sh Shell(y) | |

LABORATORY CLASSIFICATIONS:

CH INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.

CL INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, LEAN CLAYS.

MH INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS.

ML INORGANIC SILTS AND VERY FINE SANDS, WITH SLIGHT PLASTICITY.

SM SILTY SANDS, SAND-SILT MIXTURES.

SW WELL-GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.

SOLICITATION NO.
W912HY-
08-B-0016

US Army Corps of Engineers
Galveston District

TIME:$TIME$

| Rev. | Description | Date | By |
|---|---|---|---|
| | | | |

DATE:$DATE$ BY:$USER$

Drawn by:
Designed by: SK,SL,RB
Checked by: SL,RB
Submitted by: LORI K. THOMAS, P.E. Dist.Geotech & Structure Section
Approved by: PETE G. PEREZ, P.E. Chief, Engineering and Construction Division

Date: APRIL, 2008
Scale: AS SHOWN
Rev. --
Approval Recommended: HARRISON T. SUTCLIFFE, P.E. Chief, Engineering Branch

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

PREPARED UNDER THE DIRECTION OF
DAVID C. WESTON, Col., C.E.,
DISTRICT COMMANDER

HOUSTON SHIP CHANNEL, TEXAS
HOUSE TRACT PLACEMENT AREA
INTERIOR REHABILITATION, EXTERIOR LEVEE
REHABILITATION, AND DRAINAGE DITCH REPAIR

LOGS OF BORINGS

Drawing No.:
F-46
Sheet 49 of 49

File No. HSC 401-515

File:$FILE$