# LOG OF BORING AND TEST RESULTS

EUSTIS ENGINEERING SINCE 1946

**Ducks Unlimited, Inc.**
**Pierce Marsh Beneficial Use**
**Marsh Creation**
**Phase 1**
**North of West Bay Near Galveston Island**
**Galveston County, Texas**

## Boring: B-13

**Project No:** H0048
**Date:** 07/12/2022
**Latitude:** 29.31887°
**Longitude:** -94.96952°

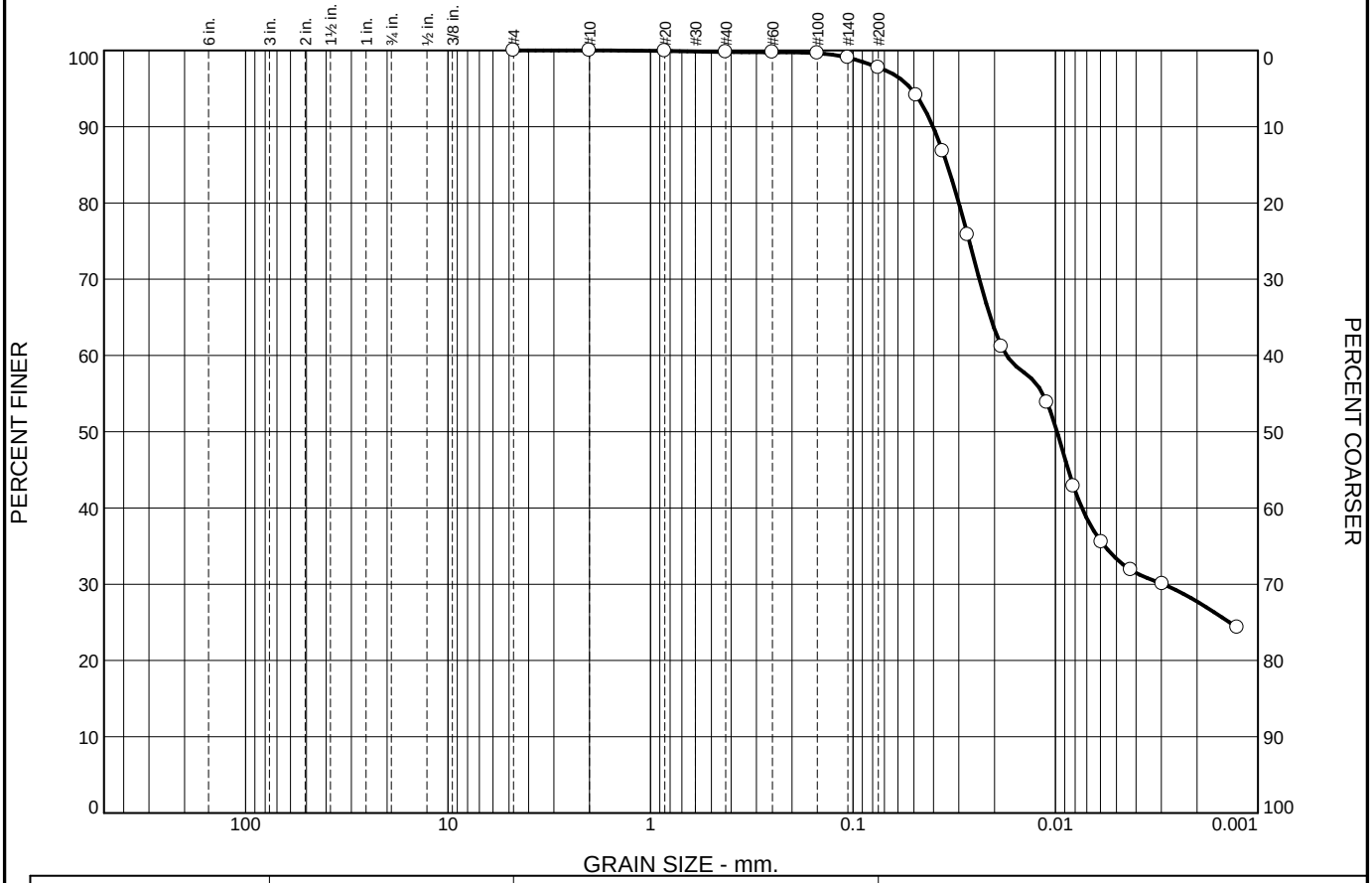
**Water Depth:** See Text
**Total Depth:** 40.0 ft

| Scale in Feet | PP | SPT | S P L R | Symbol | Visual Classification | USC | Sample Number | Depth in Feet | Water Content % | Density Dry pcf | Density Wet pcf | Shear Tests Type | Shear Tests ϕ | Shear Tests C psf | Atterberg Limits LL | Atterberg Limits PL | Atterberg Limits PI | | Other Tests |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Wet, soft gray FAT CLAY w/few organic matter | CH | 1A | 0 | 42 | | | | | | | | | | |
| | 0.50 | | | | | CL | 1B | 1 | 34 | 88 | 118 | OB | 0 | 598 | | | | | |
| | 1.00 | | | | Moist, medium stiff gray LEAN CLAY w/few organic matter | CH | 2A | 2 | 41 | | | | | | | | | | |
| | | | | | | | 2B | 3 | 23 | | | | | | 54 | 18 | 36 | | |
| 5 | 1.00 | | | | Moist, medium stiff to stiff gray, tan, & brown FAT CLAY w/little roots, few organic matter, & trace of concretions | | 3A | 4 | 34 | | | | | | | | | | |
| | | | | | | | 3B | 5 | 24 | 99 | 123 | OB | 0 | 983 | | | | | |
| | 1.00 | | | | Moist, extremely stiff to hard gray & brown FAT CLAY w/few organic matter & gravel | CH | 4A | 6 | 24 | | | | | | | | | | |
| | | | | | | | 4B | 7 | 25 | | | | | | | | | | |
| | 2.00 | | | | Moist, soft reddish-brown FAT CLAY w/few concretions | CH | 5A | 8 | 28 | | | | | | | | | | |
| 10 | | | | | | CH | 5B | 9 | 31 | | | | | | | | | | |
| | 0.50 | | | | Moist, very stiff reddish-brown & gray FAT CLAY w/trace of concretions | CL | 6A | 10 | 27 | | | | | | | | | | |
| | | | | | | | 6B | 11 | 24 | | | | | | 28 | 12 | 16 | | CON |
| | 0.50 | | | | Moist, soft reddish-brown & gray LEAN CLAY | ML | 7A | 12 | 23 | | | | | | | | | | |
| | | | | | | CL | 7B | 13 | 25 | 101 | 126 | OB | 0 | 539 | | | | | |
| | 0.50 | | | | Moist, stiff reddish-brown SILT | ML | 8A | 14 | 24 | | | | | | | | | | |
| 15 | | | | | Moist, medium stiff reddish-brown fine SANDY LEAN CLAY | | 8B | 15 | 23 | | | | | | | | | | PD |
| | 0.50 | | | | Moist, medium compact red & brown SILT | CL | 9A | 16 | 22 | | | | | | | | | | |
| | | | | | | | 9B | 17 | 22 | | | | | | | | | | |
| | 4.00 | | | | Moist, medium stiff red & brown SANDY LEAN CLAY | ML | 10A | 18 | 24 | | | | | | | | | | |
| 20 | | | | | Moist, medium compact reddish-brown SILT | CL | 10B | 19 | 26 | 99 | 125 | OB | 0 | 1024 | | | | | |
| | | | | | Moist, medium stiff to stiff reddish-brown, gray, & tan LEAN CLAY w/few gravel & trace of concretions | | 11A | 23 | 28 | | | | | | | | | | |
| | 1.00 | | | | | | 11B | 24 | 27 | | | | | | 38 | 21 | 17 | | |
| 25 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 12A | 28 | 28 | | | | | | | | | | |
| | 0.50 | | | | w/trace of organic matter & concretions | | 12B | 29 | 27 | 98 | 124 | OB | 0 | 946 | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | |
| | | | | | w/trace of silt pockets | | 13A | 33 | 31 | | | | | | | | | | |
| | 0.50 | | | | Moist, extremely stiff to very stiff brownish-red & gray FAT CLAY w/trace of concretions | CH | 13B | 34 | 28 | | | | | | | | | | |
| 35 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | 14A | 38 | 37 | | | | | | | | | | |
| | 0.50 | | | | Moist, soft gray & tan FAT CLAY w/trace of fine sand pockets & concretions | CH | 14B | 39 | 34 | 88 | 118 | OB | 0 | 315 | | | | | |
| 40 | | | | | | | | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | | | | | | | | |

EUSTIS_GINT_LIBRARY_4-18-2022.GLB EE STANDARD BORING LOG H0048.GPJ 8/18/22

**NOTES: No standing water.**

# Particle Size Distribution Report




| | % +3" | % Gravel | | % Sand | | | % Fines | |
|---|---|---|---|---|---|---|---|---|
| | | Coarse | Fine | Coarse | Medium | Fine | Silt | Clay |
| ○ | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.0 | 64.5 | 33.3 |

| | LL | PL | $D_{85}$ | $D_{60}$ | $D_{50}$ | $D_{30}$ | $D_{15}$ | $D_{10}$ | $C_c$ | $C_u$ |
|---|---|---|---|---|---|---|---|---|---|---|
| ○ | | | 0.0342 | 0.0174 | 0.0098 | 0.0029 | | | | |

| Material Description | USCS | AASHTO |
|---|---|---|
| ○ Moist, medium compact red & brown SILT w/ some clay | ML | |

**Project No.** H0048 **Client:** DUCKS UNLIMITED, INC., RICHMOND, TEXAS

**Project:** DUCKS UNLIMITED, INC. - PIERCE MARSH BENEFICIAL USE MARSH CREATION, PHASES 1 AND 2,

○ **Source of Sample:** B-13 **Depth:** 15 **Sample Number:** 8B

**Remarks:**

○Soil Specific Gravity was Estimated

ASTM D422 was Performed

EUSTIS ENGINEERING SINCE 1946

**Figure**

**Tested By:** BH & KP **Checked By:** CD

## GRAIN SIZE DISTRIBUTION TEST DATA

8/12/2022

**Client:** DUCKS UNLIMITED, INC., RICHMOND, TEXAS
**Project:** DUCKS UNLIMITED, INC. - PIERCE MARSH BENEFICIAL USE MARSH CREATION, PHASES 1 AND 2,
NORTH OF WEST BAY NEAR GALVESTON ISLAND, GALVESTON COUNTY, TEXAS.
DU CONTRACT NO. TX-0-2. DU PROJECT NO. TX-194-4. DU TASK ORDER NO. 1
**Project Number:** H0048
**Location:** B-13
**Depth:** 15 **Sample Number:** 8B
**Material Description:** Moist, medium compact red & brown SILT w/ some clay
**USCS Classification:** ML
**Testing Remarks:** Soil Specific Gravity was Estimated
ASTM D422 was Performed
**Tested by:** BH & KP **Checked by:** CD

### Sieve Test Data

**Post #200 Wash Test Weights (grams):** **Dry Sample and Tare =** 1.22
**Tare Wt. =** 0.00
**Minus #200 from wash =** 97.8%

| Dry Sample and Tare (grams) | Tare (grams) | Cumulative Pan Tare Weight (grams) | Sieve Opening Size | Cumulative Weight Retained (grams) | Percent Finer | Percent Retained |
|---|---|---|---|---|---|---|
| 54.37 | 0.00 | 0.00 | #4 | 0.00 | 100.0 | 0.0 |
| | | | #10 | 0.00 | 100.0 | 0.0 |
| | | | #20 | 0.04 | 99.9 | 0.1 |
| | | | #40 | 0.11 | 99.8 | 0.2 |
| | | | #60 | 0.13 | 99.8 | 0.2 |
| | | | #100 | 0.20 | 99.6 | 0.4 |
| | | | #140 | 0.51 | 99.1 | 0.9 |
| | | | #200 | 1.22 | 97.8 | 2.2 |

### Hydrometer Test Data

**Hydrometer test uses material passing** #10
**Percent passing #10 based upon complete sample =** 100.0
**Weight of hydrometer sample =**54.37
**Automatic temperature correction**
**Composite correction (fluid density and meniscus height) at 20 deg. C =** -6.00
**Meniscus correction only =** 1.0
**Specific gravity of solids =** 2.67
**Hydrometer type =** 152H
**Hydrometer effective depth equation: L =** 16.294964 - 0.164 **x Rm**

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer | Percent Retained |
|---|---|---|---|---|---|---|---|---|---|
| 0.50 | 22.0 | 57.0 | 51.4 | 0.0132 | 58.0 | 6.8 | 0.0487 | 94.1 | 5.9 |
| 1.00 | 22.0 | 53.0 | 47.4 | 0.0132 | 54.0 | 7.4 | 0.0361 | 86.8 | 13.2 |
| 2.00 | 22.0 | 47.0 | 41.4 | 0.0132 | 48.0 | 8.4 | 0.0272 | 75.8 | 24.2 |
| 5.00 | 22.0 | 39.0 | 33.4 | 0.0132 | 40.0 | 9.7 | 0.0185 | 61.2 | 38.8 |
| 15.00 | 22.0 | 35.0 | 29.4 | 0.0132 | 36.0 | 10.4 | 0.0110 | 53.8 | 46.2 |
| 30.00 | 22.0 | 29.0 | 23.4 | 0.0132 | 30.0 | 11.4 | 0.0081 | 42.9 | 57.1 |
| 60.00 | 22.0 | 25.0 | 19.4 | 0.0132 | 26.0 | 12.0 | 0.0059 | 35.5 | 64.5 |

## Hydrometer Test Data (continued)

| Elapsed Time (min.) | Temp. (deg. C.) | Actual Reading | Corrected Reading | K | Rm | Eff. Depth | Diameter (mm.) | Percent Finer | Percent Retained |
|---|---|---|---|---|---|---|---|---|---|
| 120.00 | 22.0 | 23.0 | 17.4 | 0.0132 | 24.0 | 12.4 | 0.0042 | 31.9 | 68.1 |
| 250.00 | 22.0 | 22.0 | 16.4 | 0.0132 | 23.0 | 12.5 | 0.0030 | 30.0 | 70.0 |
| 1440.00 | 21.5 | 19.0 | 13.3 | 0.0133 | 20.0 | 13.0 | 0.0013 | 24.3 | 75.7 |

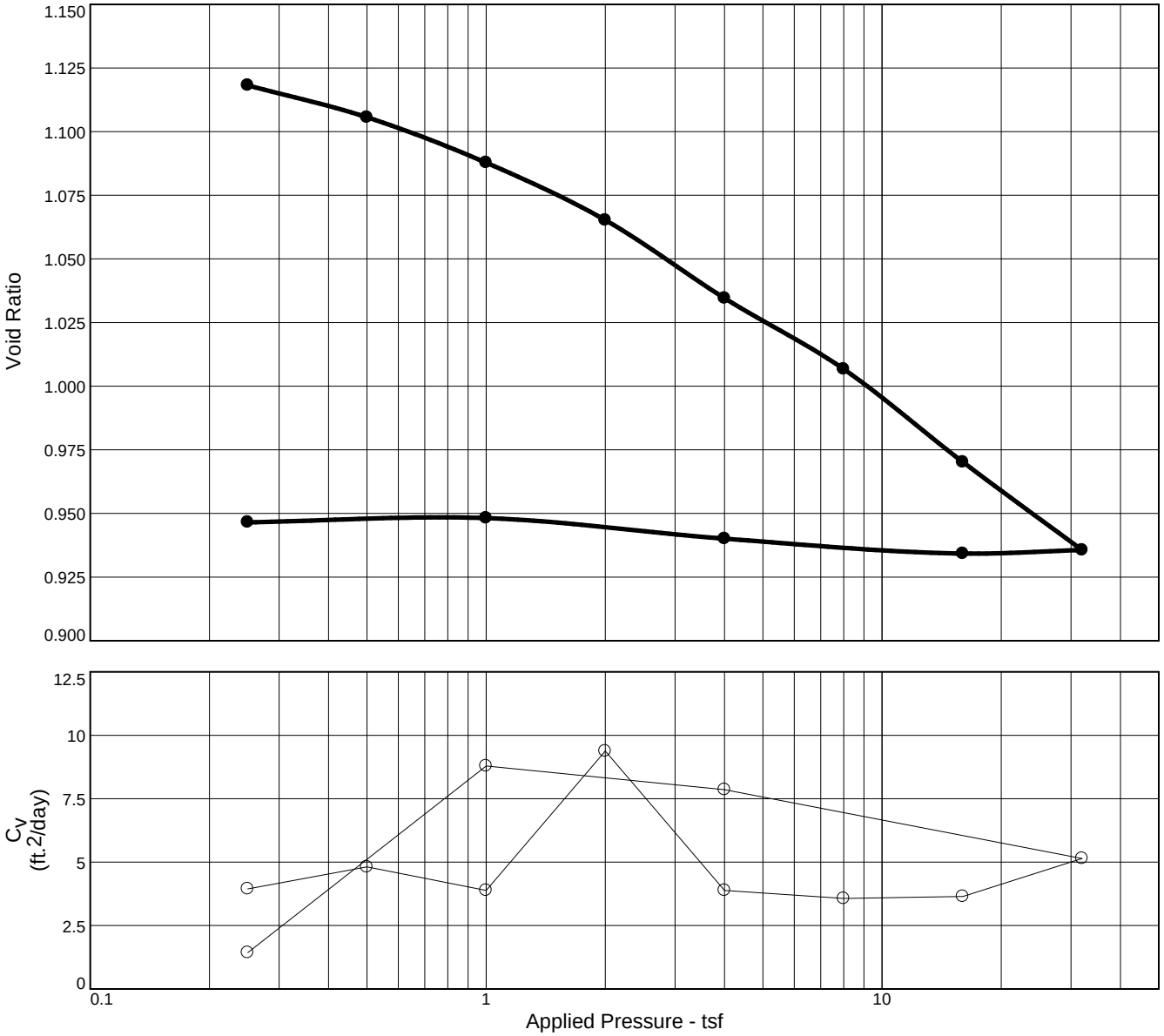
## Fractional Components

| Cobbles | Gravel | | | Sand | | | | Fines | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coarse | Fine | Total | Coarse | Medium | Fine | Total | Silt | Clay | Total |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 2.0 | 2.2 | 64.5 | 33.3 | 97.8 |

| $D_5$ | $D_{10}$ | $D_{15}$ | $D_{20}$ | $D_{30}$ | $D_{40}$ | $D_{50}$ | $D_{60}$ | $D_{80}$ | $D_{85}$ | $D_{90}$ | $D_{95}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0.0029 | 0.0074 | 0.0098 | 0.0174 | 0.0300 | 0.0342 | 0.0402 | 0.0517 |

| Fineness Modulus |
|---|
| 0.01 |

# CONSOLIDATION TEST REPORT




| Natural | | Dry Dens. (pcf) | LL | PI | Sp. Gr. | $P_c$ (tsf) | $C_c$ | Initial Void Ratio |
|---|---|---|---|---|---|---|---|---|
| Saturation | Moisture | | | | | | | |
| 98.6 % | 41.3 % | 70.1 | 28 | 16 | 2.70 | 1.8 | 0.09 | 1.132 |

| MATERIAL DESCRIPTION | USCS | AASHTO |
|---|---|---|
| M, so r-br & g LN CL | CH | |

**Project No.** H0048 **Client:** DUCKS UNLIMITED, INC., RICHMOND, TEXAS

**Project:** DUCKS UNLIMITED, INC. - PIERCE MARSH BENEFICIAL USE MARSH CREATION, PHASES 1 AND 2,

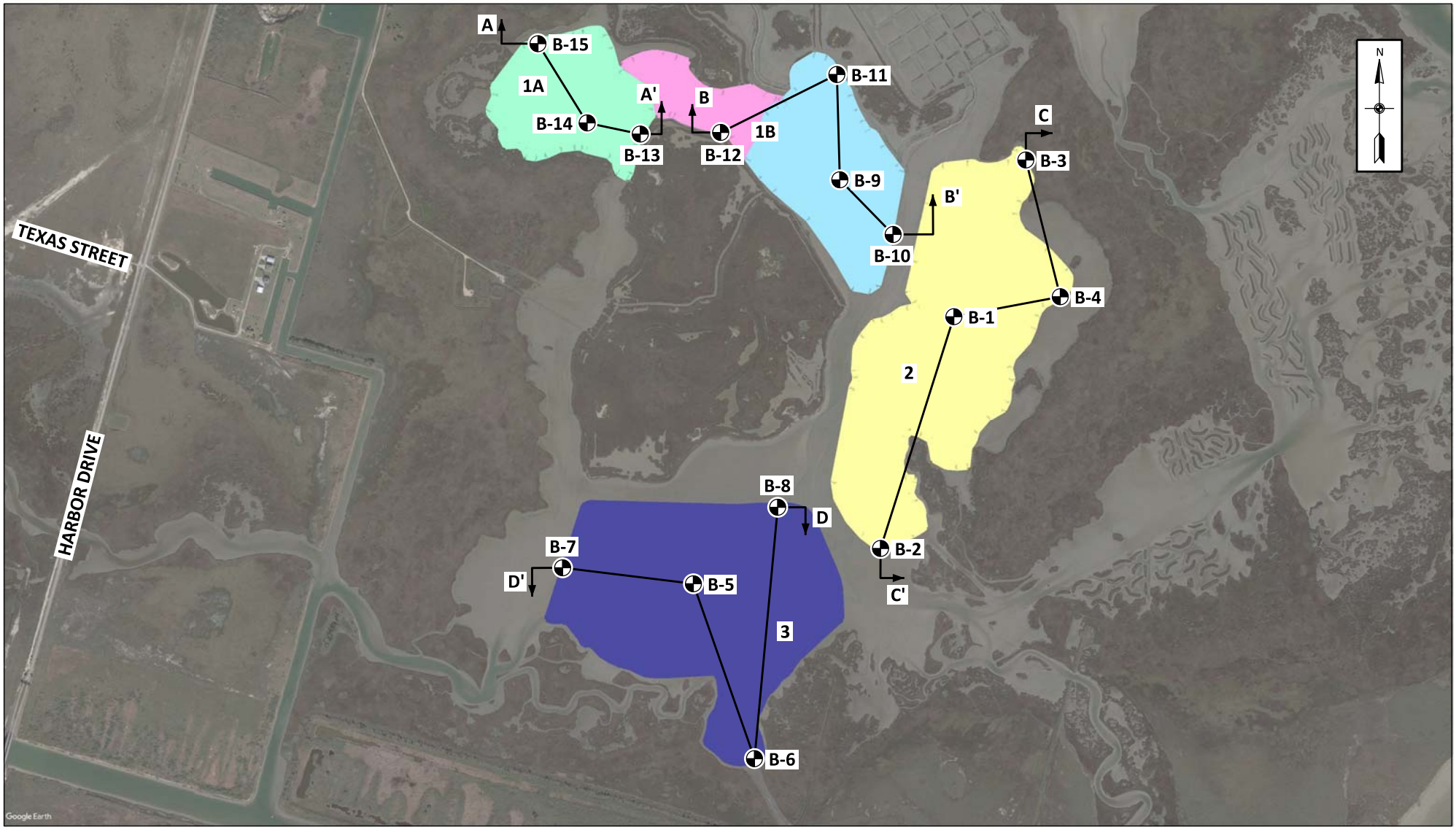
**Source of Sample:** B-13 **Depth:** 11 **Sample Number:** 6B

EUSTIS ENGINEERING SINCE 1946

**Remarks:**

**Figure**

**Tested By:** BH **Checked By:** RR




SATELLITE IMAGERY DATED: JANUARY 2022

**NOT TO SCALE**

◓ DENOTES APPROXIMATE LOCATIONS OF SOIL BORINGS DRILLED BETWEEN 11 AND 18 JULY 2022

BORING LOCATION PLAN

PHASE 1
DUCKS UNLIMITED, INC.
PIERCE MARSH BENEFICIAL USE MARSH CREATION
NORTH OF WEST BAY NEAR GALVESTON ISLAND
GALVESTON COUNTY, TEXAS
DU CONTRACT NO. TX-0-2
DU PROJECT NO. TX-194-4
DU TASK ORDER NO. 1

EUSTIS ENGINEERING L.L.C. SINCE 1946

| | |
|---|---|
| DRAWN BY: S.T.S. | JOB NO.: H0048 |
| CHECKED BY: H.C.W. | DATE: 15 AUG 2022 |
| CADD FILE: LOCATION PLAN.DGN | FIGURE 2 |

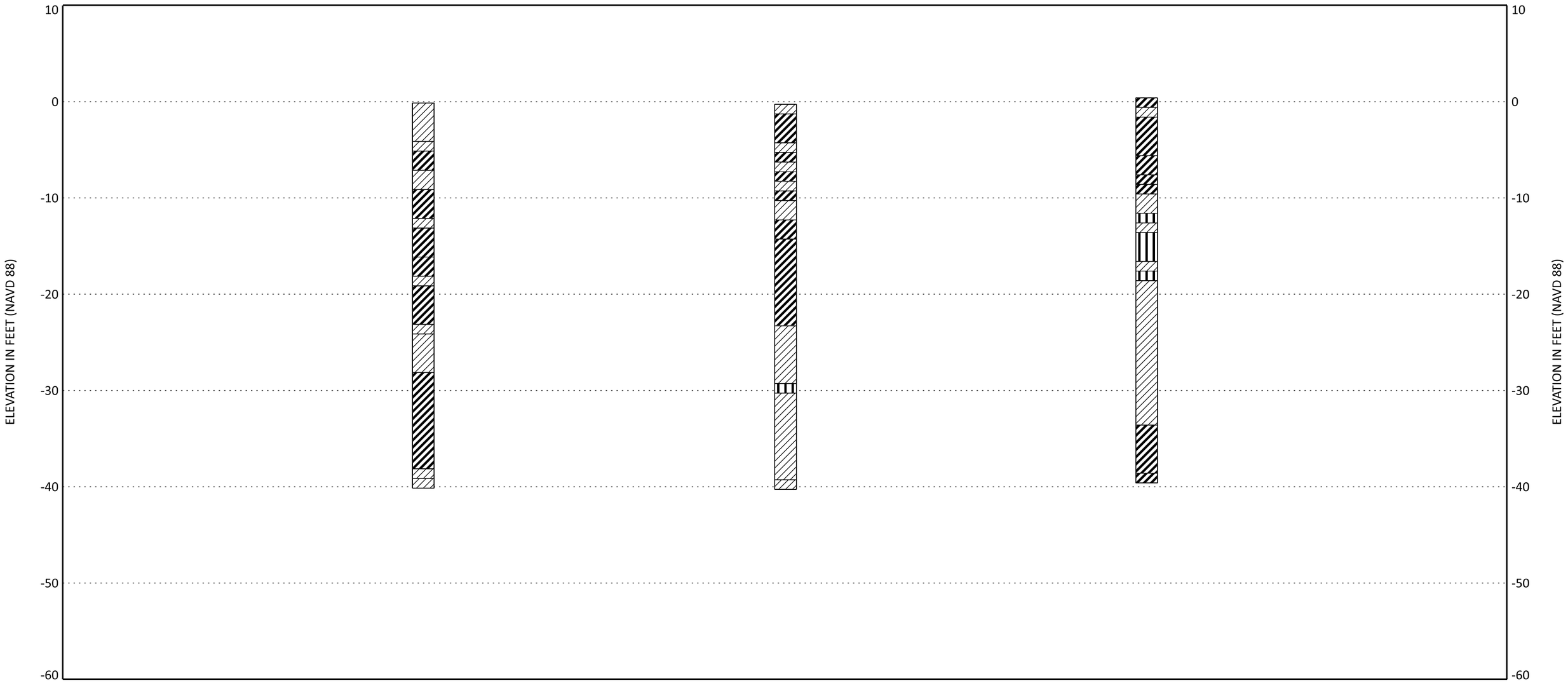
A

B-15
G.S.E. -0.14
11-12 JUL 2022

B-14
G.S.E. -0.28
12 JUL 2022

B-13
G.S.E. 0.40
12 JUL 2022

A'




BORING MATERIAL GRAPHICS

- FAT CLAY
- SILT
- LEAN CLAY

NOTE:

1. G.S.E. = GROUND SURFACE ELEVATION

SUBSURFACE SOIL PROFILE
MCA-1A

PHASE 1
DUCKS UNLIMITED, INC.
PIERCE MARSH BENEFICIAL USE MARSH CREATION
NORTH OF WEST BAY NEAR GALVESTON ISLAND
GALVESTON COUNTY, TEXAS
DU CONTRACT NO. TX-0-2
DU PROJECT NO. TX-194-4
DU TASK ORDER NO. 1

EUSTIS ENGINEERING L.L.C. SINCE 1946

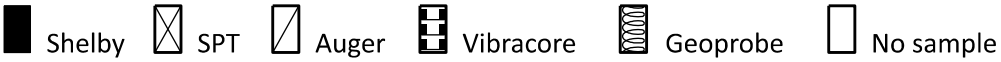
| | |
|---|---|
| DRAWN BY: S.T.S. | JOB NO.: H0048 |
| CHECKED BY: H.C.W. | DATE: 23 AUG 2022 |
| CADD FILE: PROFILE.DGN | FIGURE 3 (SHEET 1 OF 4) |

EUSTIS ENGINEERING SINCE 1946

# LEGEND AND NOTES FOR LOG OF BORING AND TEST RESULTS

PP Pocket penetrometer: Resistance in tons per square foot

SPT Standard Penetration Test: Number of blows of a 140-lb hammer dropped 30 inches required to drive 2-in. O.D., 1.4-in. I.D. sampler a distance of 1 foot into the soil after first seating it 6 inches. Values shown have not been corrected.

SPLR Type of Sampling  Shelby, SPT, Auger, Vibracore, Geoprobe, No sample

SYMBOL Clay, Silt, Sand, Peat/Humus, Shells, Stone/Gravel

Predominant type shown heavy; modifying type shown light

USC Unified Soil Classification

DENSITY Unit weight in pounds per cubic foot

SHEAR TESTS

TYPE

- UC Unconfined compression shear
- OB Unconsolidated undrained triaxial compression shear on one specimen confined at the approximate overburden pressure
- UU Unconsolidated undrained triaxial compression shear
- $\phi$ Angle of internal friction in degrees
- c Cohesion in pounds per square foot

ATTERBERG LIMITS

- LL Liquid Limit
- PL Plastic Limit
- PI Plasticity Index

OTHER TESTS

- CON Consolidation
- -#200 Percent passing a U.S. No. 200 sieve
- SV Particle size distribution (sieve only)
- PD Particle size distribution (sieve and hydrometer)
- k Coefficient of permeability in centimeters per second
- SP Swelling pressure in pounds per square foot

Other laboratory test results reported on separate figures

GENERAL NOTES

(1) If a ground water depth is shown on the boring log, these observations were made at the time of drilling and were measured below the existing ground surface. These observations are shown on the boring logs. However, ground water levels may vary due to seasonal fluctuations and other factors. If important to construction, the depth to ground water should be determined by those persons responsible for construction immediately prior to beginning work.

(2) While the individual logs of borings are considered to be representative of subsurface conditions at their respective locations on the dates shown, it is not warranted that they are representative of subsurface conditions at other locations and times.