Appendix F – Engineering

Matagorda Ship Channel Improvement, Port Lavaca, Texas

Validation Report and Supplemental Environmental Impact Statement

Calhoun and Matagorda Counties, Texas

May 2026

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in federal documents be accessible to individuals with disabilities. The Agency has made every effort to ensure that the information in Appendix F: Engineering is accessible. However, if readers have any issues accessing the information in this appendix, please contact the U.S. Army Corps of Engineers at MSC_SEIS@usace.army.mil so additional accommodations may be provided.



US Army Corps of Engineers

Galveston District

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This appendix is broken down into 3 sub-appendices.

Sub-Appendix F-1 - Engineering Report
Sub-Appendix F-2 - 2026 Engineering Plans (Separate File)
Sub-Appendix F-3 - Design Maturity Memo (Separate File)

Sub-Appendix F-1

Engineering Report

Matagorda Ship Channel Improvement, Port Lavaca, Texas
Validation Report and Supplemental Environmental Impact Statement,
Calhoun and Matagorda Counties, Texas

May 2026

US Army Corps of Engineers
Galveston District

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EXECUTIVE SUMMARY

The contents of this appendix are concerned with the engineering feasibility for the authorized deepening and widening of the Matagorda Ship Channel (MSC). In 2019, the USACE Galveston District recommended the selection of a -47'/-49' alternative to improve navigation in the MSC, which was approved via the Chief's Report and Record of Decision (ROD). Following the selection of the -47'/-49' plan, design of the Entrance Channel was initiated. During the design process, an engineering error was identified, which led to the withdrawal of the ROD. Consequently, a Validation Report (VR) and Supplemental Environmental Impact Statement (SEIS) are required to address the engineering error. During the VR and SEIS development, engineering has been revisited to select the appropriate plan and ensure the design is feasible given ensuing delays to project construction.

The recommended plan is the 2019 Tentatively Selected Plan (TSP). The recommended plan is justified by the hydraulic and hydrologic, civil, geotechnical, and cost engineering. Data collection, site surveying, mapping, and planning inform the engineering design. The feasibility design is intended to provide the best estimate of costs consequent of successful project delivery. Engineering analyses are provided to reflect updated present and future conditions. The recommended channel design is mostly unchanged from the 2019 TSP, resulting in minor modifications. Construction of the selected channel will require the management of new dredged material that was not accounted for in 2019. The placement of the new dredged material, that was not identified in 2019, has implications for both the environment and channel maintenance. Project first costs and maintenance expenses are calculated and support the plan selection process.

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1. General

1.1 Introduction

The Matagorda Ship Channel Improvement Project (MSCIP) was authorized in Section 240 of the Water Resources Development Act of 2020 (Public Law 116-260, 134 Stat. 2734), based on prior analyses demonstrating project feasibility and economic justification. In 2019, USACE-SWG completed an Integrated Feasibility Report and Environmental Impact Statement (IFR/EIS) recommending channel modifications under Section 216 of the Flood Control Act of 1970. That report concluded the plan was technically feasible and economically justified.

During the Pre-Construction Engineering and Design (PED) phase in 2021, a major error in the total dredged material quantity assumed in the 2019 IFR/EIS was identified. The volumes recalculated during PED were nearly double those reported in the 2019 analysis, producing substantial discrepancies that directly affected project cost estimates and economic assumptions and placed the project's overall economic viability in question.

An earlier Section 204(f) Feasibility Report completed in 2014, supported by an Engineering Appendix prepared by URS Corporation, had previously estimated new-work dredging quantities consistent with the PED-validated totals. That analysis projected approximately 39.94 MCY of material based on a 47-foot entrance / 45-foot bay channel configuration, closely matching the PED-validated 39.3 MCY, despite the current design assuming a deeper 49-foot entrance / 47-foot bay channel.

Additional inconsistency appears in the Environmental Resources Appendix accompanying the 2019 IFR/EIS, which repeatedly cited 46.5 MCY of new-work material for the Recommended Plan - the same plan currently being advanced - while a single reference listed only 21 MCY. This internal inconsistency reinforces that the 2019 error originated within the engineering data rather than the environmental analyses.

The validated PED estimate confirms the 2014 URS analysis and underscores the magnitude of the 2019 error. Even with the deeper channel design, the current total aligns closely with the technically robust 2014 estimate, highlighting how substantially the 2019 study understated projected dredging requirements. The updated estimate has been thoroughly reviewed and validated for project planning, design, and cost engineering purposes.

As a result of these findings, the Assistant Secretary of the Army (Civil Works) rescinded the Record of Decision (ROD) in December 2022 and directed preparation of a Validation Report (VR) and Supplemental Environmental Impact Statement (SEIS), with a subsequent ROD to follow.

This Engineering Appendix documents the updated engineering analyses and design considerations developed to address the discrepancies in dredged volumes identified relative to the 2019 IFR/EIS. It provides documentation of refinements, identifies key technical uncertainties, and describes the procedures undertaken to ensure an accurate and defensible engineering record for the MSCIP modifications.

The MSCIP study area is shown in Figure 1-1.

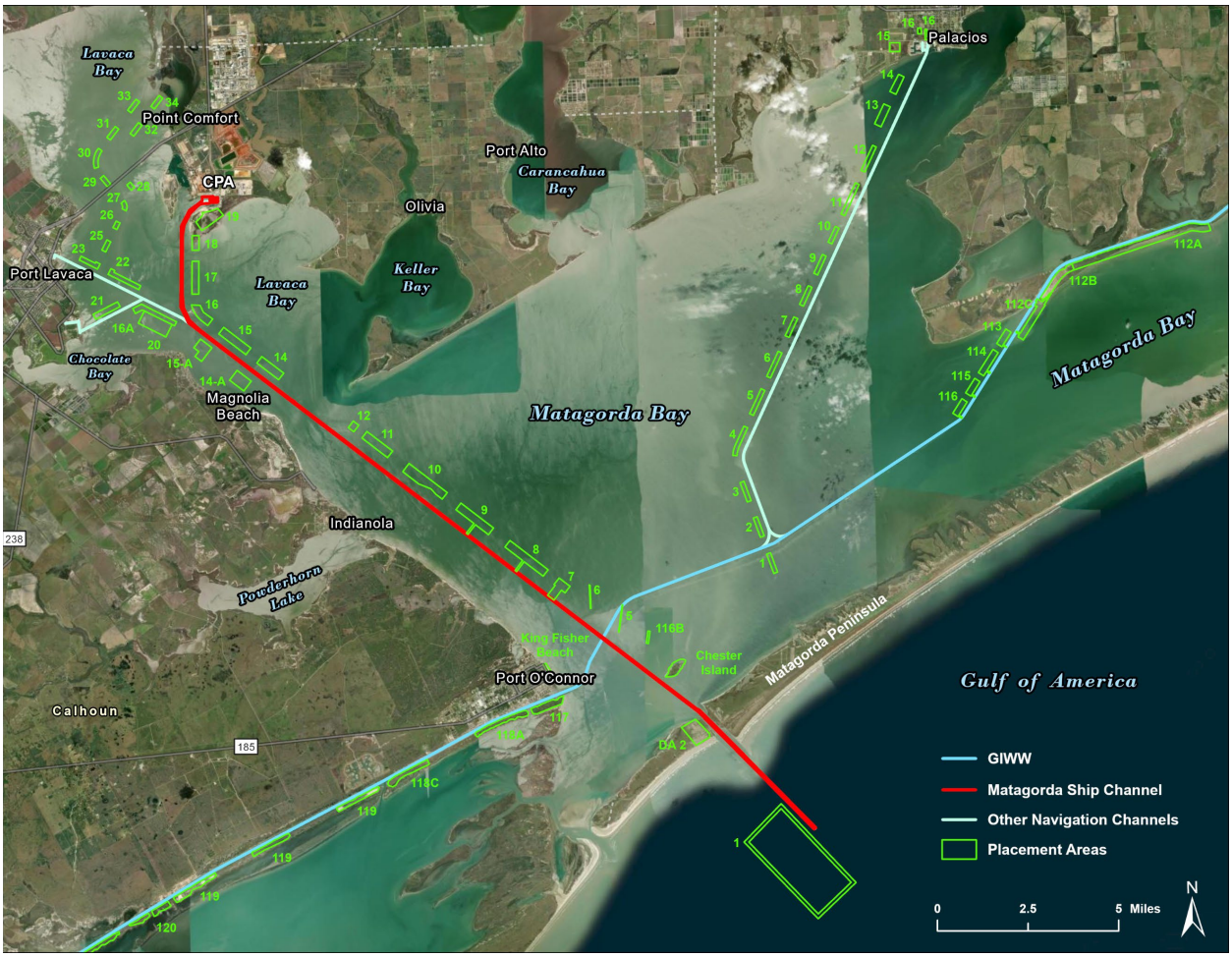


Figure 1-1: Project Study Area

1.2 Engineering Scope

The purpose of the MSCIP is to provide safe and reliable navigation in the federal channel given known economic inefficiencies under the current authorized project. The current authorized depth and width of the MSC are not sufficient to accommodate the growing demand for larger vessels.

In light of the 2019 TSP and analyses leading thereto, the primary engineering goals for the MSCIP consist of the following:

1. Update and validate new work (NW) dredging volumes.
2. Update the project shoaling analysis.
3. Formulate the Dredged Material Management Plan (DMMP) to accommodate (1) and (2) in light of new resource data.
4. Update project dredging, placement, maintenance (O&M), and mitigation costs.

Engineering risks are documented within the project's e-Risk Register. Uncertainty and risks are highlighted in Sections 1.3 and 1.4. Risks that are unable to be settled in feasibility must be addressed in PED.

1.3 Key Engineering Uncertainties

Engineering uncertainties are summarized below by order of significance.

- There will be opportunity to refine feasibility designs during Preconstruction Engineering and Design (PED).
- The -47'/-49' scale is analyzed for channel shoaling; impacts and decisions for other scale costs are inferred from a linear relationship, though these may be inherently non-linear.
- Future meteorological conditions, on average, will be similar to present-day conditions; there will not be an increase in "episodic" events.
- Cost estimates reflect the best available data at the writing of this report.

1.4 Key Risks and Possible Mitigation Strategies

There exists several key risks that could hinder the success of the project. At a high level, most risks pertain to the management of dredged material. Over the project life, millions of cubic yards will be dredged and pumped into the open water of Matagorda Bay. The key risks and mitigation strategies surrounding the DMMP are discussed in Appendix E (DMMP Appendix).

Regarding other key risks to the project, the following apply.

1. Scope change could impact project first costs, lifecycle costs, and duration.
2. Fluctuation in fuel cost and unforeseen weather events could change the project costs.
3. Unidentified pipelines may create project delays.
4. The abandonment of open-water placement area (OWPA) sites could affect bay hydraulics.
5. Consolidation of maintenance material is approximated to calculate advance maintenance (AM) depth.
6. Construction of the jetty deficiency project (MSCJD) could have inadvertent shoaling impacts; conflicts could also arise with MSCIP construction schedule.
    a. The phasing of two major construction projects (MSCIP and MSCJD) could delay the delivery of the MSCIP.
7. Shoaling mitigation features may be required over the 50-yr project life; relative to the channel average, with-project shoaling may be very high in certain areas.

1.5 Existing Authorized Channel

The existing channel consists of six distinct reaches extending approximately 26.3 miles from the Gulf of America (GoA) to the port terminal at Point Comfort. The entrance and jetty reaches are authorized to a depth of 40 feet, with 3 feet of AM and 2 feet of allowable overdepth (OD) and maintain a channel width of 300 feet. The inland reaches, continuing through Matagorda Bay and Lavaca Bay, are authorized to a depth of 38 feet, with 2 feet of AM and 2 feet of allowable OD, and generally maintain a width of 200 feet. The channel system terminates at the Point Comfort Turning Basin and adjacent North/South Basins, which share the same authorized depth and overdepth allowances. These basins vary in width to accommodate vessel turning and mooring operations.

The authorized channel is summarized in Table 1-1.

Table 1-1: Existing Authorized Channel

Station	Authorized Depth MLLW (ft)	Width (ft)
-20+246 to 0+000	38	300
0+000 to 118+502	40	200

Changes to the authorized channel depth, width, and plan geometry were thoroughly investigated prior to, and after, the 2019 IFR/EIS.

1.6 Previously Considered Alternatives

In addition to the selected plan (Section 1.7), -43'/-45' and -45'/-47' MLLW were also evaluated for economic benefits and project costs. The -43'/-45' and -45'/-47' alternatives were chosen as potential options since they are reasonably deeper than the existing channel and allow the USACE to make lasting improvements to authorized depth, rather than relatively small changes to AM depth.

In 2019, -41'/-43' MLLW was considered, though it was uniformly agreed such a scale was inadequate because the authorized depth would fall only 1 ft past AM depth. In early screening, Economics reasoned that such alternatives were unsuitable for a project of this size, providing insubstantial benefits. The project depth resulting in the best benefit to cost ratio (BCR) was found to be the -47'/-49' alternative.

1.7 Overview of Selected Plan

The 2025 Recommended Plan (RP) is the same as 2019 TSP, detailed in Table 1-2 below.

Table 1-2: 2025 Recommended Plan

Alternative	Depth Main/Entrance (MLLW)	Width Main/Entrance	Turning Basin
A	47'/49'	300'/550'	1200'

After revisiting the RP, three changes were made between 2019 and 2025 to the proposed channel footprint:

1. The entrance channel extension is to station -26+000 instead of -33+000.
    a. There is no dredge volume prism offshore of station -26+000.
2. The proposed sediment trap is removed from station -15+200 to -13+600.
    a. The design of the sediment trap was found largely ineffective between 2019 – 2023 (Section 4.7).
3. The channel terminus station is 118+581, rather than 118+502.
    a. By readjusting the alignment of stationing, the centerline is slightly longer than what was reported in 2019.

1.8 Engineering and Design Guidance

A list of pertinent Engineering Regulations (ERs) and Manuals (EMs) used in the engineering design and plan selection is provided below.

- ER 1110-2-1150 – Engineering and Design for Civil Works Projects
- ER-1110-2-1404 – Hydraulic Design of Deep-Draft Navigation Projects
- ER-1100-2-8162 – Incorporating Sea level Changes in Civil Works Programs
- ER-1110-2-8151 – Monitoring Completed Coastal Navigation Projects
- ER-1110-2-8160 – Engineering and Design, Policies for Referencing Vertical Datums
- ER 1110-2-1302 – Civil Works Cost Engineering
- EM-1110-2-5025 – Engineering and Design, Dredging and Dredged Material Management
- EM-1110-2-1100 – Coastal Engineering Manual
- EM-1110-2-1304 – Civil Works Construction Cost Index System (CWCCIS)
- EM 1110-2-1613 – Hydraulic Design of Deep Draft Navigation Projects

USACE ERs provide standard guidance and policy for design and construction of U.S. Army civil works. ERs must be closely adhered to for successful delivery of USACE projects. EMs provide technical guidance to achieve the high-level purpose of ER policy.

In the feasibility design of the MSCIP, ERs are treated as mandatory requirements for the project delivery. Details provided in relevant EMs may be utilized, though such guidance and language are not considered mandatory.

2. Hydraulics and Hydrology

2.1 Introduction

Matagorda Bay hydraulics have been investigated over the past 20 years through many studies. The MSC has been the primary focus of these studies. Previous investigations and data collection efforts have examined the currents, wave climate, water quality, salinity, and sediment transport in the bay. The goal of the Hydraulics and Hydrology (H&H) assessment is to collect the numerous findings from available literary sources, validate existing conditions, provide an updated comparison of with and without-project impacts as necessary, and identify potential shortcomings to be addressed during PED.

Most with-project conditions are not anticipated to change significantly from the present-day conditions. A high-level summary of H&H findings is provided below.

- Wind-wave growth and transformation is not expected to change considerably under with-project conditions. Future meteorology will be similar to present day.
    - Open water PA (OWPA) sites could cause more wave breaking, thereby decreasing the wave energy in the nearfield. See Section 0.
- Vessel-generated waves are expected to be similar if not reduced under with-project conditions.
    - See Section 2.3.6.
- Salinity has been previously investigated under with-project conditions; these impacts are discussed but not re-investigated herein.
    - See Section 2.4.1.
- Water levels have been previously investigated under with-project conditions; findings are discussed but not re-investigated herein.
    - See Section 2.3.7.
- Relative sea level change (RSLC) has been quantified previously; no major changes to previous findings are recommended.
    - See Section 2.3.8.
- Currents have been previously examined under with-project conditions; these findings are provided but not re-investigated herein.
    - See Section 2.3.3.

The main focus for H&H in the Matagorda Bay, and more specifically the MSC, is the Future-with-Project (FWP) sedimentation. Channel shoaling is assessed for Present-without-Project (PWOP), Future-without-Project (FWOP), and FWP conditions. The findings of this analysis are provided in Section 2.5.

2.2 Datum

Vertical datums are referenced to Mean Lower-Low Water (MLLW) to comply with the USACE ER-1110-2-8160. 3 datum controls are available in Matagorda Bay from NOAA Tides and Currents. Matagorda Bay gauges are listed with latitude, longitude and installation dates in Table 2-1 to Table 2-3. The gauges are also pictured in Figure 2-1 to Figure 2-3. Regional gauges with more complete water level records are discussed in Section 2.3.7.

Table 2-1: NOAA Station 8773767 at Matagorda Bay Entrance Channel, TX

Station ID	8773767
Station Name	Matagorda Bay Entrance Channel, TX
Latitude	28° 25.6 N
Longitude	96° 19.8 W
Established Date	September 18, 2014



Figure 2-1: NOAA Station 8773767 at Matagorda Bay Entrance Channel, TX

Table 2-2: NOAA Station 8773701 at Port O'Connor, TX

Station ID	8773701
Station Name	Port O'Connor, TX
Latitude	28° 27.1 N
Longitude	96° 23.3 W
Established Date	January 28, 1989



Figure 2-2: NOAA Station 8773701 at Port O'Connor TX

Table 2-3: NOAA Station 8773259 at Port Lavaca, TX

Station ID	8773259
Station Name	Port Lavaca, TX
Latitude	28° 38.4 N
Longitude	96° 36.6 W
Established Date	January 28, 1989



Figure 2-3: NOAA Station 8773259 at Port Lavaca, TX

2.3 Existing MetOcean Conditions

2.3.1 Tides

Tidal information is acquired from NOAA Tides & Currents. There are 3 data stations located near the MSC: 8773767 Matagorda Bay Entrance Channel, 8773701 Port O'Connor, and 8773259 Port Lavaca.

MHHW (Mean Higher-High Water) near the entrance channel is nearly +0.26 m (+0.85 ft) relative to the NAVD88 (North American Vertical Datum of 1988) vertical reference datum, while at Port O'Connor, it is nearly +0.34 m (+1.12 ft). Likewise, the (MLLW) at the entrance is -0.11 m (-0.37 ft) below NAVD88 and +0.12 m (+0.39 ft) above NAVD88 at Port O'Connor.

Station datums are shown in Figure 2-4 to Figure 2-6 to detail the tidal range in the study area; Table 2-4 provides the tidal constituents that predominantly control the mean water surface elevation in the bay.

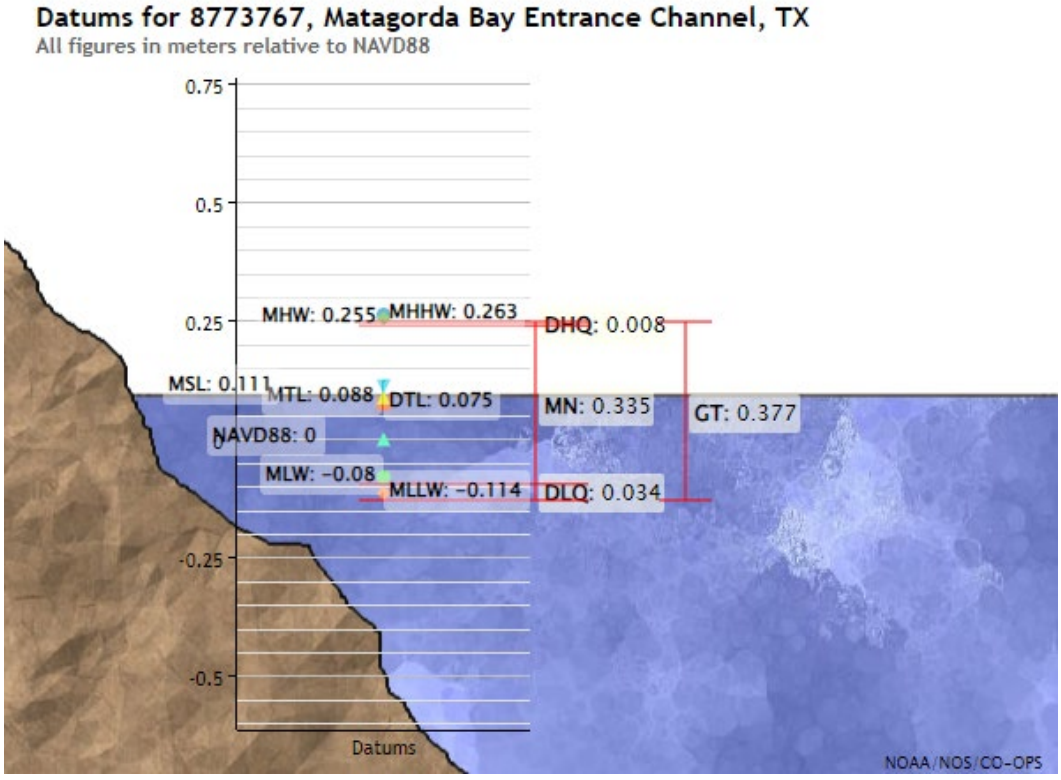


Figure 2-4: NOAA 8773767 Station Datums

Datum control for engineering calculations is primarily established at Port O'Connor, TX, Station 8773701 (Figure 2-5). The conversion from MSL to MLLW is -0.12 m, or roughly -0.4 ft. Survey data is tide-corrected from raw value to MLLW by referencing the most appropriate NOAA gauge along the channel; such practice is at the discretion of the USACE Chief of Surveys in the Southern Area Office.

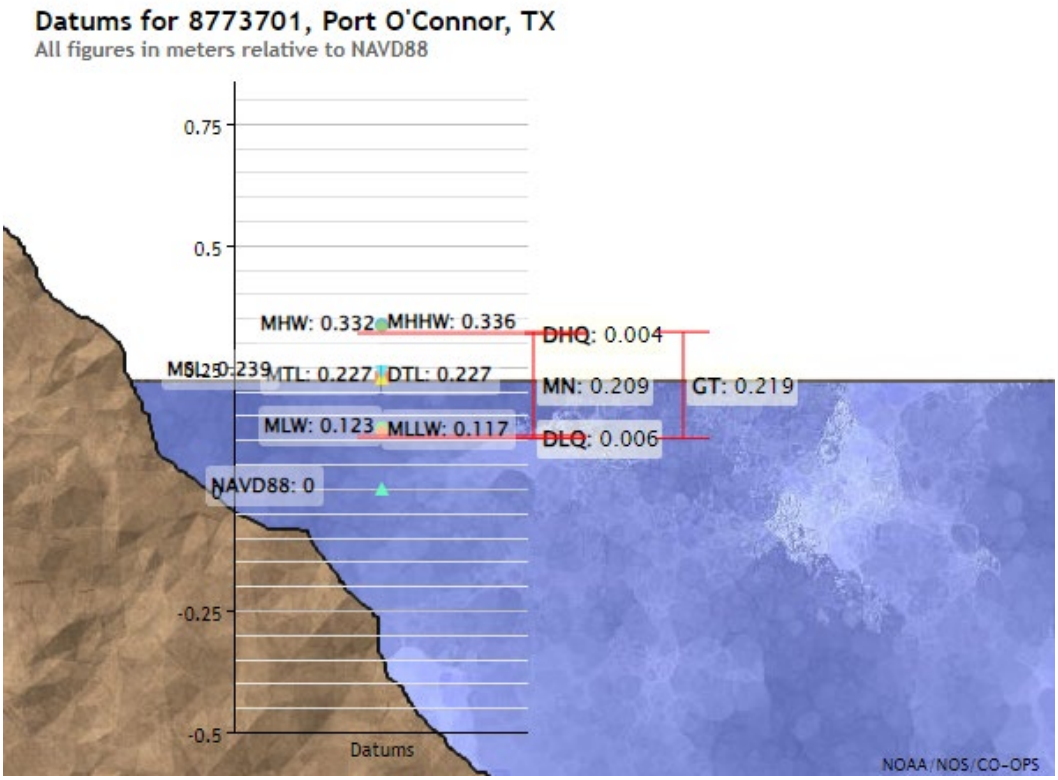


Figure 2-5: NOAA 8773701 Station Datums

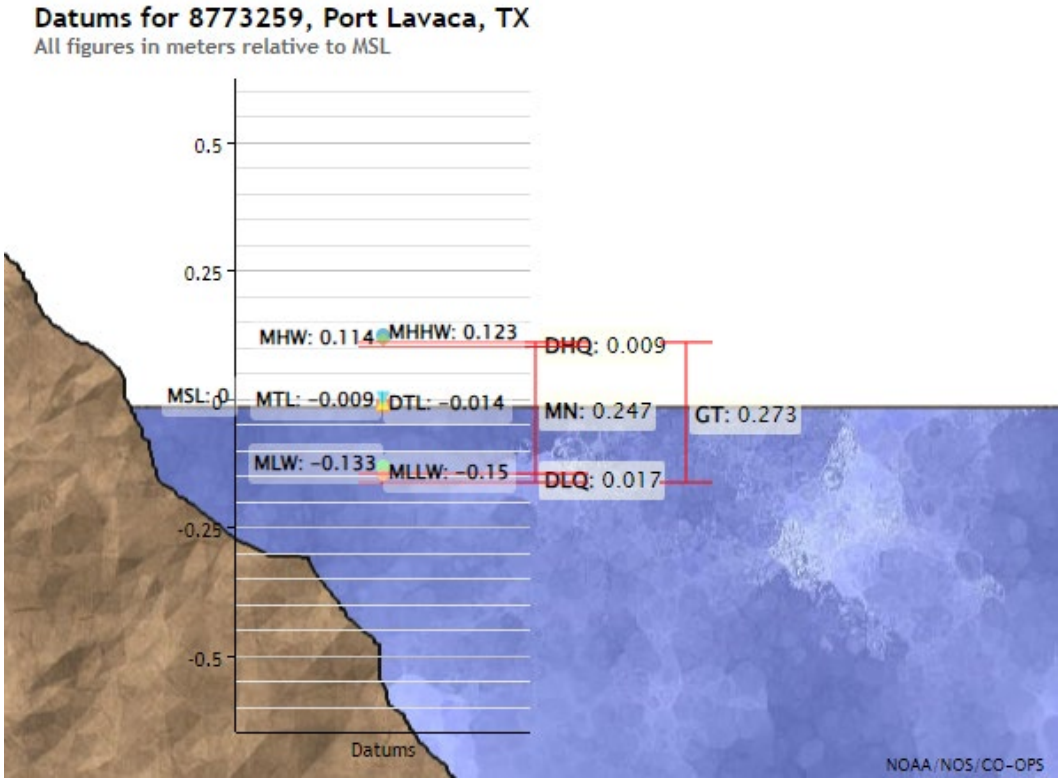


Figure 2-6: NOAA 8773259 Station Datums

The tides in Matagorda Bay are mixed. While the lunar tidal constituents are the main variable, strong, steady winds can also play a significant role in elevating or depressing the water level, also referred to as wind-driven setup and set down.

Table 2-4: Tidal Constituents taken from NOAA Tides and Currents

Name	Amplitude (ft)	Phase	Speed (degrees/hr)	Description
M2	0.14	68.0	28.98	Principal lunar semidiurnal constituent
S2	0.05	71.8	30.0	Principal solar semidiurnal constituent
N2	0.04	53.1	28.44	Larger lunar elliptic semidiurnal constituent
K1	0.37	314.8	15.04	Lunar diurnal constituent
M4	0.02	60.1	57.97	Shallow water overtides of principal lunar constituent
O1	0.37	313.2	13.94	Lunar diurnal constituent

2.3.2 Bathymetry

Bathymetry in Matagorda Bay can vary anywhere from 2 ft depth to over 120 ft depth at the entrance bottleneck. At the offshore, just outside of the authorized channel, the natural depth is nearly 40 ft MSL. The MSC entrance features extreme depths due to the constriction of flow caused by the inlet bottleneck. Depths at the inlet may exceed 120 ft MSL and are known to create adverse conditions for navigation. Moving into the bay system, open water placement sites feature shallow depths (2-5 ft MSL) created by dredging operations.

Between main Matagorda Bay and Lavaca Bay (upper-bay), numerous sand bars and reefs emerge to create additional shallow water conditions. On average, depths in Matagorda Bay are between 10-12 ft MSL, while Lavaca Bay features depths between 6-8 ft MSL. Even shallower conditions exist in eastern Matagorda Bay.

The primary bathymetric feature of Matagorda Bay, the MSC, cuts through the seabed at an authorized depth of 38 ft MLLW. Likewise, the GIWW spans across the main bay area at about 12-14 ft MLLW. Other authorized channels in the bay include the Port Lavaca and Approach Channel, as well as the Channel to Palacios. Figure 2-7 depicts the bathymetry of Matagorda Bay, sourced primarily from NOAA's Continuously Updated Digital Elevation Model (CUDEM).

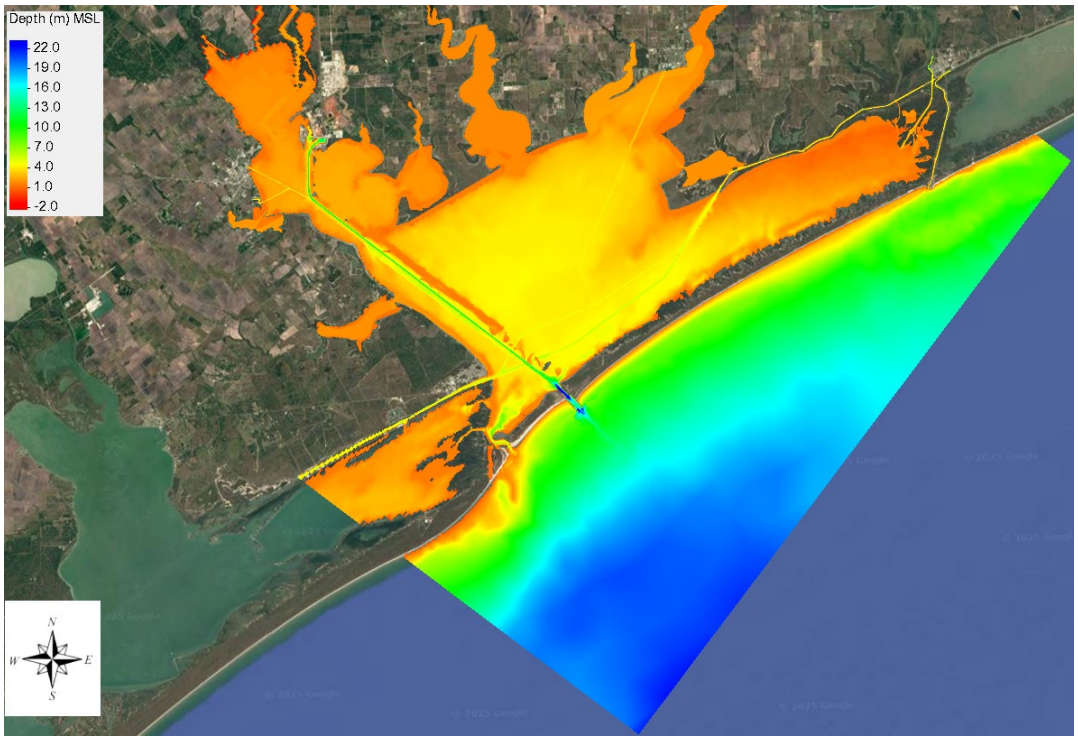


Figure 2-7: Matagorda Bay Bathymetry

2.3.3 Currents

Currents within the Matagorda Bay are usually less than 1 knot and are aligned with the shipping channel (URS, 2014). Entrance channel currents are typically higher due to the inlet and jetty deficiency. Currents at the MSC entrance are known to exceed 3 knots regularly, and severe currents may approach 7 knots. NOAA station mg0201, pictured in Figure 2-8, measures near-surface current data at the bottleneck of the MSC entrance. The details of this gauge are provided below in Table 2-5.

Table 2-5: Sensor Information for NOAA PORTS Gauge mg0201

Latitude	28° 25.6' N
Longitude	96° 19.8' W
Deployment Date	July 30, 2018
Approximate Sensor Depth	14.8ft / 4.50m
Sensor Orientation	Side (Shore-Mounted)
Sample Interval	6 minutes

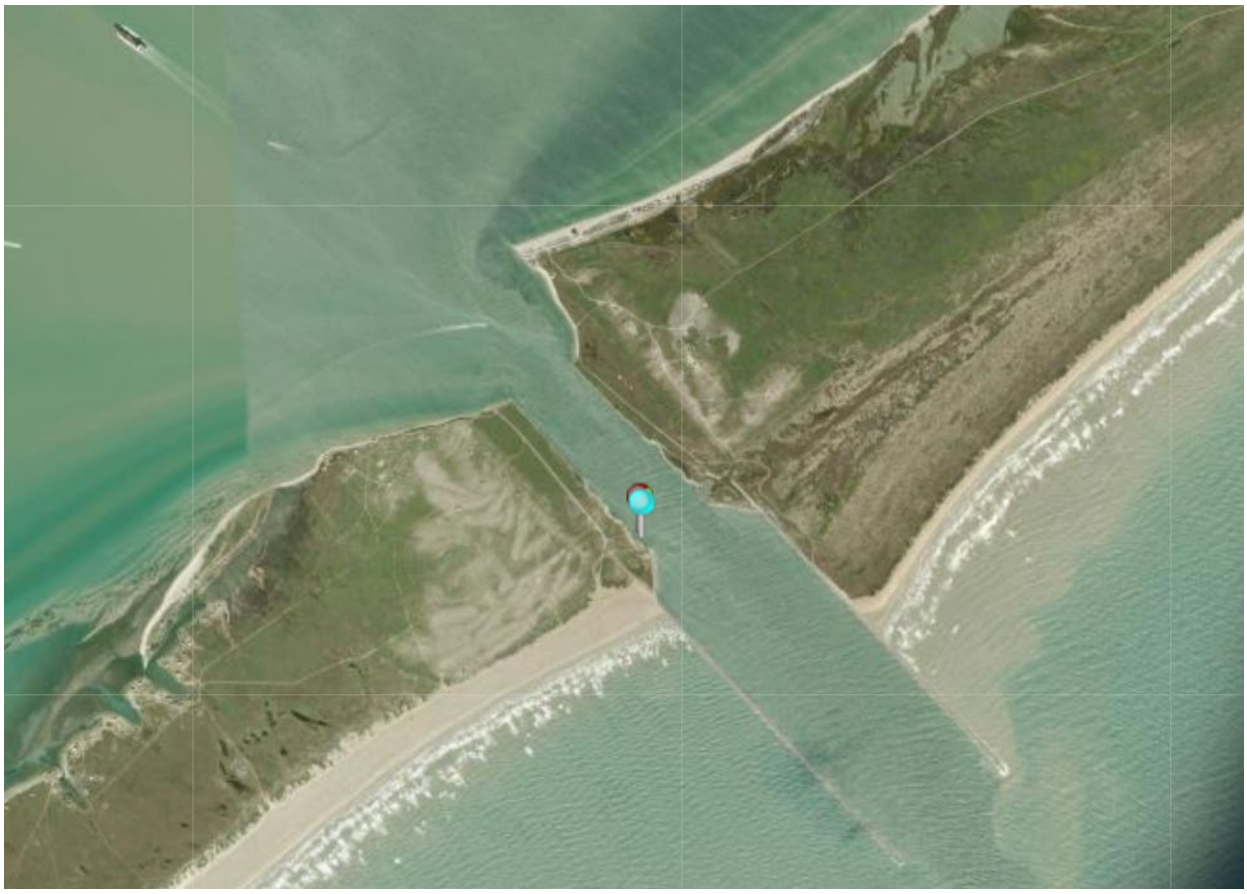


Figure 2-8: Location of NOAA PORTS Gauge mg0201 at Matagorda Bay Entrance Channel

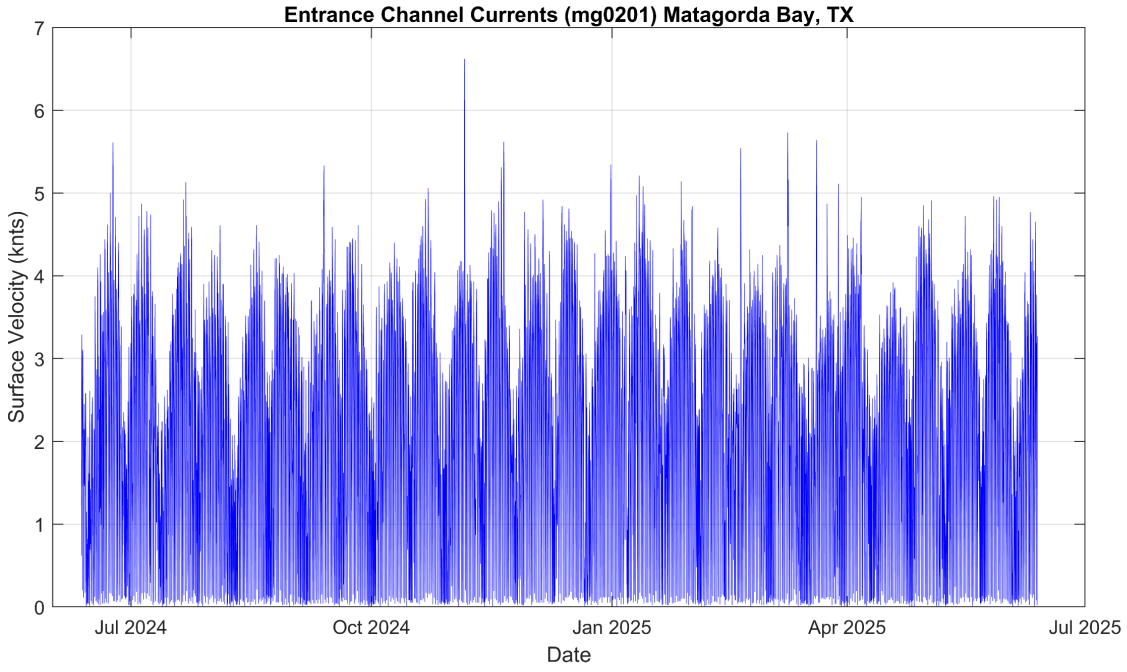


Figure 2-9: NOAA PORTS Gauge mg0201 Velocity Signal for June 2024 - June 2025

Currents for June 2024 to June 2025 are shown in Figure 2-9 from NOAA station mg0201. Flood tide direction is nearly 320°, with an ebb direction at roughly 130°. The record is summarized below by a current rose; currents were typically between 2-4 knots at peak flood and ebb (Figure 2-10).

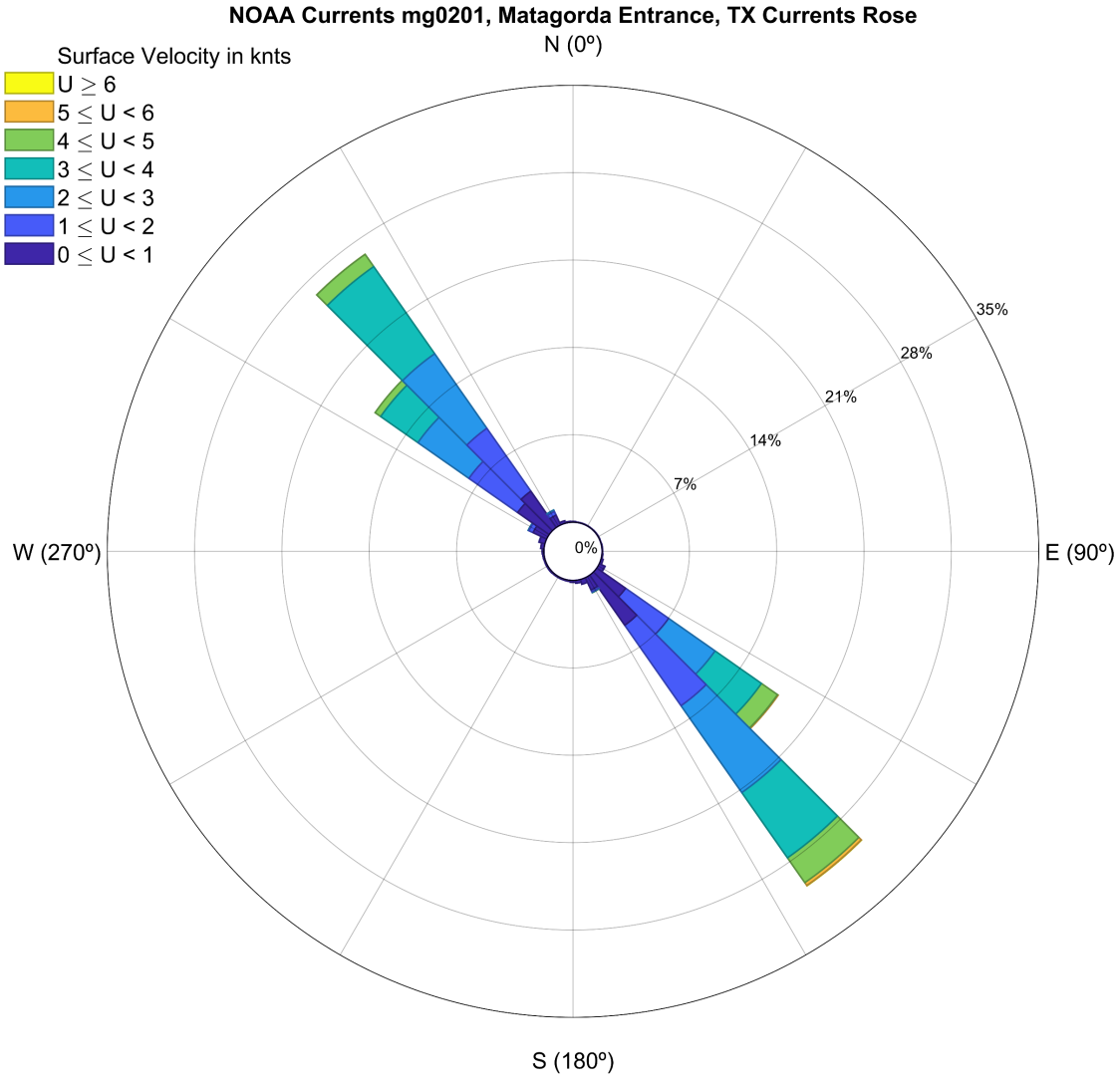


Figure 2-10: Currents Rose for NOAA Gauge mg0201 for June 2024 - June 2025

Bayside of the MSC entrance, currents are significantly reduced. The channelized current can approach 1-3 knots, which is far more manageable for commercial ship traffic. NOAA station mg0101 at Channel Marker 19 (Figure 2-11) also records near-surface current data.



Figure 2-11: Location of NOAA PORTS Gauge mg0101 west of Chester Island

A comparison is provided in Figure 2-12 for February – June of 2025. On average, the near-surface current velocity shows a decrease of 65% between mg0201 (Entrance bottleneck) and mg0101, just west of Chester Island.

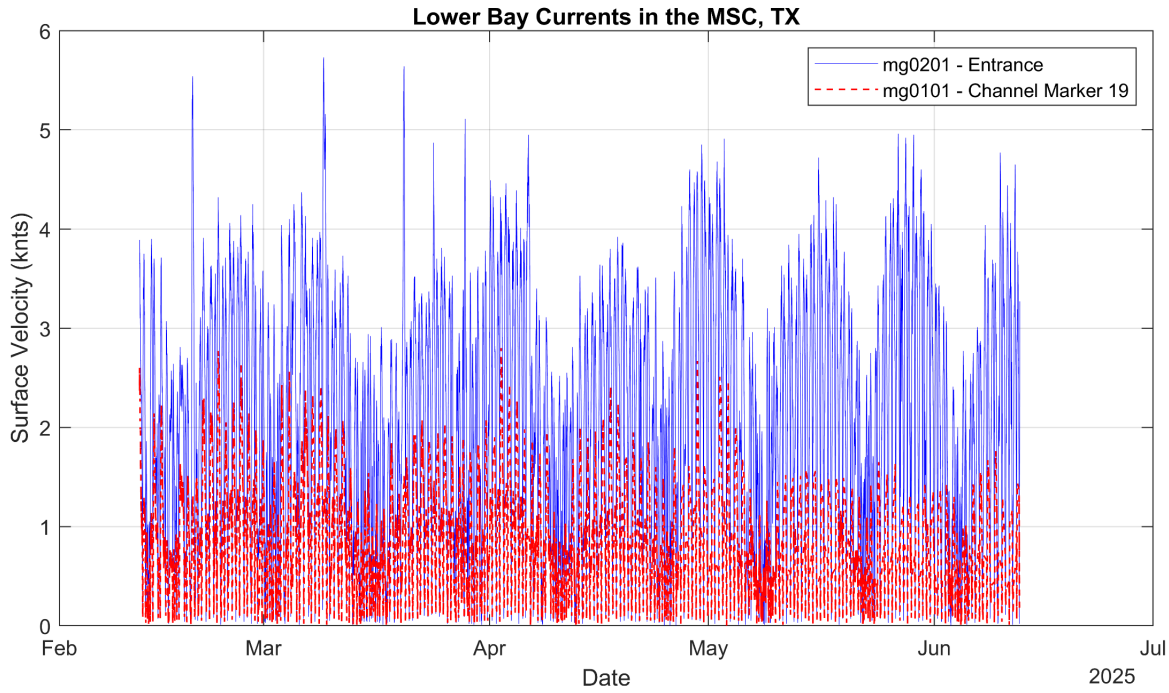


Figure 2-12: Comparison of Velocity between mg0201 and mg0101 for February 2025 - June 2025

Currents at Channel Marker 19 are displayed in Figure 2-13 by a current rose for the timeframe of February – June of 2025. The approximate flood direction is 330°. Comparing to the same current rose for the entrance station (mg0201), for February – June 2025, reveals an apparent shift from ebb-dominated to flood-dominated current.

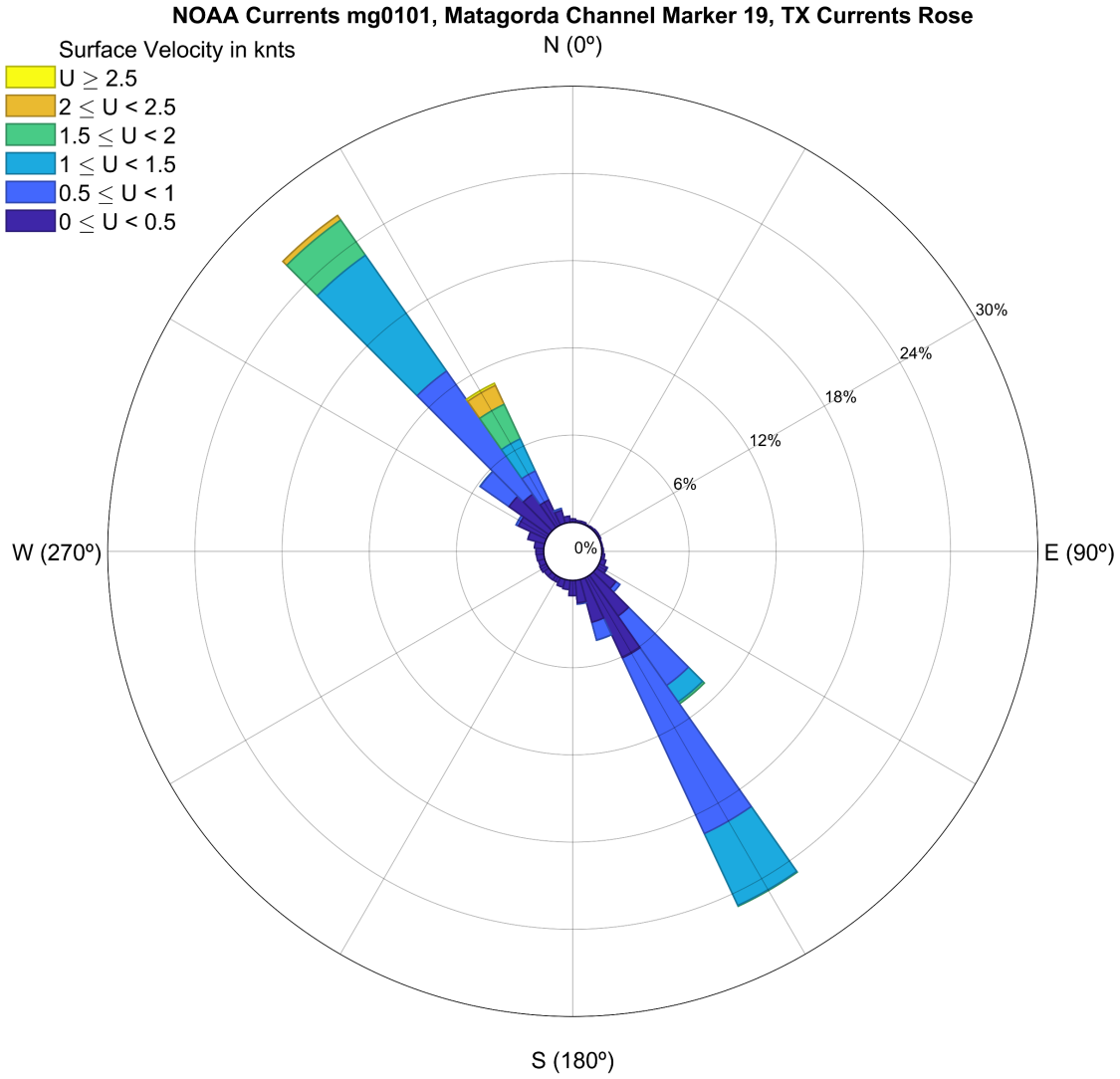


Figure 2-13: Currents Rose for NOAA Gauge mg0101 for February 2025 - June 2025

Farther from the MSC, currents in Matagorda Bay are primarily driven by wind and waves, and less by tidal exchange. The predominant direction of flow is east to west, such that most suspended sediments migrate back towards the channel.

Offshore, MSC pilots report the presence of significant cross currents that make navigation cumbersome. Likewise, cross currents often develop at the MSC intersection with the Gulf Intracoastal Waterway (GIWW) just north of Chester Island.

The Coastal Modeling System (CMS, Section 2.6), was used to simulate existing condition (PWOP) and FWP currents. Based on the timeframe of July 2019 – June

2020, it is evident from the PWOP scenario that the average current moves from east to west in Matagorda Bay. It can also be seen by Figure 2-14 that the average current vector trends to the south in Lavaca Bay. At the jetty bottleneck, currents are significantly higher than anywhere else in the bay.

Under the FWP scenario, changes to average currents are not anticipated for “normal” conditions. Lin et. al (2018) simulated Hurricane Harvey and Rita, strong tropical storms that made landfall in 2017 and 2005, respectively, with CMS. The report deduced that with-project current velocity could increase for high-energy events, such as Harvey and Rita.

The 2018 report concluded:

“Typical maximum flood and ebb current speeds are 1.3 and 1.8 m/sec, respectively, at the Matagorda Ship Channel Entrance... For Harvey, with strong wind, high storm surge, and large river inflow from CR [Colorado River] and LR [Lavaca River], the difference of maximum current speeds between PWP-PWOP, and between FWP-FWOP, is in the range of +/- 0.5 m/sec in and near the ship channel.”

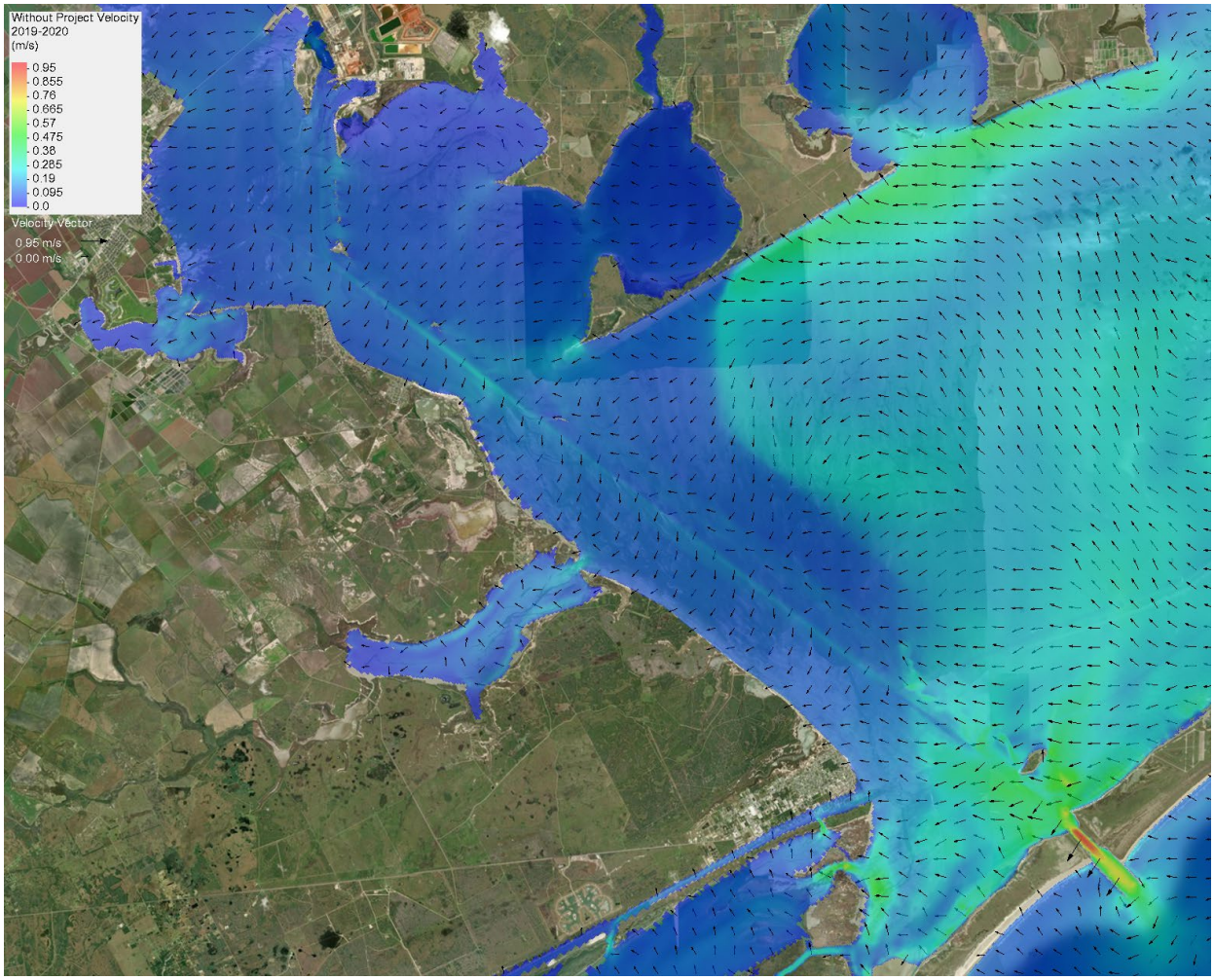


Figure 2-14: CMS Average Currents for July 2019 - July 2020

2.3.4 Wind

Winds in Matagorda Bay are primarily out of the Southeast (SE) between 0-10 m/s (0-20 knots), on average. The USACE Wave Information Study (WIS) provides historical observations with hindcasted estimates to create long-term climatology reports.

WIS Station ST73051 is pictured below in Figure 2-15 just offshore of Matagorda Bay. The approximate straight-line distance to the MSC jetties is 11 miles.

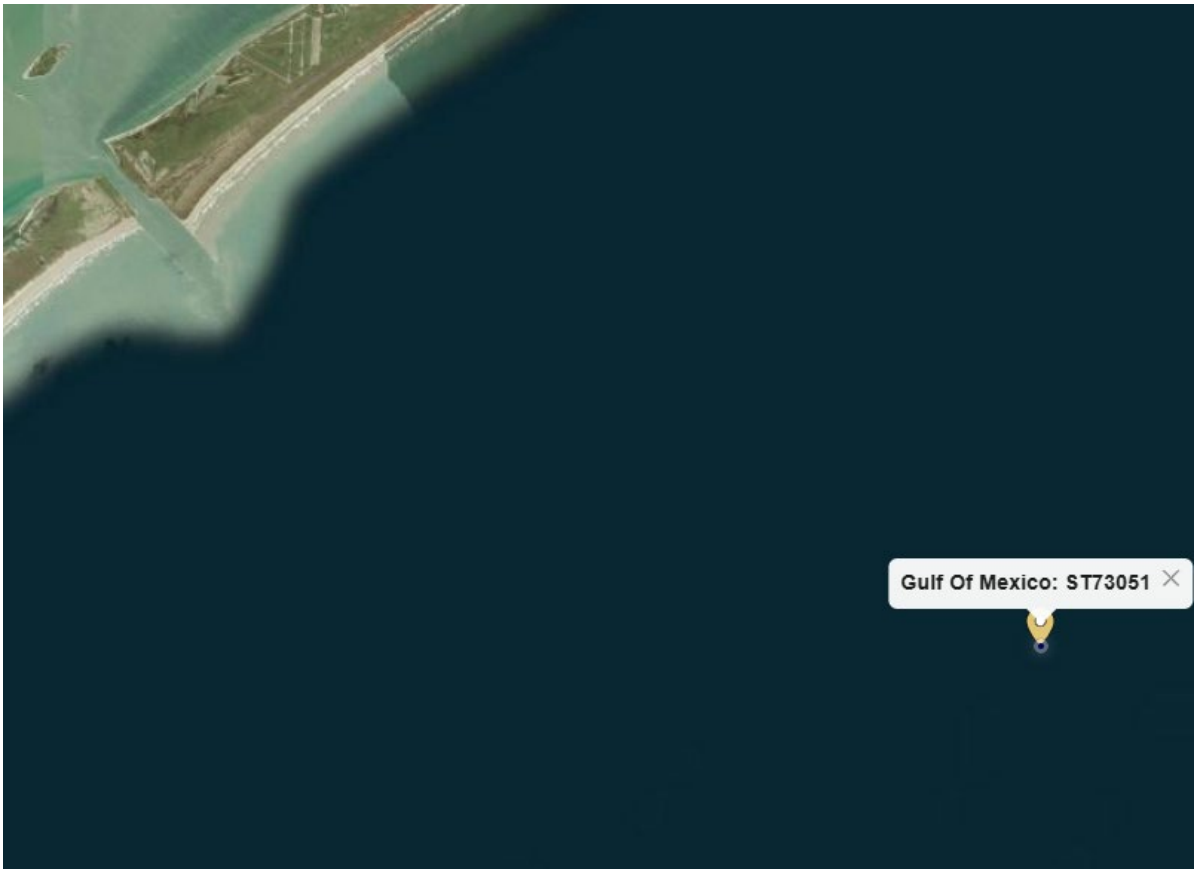


Figure 2-15: WIS Station ST73051 Offshore of MSC Entrance (Gulf of Mexico is Present-Day GoA)

The predominant wind direction from 1980-2025 is 135º-160º N. The most probable wind speed is between 5-7.5 m/s or 10-15 knots (Figure 2-16). Winds offshore of Matagorda Bay are typical for the Texas coast. A wind rose is provided in Figure 2-17 from WIS ST73051.

The inner-bay wave climate is largely driven by the local wind forcing. The large available fetch at the principal wind direction makes fully-developed seas with larger waves (2-3 ft) common in Matagorda Bay. The offshore wave climate is not fetch-limited and is primarily controlled by the duration of wind and distant storms.

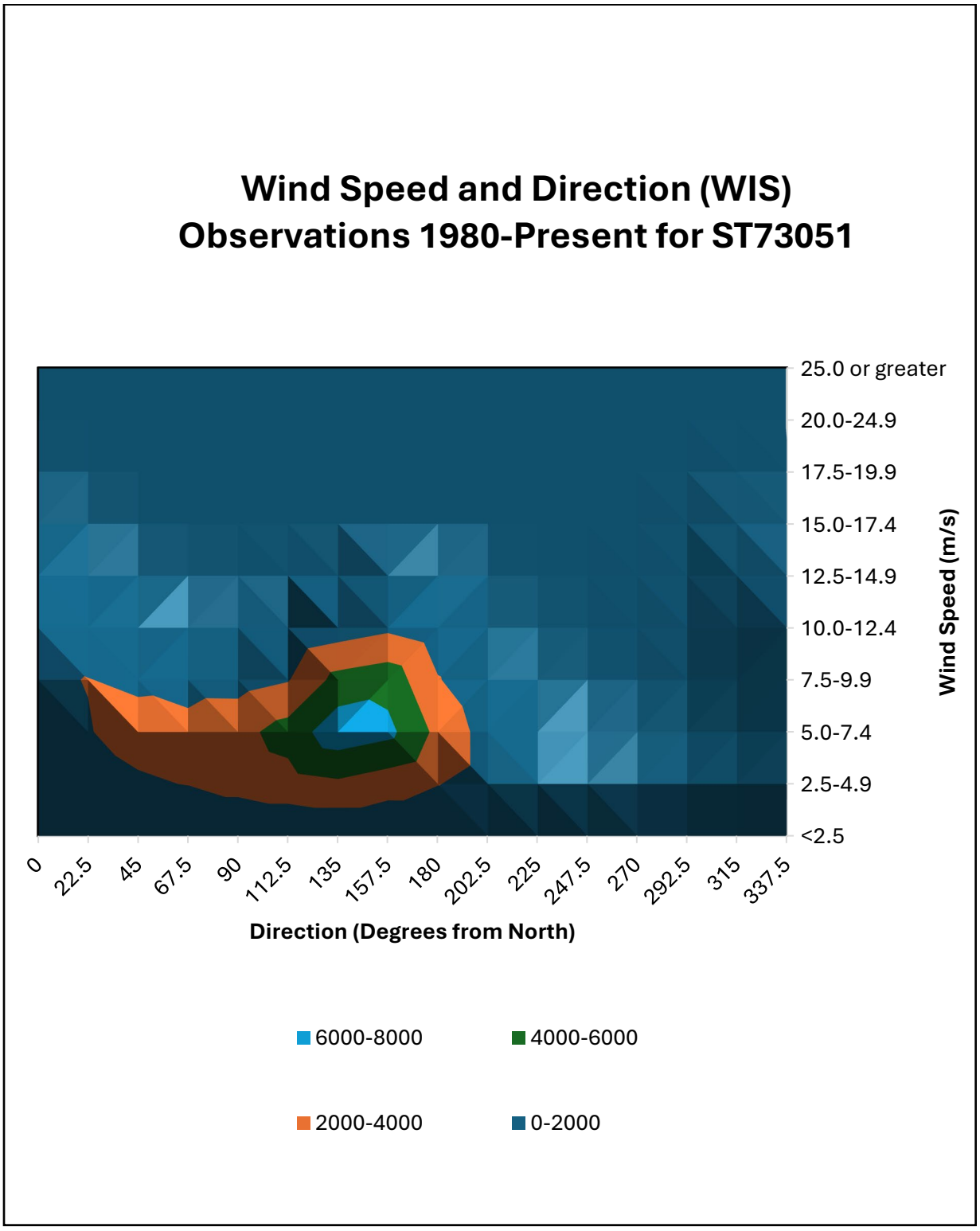


Figure 2-16: WIS ST73051 Wind Observations 1980-Present

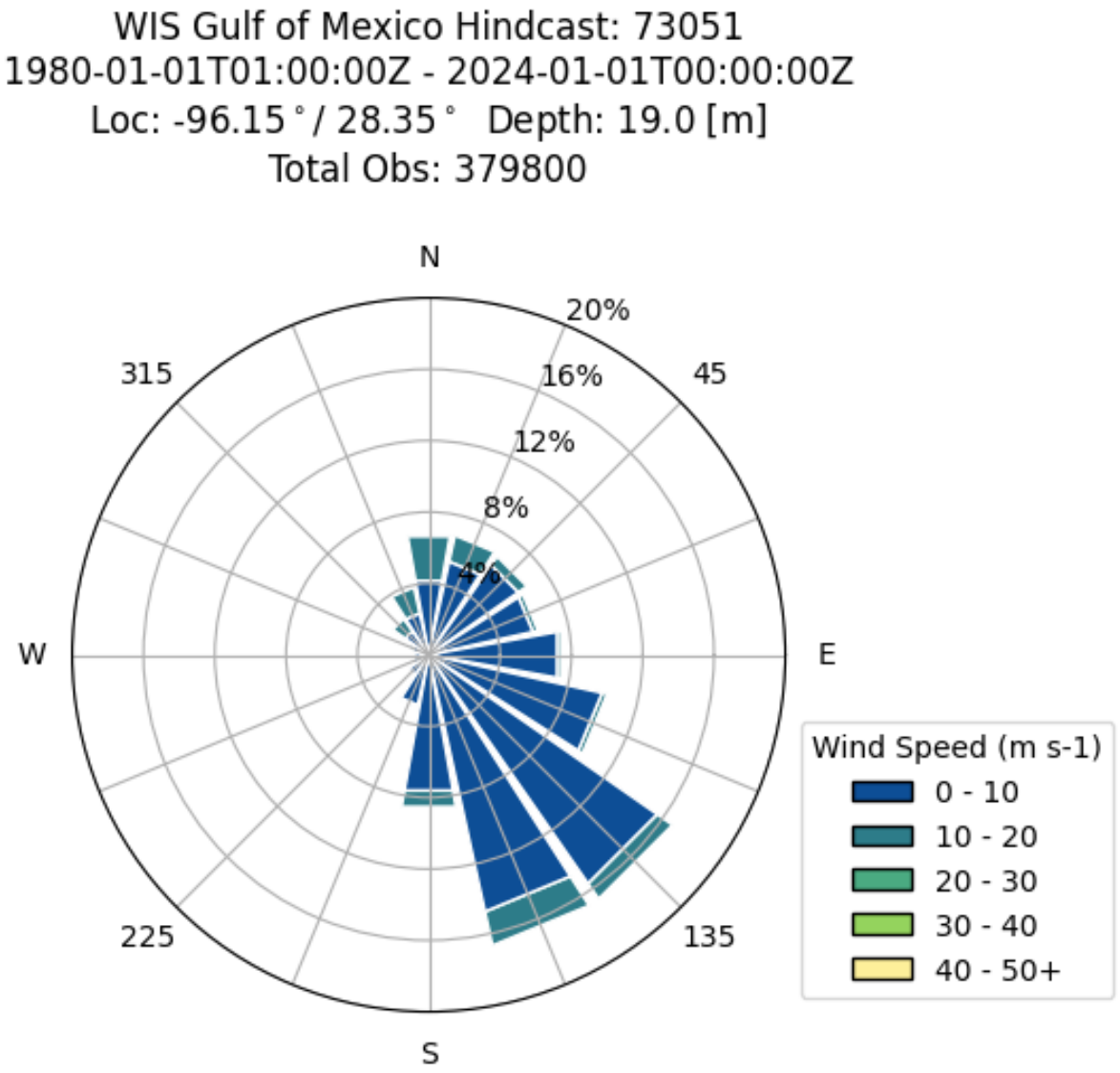


Figure 2-17: WIS ST73051 Wind Rose (Gulf of Mexico is Present-Day GoA)

2.3.5 Waves

The wave climate just offshore the MSC entrance is often described as “high-energy” due to the prevailing winds. As waves approach the jetties, the structures dissipate wave energy to reduce the swell bayside of the inlet. Bayside wave generation is more dynamic and nonlinear than that seen offshore, which is often well described by an energy spectrum.

Offshore, the average significant wave height (H_s) is usually between 0-2 m (0-6.5 ft) and incident from the SE (Figure 2-18). Episodic events, such as tropical storms, may produce offshore waves exceeding 4 m (13 ft). Notably, Hurricane Harvey generated an estimated 22 ft wave height at WIS ST73051. By use of extreme value analysis, a 22 ft wave height is nearly the 100-yr event, and the 50-yr wave is approximately 19.5 ft (Figure 2-19).

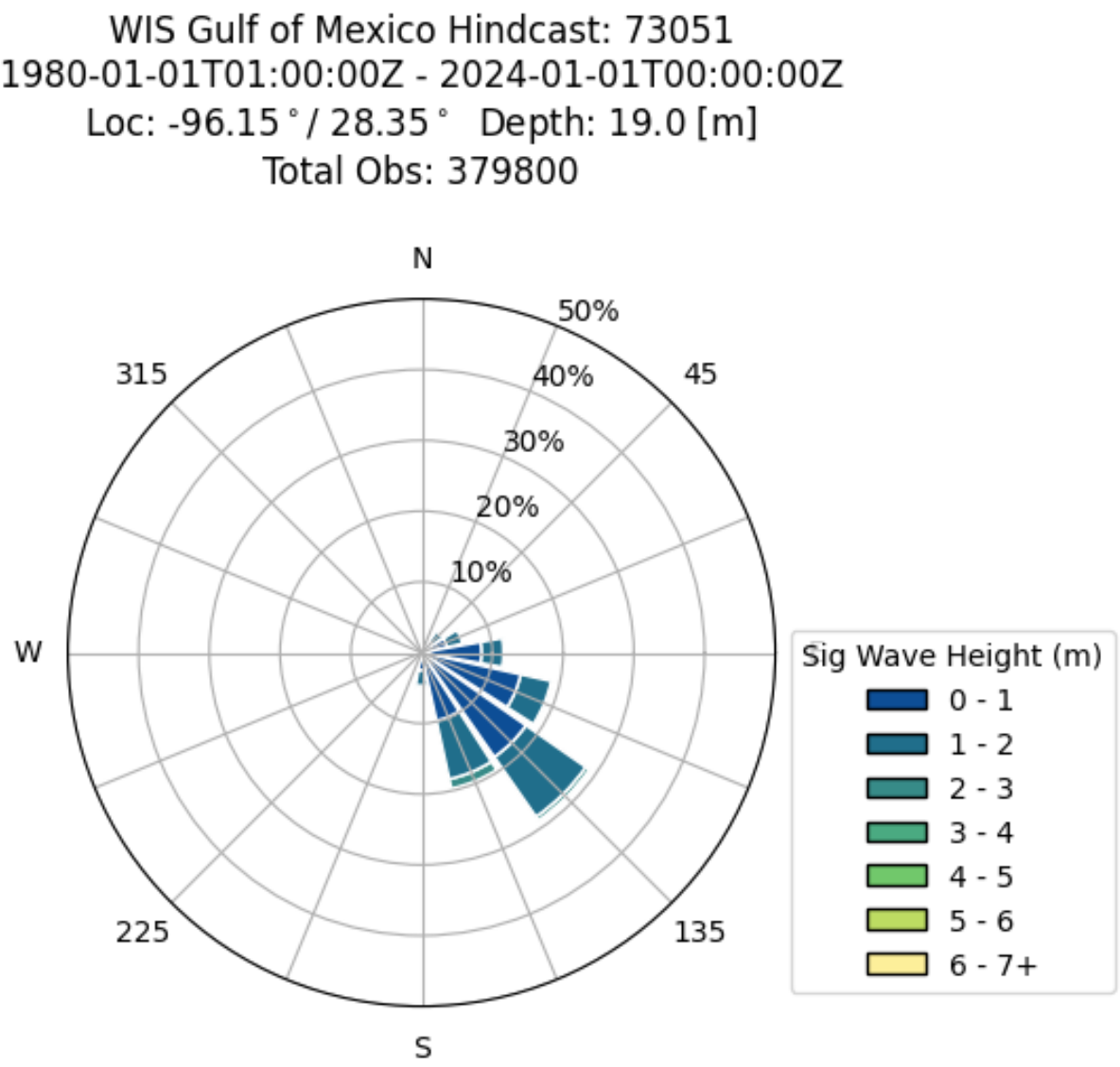
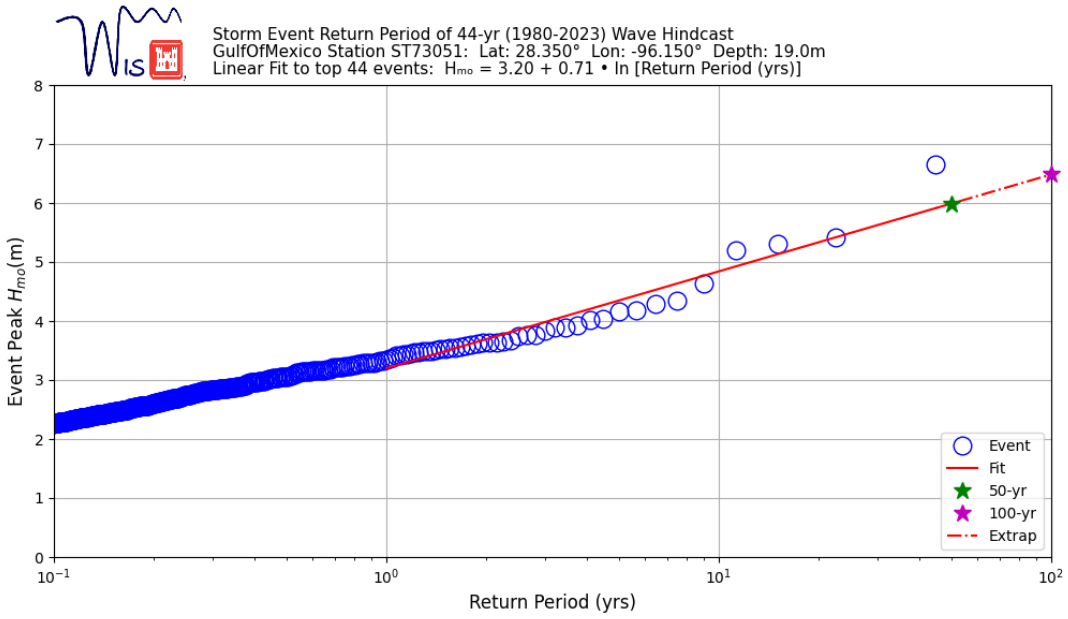


Figure 2-18: WIS ST73051 Wave Rose (Gulf of Mexico is Present-Day GoA)



Top 10 Events based on Peak H_{mo}

Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}	Event	Date/Time(UTC)	H_{mo}	T_p	θ_{mean}
1	2017/08/26 00:00	6.66	11.29	143.0	6	1998/08/22 07:00	4.35	9.11	108.0
2	1988/09/16 21:00	5.41	16.86	139.0	7	1996/01/18 02:00	4.3	9.19	167.0
3	2021/09/14 00:00	5.31	10.1	131.0	8	2015/06/16 17:00	4.18	8.47	129.0
4	2020/07/25 15:00	5.2	11.05	116.0	9	1998/09/11 12:00	4.17	10.09	138.0
5	1980/08/10 10:00	4.64	11.08	120.0	10	1983/11/19 09:00	4.03	9.23	164.0

An event is defined as any period when H_{mo} > 1.94m

θ_{mean} is the direction that waves are arriving from

Figure 2-19: WIS ST73051 Extreme Analysis Plot (Gulf of Mexico is Present-Day GoA)

The complex interaction of wave shoaling, refraction, breaking, and regeneration produces the inner-bay wave climate. Such waves are limited by available fetch and duration of wind. At the inlet, current contribution is more pronounced, which can steepen or suppress the wave height. When waves propagate in the presence of currents, the wave mechanics become even more cumbersome to resolve. Simplistic methods are presented herein to describe the inner-bay wave climate; a fetch-limited analysis was used previously to estimate average wave height and period.

In the 2014 Engineering Appendix prepared by URS, the fetch-limited wave height and period were calculated for proposed PAs. Table 2-6 details the findings of the fetch-limited analysis based on a 45-knot wind, corresponding to the 10-yr return event.

Sites A1 and A2 are in Cox Bay near present-day PA 18/19. ER3/D is located near the confined “Dredge Island” at Alcoa. Site G is near present-day Keller Bay Peninsula, and H4 corresponds to existing PA8 and PA7 north of the GIWW intersection. Figure 2-20 identifies the sites used in 2014 to develop 10-yr wave statistics.

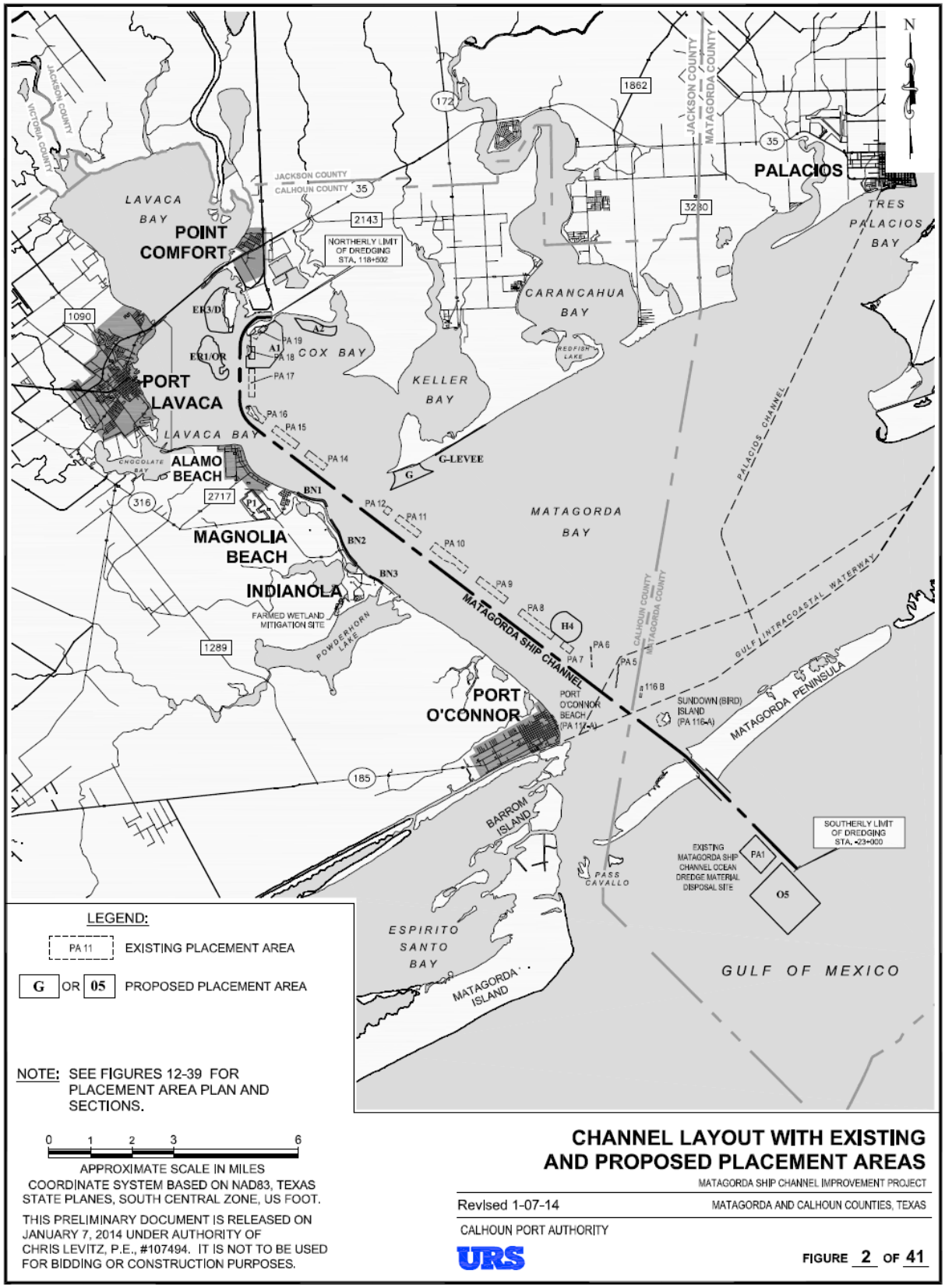


Figure 2-20: 2014 URS Wind-Wave Fetch Analysis (2014 Proposed PAs)

Table 2-6: 2014 URS 10-yr Wind Wave Estimates in Matagorda Bay

Site	Shoreline Segment	Maximum Fetch (miles)	H_{mo} (ft)	T_p (s)
A1	E	8	3.4	3.8
	S	8	3.4	3.8
	W	3.5	2.9	3
A2	E	1.5	2.3	2.5
	S	4.5	3.1	3.3
	W	0.5	1.4	1.7
ER3/D	W	3.2	2.8	3
	S	3.5	2.9	3.1
G	W	2.5	2.6	2.8
	S deep	18.9	3.9	4.6
	S shallow	18.9	3.9	4.6
H4	NW	14.5	3.8	4.4
	NE	25.8	3.9	4.8
	SE	10.8	3.2	3.5
	SW	14.5	3.8	4.4

The proposed sites from the 2014 Engineering Appendix have a limiting 10-yr wave height near 4 ft. The peak period ranges from roughly 2-5s for the 10-yr wind speed. There are no changes to the present-day wave conditions in the bay.

FWP wind-wave conditions are not expected to change significantly at the 2014 proposed PA sites, or at those recommended in the new DMMP. The addition of RSLC (Section 2.3.8) will impact the breaking condition of ambient waves, that is, where the waves break. Depending on the prevailing wind speed and direction, OWPA sites may provide a “sheltering effect.” OWPAs that could provide nearby shoreline benefit (reduction in wave energy) are identified in Section 2.8.1.

Wave energy in the bay system is predominantly attributed to wind. Vessel wave energy accounts for only a small portion of the wave climate, and the effect of swell decreases further from the inlet.

As identified in previous studies, such as Mott Macdonald (2019) and Moffatt & Nichol (2006), an increase in vessel size is expected to have an immeasurable contribution to erosion along the western banks of Matagorda Bay.

2.3.6 Vessel Waves

Wise (2006) first estimated vessel wake impacts by use of empirical methods (Figure 2-21) provided in PIANC (1987), Sorensen (1997), and Schiereck (2004). The proposed channel dimensions were different than what is now proposed under the Recommended Plan (RP). The 2006 proposed channel dimensions were 400 ft width at 44 ft MLT depth (42-43 ft MLLW). The new RP features an authorized base width of 300 ft at 47 ft MLLW depth for the main channel.

The scenarios consisted of the following.

- Scenario 1: Existing vessel in existing ship channel.
- Scenario 2: Existing vessel in proposed ship channel.
- Scenario 3: Proposed LNG vessel in proposed ship channel.

The analysis assumed a vessel speed of 8 knots. In summary, Scenario 3 when compared to Scenario 1 would result in increased drawdown (stern wave) but reduced secondary wave height at the shoreline (Alamo Beach, Magnolia Beach, Port O'Connor).

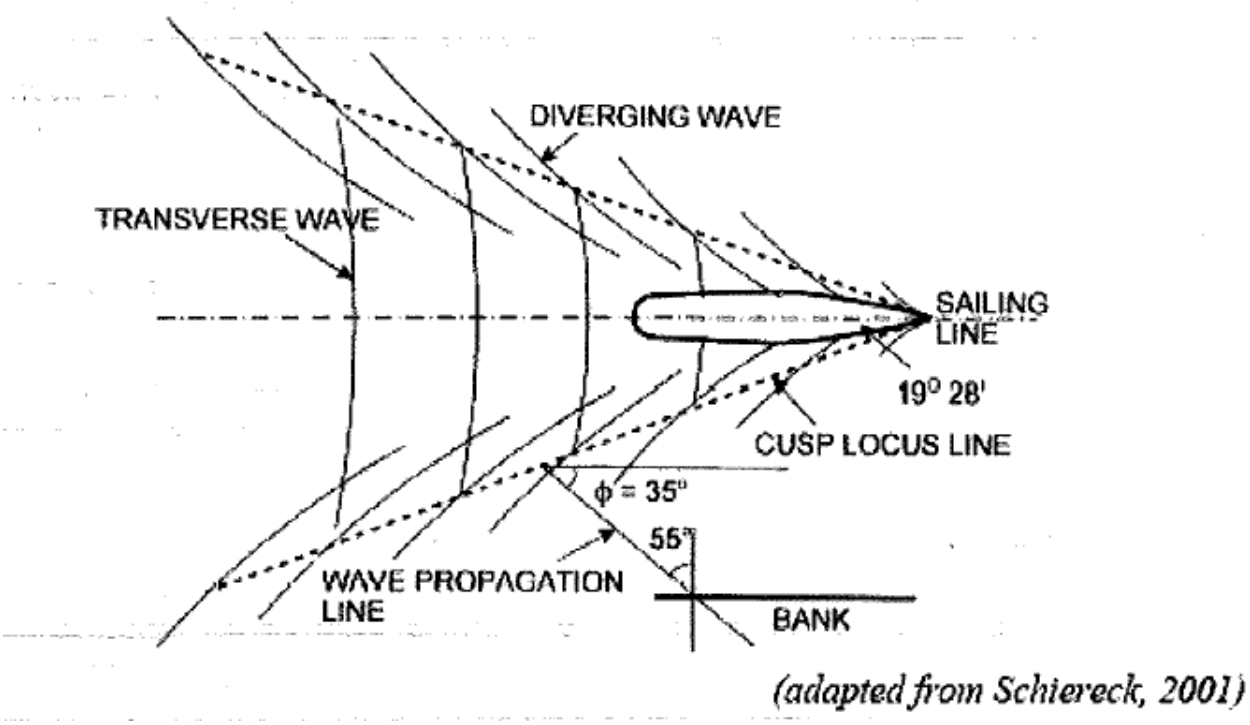


Figure 2-21: Vessel Wave Propagation (Wise, 2006)

Wise concluded that, under the proposed 2006 conditions, a 10% reduction in vessel wake height could occur. The analysis concluded that there would be no major changes to with-project vessel-wave energy. Furthermore, the author estimated that 97-99% of wave energy in Matagorda Bay is attributed to wind waves.

Per the Economic lead's direction, FWP would allow for a switch from the Panamax to Aframax-class of vessels, allowing for more cargo per trip, and subsequently, less vessels. Since changes to the with-project vessel's length or draft is expected to have a minor effect on total vessel-wave energy, vessel frequency may be re-assessed during PED if the Economic analysis is changed. Should vessel calls increase under FWP conditions, the total contribution to wave energy at the shoreline may increase.

Shoreline erosion, such as that seen at Magnolia Beach, may be further investigated in PED with a phase-resolving wave model. This will help to fully ascertain the relative energy contribution of wind-waves and vessel-waves at Matagorda Bay's western shoreline.

2.3.7 Water Level

NOAA Stations 8774770 and 8772471, at Rockport, TX and Freeport Harbor, TX, respectively, provide the most comprehensive water level records in the vicinity of the study area. The MSL record, referenced to NAVD88, for 8772471, Freeport Harbor, TX is shown in Figure 2-22.

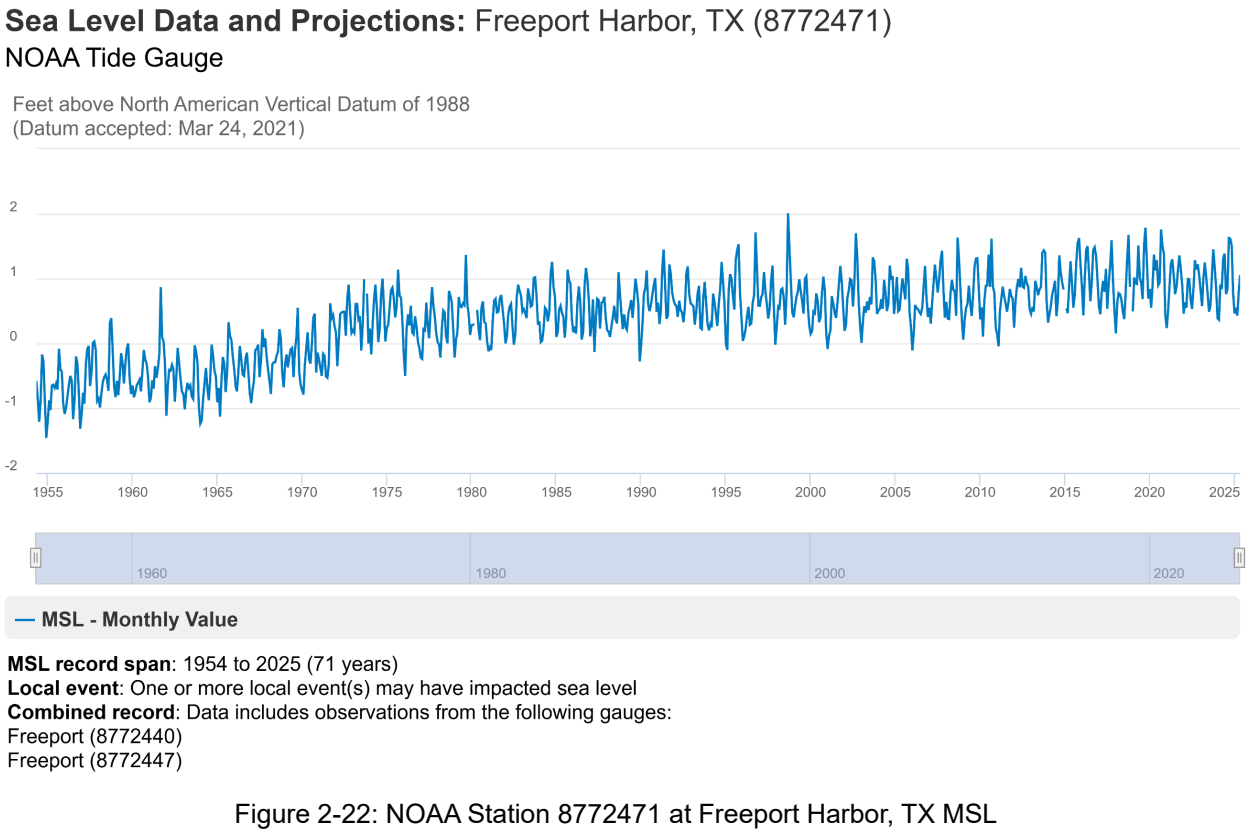


Figure 2-22: NOAA Station 8772471 at Freeport Harbor, TX MSL

Mean water levels have been rising in the study area since the NOAA gauges were first established. The most pronounced change, based on the record at gauge 8772471, occurred between 1965 and 1975. Changes to the mean sea level are discussed in Section 2.3.8.

2.3.8 Relative Sea Level Change

In compliance with ER-1100-2-8162, the USACE must incorporate Relative Sea Level Change (RSLC) into planning and engineering studies. The 2019 IFR/EIS provided an extensive analysis of the recommended RSLC for the MSCIP. In summary, the 2019 appendix suggested 1.5-2 ft of sea level rise should be used to assess environmental impacts over the project life. By use of the Sea Level Analysis Tool (SLAT), RSLC was estimated with a modified construction completion date (2029). Using NOAA station 8774770 at Rockport, TX, SLAT findings are shown in Table 2-7 for the 50-yr projection with the USACE 2019 curve. Year 2004 serves as the station's mid-epoch; datum elevations at the Rockport gauge are in reference to the mid-epoch.

Table 2-7: RSLC from Mid-Epoch to 2079 using NOAA Station 8774770

Year	Low (ft)	Intermediate (ft)	High (ft)
2004	0.0	0.0	0.0
2019	0.30	0.35	0.51
2029	0.50	0.61	0.95
2039	0.69	0.88	1.46
2049	0.89	1.17	2.04
2059	1.09	1.48	2.70
2079	1.49	2.15	4.24

By use of the intermediate curve, the SLAT calculates nearly 1.54 ft of RSLC over the 50-yr project life (2029 – 2079). The 2019 engineering assessment took an average of intermediate projections from NOAA stations at Rockport, TX (8774770) and Freeport Harbor, TX (8772471) with 2024 serving as the end of construction.

The 2019 report discusses subsidence, differences between RSLC curves, and the pros and cons of each projection. Furthermore, the 2019 report also details an extensive risk analysis regarding RSLC.

Between 2019 and 2029, the RSLC is estimated to be nearly 0.26 ft or 0.17 ft, using the intermediate curve at stations 8774770 and 8772471, respectively. Therefore, the total estimated RSLC from 2019 – 2079 is the intermediate projection of nearly 1.71 – 1.8 ft. Since the 2019 IFR/EIS reported nearly 1.5-2 ft of RSLC over 50 years, the 2 ft estimate is adopted. 2 ft of RSLC is deemed conservative for evaluating hydraulic and environmental impacts to the bay system.

2.3.9 RSLC Impacts

As stated in the 2019 IFR/EIS Engineering Appendix, “As a conservative approach (not exaggerating benefits from sea-level rise), USACE’s Low Sea-Level Curve should be used for the navigation portion of this project. In order to gage environmental impacts, the Intermediate Level Curve should be used (in the numerical model of currents and salinity).”

Impacts of RSLC are listed below for the project area:

- Navigation within the MSC is improved for vessel’s requiring more draft.
    - Costs to maintain the federal waterway are reduced with less dredging.
    - Capacity at dredged material disposal sites increases.
- Wave energy in the bay has the potential to increase with more available depth under high-wind events and storm conditions.
    - Erosion and shoreline loss may consequently increase.
    - Loading on existing infrastructure may increase.
- Existing infrastructure, such as piers, bulkheads, wharves, docks, and piles may require modification to adapt to RSLC.
    - Port facilities.
    - Aids-to-navigation (ATONs)
- Federal structures will experience higher impacts and will need to be improved to deal with RSLC. The primary federal structure is the MSC jetty system, which has a separate project authorization.
- Higher water levels create more coastal wetlands and reduce upland habitat.
    - Upland riparian zones slowly become more suitable for marsh plants, also known as marsh migration.
    - Marshes with no ability to migrate landward may drown.

2.4 Previous Studies

2.4.1 Salinity

In 2018, using CMS, Lin et al. investigated salinity impacts to Matagorda Bay due to the proposed deepening and widening of the MSC. The study focused on Hurricane Harvey (2017) and Rita (2005). In total, 20 different scenarios were simulated with varying water levels and riverine inflows.

The 2018 study found, “In Matagorda Bay, the difference of model salinity values between PWOP and PWP, and also between FWOP and FWP, is overall small, less than 2 ppt excluding the PA areas.”

The modeling also found that the minimum salinity slightly increases in Lavaca Bay under with-project conditions. Under the “medium flow” and “low flow” scenarios, the salinity in Matagorda Bay is generally higher for with-project. However, “high flow” conditions, such as those experienced during Harvey, lead to lower salinity in the middle and eastern Matagorda Bay for with-project. Overall, the impact to salinity is expected to be rather minimal with the proposed deepening and widening. Figure 2-23 illustrates the average salinity difference between FWP and FWOP scenarios for Hurricane Harvey generated by CMS.

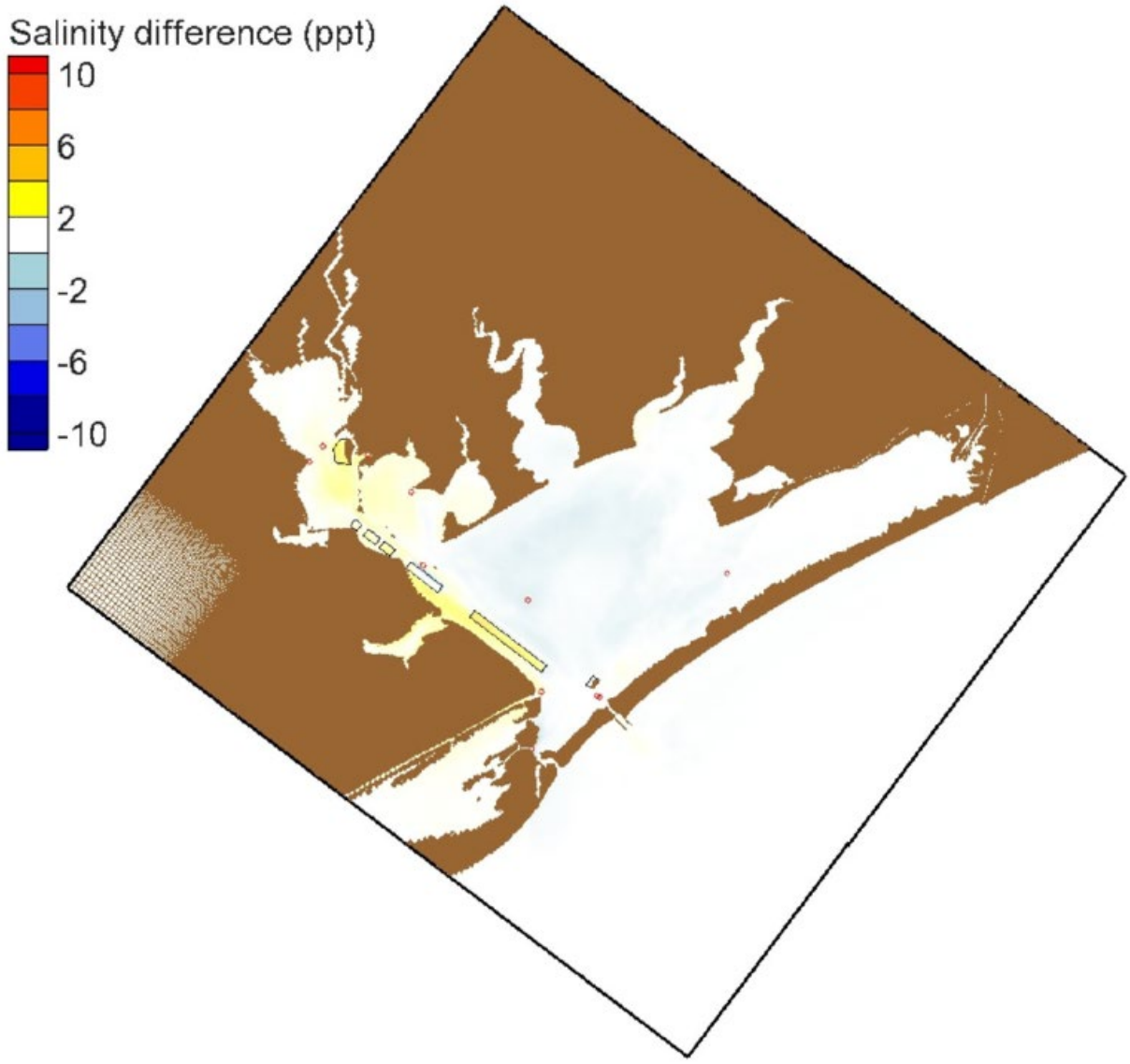


Figure 2-23: Difference of Average Salinity fields from Hurricane Harvey (FWP-FWOP) Lin et al.

2.4.2 Pass Cavallo

Pass Cavallo is a natural inlet southwest of the MSC entrance that experienced a significant decrease in cross-sectional area following construction of the MSC. Since the mid-1990s, the width of Pass Cavallo has remained relatively stable. With the widening and deepening of the MSC, concerns have been raised about the future stability of Pass Cavallo. 2024 satellite imagery of the natural inlet is shown in Figure 2-24.

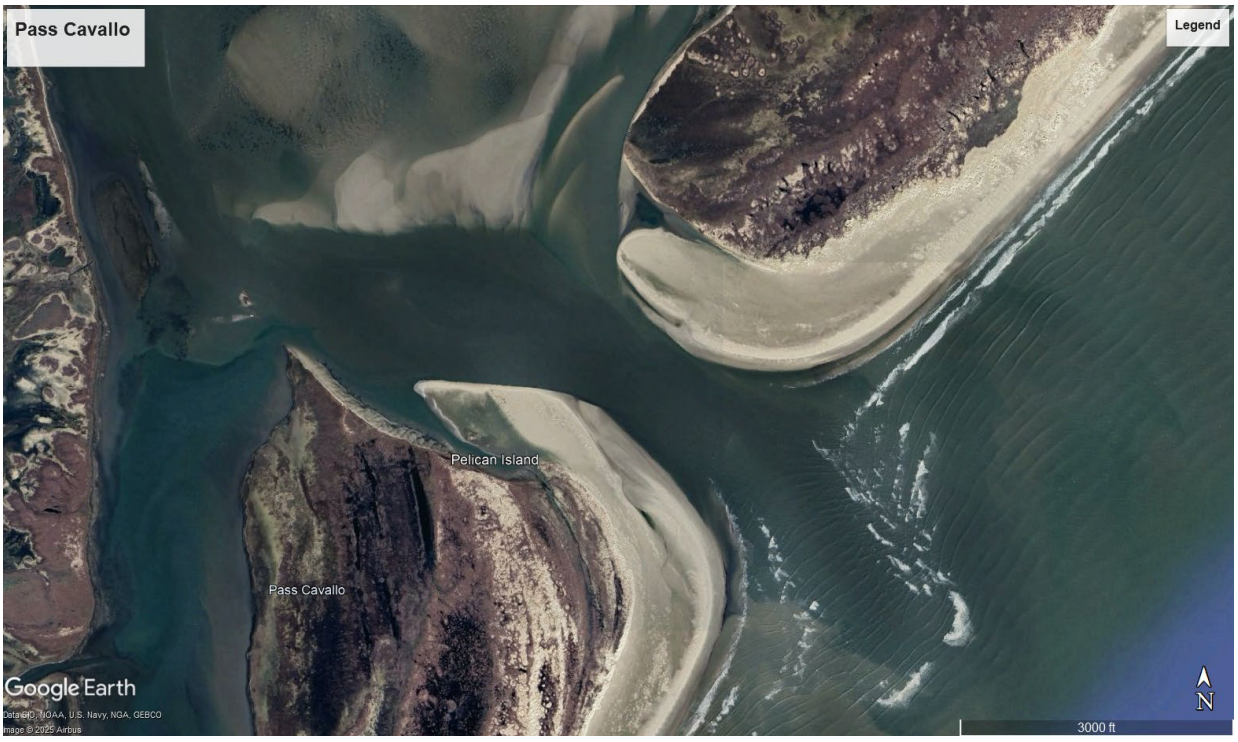


Figure 2-24: Present-Day Satellite Imagery of Pass Cavallo (01/08/2024)

Focusing on imagery since 1995, Pass Cavallo appeared to be at its widest between 2011-2013. At that time, the inlet was nearly 2,600-2,700 ft wide. Based on 2024 imagery, the Pass is currently estimated to be 1,000-1,100 ft wide.

In 2008, Kraus and Batten examined the morphology of Pass Cavallo to assess stability of the inlet by use of historical data and empirical methods. An immediate decrease in cross-sectional area between 1966 and 1995 (Figure 2-26) is attributed to the sediment load from the ebb-tidal shoal. The authors concluded that, due to anticipated collapse of this shoal, the cross-section of the Pass will equilibrate. However, since 2008, spits have formed on both sides of the inlet, leading to a substantial decrease in width (Figure 2-25). Under the presumption that the Pass's cross-sectional area is stabilizing, the depth of the Pass would be increasing.

Regarding the MSCIP, Kraus and Batten state, "Widening and deepening of the MSC entrance will not notably change the stability of Pass Cavallo, because the additional capture of the tidal prism by the ship channel will be small relative to the present value of tidal prism for Pass Cavallo and in comparison to past reductions in prism there." The ability of the Pass to stabilize following the construction of the MSC in 1962 (Figure 2-26) leads to reason that channel modifications will not be consequential to future stability.



Figure 2-25: Pass Cavallo Satellite Imagery (03/10/2011)

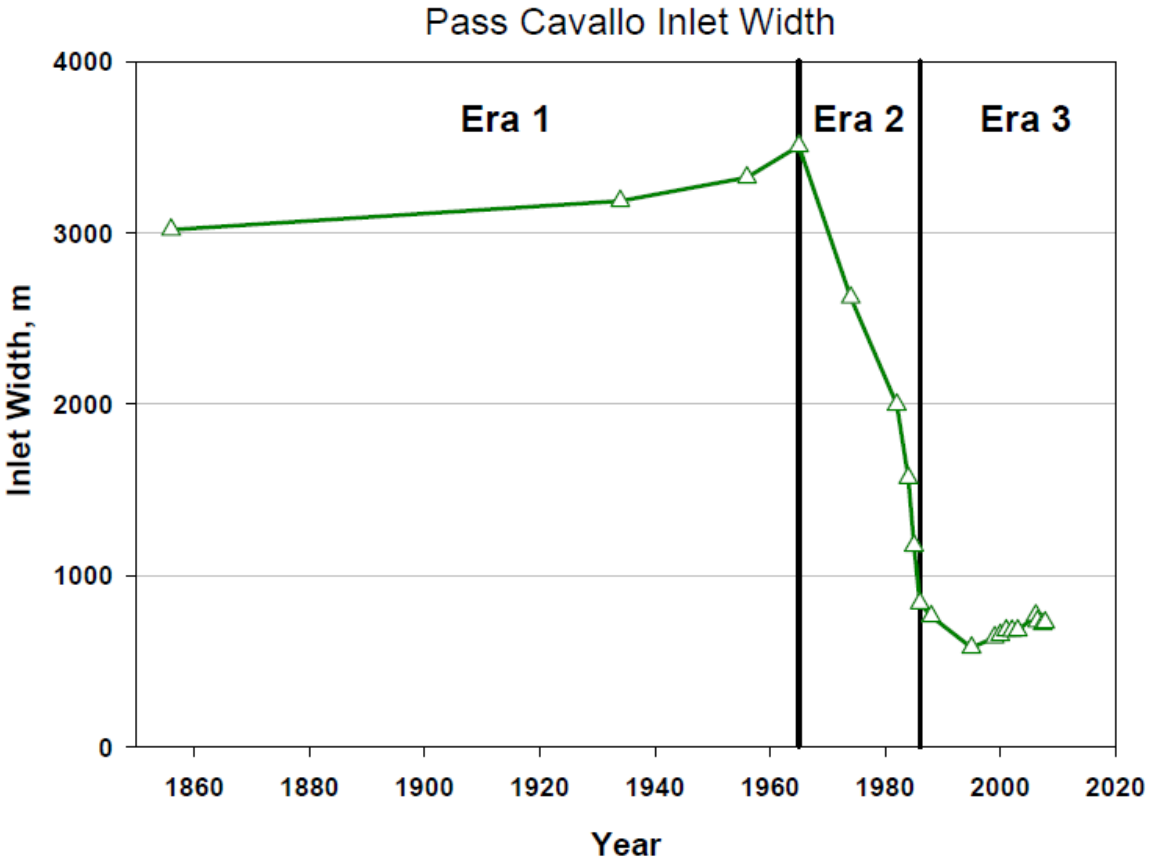


Figure 2-26: Kraus and Batten Estimate of Pass Cavallo Width over Time

2.5 Sedimentation

2.5.1 Existing Shoaling Rates

The Corps Shoaling Analysis Tool (CSAT) utilizes the National Channel Framework (NCF) reaches shown in Figure 2-27 and available eHydro survey to calculate shoaling rates.



Figure 2-27: MSC Overview (NCF)

NCF reaches for the MSC include:

- Sea Bar Jetty Channel (SJC)
- Matagorda Peninsula to Light 48 (MPL)
- Light 48 to Alcoa Channel (LAC)
- Alcoa Turning Basin (ATB)
- Point Comfort Turning Basin (PCT)

The 2019 study “existing” shoaling rates were calculated for NCF reaches by use of CSAT for the years of 2012-2015. The total annualized shoaling volume in the MSC was found to be nearly 1.8 MCY/yr (not including the Port Lavaca and Approach Channel).

A separate analysis was conducted in 2021 to update CSAT findings with newly available hydrographic survey.

In an updated CSAT report provided by the H&H team, the total annual shoaling volume in the MSC was found to be nearly 0.98 MCY/yr and 2.4 MCY/yr for 2011-2015 and 2016-2020, respectively. Given the large discrepancies for years 2011-2015 (2019 & 2021 analyses), a quality control was undertaken to better assess the existing shoaling volume in the channel.

The USACE Resident Management System (RMS) was used as a means to backcheck the existing CSAT results in the MSC. The primary findings of this backcheck are provided in Figure 2-28.

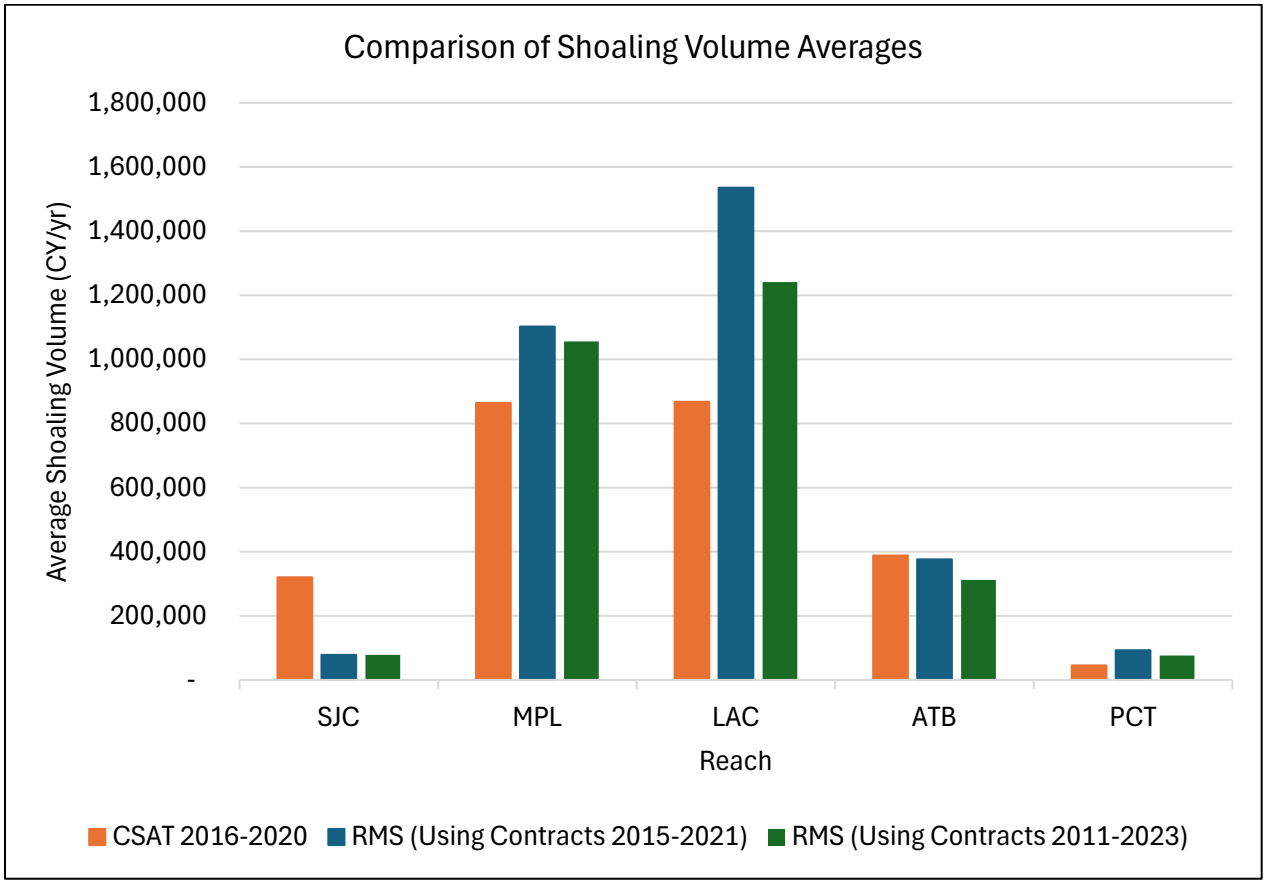


Figure 2-28: Validation of Previous CSAT (Conducted in 2021)

Removing the entrance channel reach (SJC), the difference between the CSAT and RMS data for 2016-2020 varies between 3% and 52%, depending on the reach. RMS data was checked manually for accuracy to ensure that dredging volumes were appropriately captured for the period of analysis. In summary, the comparison found that CSAT was unreliable outside of the ATB and PCT reaches of the MSC, and a more satisfactory validation was needed to reduce risk to project costs. The following was done to re-validate the shoaling quantity in the federal channel:

- A CSAT analysis was conducted for the MSC using the timeframe of 2020-2024.
- RMS data was acquired and processed for the years 2020-2024.
- A comparison was made to assess overall agreement.

2.5.1.1 Corps Shoaling Analysis Tool (CSAT) 2020-2024

The updated CSAT runs employed only surveys with adequate coverage (95% or greater) and specific designations were made for after-dredge (AD) surveys in the input files (Table 2-8). Quality control checks were made prior to running CSAT in an attempt to avoid erroneous calculations within the tool's averaging scheme.

Table 2-8: Surveys used in 2020-2024 CSAT Run for SJC

Survey Date	Survey ID	Reach Name	Coverage %
20200716	MS_01_SJC_20200716_CS	001 Sea Bar and Jetty Channel	100
20200805	MS_01_SJC_20200805_CS	001 Sea Bar and Jetty Channel	100
20200924	MS_01_SJC_20200924_CS	001 Sea Bar and Jetty Channel	100
20210301	**MS_01_SJC_20210301_CS**	**001 Sea Bar and Jetty Channel**	**100**
20210803	MS_01_SJC_20210803_CS	001 Sea Bar and Jetty Channel	100
20210915	MS_01_SJC_20210915_CS	001 Sea Bar and Jetty Channel	100
20211115	MS_01_SJC_20211115_CS	001 Sea Bar and Jetty Channel	100
20220208	**MS_01_SJC_20220208_CS**	**001 Sea Bar and Jetty Channel**	**100**
20220515	MS_01_SJC_20220515_CS	001 Sea Bar and Jetty Channel	100

Survey Date	Survey ID	Reach Name	Coverage %
20220806	MS_01_SJC_20220806_CS	001 Sea Bar and Jetty Channel	100
20230104	MS_01_SJC_20230104_CS	001 Sea Bar and Jetty Channel	100
20230430	MS_01_SJC_20230430_CS	001 Sea Bar and Jetty Channel	100
20230918	MS_01_SJC_20230918_CS	001 Sea Bar and Jetty Channel	100
20231222	**MS_01_SJC_20231222_AD**	**001 Sea Bar and Jetty Channel**	**100**
20240513	MS_01_SJC_20240513_CS	001 Sea Bar and Jetty Channel	98.83
20240709	MS_01_SJC_20240709_CS	001 Sea Bar and Jetty Channel	100
20240822	MS_01_SJC_20240822_XC	001 Sea Bar and Jetty Channel	100
Note: **BOLD cells** were designated as After Dredge (AD).			

Average results from updated CSAT runs are summarized in Table 2-9 by NCF reach.

Table 2-9: 2024 CSAT (Shoaling) Findings for MSC

NCF Reach	CSAT Shoaling Rate (ft/yr)	CSAT Volume (MCY/yr)
SJC	0.72	0.16
MPL	2.35	1.17
LAC	3.63	1.29
ATB	4.60	0.31
PCT	0.88	0.03

The updated analysis shows that, for 2020-2024, the annual shoaling volume is almost 25% higher than the previous analysis conducted in 2021 (using years 2016-2020). A comparison of the 2019 “existing” shoaling volume to the recommended existing condition is shown in Section 2.4.

Output from CSAT is shown in Figure 2-29 to Figure 2-33.



Figure 2-29: SJC CSAT Shoaling Rate 2020-2024

In determining average shoaling rates, a desktop analysis was conducted to sample the raster provided by CSAT. Discontinuities are evident at the boundaries of NCF reaches, which were not included in calculations. Sampling of reaches was done carefully to accurately gauge the average rates.

A few areas in particular, such as that at the boundary of PCT and ATB (Figure 2-33) contain erroneous data. These data represent either a survey coverage or boundary treatment issue that the CSAT routine was unable to resolve. Such errors were not included in the calculation of average shoaling rate.

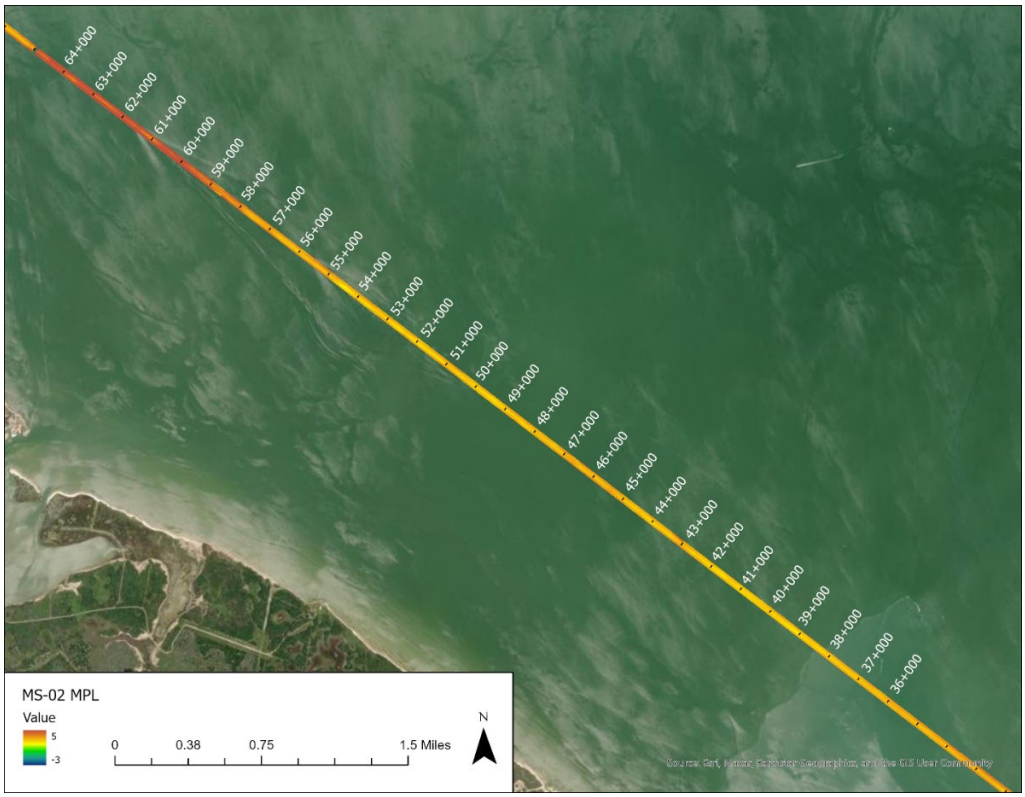


Figure 2-30: MPL CSAT Shoaling Rate 2020-2024



Figure 2-31: LAC CSAT Shoaling Rate 2020-2024 (Black boxes = Existing OWPAs)



Figure 2-32: ATB CSAT Shoaling Rate 2020-2024

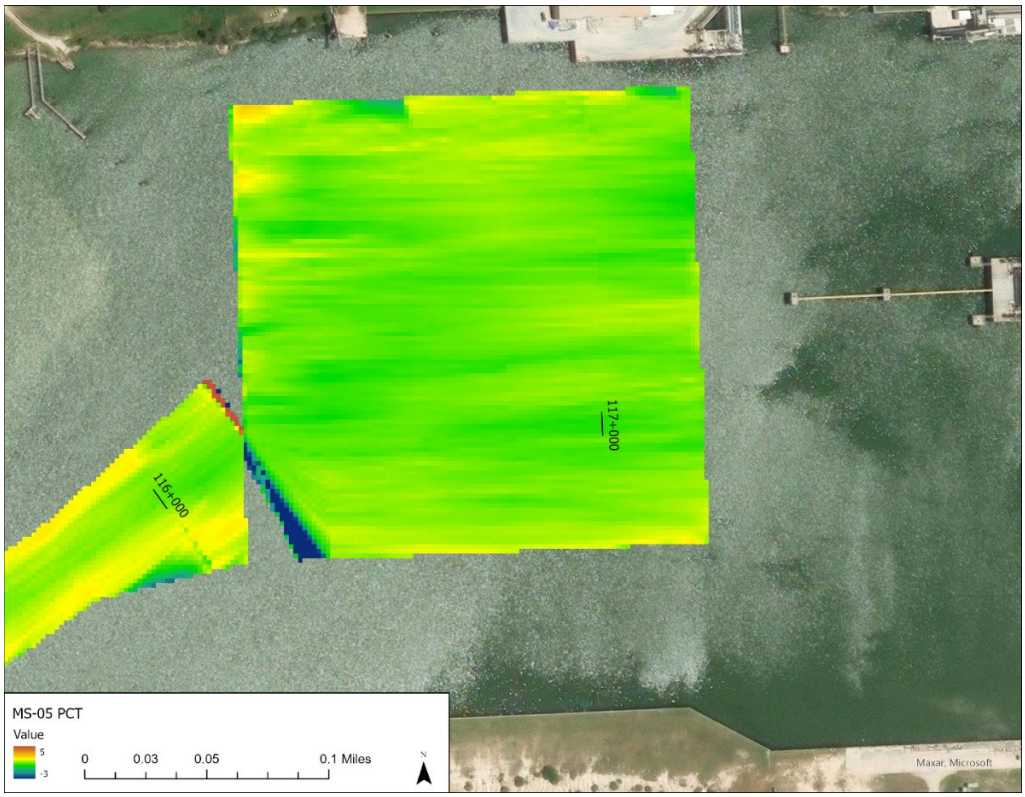


Figure 2-33: PCT CSAT Shoaling Rate 2020-2024 (Erroneous overlap in blue not used)

Just as previous CSAT runs have shown in the MSC, the greatest shoaling volume was for the LAC reach, while the ATB reach featured the highest shoaling rate. While the CSAT tool is more useful in quickly identifying shoaling hotspots and trends, the RMS data is needed to check that shoaling volumes are well represented on average.

2.5.2 Resident Management System (RMS)

The RMS database includes data for each dredging contract pertaining to the date of dredging, credit cubic yards, gross cubic yards, placement areas utilized, and reaches dredged. Remarks are also available in dredging data sheets. An example of the dredging data sheet format is shown in Table 2-10.

Table 2-10: RMS Dredging Data Sheet Format

Report Date	Gross Cubic Yards	Credit Cubic Yards	Disposal Area Used	Reach Dredged
12/7/2020	2,164	1,967	Sundown Island	DREDGING NW. @ -42' MLLW FROM STA. 15+000 TO 15+145

Using the dredging data sheets, a routine was developed to bin dredging volumes for selected stationing (reaches) and return the average time elapsed between events. Manual checks were made to ensure the routine was properly capturing the total volume, though averaging error is recognized due to the time variable assignment (start and end of dredging).

2.5.3 Selection of Existing Condition

The CSAT and RMS data agree fairly well for the 2020-2024 period of analysis. Overall, the MSC shoaling volume shows 99% agreement. However, there are larger discrepancies seen at the SJC and LAC reach. The strongest agreement is reach MPL at 99.8%, and the lowest agreement is in reach SJC, indicating 50% disagreement (Table 2-11).

Table 2-11: Estimated Agreement between RMS and CSAT for 2020-2024

Reach	% Agreement
SJC	48.0
MPL	99.8
LAC	92.5
ATB	96.2
PCT	85.6

The comparison of RMS to CSAT is shown below in Figure 2-34.

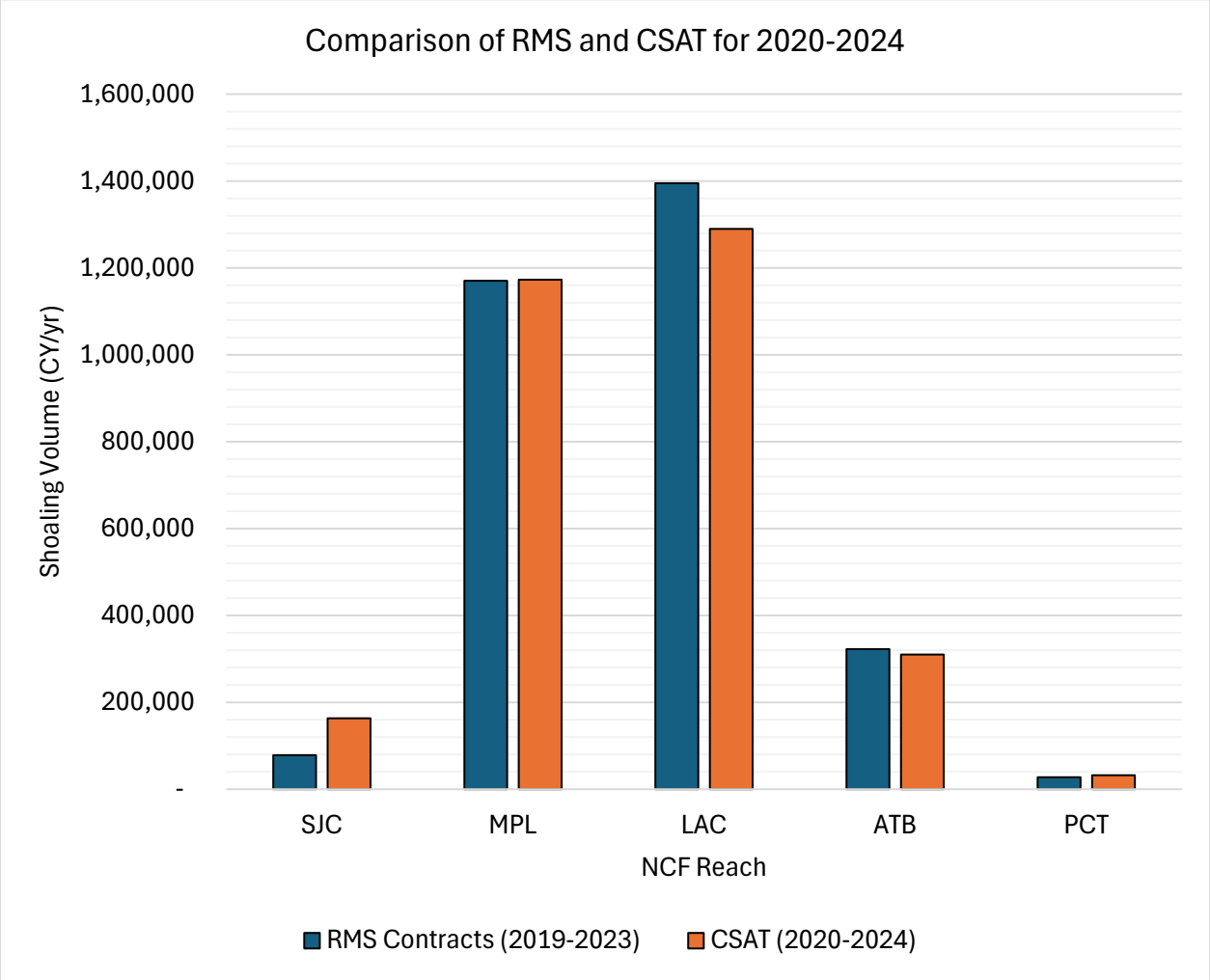


Figure 2-34: Validation of CSAT using RMS Dredging Data

A more refined approach was taken to compare the CSAT and RMS data along the MSC. On average, the two datasets show strong concurrence, however, offshore there is a clear discrepancy between the anticipated shoaling rate and what is actually dredged. A summary of the calculated rates is shown in Table 2-12.

Table 2-12: Calculated Shoaling Rates for MSC using RMS and CSAT

Reach #	Station	RMS-Calculated Rate (2019-2024) (ft/yr)	CSAT Rate (2020-2024) (ft/yr)
1	-20+246 to -14+000	0.50	1.79
2	-14+000 to 0+000	0.27	0.27
3	0+000 to 20+000	0.34	0.28
4	20+000 to 25+000	3.78	3.09
5	25+000 to 35+000	4.23	3.32
6	35+000 to 50+000	2.93	2.95
7	50+000 to 73+500	3.05	3.45
8	73+500 to 85+500	2.12	1.79
9	85+500 to 90+500	3.75	3.44
10	90+500 to 97+000	3.56	3.42
11	97+000 to 102+000	6.71	5.70
12	102+000 to 108+000	6.04	5.77
13	108+000 to 118+502	3.62	3.66

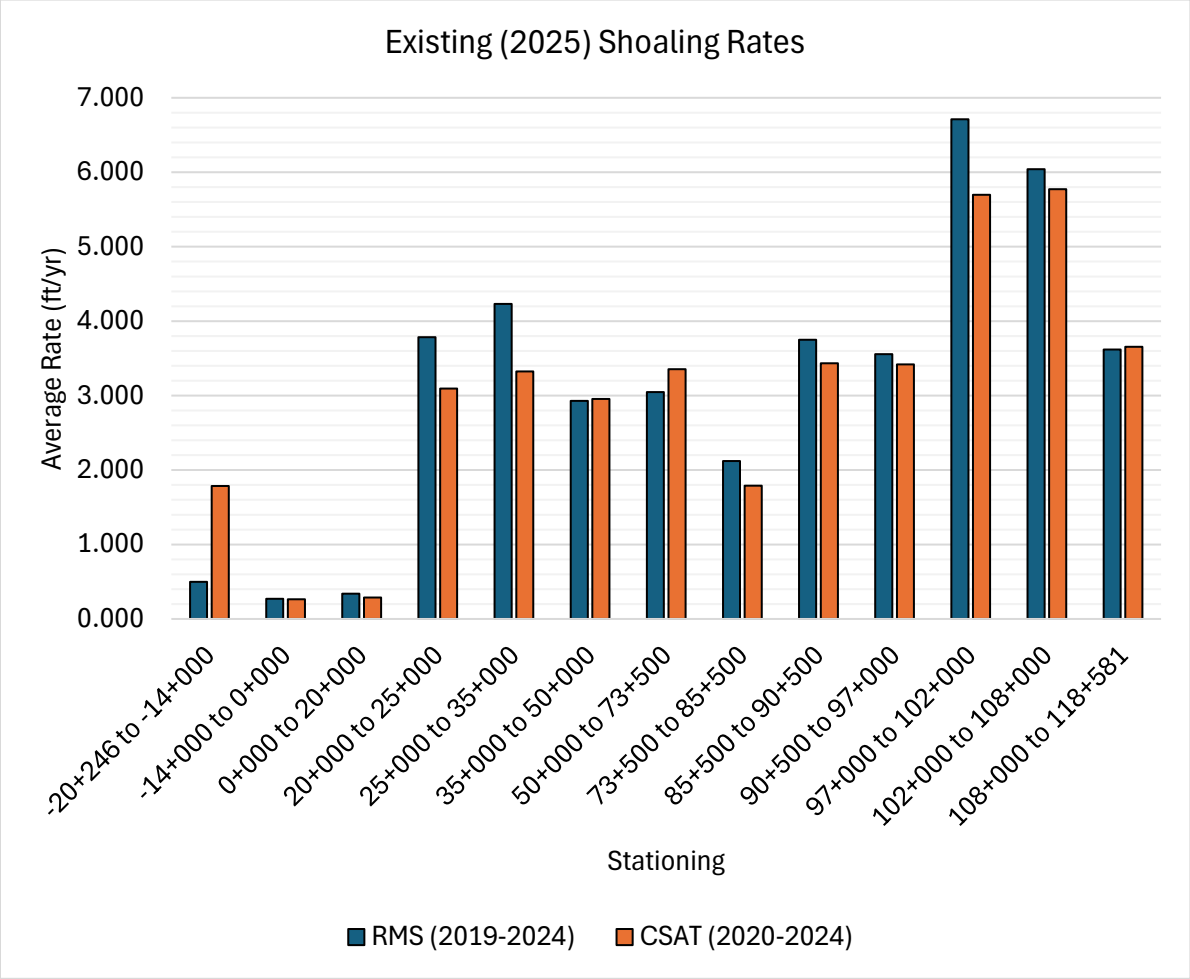


Figure 2-35: Comparison of CSAT and RMS for the MSC

By inspection of Figure 2-35, CSAT rates are capturing the same trends as the RMS data. Most of the difference between RMS and CSAT is credited to excess dredged material present on the slopes of the channel. The offshore reach, station -20+246 to -14+000, shows the most disagreement. This pronounced discrepancy can likely be attributed to one or several of the following:

- “Sweeping” of dredged material in which case the hopper is not suctioning material; rather, the dredge is pushing material outside of the channel template.
- Survey measurement error is present in the CSAT run.
- Continual movement of the offshore sand bar, which may return the channel to near-authorized depth between contract award and execution.

Since existing conditions are used to inform dredging costs, the RMS shoaling rate is chosen to inform the existing condition offshore. At this stationing, there is little dredging history to support the rather large shoaling volumes reported by CSAT. However, it should be documented that there is a risk of higher shoaling rates in the future for the offshore channel. On the contrary, the mid-upper reaches of the MSC show strong agreement between RMS and CSAT. Since the RMS data captures additional dredging (gross) volume, it is most appropriate to choose the CSAT data for these reaches.

Table 2-13 details the existing shoaling rates used in the analysis.

Table 2-13: Existing Shoaling Rates used in Shoaling Analysis

Reach #	Station	Existing Rate (ft/yr)
1	-20+246 to -14+000	0.50
2	-14+000 to 0+000	0.27
3	0+000 to 20+000	0.28
4	20+000 to 25+000	3.09
5	25+000 to 35+000	3.32
6	35+000 to 50+000	2.95
7	50+000 to 73+500	3.45
8	73+500 to 85+500	1.79
9	85+500 to 90+500	3.44
10	90+500 to 97+000	3.42
11	97+000 to 102+000	5.70
12	102+000 to 108+000	5.77
13	108+000 to 118+502	3.66

The average existing shoaling rate in the MSC is estimated as nearly 2.9 ft/yr.

2.5.4 2019 vs 2025

The new shoaling volume is shown in Table 2-14 in comparison to the 2019 feasibility assessment. The recommended shoaling volume is based on the comparison of CSAT and RMS-calculated shoaling rates, foreseeable discrepancies in the data, and best engineering judgment.

Table 2-14: Comparison of 2019 vs 2025 Existing Shoaling Volume

MSC Shoaling Volume	2019 Study	2025 Study
MCY/yr	**2.04**	**2.97**

The change in shoaling volume for the existing condition between 2019 and 2025 represents a 47% increase.

Since the offshore CSAT volume has yet to be adequately validated, it is recommended that additional surveys be acquired and subsequent analysis pursued during PED. In terms of risk, it is possible that existing volumes are higher than what is reported. To mitigate this risk, contingency is assigned to maintenance costs.

2.6 Coastal Modeling System

Coastal Modeling System (CMS) was used to investigate and evaluate morphologic changes and sediment shoaling rates for the ship channel expansion project. CMS is an integrated two-dimensional (2D) numerical modeling system for simulating waves, currents, water levels, sediment transport and morphology change, and salinity and temperature. CMS (domain pictured in Figure 2-36) is composed of CMS-Flow and CMS-Wave. CMS-Flow solves the conservative form of the shallow water equations, while CMS-Wave is a spectral phase-averaged model that solves the wave action conservation equation.

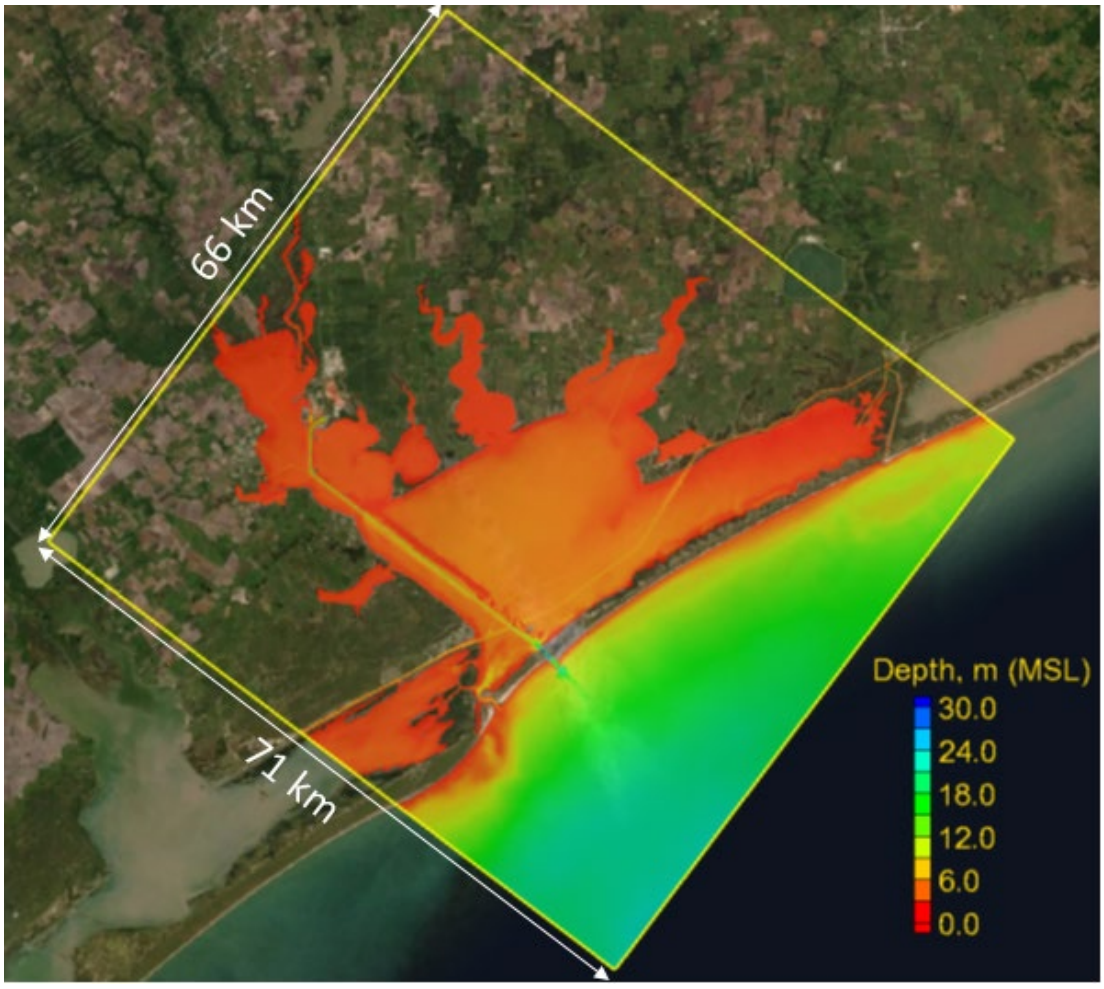


Figure 2-36: Coastal Modeling System Domain

CMS Flow + Wave was developed for the MSC and has been validated in previous studies. Likewise, with-project salinity and temperature changes were studied in past efforts for Matagorda Bay (Section 2.3.9).

Recent validations of the CMS looked at the August-September 2018 timeframe for water levels and currents. Validation for sediment transport and morphology change was also recently conducted for 2019-2020. The sediment transport scheme employed by CMS considers both cohesive and non-cohesive effects.

A few key findings should be noted from the CMS modeling:

1. For each scenario (PWOP, FWP, etc.), channel shoaling is higher in Lavaca Bay (relative to other areas) as a consequence of strong cross-channel currents and wind-generated waves acting on the shallow bay bottom.
2. The lower bay, south of Chester Island, continues to erode under PWOP conditions due to strong currents from the entrance bottleneck.
3. Sedimentation, that is the shoaling rate, is expected to be little changed for the majority of the MSC under with-project conditions.

Future conditions presented herein do not consider RSLC for the shoaling analysis. Previous CMS sedimentation studies of Matagorda Bay determined that the addition of RSLC did not change results significantly.

RSLC is believed mostly inconsequential to the channel sedimentation for a few reasons:

- RSLC is a much smaller factor in with-project scenarios when compared to channel modifications, bottleneck removal, and the inclusion of large OWPA sites.
- RSLC estimates vary greatly depending on the reference gauge(s) and projection (curve) that is selected, adding uncertainty.
- There is ambiguity as to how RSLC estimates should be applied to a bathymetric surface comprised of data from varying years.
- As sea levels rise, the gain in mean sea level may offset any potential draft restriction created by more shoal material.

The inclusion of RSLC has great value in understanding the sensitivity of water level to channel shoaling behavior. However, given much larger uncertainties in the analysis, RSLC is not necessary to inform the 50-yr channel maintenance plan. Changes in sediment transport as a consequence of RSLC are expected to be counteracted by the system’s propensity to find equilibrium.

2.7 Future Without-Project Conditions

The FWOP conditions are the same as existing conditions; the only difference is the feasibility-level bottleneck removal is integrated into the CMS domain at the MSC entrance. The construction of the MSC bottleneck removal will slightly increase sedimentation closer to the entrance. Due to this anticipated change, FWOP shoaling volumes are slightly higher than existing.

The effective OMR&R (Operations, Maintenance, Repair, and Replacement) cost of the project is gauged by the difference between FWP and FWOP conditions (Section 9). Both FWP and FWOP conditions include the jetty bottleneck removal.

2.7.1 Shoaling Analysis

The 2019 shoaling analysis did not account for FWOP conditions changing as a result of the planned bottleneck removal (see Figure 2-37). The new FWOP shoaling rates are estimated by use of the CMS results and existing rates.

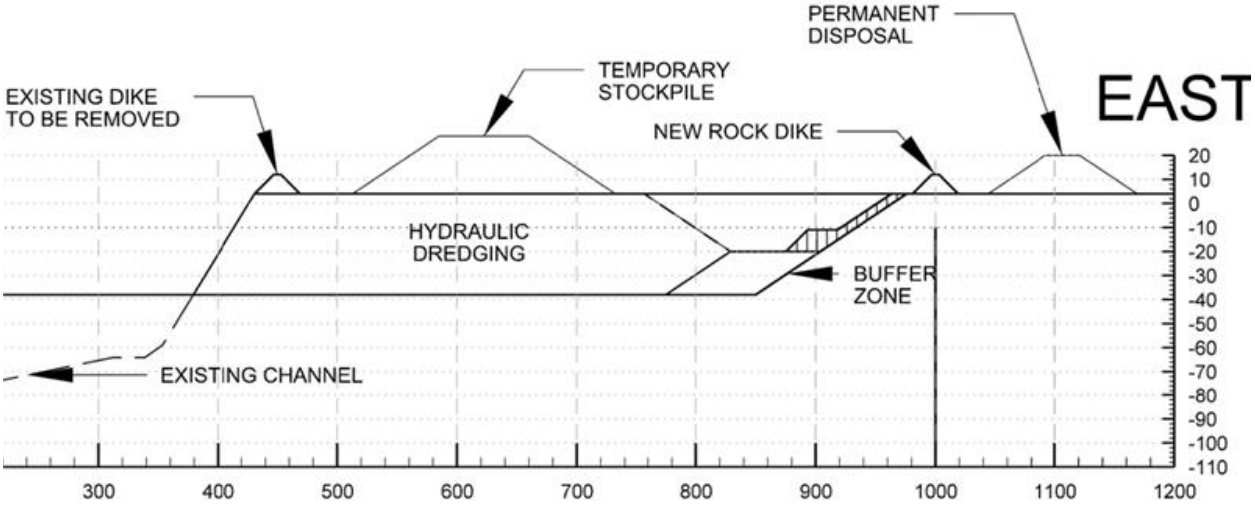


Figure 2-37: Feasibility Plan for Bottleneck Removal represented in Future Conditions

The MSCJD design was incorporated into the CMS domain for FWOP conditions. The feasibility template was merged into the CMS bathymetry (as shown above) to fully represent the future expectation for the federal channel.

To determine the FWOP and FWP shoaling rates, a scaling factor was derived by relating existing shoaling rates to those provided by the CMS (PWOP). Scaling the model shoaling rate is one of several methods to determine the FWP and FWOP shoaling impacts.

Another common method in navigation engineering is application of the PIANC “Volume-of-Cut” method. Volume-of-cut method utilizes the seabed elevation, channel depth, and existing rate to estimate the with-project shoaling rate (Section 2.8.3). A downfall of the Volume-of-Cut method is that it does not sufficiently account for morpho-dynamic pathways. The empirical equation employs a calibrated siltation rate parameter, which represents a constant process. In high-energy environments (offshore) or areas with significant sediment influx (upper-bay), the PIANC approach is far less reliable. For the purpose of projecting future shoaling, the CMS scaled rate is deemed most appropriate.

The FWOP shoaling volumes are shown in Figure 2-38 in comparison to existing (PWOP) volumes.

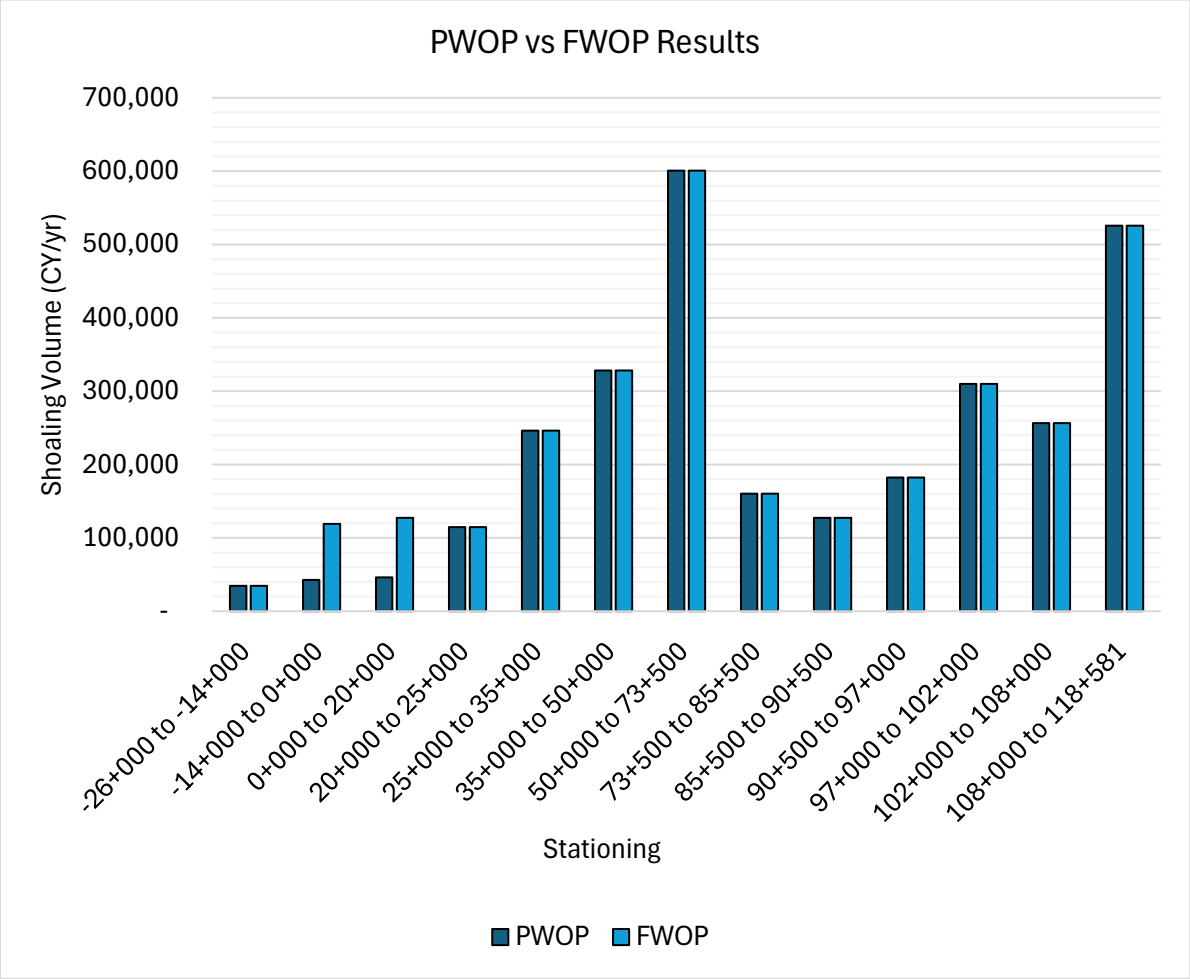


Figure 2-38: Projection of FWOP Shoaling Volumes

By use of CMS, the FWOP shoaling volume closer to the inlet shows a slight increase. While this sedimentation is expected due to the decreased velocities, the shoal material may not be dredged volume because of the much greater depths in this reach.

Shoal material is expected to go up between stations -14+000 and 20+000. Table 2-15 outlines the differences between PWOP and FWOP shoaling volume. The total existing shoaling volume is nearly 2.97 MCY/yr, while the FWOP shoaling volume is 3.13 MCY/yr. The reduced velocity bayside of the MSC inlet allows for more accretion of maintenance materials at the entrance and lower bay. The same effect is clearly evident in the FWP scenario (Section 2.8.2).

Table 2-15: PWOP vs FWOP Shoaling Volume

Stationing	PWOP Volume (CY/yr)	FWOP Volume (CY/yr)
-20+246 to -14+000	34,578	34,578
-14+000 to 0+000	42,697	118,996
0+000 to 20+000	46,194	127,357
20+000 to 25+000	114,564	114,564
25+000 to 35+000	246,195	246,195
35+000 to 50+000	328,207	328,207
50+000 to 73+500	600,666	600,666
73+500 to 85+500	160,176	160,176
85+500 to 90+500	127,256	127,256
90+500 to 97+000	182,216	182,216
97+000 to 102+000	309,858	309,858
102+000 to 108+000	256,493	256,493
108+000 to 118+502	525,702	525,702
Total	**2,974,801**	**3,132,263**

2.8 Future With-Project Conditions

FWP modeling includes FWOP conditions, along with the deepening and widening of the MSC (Alternative A), a sand engine (SE) near the south jetty, and open water placement areas (OWPAs), including the modification of Chester Island, a new Bird Island, and the expansion at PA 18/19 near Calhoun Port Authority (CPA).

2.8.1 Dredged Material Placement

Appendix E outlines the recommended management plan for dredged material resulting from the construction and maintenance of the MSCIP (FWP conditions). The 2025 DMMP is illustrated in Figure 2-39, designed to accommodate both NW and O&M dredged materials.

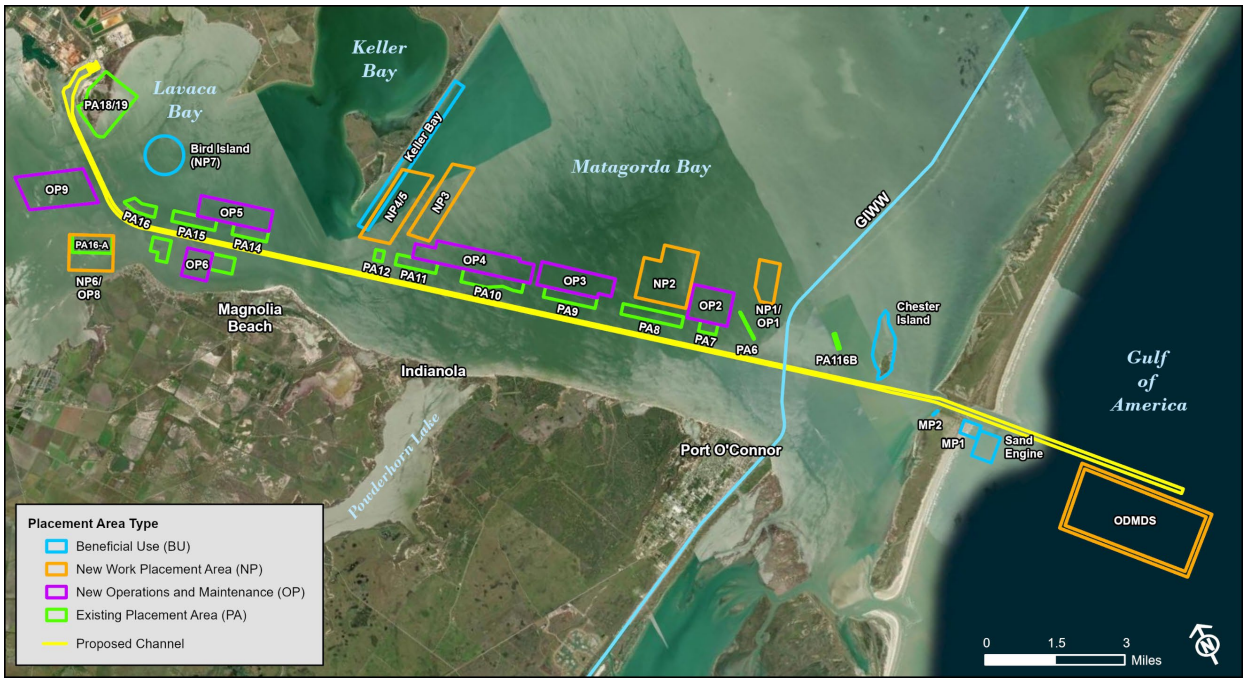


Figure 2-39: 2025 Proposed FWP DMMP

The DMMP sites for NW material are provided in Table 2-16.

Table 2-16: New Work DMMP Sites

PA Site	Alternative A Stationing
ODMDS	-26+000 to -14+000
SE	-14+000 to 0+000
NP1	0+000 to 20+000
NP2	20+000 to 47+000
NP3	47+000 to 72+000
NP4/5	72+000 to 97+000
NP6	97+000 to 101+000
Bird Island	101+000 to 118+581

Priority O&M sites are listed in Table 2-17. More explanation about “priority” O&M sites is provided in Appendix E.

Table 2-17: O&M (Maintenance) DMMP Priority Sites

PA Site	Alternative A Stationing
ODMDS	-26+000 to -14+000
SE	-14+000 to 0+000
MP1*	
Chester Island	0+000 to 20+000
MP2*	
OP1	20+000 to 25+000
OP2	25+000 to 35+000
OP3	35+000 to 50+000
OP4	50+000 to 73+500
OP5	73+500 to 85+500
OP6	85+500 to 90+500
PA-15A	90+500 to 97+000
OP8	97+000 to 102+000
OP9	102+000 to 108+000
PA 18/19 Exp.	108+000 to 118+581
*MP1 and MP2 are within USACE real estate easement	

The following OWPA sites may reduce the typical wave energy at nearby shoreline:

- NP3
- NP4/5
- Keller Bay PA (beneficial use)

Western OWPAs, such as NP6/OP8, may provide more protection from northern winds during the fall and winter months. Excluding BU sites, the location and size of OWPAs were not designed to provide shoreline benefit. The sizing of OWPA sites and further details are provided in the Appendix E.

The FWP DMMP, a result of the widening and deepening the MSC, was integrated into the CMS domain (see Figure 2-40) by use of NW and O&M volumes. The full development of the DMMP can be read in Appendix E.

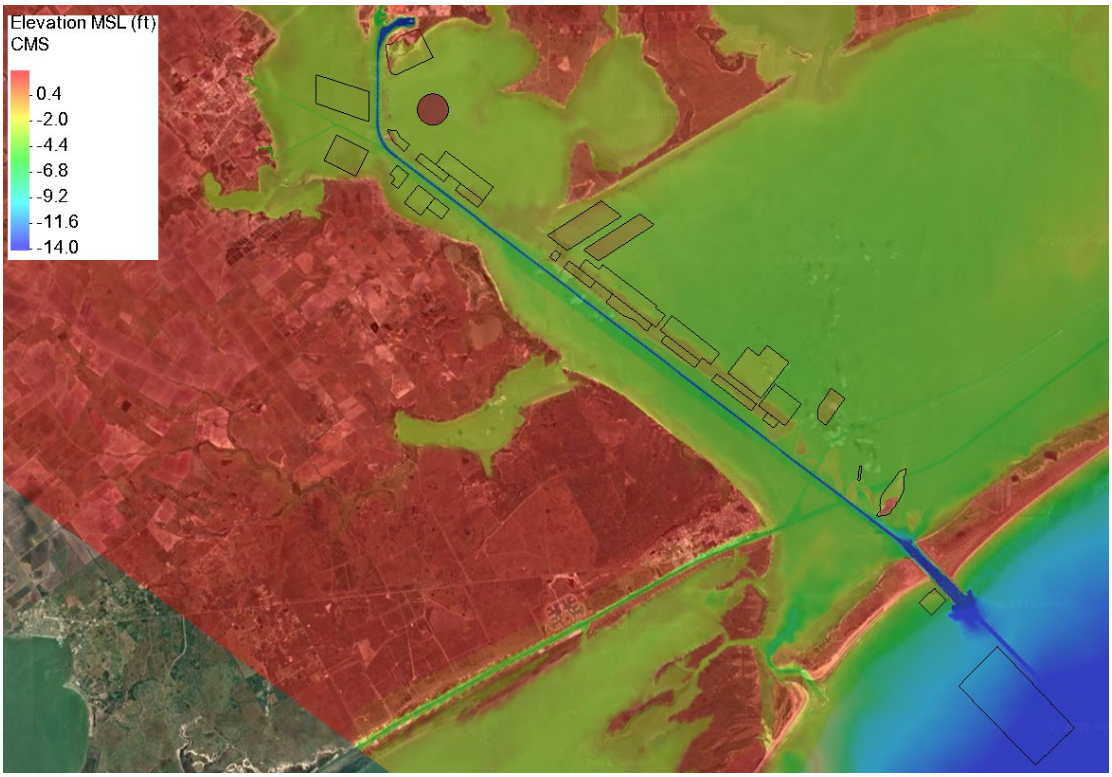


Figure 2-40: FWP CMS Modified Bathymetry

The model morphologic response (FWP vs PWOP) is shown in Figure 2-41 for a profile drawn down the channel centerline.

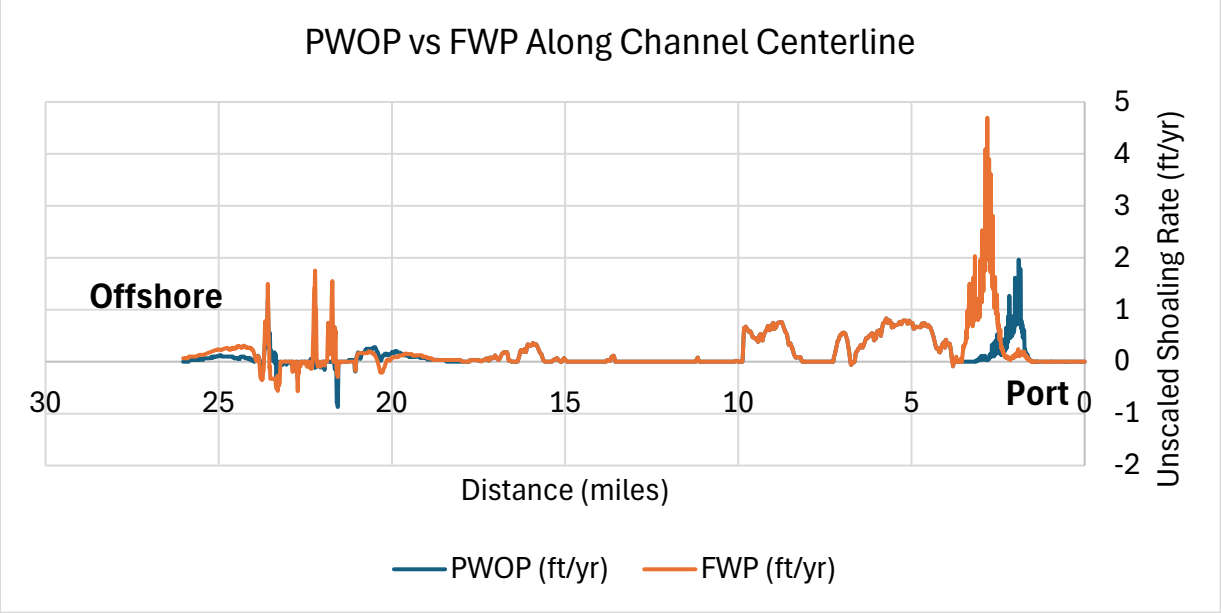


Figure 2-41: PWOP vs FWP Model Morphologic Response (Unscaled)

The FWP response is higher near the entrance where the bottleneck has been removed, and significantly higher near the bend easing as a consequence of material being transport back to the MSC from proposed PA sites.

Under FWP conditions, the channel sedimentation is largely increased near the bend easing to Point Comfort (Port Lavaca channel). This reach of channel is a notorious shoaling problem; FWP conditions indicate even worsened sedimentation as a consequence of nearby OWPAs. The peak of the channel shoal appears to shift further south under FWP conditions. The combination of bend easing and increased dredged material transport makes the northward turn more susceptible to sediment deposition.

The supposed “stilling” effect at the MSC turn (bend easing) does not allow for the increased sediment load to be easily redistributed by the tidal current. A “dead zone” of lower velocity (weak circulation) allows for heavy accretion (Figure 2-42).



Figure 2-42: FWP Morphologic Change from CMS (m)

As can be seen in Figure 2-42, most NW material sites in the DMMP have high erosion signatures. Though NP3 and NP4/5 are located further from the channel, the shallow water that is created increases the bed shear stress. Consequently, the erosion is also higher at the upper-bay NW site, NP6.

In Lavaca Bay, much of the OWPA materials are easily eroded. PAs in mid-bay are also eroded; however, the transport of these materials appears less consequential to shoaling in the adjacent section of channel.

In postprocessing CMS results, 3 observational arcs were drawn to observe the sediment flux between the natural bay bottom and channel (Figure 2-43). The primary focus was Lavaca Bay, where the FWP condition features a heavily congested placement plan in relatively shallow water.

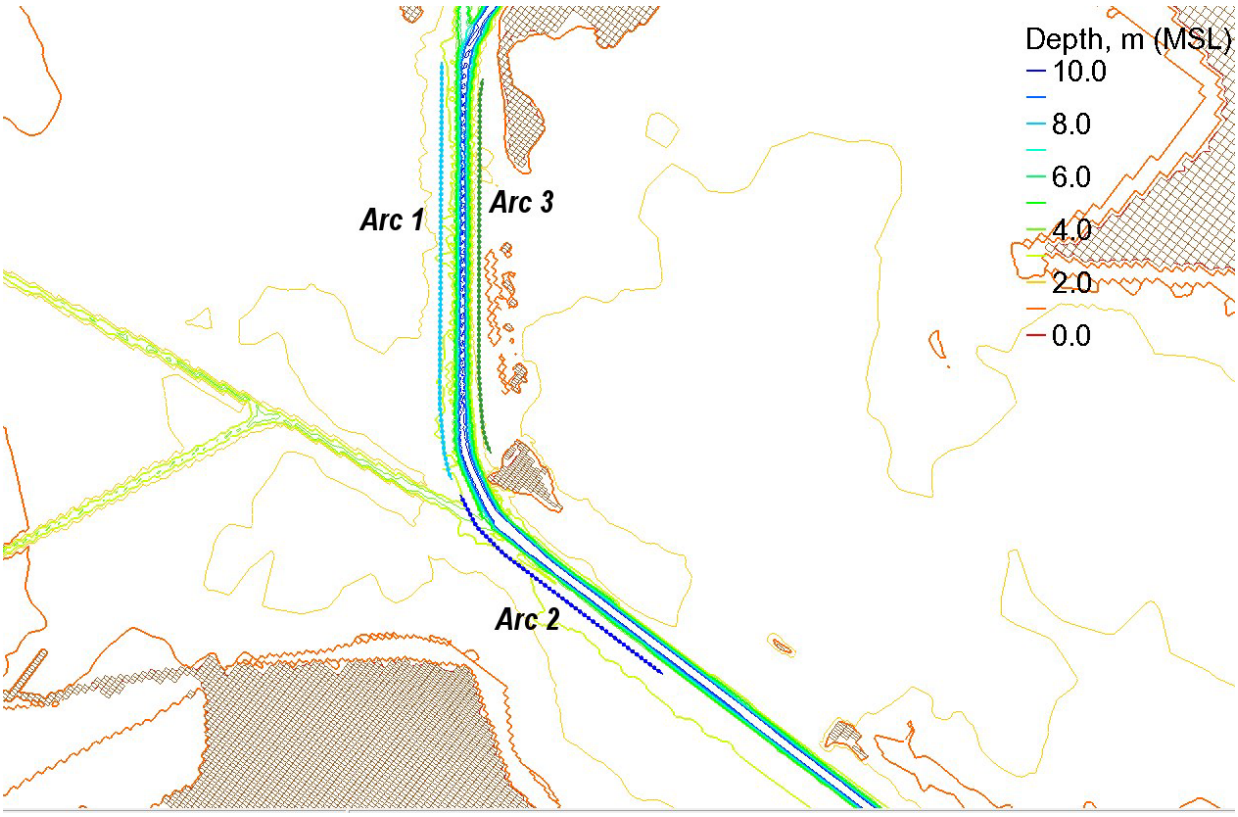


Figure 2-43: Observation Arcs for Sediment Transport in Lavaca Bay

By tracking the sediment flux for a representative month within the model, it becomes clear that the channel is capturing sediment from OWPA sites in Lavaca Bay.

With only channel widening and deepening, the shoaling rate is not drastically changed. The addition of OWPA sites, however, has a measurable impact on channel sedimentation; the total flux of sediment depends largely on proximity, material composition, and effective bed height.

Figure 2-44 illustrates how the DMMP is contributing more sediment to the channel under FWP conditions in the Lavaca Bay area. The concentration of sediment is effectively doubled at Arc 1, west of the MSC, due mostly to the presence of OP9 and NP6/OP8. At Arc 2, just south of Port Lavaca Channel (CPL), the sediment flux is roughly a factor of 1.5. Even to the east of the MSC, the model shows a slight increase in sediment transport towards the channel.

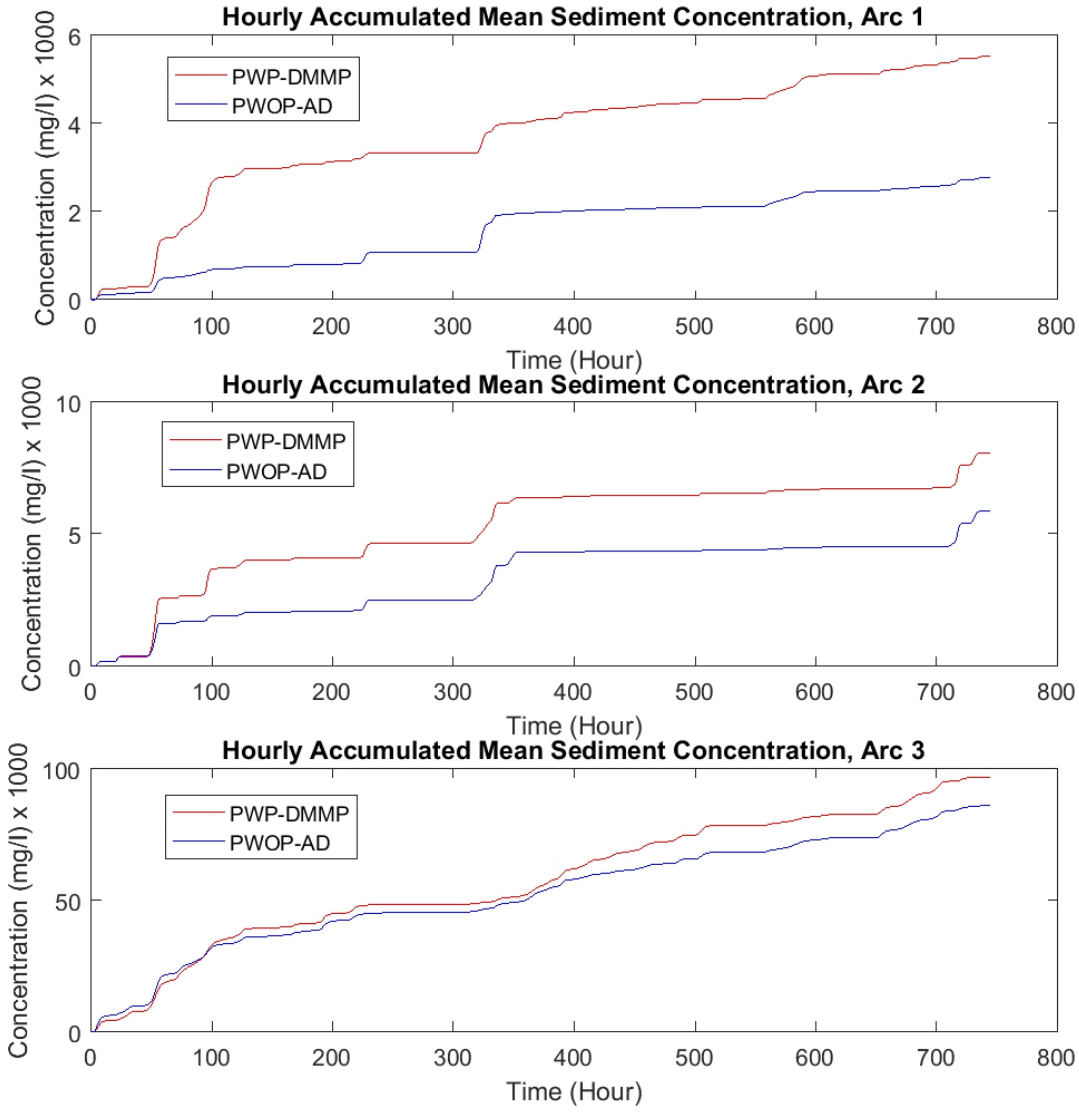


Figure 2-44: Sediment Contribution to Channel under Future Conditions (With & Without DMMP)

"PWP-DMMP" is the *FWP* condition. "PWOP-AD" refers to the CMS modeling scenario where only the channel deepening and widening is simulated for future conditions – *no OWPA* materials from the DMMP are placed in the model.

The first iteration of the DMMP (2019) aimed to reduce sedimentation in the Lavaca Bay reaches by confining NW materials and relocating O&M OWPA sites. The updated model results demonstrate that regardless of the location, east or west, OWPA materials in or near Lavaca Bay will likely migrate back to the channel.

Figure 2-45 depicts the consequence of utilizing the OWPA sites listed in Section 2.8.1. Substantial increases are seen in the model rate between stations 97+000 and 108+000.

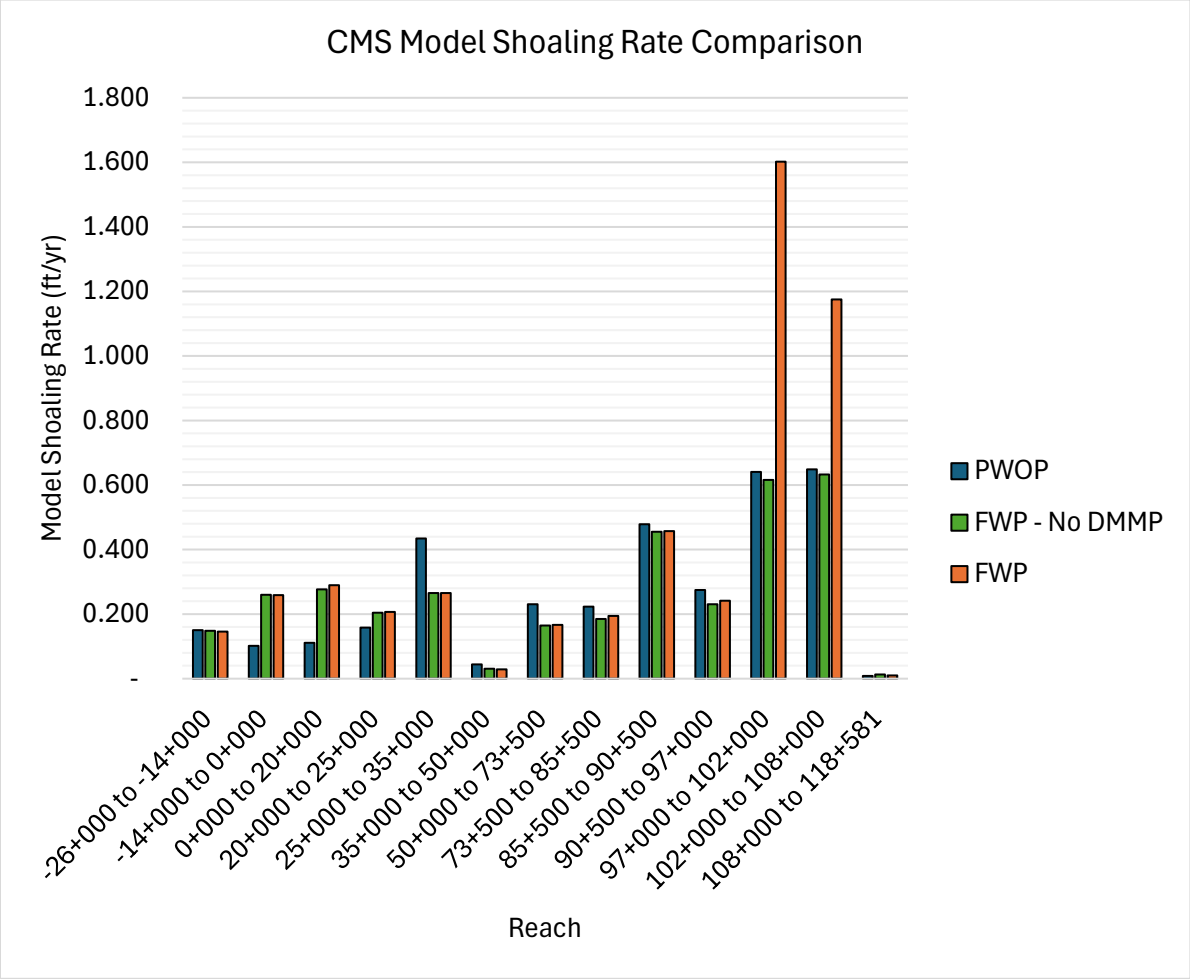


Figure 2-45: Comparison of Model Shoaling Rate for PWOP, FWP, and FWP - No DMMP

The following can be concluded from the FWOP and FWP modeling:

- The DMMP will increase the shoaling rate in the Lavaca Bay reaches; proactive steps should be taken to address this change.
- The removal of the jetty bottleneck will contribute a relatively small but measurable increase to the shoaling rate in the lower-bay reaches of the MSC.
- The FWP shoaling rate is not anticipated to worsen for much of the MSC (Station 20+000 to 97+000) as a consequence of the DMMP or channel improvements.

2.8.2 Shoaling Analysis

The findings of the FWP shoaling analysis highlighted several major challenges for the maintenance of the MSC under construction of Alternative A.

- The total change in channel footprint is nearly a factor of 1.8; this, combined with the increased sedimentation in several reaches, results in considerably higher shoaling volume.
- The open-water nature of the DMMP is a constraint on effective sediment management, creating a nearly unlimited sediment supply for the channel.

- The predominant mode of sediment transport in Matagorda Bay is east to west; sediment will return to the Lavaca Bay reaches of the MSC regardless of hydrodynamic trends and likely deposit disproportionately near the bend easing at Port Lavaca Channel.
- The DMMP does not provide an adequate solution to confine (existing) maintenance material that is currently recycling between the bay and channel.

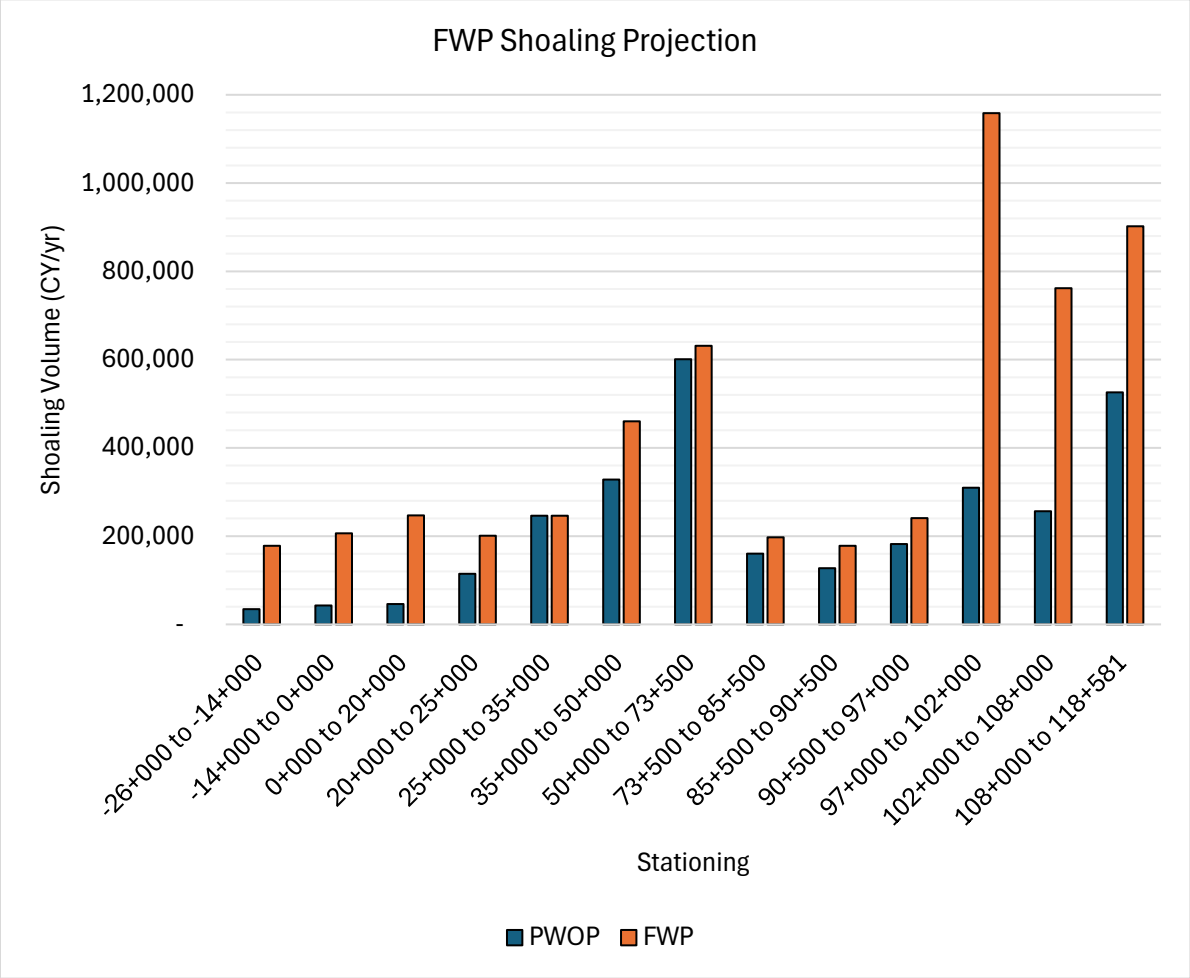


Figure 2-46: Projection of FWP Shoaling Volumes

Table 2-18 and Figure 2-46 detail the findings of the shoaling analysis for FWP conditions. The total increase in shoaling, based on PWOP figures, is nearly 90%. To reduce the FWP maintenance requirement in the upper-reaches (97+000 to 108+000), the dredged material management strategy for Lavaca Bay should be revisited in PED.

Options to reduce FWP maintenance risk in the upper-reaches include:

- Confine OP9 (Could be used as BU – see Section 6.3.1).
- Decrease the use of OWPAs in Lavaca Bay and seek BU opportunities at shoreline if possible.
- Maximize the pumping distance from the channel in maintenance contracts by specifying discharge zones when capacity allows.

Table 2-18: PWOP vs FWP Shoaling Volume

Stationing	PWOP Volume (CY/yr)	FWP Volume (CY/yr)
End to -14+000	34,578	177,833
-14+000 to 0+000	42,697	211,656
0+000 to 20+000	46,194	253,071
20+000 to 25+000	114,564	201,578
25+000 to 35+000	246,195	246,195
35+000 to 50+000	328,207	459,624
50+000 to 73+500	600,666	628,589
73+500 to 85+500	160,176	196,108
85+500 to 90+500	127,256	177,918
90+500 to 97+000	182,216	240,120
97+000 to 102+000	309,858	1,176,398
102+000 to 108+000	256,493	770,974
108+000 to CPA	525,702	902,138
Total	**2,974,801**	**5,642,202**

2.8.3 Comparison of FWP Rate to Volume-of-Cut Method

The PIANC Volume-of-Cut approach looks to quantify the shoaling at time T*. The channel seabed, h_{T^*}, is related to the initial bed elevation h_0. The corresponding siltation rate parameter, v, is calculated as follows, where h_e is the equilibrium depth of the seabed.

$$\nu = \ln\left(1 - \frac{h_{T*} - h_0}{h_e - h_0}\right) * \left(-\frac{h_0}{T^*}\right) \quad (1)$$

By use of the siltation rate, the channel depth is derived by the following relationship.

$$h_{T*} = h_0 - (h_0 - h_e)\left(1 - \exp\left(-\frac{\nu T^*}{h_0}\right)\right) \quad (2)$$

The average shoaling rate is then:

$$Average\ Shoaling\ Rate = h_0 - h_{T*} \quad (3)$$

By relating the average rate in the existing channel (Table 1-1) to the RP (Table 1-2), the change in shoaling rate is calculated (Equation 3). Comparison of PIANC shoaling volumes with the CMS-derived results highlights the benefit of using CMS. CMS predicts little to no change at the farthest offshore reach of the MSC, while PIANC predicts a much higher shoaling volume.

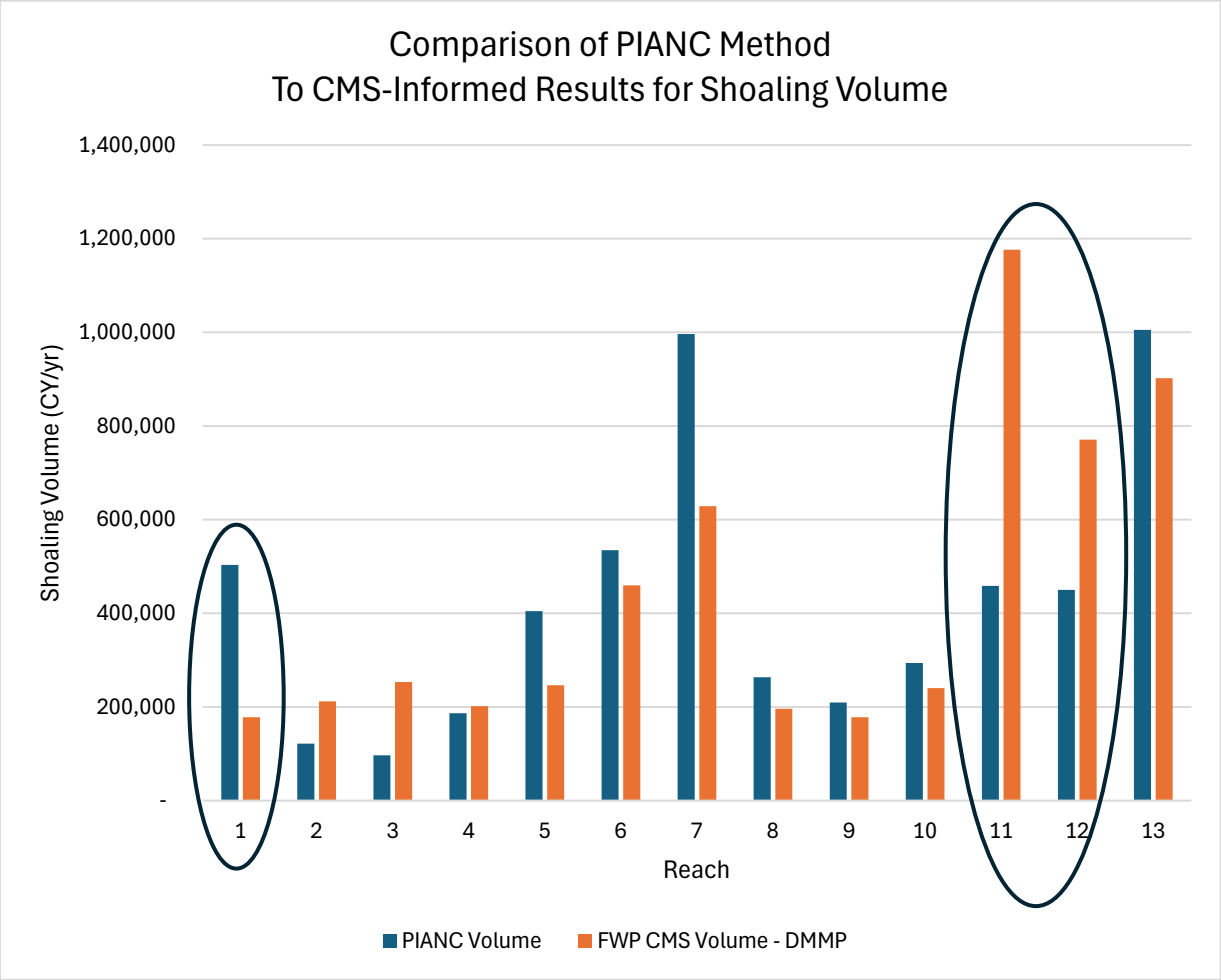


Figure 2-47: Comparison of PIANC Volume-of-Cut to CMS Results

As can be seen in Figure 2-47, CMS captures higher sedimentation in reaches 11-12 as a result of the DMMP. Likewise, the FWP removal of the bottleneck results in more shoaling, which cannot be captured by the Volume-of-Cut method. The CMS predicts lower sedimentation for the middle reaches of the MSC (5-10). Though there are large discrepancies between reaches, the CMS and PIANC Volume-of-Cut method agree fairly well on the total shoaling volume (Table 2-19).

The risk of poor offshore agreement between CMS-informed results and PIANC is higher dredging costs for entrance channel contracts. The risk to available draft is low given relatively deep water and the apparent migration of these sediments over time. Furthermore, there is no risk to available capacity since the ODMDS is to be used for the -14+000 to -26+000 channel stationing.

Table 2-19: Comparison of PIANC Volume-of-Cut to CMS Results

Stationing	PIANC Volume (cy/yr)	FWP CMS Volume (cy/yr)
-26+000 to -14+000	503,374	177,833
-14+000 to 0+000	121,732	211,656
0+000 to 20+000	96,830	253,071
20+000 to 25+000	186,459	201,578
25+000 to 35+000	404,536	246,195
35+000 to 50+000	534,638	459,624
50+000 to 73+500	996,436	628,589
73+500 to 85+500	263,563	196,108
85+500 to 90+500	209,395	177,918
90+500 to 97+000	293,758	240,120
97+000 to 102+000	458,637	1,176,398
102+000 to 108+000	450,156	770,974
108+000 to 118+581	1,005,285	902,138
Total	**5,524,800**	**5,642,202**

2.8.4 2019 vs 2025

A comparison of the 2019 FWP shoaling volume to that of 2025 is shown in Table 2-20. The 2025 shoaling volume includes updated existing conditions and numerical modeling, as well as a different DMMP.

Table 2-20: Comparison of 2019 vs 2025 FWP Shoaling Volume

MSC Shoaling Volume	2019 Study	2025 Study
MCY/yr	**3.08**	**5.64**

The change in FWP shoaling volume between 2019 and 2025 represents an 83% increase. In terms of incremental change to O&M (FWP to existing), the 2025 analysis is 40% higher than the annual shoaling increase determined in 2019.

3. Surveying, Mapping and Other Geospatial Data

3.1 Surveys

Multibeam hydrographic surveys conducted by the Galveston District's Southern Area Office in August 2023 were used to support this study. The data were imported into HYPACK to generate ground surfaces along the proposed channel alignment for the purpose of estimating new work dredging quantities. As the design progressed, channel templates of constant width but varying depths were superimposed onto the survey surfaces to evaluate alternative channel depths. During the Preconstruction Engineering and Design (PED) phase, updated hydrographic and topographic surveys may be acquired to more precisely define the improved channel's location relative to nearby land, docks, and jetties.

3.2 Mapping

Maps from Galveston District's historical archives were utilized during the initial and plan formulation phases. Most recent imagery files were used to create the plates and drawings for this appendix, supplemented by NOAA charts and Google Earth imagery.

3.3 Datum

a. Horizontal: North American Datum of 1983 (NAD 83), Texas State Plane Coordinate System, Texas South Central Zone.

b. Vertical: Mean Lower-Low Water (MLLW). Refer to Section 2.2 for additional information on MLLW datum.

4. Civil Design

4.1 Executive Summary

The civil design for the Matagorda Ship Channel Improvement Project has been refined from the 2019 plan, with the most significant updates driven by a major correction to the previously reported new work dredging volume. During the Preconstruction Engineering and Design (PED) phase, updated hydrographic surveys were conducted, and dredging quantities were recalculated and independently verified. The corrected new work volume, approximately 39.34 million cy, is nearly double the volume documented in the 2019 Engineering Appendix to the IFR/EIS (20 million cy). This correction prompted comprehensive updates to dredging volume estimates, material placement planning, and pipeline crossing treatments, while the overall channel design remains largely consistent with the original plan.

To accommodate the increased dredging volume, a revised Dredged Material Management Plan (DMMP) was developed. Environmental avoidance of sensitive seagrass beds was a critical factor in material placement planning, resulting in the removal of several proposed placement areas on the west side of the channel and the introduction of six new open-water placement areas (NP 1 - 6) and a new beneficial-use Bird Island on the east side. The plan also incorporates the strategic placement of

sandy dredged material in a nearshore Sand Engine (SE) designed to mitigate shoreline erosion.

The design continues to target safe navigation of an 800-foot Aframax-class vessel, with recommended channel depths of -47 feet MLLW inshore (Station 0+000 to Port) and -49 feet MLLW in the Entrance Channel (Offshore to 0+000).

Notable physical refinements from the 2019 plan include:

- Corrected and Updated New Work (NW) Dredging Volumes: The revised new work volume is approximately 39.34 million cy, a substantial increase from the earlier, erroneous estimate.
- Environmental Avoidance-Driven Placement Changes: Several west-side placement areas eliminated to protect seagrass beds; six new east-side open-water placement areas and Bird Island are introduced.
- Increased Advance Maintenance (AM): AM allowances increased from a uniform 2 - 3 feet to as much as 6 feet in high-shoaling zones to make long-term channel maintainability more efficient. See Section 8.
- Optimized Channel Alignment: The Channel length was shortened because the required theoretical dredging prism already extends beyond the established channel limit, making additional dredging unnecessary in that area. Additionally, a few channel reaches were adjusted to soften bends and improve navigability, based on input from channel pilots. See Section 4.8.
- Refined Pipeline Crossing Strategy: Instead of relocating all 16 pipelines, only one requires relocation, 13 will be removed, and two will remain in place under waiver.

These refinements collectively establish the engineering foundation for defining real estate requirements and completing the project’s plans and specifications.

4.2 Introduction

This section presents the engineering updates and refinements to the TSP originally proposed in the 2019 IFR/EIS. The focus is on the design elements associated with new work dredging, including the refined channel configuration, updated volume calculations, and the siting and design of one-time-use placement areas required for initial construction. These design elements and volume estimates serve as the foundation for the project’s construction cost estimate.

While the Ocean Dredged Material Disposal Site (ODMDS) and Sand Engine (SE) were also evaluated for their long-term roles in supporting future maintenance dredging, the detailed analysis of recurring dredging volumes, directly linked to projected shoaling rates, and long-term site performance is addressed in the project's DMMP. Accordingly, this section is limited to the civil design aspects of initial construction and does not address long-term maintenance capacity or operational considerations.

4.3 Design Basis and Existing Conditions

A clear understanding of existing conditions and design datums is essential for properly evaluating the proposed improvements.

4.3.1 Datum

- Horizontal: NAD 83, Texas State Plane Coordinate System, Texas South Central Zone
- Vertical: MLLW was used in the new work volume calculations.

4.3.2 Existing Ship Channel Configuration (Prior to WRDA 2020)

The current as-maintained configuration of the ship channel consists of seven defined reaches, including turning basins. These reaches are described below in sequence from seaward to landward and are also summarized in Table 4-1. All depths are referenced to MLLW.

1. Reach 1: Entrance Channel

   This reach extends approximately 2.70 miles landward from the outer sea bar to the beginning of the jetty system. It is maintained at 40 feet deep, with an advance maintenance (AM) allowance of 3 feet and an overdepth (OD) allowance of 2 feet. The channel width remains 300 feet throughout.

2. Reach 2: Jetty Channel

   Situated between two protective rubble-mound jetties, the Jetty Channel extends 1.14 miles inland from the jetty entrance to the start of the Matagorda Peninsula reach. It is also maintained at 40 feet deep, with allowances of 3 feet AM and 2 feet OD. The width remains constant at 300 feet.

3. Reach 3: Matagorda Peninsula to Light 48 (MPL)

   Beginning at the inland end of the Jetty Channel, this reach continues approximately 12.34 miles inland to Light 48, a key navigational reference. It is maintained at 38 feet deep and 200 feet wide, with 2-foot allowances for both AM and OD.

4. Reach 4: Light 48 to Alcoa Channel (LAC)

   This reach extends 8.49 miles from Light 48 inland to the entrance of the Alcoa Channel. It retains the same maintenance dimensions as the previous reach: 38 feet deep and 200 feet wide, with 2 feet each for AM and OD.

5. Reach 5: Alcoa Channel to Point Comfort Turning Basin (ATB)

   Extending 1.18 miles, this reach connects the Alcoa Channel to the Point Comfort Turning Basin. It is maintained at 38 feet deep and 200 feet wide, with 2-foot allowances for AM and OD.

6. Reach 6: Point Comfort Turning Basin (PCT)

   The Point Comfort Turning Basin measures 1,000 by 1,000 feet, maintained at 38 feet deep with AM and OD allowances of 2 feet each.

7. Reach 7: Point Comfort North and South Basins

   These basins lie adjacent to the Turning Basin and are each maintained at 38 feet deep with 2 feet allowed for both AM and OD. Both are 1,279 feet long. The North Basin narrows in width from 345 feet to 159 feet, while the South Basin maintains a width of 284 feet.

Table 4-1 summarizes the existing configuration of the MSC by seven defined reaches.

Table 4-1: Existing, As-Maintained Channel Configuration (Matagorda Ship Channel)

Reach No.	Reach Name	Channel Station	Depth (ft)	AM (ft)	OD (ft)	Width (ft)	Length (mi)
1	Entrance Channel (Sea Bar to Jetty Channel)	-20+246 - -6+000	40	3	2	300	2.70
2	Jetty Channel	-6+000 - 0+000	40	3	2	300	1.14
3	Matagorda Peninsula to Light 48	0+000 - 65+150	38	2	2	200	12.34
4	Light 48 to Alcoa Channel	65+150 - 110+000	38	2	2	200	8.49
5	Alcoa Channel to Point Comfort Turning Basin	110+000 - 116+223	38	2	2	200	1.18
6	Point Comfort Turning Basin	116+223 - 117+223	38	2	2	1,000	0.19
7	Point Comfort North and South Basins	117+223 - 118+502	38	2	2	* Varies	0.24

AM = Advance Maintenance **OD = Overdepth**

*** Varies:**

North Basin: Width narrows from 345 feet to 159 feet

South Basin: Width is 284 feet

4.3.3 Existing Port Facilities

The primary existing port facility is configured to support depths of nearly 40 ft MLT, with allowances of 2 ft for AM and 2 ft OD. Proposed improvements will increase the depth to potentially -52 ft MLLW; a 3:1 slope is specified from the channel bottom.

Engineering plans detail the proposed turning basin expansion and template widening adjacent to liquid bulk cargo terminals near CPA. Per the CPA, the design depth of the piles is 45 ft MLLW. The approximate horizontal distance from the channel bottom toe to the closest dolphin pile is 64 ft.

Adjustments to port infrastructure (dolphins, piers, piles, etc..) are the responsibility of the CPA. If the CPA determines that the deepening of port facilities requires modifications to existing structures, the onus falls upon the CPA to cover associated costs for accommodating the design vessel. A profile view is shown in Figure 4-1 for the liquid cargo public dock, sourced from G&W Surveyors' as-built drawings.

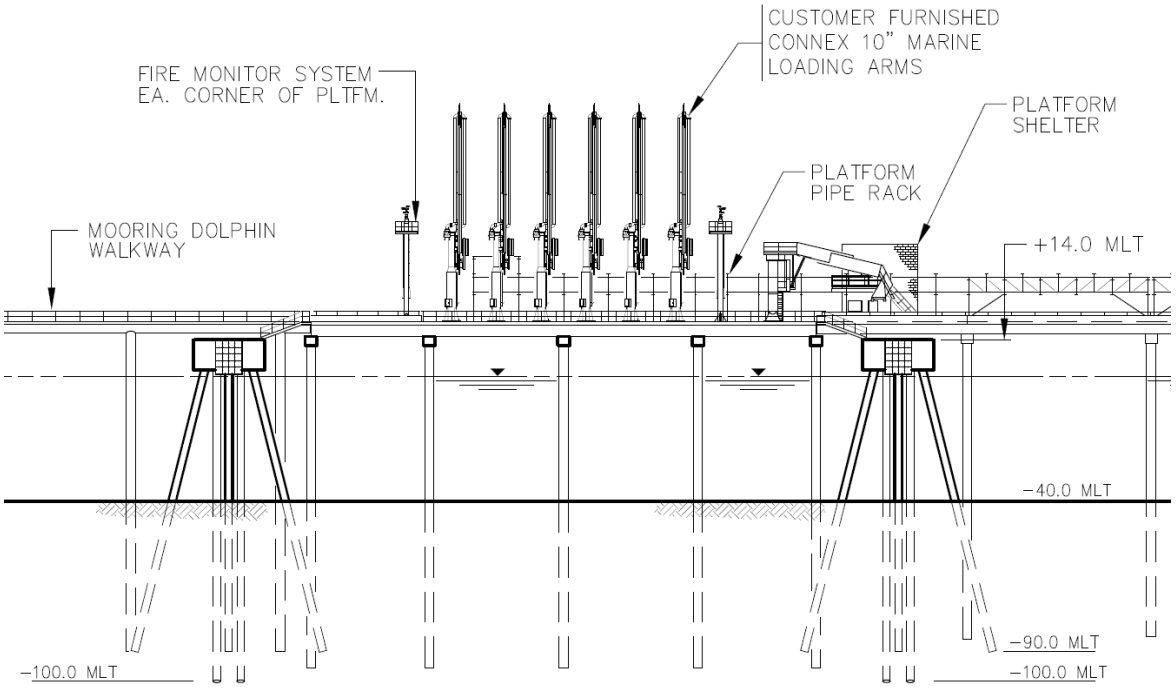


Figure 4-1: As-Built Rendering of Liquid Bulk Cargo Dock at CPA (G&W Surveyors)

Existing pile embedment depths are estimated to range between 45-60 ft, assuming the in-situ bed at the piles is at -40 ft MLLW. Without updated dock survey and supporting scour analyses, there is a risk that port infrastructure will be impacted. The CPA is expected to provide an updated cost account for the deepening of port docks.

Associated costs provided thus far consider the dredging required to deepen port facilities outside of the RP template, as well as contingency for structural impacts. Stability of port infrastructure is not expected to be impacted significantly by the construction of the authorized channel. If scour is found to be a significant concern during PED, action may be taken to mitigate structural impacts.

The estimated FWP horizontal offset from the nearest pile to the -45 ft MLLW contour is 43 ft. A basic geometric sketch of this calculation is shown in Figure 4-2.

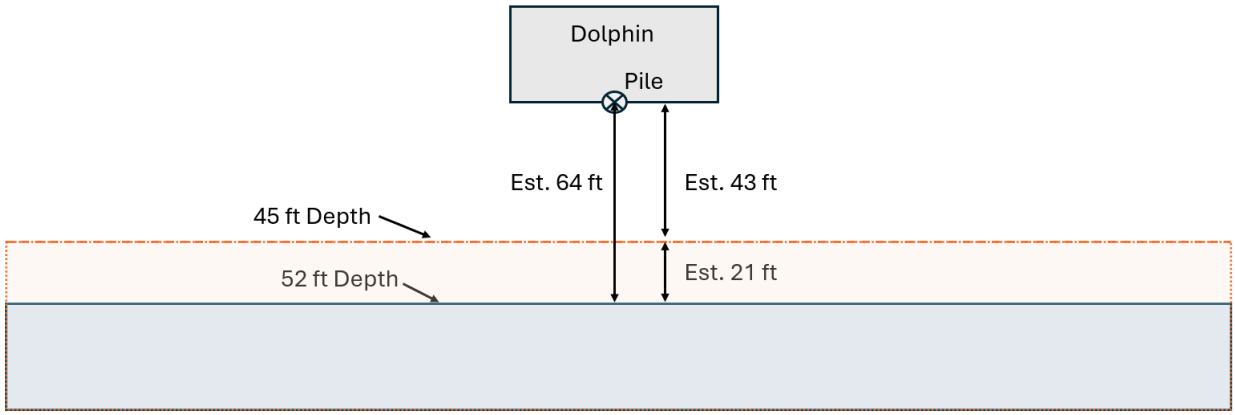


Figure 4-2: Schematic of Pile Offset with Basin Widening and Deepening

4.4 Project Development: Evaluation of Alternatives and Proposed Design

The current project design builds upon the 2019 IFR/EIS, incorporating refinements derived from further studies, pilot input, and updated guidance.

4.4.1 Plan Formulation and Evaluation of Alternatives

The project design generally retains the core navigational assumptions established for the TSP in the 2019 IFR/EIS, which provides a comprehensive explanation of the plan development process. The foundational navigation assessment from that study, including the definition of the design vessel and key maneuvering features, continues to form the basis for the currently proposed project.

From the outset, the Project Delivery Team recognized that the Matagorda Entrance and Jetty Channels have historically been maintained at depths 2 feet greater than the main channel. This added depth accounts for vessel motion, specifically pitch, roll, and heave, caused by wave action, currents, and wind in offshore waters. This essential design consideration is preserved in the updated plan.

The design vessel that governs channel geometry is a mid-size Aframax tanker, with a length overall (LOA) of 800 feet, a 138-foot beam, and 48-foot fully-drafted. All proposed channel dimensions were developed to safely accommodate this vessel.

A key feature required for this vessel class is a new 1,200-foot turning basin in the Lavaca Bay reach. This dimension is grounded in engineering criteria and simulator results. Recent Engineering Research and Development Center (ERDC) ship simulation studies indicate that turning basins should have a diameter at least 1.5 times the vessel length when tidal currents are below 1.5 knots. For an 800-foot vessel, this results in a required basin diameter of 1,200 feet, validating the proposed size.

Two principal design alternatives were considered during the 2019 evaluation:

- Alternative A: A range of six depth alternatives with bottom widths of 350 feet for the main channel and 600 feet for the Entrance and Jetty Channels.
- Alternative B: The same depth and width ranges, but with the addition of a vessel passing lane.

Channel pilots advised that a passing lane would not provide meaningful operational benefits under the Port's one-way traffic protocol. Based on that input, the passing lane concept was eliminated from further consideration, a decision that remains in place in the current project configuration.

Accordingly, the primary design elements - use of the 800-foot Aframax design vessel, the associated channel depths and widths, the 1,200-foot turning basin, and the decision to forgo a passing lane - are all carried forward from the 2019 TSP. A more detailed evaluation of depth alternatives for the current recommended plan is provided in subsection 4.4.4.5.

4.4.2 Proposed Channel Design Refinements to the 2019 IFR/EIS Plan

During the 2021 PED phase, the channel configuration established in the 2019 IFR/EIS was further refined. The following subsections outline the updated operational rules that prompted these changes, as well as the specific physical design modifications that were incorporated.

4.4.2.1 Operational Constraints and Updated Pilot Rules

A critical component of the project re-evaluation was coordination with the Matagorda Ship Channel Pilots to assess current operational constraints influencing channel design. The pilots reaffirmed that daylight restrictions and the one-way nature of the channel continue to delay vessel transits, findings consistent with the 2019 IFR/EIS. While most operational rules remain unchanged, two key updates have been implemented in response to evolving traffic conditions and navigational risks. These updates further reinforce the need for the proposed channel improvements.

Operational Rules (Unchanged from the 2019 IFR/EIS):

- One-Way Traffic: Ocean-going traffic remains strictly one-way.
- No Passing: Passing between ocean-going vessels continues to be prohibited.
- Draft-Based Daylight Restriction: Vessels drafting within 4 feet of the maximum allowable draft are restricted to daylight-only transits.
- Under-Keel Clearance: A minimum 3-foot under-keel clearance remains required, consistent with USACE EM 1110-2-1613 guidance.

Updated Operational Rules (New since 2019 IFR/EIS):

To enhance safety in response to current conditions, the pilots have adopted more conservative transit policies:

- Length-Based Daylight Restriction: The threshold for daylight-only transit has been reduced. Previously applicable to vessels ≥195 meters (639 feet), the

restriction now applies to vessels ≥175 meters (575 feet). This revision reflects increased congestion from larger inland barge traffic in the constrained bay channel.

- Current-Based Transit Restriction: The pilot rule for vessel movement under high current conditions has been made more specific. Now, vessels drafting 33 feet or more are prohibited from transiting when ebb or flood currents exceed 4 knots. This change addresses increased navigational risk in the narrow Entrance Channel and jetty area.

4.4.2.2 Physical Design Refinements

In response to updated operational constraints and detailed engineering analysis during the PED phase, the following physical refinements were incorporated into the RP. These adjustments optimize channel performance, enhance navigational safety, and improve long-term maintainability beyond the 2019 TSP:

a. Entrance Extension Channel Adjustment

   The seaward end of the Entrance Extension Channel now begins at Station -26+000, 7,000 feet closer to shore than the 2019 alignment. This change acknowledges the naturally deep seabed conditions that already meet the proposed design depth, substantially reducing the required offshore dredging footprint. The previously planned sediment trap has also been removed from the design.

b. Advance Maintenance (AM) Modifications

   Recommended AM depths are significantly altered when compared to the uniform allowances in the 2019 design. While both plans apply a 3-foot AM depth in the entrance reach, the 2019 plan maintained a uniform 2-foot AM throughout the remaining channel.

   The proposed design increases AM to 6 feet between Stations 97+000 and 108+000 and to 3 feet from Station 108+000 to the project terminus at Station 118+581. These changes address historically, and projected, severe localized shoaling in these reaches.

c. Dredging Template Update

   The 2019 "box cut" dredging design has been replaced with a trapezoidal template consistent with Galveston District guidance issued 08 April 2019. The updated template aligns with current USACE standards for feasibility, new work, and maintenance dredging.

d. Channel Stationing Update

   A northwest shift of the stationing centerline effectively changed the channel terminus from Station 118+502 to 118+581, an extension of 79 feet. This reflects minor realignment to optimize navigation geometry and better represent the available width.

e. Matagorda Peninsula Reach Realignment

The NW dredging template has been centered over the existing channel alignment to eliminate the need to relocate existing Aids to Navigation (ATON), thereby minimizing construction impacts and costs.

e. Bay Channel Centerline Adjustment

The alignment was refined to follow the existing centerline through Station 96+000, improving consistency with the current navigation route and reducing potential confusion for mariners.

g. Lavaca Bay Bend Easing Refinement

The curve at the Lavaca Bay bend was adjusted to produce a more symmetrical alignment. The channel transitions from 300 feet to 400 feet and back to 300 feet in width. While this does not precisely match the detailed 2019 alignment, it remains consistent with the original ship simulation parameters. The revised and 2019 alignments converge again near Station 101+500.

The adjoining channel, Channel to Port Lavaca (CPL), will have a newly-defined channel length based on the intersect of the proposed channel (MSC) and existing CPL starting stationing.

h. Turning Basin Approach Realignment

Beginning around Station 110+400, the proposed alignment diverges slightly from the existing channel to better center the approach toward the new turning basin—a change requested by the pilots to enhance maneuverability. The alignment rejoins the existing route near Station 116+300 and continues to the new terminus at Station 118+581.

These refinements represent practical design improvements developed during the PED phase, including reductions in offshore dredging, targeted AM increases in shoaling-prone areas, and alignment optimizations based on updated data and pilot feedback.

Collectively, they improve channel functionality and maintainability while remaining consistent with USACE engineering policy (see Section 8).

4.4.3 Proposed Improvement of Channel Dimensions

Table 4-2 outlines the channel dimensions used in the proposed design and serves as the basis for calculating new work dredging volumes. For direct comparison, Table 4-3 provides the channel dimensions from the 2019 IFR/EIS design. The dimensions presented in Table 4-2 are essential to the development of the project's Plans and Specifications (P&S). The corresponding illustration is provided in Figure 4-3.



Figure 4-3: Proposed Channel Improvements Plan View (-26+000 to 118+581)

Table 4-2: Proposed -47 / -49-Foot MLLW Channel Dimensions

Channel Reach				Proposed -47 / -49-Foot MLLW Channel Dimensions						
Segment	**Name**	**Station**		**Length** (ft)	**Bot. Width** (ft)	**Design Depth** (ft)	**AM** (ft)	**Req'd Depth** (ft)	**OD Allow** (ft)	**Side Slope**
		Begin	**End**							
Entrance Channel	Entrance Extension Channel	-26+000	-20+000	6,000	550	49	3	52	2	1V : 10H
	Entrance Channel	-20+000	-6+000	14,000						
	Jetty Channel	-6+000	0+000	6,000						
Lower Bay	Matagorda Bay Peninsula	0+000	3+454	3,454	550	47	2	49	2	1V : 5H
	Matagorda Bay Peninsula Transition	3+454	4+320	866	550 - 425	47	2	49	2	1V : 5H 1V : 3H
	Lower Matagorda Bay	4+320	9+330	5,010	425	47	2	49	2	1V : 3H
	Matagorda Bay Transition	9+330	12+000	2,670	425 - 300	47	2	49	2	1V : 3H
Mid-Bay	Matagorda Bay	12+000	75+000	63,000	300	47	2	49	2	1V : 3H
	Lavaca Bay	75+000	94+000	19,000	300					
	Lavaca Bay Transition	94+000	96+000	2,000	300 - 400	47	2	49	2	1V : 3H
	Lavaca Bay Bend Easing	96+000	97+000	1,000	400	47	2	49	2	1V : 3H
		97+000	101+000	4,000	400	47	6	53	2	1V : 3H

	Name	Begin	End	Length (ft)	Bot. Width (ft)	Design Depth (ft)	AM (ft)	Req'd Depth (ft)	OD Allow (ft)	Side Slope
	Lavaca Bay Transition	101+000	102+000	1,000	400 - 300	47	6	53	2	1V : 3H
Upper Bay	Lavaca Bay	102+000	108+000	6,000	300	47	6	53	2	1V : 3H
		108+000	110+000	2,000	300	47	3	50	2	1V : 3H
	Lavaca Bay with Proposed Turning Basin and Approach	110+000	116+302	6,302	300 1,200 990	47	3	50	2	1V : 3H
	Point Comfort Turning Basin	116+302	117+405	1,103	990 – 890	47	3	50	2	1V : 3H
	Point Comfort North and South Basins	117+405	118+581	1,176	890 – Varies	47	3	50	2	1V:3H

AM = Advance Maintenance Required Depth = Design Depth + Advance Maintenance Depth OD = Over-depth Allowance

Table 4-3: 2019 IFR/ EIS Channel Dimensions

Channel Reach				2019 IFR/EIS Channel Dimensions (Authorized, WRDA 2020)						
Segment	Name	Station		Length (ft)	Bot. Width (ft)	Design Depth (ft)	AM (ft)	Req'd Depth (ft)	OD Allow (ft)	Side Slope
		Begin	End							
Entrance Channel	Entrance Extension Channel	-33+000	-20+000	13,000	550	49	3	52	2	1V : 10 H
	Entrance Channel	-20+000	-15+200	4,800						
	Sediment Trap	-15+200	-13+600	1,600	550	49	–	49	–	1V : 10 H
	Entrance Channel	-13+600	-6+000	7,600	550	49	3	52	2	1V : 10 H
	Jetty Channel	-6+000	0+000	6,000	550					
Lower Bay	Matagorda Bay Peninsula	0+000	3+454	3,454	550	47	2	49	2	1V : 5H
	Matagorda Bay Peninsula Transition	3+454	4+320	866	550 - 425	47	2	49	2	1V : 5H 1V : 3H
	Lower Matagorda Bay	4+320	9+330	5,010	425	47	2	49	2	1V : 3H
	Matagorda Bay Transition	9+330	12+600	3,270	425 - 300	47	2	49	2	1V : 3H
Mid-Bay	Matagorda Bay	12+600	75+000	62,400	300	47	2	49	2	1V : 3H
	Lavaca Bay	75+000	95+000	20,000						

	Name	Begin	End	Length (ft)	Bot. Width (ft)	Design Depth (ft)	AM (ft)	Req'd Depth (ft)	OD Allow (ft)	Side Slope
	Lavaca Bay Transition	95+000	96+000	1,000	300 - 400	47	2	49	2	1V : 3H
	Lavaca Bay Bend Easing	96+000	101+000	5,000	400	47	2	49	2	1V : 3H
	Lavaca Bay Transition	101+000	102+000	1,000	400 - 300	47	2	49	2	1V : 3H
Upper Bay	Lavaca Bay	102+000	110+000	8,000	300	47	2	49	2	1V : 3H
	Lavaca Bay with Proposed Turning Basin and Approach	110+000	116+223	6,223	300 1,200 1,000	47	2	49	2	1V : 3H
	Point Comfort Turning Basin	116+223	117+223	1,000	1,000	47	2	49	2	1V : 3H
	Point Comfort North and South Basins	117+223	118+502	1,279	Varies	47	2	49	2	1V:3H

AM = Advance Maintenance Required Depth = Design Depth + Advance Maintenance Depth OD = Over-depth Allowance

4.4.4 New Work Channel, Volumes, and Economic Evaluation

The following subsections present the methodology and basis for estimating NW dredging volumes and their economic evaluation - critical information for developing project P&S and identifying real estate requirements.

4.4.4.1 NW Channel Template Policy and Configuration

The NW channel template used in this analysis is based on USACE Galveston District guidance dated April 8, 2019, which defines the District's policy for applying dredging templates in feasibility studies, new work construction, and maintenance dredging. An excerpt from this guidance is provided in Figure 4-4. Representative NW template configurations are shown in Figure 4-5 (Typical New Work Entrance Channel Template) and Figure 4-6 (Typical New Work Bay Channel Template).

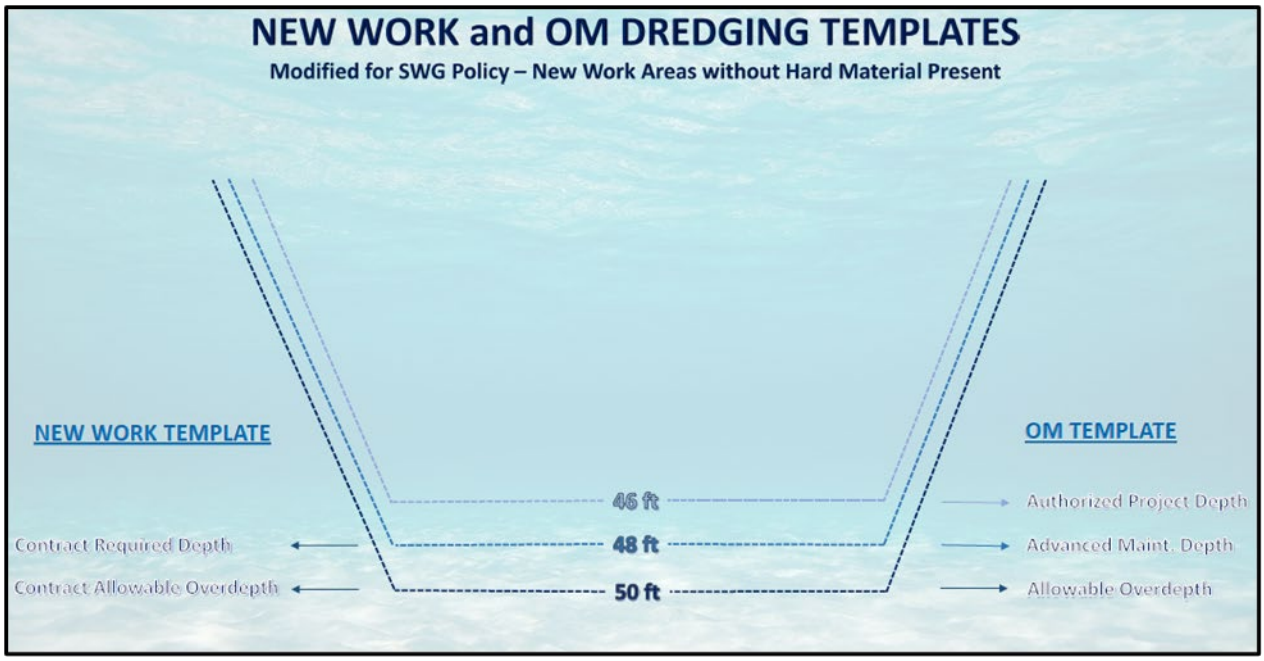


Figure 4-4: Modified for SWG Policy - New Work Areas without Hard Material Present

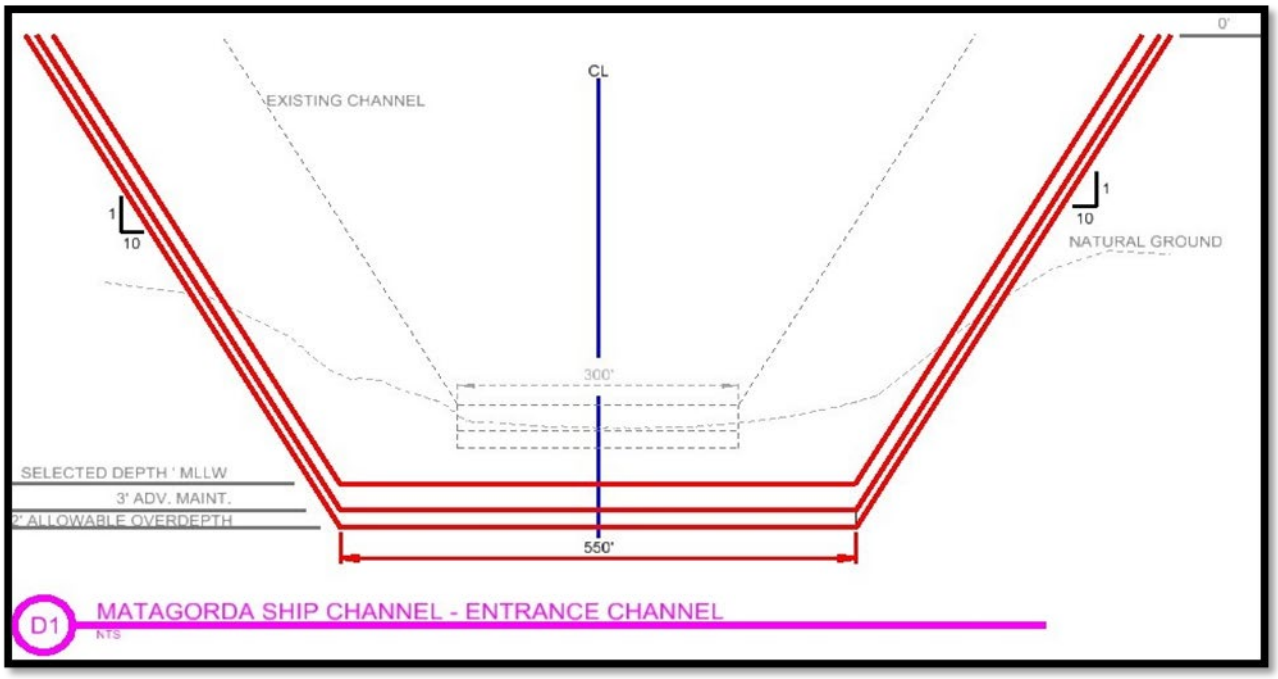


Figure 4-5: Typical New Work Entrance Channel Template

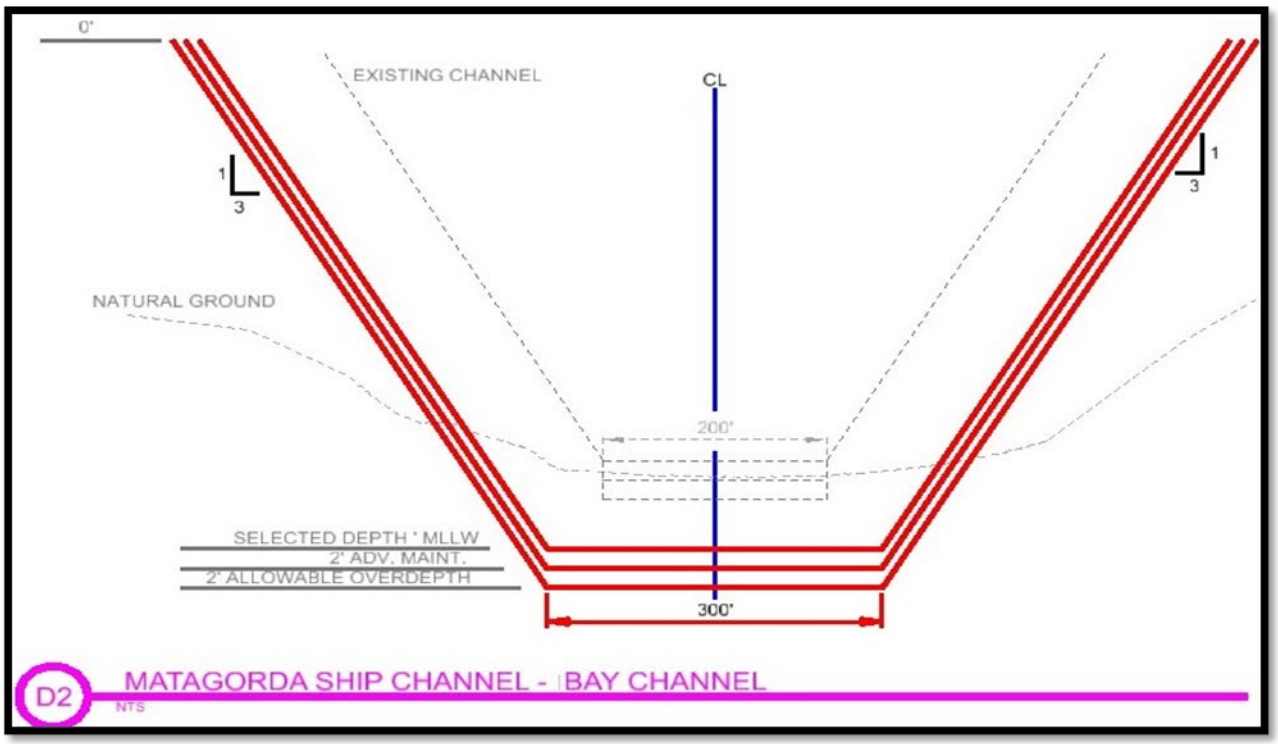


Figure 4-6: Typical New Work Bay Channel Template (AM Varies)

4.4.4.2 Definition of New Work Material and Volume Inclusion Criteria

NW dredging volumes were calculated by applying the proposed channel template to the 2023 hydrographic survey surface. NW material is defined as material located outside the limits of the existing Operations and Maintenance (O&M) dredging prism, extending to the lowest elevation of the authorized overdepth (OD). To isolate new work volumes, existing maintenance material within this footprint was subtracted. The NW volume calculations include both AM and allowable OD associated with the proposed template. Non-pay material was excluded.

4.4.4.3 Modeling Methodology and New Work Volume Estimation

Galveston District's Southern Area Office used HYPACK hydrographic survey data processing software to model the existing O&M template and evaluate three NW channel depth scenarios: -43'/-45', -45'/-47', and -47'/-49'. Volumes for each scenario were calculated at 100-foot intervals between the proposed channel bottom (including OD) and the natural bottom derived from the 2023 survey. This interval was selected to detect anomalies given the substantial increase in estimated volumes relative to those in the 2019 plan. No anomalies were found. The hydrographic data were collected using multibeam sonar in August 2023. An additional bathymetric survey of the maneuvering basin was conducted by the Non-Federal Sponsor on November 3, 2021.

Where maintenance material was present within the NW template, it was subtracted from the total to yield net NW volume. Maintenance material modeling was based on the existing channel configuration rather than strict alignment comparisons, as the improved channel does not significantly deviate from the 2019 alignment.

The volume estimates incorporate OD and AM in accordance with USACE guidance. OD, which accounts for up to 2 feet of dredging tolerance, is authorized under ER 1130-2-520 and applied uniformly across the channel. AM is used to address high-shoaling areas by permitting dredging to an additional depth beyond the required template to reduce maintenance frequency and cost. The existing Matagorda Entrance and Jetty Channels include a 3-foot AM depth, while the Matagorda Main Channel includes a 2-foot AM depth. These values were assumed to remain unchanged for the proposed channel, except in the Mid- and Upper-Bay reaches through the project terminus, where AM allowances were increased to account for persistent shoaling. This adjustment resulted in a corresponding increase in the estimated new work dredging quantity in those reaches.

4.4.4.4 Verification and Consistency with Prior PED Modeling

Modeling outputs included cross-sectional drawings (PDF) and tabulated volume data. All data were independently verified against the modeled sections to confirm accuracy. The results from this effort align closely with those from the 2021 PED modeling. When excluding maintenance material, the NW volume estimates from both modeling efforts are consistent.

4.4.4.5 Evaluation of Channel Depth Alternatives for Economic Analysis

To support the economic analysis, NW volumes were calculated for three design depths. Table 4-4 presents a side-by-side comparison of these depth scenarios and illustrates substantial differences when compared to the volumes published in the Engineering Appendix for the 2019 IFR/EIS.

This discrepancy requires clarification. Early engineering studies produced volume estimates of a similar magnitude to those presented here. However, the DMMP prepared in support of the 2019 IFR/EIS significantly underreported the new work volume. These erroneous DMMP figures were carried forward into the previous Engineering Appendix, making the published estimates incorrect.

The revised volumes presented in this report have been thoroughly verified and now serve as the official basis for project design, cost estimating, and real estate planning. Volume breakdowns for the -47'/-49', -45'/-47', and -43'/-45' depth scenarios are provided in Table 4-5, Table 4-6, and Table 4-7, respectively.

The Economics team conducted the analyses for benefits under the assumption that ship loading (changes in draft) follow the operational requirements listed in Section 4.4.2.1 for each depth alternative.

Table 4-4: New Work Volume Comparison: Scale Depths and 2019 IFR/EIS Channel Design

Channel Reach	Station	Station	VR Scale Depth Volumes (cy)			2019 IFR/EIS Depth Vol -47′/-49' (cy)	% Change between VR S.D. -47′/-49' vs 2019 IFR/EIS
			-47' / -49'	-45' / -47'	-43' / -45'		
Entrance Extension Channel	See Scale Depth Col.	- 20+000	1,195,100	754,100	389,500	2,383,334	- 49.86
Entrance Channel	- 20+000	- 6+000	3,563,700	3,107,700	2,959,700	2,265,543	57.30
Jetty Channel	- 6+000	0+000	413,500	258,700	135,200	549,977	-24.82
Matagorda Bay Channel	0+000	75+000	17,104,500	14,466,500	11,900,000	8,693,296	96.76
Lavaca Bay Channel with Proposed 1,200′ Turning Basin	75+000	116+223	16,273,600	14,377,300	12,395,600	6,500,970	150.33
Point Comfort Turning Basin	116+223	117+223	424,600	320,800	250,200	293,024	44.90
Point Comfort North and South Basins	117+223	118+581 118+502 *	359,500	254,000	194,800	277,253	29.66
		Total	**39,334,500**	**33,539,100**	**28,225,000**	**20,963,397**	**87.63**

* The TSP channel in the 2019 IFR/EIS Report ends at Station 118+502

Table 4-5: New Work Volume, VR Scale Depth -47' / -49'

Depth + AM + AO	Reach		Length (ft)	Volume (cy)
	Sta.	Sta.		
49′ + 3′ + 2′	-26+000	-14+000	12,000	3,149,800
49′ + 3′ + 2′	-14+000	0+000	14,000	2,022,400
47′ + 2′ + 2′	0+000	20+000	20,000	2,893,200
47′ + 2′ + 2′	20+000	47+000	27,000	6,929,300
47′ + 2′ + 2′	47+000	72+000	25,000	6,511,400
47′ + 2′ + 2′	72+000	97+000	25,000	6,427,200
47′ + 6′ + 2′	97+000	101+000	4,000	1,693,300
47′ + 6′ + 2′	101+000	108+000	7,000	2,893,400
47′ + 3′ + 2′	108+000	118+581	17,581	6,814,500
–				
		Total	151,581	**39,334,500**

Table 4-6: New Work Volume, VR Scale Depth -45' / -47'

Depth + AM + AO	Reach		Length (ft)	Volume (cy)
	Sta.	Sta.		
47′ + 3′ + 2′	-24+400	-14+000	10,400	2,605,300
47′ + 3′ + 2′	-14+000	0+000	14,000	1,515,200
45′ + 2′ + 2′	0+000	20+000	20,000	2,369,400
45′ + 2′ + 2′	20+000	47+000	27,000	5,899,000
45′ + 2′ + 2′	47+000	72+000	25,000	5,540,400
45′ + 2′ + 2′	72+000	97+000	25,000	5,444,700
45′ + 6′ + 2′	97+000	101+000	4,000	1,444,200 *
45′ + 6′ + 2′	101+000	108+000	7,000	2,263,600 *
45′ + 3′ + 2′	108+000	118+581	17,581	6,457,300 ♦
–				
		Total	149,981	**33,539,100**

* Includes a 28% increase in the calculated NW volume to account for the increased advance maintenance allowance.

♦ Includes an 11% increase in the calculated NW volume to account for the increased advance maintenance allowance.

Table 4-7: New Work Volume, VR Scale Depth -43' / -45'

Depth + AM + AO	Reach		Length (ft)	Volume (cy)
	Sta.	Sta.		
45′ + 3′ + 2′	-22+700	-14+000	8,700	2,408,900
45′ + 3′ + 2′	-14+000	0+000	14,000	1,075,500
43′ + 2′ + 2′	0+000	20+000	20,000	1,865,800
43′ + 2′ + 2′	20+000	47+000	27,000	4,895,200
43′ + 2′ + 2′	47+000	72+000	25,000	4,591,900
43′ + 2′ + 2′	72+000	97+000	25,000	4,486,300
43′ + 6′ + 2′	97+000	101+000	4,000	1,211,900 *
43′ + 6′ + 2′	101+000	108+000	7,000	1,955,300 *
43′ + 3′ + 2′	108+000	118+581	17,581	5,734,200 ♦
–				
		Total	148,281	**28,225,000**

* Includes a 28% increase in the calculated NW volume to account for the increased advance maintenance allowance.

♦ Includes an 11% increase in the calculated NW volume to account for the increased advance maintenance allowance.

4.4.4.6 Dredging Volumes Applied to Cost and Benefit Calculations

The channel reach breakdown is shown in Table 4-5. Table 4-7 differs from other sections of the report to align with the structure adopted for cost estimating. The NW dredging volumes served as the basis for estimating capital construction costs for each alternative, with detailed estimates provided in Section 9.5.5. These capital costs, combined with projected annual maintenance and operations costs, were factored into the economic analysis, which assessed net annual benefits by comparing total annualized costs to estimated economic benefits. Estimated maintenance dredging volumes are presented in Section 4.12.2, and the full economic evaluation is provided in the Economic Appendix of the VR/SEIS.

4.5 New Work Material Management and Placement Site Development

4.5.1 Overview of NW Dredged Material Management Strategy

The dredged material management strategy for the channel improvement project is designed to accommodate approximately 39.34 million cy of NW material generated under the recommended -47'/-49' channel plan. Material placement is assigned based on dredging reach, site capacity, proximity, and cost-effectiveness.

Table 4-8 summarizes the allocation of dredged material from each channel reach to specific placement areas. This level of detail is critical to developing refined construction cost estimates, which must account for variables such as pumping distances and available site capacity.

Table 4-8: New Work Quantity Allocation for Recommended Plan

Reach	Reach Stationing		New Work Volume (cy)	NW Volume Retained* (cy)	Assigned PA (Destination)	Estimated PA Capacity (cy)	Dredge Type
New Entrance Extension Channel	-26+000	-14+000	3,149,800	2,204,900	ODMDS	Unlimited	Hopper
Entrance Channel	-14+000	-6+000	1,608,900	1,126,300	Sand Engine (SE)	3,966,300	Hopper
Jetty Channel	-6+000	0+000	413,500	289,500			
Matagorda Bay	0+000	20+000	2,893,200	2,025,300	NP 1	3,449,800	Pipeline
Matagorda Bay	20+000	47+000	6,929,300	4,850,500	NP 2	11,070,800	Pipeline
Matagorda Bay	47+000	72+000	6,511,400	4,558,000	NP 3	5,265,000	Pipeline
Lavaca Bay	72+000	97+000	6,427,200	4,499,000	NP 4/5	5,229,600	Pipeline
Lavaca Bay	97+000	101+000	1,693,300	1,185,300	NP 6	2,319,300	Pipeline
Lavaca Bay	101+000	105+000	1,675,300	6,795,600	New Bird Island	7,544,600	Pipeline
Lavaca Bay and New 1,200' Turning Basin	105+000	116+223	7,248,500				
Point Comfort Turning	116+223	117+223	424,600				
Point Comfort North and South	117+223	118+581	359,500				
–	-26+000	118+581	**39,334,500**	**27,534,400**			
*** Assumes 70% retention at time of placement.**							

4.5.2 NW Dredging Volumes for the Recommended Plan

The material placement plan supports the updated NW dredging volumes calculated for the recommended -47'/-49' channel design. These volumes were developed using the modeling methodology described in Section 4.4.4.3. Final net volumes reflect the full new work prism and exclude existing maintenance material. Aggregated by dredging reach, these quantities form the basis for placement area assignments outlined in Table 4-8.

4.5.3 NW Dredged Material Placement Plan

The placement strategy combines both existing and newly proposed placement areas, selected based on their proximity to dredging reaches, available capacity, and cost efficiency. The plan includes use of the ODMDS, the nearshore SE, six newly designated open-water placement areas (NP 1–6), and a newly created beneficial-use Bird Island to be constructed as part of this project.

Table 4-8 provides a detailed breakdown of the placement strategy, linking the dredged volume from each reach to its designated placement area. This mapping is critical for developing accurate construction cost estimates, particularly those affected by hydraulic pumping distances and placement site logistics.

4.5.4 Expansion of Existing Placement Area

The Ocean Dredged Material Disposal Site will be expanded, encompassing a total area of 2,768 acres to provide sufficient capacity for both the new work dredged material from the project's offshore channel reaches and future maintenance material generated by the improved channel. The expanded ODMDS, located parallel to the Entrance Extension Channel in deep water ranging from -35 to -54 feet MLLW, offers effectively unlimited volumetric capacity for the project's needs.

Due to its size and strategic location, the expanded ODMDS will serve as a primary placement site for ongoing maintenance dredging, as detailed in the project's DMMP.

4.5.5 New NW Placement Areas

4.5.5.1 Site Selection and Capacity Analysis

The current plan for new dredged material placement areas reflects a comprehensive re-evaluation of the strategy initially proposed in the 2019 IFR/EIS, driven by updated environmental and infrastructure considerations.

a. Environmental and Infrastructure Siting Considerations

   A major change from the 2019 plan is the revised approach to siting new placement areas. The original strategy assumed continued use of the existing ODMDS and Chester Island, supplemented by several new features, including the SE and seven additional open-water placement areas, all planned on the west side of the ship channel.

During re-evaluation, a detailed site-specific analysis of the western side identified extensive, high-value seagrass beds within the areas proposed for the seven new open-water sites. To avoid unavoidable environmental impacts and costly mitigation, these seven sites were removed from the plan. However, two western locations - the SE site near the jetties and Placement Area NP 6 (an expansion of existing PA 16-A) - were located outside sensitive seagrass habitats and thus retained.

To offset the loss of these seven sites, a new siting analysis was conducted focusing on the east side of the channel. This effort accounted for multiple constraints, including the need to avoid oyster beds and potential cultural resources. Additionally, the presence of numerous shallow-buried pipelines across much of Lavaca Bay posed a significant constraint. Although geotechnical data indicated that up to three feet of new material could be safely placed over these pipelines, the project team adopted a conservative, risk-averse approach by siting all new placement areas with deliberate buffers away from pipeline corridors. This multi-faceted strategy underpins the final placement area designs described in the following section.

b. NW Material Capacity

For initial construction, the volumetric capacity of the new placement areas, including the SE, NPs 1 - 6, and Bird Island, was calculated based on their assigned new work material, applying a general retention rate of 70%.

4.5.5.2 Design and Features of Proposed New Work Placement Areas

The recommended plan includes the Sand Engine, six new open-water placement areas (NP 1 through NP 6), and a new beneficial-use Bird Island. The volumetric capacity of these sites to accommodate new work material was calculated using a general retention rate of 70%.

For the six open-water placement areas (NP 1 through NP 6), this new work material will be placed to an elevation that results in a final, settled grade no higher than -4 feet MLLW. This elevation limit does not apply to the construction of the Sand Engine or the beneficial-use Bird Island, which are specifically designed with features that will rise above this level.

The following sections outline the specific characteristics of each proposed feature, and the corresponding new work dredged material capacities.

a. Sand Engine (SE)

The SE is a 165-acre open-water placement site located approximately 500 feet west of the west jetty. It is strategically designated to receive new work dredged material from both the Entrance and Jetty Channels.

As a beneficial-use feature, the SE is intended to mitigate shoreline erosion caused by the jetties, which interrupt the natural littoral drift of sand along the coast. This interruption disrupts the sediment supply to the downdrift western shoreline, contributing to persistent erosion.

By placing sandy dredged material in a nearshore berm configuration, the SE facilitates gradual landward migration of sediment, helping to restore the natural sediment supply and offset the jetties' erosional effects.

To sustain its shoreline protection function over the 50-year project life, the SE is intended to be periodically renourished with maintenance dredged material. Because this function relies on the gradual dispersal of material, the SE has a finite effective capacity. A detailed assessment of its long-term performance and capacity - both for new work and maintenance use - is provided in the Appendix E.

b. NP 1

NP 1 is a 238-acre, rectangular open-water placement area located in the lower portion of Matagorda Bay, where the water depth averages -12 feet relative to MLLW. Although the pumping distance from the channel to NP 1 is relatively long, the site's location was selected based on its available capacity and environmental suitability. The estimated volumetric capacity of NP 1 is 3,449,800 cy.

c. NP 2

NP 2 is a 788-acre, roughly square open-water site with a notched indentation at its northern corner. The site is located in waters with depths ranging from -12 to -13 feet relative to MLLW. Its expansive surface area and relatively uniform bathymetry support efficient and even distribution of dredged material. The estimated volumetric capacity of this placement area is 11,070,800 cy.

d. NP 3

NP 3 is a 517-acre, elongated, rhomboid-shaped open-water area located in the mid-bay area. It lies in slightly shallower water, with depths ranging from -8 to -10 feet relative to MLLW. The site's west-east orientation results in relatively long pumping distances. The estimated volumetric capacity of this placement area is 5,265,000 cy.

e. NP 4/5

NP 4/5 is a 689-acre, rhomboid-shaped open-water area situated in waters with depths ranging from -8 to -10 feet MLLW. Its west-east elongated configuration will result in comparatively longer pumping distances. The estimated volumetric capacity of NP 4/5 is 5,229,700 cy.

f. NP 6

NP 6 expands upon existing PA 16-A, forming a 459-acre rectangular open-water placement site. It is the only new work placement area in the landward reach located on the west side of the channel corridor. Positioned in shallow water with an average depth of around -6 feet MLLW, the expansion significantly increases the site's placement utility. The estimated volumetric capacity of NP 6 is 2,319,300 cy.

g. Beneficial-Use Bird Island

A cornerstone of the project's beneficial use strategy is the creation of a new, engineered bird island in Lavaca Bay. The conceptual design is detailed below, with a plan view presented in Figure 4-7.

- Location and Siting: The island will be strategically sited approximately one mile from the ship channel in the upper part of Lavaca Bay, the region where the channel makes its sharp northward turn. It will be constructed in a relatively shallow open-water area with an average depth of approximately 7 feet MLLW.
- Physical Design: The island is conceived as an approximately 350-acre, octagonally shaped landmass. The planned topography features mild slopes down to a perimeter crest at an elevation of +6.2 feet MLLW. A 150-foot-wide raised beach is proposed with exterior slopes designed at a stable 1V:5H.
- Shoreline Protection: The wind-exposed perimeter will be armored with riprap shoreline protection to ensure long-term stability and resilience.
- Placement Capacity: The island is designed to accommodate approximately 9.7 million cubic yards of new work material. This calculation assumes a specific material retention rate (0.7) within the engineered footprint.
- Design Precedent: Further refinement of the conceptual design during the resumed PED phase will draw upon precedents from proven models for successful habitat creation, such as the Evia Bird Island, and on the planned Three-Bird Island Marsh, a beneficial-use component of the Houston Ship Channel Expansion Channel Improvement Project (HSC ECIP).

This beneficial-use island represents a significant enhancement to the project, turning dredged material into a valuable ecological asset.

4.5.5.3 Bird Island Concept Design

The Bird Island concept is modeled after an existing island located in Galveston Bay, TX. Evia Island, situated between the Houston Ship Channel (HSC) and East Bay, is a small bird island measuring nearly 4.7 acres (Figure 4-7).



Figure 4-7: Satellite Imagery of Evia Island, Galveston Bay, TX (04/02/2025)

The Evia Island design includes a hexagonal shape, perimeter revetment, and beach protected by wave trip. The island has been touted as a successful nesting ground for migratory birds. Since the design has lasted for over 20 years with proper management, it is chosen as an effective model for a new bird island in Matagorda Bay.

The bird island proposed in Matagorda Bay is based on dimensions from the plan drawing shown in Figure 4-8. While the exact shape may change before construction, the proposed alignment would generally be circular/hexagonal. To design the bird island, typical sections were taken from the Evia Island design and adjusted for project site conditions. The main variables to estimate required crest elevation are shown in Table 4-9.

Table 4-9: Variables for BI Crest Elevation

H&H Variables (ft)			
Site Water Depth (ft) MSL	50-yr SLC (ft)	MSL to MHHW (ft)	50-yr Extreme Water Level (ft) MHWW
7	2	0.4	3.8*
*** Hurricane Harvey recently exceeded this EWL by 3 ft at this location.**			

At first, the concept design employed an 80% retention critera, with 12 ft of stacked dredged material. The proposed perimeter was nearly 13,974 ft, with a beach shoreline of 2,329 ft. The proposed beach mimics the Evia Island design (Figure 4-7) at 150 ft wide. The design concept was refined for feasibility in two iterations.

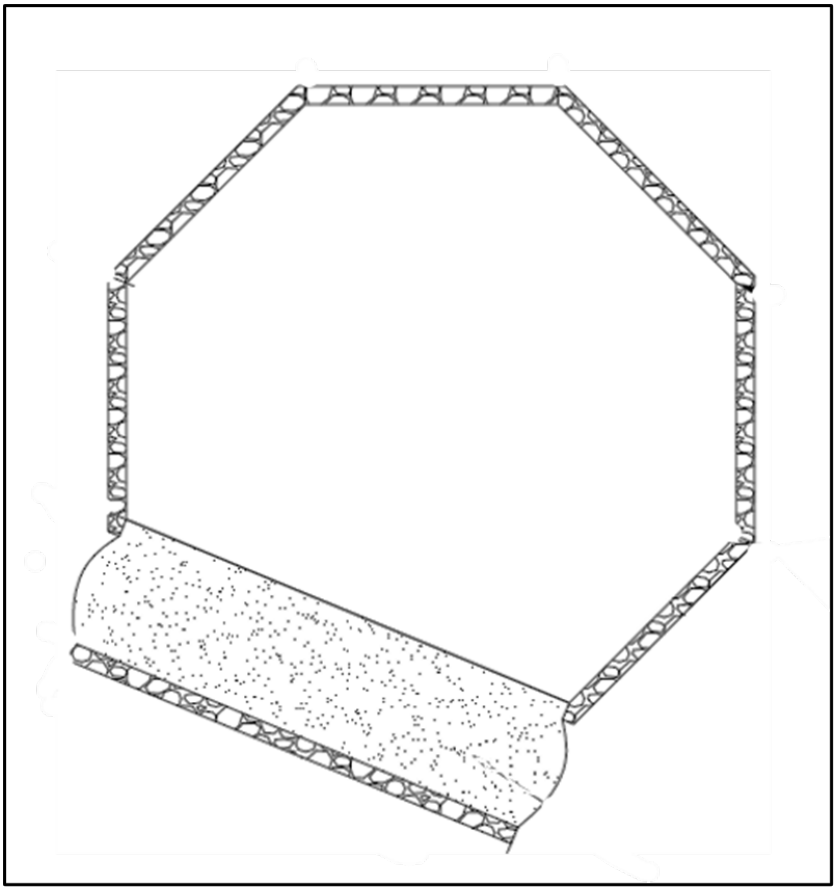


Figure 4-8: Concept New Bird Island – Plan View of Evia Island

Combining the variables in Table 4-9 with those in Table 4-10, the BI fill requirement was developed (Table 4-11), employing a 13.2 ft material stack, 1.2 ft higher than orginally assumed. The geometry assumes 30% loss, which should be verified by experience with other bird island constructions in the District before final PED plans.

Table 4-10: Bird Island Design Fill Variables

Partial-Circle (1) Area (sqft)	Partial-Circle (2) Area (sqft)	Sand Fill Length (ft)
12,394,679	2,402,547	3705
Fill to (ft) MSL	**Fill to (ft) MSL**	**Fill to (ft) MSL**
6.20	-2	6.20

Table 4-11: BI Fill Specifications

CY of Fill Base (1)	CY of Fill (2)	CY of Sand Fill	Retention Factor
6,059,621	444,916	84,392	0.69

The concept design is illustrated by plan view in Figure 4-9. The island would be exposed to the northeast side and feature terrestrial upland, beach, and shallow-water habitat. A perimeter revetment would protect the bird island from wave-induced erosion. While exact material retention is an unknown, the design calls for a fairly high retention criteria. Since modifications to the design are expected in PED, the total acreage of the BU site may change to maintain lower material costs or better capture anticipated retention.

The BI is proposed as a means to provide incremental savings to the project by confining dredged material that would otherwise return to the MSC in the way of O&M. In doing so, the additional costs, when compared to open-water placement, are primarily related to access channel construction, material shaping, riprap, sand, and geotextile. PED-level analysis may consider modifying the footprint of the BU site, however, the Engineering advice is to confine as much material as possible to prevent dredged material recycling. Because of this, without better estimates available for material retention, the footprint becomes quite large.

Based on the prescribed variables and design refinement (Figure 4-9 and Figure 4-10), the new ROM for stone tonnage, sand (CY), and geotextile (SY) is provided in Table 4-12.

Table 4-12: ROM for Bird Island

ROM Variable	Value
Sand CY	84,392
Geotextile SY	41,007
Stone Tonnage	47,985
Retention Factor	0.7

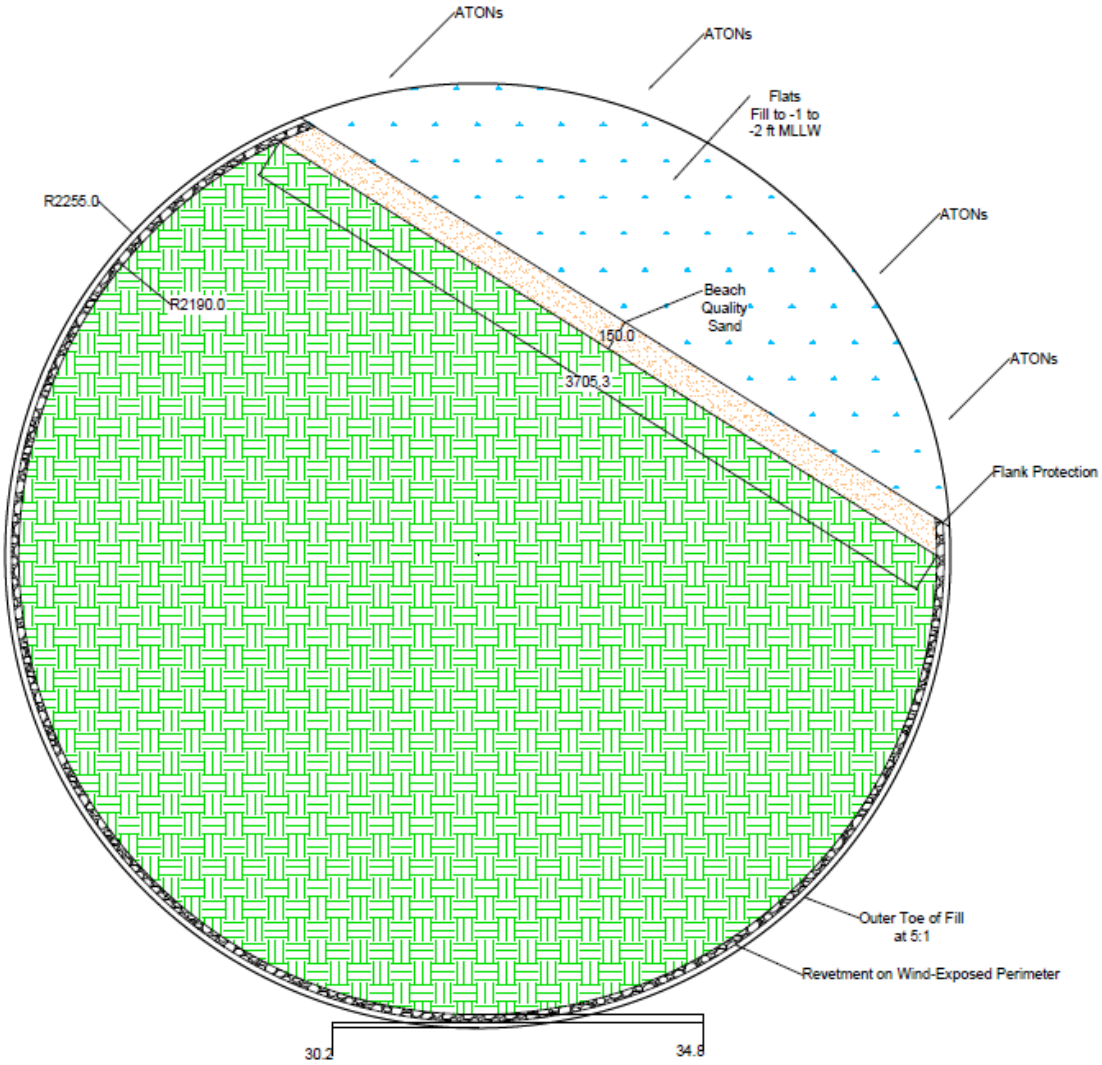


Figure 4-9: Bird Island Concept Plan View

The design typical for shoreline protection revetment is shown in Figure 4-10, which results in nearly 5 tons/lf.

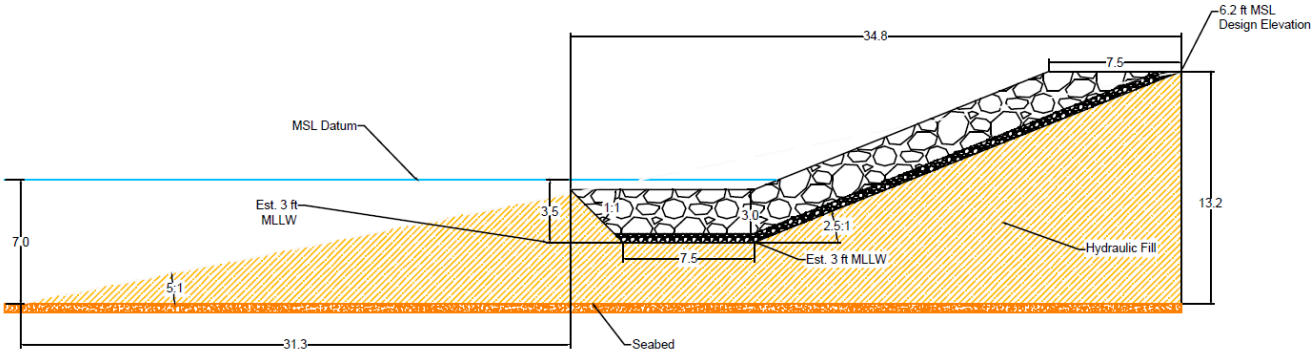


Figure 4-10: Proposed Design Typical for Bird Island Shoreline Protection

The Bird Island design has a high level of uncertainty regarding detailed rock protection design, environmental features, and long-term management. At a concept level, the design is intended to use 9.7 MCY of dredged material and create 300+ acres of land. Since it would be the largest bird island ever constructed, the exact design should be carefully refined in PED. PED may consider a series of islands, smaller overall acreage, and further investigation into optimizing environmental features. The BI design employs basic engineering assumptions to create a relatively low-cost solution under several key constraints, namely:

- Environmental resources in the immediate bay area (oysters).
- Historically (and projected) high shoaling from material recycling.
- A congested DMMP under FWP maintenance needs.
- Nearby active pipelines.

The high level of uncertainty associated with the BI results in the largest contingency among project features (Section 9.4.1). While confining the materials elsewhere is certainly feasible, new real estate (PA) interests were not identified by the NFS between 2019 and 2025. The BI is a practical solution for the following reasons:

- Costs to construct an upland PA with shoreline protection would be comparable to the Bird Island construction.
- Alternate placement sites do not comply with the “avoidance is best” planning guidance and would incur additional costs to the project, such as mitigation.

4.6 2019 vs 2025 DMMP Design

The 2025 DMMP maintains the original channel dimensions established in the 2019 plan, preserving the RP depth of -47’/-49’, widths of 300’ and 550’ for the main and entrance channels, respectively, and a 1200’ turning basin. However, several significant changes were made regarding dredged material placement areas to improve environmental outcomes and project efficiency.

Notably, material placement on the west side of the channel between stations 0+000 and 84+500, included in the 2019 plan, was removed in the 2025 update. In Lavaca Bay, the 2019 open water placement sites (NP7/OP10) were replaced with a bird island to confine dredged materials and provide for beneficial use (BU).

The semi-confined placement site near the Port of Calhoun (PA 18/19) was expanded in the 2025 plan to accommodate additional dredged material capacity, while Placement Area 1 (P1), a terrestrial upland site proposed in 2019, was removed from the plan.

A new BU option was introduced at Keller Bay Peninsula, which was not considered in the 2019 plan. Additionally, legacy open water placement sites, which were previously excluded, have been re-included in the updated plan to optimize material management. Lastly, an offshore sediment trap, part of the 2019 plan, was discarded in 2025 to reduce complexity and cost.

A summary of DMMP changes is provided in Table 4-13.

Table 4-13: Summary of DMMP changes between 2019 and 2025

Feature	2019 DMMP Design	2025 Revised DMMP Design
Channel Dimensions	No change between plans	No change – Alternative A: -47'/-49' depth, 300'/550' width, 1200' turning basin
Placement on West Side (0+000 to 84+500)	**Included**	**Removed**
Lavaca Bay Sites (NP7/OP10)	Open water placement	Replaced with **Bird Island (Beneficial Use)**
PA 18/19 (Near Port of Calhoun)	Existing semi-confined site	**Expanded** for additional capacity
Placement Area 1 (Upland Proposed Site)	**Included**	**Removed**
Keller Bay Peninsula (Beneficial Use Option)	**Not included**	**Included** in the plan
Legacy Open Water Sites	**Excluded**	**Included** in the plan
Offshore Sediment Trap	**Included**	**Removed**

4.6.1 Assumptions from Deficiency Project Material Management

The Matagorda Ship Channel Jetty Deficiency (MSCJD) project is currently in PED. The DMMP associated with the authorized feasibility study is considered in the MSCIP material management plan.

The DMMP from the MSCJD can be summarized as follows:

- Roughly 1.2 MCY of NW will be placed at Chester Island from removal of the bottleneck, allowing for northward expansion.
- Remaining NW materials will be disposed south of the west jetty to nourish the shoreline, placing near the -3.0' contour to create a linear berm.
    - The estimated volume of the material is 3.6 MCY.

4.7 Removal of Sediment Trap from Plan

In 2019, a Sediment Trap (ST) was proposed to reduce the offshore maintenance burden in the MSC. After careful review of the evaluation and justification of the trap, the following was determined:

- The ST design was not justified on a cost savings basis; the dredging cost savings are not well documented.
- The ST was not sensitivity tested with alternatives (location, orientation, size).
- It is unclear if the ST is needed; there are no strong indicators that current or future dredging requires a ST to maintain authorized depth.
- The ST did not consider the removal of the jetty bottleneck.

The 2019 ST location is shown in Figure 4-11 along with the 40’ MLLW contour.

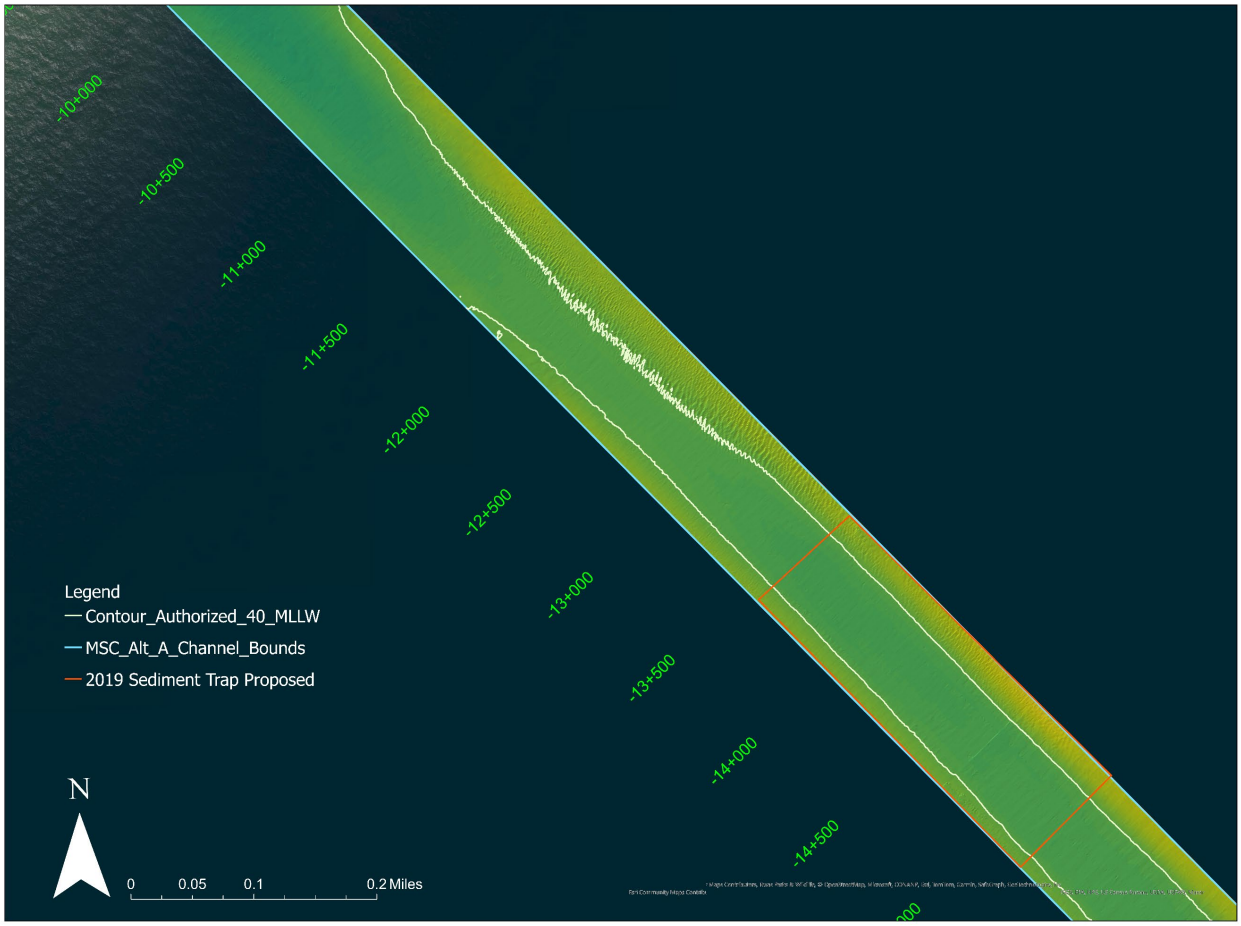


Figure 4-11: 2019 Sediment Trap Design

The ST was proposed between stationing -15+200 to -13+600 at -62 ft MLLW. The trap design was intended to reduce the persistence of an offshore “bar.” However, this bar is not clearly evident at the same location over multiple surveys. Furthermore, offshore dredging has not increased in quantity or frequency over recent years. The behavior of this offshore bar is rather unpredictable and likely migrates along the channel from year to year.

In theory, the most appropriate location for the ST would be closer to the jetties to intercept longshore transport (~-11+000 to -13+000). Longshore sediments that enter the channel towards the jetties are likely carried offshore by ebb tide currents. With active longshore transport, waves breaking in and near the surf zone would support a trap closer to the inlet.

In 2023, CMS was utilized to ascertain the performance of the ST in different locations along the channel. Two traps were given the same depth and length (62' x 1500'). The CMS model was run for 1-yr as described in Section 2.6 with the proposed deepening and widening (-47'/-49' plan). In analyzing the morphology, it became clear that the trap closer to the jetties may be more effective, as shown by Figure 4-12.

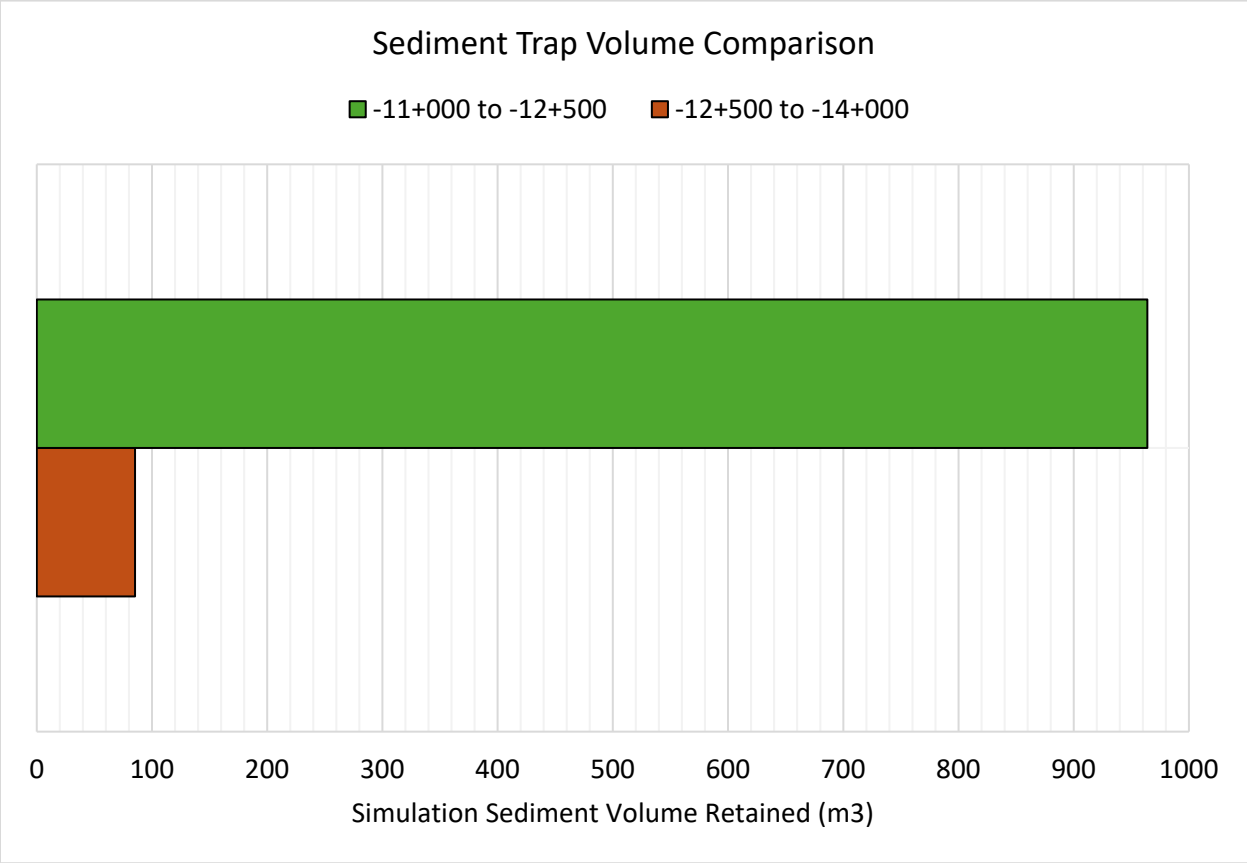


Figure 4-12: Sediment Trap Alternative Assessment

Between 2023 – 2025, there was no recommendation made for a new sediment trap location based on early sensitivity modeling. Additionally, because of reasons previously stated, the 2019 ST design was deemed unwarranted. The CSAT shoaling rate is not well corroborated by dredging data far offshore of the entrance (Section 2.5.3). CSAT results indicate that the offshore bar may stretch as far as -18+000 with the highest accretion seen near -13+000. Review of available data and model results found that the ideal location for the sediment trap was inconclusive.

Without a comprehensive understanding on the ST design efficacy, the recommendation was to not include the design in the plan. Therefore, the RP does not include construction of the sediment trap.

4.8 Reduction in Offshore Extent

In 2019, the -47'/-49' plan was proposed to extend as far as station -33+000. Hydrographic survey provided in 2023 by the Southern Area Office (SAO) shows that the recommended entrance depth (49' MLLW) is already existing past station -26+000. In effect, there is no dredged material to be removed with construction of the new channel between -26+000 and -33+000. This furthest most NW dredging limit is depicted by Figure 4-13 with the "proposed" 49' contour.

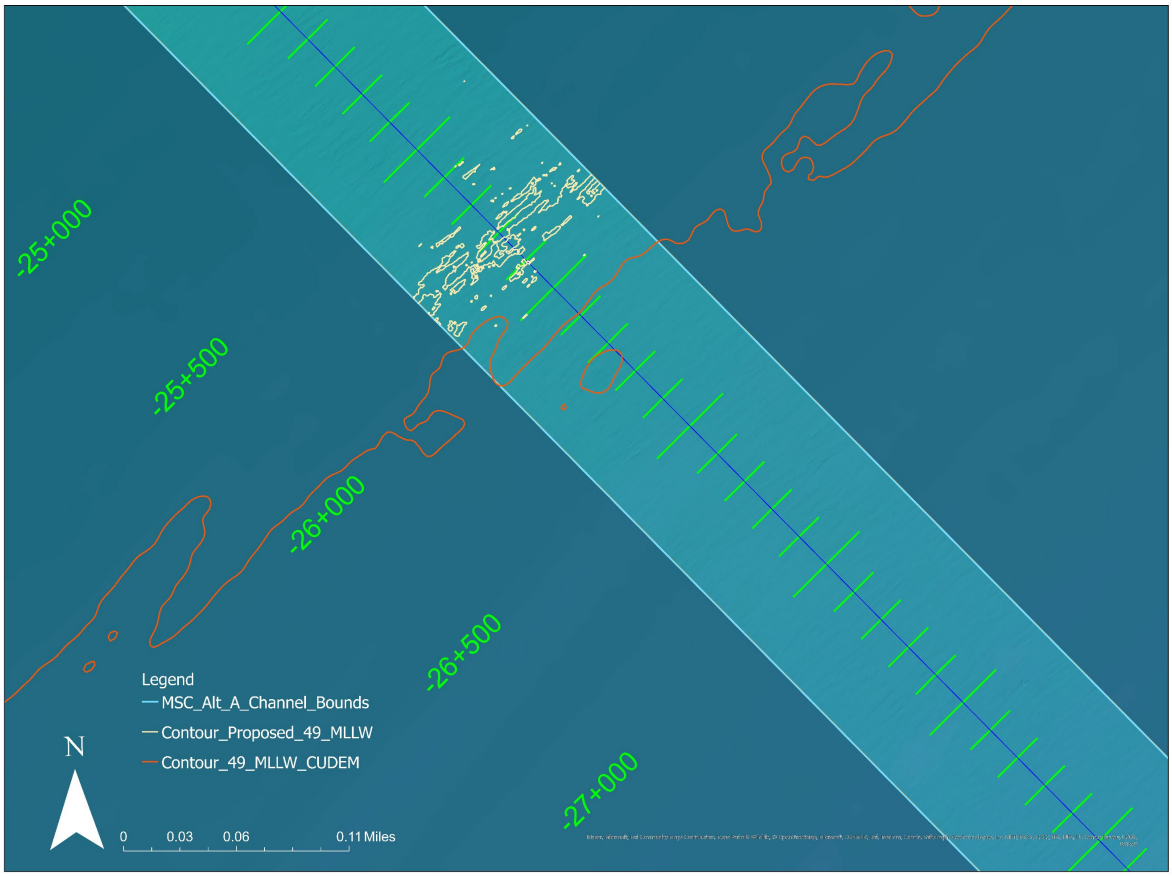


Figure 4-13: 49' Contour in Offshore MSC

The true extent of the -49' contour could vary between surveys. To verify the 2023 hydrographic survey, NOAA's CUDEM was referenced. The CUDEM agrees well in location compared to the 2023 survey (see above).

The location of the 49' contour has the potential to shift, though this is seen as a minimal risk to the project. The combination of survey data and available online datasets demonstrates that the channel is well maintained at or below this depth past station -26+000. Therefore, NW materials are not expected offshore of station -26+000 at the time of construction.

4.9 Sand Engine Design

Design of the Sand Engine (SE) is discussed in Appendix E. The SE is intended to receive both NW and O&M materials and function as BU.

4.10 Pipeline and Utility Crossings

The investigation of pipeline and utility crossings began during the 2019 IFR/EIS, where an initial screening identified 22 potential pipelines in Lavaca and Matagorda Bays and the Entrance Channel. Through further investigation, Galveston District's Real Estate Division reduced this number to 16 assumed pipeline crossings. At that time, only 13 of the 16 pipelines had been confidently located and shown on the drawings.

The 2019 IFR/EIS stated that additional investigation to verify the remaining pipelines would be conducted during the PED phase. This validation effort took place in 2021. As part of this effort, the Calhoun Port Authority (CPA) commissioned Mott MacDonald, a management, engineering, and development consultancy, to prepare a *Due Diligence Report*, initially dated December 17, 2021. The report identified 20 suspected pipelines, estimated to include one requiring relocation, 13 requiring removal, two to remain in place, and four of unknown status. The final version, dated January 16, 2022, incorporated all supporting documentation and is referred to as the *Matagorda Ship Channel (MSCIP) – Due Diligence Report*.

The report documented a comprehensive investigation to determine the existence, location, and ownership of pipelines that could impact the project's deepening and widening efforts. Its approach was exhaustive, encompassing four major components: a review of existing documentation, right-of-way (ROW) investigations, a magnetometer survey, and stakeholder engagement. The findings were intended to support the CPA in planning pipeline removal and relocation, including cost, schedule, and regulatory considerations.

The findings documented in the Mott MacDonald due diligence report provided the foundational data for the USACE Structural Team's subsequent engineering analysis. During the PED phase, the team confirmed the horizontal and vertical alignment of the known pipeline crossings, identified structural conflicts, and assessed potential debris removal requirements. The team documented these findings in a peer-reviewed Design Documentation Report (DDR) completed at the 65-percent design level.

The required actions for these pipeline crossings have been significantly refined from the original assumptions of the 2019 IFR/EIS. That earlier study made a conservative, feasibility-level assumption that all 16 conflicting pipelines would require full relocation.

In contrast, the current analysis defines a more precise and less costly set of required actions:

- Removal: Thirteen of the pipelines that conflict with the template will require removal only.
- Relocation: One pipeline - a 30-inch Federal Energy Regulatory Commission (FERC) regulated pipeline, will require relocation.
- To Remain by Waiver: The final two conflicting pipelines will be allowed to remain in place. The CPA has deemed them exempt from USACE's clearance template requirements and will issue a formal waiver to that effect.

4.10.1 Pipelines for Relocation

Magnetometer survey and subsequent pipeline inventory was developed jointly between CPA, Mott MacDonald, and T. Baker Smith (TBS) to determine relocations. Of the identified pipelines, the NFS has provided supporting evidence that two pipelines can remain in place at station 91+307, and one will be removed at station 91+335. The CESWG-OD MFR, dated February 1, 2023, specifies that authorized District channels with Advance Maintenance of 2 ft or less require 20 ft of cover between the authorized depth and pipeline. If the channel stationing calls for higher AM, the permissible elevation of pipelines will depend on the maximum dredge depth (authorized + AM + OD). To comply with USACE-SWG policy on minimum depth of cover, the reported pipeline elevations were reviewed.

Utilizing Texas Coastal Ocean Observation Network (TCOON) control monuments data, the conversion of MLT to MLLW is +1.7 ft though data provided by the NFS cites a conversion of nearly +0.3 ft. For the -47'/-49' MLLW alternative, the required elevation of pipelines for Station 0+000 to 97+000 is calculated as -67 ft MLLW.

Table 4-14 details the elevations of pipelines considered for relocation.

Table 4-14: Assessment of Pipeline Relocations for MSCIP (MLT Elevation provided by NFS)

Pipeline Name	Elevation (ft) MLT *Reported*	Elevation Required (ft) MLLW	Elevation Calculated (ft) MLLW	Stationing
L8	-70.7	-67.0	-69.0	91+307
L9	-70.7	-67.0	-69.0	91+307
L10	-50.0	-67.0	-48.3	91+335

In Table 4-14, pipelines L8 and L9 are below -67 ft MLLW. Therefore, they are not slated for relocation and may remain in place provided elevations are confirmed in the field before construction. The elevation of L8 and L9 were checked with as-built drawings provided by Mustang Engineering Inc., dated June, 1999. While L8 and L9 may remain in place, pipeline L10 will have to be relocated in accordance with SWG policy (Section 4.10.3).

4.10.2 Pipeline Risk Mitigation

Beyond the actions planned for the confirmed crossings, the risk associated with the four potential pipelines that could not be definitively located during the investigation is considered low, based on the following findings:

- The investigation found no evidence to confirm the existence of two of these potential pipelines; for planning purposes, they are presumed to be non-existent.
- The remaining two, while also unconfirmed, are believed to be located within a known pipeline corridor. This constraint on their potential location significantly mitigates the risk of an unforeseen discovery elsewhere in the project area.

Given this low probability, no further pre-construction investigation to locate these potential pipelines is planned. The project will therefore accept this as a low-level residual risk. Nevertheless, the discovery of an active, conflicting pipeline during construction would require contingency actions and would likely impact the project schedule and cost. The two pipelines in question (M7 and M8 in Table 4-15) are shown in USACE channel drawings at Station 73+212 where the CPA is planning to coordinate removal of M5 and M6.

Beyond the 16 confirmed pipelines, no other utilities are known to cross the Matagorda Ship Channel.

Table 4-15 details the data for each identified pipeline crossing. The table includes the pipeline number, station location, owner, required action (relocation or removal), size, burial depth, product conveyed, and associated USACE permit number. This information provides the basis for real estate coordination and detailed cost estimating for the project.

Findings from the NFS Due Diligence Report are depicted in Figure 4-14.

Table 4-15: Matagorda Ship Channel Pipeline Crossings Data (NFS Provided)

Pipeline No.	MSCIP Pipeline Name	Region	Station[2]	Pipeline Owner	Removal, Relocation, or Remain	Coordination Initiated	Pipeline Ownership Acknowledged	Pipe Size (in)	Elevation* (ft, MLLW)	Product Conveyed	Remarks[5]	USACE Permit No.
1	E1	Entrance Channel	-18+520	Genesis	Removal Only	Yes	Yes	24.00	-63.3	none	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Abandoned pipeline. Cooperation established.	14794
2	M1	Matagorda Bay	22+035	none	Unknown	No	No evidence of exist. pipeline	n/a	–	n/a	Not shown on USCAE channel drawings. Shown in Fugro Report. UNOCAL Letter dated October 22, 2001, indicates pipeline was never constructed. Pipeline existence not confirmed.	n/a
3	M2	Matagorda Bay	42+575	Goldston	Removal Only	No Coordination	No - ownership denied	3.00	–	Oil	Shown on both USACEs channel drawings and in Fugro Report. Not all indicators are conclusive.	3573
4	M3	Matagorda Bay	42+598	Dow	Removal Only	Yes	No - ownership denied	16.00	–	Natural Gas	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Abandoned pipeline.	6729
5	M4	Matagorda Bay	64+000	–	Unknown	No	No evidence of exist. pipeline	Not known	–	Unknown	Blocks 65 and 66. No traceability. Pipeline existence not confirmed.	Unknown
6	M5	Matagorda Bay	72+949	Lavaca	Removal Only	Yes	Yes	8.00	-48.3	none	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Cooperation established.	4566
7	M6	Matagorda Bay	72+949	Lavaca	Removal Only	Yes	Yes	8.00	-48.3	none	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Cooperation	4566
8	M7	Matagorda Bay	72+949	Lavaca	Unknown	Yes	No - ownership denied	2.50	-48.3	n/a	Shown on both USACE channel drawings and in Fugro Report. Pipeline existence not confirmed.	4566
9	M8	Matagorda Bay	72+949	Lavaca	Unknown	Yes	No - ownership denied	2.50	-48.3	n/a	Shown on both USACE channel drawings and in Fugro Report. Pipeline existence not confirmed.	4566
10	L1	Lavaca Bay	76+192	Enterprise	Removal Only	Yes	Yes	6.50	–	Natural Gas	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Cooperation established.	-
11	L2	Lavaca Bay	76+314	ONEOK	Removal Only	No	No	6.63	–	Natural Gas	Shown on both USACE channel drawings and in Fugro Report. Not all indicators are conclusive. Contact with	4702

Pipeline No.	MSCIP Pipeline Name	Region	Station[2]	Pipeline Owner	Removal, Relocation, or Remain	Coordination Initiated	Pipeline Ownership Acknowledged	Pipe Size (in)	Elevation* (ft, MLLW)	Product Conveyed	Remarks[5]	USACE Permit No.
12	L3	Lavaca Bay	82+960	Chesapeake	Removal Only	Yes	No - ownership denied	4.00	-48.3	Oil	Fugro Report shows two 4" pipelines owned by Humble at Station 83+236 with the same Corps permit number. Not all indicators are conclusive.	3555
13	L4	Lavaca Bay	82+960	Chesapeake	Removal Only	Yes	No - ownership denied	4.00	-48.3	Oil	Fugro Report shows two 4" pipelines owned by Humble at Station 83+236 with the same Corps permit number. Not all indicators are conclusive.	3555
14	L5	Lavaca Bay	82+960	Chesapeake	Removal Only	Yes	No - ownership denied	8.63	-48.3	Oil	Fugro Report shows two 4" pipelines owned by Humble at Station 83+236 with the same Corps permit number. Not all indicators are conclusive.	3552
15	L6	Lavaca Bay	82+960	Chesapeake	Removal Only	Yes	No - ownership denied	4.00	-48.3	Oil	Fugro Report shows two 4" pipelines owned by Humble at Station 83+236 with the same Corps permit number. Not all indicators are conclusive.	3556
16	L7	Lavaca Bay	83+260	Kinder Morgan	Removal Only	Yes	No - ownership denied	8.00	–	Natural Gas	Pipeline existence confirmed by magnetometer survey. Fugro Report shows two 4" pipelines owned by Onyx at Station 83+236 with the same Corps permit number. Contact with pipeline owner not established.	-
17	L8	Lavaca Bay	90+565	Ineous USA LLC	Remain in Place	Yes	Yes	8.63	-69.0	Ammonia	Not shown on USACE channel drawings. Shown in Fugro Report. Pipeline existence confirmed by magnetometer survey. Elevation shown as -70' MSL in records (0.00 MLT = -0.703' MSL). Remain in place.	-
18	L9	Lavaca Bay	90+565	Ineous USA LLC	Remain in Place	Yes	Yes	8.63	-69.0	Acrylonitrile	Not shown on USACE channel drawings. Shown in Fugro Report. Pipeline existence confirmed by magnetometer survey. Elevation shown as -70' MSL in records (0.00 MLT = -0.703' MSL). Remain in place.	-
19	L10	Lavaca Bay	91+075	Enbridge	Relocation	Yes	Yes	30.00	-48.3	Natural Gas	Pipeline existence confirmed by magnetometer survey. All indicators are conclusive. Federal Energy Regulatory (FERC) Pipeline	3560
20	L11	Lavaca Bay	105+467	Neumin Production Company	Removal Only	Yes	Yes	4.00	-48.3	None	Pipeline existence confirmed by magnetometer survey. Termination of Easement letter states it has been capped/abandoned. Abandoned pipeline.	23779

Removal Only	**13**
Relocation	**1**
Estimate of Pipelines Remaining	**2**
Unknown	**4**

Notes

1. Not for construction, permitting, ground disturbing activities, or design. Verification of pipeline location required since data shown may not accurately represent as-built conditions.
2. Based on current USACE Matagorda Ship Channel stationing, *confirmed with USACE maintenance contract drawings & differ from NFS Due Diligence Report*.
3. Pipelines to be removed following USACE, Galveston District Pipeline Guidance (CESWG-OD MFR)
4. Pipelines must be removed or relocated if their crown elevations are shallower than El. -74.00' MLLW within the Entrance Channel and -67.00' within the Matagorda and Lavaca Bays.
   - Changed from NFS Due Diligence Report.
5. Based on data gathered from existing and terminated Calhoun Port Authority (CPA) easements, leases, permits, Texas Railroad Commission, Fugro Report (2013), pipeline owner correspondence, and "Matagorda Ship Channel Improvement Project (MSCIP) Due Diligence Report," dated January 18, 2022, prepared by Mott MacDonald.

* Elevation employs a +1.7 ft vertical datum conversion from MLT to MLLW based on elevation provided in NFS Due Diligence Report.

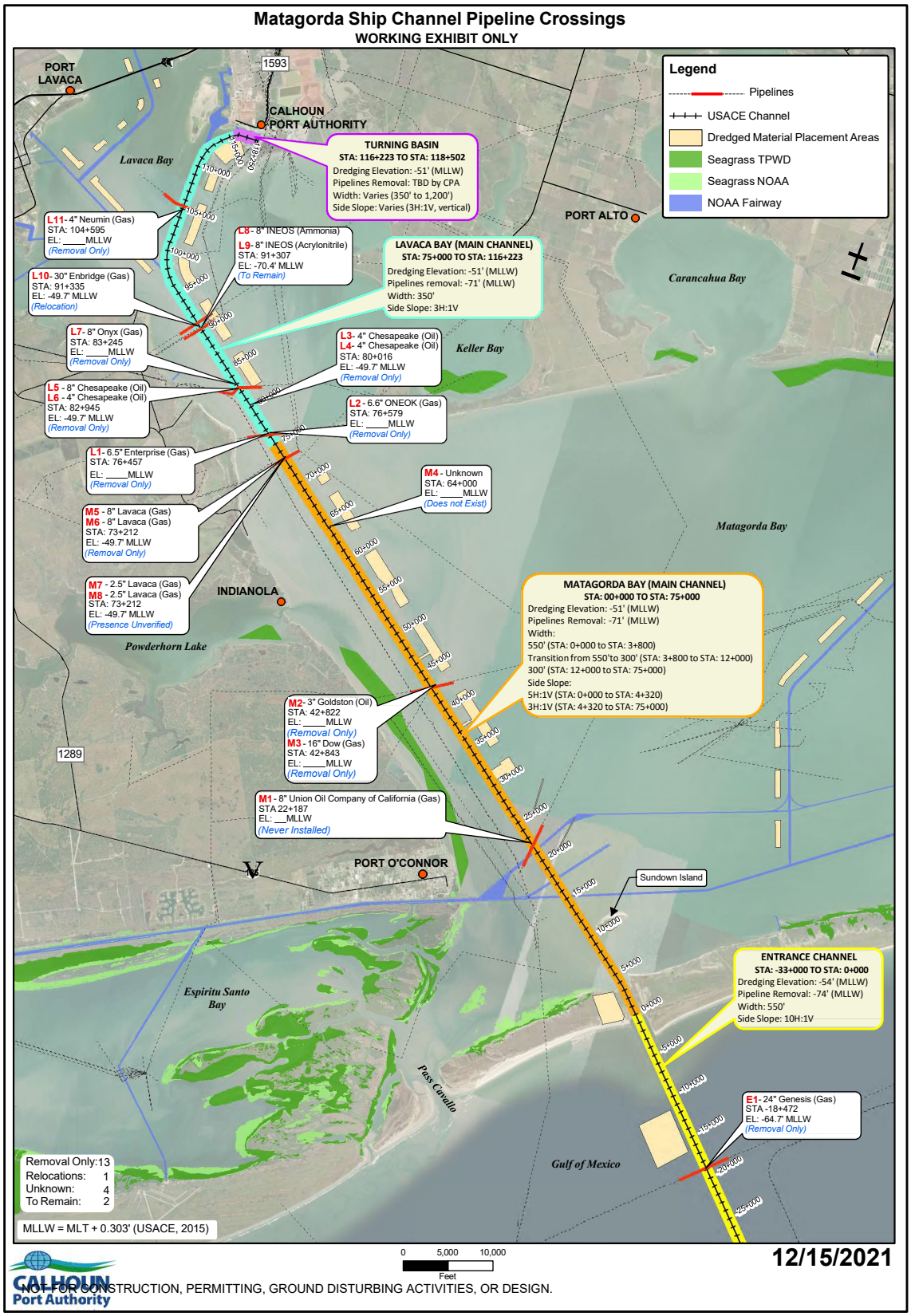


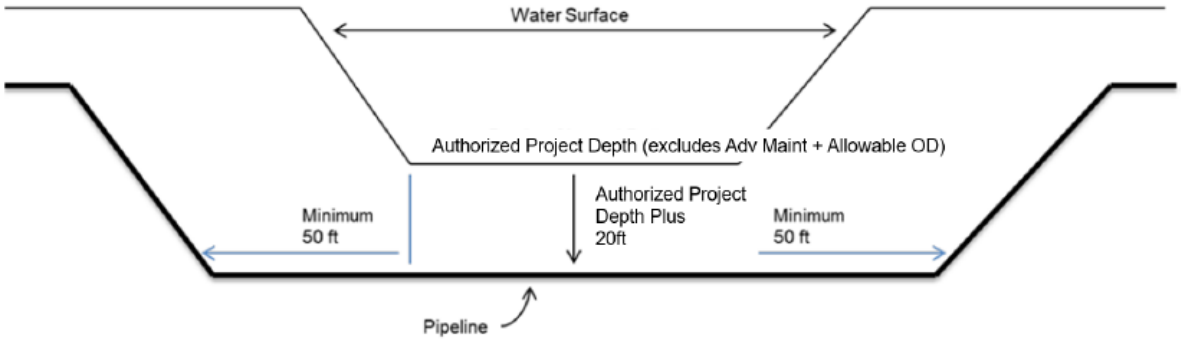
Figure 4-14: MSC Pipeline Crossings (NFS Provided – Elevations shown are not *all* Accurate)

4.10.3 CESWG-OD MFR on Pipeline Depth of Cover

MSCIP pipeline depth of cover requirements are detailed below in Figure 4-15.

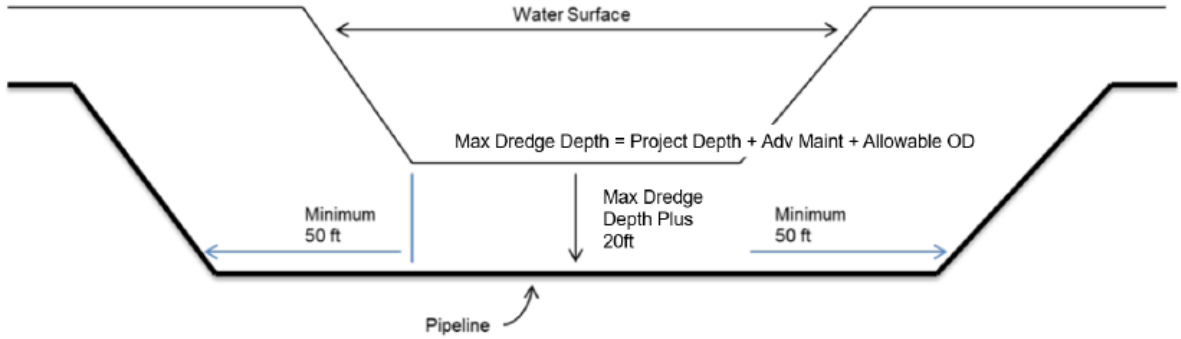
(2). Required Relocation/Removal of Pipelines in **Ongoing Studies with advanced maintenance of less than or equal to 2 feet**.

i. The existing pipeline must be deeper than **20 feet below the authorized project depth** (excludes advanced maintenance and allowable overdepth). Pipelines that do not meet this requirement must be relocated to the standards specified in 3. c. (1). ii.



Template 2: Deep Channel Pipeline Relocation Template (Ongoing Studies with less than or equal to 2 feet advanced maintenance)

(3). Evaluation of Pipelines in **New Studies** and **Ongoing Studies with advanced maintenance in excess of 2 feet**. For ongoing studies in which the advanced maintenance is greater than 2 feet, or for new studies initiated after the date of this policy, the existing pipeline must be deeper than **20 feet below the maximum dredge depth** (authorized project depth + advanced maintenance + allowable overdepth). Pipelines that do not meet this requirement must be relocated to the standards specified in 3. c. (1). ii.



Template 3: Deep Channel Pipeline Relocation Template (New Studies and Ongoing Studies - greater than 2 feet of advanced maintenance)

Figure 4-15: Depth of Cover Requirements for Pipelines per USACE-SWG Policy

4.11 Design Vessel

No changes have been made to the 2019 design vessel. The 2019 design vessel is as follows:

- Mid-size Aframax with 800 ft LOA, 138 ft beam, and fully-loaded draft of 48 ft.

Several mock ships were used in the ERDC ship simulations to assess navigability. The Eagle Kangar, an 800 ft Aframax, serves as the design vessel. Vessels chosen for 2021 ship simulations are detailed in Table 4-16 with characteristic draft. Different variations of vessel draft were simulated in the study to assess the sensitivity of ballast conditions; the limiting draft of the design vessel, per Section 4.4.2.1, is taken as 44 ft.

Table 4-16: Design Vessels used in 2021 ERDC Ship Simulations

Vessel Name	Model	LOA (ft)	Beam (ft)	Draft (ft)
Eagle Kangar	TANK25T	799.9	137.8	40.0
MT Britannia	VLCC15L	859.6	137.8	49.2

4.11.1.1 Feasibility Navigation Assessment (Ship Transit)

Based on the 2021 ship simulations, no major changes are recommended to the navigation design. The channel template is deemed suitable to accommodate the design vessel, Eagle Kangar. The Eagle Kangar was simulated at different ballasts, producing drafts of 43, 40, and 28.2 ft. The MT Britannia was implemented strictly to assess the horizontal dimensions of the channel alignment at the entrance. The conditions of the 2021 ship simulation are the same as the proposed channel template, namely:

- Entrance channel at -49 ft MLLW
- Bay side channel at -47 ft MLLW
- Entrance channel bottom width of 550 ft
- Bay side channel bottom width of 300 ft
- Bend easing north of Gallinipper Point
- 1,200 ft diameter turning basin near Point Comfort

The ship simulation concluded 41 successful transits, and one unsuccessful due to pilot unfamiliarity with transiting the design bend easing. With this exception, all transits stayed within the channel bounds. Flood and ebb tide conditions were simulated, with outbound runs proving most difficult for the vessel pilots. Overall, the simulations recommended that the proposed design features are safe and effective measured for improving the MSC. None of the runs were deemed unsafe (rating of 5).

4.11.1.2 Pilot's Rules

No major changes to the Pilot's rules are anticipated. The 2019 IFR/EIS documented the following: updates are shown in **bold**:

“The Pilots indicated daylight restrictions, as well as the one-way nature of the channel, frequently cause transportation delays. Strong currents at the jetties can also restrict the movement of vessels drafting within four feet of the maximum allowable draft, though there is not a specific rule regarding currents. The present restrictions placed on vessels transiting the MSC are listed below.

- All ocean-going traffic is one way.
- Any vessel within 4’ of maximum allowable draft is restricted to daylight only.
- Any vessel **175** meters (**575’**) or greater in length is restricted to daylight.
- No passing of ocean-going vessels.
- No movement of any vessel that is drafting **33’ or more** when current is greater than four knots, **ebb or flood**.

The USACE engineers have confirmed that the three feet under-keel (UKC) requirement is consistent with USACE UKC guidance in Engineer Manual (EM) 1110-2-1613. Therefore, a three-foot UKC requirement was used for this analysis.”

Changes to the Pilot’s rules reflect an even more conservative nighttime transit policy, consisting of a reduction in vessel size. Likewise, due to very strong currents at the entrance channel, allowable draft has been limited to ease navigational concerns.

4.12 Future With-Project

4.12.1 New Work Quantities

Hydrographic survey data provided by the Southern Area Office were used to determine the new work-volumes. The surveys were obtained in August 2023 using multibeam scan sonar. A bathymetric survey of the additional maneuvering space was performed by the Non-Federal Sponsor (NFS) on November 3, 2021. The material shown in the surveys were identified as new-work material. Quantities, including advance maintenance and allowable overdepth, were calculated from material in the template (see Section 4.5 for volumes). An example cross-section used in NW quantity calculation is shown below in Figure 4-16.

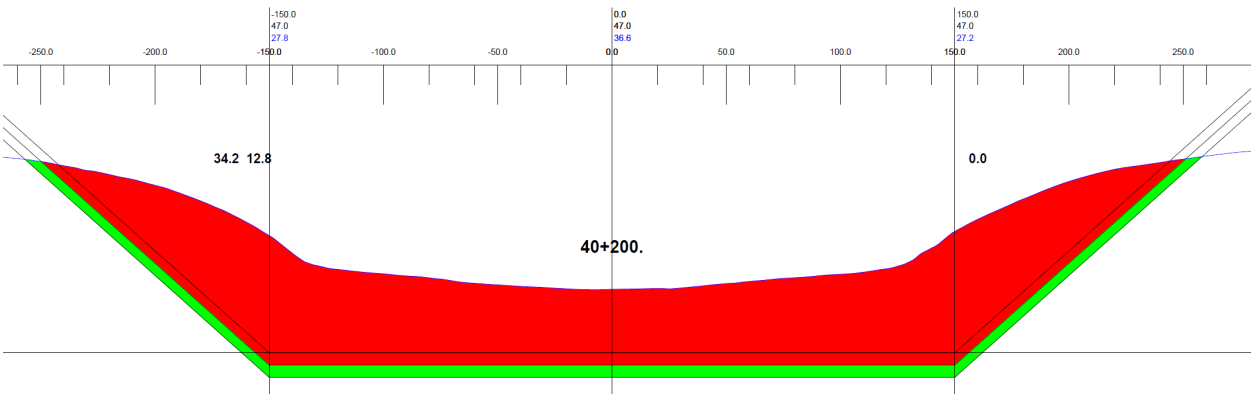


Figure 4-16: Example of HyPack Cross-Section Data used to Develop NW Volumes (Station 40+200)

4.12.2 O&M Quantities

O&M quantities are projected for FWP by use of updated shoaling conditions estimated in Section 2.8.4. The proposed dredge cycle is determined by combining the shoaling analysis with a maintenance costing procedure described in Section 8.3. Table 4-17 details the anticipated maintenance volumes for FWP under the RP (-47'/-49').

Table 4-17: FWP Maintenance Volumes

Stationing	FWP Annual Shoaling Volume (cy/yr)	FWP Dredging Cycle (Frequency in Years)	FWP Dredge Quantity (CY)
-26+000 to -14+000	177,833	4	8,891,651
-14+000 to 0+000	211,656	4	10,582,791
0+000 to 20+000	253,071	2	12,653,556
20+000 to 25+000	201,578	2	10,078,891
25+000 to 35+000	246,195	2	12,309,726
35+000 to 50+000	459,624	2	22,981,190
50+000 to 73+500	628,589	2	31,429,470
73+500 to 85+500	196,108	2	9,805,412
85+500 to 90+500	177,918	2	8,895,925
90+500 to 97+000	240,120	2	12,006,008
97+000 to 102+000	1,176,398	1	58,819,896
102+000 to 108+000	770,974	1	38,548,693
108+000 to 118+581	902,138	2	45,106,879
Total			**282,110,088**

5. Geotechnical Engineering

5.1 Introduction

The MSCIP Geotechnical section considered all the existing and available geotechnical information within USACE and Non-Federal Sponsor to determine its relevance to the feasibility of this study. The 2021 Matagorda Ship Channel (MSC) investigation was performed as part of the PED phase of MSCIP after completion of the 2019 MSCIP Feasibility Study Report. The major portion of geotechnical data used for the study-level geotechnical design was obtained from the geotechnical investigation conducted along the Matagorda Ship Channel (MSC) in 2021 and presented in the report prepared by Tolunay-Wong Engineers, Inc. in 2022 (TWEI 2022). The TWEI 2022 report is attached in Attachment G-1 of this appendix for reference.

The following sub-sections contain various geotechnical design considerations based on the available geotechnical data obtained within the project limits. The study-level design assumptions, recommendations, and appropriate design features, along with the geotechnical considerations related to the dredged material and placement areas, are described in the following sections. In addition, the results of the geotechnical laboratory testing performed as part of the 2021 MSC Geotechnical investigation were referred to for physical and engineering characteristics of the anticipated new work materials from channel excavation, which is necessary to determine dredge type and proper placement schemes.

5.2 Project Overview

The 2019 study report was based on limited geotechnical data available at the time. All previously drilled soil borings were too shallow to obtain representative samples from the proposed channel excavation zones. Despite these limitations, the available data were extrapolated to characterize the new work materials for the 2019 study-level geotechnical design.

Following 2022, the study-level geotechnical design was updated to incorporate data from the 2021 MSC investigation (TWEI, 2022). This investigation was comprehensive and specifically conducted to support the PED phase of the project. Accordingly, the 2021 MSC data are considered adequate for the current geotechnical design.

5.2.1 Review and Inventory of Available Subsurface Data from 2021 MSC Investigation (TWEI 2022).

The 2021 MSC investigation includes 72 channel borings with adequate drilling depth to collect better representative soil samples within the proposed cannel excavation zones (bottom varies from -41 ft to -54 ft MLLW). The average center-to-center distance between channel borings were 2000 feet along the approximately 29-mile-long MSC centerline.

Field investigation within the Matagorda Bay, along the jetty, and within 29 miles of the Gulf of America included the following:

Seventy-two channel borings (CB-1 through CB-13 and CB-18 through CB-76).

Seventy-two (72) channel borings were performed from mudline to about El. -70-ft MLLW.

The channel borings were drilled to obtain 3-inch-diameter Thin-Walled Tube (Shelby) Sampling of Soils (ASTM D1587) of cohesive materials as undisturbed continuous samples and Standard Penetration Test (SPT) method Sampling of Soils (ASTM D1586) of cohesionless materials as disturbed samples. Where cohesionless materials were encountered, disturbed samples were taken at approximately 5-foot depth intervals during the performance of standard penetration tests. Geotechnical laboratory tests were performed in accordance with ASTM International standards by the following USACE validated laboratories.

Forty vibracores (VB-1 through VB-40).

Forty (40) vibracores were performed from mudline to refusal within the Matagorda Bay within the proposed new work material placement areas. The purpose of vibracores were to obtain sediments and soft soils near the mudline within the proposed open-water new work dredged material Placement Areas (PAs).

Four shallow sediment sampling (CB-14 through CB-17).

The subject jetty is located at the perimeter of Matagorda Bay and Gulf of America and is travelled by large marine cargo vessels. Therefore, CB-14, CB-15, CB-16, and CB-17 were completed as shallow sediment sampling at corresponding mud elevations using a Ponar sampler to minimize impact to the shipping lane. The grab sample mud elevations vary between -19 and -34 ft MLLW.

5.3 Soil Sampling and Testing for Geotechnical Properties along the MSC

Soil samples were collected at 76 boring locations along the channel within the MSC project limits in 2021 to characterize the potential new work material that will be placed in placement areas. The geotechnical testing laboratory testing program included determination of moisture content (ASTM D2216), particle size analysis of soils with hydrometer (ASTM D422), Atterberg limits (ASTM D4318), percentage passing the No. 200 sieve (ASTM D1140), unconfined compression (ASTM D2166), unconsolidated-undrained triaxial compression (ASTM D2850), multi-stage consolidated-undrained triaxial compression (ASTM D4767) and determination of dry unit weight (ASTM D7263) for subject project geotechnical design work. A detailed summary of the laboratory testing is presented in the TWEI (2022) report, included as Attachment G-1 of this report for reference.

5.4 Interpretation of Subsurface conditions based on 2021 MSC Investigation

Based on the 2021 channel borings, the condition of subsurface soils representing the potential new work dredged materials is interpreted in Table 5-1 to Table 5-4 to support the MSCIP assessment. The new work material will be excavated from the improved MSC within the elevations between - 41 ft MLLW and the proposed channel bottom (this varies between - 51 and -54 ft MLLW) based on proposed channel templates as part of MSCIP. This information can be used to confirm MSC design slopes and potential new work material geotechnical characteristics and compute the study level quantity estimate for the MSCIP.

5.4.1 Gulf of America Reach – Station -12+000 to -33+000

Subsurface conditions along the shipping channel within the Gulf of America Sta. -13+00 to -33+00 were interpreted based on 2021 channel borings CB-1 through CB-11 drilled up to El. -70 ft MLLW.

The average mudline along the channel's centerline varies between El. -40 ft and -50 ft MLLW. The subsurface soils (representing the new work material) encountered from mudline to El. – 70 ft MLLW during the investigation at boring locations were primarily soft to firm fat clays and elastic silt. Table 5-1 presents a summary of the soil strength and index properties.

Table 5-1: Generalized Soil Profile: Sta. -12+000 to -33+000

El. (ft)	Description	Moisture Content (%)	LL	Su (psf)	SPT N_{60} (bpf)	Total Unit Weight (pcf)
-45 to -50	Soft to Firm Clay, with sand layers	24 - 30	56 – 64	400 – 1,000	–	117 - 120
-50 to -72	Soft to Firm Clay and Elastic Silt	28 - 57	45 – 82	500 – 1,400	–	103 - 128
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.4.2 Matagorda Bay Jetty Reach – Station -12+000 to 10+000

Subsurface conditions along the Matagorda Bay jetty Sta. -11+000 to 10+000 were interpreted based on 2021 channel borings CB-12, 13 and CB-18 through CB-20 drilled up to El.-70 ft MLLW.

The average mudline along the channel's centerline varies between El. -19 ft and -56 ft MLLW. The subsurface soils (representing the new work material) encountered from mudline to El. -70 ft MLLW during investigation at boring locations were primarily

medium to very dense silty and clayey sands. Table 5-2 presents a summary of the soil strength and index properties.

Table 5-2: Generalized Soil Profile: Sta. -12+000 to 10+000

El. (ft)	Description	Moisture Content (%)	% Passing No. 200	SPT N_{60} (bpf)	Total Unit Weight (pcf)
-45 to -70	Medium to very dense Silty and Clayey Sands	17 - 28	5 to 30	18 - 86	115 - 130
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test					

5.4.3 Southern Matagorda Bay Reach – Station 10+000 to 58+000

Subsurface conditions along the southern footprint of Matagorda Bay Sta. 10+000 to 58+000 were interpreted based on 2021 channel borings CB-21 through CB-44 drilled up to El.-70 ft MLLW.

Average mudline along the channel's centerline varies between El. -14 ft and -39 ft MLLW. The subsurface soils (representing the new work material) encountered during investigation at boring locations were primarily medium to firm lean and fat clays between El. -40 ft MLLW and El. -70 ft MLLW. Table 5-3 presents a summary of the soil strength and index properties.

Table 5-3: Generalized Soil Profile: Sta. 10+000 to 58+000

El. (ft)	Description	Moisture Content (%)	% Passing No. 200	Su (psf)	SPT N_{60} (bpf)	Total Unit Weight (pcf)
-15 to -40	Medium to dense Silty and Clayey Sands	23 - 40	20 to 60	–	15 - 80	115 - 130
-40 to -70	Medium to Firm Clay	28 - 57	60 - 99	800 – 1,400	–	105 - 125
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.4.4 Northern Matagorda Bay Reach – Station 58+000 to 118+500

Subsurface conditions along the northern footprint of Matagorda Bay Sta. 58+000 to 118+500 were interpreted based on 2021 channel borings CB-45 through CB-76 drilled up to El.-70 ft MLLW. Average mudline along the channel's centerline varies between El. -5 ft and -43 ft MLLW. The significant mudline elevation variation is as a result of previous dredging activity performed south of Calhoun County Navigation district.

The subsurface soils (representing the new work material) encountered during investigation at boring locations were primarily medium to firm lean and fat clays between El. -25 ft MLLW and El. -50 ft MLLW. Table 5-4 presents a summary of the soil strength and index properties.

Table 5-4: Generalized Soil Profile: Sta. 58+000 to 118+500

El. (ft)	Description	Moisture Content (%)	LL (---)	Su (psf)	SPT N_{60} (bpf)	Total Unit Weight (pcf)
-5 to -25	Soft to Firm Clay, with sand layers	24 - 30	40 - 70	400 – 1,000	–	117 - 120
-25 to -50	Medium to Firm Clay	24 - 30	40 - 80	400 – 1,600	–	115 - 125
-50 to -70	Medium to dense Silty and Clayey Sands	23 - 40	–	–	25 - 100	115 - 130
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.5 Dredged Material

5.5.1 New Work

The total volume of new work material to be dredged for the MSCIP was estimated using geometric analysis based on 2023 MSC topographic survey data, for the proposed channel excavation up to -47/-49 ft MLLW (Alternative A RP). The volume calculations are based on the proposed channel dimensions and include both the overdepth and advanced maintenance requirements. The new work template dimensions and new work material volume estimate are discussed in the Dredged Material Management Plan (DMMP) Appendix E.

Table 5-5 provides an approximate soil classification of the new work dredged material based on 2023 MSC Survey data and the 2021 geotechnical investigation data, as shown in Attachment G-1 of this appendix section. The calculation method does not account for potential subsurface layer variations between drilled locations or elevation changes of boring since the recent topographic surveys were performed. In other words, it was assumed that the soil conditions were like the closest available soil boring.

Table 5-5: New Work Dredged Material Classification for Geotechnical Engineering

Stationing Limit	Placement Area	Method	New Work Dredge Quantities per Cycle (CY) 2023 Survey	Percent Sand	Percent Stiff to Hard Clay	Percent Soft Clay and/or Silt Layer
-26+000 to -14+000	ODMDS	Hopper	3,149,800	9	51	40
-14+000 to 0+000	SAND ENGINE	Hopper	2,022,400	83.3	11.9	4.8
0+000 to 20+000	NP1	Pipeline	2,893,200	51	34	15
20+000 to 47+000	NP2	Pipeline	6,929,300	45	47	8
47+000 to 72+000	NP3	Pipeline	6,511,400	17	31	52
72+000 to 97+000	NP4/5	Pipeline	6,427,200	25	17	57
97+000 to 101+000	NP6	Pipeline	1,693,300	35	10	55
101+000 to 108+000	Bird Island	Pipeline	2,893,400	16	75	9
108+000 to 118+581	Bird Island	Pipeline	6,795,600	6	92	2

The dredge prism soil classification is based on available boring logs from the 2021 MSC geotechnical investigation and provides adequate information for estimating the soil condition for the baseline cost estimate. Additional soil investigations may be necessary within the ship channel and turning basin during PED to further delineate the stiff clay and sand deposits depending on the PED phase design requirements.

5.5.2 Maintenance Dredging

The 50 years of maintenance material for each channel reach to be dredged for the MSC for future without-project and with-project was estimated and summarized in the Dredged Material Management Plan (DMMP) Appendix E. Generally, the maintenance material is fine-grained, clay, and silt in Lavaca Bay and Matagorda Bay. Clay and silt are also prevalent in offshore maintenance materials offshore of station -17+000. The maintenance materials may generally be categorized as clay (CH) and Silt (ML). A detailed breakdown of the maintenance DMMP can be found in Appendix E.

5.5.3 New Work Material Characterization

The subsurface soil conditions at the project site influence the selection of dredging equipment required for excavation under the Dredged Material Management Plan (DMMP). Generally, the soils within the turning basin and channel comprise soft to firm clays and medium-dense to very dense silty sands and clayey sands. Dredging is considered feasible with the use of appropriately selected equipment based on the geotechnical properties of the new work materials. The available channel boring data are sufficient for dredging contractors to develop bid-level plans and prepare accurate cost estimates, using experience from comparable channel improvement projects. The retention rate of dredged material during underwater placement varies depending on several factors, including soil characteristics. For the purpose of evaluating placement area capacity, the geotechnical analysis considered an average retention rate of 70 percent for new work materials. The 70 percent retention rate was adopted conservatively based on field data from the Corpus Christi Ship Channel Improvement Project, which involved similar new work material conditions.

5.5.4 Engineering Assumptions on Open Water Placement Areas Capacity Evaluation

The proposed placement area for new work material segments was assumed as a combined block of underwater zones with a combination of authorized NP areas and the adjoining OP area, as discussed in the Dredged Material Management Plan (DMMP) Appendix E. The capacity of the combined block of underwater zones was evaluated and verified to meet the demand for the proposed new work material placement under various engineering assumptions outlined below.

- The new work dredged quantity was estimated based on 2023 Channel survey data. The Alt-A Scale 4 (47/49) represents the higher new work volume of 39.34 million CY; the capacity evaluations consider this.
- Assume a 1-foot additional excavation below the contract template by the contractor as Non-Pay Volume for Alt-A Scale 4 (47/49) was considered for PA capacity checking.

- The open water PA area was estimated using available survey and mudline elevations, and the theoretical fill volume/ PA capacity (fill placement up to -3 ft MLLW) was estimated.
- The bulking factor and material loss rate during underwater placement were combined into a single “retention factor” for the purposes of this study. Reasonable study level retention rates were assumed to evaluate the capacity of the placement areas. These factors will be monitored and verified during the PED phase using survey data.
- For the underwater Placement Areas capacity check, a retention rate of 0.70 was assumed for new work material, and 0.5 for O&M (Operations & Maintenance) material placement.
- PA Capacity impact due to potential placement limitations from existing pipelines is considered part of the study-level PA capacity estimate.
- There is no significant impact on PA capacity due to adopting an imaginary 50-foot-wide no-placement / limited fill height (3-foot) corridor along the existing utility lines.

Based on the engineering evaluations the proposed placement plan is feasible, and the capacity of the underwater placement areas are adequate to accommodate the new work material placement. A detailed evaluation of underwater PA capacity check is presented in Appendix E.

5.6 Slope Stability Analysis and Design

This section presents a limited geotechnical analysis performed as part of the study-level design and the recommendations for the PED phase geotechnical design. Based on the study-level design, the MSCIP is feasible from a geotechnical design standpoint. However, a detailed design shall be performed during the PED phase for channel stability evaluations and dredge material placement by incorporating the PED-level design requirements.

The proposed side slopes of the designed channel are at 3H:1V in Matagorda Bay and Lavaca Bay, 10H:1V Offshore, and 5H:1V between the Bay and Offshore as a transition to the channel segments' slope gradient.

Although the analysis confirms a stable slope under steady-state static conditions, it is acknowledged that the channel slopes will frequently be subject to significant pressure waves when loaded deep-draft vessels pass, and that the pressure wave can cause significant temporary fluctuation in the pore pressure well below the surface of the slope. This pore pressure fluctuation may result in shallow-slope slides at locations where the slope material is closer to a critical FS. The depths of the slides are limited by the depth of pore pressure fluctuation due to the pressure waves. The potential depths and locations of the slides will be highly variable along the channel, as can be ascertained by a review of previous slope changes, with time, along the channel slopes, which were originally dredged to a uniform slope. Since the sloughing could occur in various places along the channel and on portions of the slopes, it is not practical to find all shallow slides that will occur. Historically, the USACE Galveston District designs the slopes for the steady-state static condition and will remove the sloughed material from

the channel bottom during the maintenance-dredging cycles, along with the shoaled material.

Two types (circular and block/wedge) of slip surfaces/failure modes were considered using GeoStudio software -Morgenstern-Price method for subject channel deepening and widening. Subsurface soil profiles for slope sections were developed based on the nearest soil borings from available geotechnical data.

Stability Analyses were performed in two stages.

1) Short-term Stability (Undrained Conditions, immediately after dredging)

2) Long-term Stability (Drained Conditions, after dredging during potential surge level variation)

The channel slopes were analyzed for both undrained conditions and drained conditions.

Safety factors (associated with slope stability analyses) specified in the Engineering Manuals are as summarized below:

- EM 1110-2-5025, Table 4-8 recommends a minimum factor of safety of 1.3 for both the undrained and drained conditions for slopes less than 30 feet in height. This is not applicable because the project Channel slope height is more than 30 feet. For slopes with heights greater than 30 feet, EM 1110-2-1902, Table 3-1 recommends minimum factors of safety of 1.3 and 1.5 for undrained and drained conditions, respectively, for the earth and rock-fill dams. This is not applicable because no drained stage factor of safety for the upstream slope (channel face) is specified in the EM 1110-2-1902.
- EM 1110-2-1913, Table 6-1b recommends minimum safety factors of 1.3 and 1.4 for undrained and drained conditions for other embankments and dikes, including navigation channels. Table 6-1b also specifies that lower factors of safety may be appropriate when the consequences of failure in terms of safety, environmental damage, and economic losses are small.
- Considering the relatively low consequences of failure of a channel slope compared to a dam's failure, a minimum factor of safety of 1.3 for end-of-construction (undrained) and for long-term (drained) conditions were selected for this analysis.

A geotechnical engineering evaluation of the slope stability of the channel cut was conducted based on available geotechnical data from the 2021 Geotechnical Investigation. A total of three (3) sections were identified as critical and were analyzed for slope stability as part of this study-level design. The stability evaluation results met the minimum safety factors of 1.3 for both undrained and drained conditions. Results of slope stability models are documented in Attachment G-2. Additional sections shall be analyzed for slope stability in the PED phase of the design.

5.6.1 Additional Analyses and Design

72 channel borings were drilled as part of the 2021 geotechnical investigation to support the MSCIP. However, additional borings along the MSC and within the turning basin and

shallow sediment samplings may be required for additional laboratory testing depending on the project requirements during the PED phase.

All the open water Placement Areas (PAs) may require foundation soil assessment through additional shallow borings and vibracoring within the placement area footprints. A detailed geotechnical analysis will be needed to satisfy the PED level design requirements and support the construction of the project.

6. Environmental Considerations

The project footprint has been investigated for potential contaminants in coordination with the U.S. Environmental Protection Agency (EPA) since a portion of the footprint falls within the Alcoa Superfund Site. The investigations determined that there are no concerns based on sediment, elutriate, and water quality testing.

The development of the DMMP considered the potential impacts of material placement in and around the Alcoa Superfund Site. In an effort to minimize the movement of contaminants long-term, new PAs were not proposed within the boundaries of the superfund site (Figure 6-1). The only OWPA proposed in proximity to the superfund site boundary is OP9 west of the MSC.

6.1 Hazardous, Toxic, and Radioactive Waste

The potential for encountering Hazardous, Toxic, and Radioactive Waste (HTRW) materials, such as mercury, may be a risk; however, an investigation within the project footprint was conducted as recently as 2023. Results of these recent tests found that the constituents of concern did not exceed allowable thresholds. If future testing is determined necessary, potential obstacles may arise, affecting the timely construction and delivery of the project.

More information on HTRW is provided through a Tier 1 Evaluation in Appendix B and the Existing Conditions section of the Main Report. The 2023 sampling plan locations and laboratory results, as contracted by Alcoa to Benchmark Ecological Services is provided in Attachment H-1. The sampling and analysis plan was coordinated and submitted for review to EPA.

Based on the 2023 sampling campaign and Tier 1 Evaluation, the USACE does not expect to encounter HTRW; however, if HTRW is encountered, the NFS is 100% responsible for investigation, removal and disposal of any contaminants per ER-1165-2-132. In the unlikely event that HTRW is encountered, risks to the project pertain to cost, schedule, and the dredged material obligation. For example, the BU footprint may be less than planned due to a reduction in available material.

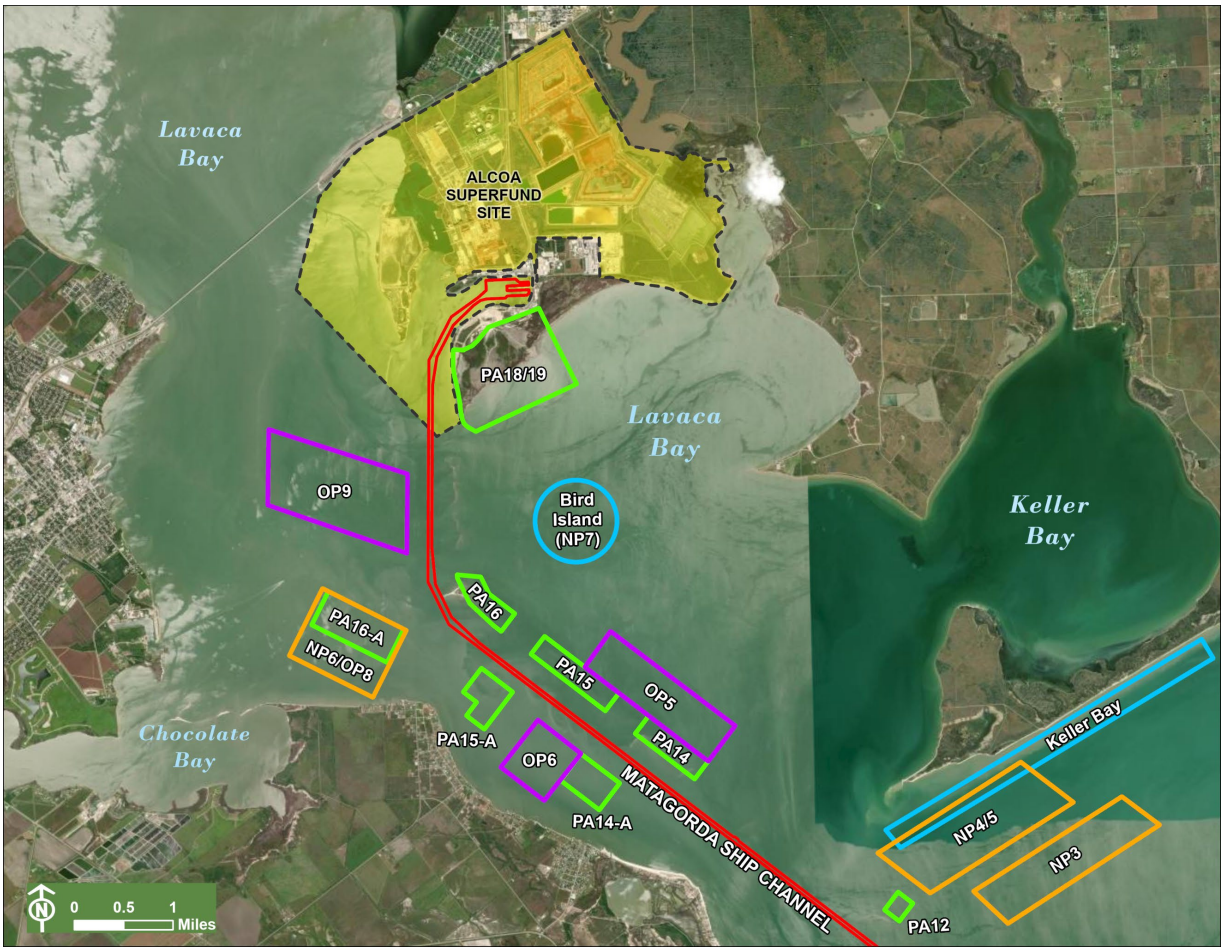


Figure 6-1: Alcoa Superfund Site with Proposed DMMP Overlay

6.1.1 Precautionary Steps

As an additional precautionary measure, a silt curtain or similar measure will be utilized, as requested by the EPA, when dredging the superfund area and as such, shall be detailed in the project specifications. Silt curtains are intended to increase settlement and intercept suspended sediments. Silt curtain design and specification writing should be reserved for the 65-95% phase of PED.

Engineering design and analyses thus far have not been conducted with respect to potential HTRW in the dredging, placement area, or mitigation footprints. Engineering risks associated with HTRW are considered low; changes to the engineering design are situational considerations that would be driven solely by new information.

6.2 Mitigation

The proposed mitigation sites were mapped in coordination with the Environmental lead on the project. The sites, pictured in Figure 6-2, are intended for cultch placement to attract oyster larvae. Suitable bay bottom was identified by use of Texas A&M University Galveston survey.

Sandy, hard, seabed was identified on the west side of the MSC, between Indianola and Port O'Connor, that would be conducive for oysters. The identified area is satisfactory for oyster larvae recruitment and long-term oyster reef growth. The mitigation area receives strong tidal influence, with northern sites proposed west of the MSC and southern sites near the intersection of the MSC and GIWW.

In total, the mitigation area would be 95 acres, split among 4 separate sites. By designating 4 separate sites, the USACE may collect better information on site-specific success criteria and use these data to better plan future mitigation efforts. The southern sites are split into 2, 20-acre cultch reefs, and the northern sites will feature a 29 and 26-acre reef.

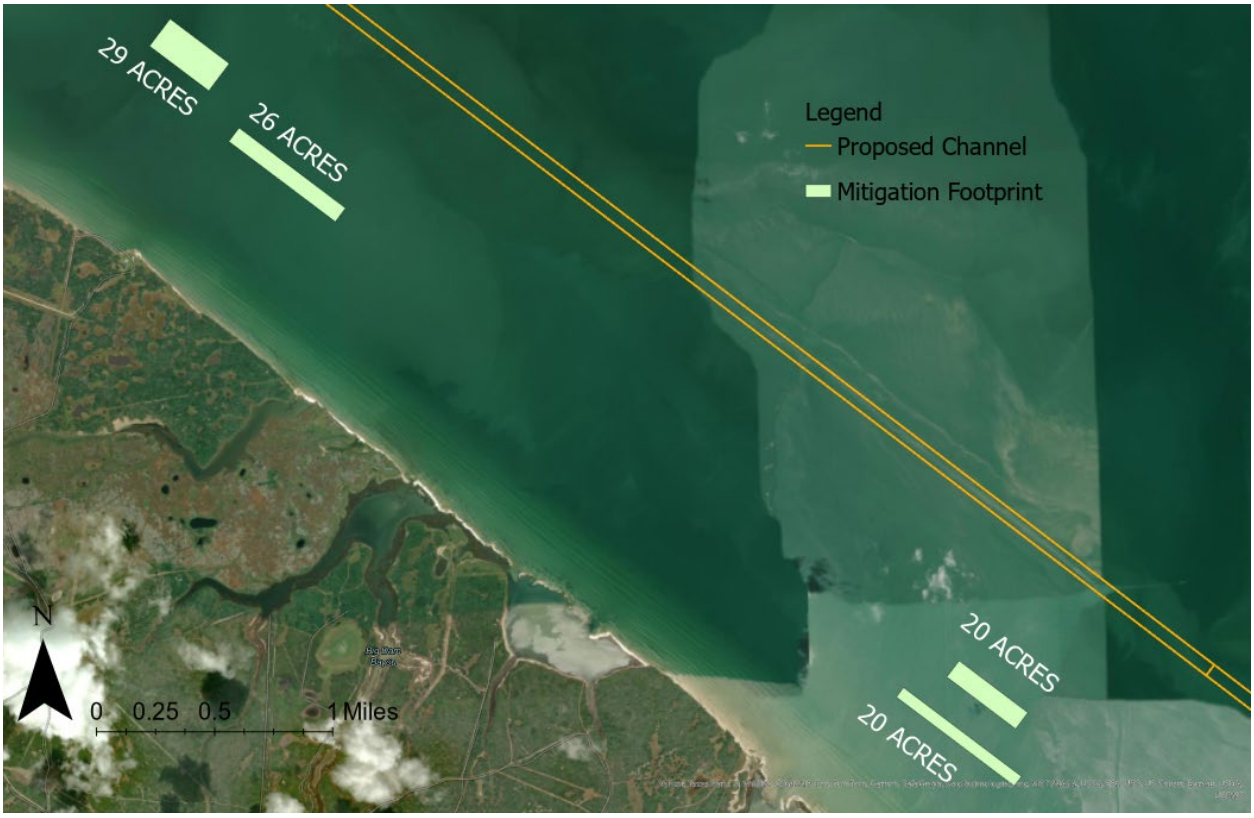


Figure 6-2: Oyster Mitigation Sites

The design of the mitigation sites is taken from the HSC-ECIP. Oyster mitigation involves placing an even layer of rock (cultch) on the seabed (Figure 6-3).

For estimating mitigation costs, the thickness of the cultch pads is assumed to be 2 ft. The oyster mitigation design will not require mechanical fill unless deemed necessary during PED.

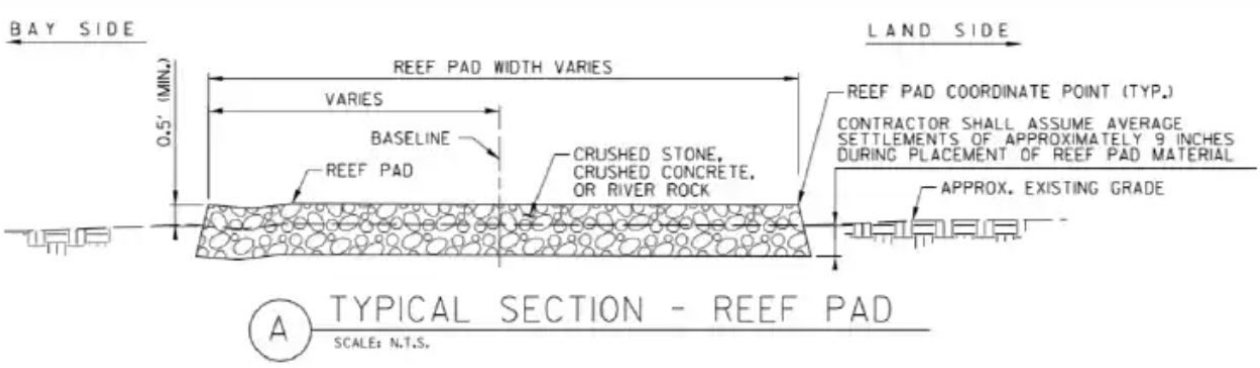


Figure 6-3: Oyster Reef Mitigation Typical Sourced from HSC-ECIP

6.3 Beneficial Use of Dredged Material

For the RP, nearly 39.34 MCY of NW material and over 280 MCY of O&M material will be dredged from the channel. To accomplish the USACE BU initiative, 4 separate BU sites are recommended for FWP. These sites include Chester Island, Sand Engine (SE), Keller Bay, and Bird Island (BI). Of the proposed BU features, only BI is intended exclusively for NW dredged material.

BU sites reflect careful coordination efforts with partner agencies and the NFS to identify sediment demand, shortages, and new opportunities, which are outlined in the DMMP, Appendix E. Of the total NW volume, BU accounts for over 28% of placement. The O&M strategy was formulated to allow for long-term BU. The Keller Bay site, for example, is not currently designated any BU material as part of the least-cost plan. However, long term collaboration with industry partners may effect placement at the Keller Bay location. Currently, BU accounts for only 8% of projected O&M material placement. This could easily increase to 25% with local partnership efforts or recategorizing proposed sites in the future (PA 18/19). The BU plan followed the steps listed below:

- Avoid placing over pipelines or known resources.
- Consider capacity requirements.
- Develop long-term nourishment plans rather than one-time placement.
    - SE is expected to receive more than 10 MCY over 50 yrs.
    - Chester Island is anticipated to receive over 12 MCY.
    - Bird Island is allocated a 9.7 MCY construction volume.
    - Keller Bay remains open for material procurement should future opportunities arise for nourishment.

6.3.1 Continuing to Pursue BU Opportunities

The DMMP allows for authorized BU within set boundaries of Matagorda Bay, Lavaca Bay, and the nearshore of Matagorda Peninsula. With growing interest in beneficial use, the intent of the project is to identify and plan future efforts that could help the USACE achieve 70% BU by 2030; such potential for cost growth is identified in the Cost and Schedule Risk Analysis (CSRA), see Section 9.2.

A list of potential improvements to the proposed BU plan is provided below:

1. Utilize proposed OP9 in Lavaca Bay to invite biological diversity through oyster recruitment, hardened structures, and shallow-water habitat while guaranteeing ease of maintenance for Operations. OP9 could be optimal for increasing recreational use for the local community.
2. Carefully expand Chester Island to create a marsh system nourished by dredged materials, featuring added erosion protection. Ongoing efforts at Chester Island are primarily concerned with training materials to the existing island footprint.
    a. Future efforts should focus on creating stable, shallow-water habitat with maintenance materials. Water depths will recruit native plant species and create habitat for crustaceans, birds, and fish. Northward expansion of Chester Island would increase environmental and recreational use.
3. Consider the upland placement of material on west Matagorda Peninsula for O&M materials over the project life (MP1 and MP2 in Appendix E). In certain scenarios, shoreline placement is preferred as opposed to the nearshore berm. Such scenarios arise when severe erosion is present, and the nourishment need is immediate; MP1 and MP2 are within existing USACE real estate easement.
    a. Pumping into the nearshore may present practical challenges for dredge operators. If the nearshore berm performance metrics prove to be poor, upland placement provides a reliable means to nourish the local beach.
4. Permit the use of maintenance materials at Matagorda Bay western shoreline, such as Indianola, Powderhorn Ranch, and Boggy Nature Park for restoration.

Each BU adjustment is a system-wide view on how to increase environmental, social, and recreational benefits. Future modifications to the BU plan do not consider new footprints; however, they do provide concept-level additions to existing/proposed sites that would greatly increase ecological value and worth to the local community. More detail on the continual improvement of the BU plan is provided in Appendix E.

7. Plan Selection

The selected plan, or 2025 Recommended Plan (RP), is the 2019 TSP (Alternative A). The Alternative A authorized depth is -47’ MLLW in the main channel (0+000 to 118+581) and -49’ MLLW in the entrance channel (-26+000 to 0+000). Changes to the RP channel template are relatively small compared to the scope of the project and have undergone the required civil design procedures in compliance with relevant ERs. The RP provides the highest net benefit to cost ratio (BCR) and is feasible according to the prescribed engineering findings. Outside of engineering considerations, several uncontrollable factors may counteract the viability of the channel deepening and widening.

The DMMP associated with the RP is detailed in Appendix E.

8. Advance Maintenance

Three approaches were explored to estimate the FWP advance maintenance for the RP. These techniques consist of the following:

- Direct method.
- Corrected (Coefficient) method.
- Spatially averaged method.

The majority of the MSC is not expected to experience a significant increase in shoaling rate under FWP conditions. Therefore, the direct method is practical to determine FWP AM. The direct method calculates the AM by the following:

$$FWP\ AM = FWP\ Dredge\ Cycle * \ FWP\ Shoaling\ Rate \quad (4)$$

The coefficient method employs a coefficient that is a function of the current AM, dredge cycle and shoaling rate (PWOP). The coefficient is calculated as:

$$Coefficient = \frac{PWOP\ AM}{PWOP\ Dredge\ Cycle * \ PWOP\ Shoaling\ Rate} \quad (5)$$

The corrected AM is then calculated as:

$$FWP\ AM = Coefficient\ x\ FWP\ Dredge\ Cycle\ x\ FWP\ Shoaling\ Rate$$

Lastly, the spatially averaged method considers the contract reaches to calculate a weighted average (based on reach length, W_x) AM:

$$FWP\ AM = \frac{\sum(W_x * AM)}{\sum W_x} \quad (6)$$

The AM estimates were determined from the FWP shoaling rates and include the effect of consolidation. Based on the assumptions outlined by the geotechnical lead, the retention rate is comprised of bulking (effective consolidation) and loss. Without factoring in the consolidation of maintenance materials, AM would likely be overestimated in reaches where the FWP shoaling rate is higher than existing. AM depths are included in all NW material quantity estimates.

8.1 Effective Settlement (Consolidation)

“Consolidation” is a terminology that is used loosely herein to describe effective settlement of low-density sediment layers in the shipping channel. MSC consolidation is estimated to range between 25-30% of the shoaled materials above the hard-bottom of the channel. The effect of consolidation is often experienced in what is known as a “fluid mud” layer. As first discussed in the 2013 RSM study, this lower-density layer of sediment has rheological properties comparable to water and can be easily resuspended by passing vessels. When ships make contact with fluid mud layers, they suffer no damage to their hull and often push material to the slopes of the channel.

Since the sediment-transport scheme used in the shoaling analysis does not include consolidation effects, the consolidation rate (%) was inferred from experience in other federal channels and available sediment data. Figure 8-1 below provides a map of sediment type throughout Matagorda Bay. As can be seen, the majority of sediments between mid-bay and Lavaca Bay are classified as mud or sandy mud.

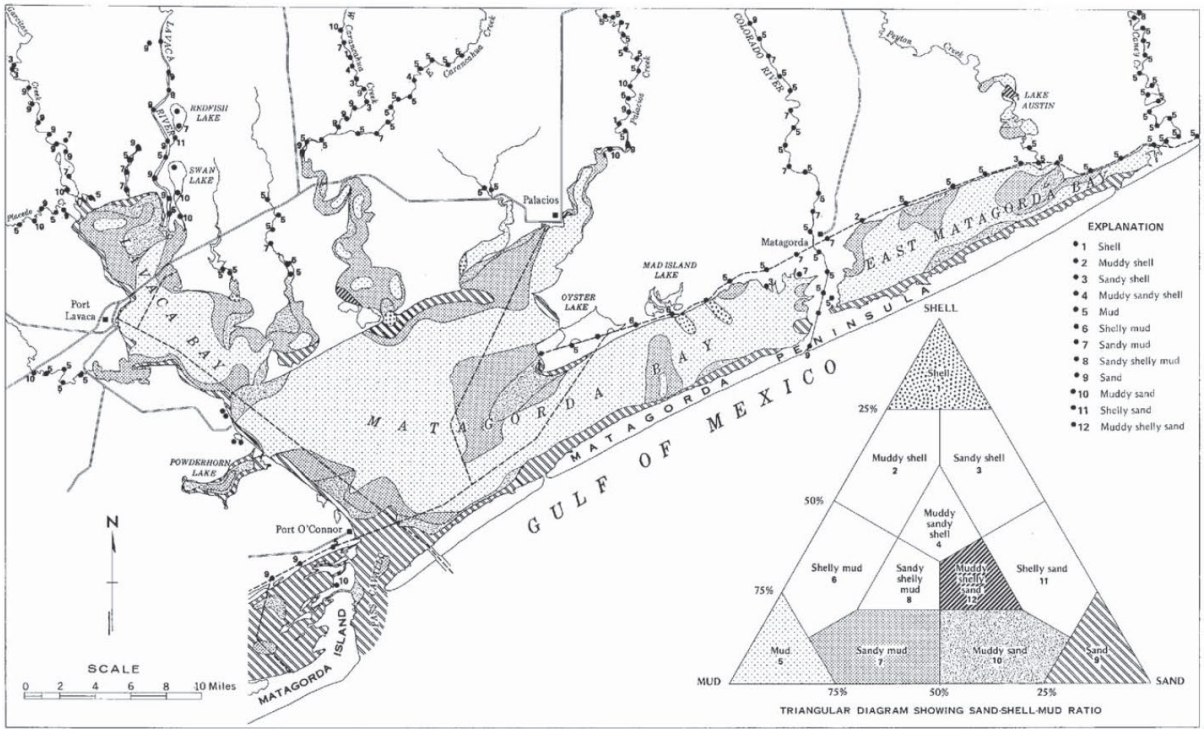


Figure 8-1: Sediment Classification in Matagorda Bay

Consolidation is time-dependent. For the purpose of this study, it is assumed that the majority of consolidation occurs within 1 year of material accretion. Table 8-1 details the reach, reach length, FWP shoaling rate, and estimated rate when accounting for consolidation effects.

Table 8-1: Shoaling Rate and Consolidated Rate for FWP

Alternative A Stationing	Reach Distance (ft)	FWP Shoaling Rate (ft/yr)	FWP Rate with Consolidation (ft/yr)
-26+000 to -14+000	12000	0.49	0.36
-14+000 to 0+000	14000	0.72	0.54
0+000 to 20+000	20000	0.85	0.64
20+000 to 25+000	5000	3.62	2.71
25+000 to 35+000	10000	2.22	1.66
35+000 to 50+000	15000	2.76	2.07
50+000 to 73+500	23500	2.42	1.81
73+500 to 85+500	12000	1.48	1.11
85+500 to 90+500	5000	3.21	2.41
90+500 to 97+000	6500	3.06	2.14
97+000 to 102+000	5000	16.02	11.21
102+000 to 108+000	6000	11.43	8.00
108+000 to 118+581	10581	3.64	2.55

Continued discharge into OWPA sites under FWP conditions could result in more persistent fluid mud layers. Because of this, the effective rate with consolidation is applied to estimate the AM depth; this rate is not used for capacity analysis.

Available dredging survey data shows that fluid mud or “fluff” layers are created during dredged material placement. Figure 8-2 illustrates an extreme case, based on October 2024 survey, where 10 ft of fluff was encountered near station 91+100 of the MSC. This fluff layer grew rapidly upstream of a “plug,” which is a precautionary absence of dredging that maintains the depth of cover over pipelines.

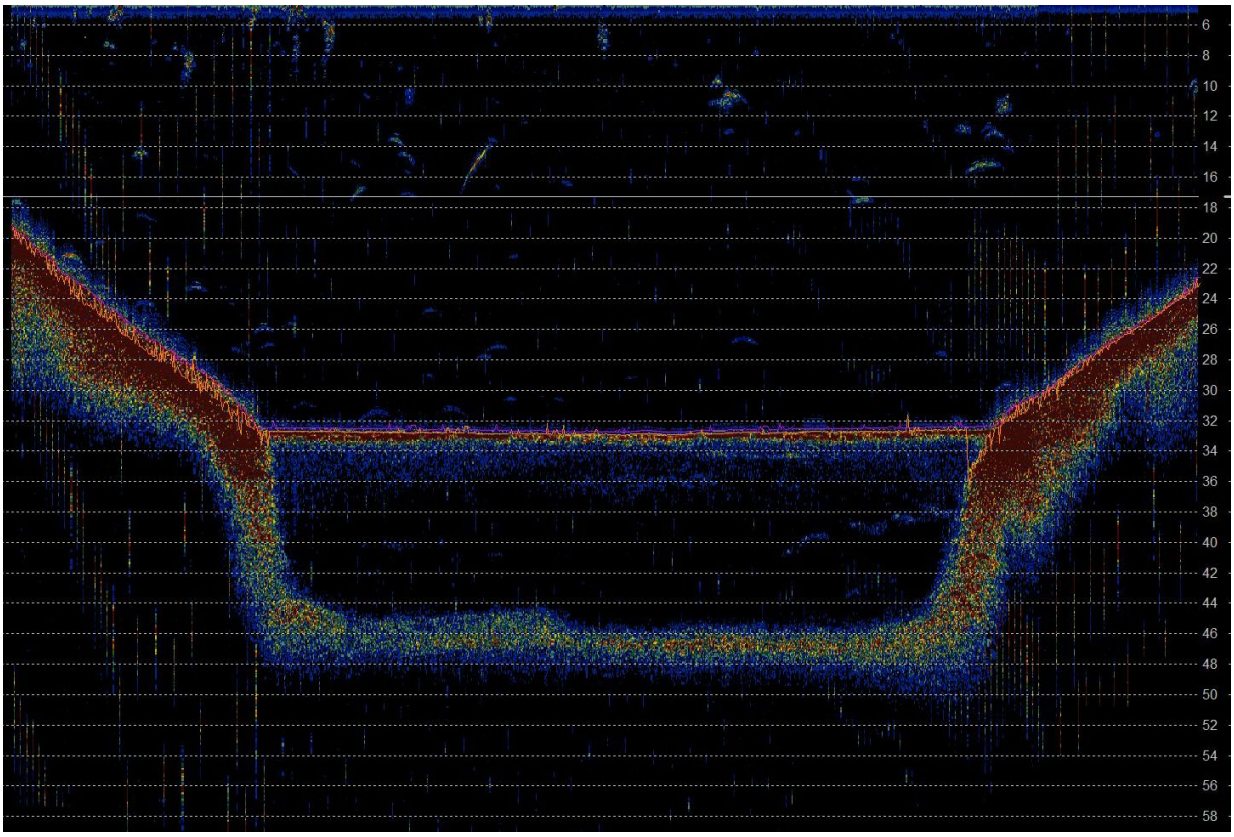


Figure 8-2: Echogram Delineation of Fluid Mud "Fluff" Layer

The densification of this fluff layer is not well understood, but survey shows that these fluid mud signatures are usually indistinct within weeks to months post-dredging. The Southern Area Office (SAO) is currently working on defining the depression, or overall loss, of this layer by use of echograms. Experience tells us that the “loss” of this signature within the channel is mainly attributed to the following:

- Tidal currents that erode and flush the layer out.
- Vessel drag on the seabed that pushes the material to the side slopes.
- Material consolidation, or effective settlement, over time.

During PED, it is recommended that the engineering team investigate consolidation more closely to better predict FWP channel shoaling behavior. The consolidation uncertainty is seen as a minimal risk; however, if consolidation is determined to be less influential in reducing maintenance volumes, the AM depth could be underestimated for the project.

Figure 8-2, though an extreme case, is reminiscent of behavior seen in other channels, such as that shown in Figure 8-3 at Gulfport Ship Channel.

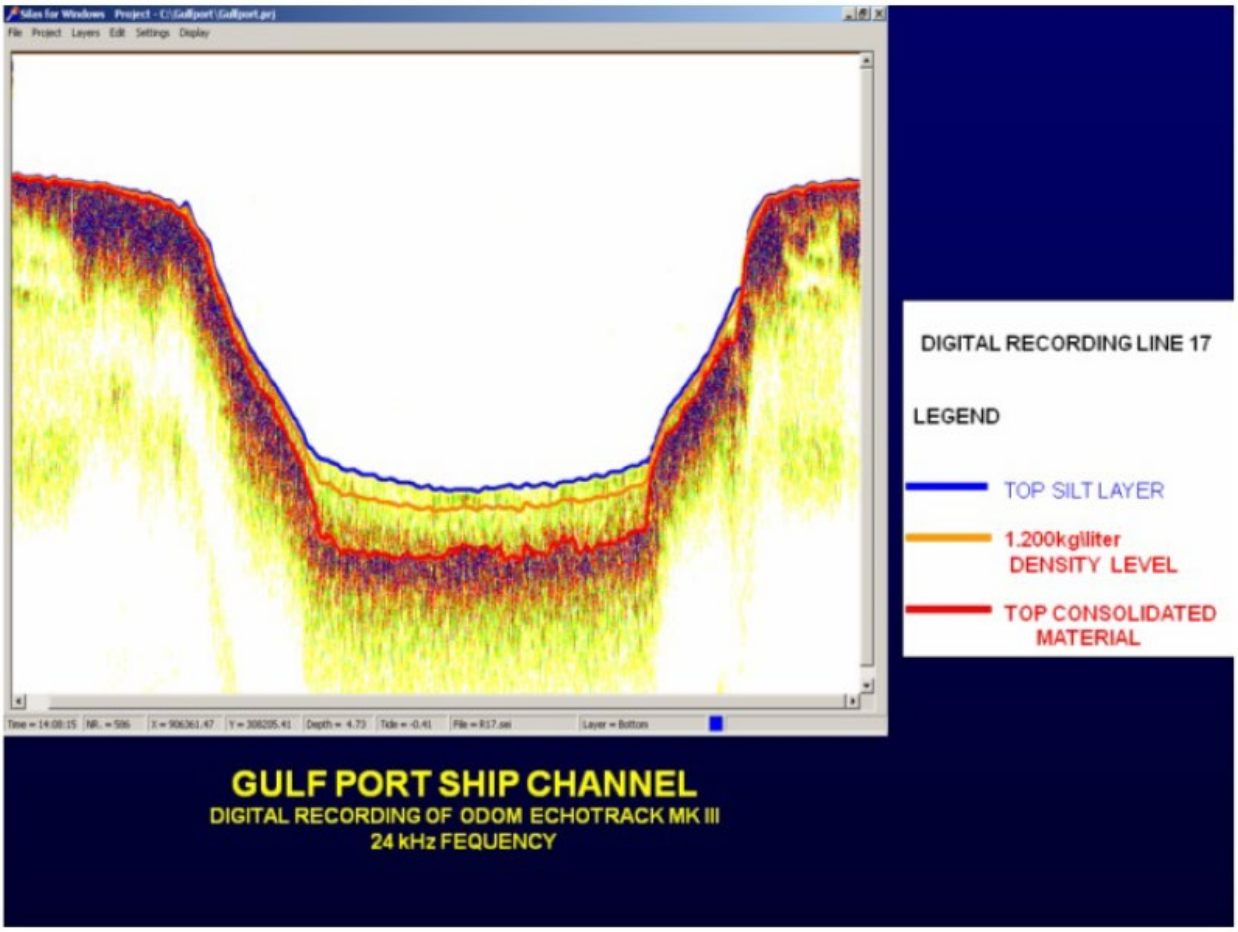


Figure 8-3: Cross-Section of Gulfport Ship Channel taken from EM-1110-2-5025

8.2 Calculated Advance Maintenance

FWP dredge cycle is estimated based on the ratio of FWP and PWOP shoaling rates in combination with the existing dredge cycle:

$$Dredge\ Cycle\ FWP = PWOP\ Dredge\ Cycle * \left(\frac{FWP\ Shoaling\ Rate}{PWOP\ Shoaling\ Rate}\right) \quad (7)$$

In reaches where the calculated dredge cycle is greater than existing, the existing condition is chosen for the proposed FWP frequency. Using the direct and corrected method for the MSC, the following table details preliminary calculations of FWP AM (Table 8-2). AM recommendations are provided in Section 8.3.

Table 8-2: FWP Advance Maintenance Calculations

Alternative A Stationing	PWOP Dredge Cycle (yr)	FWP Dredge Cycle (yr)	*FWP Dredge Cycle Proposed (yr)*	FWP Coefficient Method AM (ft)	FWP Direct Method AM (ft)
-26+000 to -14+000	4	4.1	4	1.6	1.1
-14+000 to 0+000	4	1.5	4	4.6	1.6
0+000 to 20+000	2	0.7	2	4.5	1.3
20+000 to 25+000	2	1.7	2	1.8	5.4
25+000 to 35+000	2	3.0	2	1.0	3.3
35+000 to 50+000	2	2.1	2	1.4	4.1
50+000 to 73+500	2	2.9	2	1.1	3.6
73+500 to 85+500	2	2.4	2	1.2	2.2
85+500 to 90+500	2	2.1	2	1.4	4.8
90+500 to 97+000	2	2.2	2	1.3	4.3
97+000 to 102+000	2	0.7	1	2.0	11.2
102+000 to 108+000	2	1.0	1	1.4	8.0
108+000 to 118+581	2	2.0	2	1.4	5.1

Contract groups provide a practical methodology to average the rather high shoaling rates seen in certain reaches. Contract groups were discussed with Cost Engineering to establish the O&M stationing for phasing maintenance contracts. It was determined that contracts should be staged as shown in Table 8-3.

Table 8-3: O&M Contract Grouping

Reach	O&M Contract Group
-26+000 to 0+000	1
0+000 to 97+000	2
97+000 to 118+581	3

The contract grouping informs the total weight (channel length) used in each AM calculation. A weighted average is employed for every reach except for stationing 108+000 to 118+581 (Table 8-4).

Table 8-4: Average of Advance Maintenance by Contract Group

Reach	Contract Group	FWP Spatial Average (Direct) (ft)	FWP Spatial Average (Coefficient) (ft)	*Calculation Average (ft)*	Description
-26+000 to -14+000	1	1.38	3.24	2.3	Entrance
-14+000 to 0+000					
0+000 to 20+000	2	3.22	1.91	2.6	Matagorda Peninsula to Bend Easing
20+000 to 25+000					
25+000 to 35+000					
35+000 to 50+000					
50+000 to 73+500					
73+500 to 85+500					
85+500 to 90+500					
90+500 to 97+000					
97+000 to 102+000	3	9.46	1.65	5.6	Bend Easing
102+000 to 108+000					
108+000 to 118+581		5.09	1.39	3.2	Bend Easing to Port

Seeing as how the coefficient method may underpredict the AM requirement, and the direct method is more bullish, the calculated value is taken as an average. To determine the most economical AM depth, a number of alternatives are explored from a cost viewpoint. Each alternative is based on a slight variation to the calculated AM and proposed dredge cycle.

8.3 Advance Maintenance Recommendation

To determine the most effective advance maintenance, a cost analysis was conducted to assess long-term benefits of different alternatives. Alternatives are comprised of practical combinations of AM depth and dredge frequency. The selected alternative provides the best combination of total cost and contract-next depth. In several stretches of the MSC, emergency dredging events are becoming increasingly common. Ideally, the FWP scenario would not require emergency dredging. Based on current understanding of MSC shoaling hotspots, it is likely that FWP conditions will still require emergency dredging, even if the AM depth is increased. To combat this challenge, it is recommended that high-shoaling areas be revisited during PED to alleviate any operational concerns regarding selected AM.

Cost variables were set based on early discussions with the USACE Operations group and Cost Engineering lead.

Several variables are fixed costs that are specific to dredging experience in the MSC. Fixed costs are used to replicate the most likely outcomes; however, these estimates will change depending on the circumstances. Unit costs used in the AM analysis are not representative of the final cost engineering assessment. Refer to Section 9 for final project cost estimates.

The findings of the AM cost analysis, in general, can be summarized as follows:

- No AM or dredge frequency changes are proposed for station -26+000 to 0+000.
- No AM or dredge frequency changes are proposed for station 0+000 to 97+000.
- AM depth and dredge frequency will need to change for station 97+000 to 108+000.
- AM depth, but not frequency, will need to change for station 108+000 to 118+581.

Findings from the cost analysis are presented in Table 8-5 to Table 8-8. The following assumptions are used to best identify the AM depth and dredge frequency:

- Emergency dredges < 1/yr is generally acceptable.
- AM depth should consider the existing shoaling rate.
- The balance of AM depth with dredge cycle should be informed on project first costs and lifecycle costs.
- Substantial changes to the current AM depth and dredge frequency in the MSC should not incur large changes to project first costs without supplementing analyses.
- AM depth and dredge frequency should be validated with experience on similar District deep-draft navigation projects (HSC, CCSC, SNWW).

Table 8-5: Advanced Maintenance Cost Analysis for Station 108+000 to 118+581

108+000 to 118+581	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
AM Shoaling Rate	FT/YR	3.7	3.6	3.6	3.6	3.6
AM Depth	FT	2.0	2.0	3.0	4.0	4.0
Channel Area (total)	SF	3,882,461	6,695,633	6,695,633	6,695,633	6,695,633
AM Capacity	CY	287,590	495,973	743,959	991,946	991,946
Dredge Cycle	YR	2.0	2.0	2.0	2.0	3.0
Shoaling Volume	CY	1,051,428	1,804,187	1,804,187	1,804,187	2,706,280
Dredge Vol (Includes Consolidation)	CY	736,000	1,262,931	1,262,931	1,262,931	3,788,792
Extra Volume	%	2.6	2.5	1.7	1.3	3.8
Emergency Event Frequency (shoaling)	NO. CYCLES	0.6	0.6	1.4	3.7	0.4
Emergency Event Frequency (shoaling)	YR	1.3	1.3	2.9	7.3	1.1
No. of OM Dredges per 50 years	YR	25.0	25.0	25.0	25.0	16.7

108+000 to 118+581	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No. of EM Dredges (Shoaling) per 50 Years	#	39.0	38.7	17.4	6.8	47.0
No. of EM Dredges (Shoaling) per dredging cycle	#	1.6	1.5	0.7	0.3	2.8
Cost per Dredge (2025)	$M	2.2	3.8	5.6	7.5	7.5
New Work Volume	CY	–	–	247,986	495,973	495,973
New Work Cost (2025)	$M	0.0	0.0	2.4	4.8	4.8
EM Dredge Cost per 50 year	$M	155.9	154.6	69.8	27.3	188.0
O&M Cost (2025-2075)	$M	54.6	94.1	141.2	188.2	125.5
Total Cost (2025-2075)	$M	210.5	248.7	213.3	220.3	318.2
Calculated Depth at Contract Next (ft)	ft	43.52	43.54	44.54	45.54	42.82

Alternative 2, which features 3 ft of AM at a 2-yr dredge frequency, provides the largest net benefit for station 108+000 to 118+581. This combination reduces the number of emergency dredges to less than 1 event/yr. The existing shoaling rate is estimated as 3.7 ft/yr, and the calculated AM depth is 3.2 ft at the 2-yr frequency. Employing the existing AM depth at the same frequency incurs more cost and provides less draft. Therefore, it is most practical to clear potential FWP draft restrictions and reduce costs with Alternative 2.

- **Station 108+000 to 118+581:** AM Depth = 3 ft, OD = 2 ft, Frequency = 2 yrs

Table 8-6: Advanced Maintenance Cost Analysis for Station 97+000 to 108+000

97+000 to 108+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
AM Shoaling Rate	FT/YR	5.7	13.5	13.5	13.5	13.5
AM Depth	FT	2.0	5.0	6.0	5.0	6.0
Channel Area (total)	SF	2,668,139	3,752,308	3,752,308	3,752,308	3,752,308
AM Capacity	CY	197,640	694,872	833,846	694,872	833,846
Dredge Cycle	YR	2.0	1.0	1.0	2.0	2.0
Shoaling Volume	CY	1,133,465	1,878,183	1,878,183	3,756,365	3,756,365
Dredge Vol (Incl. Consolidation)	CY	793,426	1,314,728	1,314,728	2,629,456	2,629,456
Extra Volume	%	4.0	1.9	1.6	3.8	3.2
Emergency Event Frequency (shoaling)	NO. CYCLES	0.3	1.1	1.7	0.4	0.5
Emergency Event Frequency (shoaling)	YR	0.7	1.1	1.7	0.7	0.9
No. of OM Dredges per 50 years	YR	25.0	50.0	50.0	25.0	25.0

97+000 to 108+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No. of EM Dredges (Shoaling) per 50 Years	#	75.4	44.6	28.8	69.6	53.8
No. of EM Dredges (Shoaling) per dredging cycle	#	3.0	0.9	0.6	2.8	2.2
Cost per Dredge (2025)	$M	1.5	5.3	6.3	5.3	6.3
New Work Vol	CY	–	416,923	555,898	416,923	555,898
New Work Cost (2025)	$M	0.0	4.0	5.4	4.0	5.4
EM Dredge Cost per 50 year	$M	301.5	178.4	115.3	278.4	215.3
O&M Cost (2025-2075)	$M	37.5	263.7	316.4	131.9	158.2
Total Cost (2025-2075)	$M	339.0	446.1	437.2	414.3	378.9
Calculated Depth at Contract Next (ft)	ft	40.97	42.54	43.54	33.08	34.08

Alternative 2, which features 6 ft of AM at a 1-yr dredge frequency, provides the largest net benefit for station 97+000 to 108+000. This combination reduces the number of emergency dredges to less than 1 event/yr. The existing shoaling rate is estimated at nearly 5.7 ft/yr, and the calculated AM depth is 5.6 ft at the 1-yr frequency. While the 2-yr frequency results in a better lifecycle cost, the resulting depth at Alternatives 3 or 4 would make this reach unnavigable for deep-draft vessels. Likewise, Alternative 1 is slightly more expensive for less available draft. Therefore, it is most reasonable to adopt Alternative 2.

- **Station 97+000 to 108+000:** AM Depth = 6 ft, OD = 2 ft, Frequency = 1 yr

Table 8-7: Advanced Maintenance Cost Analysis for Station 0+000 to 97+000

0+000 to 97+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
AM Shoaling Rate	FT/YR	2.7	3.3	3.3	3.3	3.3
AM Depth	FT	2.0	2.0	3.0	3.0	4.0
Channel Area (total)	SF	19,961,844	31,076,093	31,076,093	31,076,093	31,076,093
AM Capacity	CY	1,478,655	2,301,933	3,452,899	3,452,899	4,603,866
Dredge Cycle	YR	2.0	2.0	2.0	3.0	3.0
Shoaling Volume	CY	4,020,094	7,666,529	7,666,529	11,499,794	11,499,794
Dredge Vol (Incl. Consolidation)	CY	3,015,070	5,749,897	5,749,897	17,249,691	17,249,691
Extra Volume	%	2.0	2.5	1.7	5.0	3.7
Emergency Event Frequency (shoaling)	NO. CYCLES	1.0	0.7	1.5	0.3	0.4
Emergency Event Frequency (shoaling)	YR	1.9	1.3	3.0	0.8	1.1
No. of OM Dredges per 50 years	YR	25.0	25.0	25.0	16.7	16.7

0+000 to 97+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No. of EM Dredges (Shoaling) per 50 Years	#	26.0	37.4	16.6	66.6	45.8
No. of EM Dredges (Shoaling) per dredging cycle	#	1.0	1.5	0.7	4.0	2.7
Cost per Dredge (2025)	$M	11.2	17.5	26.2	26.2	34.9
New Work Vol	CY	–	–	1,150,966	1,150,966	2,301,933
New Work Cost (2025)	$M	0.0	0.0	11.1	11.1	22.2
EM Dredge Cost per 50 year	$M	103.9	149.8	66.5	266.4	183.1
O&M Cost (2025-2075)	$M	280.6	436.8	655.2	436.8	582.4
Total Cost (2025-2075)	$M	384.5	586.6	732.8	714.3	787.7
Calculated Depth at Contract Next (ft)	ft	44.92	44.00	45.00	42.51	43.51

Alternative 1, which includes 2 ft of AM at a 2-yr dredge frequency, provides the largest net benefit for station 0+000 to 97+000. The current shoaling rate is nearly 2.7 ft/yr, however, increasing the AM depth does not provide a measurable cost benefit based on the prescribed variables. With Alternative 1, the FWP increase in total cost is estimated as almost 53%, and maintains the channel near 44 ft before the next O&M contract. Alternative 2 would increase total cost by 91% from existing and only provide an additional 1 ft of draft. This large jump in cost is deemed unreasonable given the more localized shoaling concerns for this reach of the MSC. Specific areas that may need increased AM depth should be explored in PED.

- **Station 0+000 to 97+000:** AM Depth = 2 ft, OD = 2 ft, Frequency = 2 yrs

Table 8-8: Advanced Maintenance Cost Analysis for Station -26+000 to 0+000

-26+000 to 0+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
AM Shoaling Rate	FT/YR	0.4	0.6	0.6	0.6	0.6
AM Depth	FT	3.0	3.0	4.0	3.0	4.0
Channel Area (total)	SF	6,225,464	17,602,523	17,602,523	17,602,523	17,602,523
AM Capacity	CY	691,718	1,955,836	2,607,781	1,955,836	2,607,781
Dredge Cycle	YR	4.0	4.0	4.0	3.0	3.0
Shoaling Volume	CY	351,812	1,576,332	1,576,332	1,182,249	1,182,249
Dredge Vol (Incl. Consolidation)	CY	791,576	3,546,748	3,546,748	1,773,374	1,773,374
Extra Volume	%	1.1	1.8	1.4	0.9	0.7
Emergency Event Frequency (shoaling)	NO. CYCLES	6.9	1.2	2.8	0.0	0.0
Emergency Event Frequency (shoaling)	YR	27.7	4.9	11.1	0.0	0.0
No. of OM Dredges per 50 years	YR	12.5	12.5	12.5	16.7	16.7

-26+000 to 0+000	UNIT	Existing Condition	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No. of EM Dredges (Shoaling) per 50 Years	#	1.8	10.2	4.5	0.0	0.0
No. of EM Dredges (Shoaling) per dredging cycle	#	0.1	0.8	0.4	0.0	0.0
Cost per Dredge (2025)	$M	5.3	14.8	19.8	13.5	13.5
New Work Vol	CY	–	–	651,945	–	651,945
New Work Cost (2025)	$M	0.0	0.0	6.3	0.0	6.3
EM Dredge Cost per 50 year	$M	7.2	40.7	18.0	0.0	0.0
O&M Cost (2025-2075)	$M	65.6	185.6	247.4	224.3	224.3
Total Cost (2025-2075)	$M	72.8	226.2	271.7	224.3	230.6
Calculated Depth at Contract Next (ft)	ft	50.86	50.19	51.19	50.64	51.64

Alternative 1, which includes 3 ft of AM at a 4-yr dredge frequency, provides the largest net benefit for station -26+000 to 0+000. The current shoaling rate is estimated at nearly 0.4 ft/yr and FWP rates are anticipated to only slightly increase. While Alternative 3 provides a similar depth-benefit at a slightly lower cost, the associated uncertainties warrant that the existing dredge frequency remain in place.

- **Station -26+000 to 0+000:** AM Depth = 3 ft, OD = 2 ft, Frequency = 4 yrs

8.4 FWP vs FWOP Advance Maintenance

Table 8-9 below summarizes the change between FWOP and FWP for dredging cycle and recommended AM depth. FWOP AM depths are anticipated to be same as existing. Changes to the present-day maintenance dredging plan are not proposed for FWOP.

Table 8-9: FWOP vs FWP Advance Maintenance

Alternative A Stationing	FWOP Dredge Cycle (yr)	FWP Dredge Cycle (yr)	FWOP AM Depth (ft)	FWP AM Depth (ft)
-26+000 to -14+000	4	4	3	3
-14+000 to 0+000	4	4	3	3
0+000 to 20+000	2	2	2	2
20+000 to 25+000	2	2	2	2
25+000 to 35+000	2	2	2	2
35+000 to 50+000	2	2	2	2
50+000 to 73+500	2	2	2	2
73+500 to 85+500	2	2	2	2
85+500 to 90+500	2	2	2	2
90+500 to 97+000	2	2	2	2
97+000 to 102+000	2	1	2	6
102+000 to 108+000	2	1	2	6
108+000 to 118+581	2	2	2	3

The 2019 TSP did not account for any changes to AM depth. The AM analysis leads to a change under FWP conditions for station 97+000 to 118+581. Data available from CSAT and RMS clearly identifies this area as a present shoaling issue. The proposed AM plan would circumvent the need for frequent emergency dredging in the upper reaches of the MSC.

9. Project Costs

9.1 Background

In March 2019, the Matagorda Ship Channel Improvement Project (MSCIP) Feasibility Study successfully completed the Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering. After a quantity discrepancy was verified in 2020, new costs were developed based on the updated dredging quantities and a revised plan for the distribution of dredged materials. These updated costs are reflected in the report and compared to the previously certified 2019 costs.

9.2 2019 Authorized Plan

Costs included in the estimate:

- Account Code 01. Lands and Damages
- Account Code 02. Pipeline Relocations
- Account Code 06. Oyster Mitigation
- Account Code 12. New Work Dredging
- Associated Costs of dredging docks and navigation aids.

A Cost and Schedule Risk Analysis (CSRA) was conducted by Walla Walla District Cost MCX with a resulting 30% contingency at an 80% confidence level. This contingency was applied to all account codes, including Engineering and Design (30 Account) and Construction Management (31 Account), but not for Lands and Damages (01 Account).

The Real Estate office provided a separate 25% contingency for its estimated Land and Damages costs. The Project Costs were certified by Walla Walla District MCX on 22 March 2019. See **Attachment C-1** for the 2019 Cost Certification with the Total Project Cost Summary (TPCS).

9.3 Alternative Plans

Between May and June 2024, prior to developing the Recommended Plan cost estimate, an analysis of additional alternatives was conducted to identify the most cost-effective Dredged Material Management Plan (DMMP) with minimal environmental impact. ROM estimates were prepared for two alternatives, both of which utilized the same DMMP framework as the 2019 Authorized Plan. The first estimate incorporated a large hopper in the Entrance and Jetty Channel along with a 30” pipeline dredge in the Bay. The second estimate employed a combination of a 30” pipeline dredge and a medium hopper in the Bay.

The updated environmental study indicated that placement of material on the West side of the channel would result in the construction of approximately 1,270 acres of new oyster habitat. The ROM estimate for this work ranged from $482,139,000 to $602,674,000.

To reduce mitigation costs, the PDT developed five (5) new DMMP alternatives, each of which was costed and then compared. In addition, two different Bird Island concepts for beneficial use of dredged material were evaluated and compared. Alternative 1 was determined to be the most cost-effective option. To further reduce overall costs, the PDT removed the restrictions originally intended to control the elevation of underwater placement areas in the Bay.

ROM estimated costs for each alternative are presented in Table 9-1. Detailed cost analysis for all alternatives is provided in **Attachment C-2**.

Table 9-1: ROM Estimated Costs for DMMP Alternatives

Alternative	ROM
Initial Estimate	
The first estimate	$293,106,000 - $366,382,500
The second estimate	$328,840,000 - $411,050,000
Oyster Mitigation	$482,139,000 - $602,674,000
Alternatives of new DMMP	
New Alternative 1	$341,182,000 - $426,477,500
New Alternative 1A	$320,049,000 - $400,061,500
New Alternative 2	$352,860,000 - $441,075,000
New Alternative 3	$384,667,000 - $480,833,750
New Alternative 4	$358,376,000 - $447,970,000
New Alternative 5	$399,216,000 – 499,020,000
Oyster Mitigation	$66,855,000 - $83,568,750

High end estimate includes 25% contingency.

The ROM is calculated for the 47’-49’ deepening scale and excludes costs related to PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.

Based on these evaluations, the decision was made to proceed with DMMP Alternative 1A, incorporating three deepening scales: 43’/45’, 45’/47’, and 47’/49’.

9.4 2025 Recommended Plan

The Recommended Plan (deepening scale 47'-49') cost estimate was developed as part of the 2025 Post-Authorization Report for the MSCIP, utilizing the most up-to-date labor, equipment, and material rates.

9.4.1 First Costs

To determine First Project Costs, three cost estimates were developed for three deepening scales – 43'/45', 45'/47', and 47'/49 – covering the following project components:

- Account Code 01. Lands and Damages
- Account Code 02. Pipeline Relocations
- Account Code 06. Oyster Mitigation
- Account Code 12. New Work Dredging
- Account Code 12. Bird Island Construction (beneficial use of dredged material)
- Account Code 18. Cultural Resources
- Associated costs related to dock dredging, structural integrity, and navigation aid adjustments.

Construction costs were developed for each deepening scale, with the detailed cost estimate provided in Section 9.9. The percentage used to account for PED and S&A was determined by the Cost Engineer in coordination with the Project Manager and the PDT. Consistent with the 2019 Authorized Plan, the same percentage was applied to the costs, with the exception of Construction Management. The PDT elected to decrease this percentage from 5.0% to 3.5%, as shown in Table 9-2.

Table 9-2: PED and S&A Percentage

Accounts	2019	2025
30 PLANNING, ENGINEERING & DESIGN	**11%**	**11%**
Project Management	1.0%	1.0%
Planning & Environmental Compliance	0.5%	0.5%
Engineering & Design	5.0%	5.0%
Reviews, ATRs, IEPRs, VE	0.5%	0.5%
Life Cycle Updates (cost, schedule, risks)	1.0%	1.0%
Contracting & Reprographics	0.5%	0.5%
Engineering During Construction	1.0%	1.0%
Planning During Construction	0.5%	0.5%
Adaptive Management & Monitoring	0.0%	0.0%
Project Operations	1.0%	1.0%
31 CONSTRUCTION MANAGEMENT	**7%**	**5.5%**

Construction Management	5.0%	3.5%
Project Operation:	1.0%	1.0%
Project Management	1.0%	1.0%

Following the application of the 28% CSRA contingency, Project First Costs were developed for the three deepening scales. The detailed CSRA Report is presented in Section 9.7.

The resulting cost estimates are presented in Tables 9-3, 9-4 and 9-5.

Table 9-3: Project First Cost for Scale 1 (43-ft Depth in Bay; 45-ft Depth in Entrance Channel)

WBS	WBS Description	Estimate	Contingency	First Cost
01	LANDS AND DAMAGES	$25	$6	$31
02	RELOCATIONS	$31,381	$8,787	$40,168
06	FISH AND WILDLIFE FACILITIES	$31,249	$8,750	$39,999
12	NAVIGATION PORTS AND HARBORS	$247,080	$69,182	$316,262
18	CULTURAL RESOURCES PRESERVATION	$2,260	$633	$2,893
30	ENGINEERING AND DESIGN	$34,563	$9,670	$49,933
31	CONSTRUCTION MANAGEMENT	$17,158	$4,804	$21,962
–	**PROJECT FIRST COST**	–	–	**$471,248**
–	ASSOCIATED COSTS	$30,695	$7,674	$38,369

October 2025 Price Level (Values in thousands, rounded to the nearest $1K)
A 28% contingency, based on the CSRA, was applied to Accounts 02, 06, 12, 18, 30, and 31.
A 25% contingency was applied to Accounts 01 and Associated Costs.

Table 9-4: Project First Cost for Scale 2 (45-ft Depth in Bay; 47-ft Depth in Entrance Channel)

WBS	WBS Description	Estimate	Contingency	First Cost
01	LANDS AND DAMAGES	$25	$6	$31
02	RELOCATIONS	$31,381	$8,787	$40,168
06	FISH AND WILDLIFE FACILITIES	$36,861	$10,321	$47,183
12	NAVIGATION PORTS AND HARBORS	$286,306	$80,166	$366,472
18	CULTURAL RESOURCES PRESERVATION	$2,260	$633	$2,893
30	ENGINEERING AND DESIGN	$39,495	$11,051	$56,246
31	CONSTRUCTION MANAGEMENT	$19,624	$5,495	$25,119
–	**PROJECT FIRST COST**	–	–	**$538,111**
–	ASSOCIATED COSTS	$30,695	$7,674	$38,369

October 2025 Price Level (Values in thousands, rounded to the nearest $1K)

A 28% contingency, based on the CSRA, was applied to Accounts 02, 06, 12, 18, 30, and 31.
A 25% contingency was applied to Accounts 01 and Associated Costs.

Table 9-5: Project First Cost for Scale 3 (47-ft Depth in Bay; 49-ft Depth in Entrance Channel)

WBS	WBS Description	Estimate	Contingency	First Cost
01	LANDS AND DAMAGES	$25	$6	$31
02	RELOCATIONS	$31,381	$8,787	$40,168
06	FISH AND WILDLIFE FACILITIES	$40,200	$11,256	$51,456
12	NAVIGATION PORTS AND HARBORS	$334,909	$93,775	$428,684
18	CULTURAL RESOURCES PRESERVATION	$2,260	$633	$2,893
30	ENGINEERING AND DESIGN	$45,209	$12,651	$63,560
31	CONSTRUCTION MANAGEMENT	$22,481	$6,295	$28,776
	PROJECT FIRST COST			**$615,567**
	ASSOCIATED COSTS	$30,695	$7,674	$38,369

October 2025 Price Level (Values in thousands, rounded to the nearest $1K)
A 28% contingency, based on the CSRA, was applied to Accounts 02, 06, 12, 18, 30, and 31.
A 25% contingency was applied to Accounts 01 and Associated Costs.

The 47’-49’ deepening scale was selected as the Recommended Plan.

9.4.2 Project Schedule

Following the selection of the Recommended Plan, a preliminary construction schedule was developed. The MSCIP construction is anticipated to be executed through six (6) separate contracts:

- Contract 1: Dredging of the Entrance and Jetty Channel (Sta. -26+000 to 0+000)
- Contract 2: Dredging of the Mid Bay Channel (Sta. 0+000 to 101+000)
- Contract 3:
  - Phase A: Dredging of the Upper Channel (Sta. 101+000 to 118+581);
  - Phase B: Bird Island Construction
- Contract 4: Oyster Mitigation
- Contract 5: Pipeline Relocation
- Contract 6: Cultural Resources will be finalized prior to the award of Contracts 1 through 5 and is not expected to impact the overall construction schedule.

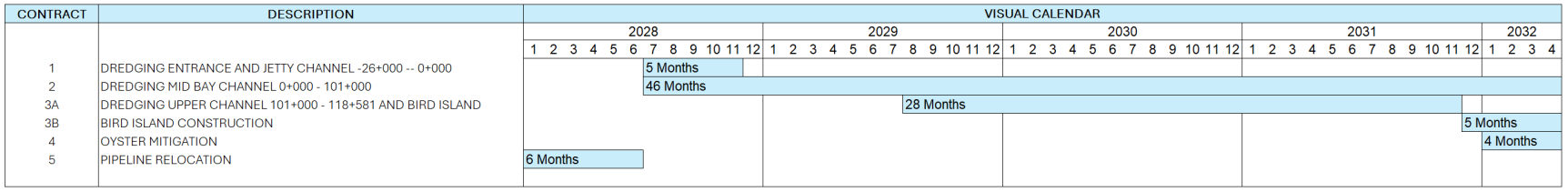
The preliminary contract schedule is provided in Table 9-6. Refer to Figure 9-1 for the Visual Contract Calendar.

Table 9-6: Preliminary Contract Schedule

CONTRACT	DESCRIPTION	DURATION (month)	START DATE	MIDPOINT	END DATE
1	DREDGING ENTRANCE AND JETTY CHANNEL -26+000 - 0+000	5	Jul-28	*FY28Q4*	Nov-28
2	DREDGING MID BAY CHANNEL 0+000 - 101+000	46	Jul-28	*FY30Q3*	Apr-32
3A	DREDGING UPPER BAY CHANNEL 101+000 - 118+581	28	Aug-29	*FY30Q4*	Nov-31
3B	BIRD ISLAND CONSTRUCTION	5	Dec-31	*FY32Q2*	Apr-32
4	OYSTER MITIGATION	4	Jan-32	*FY32Q2*	Apr-32
5	PIPELINE RELOCATION	6	Jan-28	*FY28Q2*	Jun-28

The Schedule developed for MSIP 2025 Recommended Plan (deepening scale 47’/49’).

It is assumed that the Cultural Resource Contract will be executed prior to the construction start.



* All dates and contract durations are preliminary.

Figure 9-1: Preliminary Visual Contract Calendar

9.5 Comparison of the 2019 and 2025 Plans

9.5.1 ACCOUNT CODE 01 – LANDS AND DAMAGES

The cost for this account was provided by The Real Estate office. Since 2019, the TPCS template has been revised to reflect a new accounting structure for RE costs. Previously, all RE costs were recorded under ACCOUNT 01. Under the updated template, the Federal portion of RE costs is now allocated to ACCOUNT 30 – PED.

9.5.2 ACCOUNT CODE 02 – RELOCATIONS

The cost for this account was developed in MII v4.4.4 following the guidelines of ER 1110-2-1302 and EM 1110-2-1304. It includes both the removal and relocation of pipelines within the channel.

In 2019, a total of sixteen (16) pipelines were identified, with four (4) expected to be relocated. The current 2026 plan includes a total of fourteen (14) pipelines, with thirteen (13) designated for removal and one (1) designated for relocation. The slight decrease (-4%) in cost is based on the reduction in the number of pipelines requiring relocation; therefore, material costs for steel pipes are not included.

The cost for Enbridge 30" Natural Gas Pipeline (STA.91+075) Relocation was provided by NFS.

9.5.3 ACCOUNT CODE 06 – FISH & WILDLIFE FACILITIES

The cost for this account was developed in MII v4.4.4 following the guidelines of ER 1110-2-1302 and EM 1110-2-1304. It includes building oyster habitats in the bay. The acreage was reduced from 129 acres in 2019 to 95 acres in 2026. The increase in cost, however, is based on the use of higher-quality (and more expensive) stone in the current estimate. In addition, the analysis of the 2019 estimate showed that the planned stone delivery cost was underestimated and would not cover current delivery expenses. The 2025 cost estimate is based on the recent budgetary quotes from several companies that work with Texas quarries and support stone placement along the Texas coast.

9.5.4 ACCOUNT CODE 12 – NAVIGATION PORTS AND HARBORS

The cost for this account was developed in the Cost Engineering Dredge Estimating Program (CEDEP) and the MII v4.4.4 following the guidelines of ER 1110-2-1302 and EM 1110-2-1304. It includes hopper dredging of the Entrance Channel, pipeline dredging in the bay, and Bird Island construction (beneficial use of dredged material). The cost increase is primarily driven by the increase in dredging quantities: 39.3 MCY in 2025 compared to 24.3 MCY in 2019. Bird Island was not included in the 2019 plan, and adding this feature contributes approximately $30M to the 2025 estimate. In addition, the stationing of the channel and placement areas was revised in the new project design based on environmental analysis, resulting in increased costs due to longer pumping distances. Labor rates were updated to 2025 levels, and fuel prices increased from $3.00 (2019) to $3.58 (2025).

9.5.5 ACCOUNT CODE 18 – CULTURAL RESOURCES PRESERVATION

The cost for this account was developed in MII v4.4.4 following the guidelines of ER 1110-2-1302 and EM 1110-2-1304.

This is a newly added feature that was not accounted for in the 2019 plan.

9.5.6 ACCOUNT CODE 30 – ENGINEERING AND DESIGN

The cost for this account was developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager. It is based on a percentage of the base cost and has not changed from 2019. The current estimate applies the same 11% used in 2019; however, an additional $308 was added to the PED amount to account for RE Federal Labor. An additional $5,700 was also included as “Spent Through” funding.

9.5.7 ACCOUNT CODE 31 – CONSTRUCTION MANAGEMENT

The cost for this account was developed using the guidelines provided in the TPCS, with the agreement of the cost engineer and the project manager. It is based on a percentage of the base cost and has changed from 2019. The current estimate applies 5.5% compared to the 7% used in 2019. The percent reduction is the result of PDT discussions regarding PED and S&A funding.

9.5.8 ASSOCIATED COSTS

In 2019, associated costs were included for navigation aids as well as for dredging docks and berthing areas. In 2025, an additional associated cost was incorporated to address concerns that further deepening of the berthing areas could affect the structural integrity of the existing dock infrastructure. The NFS provided an estimate of $24 million for this cost.

9.5.9 FEDERAL AND NON-FEDERAL COSTS 2019 vs 2025

For the comparison of the 2019 and 2025 Federal and Non-Federal cost allocations, the 2019 estimates were escalated to the October 2025 price level using the Civil Works Construction Cost Index System (CWCCIS). These cost comparisons are presented in Table 9-7 to 9-11.

Table 9-7: 2019 Project First Costs

WBS	Project Feature	FED (75%)	NON-FED (25%)	TOTAL
		October 2018 Price Level		
	Construction General Navigation Features (GNF)			
01	Lands and Damages (100% Non-Fed)	$0	$1,554	$1,554
02	Relocations (100% Non-Fed)	$0	$31,061	$31,061
06	Fish and Wildlife: Oyster Mitigation	$19,693	$6,564	$26,257
12	Navigation Ports and Harbors	$91,121	$30,373	$121,494
30	Planning, Engineering, and Design	$14,711	$4,904	$19,615
31	Construction Management	$9,388	$3,129	$12,517
	Total First Cost	**$134,913**	**$77,585**	**$212,498**
12	Associated Costs			$7,694

Table 9-8: CWCCIS Indices

WBS	Oct.2018	Oct.2025	Factor
01	904.17	1223.37	**1.35303**
02	904.17	1223.37	**1.35303**
06	873.73	1187.16	**1.35873**
12	852.58	1111.30	**1.30346**

Table 9-9: Escalated Costs from 2019 to October 2025 Price Level

WBS	Project Feature	FED (75%)	NON-FED (25%)	TOTAL
		October 2025 Price Level		
	Construction General Navigation Features (GNF)			
01	Lands and Damages	$0	$2,103	$2,103
02	Relocations (100% Non-Fed)	$0	$42,026	$42,026
06	Fish and Wildlife: Oyster Mitigation	$26,757	$8,919	$35,676
12	Navigation Ports and Harbors	$118,772	$39,591	$158,362
30	Planning, Engineering, and Design 11%	$19,649	$6,550	$26,198
31	Construction Management 7%	$12,504	$4,168	$16,672
	Total Escalated First Cost	**$177,681**	**$103,356**	**$281,037**
12	Associated Costs			$10,029

Table 9-10 presents the cost-sharing arrangement between Federal and Non-Federal costs, reflecting a 75% | 25% split. This allocation is based on the current working estimate for Scale 3, which includes a 47-foot depth in the Bay and a 49-foot depth in the Entrance Channel (refer to Table 9-4 for details).

Table 9-10: 2026 Project First Costs

WBS	Project Feature	FED (75%)	NON-FED (25%)	TOTAL
		October 2025 Price Level		
	Construction General Navigation Features (GNF)			
01	Lands and Damages	$0	$31	$31
02	Relocations (100% Non-Fed)	$0	$40,168	$40,168
06	Fish and Wildlife: Oyster Mitigation	$38,592	$12,864	$51,456
12	Navigation Ports and Harbors	$321,513	$107,171	$428,684
18	Cultural Resources Preservation	$2,170	$723	$2,893
30	Planning, Engineering, and Design	$47,670	$15,890	$63,560
31	Construction Management	$21,582	$7,194	$28,776
	Total First Cost	**$431,526**	**$184,041**	**$615,567**
12	Associated Costs			$38,369

*PED amount includes $5.7M Spent-Thru FY25, refer to Table 9-4 for details).

Table 9-11 details project cost variances between Federal and Non-Federal shares, comparing 2019 and 2025 estimates.

Table 9-11: 2019 vs. 2025 Project First Costs

WBS	Construction Item	Project First Costs		Difference	
		2019*	Oct. 2025	$	%
Federal Costs					
01	Lands and Damages	$0	$0	$0	N/A
02	Relocations	$0	$0	$0	N/A
06	Fish and Wildlife: Oyster Mitigation	$26,757	$38,592	$11,835	44%
12	Navigation Ports and Harbors	$118,772	$321,513	$202,741	171%
18	Cultural Resources Preservation	$0	$2,170	$2,170	N/A
30	Planning, Engineering, and Design	$19,649	$47,670	$28,022	143%
31	Construction Management	$12,504	$21,582	$9,078	73%
	Subtotal Federal Cost	**$177,681**	**$431,526**	**$253,845**	**143%**

Non-Federal Costs					
01	Lands and Damages	$2,103	$31	-$2,072	-99%
02	Relocations	$42,026	$40,168	-$1,858	-4%
06	Fish and Wildlife: Oyster Mitigation	$8,919	$12,864	$3,945	44%
12	Navigation Ports and Harbors	$39,591	$107,171	$67,580	171%
18	Cultural Resources Preservation	$0	$723	$723	N/A
30	Planning, Engineering, and Design	$6,550	$15,890	$9,341	143%
31	Construction Management	$4,168	$7,194	$3,026	73%
	Subtotal Non-Federal Cost	**$103,356**	**$184,041**	**$80,685**	**78%**
	Total Project First Cost	**$281,037**	**$615,567**	**$334,530**	**119%**
	Associated Costs	$10,029	$38,369	$28,340	283%
	Total Economic Cost	**$291,066**	**$653,936**	**$362,870**	**125%**

*Escalated to October 2025 Price Level

Project First Cost includes contingency.

9.5.10 Controllable & Uncontrollable Cost Factors

After the 2025 TPCS was developed, it was compared to the 2019 TPCS. Cost growth was divided into two overall categories: Controllable vs. Uncontrollable Cost Factors. A pie chart illustrating these differences can be found below in Figure 9-2, with a supporting table detailing the cost and their percentage in Table 9-12: Controllable vs. Uncontrollable Percent of Total Change.

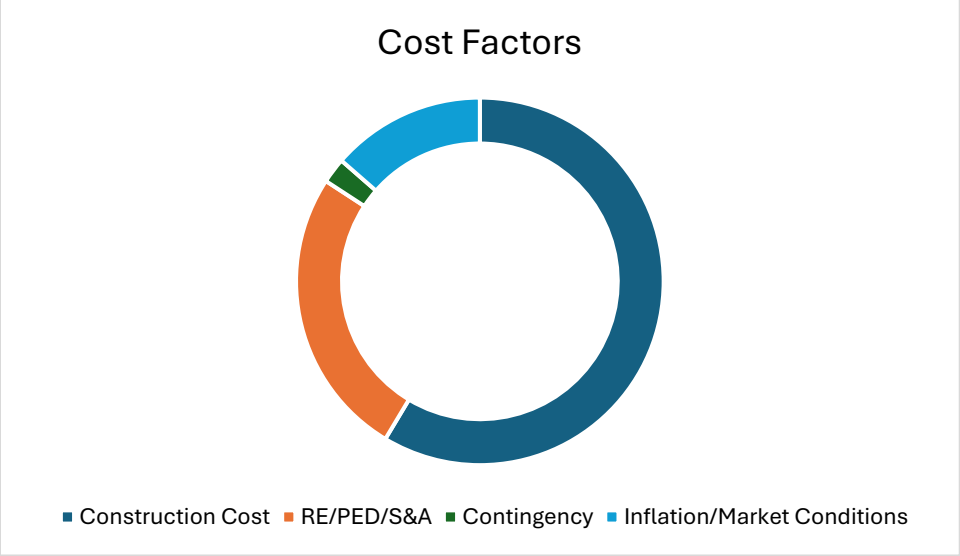


Figure 9-2: Controllable vs. Uncontrollable Cost Factors

Table 9-12: Controllable vs. Uncontrollable Percent of Total Change

Cost Factors	2019*	2025	Diff.	% Change
CONTROLLABLE				
Construction Cost	$181,913	$408,750	$226,837	59%
RE/PED/S&A	$34,337	$133,402	$99,065	26%
Contingency	$64,787	$73,415	$8,628	2%
UNCONTROLLABLE				
Inflation/Market Conditions	$21,132	$73,696	$52,564	14%
Total Project Cost (Fully Funded)	$302,169	$689,263	$387,094	

9.6 O&M Costs

The 50-year Operations and Maintenance (O&M) Cost Plan for the Future Without Project (FWOP) was developed using FWOP shoaling rates, as outlined in Section 2.7. The 50-year O&M cost plans for the Future With the Project (FWP) were developed using predicted shoaling rates described in Section 2.8. See **Attachment C-3** for the detailed 50-year O&M cost plan.

9.7 CSRA

A Cost and Schedule Risk Analysis (CSRA) conducted by the Walla Walla District Cost MCX resulted in a 28% contingency at an 80% confidence level. This contingency was applied to all account codes, including Engineering and Design (30 Account) and Construction Management (31 Account), but excluded the Lands and Damages (01 Account) and the Associated Costs.

The Real Estate office provided a separate 25% contingency for the estimated Land and Damages costs, while a 25% contingency was applied to the associated costs.

A detailed Cost and Schedule Risk Analysis (CSRA) Report is provided in **Attachment C-4**.

9.8 WBS Account Costs

The WBS Account Cost breakdown is presented in Table 9-11. For the detailed cost breakdown from MCACES (MII, Ver.4.4), refer to **Attachment C-5**.

Table 9-13: WBS Account Cost breakdown

WBS	WBS Description	Estimate	Contingency	First Cost
01	LANDS AND DAMAGES	$25	$6	$31
02	RELOCATIONS	$31,381	$8,787	$40,168
06	FISH AND WILDLIFE FACILITIES	$40,200	$11,256	$51,456
12	NAVIGATION PORTS AND HARBORS	$334,909	$93,775	$428,684
–	*Entrance Channel Hopper Dredging*	*$26,503*	*$7,421*	*$33,924*
–	*Mid Bay Channel Pipeline Dredging*	*$188,117*	*$52,673*	*$240,790*
–	*Upper Bay Channel Pipeline Dredging*	*$97,758*	*$27,372*	*$125,130*
–	*Bird Island Construction*	*$22,531*	*$6,309*	*$28,840*
18	CULTURAL RESOURCES PRESERVATION	$2,260	$633	$2,893
30	ENGINEERING AND DESIGN	$45,209	$12,651	$63,560
–	*PED*	*$44,963*	*$12,590*	*$57,552*
–	*RE*	*$246*	*$62*	*$308*
–	*Spent Thru FY2025*	–	–	*$5,700*
31	CONSTRUCTION MANAGEMENT	$22,481	$6,295	$28,776
–	PROJECT FIRST COST	–	–	$615,567
–	ASSOCIATED COSTS	$30,695	$7,674	$38,369
–	*Aid to Navigation (FED)*	*$1,898*	*$475*	*$2,373*
–	*Structural Integrity*	*$24,000*	*$6,000*	*$30,000*
–	*Dock/Berthing Area Improvements (NON-FED)*	*$4,797*	*$1,199*	*$5,996*

9.9 MCX Walla Walla Cost Certification

The project has received Cost Certificate #SWG-PN451954, that states the following:

The Matagorda Ship Channel Improvement Project, as presented by the Galveston District, has undergone a successful Cost Agency Technical Review (Cost ATR) of remaining costs, performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

Certification Date: May 26, 2026,

FY26 Remaining Costs: $609,867,000 (Cost ATR Certified)

FY25 Spent Costs: $ 5,700,000 (From Programs & PM)

FY26 Project First Cost: $615,567,000 (Remaining plus Spent)

Fully Funded Costs: $689,263,000 including Spent Costs

Note: Cost Certification assumes Efficient Implementation (Funding). Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. It remains the responsibility of the District to correctly reflect these cost values and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.

Refer to **Attachment C-6**.

10. Recommendations for Preconstruction Engineering and Design (PED)

The engineering analyses, updated designs, and risk assessments detailed in this document have advanced the MSCIP to a feasibility-level design, currently estimated at 30% complete. The PED phase is the critical next step to transform this foundation into Plans and Specifications (P&S) suitable for solicitation and construction.

The primary goal of the PED phase is to finalize the detailed engineering necessary for the initial construction contract, specifically the Dredging Entrance and Jetty Channel. Simultaneously, to ensure a seamless and effective overall project, the PED effort must address broader design considerations and refine a cohesive strategy to guide all subsequent construction contracts.

Accordingly, the recommendations presented here are structured to meet the immediate requirements of the first contract while also incorporating design refinements essential for the MSCIP as a whole.

10.1 Design Feature Refinement for Contract 1 and Project-Wide Application

The PED phase will focus on finalizing the channel layout and structural components, providing the foundation for both Contract 1 and subsequent construction phases.

10.1.1 Final Channel Design and Templates

Complete the templates for the Entrance and Jetty Channels under Contract 1, ensuring a 550-foot width and -49 feet MLLW depth. For later contracts, confirm and finalize the geometry of the Lavaca Bay bend easing, the 1,200-foot turning basin, and the approach channel. Incorporate input from the Matagorda Ship Channel Pilots to optimize alignment for the design vessel and ensure navigation safety and efficiency.

10.1.2 Risk-Based Geotechnical Investigation for Final Design

Implement a targeted, risk-based geotechnical strategy that focuses resources only on areas where significant new dredging into native material presents tangible construction or operational risks.

- Offshore Entrance Channel (Sta. -26+000 to approx. -6+000): No Additional Investigation Required
    - Confirm that no additional borings are required in this reach, as natural water depth minimizes new excavation, 1V:10H side slopes are stable, and 2021 TWEI data sufficiently characterize dredge-ability.
- Jetty Channel and Bay Transition (Sta. -6+000 to End): No Additional Investigation Required
    - Validate the long-term stability of the channel cross-section to ensure that unaccounted-for slope raveling does not increase future maintenance dredging costs.

10.1.3 Infrastructure Mitigation Plan

Develop a detailed removal and verification plan for Pipeline E1 (Station -18+520) under Contract 1. Establish a comprehensive mitigation strategy for all 16 pipelines, including:

- Document the planned single pipeline relocation and ensure the mitigation approach aligns with construction sequencing.
- Formalize waivers for the two pipelines that will remain in place.
- Address and resolve anticipated conflicts with existing and future construction activities across subsequent contracts.

This ensures all pipeline-related constraints are managed proactively, minimizing risk of delays or disputes during construction.

10.2 Modifications to the Beneficial-Use (BU) Plan

The project's BU strategy spans multiple contracts and requires detailed design to support implementation.

10.2.1 Final Design of the Sand Engine (SE)

Advance the conceptual design of the 165-acre SE for Contract 1 to a detailed construction template. Define placement elevations and develop a long-term physical monitoring plan to evaluate its effectiveness in mitigating shoreline erosion. Long-term monitoring may utilize wading-depth, land-based survey, or eHydro surveying between dredging contracts to map the migration of berm sediments.

10.2.2 Bird Island (BI) Detailed Design

Fully engineer the conceptual Bird Island design, which relies on significant new-work material from later dredging contracts. Perform geotechnical foundation analysis, conduct hydraulic modeling to ensure stability, finalize the shoreline protection revetment, and coordinate with environmental agencies to maximize habitat value. Completing this design early is essential to confirming the viability of the project-wide DMMP.

The following steps will be taken in PED:

- Obtain geotechnical borings at the Bird Island.
- Obtain detailed hydrographic survey data.
- Determine additional environmental requirements and integrate into the engineering design.
- Specific engineering steps will be taken as follows:
  1. Conduct settlement/consolidation analysis; tools such as Primary consolidation, Secondary compression and Desiccation of dredged fill (PSDDF) allow for this.
  2. Finalize site planning within prescribed footprint;
  3. Determine hydraulic loads;

4. Update protection and environmental design; environmental design will require coordination that could refine the plan view of the project footprint.

10.2.3 Activation of Future BU Opportunities

Pursue partnerships to develop plans for activating the Keller Bay Peninsula site. Although not part of initial construction, preparing a shovel-ready design for this BU site will support environmental preservation and habitat benefits, even if placement of future maintenance material from the channel is not cost-effective. Future BU opportunities and improvements are discussed within Appendix E.

10.3 Shoaling Remediation Strategy and Long-Term Maintenance

Shoaling in the upper reaches of the channel presents recurring maintenance challenges and has a direct impact on the long-term economic and operational viability of the project. The PED phase provides an opportunity to finalize strategies that address both immediate and future dredging needs.

10.3.1 Offshore Shoaling Rate Validation

Conduct an updated hydrographic survey of the offshore reach to reconcile discrepancies between CSAT model predictions and historical dredging records. Verify and finalize the baseline for new-work quantities and confirm the 3-foot Advance Maintenance (AM) depth for Contract 1.

10.3.2 Re-evaluation of the Lavaca Bay DMMP

Formally reevaluate the Lavaca Bay DMMP to address the effects of open-water placement on shoaling in the upper channel. Assess cost-benefit alternatives, such as semi-confined disposal, re-handling material to more stable locations, or doing BU to reduce recurring maintenance dredging costs. Confirm the recommended 6-foot AM depth for stations 97+000 to 108+000 based on the results of this strategic analysis.

10.4 Finalization of Construction Documents

The culmination of PED efforts will be the delivery of complete contract packages, including Plans and Specifications (P&S) for both Contract 1 and subsequent contracts. The development of construction drawings will include preparation of Design Documentation Reports (DDRs) for the first contract and future contracts.

10.4.1 Preparation of Plans and Specifications (P&S)

Prepare a complete set of P&S for the Dredging Entrance and Jetty Channel contract. This will be followed by the systematic development of contract packages for the subsequent channel reaches and the Bird Island construction.

- Draft plans and specifications are provided as an attachment to this appendix.
- See Attachment F-2 for draft project plans.
- See Attachment S-1 for a list of expected specifications for Contract 1.
- Design maturity memo is provided by Attachment F-3.

10.4.2 Final Cost and Schedule Refinement

Refine project costs based on detailed designs and updated quantity takeoffs. Update the Cost and Schedule Risk Analysis (CSRA) to reflect the matured designs, providing a high-confidence Total Project Cost and a detailed construction schedule for all planned contract phases.

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COST ENGINEERING ATTACHMENT NO. C-1

2019 Cost Certification Statement. Matagorda Ship Channel, Port Lavaca, Texas

2019 Total Project Cost Summary (TPCS)

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

For Project No. 451954

SWG – Matagorda Ship Channel, Port Lavaca, Texas
Feasibility Study

The Matagorda Ship Channel, Port Lavaca, Texas Feasibility Study, as presented by Galveston District, has undergone a successful Cost Agency Technical Review (Cost ATR), performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

As of March 22, 2019, the Cost MCX certifies the estimated total project cost:

FY19 Project First Cost: $ 212,498,000
Fully Funded Amount: $ 228,476,000

It remains the responsibility of the District to correctly reflect these cost values within the Final Report and to implement effective project management controls and implementation procedures including risk management through the period of Federal Participation.

JACOBS.MICHAEL.PIERRE.1160569537

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DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=JACOBS.MICHAEL.PIERRE.1160569537
Date: 2019.03.22 12:55:30 -07'00'

Michael P. Jacobs, PE, CCE
Chief, Cost Engineering MCX
Walla Walla District

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **MSC Feasibility**
PROJECT NO: P2 451954
LOCATION: Matagorda County, TX

DISTRICT: **Galveston District** **PREPARED:** **3/13/2019**
POC: **CHIEF, COST ENGINEERING, Willie J. Honza, P.E.**

This Estimate reflects the scope and schedule in report; MSC Feasibility

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2019									
						Effective Price Level Date: 1 OCT 18									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-18 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
06	FISH & WILDLIFE FACILITIES	$20,198	$6,059	30.0%	$26,257	0.0%	$20,198	$6,059	$26,257	$0	$26,257	9.6%	$22,131	$6,639	$28,770
12	NAVIGATION PORTS & HARBORS	$93,457	$28,037	30.0%	$121,494	0.0%	$93,457	$28,037	$121,494	$0	$121,494	7.8%	$100,766	$30,230	$130,996
02	RELOCATIONS	$23,893	$7,168	30.0%	$31,061	0.0%	$23,893	$7,168	$31,061	$0	$31,061	3.3%	$24,680	$7,404	$32,084
	CONSTRUCTION ESTIMATE TOTALS:	$137,548	$41,264		$178,812	0.0%	$137,548	$41,264	$178,812	$0	$178,812	7.3%	$147,577	$44,273	$191,850
01	LANDS AND DAMAGES	$1,243	$311	25.0%	$1,554	0.0%	$1,243	$311	$1,554	$0	$1,554	10.1%	$1,369	$342	$1,711
30	PLANNING, ENGINEERING & DESIGN	$15,092	$4,523	30.0%	$19,615	0.0%	$15,092	$4,523	$19,615	$0	$19,615	7.8%	$16,273	$4,878	$21,151
31	CONSTRUCTION MANAGEMENT	$9,628	$2,889	30.0%	$12,517	0.0%	$9,628	$2,889	$12,517	$0	$12,517	10.0%	$10,588	$3,177	$13,765
	PROJECT COST TOTALS:	$163,511	$48,987	30.0%	$212,498		$163,511	$48,987	**$212,498**	$0	**$212,498**	7.5%	$175,807	$52,669	$228,476

CHIEF, COST ENGINEERING, Willie J. Honza, P.E.

PROJECT MANAGER, Franchelle Craft

CHIEF, REAL ESTATE, Timothy Nelson

CHIEF, PLANNING, Rob Newman

CHIEF, ENGINEERING, Joe King , R.A.

CHIEF, OPERATIONS, Joe Hrametz. P.E.

CHIEF, CONSTRUCTION, Donald Carelock, P.E.

CHIEF, CONTRACTING, Jeffrey Neill

CHIEF, PM-G, Valerie Miller

CHIEF, DPM, Edmund P. Russo, Jr., PHD, P.E., D.CE, D.NE.

ESTIMATED TOTAL PROJECT COST: **$228,476**

ASSOCIATED COSTS: **$7,952**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District PREPARED: 3/13/2019
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 13-Mar-19 Effective Price Level: 1-Oct-18				Program Year (Budget EC): 2019 Effective Price Level Date: 1 OCT 18								
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1													
12	NAVIGATION PORTS & HARBORS	$22,007	$6,602	30.0%	$28,608	0.0%	$22,007	$6,602	$28,608	2020Q2	3.3%	$22,731	$6,819	$29,550
	CONSTRUCTION ESTIMATE TOTALS:	$22,007	$6,602	30.0%	**$28,608**		$22,007	$6,602	$28,608			$22,731	$6,819	$29,550
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2019Q4	2.9%	$226	$68	$294
0.5%	Planning & Environmental Compliance	$110	$33	30.0%	$143	0.0%	$110	$33	$143	2019Q4	2.9%	$113	$34	$147
5.0%	Engineering & Design	$1,100	$330	30.0%	$1,430	0.0%	$1,100	$330	$1,430	2019Q4	2.9%	$1,132	$340	$1,472
0.5%	Reviews, ATRs, IEPRs, VE	$110	$33	30.0%	$143	0.0%	$110	$33	$143	2019Q4	2.9%	$113	$34	$147
1.0%	Life Cycle Updates (cost, schedule, risks)	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2019Q4	2.9%	$226	$68	$294
0.5%	Contracting and Repographics	$110	$33	30.0%	$143	0.0%	$110	$33	$143	2019Q4	2.9%	$113	$34	$147
1.0%	Engineering During Construction	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2020Q2	4.8%	$231	$69	$300
0.5%	Planning During Construction	$110	$33	30.0%	$143	0.0%	$110	$33	$143	2020Q2	4.8%	$115	$35	$150
0.0%	Adaptive Management & Monitoring	$0	$0	30.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2019Q4	2.9%	$226	$68	$294
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,100	$330	30.0%	$1,430	0.0%	$1,100	$330	$1,430	2020Q2	4.8%	$1,153	$346	$1,500
1.0%	Project Operation:	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2020Q2	4.8%	$231	$69	$300
1.0%	Project Management	$220	$66	30.0%	$286	0.0%	$220	$66	$286	2020Q2	4.8%	$231	$69	$300
	CONTRACT COST TOTALS:	$25,968	$7,790		$33,758		$25,968	$7,790	**$33,758**			$26,843	$8,053	**$34,896**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District PREPARED: 3/13/2019
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			13-Mar-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 2													
12	NAVIGATION PORTS & HARBORS	$40,134	$12,040	30.0%	$52,174	0.0%	$40,134	$12,040	$52,174	2021Q2	6.4%	$42,694	$12,808	$55,502
	CONSTRUCTION ESTIMATE TOTALS:	$40,134	$12,040	30.0%	**$52,174**		$40,134	$12,040	$52,174			$42,694	$12,808	$55,502
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2020Q4	6.8%	$429	$129	$557
0.5%	Planning & Environmental Compliance	$201	$60	30.0%	$261	0.0%	$201	$60	$261	2020Q4	6.8%	$214	$64	$279
5.0%	Engineering & Design	$2,007	$602	30.0%	$2,609	0.0%	$2,007	$602	$2,609	2020Q4	6.8%	$2,144	$643	$2,787
0.5%	Reviews, ATRs, IEPRs, VE	$201	$60	30.0%	$261	0.0%	$201	$60	$261	2020Q4	6.8%	$214	$64	$279
1.0%	Life Cycle Updates (cost, schedule, risks)	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2020Q4	6.8%	$429	$129	$557
0.5%	Contracting & Reprographics	$201	$60	30.0%	$261	0.0%	$201	$60	$261	2020Q4	6.8%	$214	$64	$279
1.0%	Engineering During Construction	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2021Q2	8.8%	$437	$131	$568
0.5%	Planning During Construction	$201	$60	30.0%	$261	0.0%	$201	$60	$261	2021Q2	8.8%	$218	$66	$284
0.0%	Adaptive Management & Monitoring	$0	$0	30.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2020Q4	6.8%	$429	$129	$557
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$2,007	$602	30.0%	$2,609	0.0%	$2,007	$602	$2,609	2021Q2	8.8%	$2,184	$655	$2,839
1.0%	Project Operation:	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2021Q2	8.8%	$437	$131	$568
1.0%	Project Management	$401	$120	30.0%	$522	0.0%	$401	$120	$522	2021Q2	8.8%	$437	$131	$568
	CONTRACT COST TOTALS:	$47,358	$14,207		$61,566		$47,358	$14,207	**$61,566**			$50,479	$15,144	**$65,622**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.
PREPARED: 3/13/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			13-Mar-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	CONTRACT 3													
12	NAVIGATION PORTS & HARBORS	$31,316	$9,395	30.0%	$40,711	0.0%	$31,316	$9,395	$40,711	2023Q2	12.9%	$35,342	$10,603	$45,945
	CONSTRUCTION ESTIMATE TOTALS:	$31,316	$9,395	30.0%	**$40,711**		$31,316	$9,395	$40,711			$35,342	$10,603	$45,945
01	LANDS AND DAMAGES	$881	$220	25.0%	$1,102	0.0%	$881	$220	$1,102	2023Q2	12.9%	$995	$249	$1,243
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2022Q2	12.8%	$353	$106	$459
0.5%	Planning & Environmental Compliance	$157	$47	30.0%	$204	0.0%	$157	$47	$204	2022Q2	12.8%	$177	$53	$230
5.0%	Engineering & Design	$1,566	$470	30.0%	$2,036	0.0%	$1,566	$470	$2,036	2022Q2	12.8%	$1,767	$530	$2,297
0.5%	Reviews, ATRs, IEPRs, VE	$157	$47	30.0%	$204	0.0%	$157	$47	$204	2022Q2	12.8%	$177	$53	$230
1.0%	Life Cycle Updates (cost, schedule, risks)	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2022Q2	12.8%	$353	$106	$459
0.5%	Contracting & Reprographics	$157	$47	30.0%	$204	0.0%	$157	$47	$204	2022Q2	12.8%	$177	$53	$230
1.0%	Engineering During Construction	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2023Q2	17.1%	$367	$110	$477
0.5%	Planning During Construction	$157	$47	30.0%	$204	0.0%	$157	$47	$204	2023Q2	17.1%	$183	$55	$238
0.0%	Adaptive Management & Monitoring	$0	$0	30.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2022Q2	12.8%	$353	$106	$459
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,566	$470	30.0%	$2,036	0.0%	$1,566	$470	$2,036	2023Q2	17.1%	$1,834	$550	$2,384
1.0%	Project Operation:	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2023Q2	17.1%	$367	$110	$477
1.0%	Project Management	$313	$94	30.0%	$407	0.0%	$313	$94	$407	2023Q2	17.1%	$367	$110	$477
	CONTRACT COST TOTALS:	$37,834	$11,306		**$49,141**		$37,834	$11,306	**$49,141**			$42,812	$12,794	**$55,605**

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.
PREPARED: 3/13/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 13-Mar-19 Effective Price Level: 1-Oct-18				Program Year (Budget EC): 2019 Effective Price Level Date: 1 OCT 18				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	CONTRACT 4													
06	FISH & WILDLIFE FACILITIES	$20,198	$6,059	30.0%	$26,257	0.0%	$20,198	$6,059	$26,257	2022Q2	9.6%	$22,131	$6,639	$28,770
	CONSTRUCTION ESTIMATE TOTALS:	$20,198	$6,059	30.0%	**$26,257**		$20,198	$6,059	$26,257			$22,131	$6,639	$28,770
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2021Q4	10.8%	$224	$67	$291
0.5%	Planning & Environmental Compliance	$101	$30	30.0%	$131	0.0%	$101	$30	$131	2021Q4	10.8%	$112	$34	$146
5.0%	Engineering & Design	$1,010	$303	30.0%	$1,313	0.0%	$1,010	$303	$1,313	2021Q4	10.8%	$1,119	$336	$1,455
0.5%	Reviews, ATRs, IEPRs, VE	$101	$30	30.0%	$131	0.0%	$101	$30	$131	2021Q4	10.8%	$112	$34	$146
1.0%	Life Cycle Updates (cost, schedule, risks)	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2021Q4	10.8%	$224	$67	$291
0.5%	Contracting & Reprographics	$101	$30	30.0%	$131	0.0%	$101	$30	$131	2021Q4	10.8%	$112	$34	$146
1.0%	Engineering During Construction	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2022Q2	12.8%	$228	$68	$296
0.5%	Planning During Construction	$101	$30	30.0%	$131	0.0%	$101	$30	$131	2022Q2	12.8%	$114	$34	$148
0.0%	Adaptive Management & Monitoring	$0	$0	30.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2021Q4	10.8%	$224	$67	$291
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,010	$303	30.0%	$1,313	0.0%	$1,010	$303	$1,313	2022Q2	12.8%	$1,140	$342	$1,481
1.0%	Project Operation:	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2022Q2	12.8%	$228	$68	$296
1.0%	Project Management	$202	$61	30.0%	$263	0.0%	$202	$61	$263	2022Q2	12.8%	$228	$68	$296
	CONTRACT COST TOTALS:	$23,834	$7,150		**$30,984**		$23,834	$7,150	**$30,984**			$26,195	$7,858	**$34,053**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District PREPARED: 3/13/2019
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			13-Mar-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 5													
02	RELOCATIONS	$23,893	$7,168	30.0%	$31,061	0.0%	$23,893	$7,168	$31,061	2020Q2	3.3%	$24,680	$7,404	$32,083.51
	CONSTRUCTION ESTIMATE TOTALS:	$23,893	$7,168	30.0%	**$31,061**		$23,893	$7,168	$31,061			$24,680	$7,404	$32,084
01	LANDS AND DAMAGES	$362	$91	25.0%	$453	0.0%	$362	$91	$453	2020Q2	3.3%	$374	$94	$468
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2019Q4	2.9%	$246	$74	$320
0.5%	Planning & Environmental Compliance	$119	$36	30.0%	$155	0.0%	$119	$36	$155	2019Q4	2.9%	$123	$37	$160
5.0%	Engineering & Design	$1,195	$358	30.0%	$1,553	0.0%	$1,195	$358	$1,553	2019Q4	2.9%	$1,229	$369	$1,598
0.5%	Reviews, ATRs, IEPRs, VE	$119	$36	30.0%	$155	0.0%	$119	$36	$155	2019Q4	2.9%	$123	$37	$160
1.0%	Life Cycle Updates (cost, schedule, risks)	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2019Q4	2.9%	$246	$74	$320
0.5%	Real Estate	$81	$20	25.0%	$101	0.0%	$81	$20	$101	2019Q4	2.9%	$83	$21	$104
1.0%	Engineering During Construction	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2020Q2	4.8%	$250	$75	$326
0.5%	Planning During Construction	$119	$36	30.0%	$155	0.0%	$119	$36	$155	2020Q2	4.8%	$125	$38	$163
0.0%	Adaptive Management & Monitoring	$0	$0	30.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2019Q4	2.9%	$246	$74	$320
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$1,195	$358	30.0%	$1,553	0.0%	$1,195	$358	$1,553	2020Q2	4.8%	$1,252	$376	$1,628
1.0%	Project Operation:	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2020Q2	4.8%	$250	$75	$326
1.0%	Project Management	$239	$72	30.0%	$311	0.0%	$239	$72	$311	2020Q2	4.8%	$250	$75	$326
	CONTRACT COST TOTALS:	$28,517	$8,533		**$37,050**		$28,517	$8,533	**$37,050**			$29,479	$8,821	**$38,300**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC Feasibility
LOCATION: Matagorda County, TX
This Estimate reflects the scope and schedule in report; MSC Feasibility

DISTRICT: Galveston District
POC: CHIEF, COST ENGINEERING, Willie J. Honza, P.E.
PREPARED: 3/13/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: / Effective Price Level:			13-Mar-19 / 1-Oct-18	Program Year (Budget EC): / Effective Price Level Date:			2019 / 1 OCT 18	FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Associated Costs													
12	NAVIGATION PORTS & HARBORS	$3,807	$952	25.0%	$4,759	0.0%	$3,807	$952	$4,759	2020Q2	3.3%	$3,933	$983	$4,916
12	AIDS TO NAVIGATION	$1,506	$377	25.0%	$1,883	0.0%	$1,506	$377	$1,883	2020Q2	3.3%	$1,556	$389	$1,944
	CONSTRUCTION ESTIMATE TOTALS:	$5,313	$1,328	25.0%	**$6,642**		$5,313	$1,328	$6,642			$5,488	$1,372	$6,860
01	LANDS AND DAMAGES	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2019Q4	2.9%	$55	$5	$60
0.5%	Planning & Environmental Compliance	$27	$3	10.0%	$29	0.0%	$27	$3	$29	2019Q4	2.9%	$27	$3	$30
5.0%	Engineering & Design	$266	$27	10.0%	$292	0.0%	$266	$27	$292	2019Q4	2.9%	$273	$27	$301
0.5%	Reviews, ATRs, IEPRs, VE	$27	$3	10.0%	$29	0.0%	$27	$3	$29	2019Q4	2.9%	$27	$3	$30
1.0%	Life Cycle Updates (cost, schedule, risks)	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2019Q4	2.9%	$55	$5	$60
0.5%	Contracting & Reprographics	$27	$3	10.0%	$29	0.0%	$27	$3	$29	2019Q4	2.9%	$27	$3	$30
1.0%	Engineering During Construction	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2020Q2	4.8%	$56	$6	$61
0.5%	Planning During Construction	$27	$3	10.0%	$29	0.0%	$27	$3	$29	2020Q2	4.8%	$28	$3	$31
0.0%	Adaptive Management & Monitoring	$0	$0	10.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2019Q4	2.9%	$55	$5	$60
31	CONSTRUCTION MANAGEMENT													
5.0%	Construction Management	$266	$27	10.0%	$292	0.0%	$266	$27	$292	2020Q2	4.8%	$278	$28	$306
1.0%	Project Operation:	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2020Q2	4.8%	$56	$6	$61
1.0%	Project Management	$53	$5	10.0%	$58	0.0%	$53	$5	$58	2020Q2	4.8%	$56	$6	$61
	CONTRACT COST TOTALS:	$6,270	$1,424		**$7,694**		$6,270	$1,424	**$7,694**			$6,481	$1,471	**$7,952**

COST ENGINEERING ATTACHMENT NO. C-2

P2-451954 Matagorda Ship Channel Improvement Project

Cost Alternatives

P2-451954 Matagorda Ship Channel Improvement Project

Cost Alternatives

October 2023 Price Levels

This report outlines eight (8) alternatives for Matagorda Ship Channel Improvement Project, focusing on cost estimates and environmental impacts (mitigation). The report includes two (2) previously estimated alternatives and six (6) new alternatives. Each presented alternative is based on New Work dredging quantities for deepening the channel to 47' depth. Each presented alternative has the same quantities of dredged materials but differs in type and location of placement areas.

The previously estimated environmental impact requires mitigation by constructing 1,270 Acres of oyster pads reefs that can cost up to $600M. This environmental impact can be reduced by eliminating Placement Areas on the West side of the main channel. The six new alternatives represent the different approach to managing the New Work dredged materials with placing them either on the East Side or taking offshore.

The new alternatives mostly reduce the environmental impact on the West side of the channel. The unavoidable impact requires mitigation by constructing 185 Acres of oyster pads that can potentially cost up to $84M. The use of the East side of the channel for placing New Work materials could cause an environmental impact that currently is unknown; survey is underway to determine impact.

The costs in this Report are based on Rough Order of Magnitude estimate and do not include Planning Engineering Design (PED), Construction Management (CM), Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.

The following dredges were considered for potential use:

- LH — Generic Large Hopper (7,800 CY; 15,700 HP)
- MH — Generic Medium Hopper (4,000 CY; 8,600 HP)
- PL — Cutter Head Pipeline Dredge (30" pipe; 9,000HP)

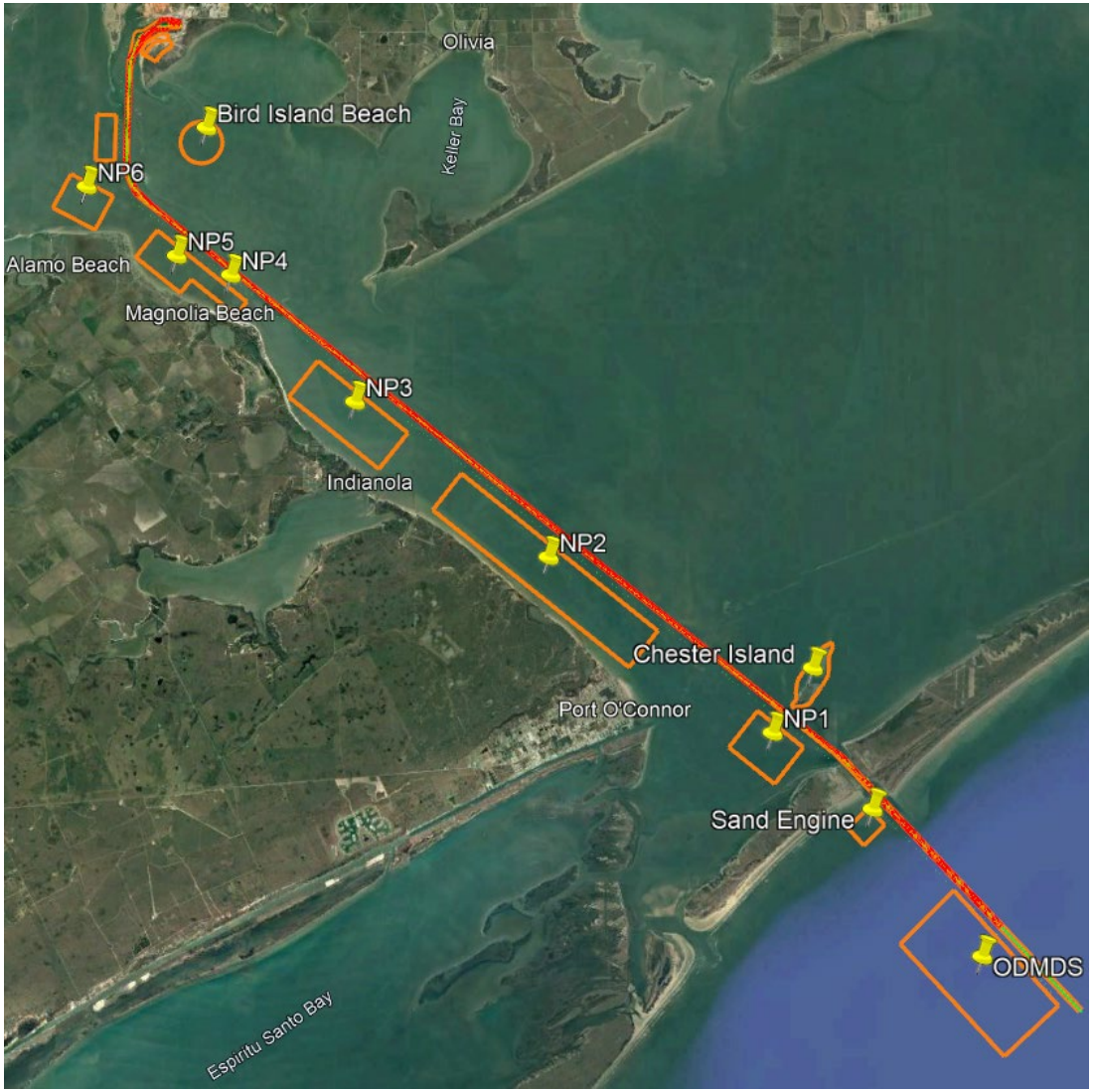
Placement Area (PA) acronyms:

- ODMDS — Offshore Dredged Material Disposal Site
- SE — Sand Engine
- CI — Chester Island
- NP1-6 — Original Placement Areas 1 through 6 (see figures for locations per alternatives below)
- BIB — Bird Island Beach

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I. The First Estimate

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
PL	20+000	25+000	NP1
PL	25+000	55+000	NP2
PL	55+000	79+000	NP3
PL	79+000	87+000	NP4
PL	87+000	95+000	NP5
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$257,307,000 - $321,634,000*

Bird Island Costs

At this point two (2) different Bird Island designs were estimated.

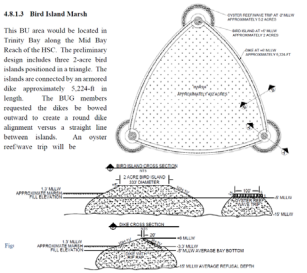
1. **Three Bird Island Marsh Cost**
   $58,389,000 - $72,986,000*
2. **Bird Island Beach Cost**
   $35,799,000 - $44,749,000*

Total Construction Cost**

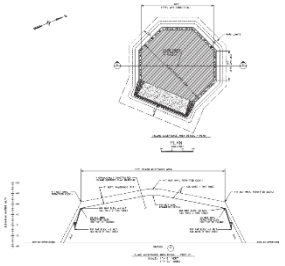
$293,106,000 - $366,382,500*

Notes

*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
**Includes the only Bird Island Beach.
No Mitigation cost was developed at this point as a preliminary environmental impact was considered being too high and the purpose of The Second Estimate was to reduce it.



Three Bird Island Marsh



Bird Island Beach

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II. The Second Estimate – Hopper in Bay

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
MH	20+000	25+000	ODMDS
MH	25+000	55+000	ODMDS
PL	55+000	79+000	NP3
PL	79+000	87+000	NP4
PL	87+000	95+000	NP5
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB

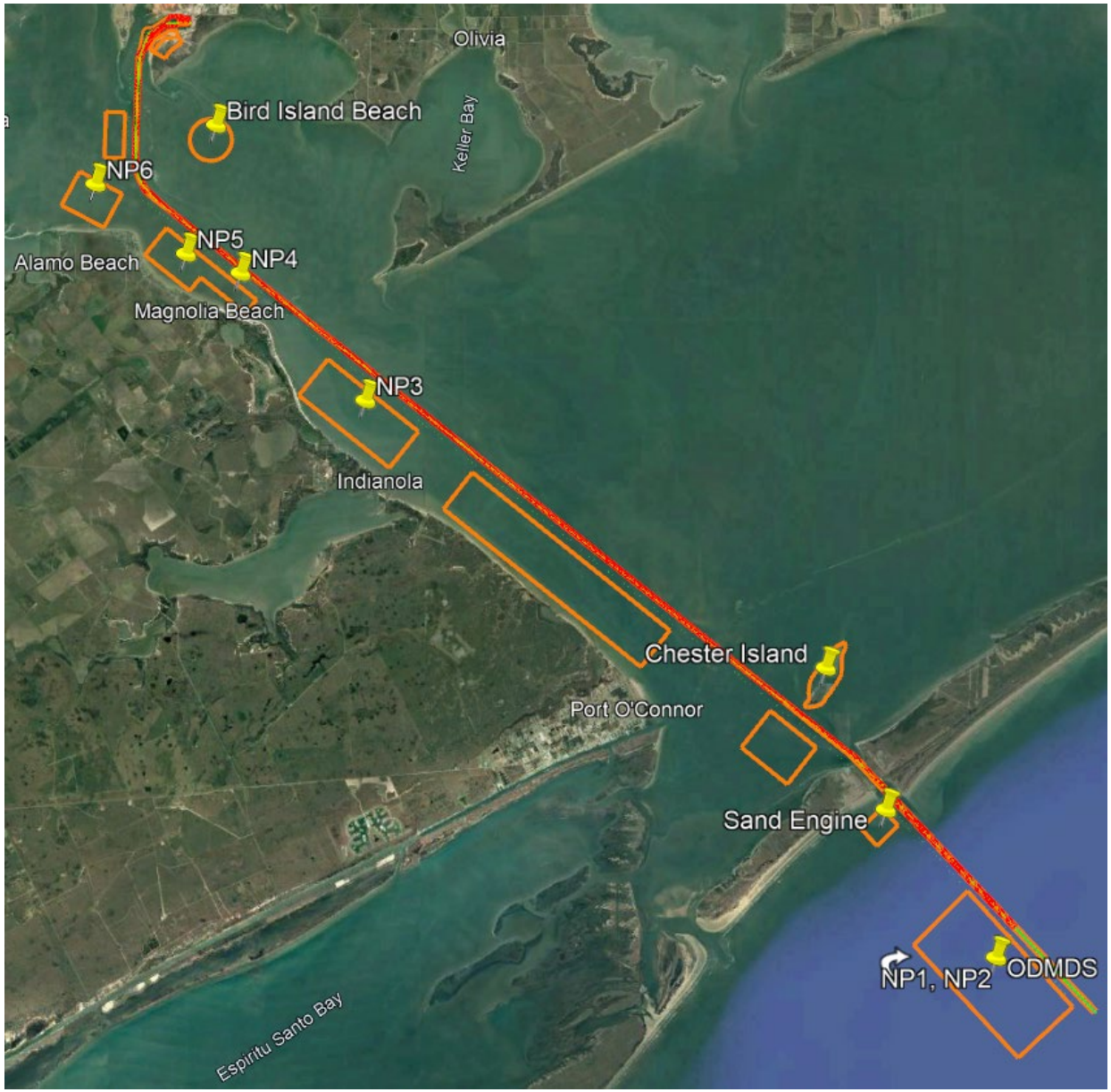
NW Dredging Cost (whole channel)
$293,041,000 - $366,301,000*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

Total Construction Cost**
$328,840,000 - $411,050,000*

Mitigation Cost***
$482,139,000 - $602,674,000*

Notes
*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
***Mitigation cost based on the construction of 1,270 Acres of oyster pads in the bay.



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III. New Alternatives

New Alternatives include the following Placement Areas:

Underwater Berms*

- NP1-2 UND BERM
- NP2-1 UND BERM
- NP3-2 BERM
- NP4-2UW Berm

Bird Islands**

- NP1-1 BIRD ISL
- NP2-2 BIRD ISL
- NP3-1 BIRD ISL
- NP4-1 Long BI***
- NP3-4 Long BI***
- BIB****

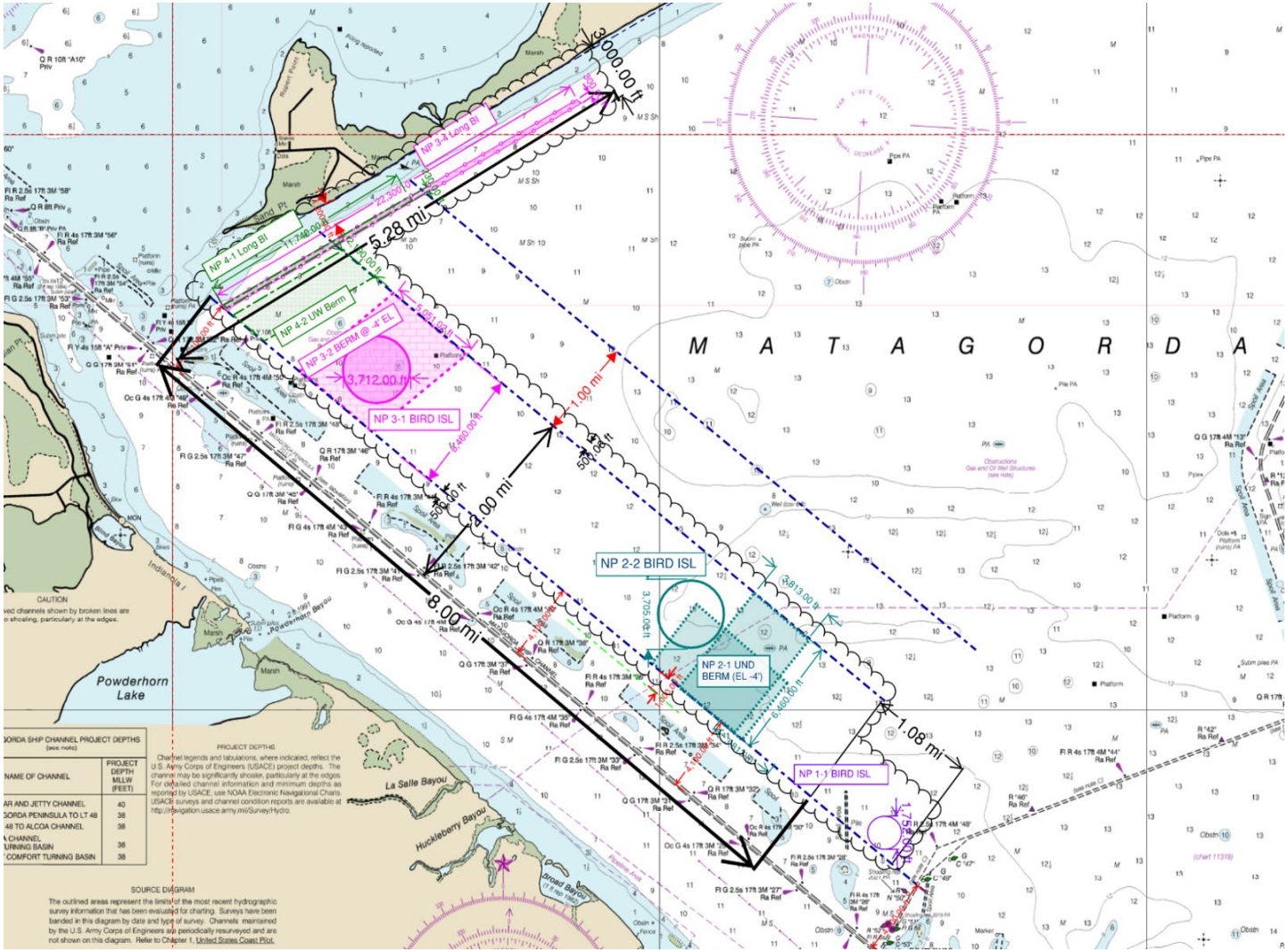
Other Changes

- NP5 goes into NP4.

Notes

*Each Berm is at -4’ elevation.

**Each new Bird Island has a simpler design: dumping materials, shaping the island, protecting the shore w/ riprap. Does not include the beach.



***The stone protection along the Long Bird Islands extends only along half of the perimeter on the Bay side.

****Previously estimated Bird Island Beach.

New placement areas on the East side only intended for New Work materials.

OM materials to be placed into existing OM PAs and new OP10 (OM cost is not considered in this report).

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New Alternative 1

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
PL	20+000	25+000	NP1-2 UND BERM
PL	25+000	55+000	NP2-1 UND BERM
PL	55+000	79+000	NP3-2 BERM
PL	79+000	87+000	NP4-2UW Berm
PL	87+000	95+000	NP4
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB

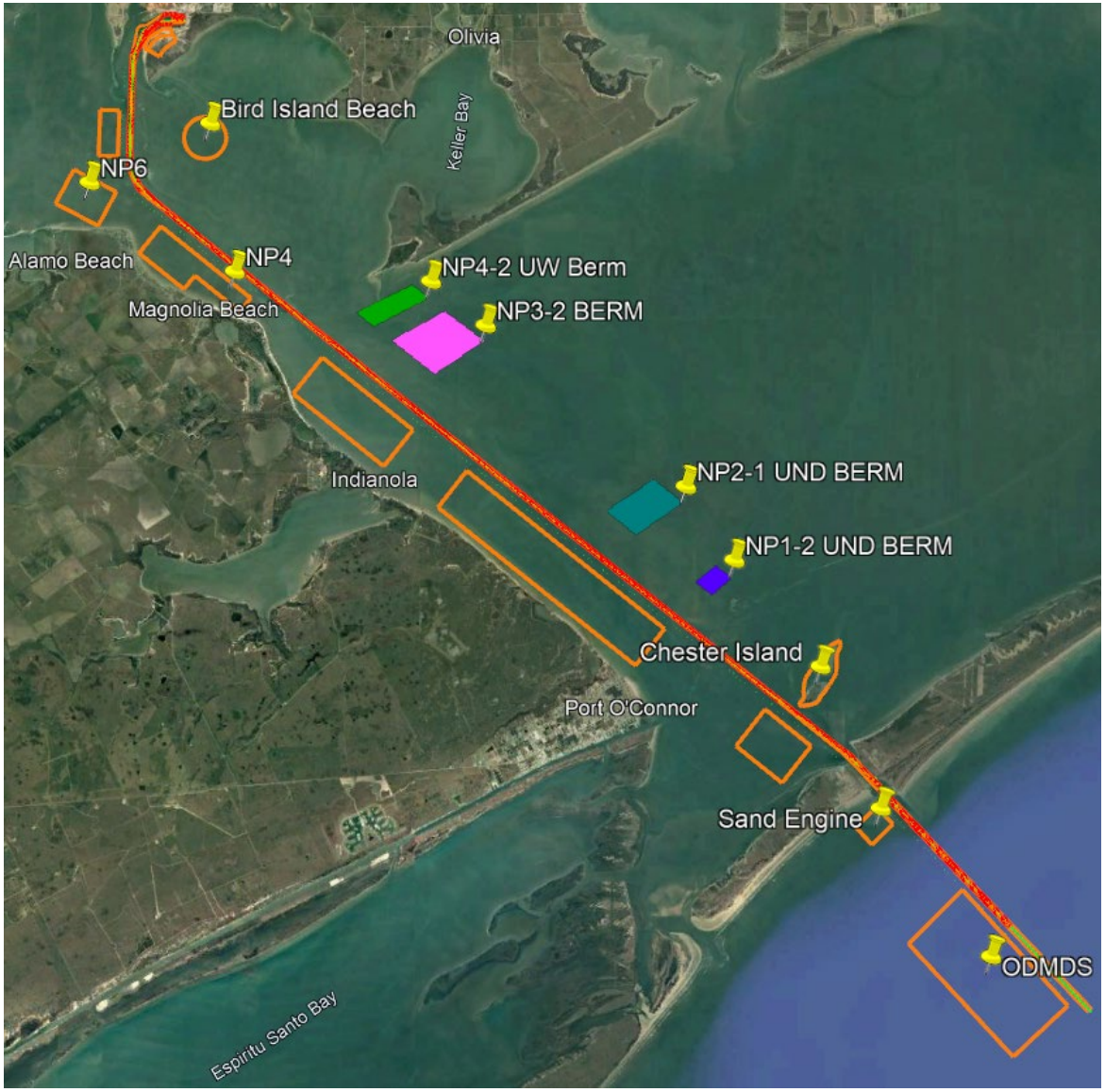
NW Dredging Cost (whole channel)
$284,250,000 - $355,312,500*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

Underwater Berms Cost (4 berms)**
$21,134,000 - $26,417,500*

Total Construction Cost***
$341,182,000 - $426,477,500*

Unavoidable Mitigation****
$66,855,000 - $83,568,750*

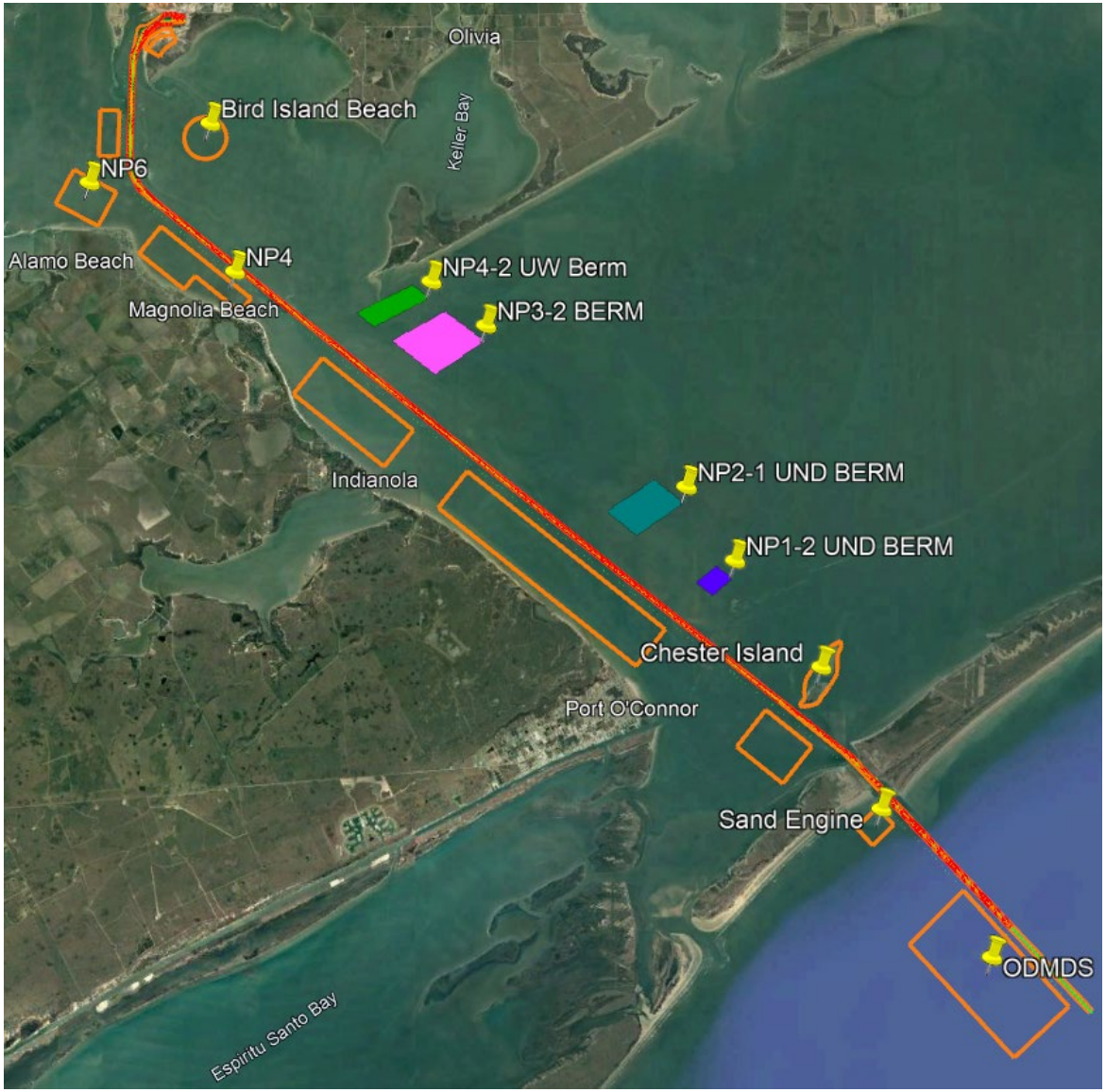


Notes
*High end estimate includes 25% contingency.
**Underwater berms have strict requirements for the size and elevation.
***Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
****Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

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New Alternative 1A

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
PL	20+000	25+000	NP1-2 UND BERM
PL	25+000	55+000	NP2-1 UND BERM
PL	55+000	79+000	NP3-2 BERM
PL	79+000	87+000	NP4-2UW Berm
PL	87+000	95+000	NP4
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$284,250,000 - $355,312,500*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

Underwater Berms Cost (4 berms)**
No additional cost

Total Construction Cost***
$320,049,000 - $400,061,500*

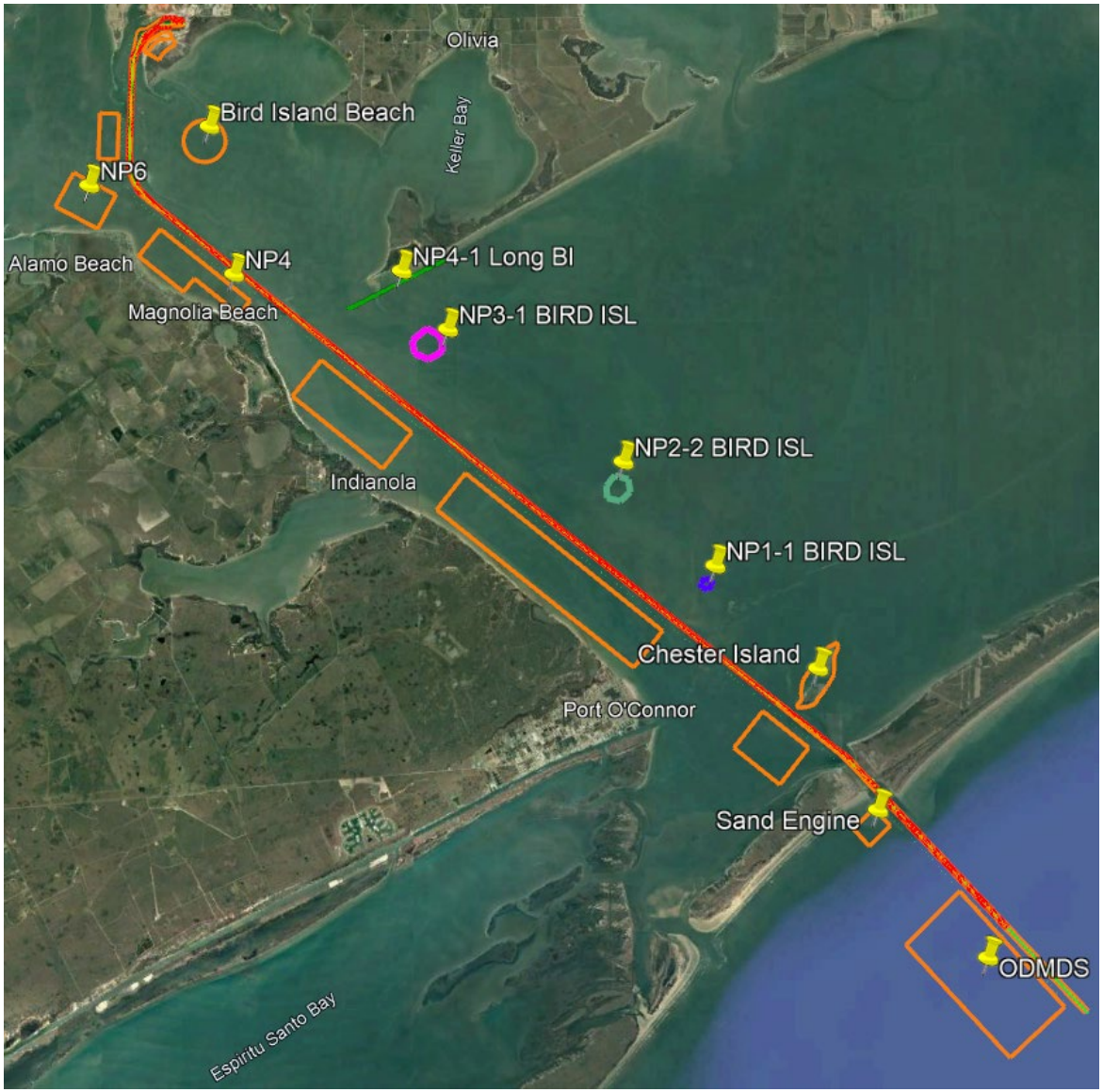
Unavoidable Mitigation****
$66,855,000 - $83,568,750*

Notes
*High end estimate includes 25% contingency.
**Underwater berms don't have strict requirements for the size and elevation.
***Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
**** Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

FOR OFFICIAL USE ONLY

New Alternative 2

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
PL	20+000	25+000	NP1-1 BIRD ISL
PL	25+000	55+000	NP2-2 BIRD ISL
PL	55+000	79+000	NP3-1 BIRD ISL
PL	79+000	87+000	NP4-1 Long BI
PL	87+000	95+000	NP4
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$275,617,000 - $344,521,000*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

New Bird Islands Cost (four islands)
$46,173,000 - $57,716,250*

Total Construction Cost**
$352,860,000 - $441,075,000*

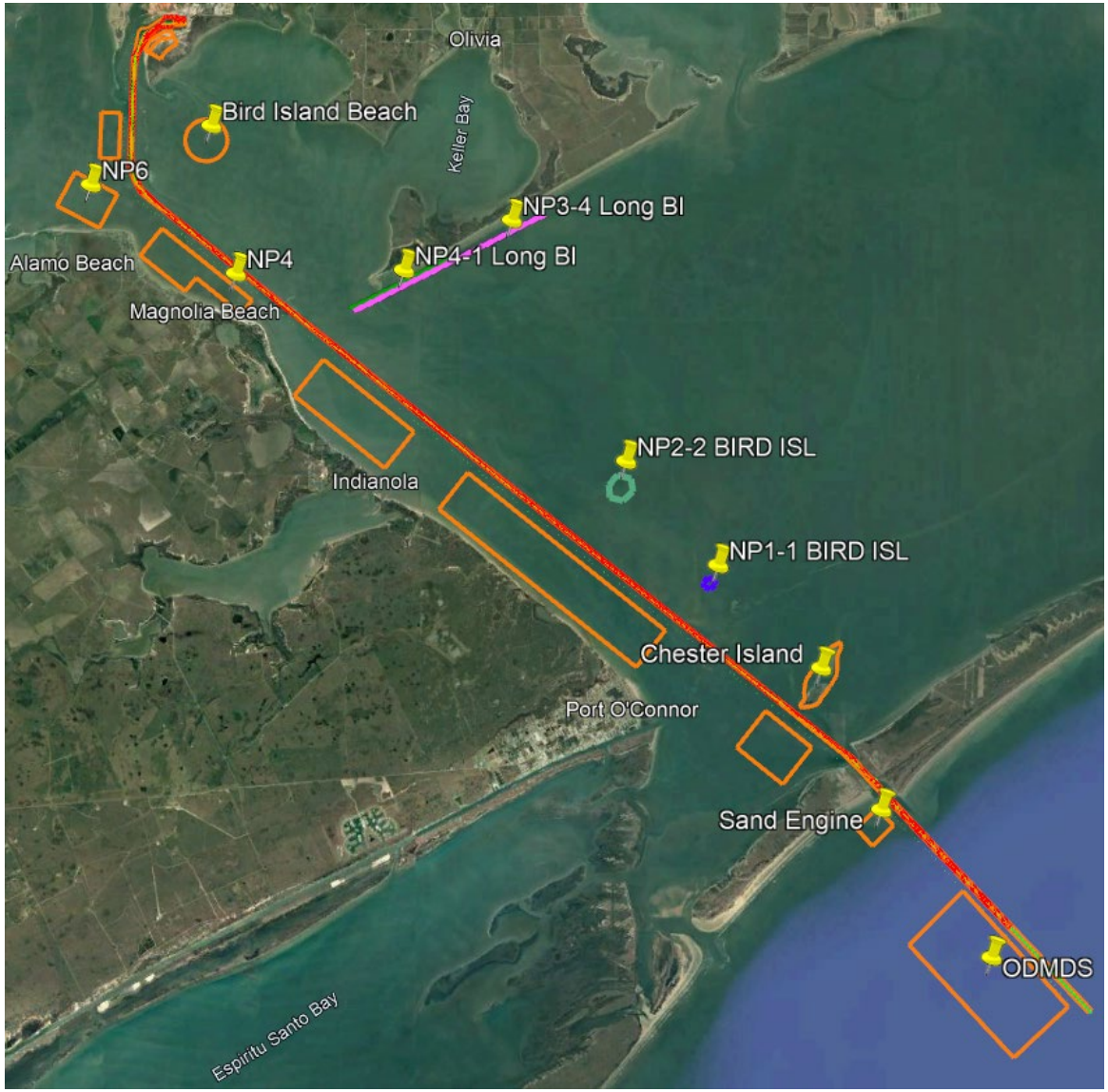
Unavoidable Mitigation***
$66,855,000 - $83,568,750*

Notes
*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
***Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

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New Alternative 3

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
PL	20+000	25+000	NP1-1 BIRD ISL
PL	25+000	55+000	NP2-2 BIRD ISL
PL	55+000	79+000	NP3-4 Long BI
PL	79+000	87+000	NP4-1 Long BI
PL	87+000	95+000	NP4
PL	95+000	100+000	NP6
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$295,184,000 - $368,980,000*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

New Bird Islands Cost (four islands)
$58,412,000 - $73,015,000*

Total Construction Cost**
$384,667,000 - $480,833,750*

Unavoidable Mitigation***
$66,855,000 - $83,568,750*

Notes
*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
***Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

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New Alternative 4

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
LH	20+000	25+000	ODMDS
LH	25+000	55+000	ODMDS
LH	55+000	79+000	ODMDS
LH	79+000	87+000	ODMDS
LH	87+000	95+000	ODMDS
LH	95+000	100+000	ODMDS
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$327,306,000 - $409,133,000*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

Total Construction Cost**
$358,376,000 - $447,970,000**

Unavoidable Mitigation***
$66,855,000 - $83,568,750*

Notes
*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
***Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

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New Alternative 5

Dredge	Channel		PA
	From	To	
LH	-26+000	-16+000	ODMDS
LH	-16+000	0+000	SE
PL	0+000	20+000	CI
MH	20+000	25+000	ODMDS
MH	25+000	55+000	ODMDS
MH	55+000	79+000	ODMDS
MH	79+000	87+000	ODMDS
MH	87+000	95+000	ODMDS
MH	95+000	100+000	ODMDS
PL	100+000	111+000	BIB
PL	111+000	118+502	BIB



NW Dredging Cost (whole channel)
$368,146,000 – 460,183,000*

Bird Island Beach Cost (one island)
$35,799,000 - $44,749,000*

Total Construction Cost**
$399,216,000 – 499,020,000**

Unavoidable Mitigation***
$66,855,000 - $83,568,750*

Notes
*High end estimate includes 25% contingency.
**Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.
***Unavoidable (West Side) mitigation cost based on the construction of 185 Acres of oyster pads in the bay. Surveys underway to determine mitigation impact to East side.

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Summary Table

##	Alternative	Description	Total Construction Cost
1	The first estimate	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Remaining Channel – Pipeline Dredge to Chester Island, NP1, NP2, NP3, NP4, NP5, NP6, Bird Island Beach (was chosen over Three Bird Island Marsh)	$293,106,000 - $366,382,500
2	The second estimate	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Channel from 20+000 to 55+000 – Medium Hopper to ODMDS; Remaining Channel – Pipeline Dredge to Chester Island, NP3, NP4, NP5, NP6, Bird Island Beach.	$328,840,000 - $411,050,000
Mitigation		Original Plan has a significant environmental impact caused by placing the New Work materials on the West side of the channel. The mitigation cost was developed for constructing 1,270 Acres of oyster pads	$482,139,000 - $602,674,000
3	New Alternative 1	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Remaining Channel – Pipeline Dredge to Chester Island, NP1-2 UND BERM, NP2-1 UND BERM, NP3-2 BERM, NP4-2UW Berm, NP4, NP6, Bird Island Beach.	$341,182,000 - $426,477,500
4	New Alternative 1A	The same as the previous Alternative 1 with no-restricted size and elevation for Underwater Berms.	$320,049,000 - $400,061,500
5	New Alternative 2	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Remaining Channel – Pipeline Dredge to Chester Island, NP1-1 BIRD ISL, NP2-2 BIRD ISL, NP3-1 BIRD ISL, NP4-1 Long BI, NP4, NP6, Bird Island Beach.	$352,860,000 - $441,075,000
6	New Alternative 3	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Remaining Channel – Pipeline Dredge to Chester Island, NP1-1 BIRD ISL, NP2-2 BIRD ISL, NP3-4 Long BI, NP4-1 Long BI, NP4, NP6, Bird Island Beach.	$384,667,000 - $480,833,750
7	New Alternative 4	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Channel from 20+000 to 100+000 – Large Hopper to ODMDS; Remaining Channel – Pipeline Dredge to Chester Island, Bird Island Beach.	$358,376,000 - $447,970,000
8	New Alternative 5	Entrance and Jetties Channel – Large Hopper to ODMDS and Sand Engine; Channel from 20+000 to 100+000 – Medium Hopper to ODMDS; Remaining Channel – Pipeline Dredge to Chester Island, Bird Island Beach.	$399,216,000 – 499,020,000
Unavoidable Mitigation		Reducing quantity of dredged material placed on the West side allowed to decrease oyster pads area to 185 Acres.	$66,855,000 - $83,568,750

Notes

High end estimate includes 25% contingency.

Total Construction Cost does not include PED, CM, Real Estate, Pipeline Relocation, Berth Dredging, O&M and other associated costs.

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COST ENGINEERING ATTACHMENT NO. C-3

50-Year O&M Plan

Yearly Costs

FWOP 50-Year O&M Plan							
YEAR	Hopper Entrance Channel	Pipeline Mid Bay	Pipeline Upper Bay	PED 4%	CM 4%	CONTINGENCY 15%	YEARLY COST
2							
3		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
4							
5	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
6							
7		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
8							
9	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
10							
11		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
12							
13	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
14							
15		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
16							
17	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
18							
19		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
20							
21	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
22							
23		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
24							
25	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
26							
27		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
28							
29	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
30							
31		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
32							
33	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
34							
35		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
36							
37	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
38							
39		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
40							
41	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
42							
43		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
44							
45	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
46							
47		$18,741,000	$7,862,000	$1,064,000	$1,064,000	$3,990,000	$32,721,000
48							
49	$5,296,000	$18,741,000	$7,862,000	$1,276,000	$1,276,000	$4,785,000	$39,236,000
50							
		ESTIMATED COSTS:	$702,024,000			TOTAL 50-YEAR PLAN:	$863,484,000

43'-45' O&M Plan							
YEAR	Hopper Entrance Channel	Pipeline Mid Bay	Pipeline Upper Bay	PED 4%	CM 4%	CONTINGENCY 15%	YEARLY COST
2			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
3		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
4			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
5	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
6			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
7		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
8			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
9	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
10			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
11		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
12			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
13	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
14			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
15		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
16			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
17	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
18			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
19		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
20			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
21	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
22			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
23		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
24			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
25	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
26			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
27		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
28			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
29	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
30			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
31		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
32			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
33	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
34			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
35		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
36			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
37	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
38			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
39		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
40			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
41	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
42			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
43		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
44			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
45	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
46			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
47		$19,706,000	$8,745,000	$1,138,000	$1,138,000	$4,268,000	$34,995,000
48			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
49	$6,834,000	$19,706,000	$8,745,000	$1,411,000	$1,411,000	$5,293,000	$43,400,000
50			$4,378,000	$175,000	$175,000	$657,000	$5,385,000
		ESTIMATED COSTS:	$874,282,000			TOTAL 50-YEAR PLAN:	$1,075,365,000

45'47' 50-Year O&M Plan							
YEAR	Hopper Entrance Channel	Pipeline Mid Bay	Pipeline Upper Bay	PED 4%	CM 4%	CONTINGENCY 15%	YEARLY COST
2			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
3		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
4			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
5	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
6			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
7		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
8			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
9	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
10			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
11		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
12			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
13	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
14			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
15		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
16			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
17	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
18			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
19		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
20			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
21	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
22			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
23		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
24			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
25	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
26			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
27		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
28			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
29	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
30			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
31		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
32			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
33	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
34			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
35		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
36			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
37	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
38			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
39		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
40			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
41	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
42			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
43		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
44			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
45	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
46			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
47		$20,315,000	$9,527,000	$1,194,000	$1,194,000	$4,476,000	$36,706,000
48			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
49	$8,174,000	$20,315,000	$9,527,000	$1,521,000	$1,521,000	$5,702,000	$46,760,000
50			$5,058,000	$202,000	$202,000	$759,000	$6,221,000
		ESTIMATED COSTS:	$940,746,000			TOTAL 50-YEAR PLAN:	$1,157,117,000

47'49' 50-Year O&M Plan							
YEAR	Hopper Entrance Channel	Pipeline Mid Bay	Pipeline Upper Bay	PED 4%	CM 4%	CONTINGENCY 15%	YEARLY COST
2			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
3		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
4			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
5	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
6			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
7		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
8			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
9	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
10			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
11		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
12			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
13	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
14			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
15		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
16			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
17	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
18			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
19		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
20			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
21	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
22			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
23		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
24			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
25	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
26			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
27		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
28			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
29	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
30			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
31		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
32			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
33	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
34			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
35		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
36			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
37	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
38			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
39		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
40			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
41	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
42			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
43		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
44			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
45	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
46			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
47		$20,944,000	$10,401,000	$1,254,000	$1,254,000	$4,702,000	$38,555,000
48			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
49	$9,637,000	$20,944,000	$10,401,000	$1,639,000	$1,639,000	$6,147,000	$50,407,000
50			$5,816,000	$233,000	$233,000	$872,000	$7,154,000
		ESTIMATED COSTS:	$1,013,324,000			TOTAL 50-YEAR PLAN:	$1,246,394,000

COST ENGINEERING ATTACHMENT NO. C-4

Cost and Schedule Risk Analysis

US Army Corps of Engineers

Prepared for:
U.S. Army Corps of Engineers
Galveston District

Matagorda Ship Channel Improvement PACR

Calhoun and Matagorda Counties, TX

CSRA for 2026 Construction Estimate



Prepared by:
USACE Cost MCX

May 2026

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Appendixes

Appendix A: Base Estimate

Appendix B: Base Schedule

Appendix C: Cost & Schedule Risk Analysis Details

1. Purpose

The U.S. Army Corps of Engineers (USACE), Galveston District, presents this Cost and Schedule Risk Analysis (CSRA) report regarding the risk findings and recommended contingencies for the Matagorda Ship Channel Improvement PACR 2026 Construction Estimate. The 2019 Matagorda Ship Channel Improvement Project, Port Lavaca, Texas, Feasibility Report and Environmental Impact Statement (FEIS), Review of Completed Projects, Calhoun and Matagorda Counties study was a Section 216 – Review of Completed Projects study.

Due to differences between the 2019 authorized plan calculations and actual dredge quantities, a Post-Authorization Change Report (PACR) was deemed appropriate to reanalyze Alternative A at three scales and determine which depth is the plan that maximizes net benefits.

A *Monte-Carlo* based risk analysis was conducted by the Project Development Team (PDT) on remaining costs in compliance with Engineer Regulation (ER) 1110-2-1302, CIVIL WORKS COST ENGINEERING (for Civil Works projects). The purpose of this risk analysis study is to present the cost and schedule risks considered and respective project contingencies at a recommended 80% confidence level of successful execution to project completion.

2. Project Scope

The purpose of the Matagorda Ship Channel, TX project (MSC) is to increase operational efficiencies of maritime commerce movement through the Port of Calhoun, Matagorda and Calhoun Counties, Texas.

3. Key Assumptions

- Contaminated Soil. There is a potential risk of encountering contaminated soil around the Alcoa docks. If HTRW is encountered the NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132. The CSRA evaluates HTRW schedule impact risk only. There is additional cost risk such as dredging (pumping distance) and LERRDS. SWG is currently addressing the risks and currently dredging or cleanup risk are considered “Game Changers” and not included in the analysis.
- Construction Estimate. The Galveston District provided MII MCACES (Micro-Computer Aided Cost Estimating Software) files electronically. The CWE files transmitted and downloaded on December 14, 2018 was the basis for the initial cost and schedule risk analyses. An updated estimate was provided in January 2026 and used for the final CSRA.
- Construction Schedule. Schedules are analyzed for impact to the project cost in terms of delayed funding, uncaptured escalation (variance from OMB factors and the local market) and unavoidable fixed contract costs and/or languishing federal administration costs incurred throughout delay.
- Sponsor. The non-federal sponsor for the study is the Calhoun Port Authority, formerly known as the Calhoun County Navigation District, of Point Comfort, Texas. The Calhoun Port Authority is supportive of the 2025 Suggested Plan.
- LLERDS. The non-federal sponsor is required to furnish all LERRDD for this proposed cost shared project.
- Relocations. The non-federal sponsor is responsible for removal of pipelines obstructing the channel.

4. Cost & Schedule Risk Analysis Process

Refer to the “Civil Works Processes for Cost & Schedule Risk Analysis”, for guidance and details on the CSRA process.

5. Base Estimate

See Appendix A for a summary of the base cost estimate from which this CSRA was conducted.

6. Base Schedule

See Appendix B for a summary of the base schedule from which this CSRA was conducted.

7. Cost & Schedule Risk Analysis

The CSRA results are provided in the following sections. In addition to contingency calculation results, the top cost and schedule risks were identified, and sensitivity analyses are presented to provide decision makers with:

- An understanding of variability and the key contributors,
- Contingency information for scheduling, budgeting, and project control purposes, and
- Provide tools to support decision making and risk management as projects progress through planning and implementation.

Additional information and details can be found in various Appendix C subsections which are described below.

- **Appendix C-1: Risk Dashboards.** Summary of the top cost & schedule risk items, confidence levels, and suggested risk reduction measures.
- **Appendix C-2: Contingency Summary.** Summary of the various contingency values for cost & schedule by confidence level.
- **Appendix C-3: Sensitivity Charts.** Summary of the major cost & schedule risk items along with a graphical representation of their potential range of impacts at the 50%, 80%, and 90% confidence levels.
- **Appendix C-4: Risk Register.** Summary of the risk register documenting risk type, risk details, likelihood, impact ratings, responsibility, suggested risk reduction measures, etc.
- **Appendix C-5: CSRA Assumptions.** Summary of the risk matrix, likelihood of occurrence definition, impact or consequence definitions for cost / schedule, and cost / schedule impact ranges as they relate to this project.
- **Appendix C-6: Risk Register Attendance.** Summary of the participants of the risk register meeting which was conducted on 11/12/2025.
- **Appendix C-7: Risk Details.** Some projects and their risk items could require more complex calculations to determine their risk impact ranges. This is not a mandatory requirement, but risk detail sheets were included to document the assumptions and calculations.

7.1. Summary of Results

The base estimate is approximately $476M escalated to the mid-point of construction excluding contingency. Based on the results of the analysis, the CSRA recommends a contingency value of $133.4M, or approximately 28% of base estimate at the 80% confidence level of successful execution. The base schedule is approximately 52 months excluding contingency. Based on the results of the analysis, the CSRA recommends a contingency value of 37.9 months, or approximately 73% of base schedule at the 80% confidence level of successful execution. See Table 1 below for a more detailed summary and Appendix C for additional details regarding risk-based contingency development.

Table 1. Summary of CSRA Results

Contingency on Base Estimate	80% Confidence Project Cost	
Base Estimate	$476,439,047	
Estimate Contingency	$133,402,933	28%
Base Estimate w/ Contingency (80% Confidence)	$609,841,980	

Contingency on Base Schedule	80% Confidence Project Schedule	
Base Schedule Start Date	January 1, 2028	
Base Schedule Finish Date	April 30, 2032	
Base Schedule Duration	51.9 Months	
Schedule Contingency Duration	37.9 Months	73%
Base Schedule w/ Contingency (80% Confidence)	89.8 Months	
Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

7.2. Cost Risk Analysis

7.2.1. Cost Confidence Levels

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall base estimate with contingency at intervals of confidence (probability). Table 2 provides the cost contingencies calculated for the various confidence levels with the 80% confidence level highlighted. Figure 1 presents this information graphically. Contingencies are rounded up to the nearest whole percentage.

Table 2. Cost Confidence Levels

Base Estimate	$476,439,047		
Confidence Level	Contingency Value	Contingency	Cost with Contingency
0%	$33,350,733	7%	$509,789,780
10%	$71,465,857	15%	$547,904,903
20%	$85,759,028	18%	$562,198,075
30%	$95,287,809	20%	$571,726,856
40%	$100,052,200	21%	$576,491,246
50%	$109,580,981	23%	$586,020,027
60%	$114,345,371	24%	$590,784,418
70%	$123,874,152	26%	$600,313,199
80%	**$133,402,933**	**28%**	**$609,841,980**
90%	$147,696,104	31%	$624,135,151
100%	$195,340,009	41%	$671,779,056

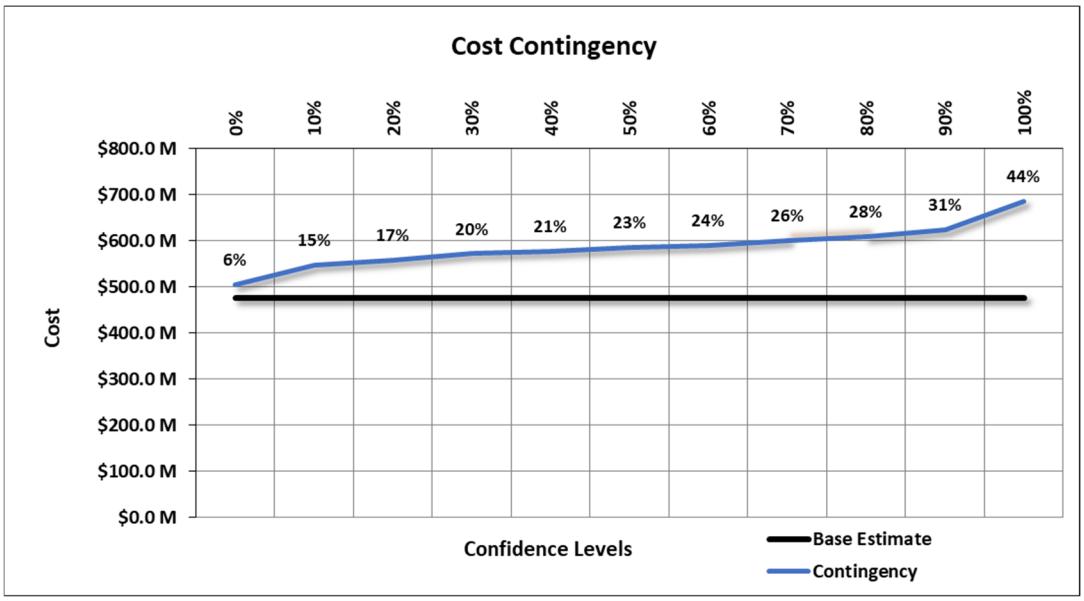


Figure 1. Cost Contingency Levels

7.2.2. Top Cost Risks

The risks/opportunities considered as key or primary cost drivers are ranked in order of potential impact (positive or negative) in Figure 2 at various confidence levels (50%, 80%, and 90%). Opportunities are shown with a negative sign to reflect the potential to decrease cost; risks are shown with a positive sign to reflect the potential to increase cost. These key cost drivers can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, these results can also be used to support development of strategies to eliminate, mitigate, accept, or transfer key risks. See Appendix C for additional details for these risks and further information regarding CSRA development.

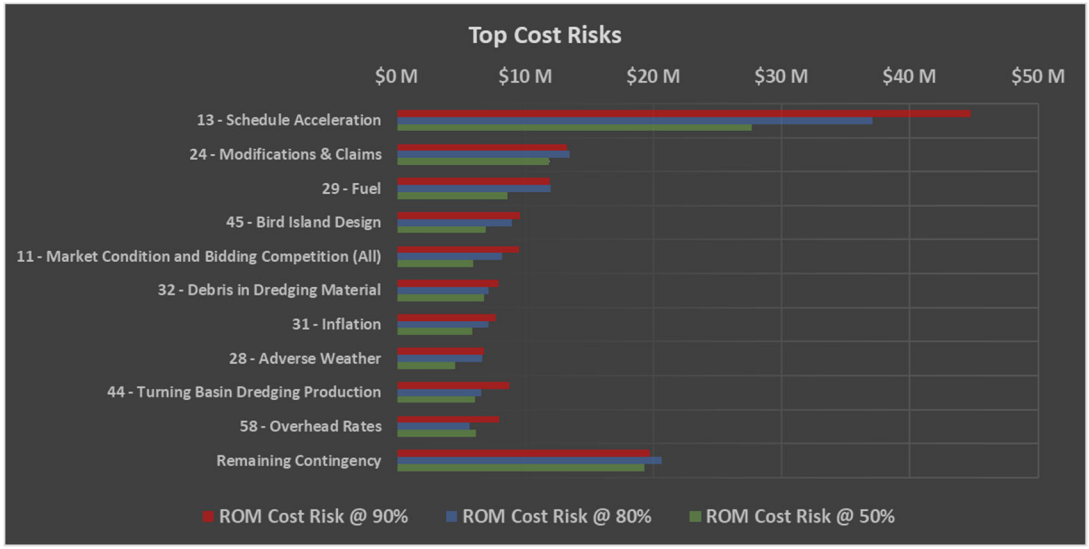


Figure 2. Top Cost Risks

- Risk 13: Schedule Acceleration. Schedule Acceleration increases cost.
- Risk 24: Modifications & Claims. Construction contract modifications can impact construction cost and schedule growth.
- Risk 29: Fuel. Fuel is a volatile cost and can greatly affect the cost of dredging projects.
- Risk 45: Bird Island Design. Bird Island Design may change

- Risk 11: Market Condition and Bidding Competition (All). There is the possibility of having a limited number of contractors bid which would increase the cost.
- Risk 32: Debris in Dredging Material. Debris could be encountered in new work dredging areas.
- Risk 31: Inflation. Inflation could exceed CWCCIS
- Risk 28: Adverse Weather. Location is subject to hurricanes.
- Risk 44: Turning Basin Dredging Production. Productivity in the turning basin could be lower than estimated.
- Risk 58: Overhead Rates. Overhead rates could be higher than estimated.

7.3. Schedule Risk Analysis

7.3.1. Schedule Confidence Levels

The result of risk or uncertainty analysis is quantification of the cumulative impact of all analyzed risks or uncertainties as compared to probability of occurrence. These results, as applied to the analysis herein, depict the overall schedule duration at intervals of confidence (probability). Table 3 provides the schedule duration contingencies calculated for the various confidence levels with the 80% confidence level highlighted. Figure 3 presents this information graphically. Contingencies are rounded up to the nearest whole percentage.

Table 3. Schedule Confidence Levels

Base Schedule Duration	51.9 Months		
Confidence Level	**Contingency Value**	**Contingency**	**Duration with Contingency**
0%	-0.5 Months	-1%	51.4 Months
10%	12.5 Months	24%	64.4 Months
20%	16.1 Months	31%	68.0 Months
30%	19.7 Months	38%	71.7 Months
40%	22.8 Months	44%	74.8 Months
50%	26.0 Months	50%	77.9 Months
60%	29.1 Months	56%	81.0 Months
70%	33.2 Months	64%	85.2 Months
80%	**37.9 Months**	**73%**	**89.8 Months**
90%	44.1 Months	85%	96.1 Months
100%	73.2 Months	141%	125.1 Months

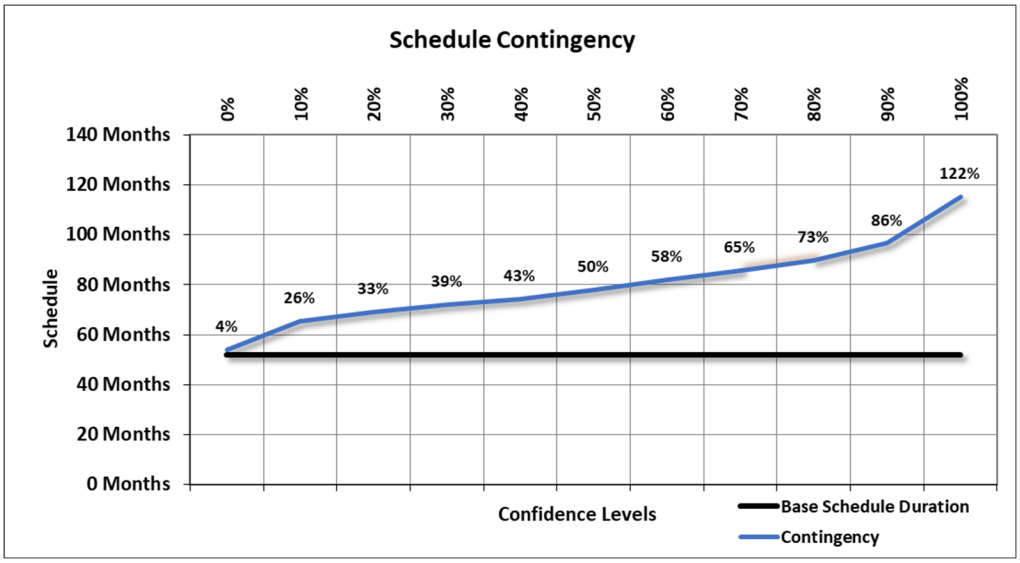


Figure 3. Schedule Contingency Levels

These contingencies were also used to calculate the projected residual fixed cost impact of project delays that are included in the Table 2 presentation of total cost contingency. The schedule contingencies were calculated by applying the high-level schedule risks identified in the risk register for each option to the durations of critical path and near critical path tasks.

The schedule was not resource loaded and contained open-ended tasks and non-zero lags (gaps in the logic between tasks) that limit the overall utility of the schedule risk analysis. These issues should be considered as limitations in the utility of the schedule contingency data presented. Schedule contingency impacts presented in this analysis are based solely on projected residual fixed costs.

7.3.2. Top Schedule Risks

The risks/opportunities considered as key or primary schedule drivers are ranked in order of potential impact (positive or negative) in Figure 4 at various confidence levels (50%, 80%, and 90%). Opportunities are shown with a negative sign to reflect the potential to decrease schedule duration; risks are shown with a positive sign to reflect the potential to increase schedule duration. These key schedule drivers can be used to support development of a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. Together with the risk register, sensitivity analysis results can also be used to support development of strategies to eliminate, mitigate, accept, or transfer key risks. See Appendix C for additional details for these risks and further information regarding CSRA development.

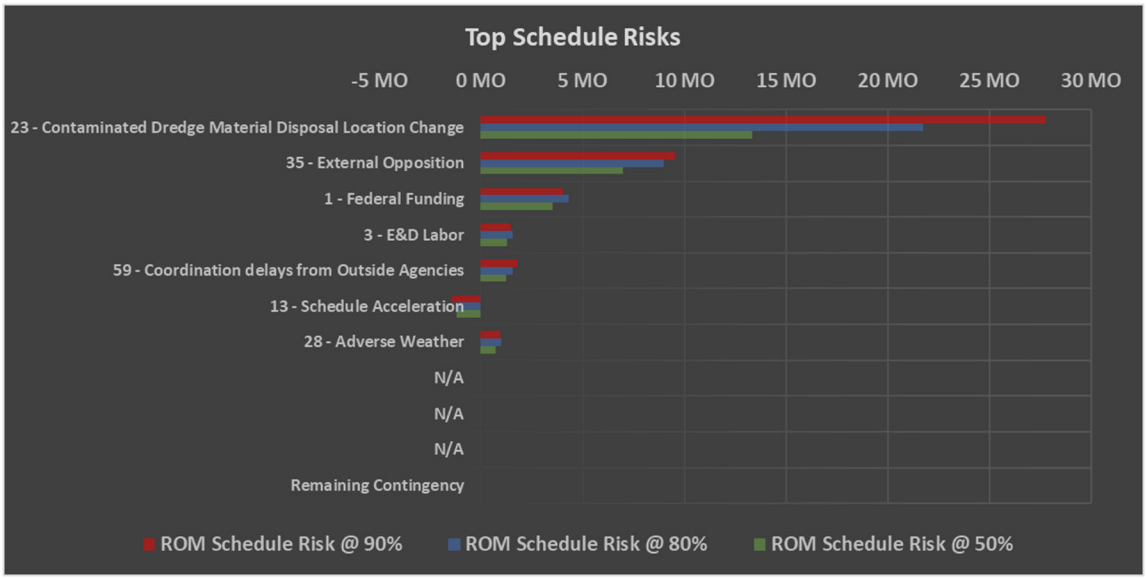


Figure 4. Top Schedule Risks

- Risk 23: Contaminated Dredge Material Disposal Location Change. Contamination could lead to changing the disposal location.
- Risk 35: External Opposition. External Opposition to the project could lead to delays
- Risk 1: Federal Funding. Annual appropriations for Design and Construction could be delayed.
- Risk 3: E&D Labor. There may be a shortage of manpower for the design of this project.
- Risk 59: Coordination delays from Outside Agencies. Multiple agency coordination could lead to consultation delays
- Risk 13: Schedule Acceleration. Schedule Acceleration increases cost.
- Risk 28: Adverse Weather. Location is subject to hurricanes.

See Appendix C for additional details for these risks and further information regarding CSRA development.

8. Recommendations, Risk Management, & Updates

8.1. Recommendations

Risk Management is an all-encompassing, iterative, and life-cycle process of project management. The Project Management Institute's (PMI) *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, *Sixth Edition*, states that "project risk management includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project." Risk identification and analysis are processes within the knowledge area of risk management. Its outputs pertinent to this effort include the risk register, risk quantification (risk analysis model), contingency report, and the sensitivity analysis.

The intended use of these outputs is implementation by the project leadership with respect to risk responses (such as mitigation) and risk monitoring and control. In short, the effectiveness of the project risk management effort requires that the proactive management of risks not conclude with the study completed in this report.

The CSRA produced by the PDT identifies issues that require the development of subsequent risk response and mitigation plans. This section provides a list of recommendations for continued management of the risks identified and analyzed in this study. Note that this list is not all inclusive and should not substitute a formal risk management and response plan.

The CSRA study serves as a “road map” towards project improvements and reduced risks over time. The PDT should include the recommended cost and schedule contingencies and incorporate risk monitoring and mitigation on those identified risks. Further iterative study and update of the risk analysis throughout the project life cycle is important in support of remaining within an approved budget and appropriation.

8.2. Risk Management

Project leadership should use of the outputs created during the risk analysis effort as tools in future risk management processes. The risk register should be updated at each major project milestone. The results of the sensitivity analysis may also be used for response planning strategy and development. These tools should be used in conjunction with regular risk review meetings.

8.3. Risk Analysis Updates

Project leadership should review risk items identified in the original risk register and add others, as required, throughout the project life cycle. Risks should be reviewed for status and reevaluation (using qualitative measure, at a minimum) and placed on risk management watch lists if any risk’s likelihood or impact significantly increases. Project leadership should also be mindful of the potential for secondary (new risks created specifically by the response to an original risk) and residual risks (risks that remain and have unintended impact following response).

Appendix A

Base Estimate

Cost & Schedule Summary for Risk Register Development 2026

Project: Matagorda Ship Channel
Project Development Phase: Current Working Estimate
Meeting Date: 11/12/2025

Schedule Start: January 2028 *Month/Year*
Schedule Finish: April 2032 *Month/Year*
Duration: 51.9 Months

Schedule Contingency Duration: 37.9 Months
Schedule Contingency: 73%
Schedule with Contingency (80% Confidence): 89.8 Months
Finish Date with Contingency (80% Confidence): June 2035

	CW_WBS	Feature of Work	Base Cost	80% Confidence	80% Confidence ($)	80% Total
	Risk Not Included In CSRA					
	01 - LANDS AND DAMAGES	Real Estate	$25,000	25%	$6,250	$31,250
			$0	0%	$0	$0
			$0	0%	$0	$0
			$0	0%	$0	$0
	Risk Included In CSRA					
1	02 - RELOCATIONS		$31,380,915	28%	$8,786,656	$40,167,571
2	06 - FISH AND WILDLIFE FACILITIES		$40,200,223	28%	$93,774,214	$428,682,123
3	12 - NAVIGATION, PORTS AND HARBORS		$334,907,909	28%	$632,800	$2,892,800
4	18 - CULTURAL RESOURCE PRESERVATION		$2,260,000	28%	$632,800	$2,892,800
5			$0	0%	$0	$0
6			$0	0%	$0	$0
7			$0	0%	$0	$0
8			$0	0%	$0	$0
9			$0	0%	$0	$0
10			$0	0%	$0	$0
11			$0	0%	$0	$0
12			$0	0%	$0	$0
13			$0	0%	$0	$0
14			$0	0%	$0	$0
15			$0	0%	$0	$0
16			$0	0%	$0	$0
17			$0	0%	$0	$0
18			$0	0%	$0	$0
19			$0	0%	$0	$0
20			$0	0%	$0	$0
21			$0	0%	$0	$0
22			$0	0%	$0	$0
23	30 - PLANNING, ENGINEERING, AND DESIGN		$45,209,000	28%	$12,658,520	$57,867,520
24	31 - CONSTRUCTION MANAGEMENT		$22,481,000	28%	$6,294,680	$28,775,680
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)				$0	$0

TOTALS				
Risk Not Included In CSRA	$25,000	25%	$6,250	$31,250
Total Construction Estimate	$408,749,047	28%	$114,449,733	$523,198,780
Total Planning, Engineering & Design	$45,209,000	28%	$12,658,520	$57,867,520
Total Construction Management	$22,481,000	28%	$6,294,680	$28,775,680
Total EXCLUDING Risk Not Included In CSRA	**$476,439,047**	**28%**	**$133,402,933**	**$609,841,980**
Total INCLUDING Risk Not Included In CSRA	**$476,464,047**	**28%**	**$133,409,183**	**$609,873,230**

Appendix B

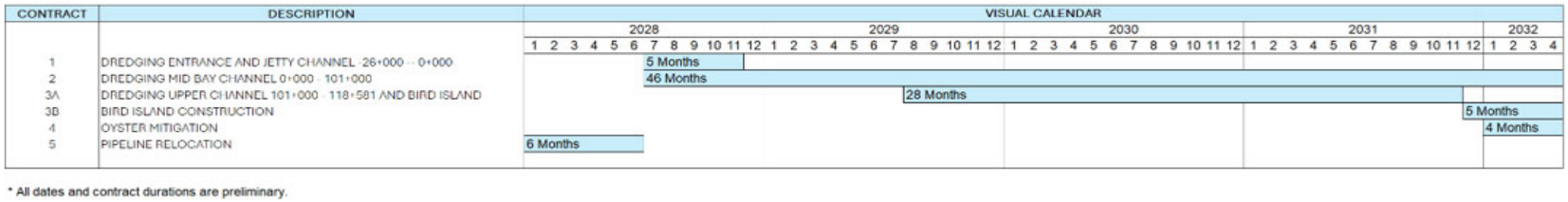
Base Schedule

Table 9-6 Preliminary Contract Schedule

CONTRACT	DESCRIPTION	DURATION (month)	START DATE	MIDPOINT	END DATE
1	DREDGING ENTRANCE AND JETTY CHANNEL -26+000 - 0+000	5	Jul-28	*FY28Q4*	Nov-28
2	DREDGING MID BAY CHANNEL 0+000 - 101+000	46	Jul-28	*FY30Q3*	Apr-32
3A	DREDGING UPPER BAY CHANNEL 101+000 - 118+581	28	Aug-29	*FY30Q4*	Nov-31
3B	BIRD ISLAND CONSTRUCTION	5	Dec-31	*FY32Q2*	Apr-32
4	OYSTER MITIGATION	4	Jan-32	*FY32Q2*	Apr-32
5	PIPELINE RELOCATION	6	Jan-28	*FY28Q2*	Jun-28

The Schedule developed for MSIP 2025 Recommended Plan (deepening scale 47'/49').

It is assumed that the Cultural Resource Contract will be executed prior to the construction start.



* All dates and contract durations are preliminary.

Figure 9.1 Preliminary Visual Contract Calendar

Appendix C

Cost & Schedule Risk Analysis Details

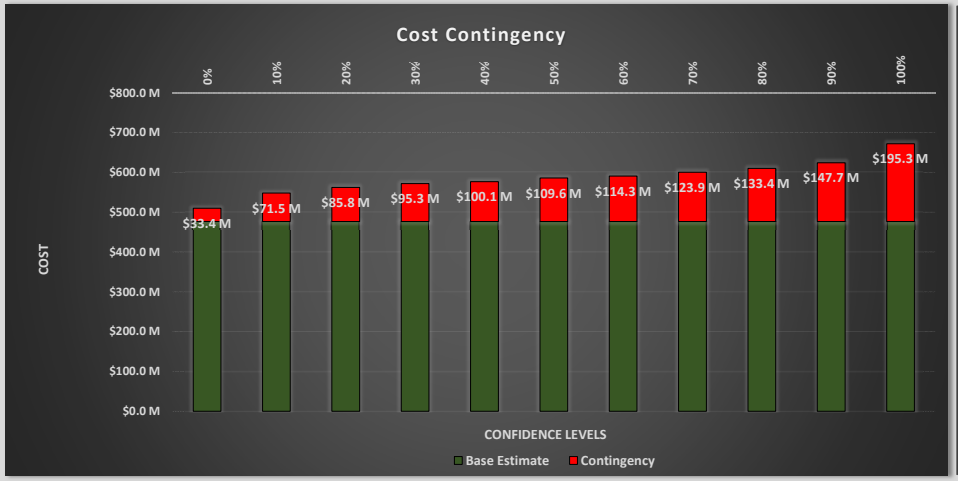
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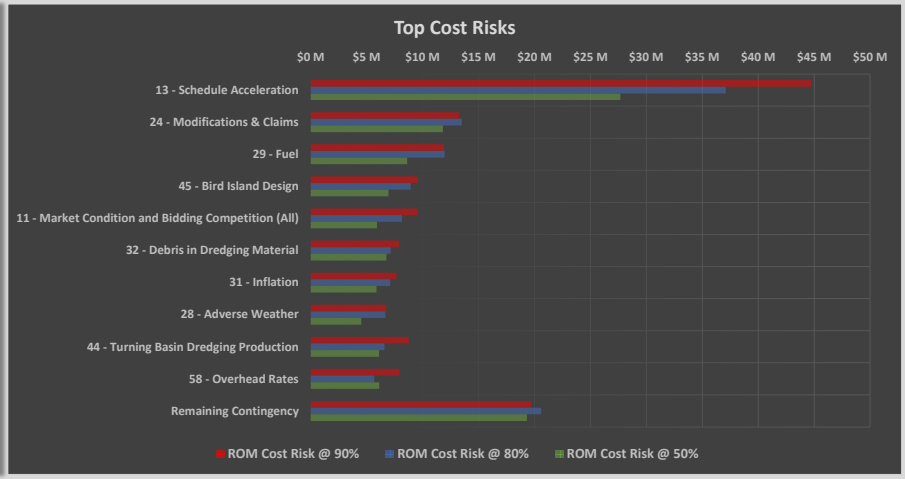
Risk Dashboards

Cost Risk Dashboard

Project: Matagorda Ship Channel
Location: Galveston, TX

Contingency on Base Estimate	80% Confidence Project Cost	
Base Estimate	$476,439,047	
Estimate Contingency	$133,402,933	28%
Base Estimate w/ Contingency (80% Confidence)	$609,841,980	





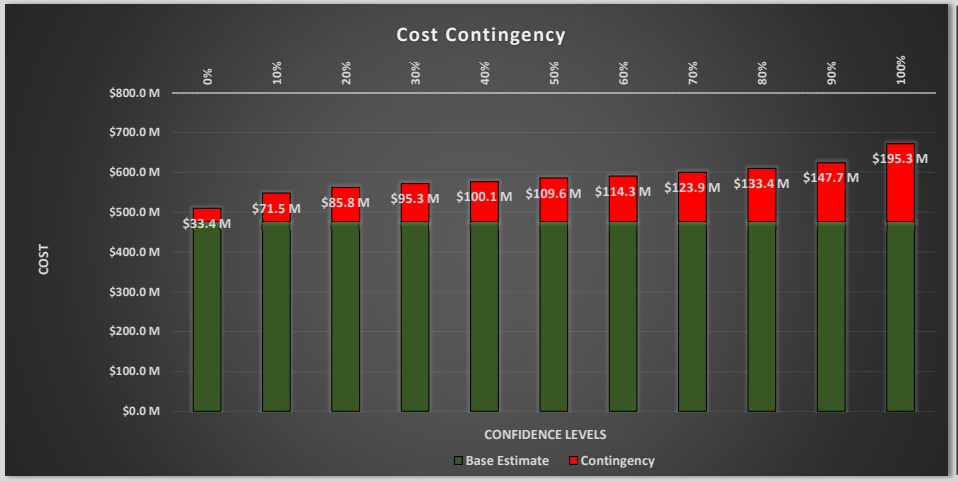
TOP COST RISKS

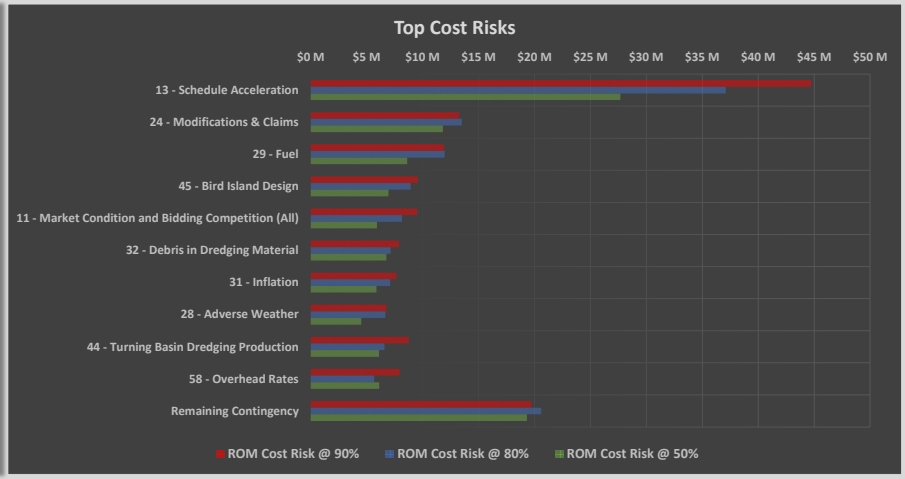
Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
13	Schedule Acceleration	Schedule Acceleration increases cost.	Schedule could be accelerated leading to additional PED costs and increase the risk of dredge availability. An accelerated schedule increases costs and causes scheduling conflicts. Schedule acceleration is for 3 years with construction complete by 2028. Sponsor relocation costs could be added to the construction costs and add additional contractor markups.	Project Management	High	High	
24	Modifications & Claims	Construction contract modifications can impact construction cost and schedule growth.	Technical complexities and site conditions could result in increased risk of contract modifications. Will impact costs, but little overall impact to larger project timeline.	Construction	High	Low	Testing and sampling during PED will minimize the possibility of claims during construction. Update survey, including debris survey and pipeline surveys, prior to construction.
29	Fuel	Fuel is a volatile cost and can greatly affect the cost of dredging projects.	Fuel could increase or decrease altering the cost. We assume an increase of $2.00 or a decrease of $1.00 based price fluctuation in the past years. Estimate assumes $3.58/gallon and is conservative.	Programs	High	Low	Accept the risk.
45	Bird Island Design	Bird Island Design may change	Design is conceptual and alignment, elevations, footprint, and functionality may change. Material quantities and location would not change but features and shape may change. Final design is dependent of input from Environmental. There is a possibility of settlement and stone quantities could change +/-50%. Beach sand quantities may change.	Technical Lead	Medium	Low	Design updates with environmental input. Establish Environmental criteria. Incorporate lessons learned from the Houston Ship Channel project.
11	Market Condition and Bidding Competition (All)	There is the possibility of having a limited number of contractors bid which would increase the cost.	Having limited competition would likely increase the cost. Corps studies have resulted in an expected dredge shortage as compared to the many anticipated projects in the Gulf region. Less competition is likely, resulting in higher bids. Timing of the contract within the fiscal year can lead to higher contract pricing. Must be able to dredge up to 60' and may have limited availability of large plants. Maximum digging depth for largest hopper dredges is up to 90' depth. Limited number of hopper dredges and there could be limited availability for the entrance channel dredging.	Contracting	High	Low	Solicit no later than the 3rd quarter of the fiscal year
32	Debris in Dredging Material	Debris could be encountered in new work dredging areas.	There is a possibility of encountering debris in the new work dredging areas.	Construction	Medium	Low	Conduct side scan or magnetometer survey prior to construction.
31	Inflation	Inflation could exceed CWCCIS	Project is for 2028-2031 and inflation could exceed CWCCIS tables. Since this is dredging the risks for fuel and labor have already been accounted. Inflation risk is for short term inflation of ~ 2 years.	Programs	Medium	Low	Accept the risk.
28	Adverse Weather	Location is subject to hurricanes.	There is a potential weather damages and delays, i.e. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. Severe weather could undo any prior construction at any point in the project and require major rework. In this event, dredge could be pulled to emergency work elsewhere.	Construction	High	High	Accept the risk.

Cost Risk Dashboard

Project: Matagorda Ship Channel
Location: Galveston, TX

Contingency on Base Estimate		80% Confidence Project Cost	
	Base Estimate	$476,439,047	
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	Base Estimate w/ Contingency (80% Confidence)	$609,841,980	





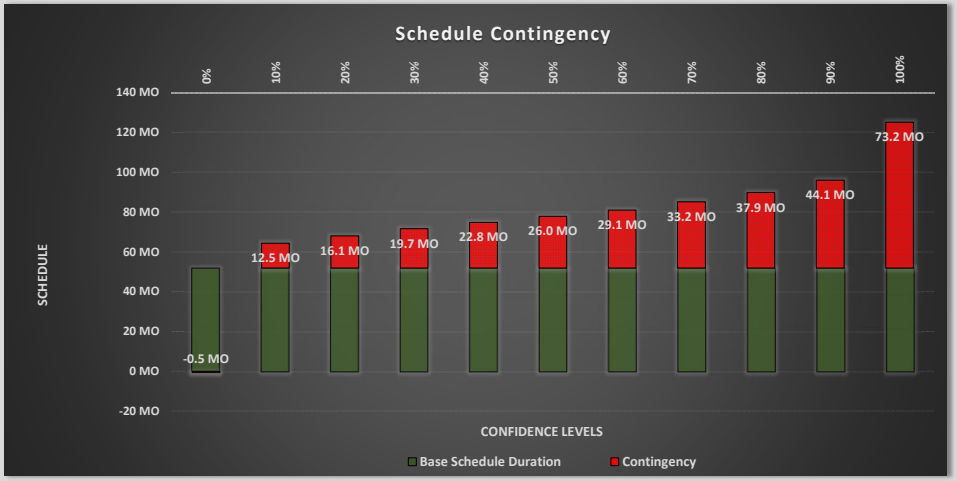
TOP COST RISKS

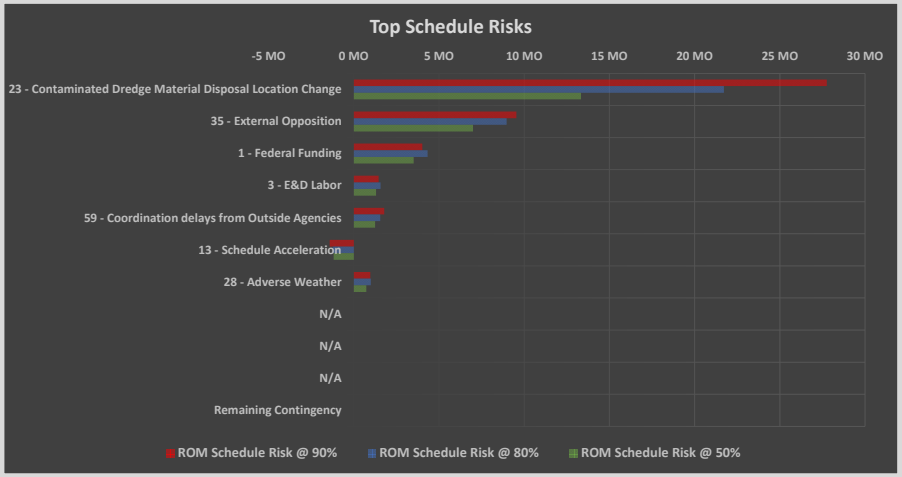
Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
44	Turning Basin Dredging Production	Productivity in the turning basin could be lower than estimated.	The estimate for the turning basin is assumed to be 55% EWT and the historical rate from RMS is 64% for channel construction. The turning basin geometry is not only more technical but it is also new work dredging that could encounter lower productivity rates. Turning basis in ~$50M worth of dredging.	Cost Engineering	Medium	Low	
58	Overhead Rates	Overhead rates could be higher than estimated	The estimate includes 25% overhead (JOOH plus HOOH). Actual contractor overheads could be higher.	Cost Engineering	Medium	Low	

Schedule Risk Dashboard

Project: Matagorda Ship Channel
Location: Galveston, TX

Contingency on Base Schedule		80% Confidence Project Schedule	
	Base Schedule Start Date	January 1, 2028	73%
	Base Schedule Finish Date	April 30, 2032	
	Base Schedule Duration	51.9 Months	
	Schedule Contingency Duration	37.9 Months	
	Base Schedule w/ Contingency (80% Confidence)	89.8 Months	
	Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	





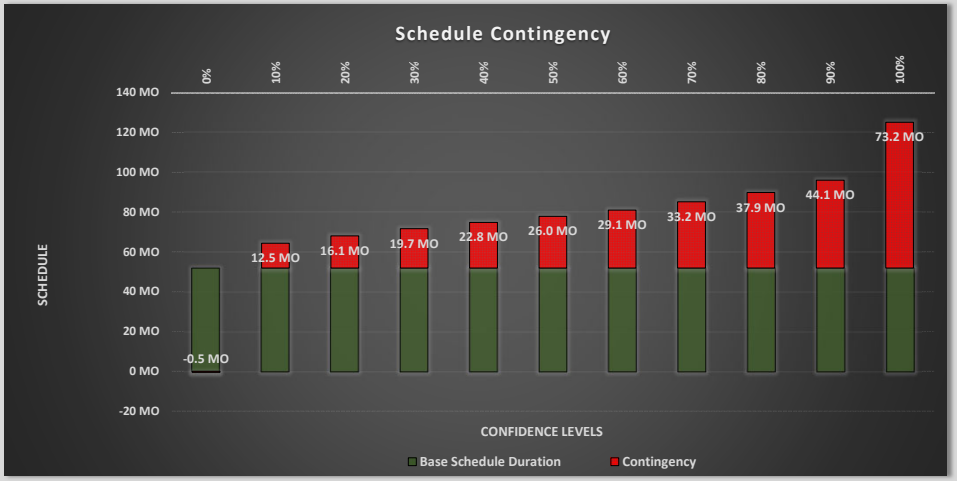
TOP SCHEDULE RISKS

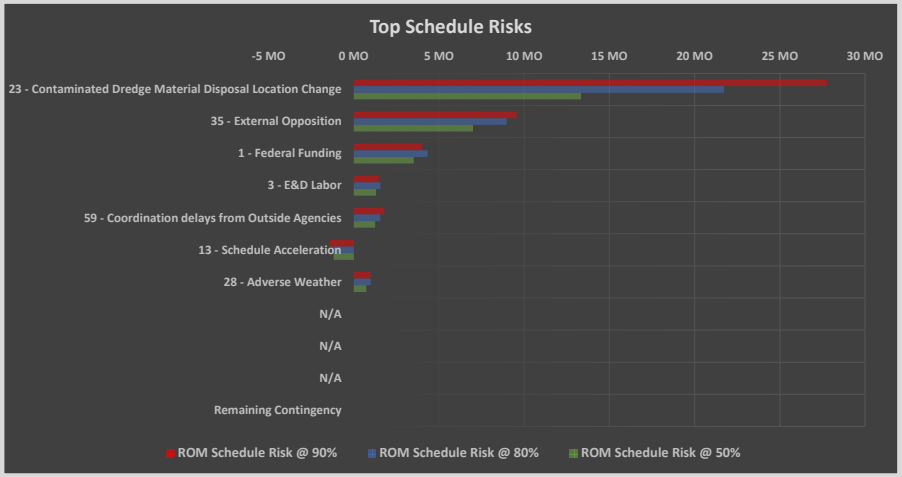
Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
23	Contaminated Dredge Material Disposal Location Change	Contamination could lead to changing the disposal location.	The only contamination that is anticipated is in the area of the Alcoa docks and is not part of the shipping channel project. Sediment testing has been done, and no contamination was present in the dredging area. Current sediment sampling indicates this is a very low risk but if it occurred prior to contracting it would be addressed by the responsible party prior to construction. The PDT feels this an unlikely risk for the project. This is a known risk that is being addressed by SWG leadership. The impact could be material placement in a controlled manner, e.g., upland confined placement area (vs. open water and outside the Superfund footprint). This is an (risk) increase in construction costs of increased pipeline distance and land acquisition costs. If HTRW is encountered, the NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132.	Environmental Compliance	Low	Medium	Conduct further sampling to verify no contamination is present within the shipping channel.
35	External Opposition	External Opposition to the project could lead to delays	Environmental groups are opposed to the project. Litigation has occurred and the PDT expects further litigation delays for this project. The worst case is the schedule is put on hold awaiting resolution. 12 months	Programs	Low	High	PDT taking steps to prepare for future litigation to reduce project delays.
1	Federal Funding	Annual appropriations for Design and Construction could be delayed.	Due to the priority of the project it is likely that the project may not receive adequate funding annually. Project is a high priority for the district and lack of PED and Construction funding is unlikely. Any delay to funding would delay the project until the following year. Any federal funding delays could delay the project execution.	Project Management	Low	Medium	Include design and construction appropriation requests. Highlight with non federal sponsor for coordination with congressional representatives.
3	E&D Labor	There may be a shortage of manpower for the design of this project.	DRP and recent budget cuts have had an impact on SWG design capacity. Heavy New Work and OM workload and schedule conflicts could create possible risk where we do not have enough people to meet the baseline schedule. PED costs should be able to cover in-house or A-E, but a 6-12MO schedule delay could be realized; it takes us about 6MO to do an AE contract.	Project Management	Low	Medium	SWG hiring through lateral hires.
59	Coordination delays from Outside Agencies	Multiple agency coordination could lead to consultation delays	Coordinating with is required with multiple resource agencies to finalize the environmental compliance process. There are concerns with agency workload and availability to complete the required consultations in the time allotted.	Programs	Low	Medium	Continued communication with the agencies. Engage USACE leadership when required.

Schedule Risk Dashboard

Project: Matagorda Ship Channel
Location: Galveston, TX

Contingency on Base Schedule		80% Confidence Project Schedule	
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	Base Schedule w/ Contingency (80% Confidence)	89.8 Months	
	Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	





TOP SCHEDULE RISKS

Risk/Opportunity Event		Risk Event Description	Team Discussions on Impact and Likelihood	Responsibility/ POC	Risk Level		Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
					Cost	Schedule	
13	Schedule Acceleration	Schedule Acceleration increases cost.	Schedule could be accelerated leading to additional PED costs and increase the risk of dredge availability. An accelerated schedule increases costs and causes scheduling conflicts. Schedule acceleration is for 3 years with construction complete by 2028. Sponsor relocation costs could be added to the construction costs and add additional contractor markups.	Project Management	High	High	
28	Adverse Weather	Location is subject to hurricanes.	There is a potential weather damages and delays, i.e. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. Severe weather could undo any prior construction at any point in the project and require major rework. In this event, dredge could be pulled to emergency work elsewhere.	Construction	High	High	Accept the risk.
N/A							
N/A							
N/A							

Appendix C-2

Contingency Summary

Project Contingency

Matagorda Ship Channel

05/15/2026 Update

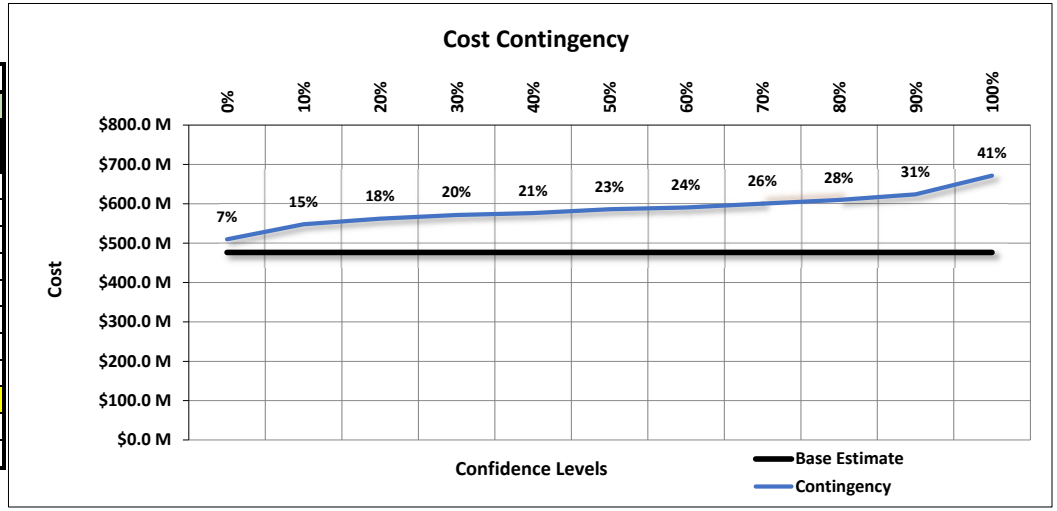
Contingency on Base Estimate	80% Confidence Project Cost	
Base Estimate	$476,439,047	
Estimate Contingency	$133,402,933	28%
Base Estimate w/ Contingency (80% Confidence)	$609,841,980	

Contingency on Base Schedule	80% Confidence Project Schedule	
Base Schedule Start Date	January 1, 2028	
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Schedule Contingency Duration	37.9 Months	73%
Base Schedule w/ Contingency (80% Confidence)	89.8 Months	
Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

- PROJECT COST CONTINGENCY DEVELOPMENT -

Cost Contingency Analysis

Base Estimate	$476,439,047		
Confidence Level	**Contingency Value**	**Contingency**	**Cost with Contingency**
0%	$33,350,733	7%	$509,789,780
10%	$71,465,857	15%	$547,904,903
20%	$85,759,028	18%	$562,198,075
30%	$95,287,809	20%	$571,726,856
40%	$100,052,200	21%	$576,491,246
50%	$109,580,981	23%	$586,020,027
60%	$114,345,371	24%	$590,784,418
70%	$123,874,152	26%	$600,313,199
80%	**$133,402,933**	**28%**	**$609,841,980**
90%	$147,696,104	31%	$624,135,151
100%	$195,340,009	41%	$671,779,056



Project Contingency

Matagorda Ship Channel

05/15/2026 Update

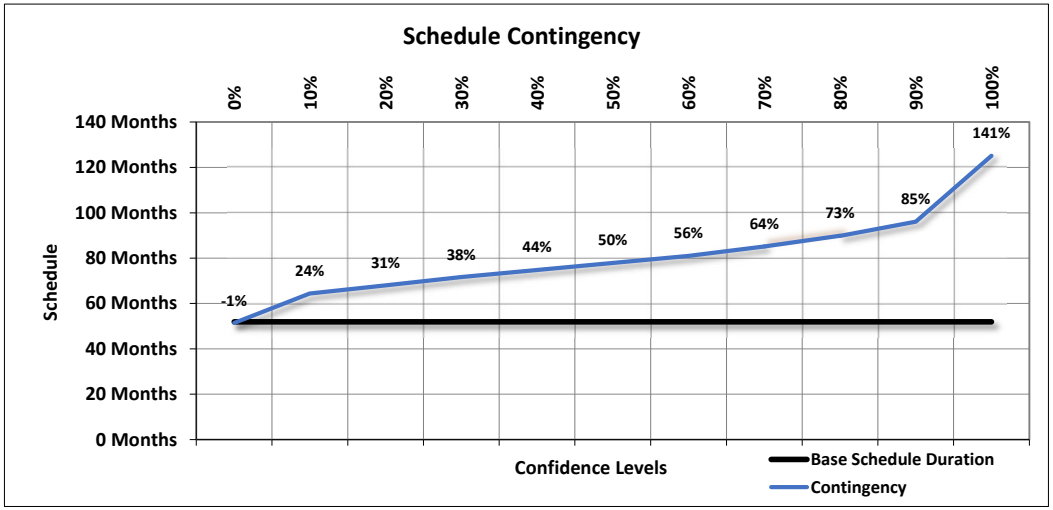
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Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

- PROJECT SCHEDULE CONTINGENCY (DURATION) DEVELOPMENT -

Schedule Contingency Analysis

Base Schedule Duration	51.9 Months		
Confidence Level	Contingency Value	Contingency	Duration with Contingency
0%	-0.5 Months	-1%	51.4 Months
10%	12.5 Months	24%	64.4 Months
20%	16.1 Months	31%	68.0 Months
30%	19.7 Months	38%	71.7 Months
40%	22.8 Months	44%	74.8 Months
50%	26.0 Months	50%	77.9 Months
60%	29.1 Months	56%	81.0 Months
70%	33.2 Months	64%	85.2 Months
80%	**37.9 Months**	**73%**	**89.8 Months**
90%	44.1 Months	85%	96.1 Months
100%	73.2 Months	141%	125.1 Months



Appendix C-3

Sensitivity Charts

Sensitivity Charts

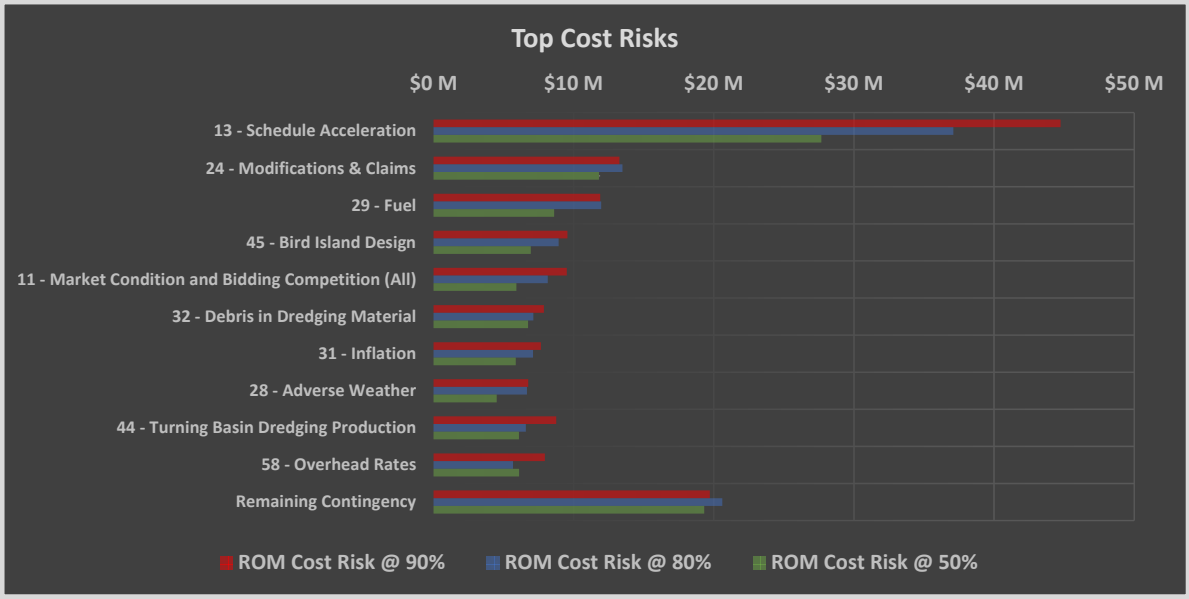
Matagorda Ship Channel

05/15/2026 Update

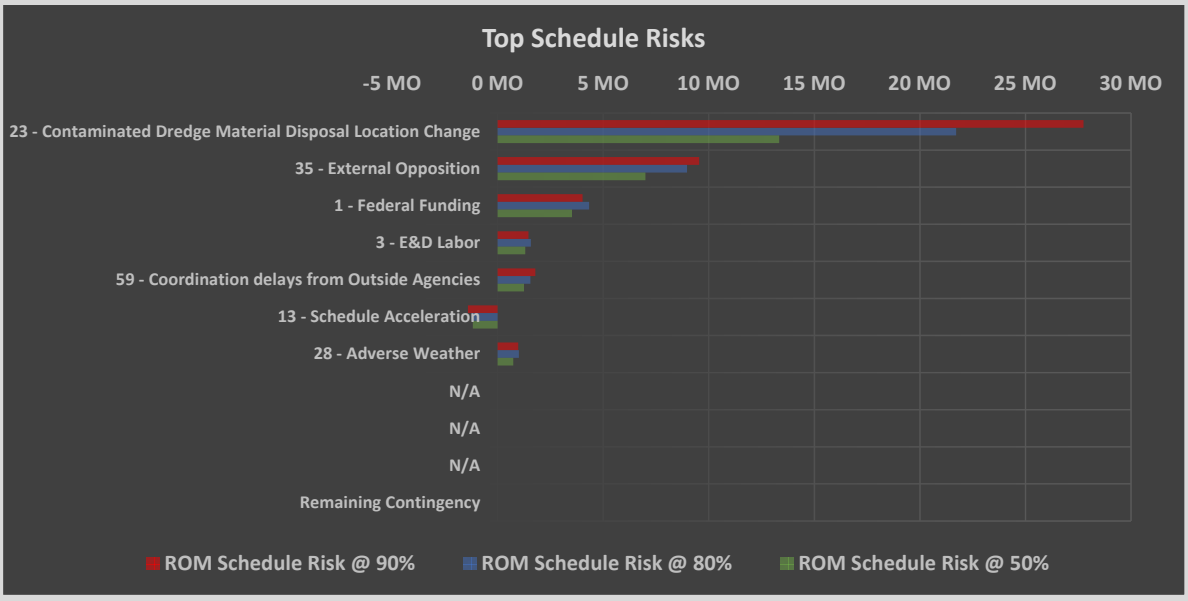
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Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

- Top Cost Risk Drivers by Confidence Levels -



- Top Schedule Risk Drivers by Confidence Levels -



Sensitivity Charts

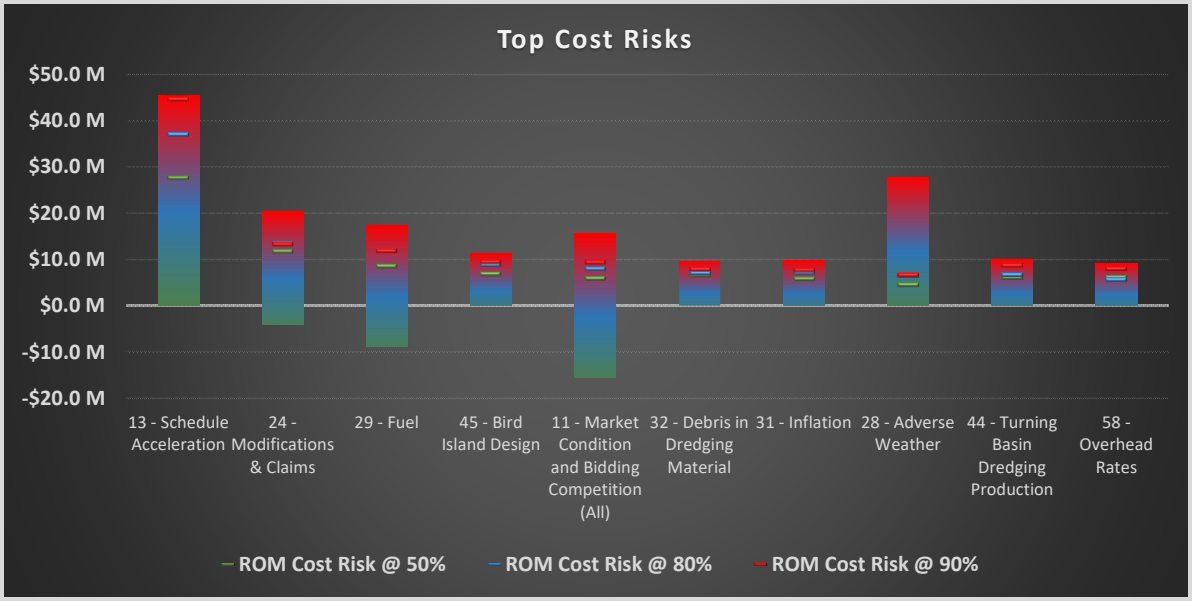
Matagorda Ship Channel

05/15/2026 Update

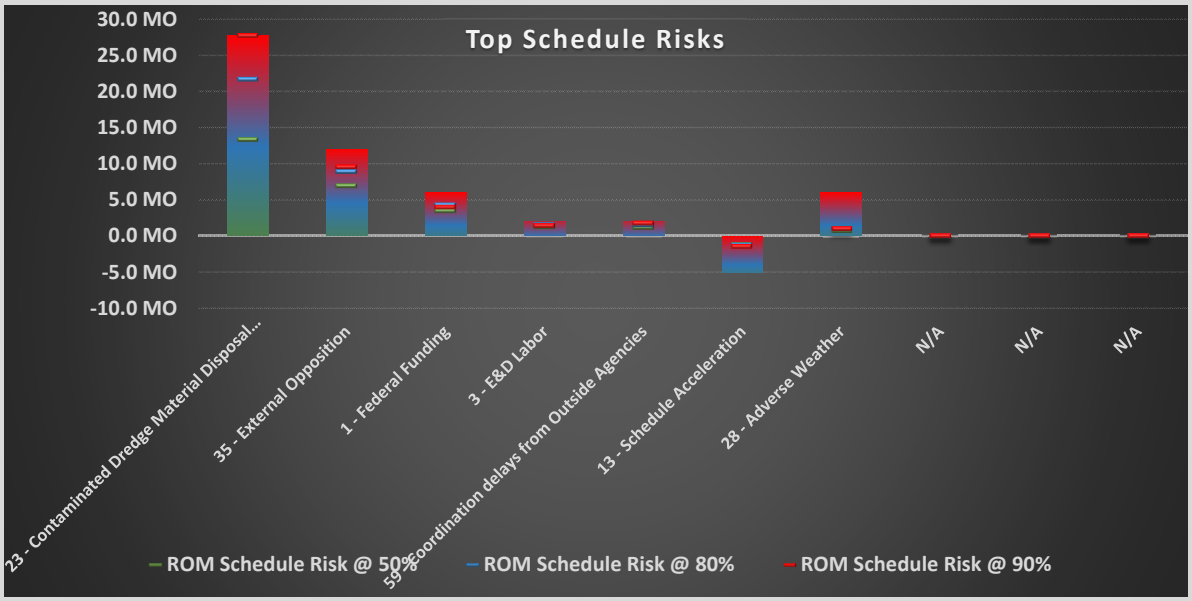
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Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

- Top Cost Risk Drivers & Ranges -



- Top Schedule Risk Drivers & Ranges -



Sensitivity Charts

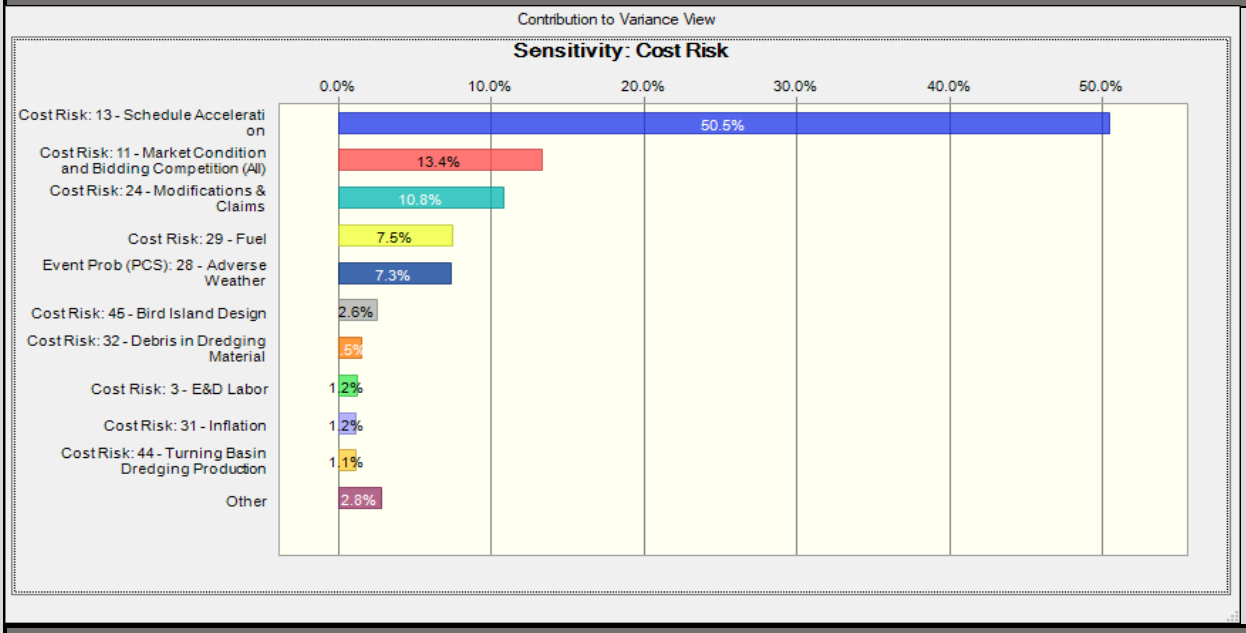
Matagorda Ship Channel

05/15/2026 Update

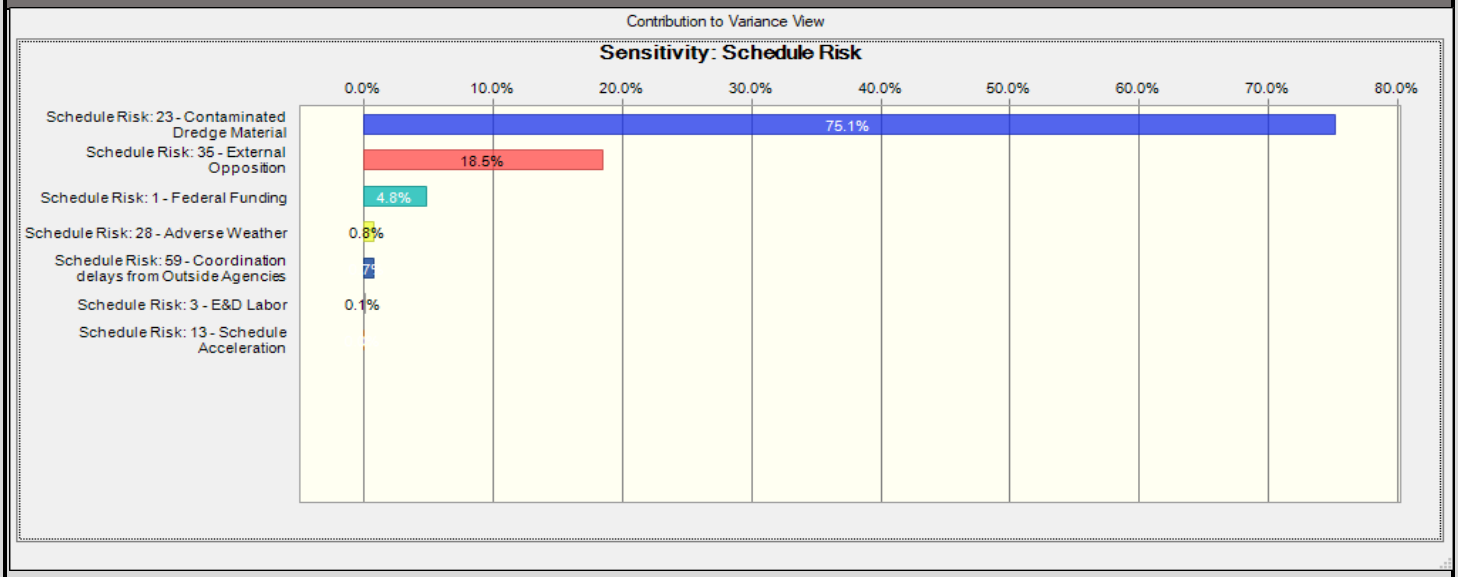
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Base Finish Date w/ Contingency (80% Confidence)	June 27, 2035	

- Cost Sensitivity Chart -



- Schedule Sensitivity Chart -



Appendix C-4

Risk Register

Matagorda Ship Channel - Current Working Estimate
06/15/2026 Update

					Project Cost		Project Schedule		Other Information					Cost Impacts			Schedule Impacts			Cost from Schedule Impacts			Event Risk Info		Cost Risk Modeling				Schedule Risk Modeling		Additional Documentation	
REF	Risk Type	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Likelihood	Impact (C)	Risk Level (C)	Impact (S)	Risk Level (S)	Cost Variance Distribution	Schedule Variance Distribution	Correlation to Other(s)	Responsibility/ POC	Affected Project Component	Low Variance (C)	Likely (C)	High Variance (C)	Low Variance (S)	Likely (S)	High Variance (S)	Low Variance (CS)	Likely (CS)	High Variance (CS)	TWO STEP (Cost & Schedule)	Event Prob (PCS)	Low Variance (TC)	Likely (TC)	High Variance (TC)	Cost Risk	Simulated Cost Cost Risk x PCS	Schedule Risk	Simulated Schedule Schedule Risk x PCS	Risk Quantification Discussions	Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
1	1 - Project & Program Management (PM)	Federal Funding	Annual appropriations for Design and Construction could be delayed.	Due to the priority of the project it is likely that the project may not receive adequate funding annually. Project is a high priority for the district and lack of PED and Construction funding is unlikely. Any delay to funding would delay the project until the following year. Any federal funding delays could delay the project execution.	Unlikely	Moderate	Low	Critical	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Contract Cost & Schedule				0.00 MO	0.00 MO	6.00 MO	$0	$0	$5,224,486	100%	1	$0	$0	$5,224,486	$0	$0	0.00 MO	0.00 MO	High assumes a 3 month delay to delays in receiving federal funding.	Include design and construction appropriation requests. Highlight with non federal sponsor for coordination with congressional representatives.
2	1 - Project & Program Management (PM)	Non Federal Funding	Non federal sponsor may not have the funds to cost share.	If the non federal sponsor cannot cost share the project a Project Partnership Agreement may not be signed and project could not start. PPA has not been signed but a Design Agreement has been implemented. No issues foreseen with signing a PPA.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Project Management											100%	1	$0	$0	$0		$0		0.00 MO		
3	1 - Project & Program Management (PM)	E&D Labor	There may be a shortage of manpower for the design of this project.	DRP and recent budget cuts have had an impact on SWG design capacity. Heavy New Work and OM workload and schedule conflicts could create possible risk where we do not have enough people to meet the baseline schedule. PED costs should be able to cover in-house or A-E, but a 6-12MO schedule delay could be realized; it takes us about 6MO to do an AE contract.	Possible	Negligible	Low	Moderate	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Contract Cost & Schedule				0.00 MO	0.00 MO	2.00 MO	$0	$0	$435,374	100%	1	$0	$0	$435,374	$0	$0	0.00 MO	0.00 MO	High assumes a 6 month schedule delay due to EDC staffing and 25% of the E&D costs.	SWG hiring through lateral hires.
4	1 - Project & Program Management (PM)	BCR	Low BCR could cancel project.	This is a go-no go risk. Currently the BCR ratio is low and could cancel project. Requested an exception for the low BCR and the risk is if the waiver will be approved. If the waiver is not signed the project would be cancelled and therefore this risk is not modeled.	Unrated	Negligible	Unrated	Negligible	Unrated	N/A -Not Modeled	N/A -Not Modeled		Project Management											100%	1	$0	$0	$0		$0		0.00 MO		
5	1 - Project & Program Management (PM)	Bird Island Scope	Scope changes could add cost and delay the project.	Possible scope growth due to incomplete or early-stage design. Environmental criteria could change and outside agencies could add features. This risks captured in the technical risks REF45 and also in the PM Beneficial Goals risk and therefore not modeled.	Unrated	Negligible	Unrated	Negligible	Unrated	N/A -Not Modeled	N/A -Not Modeled		Project Management											100%	1	$0	$0	$0		$0		0.00 MO		
6	7 - General Technical Risk (TR)	Change in New Work Dredging Quantities	The quantities of material to be dredged could vary from the quantities that have been assumed based on newer and a greater number of cross-section surveys and underwater changes over time.	Method of calculation of dredging quantities and surveying is well established from dredge history. Updating surveys could add dredging volume due to the coverage area. Quantities included over depth dredging. Estimate is well supported and the PDT does not expect significant additional quantities.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		
7	14 - Estimate and Schedule Risks (ES)	Sand Engine Disposal Site Changes	Placement point changes in the disposal area could add to the dredging costs.	The authorized footprint will not change but the placement within the footprint could add additional pumping distance.	Unlikely	Negligible	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Cost Engineering											100%	1	$0	$0	$0		$0		0.00 MO		
8	1 - Project & Program Management (PM)	Deficiency Project Impacts		The current plan is to complete this project and not have any impacts to the ship channel quantities.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Project Management											100%	1	$0	$0	$0		$0		0.00 MO		
9	7 - General Technical Risk (TR)	Pipeline Dredge Restriction in MSC	Restricted number of dredges could limit capabilities.	Restricted to 2 dredges and 2 nautical mile spacing. The PDT feel this will require coordination but will not be a cost or schedule risk to the project.	Unlikely	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		
10	5 - Contract Acquisition Risks (CA)	Special programs	No concerns	PDT discussed this topic. There is no reason for this project to fall under any special programs.	Unlikely	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Contracting											100%	1	$0	$0	$0		$0		0.00 MO		
11	5 - Contract Acquisition Risks (CA)	Market Condition and Bidding Competition (All)	There is the possibility of having a limited number of contractors bid which would increase the cost.	Having limited competition would likely increase the cost. Corps studies have resulted in an expected dredge shortage as compared to the many anticipated projects in the Gulf region. Less competition is likely, resulting in higher bids. Timing of the contract within the fiscal year can lead to higher contract pricing. Must be able to dredge up to 60' and may have limited availability of large plants. Maximum digging depth for largest hopper dredges is up to 90' depth. Limited number of hopper dredges and there could be limited availability for the entrance channel dredging.	Likely	Significant	High	Negligible	Low	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Contracting	Contract Cost	-$15,600,000	$0	$15,600,000							100%	1	-$15,600,000	$0	$15,600,000	$0	$0	0.00 MO	0.00 MO	High assumes 5% increase in cost due to the current market conditions. Low assumes 5% decrease in current costs due to the market conditions.	Solicit no later than the 3rd quarter of the fiscal year
12	5 - Contract Acquisition Risks (CA)	Small Business Goals	Small Business goals could add subcontracting costs.	5 contracts planned and most is planned for IFB dredging contracts. Small business could be added for mitigation (oyster beds).	Possible	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Contracting											100%	1	$0	$0	$0		$0		0.00 MO		
13	1 - Project & Program Management (PM)	Schedule Acceleration	Schedule Acceleration increases cost.	Schedule could be accelerated leading to additional PED costs and increase the risk of dredge availability. An accelerated schedule increases costs and causes scheduling conflicts. Schedule acceleration is for 3 years with construction complete by 2028. Sponsor relocation costs could be added to the construction costs and add additional contractor markups.	Likely	Critical	High	Critical	High	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Project Management	Contract Cost & Schedule	$0	$0	$45,400,000	-5.00 MO	0.00 MO	0.00 MO				100%	1	$0	$0	$45,400,000	$0	$0	0.00 MO	0.00 MO	High assumes no schedule savings but costs to all contracts increase by 10% along with 10% additional PED costs. Low Variance assumes 5 months schedule savings.	
14	9 - Lands and Damages Risk (RE)	DMMP Changes	DMMP changes could add real estate requirements	The non-Federal sponsor (NFS) is required to furnish all Lands, Easements, Rights-of-way, Relocations, and Disposal areas (LERRDs) for the proposed cost-shared project. Most land is owned by the non-federal sponsor. No upland land is required for the project. If DMMP were to change the placement sites it could be a future risk for LLERDS if upland placement sites are identified. All placement locations and rights are in place for placement of dredge material.	Possible	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Real Estate											100%	1	$0	$0	$0		$0		0.00 MO		
15	5 - Contract Acquisition Risks (CA)	Acquisition Strategy not defined	Acquisition Strategy has not been established and could increase cost and schedule	Estimate assumes an IFB contract. Changing the acquisition strategy to an RFP solicitation could add time to the acquisition schedule. An RFP solicitation could reduce the bid competition and lead to increased pricing. This contract is assumed to be a district priority and acquisition delays are expected to be low.	Possible	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Contracting											100%	1	$0	$0	$0		$0		0.00 MO		Coordinate with contracting group and develop contracting strategy.
16	33 - Regulatory And Environmental (ENV)	Historical/Cultural Significance	Historical/Cultural Significance	There's the possibility of some shipwrecks on the site but none of historical or cultural reference. Surveys would be conducted during PED and not impact the critical path schedule. Risk is a cultural significant artifact would either need to be removed or an alternative placement site utilized. If a site is encountered the assumption is the location could be avoided or else worked around, with minimal critical path schedule delays.	Possible	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Environmental Compliance											100%	1	$0	$0	$0		$0		0.00 MO		Perform survey to determine if any findings are significant.
17	33 - Regulatory And Environmental (ENV)	Endangered Species	Sea Turtle avoidance. Birds, Manatees	No beach disposal would be allowed during nesting time. (MAR 1 to SEP 15) . There is no beach disposal on this project. Sea turtle avoidance measures would include an avoidance plan for hopper dredge impacts to sea turtles. Chester Island has a restricted timeframe of Mar-September. The PDT feels coordination can be done with other agencies and either allow work outside the window or schedule work in the 2 month work window. Manatees are possible but not normally this far South. The risk is very low.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Environmental Compliance											100%	1	$0	$0	$0		$0		0.00 MO		
18	33 - Regulatory And Environmental (ENV)	Unexploded Ordinance	Bombing Range	Site used to be a bombing range in the late 40's. No ordinance has been encountered since the construction of the original Ship Channel in the 60's. Any UXO's would be on barrier island and not an issue for this project.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Environmental Compliance											100%	1	$0	$0	$0		$0		0.00 MO		
19	13 - Construction (CO)	HTRW Cleanup Impact Costs	HTRW Cleanup Could Add Contractor Impact Costs	Sediment sampling is conducted in advance of contracting to preclude construction within areas impacted by HTRW. If inadvertent discovery of HTRW arises during construction (i.e., encountering an unidentified pipeline, unexploded ordnance, etc.), it could lead to standby costs and/or an additional mob/demob cost during cleanup. The NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132 but this still could lead to additional contract impact costs.	Unlikely	Negligible	Low	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Construction		$0	$500,000	$2,100,000							25%	3	$0	$500,000	$2,100,000	$0	$0		0.00 MO	High assumes $0.5M Contractor Standby Costs + $1.6M Mob/Demob costs.	
22	33 - Regulatory And Environmental (ENV)	Air Quality	Construction could be delayed to minimize air quality impacts.	In attainment zone and do not foresee having any issue with EPA.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Environmental Compliance											100%	1	$0	$0	$0		$0		0.00 MO		
23	33 - Regulatory And Environmental (ENV)	Contaminated Dredge Material Disposal Location Change	Contamination could lead to changing the disposal location.	The only contamination that is anticipated is in the area of the Alcoa docks and is not part of the shipping channel project. Sediment testing has been done, and no contamination was present in the dredging area. Current sediment sampling indicates this is a very low risk but if it occurred prior to contracting it would be addressed by the responsible party prior to construction. The PDT feels this an unlikely risk for the project. This is a known risk that is being addressed by SWG leadership. The impact could be material placement in a controlled manner, e.g., upland confined placement area (vs. open water and outside the Superfund footprint). This is an (risk) increase in construction costs of increased pipeline distance and land acquisition costs. If HTRW is encountered, the NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132.	Unlikely	Moderate	Low	Critical	Medium	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Environmental Compliance	Contract Cost & Schedule				0.00 MO	0.00 MO	24.00 MO	$0	$0	$5,224,486	100%	1	$0	$0	$5,224,486	$0	$0	0.00 MO	0.00 MO	High assumes 24 month schedule delay along with additional PED costs (25% of fully rate).	Conduct further sampling to verify no contamination is present within the shipping channel.
24	13 - Construction (CO)	Modifications & Claims	Construction contract modifications can impact construction cost and schedule growth.	Technical complexities and site conditions could result in increased risk of contract modifications. Will impact costs, but little overall impact to larger project timeline.	Very Likely	Significant	High	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Construction	Contract Cost	-$4,100,000	$0	$20,400,000							100%	1	-$4,100,000	$0	$20,400,000	$0	$0		0.00 MO	Contract modifications and claims can be expected at 1% of the contract value and could go as high as 5%.	Testing and sampling during PED will minimize the possibility of claims during construction. Update survey, including debris survey and pipeline surveys, prior to construction. Provide quality contract documents to minimize claims.
26	13 - Construction (CO)	Navigation Traffic Conflicts	Traffic within the shipping channel could delay or halt construction.	Disposal pipe would have to be broken during the day to allow for ship passage. EWT accounted for in CEDEP estimate and is based on historical productivity. Additional cost and schedule risks are minimal.	Possible	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Construction											100%	1	$0	$0	$0		$0		0.00 MO		
28	4 - External Risks (EX)	Adverse Weather	Location is subject to hurricanes.	There is a potential weather damages and delays, i.e. tropical depressions or hurricane, should project construction occur during hurricane season, which is anticipated. Severe weather could undo any prior construction at any point in the project and require major rework. In this event, dredge could be pulled to emergency work elsewhere.	Possible	Critical	High	Critical	High	Single Event (2 Step)	Single Event (2 Step)	Contract Cost & Schedule	Construction	Contract Cost & Schedule	$0	$0	$20,000,000	0.00 MO	0.00 MO	6.00 MO	$0	$0	$7,822,385	25%	3	$0	$0	$27,822,385	$0	$0	0.00 MO	0.00 MO	High assumes 10% probability of occurrence. Cost is related to debris cleanup, additional mob/demob, rework, and schedule delays. A hurricane impact assumes $20M in mod/claims along, a 6 month schedule delays and associated PED and S&A costs.	Accept the risk.
29	4 - External Risks (EX)	Fuel	Fuel is a volatile cost and can greatly affect the cost of dredging projects.	Fuel could increase or decrease altering the cost. We assume an increase of $2.00 or a decrease of $1.00 based price fluctuation in the past years. Estimate assumes $3.58/gallon and is conservative.	Likely	Significant	High	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled	Contract Cost	Programs		-$8,700,000	$0	$17,300,000							100%	1	-$8,700,000	$0	$17,300,000	$0	$0		0.00 MO	High assumes $2/gallon price increase. Input into CEDEP it increased the dredging cost/cy to a high of $0.44/CY. Low assumes fuel goes down $1/gallon. Input into CEDEP decreasing dredging cost/cy $0.22/CY.	Accept the risk.
31	4 - External Risks (EX)	Inflation	Inflation could exceed CWCCIS	Project is for 2028-2031 and inflation could exceed CWCCIS tables. Since this is dredging the risks for fuel and labor have already been accounted. Inflation risk is for short term inflation of ~ 2 years.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled	Contract Cost	Programs		$0	$0	$9,800,000							100%	1	$0	$0	$9,800,000	$0	$0		0.00 MO	Assumes inflation risk for this first 4 years of construction (2 years to the midpoint) between 2.5% and 3.5%.	Accept the risk.
32	13 - Construction (CO)	Debris in Dredging Material	Debris could be encountered in new work dredging areas.	There is a possibility of encountering debris in the new work dredging areas.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled	Contract Cost	Construction		$0	$0	$9,700,000							100%	1	$0	$0	$9,700,000	$0	$0		0.00 MO	High assumes debris adds $1/cy for new work dredging quantities.	Conduct side scan or magnetometer survey prior to construction.
33	14 - Estimate and Schedule Risks (ES)	Productivity	Productivity could be lower than estimated	The types and classifications of materials for the purposes of estimating could present a risk to the project costs and schedule. Since future dredging in new work areas, there is some uncertainty about the types of material that will be encountered. Material types affect dredging efficiency which drives the costs. Geotechnical data of the dredged material may result in encountering unanticipated materials that could be more difficult to dredge that would impact productivity.	Unlikely	Marginal	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Cost Engineering											100%	1	$0	$0	$0		$0		0.00 MO		
34	1 - Project & Program Management (PM)	Beneficial Use Goals	Beneficial Use Goals could add expenses if implemented.	The district goals for BU is 70%. Currently the beneficial use for the construction project is 28%. If beneficial use goals are added to the initial scope it could raise the BU placement to 40%. *Assume ~ $5M in cost risk.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)	Contract Cost	Project Management		$0	$0	$5,000,000							100%	1	$0	$0	$5,000,000	$0	$0	0.00 MO	0.00 MO	High assumes beneficial use goals increase and add $5M to the disposal cost.	Mitigation pricing based on historic pricing from environmental group. Scope could and pricing could change for MSC and needs to be further developed and substantiated in MII.

Matagorda Ship Channel - Current Working Estimate
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REF	Risk Type	Risk/Opportunity Event	Risk Event Description	Team Discussions on Impact and Likelihood	Likelihood	Project Cost: Impact (C)	Project Cost: Risk Level (C)	Project Schedule: Impact (S)	Project Schedule: Risk Level (S)	Other Information: Cost Variance Distribution	Other Information: Schedule Variance Distribution	Other Information: Correlation to Other(s)	Other Information: Responsibility/ POC	Other Information: Affected Project Component	Cost Impacts: Low Variance (C)	Cost Impacts: Likely (C)	Cost Impacts: High Variance (C)	Schedule Impacts: Low Variance (S)	Schedule Impacts: Likely (S)	Schedule Impacts: High Variance (S)	Cost from Schedule Impacts: Low Variance (CS)	Cost from Schedule Impacts: Likely (CS)	Cost from Schedule Impacts: High Variance (CS)	Event Risk Info: TWO STEP (Cost & Schedule)	Event Risk Info: Event Prob (PCS)	Cost Risk Modeling: Low Variance (TC)	Cost Risk Modeling: Likely (TC)	Cost Risk Modeling: High Variance (TC)	Cost Risk Modeling: Cost Risk	Cost Risk Modeling: Simulated Cost Risk x PCS	Schedule Risk Modeling: Schedule Risk	Schedule Risk Modeling: Simulated Schedule Risk x PCS	Additional Documentation: Risk Quantification Discussions	Additional Documentation: Suggested Risk Reduction Measures (Avoid, Escalate, Exploit, Transfer/Share, Mitigate/Enhance, or Accept)
35	4 - External Risks (EX)	External Opposition	External Opposition to the project could lead to delays	Environmental groups are opposed to the project. Litigation has occurred and the PDT expects further litigation delays for this project. The worst case is the schedule is put on hold awaiting resolution. 12 months	Very Likely	Negligible	Low	Critical	High	Triangular (LV, ML, 80%)	Triangular (LV, ML, 80%)		Programs	Contract Cost & Schedule				0.00 MO	0.00 MO	12.00 MO	$0	$0	$2,612,243	100%	1	$0	$0	$2,612,243	$0	$0	0.00 MO	0.00 MO	Low assumes no price reduction from the base cost estimate for 16 pipeline relocations. High assumes relocation costs could exceed the estimate cost by 25%.	PDT taking steps to prepare for future litigation to reduce project delays.
36	4 - External Risks (EX)	Political Influences	Accelerated schedule due to political influences.	This project is highly visible and there is a potential risk for an accelerated schedule. This risk is accounted for in REF13 and therefore not modeled.	Unrated	Marginal	Unrated	Negligible	Unrated	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		
37	14 - Estimate and Schedule Risks (ES)	Equip/Labor rates	The equipment and labor are outdated.	Labor/equipment pricing is based on the 2024 equipment pamphlet and 2024 Seattle labor rates. The contractor rates could be higher than the estimated rates. Busy economy may require paying extra for skilled labor. Estimated labor costs are conservative and typically higher than actual costs.	Unlikely	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Cost Engineering											100%	1	$0	$0	$0		$0		0.00 MO		
38	14 - Estimate and Schedule Risks (ES)	Schedule Detail	Construction Schedule could change.	Estimate assumes 5 separate contracts. Total dredging time, based on quantities, is 48 months and likely to change. Dredging the Mid Bay Channel is on the critical path and any delays could delay the project. Bird Island construction could be delayed but the schedule includes 7 months of float and delays to the project schedule are not anticipated.	Possible	Negligible	Low	Marginal	Low	N/A -Not Modeled	N/A -Not Modeled		Cost Engineering											100%	1	$0	$0	$0		$0		0.00 MO		
40	4 - External Risks (EX)	ODMDS Expansion Permit	ODMDS permit delays	EPA expanding program for ODMDS for Matagorda. The EPA process is expected to be completed prior to construction and will not impact the schedule.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		
41	7 - General Technical Risk (TR)	Dredging Material Characteristics	Actual Material could change.	All channel borings have been completed and not likely to change.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		
43	7 - General Technical Risk (TR)	Disposal Site Changes	Disposal Sites may not have capacity.	The deep water disposal sites have plenty of capacity and there is no risk of disposal site changes. Current inner bay disposal site capacity assumes a constant loss during placement operations. Some sites may retain material depending on soil, waves, bathymetry, etc. Moving the disposal site could lead to additional dredging costs. NPG is most at risk and the existing capacity may be misleading. Worst case is diverting to NP4 or Bird Island. (Assume 200K of dredging material).	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		
44	14 - Estimate and Schedule Risks (ES)	Turning Basin Dredging Production	Productivity in the turning basin could be lower than estimated.	The estimate for the turning basin is assumed to be 55% EWT and the historical rate from RMS is 64% for channel construction. The turning basin geometry is not only more technical but it is also new work dredging that could encounter lower productivity rates. Turning basin is ~550M worth of dredging.	Possible	Moderate	Medium	Marginal	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Cost Engineering	Contract Cost	$0	$0	$10,000,000							100%	1	$0	$0	$10,000,000	$0	$0		0.00 MO	High assumes turning basin production is lower than expected and costs increase by 20%.	
45	7 - General Technical Risk (TR)	Bird Island Design	Bird Island Design may change	Design is conceptual and alignment, elevations, footprint, and functionality may change. Material quantities and location would not change but features and shape may change. Final design is dependent of input from Environmental. There is a possibility of settlement and stone quantities could change +/-50%. Beach sand quantities may change.	Likely	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Technical Lead	Contract Cost	$0	$0	$11,300,000							100%	1	$0	$0	$11,300,000	$0	$0		0.00 MO	High assumes Bird Island costs increase 50%.	Design updates with environmental input. Establish Environmental criteria. Incorporate lessons learned from the Houston Ship Channel project.
47	14 - Estimate and Schedule Risks (ES)	Relocations Estimate	The relocations estimate may change	Scope of work provided by the sponsor and many assumptions are made for the cost estimate. Cost updates have been included for the 30" natural gas pipeline. Generally the cost estimates are budget estimates that lack a basis and are likely to change.	Likely	Marginal	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Cost Engineering	Contract Cost	$0	$0	$3,100,000							100%	1	$0	$0	$3,100,000	$0	$0		0.00 MO	High assumes relocation costs double from the estimated amount.	
48	9 - Lands and Damages Risk (RE)	Relocation delays	If relocations do not occur it may delay the channel dredging projects.	Real estate needs relocations or would need a waiver in order to solicit a channel dredging contract. Real estate waivers are unlikely.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Real Estate											100%	1	$0	$0	$0		$0		0.00 MO		
49	7 - General Technical Risk (TR)	# of pipeline relocations	2 pipelines may need to be relocated.	Currently there is a memo to remain in place. There is a possibility these pipelines are not as deep as anticipated and will need to be relocated.	Possible	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		
50	7 - General Technical Risk (TR)	Oyster Mitigation Scope	If oyster growth is not successful it may require additional mitigation measures.	Dredging impacts to existing oyster beds are well known. Resource agencies may question our mitigation calculations but more mitigation is anticipated. Mitigation success monitoring is required at 5 years. If success is not achieved it may require additional oyster mitigation plus monitoring.	Possible	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Technical Lead											100%	1	$0	$0	$0		$0		0.00 MO		Survey twice a year to monitor success rate. Adaptive measures could be incorporated early to minimize the impacts. Incorporate lessons learned from Houston Ship Channel Oyster Mitigation projects.
51	4 - External Risks (EX)	Pipeline Relocations Schedule	30" Natural Gas Relocation	Texas Easter Transmission is owner of pipeline. Directional drilling anticipated in same area as current location. Approximately 1 year to complete. Design underway and on schedule to complete.	Unlikely	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		Follow up on required permits.
52	4 - External Risks (EX)	Pipeline Removals	If pipelines are not removed it could lead to schedule delays or add costs to remove.	7 pipeline removals by the port. Will require permits but do not anticipate any cost or schedule impacts. USACE to include 2 pipelines with unknown owners. These will be included in the construction contract documents.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		
53	4 - External Risks (EX)	Dock Reinforcements	Dock reinforcement will be required after dredging and the cost could increase.	The cost numbers have recently been updated but are preliminary and could increase. PDT determined our deepening does not impact dock structural integrity, dock deepening to realize benefits are associated costs. Memo provided by NFS.	Possible	Marginal	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		Update the base estimate to include the dock reinforcement costs.
54	21 - Environmental & Cultural/Historical Resources (EC)	HTRW Permits (Sponsor)	Nationwide 38 permit delays (Sponsor)	The Nationwide 38 permit is not required for the turning basin dredging area but is very close to the project site. This will not impact the project but is a public perception item to be aware.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Environmental Compliance											100%	1	$0	$0	$0		$0		0.00 MO		
55	4 - External Risks (EX)	Aids to Navigation (ATONS)	ATONS if not moved could delay the project.	If ATONS are not funded and moved it could delay the project. SWG is coordinating with the Coast Guard for multiple projects and do not anticipate any schedule impacts.	Unlikely	Negligible	Low	Negligible	Low	N/A -Not Modeled	N/A -Not Modeled		Programs											100%	1	$0	$0	$0		$0		0.00 MO		
56	14 - Estimate and Schedule Risks (ES)	Stone/Sand Material Pricing	Pricing for the Bird Island Sand/Stone and Cultch could increase	Initial budget pricing utilized but the pricing of the actual specified materials at the time of construction could increase. Stone sizing and specification could change slightly. Pricing is included for bedding stone and if Culch is required may be more expensive.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Cost Engineering	Contract Cost	$0	$0	$8,000,000							100%	1	$0	$0	$8,000,000	$0	$0		0.00 MO	High assumes 50% cost increase for the Bird Island Materials.	Update price quote based on the latest specifications.
58	14 - Estimate and Schedule Risks (ES)	Overhead Rates	Overhead rates could be higher than estimated	The estimate includes 25% overhead (JOOH plus HOOH). Actual contractor overheads could be higher.	Possible	Moderate	Medium	Negligible	Low	Triangular (LV, ML, 80%)	N/A -Not Modeled		Cost Engineering	Contract Cost	$0	$0	$9,200,000							100%	1	$0	$0	$9,200,000	$0	$0		0.00 MO	High assumes JOOH is higher than estimated and adds 3% of the direct costs.	
59	4 - External Risks (EX)	Coordination delays from Outside Agencies	Multiple agency coordination could lead to consultation delays	Coordinating with is required with multiple resource agencies to finalize the environmental compliance process. There are concerns with agency workload and availability to complete the required consultations in the time allotted.	Possible	Negligible	Low	Moderate	Medium	N/A -Not Modeled	Triangular (LV, ML, 80%)		Programs	Contract Schedule				0.00 MO	0.00 MO	2.00 MO				100%	1	$0	$0	$0	$0	$0	0.00 MO	0.00 MO	High assumes consultation delays project 2 months.	Continued communication with the agencies. Engage USACE leadership when required.

Appendix C-5

CSRA Assumptions

CSRA Assumptions

Risk Matrix

Likelihood of Occurrence	Impact or Consequence of Occurrence				
	Negligible	Marginal	Moderate	Significant	Critical
Certain	RELOOK AT BASIS OF ESTIMATE				
Very Likely	Low	Medium	High	High	High
Likely	Low	Medium	Medium	High	High
Possible	Low	Low	Medium	Medium	High
Unlikely	Low	Low	Low	Medium	Medium

Likelihood of Occurrence

Likelihood	Low % Occurrence	High % Occurrence
Certain	90%	100%
Very Likely	70%	90%
Likely	30%	70%
Possible	5%	30%
Unlikely	0%	5%
Unrated	*Needs Rated*	

Any changes to these assumptions will change the assumptions in the models.

Percent's above are based on 10 events, and are considered approximate, judgment should be used for final grouping dependent on # of occurrences, project size, flexibility and complexity.

If event occurrence is...	then it's likelihood is thought to be between...
Certain	90% and 100%
Very Likely	70% and 90%
Likely	30% and 70%
Possible	5% and 30%
Unlikely	0% and 5%

Definition
Certain: implies the event has a 90% to 100% chance of occurrence. Relook at basis of estimate.
Very Likely: implies the event has a 70% to 90% chance of occurrence.
Likely: implies the event has a 30% to 70% chance of occurrence.
Possible: implies the event has a 5% to 30% chance of occurrence.
Unlikely: implies the event has a 0% to 5% chance of occurrence.

Impact or Consequence of Occurrence

This sheet defines what the impacts are based on their cost. This is crucial to define what truly negligible, marginal, moderate, etc. are. Fill this out before the meeting so that you can show what the ranges to be concerned are.

Likelihood	% of Project Cost or Schedule Change per Cost Event Exceeds	per Schedule Event Exceeds
Negligible	0.00%	0.00%
Marginal	0.50%	1.00%
Moderate	1.00%	2.00%
Significant	2.50%	5.00%
Critical	5.00%	10.00%

Any changes to these assumptions will change the assumptions in the models.

Percent's above are based on 10 events, and are considered approximate, judgment should be used for final grouping dependent on # of occurrences, project size, flexibility and complexity.

Cost Impact

If event occurrence is...	then it's impact to total project cost is thought to be between...
Negligible	0.00% and 0.50%
Marginal	0.50% and 1.00%
Moderate	1.00% and 2.50%
Significant	2.50% and 5.00%
Critical	Over 5.00%

Definition
Negligible: implies the event has a 0.00% to 0.50% impact to project cost.
Marginal: implies the event has a 0.50% to 1.00% impact to project cost.
Moderate: implies the event has a 1.00% to 2.50% impact to project cost.
Significant: implies the event has a 2.50% to 5.00% impact to project cost.
Critical: implies the event has a greater than 5.00% impact to project cost.

Schedule Impact

If event occurrence is...	then it's impact to total project schedule is thought to be between...
Negligible	0.00% and 1.00%
Marginal	1.00% and 2.00%
Moderate	2.00% and 5.00%
Significant	5.00% and 10.00%
Critical	Over 10.00%

Definition
Negligible: implies the event has a 0.00% to 1.00% impact to project schedule.
Marginal: implies the event has a 1.00% to 2.00% impact to project schedule.
Moderate: implies the event has a 2.00% to 5.00% impact to project schedule.
Significant: implies the event has a 5.00% to 10.00% impact to project schedule.
Critical: implies the event has a greater than 10.00% impact to project schedule.

Cost / Schedule Impact Percentages Converted to Cost / Schedule Ranges

	Cost Impacts		Schedule Impacts	
Impact	Low Impact	High Impact	Low Impact	High Impact
Negligible	0.00%	0.50%	0.00%	1.00%
Marginal	0.50%	1.00%	1.00%	2.00%
Moderate	1.00%	2.50%	2.00%	5.00%
Significant	2.50%	5.00%	5.00%	10.00%
Critical	5.00%	100.00%	10.00%	100.00%

	Cost Impacts		Schedule Impacts	
Impact	Low Range	High Range	Low Range	High Range
Negligible	$0	$2,600,000	0.00 MO	0.75 MO
Marginal	$2,600,000	$5,100,000	0.75 MO	1.25 MO
Moderate	$5,100,000	$12,700,000	1.25 MO	2.75 MO
Significant	$12,700,000	$25,400,000	2.75 MO	5.25 MO
Critical	$25,400,000	∞	5.25 MO	∞

Appendix C-6

Risk Register Attendance

CSRA Risk Register Meeting Attendance

Risk Facilitator: **Phillip C. Ohnstad**

Risk Register Meeting

Date: December 4, 2018

Attendance	Name	Office	Role / Discipline
In-Person	Dale Williams	CESWG-EC-PS	Cost Engineering
In-Person	Brandon Crawford	CESWG-EC-PS	Geotechnical
In-Person	Brenda Hayden	CESWG-EC-EG	Civil
In-Person	Harmon Brown III	CESWF-PEC	Biologist
In-Person	Thomas White	CESWG-EC-HB	Civil
In-Person	Franchelle Craft	CESWG-AO-NH	Civil
In-Person	Kathryn Skalbeck	CESWF-PER-PF	Planning
In-Person	Aron Edwards	CESWG-OD-N	Operations
In-Person	Nicole Schlund	CESWG-RES	Real Estate
In-Person	Jennifer Purcell	CESWF-PEC-PE	Economist
In-Person			

Risk Register Update Meeting

Date: November 12, 2025 **through** November 13, 2025

Attendance	Name	Office	Role / Discipline
In-Person	Heather Briscoe	CESWG-PMJ	Project Manager
In-Person	Sergey Kuznetsov	CESWG-ECE-P	Cost Engineer
In-Person	Jacob Garrett	CESWG-ECH	Civil Engineer
In-Person	Ratnam Tharmendira	CESWG-ECE-S	Civil Engineer
In-Person	Jon Plymale	CESWG-ECG	Value Officer
In-Person	Hannah Hadley	CESWF	Environmental
In-Person	Britney Nealon	CESWG-RES	Real Estate
In-Person	Caitlin Bryant	CESAM-PD-D	Economist
In-Person	Walker Messer	CESAM-PD-D	Economist
In-Person	Kathy Skalbeck	CESWF	Lead Planner
In-Person	John Campbell	CESWF-PEC-TN	Archeologist
In-Person	Konstantinos Kostarelos	CESWF-PEE-T	Environmental
In-Person	Justin Tirpak	CESWF-PEE-C	Biologist
In-Person	Pablo Hernandez	CESWG-ECC-S	Construction
In-Person	Andrew Smith	CESWG-ECC-S	Area Engineer
In-Person	Jeremy Babb	CESWG-CT	Contracting
In-Person	Quinton Johnson	CESWG	Civil Engineer
Virtual	Charles Hausmann	Calhoun Port	Sponsor

Appendix C-7

Risk Details

Risk No. 11 - Market Condition and Bidding Competition (All)

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
11	Market Condition and Bidding Competition (All)	$ (15,600,000.00)	$0	$ 15,600,000.00	TBD	TBD	TBD

11	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Likely	Significant	High	Likely	Negligible	Low

Risk Event Description	There is the possibility of having a limited number of contractors bid which would increase the cost.
Team Discussions on Impact and Likelihood	Having limited competition would likely increase the cost. Corps studies have resulted in an expected dredge shortage as compared to the many anticipated projects in the Gulf region. Less competition is likely, resulting in higher bids. Timing of the contract within the fiscal year can lead to higher contract pricing. Must be able to dredge up to 60' and may have limited availability of large plants. Maximum digging depth for largest hopper dredges is up to 90' depth. Limited number of hopper dredges and there could be limited availability for the entrance channel dredging.
Likely	**No Change**
Low Variance	**Low assumes 5% decrease in current costs due to the market conditions.**
High Variance	**High assumes 5% increase in cost due to the current market conditions.**

		$ Difference
Dredging Contract Estimated Costs	$ 312,376,577.09	
Dredging Cost plus 5%	$ 327,995,405.94	$ 15,618,828.85
95% of Dredging Cost	$ 296,757,748.23	$ (15,618,828.85)

Risk No. 13 - Schedule Acceleration

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
13	Schedule Acceleration	$0	$0	$ 45,400,000.00	-5.0 Months	0.0 Months	0.0 Months

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Likely	Critical	High	Likely	Critical	High

Risk Event Description	Schedule Acceleration increases cost.
Team Discussions on Impact and Likelihood	Schedule could be accelerated leading to additional PED costs and increase the risk of dredge availability. An accelerated schedule increases costs and causes scheduling conflicts. Schedule acceleration is for 3 years with construction complete by 2028. Sponsor relocation costs could be added to the construction costs and add additional contractor markups.
Likely	**No Change**
Low Variance	**Low Variance assumes 5 months schedule savings.**
High Variance	**High assumes no schedule savings but costs to all contracts increase by 10% along with 10% additional PED costs.**

Contract Cost	$ 408,749,046.52
Contract cost plus 10%	$ 449,623,951.17
Cost Difference	$ 449,623,951.17
	$ 40,874,904.65
PED costs	$ 45,209,000.00
PED costs plus 10%	$ 49,729,900.00
Cost Difference for additional PED	$ 4,520,900.00

Risk No. 19 - HTRW Cleanup Impact Costs

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
19	HTRW Cleanup Impact Costs	$ -	$500,000	$ 2,100,000.00	TBD	TBD	TBD

11	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Unlikely	Negligible	Low	Unlikely	Negligible	Low

Risk Event Description	HTRW Cleanup Could Add Contractor Impact Costs
Team Discussions on Impact and Likelihood	Sediment sampling is conducted in advance of contracting to preclude construction within areas impacted by HTRW. If inadvertent discovery of HTRW arises during construction (i.e., encountering an unidentified pipeline, unexploded ordnance, etc.), it could lead to standby costs and/or an additional mob/demob cost during cleanup. The NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132 but this still could lead to additional contract impact costs.
Likely	**Likely assumes $0.5M Contractor Standby Costs.**
Low Variance	**No Change**
High Variance	**High assumes $0.5M Contractor Standby Costs + $1.6M Mob/Demob costs.**

Risk No. 23 - Contaminated Dredge Material Disposal Location Change

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
23	Contaminated Dredge Material Disposal Location Change	TBD	TBD	TBD	0.0 Months	0.0 Months	24.0 Months

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Unlikely	Moderate	Low	Unlikely	Critical	Medium

Risk Event Description	Contamination could lead to changing the disposal location.	
Team Discussions on Impact and Likelihood	The only contamination that is anticipated is in the area of the Alcoa docks and is not part of the shipping channel project. Sediment testing has been done, and no contamination was present in the dredging area. Current sediment sampling indicates this is a very low risk but if it occurred prior to contracting it would be addressed by the responsible party prior to construction. The PDT feels this an unlikely risk for the project. This is a known risk that is being addressed by SWG leadership. The impact could be material placement in a controlled manner, e.g., upland confined placement area (vs. open water and outside the Superfund footprint). This is an (risk) increase in construction costs of increased pipeline distance and land acquisition costs. If HTRW is encountered, the NFS is 100% responsible for investigation, removal, and disposal of any contaminants per ER-1165-2-132.	
Likely	**No Change**	**Likely assumes $0.5M Contractor Standby Costs.**
Low Variance	**No Change**	**No Change**
High Variance	**High assumes 24 month schedule delay along with additional PED costs (25% of fully rate).**	**High assumes $0.5M Contractor Standby Costs + $1.6M Mob/Demob costs; 24 month schedule delay along with additional PED costs (25% of fully rate).**

Risk No. 24 - Modifications & Claims

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
24	Modifications & Claims	$ (4,100,000.00)	$0	$ 20,400,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Very Likely	Significant	High	Very Likely	Negligible	Low

Risk Event Description	Construction contract modifications can impact construction cost and schedule growth.
Team Discussions on Impact and Likelihood	Technical complexities and site conditions could result in increased risk of contract modifications. Will impact costs, but little overall impact to larger project timeline.
Likely	**No Change**
Low Variance	**No Change**
High Variance	**Contract modifications and claims can be expected at 1% of the contract value and could go as high as 5%.**

Contract Value	$ 408,749,046.52
99% of contract Value	$ 404,661,556.05
Cost Difference	$ (4,087,490.47)
105% of contract Value	$ 429,186,498.84
Cost Difference	$ 20,437,452.33

Risk No. 29 - Fuel

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
29	Fuel	$ (8,700,000.00)	$0	$ 17,300,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Likely	Significant	High	Likely	Negligible	Low

Risk Event Description	Fuel is a volatile cost and can greatly affect the cost of dredging projects.
Team Discussions on Impact and Likelihood	Fuel could increase or decrease altering the cost. We assume an increase of $2.00 or a decrease of $1.00 based price fluctuation in the past years. Estimate assumes $3.58/gallon and is conservative.
Likely	**TBD**
Low Variance	**Low assumes fuel goes down $1/gallon. Input into CEDEP decreasing dredging cost/cy $0.22/CY.**
High Variance	**High assumes $2/gallon price increase. Input into CEDEP it increased the dredging cost/cy to a high of $0.44/CY.**

CY of Dredging	39,334,500
Low Fuel Cost	$ (8,653,590.00)
HighFuel Cost	$ 17,307,180.00

Risk No. 31 - Inflation

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
31	Inflation	$0	$0	$ 9,800,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Moderate	Medium	Possible	Negligible	Low

Risk Event Description	Inflation could exceed CWCCIS
Team Discussions on Impact and Likelihood	Project is for 2028-2031 and inflation could exceed CWCCIS tables. Since this is dredging the risks for fuel and labor have already been accounted. Inflation risk is for short term inflation of ~ 2 years.
Likely	**No Change**
Low Variance	**No Change**
High Variance	**Assumes inflation risk for this first 4 years of construction (2 years to the midpoint) between 2.5% and 3.5%.**

Total Project Cost	$ 476,439,046.52
2 years inflation @ 2.5%	$ 500,558,773.25
2 Years inflation @ 3.5%	$ 510,373,417.61
Cost Difference	$ 9,814,644.36

Risk No. 32 - Debris in Dredging Material

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
32	Debris in Dredging Material	$0	$0	9,700,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Moderate	Medium	Possible	Negligible	Low

Risk Event Description	Debris could be encountered in new work dredging areas.
Team Discussions on Impact and Likelihood	There is a possibility of encountering debris in the new work dredging areas.
Likely	**No Change**
Low Variance	**No Change**
High Variance	**High assumes debris adds $1/cy for new work dredging quantities.**

New Work Dredging Quanities 9,707,900.00

Risk No. 44 - Turning Basin Dredging Production

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
44	Turning Basin Dredging Production	$0	$0	$ 10,000,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Moderate	Medium	Possible	Marginal	Low

Risk Event Description	Productivity in the turning basin could be lower than estimated.
Team Discussions on Impact and Likelihood	The estimate for the turning basin is assumed to be 55% EWT and the historical rate from RMS is 64% for channel construction. The turning basin geometry is not only more technical but it is also new work dredging that could encounter lower productivity rates. Turning basis in ~$50M worth of dredging.
Likely	**No Change**
Low Variance	**No Change**
High Variance	**High assumes turning basin production is lower than expected and costs increase by 20%.**

Turning Basin Dredging Cost	$ 50,000,000.00
Cost plus 20%	$ 60,000,000.00
Cost Difference	$ 10,000,000.00

Risk No. 45 - Bird Island Design

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
45	Bird Island Design	$0	$0	$ 11,300,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Likely	Moderate	Medium	Likely	Negligible	Low

Risk Event Description	Bird Island Design may change
Team Discussions on Impact and Likelihood	Design is conceptual and alignment, elevations, footprint, and functionality may change. Material quantities and location would not change but features and shape may change. Final design is dependent of input from Environmental. There is a possibility of settlement and stone quantities could change +/-50%. Beach sand quantities may change.
Likely	**TBD**
Low Variance	**TBD**
High Variance	**High assumes Bird Island costs increase 50%.**

Bird Island Contract Cost	$ 22,531,331.58
Bird Island Cost plus 50%	$ 33,796,997.37
Cost Difference	$ 11,265,665.79

Risk No. 47 - Relocations Estimate

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
47	Relocations Estimate	$0	$0	$ 3,100,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Likely	Marginal	Medium	Likely	Negligible	Low

Risk Event Description	The relocations estimate may change
Team Discussions on Impact and Likelihood	Scope of work provided by the sponsor and many assumptions are made for the cost estimate. Cost updates have been included for the 30" natural gas pipeline. Generally the cost estimates are budget estimates that lack a basis and are likely to change.
Likely	**TBD**
Low Variance	**TBD**
High Variance	**High assumes relocation costs double from the estimated amount.**

Relocation Costs	$ 31,380,914.75
Relocation costs x 10%	$ 34,519,006.23
Cost Difference	$ 3,138,091.48

Risk No. 56 - Stone/Sand Material Pricing

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
56	Stone/Sand Material Pricing	$0	$0	$ 8,000,000.00	TBD	TBD	TBD

56	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Moderate	Medium	Possible	Negligible	Low

Risk Event Description	Pricing for the Bird Island Sand/Stone and Cultch could increase
Team Discussions on Impact and Likelihood	Initial budget pricing utilized but the pricing of the actual specified materials at the time of construction could increase. Stone sizing and specification could change slightly. Pricing is included for bedding stone and if Culch is required may be more expensive.
Likely	**No Change**
Low Variance	**No Change**
High Variance	**High assumes 50% cost increase for the Bird Island Materials.**

Bird Island Material Pricing	$ 10,729,300.50
Assumed 50% Markups	$ 5,364,650.25
Material Cost plus Markups	$ 16,093,950.75
50% increase in Material Costs	$ 24,140,926.13
Cost Difference	$ 8,046,975.38

Risk No. 58 - Overhead Rates

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
58	Overhead Rates	$0	$0	$ 9,200,000.00	TBD	TBD	TBD

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Moderate	Medium	Possible	Negligible	Low

Risk Event Description	Overhead rates could be higher than estimated
Team Discussions on Impact and Likelihood	The estimate includes 25% overhead (JOOH plus HOOH). Actual contractor overheads could be higher.
Likely	**TBD**
Low Variance	**TBD**
High Variance	**High assumes JOOH is higher than estimated and adds 3% of the direct costs.**

Project Costs	$ 408,749,046.52
Markup Totals	$ 102,187,261.63
Total Direct Costs	$ 306,561,784.89
Additional 3% of Direct Cost	$ 9,196,853.55

Risk No. 59 - Coordination delays from Outside Agencies

		Cost			Schedule		
REF	Risk/Opportunity Event	Low Variance	Likely	High Variance	Low Variance	Likely	High Variance
59	Coordination delays from Outside Agencies	TBD	TBD	TBD	0.0 Months	0.0 Months	2.0 Months

	Likelihood	Impact (C)	Risk Level (C)	Likelihood	Impact (S)	Risk Level (S)
RISK REGISTER RISK LEVEL	Possible	Negligible	Low	Possible	Moderate	Medium

Risk Event Description	Multiple agency coordination could lead to consultation delays
Team Discussions on Impact and Likelihood	Coordinating with is required with multiple resource agencies to finalize the environmental compliance process. There are concerns with agency workload and availability to complete the required consultations in the time allotted.
Likely	**TBD**
Low Variance	**TBD**
High Variance	**High assumes consultation delays project 2 months.**

COST ENGINEERING ATTACHMENT NO. C-5

WBS Account Cost breakdown

MSCIP

Controlled Unclassified Information

Estimated by	CESWG-ECE-P
Designed by	CESWG
Prepared by	Sergey Kuznetsov

Preparation Date	10/7/2025
Effective Date of Pricing	10/7/2025
Estimated Construction Time	1,500 Days

COST ENGINEERING ATTACHMENT NO. C-6

Cost Certificate and TPCS

WALLA WALLA COST ENGINEERING MANDATORY CENTER OF EXPERTISE

COST AGENCY TECHNICAL REVIEW

CERTIFICATION STATEMENT

SWG - PN 451954
Matagorda Ship Channel Improvement Project

The Matagorda Ship Channel Improvement Project, as presented by the Galveston District, has undergone a successful Cost Agency Technical Review (Cost ATR) of remaining costs, performed by the Walla Walla District Cost Engineering Mandatory Center of Expertise (Cost MCX) team. The Cost ATR included study of the project scope, report, cost estimates, schedules, escalation, and risk-based contingencies. This certification signifies the cost products meet the quality standards as prescribed in ER 1110-2-1150 Engineering and Design for Civil Works Projects and ER 1110-2-1302 Civil Works Cost Engineering.

Certification Date: May 26, 2026,

FY26 Remaining Costs:	$609,867,000 (Cost ATR Certified)
FY25 Spent Costs:	$ 5,700,000 (From Programs & PM)
FY26 Project First Cost:	$615,567,000 (Remaining plus Spent)
Fully Funded Costs:	$689,263,000 including Spent Costs

Note: Cost Certification assumes Efficient Implementation (Funding). Cost ATR was devoted to remaining work. It did not review spent costs, which requires an audit process. It remains the responsibility of the District to correctly reflect these cost values and to implement effective project management controls and implementation procedures including risk management through the period of Federal participation.

Derek D. Nelson, TCCC
Chief, Cost Engineering MCX
Walla Walla District

****** TOTAL PROJECT COST SUMMARY ******

PROJECT: **MSC, Channel Improvement Project. Recommended Plan 47'-49'**
PROJECT NO: P2 451954
LOCATION: Point Comfort, TX

DISTRICT: SWG **PREPARED: 1/23/2026**
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

This Estimate reflects the scope and schedule in report; MSCIP PACR

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2026									
						Effective Price Level Date: 1 OCT 25									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	**TOTAL ($K)**	Spent Thru: **1-Oct-25** ($K)	**TOTAL FIRST COST** ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*		*K*	*L*	*M*	*N*	*O*
02	RELOCATIONS	$31,381	$8,787	28.0%	$40,168	0.0%	$31,381	$8,787	$40,168	$0	$40,168	6.0%	$33,272	$9,316	$42,588
06	FISH & WILDLIFE FACILITIES	$40,200	$11,256	28.0%	$51,456	0.0%	$40,200	$11,256	$51,456	$0	$51,456	17.5%	$47,230	$13,224	$60,455
12	NAVIGATION PORTS & HARBORS	$334,909	$93,775	28.0%	$428,684	0.0%	$334,909	$93,775	$428,684	$0	$428,684	12.5%	$376,793	$105,502	$482,295
18	CULTURAL RESOURCE PRESERVATION	$2,260	$633	28.0%	$2,893	0.0%	$2,260	$633	$2,893	$0	$2,893	6.0%	$2,396	$671	$3,067
	CONSTRUCTION ESTIMATE TOTALS:	$408,750	$114,450		$523,200	0.0%	$408,750	$114,450	$523,200	$0	$523,200	12.5%	$459,691	$128,713	$588,404
01	LANDS AND DAMAGES	$25	$6	25.0%	$31	0.0%	$25	$6	$31	$0	$31	0.0%	$25	$6	$31
30	PLANNING, ENGINEERING & DESIGN	$45,209	$12,651	28.0%	$57,860	0.0%	$45,209	$12,651	$57,860	$5,700	$63,560	7.1%	$48,438	$13,555	$67,693
31	CONSTRUCTION MANAGEMENT	$22,481	$6,295	28.0%	$28,776	0.0%	$22,481	$6,295	$28,776	$0	$28,776	15.1%	$25,886	$7,248	$33,135
	PROJECT COST TOTALS:	$476,465	$133,402	28.0%	$609,867		$476,465	$133,402	**$609,867**	$5,700	**$615,567**	12.1%	$534,040	$149,523	$689,263

	CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.
	PROJECT MANAGER, Heather Briscoe
	CHIEF, REAL ESTATE, Timothy Nelson
	CHIEF, PLANNING, Andrea Catanzaro
	CHIEF, ENGINEERING, Martin Regner, P.E. , C.C.E.
	CHIEF, OPERATIONS, Robert Koch
	CHIEF, CONSTRUCTION, Don Carelock, P.E.
	CHIEF, CONTRACTING, Shamekia Chapman
	CHIEF, PM-PB, Elizabeth Fiocchi
	CHIEF, DPM, Byron D. Williams, PMP

TOTAL PROJECT COST (FULLY FUNDED):	**$689,263**
TOTAL PROJECT FIRST COST:	**$615,567**
TOTAL ASOCCIATED FIRST COST*:	**$38,369**

*not included in PROJECT COST

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25								137%
				RISK BASED										
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 1: Entrance Channel Hopper Dredging													
12	NAVIGATION PORTS & HARBORS	$26,503	$7,421	28.0%	$33,924	0.0%	$26,503	$7,421	$33,924	2028Q4	7.4%	$28,466	$7,971	$36,437
	CONSTRUCTION ESTIMATE TOTALS:	$26,503	$7,421	28.0%	**$33,924**		$26,503	$7,421	$33,924			$28,466	$7,971	$36,437
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2027Q3	4.7%	$277	$78	$355
0.5%	Planning & Environmental Compliance	$133	$37	28.0%	$170	0.0%	$133	$37	$170	2027Q3	4.7%	$139	$39	$178
5.0%	Engineering & Design	$1,325	$371	28.0%	$1,696	0.0%	$1,325	$371	$1,696	2027Q3	4.7%	$1,387	$388	$1,776
0.5%	Reviews, ATRs, IEPRs, VE	$133	$37	28.0%	$170	0.0%	$133	$37	$170	2027Q3	4.7%	$139	$39	$178
1.0%	Life Cycle Updates (cost, schedule, risks)	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2027Q3	4.7%	$277	$78	$355
0.5%	Contracting & Reprographics	$133	$37	28.0%	$170	0.0%	$133	$37	$170	2027Q3	4.7%	$139	$39	$178
1.0%	Engineering During Construction	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2028Q4	8.8%	$288	$81	$369
0.5%	Planning During Construction	$133	$37	28.0%	$170	0.0%	$133	$37	$170	2028Q4	8.8%	$144	$40	$185
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2027Q3	4.7%	$277	$78	$355
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$928	$260	28.0%	$1,187	0.0%	$928	$260	$1,187	2028Q4	8.8%	$1,009	$283	$1,292
1.0%	Project Operation:	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2028Q4	8.8%	$288	$81	$369
1.0%	Project Management	$265	$74	28.0%	$339	0.0%	$265	$74	$339	2028Q4	8.8%	$288	$81	$369
	CONTRACT COST TOTALS:	$30,876	$8,645		$39,521		$30,876	$8,645	**$39,521**			$33,121	$9,274	**$42,394**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25								144%
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	CONTRACT 2: Mid Bay Pipeline Dredging													
12	NAVIGATION PORTS & HARBORS	$188,117	$52,673	28.0%	$240,790	0.0%	$188,117	$52,673	$240,790	2030Q3	12.3%	$211,325	$59,171	$270,496
	CONSTRUCTION ESTIMATE TOTALS:	$188,117	$52,673	28.0%	**$240,790**		$188,117	$52,673	$240,790			$211,325	$59,171	$270,496
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2027Q3	4.7%	$1,969	$551	$2,521
0.5%	Planning & Environmental Compliance	$941	$263	28.0%	$1,204	0.0%	$941	$263	$1,204	2027Q3	4.7%	$985	$276	$1,260
5.0%	Engineering & Design	$9,406	$2,634	28.0%	$12,039	0.0%	$9,406	$2,634	$12,039	2027Q3	4.7%	$9,847	$2,757	$12,604
0.5%	Reviews, ATRs, IEPRs, VE	$941	$263	28.0%	$1,204	0.0%	$941	$263	$1,204	2027Q3	4.7%	$985	$276	$1,260
1.0%	Life Cycle Updates (cost, schedule, risks)	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2027Q3	4.7%	$1,969	$551	$2,521
0.5%	Contracting & Reprographics	$941	$263	28.0%	$1,204	0.0%	$941	$263	$1,204	2027Q3	4.7%	$985	$276	$1,260
1.0%	Engineering During Construction	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2030Q3	15.0%	$2,163	$606	$2,769
0.5%	Planning During Construction	$941	$263	28.0%	$1,204	0.0%	$941	$263	$1,204	2030Q3	15.0%	$1,081	$303	$1,384
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2027Q3	4.7%	$1,969	$551	$2,521
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$6,584	$1,844	28.0%	$8,428	0.0%	$6,584	$1,844	$8,428	2030Q3	15.0%	$7,570	$2,120	$9,690
1.0%	Project Operation:	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2030Q3	15.0%	$2,163	$606	$2,769
1.0%	Project Management	$1,881	$527	28.0%	$2,408	0.0%	$1,881	$527	$2,408	2030Q3	15.0%	$2,163	$606	$2,769
	CONTRACT COST TOTALS:	$219,156	$61,364		$280,520		$219,156	$61,364	**$280,520**			$245,174	$68,649	**$313,823**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26				Program Year (Budget EC): 2026								145%
		Effective Price Level: 1-Oct-25				Effective Price Level Date: 1 OCT 25								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 3 PHASE A: Upper Bay Pipeline Dredging													
12	NAVIGATION PORTS & HARBORS	$97,758	$27,372	28.0%	$125,130	0.0%	$97,758	$27,372	$125,130	2030Q4	13.1%	$110,530	$30,949	$141,479
	CONSTRUCTION ESTIMATE TOTALS:	$97,758	$27,372	28.0%	**$125,130**		$97,758	$27,372	$125,130			$110,530	$30,949	$141,479
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2028Q3	8.0%	$1,055	$296	$1,351
0.5%	Planning & Environmental Compliance	$489	$137	28.0%	$626	0.0%	$489	$137	$626	2028Q3	8.0%	$528	$148	$675
5.0%	Engineering & Design	$4,888	$1,369	28.0%	$6,257	0.0%	$4,888	$1,369	$6,257	2028Q3	8.0%	$5,277	$1,478	$6,754
0.5%	Reviews, ATRs, IEPRs, VE	$489	$137	28.0%	$626	0.0%	$489	$137	$626	2028Q3	8.0%	$528	$148	$675
1.0%	Life Cycle Updates (cost, schedule, risks)	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2028Q3	8.0%	$1,055	$296	$1,351
0.5%	Contracting & Reprographics	$489	$137	28.0%	$626	0.0%	$489	$137	$626	2028Q3	8.0%	$528	$148	$675
1.0%	Engineering During Construction	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2030Q4	15.9%	$1,133	$317	$1,450
0.5%	Planning During Construction	$489	$137	28.0%	$626	0.0%	$489	$137	$626	2030Q4	15.9%	$566	$159	$725
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2028Q3	8.0%	$1,055	$296	$1,351
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$3,422	$958	28.0%	$4,380	0.0%	$3,422	$958	$4,380	2030Q4	15.9%	$3,965	$1,110	$5,075
1.0%	Project Operation:	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2030Q4	15.9%	$1,133	$317	$1,450
1.0%	Project Management	$978	$274	28.0%	$1,251	0.0%	$978	$274	$1,251	2030Q4	15.9%	$1,133	$317	$1,450
	CONTRACT COST TOTALS:	$113,888	$31,889		**$145,777**		$113,888	$31,889	**$145,777**			$128,487	$35,976	**$164,463**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 3 PHASE B: Bird Island Construction													
12	NAVIGATION PORTS & HARBORS	$22,531	$6,309	28.0%	$28,840	0.0%	$22,531	$6,309	$28,840	2032Q2	17.5%	$26,471	$7,412	$33,883
	CONSTRUCTION ESTIMATE TOTALS:	$22,531	$6,309	28.0%	**$28,840**		$22,531	$6,309	$28,840			$26,471	$7,412	$33,883
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2028Q3	8.0%	$243	$68	$311
0.5%	Planning & Environmental Compliance	$113	$32	28.0%	$144	0.0%	$113	$32	$144	2028Q3	8.0%	$122	$34	$156
5.0%	Engineering & Design	$1,127	$315	28.0%	$1,442	0.0%	$1,127	$315	$1,442	2028Q3	8.0%	$1,216	$341	$1,557
0.5%	Reviews, ATRs, IEPRs, VE	$113	$32	28.0%	$144	0.0%	$113	$32	$144	2028Q3	8.0%	$122	$34	$156
1.0%	Life Cycle Updates (cost, schedule, risks)	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2028Q3	8.0%	$243	$68	$311
0.5%	Contracting & Reprographics	$113	$32	28.0%	$144	0.0%	$113	$32	$144	2028Q3	8.0%	$122	$34	$156
1.0%	Engineering During Construction	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2032Q2	21.5%	$274	$77	$350
0.5%	Planning During Construction	$113	$32	28.0%	$144	0.0%	$113	$32	$144	2032Q2	21.5%	$137	$38	$175
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2028Q3	8.0%	$243	$68	$311
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$789	$221	28.0%	$1,009	0.0%	$789	$221	$1,009	2032Q2	21.5%	$958	$268	$1,226
1.0%	Project Operation:	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2032Q2	21.5%	$274	$77	$350
1.0%	Project Management	$225	$63	28.0%	$288	0.0%	$225	$63	$288	2032Q2	21.5%	$274	$77	$350
	CONTRACT COST TOTALS:	$26,249	$7,350		**$33,598**		$26,249	$7,350	**$33,598**			$30,698	$8,595	**$39,294**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 4: Oyster Mitigation													
06	FISH & WILDLIFE FACILITIES	$40,200	$11,256	28.0%	$51,456	0.0%	$40,200	$11,256	$51,456	2032Q2	17.5%	$47,230	$13,224	$60,455
	CONSTRUCTION ESTIMATE TOTALS:	$40,200	$11,256	28.0%	**$51,456**		$40,200	$11,256	$51,456			$47,230	$13,224	$60,455
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2029Q3	11.4%	$448	$125	$573
0.5%	Planning & Environmental Compliance	$201	$56	28.0%	$257	0.0%	$201	$56	$257	2029Q3	11.4%	$224	$63	$287
5.0%	Engineering & Design	$2,010	$563	28.0%	$2,573	0.0%	$2,010	$563	$2,573	2029Q3	11.4%	$2,239	$627	$2,866
0.5%	Reviews, ATRs, IEPRs, VE	$201	$56	28.0%	$257	0.0%	$201	$56	$257	2029Q3	11.4%	$224	$63	$287
1.0%	Life Cycle Updates (cost, schedule, risks)	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2029Q3	11.4%	$448	$125	$573
0.5%	Contracting & Reprographics	$201	$56	28.0%	$257	0.0%	$201	$56	$257	2029Q3	11.4%	$224	$63	$287
1.0%	Engineering During Construction	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2032Q2	21.5%	$488	$137	$625
0.5%	Planning During Construction	$201	$56	28.0%	$257	0.0%	$201	$56	$257	2032Q2	21.5%	$244	$68	$313
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2029Q3	11.4%	$448	$125	$573
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$1,407	$394	28.0%	$1,801	0.0%	$1,407	$394	$1,801	2032Q2	21.5%	$1,709	$479	$2,188
1.0%	Project Operation:	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2032Q2	21.5%	$488	$137	$625
1.0%	Project Management	$402	$113	28.0%	$515	0.0%	$402	$113	$515	2032Q2	21.5%	$488	$137	$625
	CONTRACT COST TOTALS:	$46,833	$13,113		**$59,946**		$46,833	$13,113	**$59,946**			$54,904	$15,373	**$70,277**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	CONTRACT 5: Pipeline Relocations													
02	RELOCATIONS	$31,381	$8,787	28.0%	$40,168	0.0%	$31,381	$8,787	$40,168	2028Q2	6.0%	$33,272	$9,316	$42,588
	CONSTRUCTION ESTIMATE TOTALS:	$31,381	$8,787	28.0%	**$40,168**		$31,381	$8,787	$40,168			$33,272	$9,316	$42,588
01	LANDS AND DAMAGES	$25	$6	25.0%	$31	0.0%	$25	$6	$31	2026Q1	0.0%	$25	$6	$31
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2026Q1	0.0%	$314	$88	$402
0.5%	Planning & Environmental Compliance	$157	$44	28.0%	$201	0.0%	$157	$44	$201	2026Q1	0.0%	$157	$44	$201
5.0%	Engineering & Design	$1,569	$439	28.0%	$2,008	0.0%	$1,569	$439	$2,008	2026Q1	0.0%	$1,569	$439	$2,008
0.5%	Reviews, ATRs, IEPRs, VE	$157	$44	28.0%	$201	0.0%	$157	$44	$201	2026Q1	0.0%	$157	$44	$201
1.0%	Life Cycle Updates (cost, schedule, risks)	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2026Q1	0.0%	$314	$88	$402
0.5%	Contracting & Reprographics	$157	$44	28.0%	$201	0.0%	$157	$44	$201	2026Q1	0.0%	$157	$44	$201
1.0%	Engineering During Construction	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2028Q2	7.1%	$336	$94	$430
0.5%	Planning During Construction	$157	$44	28.0%	$201	0.0%	$157	$44	$201	2028Q2	7.1%	$168	$47	$215
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2026Q1	0.0%	$314	$88	$402
	Real Estate (All Federal Labor)	$246	$62	25.0%	$308	0.0%	$246	$62	$308	2026Q1	0.0%	$246	$62	$308
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$1,098	$308	28.0%	$1,406	0.0%	$1,098	$308	$1,406	2028Q2	7.1%	$1,176	$329	$1,506
1.0%	Project Operation:	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2028Q2	7.1%	$336	$94	$430
1.0%	Project Management	$314	$88	28.0%	$402	0.0%	$314	$88	$402	2028Q2	7.1%	$336	$94	$430
	CONTRACT COST TOTALS:	$36,830	$10,304		**$47,134**		$36,830	$10,304	**$47,134**			$38,876	$10,877	**$49,754**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER *A*	Civil Works Feature & Sub-Feature Description *B*	COST ($K) *C*	CNTG ($K) *D*	CNTG (%) *E*	TOTAL ($K) *F*	ESC (%) *G*	COST ($K) *H*	CNTG ($K) *I*	TOTAL ($K) *J*	Mid-Point Date *P*	INFLATED (%) *L*	COST ($K) *M*	CNTG ($K) *N*	FULL ($K) *O*
	CONTRACT 6: Cultural Resources													
18	CULTURAL RESOURCE PRESERVATION	$2,260	$633	28.0%	$2,893	0.0%	$2,260	$633	$2,893	2028Q2	6.0%	$2,396	$671	$3,067
	CONSTRUCTION ESTIMATE TOTALS:	$2,260	$633	28.0%	**$2,893**		$2,260	$633	$2,893			$2,396	$671	$3,067
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2026Q1	0.0%	$23	$6	$29
0.5%	Planning & Environmental Compliance	$11	$3	28.0%	$14	0.0%	$11	$3	$14	2026Q1	0.0%	$11	$3	$14
5.0%	Engineering & Design	$113	$32	28.0%	$145	0.0%	$113	$32	$145	2026Q1	0.0%	$113	$32	$145
0.5%	Reviews, ATRs, IEPRs, VE	$11	$3	28.0%	$14	0.0%	$11	$3	$14	2026Q1	0.0%	$11	$3	$14
1.0%	Life Cycle Updates (cost, schedule, risks)	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2026Q1	0.0%	$23	$6	$29
0.5%	Contracting & Reprographics	$11	$3	28.0%	$14	0.0%	$11	$3	$14	2026Q1	0.0%	$11	$3	$14
1.0%	Engineering During Construction	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2028Q2	7.1%	$24	$7	$31
0.5%	Planning During Construction	$11	$3	28.0%	$14	0.0%	$11	$3	$14	2028Q2	7.1%	$12	$3	$15
0.0%	Adaptive Management & Monitoring	$0	$0	28.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
1.0%	Project Operations	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2026Q1	0.0%	$23	$6	$29
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
3.5%	Construction Management	$79	$22	28.0%	$101	0.0%	$79	$22	$101	2028Q2	7.1%	$85	$24	$108
1.0%	Project Operation:	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2028Q2	7.1%	$24	$7	$31
1.0%	Project Management	$23	$6	28.0%	$29	0.0%	$23	$6	$29	2028Q2	7.1%	$24	$7	$31
	CONTRACT COST TOTALS:	$2,633	$737		**$3,370**		$2,633	$737	**$3,370**			$2,780	$778	**$3,559**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	ASSOCIATED COSTS (FED): Aid to Navigation													
12	NAVIGATION PORTS & HARBORS	$1,898	$475	25.0%	$2,373	0.0%	$1,898	$475	$2,373	2028Q2	6.0%	$2,012	$503	$2,515
	CONSTRUCTION ESTIMATE TOTALS:	$1,898	$475	25.0%	**2,373**		$1,898	$475	$2,373			$2,012	$503	$2,515
01	LANDS AND DAMAGES	$0	$0	25.0%	$ -	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.0%	Project Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning & Environmental Compliance	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering & Design	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Reviews, ATRs, IEPRs, VE	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Life Cycle Updates (cost, schedule, risks)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Contracting & Reprographics	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
0.0%	Construction Management	$0	$0	25.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operation:	$0	$0	25.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Management	$0	$0	25.0%	0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$1,898	$475		**2,373**		$1,898	$475	**$2,373**			$2,012	$503	**$2,515**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	ASSOCIATED COSTS (NON-FED): Structural Integrity													
12	NAVIGATION PORTS & HARBORS	$24,000	$6,000	25.0%	$30,000	0.0%	$24,000	$6,000	$30,000	2028Q2	6.0%	$25,446	$6,361	$31,807
	CONSTRUCTION ESTIMATE TOTALS:	$24,000	$6,000	25.0%	**$30,000**		$24,000	$6,000	$30,000			$25,446	$6,361	$31,807
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.0%	Project Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning & Environmental Compliance	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering & Design	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Reviews, ATRs, IEPRs, VE	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Life Cycle Updates (cost, schedule, risks)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Contracting & Reprographics	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
0.0%	Construction Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operation:	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$24,000	$6,000		**$30,000**		$24,000	$6,000	**$30,000**			$25,446	$6,361	**$31,807**

****** TOTAL PROJECT COST SUMMARY ******

****** CONTRACT COST SUMMARY ******

PROJECT: MSC, Channel Improvement Project. Recommended Plan 47'-49'
LOCATION: Point Comfort, TX
This Estimate reflects the scope and schedule in report; MSCIP PACR

DISTRICT: SWG
POC: CHIEF, COST ENGINEERING, Adam Tallman, P.E. , C.C.E.

PREPARED: 1/23/2026

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 15-Jan-26 Effective Price Level: 1-Oct-25				Program Year (Budget EC): 2026 Effective Price Level Date: 1 OCT 25				FULLY FUNDED PROJECT ESTIMATE				
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	ASSOCIATED COSTS (NON-FED): Dock/Berthing Area Improvements													
12	NAVIGATION PORTS & HARBORS	$4,797	$1,199	25.0%	$5,996	0.0%	$4,797	$1,199	$5,996	2028Q2	6.0%	$5,086	$1,271	$6,357
	CONSTRUCTION ESTIMATE TOTALS:	$4,797	$1,199	25.0%	**$5,996**		$4,797	$1,199	$5,996			$5,086	$1,271	$6,357
01	LANDS AND DAMAGES	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
30	PLANNING, ENGINEERING & DESIGN													
0.0%	Project Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning & Environmental Compliance	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering & Design	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Reviews, ATRs, IEPRs, VE	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Life Cycle Updates (cost, schedule, risks)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Contracting & Reprographics	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Engineering During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Planning During Construction	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	Real Estate (All Federal Labor)	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
0.0%	Construction Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operation:	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Management	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONTRACT COST TOTALS:	$4,797	$1,199		**$5,996**		$4,797	$1,199	**$5,996**			$5,086	$1,271	**$6,357**

ATTACHMENT G-1

This section presents the Final Geotechnical Data Report Matagorda Bay Ship Channel Improvement Project Matagorda Bay, Texas", January 2022 by Tolunay-Wong Engineers, Inc (TWEI 2022), Houston, Texas.

TOLUNAY-WONG ENGINEERS

U.S. Army Corps of Engineers

Final Geotechnical Data Report
Matagorda Bay Ship Channel Improvement Project
Matagorda Bay, Texas

TWEI Project No.: 21.14.223

Prepared for:
Calhoun Port Authority
Calhoun County, Texas

Prepared by:
Tolunay-Wong Engineers, Inc.
Houston, Texas

January 30, 2022

Geotechnical Engineering
Construction Materials Testing
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Tolunay-Wong Engineers, Inc.

January 30, 2022
TWEI Project No.: 21.14.223

Calhoun Port Authority
2525 South FM 1593
P.O. Box 397
Point Comfort, Texas 77978

Attn: Ms. Felicia F. Harral, P.E.
ffh@calhounport.com

Ref: Final Geotechnical Data Report
Matagorda Bay Ship Channel Improvement Project
Calhoun County, Texas

Dear Ms. Harral,

Tolunay-Wong Engineers, Inc. (TWEI) is pleased to submit this final geotechnical data report for the planned improvement of the existing shipping channel within the Matagorda Bay south of Calhoun County, Texas.

This final report includes the findings of 72 channel borings, 40 vibracores, and four sediment sampling along the Matagorda bay, through the jetty and near the coast of Gulf of Mexico. This report incorporates the comments provided by USACE within the draft report dated January 7th, 2022.

Our fieldwork was impacted approximately 1 month, as a result of an employee onboard the lift boat, Opportunity testing positive for COVID 19. For the safety of our employees we immediately demobilized from the site to facilitate the employees to obtain treatment and to screen for virus. After confirmation of the safety of our employees, we remobilized to the project site to complete the fieldwork onboard lift boat, Dularge.

If there are any questions or comments concerning the information presented within this final geotechnical data report, please let us know. We look forward to working with Calhoun Port Authority and USACE as work progresses into detailed design and construction.

Sincerely,

TOLUNAY-WONG ENGINEERS, INC.
TBPELS Firm Registration No. 124

Aby Abraham

Aby Abraham, P.E.
Senior Project Manager



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1 INTRODUCTION

1.1 Project Description

This final geotechnical data report presents factual information associated with the geotechnical investigation for the deepening and widening of existing Matagorda Bay shipping channel south of Calhoun County, Texas. The deepening and widening activities will encompass approximately 29 miles, commencing near Calhoun County Navigation District Facilities and terminate within the Gulf of Mexico. Plan view of the project alignment prepared by U.S. Army Corps of Engineers (USACE) is presented within Appendix A, Sheets CN 101 through CN 113.

This final report supersedes the draft report submitted to USACE dated January 7th, 2022. Major revisions incorporated within the final report includes:

1. Incorporation of comments provided by USACE within the draft report; and,
2. Incorporation of laboratory test results performed on 20 vibracore specimens.

This final data report includes the findings of the 72 channel borings, 40 vibracores and 4 sediment samples.

The design of the Matagorda Bay ship channel deepening, and the dredging activity will be performed by U.S. Army Corps of Engineers (USACE) based on the findings of this and previously performed geotechnical studies.

1.2 COVID 19

We had mobilized to the project site on July 12th onboard the lift boat Opportunity to drill and sample channel borings. As a result of an employee testing positive for COVID 19 while working within the lift boat Opportunity, we demobilized from the project site on July 29th, 2021. Demobilization was conducted to allow:

1. The impacted employee to obtain medical attention;
2. Other employees potentially exposed to COVID 19 to be tested; and,
3. Minimize the further spread of virus.

Prior to demobilization, we had completed 40 channel borings and 40 vibracores. After confirmation of the safety of our employees, quarantine protocols, and the allocation of another lift boat, Dularge we remobilized to the project site to complete 32 channel borings from September 30th through October 26th, 2021.

As a result of relatively limited access within the jetty at the perimeter of Matagorda Bay and Gulf of Mexico, and frequent large cargo vessel traffic through the jetty, channel borings CB-14 through CB-17 were converted to shallow sediment sampling. Utilizing a charter boat furnished by Lloyd Marine, the sedimentation sampling activity was completed on October 31st, 2021.

2 Scope of Work

2.1 Geotechnical Work

The purpose of the geotechnical investigation is to explore the subsurface soil conditions along the existing ship channel alignment in Matagorda Bay and to support the design for proposed widening and deepening of channel.

The scope of services for the geotechnical investigation consists of four major components: (1) Pre-mobilization, (2) Field Investigation, (3) Laboratory Testing and (4) Geotechnical Factual Report. Summary of the tasks completed for the four components are presented below.

1. Tasks accomplished as part of pre-mobilization activity include the following:
    a. Development of Accident Prevention Plan and overall Time (Gantt) schedule for the geotechnical study;
    b. Perform Texas One Calls and magnetometer survey to identify buried pipelines and structures around the proposed test locations. The magnetometer survey was performed by T. Baker Smith (TBS) under subcontract to TWEI;
    c. Daily coordination with the Matagorda Bay pilots in advance for approval to perform the geotechnical exploration within the exploration within the channel.
2. Tasks accomplished as part of the field investigation from July 29th through October 31st, 2021 includes the following:
    a. Mobilization of experienced geotechnical technicians, drillers and helpers, and crew boat personnels to the project site;
    b. Major equipment mobilized for the execution of field investigation were:
        i. One survey and one support vessel to perform the 40 vibracores. The recovery of vibracore tube specimens were performed by TBS under subcontract to TWEI;
        ii. Two lift boats, Opportunity and Dularge and support vessels to conduct the 72 channel borings;
        iii. One charted boat to perform sediment sampling at four locations within the jetty;
        iv. One truck mounted drilling rig (DR-14) secured onto the decks of the lift boats; and,
        v. Miscellaneous trucks and trailers for the transport of equipment and recovered soil samples.
    c. Measure depth to mudline at the test locations;
    d. Drill and sample 72 channel borings from mudline to El. -70-ft MLLW (Mean Low Lower Water);
    e. Recover 40 vibracore soil samples from mudline to about 10-ft depth by vibrating a 20-ft length core barrel to refusal;
    f. Prepare and submittal of field boring and vibracore logs on a daily basis to Calhoun Port Authority and USACE representatives;

g. Transport of recovered soil samples from the channel borings and sediment sampling to TWEI USACE approved laboratory in Houston, Texas; and,

h. Transport the intact vibracore barrels to TWEI laboratory in Corpus Christ, Texas.

3. Laboratory testing of the recovered soil samples from the channel borings were conducted in accordance with ASTM standards and in close coordination with USACE.

    a. Based on the findings of the furnished preliminary channel boring logs, USACE provided laboratory assignments for the individual channel borings; and,

    b. The laboratory tests were performed to primarily evaluate the index and strength properties of soils.

4. The recovered vibracore specimens were extruded from the 20-ft length core barrel at TWEI laboratory in Corpus Christi, Texas. The specimens were visually classified, photos obtained, and trimmed to about 3-ft length. The strength characteristics were estimated by performing pocket penetrometers or torvane tests.

    a. Preliminary vibracore logs and photos of the extruded specimens were provided to USACE; and,

    b. Laboratory assignments consisting of index testing were provided by USACE.

5. The development of geotechnical data report included the following tasks:

    a. Evaluate subsurface stratigraphy along the ship channel alignment;

    b. Boring logs presenting tabulated field and laboratory test results;

    c. Fence diagram incorporating the 72 channel borings; and,

    d. Summary and detailed results of laboratory test.

TWEI scope of services did not include development of geotechnical design parameters, evaluation of historical geotechnical study, engineering analysis or environmental assessment.

2.2 Environmental Work

Shallow environmental soil samples along the Matagorda shipping channel were recovered from mudline to about El. -56-ft MLLW to design the proposed widening and deepening of the channel. Soil samples were collected by TWEI under the supervision of Lloyd Engineering, Inc. The soil samples were transferred to Lloyd upon completion of field investigation. A standalone report presenting the environmental work and findings were prepared by Lloyd for the subject project.

3 FIELD EXPLORATION

3.1 General

The field exploration for the ship channel improvement was performed from July 12th through October 31st, 2021. As a result of an employee testing positive for COVID 19, we had demobilized from the project site between July 29th through September 29th, 2021.

Pre-mobilization tasks consisting of Texas One Calls, and magnetometer survey were performed to identify buried pipelines and obstructions near the channel boring locations. In the event an obstruction was detected, the test locations were offset about 300- to 600-ft along the banks of the shipping channel. The finding of the magnetometer survey and the proposed offsets were discussed with Calhoun Port Authority and USACE prior to drilling and sampling.

Field investigation within the Matagorda Bay, along the jetty, and within 29 miles of Gulf of Mexico included the following:

1. 72 channel borings (CB-1 through CB-13 and CB-18 through CB-76). Prior to COVID 19 occurrence, 40 channel borings were completed aboard lift boat Opportunity. Re-mobilization to site and completion of 32 channel borings were accomplished onboard lift boat Dularge;
2. 40 vibracores (VB-1 through VB-40) by TBS; and,
3. 4 shallow sediment sampling (CB-14 through CB-17).

Details of the field investigation are presented within subsequent sections.

3.2 Channel boring Locations

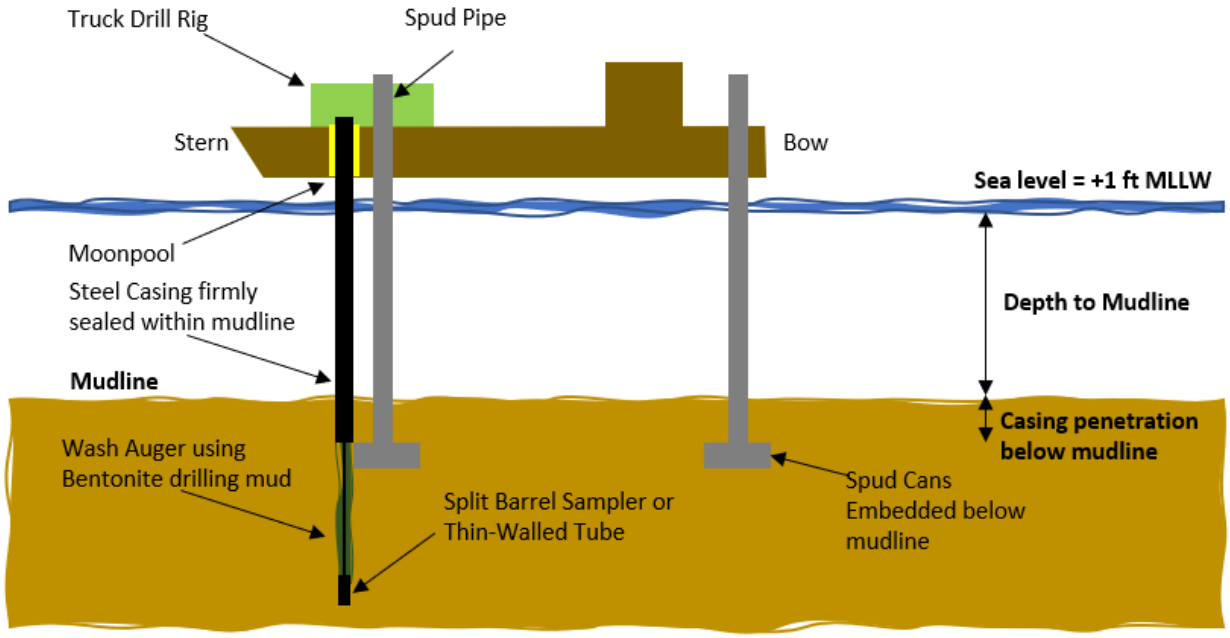
Seventy two (72) tests borings were performed from mudline to about El. -70-ft MLLW aboard self-elevating lift boats Opportunity and Dularge. The channel borings design coordinates were initially planned near the toe of the Matagorda Bay shipping channel.

Large cargo vessels frequently travel through the shipping channel. In an attempt to minimize disruption of the shipping channel, the channel borings were relocated along the crest of shipping channel. The channel boring offsets were discussed with Calhoun Port Authority and USACE in advance.

An experienced geotechnical technician equipped with a GPS device (+/-1-ft) closely communicated with the Capitan to safety position the lift boat along the shipping channel crest and within close proximity of the design location. Approximate plan view of the channel borings locations is presented within Appendix A, Sheets CN 101 through CN 113.

The horizontal coordinates of the as-drilled test locations and the offset with reference to the design coordinates were determined by the geotechnical technician. The lift boat was secured in-place by the penetration of spud legs below the mudline and elevating the deck few feet above the sea level.

Typical depiction of drilling and sampling activity onboard the lift boats with a truck mounted drilling rig is shown below.



The technician obtained depth to mudline with reference to the sealevel using a weighted measuring tape. Based on the review of historical tide information from NOAA website, the sea level within the Matagorda Bay and Gulf of Mexico is estimated at El. +1-ft MLLW.

Details of the channel borings including completion dates, as-drilled horizontal coordinates and offsets from design location, mudline and termination elevations, and steel casing penetration below mudline are presented within Appendix A, Sheets CN 126 and CN 127.

3.3 Channel boring Drilling and Sampling

The channel borings were drilled and sampled with a truck mounted drill rig secured on the deck of lift boats Opportunity and Dularge.

3.3.1 Drilling Channel borings

Drilling and sampling of the channel borings were performed using truck mounted drilling rig DR-15. The rig is equipped with a calibrated Standard Penetration Test (SPT) automatic hammer. The calibration record for the SPT hammer is presented at the end of Appendix B.

The channel borings were performed in accordance with ASTM D 1452. After the lift boat was elevated and leveled, a 5-in. diameter steel casing was firmly embedded within the mudline to obtain a competent seal for the circulation of bentonite drilling mud. Drilling and sampling were advanced through the steel casing using rotary wash method from mudline to borehole termination depth.

Upon completion of drilling and sampling, the bentonite mud was deposited near the mudline and the steel casings were extracted.

3.3.2 Soil Sampling

At the onset of the geotechnical investigation, soil sampling was being conducted at continuous 2-ft interval from mudline to -70-ft MLLW. After discussion with USACE on July 16th, 2021, the sampling frequency was modified as follows:

Elevation	Sampling Interval
Mudline to El. -45-ft	5-ft spacing
-47.5-ft to -70-ft	2.5-ft spacing

3.3.2.1 Hydraulic Push Sampling

Clays and soils inferred predominantly as clay type soils during field investigation were recovered from the channel borings by hydraulically pushing a 3-in diameter, thin-walled tube to a distance of about 24-in. The field sampling procedures were conducted in general accordance with the Standard Practice for Thin-Walled Tube (Shelby) Sampling of Soils (ASTM D1587). Shelby tubes were lowered to the bottom of the borehole using the drill rod and hydraulically pushed in a continuous motion for 24-in into undisturbed soil. Pocket penetrometer and/or hand torvane tests were performed to estimate the consistency of clays encountered within extruded samples. The samples were extruded in the field and placed within rigid containers for transport to TWEI laboratory in Houston, Texas. The recovered soil sample depths and field measured pocket penetrometer and/or hand torvane readings are shown on the channel boring logs in Appendix B.

3.3.2.2 Standard Penetration Test Sampling

Sands and silts, and very soft clays unable to recover with hydraulic push method were obtained using Standard Penetration Test (SPT) method (ASTM D1586). Samples were obtained at 18-in. depth intervals with a standard 2-in diameter (OD) split-barrel drive sampler. The sampler was driven by a 140-lb automatic hammer with a 30-in. drop. The sampler was driven 18-in. (or until refusal) with blow counts for each 6-in. increment noted on the boring logs. Refusal was defined as ten (10) blows without advancement, fifty (50) blows for less than 6-in of advancement and one-hundred (100) blows for 6-in to 18-in of advancement.

The automatic hammer energy calibration used for the explorations were determined in accordance with ASTM D 4633 and is provided at the end of Appendix B. The average SPT hammer energy transfer ratio measured 91%. The field measured SPT N values were normalized to an energy ratio of 60% efficiency taking into consideration SPT automatic hammer's energy transfer ratio (E_r) using the equation below.

$$N_{60} = N_{SPT} \frac{E_r}{60}$$

The resulting SPT N_{60} values are also included within the channel boring logs within Appendix B. The undrained shear strength of clays recovered by SPT method were calculated using the empirical equation shown below.

Undrained Shear Strength (Su, ksf) = SPT N_{60} x 0.130

The soil samples obtained by SPT sampling were retained within moisture seal containers for transport to the USACE approved TWEI laboratory in Houston, Texas.

3.3.3 Boring Logs

TWEI interpretations of general subsurface soil and groundwater conditions are included on the channel boring logs in Appendix B. The electronic gINT files were shared with USACE independent of this geotechnical data report. The interpretations of the soil types throughout the boring depths and the locations of strata changes were based on visual classifications during field sampling using the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) [ASTM D2488] and laboratory testing using the Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) [ASTM D2487]. A key to the symbols and terms used on the boring logs is also included in Appendix B.

3.4 Vibracore Location and Sampling

Forty (40) vibracores were performed from mudline to refusal within the Matagorda Bay by TBS under subcontract to TWEI. TBS provided a 36-ft length barge, support vessels with survey capabilities, 20-ft length aluminum vibracore tubes of 3-in. outside diameter (2-3/4 in. ID), and trained personnel's to perform the vibracores.

The purpose of vibracores were to obtain sediments and soft soils near the mudline. The vibracore horizontal coordinates were selected by USACE withn the proposed open-water new work dredged material Placement Areas (PAs), as shown within Appendix A, Sheets CN 104 through CN 112.

The test locations horizontal coordinates and mudline elevation were measured utilizing the GPS device and fathometer mounted within the support vessel. Captain of the support vessel transported the lift boat utilized to perform the vibracores within close proximity of test location (+/- 10-ft). The as-cored horizontal coordinates and the mudline elevations of the 40 vibracores are presented within Appendix A, Sheet CN 128.

Through the moon pool of the lift boat, the 20-ft length vibracore tubes were sunk to the mudline and allowed to penetrate the soft sediments by the tubes self-weight. Thereafter, utilizing the onboard electric vibrating equipment, the tubes were further advanced until refusal. The maximum depth of vibracore tube penetration below mudline was documented by the onboard TBS technician. The tubes were extracted from the mudline utilizing the onboard winch, and the length of the recovered sediment / soils specimen were measured by the onboard TBS technician. The maximum depth of vibracore penetration, and the length of sediment / soil recovery from the 40 test locations are presented within Appendix A, Sheet CN 128.

Representative photo of vibracore field activity is shown below.



The vibracore tubes were trimmed (i.e. sediment / soil samples were not extruded in the field), the ends were sealed, and transported to TWEI laboratory in Corpus Christi, Texas for visual classification and further index testing. The 40 vibracore logs are presented within Appendix C.

3.5 Jetty Sediment: Ponar Sampling

Geotechnical tests CB-14 through CB-17 were initially planned as channel borings for termination near El. -70-ft MLLW within the footprint of the jetty. The jetty is located at the perimeter of Matagorda Bay and Gulf of Mexico and is travelled by large marine cargo vessels. Plan view of the jetty is presented within Appendix A, Sheet CN 116.

To minimize impact to the shipping lane, the channel borings were converted to shallow sediment sampling, using a Ponar sampler. Additionally, the four test locations were further offset beyond the footprint of the existing shipping lane. The modification of field testing procedure was discussed with USACE and Port of Calhoun engineers in advance. Plan view of Ponar sampling locations CB-14 through CB-17 are presented within Appendix A, Sheet CN 116.

Sediment sampling using the Ponar sampler was accomplished by mobilizing a charter boat on October 31st, 2021 equipped with GPS instrument. Upon reaching the test location, the onboard technician documented the horizontal coordinates and measured the depth to mudline using a weighted measuring tape.

The Ponar sampler was lowered to the mudline and dragged along the surface to collect sufficient sample by traveling the charter boat forward. The Ponar sampler was winched to the deck of the charter boat and the recovered samples (gravel, shell and sands) were placed within proctor bags.

The approximate horizontal coordinates of the test locations, and the depth to mudline measurements are presented within Appendix A, Sheet CN 129. Based on the review of historical tide information from NOAA website, the sea level within the jetty is estimated at El. +1-ft MLLW.

Representative photo of the Ponar sampler used at CB-14 through CB-17 is shown below.



After visual observation, the recovered samples were transported to TWEI laboratory in Houston, Texas for further index testing. The Ponar sampling logs CB-14 through CB-17 are presented within Appendix D.

4 LABORATORY TESTING

Laboratory testing program was conducted on select soil and sediment samples recovered from the channel borings, vibracores and Ponar samplers. Laboratory tests were performed to assist in classification and evaluation of the index and strength properties. The test assignments were selected by USACE based on the field logs furnished by TWEI. Laboratory tests were performed in accordance with ASTM International standards by the following USACE validated laboratories:

- TWEI, Houston Texas; and,
- TRI, Austin Texas.

USACE validation certificates of the aforementioned laboratories are provided within Appendix F. The summary of laboratory tests performed are presented below.

Laboratory Testing Program	
Test Description	**Test Method**
Visual Classifications	ASTM D 2488
Water (Moisture) Content	ASTM D 2216
Material Passing Sieve No. 200	ASTM D 1140
Particle Size Analysis of Soils (with Hydrometer)	ASTM D 422
Liquid Limit, Plastic Limit and Plasticity Index	ASTM D 4318
Unconfined Compression (UC)	ASTM D 2166
Unconsolidated-Undrained Triaxial Compression (UU)	ASTM D 2850
Multi-Stage Consolidated-Undrained Triaxial Compression (CU)	ASTM D 4767
Density (Unit Weight)	ASTM D 7263

4.1 Geotechnical Tests

Brief description of the geotechnical tests performed to measure soil index and strength characteristics are presented below.

- ***Visual Classification of Soil – ASTM D 2488.*** This practice covers procedures for identifying soils and the description of soils for engineering purposes.

- ***Laboratory Determination of Water (Moisture) Content of Soil and Rock – ASTM D 2216***. The water content of the soil/rock, expressed as a percentage, is defined as the ratio of the mass of fluid to the mass of soil solids. The moisture content can provide an indication of cohesive soil shear strength and compressibility when compared to Atterberg Limits.

- ***Amount of Material in Soils Finer Than the No. 200 (75-μm) Sieve – ASTM D 1140***. This test measures the total amount of material in soils finer than the No. 200 sieve.

- ***Particle Size Analysis of Soils (with hydrometer) – ASTM D 422***. This test measures gradation, as a result of soils passing through different size sieves. A grain size curve is developed from the sieve analysis test. The test result aid in classifying the soils and provide an indication of the soil hydraulic conductivity (permeability). The gradation of clay size fraction which is material finer than 2 μm are measured using hydrometer. The fraction size provides an indication of the mineralogy.

- ***Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D 4318.*** These tests collectively, also known as Atterberg Limits, are used for soil classification and provide an indication of volume change potential when considered in conjunction with the natural moisture content. The liquid limit and plastic limit establish the boundaries of the consistency states of plastic soils. The Plasticity Index (PI) is the difference between the liquid limit and the plastic limit. Oven dry liquid limit tests were performed on selected specimens exhibiting significant quantity of organics.

- ***Unconfined Compression (UC) – ASTM D 2166***. This test provides a quick measure of compressive strength for those soils that possess sufficient cohesion to permit testing in the unconfined state.

- ***Unconsolidated-Undrained (UU) Triaxial Compression Test – ASTM D 2850***. This test measures the strength and stress-strain relationships of a cylindrical specimen of either undisturbed or remolded cohesive soil. The tests were performed under all-around cell pressures corresponding to total soil overburden pressures (undrained conditions) compatible with the sample depths. No drainage of the specimen is permitted during the test. The specimen is sheared in compression without drainage at a constant rate of axial deformation (strain controlled). The testing apparatus electronically measures the axial loads with calibrated load cells and axial strain. The results including the deviator stress (the principal stress difference), undrained shear strength, and axial strain are electronically retained within database.

  The deviator stresses at various strain intervals are calculated by dividing the axial load with corresponding average cross section area. The undrained shear strength is considered one half of the peak deviator stress. Refer to *"Calculation"* section within ASTM D 2850 for details.

- ***Multi-Stage Consolidated-Undrained (CU) Triaxial Compression with Pore Pressure Measurements – ASTM D 4767***. In this test, one clay sample is allowed to consolidate and loaded to three pre-determined confining pressures.

  The first and second stages are loaded to near failure conditions as determined by the peak principal stress ratio. The third stage is extended to failure or 15% strain to reach "fully softened" condition. Pore water pressures are continuously monitored during loading. The test provides measured total (undrained) and effective (drained) soil parameters (cohesion and soil friction).

  To calculate the shear strength, the Mohr's circle at failure is prepared on an arithmetic plot with shear stress as ordinate and normal stress as the abscissa. The Mohr's circles are prepared for normal stress and effective normal stress taking into consideration the pore-water pressure measurements.

A line is drawn tangent to the Mohr's circle and intercepts the ordinate. The slope of the line tangent to the Mohr's circle is considered as the friction angle. The intercept crossing the ordinate is considered as the cohesion.

- ***Density (Unit Weight) of Soil – ASTM D 7263***. Total unit weight of the soil aggregate is defined as the weight of the aggregate (soil plus water) per unit volume. Based on the total unit weight and moisture content, the dry unit weight can be estimated.

The geotechnical laboratory test results are presented on the test logs within Appendices B through D. Summary table of various geotechnical test results in tabular format is presented within Appendix E, Pages E-1 through E-32. Graphical plot of Atterberg limit tests performed is presented within Appendix E, Page E-33. Also included within Appendix E are detailed test results for:

- Hydrometer and Sieve Analysis, Pages E-34 through E-365;
- UC and UU Triaxial Tests, Pages E-366 through E-607; and,
- CU Multi-Stage Triaxial Tests, Pages E-608 through E-705.

4.2 Environmental Tests

Shallow environmental soil samples along the Matagorda shipping channel were recovered for design work for proposed widening and deepening of the channel. The findings were prepared by Lloyd Engineering, Inc., and submitted as a standalone report to USACE.

5 SUBSURFACE CONDITONS

General assessment of the soil conditions along the Matagorda Bay shipping channel are presented below from mudline to El. -70-ft MLLW. The subsurface conditions were primarily inferred from channel borings CB-1 through CB-13, and CB-18 through CB-76. Within the jetty located at the perimeter of Matagorda Bay and Gulf of Mexico, sedimentation sampling was performed along the mudline using a Ponar sampler.

Plan view of the geotechnical test locations are presented within Appendix A, Sheets CN 101 through CN 113. The corresponding fence diagrams depicting the soil type and strength are presented within Appendix A, Sheets CN 114 through CN 125. Detailed channel boring logs are presented within Appendix B.

The Matagorda Bay shipping channel from the northly limit, Calhoun County Navigation district to the jetty is located between Sta. 118.4+000 and 0+000. From the jetty to the southerly limit within Gulf of Mexico, the shipping channel is situated between Sta. 0+0000 and -33+000.

5.1 Gulf of Mexico (Sta. -13+000 to -33+000, CB-1 to CB-11)

Soil conditions along the shipping channel within the Gulf of Mexico Sta. -13+00 to -33+00 were inferred from channel borings CB-1 through CB-11. The mudline elevation along the crest varies from El. -40-ft to -50-ft MLLW.

Primarily soft to firm fat clays and elastic silt were encountered from mudline to El. -72-ft MLLW. To a lesser extent loose to dense clayey and silty sands of 5-ft thickness encountered at mudline within channel borings CB-01, 10, and 11. Summary of the soil strength and index properties in tabular format is presented below.

Generalized Soil Profile: Sta. -13+000 to -33+000						
El. (ft)	**Description**	**Moisture Content (%)**	**LL (---)**	**Su (psf)**	**SPT N_{60} (bpf)**	**Total Unit Weight (pcf)**
-45 to -50	Soft to Firm Clay, with sand layers	24 - 30	56 – 64	400 – 1,000	---	117 - 120
-50 to -72	Soft to Firm Clay and Elastic Silt	28 - 57	45 - 82	500 – 1,400	---	103 - 128
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.2 Matagorda Bay Jetty (Sta. -11+000 to 9+000, CB-12 to CB-20)

Soil conditions along the Matagorda Bay jetty Sta. -11+000 to 9+000 were inferred from channel borings CB-12, 13 and CB-18 through CB-20. At CB-14 through CB-17 locations shallow sediment samples were recovered from the mudline. Elevation of the mudline measured along the crest varies from El. -19-ft to -56-ft MLLW.

Primarily medium to very dense silty and clayey sands were encountered from mudline to El. -70-ft MLLW. To a lesser extent medium to firm clays were encountered below El. -62-ft MLLW at channel boring CB-18.

Summary of the soil strength and index properties in tabular format is presented below.

Generalized Soil Profile: Sta. -11+000 to 9+000						
El. (ft)	**Description**	**Moisture Content (%)**	**% Passing No. 200**	**Su (psf)**	**SPT N_{60} (bpf)**	**Total Unit Weight (pcf)**
-45 to -70	Medium to very dense Silty and Clayey Sands	17 - 28	5 to 30	-	18 - 86	115 - 130
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.3 Southern Matagorda Bay (Sta. 11+000 to 57+000, CB-21 to CB-44)

Soil conditions along the shipping channel within the southern footprint of Matagorda Bay Sta. 11+000 to 57+000 were inferred from channel borings CB-21 through CB-44. The mudline elevation along the crest varies from El. -14-ft to -39-ft MLLW.

Primarily medium to dense cohesionless silty and clayey sands were encountered from mudline to El. -40-ft MLLW. Thereafter, medium to firm lean and fat clays were encountered to El. -70-ft MLLW. Summary of the soil strength and index properties in tabular format is presented below.

Generalized Soil Profile: Sta. 11+000 to 57+000						
El. (ft)	**Description**	**Moisture Content (%)**	**% Passing No. 200**	**Su (psf)**	**SPT N_{60} (bpf)**	**Total Unit Weight (pcf)**
-15 to -40	Medium to dense Silty and Clayey Sands	23 - 40	20 to 60	-	15 - 80	115 - 130
-40 to -70	Medium to Firm Clay	28 - 57	60 - 99	800 – 1,400	---	105 - 125
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

5.4 Northern Matagorda Bay (Sta. 59+000 to 118+500, CB-45 to CB-76)

Soil conditions along the shipping channel within the northern footprint of Matagorda Bay Sta. 59+00 to 118+50 were inferred from channel borings CB-45 through CB-76. The mudline elevation along the crest varies from El. -5-ft to -43-ft MLLW. The significant variation is as a result of previous dredging activity performed south of Calhoun County Navigation district.

Primarily soft clays were encountered from mudline El. -5-ft to about El. -25-ft, and underlain by medium to firm clays to about El. -50-ft. Thereafter, dense sands were encountered to El. -70-ft MLLW.

Summary of the soil strength and index properties in tabular format is presented below.

Generalized Soil Profile: Sta. 11+000 to 57+000						
El. (ft)	**Description**	**Moisture Content (%)**	**LL (---)**	**Su (psf)**	**SPT N_{60} (bpf)**	**Total Unit Weight (pcf)**
-5 to -25	Soft to Firm Clay, with sand layers	24 - 30	40 - 70	400 – 1,000	---	117 - 120
-25 to -50	Medium to Firm Clay	24 - 30	40 - 80	400 – 1,600	---	115 - 125
-50 to -70	Medium to dense Silty and Clayey Sands	23 - 40	---	-	25 - 100	115 - 130
LL: Liquid Limit, Su = Undrained Shear Strength, SPT = Standard Penetration Test						

6 LABORATORY TEST RESULTS

The laboratory test results are presented on the boring logs within Appendices B through D. Summary sheets and detailed results of various geotechnical laboratory tests are presented within the Appendix E.

The results of thirty five (35) consolidated-undrained (CU) multi-stage triaxial compression are further discussed below. Based on soil index properties (water content or plasticity index) and the results of high quality CU tests, empirical site specific correlation can be prepared for slope stability analysis to support the dredging activity.

6.1 Consolidated Undrained (CU) Multi-Stage Triaxial Compression Tests

Undisturbed samples of cohesive samples were selected by USACE to perform multi-stage consolidated-undrained triaxial compression tests in accordance with ASTM D4767. This test method determines the strength and stress-strain relationships of a cylindrical cohesive specimen. Details of the test procedure is presented within Section 4, Laboratory Testing.

The results including effective and total stress cohesion and fiction angle are summarized in tabular format within Appendix E, page E-32. Detailed CU test results are presented within Appendix E, CU Multi-Stage Triaxial Tests, pages E-608 through E-705.

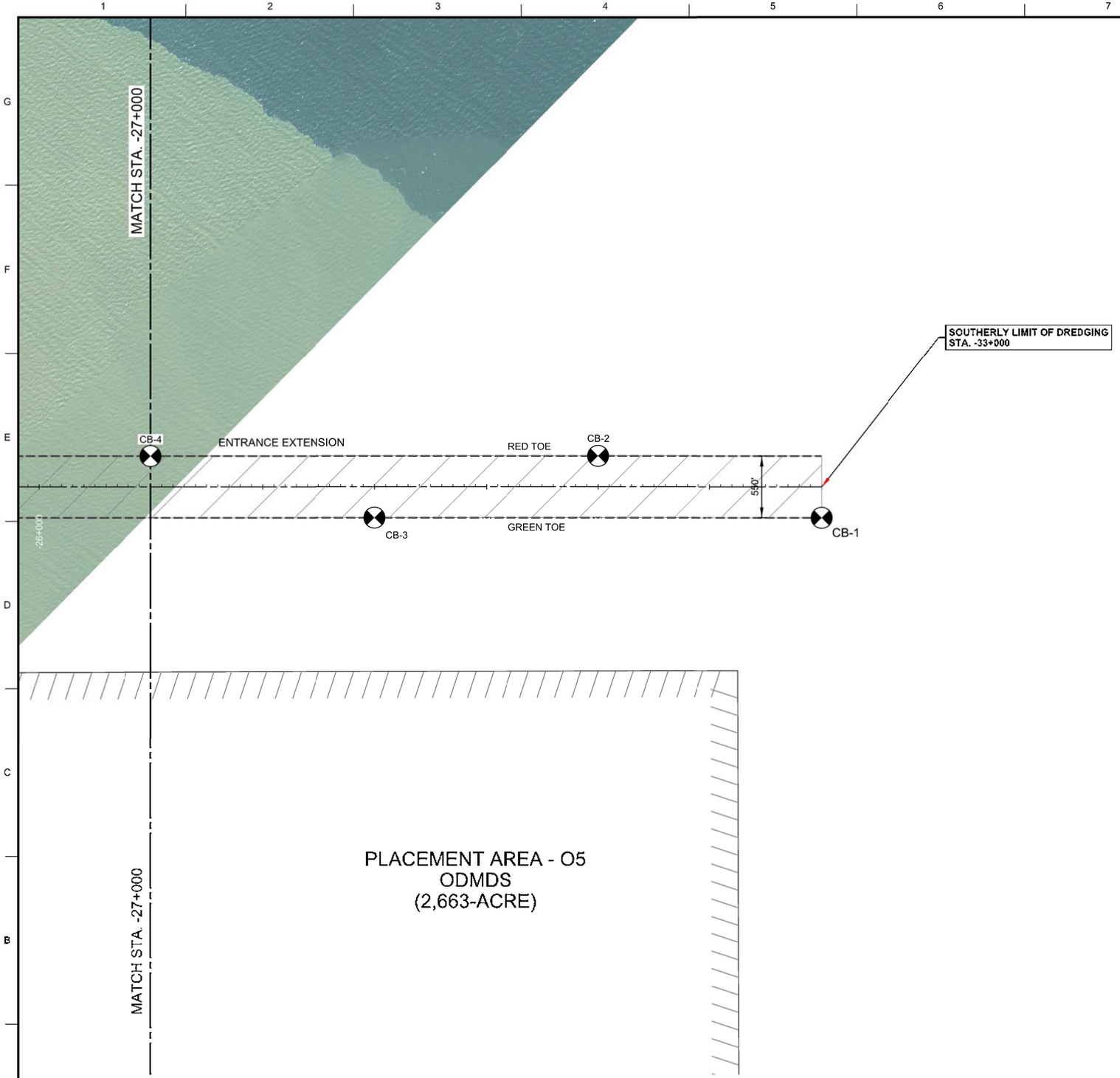
The design cohesion and friction angles should be also evaluated with respect to the index properties (Atterberg Limit, moisture content, etc), and published correlations (Soil Strength and Slope Stability Chapter 5, 2nd Edition by Duncan Et. Al.)

7 LIMITATIONS

This data geotechnical data report has been prepared for the exclusive use of Port of Calhoun and USACE for the Matagorda Bay shipping channel dredging project. This data report has been prepared in accordance with generally-accepted geotechnical engineering practices common to the local area. No other warranty, expressed or implied, is made.

APPENDIX A

PLAN VIEW TEST LOCATIONS, FENCE DIAGRAMS, AS-TESTED COORDINATES AND ELEVATION



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. -27+000 TO STA. -33+000
SCALE: 1"=500'

PLAN NORTH

0 500' 1000'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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Galveston District

MARK	DESCRIPTION	DATE

DESIGNED BY: TUAN NGUYEN
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CHECKED BY: CESAR RAMOS
SUBMITTED BY: CESAR RAMOS
SCALE: AS NOTED
ANSI D

ISSUE DATE: DATE 2021
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.:
SWG FILE NO.: GUAD 0705-0244

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GALVESTON, TEXAS 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL,
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. -27+000 TO STA. -33+000

SHEET ID
CN101

35% REVIEW

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN101 (PLAN VIEW).dgn
Model Name: ANSI D Date: 3/5/2021 Time: 8:02:18 PM
By: m3ecetqn

F O F M E X I C O

MATCH STA. -13+000

MATCH STA. -27+000

N OF

SEAGULL TRANSMISSION CO
PERMIT NO. 14794
STA. -18+767 ±
1-24" PIPELINE
(OLD STA. -18+570 +/-)

STA. -20+000.00

P.I. STA. -20+246.49

PROPOSED SEDIMENT TRAP

CB-10

CB-11

CB-9

CB-8

CB-7

CB-6

CB-5

CB-4

RED TOE

GREEN TOE

RED TOE

GREEN TOE

850'

550'

550'

WHISTLE BOUY

N. 45° 25' 40" E.

-14+000

-15+000

-16+000

-17+000

-18+000

-19+000

-20+000

-21+000

-22+000

-23+000

-24+000

-25+000

-26+000

PLACEMENT AREA - 1
ODMDS
(457-ACRE)

PLACEMENT AREA - O5
ODMDS
(2,663-ACRE)

MATCH STA. -13+000

MATCH STA. -27+000

PLAN NORTH

A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. -13+000 TO STA. -27+000
SCALE: 1"=500'

0 500' 1000'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN102 (PLAN VIEW).dgn
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SUBMITTED BY: CESAR RAMOS
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PLAN VIEW
STA. -13+000 TO STA. -27+000

SHEET ID
CN102

35% REVIEW



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 0+000 TO STA. -13+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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PLAN VIEW
STA. 0+000 TO STA. -13+000

SHEET ID
CN103

35% REVIEW

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SUNDOWN ISLAND

MATCH STA. 13+000

MATCH STA. 0+000

CB-22

CB-21

CB-20

CB-19

CB-18

RED TOE

GREEN TOE

300'

425'

550'

RANGE "B" FRONT LIGHT

MATAGORDA PENNINSULA

N=13356161.77
E=2815990.67

N=13352523.10
E=2820761.41

N=13354253.48
E=2814535.20

N=13350614.80
E=2819305.94

VB-3

VB-2

VB-1

NP-1
(331-ACRE)

LPG

STA. 3+319.91

STA. 3+453.66

P.I. STA. 3+453.66

CHANNEL-2

"MP-3"
285641.76
224842.94

"MP-2"
285414.72
224165.23

"BP-2E"
285414.72
224165.23

0+000 C/L SOUTH JETTY
X=2,858,202.8300
Y=224,755.9000

PLAN NORTH

0 500' 1000'

A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 13+000 TO STA. 0+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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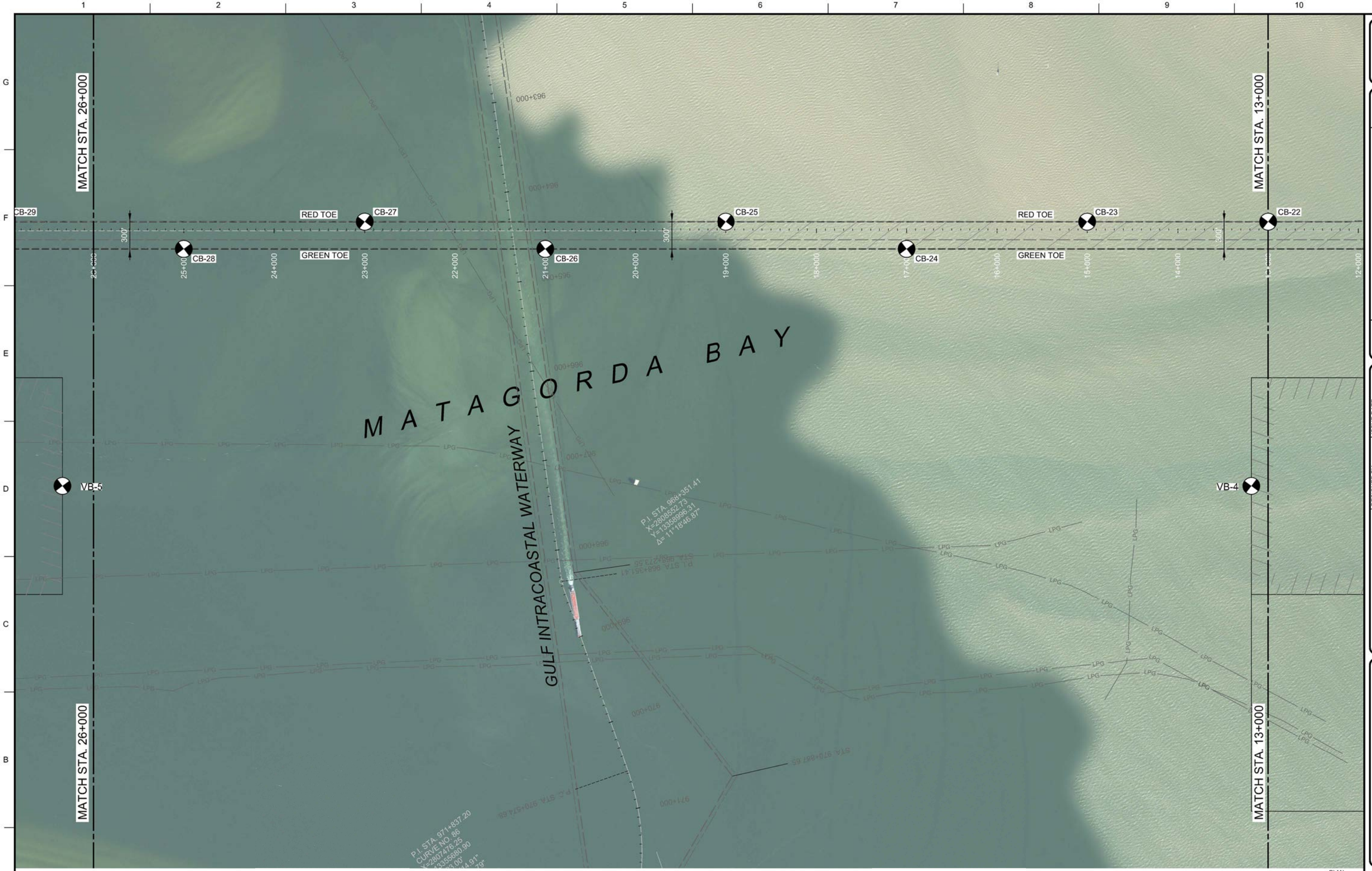
PLAN VIEW
STA. 13+000 TO STA. 0+000

SHEET ID

CN104

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A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 26+000 TO STA. 13+000
SCALE: 1"=500'

0 500' 1000'

%PRODUCTION DATA 1%
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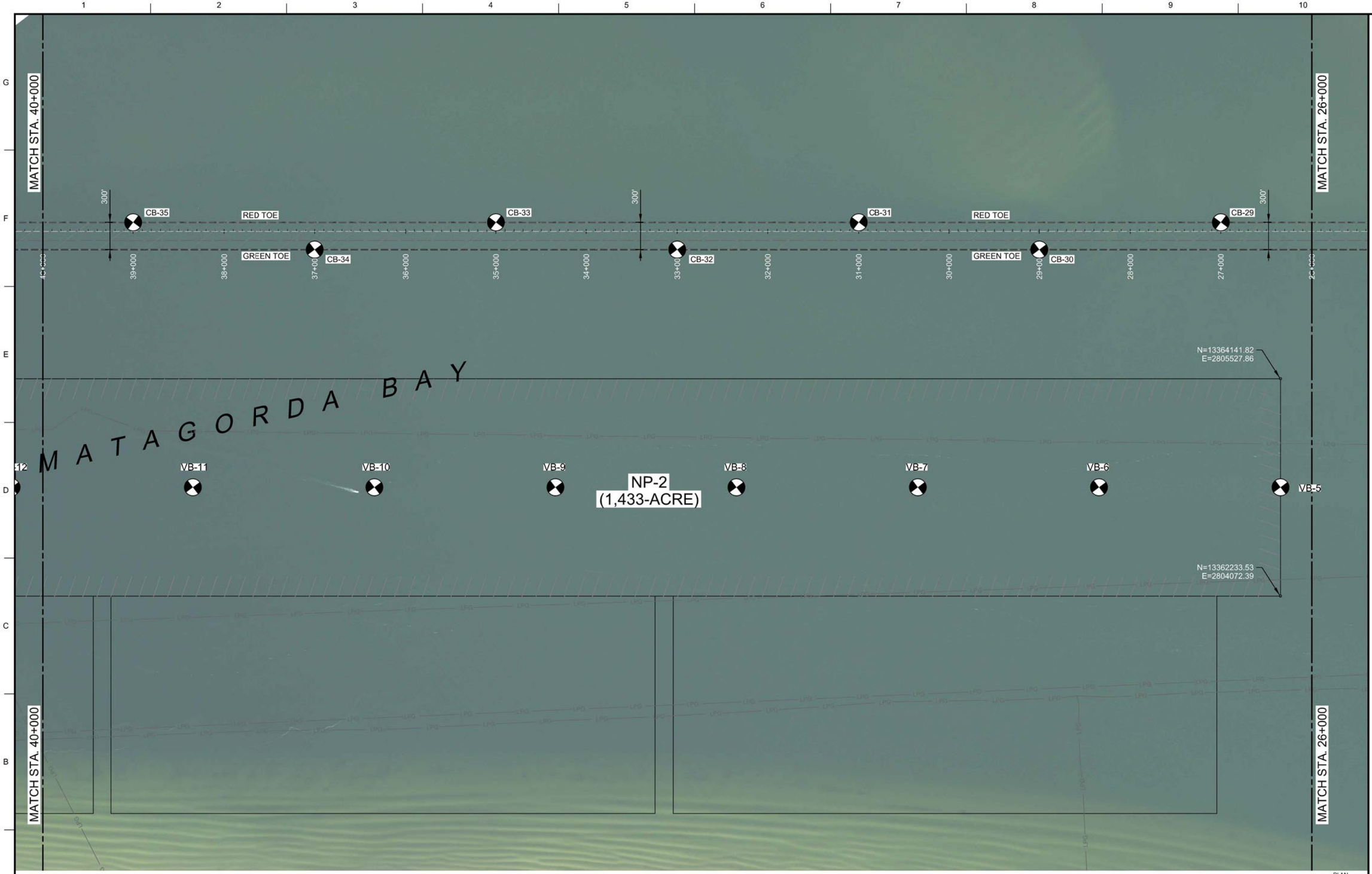
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 26+000 TO STA. 13+000

SHEET ID
CN105

35% REVIEW

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A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 40+000 TO STA. 26+000

SCALE: 1"=500'

0 500' 1000'

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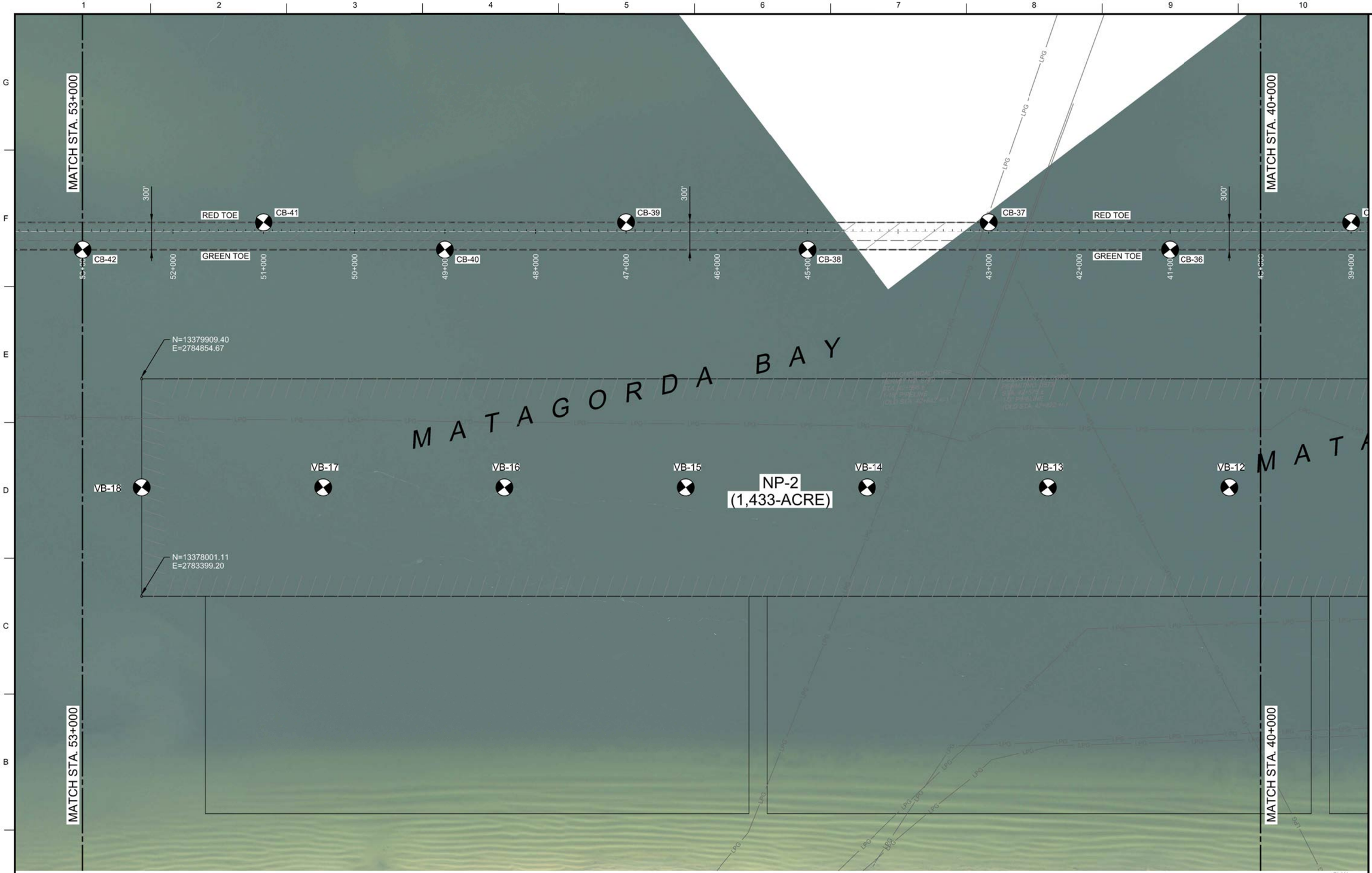
PLAN VIEW
STA. 40+000 TO STA. 26+000

SHEET ID

CN106

35% REVIEW

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By: m3ecetqn



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 53+000 TO STA. 40+000

SCALE: 1"=500'

0 500' 1000'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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MATAGORDA SHIP CHANNEL, TEXAS

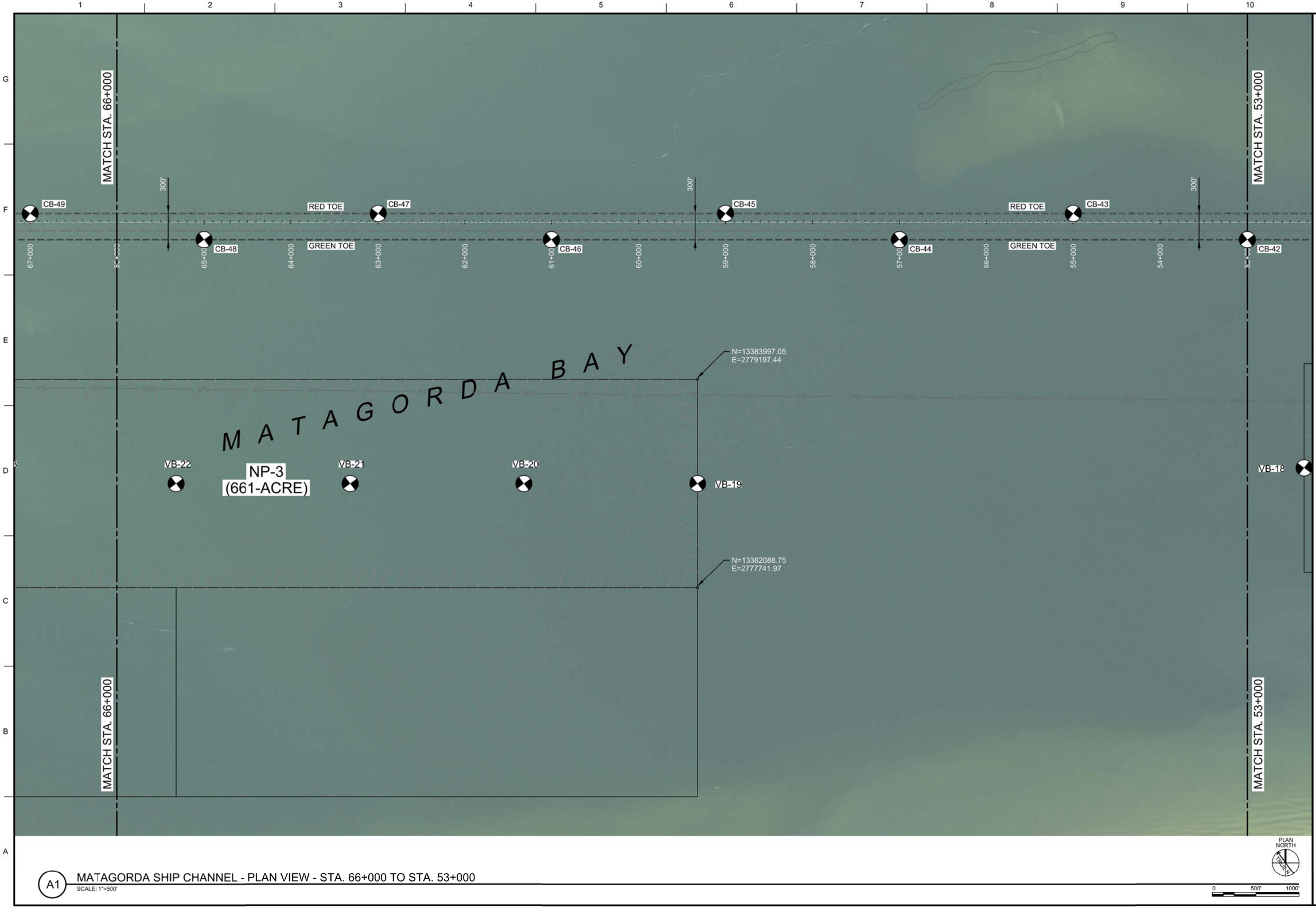
PLAN VIEW
STA. 53+000 TO STA. 40+000

SHEET ID

CN107

35% REVIEW

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By: m3ecetqn



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 66+000 TO STA. 53+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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SWG FILE NO.:	GUAD 0705-0244

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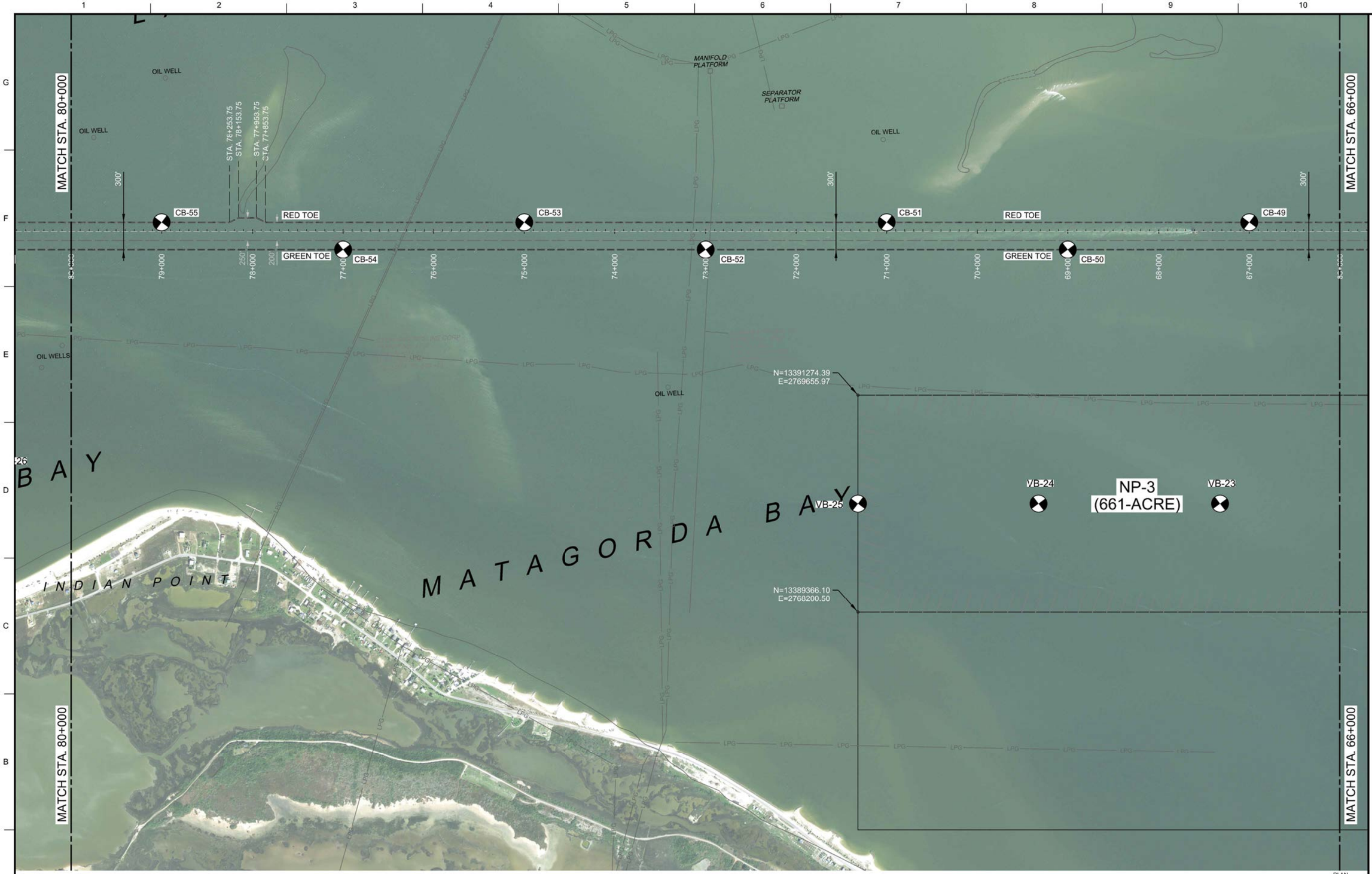
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 66+000 TO STA. 53+000

SHEET ID
CN108

35% REVIEW

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN108 (PLAN VIEW).dgn
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By: m3ecetqn



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 80+000 TO STA. 66+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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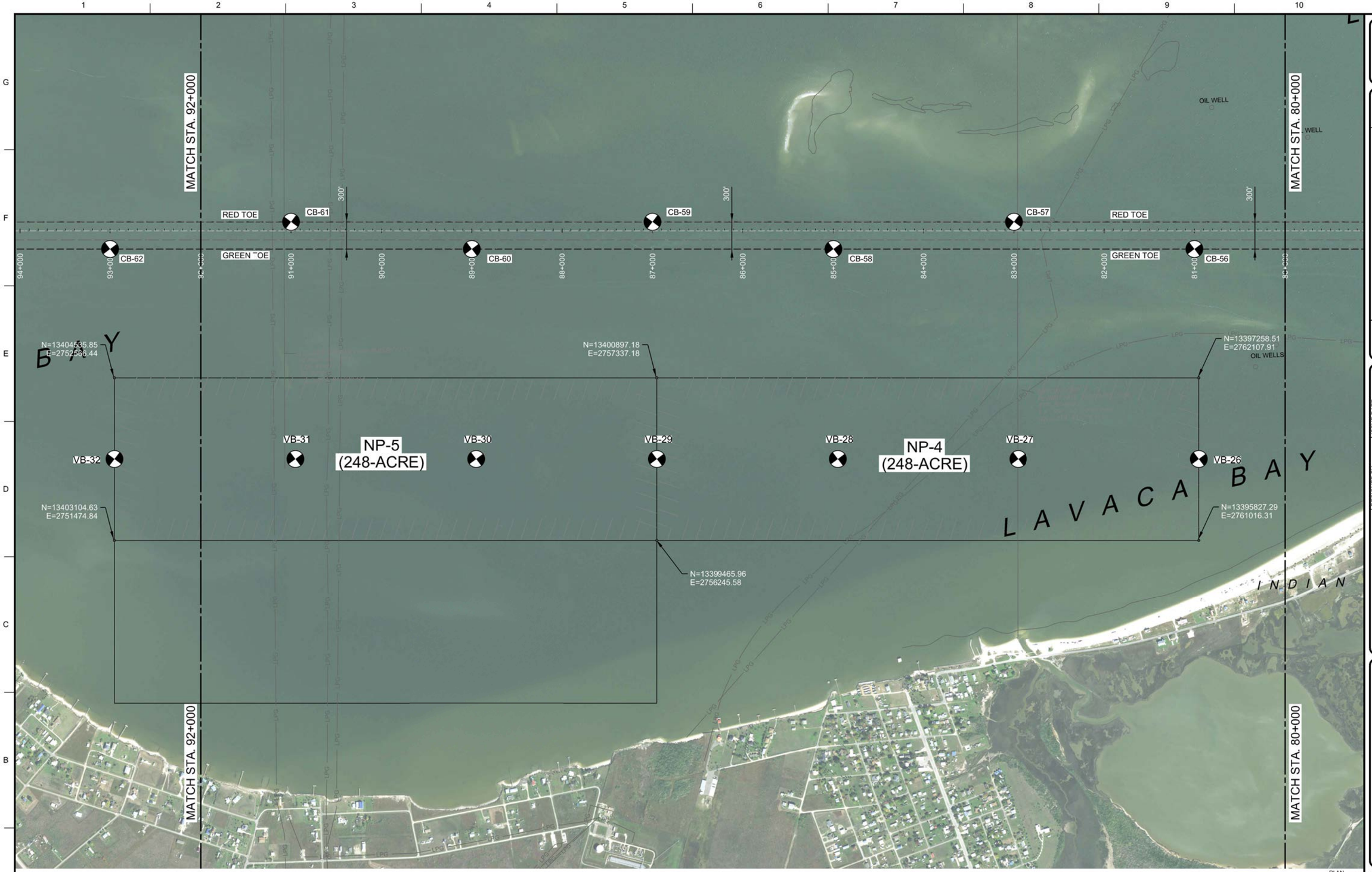
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 80+000 TO STA. 66+000

SHEET ID
CN109

35% REVIEW

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN109 (PLAN VIEW).dgn
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A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 92+000 TO STA. 80+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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Galveston District

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CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 92+000 TO STA. 80+000

SHEET ID
CN110

35% REVIEW

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN110 (PLAN VIEW).dgn
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By: m3ecetqn



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 106+000 TO STA. 92+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

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SIZE: ANSI D	SCALE: AS NOTED

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GALVESTON, TEXAS 77550

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TIMOTHY R. VAIL,
COLONEL, EN, U.S. ARMY, COMMANDING

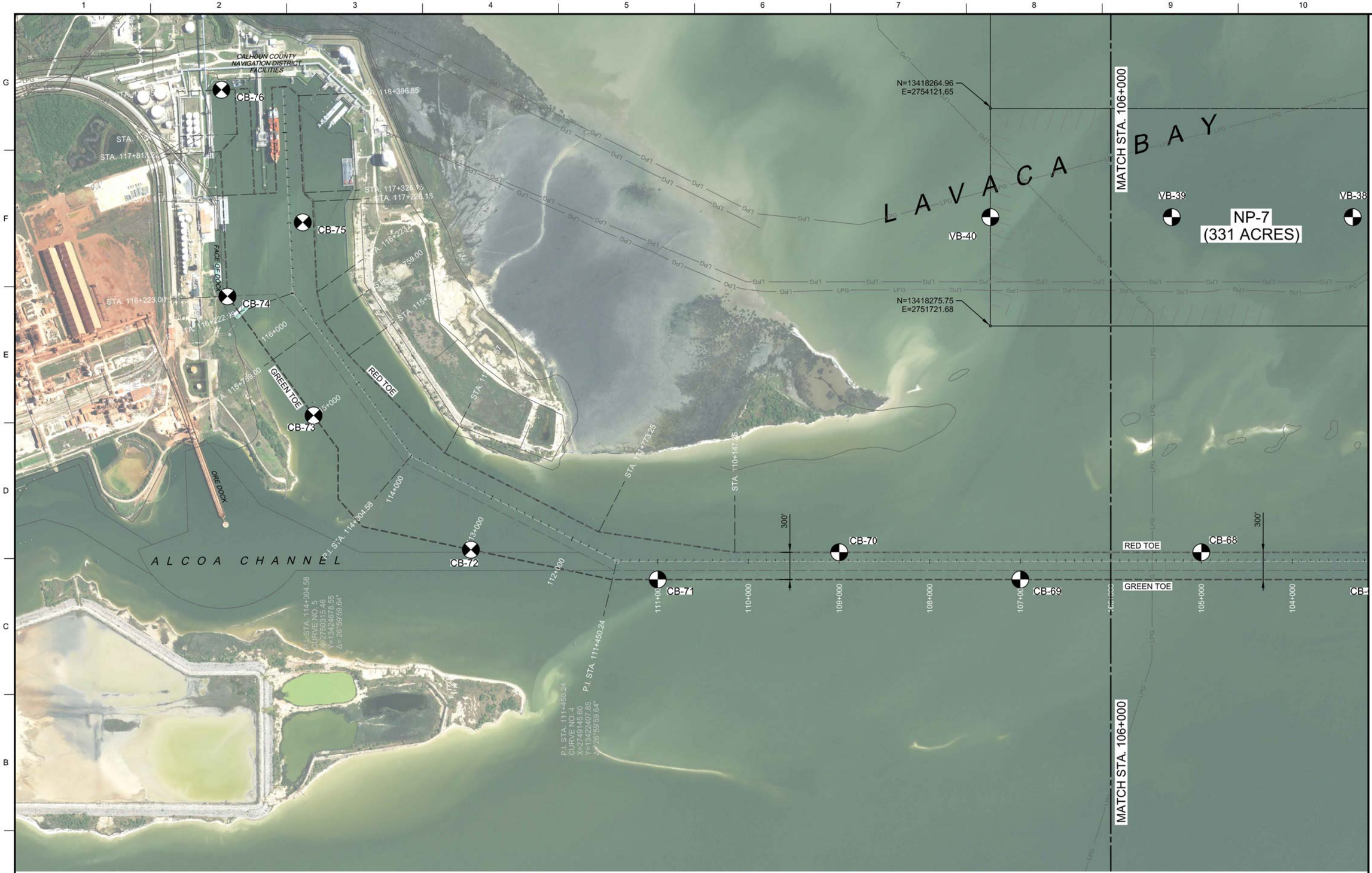
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 106+000 TO STA. 92+000

SHEET ID
CN111

35% REVIEW

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Model Name: ANSI D Date: 3/5/2021 Time: 8:35:49 PM
By: m3ecetqn



U.S. Army Corps of Engineers
Galveston District

MARK	DESCRIPTION	DATE

DESIGNED BY:	TUAN NGUYEN
DRAWN BY:	TUAN NGUYEN
CHECKED BY:	CESAR RAMOS
SUBMITTED BY:	CESAR RAMOS
SIZE:	ANSI D
ISSUE DATE:	DATE 2021
SOLICITATION NO.:	W912HY21B0000
CONTRACT NO.:	
SWG FILE NO.:	GUAD 0705-0244

U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TEXAS 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL,
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
STA. 118+502 TO STA. 106+000

SHEET ID

CN112

PLAN NORTH
TRUE N.

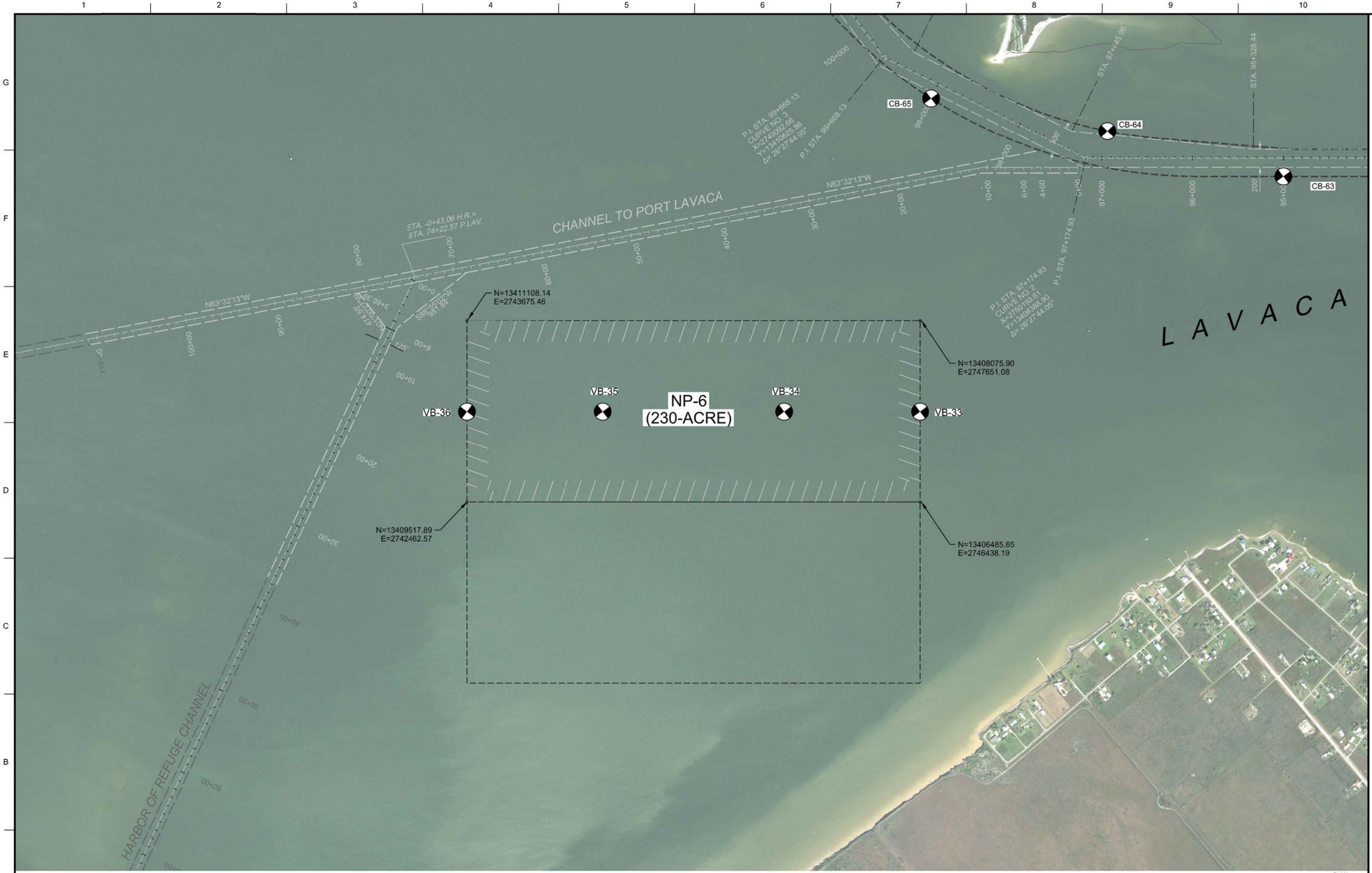
0 500' 1000'

A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - STA. 118+502 TO 106+000
SCALE: 1"=500'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

35% REVIEW

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN112 (PLAN VIEW).dgn
Model Name: ANSI D Date: 3/5/2021 Time: 8:38:31 PM
By: m3ecetqn



A1 MATAGORDA SHIP CHANNEL - PLAN VIEW - NP-6
SCALE: 1"=500'

PLAN NORTH

0 500' 1000'

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

35% REVIEW

U.S. Army Corps of Engineers
Galveston District

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
TUAN NGUYEN	DATE 2021
DRAWN BY:	SOLICITATION NO.:
TUAN NGUYEN	W912HY21B0000
CHECKED BY:	CONTRACT NO.:
CESAR RAMOS	
SUBMITTED BY:	SWG FILE NO.:
CESAR RAMOS	GUAD 0705-0244
SCALE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TEXAS 77550

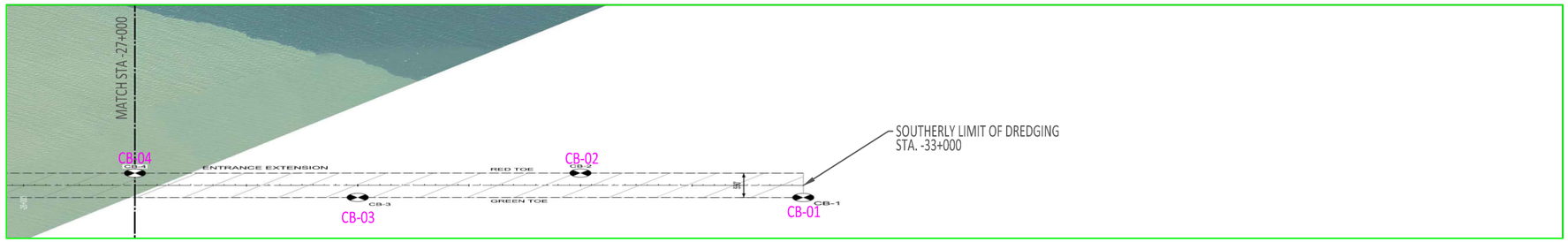
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL,
COLONEL, EN, U.S. ARMY, COMMANDING

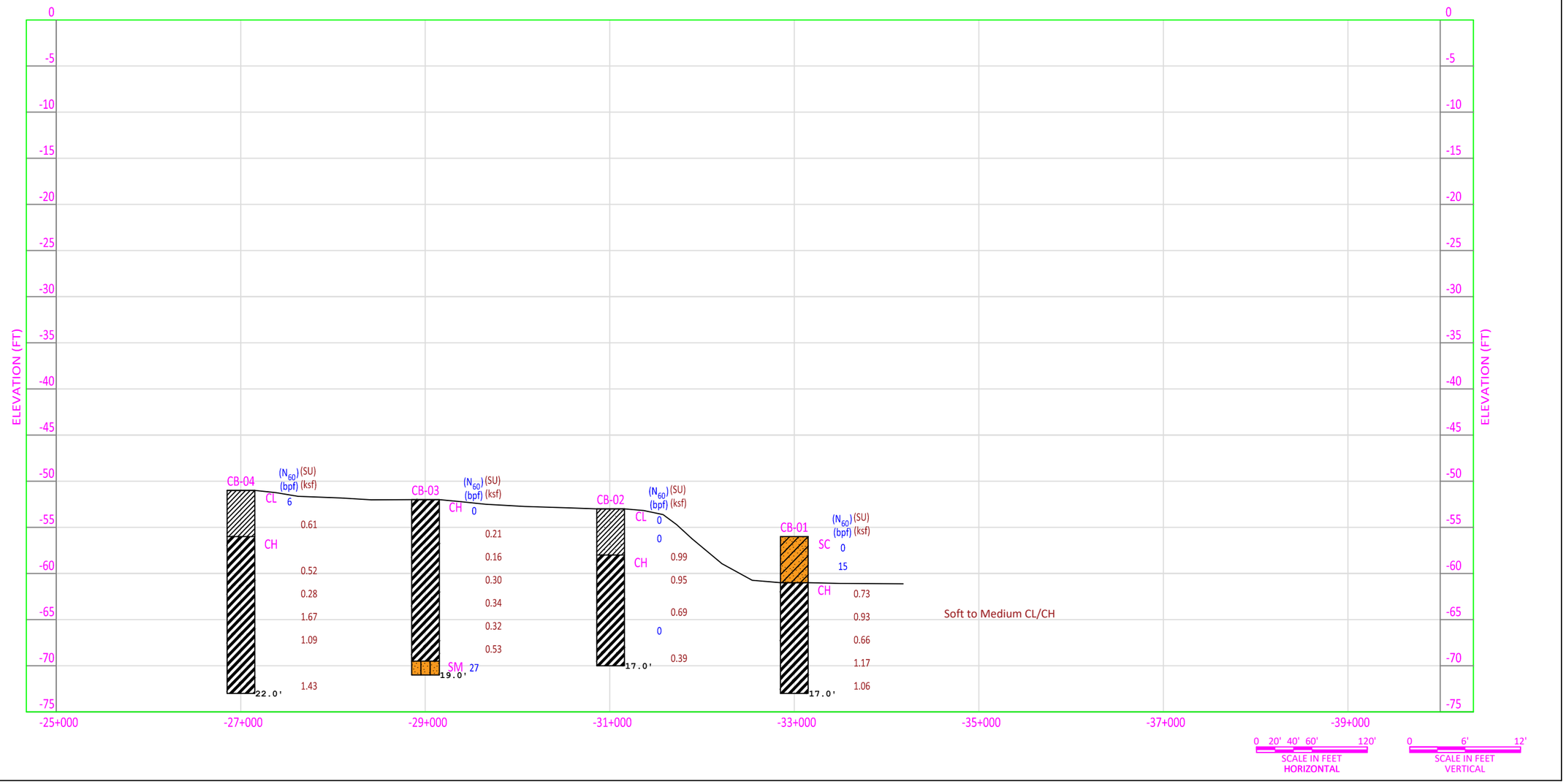
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PLAN VIEW
NP-6

SHEET ID
CN113

File: W:\CADD\Projects\GUAD\0705-0244 MSC DEEPENING Contract No.1 FY22\CAD_BIM_Sheets\GUAD 0705-0244_CN113 (PLAN VIEW).dgn
Model Name: ANSI D Date: 3/5/2021 Time: 8:46:12 PM
By: m3ecetqn





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil		
CL	CH	MH	
CL	CH	CL-ML	
CL	CH		

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Shiney Verghese, Verg Engineers
SIZE: 11" by 17"
ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

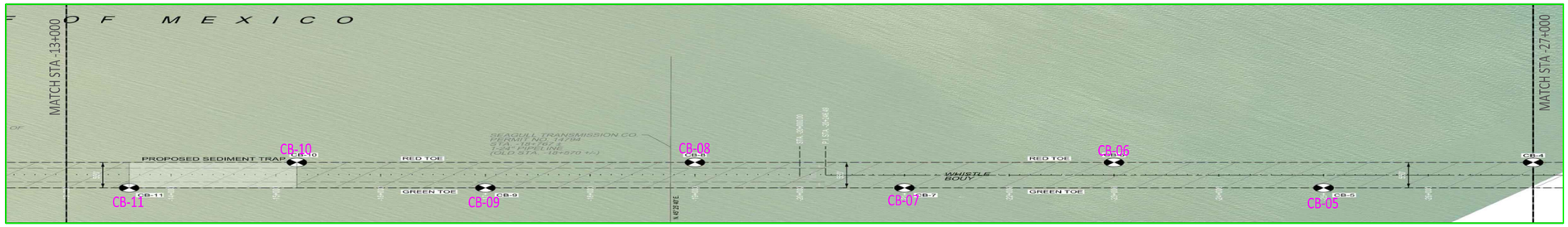
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

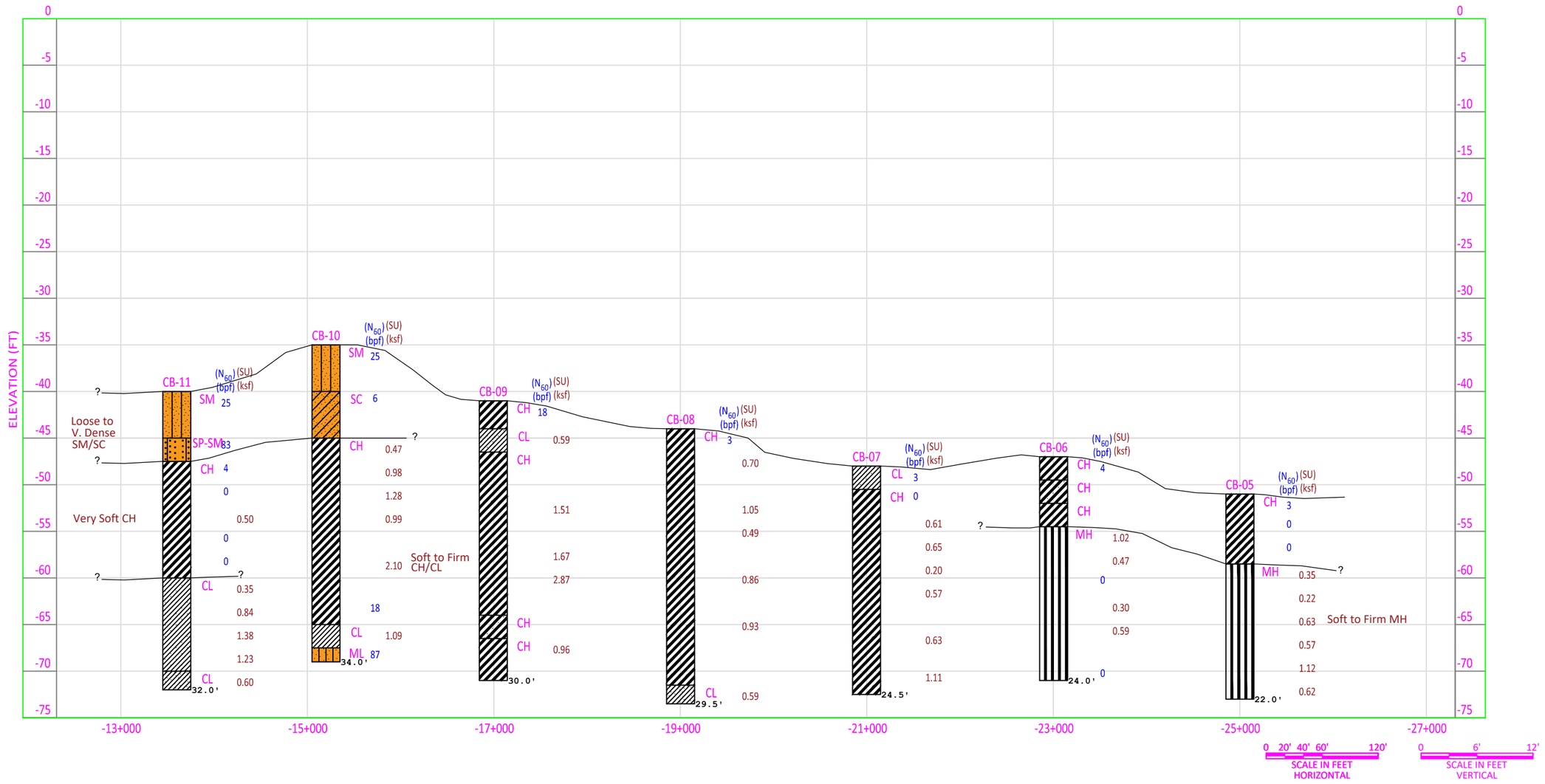
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAL
COLONEL, EN, U.S. ARMY - COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. -27+000 TO STA. -33+000

SHEET ID
CN 114





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil
	SP
ML	SM
SC	SP-SM

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Tommy Wong Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

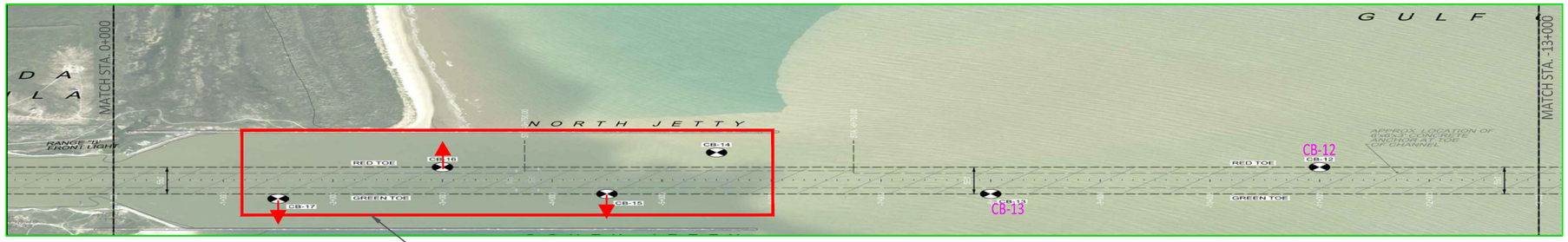
US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

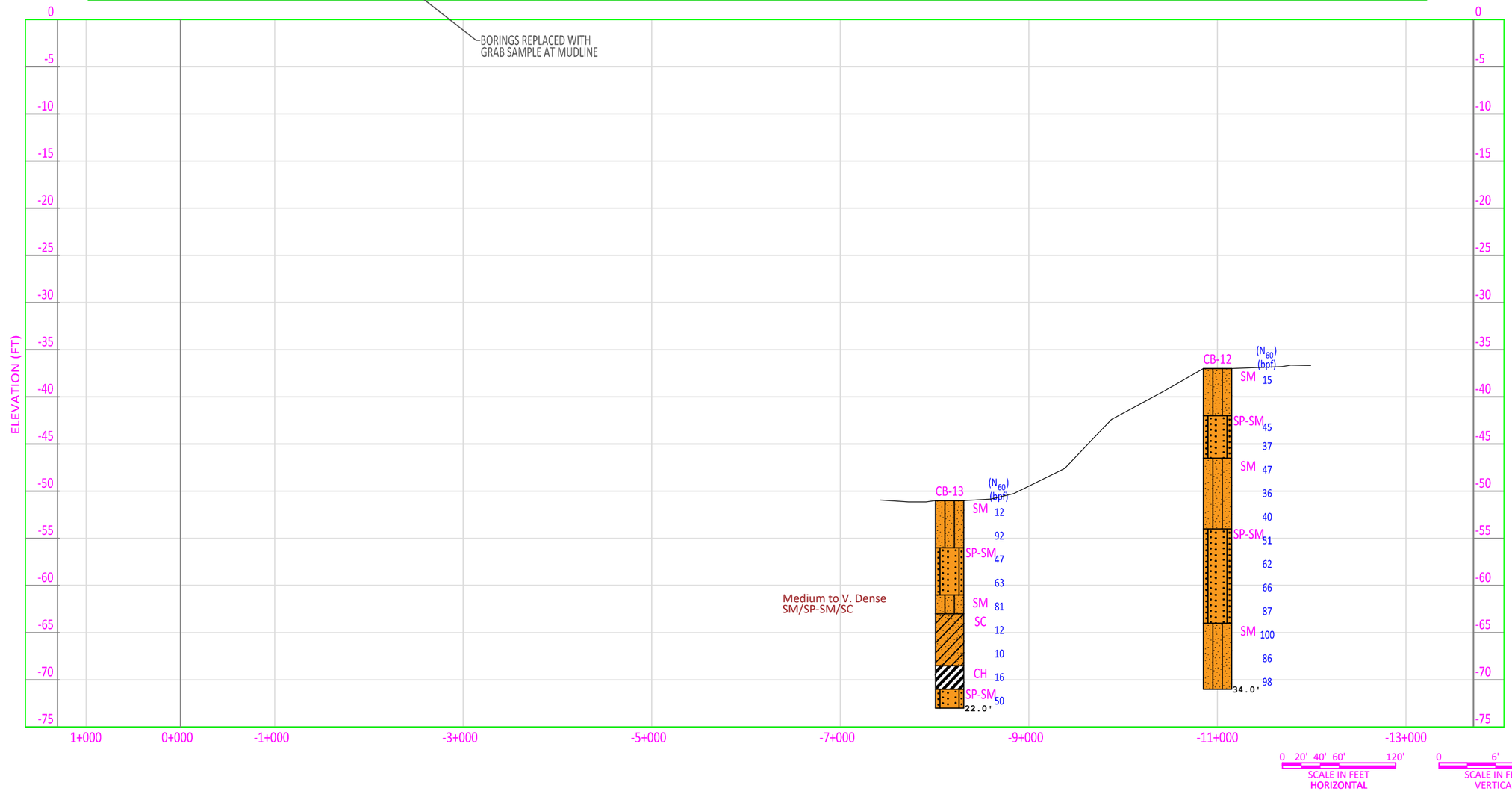
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. -13+000 TO STA. -27+000

SHEET ID
CN 115



BORINGS REPLACED WITH GRAB SAMPLE AT MUDLINE



Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Taylor Wong Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT 2000 FORT POINT ROAD GLAVESTON, TX 77550

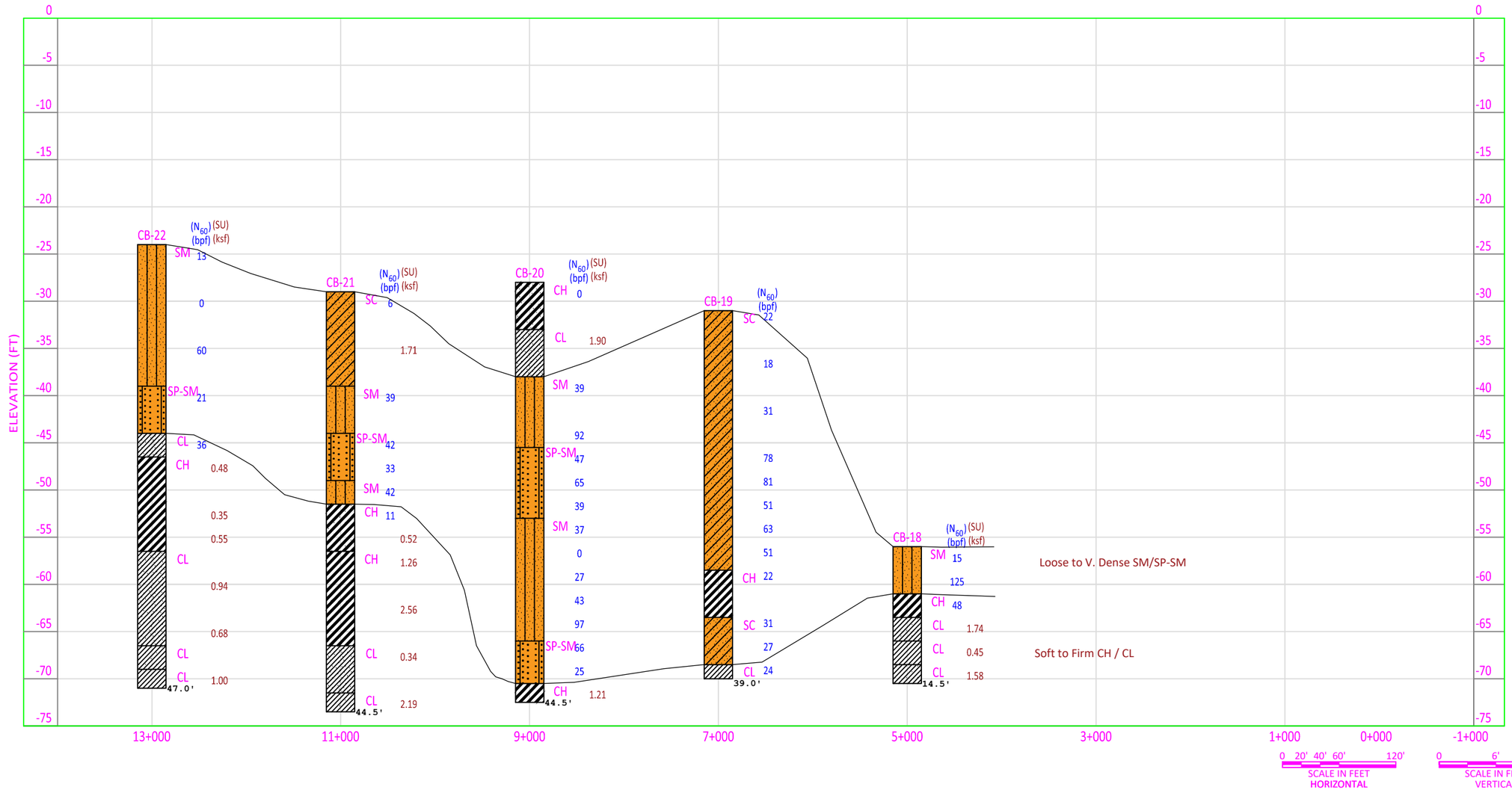
PREPARED UNDER THE DIRECTION OF TIMOTHY R. VAIL COLONEL, EN U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 0+000 TO STA. -13+000

SHEET ID
CN 116





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil		
CL	CH	MH	
CL	CH	CL-ML	
CL	CH		

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Stanley Wong Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

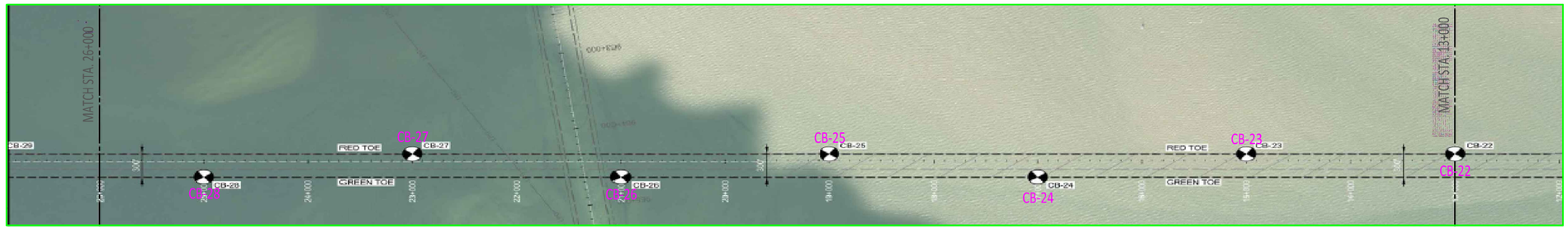
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

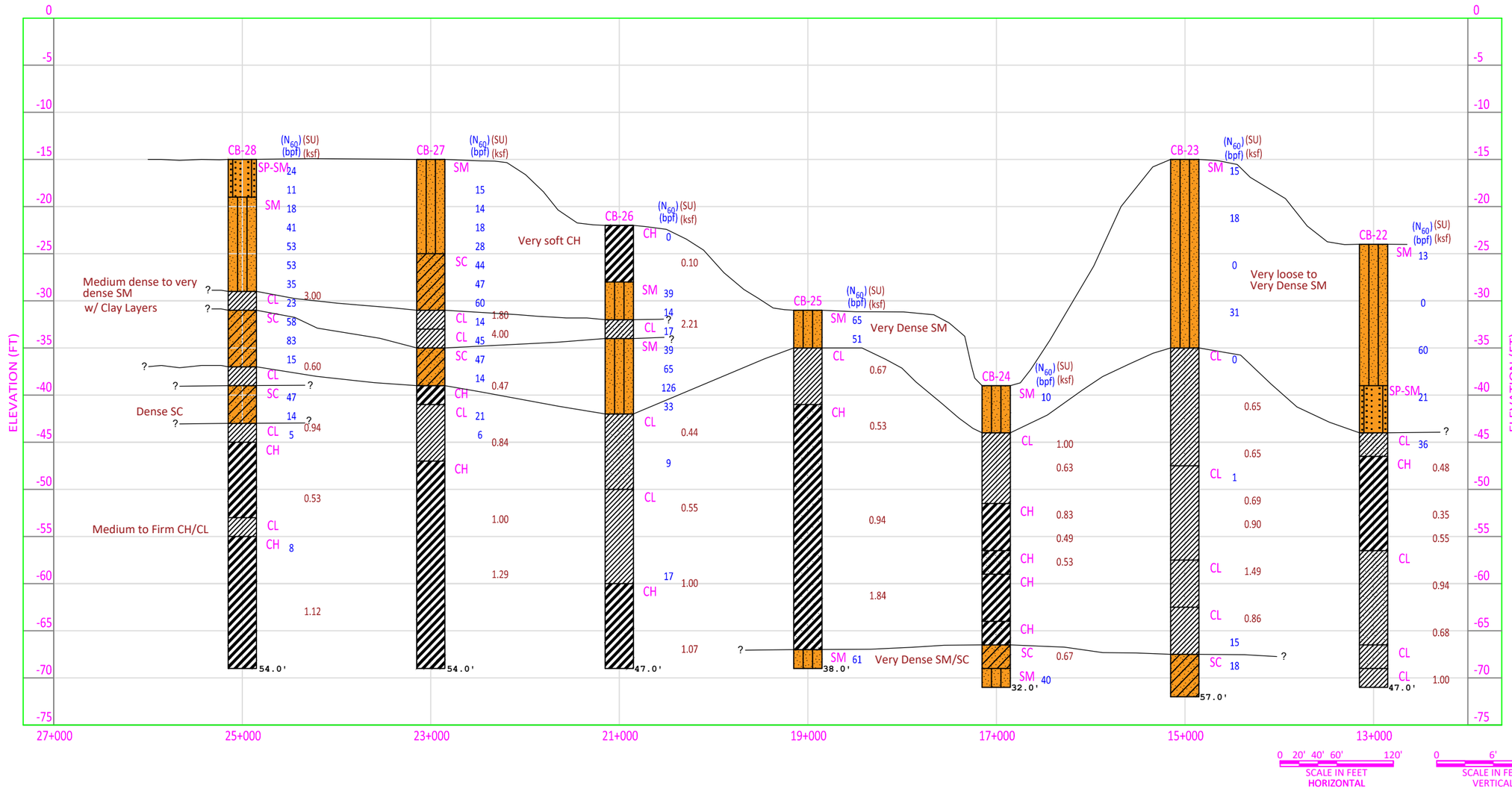
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN : U.S. ARMY : COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 13+000 TO STA. 0+000

SHEET ID
CN 117





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY:	AA	ISSUE DATE:	12/16/21
DRAWN BY:	TT	SOLICITATION NO.:	W912HY21B0000
CHECKED BY:	AA	CONTRACT NO.:	N/A
SUBMITTED BY: Tommy Wong Engineers		SWG FILE NO.:	GUAD 0705-0244
SIZE: 11" by 17"			

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

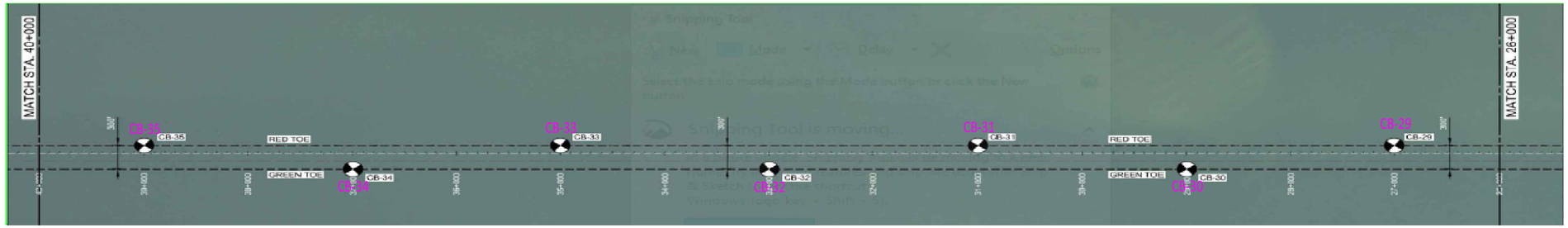
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

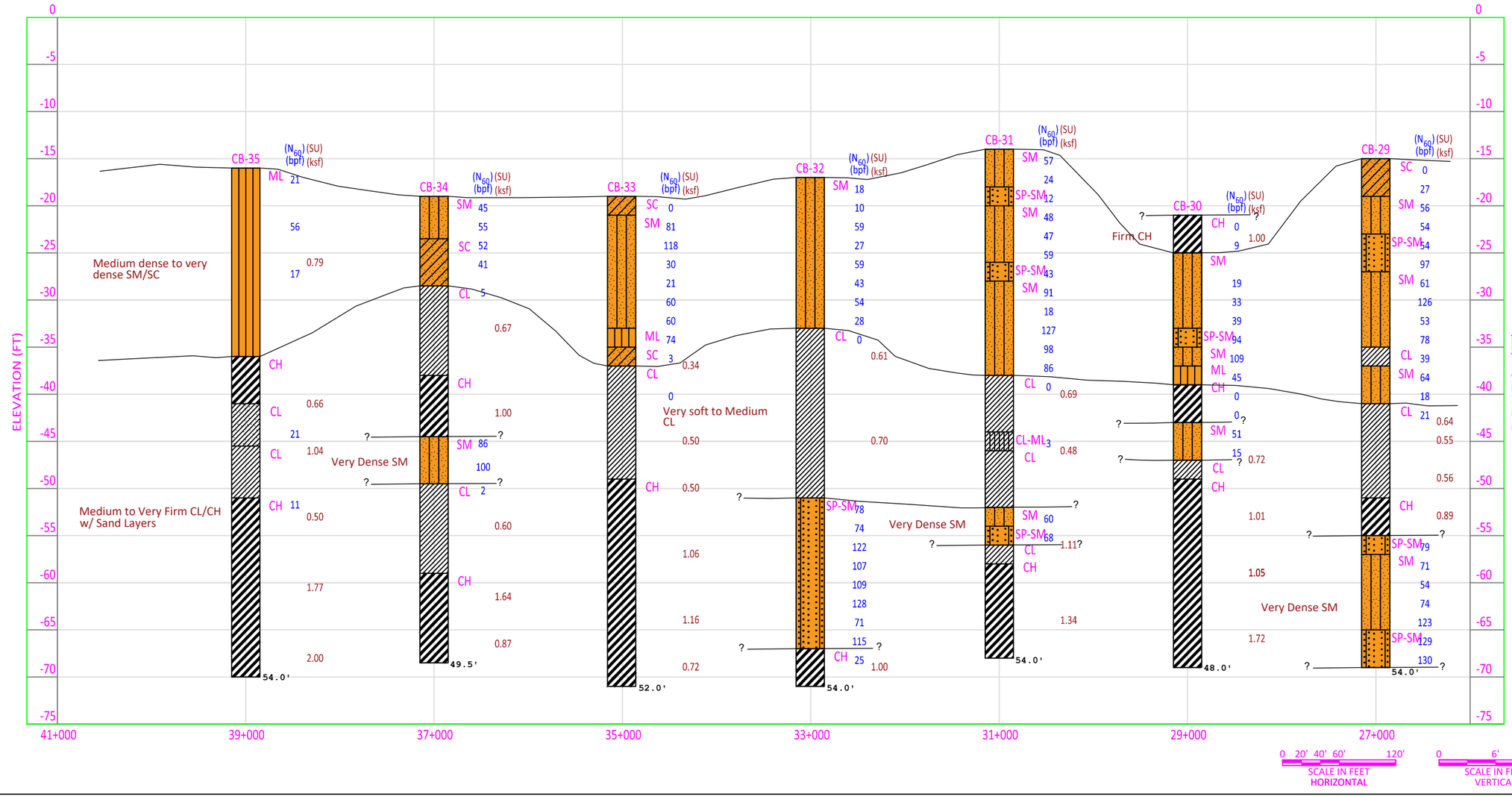
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 26+000 TO STA. 13+000

SHEET ID

CN 118





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Stacy Young Engineers
SIZE: 11" by 17"
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

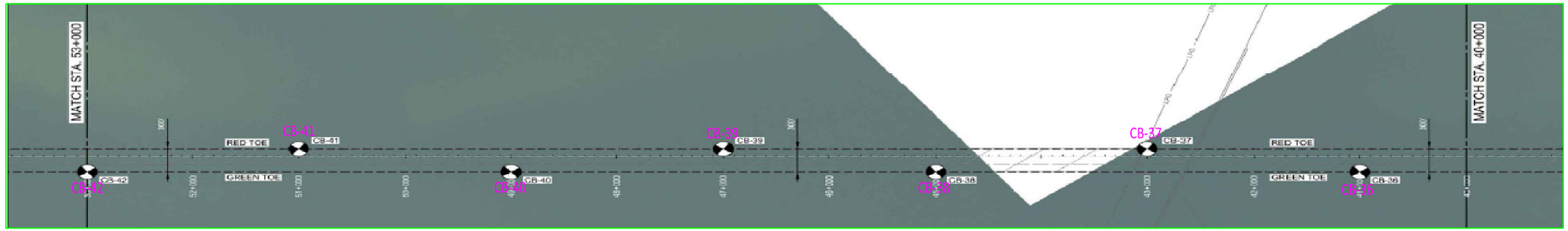
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77550

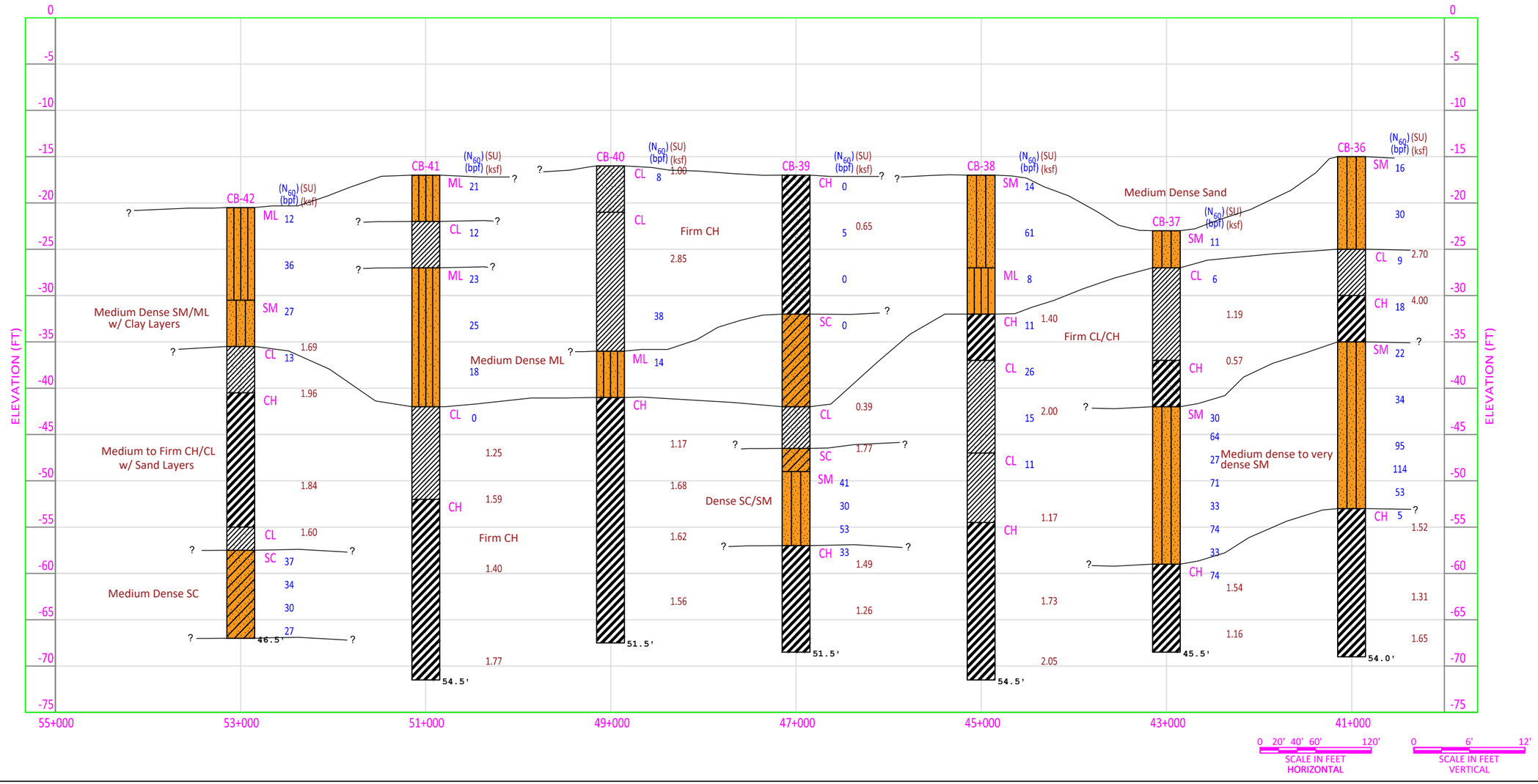
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 40+000 TO STA. 26+000

SHEET ID
CN 119





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

NO.	DESCRIPTION	MARK	DATE
01	Issued for Finnal Factual Report	AA	12/16/21

SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Ramsey Kong Engineers
SIZE: 11" by 17"
SWG FILE NO.: GUAD 0705-0244

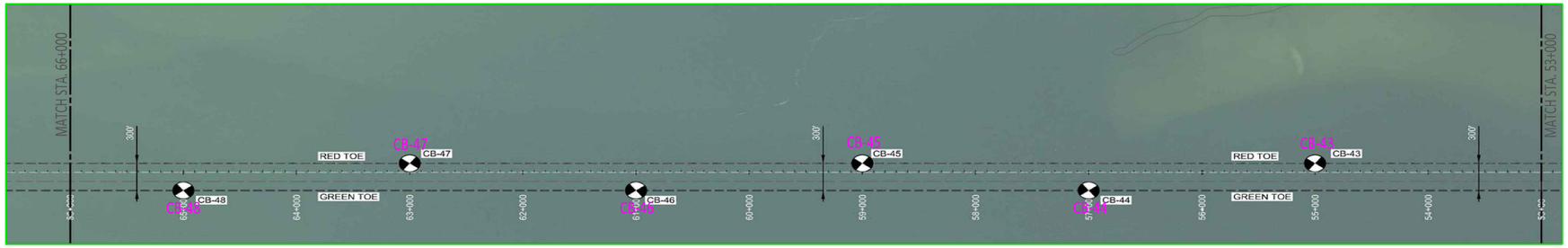
US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

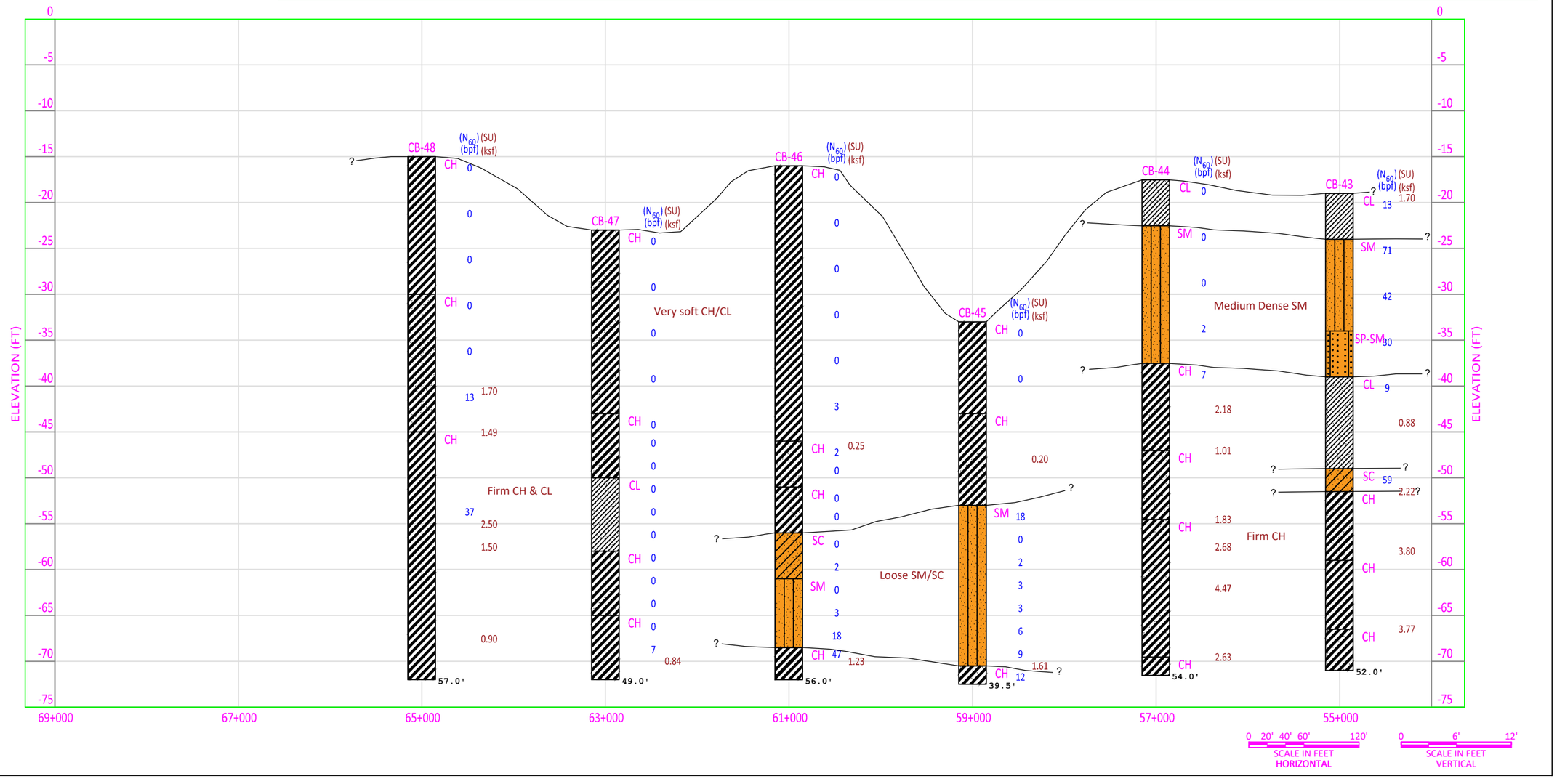
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAL.
COLONEL. EN. U.S. ARMY. COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 53+000 TO STA. 40+000

SHEET ID
CN 120





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil		
CL	CH	MH	
CL	CH	CL-ML	
CL	CH		

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUBMITTED BY:
AA	TT	AA	Tetra Tech Moving Engineers

SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 07/05-0244

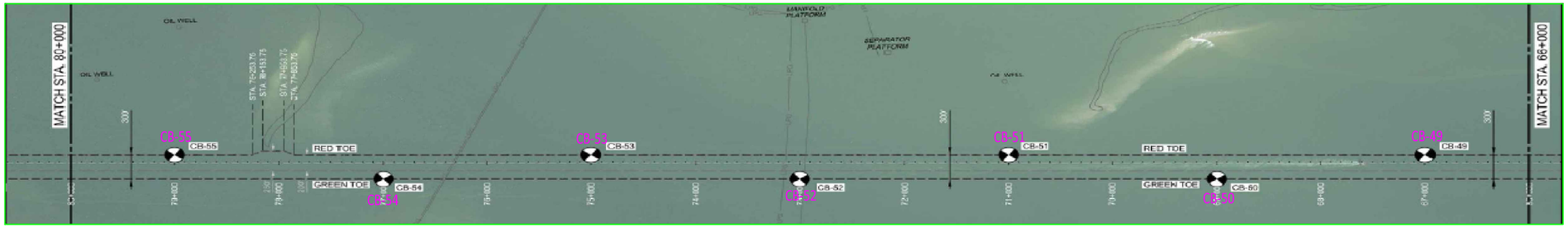
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77550

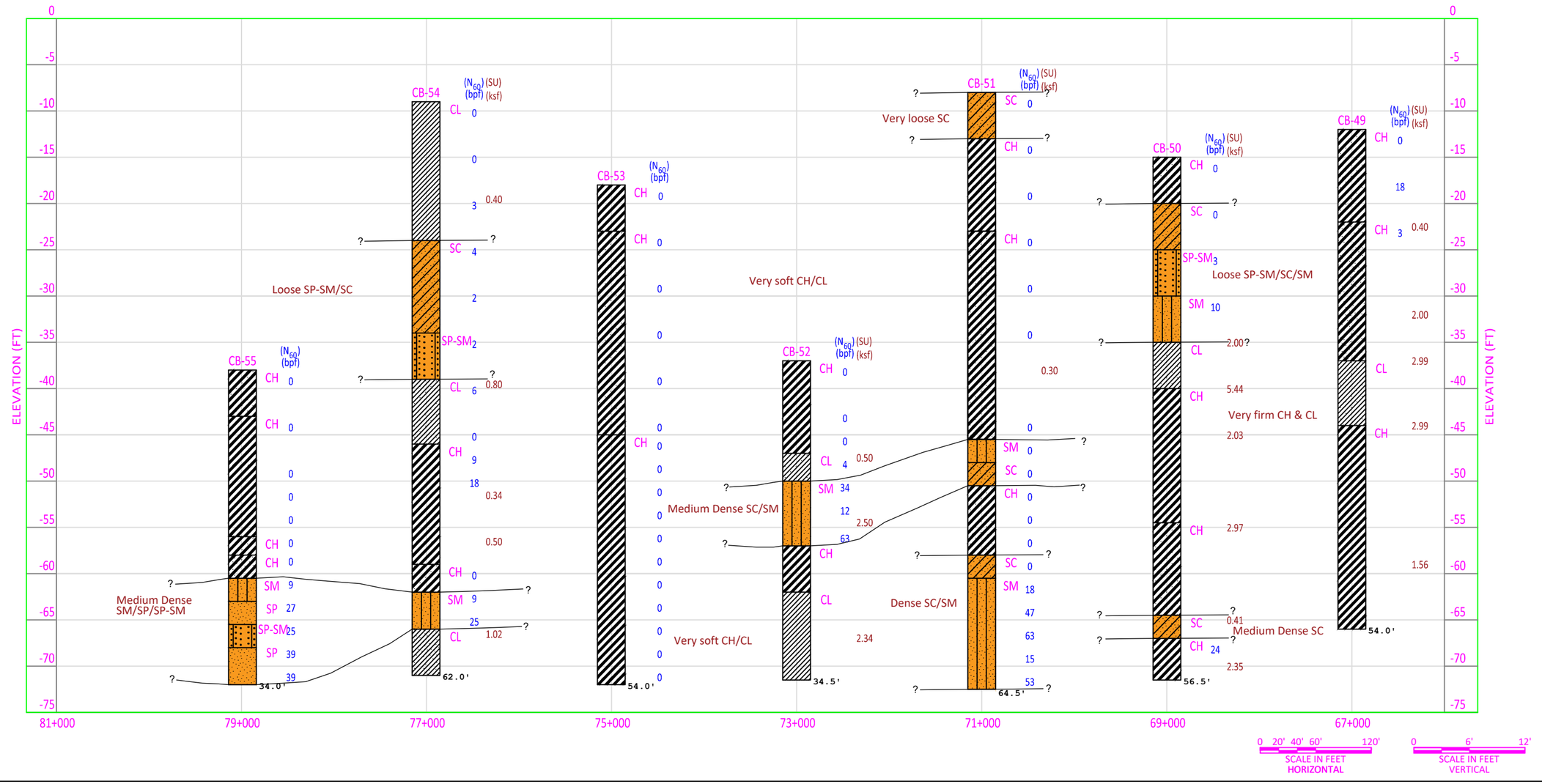
PREPARED UNDER THE DIRECTION OF
TIMOTH R. VAL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 66+000 TO STA. 53+000

SHEET ID
CN 121





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

NO.	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Timothy Wong Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

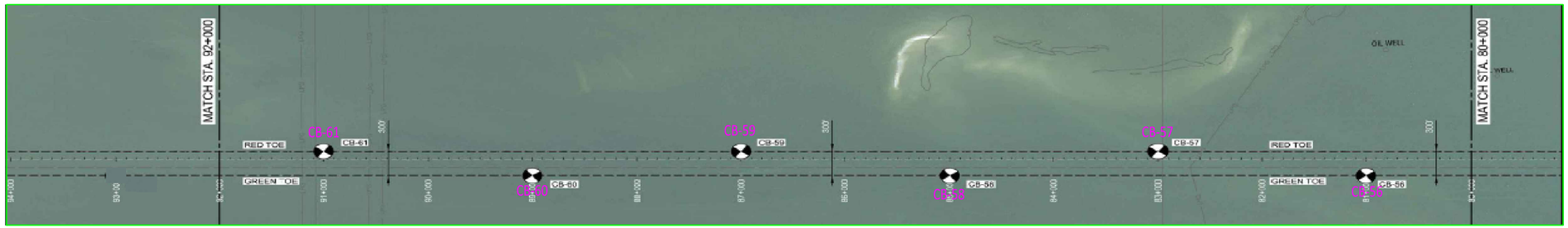
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

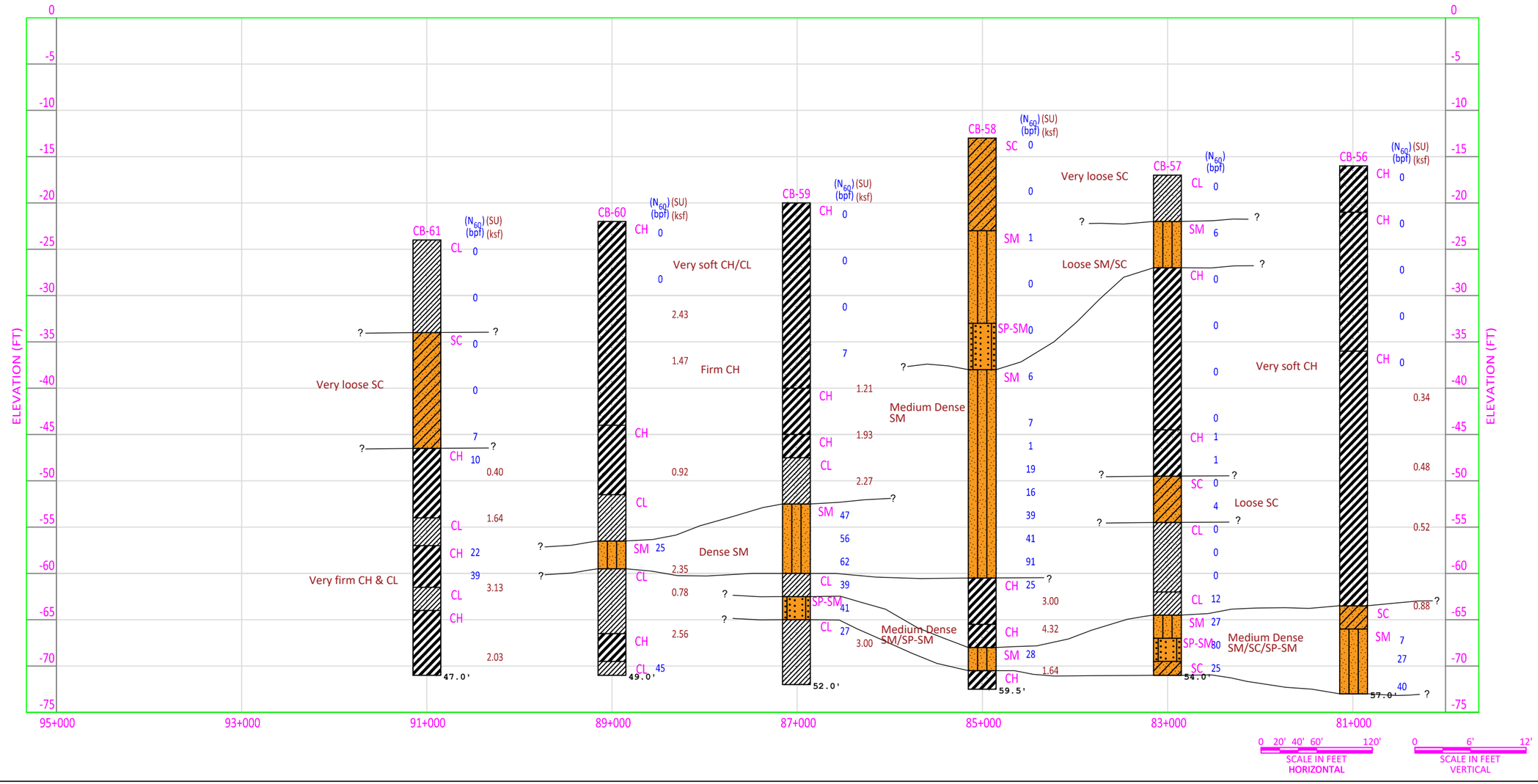
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 80+000 TO STA. 66+000

SHEET ID
CN 122





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	
01	Issued for Finnal Factual Report	

DESIGNED BY: AA | ISSUE DATE: 12/16/21
DRAWN BY: TT | SOLICITATION NO.: W912HY21B0000
CHECKED BY: AA | CONTRACT NO.: N/A
SUBMITTED BY: Ridley Young Engineers | SWG FILE NO.: GUAD 0705-0244
SIZE: 11" by 17"

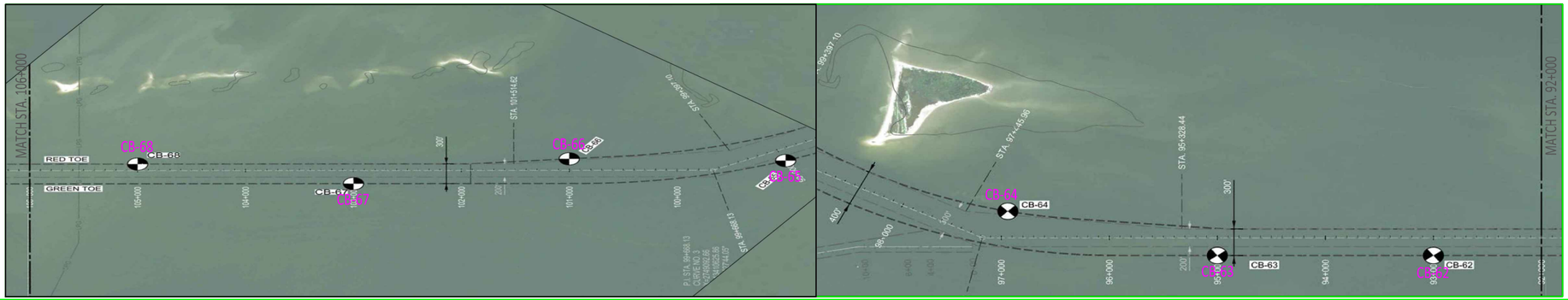
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TX 77550

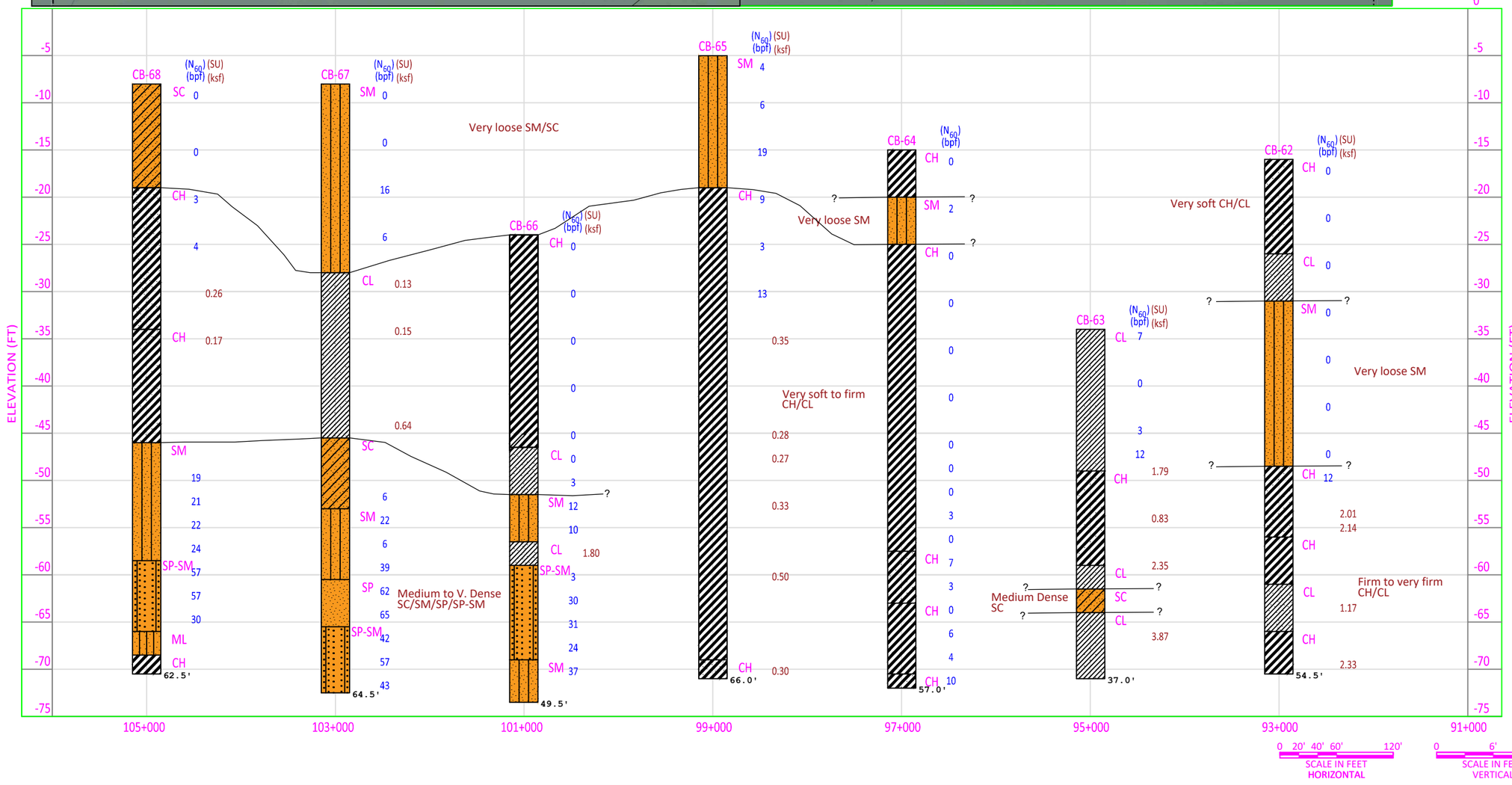
PREPARED UNDER THE DIRECTION OF
TIMOTH R. VAL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 92+000 TO STA. 80+000

SHEET ID
CN 123





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA	SOLICITATION NO.: W912HY21B0000	ISSUE DATE: 12/16/21	
DRAWN BY: TT	CONTRACT NO.: N/A		
CHECKED BY: AA	SWG FILE NO.: GUAD 0705-0244		
SUBMITTED BY: Shirley Wong Engineers	SIZE: 11" by 17"		

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAL
COLONEL, EN, U.S. ARMY, COMMANDING

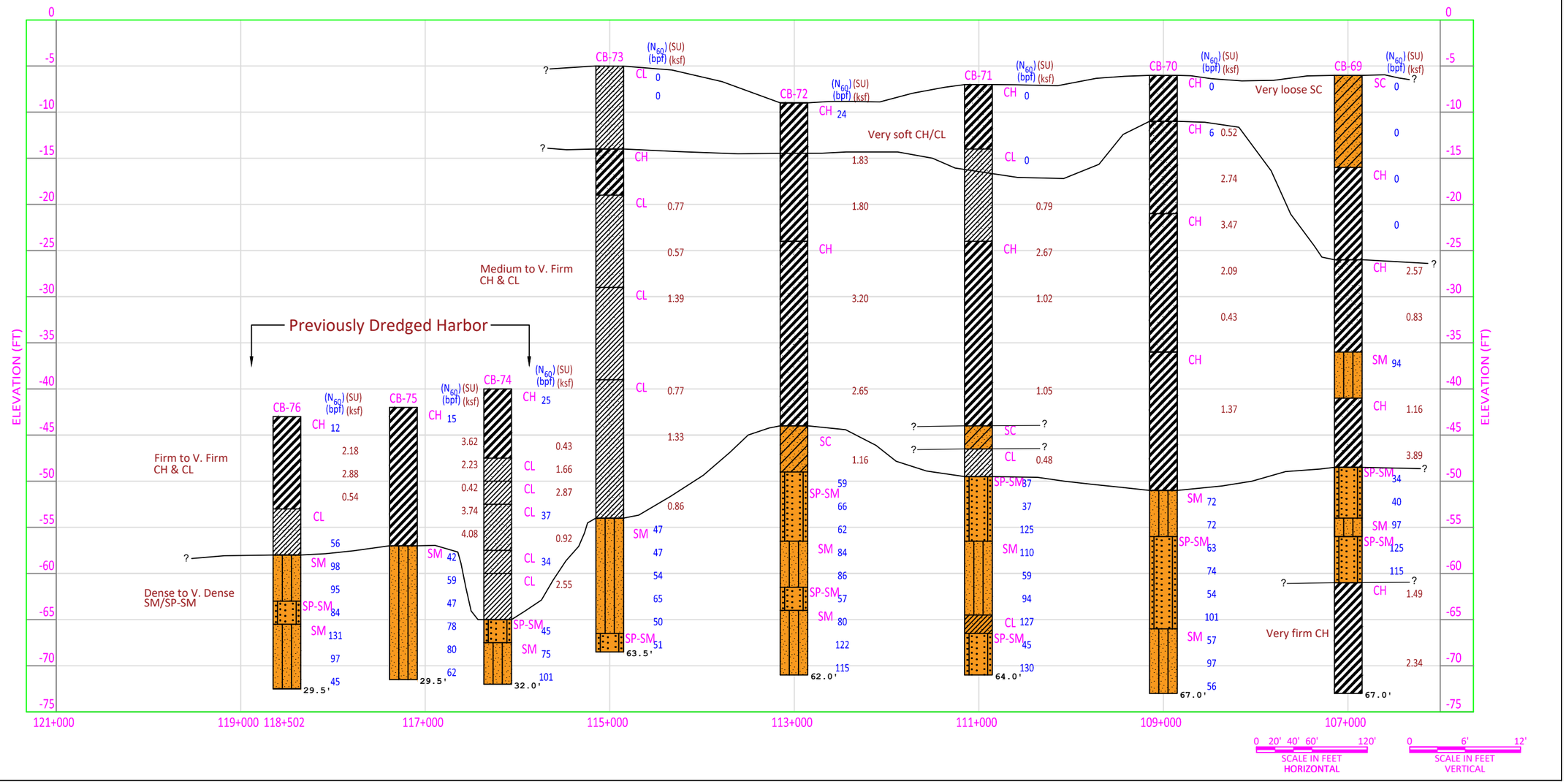
CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 106+000 TO STA. 92+000

SHEET ID

CN 124





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil		
CL	CH	MH	
CL	CH	CL-ML	
CL	CH		

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Posey Young Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT 2000 FORT POINT ROAD GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF TIMOTHY R. VAIL COLONEL, EN: U.S. ARMY: COMMANDING

CHANNEL IMPROVEMENT PROJECT MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 118+502 TO STA. 106+000

SHEET ID
CN 125

Test Boring Summary Table (1/2)

ID	Start	Finish	As-Drilled Latitude (Northing)	As-Drilled Longitude (Westing)	Horizontal Offset	Direction	Approximate Mudline MLLW El. (1)	Drill Depth Below Mudline	Casing Depth Below Mudline	Termination MLLW El.	Remark
-	-	-	-	-	ft	-	ft	ft	ft	ft	
CB-1	10/6/2021	10/6/2021	28°21'38.70"N	96°15'30.60"W	35	NE	-56	17	10	-73	
CB-2	10/6/2021	10/6/2021	28°21'57.00"N	96°15'41.70"W	35	NE	-53	17	10	-70	
CB-3	10/6/2021	10/6/2021	28°22'7.30"N	96°16'1.70"W	17	SW	-52	19	11	-72	
CB-4	10/6/2021	10/6/2021	28°22'25.7"N	96°16'12.6"W	25	NW	-51	22	10	-73	
CB-5	10/5/2021	10/5/2021	28°22'36.2"N	96°16'32.5"W	20	NW	-51	22	10	-73	
CB-6	10/5/2021	10/5/2021	28°22'54.1"N	96°16'43.2"W	30	SW	-47	24.5	8	-71.5	
CB-7	10/5/2021	10/5/2021	28°23'05.3"N	96°17'04.5"W	120	NW	-48	24.5	8	-72.5	
CB-8	10/4/2021	10/4/2021	28°23'22.6"N	96°17'13.8"W	55	SE	-44	29.5	8	-73.5	
CB-9	10/4/2021	10/4/2021	28°23'33.6"N	96°17'33.5"W	30	SE	-41	30	6	-71	
CB-10	10/4/2021	10/4/2021	28°23'51.30"N	96°17'42.90"W	83	NE	-35	34	7	-70	
CB-11	10/3/2021	10/3/2021	28°23'58.70"N	96°18'00.00"W	35	N	-40	32	4	-70	
CB-12	10/3/2021	10/3/2021	28°24'20.80"N	96°18'14.80"W	55	W	-37	33.5	8	-70.5	
CB-13	10/2/2021	10/3/2021	28°24'37.10"N	96°18'42.50"W	150	S	-51	21.5	5	-73.5	
CB-18	10/9/2021	10/9/2021	28°26'15.20"N	96°20'19.80"W	135	NE	-56	14.5	6	-71	
CB-19	10/2/2021	10/2/2021	28°26'23.40"N	96°20'41.90"W	55	NW	-31	40	5	-71	
CB-20	9/30/2021	10/1/2021	28°26'39.00"N	96°20'55.90"W	21	NW	-28	42.5	5	-70.5	
CB-21	10/1/2021	10/1/2021	28°26'47.10"N	96°21'15.90"W	90	NW	-29	45.5	4	-74.5	
CB-22	10/7/2021	10/7/2021	28°27'04.10"N	96°21'31.40"W	135	NE	-24	47	10	-71	
CB-23	10/7/2021	10/8/2021	28°27'17.30"N	96°21'49.70"W	225	N	-15	57	17	-72	
CB-24	10/8/2021	10/8/2021	28°27'25.30"N	96°22'9.10"W	40	NW	-39	31.5	7	-71.5	
CB-25	7/12/2021	7/12/2021	28°27'40.50"N	96°22'23.70"W	82	NE	-31	38	6	-69	
CB-26	7/12/2021	7/13/2021	28°27'50.10"N	96°22'43.70"W	30	N	-22	47	6	-69.0	
CB-27	7/13/2021	7/13/2021	28°28'5.40"N	96°22'58.00"W	137	NE	-15	54	5	-69.0	
CB-28	7/13/2021	7/13/2021	28°28'14.40"N	96°23'18.80"W	14	SW	-15.3	54	5	-69.3	
CB-29	7/14/2021	7/14/2021	28°28'30.30"N	96°23'33.50"W	123	NE	-14.6	54	4	-68.6	
CB-30	7/14/2021	7/14/2021	28°28'39.10"N	96°23'53.60"W	22	SE	-21	48	7.5	-69.0	
CB-31	7/14/2021	7/15/2021	28°28'54.60"N	96°24'8.30"W	103	NE	-13.6	55	3.5	-68.6	
CB-32	7/15/2021	7/15/2021	28°29'3.90"N	96°24'28.80"W	11	S	-16.6	54	3	-70.6	
CB-33	7/15/2021	7/16/2021	28°29'19.10"N	96°24'43.50"W	81	NE	-18.6	52	5.5	-70.6	
CB-34	7/16/2021	7/17/2021	28°29'29.70"N	96°25'04.40"W	136	N	-19	49.5	5	-68.5	
CB-35	7/17/2021	7/17/2021	28°29'45.00"N	96°25'18.50"W	190	N	-16	54	7	-70.0	
CB-36	7/17/2021	7/17/2021	28°29'53.40"N	96°25'39.00"W	12	W	-15	54	9	-69.0	
CB-37	7/17/2021	7/18/2021	28°30'09.20"N	96°25'54.30"W	108	N	-23	45.5	6	-68.5	
CB-38	7/18/2021	7/19/2021	28°30'18.10"N	96°26'14.10"W	17	SE	-17	54.5	2	-71.5	
CB-39	7/18/2021	7/18/2021	28°30'32.90"N	96°26'29.10"W	25	NE	-18	51.5	1.5	-69.5	
CB-40	7/18/2021	7/19/2021	28°30'42.70"N	96°26'48.80"W	15	SE	-16	51.5	7	-67.5	
CB-41	7/19/2021	7/19/2021	28°30'58.40"N	96°27'04.00"W	107	SW	-17	54.5	5.5	-71.5	
CB-42	7/19/2021	7/20/2021	28°31'07.40"N	96°27'24.08"W	12	SW	-20.5	46.5	3.5	-67.0	
CB-43	7/20/2021	7/20/2021	28°31'22.70"N	96°27'38.80"W	78	NE	-19	52	5	-71.0	
CB-44	7/20/2021	7/20/2021	28°31'32.30"N	96°28'0.00"W	87	NW	-18	54	1	-72.0	
CB-45	7/20/2021	7/21/2021	28°31'47.80"N	96°28'13.60"W	119	SW	-33	39	19.5	-72	
CB-46	7/21/2021	7/21/2021	28°31'56.70"N	96°28'34.30"W	26	NE	-16	54.5	12.5	-70.5	
CB-47	7/21/2021	7/22/2021	28°23'12.00"N	96°28'47.50"W	189	NE	-23	48	19	-71	
CB-48	7/22/2021	7/22/2021	28°32'21.50"N	96°29'09.10"W	10	SE	-15	57	9	-72	

Notes:

1. ELEVATION DATUM: Mean Lower Low Water.

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Tetra Tech Valdez Engineers
SIZE: E, 17" by 11"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

Geotechnical Test Details

SHEET ID
CN 126

Test Boring Summary Table (2/2)

ID	Start	Finish	As-Drilled Latitude (Northing)	As-Drilled Longitude (Westing)	Horizontal Offset	Direction	Approximate Mudline MLLW El. (1)	Drill Depth Below Mudline	Casing Depth Below Mudline	Termination MLLW El.	Remark
-	-	-	-	-	ft	-	ft	ft	ft	ft	
CB-49	7/22/2021	7/22/2021	28°32'37.40"N	96°29'24.40"W	122	NE	-17	54	7	-71	
CB-50	7/23/2021	7/23/2021	28°32'46.10"N	96°29'44.50"W	26	SW	-15	56.5	4	-71.5	
CB-51	7/23/2021	7/23/2021	28°33'02.1"N	96°29'58.9"W	144	NE	-8	64	24	-72	
CB-52	7/24/2021	7/24/2021	28°33'09.9"N	96°30'20.6"W	164	SW	-37	34.5	24	-71.5	
CB-53	7/24/2021	7/24/2021	28°33'26.6"N	96°30'34.4"W	107	NE	-18	54	TBD	-72	
CB-54	7/24/2021	7/24/2021	28°33'35.7"N	96°30'55.0"W	53	NW	-9	62	TBD	-71	
CB-55	7/25/2021	7/25/2021	28°33'50.9"N	96°31'9.3"W	76	NE	-38	33.5	6	-71.5	
CB-56	7/25/2021	7/25/2021	28°34'00.2"N	96°31'29.5"W	9	S	-16	56.5	0.5	-72.5	
CB-57	7/25/2021	7/25/2021	28°34'17.1"N	96°31'45.4"W	220	NE	-17	54	7	-71	Offset due to pipeline
CB-58	7/26/2021	7/26/2021	28°34'24.40"N	96°32'04.40"W	63	SE	-13	59.5	36	-72.5	
CB-59	7/26/2021	7/26/2021	28°34'40.40"N	96°32'19.00"W	114	NE	-20	52	25	-72	
CB-60	7/26/2021	7/26/2021	28°34'49.40"N	96°32'41.10"W	126	W	-22	49	9	-71	
CB-61	7/27/2021	7/27/2021	28°35'09.50"N	96°33'00.20"W	698	NW	-24	47	7	-71	Offset due to pipeline
CB-62	7/27/2021	7/27/2021	28°35'14.10"N	96°33'15.00"W	30	SW	-16	54.5	10.5	-70.5	
CB-63	7/27/2021	7/27/2021	28°35'26.20"N	96°33'32.40"W	48	SW	-33	37	1	-70	
CB-64	7/28/2021	7/28/2021	28°35'42.60"N	96°33'45.80"W	10	NE	-14	57	10	-71	
CB-65	10/25/2021	10/26/2021	28°35'56.70"N	96°34'3.90"W	300	SW	-5	66	27	-71	The casing penetration of 27-ft below mudline were through the very soft sediments or clay soils.
CB-66	10/9/2021	10/10/2021	28°36'17.10"N	96°33'59.30"W	20	SE	-24	49.5	29	-73.5	The casing penetration of 29-ft below mudline were through the very soft sediments or clay soils.
CB-67	10/11/2021	10/12/2021	28°36'36.60"N	96°34'3.50"W	50	SW	-8	64	26	72	The casing penetration of 26-ft below mudline were through the very soft sediments or clay soils.
CB-68	10/12/2021	10/12/2021	28°36'57.20"N	96°33'57.50"W	160	NE	-8	62.5	26	-70.5	The casing penetration of 26-ft below mudline were through the very soft sediments or clay soils.
CB-69	10/12/2021	10/13/2021	28°37'18.70"N	96°34'3.60"W	320	SW	-6	67	20	-73	The casing penetration of 20-ft below mudline were through the very soft sediments or clay soils.
CB-70	10/13/2021	10/14/2021	28°37'37.20"N	96°33'55.90"W	215	NE	-6	66.5	23	-72.5	The casing penetration of 23-ft below mudline were through 15-ft of very soft sediments or clay soils, the other 8-ft was through very stiff clay and we double check this number now with the driller .
CB-71	10/14/2021	10/14/2021	28°37'54.80"N	96°34'02.60"W	215	SW	-7	63.5	16	-70.5	
CB-72	10/15/2021	10/15/2021	28°38'14.90"N	96°33'55.90"W	185	SE	-9	61.5	8	-70.5	
CB-73	10/15/2021	10/15/2021	28°38'33.30"N	96°33'36.60"W	245	NE	-5	63	10	-68	
CB-74	10/16/2021	10/17/2021	28°38'42.20"N	96°33'24.70"W	30	SW	-40	31.5	6	-71.5	
CB-75	10/17/2021	10/17/2021	28°38'33.50"N	96°33'15.60"W	50	SW	-42	29	19	-71	
CB-76	10/17/2021	10/18/2021	28°38'41.20"N	96°33'01.40"W	250	SW	-43	29	5	-72	

Notes:

1. ELEVATION DATUM: Mean Lower Low Water

01 | Issued for Finnal Factual Report
MARK | DESCRIPTION

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Tommy Wong Engineers
SIZE: 11" by 17"

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

Geotechnical Test Details

SHEET ID
CN 127

Vibracore Summary Table

ID	Start	Finish	As-Cored Latitude (Northing)	As-Cored Longitude (Westing)	Horizontal Offset	Approximate Mudline MLLW El. (1)	Soil Recovered Below Mudline	Total Vibracore Penetration below Mudline	Recovered	Remark
-	-	-	-	-	ft	ft	ft	ft	%	-
VB-1	22-Jul-21	22-Jul-21	28 26 04.17999	96 21 01.12274	4.9	-13.2	2.4	3.5	69%	
VB-2	22-Jul-21	22-Jul-21	28 26 16.51231	96 21 18.66170	0.6	-12.6	5.4	6.0	90%	
VB-3	21-Jul-21	21-Jul-21	28 26 28.86403	96 21 36.11503	4.3	-12.5	3.5	4.4	80%	
VB-4	21-Jul-21	21-Jul-21	28 26 41.22793	96 21 53.66556	0.1	-11.7	7.0	7.8	90%	
VB-5	22-Jul-21	22-Jul-21	28 28 02.51087	96 23 48.82208	4.0	-11.5	9.6	10.1	95%	
VB-6	22-Jul-21	22-Jul-21	28 28 14.86534	96 24 06.40062	4.4	-11.5	4.6	5.6	82%	
VB-7	22-Jul-21	22-Jul-21	28 28 27.25088	96 24 23.88090	0.2	-11.5	5.8	6.4	91%	
VB-8	22-Jul-21	22-Jul-21	28 28 39.60211	96 24 41.36208	2.7	-11.7	4.7	6.2	76%	
VB-9	22-Jul-21	22-Jul-21	28 28 51.95307	96 24 58.91389	0.9	-11.9	4.1	5.8	71%	
VB-10	22-Jul-21	22-Jul-21	28 29 04.31114	96 25 16.40728	1.6	-11.7	4.3	5.1	84%	
VB-11	26-Jul-21	26-Jul-21	28 29 16.63030	96 25 33.96098	4.1	-11.5	7.0	8.6	81%	
VB-12	26-Jul-21	26-Jul-21	28 29 29.00201	96 25 51.41935	4.0	-11.75	5.8	6.7	87%	
VB-13	23-Jul-21	23-Jul-21	28 29 41.36898	96 26 08.93748	3.8	-12.2	3.9	4.5	87%	
VB-14	23-Jul-21	23-Jul-21	28 29 53.74222	96 26 26.49703	2.1	-13	6.9	8.5	81%	
VB-15	23-Jul-21	23-Jul-21	28 30 06.07239	96 26 44.02342	0.1	-11.2	3.3	4.4	75%	
VB-16	23-Jul-21	23-Jul-21	28 30 18.45713	96 27 01.48944	6.3	-10.6	9.3	10.9	85%	
VB-17	23-Jul-21	23-Jul-21	28 30 30.77470	96 27 19.08118	1.0	-10.4	5.8	6.5	89%	
VB-18	23-Jul-21	23-Jul-21	28 30 43.04951	96 27 36.67282	7.1	-10.6	5.1	6.9	74%	
VB-19	26-Jul-21	26-Jul-21	28 31 24.81263	96 28 39.00629	1.9	-10.8	8.3	9.4	88%	
VB-20	26-Jul-21	26-Jul-21	28 31 37.15234	96 28 56.54069	1.3	-10.6	10.7	11.9	90%	
VB-21	26-Jul-21	26-Jul-21	28 31 49.48923	96 29 14.08103	1.0	-9.3	3.8	4.5	84%	
VB-22	26-Jul-21	26-Jul-21	28 32 01.83618	96 29 31.61793	1.4	-7.8	10.3	11.2	92%	
VB-23	26-Jul-21	26-Jul-21	28 32 14.21343	96 29 49.10083	5.4	-9.1	7.7	8.8	88%	
VB-24	26-Jul-21	26-Jul-21	28 32 26.44454	96 30 06.67647	7.1	-9.5	9.8	11.6	84%	
VB-25	26-Jul-21	26-Jul-21	28 32 38.83146	96 30 24.18115	3.8	-9.5	8.7	10.2	85%	
VB-26	27-Jul-21	27-Jul-21	28 33 42.05859	96 31 45.26274	7.2	-5.8	13.2	14.8	89%	
VB-27	27-Jul-21	27-Jul-21	28 33 54.34757	96 32 02.85681	0.6	-6.9	12.0	13.5	89%	
VB-28	27-Jul-21	27-Jul-21	28 34 06.69762	96 32 20.49005	8.0	-5.3	4.2	5.5	76%	
VB-29	27-Jul-21	27-Jul-21	28 34 19.09119	96 32 37.95392	7.4	-4.9	6.6	7.8	85%	
VB-30	27-Jul-21	27-Jul-21	28 34 31.35814	96 32 55.50385	0.8	-6.8	6.4	7.9	81%	
VB-31	28-Jul-21	28-Jul-21	28 34 43.38710	96 33 12.54269	3.0	-6.3	3.0	4.8	63%	
VB-32	27-Jul-21	27-Jul-21	28 34 56.02278	96 33 30.57363	1.7	-5.6	5.4	6.9	78%	
VB-33	27-Jul-21	27-Jul-21	28 35 31.31313	96 34 25.58163	1.0	-6.1	14.4	15.5	93%	
VB-34	28-Jul-21	28-Jul-21	28 35 40.60194	96 34 38.80484	6.2	-4.9	16.0	18.0	89%	
VB-35	28-Jul-21	28-Jul-21	28 35 52.92418	96 34 56.31987	3.6	-6.2	16.5	17.5	94%	
VB-36	28-Jul-21	28-Jul-21	28 36 02.14545	96 35 09.44913	2.7	-4.6	13.4	15.2	88%	
VB-37	28-Jul-21	28-Jul-21	28 36 19.48823	96 33 18.83698	2.5	-6.1	13.7	15.0	91%	
VB-38	28-Jul-21	28-Jul-21	28 36 39.28871	96 33 18.23592	0.4	-6.3	8.5	10.3	83%	
VB-39	28-Jul-21	28-Jul-21	28 36 59.10580	96 33 17.65993	2.1	-6.1	13.6	15.2	89%	
VB-40	28-Jul-21	28-Jul-21	28 37 18.90005	96 33 17.08543	2.2	-5.2	14.0	15.6	90%	

Notes:

1. ELEVATION DATUM: Mean Lower Low Water

01 Issued for Finnal Factual Report
MARK DESCRIPTION

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Shiney Wong Engineers
SIZE: 11" by 17"
ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL. EN : U.S. ARMY : COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

Geotechnical Test Details

SHEET ID
CN 128

Shallow Sedimentation Sampling Summary Table

ID	Start	Finish	As-Sampled Latitude (Northing)	As-Samled Longitude (Westing)	Horizontal Offset	Direction	Approximate Mudline MLLW El. (1)	Drill Depth Below Mudline	Casing Depth Below Mudline	Termination MLLW El.	Remark
CB-14	10/31/2021	10/31/2021	28°25'2.37"N	96°18'55.25"W	95	S	-23	------	------	------	Grab sample of mudline sediments. Contains shells, sand, silt and clay.
CB-15	10/31/2021	10/31/2021	28°25'3.79"N	96°19'9.86"W	50	SW	-22	------	------	------	Grab sample of mudline sediments. Contains shells, and gravel.
CB-16	10/31/2021	10/31/2021	28°25'18.33"N	96°19'16.91"W	30	S	-19	------	------	------	Grab sample of mudline sediments. Contains shells, and gravel.
CB-17	10/31/2021	10/31/2021	28°25'24.71"N	96°19'33.74"W	40	W	-34	------	------	------	Grab sample of mudline sediments. Contains shells, and gravel.

Notes:

1. ELEVATION DATUM: Mean Lower Low Water

MARK	DESCRIPTION
01	Issued for Finnal Factual Report

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Shirley Wong Engineers
ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244
SIZE: 11" by 17"

US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

Geotechnical Test Details

SHEET ID

CN 129

APPENDIX B
CHANNEL BORING LOGS

KEY TO SYMBOLS AND TERMS USED ON BORING LOGS FOR SOIL

Most Common Unified Soil Classifications System Symbols

- Lean Clay (CL)
- Lean Clay w/ Sand (CL)
- Sandy Lean Clay (CL)
- Fat Clay (CH)
- Fat Clay w/ Sand (CH)
- Sandy Fat Clay (CH)
- Silty Clay (CL-ML)
- Silty Clay with Sand (CL-ML)
- Sandy Silty Clay (CL-ML)
- Silty Clayey Sand (SC-SM)
- Clayey Sand (SC)
- Sandy Silt (ML)
- Silty Sand (SM)
- Silt w/ Sand (ML)
- Well Graded Sand (SW)
- Well Graded Sand w/ Gravel (SW-GM)
- Poorly Graded Sand (SP)
- Poorly Graded Sand w/ Silt (SP-SM)
- Silt (ML)
- Elastic Silt (MH)
- Elastic Silt w/ Sand (MH-SP)
- Silty Gravel (GM)
- Clayey Gravel (GC)
- Well Graded Gravel (GW)
- Well Graded Gravel w/ Sand (SP-GM)
- Poorly Graded Gravel (GP)
- Peat

Miscellaneous Materials

- Fill
- Concrete
- Asphalt and/or Base

Sampler Symbols	Meaning
	Pavement core
	Thin - walled tube sample
	Standard Penetration Test (SPT)
	Auger sample
	Sampling attempt with no recovery

Field Test Data

90%/100%	Sample Recovery (Field %)
(P) 2.50	Pocket penetrometer reading in tons per square foot
(T) 1.13	Torvane Measurement in tons per square foot
8/6"	Blow count per 6 - in. interval of the Standard Penetration Test
DP	Drill rig down pressure during tube push in pounds/square inch
PID	Photoionization detector
PPM	Parts per million
	Observed free water during drilling
	Observed static water level

Laboratory Test Data

90%/100%	Sample Recovery (Lab %)
Wc (%)	Moisture content in percent
Dens. (pcf)	Dry unit weight in pounds per cubic foot
LL	Liquid Limit in percent
PI	Plasticity Index
#200 (%)	Percent passing the No. 200 mesh sieve

Strength Legend (ksf)

Qu	Unconfined Compressive Strength
Su	Undrained Shear Strength
UU	Unconsolidated-Undrained Test
UC	Unconfined Compression Test
T	Torvane
P	Pocket Penetrometer ***
M	Miniature Vane Shear

RELATIVE DENSITY OF COHESIONLESS & SEMI-COHESIONLESS SOILS

The following descriptive terms for relative density apply to cohesionless soils such as gravels, silty sands, and sands as well as semi-cohesive and semi-cohesionless soils such as sandy silts, and clayey sands.

Relative Density	Typical N Value Range*
Very Loose	Less than 4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Greater than 50

* N is the number of blows from a 140-lb weight having a free fall of 30-in. required to penetrate the final 12-in. of an 18-in. sample interval.

CONSISTENCY OF COHESIVE SOILS

The following descriptive terms for consistency apply to cohesive soils such as clays, sandy clays, and silty clays.

Undrained Shear Strength, Su (ksf)**	Consistency	Blows per Foot
< 0.25	Very soft	< 2
0.25 - 0.50	Soft	2-4
0.50 - 1.00	Medium	4-8
1.00 - 2.00	Firm	8-15
2.00 - 4.00	Very Firm	15-30
> 4.00	Hard	> 30

** Su = T = M; Su = Qu/2 = P/2

*** Based on our experience, we adjusted the field measurements of the undrained shear strength of natural, overconsolidated Pleistocene Gulf Coast clays by applying a correction factor of 0.67 to the penetrometer readings. The strengths measured by penetrometer are paritally controlled by the presence of macroscopic soil defects and features such as slickensides, which are generally not reflected in penetrometer readings.

LOG OF BORING CB-01

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 21' 38.70" N 96° 15' 30.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -56 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 17 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
0	0	SP-1	CLAYEY SAND (SC), very loose, gray		WOR/6" WOR/6" WOR/6"	0	48.6		43	24	47.4				
		SP-2	-medium dense from 2.5' to 5'		6/6" 7/6" 3/6"	15	27.7				46				
-60	5	ST-1	FAT CLAY (CH), medium, gray slickensided with sand pockets	(P)0.75			58.9	65.6	92	57	99.8	(P)0.50	(UU)0.73	2.8	
		ST-2		(P)1.25			57.7	66.5	80	48	99.6	(P)0.84	(UC)0.93	2	
-65	10	ST-3		(P)1.00			53.7	68			99.9	(P)0.67	(UC)0.66	2.5	
		ST-4	-firm from 12.5' to 17'	(P)1.25			55.9	66.8	86	51	99.6	(P)0.84	(UC)1.17	3	
-70	15	ST-5		(P)1.25			44.5	77.6			99.6	(P)0.84	(UC)1.06	4.7	
			Bottom @ 17 ft.												
-75	20														
-80	25														
-85	30														
-90	35														
-95	40														

COMPLETION DEPTH: 17 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 57 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-02

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 21' 57.00" N 96° 15' 41.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -53 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 17 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-55				SP-1	LEAN CLAY WITH SAND (CL), very soft, dark gray		WOP/6" WOP/6" WOP/6"	0	53.8				71.3				
				SP-2			WOP/6" WOP/6" WOP/6"	0	47.9				78.5				
	5			ST-1	FAT CLAY (CH), medium, brown and gray -with ferrous nodules from 5' to 10'	(P)2.00			38.3	83.1	80	47	99.7	(P)1.34	(UC)0.99	7.3	
-60				ST-2		(P)2.25			40.2	81.1			99.8	(P)1.50	(UU)0.95	7.3	
	10			ST-3	-slickensided from 10' to 12.5'	(P)2.00			49	72.2	82	50	99.9	(P)1.34	(UC)0.69	2.9	
-65				SP-3	-very soft from 12.5' to 15'		WOH/6" WOH/6" WOH/6"	0	54.6		78	46	99.3				
	15			ST-4	-soft from 15' to 17'	(P)1.25			53	69.6	73	46	99.3	(P)0.84	(UC)0.39	11	
-70					Bottom @ 17 ft.												
	20																
-75																	
	25																
-80																	
	30																
-85																	
	35																
-90																	
	40																

COMPLETION DEPTH: 17 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 54 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-03

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 07.30" N 96° 16' 01.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -52 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 19 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			▼												
			SP-1	FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	57.9		62	38	90				
-55			ST-1	-with sand pockets from 2.5' to 10'	(T)0.17			54.3	69.8			87.3	(T)0.34	(UC)0.21	15	
	5		ST-2	-with shell fragments from 5' to 7.5'	(T)0.12					67	43	90.3	(T)0.24			
-60			ST-3	-soft from 7.5' to 15'	(P)1.00			56.4	67.6			96.5	(P)0.67	(UC)0.30	11.3	
	10		ST-4	-with ferrous nodules from 10' to 12.5'	(P)1.00			53.4	69.4	65	41	87.1	(P)0.67	(UC)0.34	15	
-65			ST-5		(P)1.00			62.7	62.5			93.1	(P)0.67	(UC)0.32	11.5	
	15		ST-6	-medium from 15' to 17'	(P)1.25			63.2	63.1	70	45	95.7	(P)0.83	(UU)0.53	2.8	
-70			SP-2	SILTY SAND (SM), medium dense, gray		14/6" 8/6" 10/6"	27	21.9				15.7				
	20			Bottom @ 19 ft.												
-75																
	25															
-80																
	30															
-85																
	35															
-90																
	40															

COMPLETION DEPTH: 19 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 53 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 11-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-04

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 25.70" N 96° 16' 12.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -51 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	LEAN CLAY (CL), medium, gray with sand pockets and ferrous nodules		2/6" 2/6" 2/6"	6	33.8		40	19	99				
-55				ST-1		(P)2.50			32	87.8			99.7	(P)1.68	(UC)0.61	3.5	
	5			ST-2	FAT CLAY (CH), very firm, tan & reddishbrown -slickensided with ferrous nodules from 5' to 22'	(P)4.00			35.3	87.3	65	41	99.3	(P)2.68			
				ST-3	-medium with calcareous nodules from 7.5' to 9.5'	(P)1.75			35.2	81.7			99.6	(P)1.18	(UC)0.52	4.2	
-60	10			ST-4	-very firm from 10' to 12'	(P)3.75			36.1	81.8	75	47	99.9	(P)2.51			CU
				ST-5	-firm from 12.5' to 14.5'	(P)2.00			42.3	80.4			99.8	(P)1.34	(UU)1.67	2.2	
-65	15			ST-6	-firm from 15' to 17'	(P)4.25			41	80			99.6	(P)2.84	(UC)1.09	2.8	
				ST-7	-very firm from 17.5' to 19.5'	(P)3.50			44.3	76.5	82	48	99.8	(P)2.34			
-70	20			ST-8	-firm from 20' to 22'	(P)3.50			46.3	75.7			99.8	(P)2.34	(UC)1.43	3.5	
					Bottom @ 22 ft.												
-75	25																
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-05

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 36.20" N 96° 16' 32.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -51 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), soft, gray -with silt pockets and sand pockets		WOH/6" 1/6" 1/6"	3	51.4		64	36	92.1				
				SP-2	-very soft from 2.5' to 7.5'		WOH/6" WOH/6" WOH/6"	0	57.2				98.2				
-55	5			SP-3			WOH/6" WOH/6" WOH/6"	0	54.6				99.9				
				ST-1	ELASTIC SILT (MH), medium dense, gray	(P)0.75			59.5	65.8	86	44	99.6	(P)0.50	(UU)0.35	12.1	
-60	10			ST-2		(P)1.00			61.8				99.6	(P)0.67			
				ST-3		(P)1.00			56.8	66.5	77	39	99.9	(P)0.67	(UC)0.63	4.7	
-65	15			ST-4		(P)1.25			58.4	66.7			99.9	(P)0.83	(UC)0.57	6	
				ST-5		(P)1.25			59.1	66.1	78	40	99.7	(P)0.83	(UC)1.12	3.3	
-70	20			ST-6		(P)0.75			36.7	83.8			99.3	(P)0.50	(UC)0.62	11.5	
					Bottom @ 22 ft.												
-75	25																
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-06

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 54.10" N 96° 16' 43.20" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -47 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 24 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), medium, gray -no recovery in shelby tube from 0' to 2.5'		1/6" 2/6" 1/6"	4	61.1		55	28	96.2				
-50				ST-1	FAT CLAY WITH SAND (CH), soft, gray	(P)0.50			48.5	73.4			82.4	(P)0.33			
	5			ST-2	FAT CLAY (CH), soft, gray	(T)0.14			48.2	75.3			96.4	(T)0.28			
-55				ST-3	ELASTIC SILT (ML), medium dense, gray	(P)1.00			54.5	66.5	74	35	99.7	(P)0.67	(UC)1.02	10.8	
	10			ST-4	-medium dense from 10' to 12'	(P)1.25			58.3	65.3			99.8	(P)0.83	(UU)0.47	5.3	
-60				SP-2	-very loose from 12.5' to 14.5' -no recovery in shelby tube from 12.5' to 14.5'		WOH/6" WOH/6" WOH/6"	0	61.9				99				
	15			ST-5	-medium dense from 15' to 22.5'	(P)1.25			57.8		70	34	99.9	(P)0.83			
-65				ST-6	-slickensided from 17.5' to 22.5'	(P)1.25			42.9	72.3			99.8	(P)0.83	(UC)0.60	4.7	
	20			ST-7		(P)1.50			55.1	66.5			99.5	(P)1.00			
-70				SP-3	-very loose from 22.5' to 24' -no recovery in shelby tube from 22.5' to 24.5'		WOH/6" WOH/6" WOH/6"	0	57.3		77	38	99.6				
	25				Bottom @ 24 ft.												
-75																	
	30																
-80																	
	35																
-85																	
	40																

COMPLETION DEPTH: 24 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 48 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-07

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 29°23' 05.30 " N 96° 17' 04.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -48 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 24.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			SP-1	LEAN CLAY WITH SAND (CL), soft, gray with silt pockets and sand pockets		3/6" 1/6" 1/6"	3	42.1		45	26	84				
-50				SP-2	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	55.4				99.7				
	5			ST-1	-medium from 5' to 20' -with ferrous stains from 5' to 7' -slickensided from 5' to 25'	(P)0.75			60.9	64.3			99.7	(P)0.50	(UU)0.61	2	
-55				ST-2		(P)1.00			61	63.9	80	44	99.6	(P)0.67	(UC)0.65	3	
	10			ST-3		(P)0.75							99.9	(P)0.50			
-60				ST-4		(P)1.00			53	75.1			99.2	(P)0.67	(UC)0.57	3.8	
	15			ST-5		(P)1.25			57	66.9	82	44	99.7	(P)0.83			
-65				ST-6		(P)1.25			46.5	75			99.5	(P)0.83	(UC)0.63	9.5	
	20			ST-7	-firm from 20' to 24.5'	(P)1.50			45.7	77.9	55	29		(P)1.00			
-70				ST-8		(P)1.75			45.9	75.2			99.5	(P)1.17	(UC)1.11	3.6	
	25				Bottom @ 24.5 ft.												
-75																	
	30																
-80																	
	35																
-85																	
	40																

COMPLETION DEPTH: 24.5 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 49 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-08

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 22.6" N
96° 17' 13.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -44 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 29.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-45				SP-1	FAT CLAY (CH), soft, gray -with ferrous nodules and shell fragments from 0' to 2.5'		WOH/6" WOH/6" 2/6"	3	47.4				98.2				
				ST-1	-medium from 2.5' to 7'	(P)1.25			41	77.2	69	41	99.1	(P)0.83	(UC)0.70	9.8	
	5			ST-2	-very firm from 5' to 7.5' -with ferrous nodules from 5' to 30'	(P)2.25			46.4	72.9			99.7	(P)0.83			
-50				ST-3	-firm from 7.5' to 9.5'	(P)1.25			34.1	86.6	60	37	99.1	(P)0.83	(UC)1.05	7.8	
	10			ST-4	-medium from 10' to 27.5' -slickensided from 10' to 17.5'	(P)1.25			50.7	69.8			99.8	(P)0.83			
-55				ST-5		(P)1.25			54	69.2			99.9	(P)0.86			
	15			ST-6	-with sand seams from 15' to 27.5'	(P)1.25			56.5	67.5	85	51	99.7	(P)0.83	(UC)0.86	2.5	
-60				ST-7		(P)1.00			51.7	70.8				(P)0.67			
	20			ST-8		(P)1.00			38.6	84.6			98.9	(P)0.67	(UC)0.93	4.5	
-65				ST-9		(P)1.25			45.3	77.5	50	27	99.6	(P)0.83			
	25			ST-10		(P)1.00			40.4	82.7			99.7	(P)0.67			
-70				ST-11	SANDY LEAN CLAY (CL), medium, gray with ferrous nodules, sand pockets and shell fragments	(P)1.00			34.3	89.4			64.9	(P)0.67	(UC)0.60	3.2	
	30				Bottom @ 29.5 ft.												
-75																	
	35																
-80																	
	40																

COMPLETION DEPTH: 29.5 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 45 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-09

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 33.60" N
96° 17' 33.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -41 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 30 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very firm, dark brown		5/6" 5/6" 7/6"	18	44.6		65	32	98.5				
-45	5			ST-1	LEAN CLAY WITH SAND (CL), medium, dark brown with ferrous nodules and sand pockets	(P)1.75			27.4	95.9			77.6	(P)1.17	(UC)0.60	6.3	
				ST-2	FAT CLAY (CH), very firm, brown and dark brown	(P)4.00			28.2	93.2				(P)2.68			
-50	10			ST-3		(P)3.50			33.1	90.2	64	34	98.7	(P)2.34			
				ST-4	-firm from 10.5' to 12.5'	(P)3.25			36.1	84.4			99.5	(P)2.17	(UC)1.51	5.8	
-55	15			ST-5	-with calcareous nodules from 13' to 18' -very firm from 13' to 15'	(P)4.00			34.9	85.9			99.3	(P)2.68			
				ST-6	-firm from 15.5' to 17.5'	(P)3.75			31.2	88.5	78	43	69.4	(P)2.51	(UC)1.67	7.6	
-60	20			ST-7	-very firm from 17.5' to 23' -hard from 18' to 20.5'	(P)4.50+			36.8	84.9			99.6	(P)3.01	(UC)2.87	4.1	
				ST-8	-very firm from 20.5' to 30.5'	(P)3.75			36.5	84.4			99.1	(P)2.51			
-65	25			ST-9	FAT CLAY WITH SAND (CH), very firm, dark brown	(P)4.00			32.6	88.3	73	38	83.7	(P)2.68			
				ST-10	FAT CLAY (CH), medium, gray	(P)3.75			28.2	90.5			99.5	(P)2.51	(UC)0.96	1.9	
-70	30			ST-11	-very firm from 28' to 30'	(P)3.75			28.1	91.9			83.1	(P)2.51			
					Bottom @ 30 ft.												
-75	35																
-80	40																

COMPLETION DEPTH: 30 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 42 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 6-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-10

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 51.30" N 96° 17' 42.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -35 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-35	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray		3/6" 10/6" 7/6"	25	23.7				17.6				
-40	5			SP-2	CLAYEY SAND (SC), loose, gray & reddishbrown with shell fragments, ferrous nodules and calcareous nodules		3/6" 2/6" 2/6"	6	26.2				40.7				
-45	10			ST-1	FAT CLAY (CH), firm, tan & reddishbrown -with sand seams and calcareous nodules from 10' to 20' -with ferrous nodules from 10' to 27.5'	(P)2.50					56	34	94.2	(P)1.67			
				ST-2	-slickensided from 12.5' to 17.5'	(P)4.25			27.3	95.4			97.1	(P)2.84	(UC)0.98	2.2	
-50	15			ST-3		(P)2.75			36.2	83.7			97.9	(P)1.84	(UU)1.28	3.6	
				ST-4		(P)3.00			32.4	88.1	88	59	98	(P)2.01	(UC)0.99	1.3	
-55	20			ST-5	-slickensided from 20' to 22.5'	(P)4.00			12.1	102.5				(P)2.67			
				ST-6	-very firm from 22.5' to 30' -with shell fragments and sand seams from 22.5' to 25' -with calcareous nodules from 22.5' to 27.5'	(P)3.00			27.5	93			98.2	(P)2.01	(UC)2.10	4.1	
-60	25			ST-7	-slickensided with silt pockets from 25' to 27.5'	(P)4.25			32.6	86.6	75	47	99.4	(P)2.84			
				SP-3			4/6" 6/6" 6/6"	18	33.3				99.5				
-65	30			ST-8	LEAN CLAY (CL), firm, brown	(P)3.50			27.3	98.4	43	21	94	(P)2.34	(UC)1.09	4.7	
				SP-4	SANDY SILT (ML), very dense, brown		19/6" 24/6" 29/6"	87	27.5				57				
					Bottom @ 34 ft.												
-70	35																
-75	40																

COMPLETION DEPTH: 34 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 36 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 7-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-11

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 58.70" N
96° 18' 00.00" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -40 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 32 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-40	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray with shell fragments		3/6" 5/6" 12/6"	25	24.5				22.5				
-45	5			SP-2	POORLY GRADED SAND WITH SILT (SP-SM), very dense, gray		25/6" 26/6" 29/6"	83	23.4				7.3				
				SP-3	FAT CLAY (CH), medium, dark gray with sand pockets		2/6" 1/6" 2/6"	4	44.1		64	40	92.6				
-50	10			SP-4	-very soft from 10' to 12.5'		WOH/6" WOH/6" WOH/6"	0	49.5								
				ST-1	-medium from 12.5' to 14.5'	(P)1.00							97.7	(P)0.67			
-55	15			SP-5	-very soft from 15' to 20' -no recovery in shelby tube from 15' to 17'		WOR/6" WOH/6" WOH/6"	0	60.3		90	59	95.3				
				SP-6			WOH/6" WOH'6" WOH/6"	0	44.5				95.7				
-60	20			ST-2	LEAN CLAY WITH SAND (CL), soft, gray	(P)1.00			30	89.2			77.5	(P)0.67	(UU)0.35	14.6	
				ST-3	-medium from 22.5' to 25' -tan and reddishbrown from 22.5' to 30' -with ferrous nodules from 22.5' to 30' -with calcareous nodules from 22.5' to 27.5'	(P)1.50			23.3	103	47	30	78.3	(P)1.50	(UC)0.84	3.7	
-65	25			ST-4	-very firm from 25' to 30' -slickensided from 25' to 27.5'	(P)3.25			23.1	104.2			78.6	(P)2.17	(UC)1.38	9.8	
				ST-5		(P)1.75			17.9	112.9	30	15	73.5	(P)1.17	(UC)1.23	2.5	
-70	30			ST-6	SANDY LEAN CLAY (CL), medium, gray with calcareous nodule	(P)2.50			17.5	108.3			66.5	(P)1.67	(UC)0.60	3	
					Bottom @ 32 ft.												
-75	35																
-80	40																

COMPLETION DEPTH: 32 ft
DATE BORING STARTED: 10-3-21
DATE BORING COMPLETED: 10-3-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 41 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 4-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-12

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 24' 20.80" N
96° 18' 14.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -37 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			SP-1	SILTY SAND (SM), medium dense, dark brown with shell fragments		3/6" 4/6" 6/6"	15	20.2				12				
-40																	
	5			SP-2	POORLY GRADED SAND WITH SILT (SP-SM), dense, gray with shell fragments		16/6" 15/6" 15/6"	45	23.6				5.3				
-45				SP-3			6/6" 9/6" 16/6"	37	23								
	10			SP-4	SILTY SAND (SM), dense, light brown and brown with shell fragments		6/6" 12/6" 19/6"	47	19.4				22.6				
-50				SP-5			6/6" 12/6" 12/6"	36	22.4				16				
	15			SP-6			8/6" 12/6" 15/6"	40	21.2				15.1				
-55				SP-7	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown with shell fragments		8/6" 15/6" 19/6"	51	22.9				8.6				
	20			SP-8			9/6" 16/6" 25/6"	62	23.1				11.7				
-60				SP-9			12/6" 19/6" 25/6"	66	23.6				11.3				
	25			SP-10			15/6" 22/6" 36/6"	87	23.4								
-65				SP-11	SILTY SAND (SM), very dense, brown with shell fragments		18/6" 26/6" 40/6"	100	22.6				12.9				
	30			SP-12			18/6" 26/6" 31/6"	86	25				15.1				
-70				SP-13			14/6" 27/6" 38/6"	98	24.5				16.8				
					Bottom @ 34 ft.												
-75	35																
	40																

COMPLETION DEPTH: 34 ft
DATE BORING STARTED: 10-3-21
DATE BORING COMPLETED: 10-3-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 38 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-13

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 24' 37.10" N
96° 18' 42.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -51 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-55	5			SP-1	SILTY SAND (SM), medium dense, light brown with cemented sand and shell fragments		3/6" 5/6" 3/6"	12	19.6				19				
				SP-2	-very dense from 2.5' to 5'		10/6" 26/6" 35/6"	92	20.2				13.2				
-60	10			SP-3	POORLY GRADED SAND WITH SILT (SP-SM), dense, brown with cemented sand and shell fragments		7/6" 12/6" 19/6"	47	22.5				11.5				
				SP-4	-very dense from 7.5' to 10'		7/6" 20/6" 22/6"	63	19.7				11				
				SP-5	SILTY SAND (SM), very dense, brown		11/6" 23/6" 31/6"	81	22.6				13.6				
-65	15			SP-6	CLAYEY SAND (SC), medium dense, brown		3/6" 6/6" 2/6"	12	23		22	6	24.6				
				SP-7			6/6" 4/6" 3/6"	10	28.9				26.9				
-70	20			SP-8	FAT CLAY (CH), very firm, gray		3/6" 5/6" 6/6"	16	49.7		75	30	95.2				
				SP-9	POORLY GRADED SAND WITH SILT (SP-SM), very dense, light brown with cemented sand and shell fragments		8/6" 15/6" 18/6"	50	25.5				11.3				
-75	25				Bottom @ 22 ft.												
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-2-21
DATE BORING COMPLETED: 10-3-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 5-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-18

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 15.20" N
96° 20' 19.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -56 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 14.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray -with shell fragments from 0.5' to 2'		WOR/6" 3/6" 7/6"	15	39.1				14.8				
-60				SP-2	-very dense from 3' to 4.5'		9/6" 33/6" 50/3"	125	13.6				21.2				
	5			SP-3	FAT CLAY (CH), very firm, gray		7/6" 13/6" 19/6"	48	26.2				96.4				
-65				ST-1	LEAN CLAY WITH SAND (CL), firm, gray with sand pockets , ferrous nodules and shell fragments	(P)3.75			19.7	106.5	34	17	74.8	(P)2.50	(UU)1.74	15	
	10			ST-2	LEAN CLAY (CL), very firm, gray with sand pockets , ferrous nodules and shell fragments	(P)3.75			23.9	99.6	34	16	87.8	(P)2.50			
-70				ST-3	LEAN CLAY WITH SAND (CL), firm, gray with sand pockets , ferrous nodules and shell fragments	(P)3.50			21.1	104.1	47	29	73.9	(P)2.35	(UC)1.58	2.6	
	15				Bottom @ 14.5 ft.												
-75	20																
-80	25																
-85	30																
-90	35																
-95	40																

COMPLETION DEPTH: 14.5 ft
DATE BORING STARTED: 10-9-21
DATE BORING COMPLETED: 10-9-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 57 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 6-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-19

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 23.40" N 96° 20' 41.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -31 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 37.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			SP-1	CLAYEY SAND (SC), medium dense, dark brown and brown -shell fragments from 0' to 27.5'		2/6" 6/6" 9/6"	22	18.3				10.1				
-35	5			SP-2	-with clay pockets from 5' to 10'		2/6" 4/6" 8/6"	18	18.7				54.6				
-40	10			SP-3			2/6" 7/6" 14/6"	31	22.7				9.7				
-45	15			SP-4	-becomes dense from 15' to 17.5'		11/6" 20/6" 32/6"	78	20				10.6				
				SP-5	-becomes very dense from 17.5' to 20'		20/6" 26/6" 28/6"	81	21.3				11.9				
-50	20			SP-6	-becomes dense from 20' to 27.5'		13/6" 16/6" 18/6"	51	23.3				8.5				
				SP-7			13/6" 19/6" 23/6"	63	22.5								
-55	25			SP-8			20/6" 26/6" 8/6"	51	15.9				29.0				
				SP-9	FAT CLAY (CH), firm, brown		3/6" 6/6" 9/6"	22	28.9				93.8				
-60	30			ST-1	-with silt pockets and ferrous nodules from 30' to 35'	(P)4.00			25.9	98.4	66	42	98.1	(P)2.28	(UU)1.707	2.4	
				SP-10	CLAYEY SAND (SC), medium dense, brown		6/6" 9/6" 12/6"	31	22.9				92.1				
-65	35			SP-11			4/6" 9/6" 9/6"	27	22.5				37.6				
				SP-12	SANDY LEAN CLAY (CL), very firm, reddishbrown		6/6" 7/6" 9/6"	24	23.2				97.7				
-70	40				Bottom @ 32 ft.												

COMPLETION DEPTH: 32 ft
DATE BORING STARTED: 10-2-21
DATE BORING COMPLETED: 10-2-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 32 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 6-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-20

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 39.00" N 96° 20' 55.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -28 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 39.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-30				SP-1	SANDY FAT CLAY (CH), very soft, tan and reddishbrown with shell fragments		WOR/6" WOR/6" WOR/6"	0	49.6								
	5			ST-1	SANDY LEAN CLAY (CL), firm, tan and reddishbrown with sand pockets, ferrous nodules and calcareous nodules	(P)3.00			19.9	110.2	37	21	61.7	(P)2.00	(UU)1.90	14.8	
-35																	
	10			SP-2	SILTY SAND (SM), dense, light brown with shell fragments		3/6" 10/6" 16/6"	39	12.8				14.1				
-40																	
	15			SP-3	-very dense from 15.5' to 17.5'		16/6" 30/6" 31/6"	92	18.2								
-45				SP-4	POORLY GRADED SAND WITH SILT (SP-SM), dense, brown		4/6" 16/6" 15/6"	47	21.7				10.5				
	20			SP-5	-very dense from 20.5' to 22'		10/6" 18/6" 25/6"	65	16.6				7.9				
-50				SP-6	-dense from 23' to 25'		8/6" 12/6" 14/6"	39	16.2								
	25			SP-7	SILTY SAND (SM), dense, brown and gray		6/6" 10/6" 15/6"	37	20.1				12.9				
-55				SP-8	-disturbed and very loose from 28.5' to 30'		WOH/6" WOH/6" WOH/6"	0	33.5				15.6				
	30			SP-9	-medium dense from 30.5' to 32'		7/6" 10/6" 8/6"	27	22.8								
-60				SP-10	-dense from 33' to 34.5'		8/6" 13/6" 16/6"	43	26				17.8				
	35			SP-11	-very dense from 35.5' to 38'		25/6" 29/6" 35/6"	97	20.5				15.3				
-65				SP-12	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown		9/6" 19/6" 25/6"	66	22.4				9.6				
	40																

COMPLETION DEPTH: 44.5 ft
DATE BORING STARTED: 9-30-21
DATE BORING COMPLETED: 10-1-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 29 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 5-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-20

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 39.00" N
96° 20' 55.90" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -28 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 39.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-70	40			SP-13	POORLY GRADED SAND WITH SILT (SP-SM), medium dense, brown		11/6" 9/6" 8/6"	25	21.2								
				ST-2	FAT CLAY (CH), firm , brown and gray with silt pockets, shell fragments and ferrous nodules	(P)4.00			28.8	94.7	50	28	93.6	(P)2.68	(UC)1.20	4.1	
-75	45				Bottom @ 44.5 ft.												
-80	50																
-85	55																
-90	60																
-95	65																
-100	70																
-105	75																
	80																

COMPLETION DEPTH: 44.5 ft
DATE BORING STARTED: 9-30-21
DATE BORING COMPLETED: 10-1-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 29 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 5-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-21

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 47.10" N 96° 21' 15.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -29 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 44.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-30				SPT-1	CLAYEY SAND (SC), loose, dark gray and tan		2/6" 2/6" 2/6"	6	21.6				32.3				
-35	5			ST-1	-medium dense from 5' to 10'	(P)3.50			13.1	119.3	25	8	43.7	(P)2.35	(UU)1.71	14.6	
-40	10			SP-2	SILTY SAND (SM), dense, light brown with shell fragments		8/6" 11/6" 15/6"	39	20.9				12.9				
-45	15			SP-3	POORLY GRADED SAND WITH SILT (SP-SM), dense, tan and reddishbrown		7/6" 13/6" 15/6"	42	21.3				8.9				
				SP-4			7/6" 10/6" 12/6"	33	23.1				9				
-50	20			SP-5	SILTY SAND (SM), dense, light brown with shell fragments		18/6" 19/6" 9/6"	42	16				23.8				
				SP-6	FAT CLAY WITH SAND (CH), firm, brown with shell fragments		3/6" 3/6" 4/6"	11	36.4		60	33	82.7				
-55	25			ST-2	-medium from 25' to 27.5'	(P)0.75			38.4	83.2				(P)0.50			
				ST-3	FAT CLAY (CH), firm, gray	(P)3.50			27.5	94.3			85	(P)2.35	(UC)1.26	3.8	
-60	30			ST-4	-very firm from 30' to 37.5'	(P)4.50+			26.8	98.3				(P)3.00			
				ST-5	-slickensided from 32.5' to 37.5'	(P)4.50+			23.4	102.9	52	28	96.1	(P)3.00	(UC)2.56	4.8	
-65	35			ST-6		(P)3.75			24.8	101.7				(P)2.50			
				ST-7	SANDY LEAN CLAY (CL), soft, tan and reddishbrown with sand pockets and shell fragments	(P)2.50			23.4	104.9				(P)1.47	(UC)0.34	9.8	
	40																

COMPLETION DEPTH: 44.5 ft
DATE BORING STARTED: 10-1-21
DATE BORING COMPLETED: 10-1-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 30 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 4-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-21

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 47.10" N 96° 21' 15.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -29 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 44.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-70	40			ST-8	SANDY LEAN CLAY (CL), firm, tan and reddishbrown	(P)2.25			22.4	104	31	13	62.9	(P)1.50			
				ST-9	LEAN CLAY WITH SAND (CL), very firm, tan and reddishbrown with ferrous nodules and calcareous nodules	(P)3.25			23.7	99.9			74.2	(P)2.17	(UC)2.20	2	
-75	45				Bottom @ 44.5 ft.												
-80	50																
-85	55																
-90	60																
-95	65																
-100	70																
-105	75																
	80																

COMPLETION DEPTH: 44.5 ft
DATE BORING STARTED: 10-1-21
DATE BORING COMPLETED: 10-1-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 30 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 4-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-22

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 04.10" N 96° 21' 31.40" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -24 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-25				SP-1	SILTY SAND (SM), medium dense, dark gray with shell fragments		1/6" 3/6" 6/6"	13	21.6				22.3				
	5																
-30				SP-2	-very loose from 5.5' to 7'		WOH/6" WOH/6" WOH/6"	0	26.3				21.9				
	10																
-35				SP-3	-very dense from 10.5' to 15'		11/6" 16/6" 24/6"	60	22.6				18.1				
	15																
-40				SP-4	POORLY GRADED SAND WITH SILT (SP-SM), medium dense, brown with shell fragments		4/6" 5/6" 9/6"	21	22.9				6.6				
	20																
-45				SP-5	SANDY LEAN CLAY (CL), hard, gray with shell fragments		6/6" 11/6" 13/6"	36	92.6				54.6				
				ST-1	FAT CLAY (CH), soft, brown	(P)1.25			41.5	80.6			99.7	(P)0.84	(UU)0.48	5.6	
	25			ST-2	-medium from 25' to 27' -with shell fragments from 25' to 27.5'	(P)1.00			41.8	88.2				(P)0.67			
-50				ST-3	-soft from 27.5' to 29.5'	(P)1.25			42.3	79.8			97.8	(P)0.83	(UC)0.35	11	
	30			ST-4	-medium from 30.5' to 32.5'	(P)1.25							99.5	(P)0.83			
-55				ST-5	SANDY LEAN CLAY (CL), firm, brown and light brown	(P)2.25			20.8	109.4				(P)1.50			
	35			ST-6	-medium with ferrous nodules and calcareous nodules from 35' to 37.5'	(P)2.25			21	105.3				(P)1.50	(UC)0.94	2.7	
-60				ST-7	-very firm from 37.5' to 42.5'	(P)3.25			21.7	103			62.9	(P)2.14			
	40																

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 10-7-21
DATE BORING COMPLETED: 10-7-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-22

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 04.10" N
96° 21' 31.40" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -24 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-65	40		ST-8	SANDY LEAN CLAY (CL), very firm, brown and light brown	(P)4.00			20.3	106				(P)2.68	(UC)0.68	2.8	
			ST-9	LEAN CLAY WITH SAND (CL), firm, brown and light brown	(P)4.50+			24.2	102.8			77.4	(P)3.00			
-70	45		ST-10	LEAN CLAY (CL), medium, brown	(P)4.00			25.8	98.6			95.9	(P)2.68	(UC)0.99	3.8	
				Bottom @ 47 ft.												
-75	50															
-80	55															
-85	60															
-90	65															
-95	70															
-100	75															
	80															

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 10-7-21
DATE BORING COMPLETED: 10-7-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-23

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 17.30" N 96° 21' 49.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -15 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray		2/6" 5/6" 5/6"	15	27.5				18.6				
-20	5			SP-2			7/6" 10/6" 2/6"	18	26.4				19.6				
-25	10			SP-3	-disturbed and very loose from 10.5' to 15'		WOH/6" WOH/6" WOH/6"	0	31.8				25.1				
-30	15			SP-4	-dense from 15.5' to 20'		5/6" 8/6" 13/6"	31	24.2				12.5				
-35	20			SP-5	LEAN CLAY WITH SAND (CL), very soft, tan and reddishbrown with sand pockets and shell fragments		WOH/6" WOH/6" 1/6"	0	35.6		38	16	77.1				
-40	25			ST-1	-medium with ferrous nodules from 25' to 32.5'	(P)0.75			39.2	80.8				(P)0.50	(UC)0.65	6.3	
-45	30			ST-2	-with sand seams from 30' to 32.5'	(P)0.75			35.1	83.2				(P)0.50	(UU)0.65	5.3	
				SP-6	LEAN CLAY (CL), very soft, tan and reddishbrown with sand pockets		WOH/6" WOH/6" 1/6"	1	37		36	19	99.1				
-50	35			ST-3	-medium from 35' to 40'	(P)1.25			42.4	78.2				(P)0.83			
				ST-4	-tan and reddishbrown from 37.5' to 42.5' -with ferrous nodules from 37.5' to 40' -slickensided from 37.5' to 42.5'	(P)2.50			22.9	103.1			88.9	(P)1.34	(UC)0.90	1.8	
-55	40																

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 10-7-21
DATE BORING COMPLETED: 10-8-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 17-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-23

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 17.30" N 96° 21' 49.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -15 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40		ST-5	LEAN CLAY (CL), very firm, tan and reddishbrown	(P)3.50			21.3	105.2				(P)2.00			
			ST-6	LEAN CLAY WITH SAND (CL), firm, tan and reddishbrown	(P)4.00			19.1	106	46	26	77.5	(P)2.68	(UC)1.49	2.6	
-60	45		ST-7	-very firm from 45' to 47.5'	(P)4.25			27.7	94.5				(P)2.84			
			ST-8	LEAN CLAY (CL), medium, tan and reddishbrown	(P)4.50+			26.8	90.6			95.3	(P)3.00	(UC)0.86	3.2	
-65	50		SP-7	-very firm with shell fragments from 50' to 52.5'		3/6" 3/6" 7/6"	15	19.9								
			SP-8	CLAYEY SAND (SC), medium dense, light gray with calcareous nodules and sand pockets		4/6" 6/6" 6/6"	18	21.7		44	24	30.5				
-70	55		ST-9		(P)2.00			22.5				49	(P)1.34			
				Bottom @ 57 ft.												
-75	60															
-80	65															
-85	70															
-90	75															
-95	80															

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 10-7-21
DATE BORING COMPLETED: 10-8-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 17-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-24

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 25.30" N 96° 22' 09.10" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -39 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 32 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-40				SP-1	SILTY SAND (SM), medium dense, brown with shell fragments		4/6" 3/6" 4/6"	10	23.7				14.9				
	5			ST-1	LEAN CLAY (CL), medium, brown with shell fragments and sand pockets	(P)1.75			33.4	86.8	38	20	98.9	(P)1.17	(UU)0.99	4.3	
-45				ST-2		(P)1.75			33.7	89.6			94	(P)1.17	(UC)0.63	8.8	
	10			ST-3	-firm from 10' to 12.5'	(P)2.25			29.9	88.3			99.1	(P)1.50			
-50				ST-4	FAT CLAY (CH), medium, brown	(P)2.00			41.4	78.7	56	32	99.2	(P)1.34	(UC)0.83	4	
	15			ST-5	-firm from 15' to 17.5'	(P)2.75			33.8	88			99.2	(P)1.84			
-55				ST-6	SANDY FAT CLAY (CH), medium, gray with ferrous and calcareous nodules	(P)4.50+			24.9	99.8			65.6	(P)3.00	(UC)0.53	6	
	20			ST-7	FAT CLAY, firm, gray with ferrous and calcareous nodules	(P)2.50			26.6	89.4	60	37	88.5	(P)1.67			
-60				ST-8	-very firm from 22.5' to 25'	(P)3.75			27.4	89.8				(P)2.51			
	25			ST-9	FAT CLAY WITH SAND (CH), very firm, gray with sand pockets	(P)3.75			29.9	93.7			71.3	(P)2.51			
-65				ST-10	CLAYEY SAND (SC), medium dense, gray with ferrous nodules and sand pockets	(P)2.50			21.7	105.2	46	24	28.2	(P)1.67	(UC)0.67	3.4	
	30			SP-2	SILTY SAND (SM), dense, gray		10/6" 12/6" 15/6"	40	21.9				16.5				
-70					Bottom @ 32 ft.												
	35																
-75																	
	40																

COMPLETION DEPTH: 32 ft
DATE BORING STARTED: 10-8-21
DATE BORING COMPLETED: 10-8-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 40 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 7-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-25

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 40.5" N 96° 22' 23.7" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -31 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 38 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SILTY SAND (SM), very dense, gray with clay pockets		13/6" 19/6" 24/6"	65	23				21.8				HYD,SV
				SP-2			21/6" 21/6" 13/6"	51	23.2				16.1				
-35	5			SP-3	FAT CLAY (CH), very soft, brown		WOH/6" WOH/6" WOH/6"	0	40.8								
				ST-1	-medium from 6' to 10'	(T)0.30 (P)0.50			32.6	92.1	39	19		(T)0.60 (P)0.34	(UC)0.67	4.9	
				ST-2		(T)0.30 (P)0.50							74.8	(T)0.60 (P)0.34			
-40	10			ST-3	FAT CLAY WITH SAND (CH), very soft, brown	(P)1.00			37.9	84.5				(P)0.50			
				ST-4		(T)0.40 (P)0.75			35.2	85.1	54	30		(T)0.80 (P)0.50	(UC)0.53	3.8	
-45	15			ST-5	-with sand seams from 14' to 16'	(P)1.00			30.2	92.2			96.6	(P)0.67			
				ST-6		(P)1.00			37.8					(P)0.50			
				ST-7	-firm from 18' to 22'	(P)1.25			41.1	82.7				(P)0.84			
-50	20			ST-8		(P)1.50			31.4	88.1			99.6	(P)1.00			
				ST-9	-medium from 22' to 36' -with silt seams from 22' to 24'	(P)1.50			36.8	82.4	56	31		(P)1.00	(UC)0.94	7.8	
-55	25			ST-10	-with sand seam and shell fragments from 24' to 26'	(P)1.50			38.9	81.9				(P)1.00			
				ST-11		(P)1.50			44.2	76.5			99.5	(P)1.00			
				ST-12	-slickensided from 28' to 34'	(P)1.50			48.4	71.9				(P)1.00			
-60	30			ST-13		(P)1.75			40.5	79.9	65	41		(P)1.17	(UC)1.84	2.1	
				ST-14		(P)1.50			33.6	88.2			89.3	(P)1.00			
-65	35			ST-15		(P)1.75			34.7	87				(P)1.17			
				SP-4	SILTY SAND (SM), very dense, gray		16/6" 19/6" 21/6"	61	22.2				15.6				SV
-70	40				Bottom @ 38 ft.												

COMPLETION DEPTH: 38 ft
DATE BORING STARTED: 7-12-21
DATE BORING COMPLETED: 7-12-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 32 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-26

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 50.1" N
96° 22' 43.7" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -22 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SANDY FAT CLAY (CH), very soft, gray with silt pockets		WOR/6" WOR/6" WOR/6"	0	55.6								
-25				ST-1		(T)0.05 (P)0.00			39.8	79.1	50	29		(T)0.10 (P)0.00			
	5			ST-2		(T)0.05 (P)0.00			47.9	74.7			57.1	(T)0.10 (P)0.00			
				SP-2	SILTY SAND (SM), dense, brown -with clay pockets from 6' to 8'		22/6" 14/6" 12/6"	39	25.4				19.9				HYD,SV
-30				SP-3	-medium dense, with shell deposits from 8' to 10'		1/6" 1/6" 8/6"	14	28.9								
	10			SP-4	SANDY LEAN CLAY (CL),very firm, brown with sand layers		2/6" 3/6" 8/6"	17	37.6				61				
				SP-5	SILTY SAND (SM), dense, brown		6/6" 7/6" 19/6"	39	25.6								
-35				SP-6	-very dense from 14' to 18'		13/6" 18/6" 25/6"	65	25				16				HYD,SV
	15			SP-7			13/6" 33/6" 50/5.5"	126	25.2								
-40				SP-8	-dense from 18' to 20'		13/6" 15/6" 7/6"	33	25.5				17.7				SV
	20			SP-9	Sandy LEAN CLAY (CL), very soft, brown with silt pockets		WOH/6" WOH/6" WOH/6"	0	30		31	12					
				ST-3	-soft from 22' to 24' -with sand seam from 22' to 24'	(P)1.50			31.6	90.8				(P)1.00	(UC)0.44	9.3	
-45				SP-10	-firm from 24' to 26'		2/6" 2/6" 4/6"	9	27.2								
	25			ST-4	-disturbed from 26' to 28'	(T)0.07 (P)0.25			30.1	93	27	9	60.8	(T)0.14 (P)0.17			
-50				ST-5	LEAN CLAY (CL), medium, brown with sand seams	(P)1.25			36.2	85.3				(P)0.84			
	30			ST-6		(P)1.50			29.5	88.3				(P)1.00	(UC)0.55	8.8	
-55				ST-7	-slickensided from 32' to 38'	(T)0.40 (P)0.75			35	86.8			94.7	(T)0.80 (P)0.50			
	35			ST-8		(P)1.50			29.3	95.8				(P)1.00			
				SP-11			WOH/6" 3/5" 8/6"	17	34.4		47	24	99.6				
-60				ST-9	FAT CLAY (CH), medium, brown	(P)1.75			30.4	91.7				(P)1.17	(UC)1.00	9.3	
	40																

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 7-12-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 23 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% .3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-26

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 27' 50.1" N
96° 22' 43.7" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -22 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-10	FAT CLAY (CH), medium, brown -with sand pockets from 40' to 47'	(P)1.50			40.2	80.6				(P)1.00			
-65				ST-11	-with shell fragments from 42' to 44'	(T)0.50 (P)1.25			33.6	88.2			92.5	(T)1.00 (P)0.84			
	45			ST-12		(P)1.50			31.7	91.3				(P)1.00	(UC)1.07	10	
-70					Bottom @ 47 ft.												
	50																
-75																	
	55																
-80																	
	60																
-85																	
	65																
-90																	
	70																
-95																	
	75																
-100																	
	80																

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 7-12-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 23 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% .3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-27

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 05.4" N
96° 22' 58.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray -disturbed from 0' to 2'		11/6" 15/6" 18/6"	50	21.7				12.4				HYD,SV
				SP-2			2/6" 3/6" 7/6"	15	25.3								
-20	5			SP-3			4/6" 5/6" 4/6"	14	27.2				14.1				HYD.SV
				SP-4			6/6" 5/6" 7/6"	18	25.6								
				SP-5			7/6" 9/6" 10/6"	28	25.6								
-25	10			SP-6	CLAYEY SAND (SC), dense, brown		4/6" 12/6" 17/6"	44	24.3				44.3				SV
				SP-7	-becomes gray at 2'		12/6" 14/6" 17/6"	47	24.7								
-30	15			SP-8	-becomes very dense from 14' to 16'		13/6" 21/6" 19/6"	60	26.1								
				SP-9	LEAN CLAY with SAND (CL), firm, brown		2/6" 3/6" 6/6"	14	42.8		34	15	73.6				
				SP-10	SANDY LEAN CLAY (CL), hard, brown		6/6" 14/6" 16/6"	45	29.5				53.4				SV
-35	20			SP-11	CLAYEY SAND (SC), dense, gray		7/6" 12/6" 19/6"	47	24.4								
				SP-12	-medium dense from 22' to 24' -becomes brown at 22'		3/6" 4/6" 5/6"	14	31.4				42.3				
-40	25			ST-1	FAT CLAY (CH), firm, brown with sand pockets	(P)1.00			45.7	76.6	58	30	95.4	(P)0.67	(UC)0.47	12.8	
				SP-13	LEAN CLAY (CL), firm, brown		WOH/6" 6/6" 8/6"	21	31.6							
				SP-14	-soft from 28' to 30'		WOH/6" WOH/6"	6	29.8							
-45	30			ST-2	-medium from 30' to 32' -with silt seams from 30' to 32'	(P)1.25	4/6"		34	89.2	40	20		(P)0.84			
				ST-3	FAT CLAY (CH), medium, brown -with shell fragments from 32' to 34'	(P)1.25			36.9	83.8				(P)0.84	(UC)0.81	7	
-50	35			ST-4		(P)1.25			29.1	94.8			92.6	(P)0.84			
				ST-5		(P)1.25			35	88.8				(P)0.84			
				ST-6	-firm with sand pockets from 38' to 40'	(P)1.25			33	87.2			99.7	(P)0.84	(UC)1.00	6	
-55	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-13-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-27

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 05.4" N 96° 22' 58.0" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -15 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			SP-15	FAT CLAY (CH), firm, brown -disturbed from 40' to 42'		WOH/6" WOH/6" WOH/6"	0	39.3		56	32	98.2				
				ST-7	-with silt seams from 42' to 46'	(P)1.50			34.5	88.5				(P)1.00			
-60	45			ST-8	-with sand pockets from 44' to 46'	(P)1.50			34.6	89				(P)1.00	(UC)1.29	8	
				ST-9		(P)1.50			36.9	82.3				(P)1.00			
				ST-10	-medium from 48' to 50'	(P)1.00			38.1	84.2	61	36	97.4	(P)0.67	(UC)0.97	15	
-65	50			ST-11	-firm from 50' to 54'	(P)1.50			54.5	69.8				(P)1.00			
				ST-12		(P)1.50			51.1	71.3				(P)1.00			
					Bottom @ 54 ft.												
-70	55																
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-13-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-28

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 14.4" N
96° 23' 18.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	POORLY GRADED SAND WITH SILT (SP-SM), medium dense, brown		6/6" 9/6" 7/6"	24	23.2				9.6				HYD.SV
				SP-2			2/6" 3/6" 4/6"	11	23.9								
-20	5			SP-3	SILTY SAND (SM), medium dense, brown		2/6" 5/6" 7/6"	18	24.4				18.8				
				SP-4	-dense from 6' to 8'		9/6" 12/6" 15/6"	41	25.8				12.1				SV
				SP-5	-very dense and gray from 8' to 12'		11/6" 15/6" 20/6"	53	23.9								
-25	10			SP-6			7/6" 15/6" 20/6"	53	27								
				SP-7	-medium dense and brown from 12' to 14'		10/6" 11/6" 12/6"	35	24.6				16.1				HYD.SV
-30	15			SP-8	LEAN CLAY with SAND (CL), firm, brown		3/6" 7/6" 8/6"	23	39.9		44	21	82.6				
				SP-9	CLAYEY SAND (SC), very dense, brown		8/6" 15/6" 18/6"	58	26								
				SP-10	-with clay pockets from 18' to 20'		10/6" 22/6" 33/6"	83	26.8								
-35	20			SP-11	-medium dense from 20' to 22'		8/6" 6/6" 4/6"	15	30.7		33	11	36.3				
				ST-1	LEAN CLAY (CL), firm, brown	(P)1.50			29.3	91				(P)1.00	(UC)0.60	4.8	
				SP-12	CLAYEY SAND (SC), dense, brown with clay pockets		12/6" 14/6" 17/6"	47	25.2				37.2				
-40	25			SP-13	-medium from 26' to 28'		8/6" 5/6" 4/6"	14	25.1				41.6				
				SP-14	LEAN CLAY (CL), soft, brown		4/6" 1/6" 2/6"	5	29.4								
-45	30			ST-2	FAT CLAY (CH), medium, brown with sand seams from 30' to 32'	(T)0.35 (P)1.25			35.9	85.1				(T)0.70 (P)0.84	(UC)0.94	5.5	
				ST-3	-with sand pockets from 32' to 38'	(T)0.50 (P)1.25			40.6	81.9	52	27	99.2	(T)1.00 (P)0.84			
-50	35			ST-4		(P)1.50			29.5	94.6				(P)1.00			
				ST-5		(T)0.30 (P)1.00			34.3	91.6				(T)0.60 (P)0.84	(UC)0.53	10.3	
				ST-6	LEAN CLAY (CL), firm, brown	(P)1.50			35.6	87.3	28	9	99.4	(P)1.00			
-55	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-13-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-28

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 14.4" N
96° 23' 18.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			SP-15	FAT CLAY (CH), medium, brown		3/6" 2/6" 3/6"	8	36.3								
				ST-7	-becomes gray at 42' -with sand pockets from 42' to 50' -becomes firm from 42' to 54'	(P)1.50			33.2	87.9				(P)1.00			
				ST-8		(P)1.50			36.5	85.6				(P)1.00			
-60	45			ST-9		(T)0.55 (P)1.25			34.4	88				(T)1.10 (P)0.84	(UC)1.12	6.5	
				ST-10		(P)1.50			36.1	84.5	64	37	99.6	(P)1.00			
-65	50			ST-11		(P)1.75			50.8	70.7				(P)1.17			
				ST-12		(P)1.50			48.9	73				(P)1.00			
					Bottom @ 54 ft.												
-70	55																
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-13-21
DATE BORING COMPLETED: 7-13-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-29

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 33.5" N
96° 23' 33.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	CLAYEY SAND (SC), very loose, dark gray		WOR/6" WOR/6" WOR/6"	0									HYD
				SP-2	-medium dense from 2.5' to 4'		WOR/6" 6/6" 12/6"	27	33.9		31	14	40.6				
-20	5			SP-3	SILTY SAND (SM), very dense, brown with shell fragments		8/6" 15/6" 22/6"	56	24.7				17.1				SV
				SP-4			18/6" 22/6" 14/6"	54									
				SP-5	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown -with shell deposits from 8' to 12'		8/6" 14/6" 22/6"	54	25.4				9.4				
-25	10			SP-6			14/6" 25/6" 39/6"	97									
				SP-7	SILTY SAND (SM), very dense, tan		14/6" 18/6" 22/6"	61	24.9				14.3				
				SP-8			22/6" 33/6" 50/5"	126									
-30	15			SP-9			8/6" 13/6" 22/6"	53	25.6								
				SP-10			11/6" 23/6" 29/6"	78					20.6				SV
-35	20			SP-11	SANDY LEAN CLAY (CL), very firm, brown with sand pockets		5/6" 11/6" 15/6"	39	36.9		29	12	61.4				
				SP-12	CLAYEY SAND (SC), very dense, brown and tan		14/6" 18/6" 24/6"	64	23.6								
-40	25			SP-13	-medium dense from 24' to 26'		WOH/6" 3/6" 9/6"	18	28.3		24	7	47.1				
				SP-14	LEAN CLAY (CL), firm, reddishbrown with sand pockets		6/6" 5/6" 9/6"	21	23								
				ST-1	-with shell fragments from 28' to 32' -medium from 28' to 32'	(T)0.35 (P)0.75			31.7	89.5				(T)0.70 (P)0.50	(UC)0.64	10.8	
-45	30			ST-2		(T)0.50 (P)0.50			27.1	97.4				(T)1.00 (P)0.34	(UC)0.55	9	
				ST-3	-firm from 32' to 34'	(P)1.50			28.3	93.6				(P)1.00			
-50	35			ST-4	-medium from 34' to 36'	(P)1.50			27.8	95.6				(P)1.00	(UC)0.56	9.8	
				ST-5	FAT CLAY (CH), firm, tan and brown -with sand seams from 36' to 40'	(P)1.50			34.9	87.9				(P)1.00			
				ST-6	-with shell fragments from 38' to 40'	(P)1.75			39.8	82.1				(P)1.17	(UC)0.89	10	
-55	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-14-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape through casing. 2) Drlll Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-29

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 33.5" N
96° 23' 33.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			SP-15	POORLY GRADED SAND with SILT (SP-SM), very dense, gray		3/6" 17/6" 35/6"	79	22.9				10.7				
				SP-16	SILTY SAND (SM), very dense, gray		5/6" 15/6" 32/6"	71	23.2				14.1				HYD,SV
-60	45			SP-17			4/6" 17/6" 19/6"	54	22.4								
				SP-18			3/6" 13/6" 36/6"	74	25.3								
				SP-19			17/6" 31/6" 50/5"	123	24.4								
-65	50			SP-20	POORLY GRADED SAND with SILT (SP-SM), very dense, gray and tan		24/6" 35/6" 50/5"	129					10.6				SV
				SP-21			25/6" 50/5.5	130	25.5								
					Bottom @ 54 ft.												
-70	55																
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-14-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-30

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 29° 28' 39.1" N
96° 23' 53.6" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -21 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 48 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY WITH SAND (CH), very soft, reddishbrown -with sand pockets from 0' to 4'		WOH/6" WOH/6" WOH/6"	0	46.8		50	28	77.8				HYD,SV
				SP-2	-medium from 2' to 4'		WOH/6" 1/6" 5/6"	9	66.7		59	35	82				
-25	5			SP-3	SILTY SAND (SM), brown -disturbed with clay pockets from 4' to 6'		21/6" 47/6" 31/6"	118	24.3				38				HYD,SV
				SP-4	-medium dense from 6' to 8' -becomes brown at 6'		3/6" 4/6" 9/6"	19	25.6								
-30	10			SP-5	-dense from 8' to 12'		3/6" 9/6" 13/6"	33	24.2				20.4				SV
				SP-6			6/6" 12/6" 14/6"	39	25.5								
				SP-7	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown		12/6" 25/6" 37/6"	94	23.1				11.8				
-35	15			SP-8	SILTY SAND (SM), very dense, brown with shell fragments		17/6" 36/6" 36/6"	109	24.3								
				SP-9	SANDY SILT (ML), dense, gray with shell fragments		11/6" 11/6" 19/6"	45	26.8				55.3				SV
				SP-10	FAT CLAY (CH), very soft, brown		WOH/6" WOH/6" WOH/6"	0	34.4				96.6				
-40	20			SP-11	-with silt pockets from 20' to 22'		WOH/6" WOH/6" WOH/6"	0	42.1		54	30	98.8				
				SP-12	SILTY SAND (SM), very dense, brown		12/6" 15/6" 19/6"	51	26.4				31.8				
-45	25			SP-13	-medium dense from 24' to 26'		4/6" 7/6" 3/6"	15	26.4								
				ST-1	LEAN CLAY (CL), medium, reddishbrown	(P)1.25			32	94.6	40	20	99	(P)0.84	(UC)0.72	11.8	
				ST-2	FAT CLAY (CH), firm, brown	(P)1.50			33.6	91.3				(P)1.00			
-50	30			ST-3		(P)1.50			46	81.3			97.6	(P)1.00			
				ST-4	-becomes reddishbrown at 32'	(P)1.25			37.5	84.8			98.9	(P)0.84	(UC)1.01	5.8	
-55	35			ST-5		(P)1.50			37.9	83.3	60	36		(P)1.00			
				ST-6		(P)1.50			33	90.2				(P)1.00			
-60	40			ST-7	-with sand pockets and shell fragments from 38' to 40'	(P)1.50			35.1	86.9			98.5	(P)1.00	(UC)1.05	6.8	

COMPLETION DEPTH: 48 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-14-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 22 FT. Based on weighted measuring tape though casing . 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 8-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-30

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 29° 28' 39.1" N
96° 23' 53.6" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -21 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 48 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-8	FAT CLAY (CH), medium, gray	(P)1.50			42.2	78.5				(P)1.00			
				ST-9		(P)1.50			49.5	74				(P)1.00			
-65	45			ST-10	-firm, with slickensided from 44' to 46'	(P)2.00			48.6	71.9			99.3	(P)1.34	(UC)1.72	3.6	
				ST-11		(P)1.50			51.3	71.4			99.6	(P)1.00			
					Bottom @ 48 ft.												
-70	50																
-75	55																
-80	60																
-85	65																
-90	70																
-95	75																
-100	80																

COMPLETION DEPTH: 48 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-14-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 22 FT. Based on weighted measuring tape though casing . 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 8-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-31

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 54.6" N
96° 24' 08.3" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -14 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-15				SP-1	SILTY SAND (SM), tan -disturbed from 0' to 2'		9/6" 15/6" 22/6"	57	24.1				14.8				HYD,SV
				SP-2	-becomes gray from 2' to 4'		13/6" 9/6" 7/6"	24	23								
	5			SP-3	POORLY GRADED SAND with SILT (SP-SM), loose, brown		4/6" 4/6" 4/6"	12	26.4				9.2				HYD,SV
-20				SP-4	SILTY SAND (SM), dense, gray and tan		9/6" 13/6" 19/6"	48	25.6								
				SP-5	-with shell fragments from 8' to 10'		8/6" 13/6" 18/6"	47	26.4				16.5				SV
	10			SP-6			8/6" 14/6" 25/6"	59	24.7								
-25				SP-7	POORLY GRADED SAND with SILT (SP-SM), medium dense, tan		8/6" 11/6" 18/6"	43	28.8				11.6				
	15			SP-8	SILTY SAND (SM), very dense, brown		11/6" 22/6" 38/6"	91	25.7								
-30				SP-9	-becomes medium dense from 16' to 18' -with shell fragments from 16' to 24'		2/6" 3/6" 9/6"	18	27								
				SP-10	-becomes very dense from 18' to 24'		18/6" 35/6" 49/6"	127	25.7				14.2				
	20			SP-11			13/6" 27/6" 38/6"	98	25.4								
-35				SP-12	-becomes tan from 22' to 24'		15/6" 22/6" 35/6"	86	23.2				45.9				SV
	25			SP-13	LEAN CLAY (CL), very soft, brown -with shell fragments from 24' to 28'		WOH/6" WOH/6" WOH/6"	0	39.8		36	17	98.7				
-40				ST-1	-becomes medium dense and reddishbrown from 26' to 30'	(T)0.50 (P)1.25			32.8	90.5			96.8	(T)1.00 (P)0.84	(UC)0.69	9.8	
				ST-2	-firm from 28' to 30'	(P)1.75			22.8	101.1				(P)1.17			
	30			SP-14	SILTY CLAY WITH SAND (CL-ML), soft, brown		5/6" 1/6" 1/6"	3	29.5		26	7	77.3				
-45				ST-3	LEAN CLAY (CL), soft, reddishbrown -with shell fragments from 32' to 36'	(T)0.20 (P)0.50			30.5	92.5				(T)0.40 (P)0.34	(UC)0.48	11	
				ST-4	-becomes medium from 34' to 36'	(T)0.35 (P)1.25			29.7	94.5			91.7	(T)0.70 (P)0.84			
	35			ST-5	-firm with sand pockets from 36' to 38'	(P)1.75			31.9	90.9				(P)1.17			
-50				SP-15	SILTY SAND (SM), very dense, tan		7/6" 13/6"	60	24.8								
	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-15-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 15 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-31

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 54.6" N 96° 24' 08.3" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -14 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			SP-16	POORLY GRADED SAND with SILT (SP-SM), dense, tan		27/6" 17/6" 27/6" 18/6"	68	22.3				8.8				
				ST-5	LEAN CLAY (CL), firm, brown with sand and shell fragments	(P)1.75			37.8	83.9	43	22		(P)1.17	(UC)1.11	9.5	
				ST-6	FAT CLAY (CH), firm, gray	(P)2.00			32.4	89.7				(P)1.34			
-60	45			ST-7		(P)1.75			44	76.5				(P)1.17			
				ST-8		(P)1.75			47.6	74.1				(P)1.17			
-65	50			ST-9	-slickensided from 50' to 52'	(P)2.00			55.4	68.9	88	52		(P)1.34	(UC)0.82	1.7	
				ST-10	-firm from 52' to 54'	(P)2.00			49.1	72.5				(P)1.34			
-70	55				Bottom @ 54 ft.												
-75	60																
-80	65																
-85	70																
-90	75																
	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-14-21
DATE BORING COMPLETED: 7-15-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 15 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-32

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 03.9" N 96° 24' 28.8" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -17 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SILTY SAND (SM), medium dense, brown and gray		4/6" 6/6" 6/6"	18	25.4				17.1				HYD,SV
-20				SP-2	-loose from 2.5' to 4'		2/6" 3/6" 4/6"	10	25.6				16.5				HYD,SV
	5			SP-3	-very dense from 4.5' to 6'		12/6" 19/6" 21/6"	59	24.3								
				SP-4	-medium dense at 6.5' to 8'		7/6" 8/6" 10/6"	27	25.7								
-25				SP-5	-very dense from 8.5' to 10'		7/6" 16/6" 23/6"	59	24.8				14.3				SV
	10			SP-6	-medium dense from 10.5' to 12'		7/6" 14/6" 12/6"	43	26.6								
-30				SP-7	-very dense at 12.5' from 14'		10/6" 8/6" 28/6"	54	24.9								
	15			SP-8	-medium dense from 14.5' to 16'		10/6" 12/6" 7/6"	28	24.3				23.5				SV
				SP-9	LEAN CLAY (CL), very soft, brown		WOH/6" WOH/6"	0	35.3				94.5				
-35				ST-1	-medium from 18' to 20' -with sand seams from 18' to 24'	(P)1.00	WOH/6"		31.3	90.6				(P)0.67	(UU)0.61	13.1	
	20			ST-2	-firm with silt pockets from 20' to 22'	(P)1.50			32.9	87.5	44	24		(P)1.00			
				ST-3	-medium from 22' to 30'	(P)1.00			38	83.2				(P)0.67			
-40				ST-4		(P)1.00			45	85.6	44	24	99.1	(P)0.67			
	25			ST-5		(P)1.00			43.2	81.2				(P)0.67			
-45				ST-6		(P)1.50			34.1	88.4	42	22	95.4	(P)1.00	(UC)0.70	6.1	
	30			ST-7	-firm from 30' to 34'	(P)1.50			32	90				(P)1.00			CU
-50				ST-8	-with sand pockets and shell fragments from 32' to 34'	(P)1.50			35.4	86			89.7	(P)1.00			
	35			SP-10	POORLY GRADED SAND WITH SILT (SP-SM), very dense, gray		10/6" 18/6" 34/6"	78	23.9				9.8				SV
				SP-11			12/6" 17/6" 32/6"	74	24.7								
-55				SP-12			17/6" 32/6"	122	23.6				6.5				SV
	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-15-21
DATE BORING COMPLETED: 7-15-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 3-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-32

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 03.9" N
96° 24' 28.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-13	POORLY GRADED SAND WITH SILT (SP-SM), very dense, gray		46/6" 16/6" 33/6" 38/6"	107	22.7								
-60				SP-14			17/6" 34/6" 38/6"	109	22.1								
	45			SP-15			17/6" 34/6" 50/5"	128	22.3								
				SP-16			18/6" 32/6" 15/6"	71	22.5								
-65				SP-17			12/6" 29/6" 47/6"	115	23.1								
	50			SP-18	FAT CLAY (CH), very firm, gray		9/6" 6/6" 4/6"	25	46.8								
-70				ST-9	-firm from 53' to 55'	(P)1.50			42.8		84	48	99.3	(P)1.00			
					Bottom @ 54 ft.												
	55																
-75																	
	60																
-80																	
	65																
-85																	
	70																
-90																	
	75																
-95																	
	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-15-21
DATE BORING COMPLETED: 7-15-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 3-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-33

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 19.1" N
96° 24' 43.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -19 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-20				SP-1	CLAYEY SAND (SC), very soft, tan with silt pockets		WOR/6" WOR/6" WOR/6"	0	40.7		33	16	35.1				HYD,SV
				SP-2	SILTY SAND (SM), very dense, tan		18/6" 25/6" 29/6"	81	25.1				15.8				HYD,SV
	5			SP-3	-with shell fragments from 4.5' to 6'		24/6" 36/6" 42/6"	118	24.2								
-25				SP-4	-medium dense from 6.5' to 10'		12/6" 13/6" 17/6"	30	26								
				SP-5			8/6" 8/6" 6/6"	21	24.8				22.3				HYD,SV
	10			SP-6	- very dense from 10.5' to 14' -with clay pockets from 10.5' to 12'		6/6" 8/6" 32/6"	60	24.9								
-30				SP-7	-with shell fragments at 12.5' to 14'		11/6" 24/6" 16/6"	60	25.2								
	15			SP-8	SANDY SILT (ML), very dense, brown with clay pockets		4/6" 16/6" 33/6"	74	23.7				69.8				SV
-35				SP-9	CLAYEY SAND (SC), very loose, brown		4/6" 1/6" 1/6"	3	26.9		NP	NP	46.8				
				ST-1	LEAN CLAY (CL), soft, brown -with shell fragments from 18' to 20'	(T)0.19 (P)0.50			33.4	88.1				(T)0.38 (P)0.34			
	20			SP-10	-very soft from 20.5' to 22'		WOH/6" WOH/6" WOH/6"	0	36.6		43	25	96.1				
-40				ST-2	-becomes soft from 22' to 24' -with sand layer from 22' to 26'	(T)0.11 (P)0.50			37.3	83.4				(T)0.22 (P)0.34			
				ST-3	-medium from 24' to 28'	(T)0.30 (P)0.75			39	80.1				(T)0.60 (P)0.50			
	25																
-45				ST-4	-with sand pockets from 26' to 28'	(T)0.40 (P)0.75								(T)0.80 (P)0.50			CU
				ST-5	-soft with sand seams from 28' to 30'	(T)0.35 (P)0.50			39.6	87.4				(T)0.70 (P)0.34			
	30			ST-6	FAT CLAY (CH), firm, brown -with sand pockets from 30' to 44'	(P)1.50			36.8	79.4				(P)1.00			
-50				ST-7	-medium from 32' to 34'	(P)1.50			30.9	90.4				(P)1.00	(UU)0.50	13	
				ST-8	-slickensided with sand seams from 34' to 36' -firm from 34' to 50'	(P)1.75			33.4	88.3				(P)1.17			
	35																
-55				ST-9		(P)1.50			38.3	85.4	53	30	95.1	(P)1.00			
				ST-10		(P)1.50			36.3	85.1				(P)1.00	(UU)1.06	5.3	
	40																

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-15-21
DATE BORING COMPLETED: 7-16-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-33

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 19.1" N 96° 24' 43.5" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -19 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-60	40			ST-11	FAT CLAY (CH), firm, brown -becomes gray from 40'	(P)1.75			41.1	78.3				(P)1.17			
				ST-12	-with shell fragments from 42' to 46'	(P)1.75			35.3	82.8				(P)1.17			
				ST-13		(P)1.50			38.2	82.3				(P)1.00	(UC)1.16	3.7	
-65	45			ST-14	-with sand pockets from 46' to 48'	(P)1.50			41.6	76.7				(P)1.00			
				ST-15		(P)1.75			47.6	72.3				(P)1.17			
-70	50			ST-16	-medium with sand seams and shell fragments from 50' to 52'	(P)2.25			52.3	69.8	90	55	98.6	(P)1.51	(UC)0.72	6	
					Bottom @ 52 ft.												
-75	55																
-80	60																
-85	65																
-90	70																
-95	75																
	80																

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-15-21
DATE BORING COMPLETED: 7-16-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-34

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 28.7" N
96° 25' 04.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -19 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-20				SP-1	SILTY SAND (SM), dense, brown		6/6" 16/6" 14/6"	45	22.4				19.4				HYD,SV
				SP-2	-very dense from 2.5' to 4'		17/6" 20/6" 16/6"	55	22.3								
	5			SP-3	CLAYEY SAND (SC), very dense, brown		12/6" 15/6" 19/6"	52	23.3				41.4				HYD,SV
-25				SP-4	-dense from 6.5' to 8'		12/6" 13/6" 14/6"	41	23.9								
	10			SP-5	LEAN CLAY (CL), medium, brown		WOH/6" 1/6" 2/6"	5	46.3		39	19	90.6				
-30				ST-1		(P)1.00								(P)0.67			
-35	15																
	20			ST-2	FAT CLAY (CH), medium, brown -with silt layer from 19' to 21'	(P)1.00			41.3	81.9	76	46	99.4	(P)0.67			
-40				ST-3	-with sand pockets and shell fragments from 23' to 25'	(P)1.50			34.3	87.3				(P)1.00			
	25			SP-6	SILTY SAND (SM), very dense, gray with shell fragments		12/6" 24/6" 33/6"	86	20.8				17.3				HYD,SV
-45				SP-7			13/6" 19/6" 47/6"	100									
	30			SP-8	LEAN CLAY (CL), very soft, brown -with sand pockets from 30' to 37'		3/6" 1/6" 1/6"	2	42.3								
-50				ST-4	-firm from 32.5' to 34.5'	(P)1.50								(P)1.00			CU
	35			ST-5	-medium from 35' to 37'	(P)1.50			35	87.6	46	27	99.1	(P)1.00	(UC)0.60	15	
-55				ST-6	-firm from 37.5' to 49.5' -becomes gray at 37.5' -with sand seams from 37.5' to 42'	(P)2.00			34.5	83.6				(P)1.34			
	40																

COMPLETION DEPTH: 49.5 ft
DATE BORING STARTED: 7-16-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-34

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 28.7" N
96° 25' 04.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -19 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-60	40			ST-7	FAT CLAY (CH), firm, gray	(P)2.25			34.3	84.6				(P)1.51			
				ST-8	-with sand pockets and shell fragments from 42.5' to 44.5'	(P)2.25			43.1	76.9	72	45	99	(P)1.51	(UC)1.64	5.3	
-65	45			ST-9	-medium from 45' to 49.5'	(P)1.75			41.1	74.7				(P)1.17			
				ST-10	-with shell fragments from 47.5' to 49.5'	(P)2.00			52.2	68.5	91	61	99.3	(P)1.34	(UC)0.87	5.5	
-70	50				Bottom @ 49.5 ft.												
-75	55																
-80	60																
-85	65																
-90	70																
-95	75																
	80																

COMPLETION DEPTH: 49.5 ft
DATE BORING STARTED: 7-16-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-35

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 45.0" N
96° 25' 18.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SILT (ML), medium dense, brown		1/6" 6/6" 8/6"	21	25.2								HYD,SV
-20	5			SP-2	-very dense from 5.5' to 7'		13/6" 17/6" 20/6"	56	24.6				91.4				HYD,SV
-25	10			SP-3	-medium dense with shell fragments from 10.5' to 20'		6/6" 6/6" 5/6"	17	33.4		NP	NP	94.2				
-30	15			ST-1	-with sand seams at 15' to 20'	(P)1.50			34.6	87.2				(P)1.00			
-35	20			ST-2	FAT CLAY (CH), medium, brown -with sand pockets and sand seams	(P)1.50			37.6	82.3	73	39	97.2	(P)1.00	(UU)0.79	6.3	
-40	25			ST-3	SANDY LEAN CLAY (CL), medium, brown with sand pockets	(P)2.00			33.7	88.1				(P)1.34	(UC)0.66	5.3	
-45				SP-4	-with sand layer at 27.5' to 29.5' -firm from 27.5' to 30'		7/6" 5/6" 9/6"	21	29.9		30	15	61.2				
-50	30			ST-4	LEAN CLAY (CL), firm, brown -with sand pockets from 29.5' to 32'	(P)1.75			39.2	79.9				(P)1.17	(UC)1.04	6	
				ST-5		(P)1.50			34	89.7	45	25	99	(P)1.00			
-55	35			SP-5	FAT CLAY (CH), firm, gray		6/6" 3/6" 4/6"	11	41.7								
	40			ST-6	-with sand and shell fragments from 37' to 39.5'	(T)0.40 (P)0.75			41.7	77	67	40	99.4	(T)0.80 (P)0.50			

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-35

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 45.0" N
96° 25' 18.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40		ST-7	FAT CLAY (CH), medium, gray -firm from 40' to 52'	(P)1.50			35	84				(P)1.00			
			ST-8		(P)1.50			41.5	75.6				(P)1.00			
-60	45		ST-9		(P)1.50			45.6	73				(P)1.00	(UC)1.77	4.6	
			ST-10		(P)1.50			41.8	74.5				(P)1.00			
-65	50		ST-11		(P)1.50			43.7	74.2				(P)1.00			
			ST-12	-very firm from 52' to 54'	(P)1.50			49.1	71.7	90	55	99.8	(P)1.00	(UC)2.00	6	
-70				Bottom @ 54 ft.												
	55															
-75	60															
-80	65															
-85	70															
-90	75															
-95	80															

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-36

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 53.4" N
96° 25' 39.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
-15	0			SP-1	SILTY SAND (SM), medium dense, gray		3/6" 4/6" 7/6"	16	22.9				21.7				HYD,SV
-20	5			SP-2	-dense from 5.5' to 10'		6/6" 9/6" 11/6"	30	22.9				43.1				HYD,SV
-25	10			SP-3	LEAN CLAY (CL), firm, brown with sand layer		1/6" 3/6" 3/6"	9	37.4		31	14	95.2				
-30	15			SP-4	FAT CLAY (CH), very firm, brown with silt pockets		4/6" 5/6" 7/6"	18	25.1		50	30	90.4				
-35	20			SP-5	SILTY SAND (SM), medium dense, brown		4/6" 7/6" 8/6"	22	23.7				32.4				
-40	25			SP-6	-dense from 25.5' to 27'		4/6" 7/6" 16/6"	34	20								
-45	30			SP-7	-very dense from 30.5' to 37.5'		13/6" 26/6" 37/6"	95	22.7				23.9				SV
				SP-8			17/6" 35/6" 40/6"	114	23.4								
-50	35			SP-9			17/6" 15/6" 20/6"	53	23.1				21.4				
-55	40			SP-10	FAT CLAY (CH), medium, gray -with shell fragments from 37.5' to 39.5'		WOH/6" WOH/6" 3/6"	5	36.3				99.3				HYD,SV

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-36

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 53.4" N
96° 25' 39.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40		ST-1	FAT CLAY (CH), firm, gray -with sand seams from 40' to 42' -with sand pockets from 40' to 47'	(P)2.00			36.2	86.3	55	33	98.7	(P)1.34	(UC)1.52	6.5	
			ST-2		(P)2.00			35.8	85.3				(P)1.34			
-60	45		ST-3		(P)2.50			39.2	79.2				(P)1.68			
			ST-4	-with shell fragments from 47.5' to 49.5'	(P)2.00			45.1	75	83	56	99.6	(P)1.34	(UC)1.31	2.1	
-65	50		ST-5		(P)2.25			46.2	74.9				(P)1.50			
			ST-6		(P)2.25			42.8	76	85	58	99.8	(P)1.50	(UC)1.65	3.4	
				Bottom @ 54 ft.												
-70	55															
-75	60															
-80	65															
-85	70															
-90	75															
-95	80															

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-17-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-37

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 09.2" N
96° 25' 54.3" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -23 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 45.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-25				SP-1	SILTY SAND (SM), medium dense, brown with clay pockets		2/6" 3/6" 4/6"	11	24.9								HYD,SV
	5			SP-2	LEAN CLAY (CL), medium, brown -with sand pockets from 4.5' to 14'		1/6" 2/6" 2/6"	6	30.9		44	24	98.4				HYD
-30				ST-1	-firm from 9' to 14' -with sand seams at 9' to 14'	(P)3.25			25	96.5				(P)2.18	(UU)1.19	6.8	
	10																
-35																	
	15			ST-2	SANDY FAT CLAY (CH), medium, brown with sand seams	(P)2.25			23.9	100.8	53	31	57.2	(P)1.50	(UC)0.57	4.6	
-40																	
	20			SP-3	SILTY SAND (SM), dense, brown -with shell fragments from 19.5' to 21'		3/6" 9/6" 11/6"	30	27.8								
-45				SP-4	-very dense from 21.5' to 23'		14/6" 15/6" 27/6"	64	22.9				30.7				SV
	25			SP-5	-medium dense from 24' to 25.5'		8/6" 9/6" 9/6"	27	24								
-50				SP-6	-very dense from 26.5' to 28'		23/6" 23/6" 24/6"	71	21.6				43.2				HYD,SV
	30			SP-7	-medium dense from 29' to 30.5'		7/6" 11/6" 11/6"	33	24.4								
-55				SP-8	-becomes tan at 31.5' -very dense from 31.5' to 33'		12/6" 22/6" 27/6"	74	24.8				38.5				SV
	35			SP-9	-dense from 34' to 35.5'		5/6" 7/6" 15/6"	33	24.1								
-60				SP-10	FAT CLAY (CH), hard, gray		15/6" 27/6" 22/6"	74	39.2		56	34	96.4				
	40			ST-3	-firm from 38.5' to 45.5'	(P)1.75			39.1	79.7				(P)1.17	(UC)1.54	3.6	

COMPLETION DEPTH: 45.5 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 24 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-37

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 09.2" N 96° 25' 54.3" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -23 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 45.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			FAT CLAY (CH), firm, gray												
-65			ST-4	-with shell fragments from 41' to 43'	(P)2.00			39.9	77.4	86	54	99.8	(P)1.34			
	45		ST-5		(P)2.00			50.6	71.1	75	41	99.5	(P)1.34	(UC)1.16	2.6	
				Bottom @ 45.5 ft.												
-70	50															
-75	55															
-80	60															
-85	65															
-90	70															
-95	75															
-100	80															

COMPLETION DEPTH: 45.5 ft
DATE BORING STARTED: 7-17-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 24 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-38

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 18.1" N
96° 26' 14.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray		WOH/6" 4/6" 5/6"	14	24.2				37				HYD,SV
-20																	
	5			SP-2	-very dense from 5.5' to 10' -becomes brown at 5'		10/6" 16/6" 24/6"	61	23.4								
-25																	
	10			SP-3	SILT WITH SAND (ML), loose, gray		2/6" 3/6" 2/6"	8	29.1				80.5				HYD,SV
-30																	
	15			SP-4	FAT CLAY (CH), medium, brown		3/6" 4/6" 3/6"	11	31.2		50	29	97.9				
-35																	
	20			SP-5	LEAN CLAY WITH SAND (CL), very firm, brown		4/6" 8/6" 9/6"	26	22.8								
-40																	
	25			SP-6			5/6" 5/6" 5/6"	15	26				79				HYD,SV
-45																	
	30			SP-7	LEAN CLAY (CL), firm, gray		1/6" 4/6" 3/6"	11	33.8		43	23	98.6				
-50				ST-1		(P)1.75								(P)1.17			CU
	35			ST-2	-with silt layer from 35' to 37.5'	(P)1.75			25.7	95.4				(P)1.17			
-55				ST-3	FAT CLAY (CH), firm, gray	(P)1.75			35.7	83.6	69	41	99.7	(P)1.17	(UC)1.73	4	
	40																

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 2-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-38

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 18.1" N
96° 26' 14.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-40	40		ST-4	FAT CLAY (CH), firm, gray	(P)1.50			32.5	83.8				(P)1.00			
-45	45		ST-5		(P)1.50			33.4	84.9				(P)1.00			
-50	50		ST-6		(P)2.00			44.3	76.7	74	41	99.7	(P)1.34	(UC)1.73	4.8	
-55	55		ST-7		(P)2.25			37.9	77.5				(P)1.50			
-60	60		ST-8		(P)1.75			39.3	75.5				(P)1.17			
-65	65		ST-9	-very firm from 52.5' to 54.5'	(P)1.50			49.8	71	76	49	99.6	(P)1.00	(UC)2.05	4	
-70	70			Bottom @ 54.5 ft.												
-75	75															
-80	80															
-85																
-90																
-95																

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 2-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-39

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 32.9" N
96° 26' 29.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 51.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	SANDY FAT CLAY (CH), very soft, gray with shell fragments and sand pockets		WOH/6" WOH/6" WOH/6'	0	32.6								
-20																	
	5			SP-2	-medium from 5.5' to 7'		1/6" 1/6" 2/6"	5	30.6		55	32	51.4				HYD
-25																	
	10			SP-3	-very soft from 10.5' to 15'		WOH/6" WOH/6" WOH/6"	0	27.2								
-30																	
	15			SP-4	CLAYEY SAND (SC), very loose, gray with shell fragments and sand pockets		WOH/6" WOH/6" WOH/6"	0	33		33	15	46.9				
-35																	
	20			ST-1		(P)N/A			47.8	78.1							
-40																	
	25			ST-2	SANDY LEAN CLAY (CL), soft, gray with shell fragments	(T)0.30 (P)0.50			23.6	100.8	39	19	51.7	(T)0.60 (P)0.34	(UC)0.39	9	
				ST-3	-very firm from 27' to 29'	(P)3.25			21.6	108				(P)2.18			
-45																	
	30			ST-4	CLAYEY SAND (SC), dense, gray	(P)2.25			21.1	106.7	42	23	32.8	(P)1.51	(UU)1.77	14.8	
				SP-5	SILTY SAND (SM), dense, gray		9/6" 12/6" 15/6"	41	21.7				27.4				HYD,SV
-50																	
	35			SP-6			7/6" 9/6" 11/6"	30	22.3								
-55				SP-7	-very dense with clay pockets from 37.5' to 39'		12/6" 20/6" 15/6"	53	22.4				23.1				SV
	40																

COMPLETION DEPTH: 51.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 2-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-39

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 32.9" N 96° 26' 29.1" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -17 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 51.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-8	FAT CLAY (CH), hard, gray -with sand pockets at 40' to 44'		7/6" 8/6" 14/6"	33	27								
-60				ST-5	-very firm from 42' to 46.5'	(P)4.00			30.6	93.5	81	49	99.5	(P)2.68	(UC)1.49	1.8	
	45			ST-6		(P)3.00			36.7	85.3				(P)2.00			
-65				ST-7	-with shell fragments from 47' to 49.5' -firm from 47' to 51.5'	(P)2.00			39.7	81.7				(P)1.34	(UC)1.26	2.2	
	50			ST-8		(P)2.25			45.8	73.3	82	48	99.7	(P)1.50			
					Bottom @ 51.5 ft.												
-70	55																
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 51.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-18-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 2-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-40

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 42.7" N
96° 26' 48.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 51.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SANDY LEAN CLAY (CL), firm, brown with shell fragments		WOH/6" 1/6" 4/6"	8					54.5				
-20	5			ST-1	LEAN CLAY (CL), very firm, brown -with sand seams and shell fragments from 5' to 7'	(P)3.25			24.8	98.2	35	15	91.6	(P)2.18			SV
-25	10			ST-2	-with sand layer at 10' to 12'	(P)4.25			22.9	97.7				(P)2.85			
-30	15			SP-2	-with shell fragments at 15.5' to 20.5' -hard from 15.5' to 20'		5/6" 10/6" 15/6"	38	28								HYD,SV
-35	20			SP-3	SANDY SILT (ML), medium dense, gray with clay pockets		8/6" 5/6" 4/6"	14					63				
-40	25			ST-3	FAT CLAY (CH), firm, gray -with sand pockets from 25' to 29.5'	(P)1.50			42.7		72	44	91.5	(P)1.00			CU
				ST-4	-medium from 27' to 29'	(T)0.55 (P)1.00			33.3	89				(T)1.10 (P)0.67			
-45	30			ST-5	-with shell fragments from 29.5' to 36.5' -firm from 29.5' to 49'	(P)1.75			40.8	79.2				(P)1.17			
				ST-6		(P)2.00			44.1	76.4				(P)1.34			
-50	35			ST-7		(P)2.00			48.9	73.6	82	48	99.3	(P)1.34	(UC)1.61	3	HYD
				ST-8		(P)2.50			47.9	73				(P)1.68			
-55	40																

COMPLETION DEPTH: 51.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-19-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-40

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 42.7" N
96° 26' 48.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 51.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-9	FAT CLAY (CH), firm, gray	(P)2.50			47.1	73.3	82	49	99.7	(P)1.68	(UC)1.62	3.9	
				ST-10	-with sand pockets from 42' to 44'	(P)2.00			45.8	75.9				(P)1.34			
-60	45			ST-11		(P)3.25			43.9	74.4				(P)2.18	(UU)1.92	2.7	
				ST-12		(P)2.00			38.1	79.9				(P)1.34	(UC)1.56	1.9	
-65	50			ST-13	-very firm from 49.5' to 51.5'	(P)2.00			39.6	81.1	80	45	96.4	(P)1.34	(UC)2.19	3.2	
					Bottom @ 51.5 ft.												
-70	55																
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 51.5 ft
DATE BORING STARTED: 7-18-21
DATE BORING COMPLETED: 7-19-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-41

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 58.4" N
96° 27' 04.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-20				SP-1	SANDY SILT (ML), medium dense, brown		4/6" 7/6" 7/6"	21	23.3				57.5				HYD,SV
	5			SP-2	LEAN CLAY (CL), firm, brown		3/6" 5/6" 3/6"	12	26.1		34	16	90.2				
-25																	
	10			SP-3	SANDY SILT (ML), medium dense, brown		4/6" 7/6" 8/6"	23	26.3				54.7				HYD,SV
-30																	
	15			SP-4			7/6" 8/6" 9/6"	25	24.5								
-35																	
	20			SP-5			6/6" 7/6" 5/6"	18	26.6				51				HYD,SV
-40																	
	25			SP-6	LEAN CLAY (CL), very soft, gray		WOH/6" WOH/6" WOH/6"	0	39.7		41	22	95.9				
-45																	
	30			ST-1	-becomes firm from 30' to 35'	(P)1.25			31.6	87.5				(P)0.84	(UU)1.25	3.1	
-50				ST-2		(P)1.50			37.8	82.3				(P)1.00			
	35			ST-3	FAT CLAY (CH), firm, gray	(P)1.75			43.5	78.5	72	47	99.5	(P)1.17	(UC)1.59	3	
-55				ST-4		(P)1.50			39.8	79.5				(P)1.00			
	40																

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-19-21
DATE BORING COMPLETED: 7-19-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-41

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 58.4" N
96° 27' 04.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-40	40		ST-5	FAT CLAY (CH), firm, gray	(P)1.50			41.5	77.1				(P)1.17			
-60	45		ST-6		(P)1.75			48.3	72.3	80	49	99	(P)1.17	(UC)1.40	2.5	
			ST-7		(P)1.50			45.7	75.1				(P)1.00			
-65			ST-8		(P)1.50			43.5	77	74	42	95.2	(P)1.00	(UC)1.70	7.3	
	50		ST-9		(P)1.50			43.1	76.6				(P)1.00			
-70			ST-10		(P)1.75			43.9	75.5	87	53	99.7	(P)1.17	(UC)1.77	2.5	
	55			Bottom @ 54.5 ft.												
-75																
	60															
-80																
	65															
-85																
	70															
-90																
	75															
-95																
	80															

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-19-21
DATE BORING COMPLETED: 7-19-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-42

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 07.4" N
96° 27' 24.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -20.5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 46.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SANDY SILT (ML), medium dense, brown		3/6" 6/6" 6/6"	12	25.2				54.7				HYD,SV
-25	5			SP-2	-dense from 5.5' to 7'		5/6" 9/6" 15/6"	36	23.4								
-30	10			SP-3	SILTY SAND (SM), medium dense, brown		5/6" 7/6" 11/6"	27	27.7				29.4				HYD,SV
-35	15			SP-4	SANDY LEAN CLAY (CL), firm, brown		4/6" 5/6" 4/6"	13	27.9		30	10	66.9				
-40	20			ST-1	FAT CLAY (CH), firm, gray -with shell fragments and sand pockets from 20' to 22'	(P)2.00			38.6	80.7	68	43	95.2	(P)1.34	(UC)1.96	3.6	
				ST-2	-with sand seams from 22' to 24'	(P)2.00			39.6	81.3				(P)1.34			
-45	25			ST-3	-with sand pockets from 24.5' to 26.5'	(P)2.50			44.5	75.9				(P)1.68			
				ST-4		(P)2.50			42.7		73	43	99	(P)1.68			CU
-50	30			ST-5		(P)2.75			44.1	76.6				(P)1.84			
				ST-6	-with sand pockets from 32' to 34'	(P)2.50			47.7	73.7				(P)1.68			
-55	35			ST-7	LEAN CLAY WITH SAND (CL), firm, gray	(P)2.00			27.1	93.6	46	27	73.7	(P)1.34	(UC)1.60	3.2	
				SP-5	CLAYEY SAND (SC), dense, gray		10/6" 11/6" 14/6"	37	21.5				43.2				HYD,SV
-60	40																

COMPLETION DEPTH: 46.5 ft
DATE BORING STARTED: 7-19-21
DATE BORING COMPLETED: 7-20-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 21.5 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-42

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 07.4" N 96° 27' 24.8" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -20.5 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 46.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-6	CLAYEY SAND (SC), dense, gray		9/6" 11/6" 12/6"	34	21.4								
				SP-7	-with gravel from 42.5' to 46.5'		15/6" 9/6" 11/6"	30	16.5				31.8				
-65	45			SP-8	-medium dense from 45' to 46.5'		14/6" 7/6" 11/6"	27	18.2				30.4				HYD,SV
					Bottom @ 46.5 ft.												
-70	50																
-75	55																
-80	60																
-85	65																
-90	70																
-95	75																
-100	80																

COMPLETION DEPTH: 46.5 ft
DATE BORING STARTED: 7-19-21
DATE BORING COMPLETED: 7-20-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 21.5 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-43

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 22.7" N 96° 27' 38.8" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -19 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-20				SP-1	LEAN CLAY (CL), firm, brown with sand pockets		2/6" 4/6" 5/6"	13	30.8		38	18	90.6				HYD
	5																
-25				SP-2	SILTY SAND (SM), very dense, brown		9/6" 17/6" 30/6"	71	18.7				45.1				HYD,SV
	10																
-30				SP-3	-dense from 10.5' to 15'		9/6" 14/6" 14/6"	42	25.3				19.2				
	15																
-35				SP-4	POORLY GRADED SAND WITH SILT (SP-SM), dense, brown		6/6" 9/6" 11/6"	30	21.6				11.4				HYD,SV
	20																
-40				SP-5	SANDY LEAN CLAY (CL), firm, brown		2/6" 3/6" 3/6"	9	29.4								
	25			ST-1	-medium from 25' to 27'	(P)2.00			28.3	97.8	33	17	58.8	(P)1.34	(UU)0.88	14.8	
-45				ST-2	-firm with sand pockets from 27.5' to 30'	(P)1.50			37.3	83				(P)1.00			
	30																
-50				SP-6	CLAYEY SAND (SC), dense, gray with shell fragments		17/6" 21/6" 18/6"	59	21.3				35.5				HYD,SV
				ST-3	FAT CLAY WITH SAND (CH), very firm, gray and tan with sand pockets	(P)3.00			22.7	105.1	55	33	84.2	(P)2.00	(UC)2.22	4.9	
	35			ST-4		(P)4.50+			21.6	106.6				(P)3.02			
-55				ST-5		(P)4.50+			23.3	102.7				(P)3.02			
	40																

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-20-21
DATE BORING COMPLETED: 7-20-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-43

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 22.7" N 96° 27' 38.8" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -19 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-60	40		ST-6	FAT CLAY (CH), very firm, red and tan	(P)4.50+			25.3	99.6	65	40	98.9	(P)3.02	(UC)3.80	4.3	
			ST-7		(P)4.50+			30.3	94.7				(P)3.02			
-65	45		ST-8		(P)4.50+			22.7	103.2				(P)3.02			
			ST-9	FAT CLAY WITH SAND (CH), very firm, red and tan	(P)3.50			20.2	106.9	51	31	82.8	(P)2.34	(UC)3.77	8.8	
-70	50		ST-10	-firm and gray from 50' to 52'	(P)3.75			29.9	92.1				(P)1.84			
				Bottom @ 52 ft.												
-75	55															
-80	60															
-85	65															
-90	70															
-95	75															
	80															

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-20-21
DATE BORING COMPLETED: 7-20-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 20 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 5-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-44

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 32.3" N 96° 28' 00.0" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -18 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-20				SP-1	SANDY LEAN CLAY (CL), very soft, gray with silt pockets and shell fragments		WOR/6" WOR/6" WOR/6"	0	47.6		44	27	64				HYD
	5			SP-2	SILTY SAND (SM), very loose, gray -with shell fragments from 5.5' to 13'		WOH/6" WOH/6" WOH/6"	0	28								
-25																	
	10			SP-3			WOH/6" WOH/6" WOH/6"	0	25.1				29.4				HYD,SV
-30																	
	15			SP-4			WOH/6" WOH/6" 1/6"	2	25.2				35.9				HYD,SV
-35																	
	20			SP-5	FAT CLAY WITH SAND (CH), medium, gray		2/6" 2/6" 3/6"	7	34.8		55	36	73				
-40																	
	25			ST-1	-very firm from 25' to 29.5'	(P)3.25			29.7					(P)2.18			CU
-45				ST-2	-with sand pockets from 26.5' to 29.5'	(P)4.50+			30.2	93.5				(P)3.02			
	30			ST-3	SANDY FAT CLAY (CH), firm, gray	(P)4.00			30.3	89.9	78	54	61.2	(P)2.68	(UC)1.01	0.6	
-50				ST-4	-very firm from 32' to 37' -with sand seams from 32' to 34' -with sand pockets from 32' to 37'	(P)3.25			26.5	93.8				(P)2.18			
	35			ST-5	-with calcareous deposits from 34' to 37'	(P)3.00			37.3	83.2				(P)2.00			
-55				ST-6	FAT CLAY WITH SAND (CH), firm, gray	(P)3.75			30.4	92.1	57	35	84.5	(P)2.50	(UC)1.83	3.5	
	40				-becomes gray from 39' to 41.5'												

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-20-21
DATE BORING COMPLETED: 7-21-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 1-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-44

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 32.3" N
96° 28' 00.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -18 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-60	40		ST-7	FAT CLAY WITH SAND (CH), very firm, gray -very firm from 39.5' to 44'	(P)4.00			22.7	101.7				(P)2.68			
			ST-8	-becomes brown from 42' to 49' -with sand pockets from 42' to 44'	(P)4.50+			24.1	100.8				(P)3.02			
-65	45		ST-9	-with calcareous deposits from 44' to 48.5' -hard from 44.5' to 46.5'	(P)4.50+			20.9	107.1	57	37	77.9	(P)3.02	(UC)4.47	10.3	
			ST-10	-very firm from 47' to 52'	(P)4.50+			17.8	111.2				(P)3.02			
-70	50		ST-11		(P)4.50+			21.1	105.1				(P)3.02			
			ST-12	FAT CLAY (CH), very firm, gray	(P)4.50+			31.6	92	79	52	98.9	(P)3.02	(UC)2.63	1.4	
-75	55			Bottom @ 54 ft.												
-80	60															
-85	65															
-90	70															
-95	75															
	80															

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-20-21
DATE BORING COMPLETED: 7-21-21
LOGGER: C.Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 1-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-45

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 47.8" N
96° 28' 13.6" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -33 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 39.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very soft, gray		WOH//6" WOH/6" WOH/6"	0	73.5		76	44	86.5				HYD,SV
-35																	
	5			SP-2			WOH/6" WOH/6" WOH/6"	0	79.4								
-40																	
	10			ST-1	FAT CLAY WITH SAND (CH), very soft, gray	(T)0.10			58.2	67			84	(T)0.20			HYD,SV
-45																	
	15			ST-2		(T)0.10			40.3	81.8				(T)0.20			
-50				ST-3		(T)0.10			42.5	80.4	51	29	73.5	(T)0.20			
	20			SP-3	SILTY SAND (SM), medium dense, gray		4/6" 5/6" 7/6"	18	20.1								
-55				SP-4	-becomes very loose from 22.5' to 32'		WOH/6" WOH/6" WOH/6"	0	26.5		NP	NP	21.1				
	25			SP-5			WOH/6" WOH/6" 1/6"	2	21.4								
-60				SP-6			1/6" 1/6" 1/6"	3	18.8								
	30			SP-7			1/6" 1/6" 1/6"	3	17.4		NP	NP	16.4				
-65				SP-8	-loose from 33' to 37.5'		1/6" 2/6" 2/6"	6	21.1								
	35			SP-9			2/6" 3/6" 3/6"	9	16.8								
-70				SP-10	FAT CLAY WITH SAND (CH), firm, gray with sand seams		3/6" 4/6" 4/6"	12	22.8		57	35	84.8				
	40				Bottom @ 39.5 ft.												

COMPLETION DEPTH: 39.5 ft
DATE BORING STARTED: 7-20-21
DATE BORING COMPLETED: 7-20-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 34 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 20-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-46

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 56.7" N 96° 28' 34.3" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -16 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 56 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	90.8		76	43					HYD,SV
-20	5			SP-2			WOR/6" WOR/6" WOR/6"	0									
-25	10			SP-3			WOR/6" WOR/6" WOR/6"	0									
-30	15			SP-4	-becomes brown from 15.5' to 17'		WOR/6" WOR/6" WOR/6"	0	73.9		67	39					HYD,SV
-35	20			SP-5	-becomes tan from 20.5' to 25'		WOR/6" WOR/6" WOR/6"	0	70.7								
-40	25			SP-6	-soft from 25.5' to 30'		1/6" 1/6" 1/6"	3	56.9								
-45	30			SP-7	FAT CLAY WITH SAND (CH), very soft, gray		WOH/6" WOH/6" 1/6"	2	46.3		55	32	75.3				
-50				SP-8			WOR/6" WOR/6" WOR/6"	0	47.2								
-55	35			SP-9	SANDY FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	43.1		50	28	66.5				
				SP-10			WOR/6" WOR/6" WOR/6"	0	39.5								
	40																

COMPLETION DEPTH: 56 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-22-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 13-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-46

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 56.7" N 96° 28' 34.3" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -16 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 56 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-11	CLAYEY SAND (SC), very loose, gray		WOR/6" WOR/6" WOR/6"	0	40.1		36	19	43.7				
-60				SP-12			WOH/6" WOH/6" 1/6"	2	26.6								
	45			SP-13	SILTY SAND (SM), very loose, gray		WOR/6" WOR/6" WOR/6"	0	26.5				17.5				SV
-65				SP-14	-with shell fragments from 48' to 52'		1/6" 1/6" 1/6"	3	29				22				
	50			SP-15			5/6" 5/6" 7/6"	18	24.2								
-70				SP-16	FAT CLAY (CH), hard, gray		14/6" 15/6" 16/6"	47	30.2				87.1				SV
	55			ST-1	-firm from 52' to 56'	(P)4.50+			29.2	92.5	71	44	98.6	(P)3.02	(UC)1.23	1.2	
					Bottom @ 56 ft.												
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 56 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-22-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 13-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-47

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 12.0" N 96° 28' 47.5" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -23 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	73.6		67	41					HYD,SV
-25																	
	5			SP-2			WOR/6" WOR/6" WOR/6"	0									
-30																	
	10			SP-3			WOR/6" WOR/6" WOR/6"	0	81.1		81	51					HYD,SV
-35																	
	15			SP-4	-with shell fragments from 15.5' to 17'		WOR/6" WOR/6" WOR/6"	0	58.6								
-40																	
	20			SP-5	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	50.7		53	31	75.1				
-45				SP-6			WOR/6" WOR/6" WOR/6"	0	52.7								
	25			SP-7			WOR/6" WOR/6" WOR/6"	0	50.7								
-50				SP-8	SANDY LEAN CLAY (CL), very soft, gray		WOR/6" WOR/6" WOR/6"	0	46.5		48	24	67.6				
	30			SP-9			WOR/6" WOR/6" WOR/6"	0	41.4								
-55				SP-10			WOR/6" WOR/6" WOR/6"	0	42.9								
	35			SP-11	FAT CLAY WITH SAND (CH), very soft, gray -with calcareous deposits from 35' to 36.5'		WOR/6" WOR/6" WOR'6"	0	50.7		59	34	82.2				
-60				SP-12			WOR/6" WOR/6" WOR/6"	0	54.6								
	40																

COMPLETION DEPTH: 49 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-22-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 24-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-47

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 12.0" N
96° 28' 47.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -23 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40		SP-13	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	68.5								
-65			SP-14	FAT CLAY (CH), very soft, gray with calcareous deposits		WOH/6" WOH/6" WOH/6"	0	71.8		88	44	96.6				
	45		SP-15	-medium from 45' to 49'		2/6" 2/6" 3/6"	7	68								
-70			ST-1		(P)1.25			73.9	55.4	106	60	91.2	(P)0.84	(UC)0.84	4.2	
				Bottom @ 49 ft.												
	50															
-75																
	55															
-80																
	60															
-85																
	65															
-90																
	70															
-95																
	75															
-100																
	80															

COMPLETION DEPTH: 49 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-22-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 24-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-48

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 21.5" N
96° 29' 09.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
-15	0			SP-1	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0					88.5				HYD,SV
-20	5			SP-2			WOR/6" WOR/6" 1/6"	0									
-25	10			SP-3	-with sand pockets from 10.5' to 15'		WOH/6" WOH/6" WOH/6"	0									
-30	15			SP-4	SANDY FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0					65.2				HYD,SV
-35	20			SP-5			WOH/6" WOH/6" WOH/6"	0									
-40	25			SP-6	-firm from 25.5' to 30'		3/6" 4/6" 5/6"	13									
-45	30			ST-1	FAT CLAY (CH), firm, gray -with sand seams from 30' to 32' -becomes tan from 30' to 35'	(P)4.50			23.5	103.6	56	34		(P)3.02	(UC)1.49	3.4	
				SP-2	-very firm from 32.5' to 37'	(P)3.75								(P)2.50			
-50	35			SP-3	-becomes reddishbrown from 35' to 40'	(P)4.50+			19.9	108.9				(P)3.02			
				SP-7	-hard from 37.5' to 39'		9/6" 11/6" 14/6"	37									
-55	40																

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-48

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 21.5" N
96° 29' 09.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40		ST-4	FAT CLAY (CH), firm, gray -becomes tan from 40' to 57' -with silt seams from 40' to 42.5'	(P)3.75			26.1	100.2				(P)2.50			
			ST-5	-firm from 42.5' to 44' -becomes light gray from 42.5' to 57'	(P)4.25			27.3	98.6	65	42		(P)2.85	(UC)1.50	1	
-60	45		ST-6	-very firm from 45' to 49.5'	(P)4.50			24.8	98.8				(P)3.02			
			ST-7		(P)4.25			28.6	96.9				(P)2.85			
-65	50		ST-8	-firm from 50' to 52'	(P)2.75			34.8	86.1				(P)1.84			
			ST-9	-medium from 52.5' to 54.5'	(P)2.75			38.1	83.5	87	57		(P)1.84	(UC)0.90	0.8	
-70	55		ST-10	-firm from 55' to 57'	(P)2.50			35.3	86				(P)1.68			
				Bottom @ 57 ft.												
-75	60															
-80	65															
-85	70															
-90	75															
-95	80															

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-49

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 37.4" N
96° 29' 24.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-17	0			SP-1	FAT CLAY WITH SAND (CH), very soft, gray and brown with shell fragments and calcareous deposits		WOH/6" WOH/6" WOH/6"	0	48.9		52	29	75.7				HYD,SV
-20																	
	5			SP-2	-very firm from 5.5' to 10'		9/6" 6/6" 6/6"	18	24.4								
-25																	
	10			SP-3	SANDY FAT CLAY (CH), very soft, gray and brown		WOH/6" WOH/6" 2/6"	3	36.2		50	27	61.1				HYD,SV
-30																	
	15			ST-1	-very firm from 15' to 25'	(P)3.50			30.1	95				(P)2.35			
-35																	
	20			ST-2	-with calcareous deposits from 20' to 25'	(P)3.00			24.1	101.5				(P)2.00			
-40																	
	25			ST-3	LEAN CLAY WITH SAND (CL), very firm, reddishbrown and tan	(P)3.00			21.3	107.6	47	27	76.2	(P)2.00	(UC)2.99	15	
				ST-4	-slickensided from 27' to 32'	(P)3.50			24.3	103.2				(P)2.35			
-45																	
	30			ST-5	-gray from 29.5' to 31.5'	(P)4.50+			25.1	100.4				(P)3.02			
				ST-6	FAT CLAY (CH), very firm, gray -slickensided from 32' to 55'	(P)4.50+			27.7	98.1	64	41	88	(P)3.02	(UC)2.99	2.7	
-50																	
	35			ST-7	-with calcareous deposit from 35' to 55' -with sand seams from 35' to 37.5'	(P)3.25			19.6	111.1				(P)2.18			
				ST-8		(P)4.50+			24.9	100.2				(P)3.02			
-55																	
	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-49

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 37.4" N
96° 29' 24.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-9	FAT CLAY (CH), very firm, gray -with ferrous nodules from 40' to 45'	(P)4.50+			18.5	107.4	60	37	86.7	(P)3.02	(UC)2.22	2.2	
-60				ST-10		(P)4.50+			22.7	105.4				(P)3.02			
	45			ST-11		(P)4.50+			23.7	103.8				(P)3.02			
-65				ST-12	-firm from 47.5' to 49.5' -becomes brown at 47.5'	(P)4.50+			32.6	90.9	56	34	92.2	(P)3.02	(UC)1.56	0.7	
	50			ST-13	-very firm from 50' to 54' -with calcareous nodules from 50' to 52.5'	(P)4.50+			35.9	85.5				(P)3.02			
-70				ST-14	-with ferrous nodules from 52.5' to 55'	(P)4.00			35.9	85.1	74	47	95.3	(P)2.68			
					Bottom @ 54 ft.												
	55																
-75																	
	60																
-80																	
	65																
-85																	
	70																
-90																	
	75																
-95																	
	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-50

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 46.1" N
96° 29' 44.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 56.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	FAT CLAY WITH SAND (CH), very soft, gray with shell fragments and calcareous nodules		WOR/6" WOR/6" WOR/6"	0	74.7		70	45	74.8				
-20	5			SP-2	CLAYEY SAND (SC), very loose, gray with calcareous nodules		WOR/6" WOR/6" WOR/6"	0	43.4				46.2				HYD
-25	10			SP-3	POORLY GRADED SAND WITH SILT (SP-SM), very loose, gray		2/6" 1/6" 1/6"	3	24.7				8.5				
-30	15			SP-4	SILTY SAND (SM), loose, gray		5/6" 4/6" 3/6"	10	24				13.3				HYD,SV
-35	20			ST-1	LEAN CLAY WITH SAND (CL), very firm, tan and brown	(P)3.00			26.7	96.2	44	23	79.3	(P)2.00			
-40	25			ST-2	FAT CLAY (CH), hard, reddishbrown and tan	(P)4.50+			17.2	113.9				(P)3.02	(UU)5.44	11.1	
-45	30			ST-3	-very firm from 30' to 40' -slickensided from 30' to 40'	(P)4.50+			25.4	99.6				(P)3.02			
				ST-4		(P)4.50+			27.8	96.9	66	41	92.3	(P)3.02	(UC)2.03	2	
-50	35			ST-5		(P)4.50+			25.2	99.9				(P)3.02			
				ST-6		(P)4.50+			22.9	103.9				(P)3.02			
-55	40																

COMPLETION DEPTH: 56.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-50

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 46.1" N
96° 29' 44.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 56.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			ST-7	FAT CLAY WITH SAND (CH), very firm, gray slickensided	(P)4.50+			20.7	107.2	54	32	82.6	(P)3.02	(UC)2.97	2.1	
				ST-8		(P)4.50+			19.6	109.2				(P)3.02			
-60	45			ST-9		(P)4.50+			22.7	103.1				(P)3.02			
				ST-10		(P)4.50+			24.5	100.4				(P)3.02			
-65	50			ST-11	CLAYEY SAND (SC), loose, gray	(P)1.50			20.5	101.2	30	13	48	(P)1.00	(UC)0.41	2.1	
				SP-5	FAT CLAY (CH), very firm, tan		5/6" 7/6" 9/6"	24	34.2								
-70	55			ST-12		(P)3.50			33.2	87.6	82	51	97.1	(P)2.35			
					Bottom @ 56.5 ft.												
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 56.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 16 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 4-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-51

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 02.1" N 96° 29' 58.9" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			SP-1	CLAYEY SAND (SC), very loose, gray		WOH/6" WOH/6" WOH/6"	0	53.7				49				
-10	5			SP-2	FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	85.4		81	51	91.5				HYD
-15	10				-pushed shelby tube but no recovery from 10' to 12'												
-20				SP-3			WOH/6" WOH/6" WOH/6"	0	83.6				89.3				HYD,SV
-25	15			SP-4	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	73.2				83.4				
-30	20			SP-5	-pushed shelby tube but no recovery from 20' to 22'		WOR/6" WOR/6" WOR/6"	0	56.7		50	27	72.2				
-35	25			SP-6	-pushed shelby tube but no recovery from 25' to 27'		WOR/6" WOR/6" WOR/6"	0	53.6								
-40	30			ST-1		(T)0.15			45.4	76.6	54	31	75.7	(T)0.30			
-45	35			SP-7	-pushed shelby tube but no recovery from 35' to 37' -with sand pockets from 35.5' to 37'		WOR/6" WOR/6" WOR/6"	0	39.9								
	40			SP-8	SILTY SAND (SM), very loose, gray		WOR/6" WOR/6" WOR/6"	0	26.5				20.7				HYD,SV

COMPLETION DEPTH: 64.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 14-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-51

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 02.1" N 96° 29' 58.9" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-50	40			SP-9	CLAYEY SAND (SC), very loose, gray		WOR/6" WOR/6" WOR/6"	0	34.7		29	9	45.5				
				SP-10	FAT CLAY WITH SAND (CH), very soft, gray -no recovery from 42.5' to 47.5' -pushed shelby tube but no recovery from 43' to 45'		WOR/6" WOR/6" WOR/6"	0	53.7								
-55	45			SP-11	-pushed shelby tube but no recovery from 45' to 47'		WOR/6" WOR/6" WOR/6"	0	48.5				73.3				
				SP-12			WOR/6" WOR/6" WOR/6"	0	85.4								
-60	50			SP-13	CLAYEY SAND (SC), very loose, gray -pushed shelby tube but no recovery from 50' to 52'		WOR/6" WOR/6" WOR/6"	0	30.4		36	20	45.5				
				SP-14	SILTY SAND (SM), medium dense, gray		4/6" 5/6" 7/6"	18	16.3				13.8				SV
-65	55			SP-15	-dense from 55.5' to 60'		6/6" 16/6" 15/6"	47	28.6								
				SP-16	-very dense from 58' to 64.5'		12/6" 20/6" 22/6"	63	18.2								
-70	60			SP-17	-disturbed		2/6" 4/6" 6/6"	15	29.9								
				SP-18			9/6" 11/6" 24/6"	53	21.7				17				
	65				Bottom @ 64.5 ft.												
-75	70																
-80	75																
-85	80																

COMPLETION DEPTH: 64.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 14-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-52

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 09.9" N 96° 30' 20.6" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -37 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very soft, gray with silt pockets		WOR/6" WOR/6" WOR/6"	0	83.9		77	48	88				HYD
-40																	
	5			SP-2			WOR/6" WOR/6" WOR/6"	0	81.6								
-45				SP-3			WOR/6" WOR/6" WOR/6"	0	61.9								
	10			SP-4	LEAN CLAY WITH SAND (CL), medium, gray with shell fragments		WOH/6" 1/6" 2/6"	4	42.8		48	29	74.4				
-50				SP-5	SILTY SAND (SM), medium dense, gray with shell fragments		7/6" 15/6" 8/6"	34	22.2				37.4				HYD,SV
	15			SP-6	-loose with clay pockets from 15.5' to 17'		7/6" 1/6" 7/6"	12	24.8								
-55				SP-7	-very dense from 18.5' to 20'		23/6" 21/6" 21/6"	63	23				17.1				SV
	20			ST-1	FAT CLAY (CH), very firm, brown and tan	(P)4.50+			30.9		73	47	96.6	(P)3.02			CU
-60				ST-2		(P)3.75			29.7	93.3				(P)2.50			
	25			ST-3	LEAN CLAY (CL), very firm, brown and tan	(P)4.50+			22.1	104.9	46	26	95.3	(P)3.02	(UC)3.68	6.8	
-65				ST-4	-with sand pockets from 27.5' to 30'	(P)3.25			18.1	112.1				(P)2.18			
	30			ST-5	-with sand seams from 30' to 34.5'	(P)3.75			19.4	109.5	30	13	91.6	(P)2.50	(UC)2.34	12.8	
-70				ST-6		(P)3.00			20.7	106.8			86.1	(P)2.00	(UC)2.37	5.3	
	35				Bottom @ 34.5 ft.												
-75																	
	40																

COMPLETION DEPTH: 34.5 ft
DATE BORING STARTED: 7-24-21
DATE BORING COMPLETED: 7-24-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 38 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 24-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-53

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 26.6" N
96° 30' 34.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -18 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			SP-1	FAT CLAY (CH), very soft, gray with calcareous deposits		WOR/6" WOR/6" WOR/6"	0	95		85	49	95				HYD,SV
-20																	
	5			SP-2	FAT CLAY WITH SAND (CH), very soft, gray		WOR//6" WOR/6" WOR/6"	0	84.5		79	54	83.7				
-25																	
	10			SP-3			WOR/6" WOR/6" WOR/6"	0	62.1								
-30																	
	15			SP-4			WOR/6" WOR/6" WOR/6"	0	63.6		75	51	77.6				
-35																	
	20			SP-5			WOR/6" WOR/6" WOR/6"	0	65.5								
-40																	
	25			SP-6	-with calcareous nodules from 25' to 27.5'		WOR/6" WOR/6" WOR/6"	0	68.4								
-45					FAT CLAY (CH), very soft, gray												
				SP-7			WOR/6" WOR/6" WOR/6"	0	74.6		82	44	93.9				
	30			SP-8			WOR/6" WOR/6" WOR/6"	0	71.8								
-50																	
				SP-9			WOR/6" WOR/6" WOR/6"	0	78								
	35			SP-10			WOR/6" WOR/6 WOR/6"	0	73.7		94	58	99.3				HYD,SV
-55																	
				SP-11			WOR/6" WOR/6" WOR/6"	0	77.3								
	40																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-24-21
DATE BORING COMPLETED: 7-24-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 15-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-53

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 26.6" N
96° 30' 34.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -18 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40		SP-12	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	78								
-60			SP-13			WOR/6" WOR/6" WOR/6"	0	79.6		92	56	93.4				
	45		SP-14	-with shell fragments from 45' to 50'		WOR/6" WOR/6" WOR/6"	0	69.3								
-65			SP-15			WOR/6" WOR/6" WOR/6"	0	59								
	50		SP-16			WOR/6" WOR/6" WOR/6"	0	82		110	67	98.6				
-70			SP-17			WOR/6" WOR/6" WOR/6"	0	79.6								
				Bottom @ 54 ft.												
	55															
-75																
	60															
-80																
	65															
-85																
	70															
-90																
	75															
-95																
	80															

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-24-21
DATE BORING COMPLETED: 7-24-21
LOGGER: Z.Abuhamdeh
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 19 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 15-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-54

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 35.7" N
96° 30' 55.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-10				SP-1	LEAN CLAY (CL), very soft, gray		WOR/6" WOR/6" WOR/6"	0	85.7								
-15	5			SP-2	-with shell fragments from 5.5' to 7'		WOR/6" WOR/6" WOR/6"	0	68.6								
-20	10			SP-3			WOH/6" 1/6" 1/6"	3	56.4								
-25	15			SP-4	CLAYEY SAND (SC), loose, gray -with shell fragments from 15.5' to 17'		1/6" 1/6" 2/6"	4	38.3				42.5				HYD
-30	20			SP-5	-no sample recovery in SPT from 20.5' to 22'		WOH/6" WOH/6" 1/6"	2									
-35	25			SP-6	POORLY GRADED SAND WITH SILT (SP-SM), very loose gray with shell fragments		1/6" 1/6" WOH/6"	2	31.2				11.1				
-40	30			SP-7	LEAN CLAY WITH SAND (CL),soft, gray with shell fragments		1/6" 1/6" 3/6"	6	48.9		44	24	80.3				
-45	35			SP-8	-no sample recovery in SPT from 35.5' to 37'		WOH/6" WOH/6" WOH/6"	0									
	40			SP-9	FAT CLAY (CH), firm, gray with shell fragments		WOH/6" 3/6" 3/6"	9	40.3								

COMPLETION DEPTH: 62 ft
DATE BORING STARTED: 7-24-21
DATE BORING COMPLETED: 7-24-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 10 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 14-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-54

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 35.7" N
96° 30' 55.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-50	40		SP-10	FAT CLAY (CH), very firm, gray with shell fragments		9/6" 5/6" 7/6"	18	56.9		68	43	98.3				HYD
			ST-1	-soft from 42.5' to 50'	(T)0.25 (P)0.25			60.2	62.9				(T)0.50 (P)0.17	(UC)0.34	7.3	
-55	45		ST-2		(T)0.20 (P)0.25			59.1	65.1				(T)0.40 (P)0.17			
			ST-3		(T)0.30 (P)0.50			58	66.2				(T)0.60 (P)0.34	(UC)0.50	6	
-60	50		SP-11	FAT CLAY WITH SAND (CH), very soft		WOH/6" WOH/6" WOH/6"	0	57.5		74	46	70.6				
			SP-12	SILTY SAND (SM), loose, gray		1/6" 1/6" 5/6"	9	20				12.3				SV
-65	55		SP-13	-medium dense from 55.5' to 57'		7/6" 8/6" 9/6"	25	18								
			ST-4	SANDY LEAN CLAY (CL), firm, gray	(P)1.50			20.6	106.6	30	14	57.3	(P)1.00	(UC)1.02	12.5	
-70	60		ST-5		(P)2.00			20.5	106.8				(P)1.34			
				Bottom @ 62 ft.												
-75	65															
-80	70															
-85	75															
	80															

COMPLETION DEPTH: 62 ft
DATE BORING STARTED: 7-24-21
DATE BORING COMPLETED: 7-24-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 10 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 14-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-55

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 50.9" N
96° 31' 09.3" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -38 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			SP-1	FAT CLAY WITH SAND (CH), very soft, gray with silt pockets and shell fragments		WOR/6" WOR/6" WOR/6"	0	72.9				82.4				
-40																	
	5			SP-2	FAT CLAY (CH), very soft, gray with silt pockets and shell fragments		WOR/6" WOR/6" WOR/6"	0	78.5		74	48	95				HYD,SV
-45																	
	10			SP-3			WOR/6" WOR/6" WOR/6"	0	75.4								
-50				SP-4			WOH/6" WOH/6" WOH/6"	0	72.8		82	58	98.6				
	15			SP-5			WOH/6" WOH/6" WOH/6"	0	74.2								
-55				SP-6	FAT CLAY WITH SAND (CH), very soft, gray with silt pockets and shell fragments		WOH/6" WOH/6" WOH/6"	0	65.7		64	41	80.3				
	20			SP-7	SANDY FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	45.1		53	32	56.6				HYD,SV
-60				SP-8	SILTY SAND (SM), loose, gray		1/6" 2/6" 4/6"	9	24.4				12.7				SV
	25			SP-9	POORLY GRADED SAND (SP), medium dense, gray		6/6" 8/6" 10/6"	27	21.8				4.9				
-65				SP-10	POORLY GRADED SAND WITH SILT (SP-SM), medium dense, gray		7/6" 8/6" 9/6"	25	23.9				5.4				SV
	30			SP-11	POORLY GRADED SAND (SP), dense, gray		6/6" 12/6" 14/6"	39	21.1				3.7				
-70				SP-12			11/6" 14/6" 12/6"	39	22.5				4.4				SV
					Bottom @ 34 ft.												
	35																
-75																	
	40																

COMPLETION DEPTH: 34 ft
DATE BORING STARTED: 7-25-21
DATE BORING COMPLETED: 7-25-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 39 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 6-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-56

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 00.2" N
96° 31' 29.5" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SANDY FAT CLAY (CH), very soft, gray with shell fragments		WOR/6" WOR/6" WOR/6"	0	54				63				
-20	5			SP-2	FAT CLAY WITH SAND (CH), very soft, gray with shell fragments		WOR/6" WOR/6" WOR/6"	0	52.3		57	35	79.7				HYD,SV
-25	10			SP-3			WOR/6" WOR/6" WOR/6"	0	72.8								
-30	15			SP-4			WOR/6" WOR/6" WOR/6"	0	64								
-35	20			SP-5	FAT CLAY (CH), very soft, gray -with shell fragments from 20' to 25'		WOR/6" WOR/6" WOR/6"	0	45.3		68	42	91.4				HYD,SV
-40	25			ST-1	-soft from 25' to 40'	(T)0.10 (P)0.50			61.4	62.8				(T)0.20 (P)0.34			
-45	30			ST-2		(T)0.25 (P)0.50			63	63.2				(T)0.50 (P)0.34			
-50	35			ST-3		(T)0.25 (P)0.50			60.3	63	89	53	97.2	(T)0.50 (P)0.34	(UC)0.48	2.7	
				ST-4		(T)0.20 (P)0.50			57.9	64.6				(T)0.40 (P)0.34			
-55	40			ST-5		(T)0.20 (P)0.50			64.4	61.2				(T)0.40 (P)0.34			

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-25-21
DATE BORING COMPLETED: 7-25-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 1-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-56

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 00.2" N 96° 31' 29.5" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -16 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-6	FAT CLAY (CH), medium, gray -with shell fragments from 40' to 47.5'	(P)1.00			62.4	63.9	83	56	95.4	(P)0.67	(UC)0.52	3.7	
				ST-7		(T)0.15 (P)0.75			42.4	77.7				(T)0.30 (P)0.50			
-60	45			ST-8		(T)0.25 (P)0.75			31.7	88				(T)0.50 (P)0.50			
				ST-9	CLAYEY SAND (SC), medium dense, gray	(T)0.10 (P)0.75			20.6	107	36	20	46.9	(T)0.20 (P)0.50	(UC)0.88	15	
-65	50				SILTY SAND (SM), loose, gray												
				SP-6			2/6" 2/6" 3/6"	7	19.1				12.2				SV
				SP-7	-tan from 52.5' to 55' -medium dense from 52.5' to 56.5		4/6" 8/6" 10/6"	27	20								
-70	55			SP-8			10/6" 12/6" 15/6"	40	19.8				15.8				SV
					Bottom @ 57 ft.												
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-25-21
DATE BORING COMPLETED: 7-25-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 1-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-57

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 17.1" N
96° 31' 45.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	SANDY LEAN CLAY (CL), very soft, gray with silt pockets and shell fragments		WOR/6" WOR/6" WOR/6"	0	64.1				58				
-20	5			SP-2	SILTY SAND (SM), very loose, gray with shell fragments		2/6" 1/6" 3/6"	6	22.8				12.4				HYD,SV
-25	10			SP-3	FAT CLAY (CH), very soft, gray with silt pockets and shell fragments		WOH/6" WOH/6" WOH'6"	0	50								
-30	15			SP-4			WOH/6" WOH/6" WOH/6"	0	47.9		53	30	86.3				HYD,SV
-35	20			SP-5			WOH/6" WOH/6" WOH/6"	0	57.2								
-40	25			SP-6			WOH/6" WOH/6" WOH/6"	0	58.5				92.8				
-45	30			SP-7	FAT CLAY WITH SAND (CH), very soft, gray		WOH/6" WOH/6" 1/6"	1	46.9		60	36	83				
				SP-8			WOH/6" WOH/6" 1/6"	1	41								
-50	35			SP-9	CLAYEY SAND (SC), very loose, gray with shell fragments		WOH/6" WOH/6" WOH'6"	0	30.2		28	13	31.3				
				SP-10	-loose from 35' to 36.5'		2/6" 1/6" 2/6"	4	22.2				24.3				HYD,SV
-55	40			SP-11	SANDY LEAN CLAY (CL), very soft, gray with shell fragments		WOH/6" WOH/6" WOH/6"	0	38.6								

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-25-21
DATE BORING COMPLETED: 7-25-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-57

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 17.1" N
96° 31' 45.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -17 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-12	SANDY LEAN CLAY (CL), very soft, gray		WOH/6" WOH/6" WOH/6"	0	29.6		35	18	55.7				
-60				SP-13			WOH/6" WOH/6" WOH/6"	0	29.3								
	45			SP-14	LEAN CLAY WITH SAND (CL), medium, gray		WOH/6" 3/6" 5/6"	12	22.4				82.1				
-65				SP-15	SILTY SAND (SM), medium dense, tan with clay pockets		5/6" 7/6" 11/6"	27	20.9				21.7				SV
	50			SP-16	POORLY GRADED SAND WITH SILT (SP-SM), very dense, tan		22/6" 21/6" 32/6"	80	20				7.1				
-70				SP-17	CLAYEY SAND (SC), firm, gray with shell fragments		5/6" 7/6" 10/6"	25	30.7				48				
	55				Bottom @ 54 ft.												
-75																	
	60																
-80																	
	65																
-85																	
	70																
-90																	
	75																
-95																	
	80																

COMPLETION DEPTH: 54 ft
DATE BORING STARTED: 7-25-21
DATE BORING COMPLETED: 7-25-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 18 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-58

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 24.4" N
96° 32' 04.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -13 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 59.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			SP-1	CLAYEY SAND (SC), very loose, gray with shell fragments		WOH/6" WOH/6" WOH/6"	0	38.4				32.8				
-15	5			SP-2			WOH/6" WOH/6" WOH/6"	0	30.7				44.3				HYD,SV
-20	10			SP-3	SILTY SAND (SM), very loose, gray		2/6" 1/6" WOH/6"	1	24.8				13.7				
-25	15			SP-4	-with shell fragments from 15' to 35'		WOH/6" WOH/6" WOH/6"	0	23.4								
-30	20			SP-5	POORLY GRADED SAND WITH SILT (SP-SM), very loose, gray		WOH/6" WOH/6" WOH/6"	0	22.6				10.6				
-35	25			SP-6	SILTY SAND (SM), loose, gray		WOH/6" 2/6" 2/6"	6	21.8				30				HYD,SV
-40	30			SP-7			3/6" 2/6" 3/6"	7	20.4								
-45				SP-8	-with clay pockets from 32.5' to 35'		1/6" WOH/6" 1/6"	1	25.4				26.2				
-50	35			SP-9	-medium dense from 35' to 45' -tan from 35' to 47.5'		8/6" 6/6" 7/6"	19	21.6								
	40			SP-10	-with shell fragments from 37.5' to 40'		2/6" 5/6" 6/6"	16	27.3								

COMPLETION DEPTH: 59.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 14 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 11-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-58

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 24.4" N
96° 32' 04.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -13 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 59.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			SP-11	SILTY SAND (SM), dense, gray		13/6" 23/6" 3/6"	39	20.7				20.6				HYD,SV
-55				SP-12			7/6" 13/6" 14/6"	41	20.8								
	45			SP-13	-very dense from 45' to 47.5'		14/6" 27/6" 33/6"	91	19.2								
-60				SP-14	FAT CLAY (CH), very firm, tan and brown		9/6" 8/6" 9/6"	25	26.4		64	41	88.4				
	50			ST-1	-with calcareous deposits from 50' to 52.5'	(P)4.50+			22.1	102.3				(P)3.00			
-65				ST-2	FAT CLAY WITH SAND (CH), hard, gray	(P)4.50+			21.8	104.5	56	35	80.8	(P)3.00	(UU)4.32	11.6	
	55			SP-15	SILTY SAND (SM), medium dense, gray		5/6" 7/6" 12/6"	28	20.4				12.4				SV
-70				ST-3	FAT CLAY WITH SAND (CH), firm, gray and tan with sand pockets	(P)4.00			19.3	107.7	64	41	77.2	(P)2.68	(UC)1.64	1.2	
	60				Bottom @ 59.5 ft.												
-75																	
	65																
-80																	
	70																
-85																	
	75																
-90																	
	80																

COMPLETION DEPTH: 59.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 14 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 11-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-59

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 40.4" N
96° 32' 19.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -20 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-20	0				▼												
				SP-1	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	66.6		56	35	70.5				HYD,SV
-25	5			SP-2			WOR/6" WOR/6" WOR/6"	0	24.6								
-30	10			SP-3	-with sand pockets from 10' to 20'		WOR/6" WOR/6" WOR/6"	0	10.3								
-35	15			SP-4	-medium from 15' to 20' -tan from 15' to 20'		3/6" 3/6" 2/6"	7	22.3		61	39	82.3				HYD
-40	20			ST-1	FAT CLAY (CH), firm, tan slickensided with sand seams and ferrous deposits	(P)3.00			30.3	92.9	74	48	93.7	(P)2.00	(UU)1.21	1.1	
-45	25			ST-2	FAT CLAY WITH SAND (CH), firm, gray	(P)3.25			27.2	95.1	71	47	80.5	(P)2.18	(UC)1.93	2.6	
				ST-3	SANDY LEAN CLAY (CL), firm, gray with calcareous deposits	(P)2.75			19		31	14	59.9	(P)1.84			CU
-50	30			ST-4	-very firm from 30' to 32.5'	(P)2.75			15.9	116.3	32	16	67.5	(P)1.84	(UC)2.27	3.6	
				SP-5	SILTY SAND (SM), dense, gray and tan		11/6" 14/6" 17/6"	47	22				18.3				SV
-55	35			SP-6	-very dense from 35.5' to 40'		10/6" 18/6" 19/6"	56	11								
				SP-7			9/6" 15/6" 26/6"	62	20.3				31				SV
-60	40																

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 21 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 13-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-59

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 40.4" N
96° 32' 19.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -20 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 52 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-60	40			SP-8	LEAN CLAY WITH SAND (CL), very firm, gray and tan with sand pockets		11/6" 11/6" 15/6"	39	15.4		32	16	76.1				
				SP-9	POORLY GRADED SAND WITH SILT (SP-SM), dense, tan		10/6" 11/6" 16/6"	41	23.1				9.7				SV
-65	45			SP-10	LEAN CLAY WITH SAND (CL), very firm, gray and tan with sand seams		7/6" 14/6" 4/6"	27	13.6								
				ST-5	-hard from 47.5' to 52' -with sand pockets from 47.5' to 52' -with calcareous deposits from 47.5' to 50'	(P)4.50+			18.6	110.3	41	23	79.3	(P)3.00			
-70	50			ST-6		(P)4.50+			10.6	112.4				(P)3.00			
					Bottom @ 52 ft.												
-75	55																
-80	60																
-85	65																
-90	70																
-95	75																
-100	80																

COMPLETION DEPTH: 52 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 21 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 13-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-60

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 49.4" N
96° 32' 41.1" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -22 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	70.1		56	32	77.3				HYD,SV
-25																	
	5			SP-2	-with sand pockets from 5.5' to 10'		WOR/6" WOR/6" WOR/6"	0	15.7								
-30																	
	10			ST-1	-very firm from 10' to 12' -with calcareous deposits from 10' to 22'	(P)3.25			34.3	92.1	73	47	83.2	(P)2.18	(UU)2.43	6.8	HYD,SV
-35																	
	15			ST-2	-firm and slickensided from 15' to 17' -brown from 15' to 20'	(P)4.50+			20.8	106.5				(P)3.00	(UC)1.47	1.2	
-40																	
	20			ST-3	-very firm from 20' to 22'	(P)4.50+			16.3	104.3				(P)3.00			
				ST-4	FAT CLAY (CH), very firm, gray and tan	(P)4.00			27.1		67	42	85.2	(P)2.68			CU
-45																	
	25			ST-5		(P)4.25			20	104				(P)2.85			
				ST-6	-medium and slickensided from 27' to 29'	(P)4.25			11.2	115				(P)2.85	(UC)0.92	2	
-50																	
	30			ST-7	LEAN CLAY WITH SAND (CL), very firm, gray -with silt pockets from 30' to 32.5'	(P)4.50+			19.1	110.7	41	22	74.7	(P)3.00			
-55				ST-8		(P)4.50+			12.4	114.7				(P)3.00			
	35			SP-3	SILTY SAND (SM), medium dense, gray -with sand pockets from 35' to 37.5'		6/6" 7/6" 10/6"	25	23.5				15.5				HYD,SV
-60				ST-9	LEAN CLAY WITH SAND (CL), very firm, tan	(P)3.50			19.8	106.6	39	21	79.9	(P)2.35			
	40																

COMPLETION DEPTH: 49 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 23 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-60

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 49.4" N
96° 32' 41.1" W
STATE PLANE COORD: N --
E --
MUDLINE ELEVATION: -22 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-10	LEAN CLAY WITH SAND (CL), medium, tan	(P)2.50			12.2	114.6				(P)1.68	(UC)0.78	2.6	
-65				ST-11	-very firm from 42' to 44'	(P)4.25			13.5	107				(P)2.85			
	45			ST-12	FAT CLAY (CH), very firm, tan with calcareous deposits	(P)4.50+			27.1	96.8	79	51	91.6	(P)3.00	(UC)2.56	2.1	
-70				SP-4	LEAN CLAY (CL), hard, tan		12/6" 13/6" 17/6"	45	25.4		45	24	94.6				
	50				Bottom @ 49 ft.												
-75																	
	55																
-80																	
	60																
-85																	
	65																
-90																	
	70																
-95																	
	75																
-100																	
	80																

COMPLETION DEPTH: 49 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 23 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 9-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-61

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 09.5" N, 96° 33' 00.2" W
STATE PLANE COORD: N --, E --
MUDLINE ELEVATION: -24 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-25				SP-1	LEAN CLAY WITH SAND (CL), very soft, gray with silt pockets and sand pockets		WOR/6" WOR/6" WOR/6"	0	64.6				81.6				HYD,SV
	5																
-30				SP-2			WOH/6" WOH/6" WOH/6"	0	35.3								
	10																
-35				SP-3	CLAYEY SAND (SC), very loose, gray with shell fragments		WOH/6" WOH/6" WOH/6"	0	32.5		34	18	41				
	15																
-40				SP-4			WOH/6" WOH/6" WOH/6"	0	27.2								
	20																
-45				SP-5	-loose from 20.5' to 22'		WOH/6" 2/6" 3/6"	7	26.7		25	10	48				HYD,SV
				SP-6	FAT CLAY (CH), medium, gray with shell fragments		WOH/6" 3/6" 4/6"	10	28.4								
	25			ST-1	-slickensided from 25' to 27'	(P)2.75			29.4	93.8				(P)1.84	(UC)0.40	0.5	
-50				ST-2	-very firm with calcareous deposits from 27.5' to 30'	(P)4.50+			50.1	85.9			69.8	(P)3.00			
	30			ST-3	LEAN CLAY WITH SAND (CL), firm, gray and tan with sand layers	(P)4.50+			21.5	105	34	19	76.8	(P)3.00	(UC)1.64	3.4	
				SP-7	FAT CLAY (CH), very firm, tan and gray with sand pockets		6/6" 9/6" 6/6"	22	25.1				92.7				
-60	35			SP-8			7/6" 11/6" 15/6"	39	25.1				85				
				ST-4	LEAN CLAY WITH SAND (CL), very firm, tan and gray	(P)3.50			18.6	107.4	38	22	71.3	(P)2.35	(UC)3.13	7.5	
	40																

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-61

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 09.5" N
96° 33' 00.2" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -24 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 47 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-65	40		ST-5	FAT CLAY (CH), very firm, tan and gray	(P)4.00							92.8	(P)2.68			CU
			ST-6		(P)3.75			19.9	107.1				(P)2.51			
-70	45		ST-7	-slickensided from 45' to 47'	(P)4.50+			24.4	100.5	53	34	97.6	(P)3.00	(UC)2.03	1.5	
				Bottom @ 47 ft.												
-75	50															
-80	55															
-85	60															
-90	65															
-95	70															
-100	75															
	80															

COMPLETION DEPTH: 47 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-62

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 14.1" N
96° 33' 15.0" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -16 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	FAT CLAY WITH SAND (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	32.7								
-20	5			SP-2	-with shell fragments from 5' to 10'		WOR/6" WOR/6" WOR/6"	0	70.2				74.4				
-25	10			SP-3	SANDY LEAN CLAY (CL), very soft, gray		WOR/6" WOR/6" WOR/6"	0	50		44	25	63.2				HYD,SV
-30	15			SP-4	SILTY SAND (SM), very loose, gray with shell fragments and sand pockets		WOR/6" WOR/6" WOR/6"	0	25.9				15.1				
-35	20			SP-5			WOH/6" WOH/6" WOH/6"	0	25.2				18				HYD,SV
-40	25			SP-6			WOH/6" WOH/6" WOH/6"	0	25.5				20.3				HYD,SV
-45	30			SP-7			WOH/6" WOH/6" WOH/6"	0	24.3				19.9				SV
-50	35			SP-8	FAT CLAY WITH SAND (CH), medium, gray and tan		2/6" 3/6" 5/6"	12	27.8		67	45	80.5				
				ST-1	-very firm from 35' to 40'	(P)4.50+			24	98.9				(P)3.00			
-55	40			ST-2	-with sand pockets, sand seams, and calcareous deposits from 37.5' to 40'	(P)3.00					58	37	81.3	(P)2.01			CU

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-62

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 14.1" N 96° 33' 15.0" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -16 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 54.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40		ST-3	FAT CLAY (CH), very firm, gray slickensided	(P)4.25			23.7	99.3			86.4	(P)2.85	(UC)2.14	2	
			ST-4		(P)4.50			20	106.9				(P)3.00			
-60	45		ST-5	SANDY LEAN CLAY (CL), very firm, gray with calcareous deposits and sand pockets	(P)3.50			26.1	99.6	45	28	77.9	(P)2.35	(UU)2.42	12.8	
			ST-6	-firm from 47.5' to 49.5'	(P)3.75			19.6	108.2			51.3	(P)2.51	(UC)1.17	4.2	
-65	50		ST-7	FAT CLAY (CH), very firm, reddish gray and tan slickensided with calcareous deposits	(P)4.50+			22.5	102.7				(P)3.00			
			ST-8		(P)4.50+			22.7	101.6			99.3	(P)3.00	(UC)2.33	2.2	
-70	55			Bottom @ 54.5 ft.												
-75	60															
-80	65															
-85	70															
-90	75															
-95	80															

COMPLETION DEPTH: 54.5 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: C. Marlowe
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 17 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 7-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-63

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 26.2" N
96° 33' 32.4" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -34 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 37 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-35	0			SP-1	LEAN CLAY WITH SAND (CL), medium, gray with sand pockets and shell fragments		1/6" 4/6" 1/6"	7	31.2								HYD
-40	5			SP-2			WOH/6" WOH/6" WOH/6"	0	26.7								HYD,SV
-45	10			SP-3			WOH/6" WOH/6" 2/6"	3	25		30	14					HYD,SV
				SP-4			3/6" 5/6" 3/6"	12	22.5		38	18	82.3				SV
-50	15			ST-1	FAT CLAY (CH), firm, gray	(P)3.25			31.4	92.6				(P)2.18	(UC)1.79	3.2	
				ST-2	-very firm from 17.5' to 19.5'	(P)3.25			28.4	94			89.8	(P)2.18			
-55	20			ST-3	-medium and slickensided from 20' to 22'	(P)3.50			27.2	96.8	70	46	90.6	(P)2.35	(UU)0.83	0.4	
				ST-4	-very firm from 22.5' to 24.5'	(P)3.50			31.3	89.4				(P)2.35			
-60	25			ST-5	LEAN CLAY WITH SAND (CL), very firm, gray with sand pockets	(P)3.50			21.3		45	26	81.8	(P)2.35			CU
				ST-6	CLAYEY SAND (SC), medium dense, gray	(P)3.00							27.3	(P)2.01			
-65	30			ST-7	LEAN CLAY WITH SAND (CL), very firm, reddishbrown and gray -with ferrous nodules from 30' to 32'	(P)4.50+			17.3	115.1				(P)3.00			
				ST-8		(P)4.50+			18.3	110.2	48	31	74.1	(P)3.00	(UC)3.87	4	
-70	35			ST-9	-firm from 35' to 37'	(P)4.50+			19.5	107.3			73	(P)3.00	(UC)1.44	1.7	
	40				Bottom @ 37 ft.												

COMPLETION DEPTH: 37 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: C Doss
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 34 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 1-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-64

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 42.6" N
96° 33' 45.8" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -15 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-15	0				▼												
				SP-1	FAT CLAY (CH), very soft, gray with sand pocket and shell fragments		WOR/6" WOR/6" WOR/6"	0	70.7								
-20	5			SP-2	SILTY SAND (SM), very loose, gray with shell fragments		1/6" 1/6" 1/6"	2	33.8				26.5				SV
-25	10			SP-3	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	50.5		53	31	88.9				HYD,SV
-30	15			SP-4			WOR/6" WOR/6" WOR/6"	0	59.5								
-35	20			SP-5	-with shell fragments from 20' to 42.5'		WOR/6" WOR/6" WOR/6"	0	60.2				96				
-40	25			SP-6			WOH/6" WOH/6" WOH/6"	0	59.5		73	48	91.2				HYD,SV
-45	30			SP-7			WOH/6" WOH/6" WOH/6"	0	48.6								
				SP-8			WOH/6" WOH/6" WOH/6"	0	58.1				89.7				
-50	35			SP-9			WOH/6" WOH/6" WOH/6"	0	44.9		53	31	93.3				HYD,SV
				SP-10	-soft from 37.5' to 40'		WOH//6" WOH/6" 2/6"	3	41.5								
-55	40																

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 15 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 10-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-64

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 42.6" N
96° 33' 45.8" W
STATE PLANE COORD: N --
E --
MUDLINE ELEVATION: -15 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 57 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-55	40			SP-11	FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	41.2								
				SP-12	FAT CLAY WITH SAND (CH), medium, gray		WOH/6" 2/6" 3/6"	7	47.4				78.8				
-60	45			SP-13	-soft from 45' to 47.5'		WOH/6" WOH/6" 2/6"	3	49.9								
				SP-14	FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	61.9				97.2				
-65	50			SP-15	-medium from 50.5' to 54.5'		WOH/6" WOH/6" 4/6"	6	58.5		80	57	98.1				
				SP-16			WOH/6" WOH/6" 3/6"	4	55.7								
-70	55			SP-17	FAT CLAY WITH SAND (CH), medium, gray		WOH/6" 3/6" 4/6"	10	38		68	43	79.5				
					Bottom @ 57 ft.												
-75	60																
-80	65																
-85	70																
-90	75																
-95	80																

COMPLETION DEPTH: 57 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: C. M/ C. D
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 15 FT. Based on weighted measuring tape though casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91% 3) Boring drilled using a self-elevating lifeboat, the Opportunity. 4) Casing embedded 10-ft below mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-65

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 56.70" N 96° 34' 03.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -5 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 66 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-5	0				▼												
				SP-1	SILTY SAND (SM), loose, gray with shell fragments		3/6" 2/6" 1/6"	4	31.9								
-10	5			SP-2			2/6" 1/6" 3/6"	6	32.5				22.7				
-15	10			SP-3	-medium dense from 9.5' to 14'		2/6" 5/6" 8/6"	19	28.8				19				
-20	15			SP-4	FAT CLAY (CH), medium, gray -with sand pockets from 14' to 24' -with shell fragments from 14' to 34'		3/6" 3/6" 3/6"	9	51.3				87.8				
-25	20			SP-5	-soft from 19.5' to 21'		2/6" 1/6" 1/6"	3	69.4								
-30	25			SP-6	-firm from 24.5' to 26'		4/6" 5/6" 4/6"	13	70.1				87.1				
-35	30			ST-1	-soft from 29' to 49'	(T)0.13					75	40	88.9	(T)0.26			
-40	35			ST-2		(T)0.17			70.3	57.7				(T)0.34			
-45	40			ST-3		(T)0.18			69.1	59.1			95.7	(T)0.36	(UC)0.28	11	

COMPLETION DEPTH: 66 ft
DATE BORING STARTED: 10-25-21
DATE BORING COMPLETED: 10-26-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 6 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 27-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-65

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 56.70" N 96° 34' 03.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -5 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 66 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-45	40				FAT CLAY (CH), soft, gray												
				ST-4		(P)1.00			67.5	59.3			96.6	(P)0.67	(UU)0.27	5.6	
				ST-5		(T)0.17								(T)0.34			
-50	45			ST-6		(T)0.13			62.7	61.6	95	66	98.9	(T)0.26	(UC)0.33	6.5	
					-with shell fragments from 47.5' to 52.5'												
				ST-7	-very soft from 49' to 53'	(T)0.11			62.9	60.8				(T)0.22			
-55	50			ST-8		(T)0.09			66.7	59.7				(T)0.18			
					-medium from 53' to 63'												
				ST-9		(P)1.00			61.4	62.6	82	55	95.9	(P)0.67	(UC)0.50	5.8	
-60	55			ST-10		(P)1.25			35.9	85.7				(P)0.83			
					-with sand pockets from 57.5' to 63'												
				ST-11		(P)1.00			55.5	67.2				(P)0.67			
-65	60			ST-12		(P)1.00			38.1	80.1				(P)0.67			
				ST-13	FAT CLAY WITH SAND (CH), soft, gray with shell fragments and sand pockets	(P)1.00			37.9	85.3	67	42	69.8	(P)0.67	(UC)0.30	8.3	
-70	65				Bottom @ 66 ft.												
-75	70																
-80	75																
-85	80																

COMPLETION DEPTH: 66 ft
DATE BORING STARTED: 10-25-21
DATE BORING COMPLETED: 10-26-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 6 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 27-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-66

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 17.10" N
96° 33' 59.30" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -24 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-25				SP-1	FAT CLAY (CH), very soft, gray with spoils -with sand pockets from 0' to 10'		WOR/6" WOR/6" WOR/6"	0	103.3								
	5																
-30				SP-2			WOR/6" WOR/6" WOR/6"	0	118.3				98.3				
	10																
-35				SP-3			WOR/6" WOR/6" WOR/6"	0	143.6				89.5				
	15																
-40				SP-4			WOR/6" WOR/6" WOR/6"	0	115.4		116	73	96				
	20																
-45				SP-5	-with shell fragments and sand pockets from 20.5' to 22.5'		WOR/6" WOR/6" WOR/6"	0	110.1								
				SP-6	SANDY LEAN CLAY (CL), very soft, gray		WOR/6" WOR/6" WOR/6"	0	34.4				51.3				
	25																
-50				SP-7	-soft from 25.5' to 27.5'		WOR/6" WOH/6" 2/6"	3	30.5								
				SP-8	SILTY SAND (SM), medium dense, light brown		WOH/6" 4/6" 4/6"	12	18.7		NP	NP	48.9				
	30																
-55				SP-9	-no recovery in shelby tube from 30' to 32'		3/6" 4/6" 3/6"	10	17.8								
				ST-1	SANDY LEAN CLAY (CL), firm, light gray with ferrous stains	(P)2.25			7.7	121.8				(P)1.50	(UU)1.80	14.8	
	35																
-60				SP-10	POORLY GRADED SAND WITH SILT (SP-SM), very loose, light brown		WOH/6" WOH/6" 2/6"	3	23.8								
				SP-11	-medium dense from 38' to 39.5'		6/6" 9/6" 11/6"	30	21.9				7.4				
	40																

COMPLETION DEPTH: 49.5 ft
DATE BORING STARTED: 10-9-21
DATE BORING COMPLETED: 10-10-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 29-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-66

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 17.10" N 96° 33' 59.30" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -24 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 49.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-65	40			SP-12	POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown		10/6" 8/6" 13/6"	31	19.6				5.4				
				SP-13	-medium dense from 43' to 45'		9/6" 8/6" 8/6"	24	21.4								
-70	45			SP-14	SILTY SAND (SM), dense, tan and reddishbrown with sand pockets and ferrous nodules		8/6" 9/6" 16/6"	37	23.7				41.7				
				ST-2		(P)1.50			19.6	107.4	NP	NP	47.1	(P)1.00			
-75	50				Bottom @ 49.5 ft.												
-80	55																
-85	60																
-90	65																
-95	70																
-100	75																
	80																

COMPLETION DEPTH: 49.5 ft
DATE BORING STARTED: 10-9-21
DATE BORING COMPLETED: 10-10-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 25 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 29-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-67

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 36.60" N 96° 34' 03.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			SP-1	SILTY SAND (SM), very loose, gray with shell fragments and spoils		WOR/6" WOR/6" WOR/6"	0	22.1								
-10	5			SP-2			WOR/6" WOR/6" WOR/6"	0	41.5				28.2				
-15	10			SP-3	-medium dense from 10.5' to 12' -with clay balls from 10.5' to 20'		2/6" 5/6" 6/6"	16	31.6								
-20	15			SP-4	-loose from 15.5' to 20'		2/6" 2/6" 2/6"	6	28.4				28.5				
-25	20			ST-1	LEAN CLAY WITH SAND (CL), medium, gray with shell fragments	(T)0.16			68.2	58.5				(T)0.32		14.5	
-30	25			ST-2	-very soft from 25' to 27'	(P)0.75			42.7	76.7	42	19	79.4	(P)0.50	(UU)0.15	7.3	
-35	30			ST-3	-medium with ferrous nodules from 30' to 37'	(P)0.75			53.6	70.7				(P)0.50			
-40	35			ST-4		(P)0.75								(P)0.50			
-45	40			ST-5	CLAYEY SAND (SC), very loose, gray -with shell fragments from 37.5' to 42.5'	(T)0.008			24.7		25	9	40.5	(T)0.16			

COMPLETION DEPTH: 64.5 ft
DATE BORING STARTED: 10-11-21
DATE BORING COMPLETED: 10-12-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 26-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-67

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 36.60" N 96° 34' 03.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-6	CLAYEY SAND (SC), very loose, gray	(T)0.01			27.2					(T)0.02			
-50				SP-5	-loose from 43' to 45'		2./6" 2/6" 2/6"	6	23.9		25	9	28.8				
	45			SP-6	SILTY SAND (SM), medium dense, light brown		4/6" 7/6" 8/6"	22	21				24.2				
-55				SP-7	-loose from 48' to 49.5'		3/6" 2/6" 2/6"	6	23								
	50			SP-8	-dense from 50.5' to 52.5'		8/6" 10/6" 16/6"	39	21.6								
-60				SP-9	POORLY GRADED SAND (SP), very dense, light brown with shell fragments		8/6" 17/6" 24/6"	62	19.1				3.7				
	55			SP-10			14/6" 23/6" 20/6"	65	18.1								
-65				SP-11	POORLY GRADED SAND WITH SILT (SP-SM), dense, light gray with gravels		13/6" 17/6" 11/6"	42	15.1								
	60			SP-12	-very dense from 60.5' to 62'		9/6" 21/6" 17/6"	57	16.8				6.7				
-70				SP-13	-dense from 63' to 64.5'		15/6" 13/6" 16/6"	43	16.7								
	65				Bottom @ 64.5 ft.												
-75																	
	70																
-80																	
	75																
-85																	
	80																

COMPLETION DEPTH: 64.5 ft
DATE BORING STARTED: 10-11-21
DATE BORING COMPLETED: 10-12-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 26-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-68

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 57.20" N
96° 33' 57.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -8 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	CLAYEY SAND (SC), very soft, dark gray with shell fragments		WOH/6" WOH/6" WOH/6"	0	50.4				49.5				
-10	5																
-15	10			SP-2			WOR/6" WOR/6" WOR/6"	0	44.5				36.6				
-20	15			SP-3	SANDY FAT CLAY (CH), soft, gray with sand pockets and shell fragments		1/6" 1/6" 1/6"	3	46.5		64	39	54.6				
-25	20			SP-4	-medium from 16.5' to 21'		1/6" 1/6" 2/6"	4	60.6								
-30	25			ST-1	-soft from 21' to 25'	(T)0.14								(T)0.28			
-35	30			ST-2	FAT CLAY WITH SAND (CH), very soft, gray with shell fragments	(T)0.09			42.9	77.3	51	25	79.7	(T)0.18	(UC)0.17	11.3	
-40	35			ST-3	-soft from 31' to 33'	(T)0.13			39.2	77.7				(T)0.26			
-45	40			ST-4	-very soft from 36' to 38'	(T)0.11			36.3					(T)0.22			
				ST-5	SILTY SAND (SM), medium dense, gray	(T)0.16			23.2		NP	NP	19.6	(T)0.32			

COMPLETION DEPTH: 62.5 ft
DATE BORING STARTED: 10-12-21
DATE BORING COMPLETED: 10-12-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 26-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-68

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 57.20" N 96° 33' 57.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40				SILTY SAND (SM), medium dense, gray												
-50				SP-5			4/6" 6/6" 7/6"	19	19.1								
	45			SP-6	-with shell fragments from 43.5' to 50.5'		5/6" 7/6" 7/6"	21	19.9				23.7				
-55				SP-7			4/6" 7/6" 8/6"	22	20.6								
	50			SP-8			5/6" 7/6" 9/6"	24	20.4				18.8				
-60				SP-9	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown with shell fragments		8/6" 12/6" 26/6"	57	20.9				8.6				
	55			SP-10			9/6" 20/6" 18/6"	57	17.3				6.8				
-65				SP-11	-dense from 56' to 58'		6/6" 9/6" 11/6"	30	11.5				8.3				
	60			ST-6	SANDY SILT (ML), medium dense, brown	(P)2.25			19.9	103.5	NP	NP	54.6	(P)1.50			
-70				ST-7	FAT CLAY (CH), very firm, brown with sand seams, sand pockets and ferrous nodules	(P)4.50+			27.4	96				(P)3.00			
					Bottom @ 62.5 ft.												
	65																
-75																	
	70																
-80																	
	75																
-85																	
	80																

COMPLETION DEPTH: 62.5 ft
DATE BORING STARTED: 10-12-21
DATE BORING COMPLETED: 10-12-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 9 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 26-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-69

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 18.70" N
96° 34' 03.60" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 67 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	CLAYEY SAND (SC), very loose, gray with shell fragments		WOR/6" WOR/6" WOR/6"	0	44.7		36	18	37.6				
-10	5			SP-2			WOR/6" WOR/6" WOR/6"	0	39.3				48.9				
-15	10			SP-3	FAT CLAY (CH), very soft, gray with sand pockets and shell fragments		WOR/6" WOH/6" WOH/6"	0	65.7				86.3				
-20	15			SP-4			WOH/6" WOH/6" WOH/6"	0	52.8								
-25	20			ST-1	SANDY FAT CLAY (CH), very firm, tan and reddishbrown with calcareous and ferrous nodules	(P)4.50+			20.8	106.6	56	35	68.6	(P)3.00	(UU)2.57	14.8	
-30	25			ST-2		(P)4.50+			13.7	123.2				(P)3.00	(UC)0.83	6.3	
-35	30			SP-5	SILTY SAND (SM), very dense, light brown		15/6" 27/6" 35/6"	94	22.3				18.7				
-40	35			ST-3	FAT CLAY WITH SAND (CH), very firm, tan and reddishbrown with sand pockets ,ferrous and calcareous nodules	(P)4.50+					63	41	72.7	(P)3.00			
-45	40																

COMPLETION DEPTH: 67 ft
DATE BORING STARTED: 10-12-21
DATE BORING COMPLETED: 10-13-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 7 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 20-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-69

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 18.70" N 96° 34' 03.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 67 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-4	FAT CLAY WITH SAND (CH), very firm, tan and reddishbrown with sand pockets ,ferrous and calcareous nodules	(P)4.50+			17.7	110				(P)3.00	(UC)3.89	5.8	
-50	45			SP-6	POORLY GRADED SAND WITH SILT (SP-SM), dense, light brown		6/6" 10/6" 13/6"	34	22.5				11.8				
				SP-7			10/6" 15/6" 12/6"	40	24.3								
-55	50			SP-8	SILTY SAND (SM), very dense, tan and reddishbrown		14/6" 24/6" 40/6"	97	21.5				12.5				
				SP-9	POORLY GRADED SAND WITH SILT (SP-SM), very dense, tan and reddishbrown with gravels		17/6" 39/6" 44/6'	125	17.2								
-60				SP-10			22/6" 42/6" 34/6"	115	17.9				11.5				
	55			ST-5	FAT CLAY (CH), firm, tan and reddishbrown slickensided with ferrous and calcareous nodules	(P)4.25			30	94.5	62	38	98.9	(P)2.84	(UC)1.49	1.9	
-65				ST-6	-very firm from 57.5' to 67'	(P)4.50+			26.4	98.5				(P)3.00			
	60			ST-7		(P)4.50+			25.7	96.5				(P)3.00			
-70				ST-8		(P)4.50+			25.5	100.9			93.3	(P)3.00	(UC)2.34	2.2	
	65			ST-9		(P)4.50+			11.6	114.8				(P)3.00			
					Bottom @ 67 ft.												
-75	70																
-80	75																
-85	80																

COMPLETION DEPTH: 67 ft
DATE BORING STARTED: 10-12-21
DATE BORING COMPLETED: 10-13-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 7 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 20-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-70

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 37.20" N
96° 33' 55.90" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 67 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
	0			SP-1	FAT CLAY WITH SAND (CH), very soft, gray with shell fragments		WOR/6" WOR/6" WOR/6"	0	71.6		56	30	75.2				
-10	5			SP-2	SANDY FAT CLAY (CH), medium, light gray with shell fragments and ferrous nodules		WOH/6" 2/6" 2/6"	6	31.8				67.8				
-15	10			ST-1	-with calcareous nodules and sand pockets from 10' to 15'	(P)4.50+			27.2	90.6				(P)3.00	(UC)0.52	12	
-20	15			ST-2	FAT CLAY WITH SAND (CH), very firm, tan and reddishbrown	(P)4.50+			29.5	95	69	44	79.7	(P)3.00	(UC)2.74	3.5	
-25	20			ST-3		(P)4.50+			21.6	107.1				(P)3.00	(UU)3.47	12.1	
-30	25			ST-4		(P)4.50+			28.6	95				(P)3.00	(UC)2.09	2.5	
-35	30			ST-5	FAT CLAY (CH), very firm, tan and reddishbrown	(P)3.75					94	58	97.7	(P)2.50			
-40	35			ST-6		(P)4.00			31.1	92.2				(P)2.68			
-45	40																

COMPLETION DEPTH: 67 ft
DATE BORING STARTED: 10-13-21
DATE BORING COMPLETED: 10-14-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 7 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 23-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-70

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 37.20" N 96° 33' 55.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 67 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-7	FAT CLAY (CH), firm, tan and reddishbrown	(P)4.25			31.7	90.7				(P)2.84	(UC)1.37	1.4	
				ST-8	- very firm with sand pockets from 42.5' to 45'	(P)3.75			24.3	101.3	61	37	97.7	(P)2.50			
-50	45			SP-3	SILTY SAND (SM), very dense, light brown with gravels and shell fragments		12/6" 17/6" 31/6"	72	17.7				18.4				
				SP-4			15/6" 21/6" 27/6"	72	21.7								
-55	50			SP-5	POORLY GRADED SAND WITH SILT (SP-SM), very dense, light brown		10/6" 17/6" 25/6"	63	18.4				8.9				
				SP-6			17/6" 22/6" 27/6"	74	20.3				6.3				
-60	55			SP-7			10/6" 15/6" 21/6	54	17.2								
				SP-8			20/6" 28/6" 39/6"	101	19.5				10.8				
-65	60			SP-9	SILTY SAND (SM), very dense, light brown		12/6" 17/6" 21/6"	57	21.7				14.7				
				SP-10			18/6" 30/6" 34/6"	97	18.7								
-70	65			SP-11			11/6" 17/6" 20/6"	56	20.4				17.3				
					Bottom @ 67 ft.												
-75	70																
-80	75																
-85	80																

COMPLETION DEPTH: 67 ft
DATE BORING STARTED: 10-13-21
DATE BORING COMPLETED: 10-14-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 7 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 23-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-71

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 54.80" N 96° 34' 02.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -7 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY WITH SAND (CH), very soft, gray with shell fragments and sand pockets		WOR/6" WOR/6" WOR/6"	0	98.9		51	29	70.5				
-10																	
	5																
-15				SP-2	SANDY LEAN CLAY (CL), very soft, dark gray with shell fragments and sand pockets		WOR/6" WOR/6" WOR/6"	0	55.4				55.1				
	10																
				ST-1	-medium with ferrous nodules from 12' to 17'	(P)3.25			23	99	29	13	56.6	(P)2.17	(UU)0.79	14.8	
-20																	
	15																
-25				ST-2	FAT CLAY (CH), very firm, tan and reddishbrown slickensided with ferrous nodules	(P)4.50+			24.8	102.7				(P)3.00	(UC)2.67	3.3	
	20																
				ST-3	-firm with calcareous nodules from 22' to 24'	(P)3.50			35.8	86.9				(P)2.34	(UC)1.02	1.6	
-30																	
	25																
-35				ST-4	-very firm from 27' to 29'	(P)3.75			34.6	87.1	58	36	97.8	(P)2.51			
	30																
				ST-5	-firm with calcareous nodules from 32' to 37'	(P)3.75			36.6	85.6				(P)2.51	(UC)1.05	2	
-40																	
	35																
-45				ST-6	CLAYEY SAND (SC), very dense, tan with calcareous nodules	(P)4.00			16.7	115.5	24	8	48.4	(P)2.68			
	40																

COMPLETION DEPTH: 64 ft
DATE BORING STARTED: 10-14-21
DATE BORING COMPLETED: 10-14-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 8 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 16-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-71

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 37' 54.80" N
96° 34' 02.60" W
STATE PLANE COORD: N --
E --
MUDLINE ELEVATION: -7 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 64 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	40			ST-7	SANDY LEAN CLAY (CL), soft, tan with ferrous nodules	(P)2.25			20.5	108.6				(P)1.50	(UC)0.48	2.8	
-50				SP-3	POORLY GRADED SAND WITH SILT (SP-SM), dense, tan		8/6" 13/6" 12/6"	37	31				10.5				
	45			SP-4			8/6" 12/6" 13/6"	37	26.1								
-55				SP-5	-very dense from 47.5' to 49.5'		21/6" 41/6" 42/6"	125	20.7				7.9				
	50			SP-6	SILTY SAND (SM), very dense, tan and reddishbrown		22/6" 37/6" 36/6"	110	20.2				18.7				
-60				SP-7			17/6" 19/6" 21/6"	59	18.9								
	55			SP-8			25/6" 26/6" 36/6"	94	15.8				17.9				
-65				SP-9	SANDY LEAN CLAY (CL), hard, tan and reddishbrown with sand pockets and ferrous nodules		25/6" 36/6" 48/6"	127	21.7				60.7				
	60			SP-10	POORLY GRADED SAND WITH SILT (SP-SM), dense, tan and reddishbrown		12/6" 15/6" 15/6"	45	19.5								
-70				SP-11	-very dense from 62.5' to 64'		17/6" 38/6" 48/6"	130	20.5				6.2				
	65				Bottom @ 64 ft.												
-75																	
	70																
-80																	
	75																
-85																	
	80																

COMPLETION DEPTH: 64 ft
DATE BORING STARTED: 10-14-21
DATE BORING COMPLETED: 10-14-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 8 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 16-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-72

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 14.90" N
96° 33' 55.90" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-10				SP-1	FAT CLAY (CH), very firm, light gray with ferrous nodules and calcareous -with sand pockets from 0' to 5'		5/6" 8/6" 8/6"	24	28.8		65	38	93				
-15	5			ST-1	-tan and reddishbrown from 5' to 15' -firm and slickensided from 5' to 15'	(P)3.75			30.4	94			94.1	(P)2.50	(UU)1.83	2.9	
-20	10			ST-2		(P)4.50+			22.4	102.9				(P)3.00	(UC)1.80	2.5	
-25	15			ST-3	FAT CLAY WITH SAND (CH), very firm, tan and reddishbrown	(P)3.25			28	96.8	70	46	84.2	(P)2.17			
-30	20			ST-4		(P)4.50+			18.6	110.1				(P)3.00	(UC)3.20	4.8	
-35	25			ST-5		(P)4.50+			26.6	95.7				(P)3.00			
-40	30			ST-6		(P)4.50+			24.9	98	65	41	73.9	(P)3.00	(UC)2.65	5.5	
-45	35			ST-7	CLAYEY SAND (SC), dense, tan and reddishbrown with sand pockets, ferrous and calcareous nodules	(P)2.00			19.8	106.3				(P)1.34			
	40			ST-8		(P)3.50			17.5	112	27	10	46.9	(P)2.34	(UC)1.16	3.5	

COMPLETION DEPTH: 62 ft
DATE BORING STARTED: 10-15-21
DATE BORING COMPLETED: 10-15-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 10 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-72

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 14.90" N
96° 33' 55.90" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 62 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-50	40			SP-2	POORLY GRADED SAND WITH SILT (SP-SM), very dense, light brown		12/6" 15/6" 24/6"	59	24				11.7				
				SP-3			18/6" 21/6" 23/6"	66	21.1				6.7				
-55	45			SP-4			11/6" 18/6" 23/6"	62	22.6								
				SP-5	SILTY SAND (SM), very dense, tan and reddishbrown		15/6" 21/6" 35/6"	84	17.8				16.8				
-60	50			SP-6			15/6" 25/6" 32/6"	86	21.6								
				SP-7	POORLY GRADED SAND WITH SILT (SP-SM), very dense, tan and redddishbrown		9/6" 15/6" 23/6"	57	18.8				9.6				
-65	55			SP-8	SILTY SAND (SM), very dense, light brown		18/6" 22/6" 31/6"	80	23				15.1				
				SP-9			14/6" 37/6" 44/6"	122	20.5								
-70	60			SP-10			20/6" 34/6" 42/6"	115	21.2				15.1				
					Bottom @ 62 ft.												
-75	65																
-80	70																
-85	75																
	80																

COMPLETION DEPTH: 62 ft
DATE BORING STARTED: 10-15-21
DATE BORING COMPLETED: 10-15-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 10 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-73

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 33.30" N
96° 33' 36.60" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 63.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
-5	0			SP-1	SANDY LEAN CLAY (CL), very soft, gray -with sand pockets and shell fragments		WOR/6" WOR/6" WOR/6"	0	51.1		34	17					
				SP-2			WOR/6" WOR/6" WOR/6"	0	46.9								
-10	5																
-15	10			ST-1	SANDY FAT CLAY (CH), firm, brown and gray with sand pockets	(P)1.50					64	42	61.8	(P)1.00			
-20	15			ST-2	SANDY LEAN CLAY (CL), very firm, tan and reddishbrown with sand pockets, ferrous and calcareous nodules	(P)3.75					38	22	64.5	(P)2.50			
-25	20			ST-3	-medium from 19' to 24'	(P)4.50+			18.3	109.4				(P)3.00	(UC)0.57	2.8	
-30	25			ST-4	LEAN CLAY WITH SAND (CL), firm, tan with sand pockets, ferrous and calcareous nodules	(P)4.50+			25.1	100			76.3	(P)3.00	(UU)1.39	1.3	
-35	30			ST-5	-very firm from 29' to 34'	(P)4.50+			24.2	99				(P)3.00			
-40	35			ST-6	SANDY LEAN CLAY (CL), medium, tan with ferrous and calcareous nodules	(P)3.25			18.9	108.1	35	20	62.9	(P)2.17	(UC)0.77	5.3	
-45	40			ST-7	-firm from 39' to 41'	(P)4.50+			22.4	106.2				(P)3.00	(UC)1.33	2.2	

COMPLETION DEPTH: 63.5 ft
DATE BORING STARTED: 10-15-21
DATE BORING COMPLETED: 10-15-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 6 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-73

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 33.30" N
96° 33' 36.60" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 63.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-45	40				SANDY LEAN CLAY (CL), very firm, tan												
				ST-8		(P)4.00			24.2	101.5				(P)2.68			
				ST-9		(P)4.50+			14.1	116.7				(P)3.00			
-50	45			ST-10	-medium from 46.5' to 49'	(P)4.50+			17.1	111.1				(P)3.00	(UC)0.86	2.4	
					SILTY SAND (SM), dense, brown and tan												
-55	50			SP-3			8/6" 13/6" 18/6"	47	19.3								
				SP-4			7/6" 11/6" 22/6"	47	19.2								
-60	55			SP-5	-very dense from 54.5' to 61.5'		11/6" 16/6" 20/6"	54	20.4				15.8				
				SP-6			16/6" 17/6" 26/6"	65	19.5				17.6				
-65	60			SP-7			7/6" 21/6" 12/6"	50	18.4				13.8				
				SP-8	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown and tan		9/6" 16/6" 18/6"	51	19.8				11.4				
					Bottom @ 63.5 ft.												
-70	65																
-75	70																
-80	75																
-85	80																

COMPLETION DEPTH: 63.5 ft
DATE BORING STARTED: 10-15-21
DATE BORING COMPLETED: 10-15-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 6 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

LOG OF BORING CB-74

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 42.20" N, 96° 33' 24.70" W
STATE PLANE COORD: N 28.41764 ft, E 96.3195 ft
MUDLINE ELEVATION: -40 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 32 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-40	0				▼												
				SP-1	FAT CLAY (CH), very firm, light gray with ferrous nodules -with sand pockets from 0' to 5'		5/6" 8/6" 9/6"	25	50.9		70	42	90.3				
-45	5			ST-1	-soft with calcareous nodules from 5' to 7.5'	(P)4.25			20	107.3			98.8	(P)2.84	(UC)0.43	0.9	
				ST-2	LEAN CLAY WITH SAND (CL), firm, tan and reddishbrown	(P)4.50+			19.9	106	38	17	74.7	(P)3.00	(UC)1.66	2.9	
-50	10			ST-3	LEAN CLAY (CL), very firm, tan and reddishbrown	(P)4.25			21.2	103.8			85.7	(P)2.84	(UC)2.87	2.7	
				SP-2	SANDY LEAN CLAY (CL), hard, tan and reddishbrown with ferrous nodules and sand seams		8/6" 10/6" 15/6"	37	24.8								
-55	15			ST-4	-medium from 15' to 17.5'	(P)3.25			21.8	103.3	31	13	59.5	(P)2.17	(UC)0.92	3.3	
				SP-3	LEAN CLAY WITH SAND (CL), hard, light brown		10/6" 10/6" 13/6"	34	24.5				78.7				
-60	20			ST-5	LEAN CLAY (CL), very firm, tan and reddishbrown with ferrous nodules and sand seams	(P)2.50			23.8	99.9	34	15	87.1	(P)1.67	(UU)2.55	3.3	
				ST-6	-firm from 22.5' to 25'	(P)2.50			26	93.5				(P)1.67			
-65	25			SP-4	POORLY GRADED SAND WITH SILT (SP-SM), dense, tan and reddishbrown with ferrous nodules		7/6" 12/6" 18/6"	45	21.8				9.4				
				SP-5	SILTY SAND (SM), very dense, light brown		12/6" 19/6" 32/6"	75	21.2								
-70	30			SP-6			27/6" 32/6" 35/6"	101	20.1				18.6				
					Bottom @ 32 ft.												
-75	35																
-80	40																

COMPLETION DEPTH: 32 ft
DATE BORING STARTED: 10-16-21
DATE BORING COMPLETED: 10-17-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 41 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 6-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-75

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 33.50" N, 96° 33' 15.60" W
STATE PLANE COORD: N 28.42175 ft, E 96.3212 ft
MUDLINE ELEVATION: -42 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 29.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very firm, tan and reddishbrown with ferrous and calcareous nodules		3/6" 5/6" 5/6"	15	27.9		62	38					
-45				ST-1		(P)4.25			26.7	96.6			94.6	(P)2.84	(UU)3.62	4.1	
	5			ST-2		(P)4.25			26.4	96.4	68	45	94.3	(P)2.84	(UC)2.23	3.9	
-50				ST-3		(P)4.50+								(P)3.00			
	10			ST-4		(P)4.50+			20.6	106.3	51	31	85	(P)3.00	(UC)3.74	14.5	
-55				ST-5	-hard from 12.5' to 15'	(P)4.50+			20.6	106	52	30	89.9	(P)3.00	(UC)4.08	10.3	
	15			SP-2	SILTY SAND (SM), dense, light brown		10/6" 13/6" 15/6"	42	23.3							
-60				SP-3	-very dense from 18' to 19.5'		15/6" 18/6" 21/6"	59	24.7				24.5			
	20			SP-4	-dense from 20.5' to 22'		10/6" 13/6" 18/6"	47	21.6				17.3			
-65				SP-5	-very dense from 23' to 29.5'		17/6" 24/6" 28/6"	78	18.9				11.3			
	25			SP-6			1783" 21/6" 32/6"	80	18				12.1			
-70				SP-7			12/6" 18/6" 23/6"	62	17.5				13.5			
	30				Bottom @ 29.5 ft.												
-75																	
	35																
-80																	
	40																

COMPLETION DEPTH: 29.5 ft
DATE BORING STARTED: 10-17-21
DATE BORING COMPLETED: 10-17-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 43 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 19-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-76

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 38' 41.20" N
96° 33' 01.40" W

STATE PLANE COORD: N 28.4173 ft
E 96.31556 ft

MUDLINE ELEVATION: -43 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 29.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-45				SP-1	FAT CLAY (CH), firm, tan and reddishbrown slickensided with ferrous and calcareous nodules		WOH/6" 4/6" 4/6"	12	50.5		77	43					
				ST-1	-very firm from 2.5' to 7.5'	(P)3.50			28.4	93.5	77	51	97.7	(P)2.34	(UU)2.18	2.6	
	5			ST-2		(P)3.50			27.9	94.5	66	42	97.4	(P)2.34	(UC)2.88	6.8	
-50				ST-3	-medium from 7.5' to 10'	(P)4.50+			27.3	97.2	67	43	96.6	(P)3.00	(UC)0.54	0.7	
	10			ST-4	SANDY LEAN CLAY (CL), medium, tan and reddishbrown with ferrous nodules and sand pockets	(P)1.25			23.9	97.1				(P)0.83			
-55				SP-2	-hard from 13' to 15'		12/6" 15/6" 22/6"	56	19.2				56.1				
	15			SP-3	SILTY SAND (SM), very dense, tan and reddishbrown		15/6" 30/6" 35/6"	98	23.3				19.4				
-60				SP-4			21/6" 24/6" 39/6"	95	21.5								
	20			SP-5	POORLY GRADED SAND WITH SILT (SP-SM), very dense, tan and reddishbrown		16/6" 25/6" 31/6"	84	21.5				10.1				
-65				SP-6	SILTY SAND (SM), very dense, tan and reddishbrown		27/6" 39/6" 48/6"	131	20.5				26.1				
	25			SP-7			15/6" 26/6" 38/6"	97	20.3				16.9				
-70				SP-8			12/6" 14/6" 16/6"	45	23.8				20				
	30				Bottom @ 29.5 ft.												
-75																	
	35																
-80																	
	40																

COMPLETION DEPTH: 29.5 ft
DATE BORING STARTED: 10-17-21
DATE BORING COMPLETED: 10-18-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 44 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 5-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

Table 1: Summary of SPT Test Results

Project: SPT Rig Calibration

SPT Rig ID	Test Date	Rod [1] Length (ft)	Beginning [2] Depth (ft)	Final [2] Depth (ft)	Blows Applied (blows/6")	N Value	N_{60} Value	Avg. Max. Compressive Force (kips)	Average Maximum Velocity (ft/sec)	Average Transferred Energy (lb-ft)	Average [3] Transfer Ratio
DR-15	5-Apr-21	34.0	29.0	30.5	**7-10-11**	**21**	**32**	30.4	14.8	307	87.7%
		35.0	30.5	32.0	**10-15-17**	**32**	**49**	30.7	15.1	318	90.8%
		37.0	32.0	33.5	**15-15-16**	**31**	**47**	31.6	15.6	323	92.2%
		38.0	33.5	35.0	**16-18-14**	**32**	**49**	31.1	14.4	316	90.3%
		40.0	35.0	36.5	**18-18-21**	**39**	**59**	33.1	15.9	324	92.7%
					Overall Average Values:			31.4	15.2	317.6	**91.0%**
					Standard Deviation:			1.0	0.6	6.8	2.0%

Notes:

Overall Average Values Presented represent the average weighted by the N-value for each data set

1 - Below the location of gages

2 - Depth at existing grade

3 - Computed from the ratio of average transferred energy (EMX) to that of the SPT Hammer potential energy of 350 lb-ft assuming a drop height of 30 inches

APPENDIX C
VIBRACORE LOGS

LOG OF BORING VB-01

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 04.18" N
96° 21' 01.12" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -13.2 ft MLLW

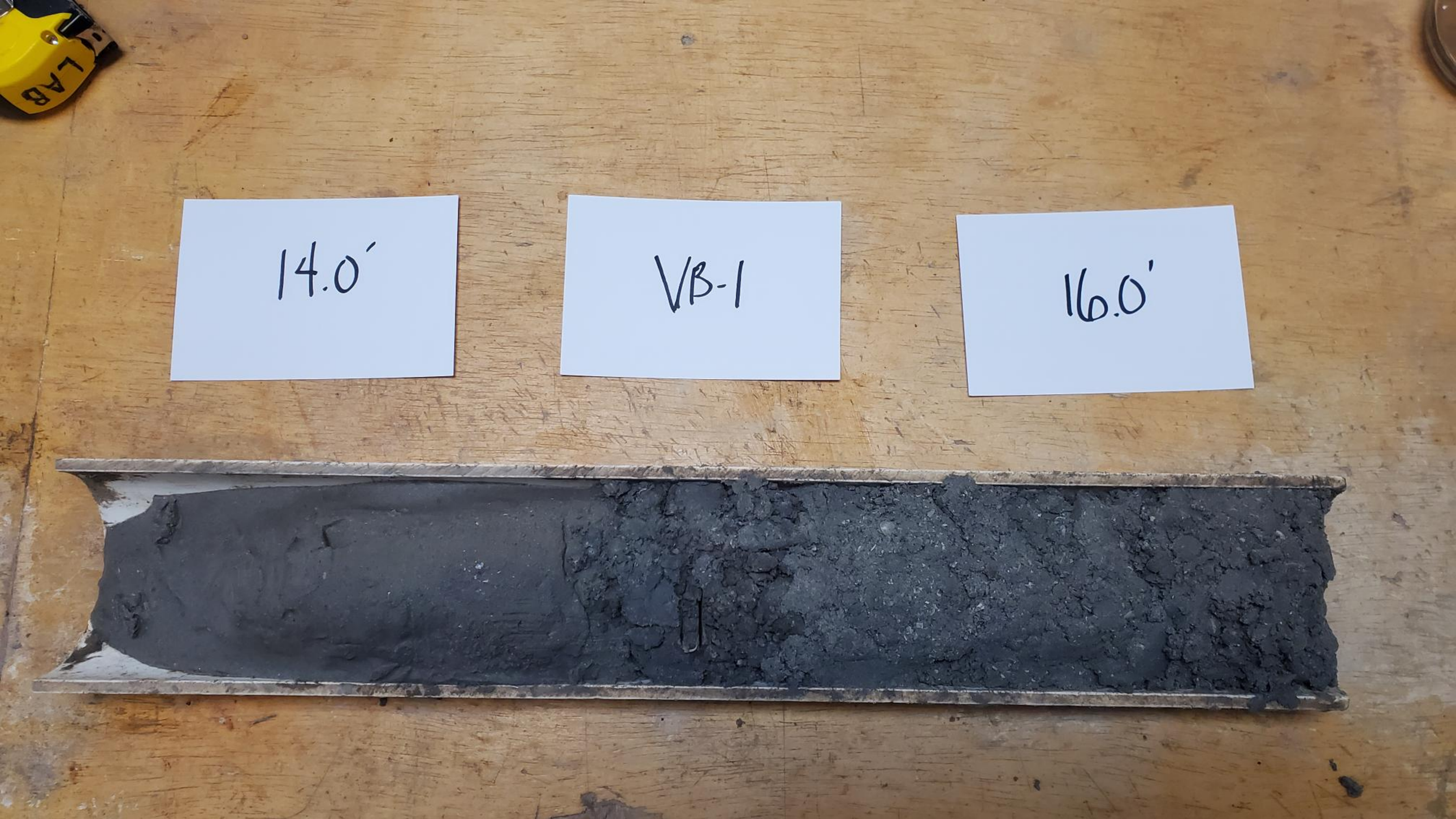
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				J-1	SILTY SAND (SM) / POORLY GRADED SAND WITH SILT (SP-SM), dark gray				21.9				8.3				SV
-15				J-2					19.6				13.1				SV
					Bottom @ 2 ft.												
-20	5																
-25	10																
-30	15																
-35	20																
-40	25																
-45	30																
-50	35																
	40																

COMPLETION DEPTH: 2 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 69%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


14.0'
VB-1
16.0'

LOG OF BORING VB-02

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 16.51" N
96° 21' 18.67" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -12.6 ft MLLW

DRILLING METHOD:

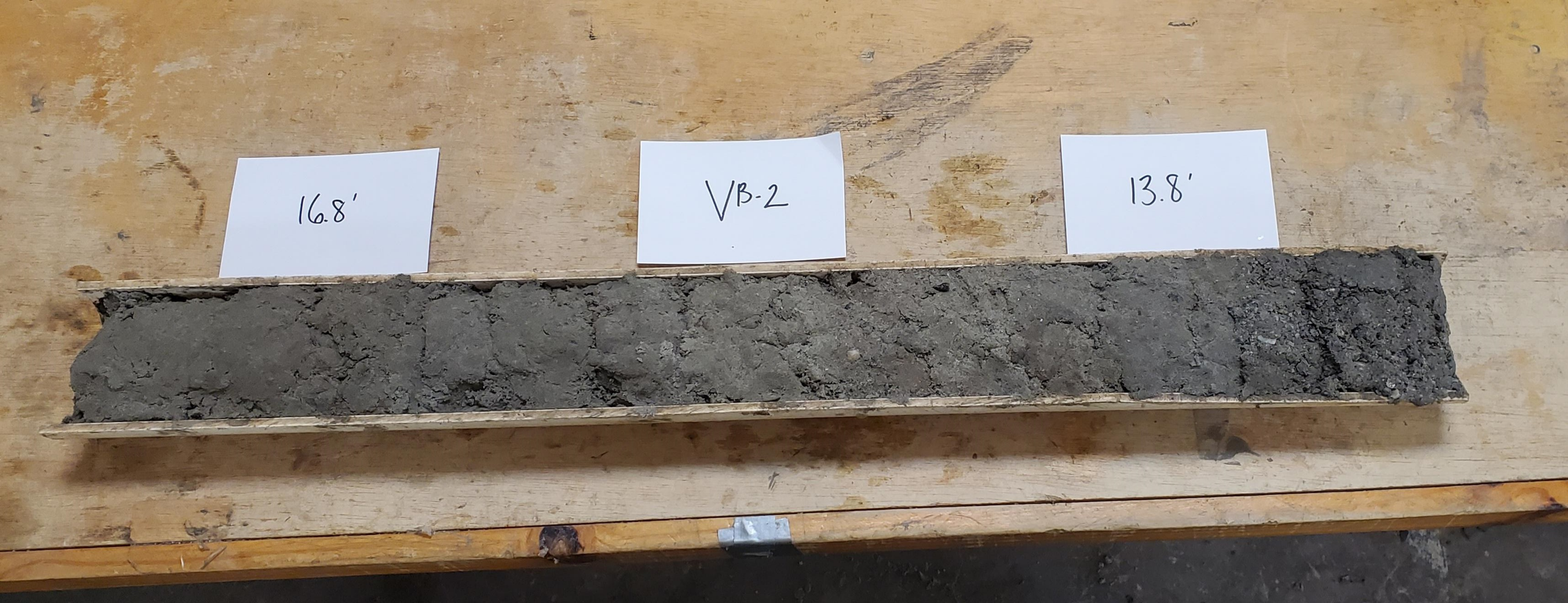
Hollow Aug: Wash Bored:

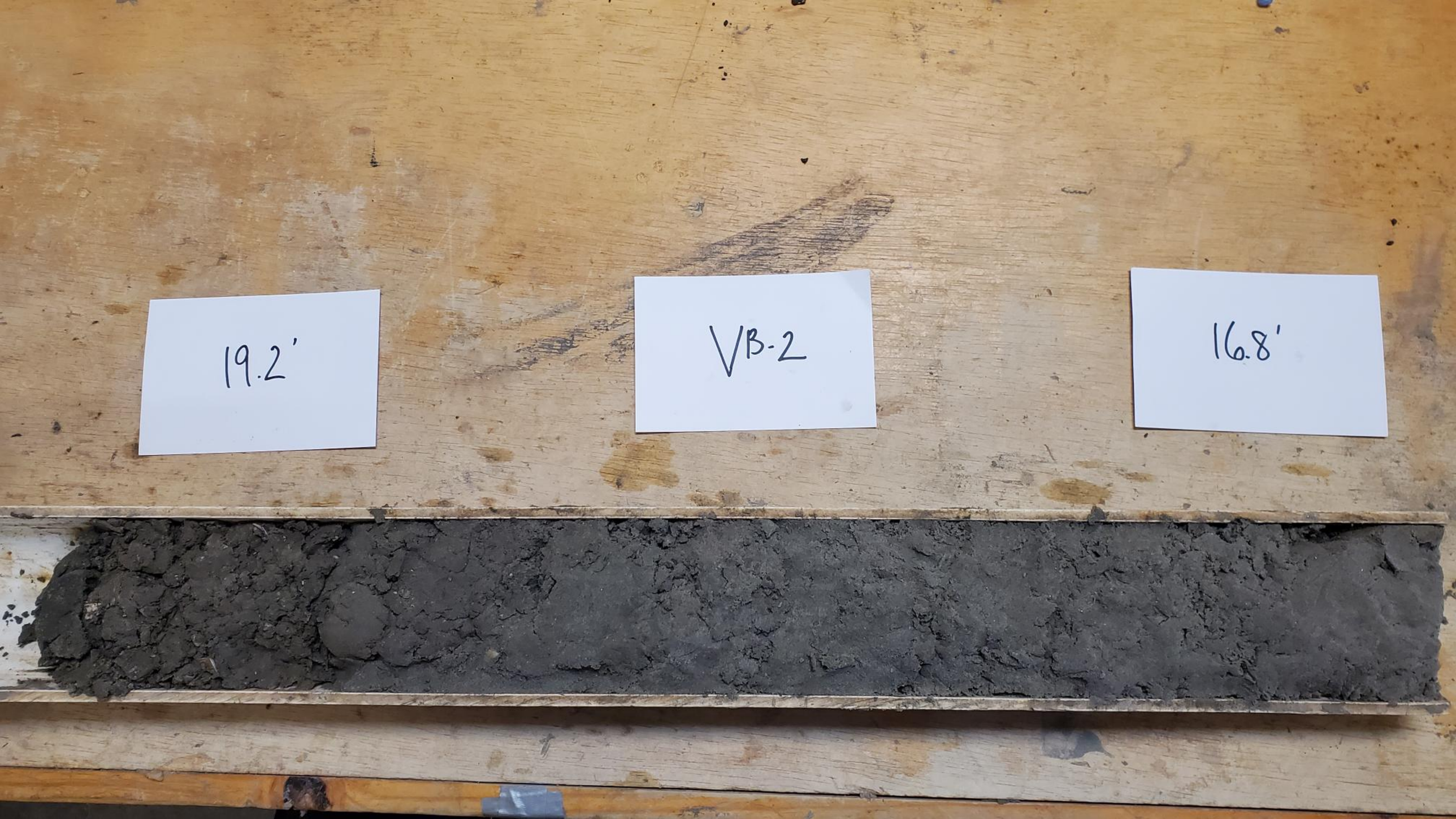
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			J-1	POORLY GRADED SAND WITH SILT (SP-SM), gray				18.7				9.2				SV
				J-2					16.8								
-15				J-3					20.4				6.3				SV
				J-4					20.5								
	5			J-5	SILTY SAND (SM), gray				20.4								
				J-6					19.8				20.9				SV
					Bottom @ 5.4 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

COMPLETION DEPTH: 5.4 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 90%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


16.8'
VB-2
13.8'


19.2'
VB-2
16.8'

LOG OF BORING VB-03

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 28.86" N
96° 21' 36.12" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -12.5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

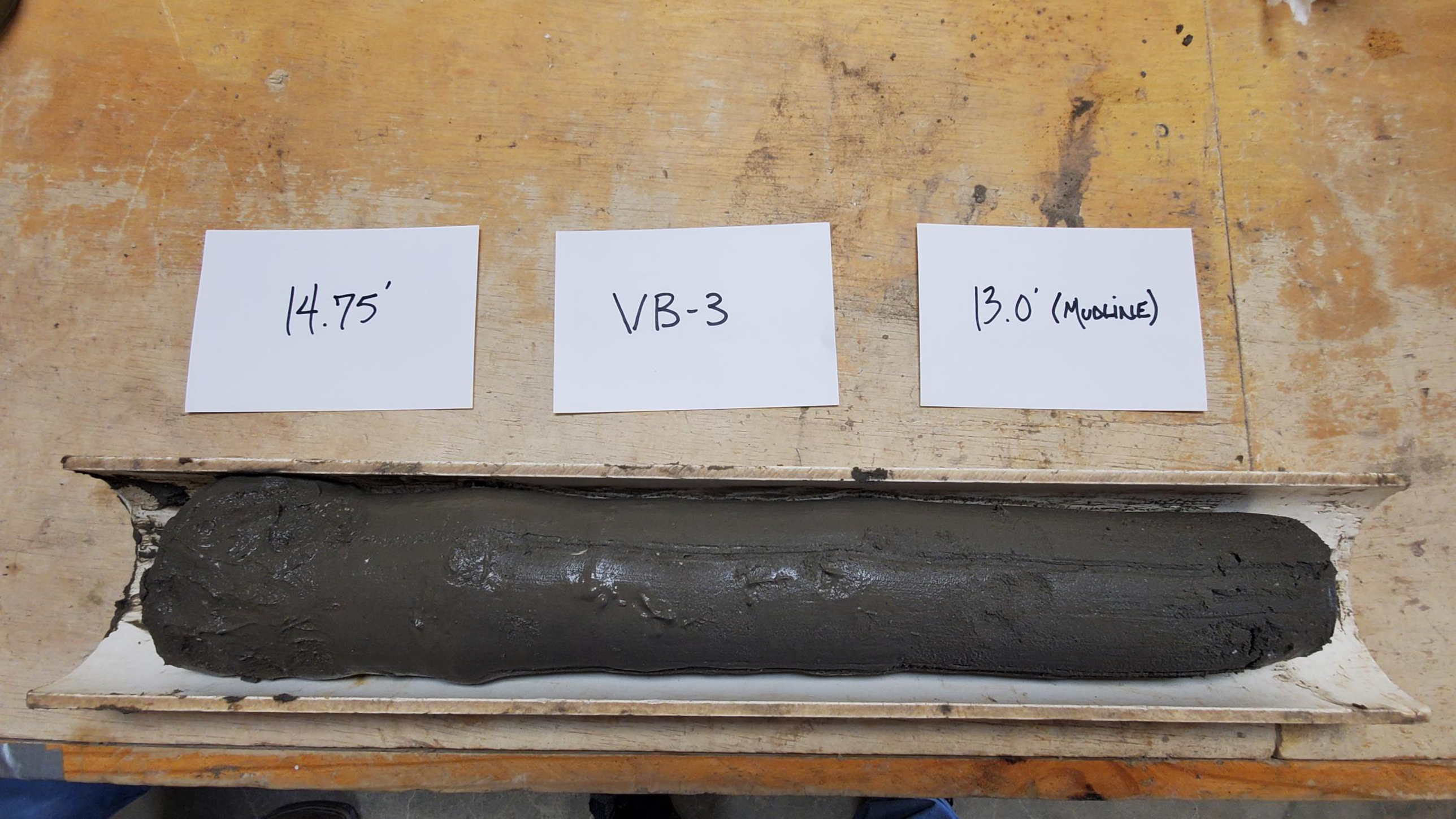
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	CLAYEY SAND (SC), loose, gray	(T)0.60			32.3				33.9	(T)1.20			SV
				T-2		(T)0.40			27.1					(T)0.80			
-15				J-3	SILTY SAND (SM) / POORLY GRADED SAND WITH SILT (SP-SM), gray				22.7				7.6				
				J-4					20.6				15.8				SV
					Bottom @ 3.5 ft.												
-20	5																
	10																
-25																	
	15																
-30																	
	20																
-35																	
	25																
-40																	
	30																
-45																	
	35																
-50																	
	40																

COMPLETION DEPTH: 3.5 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-21-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 80%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


14.75'
VB-3
13.0' (MUDLINE)


16.5
VB-3
14.75

LOG OF BORING VB-04

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 26' 41.23" N
96° 21' 53.67" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.7 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), loose, gray	(T)0.20			26.8				26.6	(T)0.40			SV
				T-2		(T)0.20			27.0					(T)0.40			
				T-3	-medium from 2' to 3'	(T)0.60			22.4				6.8	(T)1.20			
-15				T-4		(T)0.30			24.8				15.4	(T)0.60			SV
				J-5	SILTY SAND (SM), loose, gray				23.6								
	5			J-6					22.1				16.2				
				J-7					20.4				22.1				SV
					Bottom @ 7 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

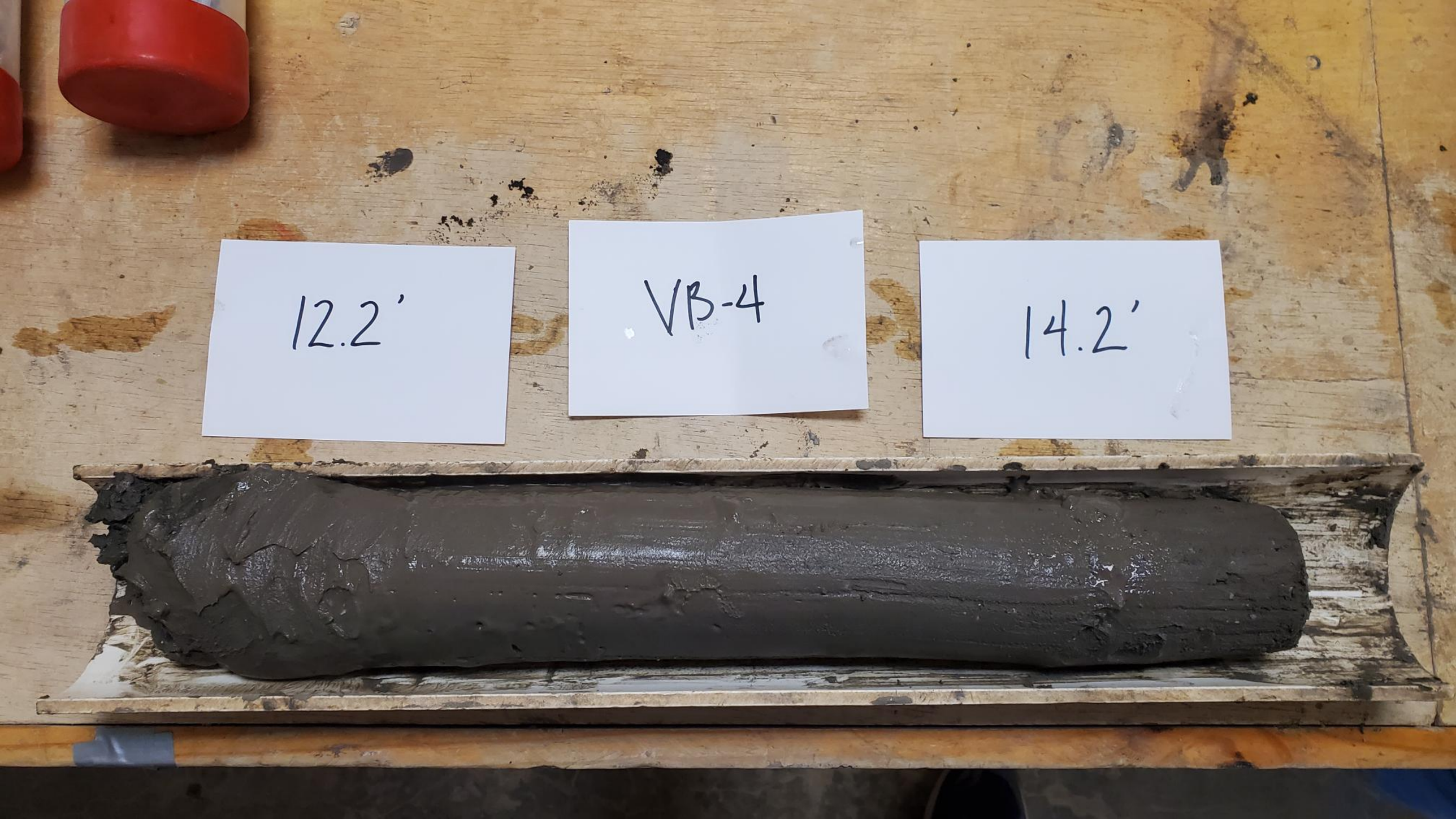
COMPLETION DEPTH: 7 ft
DATE BORING STARTED: 7-21-21
DATE BORING COMPLETED: 7-21-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 90%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


16.2'
VB-4
19.2'


12.2'
VB-4
14.2'

LOG OF BORING VB-05

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 02.51" N
96° 23' 48.82" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.5 ft MLLW

DRILLING METHOD:

Hollow Aug: Wash Bored:

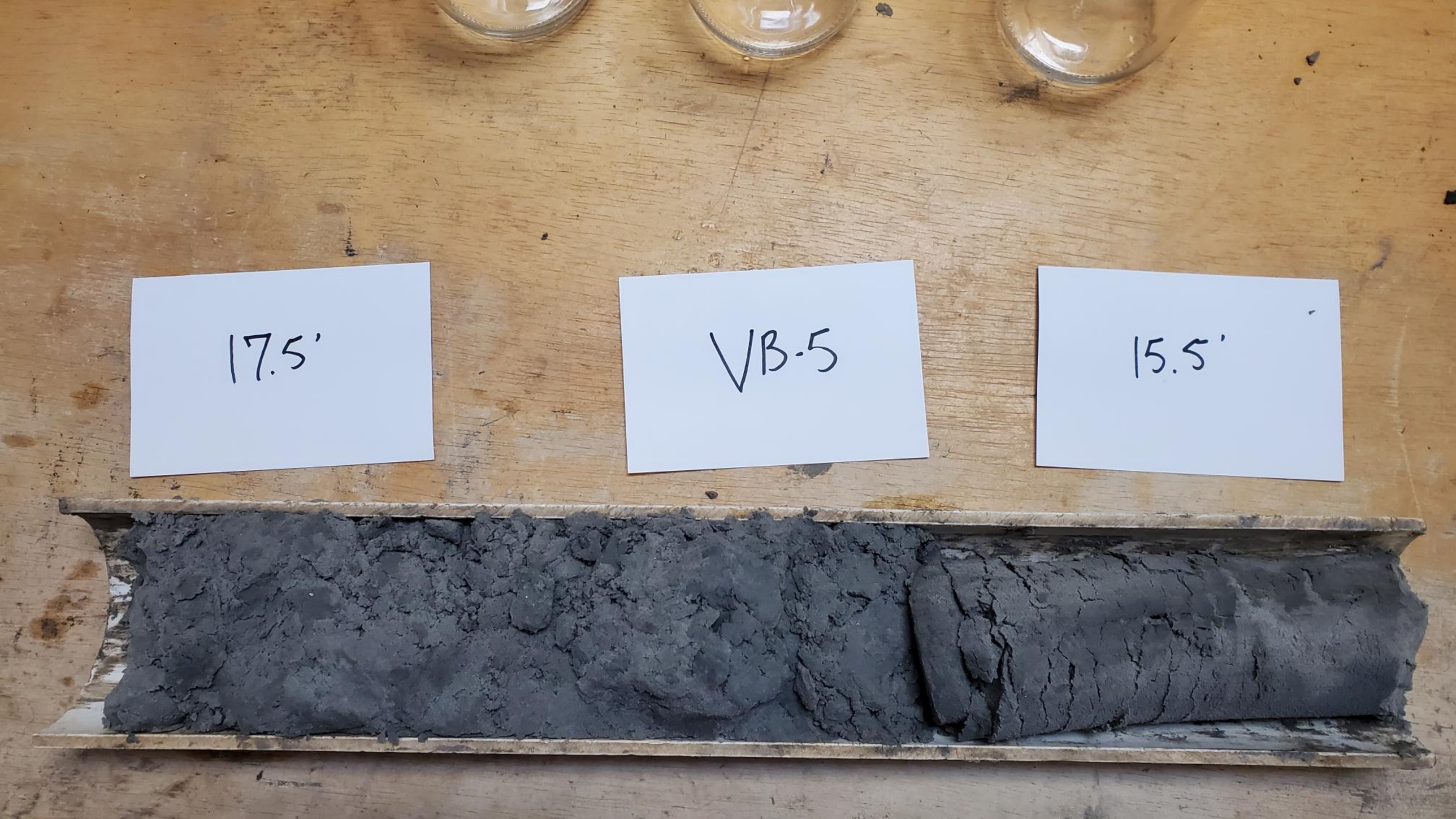
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			J-1	CLAYEY SAND (SC), loose, gray				33.1		27	7	28.0				SV
				J-2					33.1								
-15				T-3	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray	(T)0.20			23.4				10.3	(T)0.40			SV
				J-4					22.3				8.7				
	5			J-5					19.5								
				J-6					23.6				8.3				SV
				J-7					21.5								
				J-8	LEAN CLAY with SAND (CL), very soft, gray				42.9		48	31	72.6				
-20				J-9	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray				24.1								
	10			J-10					21.8				7.1				SV
					Bottom @ 9.5 ft.												
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

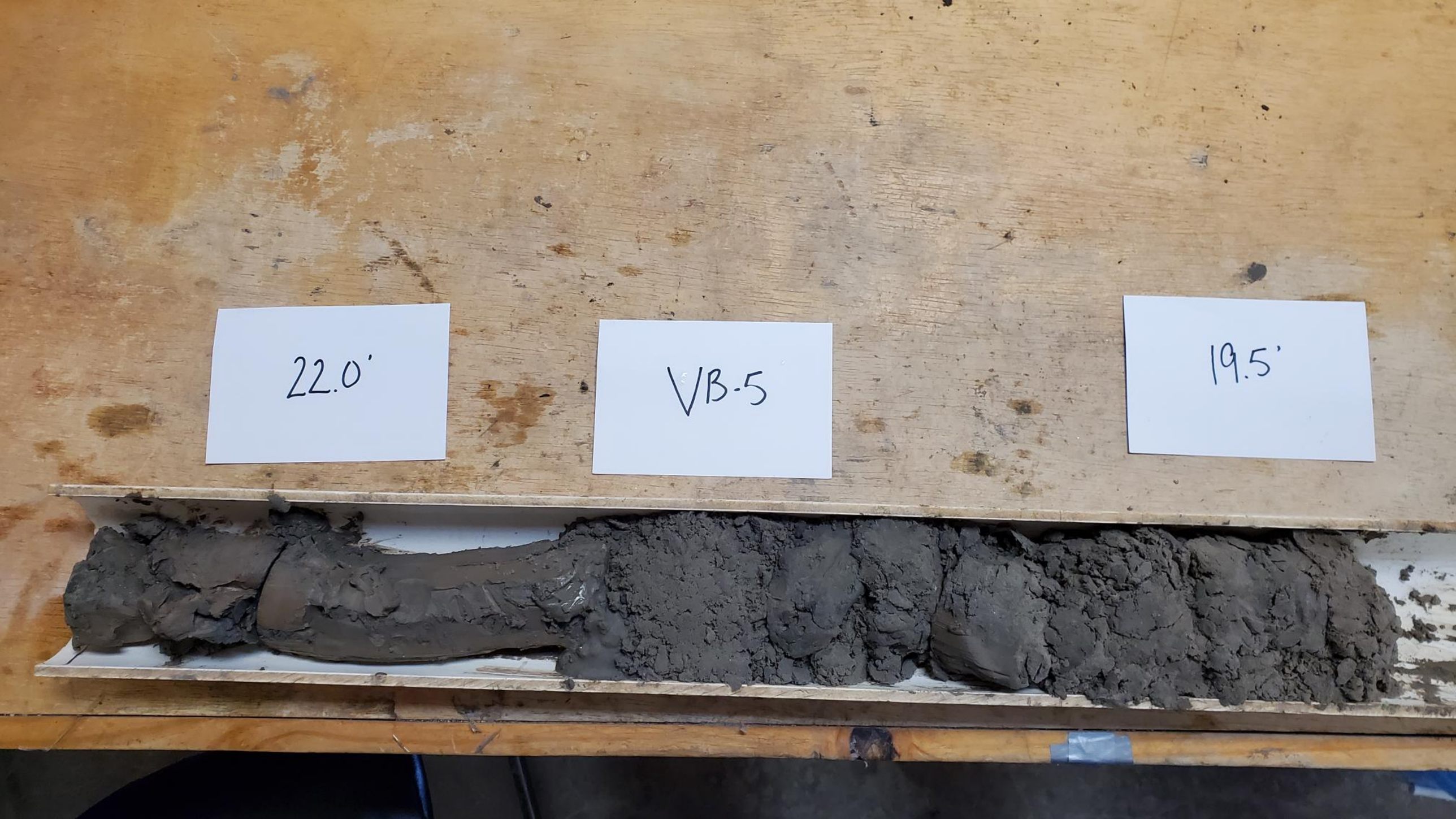
COMPLETION DEPTH: 9.5 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 95%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.5'
VB-5
15.5'


22.0'
VB-5
19.5'

LOG OF BORING VB-06

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

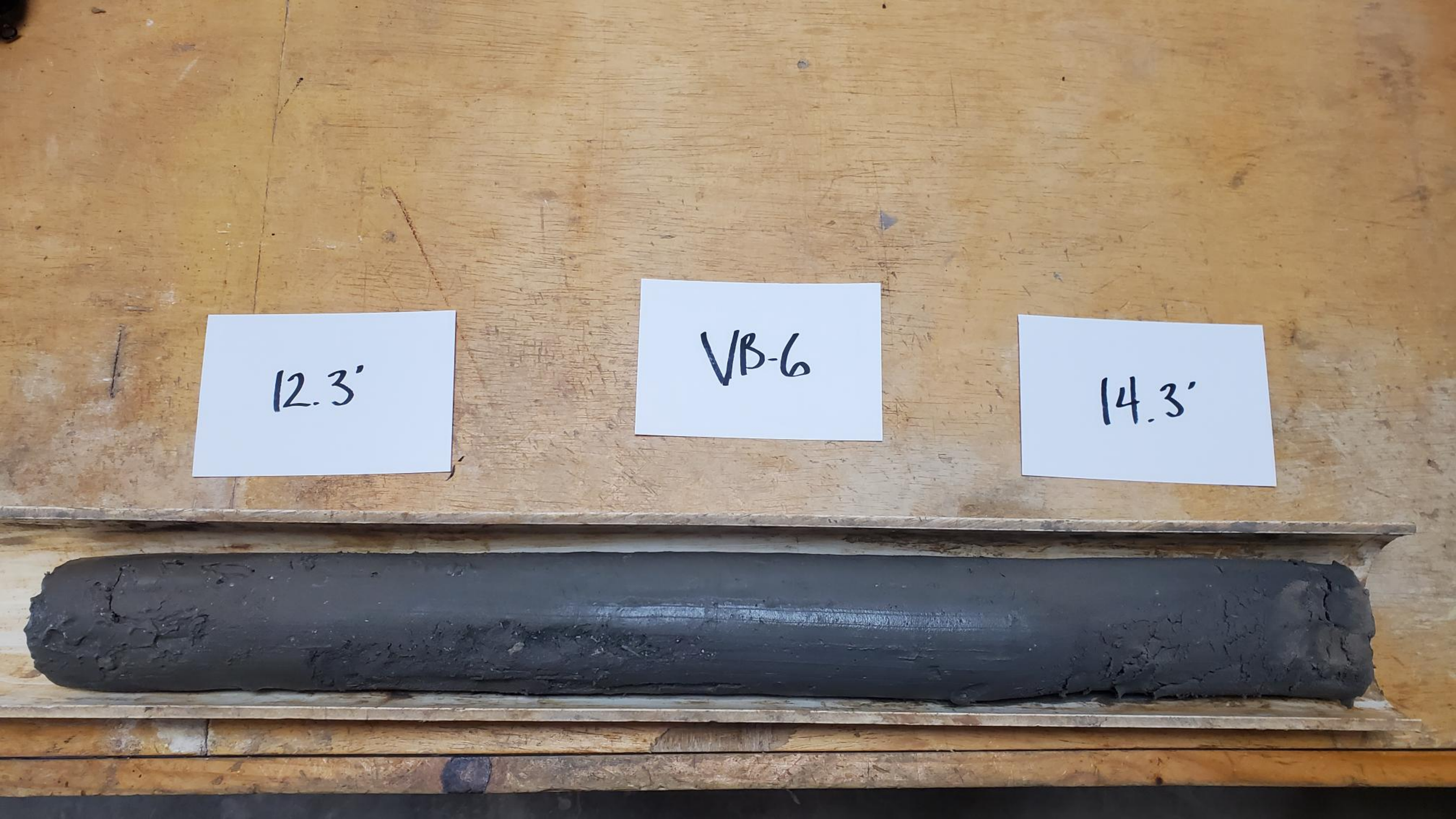
GPS COORDINATE: 28° 28' 14.87" N 96° 24' 06.40" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -11.5 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), loose, gray	(T)0.45			28.7				25.3	(T)0.90			SV
				T-2	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray	(T)0.40			23				6.7	(T)0.80			
				J-3					20.9				5.6				SV
-15				J-4	POORLY GRADED SAND (SP), loose, gray				21.8				4.4				
				J-5					21.3				3.3				SV
	5				Bottom @ 4.6 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

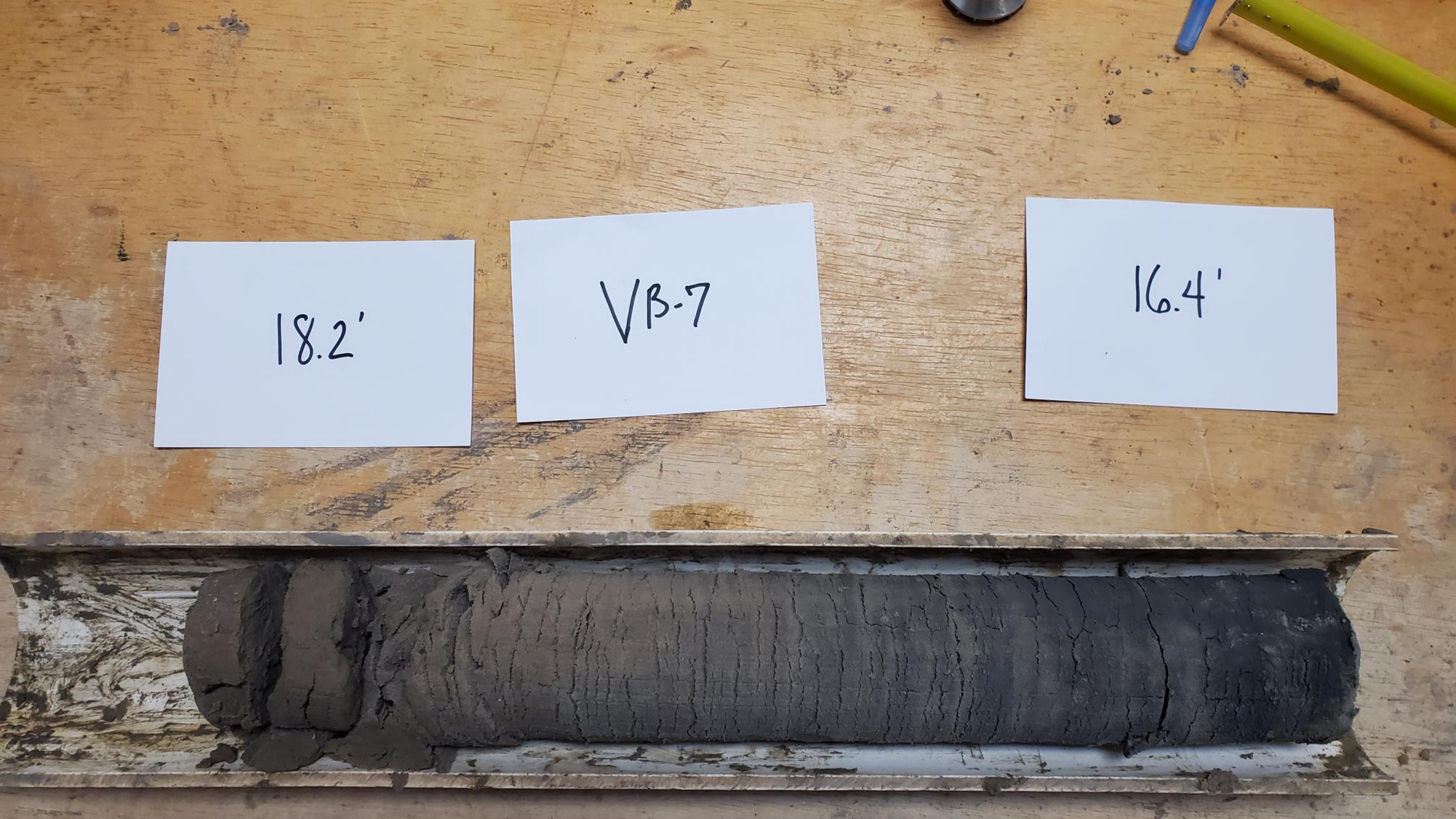
COMPLETION DEPTH: 4.6 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 82%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


12.3'
VB-6
14.3'


14.3'
VB-6
16.9'


18.2'
VB-7
16.4'

LOG OF BORING VB-07

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 27.25" N
96° 24' 23.88" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

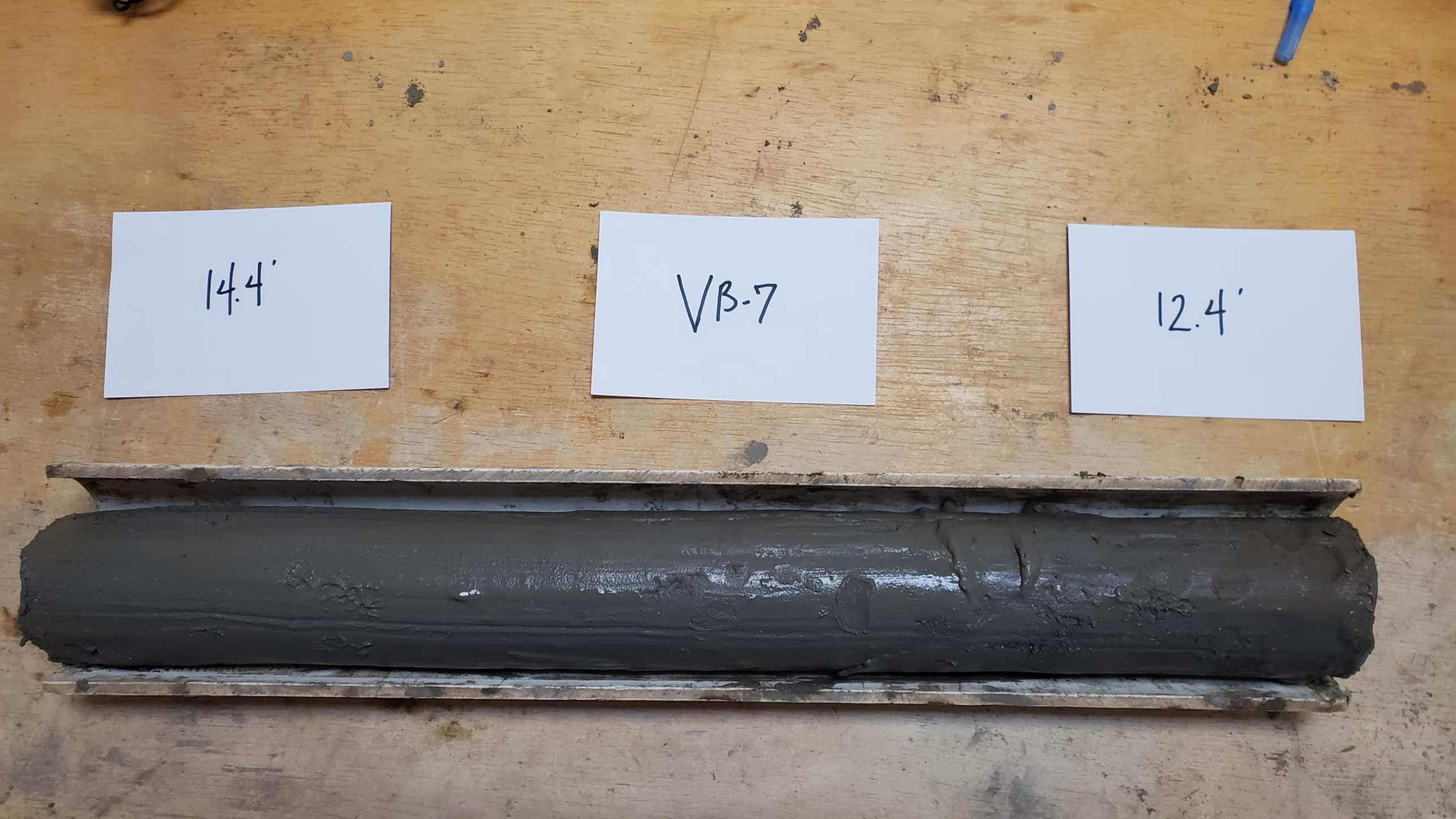
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), loose, gray	(T)0.40			31.9				26.1	(T)0.80			SV
				T-2	-soft from 1' to 2'	(T)0.20			30.3				24.7	(T)0.40			
				T-3	SANDY FAT CLAY (CH), soft, gray	(T)0.20			37.3				57.3	(T)0.40			SV
-15				J-4	POORLY GRADED SAND WITH SILT (SP-SM), loose, tan				21.3				6.4				
				J-5	-gray from 4' to 5.8'				20.9								
	5			J-6					22.8				3.1				SV
					Bottom @ 5.8 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

COMPLETION DEPTH: 5.8 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 91%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


14.4'
VB-7
12.4'

LOG OF BORING VB-08

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 39.60" N
96° 24' 41.36" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.7 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

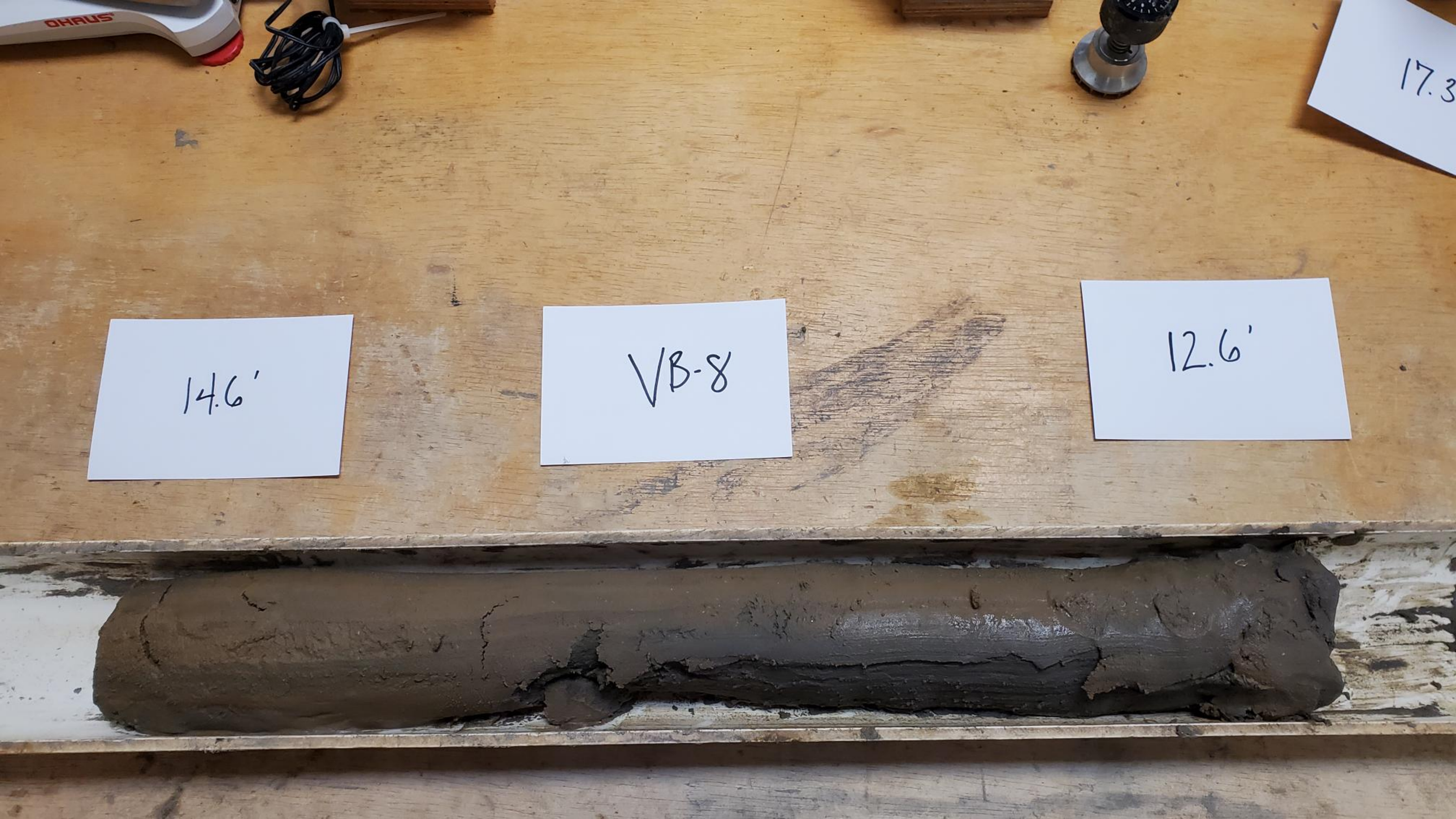
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			▼												
			T-1	CLAYEY SAND (SC), loose, gray and tan	(T)0.20			35.0				33.7	(T)0.40			SV
			T-2		(T)0.20			28.2				20.2	(T)0.40			
			J-3	POORLY GRADED SAND WITH SILT (SP-SM), loose, brown				21.2				11.4				SV
-15			J-4	SANDY LEAN CLAY (CL) / CLAYEY SAND (SC), brown				26.1				39.6				
			J-5					26.9				56.4				SV
	5			Bottom @ 4.7 ft.												
-20	10															
-25	15															
-30	20															
-35	25															
-40	30															
-45	35															
-50	40															

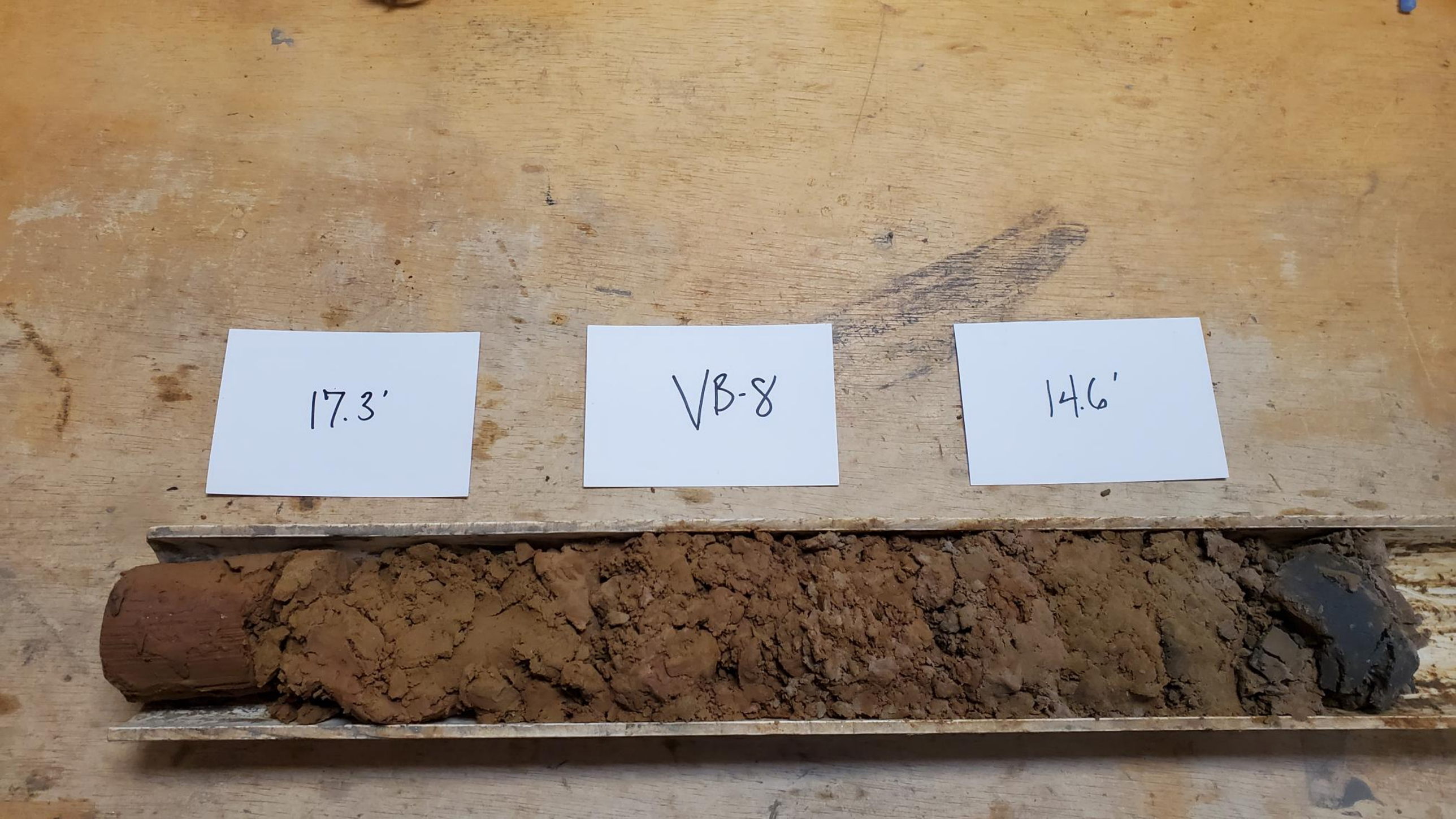
COMPLETION DEPTH: 4.7 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 76%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


OHAUS
14.6'
VB-8
12.6'
17.3


17.3'
VB-8
14.6'

LOG OF BORING VB-09

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 28' 51.95" N
96° 24' 58.91" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

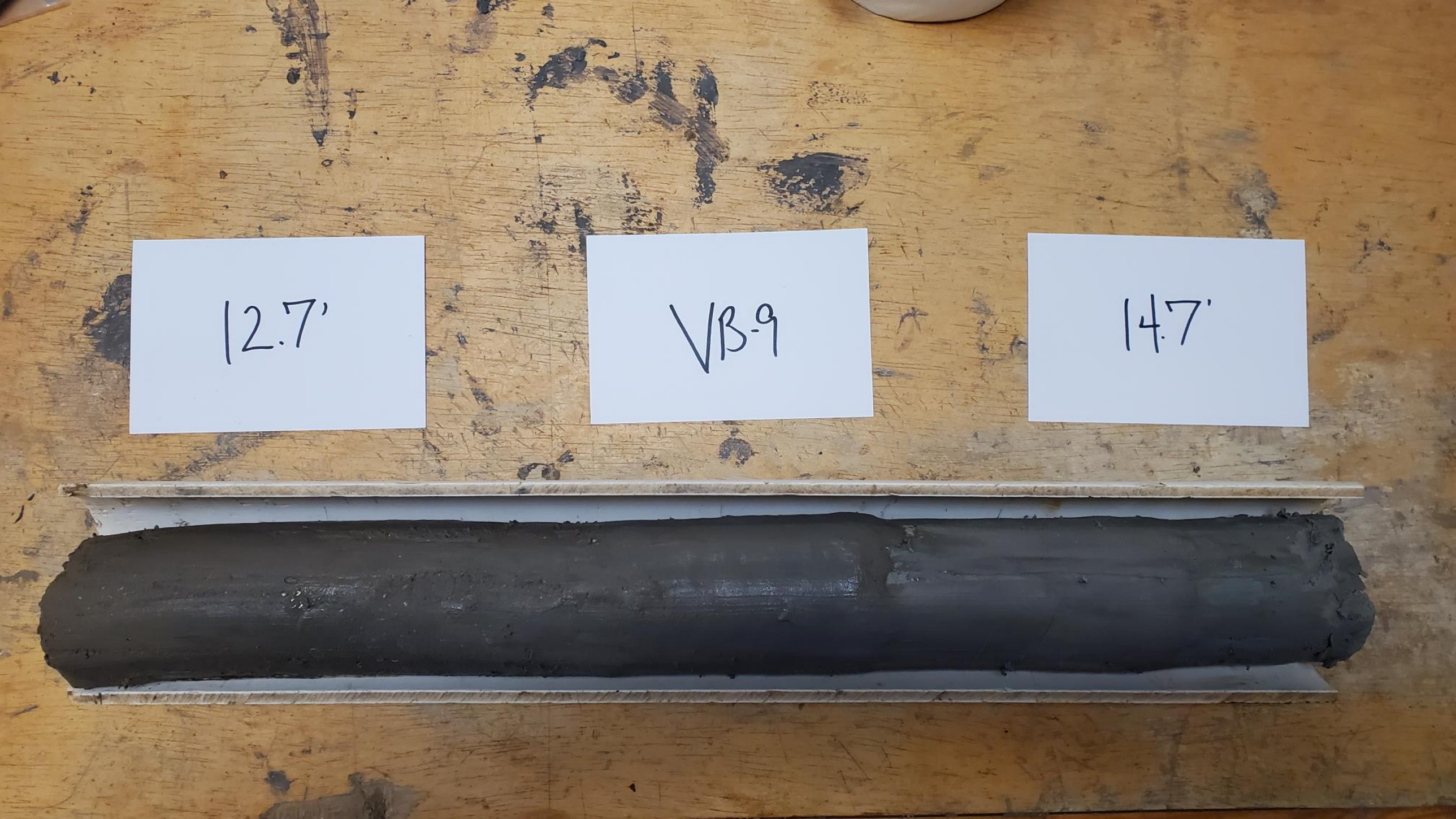
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), loose, gray	(T)0.30			44.6				45.8	(T)0.60			SV
				T-2		(T)0.40			34.9				31.8	(T)0.80			
-15				T-3	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray	(T)0.40			25.3				9.6	(T)0.80			SV
				J-4					20.8				8.7				SV
					Bottom @ 4 ft.												
	5																
-20																	
	10																
-25																	
	15																
-30																	
	20																
-35																	
	25																
-40																	
	30																
-45																	
	35																
-50																	
	40																

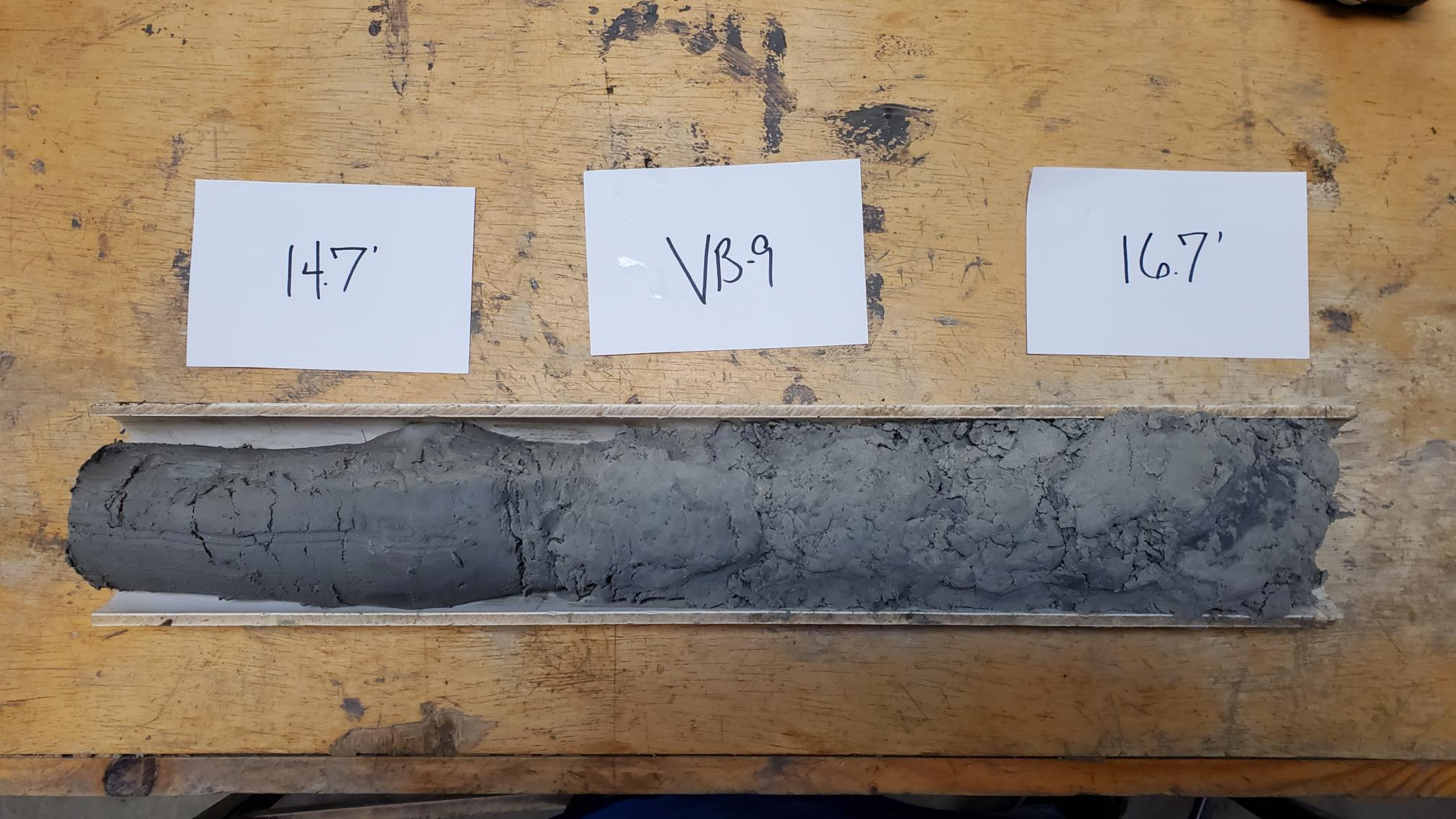
COMPLETION DEPTH: 4 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 71%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


12.7'
VB-9
14.7'


14.7'
VB-9
16.7'

LOG OF BORING VB-10

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 04.31" N
96° 25' 16.41" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.7 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

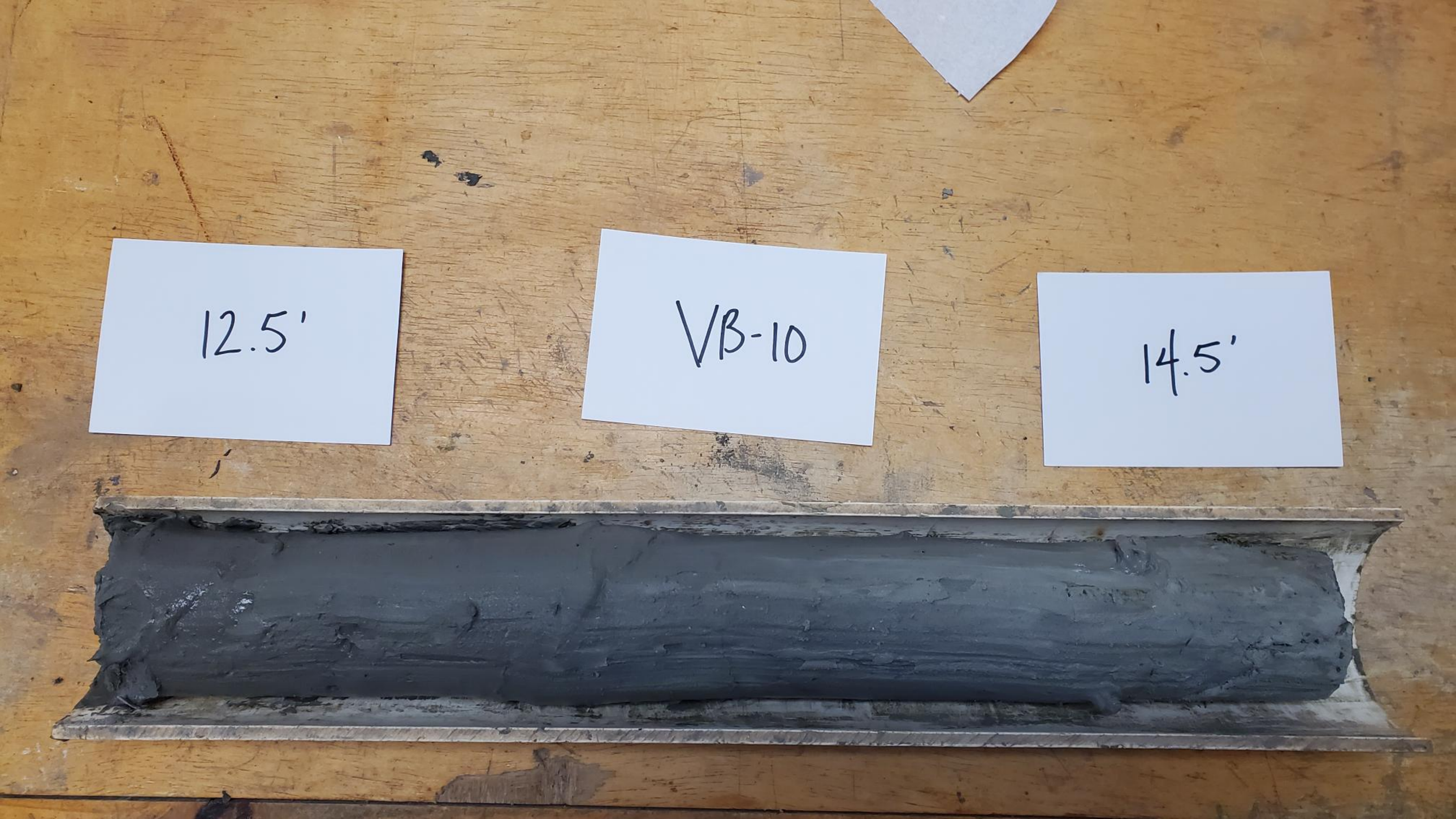
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), very loose, gray	(T)0.10			37.7				35.0	(T)0.20			SV
				T-2	-soft from 1' to 2'	(T)0.20			20.7				21.0	(T)0.40			
				T-3	SILTY SAND (SM), very loose, gray	(T)0.20			23.5				27.3	(T)0.40			SV
-15				J-4					22.4				26.1				
					Bottom @ 4 ft.												
-20	5																
	10																
-25																	
	15																
-30																	
	20																
-35																	
	25																
-40																	
	30																
-45																	
	35																
-50																	
	40																

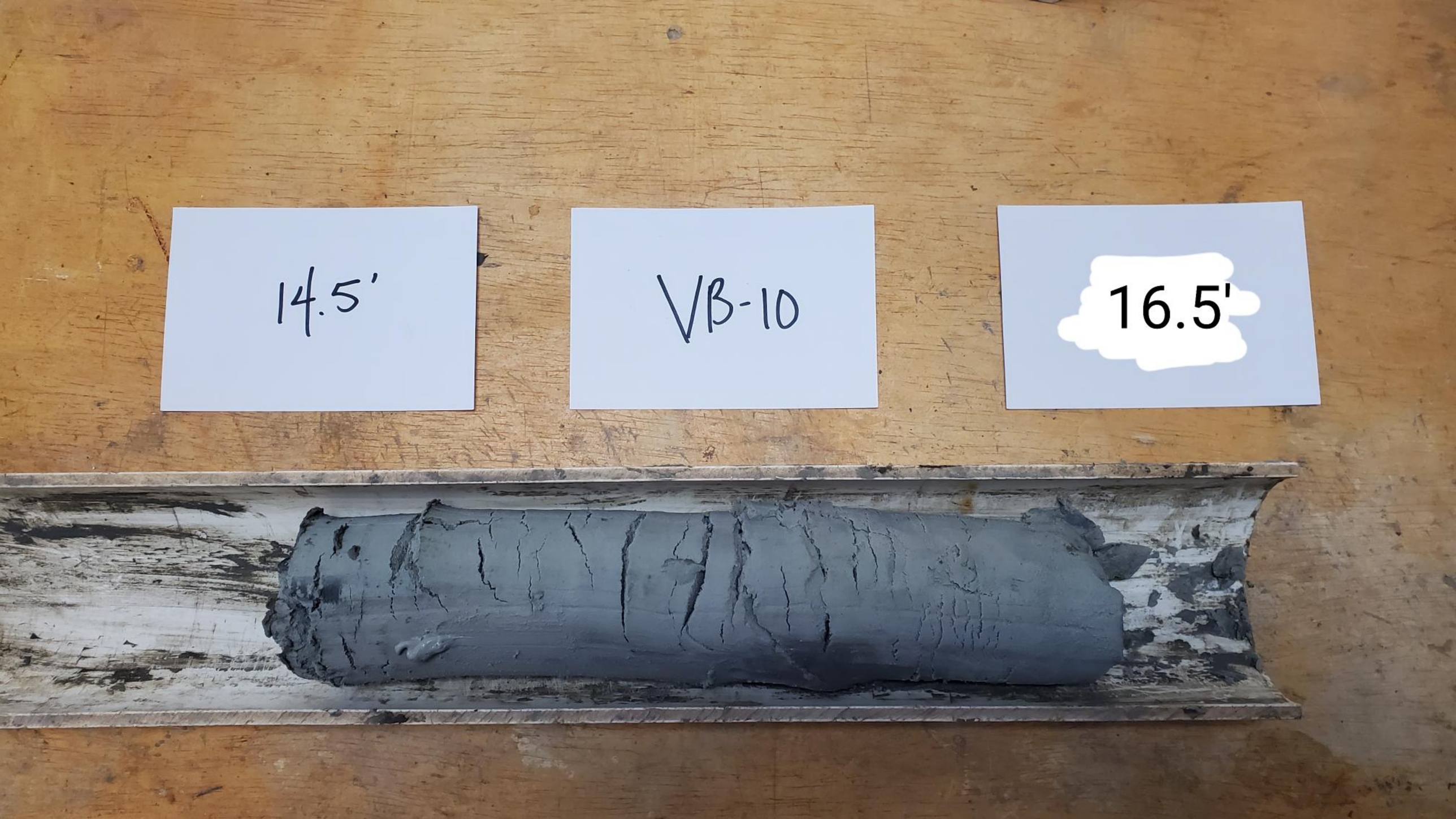
COMPLETION DEPTH: 4 ft
DATE BORING STARTED: 7-22-21
DATE BORING COMPLETED: 7-22-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 82%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


12.5'
VB-10
14.5'


14.5'
VB-10
16.5'

LOG OF BORING VB-11

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 16.63" N
96° 25' 33.96" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

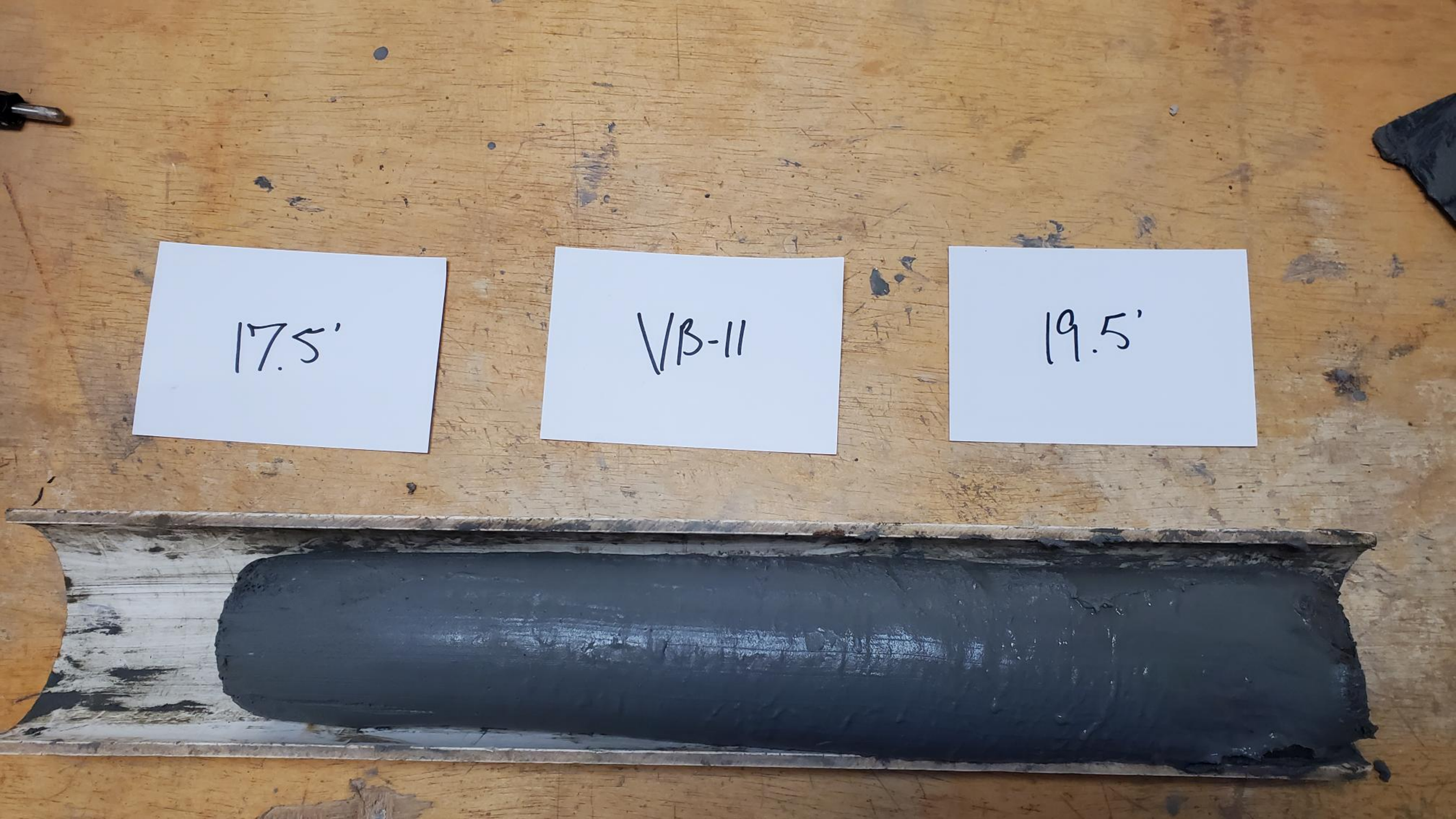
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	CLAYEY SAND (SC), loose, gray	(T)0.10			55.3				49.5	(T)0.20			SV
				T-2		(T)0.30			28.7				35	(T)0.60			
				T-3		(T)0.30			27.5				27.1	(T)0.60			
-15				T-4		(T)0.30			27.4				24.1	(T)0.60			SV
	5			T-5		(T)0.20			25.8				23.1	(T)0.40			
				T-6		(T)0.20			25.7				25.3	(T)0.40			
				T-7		(T)0.10			25.2				19	(T)0.20			SV
					Bottom @ 7 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

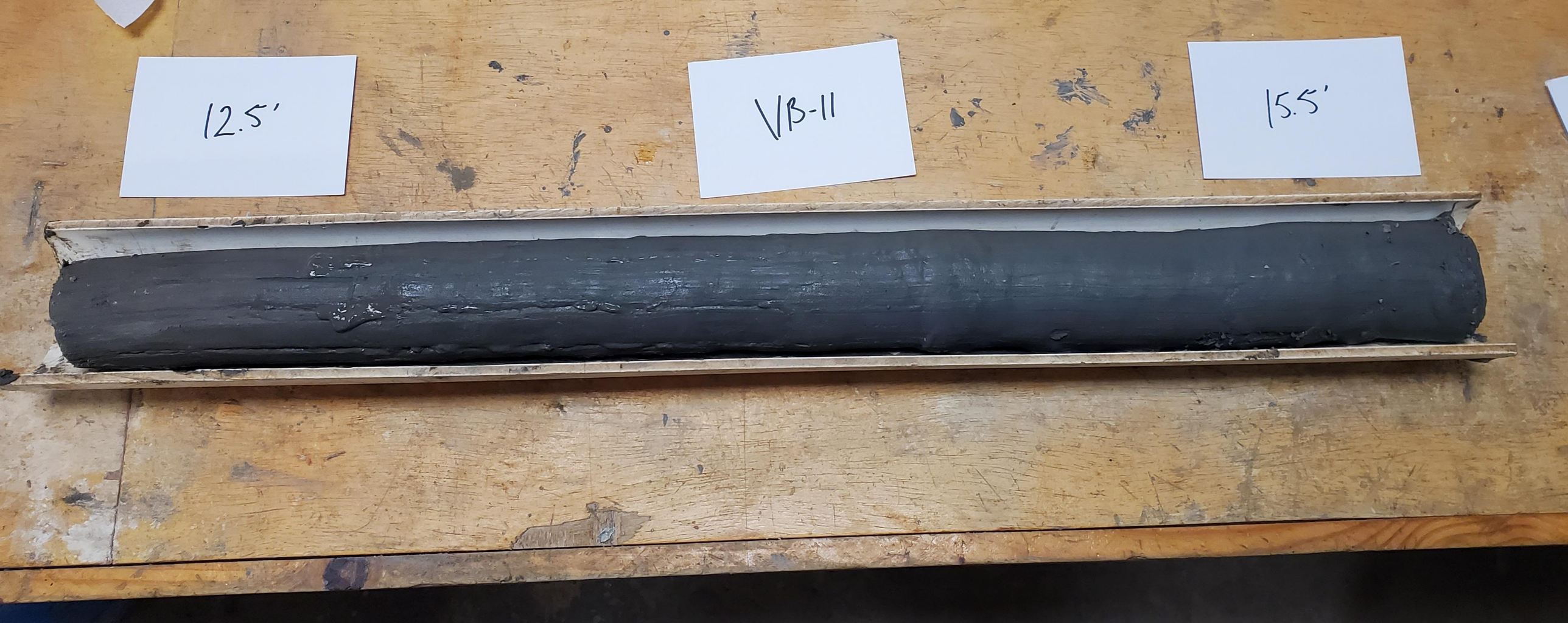
COMPLETION DEPTH: 7 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 81%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.5'
VB-11
19.5'


12.5'
VB-11
15.5'

LOG OF BORING VB-12

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 29.00" N 96° 25' 51.42" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -11.8 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				J-1	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray				25.2				6.8				SV
				J-2					21				8.4				
				J-3					21				11.2				SV
-15				T-4	LEAN CLAY with SAND (CL), medium, gray	(T)0.35			24.5				80.2	(T)0.70			
				T-5		(T)0.30			37.5				74.4	(T)0.60			SV
	5			T-6	CLAYEY SAND (SC), loose, gray	(T)0.30			43.1				43.6	(T)0.60			
					Bottom @ 5.75 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

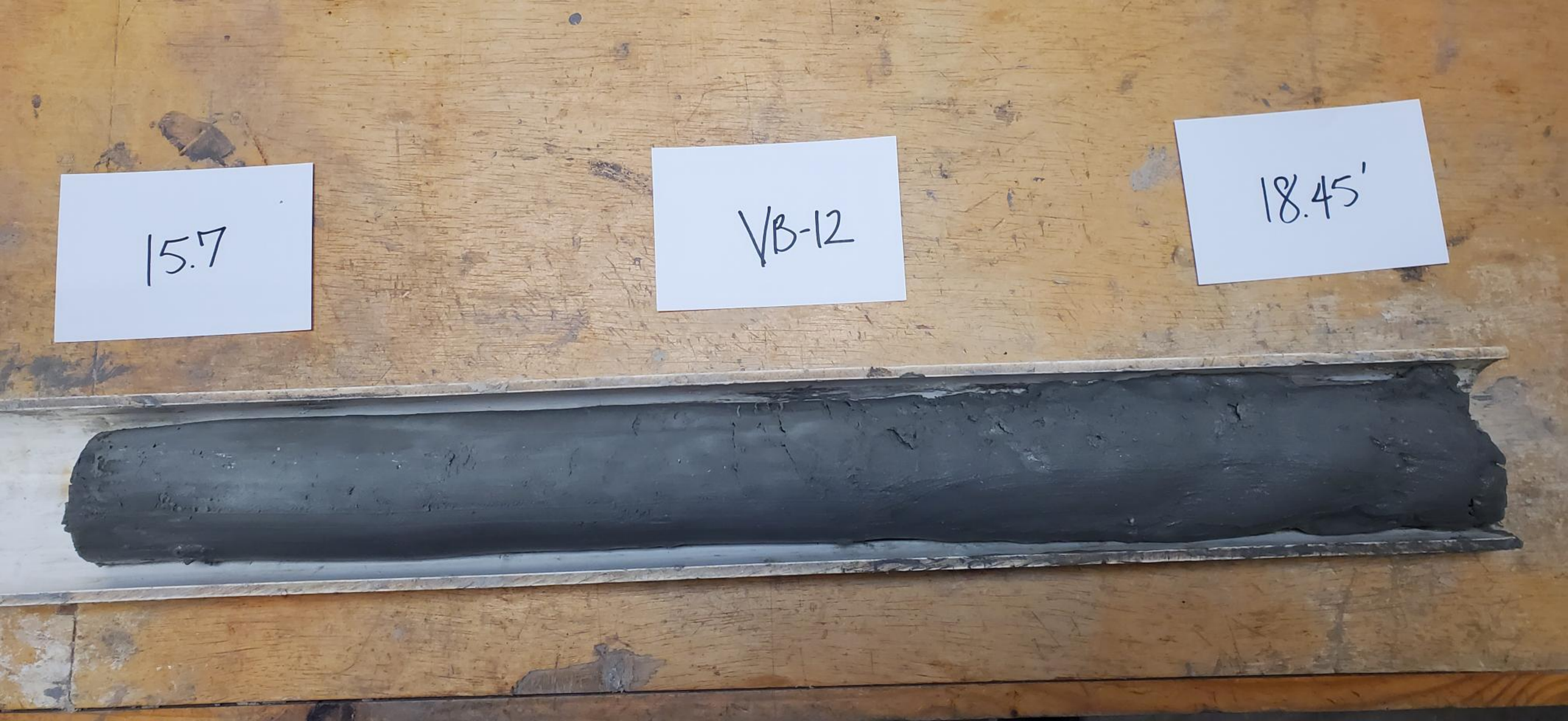
COMPLETION DEPTH: 5.75 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 87%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


12.7'
VB-12
15.7


15.7
VB-12
18.45'

LOG OF BORING VB-13

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 41.37" N
96° 26' 08.94" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -12.2 ft MLLW

DRILLING METHOD:

Hollow Aug: Wash Bored:

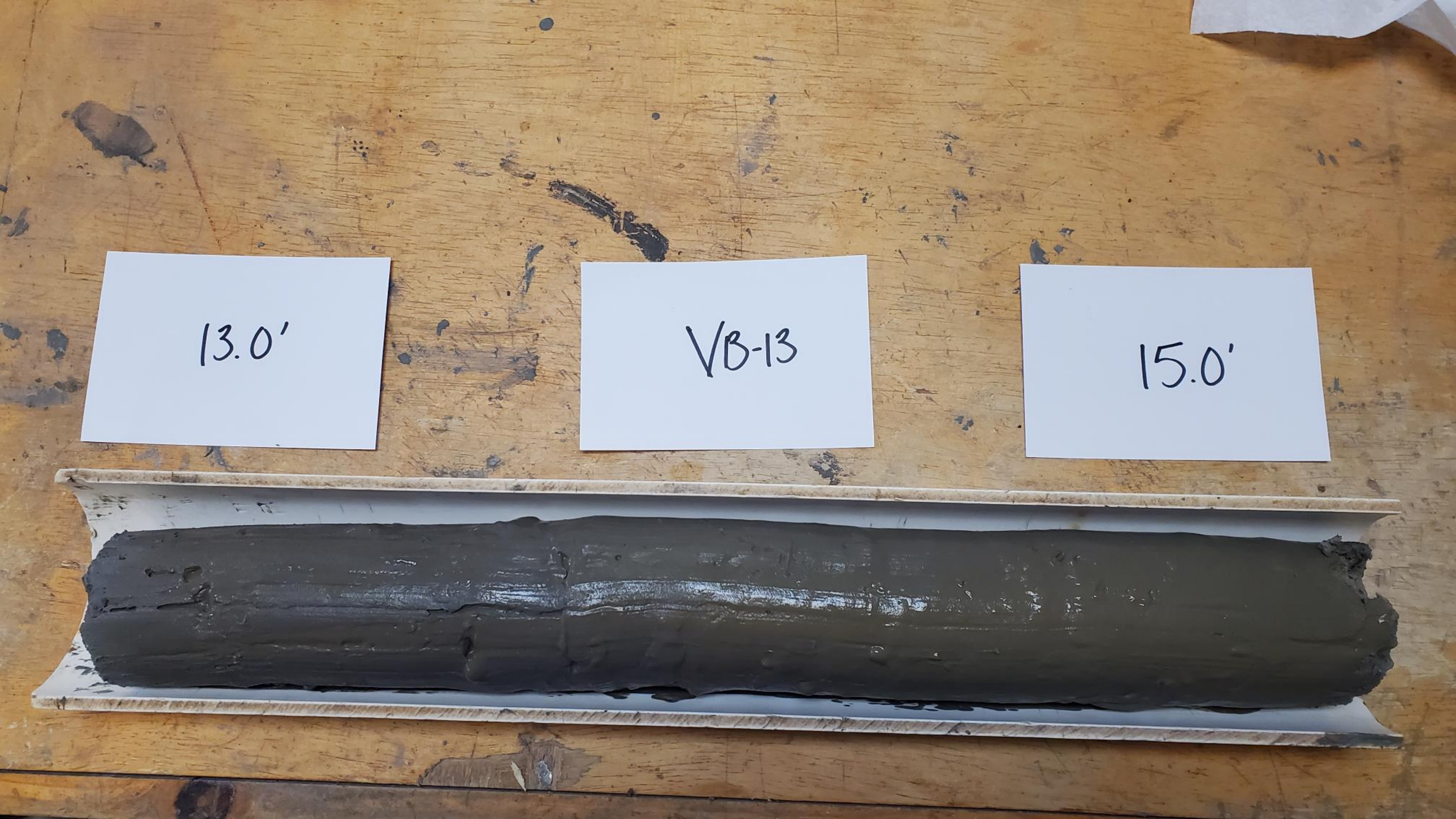
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			▼												
			T-1	SANDY LEAN CLAY (CL), very soft, gray	(T)0.10			47.3				65.1	(T)0.20			SV
			T-2	CLAYEY SAND (SC), very loose, gray	(T)0.15			28.5				15.2	(T)0.30			
-15			J-3	POORLY GRADED SAND WITH SILT (SP-SM), loose, gray				20.8				5.1				
			J-4					20.4				10.0				SV
				Bottom @ 4 ft.												
-20	5															
	10															
-25																
	15															
-30																
	20															
-35																
	25															
-40																
	30															
-45																
	35															
-50																
	40															

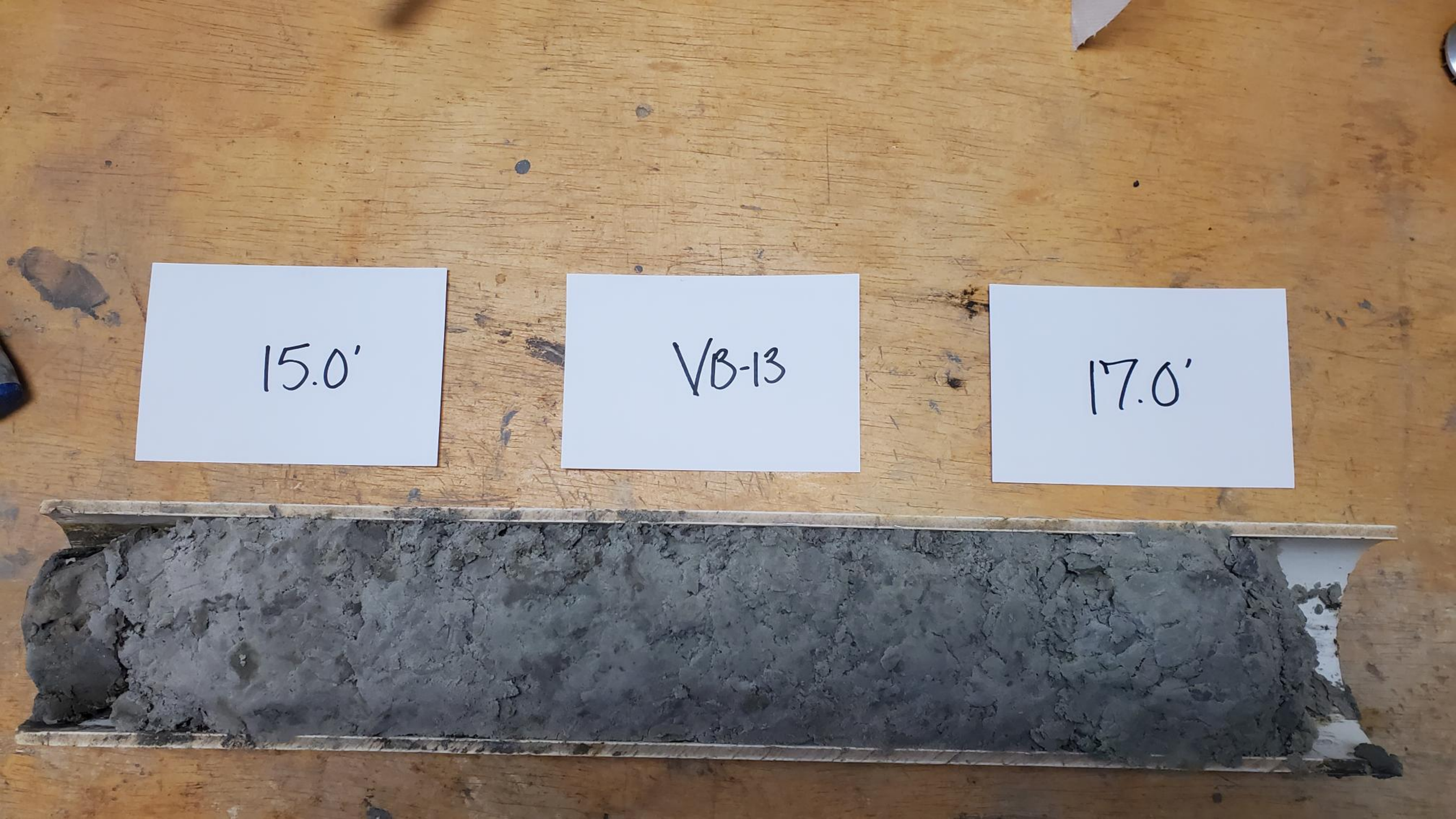
COMPLETION DEPTH: 4 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 87%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


13.0'
VB-13
15.0'


15.0'
VB-13
17.0'

LOG OF BORING VB-14

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 29' 53.74" N 96° 26' 26.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -13 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

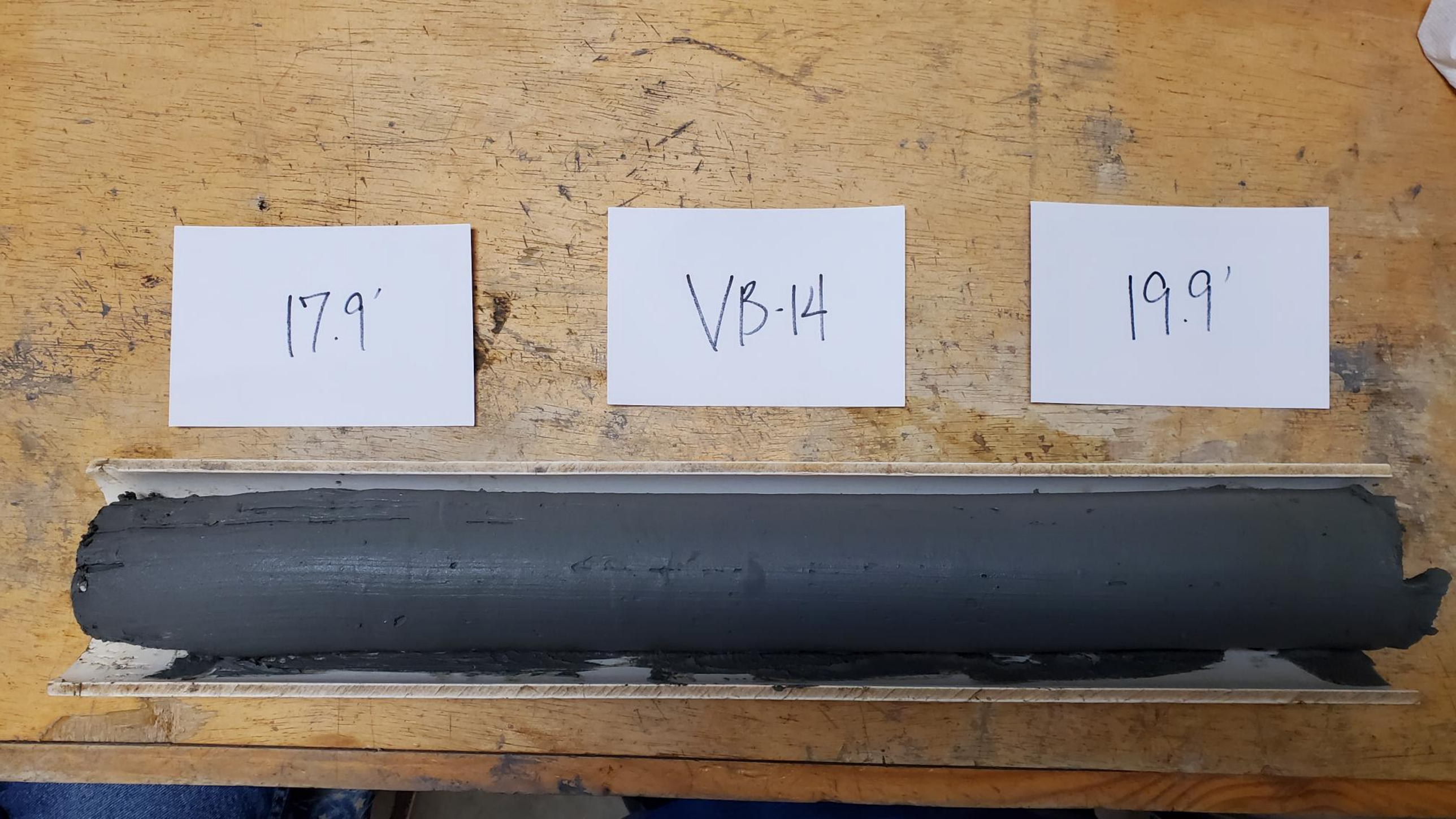
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	SANDY FAT CLAY (CH) / FAT CLAY with SAND (CH), medium, gray	(T)0.40			64.5		52	36	74.2	(T)0.80			SV
				T-2		(T)0.40			71.3				66.8	(T)0.80			
-15				T-3		(T)0.45			60.5					(T)0.90			
				T-4		(T)0.40			57.7				69.5	(T)0.80			
				T-5		(T)0.45			43.3					(T)0.90			
	5			T-6	-firm from 5' to 6'	(T)0.60			36					(T)1.20			
				T-7	-medium from 6' to 6.5'	(T)0.40			55.6		54	37	81.2	(T)0.80			
-20					Bottom @ 6.5 ft.												
	10																
-25																	
	15																
-30																	
	20																
-35																	
	25																
-40																	
	30																
-45																	
	35																
-50																	
	40																

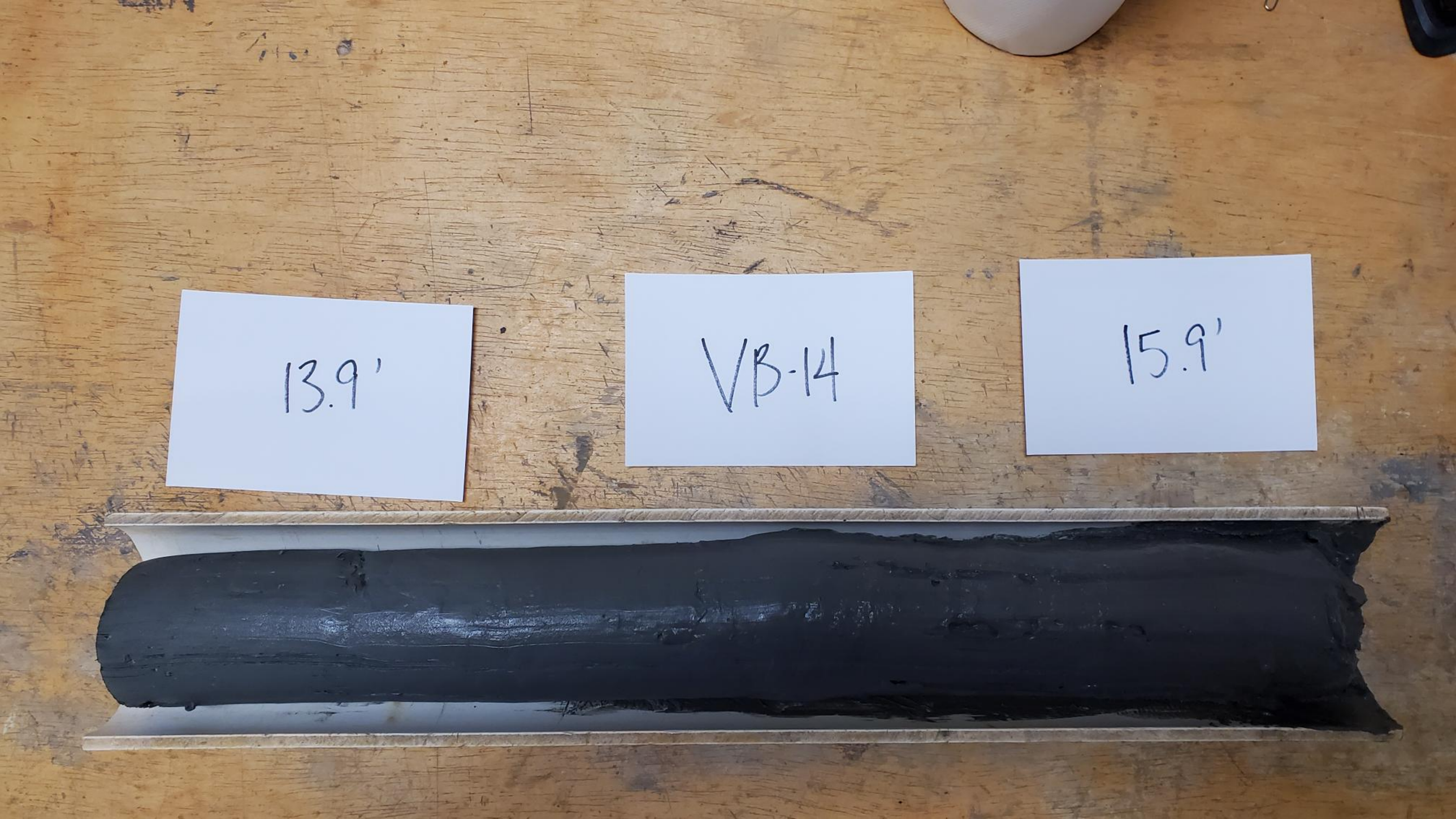
COMPLETION DEPTH: 6.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 81%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.9'
VB-14
19.9'


13.9'
VB-14
15.9'

LOG OF BORING VB-15

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 06.07" N
96° 26' 44.02" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -11.2 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

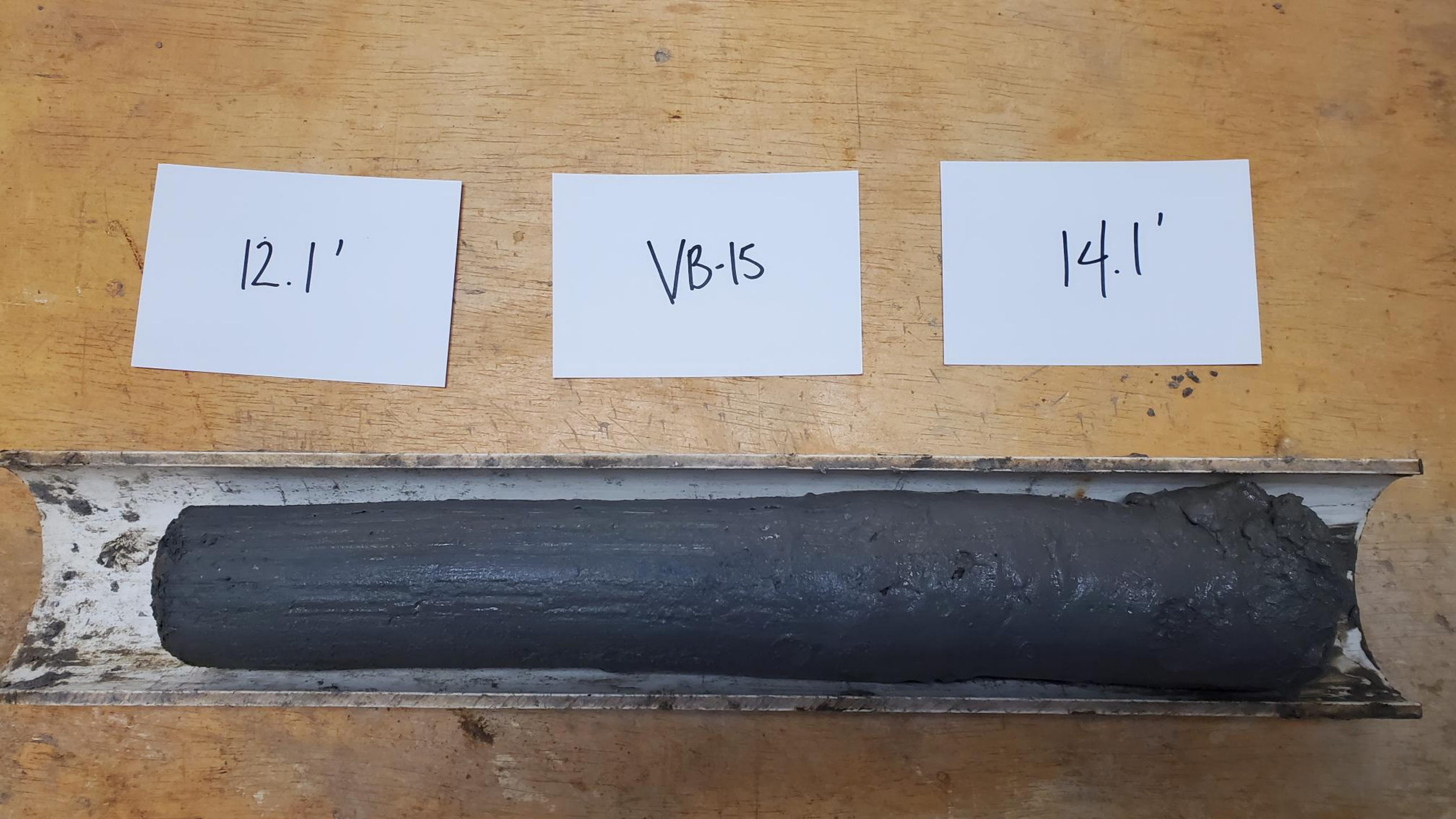
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0		T-1	SANDY FAT CLAY (CH) / FAT CLAY with SAND (CH), medium, gray	(T)0.40			68.4		65	45	67.9	(T)0.80			SV
			T-2		(T)0.30			78				74.6	(T)0.60			
			T-3		(T)0.20			28.6					(T)0.40			
-15	5		T-4	CLAYEY SAND (SC), loose, gray	(T)0.20			24.3		42	22	21.9	(T)0.40			
				Bottom @ 3.3 ft.												
-20	10															
-25	15															
-30	20															
-35	25															
-40	30															
-45	35															
-50	40															

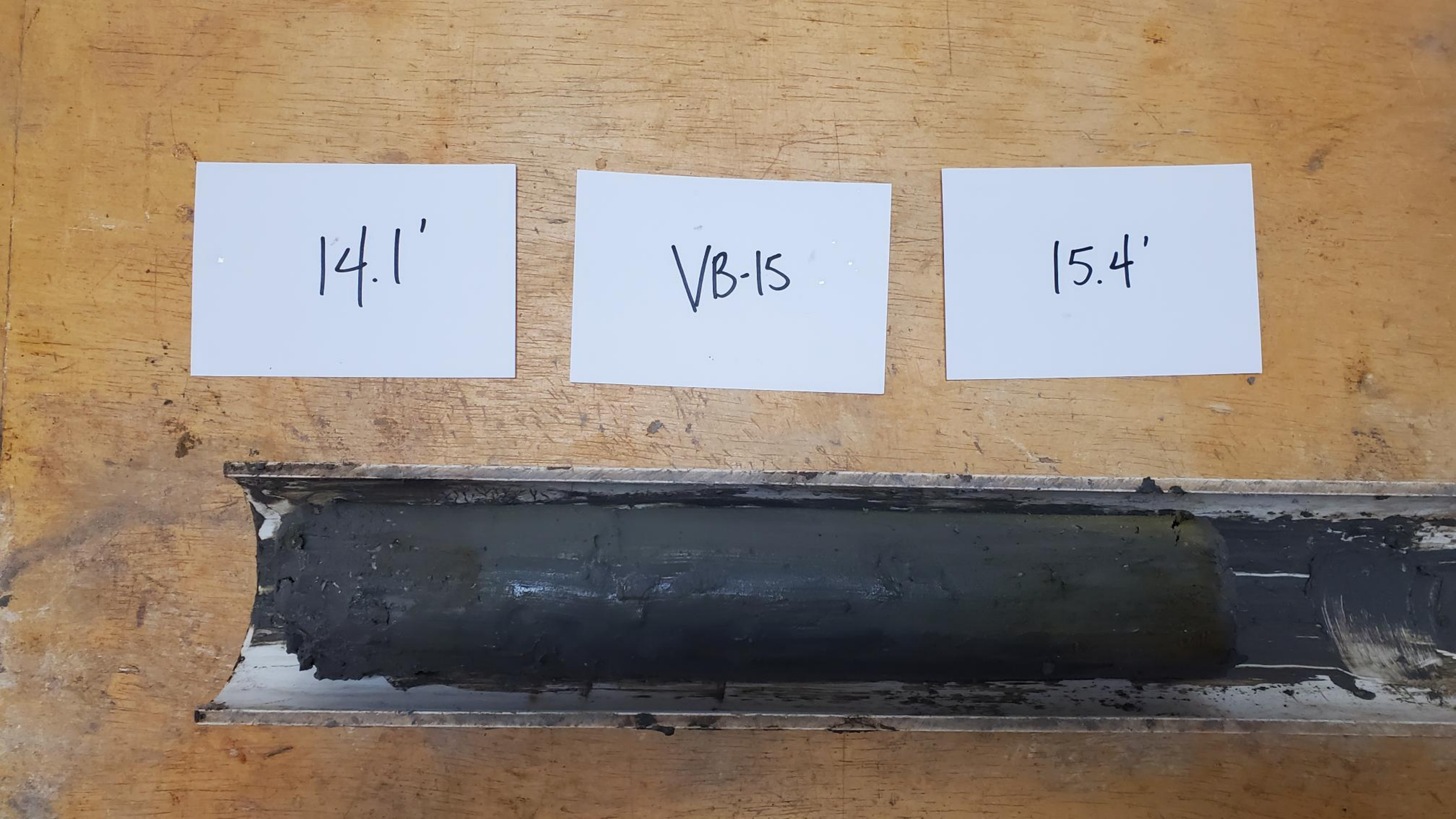
COMPLETION DEPTH: 3.3 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 75%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


12.1'
VB-15
14.1'


14.1'
VB-15
15.4'

LOG OF BORING VB-16

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 18.46" N
96° 27' 01.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -10.6 ft MLLW

DRILLING METHOD:

Hollow Aug: Wash Bored:

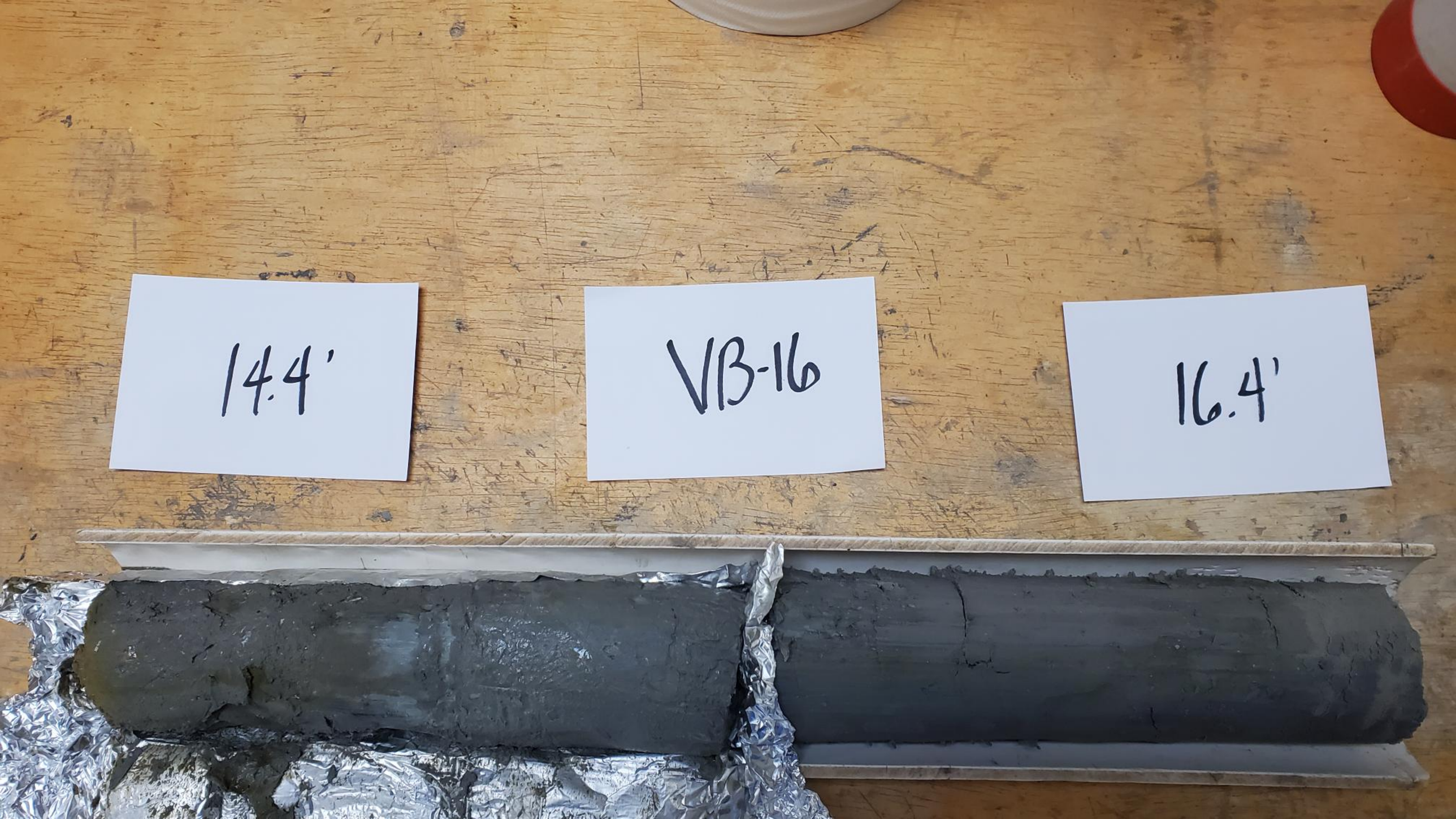
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	SANDY FAT CLAY (CH), medium, gray with shell fragments	(T)0.30			69.5		89	67	56.4	(T)0.60			SV
				T-2		(T)0.30			68.9				61.6	(T)0.60			
				T-3		(T)0.30			61.2				58.8	(T)0.60			
				T-4	CLAYEY SAND (SC), loose, gray	(T)0.30			26.6		45	29	20.5	(T)0.60			
-15				T-5		(T)0.45			27.1				13.8	(T)0.90			SV
	5			J-6	POORLY GRADED SAND WITH SILT (SP-SM), medium dense, tan				22.9				9.7				
				J-7					22.4				9.2				SV
				J-8					22				12				
				J-9	-brown from 8' to 9'				23				8.8				SV
-20					Bottom @ 9 ft.												
	10																
-25																	
	15																
-30																	
	20																
-35																	
	25																
-40																	
	30																
-45																	
	35																
-50																	
	40																

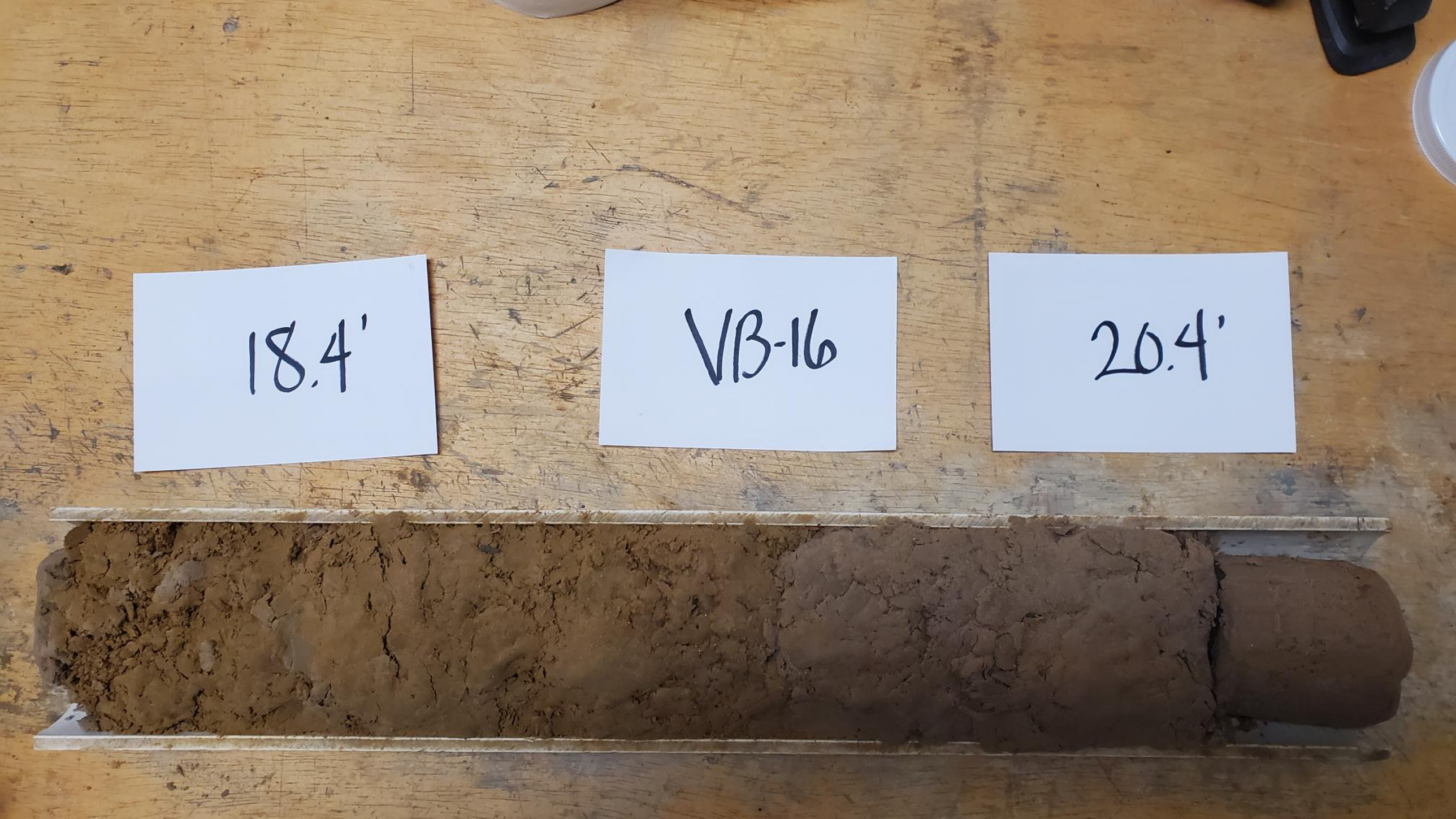
COMPLETION DEPTH: 9 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 85%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


14.4'
VB-16
16.4'


18.4'
VB-16
20.4'

LOG OF BORING VB-17

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 30.77" N
96° 27' 19.08" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -10.4 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	SANDY CLAY (SC), loose, gray	(T)0.30			47		80	55	34.8	(T)0.60			
				T-2		(T)0.40			31					(T)0.80			
				T-3	SILTY SAND (SM), loose, gray and tan	(T)0.40			28.9				42.8	(T)0.80			
				T-4	SANDY SILT (ML), loose, brown	(T)0.30			27.3				66.6	(T)0.60			SV
-15	5			J-5					22				68.3				
				J-6					23.4				72.8				SV
					Bottom @ 5.5 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

COMPLETION DEPTH: 5.5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


11.5'
VB-17
14.5'


16.5'
VB-17
17.0'

LOG OF BORING VB-18

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 30' 43.05" N
96° 27' 36.67" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -10.6 ft MLLW

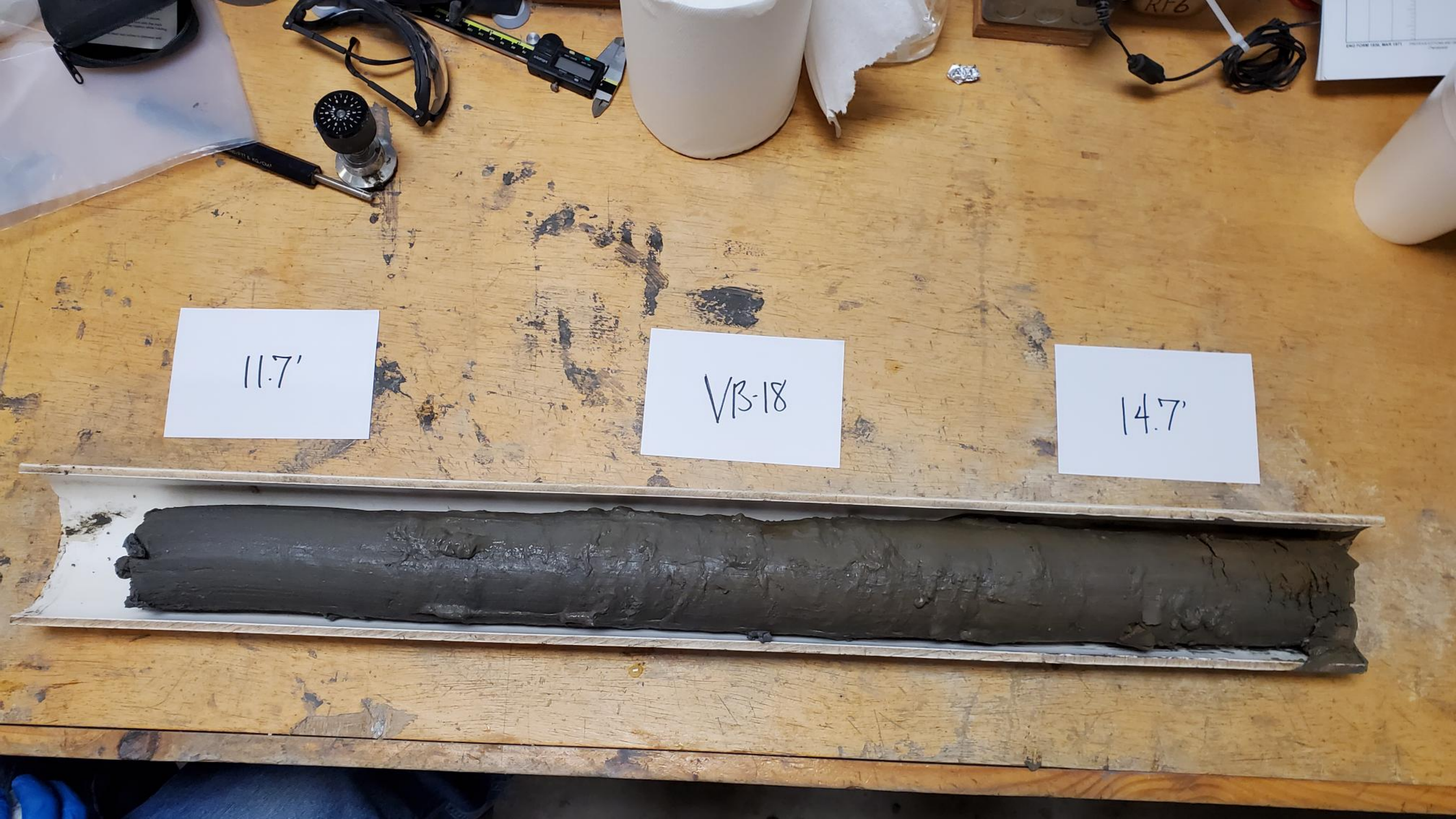
DRILLING METHOD:
Hollow Aug: Wash Bored:

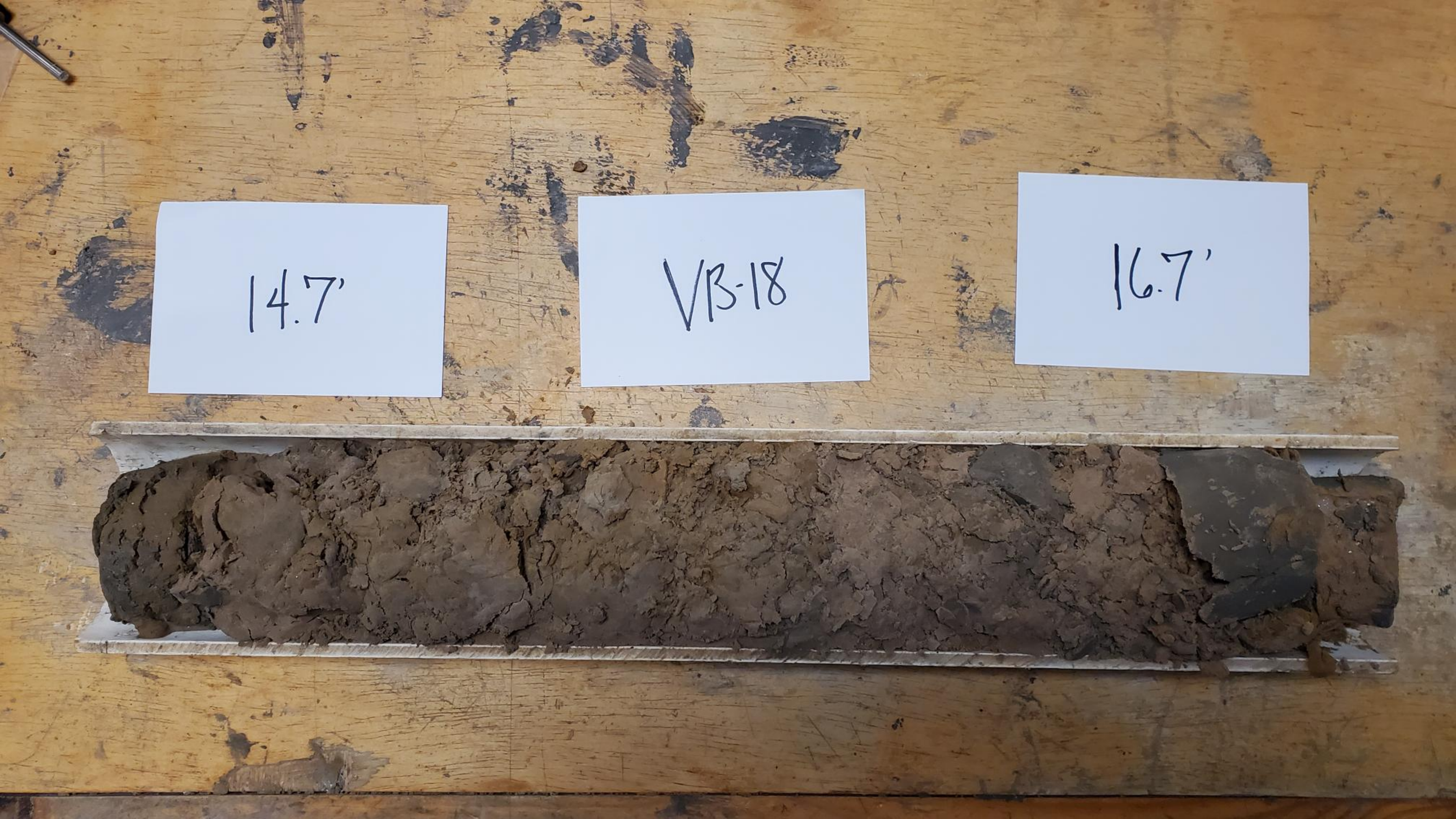
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	FAT CLAY with SAND (CH), soft, dark gray	(T)0.20			79.5		77	55	79.1	(T)0.40			
				T-2	CLAYEY SAND (SC), loose, dark gray	(T)0.30			49.3				44.2	(T)0.60			
				T-3	SILTY SAND (SM) / SANDY SILT (ML), loose, brown and gray	(T)0.20			27.6				17.4	(T)0.40			SV
				J-4					19.4				60.4				
-15	5			J-5					22.7				14				SV
					Bottom @ 5 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

COMPLETION DEPTH: 5 ft
DATE BORING STARTED: 7-23-21
DATE BORING COMPLETED: 7-23-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 74%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


11.7'
VB-18
14.7'


14.7'
VB-18
16.7'

LOG OF BORING VB-19

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 24.81" N
96° 28' 39.01" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -10.8 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

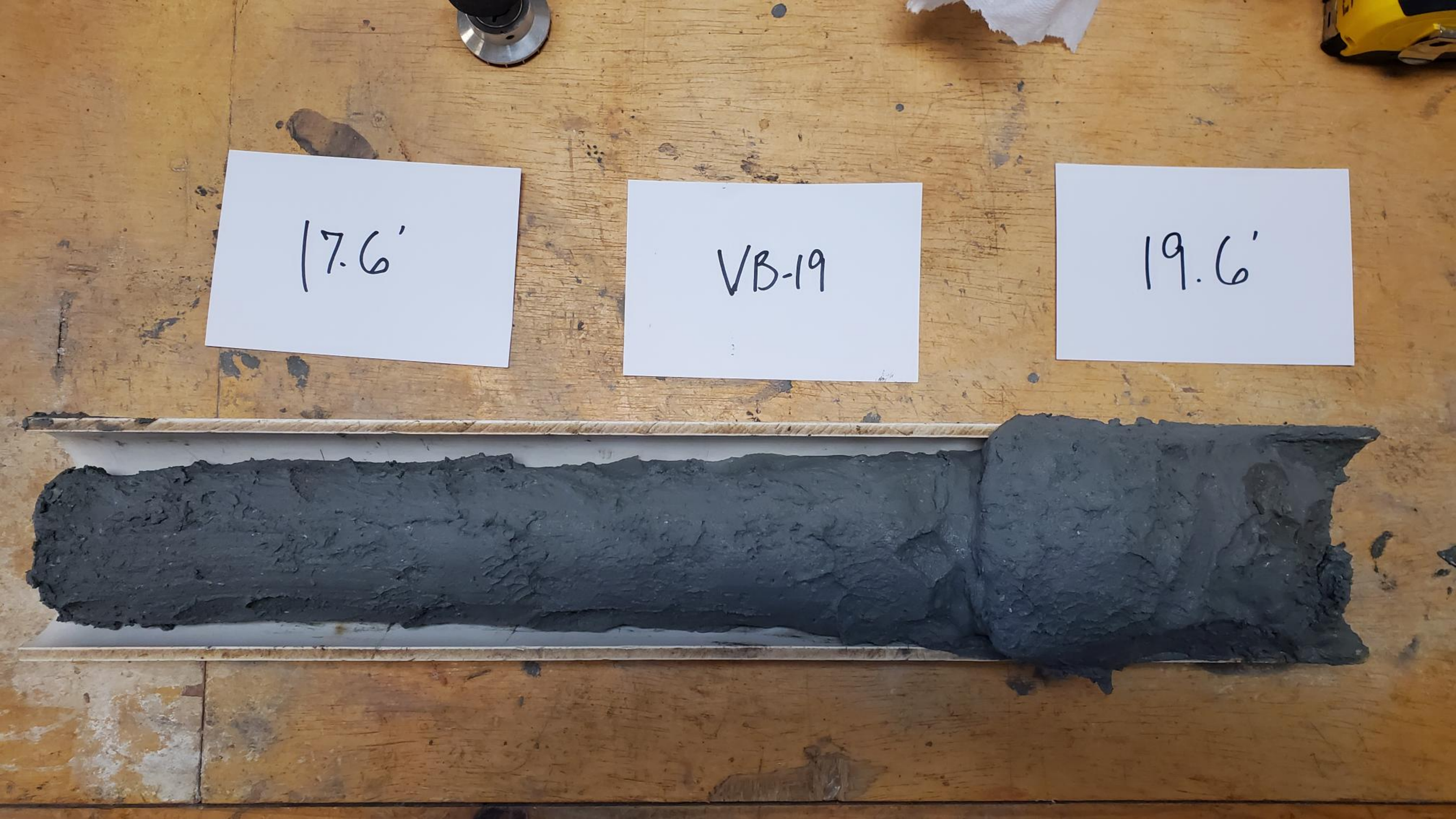
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			T-1	SANDY LEAN CLAY (CL), soft, gray	(T)0.20			115.3				82.9	(T)0.40			SV
				T-2	CLAYEY SAND (SC), medium dense, gray	(T)0.20			49.7		44	21	47.8	(T)0.40			
				T-3		(T)0.50			37.9				40	(T)1.00			
				T-4		(T)0.20			51.8					(T)0.40			
-15				T-5		(T)0.20			26.9					(T)0.40			
	5			T-6		(T)0.10			27.9				26.2	(T)0.20			
				T-7		(T)0.20			36.8		30	17	30.4	(T)0.40			
				J-8					39				37				SV
					Bottom @ 8 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

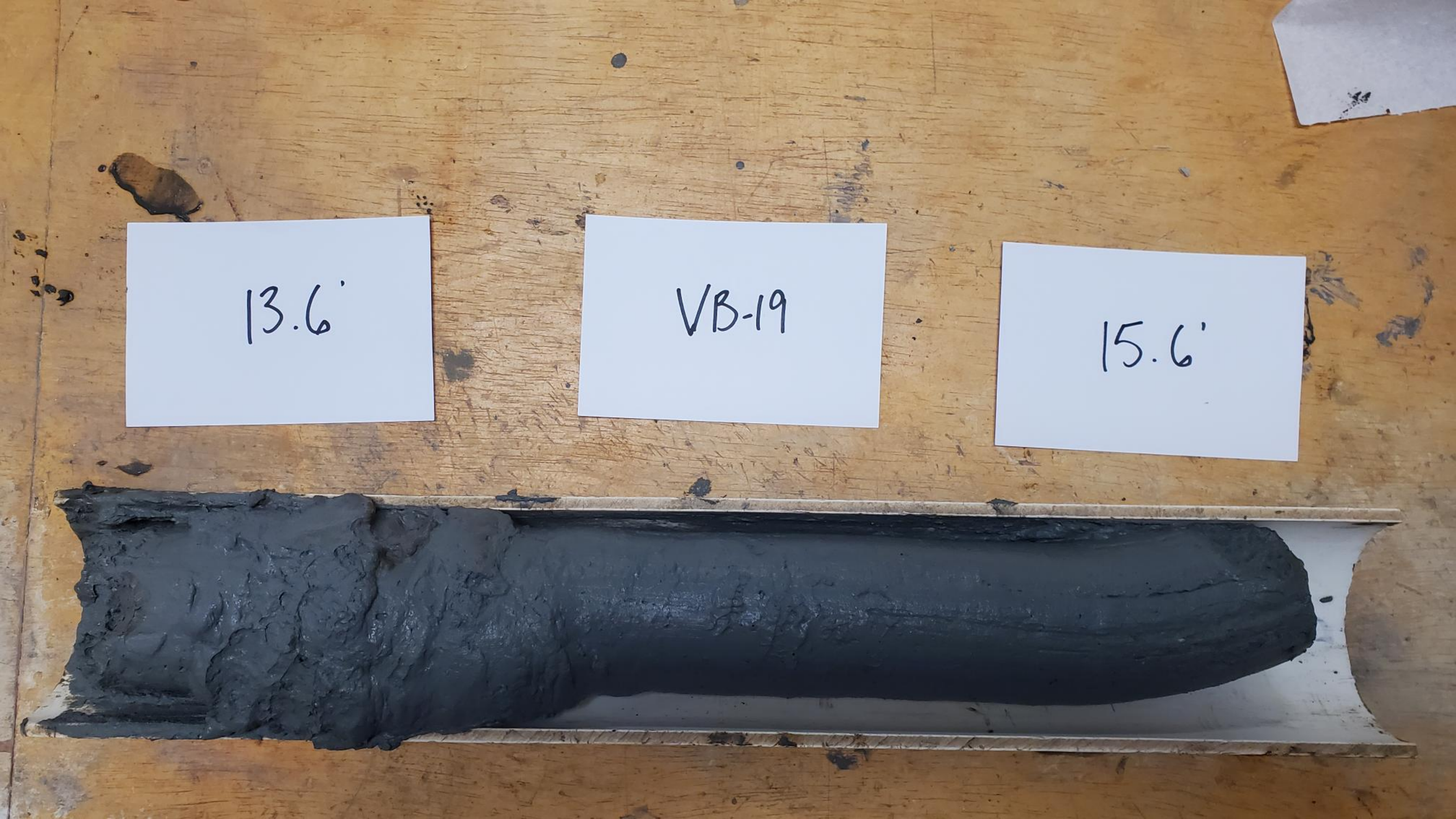
COMPLETION DEPTH: 8 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 88%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.6'
VB-19
19.6'


13.6'
VB-19
15.6'

LOG OF BORING VB-20

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

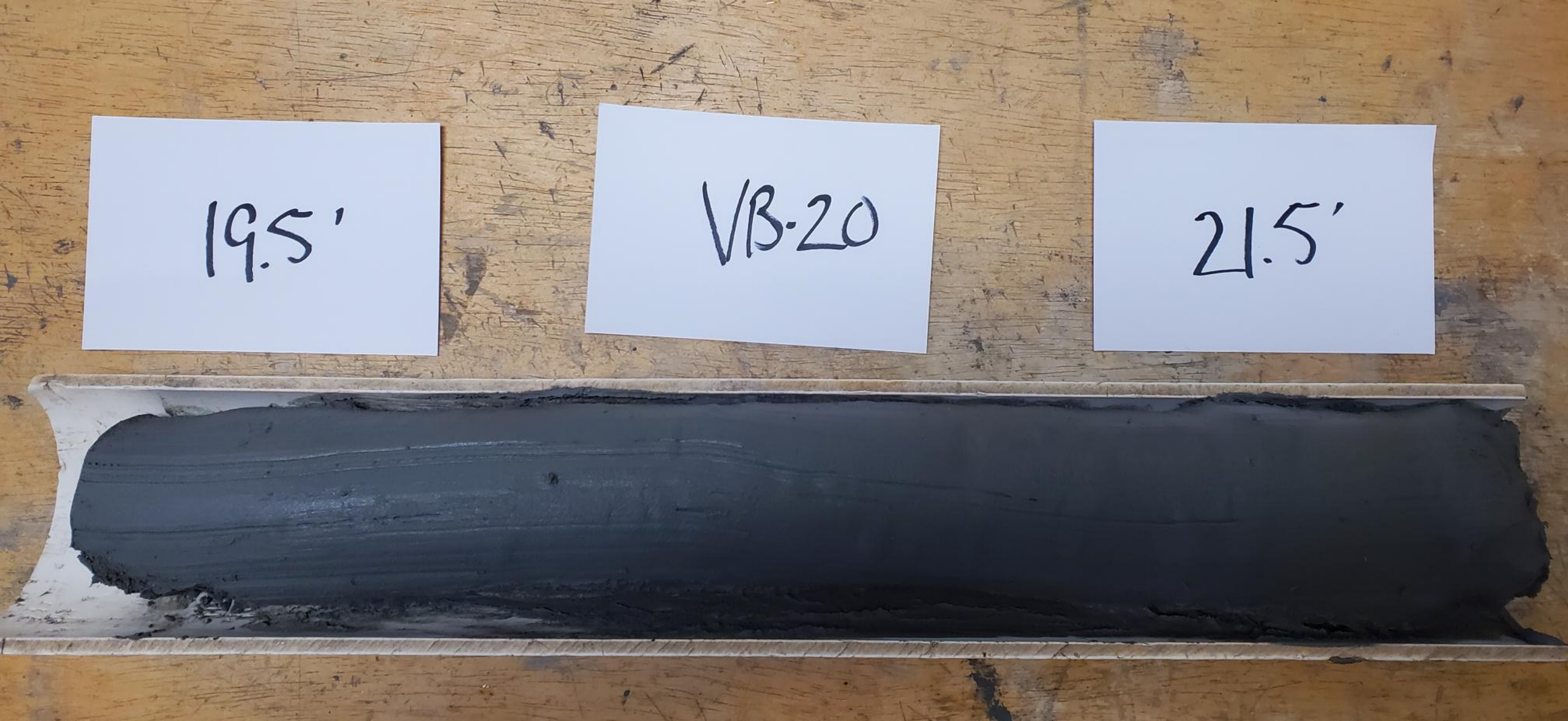
GPS COORDINATE: 28° 31' 37.15" N 96° 28' 56.54" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -10.6 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	SANDY FAT CLAY (CH), medium, dark gray -with shell fragments from 0' to 3'	(T)0.25			86.6		79	59	90.5	(T)0.50			SV
				T-2		(T)0.25			56.3				63.7	(T)0.50			
				T-3		(T)0.45			53.9					(T)0.90			
				T-4		(T)0.35			50.5				66.7	(T)0.70			
-15	5			T-5		(T)0.25			49					(T)0.50			
				T-6		(T)0.25			53.5					(T)0.50			
				T-7	CLAYEY SAND (SC), medium dense, dark gray	(T)0.35			43.6				47	(T)0.70			
				T-8		(T)0.45			45.3					(T)0.90			
				T-9	SANDY LEAN CLAY (CL), medium, dark gray	(T)0.45			48.3				53.1	(T)0.90			
-20	10			T-10	CLAYEY SAND (SC), medium dense, dark gray	(T)0.40			50.8					(T)0.80			
				T-11		(T)0.40			37.7		41	27	44.1	(T)0.80			SV
					Bottom @ 10.5 ft.												
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
-50	40																

COMPLETION DEPTH: 10.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 90%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


19.5'
VB-20
21.5'


14.5'
VB-20
17.5'

LOG OF BORING VB-21

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 31' 49.49" N
96° 29' 14.08" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9.1 ft MLLW

DRILLING METHOD:

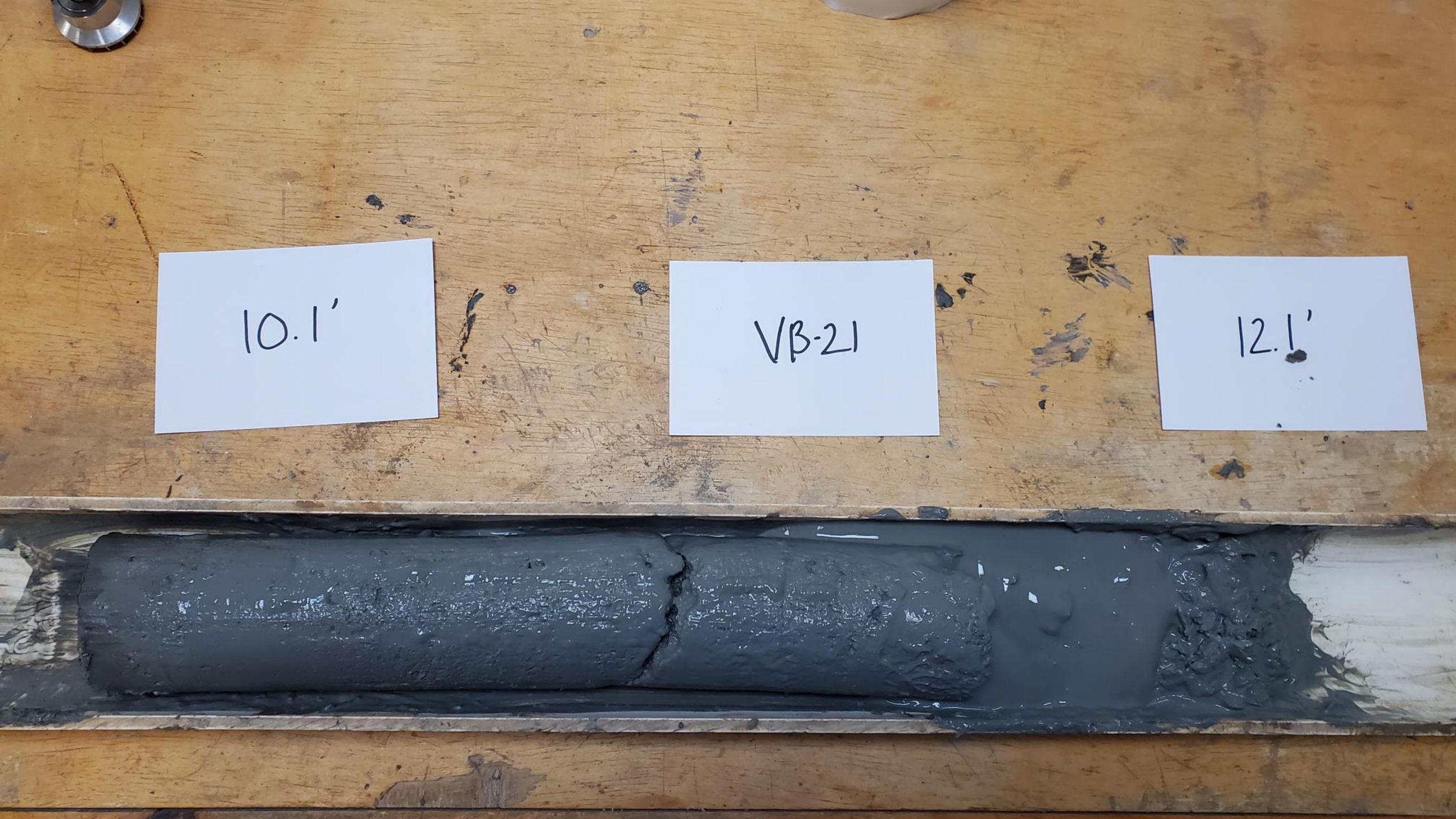
Hollow Aug: Wash Bored:

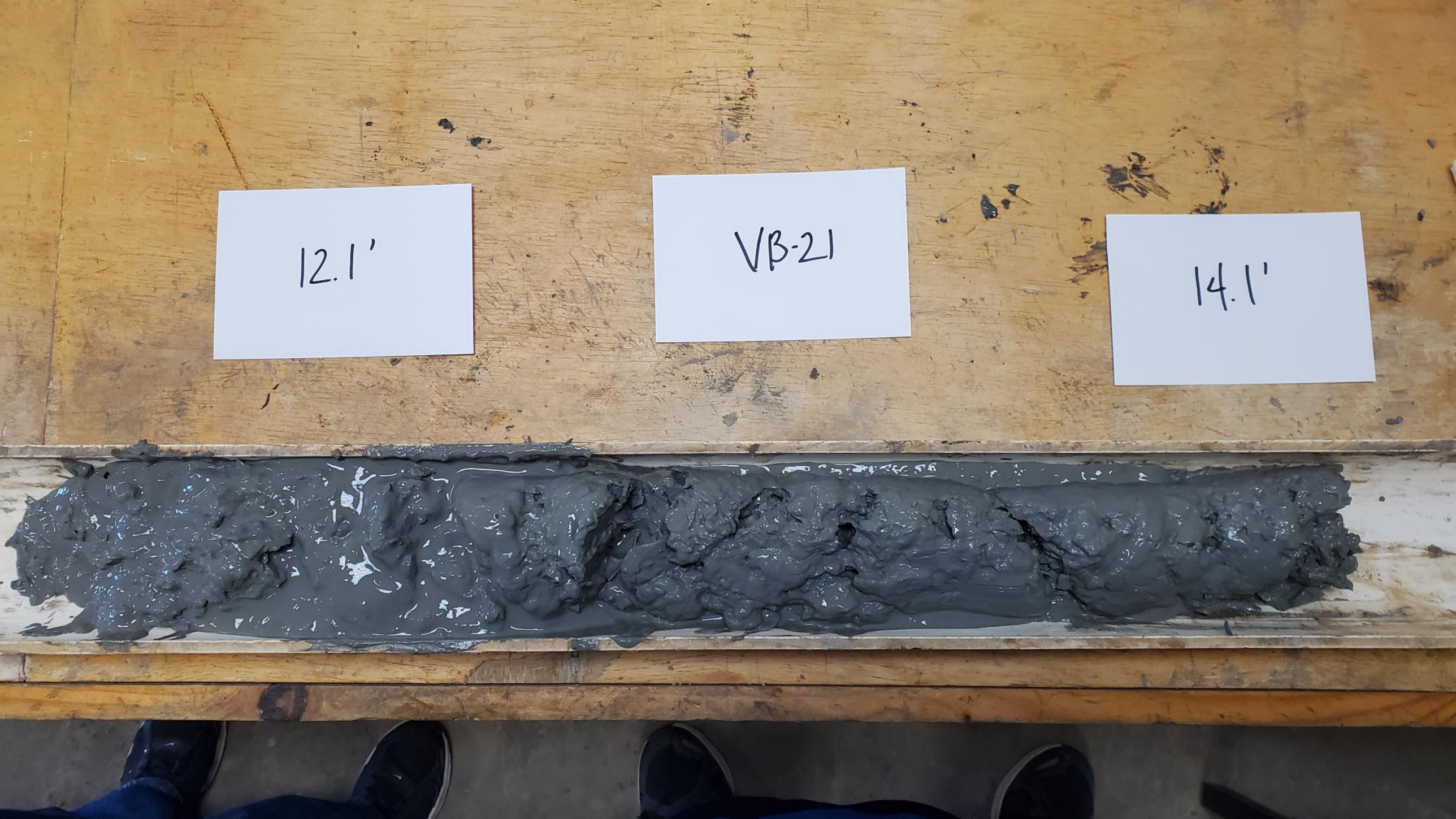
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-10				T-1	CLAYEY SAND (SC) / SANDY LEAN CLAY (CL), very loose, gray, with shell fragments	(T)0.05			62.2		35	16	48.2	(T)0.10			SV
				J-2					53.4				30				
				J-3					54.4				27.2				
				J-4	SILTY GRAVEL with SAND (GM), very loose, gray, with shell fragments				43.9		32	6	25.2				SV
-15	5				Bottom @ 4 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
	40																

COMPLETION DEPTH: 4 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 84%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


10.1'
VB-21
12.1'


12.1'
VB-21
14.1'

LOG OF BORING VB-22

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 01.84" N
96° 29' 31.62" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -7.7 ft MLLW

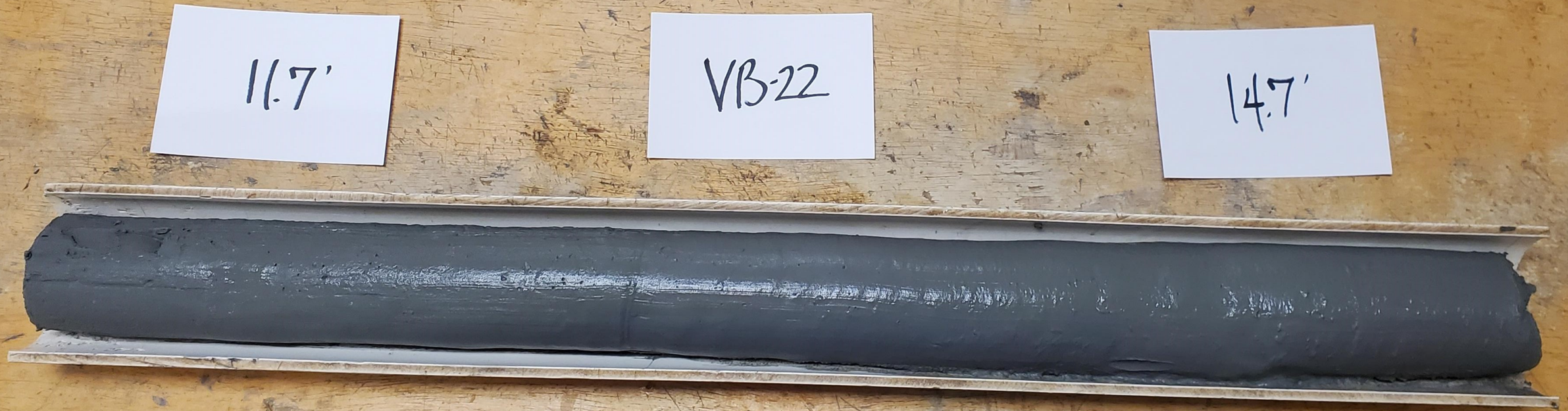
DRILLING METHOD:
Hollow Aug: Wash Bored:

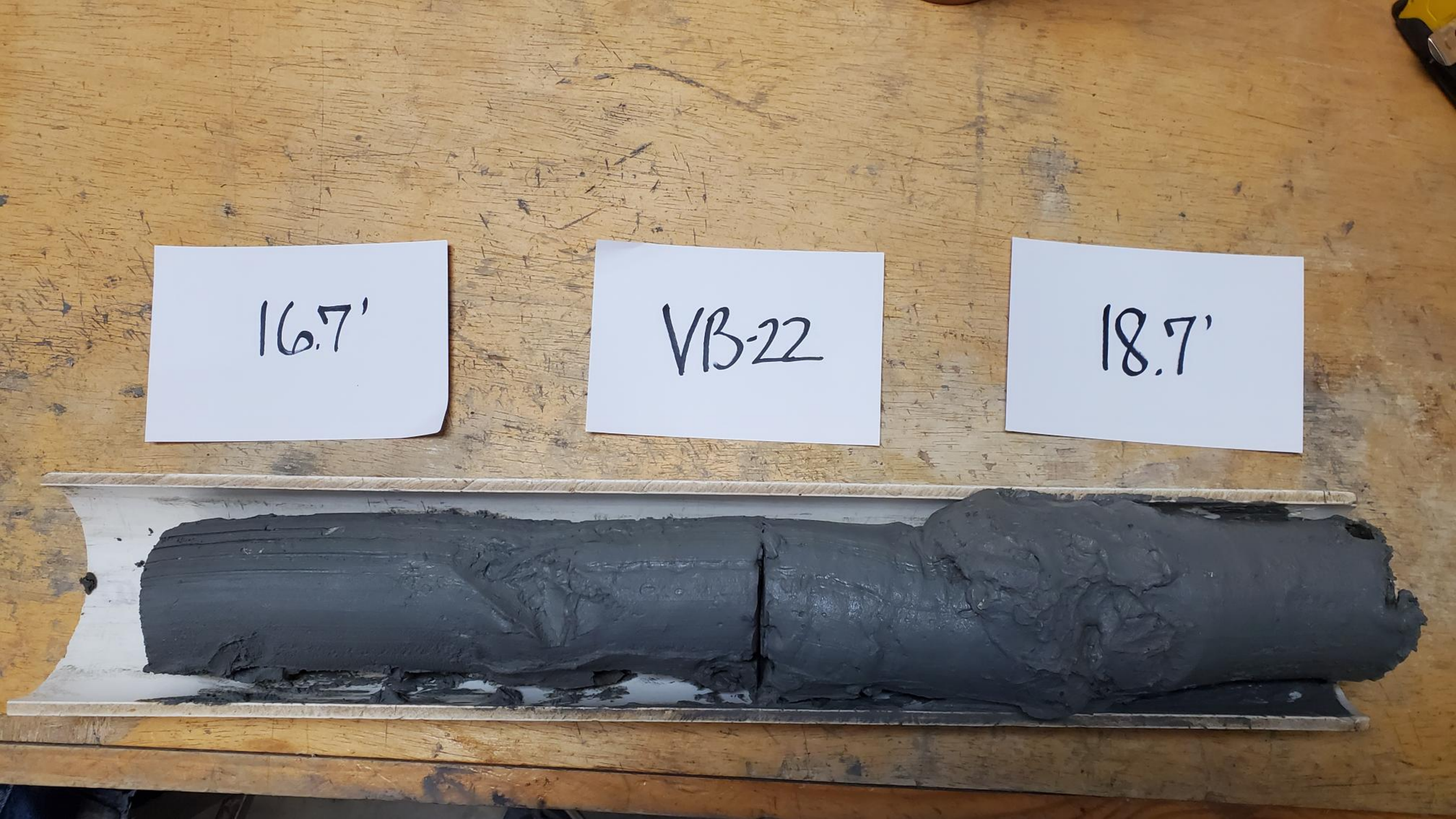
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	CLAYEY SAND (SC) medium dense, dark gray, with shell fragments	(T)0.25			47.5		45	20	40.1	(T)0.50			SV
				T-2	LEAN CLAY with SAND (CL), medium, dark gray with shell fragments	(T)0.25			39.1					(T)0.50			
-10				T-3		(T)0.30			32.7				76.2	(T)0.60			
				T-4	SANDY LEAN CLAY (CL), medium, dark gray, with shell fragments	(T)0.45			31.8					(T)0.90			
	5			T-5	SILTY CLAYEY SAND (SC-SM), medium dense, gray with shell fragments	(T)0.25			29.2		27	7	33.3	(T)0.50			
				T-6	SANDY LEAN CLAY (CL), medium, dark gray	(T)0.40			32.1					(T)0.80			
				T-7		(T)0.30			36.4				50.6	(T)0.60			
-15				T-8		(T)0.45			40.6					(T)0.90			
				T-9		(T)0.40			51.5					(T)0.80			
	10			J-10	SANDY FAT CLAY (CH), medium, dark gray				51.6		61	37	60.4				SV
					Bottom @ 10 ft.												
-20																	
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

COMPLETION DEPTH: 10 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 92%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


11.7'
VB-22
14.7'


16.7'
VB-22
18.7'

LOG OF BORING VB-23

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 14.21" N
96° 29' 49.10" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	CLAYEY SAND (SC), loose, dark gray, with shell fragments	(T)0.20			54		84	61	54	(T)0.40			
-10				T-2		(T)0.20			52.4					(T)0.40			
				J-3					46.3				52.1				
				T-4	SANDY FAT CLAY (CH), medium, dark gray	(T)0.40			45.6		58	39	13.8	(T)0.80			
				T-5		(T)0.30			49.8				48.6	(T)0.60			
				T-6		(T)0.30			43.7					(T)0.60			
	5			T-7	SILTY CLAYEY SAND (SC-SM), loose, dark gray	(T)0.20			29.4				70.9	(T)0.40			
-15				T-8		(T)0.30			29.6					(T)0.60			
				T-9		(T)0.20			31.6		27	6	62.1	(T)0.40			
					Bottom @ 7.5 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
	40																

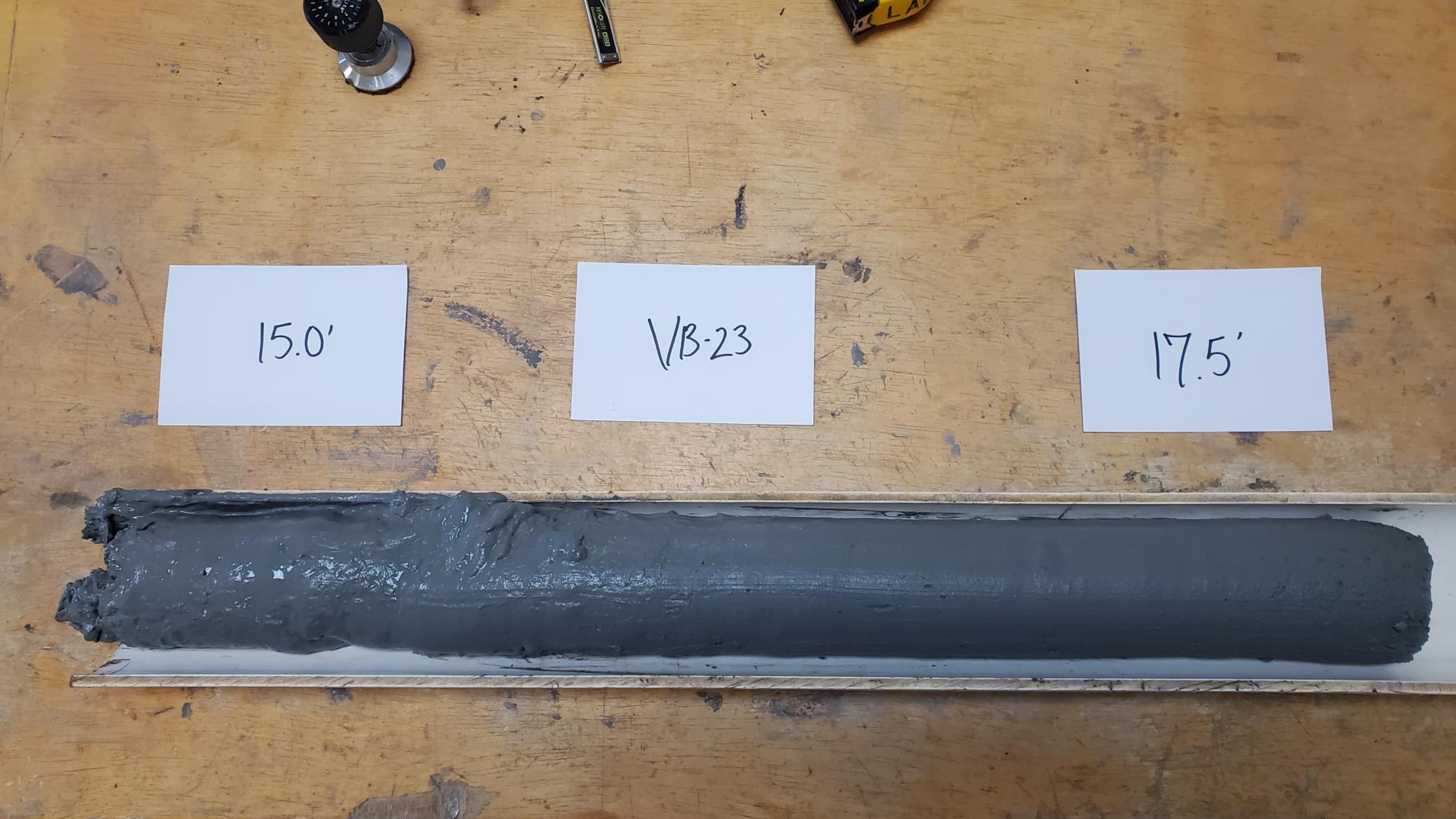
COMPLETION DEPTH: 7.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 88%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


10.0'
VB-23
13.0'


15.0'
VB-23
17.5'

LOG OF BORING VB-24

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 26.44" N
96° 30' 06.68" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9.5 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

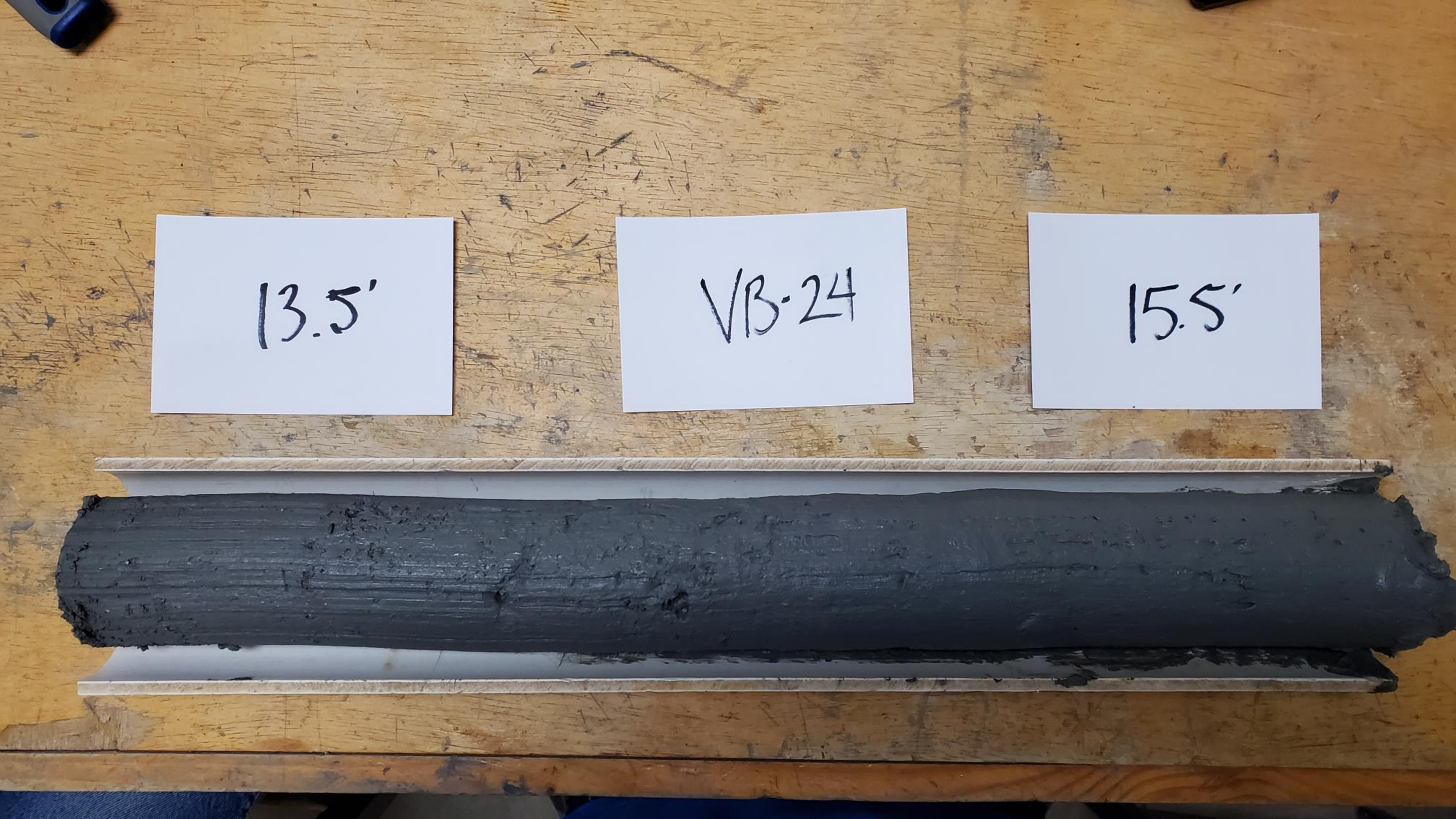
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-10				T-1	SANDY FAT CLAY (CH), medium, dark gray, with shell fragments	(T)0.45			49.8		64	40	57.2	(T)0.90			
				T-2		(T)0.45			56					(T)0.90			
				J-3					57				59.5				
				T-4		(T)0.45			41.8					(T)0.90			
				T-5		(T)0.30			50.1					(T)0.60			
-15	5			T-6	SANDY LEAN CLAY (CL), medium, dark gray with shell fragments	(T)0.40			41.8		43	30	52	(T)0.80			
				T-7		(T)0.45			41.4					(T)0.90			
				T-8		(T)0.30			45.8				63.4	(T)0.60			
				T-9		(T)0.45			44.6					(T)0.90			
				T-10		(T)0.40			42.6		46	31	60.4	(T)0.80			
-20	10				Bottom @ 9.5 ft.												
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
	40																

COMPLETION DEPTH: 9.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 84%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


13.5'
VB-24
15.5'

17.5'

VB-24

19.5'

LOG OF BORING VB-25

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 32' 38.83" N
96° 30' 24.18" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -9.5 ft MLLW

DRILLING METHOD:

Hollow Aug: Wash Bored:

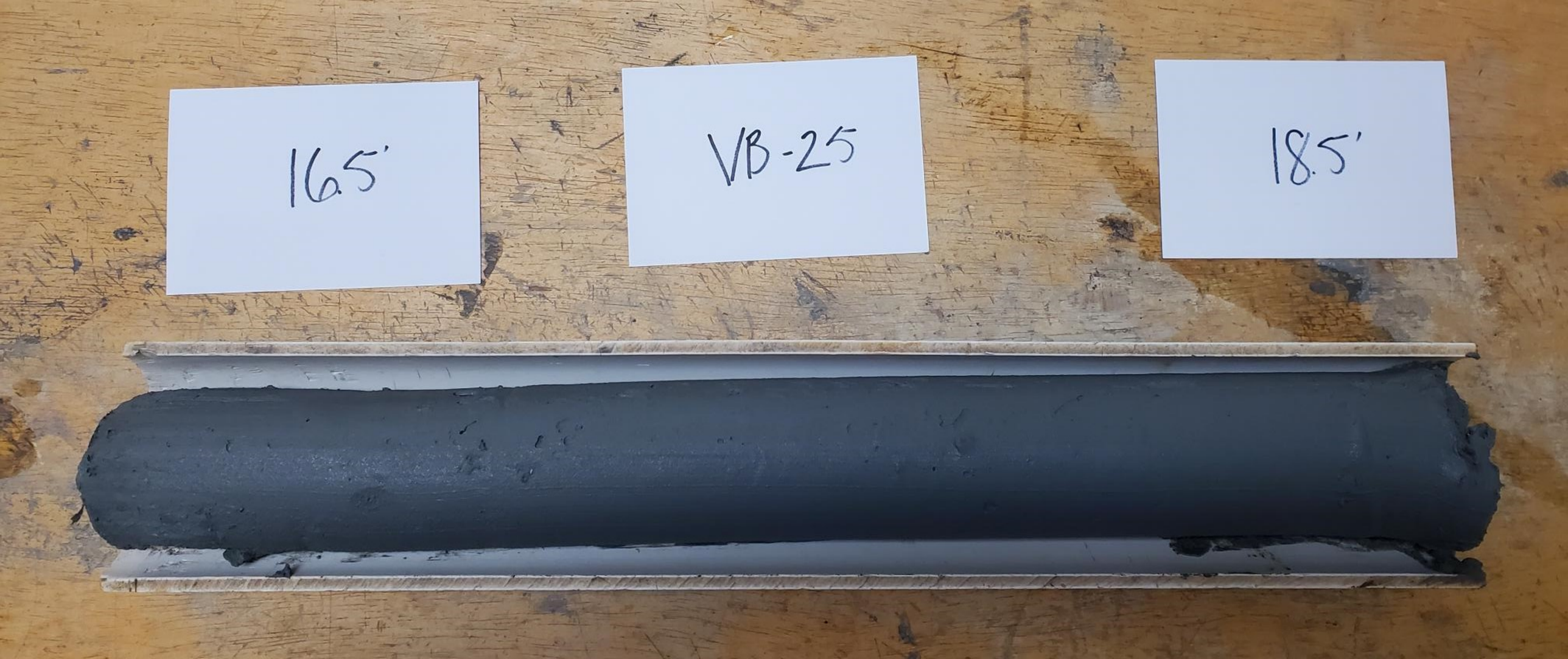
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	SANDY FAT CLAY (CH) / CLAYEY SAND (SC), medium, dark gray, with shell fragments	(T)0.30			57.8		64	42	56.5	(T)0.60			
-10				T-2	-soft from 1' to 2'	(T)0.20			53.7					(T)0.40			
				T-3		(T)0.30			55.8				55.9	(T)0.60			
				T-4		(T)0.30			58.1					(T)0.60			
	5			T-5		(T)0.40			44.9		58	41	47.4	(T)0.80			
-15				T-6		(T)0.30			42					(T)0.60			
				T-7		(T)0.40			43.6				52.1	(T)0.80			
				T-8		(T)0.30			44.4					(T)0.60			
				T-9	SANDY LEAN CLAY (CL), medium, dark gray	(T)0.30			38.6		42	26	51.3	(T)0.60			
					Bottom @ 8.5 ft.												
-20	10																
-25	15																
-30	20																
-35	25																
-40	30																
-45	35																
	40																

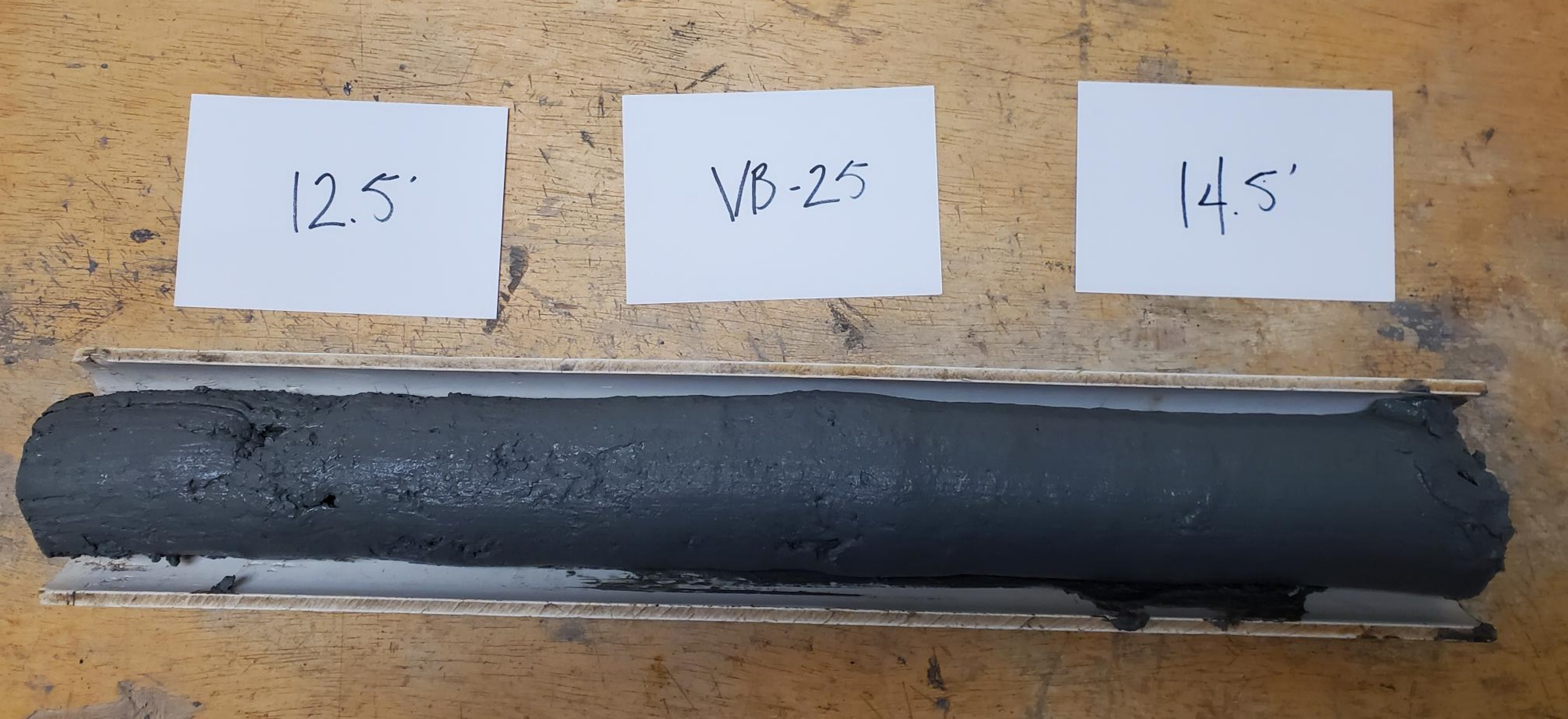
COMPLETION DEPTH: 8.5 ft
DATE BORING STARTED: 7-26-21
DATE BORING COMPLETED: 7-26-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 83%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


16.5'
VB-25
18.5'


12.5'
VB-25
14.5'

LOG OF BORING VB-26

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 42.06" N
96° 31' 45.26" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -5.6 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

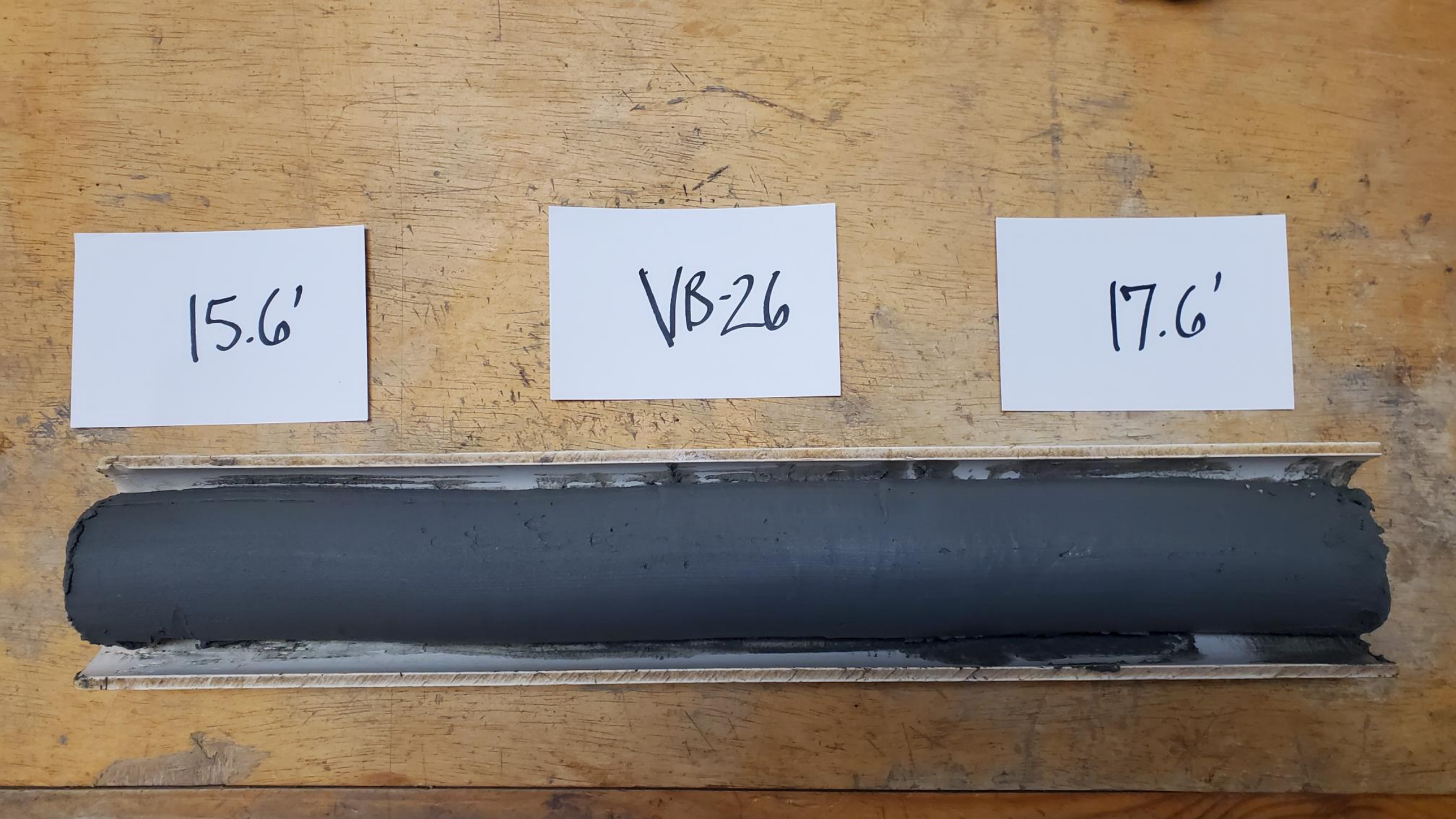
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	CLAYEY SAND (SC), medium dense, dark gray with shell fragments	(T)0.55			36.1				38.5	(T)1.10			SV
				J-2					48								
				J-3					40.9				30.2				
				T-4		(T)0.40			26.4					(T)0.80			
-10				T-5		(T)0.30			30.2				28.1	(T)0.60			SV
	5			T-6	SANDY FAT CLAY (CH), firm, dark gray, with shell fragments	(T)0.50			32.9					(T)1.00			
				T-7	-medium from 6' to 8'	(T)0.45			37.6				53.9	(T)0.90			
				T-8		(T)0.40			38.5					(T)0.80			
				T-9		(T)0.50			37.8				58.8	(T)1.00			SV
-15				T-10		(T)0.50			37.6					(T)1.00			
	10			T-11		(T)0.60			39.8				50.4	(T)1.20			
				T-12		(T)0.60			45.8					(T)1.20			
				T-13		(T)0.50			46				73	(T)1.00			SV
					Bottom @ 13 ft.												
-20	15																
-25	20																
-30	25																
-35	30																
-40	35																
-45	40																

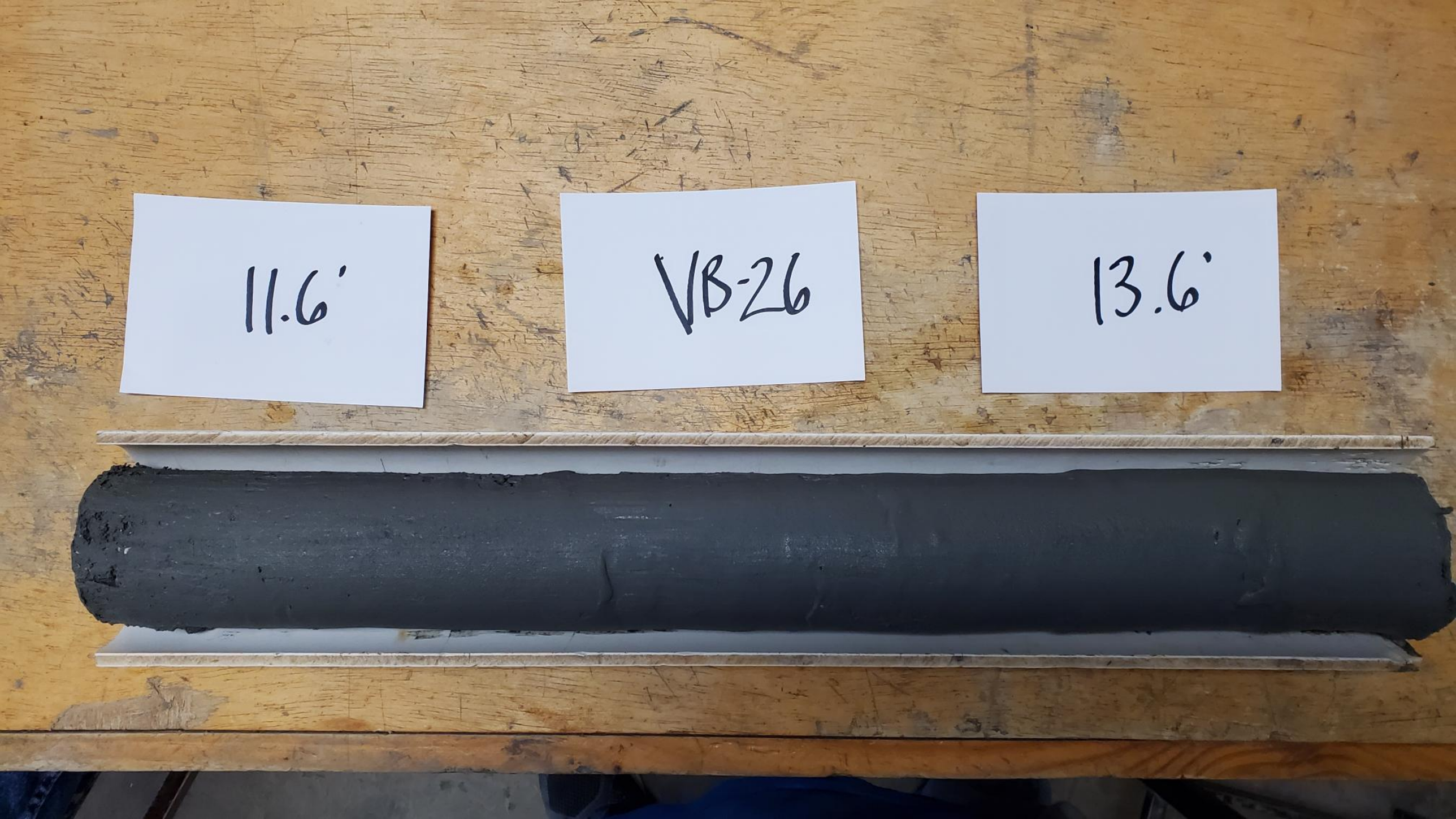
COMPLETION DEPTH: 13 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


15.6'
VB-26
17.6'


11.6'
VB-26
13.6'

LOG OF BORING VB-27

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 33' 54.35" N
96° 32' 02.86" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6.7 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				J-1	CLAYEY SAND (SC), loose, dark gray, with shell fragments				43.3				29.8				SV
				J-2					29.8								
				T-3		(T)0.30			28.4				24.6	(T)0.60			
-10				T-4	SANDY LEAN CLAY (CL), medium, dark gray	(T)0.30			39.3				62.3	(T)0.60			SV
	5			T-5		(T)0.30			37.1					(T)0.60			
				T-6		(T)0.30			31.7				69.5	(T)0.60			
				T-7	-soft from 5' to 6'	(T)0.20			31					(T)0.40			
				T-8		(T)0.30			35.9				51	(T)0.60			SV
-15				T-9		(T)0.30			36.9					(T)0.60			
				T-10		(T)0.30			30.3				66.3	(T)0.60			
	10			T-11		(T)0.40			31.4					(T)0.80			
				T-12		(T)0.35			29.5				60.1	(T)0.70			SV
					Bottom @ 12 ft.												
-20																	
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

COMPLETION DEPTH: 12 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


13.7
VB-27
16.7


7.7'
VB-27
10.7'

LOG OF BORING VB-28

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 06.70" N
96° 32' 20.49" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -5.0 ft MLLW

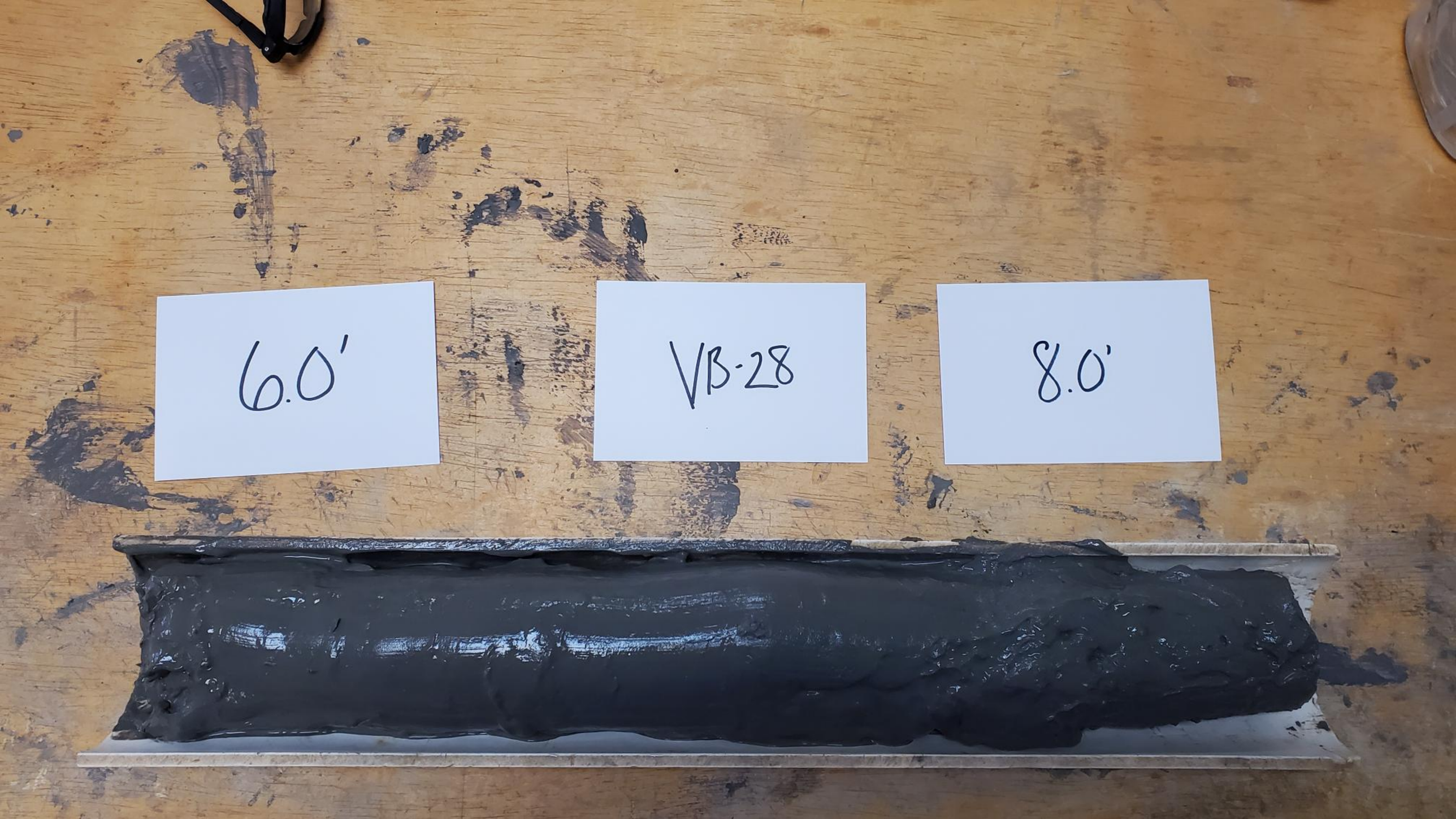
DRILLING METHOD:
Hollow Aug: Wash Bored:

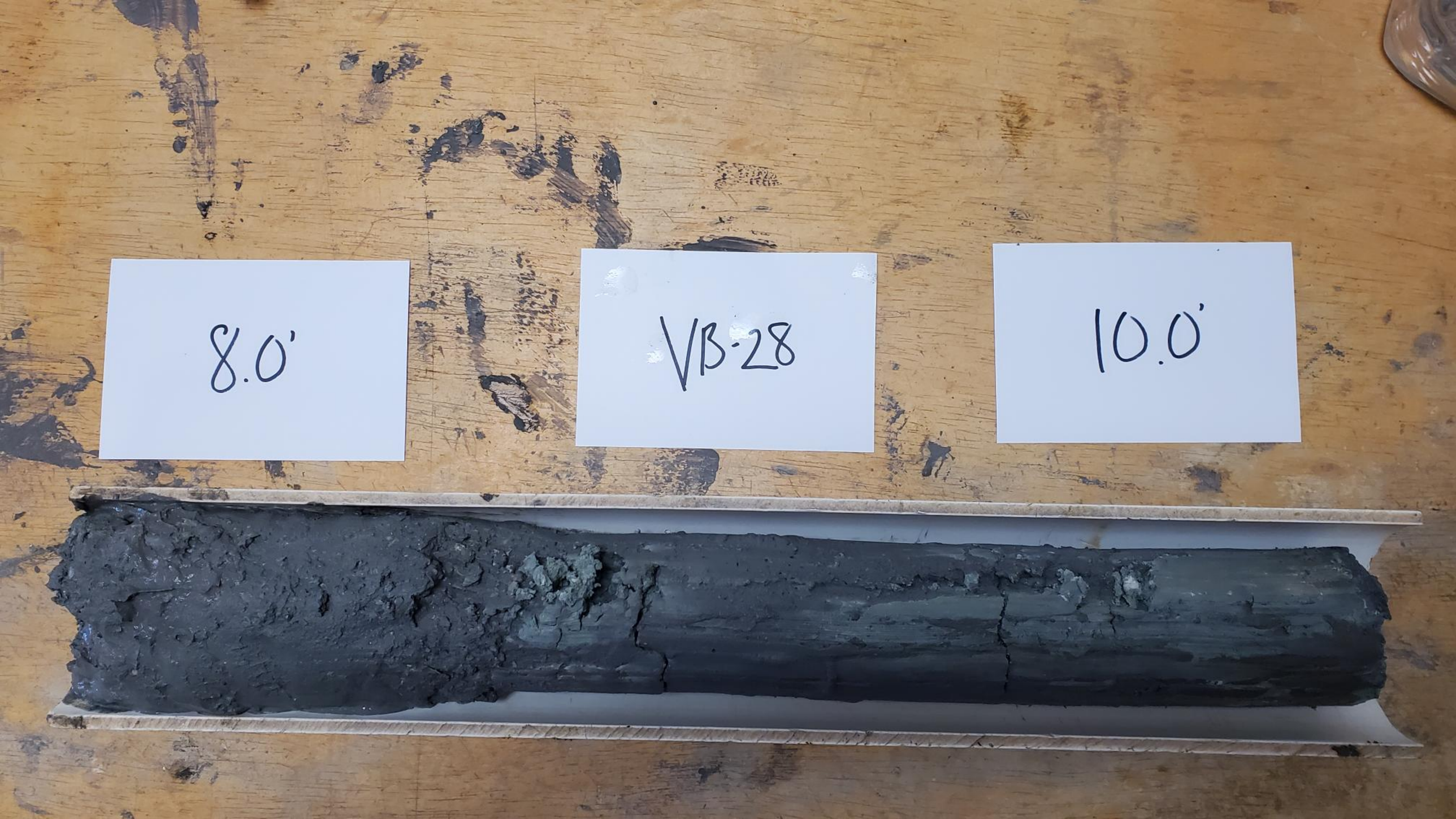
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-5	0				▼												
				T-1	SANDY CLAY (SC), loose, dark gray	(T)0.05			53.8		37	23	36.9	(T)0.10			
				T-2	SANDY CLAY (CL), medium, gray	(T)0.10			35.1					(T)0.20			
				T-3		(T)0.20			31.7					(T)0.40			
				T-4	-firm from 3' to 4'	(T)0.50			21.9		26	10	61.3	(T)1.00			
					Bottom @ 4 ft.												
-10	5																
-15	10																
-20	15																
-25	20																
-30	25																
-35	30																
-40	35																
-45	40																

COMPLETION DEPTH: 4 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 76%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


6.0'
VB-28
8.0'


8.0'
VB-28
10.0'

LOG OF BORING VB-29

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 19.09" N
96° 32' 37.95" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -4.7 ft MLLW

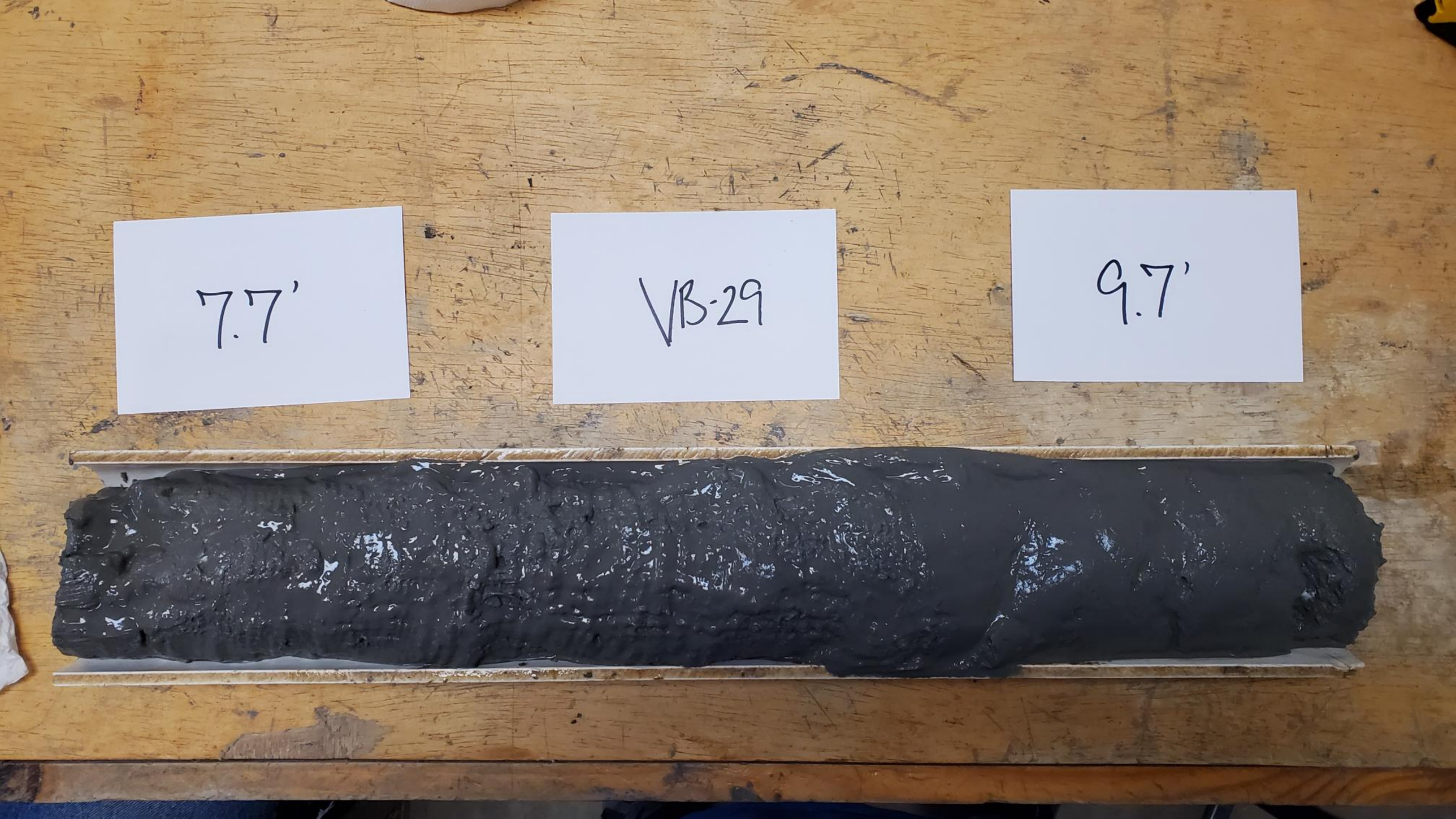
DRILLING METHOD:
Hollow Aug: Wash Bored:

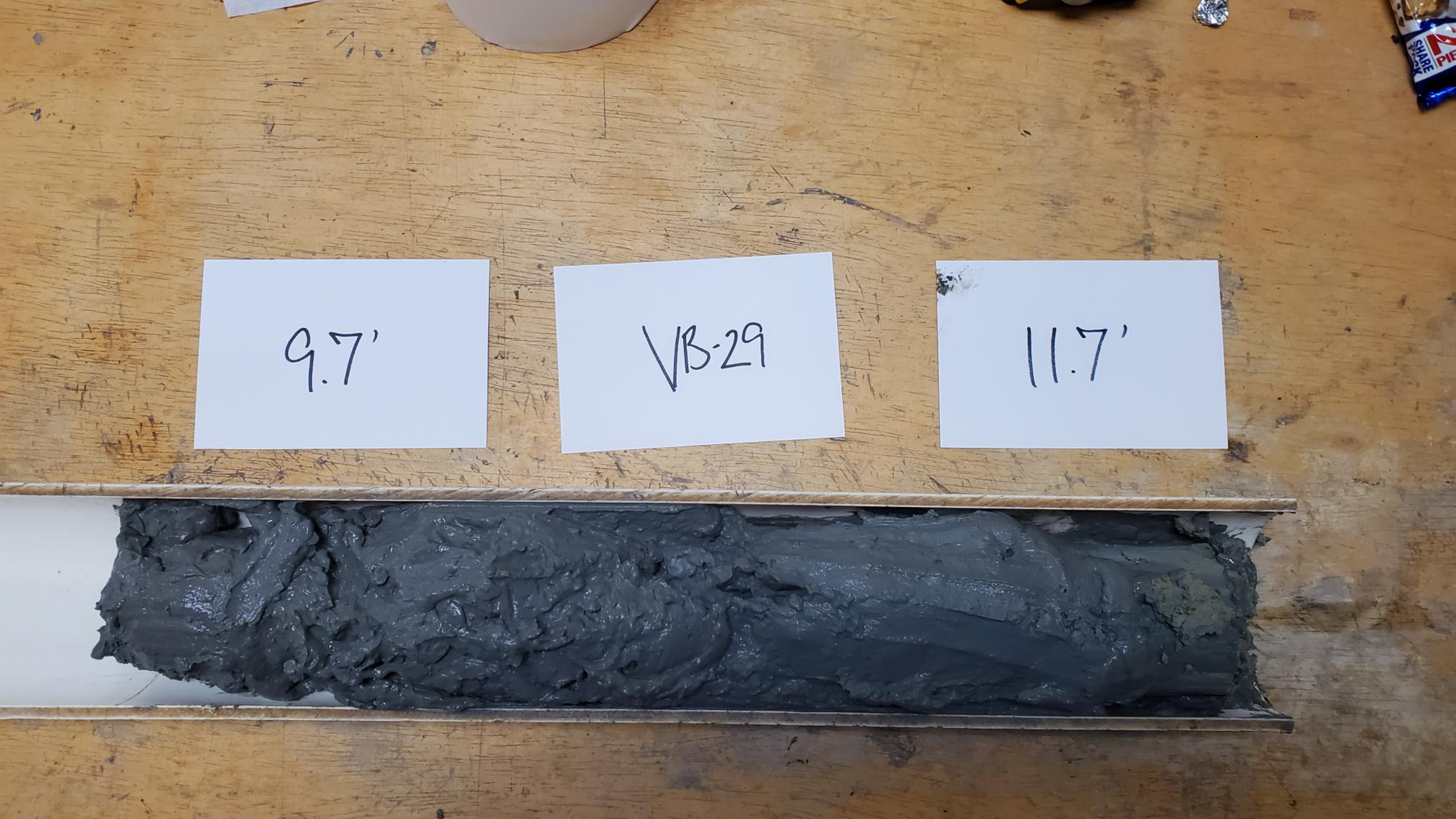
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
-5	0			J-1	FAT CLAY (CH), very soft, dark gray				165		96	73	97.1				
				J-2					100.2								
				J-3	CLAYEY SAND (SC), loose, dark gray, with shell fragments				41.9								
				J-4					38.2		33	14	21.7				
				J-5					44				38.3				
-10	5			J-6					45.2				48.5				
				T-7	LEAN CLAY (CL), medium, dark gray	(T)0.40			32				92.2	(T)0.80			SV
					Bottom @ 6.5 ft.												
-15	10																
-20	15																
-25	20																
-30	25																
-35	30																
-40	35																
	40																

COMPLETION DEPTH: 6.5 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 85%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


7.7'
VB-29
9.7'


9.7'
VB-29
11.7'

LOG OF BORING VB-30

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 31.36" N 96° 32' 55.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6.6 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

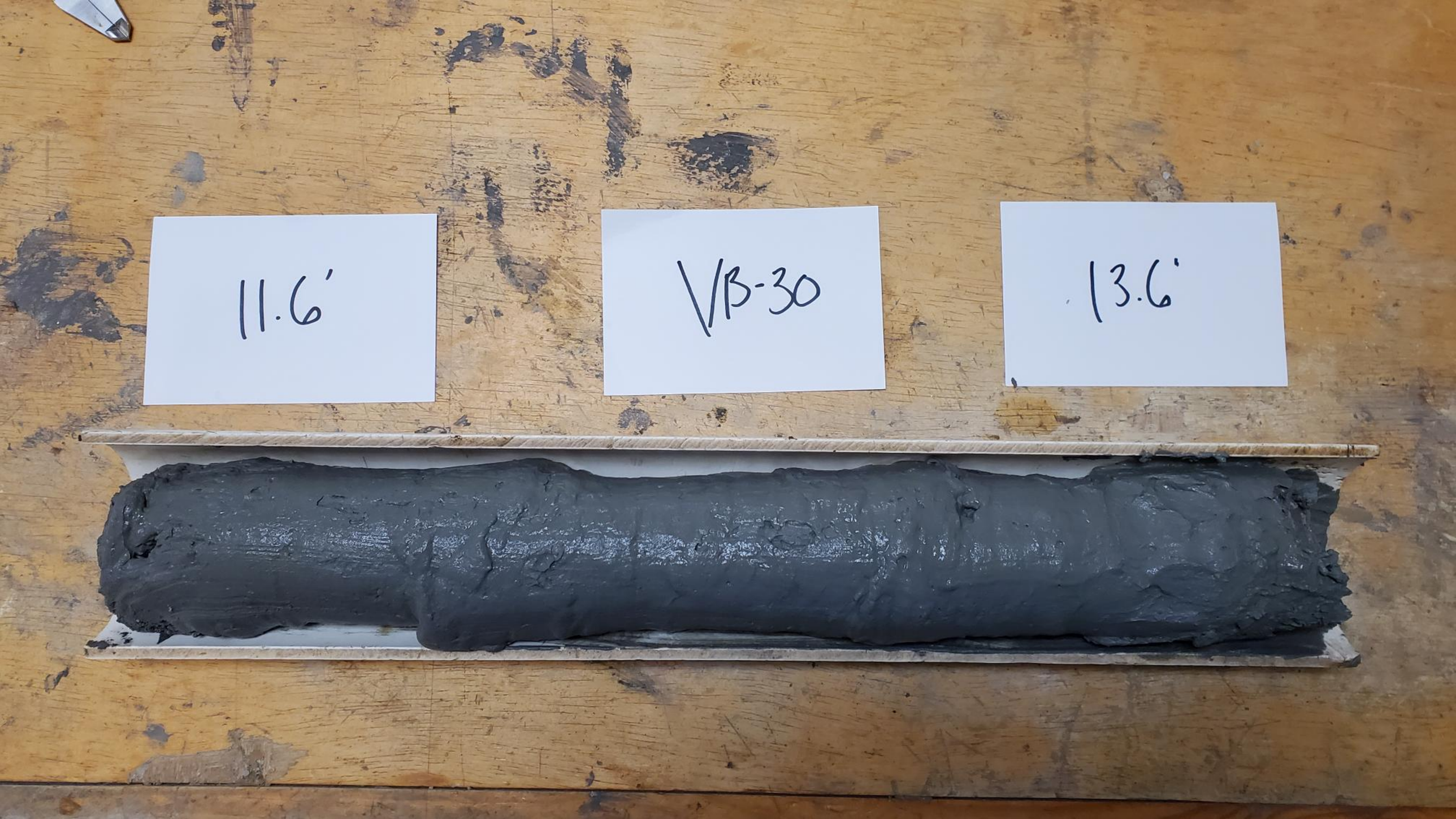
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			J-1	FAT CLAY with SAND (CH), very soft, dark gray				110.5		77	58	73.5				
-10	5			T-2	CLAYEY SAND (SC), loose, dark gray, with shell fragments	(T)0.10			38					(T)0.20			
				T-3		(T)0.25			38.6				25.1	(T)0.50			
				T-4		(T)0.30			42					(T)0.60			
				T-5		(T)0.30			38.2					(T)0.60			
				T-6		(T)0.20			33		41	24	35.2	(T)0.40			
					Bottom @ 6 ft.												
-15	10																
-20	15																
-25	20																
-30	25																
-35	30																
-40	35																
-45	40																

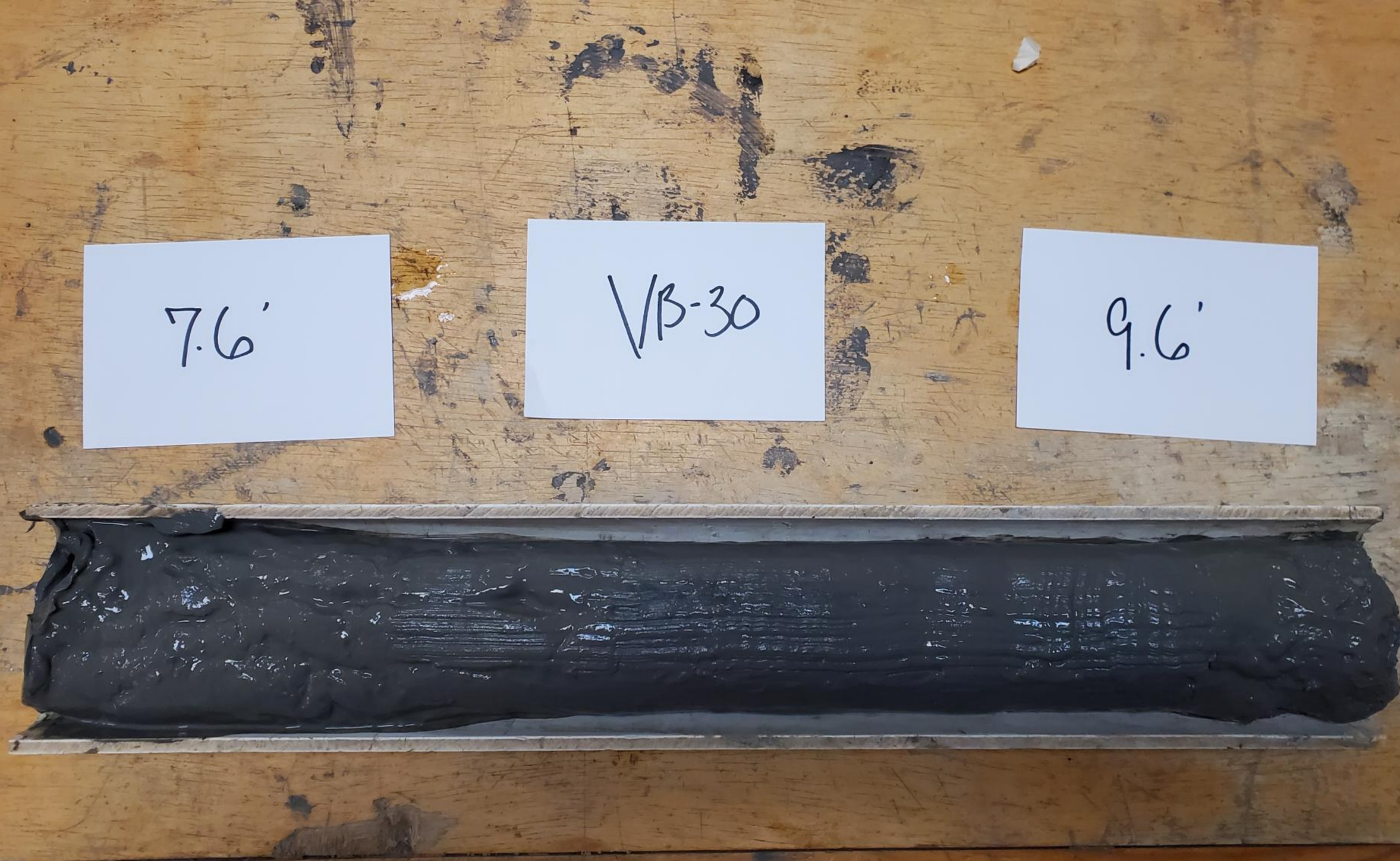
COMPLETION DEPTH: 6 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 81%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


11.6'
VB-30
13.6'


7.6'
VB-30
9.6'

LOG OF BORING VB-31

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 43.39" N
96° 33' 12.54" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6.1 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

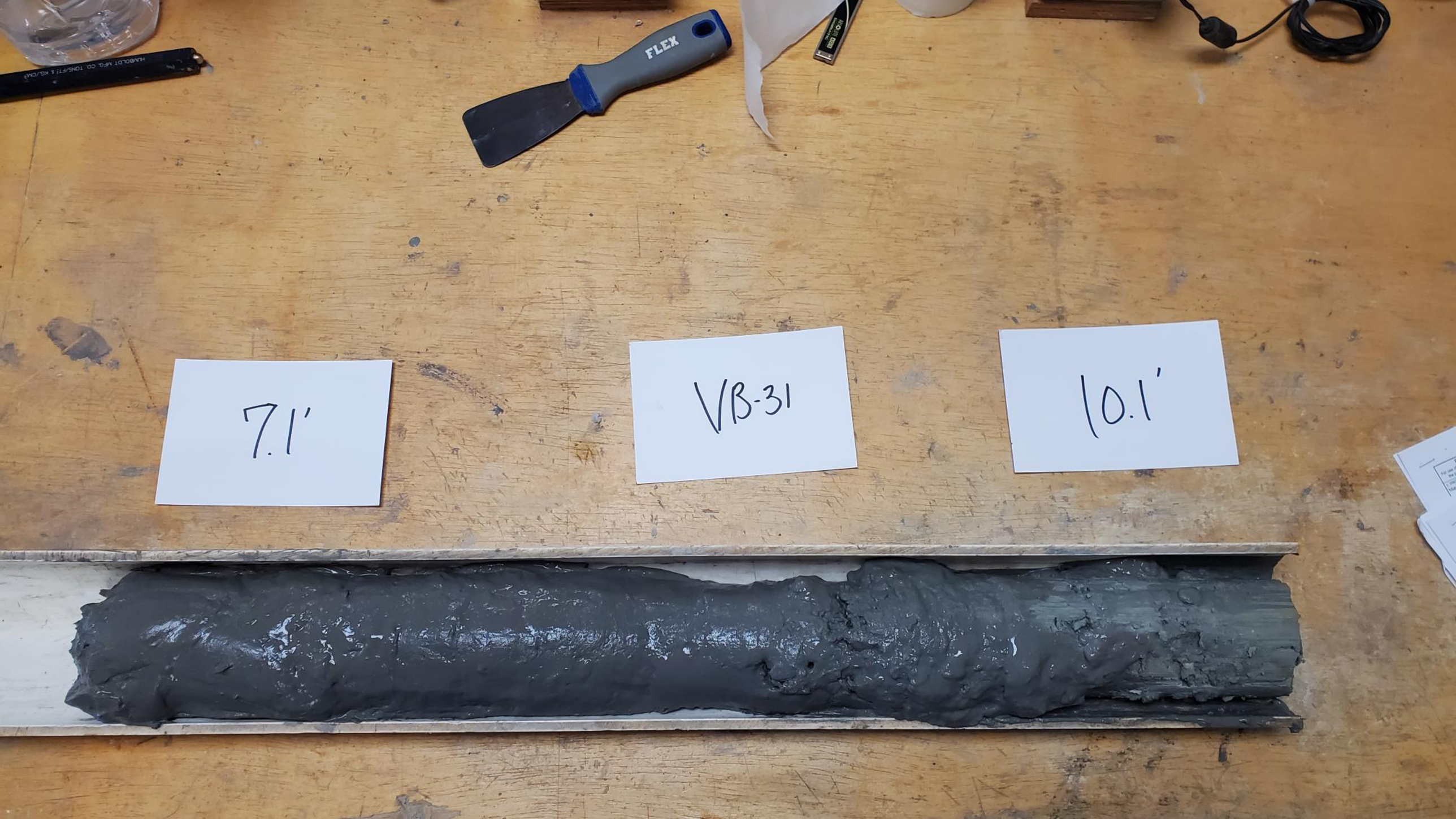
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			▼												
			J-1	CLAYEY SAND (SC), loose, gray, with shell fragments				47.2		61	43	27.6				
			J-2					43.8								
			T-3	LEAN CLAY (CL), medium, gray, with shell fragments	(T)0.30			31.5		49	36	50.5	(T)0.60			
-10	5			Bottom @ 3 ft.												
-15	10															
-20	15															
-25	20															
-30	25															
-35	30															
-40	35															
-45	40															

COMPLETION DEPTH: 3 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 63%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


FLEX
7.1'
VB-31
10.1'

LOG OF BORING VB-32

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 34' 56.02" N
96° 33' 30.57" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -5.3 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			J-1	FATCLAY (CH), very soft, dark gray				116		96	73	89.2				
				J-2	SANDY FAT CLAY (CH), very soft, dark gray				93.6								
				J-3					78.9				59.1				
				J-4	FAT CLAT with SAND (CH), very soft, gark gray				37.8								
				J-5	-with shell fragments from 3' to 4.5'				39								
-10	5			T-6	-medium from 4.5' to 5'	(T)0.40			26.6		51	34	76.8	(T)0.80			
					Bottom @ 5 ft.												
-15	10																
-20	15																
-25	20																
-30	25																
-35	30																
-40	35																
-45	40																

COMPLETION DEPTH: 5 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 78%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


6.3'
VB-32
9.3'


9.3'
VB-32
11.3'

LOG OF BORING VB-33

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 31.31" N 96° 34' 25.58" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6.0 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

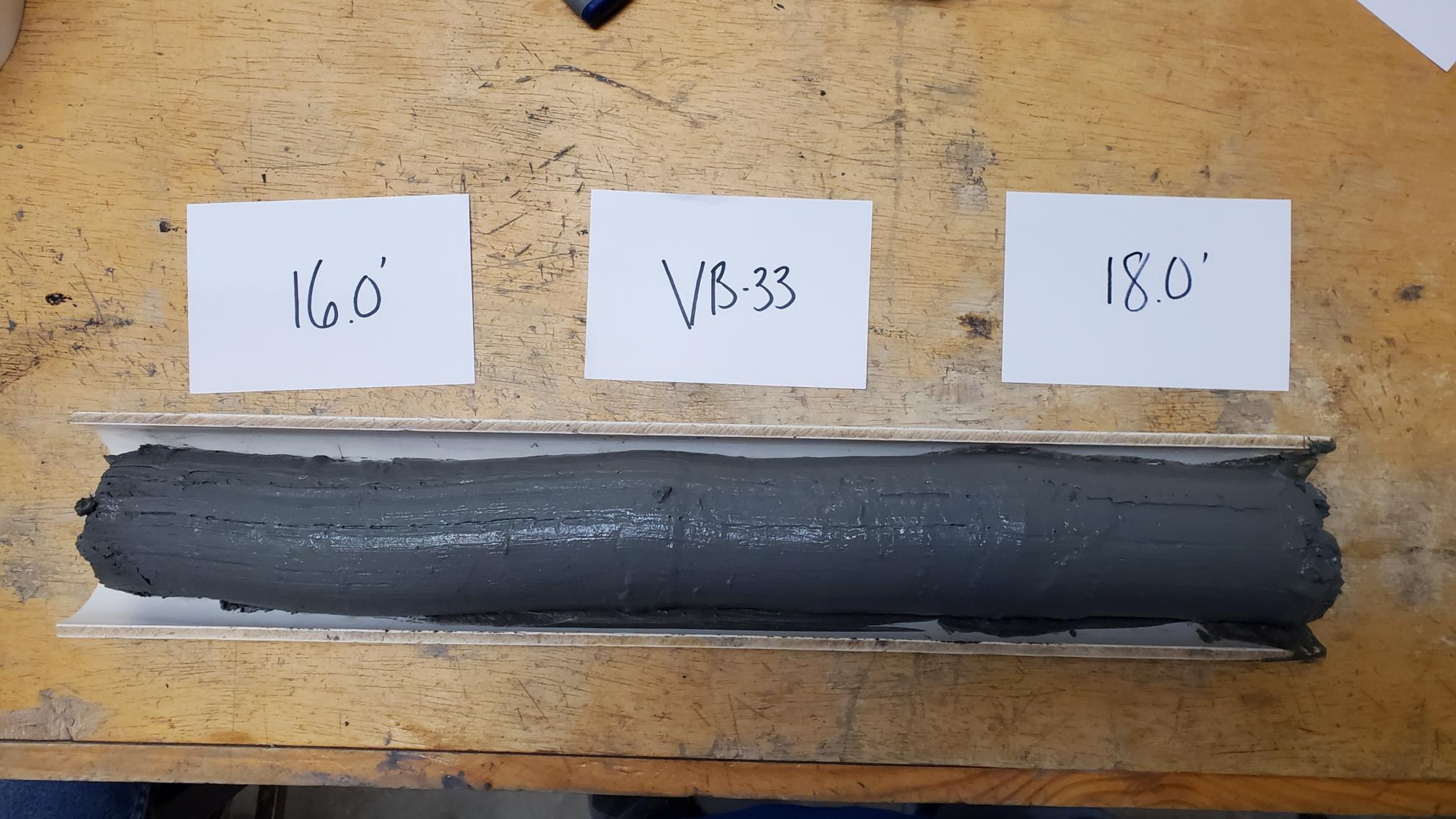
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
					FAT CLAY (CH), very soft, dark gray -tube delivered damaged / no sample was returned from 0' to 2'												
				J-1					137.3		87	66	87.5				
				J-2					101.7								
-10				J-3					104.7								
	5			T-4	SANDY LEAN CLAY (CL) / CLAYEY SAND (SC), medium, dark gray	(T)0.30			62.5		49	35	46.4	(T)0.60			
				T-5	-with shell fragments from 5' to 8'	(T)0.20			44.4					(T)0.40			
				T-6	-soft from 6' to 7'	(T)0.30			49.5				43.3	(T)0.60			
				T-7		(T)0.30			55.1					(T)0.60			
-15				T-8	-with shell fragments from 9' to 11'	(T)0.30			57.6		48	31	56.2	(T)0.60			
	10			T-9		(T)0.40			56.5					(T)0.80			
				T-10		(T)0.30			52.3				56.5	(T)0.60			
				T-11		(T)0.40			49.4					(T)0.80			
				T-12		(T)0.30			49.9				53.3	(T)0.60			
-20					Bottom @ 13.5 ft.												
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

COMPLETION DEPTH: 13.5 ft
DATE BORING STARTED: 7-27-21
DATE BORING COMPLETED: 7-27-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 93%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


16.0'
VB-33
18.0'


10.0'
VB-33
13.0'

LOG OF BORING VB-34

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 40.60" N
96° 34' 38.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -4.8 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
-5	0			J-1	FAT CLAY (CH), very soft, dark gray				156.9		120	95	97.3				
				J-2					150.2								
				J-3					129.2								
				T-4	CLAYEY SAND (SC), loose, dark gray	(T)0.10			93.4		45	31	47.7	(T)0.20			
				T-5		(T)0.10			78.9					(T)0.20			
-10	5			T-6	SANDY LEAN CLAY (CL), very soft, dark gray	(T)0.10			86.7				69.7	(T)0.20			
				T-7	-becomes soft at 6'	(T)0.15			46.7					(T)0.30			
				T-8	-medium from 7' to 8'	(T)0.30			44.1		39	26	52.2	(T)0.60			
				T-9		(T)0.20			49.8					(T)0.40			
-15	10			T-10	SANDY FAT CLAY (CH), soft, dark gray	(T)0.20			56.6				66.3	(T)0.40			
				T-11		(T)0.20			56.7					(T)0.40			
				T-12	FAT CLAY with SAND (CH), medium, dark gray	(T)0.30			62.3		56	40	75.3	(T)0.60			
				T-13		(T)0.30			69.8					(T)0.60			
				T-14		(T)0.30			63.1					(T)0.60			
				T-15	-firm from 14' to 15'	(T)0.50			65.2		63	47	80.5	(T)1.00			
-20	15				Bottom @ 15 ft.												
-25	20																
-30	25																
-35	30																
-40	35																
	40																

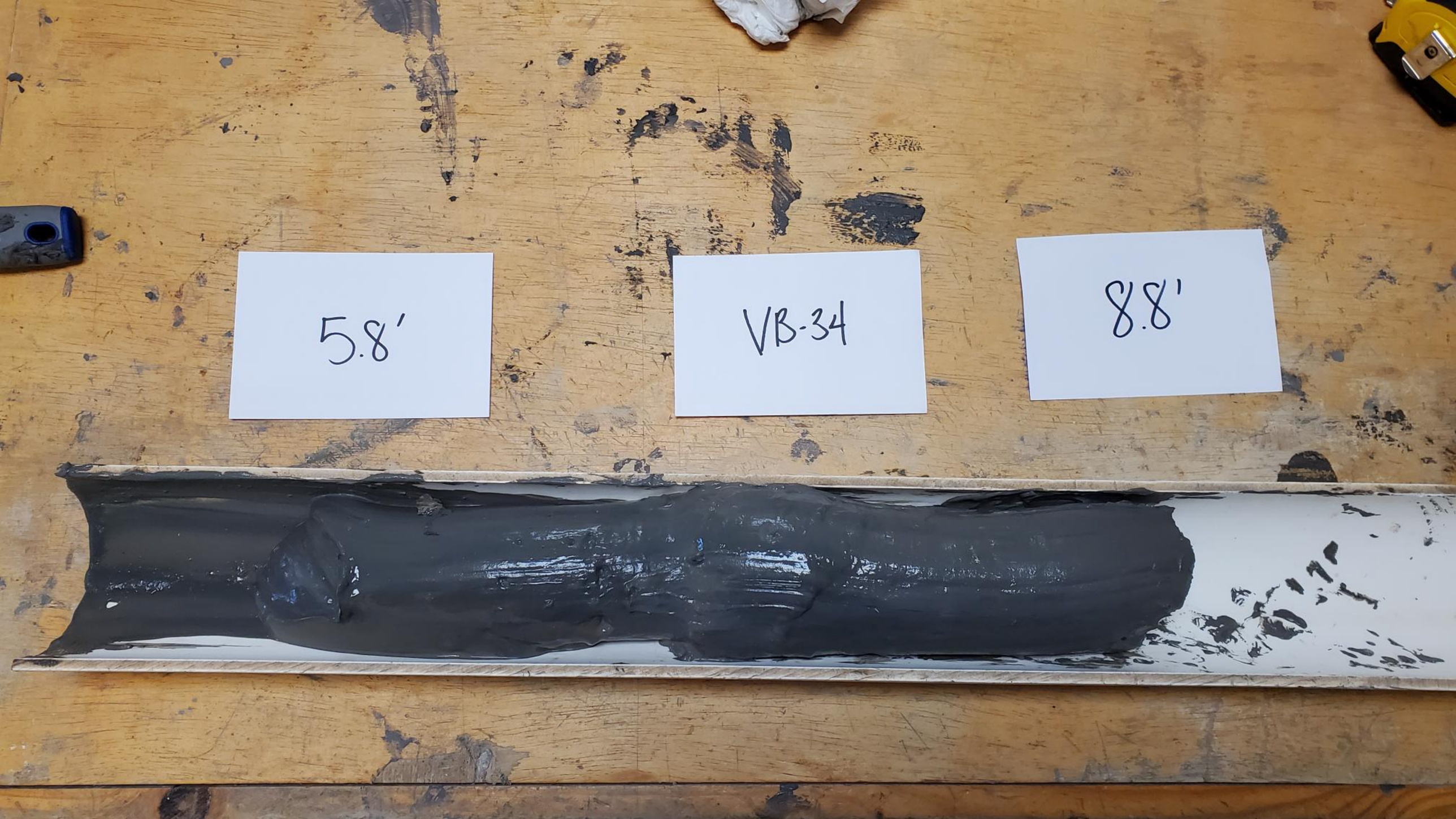
COMPLETION DEPTH: 15 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


14.8'
VB-34
17.8'


5.8'
VB-34
8.8'

LOG OF BORING VB-35

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 35' 52.92" N
96° 34' 56.32" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6.1 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

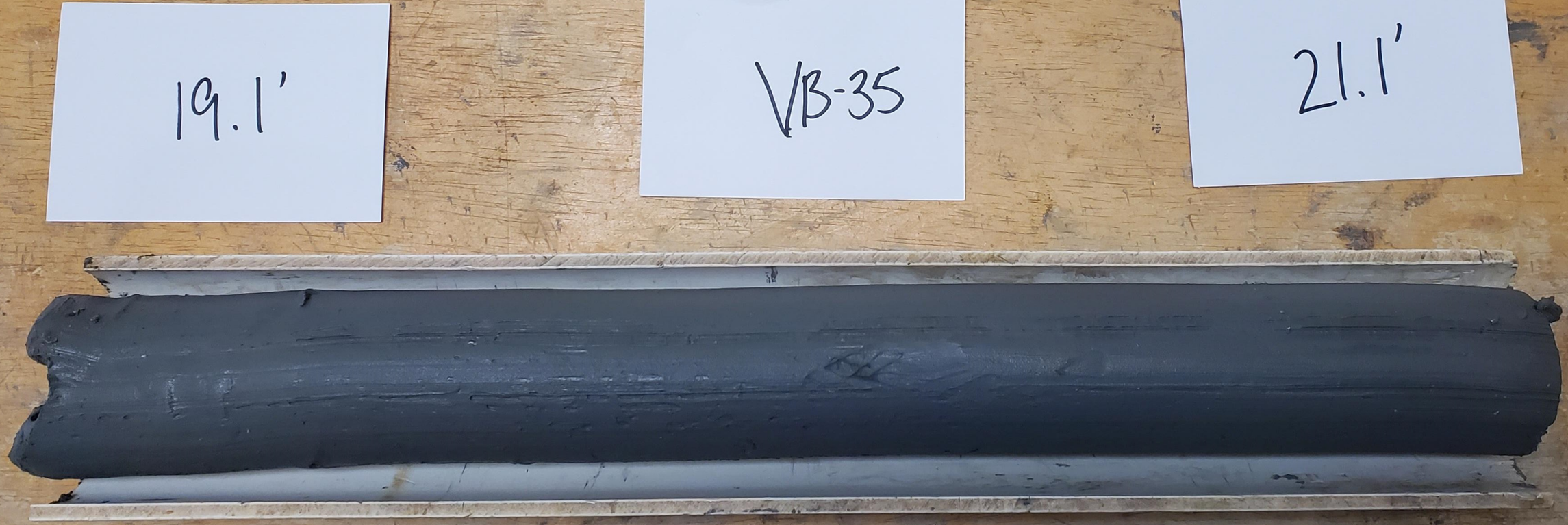
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			J-1	FAT CLAY (CH), very soft, dark gray				92.9		108	81	96.7				
				T-2		(T)0.10			136					(T)0.20			
				T-3		(T)0.10			127.8				93	(T)0.20			
				T-4		(T)0.20			92.5					(T)0.40			
-10				T-5	LEAN CLAY with SAND (CL), soft, dark gray	(T)0.20			43.3		47	33	71.6	(T)0.40			
	5			T-6	-medium from 5' to 6'	(T)0.30			50.5					(T)0.60			
				T-7	FAT CLAY with SAND (CH), medium, dark gray	(T)0.20			58.2				69.2	(T)0.40			
				T-8	-soft from 6' to 7'	(T)0.30			61.8					(T)0.60			
				T-9		(T)0.30			65.2		56	37	77.6	(T)0.60			
-15				T-10		(T)0.30			65.3					(T)0.60			
	10			T-11		(T)0.30			70.2				83.4	(T)0.60			
				T-12		(T)0.40			71					(T)0.80			
				T-13		(T)0.30			74.7		81	63	87.2	(T)0.60			
				T-14		(T)0.40			73.5					(T)0.80			
-20				T-15		(T)0.40			71.2				83.4	(T)0.80			
	15			T-16		(T)0.40			83.4					(T)0.80			
				T-17		(T)0.30			66.7		71	42	82.9	(T)0.60			
					Bottom @ 16.5 ft.												
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

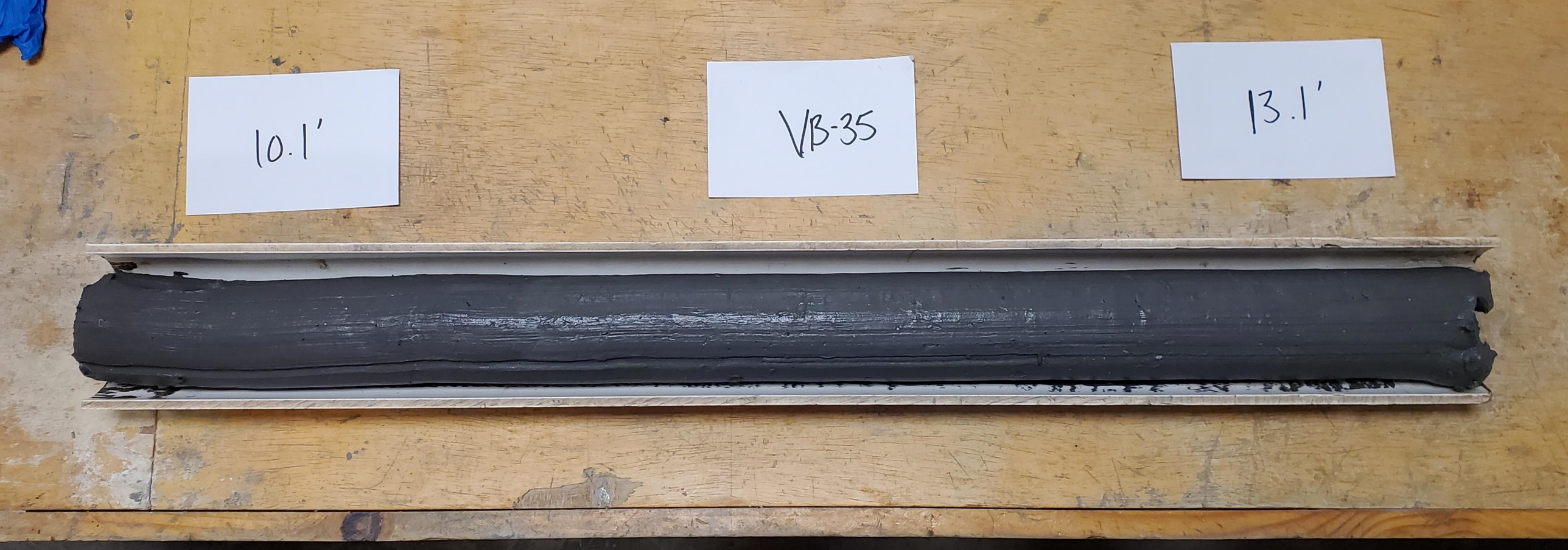
COMPLETION DEPTH: 16.5 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


19.1'
VB-35
21.1'


10.1'
VB-35
13.1'

LOG OF BORING VB-36

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 02.14" N 96° 35' 09.45" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6.1 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

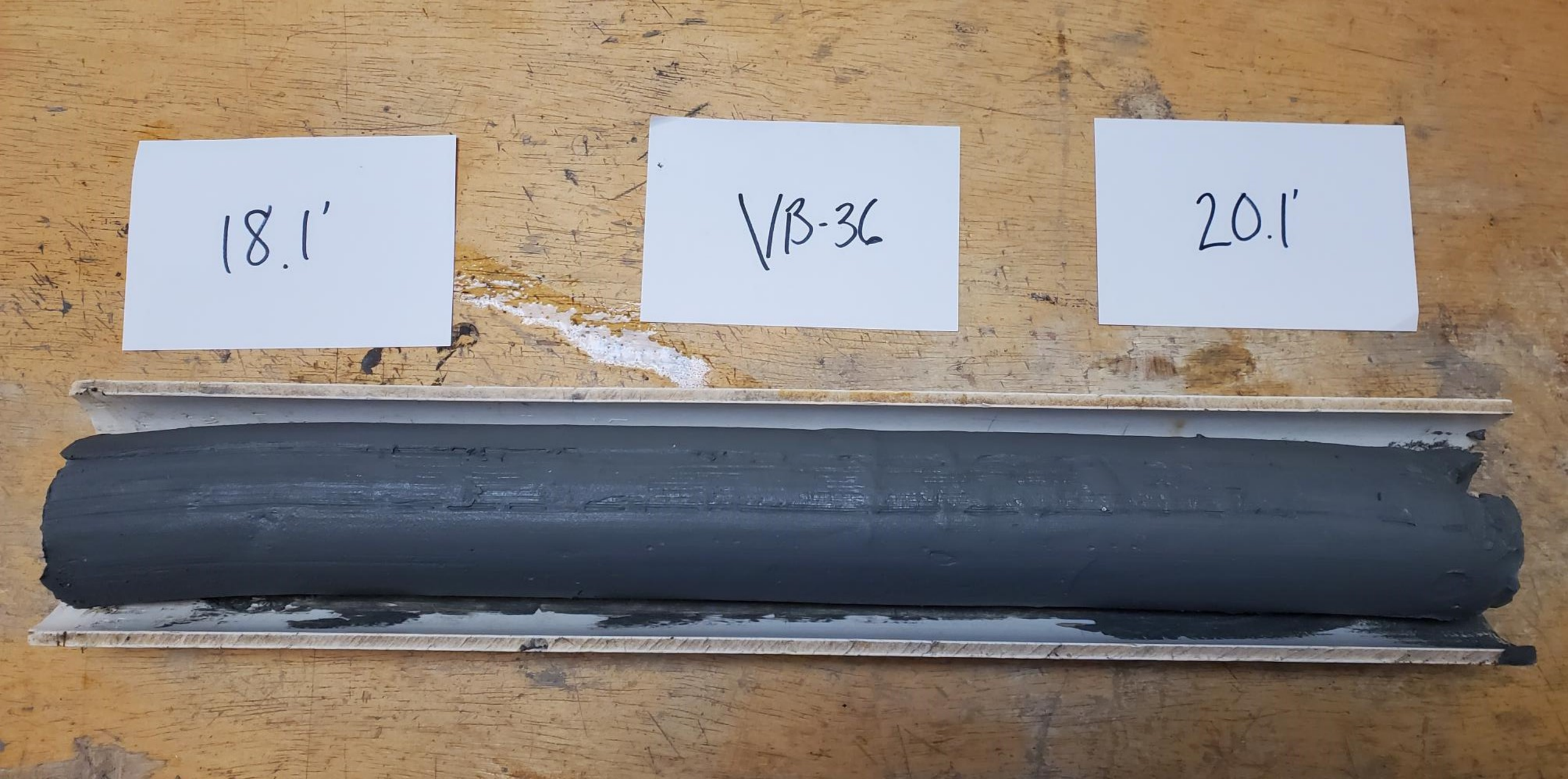
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	FAT CLAY (CH), very soft, dark gray	(T)0.10			89.1				85.4	(T)0.20			
				J-2					128.3								
				T-3	-soft from 2' to 4'	(T)0.20			136.5				99.2	(T)0.40			
				T-4		(T)0.20			129.3		87	72		(T)0.40			
-10				J-5					134.9				98.5				
	5			J-6					127.8		73	53					
				T-7	SANDY FAT CLAY (CH), soft, dark gray	(T)0.20			65.4				68.7	(T)0.40			
				T-8		(T)0.20			57.8					(T)0.40			
				T-9	FAT CLAY with SAND (CH), soft, dark gray	(T)0.20			62.4				81.6	(T)0.40			
-15				T-10		(T)0.30			67.1		115	91		(T)0.60			
	10			T-11	-medium from 9' to 11'	(T)0.30			73.2				83.4	(T)0.60			
				T-12	FAT CLAY (CH), soft, dark gray	(T)0.20			79.6					(T)0.40			
				T-13		(T)0.20			74.5		82	63	90.4	(T)0.40			
-20					Bottom @ 13 ft.												
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

COMPLETION DEPTH: 13 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 88%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


18.1'
VB-36
20.1'


10.1'
VB-36
13.1'

LOG OF BORING VB-37

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 19.49" N
96° 33' 18.84" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6.0 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

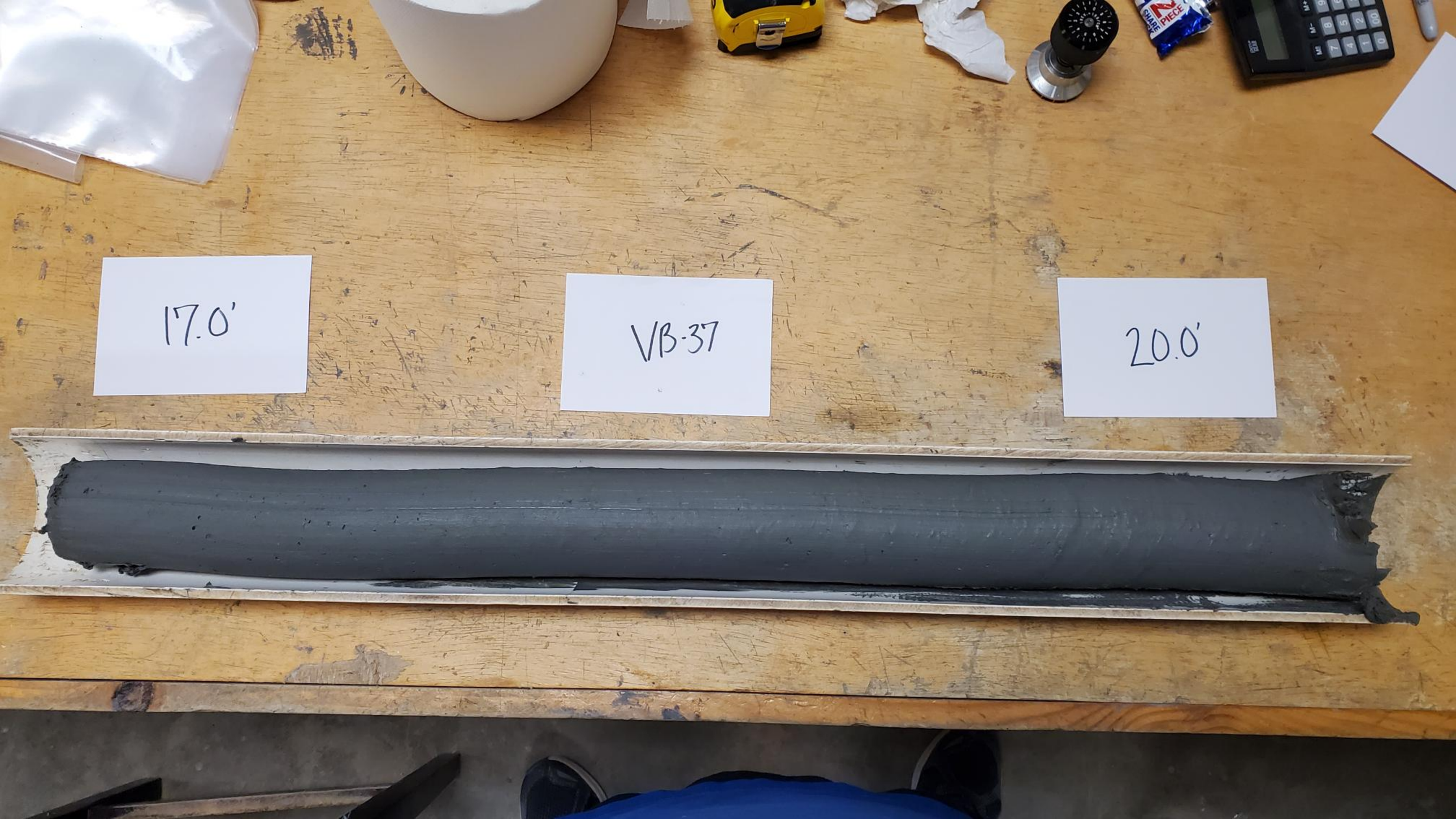
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	FAT CLAY (CH), very soft, dark gray	(T)0.10			117.9		78	58	97.6	(T)0.20			
				T-2		(T)0.10			133.2					(T)0.20			
				T-3	SANDY FAT CLAY (CH), soft, dark gray	(T)0.20			49.4				57.4	(T)0.40			
				T-4		(T)0.20			77.7					(T)0.40			
-10	5			T-5	-medium from 4' to 5'	(T)0.25			43.1		83	58	66.1	(T)0.50			
				T-6		(T)0.20			46.2					(T)0.40			
				T-7	-medium from 6' to 7'	(T)0.30			46.2				60.8	(T)0.60			
				T-8		(T)0.15			48.1					(T)0.30			
				T-9	FAT CLAY (CH), medium, dark gray	(T)0.30			64.8		63	47	88.6	(T)0.60			
-15	10			T-10	-soft from 9' to 10'	(T)0.20			64					(T)0.40			
				T-11		(T)0.30			65.8					(T)0.60			
				T-12		(T)0.40			66.7				94.2	(T)0.80			
				T-13		(T)0.30			64.8					(T)0.60			
-20				T-14		(T)0.30			74.3		78	54	97.7	(T)0.60			
	15				Bottom @ 13.5 ft.												
-25	20																
-30	25																
-35	30																
-40	35																
-45	40																

COMPLETION DEPTH: 13.5 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 91%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.0'
VB-37
20.0'

9.0'

VB-37

11.0'



LOG OF BORING VB-38

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 39.29" N 96° 33' 18.24" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -6.2 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

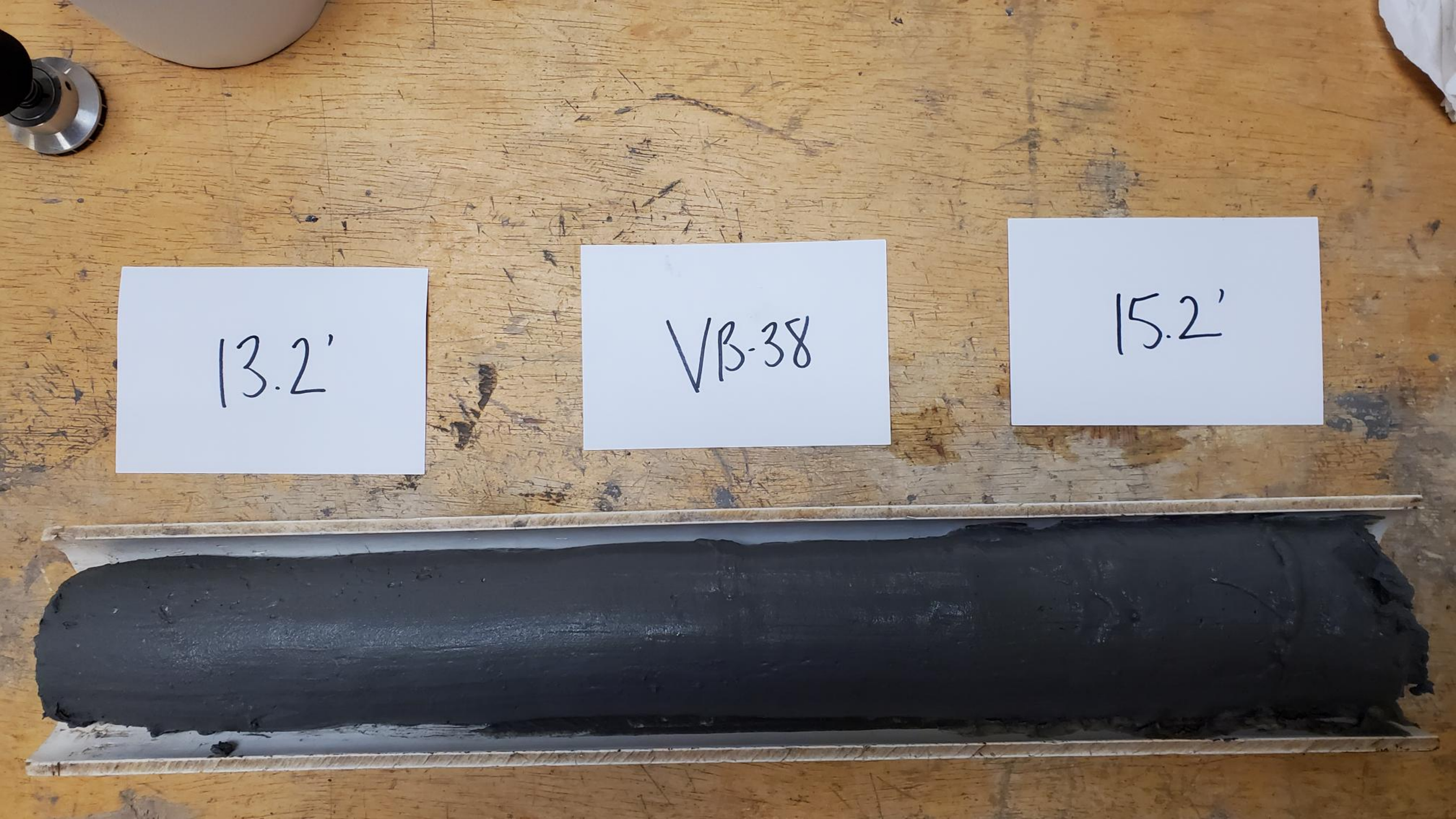
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				T-1	FAT CLAY (CH), very soft, dark gray, with shell fragments	(T)0.10			135.2		84	65	98.9	(T)0.20			
				T-2		(T)0.10			134.1					(T)0.20			
				T-3	-soft from 2' to 3'	(T)0.20			75.3					(T)0.40			
-10				T-4	SANDY LEAN CLAY (CL), soft, dark gray with shell fragments	(T)0.20			58.8		42	29	61.4	(T)0.40			
	5			T-5		(T)0.20			37.4					(T)0.40			
				T-6	-medium from 5' to 8'	(T)0.35			37.8				52.7	(T)0.70			
				T-7		(T)0.25			34.9					(T)0.50			
				T-8		(T)0.40			35		37	24	56.8	(T)0.80			
-15					Bottom @ 8 ft.												
	10																
-20																	
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

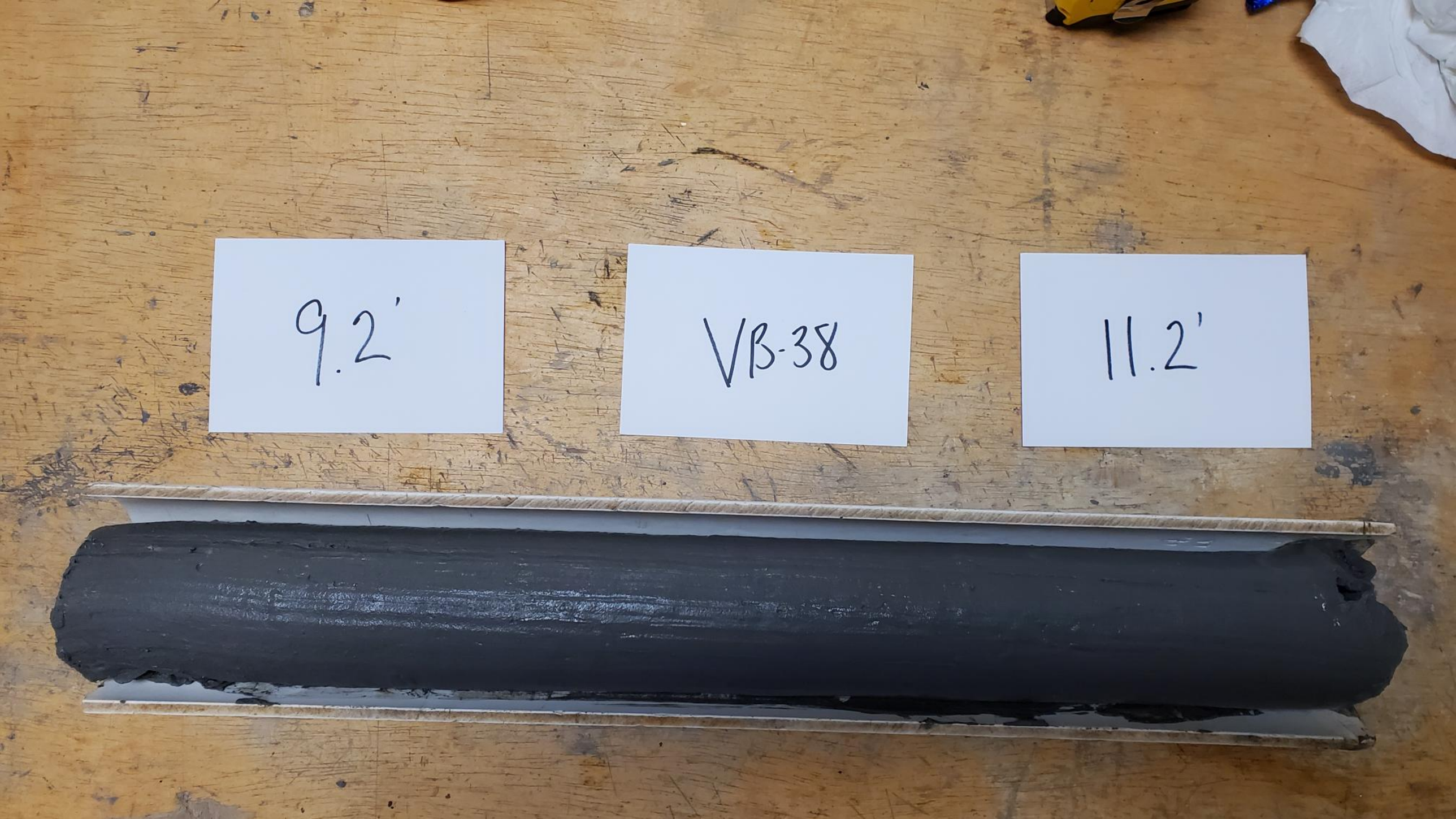
COMPLETION DEPTH: 8 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 83%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


13.2'
VB-38
15.2'


9.2'
VB-38
11.2'

LOG OF BORING VB-39

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 36' 59.10" N
96° 33' 17.66" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -6.0 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:

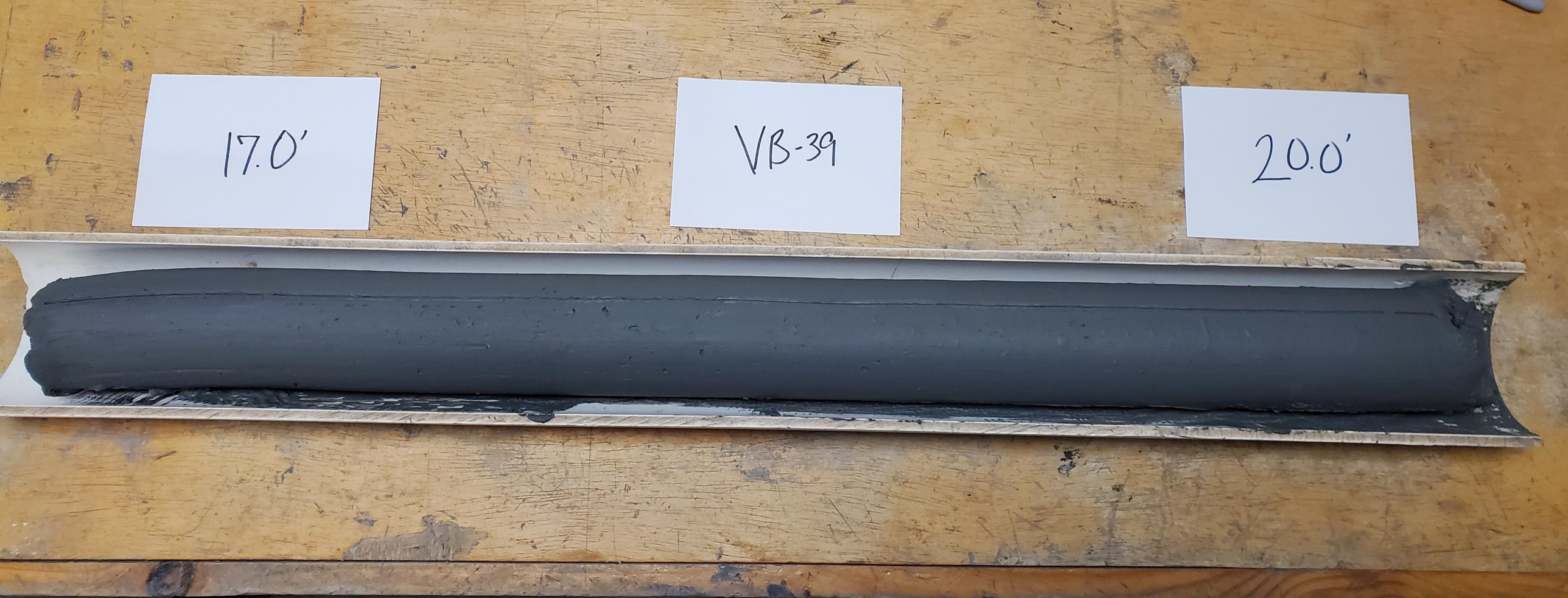
ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			T-1	FAT CLAY with SAND (CH), very soft, dark gray	(T)0.10			65.1		60	45	74	(T)0.20			
				T-2	-soft from 1' to 2'	(T)0.15			88.6					(T)0.30			
				T-3	SANDY FAT CLAY (CH), soft, dark gray	(T)0.20			47.6				55	(T)0.40			
				T-4	-very soft from 3' to 4'	(T)0.05			60.5					(T)0.10			
-10				T-5	SANDY LEAN CLAY (CL), medium, dark gray	(T)0.25			34.9		40	28	51.2	(T)0.50			
	5			T-6	-soft from 5' to 6'	(T)0.20			34.7					(T)0.40			
				T-7		(T)0.25			43				67.2	(T)0.50			
				J-8					42.9								
				T-9	FAT CLAY with SAND (CH), medium, dark gray	(T)0.30			91.9		66	47	78.5	(T)0.60			
-15				T-10	FAT CLAY (CH), medium, dark gray	(T)0.40			62.8					(T)0.80			
	10			T-11		(T)0.30			71.5				94	(T)0.60			
				T-12		(T)0.40			77.1					(T)0.80			
				T-13		(T)0.30			73.3				96.6	(T)0.60			
				T-14		(T)0.40			77.2		92	67	97.1	(T)0.80			
-20					Bottom @ 13.5 ft.												
	15																
-25																	
	20																
-30																	
	25																
-35																	
	30																
-40																	
	35																
-45																	
	40																

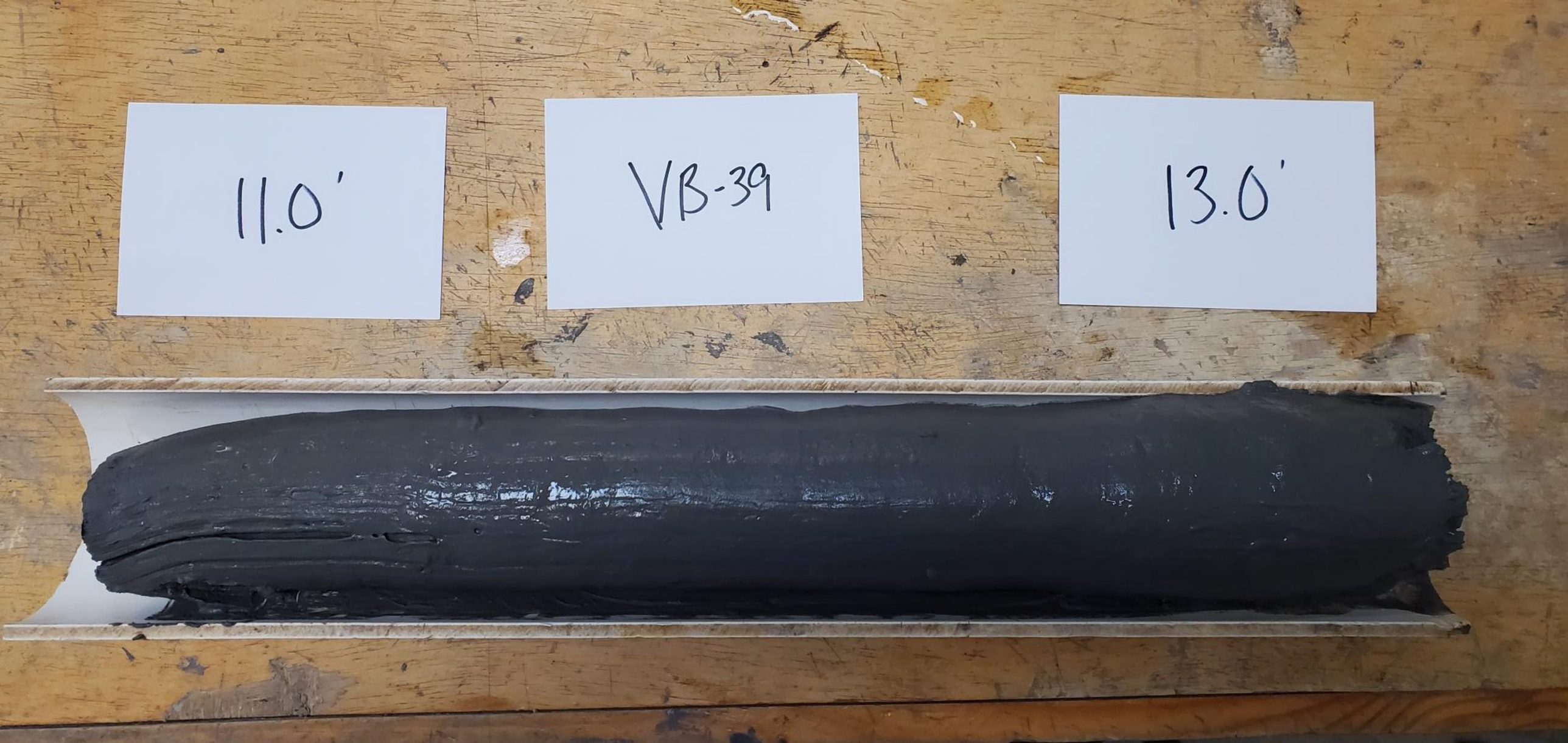
COMPLETION DEPTH: 13.5 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 89%.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


17.0'
VB-39
20.0'


11.0'
VB-39
13.0'

LOG OF BORING VB-40

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

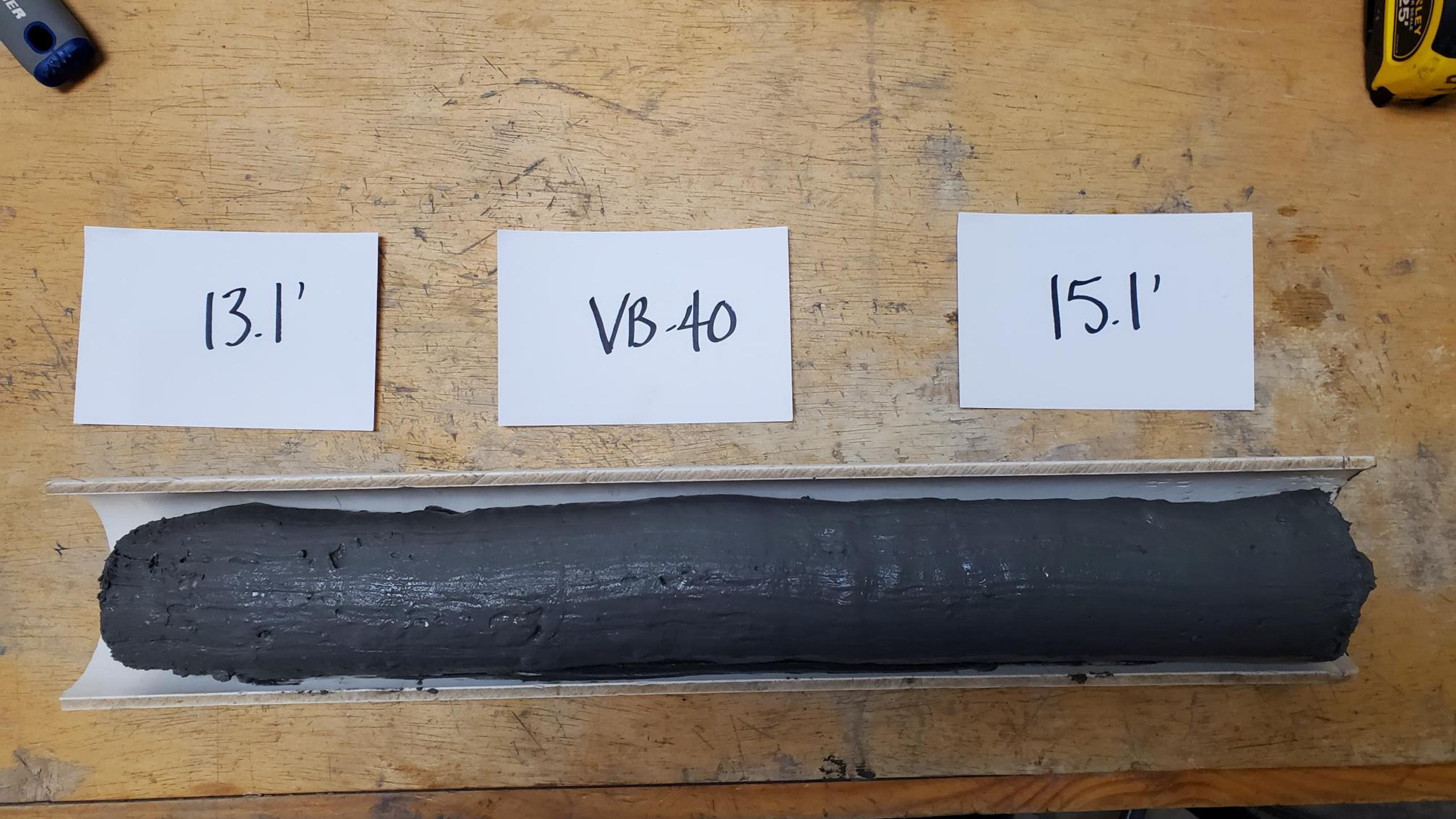
GPS COORDINATE: 28° 37' 18.90" N 96° 33' 17.09" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -5.1 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

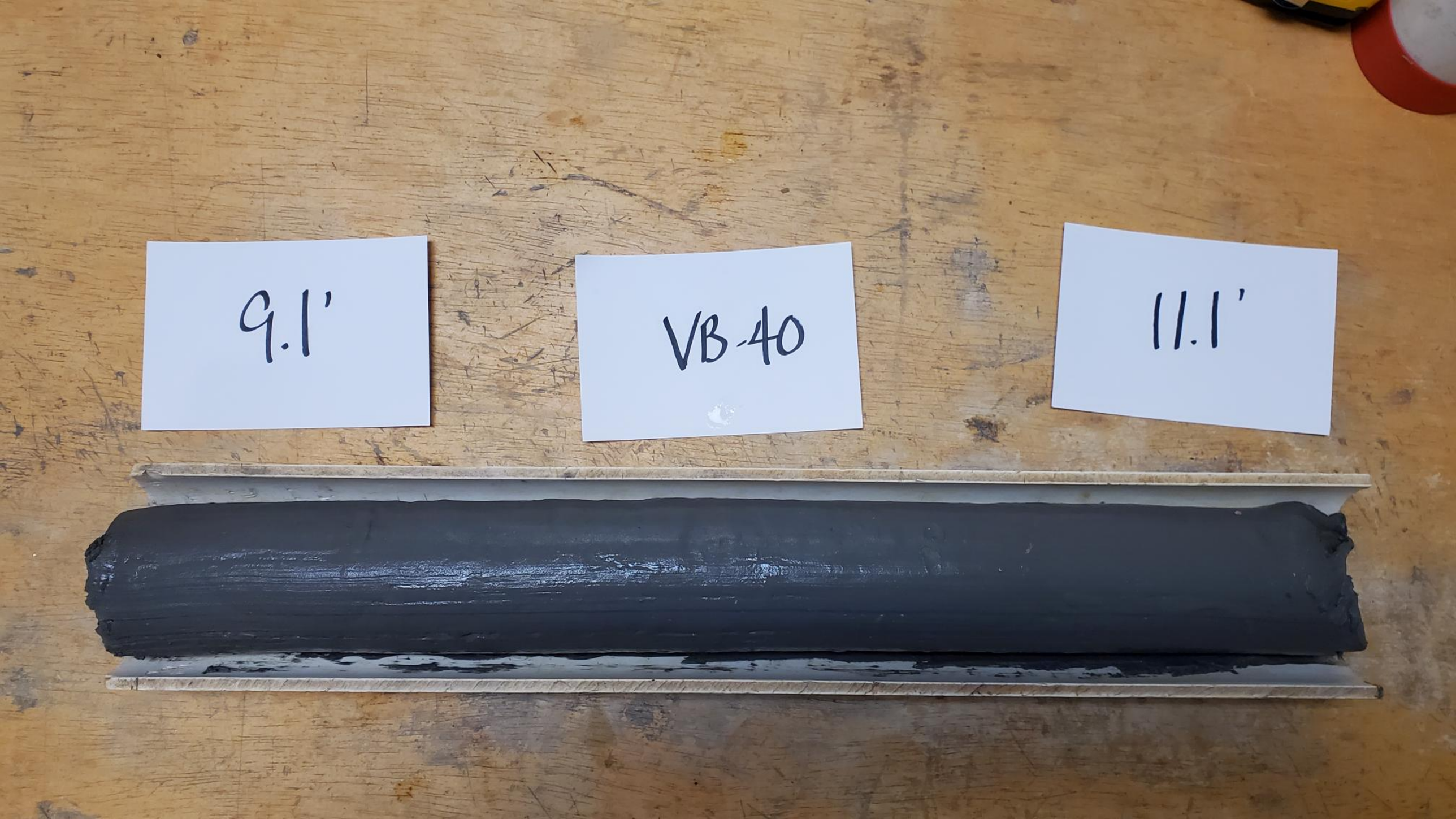
ELEVATION (FT)	DEPTH (FT)	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0	T-1	FAT CLAY (CH), soft, dark gray	(T)0.20			104		97	65	95.4	(T)0.40			
		T-2	very soft from 1' to 2'	(T)0.10			118.5					(T)0.20			
		T-3	SANDY FAT CLAY (CH)/FAT CLAY with SAND (CH), very soft, dark gray	(T)0.10			83.1				82.8	(T)0.20			
		T-4	-medium from 3' to 4'	(T)0.25			44.8					(T)0.50			
		T-5	-soft from 4' to 5'	(T)0.20			50.6		57	44	62.4	(T)0.40			
-10	5	T-6	SANDY LEAN CLAY (CL), medium, dark gray, with shell fragments	(T)0.30			41					(T)0.60			
		T-7		(T)0.35			39.7					(T)0.70			
		T-8		(T)0.40			40.3		32	18	57.7	(T)0.80			
		T-9		(T)0.30			48.2					(T)0.60			
		T-10	FAT CLAY with SAND (CH), medium, dark gray	(T)0.40			63.1					(T)0.80			
-15	10	T-11		(T)0.40			59.6		56	42	84.8	(T)0.80			
			Bottom @ 11 ft.												
-20	15														
-25	20														
-30	25														
-35	30														
-40	35														
-45	40														

COMPLETION DEPTH: 11 ft
DATE BORING STARTED: 7-28-21
DATE BORING COMPLETED: 7-28-21
LOGGER: N. Avila
PROJECT NO.: 21.14.223

NOTES: 1) Boring performed by T. Baker Smith/Naismith using a work barge and an electric vibracore rig. 2) Vibrcore samples collected to depth of refusal at each sample point. 3) Total core recovery = 90%.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 1/20/22


13.1'
VB-40
15.1'


9.1'
VB-40
11.1'

APPENDIX D
PONAR SAMPLING LOGS

LOG OF BORING CB-14

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28.41730 N 96.31556 W
STATE PLANE COORD: N --, E --
MUDLINE ELEVATION: -23 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
0	0				SILTY SAND (SM), gray w/ heavy shell and clay pockets Bottom @ 1 ft.												
-25	5																
-30	10																
-35	15																
-40	20																
-45	25																
-50	30																
-55	35																
-60	40																

COMPLETION DEPTH: 1 ft
DATE BORING STARTED: 10-31-21
DATE BORING COMPLETED: 10-31-21
LOGGER: C.Wild
PROJECT NO.: 21.14.223

NOTES:

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-15

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28.41764 N 96.31950 W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -22 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
0	0			SILTY GRAVEL (GM), gray w/ heavy rocks and shell fragments				14				2				
-22	1			Bottom @ 1 ft.												
-25	5															
-30	10															
-35	15															
-40	20															
-45	25															
-50	30															
-55	35															
-60	40															

COMPLETION DEPTH: 1 ft
DATE BORING STARTED: 10-31-21
DATE BORING COMPLETED: 10-31-21
LOGGER: C.Wild
PROJECT NO.: 21.14.223

NOTES:

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-16

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28.42175 N 96.32120 W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -19 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-19	0			SILTY GRAVEL (GM), gray w/ heavy rocks and shell fragments				14				1.5				
				Bottom @ 1 ft.												
-20																
-25	5															
-30	10															
-35	15															
-40	20															
-45	25															
-50	30															
-55	35															
	40															

COMPLETION DEPTH: 1 ft
DATE BORING STARTED: 10-31-21
DATE BORING COMPLETED: 10-31-21
LOGGER: C.Wild
PROJECT NO.: 21.14.223

NOTES:

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-17

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28.42353 N 96.32620 W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -34 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-35	0				SILTY GRAVEL (GM), gray w/ heavy rocks and shell fragments Bottom @ 1 ft.				7				3				
-40	5																
-45	10																
-50	15																
-55	20																
-60	25																
-65	30																
-70	35																
	40																

COMPLETION DEPTH: 1 ft
DATE BORING STARTED: 10-31-21
DATE BORING COMPLETED: 10-31-21
LOGGER: C.Wild
PROJECT NO.: 21.14.223

NOTES:

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

APPENDIX E

SUMMARY AND DETAILED LABORATORY TEST RESULTS

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-01	SP-1	0.5	-57	SC	47.4			48.6								24	43	19
	SP-2	2.5	-59	SC	46.0			27.7						x	X			
	ST-1	5	-61	CH	99.8		0.50	58.9	65.6	104.2	0.73	2.8	3		X	57	92	35
	ST-2	7.5	-64	CH	99.6		0.84	57.7	66.5	104.9	0.93	2.0				48	80	32
	ST-3	10	-66	CH	99.9		0.67	53.7	68.0	104.5	0.66	2.5			X			
	ST-4	12.5	-69	CH	99.6		0.84	55.9	66.8	104.1	1.17	3.0				51	86	35
	ST-5	15	-71	CH	99.6		0.84	44.5	77.6	112.1	1.06	4.7			X			
CB-02	SP-1	0.5	-54	CL	71.3			53.8							X			
	SP-2	2.5	-56	CL	78.5			47.9							X			
	ST-1	5	-58	CH	99.7		1.34	38.3	83.1	114.9	0.99	7.3				47	80	33
	ST-2	7.5	-61	CH	99.8		1.50	40.2	81.1	113.7	0.95	7.3	3		X			
	ST-3	10	-63	CH	99.9		1.34	49.0	72.2	107.6	0.69	2.9				50	82	32
	SP-3	12.5	-66	CH	99.3			54.6								46	78	32
	ST-4	15	-68	CH	99.3		0.84	53.0	69.6	106.5	0.39	11.0				46	73	27
CB-03	SP-1	0.5	-53	CH	90.0			57.9							X	38	62	24
	ST-1	2.5	-55	CH	87.3	0.34		54.3	69.8	107.7	0.21	15.0			X			
	ST-2	5	-57	CH	90.3	0.24		14.3	88.0	100.6				X		43	67	24
	ST-3	7.5	-60	CH	96.5		0.67	56.4	67.6	105.7	0.30	11.3			X			
	ST-4	10	-62	CH	87.1		0.67	53.4	69.4	106.5	0.34	15.0				41	65	24
	ST-5	12.5	-65	CH	93.1		0.67	62.7	62.5	101.7	0.32	11.5			X			
	ST-6	15	-67	CH	95.7		0.83	63.2	63.1	103.0	0.53	2.8	6			45	70	25
	SP-2	17.5	-70	SM	15.7			21.9							X			
CB-04	SP-1	0.5	-52	CL	99.0			33.8								19	40	21
	ST-1	2.5	-54	CL	99.7		1.68	32.0	87.8	115.9	0.61	3.5			X			
	ST-2	5	-56	CH	99.3		2.68	35.3	87.3	118.1						41	65	24
	ST-3	7.5	-59	CH	99.6		1.18	35.2	81.7	110.5	0.52	4.2			X			
	ST-4	10	-61	CH	99.9		2.51	36.1	81.8	111.3				X		47	75	28
	ST-5	12.5	-64	CH	99.8		1.34	42.3	80.4	114.4	1.67	2.2	5					
	ST-6	15	-66	CH	99.6		2.84	41.0	80.0	112.8	1.09	2.8			X			
	ST-7	17.5	-69	CH	99.8		2.34	44.3	76.5	110.4						48	82	34
	ST-8	20	-71	CH	99.8		2.34	46.3	75.7	110.7	1.43	3.5			X			
CB-05	SP-1	0.5	-52	CH	92.1			51.4								36	64	28
	SP-2	2.5	-54	CH	98.2			57.2							X			
	SP-3	5	-56	CH	99.9			54.6							X			
	ST-1	7.5	-59	MH	99.6		0.50	59.5	65.8	105.0	0.35	12.1	3			44	86	42
	ST-2	10	-61	MH	99.6		0.67	61.8	62.1	100.5				X				
	ST-3	12.5	-64	MH	99.9		0.67	56.8	66.5	104.3	0.63	4.7				39	77	38
	ST-4	15	-66	MH	99.9		0.83	58.4	66.7	105.7	0.57	6.0			X			
	ST-5	17.5	-69	MH	99.7		0.83	59.1	66.1	105.2	1.12	3.3				40	78	38
	ST-6	20	-71	MH	99.3		0.50	36.7	83.8	114.6	0.62	11.5			X			
CB-06	SP-1	0.5	-48	CH	96.2			61.1								28	55	27
	ST-1	2.5	-50	CH	82.4		0.33	48.5	73.4	109.0					X			
	ST-2	5	-52	CH	96.4	0.28		48.2	75.3	111.6								
	ST-3	7.5	-55	MH	99.7		0.67	54.5	66.5	102.7	1.02	10.8				35	74	39
	ST-4	10	-57	MH	99.8		0.83	58.3	65.3	103.4	0.47	5.3	4					
	SP-2	12.5	-60	MH	99.0			61.9							X			
	ST-5	15	-62	MH	99.9		0.83	57.8	66.7	105.3				X		34	70	36
	ST-6	17.5	-65	MH	99.8		0.83	42.9	72.3	103.3	0.60	4.7			X			
	ST-7	20	-67	MH	99.5		1.00	55.1	66.5	103.1								
	SP-3	22.5	-70	MH	99.6			57.3							X	38	77	39

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-07	SP-1	0.5	-49	CL	84.0			42.1								26	45	19
	SP-2	2.5	-51	CH	99.7			55.4							X			
	ST-1	5	-53	CH	99.7		0.50	60.9	64.3	103.5	0.61	2.0	2					
	ST-2	7.5	-56	CH	99.6		0.67	61.0	63.9	102.9	0.65	3.0				44	80	36
	ST-3	10	-58	CH	99.9		0.50	54.0	69.2	106.6				X	X			
	ST-4	12.5	-61	CH	99.2		0.67	53.0	75.1	114.9	0.57	3.8						
	ST-5	15	-63	CH	99.7		0.83	57.0	66.9	105.0						44	82	38
	ST-6	17.5	-66	CH	99.5		0.83	46.5	75.0	109.9	0.63	9.5			X			
	ST-7	20	-68	CH			1.00	45.7	77.9	113.5						29	55	26
	ST-8	22.5	-71	CH	99.5		1.17	45.9	75.2	109.7	1.11	3.6			X			
CB-08	SP-1	0.5	-45	CH	98.2			47.4										
	ST-1	2.5	-47	CH	99.1		0.83	41.0	77.2	108.9	0.70	9.8			X	41	69	28
	ST-2	5	-49	CH	99.7		0.83	46.4	72.9	106.7								
	ST-3	7.5	-52	CH	99.1		0.83	34.1	86.6	116.1	1.05	7.8				37	60	23
	ST-4	10	-54	CH	99.8		0.83	50.7	69.8	105.2				X				
	ST-5	12.5	-57	CH	99.9		0.86	54.0	69.2	106.6					X			
	ST-6	15	-59	CH	99.7		0.83	56.5	67.5	105.6	0.86	2.5				51	85	34
	ST-7	17.5	-62	CH			0.67	51.7	70.8	107.4								
	ST-8	20	-64	CH	98.9		0.67	38.6	84.6	117.3	0.93	4.5	8		X			
	ST-9	22.5	-67	CH	99.6		0.83	45.3	77.5	112.6						27	50	23
	ST-10	25	-69	CH	99.7		0.67	40.4	82.7	116.1					X			
	ST-11	27.5	-72	CL	64.9		0.67	34.3	89.4	120.1	0.60	3.2						
CB-09	SP-1	0.5	-42	CH	98.5			44.6								32	65	33
	ST-1	3	-44	CL	77.6		1.17	27.4	95.9	122.2	0.60	6.3			X			
	ST-2	5.5	-47	CH			2.68	28.2	93.2	119.5								
	ST-3	8	-49	CH	98.7		2.34	33.1	90.2	120.1						34	64	30
	ST-4	10.5	-52	CH	99.5		2.17	36.1	84.4	114.9	1.51	5.8			X			
	ST-5	13	-54	CH	99.3		2.68	34.9	85.9	115.9								
	ST-6	15.5	-57	CH	69.4		2.51	31.2	88.5	116.1	1.67	7.6	6			43	78	35
	ST-7	18	-59	CH	99.6		3.01	36.8	84.9	116.1	2.87	4.1			X			
	ST-8	20.5	-62	CH	99.1		2.51	36.5	84.4	115.2								
	ST-9	23	-64	CH	83.7		2.68	32.6	88.3	117.1						38	73	35
	ST-10	25.5	-67	CH	99.5		2.51	28.2	90.5	116.0	0.96	1.9			X			
	ST-11	28	-69	CH	83.1		2.51	28.1	91.9	117.7								
CB-10	SP-1	0.5	-36	SM	17.6			23.7							X			
	SP-2	5	-40	SC	40.7			26.2							X			
	ST-1	10	-45	CH	94.2		1.67	29.1	91.0	117.5				X		34	56	22
	ST-2	12.5	-48	CH	97.1		2.84	27.3	95.4	121.4	0.98	2.2						
	ST-3	15	-50	CH	97.9		1.84	36.2	83.7	114.0	1.28	3.6	6					
	ST-4	17.5	-53	CH	98.0		2.01	32.4	88.1	116.6	0.99	1.3				59	88	29
	ST-5	20	-55	CH			2.67	12.1	102.5	114.9								
	ST-6	22.5	-58	CH	98.2		2.01	27.5	93.0	118.6	2.10	4.1						
	ST-7	25	-60	CH	99.4		2.84	32.6	86.6	114.8						47	75	28
	SP-3	27.5	-63	CH	99.5			33.3							X			
	ST-8	30	-65	CL	94.0		2.34	27.3	98.4	125.3	1.09	4.7				21	43	22
	SP-4	32.5	-68	ML	57.0			27.5							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-11	SP-1	0.5	-41	SM	22.5			24.5							X			
	SP-2	5	-45	SP-SM	7.3			23.4							X			
	SP-3	7.5	-48	CH	92.6			44.1								40	64	24
	SP-4	10	-50	CH				49.5										
	ST-1	12.5	-53	CH	97.7		0.67	50.7	72.5	109.3				X				
	SP-5	15	-55	CH	95.3			60.3								59	90	31
	SP-6	17.5	-58	CH	95.7			44.5							X			
	ST-2	20	-60	CL	77.5		0.67	30.0	89.2	116.0	0.35	14.6	8					
	ST-3	22.5	-63	CL	78.3		1.50	23.3	103.0	127.0	0.84	3.7				30	47	17
	ST-4	25	-65	CL	78.6		2.17	23.1	104.2	128.3	1.38	9.8						
	ST-5	27.5	-68	CL	73.5		1.17	17.9	112.9	133.1	1.23	2.5				15	30	15
	ST-6	30	-70	CL	66.5		1.67	17.5	108.3	127.3	0.60	3.0			X			
CB-12	SP-1	0.5	-38	SM	12.0			20.2							X			
	SP-2	5.5	-43	SP-SM	5.3			23.6										
	SP-3	7.5	-45	SP-SM				23.0										
	SP-4	10	-47	SM	22.6			19.4							X			
	SP-5	12.5	-50	SM	16.0			22.4										
	SP-6	15	-52	SM	15.1			21.2							X			
	SP-7	17.5	-55	SP-SM	8.6			22.9										
	SP-8	20	-57	SP-SM	11.7			23.1										
	SP-9	22.5	-60	SP-SM	11.3			23.6							X			
	SP-10	25	-62	SP-SM				23.4										
	SP-11	27.5	-65	SM	12.9			22.6										
	SP-12	30	-67	SM	15.1			25.0										
	SP-13	32.5	-70	SM	16.8			24.5										
CB-13	SP-1	0.5	-52	SM	19.0			19.6							X			
	SP-2	3	-54	SM	13.2			20.2										
	SP-3	5.5	-57	SP-SM	11.5			22.5							X			
	SP-4	8	-59	SP-SM	11.0			19.7										
	SP-5	10.5	-62	SM	13.6			22.6							X			
	SP-6	13	-64	SC	24.6			23.0								6	22	16
	SP-7	15.5	-67	SC	26.9			28.9							X			
	SP-8	18	-69	CH	95.2			49.7								30	75	45
	SP-9	20.5	-44	SP-SM	11.3			25.5										
CB-14	-	0	-23	SP-SM	5.2			16.8							X			
CB-15	-	0	-22	GW	1.7			13.8							X			
CB-16	-	0	-19	GW	1.5			14.0							X			
CB-17	-	0	-34	SW	3.1			7.4							X			
CB-18	SP-1	0.5	-57	SM	14.8			39.1							X			
	SP-2	3	-59	SM	21.2			13.6							X			
	SP-3	5.5	-62	CH	96.4			26.2										
	ST-1	7.5	-64	CL	74.8		2.50	19.7	106.5	127.5	1.74	15.0	3			17	34	17
	ST-2	10	-66	CL	87.8		2.50	23.9	99.6	123.4				X		16	34	18
	ST-3	12.5	-69	CL	73.9		2.35	21.1	104.1	126.1	1.58	2.6				29	47	18

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-19	SP-1	0	-31	SC	10.1			18.3										
	SP-2	5	-36	SC	54.6			18.7							X			
	SP-3	10	-41	SC	9.7			22.7							X			
	SP-4	15	-46	SC	10.6			20.0										
	SP-5	17.5	-49	SC	11.9			21.3							X			
	SP-6	20	-51	SC	8.5			23.3										
	SP-7	22.5	-54	SC				22.5										
	SP-8	25	-56	SC	29.0			15.9							X			
	SP-9	27.5	-59	CH	93.8			28.9										
	ST-1	30	-61	CH	98.1		2.28	25.9	98.4	123.9	1.71	2.4	4			42	66	24
	SP-10	32.5	-64	SC	92.1			22.9							X			
	SP-11	35	-66	SC	37.6			22.5										
	SP-12	37.5	-69	CL	97.7			23.2										
CB-20	SP-1	0.5	-29	CH				49.6										
	ST-1	5	-33	CL	61.7		2.00	19.9	110.2	132.1	1.90	14.8	2			21	37	16
	SP-2	10.5	-39	SM	14.1			12.8							X			
	SP-3	15.5	-44	SM				18.2										
	SP-4	18	-46	SP-SM	10.5			21.7							X			
	SP-5	20.5	-49	SP-SM	7.9			16.6										
	SP-6	23	-51	SP-SM				16.2										
	SP-7	25.5	-54	SM	12.9			20.1							X			
	SP-8	28	-56	SM	15.6			33.5										
	SP-9	30.5	-59	SM				22.8										
	SP-10	33	-61	SM	17.8			26.0										
	SP-11	35.5	-64	SM	15.3			20.5							X			
	SP-12	38	-66	SP-SM	9.6			22.4										
	SP-13	40.5	-69	SP-SM				21.2										
	ST-2	42.5	-71	CH	93.6		2.68	28.8	94.7	122.0	1.20	4.1				28	50	22
CB-21	SP-1	0.5	-30	SC	32.3			21.6							X			
	ST-1	5	-33	SC	43.7		2.35	13.1	119.3	134.9	1.71	14.6	2			8	25	17
	SP-2	10.5	-39	SM	12.9			20.9							X			
	SP-3	15.5	-44	SP-SM	8.9			21.3							X			
	SP-4	18	-46	SP-SM	9.0			23.1										
	SP-5	20.5	-49	SM	23.8			16.0							X			
	SP-6	23	-51	CH	82.7			36.4								33	60	27
	ST-2	25	-53	CH			0.50	38.4	83.2	115.1				X				
	ST-3	27.5	-56	CH	85.0		2.35	27.5	94.3	120.2	1.26	3.8						
	ST-4	30	-58	CH			3.00	26.8	98.3	124.6								
	ST-5	32.5	-61	CH	96.1		3.00	23.4	102.9	127.0	2.56	4.8				28	52	24
	ST-6	35	-63	CH			2.50	24.8	101.7	126.9								
	ST-7	37.5	-66	CL			1.47	23.4	104.9	129.4	0.34	9.8						
	ST-8	40	-68	CL	62.9		1.50	22.4	104.0	127.3						13	31	18
	ST-9	42.5	-71	CL	74.2		2.17	23.7	99.9	123.6	2.20	2.0						

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-22	SP-1	0.5	-35	SM	22.3			21.6							X			
	SP-2	5.5	-40	SM	21.9			26.3							X			
	SP-3	10.5	-45	SM	18.1			22.6							X			
	SP-4	15.5	-50	SP-SM	6.6			22.9										
	SP-5	20.5	-55	CL	54.6			92.6							X			
	ST-1	22.5	-57	CH	99.7		0.84	41.5	80.6	114.0	0.48	5.6	3			27	50	23
	ST-2	25	-59	CH			0.67	41.8	88.2	125.1								
	ST-3	27.5	-62	CH	97.8		0.83	42.3	79.8	113.6	0.35	11.0						
	ST-4	30	-64	CH	99.5		0.83	45.5	74.8	108.8				X		32	58	26
	ST-5	32.5	-67	CL			1.50	20.8	109.4	132.2								
	ST-6	35	-69	CL			1.50	21.0	105.3	127.4	0.94	2.7						
	ST-7	37.5	-72	CL	62.9		2.14	21.7	103.0	125.4						18	36	18
	ST-8	40	-74	CL			2.68	20.3	106.0	127.5	0.68	2.8						
	ST-9	42.5	-77	CL	77.4		3.00	24.2	102.8	127.7						17	37	20
	ST-10	45	-79	CL	95.9		2.68	25.8	98.6	124.0	0.99	3.8						
CB-23	SP-1	0.5	-16	SM	18.6			27.5							X			
	SP-2	5.5	-21	SM	19.6			26.4							X			
	SP-3	10.5	-26	SM	25.1			31.8							X			
	SP-4	15.5	-31	SM	12.5			24.2							X			
	SP-5	20.5	-36	CL	77.1			35.6								16	38	22
	ST-1	25	-40	CL			0.50	39.2	80.8	112.5	0.65	6.3						
	ST-2	30	-45	CL			0.50	35.1	83.2	112.4	0.65	5.3	3					
	SP-6	33	-48	CL	99.1			37.0								19	36	17
	ST-3	35	-50	CL			0.83	42.4	78.2	111.4				X				
	ST-4	37.5	-53	CL	88.9		1.34	22.9	103.1	126.7	0.90	1.8						
	ST-5	40	-55	CL			2.00	21.3	105.2	127.6								
	ST-6	42.5	-58	CL	77.5		2.68	19.1	106.0	126.2	1.49	2.6				26	46	20
	ST-7	45	-60	CL			2.84	27.7	94.5	120.7								
	ST-8	47.5	-63	CL	95.3		3.00	26.8	90.6	114.9	0.86	3.2						
	SP-7	50.5	-66	CL				19.9										
	SP-8	53	-68	SC	30.5			21.7								24	44	20
	ST-9	55	-70	SC	49.0		1.34	22.5										
CB-24	SP-1	0.5	-40	SM	14.9			23.7							X			
	ST-1	5	-44	CL	98.9		1.17	33.4	86.8	115.8	0.99	4.3	2			20	38	18
	ST-2	7.5	-47	CL	94.0		1.17	33.7	89.6	119.8	0.63	8.8						
	ST-3	10	-49	CL	99.1		1.50	29.9	88.3	114.7					X			
	ST-4	12.5	-52	CH	99.2		1.34	41.4	78.7	111.3	0.83	4.0				32	56	24
	ST-5	15	-54	CH	99.2		1.84	33.8	88.0	117.7				X				
	ST-6	17.5	-57	CH	65.6		3.00	24.9	99.8	124.7	0.53	6.0			X			
	ST-7	20	-59	CH	88.5		1.67	26.6	89.4	113.2						37	60	23
	ST-8	22.5	-62	CH			2.51	27.4	89.8	114.4								
	ST-9	25	-64	CH	71.3		2.51	29.9	93.7	121.7								
	ST-10	27.5	-67	SC	28.2		1.67	21.7	105.2	128.0	0.67	3.4				24	46	22
	SP-2	30.5	-70	SM	16.5			21.9							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-25	SP-1	0.5	-32	SM	21.8			23.0							X			
	SP-2	2.5	-34	SM	16.1			23.2										
	SP-3	4.5	-36	CH				40.8										
	ST-1	6	-37	CH		0.6	0.34	32.6	92.1	122.1	0.67	4.9				19	39	20
	ST-2	8	-39	CH	74.8	0.6	0.34											
	ST-3	10	-41	CH			0.50	37.9	84.5	116.5								
	ST-4	12	-43	CH		0.8	0.50	35.2	85.1	115.1	0.53	3.8				30	54	24
	ST-5	14	-45	CH	96.6		0.67	30.2	92.2	120.0								
	ST-6	16	-47	CH			0.50	37.8										
	ST-7	18	-49	CH			0.84	41.1	82.7	116.7								
	ST-8	20	-51	CH	99.6		1.00	31.4	88.1	115.8								
	ST-9	22	-53	CH			1.00	36.8	82.4	112.7	0.94	7.8				31	56	25
	ST-10	24	-55	CH			1.00	38.9	81.9	113.8								
	ST-11	26	-57	CH	99.5		1.00	44.2	76.5	110.3								
	ST-12	28	-59	CH			1.00	48.4	71.9	106.7								
	ST-13	30	-61	CH			1.17	40.5	79.9	112.3	1.84	2.1				41	65	24
	ST-14	32	-63	CH	89.3		1.00	33.6	88.2	117.8								
	ST-15	34	-65	CH			1.17	34.7	87.0	117.2								
	SP-4	36.5	-68	SM	15.6			22.2							X			
CB-26	SP-1	0.5	-23	CL				55.6										
	ST-1	2	-24	SM		0.1	0.00	39.8	79.1	110.6						29	50	21
	ST-2	4	-26	SM	57.1	0.1	0.00	47.9	74.7	110.5								
	SP-2	6.5	-29	SM	19.9			25.4							X			
	SP-3	8.5	-31	SM				28.9										
	SP-4	10.5	-33	CL	61.0			37.6										
	SP-5	12.5	-35	SM				25.6										
	SP-6	14.5	-37	SM	16.0			25.0							X			
	SP-7	16.5	-39	SM				25.2										
	SP-8	18.5	-41	SM	17.7			25.5							X			
	SP-9	20.5	-43	CL				30.0								12	31	19
	ST-3	22	-44	CL			1.00	31.6	90.8	119.5	0.44	9.3						
	SP-10	24.5	-47	CL				27.2										
	ST-4	26	-48	CL	60.8	0.14	0.17	30.1	93.0	121.0						9	27	18
	ST-5	28	-50	CL			0.84	36.2	85.3	116.2								
	ST-6	30	-52	CL			1.00	29.5	88.3	114.3	0.55	8.8						
	ST-7	32	-54	CL	94.7	0.8	0.50	35.0	86.8	117.2								
	ST-8	34	-56	CL			1.00	29.3	95.8	123.9								
	SP-11	36.5	-59	CL	99.6			34.4								24	47	23
	ST-9	38	-60	CH			1.17	30.4	91.7	119.6	1.00	9.3						
	ST-10	40	-62	CH			1.00	40.2	80.6	113.0								
	ST-11	42	-64	CH	92.5	1	0.84	33.6	88.2	117.8								
	ST-12	45	-67	CH			1.00	31.7	91.3	120.2	1.07	10.0						

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-27	SP-1	0.5	-16	SM	12.4			21.7							X			
	SP-2	2.5	-18	SM				25.3										
	SP-3	4.5	-20	SM	14.1			27.2							X			
	SP-4	6.5	-22	SM				25.6										
	SP-5	8.5	-24	SM				25.6										
	SP-6	10.5	-26	SC	44.3			24.3							X			
	SP-7	12.5	-28	SC				24.7										
	SP-8	14.5	-30	SC				26.1										
	SP-9	16.5	-32	CL	73.6			42.8								15	34	19
	SP-10	18.5	-34	CL	53.4			29.5							X			
	SP-11	20.5	-36	SC				24.4										
	SP-12	22.5	-38	SC	42.3			31.4										
	ST-1	24	-39	CH	95.4		0.67	45.7	76.6	111.6	0.47	12.8				30	58	28
	SP-13	26.5	-42	CL				31.6										
	SP-14	28.5	-44	CL				29.8										
	ST-2	30	-45	CL			0.84	34.0	89.2	119.5						20	40	20
	ST-3	32	-47	CH			0.84	36.9	83.8	114.7	0.81	7.0						
	ST-4	34	-49	CH	92.6		0.84	29.1	94.8	122.4								
	ST-5	36	-51	CH			0.84	35.0	88.8	119.9								
	ST-6	38	-53	CH	99.7		0.84	33.0	87.2	116.0	1.00	6.0						
	SP-15	40.5	-56	CH	98.2			39.3								32	56	24
	ST-7	42	-57	CH			1.00	34.5	88.5	119.0								
	ST-8	44	-59	CH			1.00	34.6	89.0	119.8	1.29	8.0						
	ST-9	46	-61	CH			1.00	36.9	82.3	112.7								
	ST-10	48	-63	CH	97.4		0.67	38.1	84.2	116.3	0.97	15.0				36	61	25
	ST-11	50	-65	CH			1.00	54.5	69.8	107.8								
	ST-12	52	-67	CH			1.00	51.1	71.3	107.7								
CB-28	SP-1	0.5	-16	SP-SM	9.6			23.2							X			
	SP-2	2.5	-18	SP-SM				23.9										
	SP-3	4.5	-20	SM	18.8			24.4										
	SP-4	6.5	-22	SM	12.1			25.8							X			
	SP-5	8.5	-24	SM				23.9										
	SP-6	10.5	-26	SM				27.0										
	SP-7	12.5	-28	SM	16.1			24.6							X			
	SP-8	14.5	-30	CL	82.6			39.9								21	44	23
	SP-9	16.5	-32	SC				26.0										
	SP-10	18.5	-34	SC				26.8										
	SP-11	20.5	-36	SC	36.3			30.7								11	33	22
	ST-1	22	-37	CL			1.00	29.3	91.0	117.7	0.60	4.8						
	SP-12	24.5	-40	SC	37.2			25.2										
	SP-13	26.5	-42	SC	41.6			25.1							X			
	SP-14	28.5	-44	CL				29.4										
	ST-2	30	-45	CH		0.7	0.84	35.9	85.1	115.7	0.94	5.5						
	ST-3	32	-47	CH	99.2	1	0.84	40.6	81.9	115.2						27	52	25
	ST-4	34	-49	CH			1.00	29.5	94.6	122.5								
	ST-5	36	-51	CH		0.6	0.84	34.3	91.6	123.0	0.53	10.3						
	ST-6	38	-53	CL	99.4		1.00	35.6	87.3	118.4						9	28	19
	SP-15	40.5	-56	CH				36.3										
	ST-7	42	-57	CH			1.00	33.2	87.9	117.1								
	ST-8	44	-59	CH			1.00	36.5	85.6	116.8								
	ST-9	46	-61	CH		1.1	0.84	34.4	88.0	118.3	1.12	6.5						
	ST-10	48	-63	CH	99.6		1.00	36.1	84.5	115.0						37	64	27
	ST-11	50	-65	CH			1.17	50.8	70.7	106.6								
	ST-12	52	-67	CH			1.00	48.9	73.0	108.7								

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-29	SP-1	0.5	-15	SC														
	SP-2	2.5	-17	SC	40.6			33.9							X	14	31	17
	SP-3	4.5	-19	SM	17.1			24.7							X			
	SP-4	6.5	-21	SM														
	SP-5	8.5	-23	SP-SM	9.4			25.4										
	SP-6	10.5	-25	SP-SM														
	SP-7	12.5	-27	SM	14.3			24.9							X			
	SP-8	14.5	-29	SM														
	SP-9	16.5	-31	SM				25.6										
	SP-10	18.5	-33	SM	20.6										X			
	SP-11	20.5	-35	CL	61.4			36.9								12	29	17
	SP-12	22.5	-37	SM				23.6										
	SP-13	24.5	-39	SM	47.1			28.3								7	24	17
	SP-14	26.5	-41	CL				23.0										
	ST-1	28	-43	CL		0.7	0.50	31.7	89.5	117.9	0.64	10.8						
	ST-2	30	-45	CL		1	0.34	27.1	97.4	123.8	0.55	9.0						
	ST-3	32	-47	CL			1.00	28.3	93.6	120.1								
	ST-4	34	-49	CL			1.00	27.8	95.6	122.2	0.56	9.8						
	ST-5	36	-51	CH			1.00	34.9	87.9	118.6								
	ST-6	38	-53	CH			1.17	39.8	82.1	114.8	0.89	10.0						
	SP-15	40.5	-55	SP-SM	10.7			22.9										
	SP-16	42.5	-57	SM	14.1			23.2							X			
	SP-17	44.5	-59	SM				22.4										
	SP-18	46.5	-61	SM				25.3										
	SP-19	48.5	-63	SM				24.4										
	SP-20	50.5	-65	SP-SM	10.6										X			
	SP-21	52.5	-67	SP-SM				25.5										
CB-30	SP-1	0.5	-22	CH	77.8			46.8							X	28	50	22
	SP-2	2.5	-24	CH	82.0			66.7								35	59	24
	SP-3	4.5	-26	SM	38.0			24.3							X			
	SP-4	6.5	-28	SM				25.6										
	SP-5	8.5	-30	SM	20.4			24.2							X			
	SP-6	10.5	-32	SM				25.5										
	SP-7	12.5	-34	SP-SM	11.8			23.1										
	SP-8	14.5	-36	SM				24.3										
	SP-9	16.5	-38	ML	55.3			26.8							X			
	SP-10	18.5	-40	CH	96.6			34.4										
	SP-11	20.5	-42	CH	98.8			42.1								30	54	24
	SP-12	22.5	-44	SM	31.8			26.4										
	SP-13	24.5	-46	SM				26.4										
	ST-1	26	-47	CL	99.0		0.84	32.0	94.6	124.9	0.72	11.8				20	40	20
	ST-2	28	-49	CH			1.00	33.6	91.3	122.0								
	ST-3	30	-51	CH	97.6		1.00	46.0	81.3	118.7								
	ST-4	32	-53	CH	98.9		0.84	37.5	84.8	116.6	1.01	5.8						
	ST-5	34	-55	CH			1.00	37.9	83.3	114.9						36	60	24
	ST-6	36	-57	CH			1.00	33.0	90.2	120.0								
	ST-7	38	-59	CH	98.5		1.00	35.1	86.9	117.4	1.05	6.8						
	ST-8	40	-61	CH			1.00	42.2	78.5	111.6								
	ST-9	42	-63	CH			1.00	49.5	74.0	110.6								
	ST-10	44	-65	CH	99.3		1.34	48.6	71.9	106.8	1.72	3.6						
	ST-11	46	-67	CH	99.6		1.00	51.3	71.4	108.0								

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-31	SP-1	0.5	-14	SM	14.8			24.1							X			
	SP-2	2.5	-16	SM				23.0										
	SP-3	4.5	-18	SP-SM	9.2			26.4							X			
	SP-4	6.5	-20	SM				25.6										
	SP-5	8.5	-22	SM	16.5			26.4							X			
	SP-6	10.5	-24	SM				24.7										
	SP-7	12.5	-26	SP-SM	11.6			28.8										
	SP-8	14.5	-28	SM				25.7										
	SP-9	16.5	-30	SM				27.0										
	SP-10	18.5	-32	SM	14.2			25.7										
	SP-11	20.5	-34	SM				25.4										
	SP-12	22.5	-36	SM	45.9			23.2							X			
	SP-13	24.5	-38	CL	98.7			39.8								17	36	19
	ST-1	26	-40	CL	96.8	1	0.84	32.8	90.5	120.2	0.69	9.8						
	ST-2	28	-42	CL			1.17	22.8	101.1	124.2								
	SP-14	30.5	-44	CL-ML	77.3			29.5								7	26	19
	ST-3	32	-46	CL		0.4	0.34	30.5	92.5	120.7	0.48	11.0						
	ST-4	34	-48	CL	91.7	0.7	0.84	29.7	94.5	122.6								
	ST-5	36	-50	CL			1.17	31.9	90.9	119.9								
	SP-15	38.5	-52	SM				24.8										
	SP-16	40.5	-54	SP-SM	8.8			22.3										
	ST-5	42	-56	CL			1.17	37.8	83.9	115.6	1.11	9.5				22	43	21
	ST-6	44	-58	CH			1.34	32.4	89.7	118.8								
	ST-7	46	-60	CH			1.17	44.0	76.5	110.2								
	ST-8	48	-62	CH			1.17	47.6	74.1	109.4								
	ST-9	50	-64	CH			1.34	55.4	68.9	107.1	0.82	1.7				52	88	36
	ST-10	52	-66	CH			1.34	49.1	72.5	108.1								
CB-32	SP-1	0.5	-17	SM	17.1			25.4							X			
	SP-2	2.5	-19	SM	16.5			25.6							X			
	SP-3	4.5	-21	SM				24.3										
	SP-4	6.5	-23	SM				25.7										
	SP-5	8.5	-25	SM	14.3			24.8							X			
	SP-6	10.5	-27	SM				26.6										
	SP-7	12.5	-29	SM				24.9										
	SP-8	14.5	-31	SM	23.5			24.3							X			
	SP-9	16.5	-33	CL	94.5			35.3										
	ST-1	18	-35	CL			0.67	31.3	90.6	119.0	0.61	13.1	7					
	ST-2	20	-37	CL			1.00	32.9	87.5	116.3						24	44	20
	ST-3	22	-39	CL			0.67	38.0	83.2	114.8								
	ST-4	24	-41	CL	99.1		0.67	45.0	85.6	124.1						24	44	20
	ST-5	26	-43	CL			0.67	43.2	81.2	116.3								
	ST-6	28	-45	CL	95.4		1.00	34.1	88.4	118.5	0.70	6.1				22	42	20
	ST-7	30	-47	CL			1.00	32.0	90.0	118.8				X				
	ST-8	32	-49	CL	89.7		1.00	35.4	86.0	116.4								
	SP-10	34.5	-51	SP-SM	9.8			23.9							X			
	SP-11	36.5	-53	SP-SM				24.7										
	SP-12	38.5	-55	SP-SM	6.5			23.6							X			
	SP-13	40.5	-57	SP-SM				22.7										
	SP-14	42.5	-59	SP-SM				22.1										
	SP-15	44.5	-61	SP-SM				22.3										
	SP-16	46.5	-63	SP-SM				22.5										
	SP-17	48.5	-65	SP-SM				23.1										
	SP-18	50.5	-67	CH				46.8										
	ST-9	52	-69	CH	99.3		1.00	42.8								48	84	36

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-33	SP-1	0.5	-19	SC	35.1			40.7							X	16	33	17
	SP-2	2.5	-21	SM	15.8			25.1							X			
	SP-3	4.5	-23	SM				24.2										
	SP-4	6.5	-25	SM				26.0										
	SP-5	8.5	-27	SM	22.3			24.8							X			
	SP-6	10.5	-29	SM				24.9										
	SP-7	12.5	-31	SM				25.2										
	SP-8	14.5	-33	ML	69.8			23.7							X			
	SP-9	16.5	-35	SC	46.8			26.9								0	0	0
	ST-1	18	-37	CL		0.38	0.34	33.4	88.1	117.5								
	SP-10	20.5	-39	CL	96.1			36.6								25	43	18
	ST-2	22	-41	CL		0.22	0.34	37.3	83.4	114.5								
	ST-3	24	-43	CL		0.6	0.50	39.0	80.1	111.3								
	ST-4	26	-45	CL		0.8	0.50	37.9	84.9	117.1				X		30	50	20
	ST-5	28	-47	CL		0.7	0.34	39.6	87.4	122.0								
	ST-6	30	-49	CH			1.00	36.8	79.4	108.6								
	ST-7	32	-51	CH			1.00	30.9	90.4	118.3	0.50	13.0						
	ST-8	34	-53	CH			1.17	33.4	88.3	117.8								
	ST-9	36	-55	CH	95.1		1.00	38.3	85.4	118.1						30	53	23
	ST-10	38	-57	CH			1.00	36.3	85.1	116.0	1.06	5.3	15					
	ST-11	40	-59	CH			1.17	41.1	78.3	110.5								
	ST-12	42	-61	CH			1.17	35.3	82.8	112.0								
	ST-13	44	-63	CH			1.00	38.2	82.3	113.7	1.16	3.7						
	ST-14	46	-65	CH			1.00	41.6	76.7	108.6								
	ST-15	48	-67	CH			1.17	47.6	72.3	106.7								
	ST-16	50	-69	CH	98.6		1.51	52.3	69.8	106.3	0.72	6.0				55	90	35
CB-34	SP-1	0.5	-20	SM	19.4			22.4							X			
	SP-2	2.5	-22	SM				22.3										
	SP-3	4.5	-24	SC	41.4			23.3							X			
	SP-4	6.5	-26	SC				23.9										
	SP-5	9.5	-29	CL	90.6			46.3								19	39	20
	ST-1	14	-33	CL			0.67											
	ST-2	19	-38	CH	99.4		0.67	41.3	81.9	115.7						46	76	30
	ST-3	23	-42	CH			1.00	34.3	87.3	117.2								
	SP-6	25.5	-45	SM	17.3			20.8							X			
	SP-7	28	-47	SM														
	SP-8	30.5	-50	CL				42.3										
	ST-4	32.5	-52	CL			1.00	30.2	92.4	120.3				X				
	ST-5	35	-54	CL	99.1		1.00	35.0	87.6	118.3	0.60	15.0				27	46	19
	ST-6	37.5	-57	CL			1.34	34.5	83.6	112.4								
	ST-7	40	-59	CH			1.51	34.3	84.6	113.6								
	ST-8	42.5	-62	CH	99.0		1.51	43.1	76.9	110.0	1.64	5.3				45	72	27
	ST-9	45	-64	CH			1.17	41.1	74.7	105.4								
	ST-10	47.5	-67	CH	99.3		1.34	52.2	68.5	104.3	0.87	5.5				61	91	30

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-35	SP-1	0.5	-17	ML				25.2										
	SP-2	5.5	-22	ML	91.4			24.6							X			
	SP-3	10.5	-27	ML	94.2			33.4							X	0	0	0
	ST-1	15	-31	ML			1.00	34.6	87.2	117.4								
	ST-2	20	-36	CH	97.2		1.00	37.6	82.3	113.2	0.79	6.3	8			39	73	34
	ST-3	25	-41	CL			1.34	33.7	88.1	117.8	0.66	5.3						
	SP-4	27.5	-44	CL	61.2			29.9								15	30	15
	ST-4	29.5	-46	CL			1.17	39.2	79.9	111.2	1.04	6.0						
	ST-5	32	-48	CL	99.0		1.00	34.0	89.7	120.2						25	45	20
	SP-5	35	-51	CH				41.7										
	ST-6	37	-53	CH	99.4	0.8	0.50	41.7	77.0	109.1						40	67	27
	ST-7	39.5	-56	CH			1.00	35.0	84.0	113.4								
	ST-8	42	-58	CH			1.00	41.5	75.6	107.0								
	ST-9	44.5	-61	CH			1.00	45.6	73.0	106.3	1.77	4.6						
	ST-10	47	-63	CH			1.00	41.8	74.5	105.6								
	ST-11	49.5	-66	CH			1.00	43.7	74.2	106.6								
	ST-12	52	-68	CH	99.8		1.00	49.1	71.7	106.9	2.00	6.0				55	90	35
CB-36	SP-1	0.5	-16	SM	21.7			22.9							X			
	SP-2	5.5	-21	SM	43.1			22.9							X			
	SP-3	10.5	-26	CL	95.2			37.4								14	31	17
	SP-4	15.5	-31	CH	90.4			25.1								30	50	20
	SP-5	20.5	-36	SM	32.4			23.7										
	SP-6	25.5	-41	SM				20.0										
	SP-7	30.5	-46	SM	23.9			22.7							X			
	SP-8	33	-48	SM				23.4										
	SP-9	35.5	-51	SM	21.4			23.1										
	SP-10	38	-53	CH	99.3			36.3							X			
	ST-1	40	-55	CH	98.7		1.34	36.2	86.3	117.5	1.52	6.5				33	55	22
	ST-2	42.5	-58	CH			1.34	35.8	85.3	115.8								
	ST-3	45	-60	CH			1.68	39.2	79.2	110.2								
	ST-4	47.5	-63	CH	99.6		1.34	45.1	75.0	108.8	1.31	2.1				56	83	27
	ST-5	50	-65	CH			1.50	46.2	74.9	109.5								
	ST-6	52	-67	CH	99.8		1.50	42.8	76.0	108.5	1.65	3.4				58	85	27
CB-37	SP-1	0.5	-24	SM				24.9										
	SP-2	4.5	-28	SM	98.4			30.9							X	24	44	20
	ST-1	9	-32	CL			2.18	25.0	96.5	120.6	1.19	6.8	4					
	ST-2	14	-37	CH	57.2		1.50	23.9	100.8	124.9	0.57	4.6				31	53	22
	SP-3	19.5	-43	SM				27.8										
	SP-4	21.5	-45	SM	30.7			22.9							X			
	SP-5	24	-47	SM				24.0										
	SP-6	26.5	-50	SM	43.2			21.6							X			
	SP-7	29	-52	SM				24.4										
	SP-8	31.5	-55	SM	38.5			24.8							X			
	SP-9	34	-57	SM				24.1										
	SP-10	36.5	-60	CH	96.4			39.2								34	56	22
	ST-3	38.5	-62	CH			1.17	39.1	79.7	110.9	1.54	3.6						
	ST-4	41	-64	CH	99.8		1.34	39.9	77.4	108.3						54	86	32
	ST-5	43.5	-67	CH	99.5		1.34	50.6	71.1	107.1	1.16	2.6				41	75	34

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-38	SP-1	0.5	-18	SM	37.0			24.2							X			
	SP-2	5.5	-23	SM				23.4										
	SP-3	10.5	-28	ML	80.5			29.1							X			
	SP-4	15.5	-33	CH	97.9			31.2								29	50	21
	SP-5	20.5	-38	CL				22.8										
	SP-6	25.5	-43	CL	79.0			26.0							X			
	SP-7	30.5	-48	CL	98.6			33.8								23	43	20
	ST-1	32.5	-50	CL			1.17	38.3	83.5	115.5				X				
	ST-2	35	-52	CL			1.17	25.7	95.4	119.9								
	ST-3	37.5	-55	CH	99.7		1.17	35.7	83.6	113.4	1.73	4.0				41	69	28
	ST-4	40	-57	CH			1.00	32.5	83.8	111.0								
	ST-5	42.5	-60	CH			1.00	33.4	84.9	113.3								
	ST-6	45	-62	CH	99.7		1.34	44.3	76.7	110.7	1.73	4.8				41	74	33
	ST-7	47.5	-65	CH			1.50	37.9	77.5	106.9								
	ST-8	50	-67	CH			1.17	39.3	75.5	105.2								
	ST-9	52.5	-70	CH	99.6		1.00	49.8	71.0	106.4	2.05	4.0				49	76	27
CB-39	SP-1	0.5	-15	CH				32.6										
	SP-2	5.5	-20	CH	51.4			30.6							X	32	55	23
	SP-3	10.5	-25	CH				27.2										
	SP-4	15.5	-30	SC	46.9			33.0								15	33	18
	ST-1	20	-34	SC				47.8	78.1	115.4								
	ST-2	25	-39	CL	51.7	0.6	0.34	23.6	100.8	124.6	0.39	9.0				19	39	20
	ST-3	27	-41	CL			2.18	21.6	108.0	131.3								
	ST-4	29.5	-44	SC	32.8		1.51	21.1	106.7	129.2	1.77	14.8	12			23	42	19
	SP-5	32.5	-47	SM	27.4			21.7							X			
	SP-6	35	-49	SM				22.3										
	SP-7	37.5	-52	SM	23.1			22.4							X			
	SP-8	40	-54	CH				27.0										
	ST-5	42	-56	CH	99.5		2.68	30.6	93.5	122.1	1.49	1.8				49	81	32
	ST-6	44.5	-59	CH			2.00	36.7	85.3	116.6								
	ST-7	47	-61	CH			1.34	39.7	81.7	114.1	1.26	2.2						
	ST-8	49.5	-64	CH	99.7		1.50	45.8	73.3	106.9						48	82	34
CB-40	SP-1	0.5	-17	CL	54.5										X			
	ST-1	5	-21	CL	91.6		2.18	24.8	98.2	122.6					X	15	35	20
	ST-2	10	-26	CL			2.85	22.9	97.7	120.1								
	SP-2	15.5	-32	CL				28.0										
	SP-3	20.5	-37	ML	63.0										X			
	ST-3	25	-41	CH	91.5		1.00	42.7	83.3	118.9				X		44	72	28
	ST-4	27	-43	CH		1.1	0.67	33.3	89.0	118.6								
	ST-5	29.5	-46	CH			1.17	40.8	79.2	111.5								
	ST-6	32	-48	CH			1.34	44.1	76.4	110.1								
	ST-7	34.5	-51	CH	99.3		1.34	48.9	73.6	109.6	1.61	3.0			X	48	82	34
	ST-8	37	-53	CH			1.68	47.9	73.0	108.0								
	ST-9	39.5	-56	CH	99.7		1.68	47.1	73.3	107.8	1.62	3.9				49	82	33
	ST-10	42	-58	CH			1.34	45.8	75.9	110.7								
	ST-11	44.5	-61	CH			2.18	43.9	74.4	107.1	1.92	2.7	18					
	ST-12	47	-63	CH			1.34	38.1	79.9	110.3	1.56	1.9						
	ST-13	49.5	-66	CH	96.4		1.34	39.6	81.1	113.2	2.19	3.2				45	80	35

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-41	SP-1	0.5	-18	ML	57.5			23.3							X			
	SP-2	5.5	-23	CL	90.2			26.1								16	34	18
	SP-3	10.5	-28	ML	54.7			26.3							X			
	SP-4	15.5	-33	CL				24.5										
	SP-5	20.5	-38	CL	51.0			26.6							X			
	SP-6	25.5	-43	CL	95.9			39.7								22	41	19
	ST-1	30	-47	CL			0.84	31.6	87.5	115.2	1.25	3.1	12					
	ST-2	32.5	-50	CL			1.00	37.8	82.3	113.4								
	ST-3	35	-52	CH	99.5		1.17	43.5	78.5	112.6	1.59	3.0				47	72	25
	ST-4	37.5	-55	CH			1.00	39.8	79.5	111.1								
	ST-5	40	-57	CH			1.17	41.5	77.1	109.1								
	ST-6	42.5	-60	CH	99.0		1.17	48.3	72.3	107.2	1.40	2.5				49	80	31
	ST-7	45	-62	CH			1.00	45.7	75.1	109.4								
	ST-8	47.5	-65	CH	95.2		1.00	43.5	77.0	110.5	1.70	7.3				42	74	32
	ST-9	50	-67	CH			1.00	43.1	76.6	109.6								
	ST-10	52.5	-70	CH	99.7		1.17	43.9	75.5	108.6	1.77	2.5				53	87	34
CB-42	SP-1	0.5	-21	ML	54.7			25.2							X			
	SP-2	5.5	-26	ML				23.4										
	SP-3	10.5	-31	SM	29.4			27.7							X			
	SP-4	15.5	-36	CL	66.9			27.9								10	30	20
	ST-1	20	-41	CH	95.2		1.34	38.6	80.7	111.9	1.96	3.6				43	68	25
	ST-2	22	-43	CH			1.34	39.6	81.3	113.5								
	ST-3	24.5	-45	CH			1.68	44.5	75.9	109.7								
	ST-4	27	-48	CH	99.0		1.68	42.7	76.9	109.7				X		43	73	30
	ST-5	29.5	-50	CH			1.84	44.1	76.6	110.4								
	ST-6	32	-53	CH			1.68	47.7	73.7	108.9								
	ST-7	34.5	-55	CL	73.7		1.34	27.1	93.6	119.0	1.60	3.2				27	46	19
	SP-5	37.5	-58	SC	43.2			21.5							X			
	SP-6	40	-61	SC				21.4										
	SP-7	42.5	-63	SC	31.8			16.5										
	SP-8	45	-66	SC	30.4			18.2							X			
CB-43	SP-1	0.5	-20	CL	90.6			30.8							X	18	38	20
	SP-2	5.5	-25	SM	45.1			18.7							X			
	SP-3	10.5	-30	SM	19.2			25.3										
	SP-4	15.5	-35	SP-SM	11.4			21.6							X			
	SP-5	20.5	-40	CL				29.4										
	ST-1	25	-44	CL	58.8		1.34	28.3	97.8	125.5	0.88	14.8	10			17	33	16
	ST-2	27.5	-47	CL			1.00	37.3	83.0	114.0								
	SP-6	30.5	-50	SC	35.5			21.3							X			
	ST-3	32.5	-52	CH	84.2		2.00	22.7	105.1	129.0	2.22	4.9				33	55	22
	ST-4	35	-54	CH			3.02	21.6	106.6	129.6								
	ST-5	37.5	-57	CH			3.02	23.3	102.7	126.6								
	ST-6	40	-59	CH	98.9		3.02	25.3	99.6	124.8	3.80	4.3				40	65	25
	ST-7	42.5	-62	CH			3.02	30.3	94.7	123.4								
	ST-8	45	-64	CH			3.02	22.7	103.2	126.6								
	ST-9	47.5	-67	CH	82.8		2.34	20.2	106.9	128.5	3.77	8.8				31	51	20
	ST-10	50	-69	CH			1.84	29.9	92.1	119.6								

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-44	SP-1	0.5	-19	CL	64.0			47.6							X	27	44	17
	SP-2	5.5	-24	SM				28.0										
	SP-3	10.5	-29	SM	29.4			25.1							X			
	SP-4	15.5	-34	SM	35.9			25.2							X			
	SP-5	20.5	-39	CH	73.0			34.8								36	55	19
	ST-1	25	-43	CH			2.18	29.7	92.6	120.1				X				
	ST-2	27	-45	CH			3.02	30.2	93.5	121.7								
	ST-3	29.5	-48	CH	61.2		2.68	30.3	89.9	117.1	1.01	0.6				54	78	24
	ST-4	32	-50	CH			2.18	26.5	93.8	118.7								
	ST-5	34.5	-53	CH			2.00	37.3	83.2	114.2								
	ST-6	37	-55	CH	84.5		2.50	30.4	92.1	120.1	1.83	3.5				35	57	22
	ST-7	39.5	-58	CH			2.68	22.7	101.7	124.8								
	ST-8	42	-60	CH			3.02	24.1	100.8	125.1								
	ST-9	44.5	-63	CH	77.9		3.02	20.9	107.1	129.5	4.47	10.3				37	57	20
	ST-10	47	-65	CH			3.02	17.8	111.2	131.0								
	ST-11	49.5	-68	CH			3.02	21.1	105.1	127.3								
	ST-12	52	-70	CH	98.9		3.02	31.6	92.0	121.1	2.63	1.4				52	79	27
CB-45	SP-1	0.5	-34	CH	86.5			73.5							X	44	76	32
	SP-2	5.5	-39	CH				79.4										
	ST-1	10	-43	CH	84.0	0.2		58.2	67.0	106.0					X			
	ST-2	15	-48	CH		0.2		40.3	81.8	114.8								
	ST-3	17.5	-51	CH	73.5	0.2		42.5	80.4	114.6						29	51	22
	SP-3	20.5	-54	SM				20.1										
	SP-4	23	-56	SM	21.1			26.5								0	0	0
	SP-5	25.5	-59	SM				21.4										
	SP-6	28	-61	SM				18.8										
	SP-7	30.5	-64	SM	16.4			17.4								0	0	0
	SP-8	33	-66	SM				21.1										
	SP-9	35.5	-69	SM				16.8										
	SP-10	38	-71	CH	84.8			22.8								35	57	22
CB-46	SP-1	0.5	-17	CH				90.8							X	43	76	33
	SP-2	5.5	-22	CH														
	SP-3	10.5	-27	CH											X			
	SP-4	15.5	-32	CH				73.9								39	67	28
	SP-5	20.5	-37	CH				70.7										
	SP-6	25.5	-42	CH				56.9										
	SP-7	30.5	-47	CH	75.3			46.3								32	55	23
	SP-8	32.5	-49	CH				47.2										
	SP-9	35.5	-52	CH	66.5			43.1								28	50	22
	SP-10	37.5	-54	CH				39.5										
	SP-11	40.5	-57	SM	43.7			40.1								19	36	17
	SP-12	43	-59	SM				26.6										
	SP-13	45.5	-62	SM	17.5			26.5							X			
	SP-14	48	-64	SM	22.0			29.0										
	SP-15	50.5	-67	SM				24.2										
	SP-16	52.5	-69	CH	87.1			30.2							X			
	ST-1	54	-70	CH	98.6		3.02	29.2	92.5	119.5	1.23	1.2				44	71	27

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-47	SP-1	0.5	-24	CH				73.6							X	41	67	26
	SP-2	5.5	-29	CH														
	SP-3	10.5	-34	CH				81.1							X	51	81	30
	SP-4	15.5	-39	CH				58.6										
	SP-5	20.5	-44	CH	75.1			50.7								31	53	22
	SP-6	22.5	-46	CH				52.7										
	SP-7	25	-48	CH				50.7										
	SP-8	27.5	-51	CL	67.6			46.5								24	48	24
	SP-9	30	-53	CL				41.4										
	SP-10	32.5	-56	CL				42.9										
	SP-11	35	-58	CH	82.2			50.7								34	59	25
	SP-12	37.5	-61	CH				54.6										
	SP-13	40	-63	CH				68.5										
	SP-14	42.5	-66	CH	96.6			71.8								44	88	44
	SP-15	45	-68	CH				68.0										
	ST-1	47	-70	CH	91.2		0.84	73.9	55.4	96.3	0.84	4.2				60	106	46
CB-48	SP-1	0.5	-16	CH	88.5										X			
	SP-2	5.5	-21	CH														
	SP-3	10.5	-26	CH														
	SP-4	15.5	-31	CH	65.2										X			
	SP-5	20.5	-36	CH														
	SP-6	25.5	-41	CH														
	ST-1	30	-45	CH			3.02	23.5	103.6	127.9	1.49	3.4				34	56	22
	SP-2	32.5	-48	CH			2.50											
	SP-3	35	-50	CH			3.02	19.9	108.9	130.6								
	SP-7	38	-53	CH														
	ST-4	40	-55	CH			2.50	26.1	100.2	126.4								
	ST-5	42.5	-58	CH			2.85	27.3	98.6	125.5	1.50	1.0				42	65	23
	ST-6	45	-60	CH			3.02	24.8	98.8	123.3								
	ST-7	47.5	-63	CH			2.85	28.6	96.9	124.6								
	ST-8	50	-65	CH			1.84	34.8	86.1	116.1								
	ST-9	52.5	-68	CH			1.84	38.1	83.5	115.3	0.90	0.8				57	87	30
	ST-10	55	-70	CH			1.68	35.3	86.0	116.4								
CB-49	SP-1	0.5	-18	CH	75.7			48.9							X	29	52	23
	SP-2	5.5	-23	CH				24.4										
	SP-3	10.5	-28	CH	61.1			36.2							X	27	50	23
	ST-1	15	-32	CH			2.35	30.1	95.0	123.6								
	ST-2	20	-37	CH			2.00	24.1	101.5	126.0								
	ST-3	25	-42	CL	76.2		2.00	21.3	107.6	130.5	2.99	15.0				27	47	20
	ST-4	27	-44	CL			2.35	24.3	103.2	128.3								
	ST-5	29.5	-47	CL			3.02	25.1	100.4	125.6								
	ST-6	32	-49	CH	88.0		3.02	27.7	98.1	125.3	2.99	2.7				41	64	23
	ST-7	34.5	-52	CH			2.18	19.6	111.1	132.9								
	ST-8	37	-54	CH			3.02	24.9	100.2	125.1								
	ST-9	39.5	-57	CH	86.7		3.02	18.5	107.4	127.3	2.22	2.2				37	60	23
	ST-10	42	-59	CH			3.02	22.7	105.4	129.3								
	ST-11	44.5	-62	CH			3.02	23.7	103.8	128.4								
	ST-12	47	-64	CH	92.2		3.02	32.6	90.9	120.5	1.56	0.7				34	56	22
	ST-13	49.5	-67	CH			3.02	35.9	85.5	116.2								
	ST-14	52	-69	CH	95.3		2.68	35.9	85.1	115.7						47	74	27

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-50	SP-1	0.5	-16	CH	74.8			74.7								45	70	25
	SP-2	5.5	-21	SC	46.2			43.4							X			
	SP-3	10.5	-26	SP-SM	8.5			24.7										
	SP-4	15.5	-31	SM	13.3			24.0							X			
	ST-1	20	-35	CL	79.3		2.00	26.7	96.2	121.9						23	44	21
	ST-2	25	-40	CH			3.02	17.2	113.9	133.5	5.44	11.1	10					
	ST-3	30	-45	CH			3.02	25.4	99.6	124.9								
	ST-4	32	-47	CH	92.3		3.02	27.8	96.9	123.8	2.03	2.0				41	66	25
	ST-5	34.5	-50	CH			3.02	25.2	99.9	125.1								
	ST-6	37	-52	CH			3.02	22.9	103.9	127.7								
	ST-7	39.5	-55	CH	82.6		3.02	20.7	107.2	129.4	2.97	2.1				32	54	22
	ST-8	42	-57	CH			3.02	19.6	109.2	130.6								
	ST-9	44.5	-60	CH			3.02	22.7	103.1	126.5								
	ST-10	47	-62	CH			3.02	24.5	100.4	125.0								
	ST-11	49.5	-65	SC	48.0		1.00	20.5	101.2	121.9	0.41	2.1				13	30	17
	SP-5	52.5	-68	CH				34.2										
	ST-12	54.5	-70	CH	97.1		2.35	33.2	87.6	116.7						51	82	31
CB-51	SP-1	0.5	-9	SC	49.0			53.7										
	SP-2	5.5	-14	CH	91.5			85.4							X	51	81	30
	SP-3	10.5	-19	CH	89.3			83.6							X			
	SP-4	15.5	-24	CH	83.4			73.2										
	SP-5	20.5	-29	CH	72.2			56.7								27	50	23
	SP-6	25.5	-34	CH				53.6										
	ST-1	30	-38	CH	75.7	0.3		45.4	76.6	111.4						31	54	23
	SP-7	35.5	-44	CH				39.9										
	SP-8	38	-46	SM	20.7			26.5							X			
	SP-9	40.5	-49	SC	45.5			34.7								9	29	20
	SP-10	43	-51	CH				53.7										
	SP-11	45.5	-54	CH	73.3			48.5										
	SP-12	48	-56	CH				85.4										
	SP-13	50.5	-59	SC	45.5			30.4								20	36	16
	SP-14	53	-61	SM	13.8			16.3							X			
	SP-15	55.5	-64	SM				28.6										
	SP-16	58	-66	SM				18.2										
	SP-17	60.5	-69	SM				29.9										
	SP-18	63	-71	SM	17.0			21.7							X			
CB-52	SP-1	0.5	-38	CH	88.0			83.9							X	48	77	29
	SP-2	5.5	-43	CH				81.6										
	SP-3	8	-45	CH				61.9										
	SP-4	10.5	-48	CL	74.4			42.8								29	48	19
	SP-5	13	-50	SM	37.4			22.2							X			
	SP-6	15.5	-53	SM				24.8										
	SP-7	18.5	-56	SM	17.1			23.0							X			
	ST-1	20	-57	CH	96.6		3.02	30.9	91.6	119.9				X		47	73	26
	ST-2	22.5	-60	CH			2.50	29.7	93.3	121.0								
	ST-3	25	-62	CL	95.3		3.02	22.1	104.9	128.1	3.68	6.8				26	46	20
	ST-4	27.5	-65	CL			2.18	18.1	112.1	132.4								
	ST-5	30	-67	CL	91.6		2.50	19.4	109.5	130.7	2.34	12.8				13	30	17
	ST-6	32.5	-70	CL	86.1		2.00	20.7	106.8	128.9	2.37	5.3						

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-53	SP-1	0.5	-19	CH	95.0			95.0							X	49	85	36
	SP-2	5.5	-24	CH	83.7			84.5								54	79	25
	SP-3	10.5	-29	CH				62.1										
	SP-4	15.5	-34	CH	77.6			63.6								51	75	24
	SP-5	20.5	-39	CH				65.5										
	SP-6	25.5	-44	CH				68.4										
	SP-7	27.5	-46	CH	93.9			74.6								44	82	38
	SP-8	30	-48	CH				71.8										
	SP-9	32.5	-51	CH				78.0										
	SP-10	35	-53	CH	99.3			73.7							X	58	94	36
	SP-11	37.5	-56	CH				77.3										
	SP-12	40	-58	CH				78.0										
	SP-13	42.5	-61	CH	93.4			79.6								56	92	36
	SP-14	45	-63	CH				69.3										
	SP-15	47.5	-66	CH				59.0										
	SP-16	50	-68	CH	98.6			82.0								67	110	43
	SP-17	52.5	-71	CH				79.6										
CB-54	SP-1	0.5	-10	CL				85.7										
	SP-2	5.5	-15	CL				68.6										
	SP-3	10.5	-20	CL				56.4										
	SP-4	15.5	-25	SC	42.5			38.3										
	SP-5	20.5	-30	SC														
	SP-6	25.5	-35	SP-SM	11.1			31.2										
	SP-7	30.5	-40	CL	80.3			48.9								24	44	20
	SP-8	35.5	-45	CL														
	SP-9	38	-47	CH				40.3										
	SP-10	40.5	-50	CH	98.3			56.9							X	43	68	25
	ST-1	42.5	-52	CH		0.5	0.17	60.2	62.9	100.8	0.34	7.3						
	ST-2	45	-54	CH		0.4	0.17	59.1	65.1	103.6								
	ST-3	47.5	-57	CH		0.6	0.34	58.0	66.2	104.6	0.50	6.0						
	SP-11	50.5	-60	CH	70.6			57.5								46	74	28
	SP-12	53	-62	SM	12.3			20.0							X			
	SP-13	55.5	-65	SM				18.0										
	ST-4	57.5	-67	CL	57.3		1.00	20.6	106.6	128.6	1.02	12.5				14	30	16
	ST-5	60	-69	CL			1.34	20.5	106.8	128.7								
CB-55	SP-1	0.5	-39	CH	82.4			72.9										
	SP-2	5.5	-44	CH	95.0			78.5							X	48	74	26
	SP-3	10.5	-49	CH				75.4										
	SP-4	13	-51	CH	98.6			72.8								58	82	24
	SP-5	15.5	-54	CH				74.2										
	SP-6	18	-56	CH	80.3			65.7								41	64	23
	SP-7	20	-58	CH	56.6			45.1							X	32	53	21
	SP-8	22.5	-61	SM	12.7			24.4							X			
	SP-9	25	-63	SP	4.9			21.8										
	SP-10	27.5	-66	SP-SM	5.4			23.9							X			
	SP-11	30	-68	SP	3.7			21.1										
	SP-12	32.5	-71	SP	4.4			22.5							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-56	SP-1	0.5	-17	CH	63.0			54.0										
	SP-2	5.5	-22	CH	79.7			52.3							X	35	57	22
	SP-3	10.5	-27	CH				72.8										
	SP-4	15.5	-32	CH				64.0										
	SP-5	20.5	-37	CH	91.4			45.3							X	42	68	26
	ST-1	25	-41	CH		0.2	0.34	61.4	62.8	101.4								
	ST-2	30	-46	CH		0.5	0.34	63.0	63.2	103.0								
	ST-3	32.5	-49	CH	97.2	0.5	0.34	60.3	63.0	101.0	0.48	2.7				53	89	36
	ST-4	35	-51	CH		0.4	0.34	57.9	64.6	102.0								
	ST-5	37.5	-54	CH		0.4	0.34	64.4	61.2	100.6								
	ST-6	40	-56	CH	95.4		0.67	62.4	63.9	103.8	0.52	3.7				56	83	27
	ST-7	42.5	-59	CH		0.3	0.50	42.4	77.7	110.6								
	ST-8	45	-61	CH		0.5	0.50	31.7	88.0	115.9								
	ST-9	47.5	-64	SC	46.9	0.2	0.50	20.6	107.0	129.0	0.88	15.0				20	36	16
	SP-6	50.5	-67	SM	12.2			19.1							X			
	SP-7	52.5	-69	SM				20.0										
	SP-8	55.5	-72	SM	15.8			19.8							X			
CB-57	SP-1	0.5	-18	CL	58.0			64.1										
	SP-2	5.5	-23	SM	12.4			22.8							X			
	SP-3	10.5	-28	CH				50.0										
	SP-4	15.5	-33	CH	86.3			47.9							X	30	53	23
	SP-5	20.5	-38	CH				57.2										
	SP-6	25.5	-43	CH	92.8			58.5										
	SP-7	27.5	-45	CH	83.0			46.9								36	60	24
	SP-8	30	-47	CH				41.0										
	SP-9	32.5	-50	SC	31.3			30.2								13	28	15
	SP-10	35	-52	SC	24.3			22.2							X			
	SP-11	37.5	-55	CL				38.6										
	SP-12	40	-57	CL	55.7			29.6								18	35	17
	SP-13	42.5	-60	CL				29.3										
	SP-14	45	-62	CL	82.1			22.4										
	SP-15	47.5	-65	SM	21.7			20.9							X			
	SP-16	50	-67	SP-SM	7.1			20.0										
	SP-17	52.5	-70	SC	48.0			30.7										
CB-58	SP-1	0.5	-14	SC	32.8			38.4										
	SP-2	5	-18	SC	44.3			30.7							X			
	SP-3	10	-23	SM	13.7			24.8										
	SP-4	15	-28	SM				23.4										
	SP-5	20	-33	SP-SM	10.6			22.6										
	SP-6	25	-38	SM	30.0			21.8							X			
	SP-7	30	-43	SM				20.4										
	SP-8	32.5	-46	SM	26.2			25.4										
	SP-9	35	-48	SM				21.6										
	SP-10	37.5	-51	SM				27.3										
	SP-11	40	-53	SM	20.6			20.7							X			
	SP-12	42.5	-56	SM				20.8										
	SP-13	45	-58	SM				19.2										
	SP-14	47.5	-61	CH	88.4			26.4								41	64	23
	ST-1	50	-63	CH			3.00	22.1	102.3	124.9								
	ST-2	52.5	-66	CH	80.8		3.00	21.8	104.5	127.3	4.32	11.6	20			35	56	21
	SP-15	55	-68	SM	12.4			20.4							X			
	ST-3	57.5	-71	CH	77.2		2.68	19.3	107.7	128.5	1.64	1.2				41	64	23

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-59	SP-1	0.5	-21	CH	70.5			66.6							X	35	56	21
	SP-2	5.5	-26	CH				24.6										
	SP-3	10.5	-31	CH				10.3										
	SP-4	15.5	-36	CH	82.3			22.3							X	39	61	22
	ST-1	20	-40	CH	93.7		2.00	30.3	92.9	121.0	1.21	1.1	8			48	74	26
	ST-2	25	-45	CH	80.5		2.18	27.2	95.1	121.0	1.93	2.6				47	71	24
	ST-3	27.5	-48	CL	59.9		1.84	19.0	108.4	129.0				X		14	31	17
	ST-4	30	-50	CL	67.5		1.84	15.9	116.3	134.8	2.27	3.6				16	32	16
	SP-5	33	-53	SM	18.3			22.0							X			
	SP-6	35.5	-56	SM				11.0										
	SP-7	38	-58	SM	31.0			20.3							X			
	SP-8	40.5	-61	CL	76.1			15.4								16	32	16
	SP-9	43	-63	SP-SM	9.7			23.1							X			
	SP-10	45.5	-66	CL				13.6										
	ST-5	47.5	-68	CL	79.3		3.00	18.6	110.3	130.8						23	41	18
	ST-6	50	-70	CL			3.00	10.6	112.4	124.3								
CB-60	SP-1	0.5	-23	CH	77.3			70.1							X	32	56	24
	SP-2	5.5	-28	CH				15.7										
	ST-1	10	-32	CH	83.2		2.18	34.3	92.1	123.7	2.43	6.8	4		X	47	73	26
	ST-2	15	-37	CH			3.00	20.8	106.5	128.7	1.47	1.2						
	ST-3	20	-42	CH			3.00	16.3	104.3	121.3								
	ST-4	22	-44	CH	85.2		2.68	27.1	97.3	123.7				X		42	67	25
	ST-5	24.5	-47	CH			2.85	20.0	104.0	124.8								
	ST-6	27	-49	CH			2.85	11.2	115.0	127.9	0.92	2.0						
	ST-7	29.5	-52	CL	74.7		3.00	19.1	110.7	131.8						22	41	19
	ST-8	32	-54	CL			3.00	12.4	114.7	128.9								
	SP-3	34.5	-57	SM	15.5			23.5							X			
	ST-9	37.5	-60	CL	79.9		2.35	19.8	106.6	127.7						21	39	18
	ST-10	39.5	-62	CL			1.68	12.2	114.6	128.6	0.78	2.6						
	ST-11	42	-64	CL			2.85	13.5	107.0	121.4								
	ST-12	44.5	-67	CH	91.6		3.00	27.1	96.8	123.0	2.56	2.1				51	79	28
	SP-4	47.5	-70	CL	94.6			25.4								24	45	21
CB-61	SP-1	0.5	-25	CL	81.6			64.6										
	SP-2	5.5	-30	CL				35.3										
	SP-3	10.5	-35	SC	41.0			32.5								18	34	16
	SP-4	15.5	-40	SC				27.2										
	SP-5	20.5	-45	SC	48.0			26.7							X	10	25	15
	SP-6	23	-47	CH				28.4										
	ST-1	25	-49	CH			1.84	29.4	93.8	121.4	0.40	0.5						
	ST-2	27.5	-52	CH	69.8		3.00	50.1	85.9	128.9								
	ST-3	30	-54	CL	76.8		3.00	21.5	105.0	127.6	1.64	3.4				19	34	15
	SP-7	33	-57	CH	92.7			25.1										
	SP-8	35.5	-60	CH	85.0			25.1										
	ST-4	37.5	-62	CL	71.3		2.35	18.6	107.4	127.4	3.13	7.5				22	38	16
	ST-5	40	-64	CH	92.8		2.68	23.3	99.8	123.1				X				
	ST-6	42.5	-67	CH			2.51	19.9	107.1	128.4								
	ST-7	45	-69	CH	97.6		3.00	24.4	100.5	125.0	2.03	1.5				34	53	19

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-62	SP-1	0.5	-17	CH				32.7										
	SP-2	5.5	-22	CH	74.4			70.2										
	SP-3	10.5	-27	CL	63.2			50.0							X	25	44	19
	SP-4	15.5	-32	SM	15.1			25.9										
	SP-5	20.5	-37	SM	18.0			25.2							X			
	SP-6	25.5	-42	SM	20.3			25.5							X			
	SP-7	30.5	-47	SM	19.9			24.3							X			
	SP-8	33	-49	CH	80.5			27.8								45	67	22
	ST-1	35	-51	CH			3.00	24.0	98.9	122.6								
	ST-2	37.5	-54	CH	81.3		2.01	28.4	95.9	123.1				X		37	58	21
	ST-3	40	-56	CH	86.4		2.85	23.7	99.3	122.8	2.14	2.0						
	ST-4	42.5	-59	CH			3.00	20.0	106.9	128.3								
	ST-5	45	-61	CL	77.9		2.35	26.1	99.6	125.6	2.42	12.8	18			28	45	17
	ST-6	47.5	-64	CL	51.3		2.51	19.6	108.2	129.4	1.17	4.2						
	ST-7	50	-66	CH			3.00	22.5	102.7	125.8								
	ST-8	52.5	-69	CH	99.3		3.00	22.7	101.6	124.7	2.33	2.2						
CB-63	SP-1	0	-33	CL				31.2							X			
	SP-2	5	-38	CL				26.7							X			
	SP-3	10	-43	CL				25.0							X	14	30	16
	SP-4	12.5	-46	CL	82.3			22.5							X	18	38	20
	ST-1	15	-48	CH			2.18	31.4	92.6	121.7	1.79	3.2						
	ST-2	17.5	-51	CH	89.8		2.18	28.4	94.0	120.7								
	ST-3	20	-53	CH	90.6		2.35	27.2	96.8	123.1	0.83	0.4	8			46	70	24
	ST-4	22.5	-56	CH			2.35	31.3	89.4	117.4								
	ST-5	25	-58	CL	81.8		2.35	21.3	110.3	133.8				X		26	45	19
	ST-6	27.5	-61	SC	27.3		2.01											
	ST-7	30	-63	CL			3.00	17.3	115.1	135.0								
	ST-8	32.5	-66	CL	74.1		3.00	18.3	110.2	130.4	3.87	4.0				31	48	17
	ST-9	35	-68	CL	73.0		3.00	19.5	107.3	128.2	1.44	1.7						
CB-64	SP-1	0.5	-15	CH				70.7										
	SP-2	5.5	-20	SM	26.5			33.8							X			
	SP-3	10.5	-25	CH	88.9			50.5							X	31	53	22
	SP-4	15.5	-30	CH				59.5										
	SP-5	20.5	-35	CH	96.0			60.2										
	SP-6	25.5	-40	CH	91.2			59.5							X	48	73	25
	SP-7	30.5	-45	CH				48.6										
	SP-8	33	-47	CH	89.7			58.1										
	SP-9	35.5	-50	CH	93.3			44.9							X	31	53	22
	SP-10	38	-52	CH				41.5										
	SP-11	40.5	-55	CH				41.2										
	SP-12	43	-57	CH	78.8			47.4										
	SP-13	45.5	-60	CH				49.9										
	SP-14	48	-62	CH	97.2			61.9										
	SP-15	50.5	-65	CH	98.1			58.5								57	80	23
	SP-16	53	-67	CH				55.7										
	SP-17	55.5	-70	CH	79.5			38.0								43	68	25

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-65	SP-1	0.5	-6	SM				31.9										
	SP-2	4.5	-10	SM	22.7			32.5							X			
	SP-3	9.5	-15	SM	19.0			28.8							X			
	SP-4	14.5	-20	CH	87.8			51.3							X			
	SP-5	19.5	-25	CH				69.4										
	SP-6	24.5	-30	CH	87.1			70.1										
	ST-1	29	-34	CH	88.9	0.26		65.2	61.7	101.9				X		40	75	35
	ST-2	34	-39	CH		0.34		70.3	57.7	98.3								
	ST-3	39	-44	CH	95.7	0.36		69.1	59.1	99.9	0.28	11.0						
	ST-4	41.5	-47	CH	96.6		0.67	67.5	59.3	99.3	0.27	5.6	16					
	ST-5	44	-49	CH		0.34												
	ST-6	46.5	-52	CH	98.9	0.26		62.7	61.6	100.2	0.33	6.5				66	95	29
	ST-7	49	-54	CH		0.22		62.9	60.8	99.0								
	ST-8	51.5	-57	CH		0.18		66.7	59.7	99.5								
	ST-9	54	-59	CH	95.9		0.67	61.4	62.6	101.0	0.50	5.8				55	82	27
	ST-10	56.5	-62	CH			0.83	35.9	85.7	116.5								
	ST-11	59	-64	CH			0.67	55.5	67.2	104.5								
	ST-12	61.5	-67	CH			0.67	38.1	80.1	110.6								
	ST-13	64	-69	CH	69.8		0.67	37.9	85.3	117.6	0.30	8.3				42	67	25
CB-66	SP-1	0.5	-25	CH				103.3										
	SP-2	5.5	-30	CH	98.3			118.3										
	SP-3	10.5	-35	CH	89.5			143.6										
	SP-4	15.5	-40	CH	96.0			115.4								73	116	43
	SP-5	20.5	-45	CH				110.1										
	SP-6	23	-47	CL	51.3			34.4							X			
	SP-7	25.5	-50	CL				30.5										
	SP-8	28	-52	SM	48.9			18.7								0	0	0
	SP-9	30.5	-55	SM				17.8										
	ST-1	32.5	-57	CL			1.50	7.7	121.8	131.2	1.80	14.8	13					
	SP-10	35.5	-60	SP-SM				23.8										
	SP-11	38	-62	SP-SM	7.4			21.9										
	SP-12	40.5	-65	SP-SM	5.4			19.6							X			
	SP-13	43	-67	SP-SM				21.4										
	SP-14	45.5	-70	SM	41.7			23.7							X			
	ST-2	47.5	-72	SM	47.1		1.00	19.6	107.4	128.5						0	0	0
CB-67	SP-1	0.5	-9	SM				22.1										
	SP-2	5.5	-14	SM	28.2			41.5										
	SP-3	10.5	-19	SM				31.6										
	SP-4	15.5	-24	SM	28.5			28.4										
	ST-1	20	-28	CL		0.32		68.2	58.5	98.4	0.13	14.5						
	ST-2	25	-33	CL	79.4		0.50	42.7	76.7	109.5	0.15	7.3	10			19	42	23
	ST-3	30	-38	CL			0.50	53.6	70.7	108.6								
	ST-4	35	-43	CL			0.50	40.9	78.3	110.3				X				
	ST-5	37.5	-46	SC	40.5	0.16		24.7								9	25	16
	ST-6	40	-48	SC		0.02		27.2										
	SP-5	43	-51	SC	28.8			23.9								9	25	16
	SP-6	45.5	-54	SM	24.2			21.0							X			
	SP-7	48	-56	SM				23.0										
	SP-8	50.5	-59	SM				21.6										
	SP-9	53	-61	SP	3.7			19.1										
	SP-10	55.5	-64	SP				18.1										
	SP-11	58	-66	SP-SM				15.1										
	SP-12	60.5	-69	SP-SM	6.7			16.8										
	SP-13	63	-71	SP-SM				16.7										

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-68	SP-1	0.5	-9	SC	49.5			50.4							X			
	SP-2	6.5	-15	SC	36.6			44.5										
	SP-3	11.5	-20	CH	54.6			46.5								39	64	25
	SP-4	16.5	-25	CH				60.6										
	ST-1	21	-29	CH		0.28		63.6	62.3	101.9				X				
	ST-2	26	-34	CH	79.7	0.18		42.9	77.3	110.5	0.17	11.3				25	51	26
	ST-3	31	-39	CH		0.26		39.2	77.7	108.2								
	ST-4	36	-44	CH		0.22		36.3										
	ST-5	38	-46	SM	19.6	0.32		23.2								0	0	0
	SP-5	41	-49	SM				19.1										
	SP-6	43.5	-52	SM	23.7			19.9							X			
	SP-7	46	-54	SM				20.6										
	SP-8	48.5	-57	SM	18.8			20.4										
	SP-9	51	-59	SP-SM	8.6			20.9							X			
	SP-10	53.5	-62	SP-SM	6.8			17.3										
	SP-11	56	-64	SP-SM	8.3			11.5							X			
	ST-6	58	-66	ML	54.6		1.50	19.9	103.5	124.1						0	0	0
	ST-7	60.5	-69	CH			3.00	27.4	96.0	122.3								
CB-69	SP-1	0.5	-7	SC	37.6			44.7							X	18	36	18
	SP-2	5.5	-12	SC	48.9			39.3										
	SP-3	10.5	-17	CH	86.3			65.7										
	SP-4	15.5	-22	CH				52.8										
	ST-1	20	-26	CH	68.6		3.00	20.8	106.6	128.8	2.57	14.8	8			35	56	21
	ST-2	25	-31	CH			3.00	13.7	123.2	140.1	0.83	6.3						
	SP-5	30.5	-37	SM	18.7			22.3							X			
	ST-3	35	-41	CH	72.7		3.00	24.0	101.8	126.2				X		41	63	22
	ST-4	40	-46	CH			3.00	17.7	110.0	129.5	3.89	5.8						
	SP-6	43	-49	SP-SM	11.8			22.5							X			
	SP-7	45.5	-52	SP-SM				24.3										
	SP-8	48	-54	SM	12.5			21.5							X			
	SP-9	50.5	-57	SP-SM				17.2										
	SP-10	53	-59	SP-SM	11.5			17.9							X			
	ST-5	55	-61	CH	98.9		2.84	30.0	94.5	122.9	1.49	1.9				38	62	24
	ST-6	57.5	-64	CH			3.00	26.4	98.5	124.5								
	ST-7	60	-66	CH			3.00	25.7	96.5	121.3								
	ST-8	62.5	-69	CH	93.3		3.00	25.5	100.9	126.6	2.34	2.2						
	ST-9	65	-71	CH			3.00	11.6	114.8	128.1								

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-70	SP-1	0.5	-7	CH	75.2			71.6							X	30	56	26
	SP-2	5.5	-12	CH	67.8			31.8										
	ST-1	10	-16	CH			3.00	27.2	90.6	115.2	0.52	12.0						
	ST-2	15	-21	CH	79.7		3.00	29.5	95.0	123.0	2.74	3.5				44	69	25
	ST-3	20	-26	CH			3.00	21.6	107.1	130.2	3.47	12.1	8					
	ST-4	25	-31	CH			3.00	28.6	95.0	122.2	2.09	2.5						
	ST-5	30	-36	CH	97.7		2.50	38.3	83.3	115.2				X		58	94	36
	ST-6	35	-41	CH			2.68	31.1	92.2	120.9								
	ST-7	40	-46	CH			2.84	31.7	90.7	119.5	1.37	1.4						
	ST-8	42.5	-49	CH	97.7		2.50	24.3	101.3	125.9						37	61	24
	SP-3	45.5	-52	SM	18.4			17.7							X			
	SP-4	48	-54	SM				21.7										
	SP-5	50.5	-57	SP-SM	8.9			18.4										
	SP-6	53	-59	SP-SM	6.3			20.3							X			
	SP-7	55.5	-62	SP-SM				17.2										
	SP-8	58	-64	SP-SM	10.8			19.5							X			
	SP-9	60.5	-67	SM	14.7			21.7										
	SP-10	63	-69	SM				18.7										
	SP-11	65.5	-72	SM	17.3			20.4							X			
CB-71	SP-1	0.5	-8	CH	70.5			98.9							X	29	51	22
	SP-2	7.5	-15	CL	55.1			55.4										
	ST-1	12	-19	CL	56.6		2.17	23.0	99.0	121.8	0.79	14.8	5			13	29	16
	ST-2	17	-24	CH			3.00	24.8	102.7	128.2	2.67	3.3						
	ST-3	22	-29	CH			2.34	35.8	86.9	118.0	1.02	1.6						
	ST-4	27	-34	CH	97.8		2.51	34.6	87.1	117.2						36	58	22
	ST-5	32	-39	CH			2.51	36.6	85.6	116.9	1.05	2.0						
	ST-6	37	-44	SC	48.4		2.68	16.7	115.5	134.8						8	24	16
	ST-7	39.5	-47	CL			1.50	20.5	108.6	130.9	0.48	2.8						
	SP-3	42.5	-50	SP-SM	10.5			31.0							X			
	SP-4	45	-52	SP-SM				26.1										
	SP-5	47.5	-55	SP-SM	7.9			20.7										
	SP-6	50	-57	SM	18.7			20.2							X			
	SP-7	52.5	-60	SM				18.9										
	SP-8	55	-62	SM	17.9			15.8										
	SP-9	57.5	-65	CL	60.7			21.7							X			
	SP-10	60	-67	SP-SM				19.5										
	SP-11	62.5	-70	SP-SM	6.2			20.5							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-72	SP-1	0.5	-10	CH	93.0			28.8							X	38	65	27
	ST-1	5	-14	CH	94.1		2.50	30.4	94.0	122.6	1.83	2.9	2					
	ST-2	10	-19	CH			3.00	22.4	102.9	125.9	1.80	2.5						
	ST-3	15	-24	CH	84.2		2.17	28.0	96.8	123.9						46	70	24
	ST-4	20	-29	CH			3.00	18.6	110.1	130.6	3.20	4.8						
	ST-5	25	-34	CH			3.00	26.6	95.7	121.2								
	ST-6	30	-39	CH	73.9		3.00	24.9	98.0	122.4	2.65	5.5				41	65	24
	ST-7	35	-44	SC			1.34	19.8	106.3	127.3								
	ST-8	37.5	-47	SC	46.9		2.34	17.5	112.0	131.6	1.16	3.5				10	27	17
	SP-2	40.5	-50	SP-SM	11.7			24.0							X			
	SP-3	43	-52	SP-SM	6.7			21.1										
	SP-4	45.5	-55	SP-SM				22.6										
	SP-5	48	-57	SM	16.8			17.8							X			
	SP-6	50.5	-60	SM				21.6										
	SP-7	53	-62	SP-SM	9.6			18.8										
	SP-8	55.5	-65	SM	15.1			23.0							X			
	SP-9	58	-67	SM				20.5										
	SP-10	60.5	-70	SM	15.1			21.2							X			
CB-73	SP-1	0.5	-6	CL	67.9			51.1							X	17	34	17
	SP-2	2.5	-8	CL				46.9										
	ST-1	9	-14	CH	61.8		1.00	32.9	88.4	117.5						42	64	22
	ST-2	14	-19	CL	64.5		2.50	19.1	107.9	128.5				X		22	38	16
	ST-3	19	-24	CL			3.00	18.3	109.4	129.4	0.57	2.8						
	ST-4	24	-29	CL	76.3		3.00	25.1	100.0	125.1	1.39	1.3	10					
	ST-5	29	-34	CL			3.00	24.2	99.0	123.0								
	ST-6	34	-39	CL	62.9		2.17	18.9	108.1	128.5	0.77	5.3				20	35	15
	ST-7	39	-44	CL			3.00	22.4	106.2	130.0	1.33	2.2						
	ST-8	41.5	-47	CL			2.68	24.2	101.5	126.1								
	ST-9	44	-49	CL			3.00	14.1	116.7	133.2								
	ST-10	46.5	-52	CL			3.00	17.1	111.1	130.1	0.86	2.4						
	SP-3	49.5	-55	SM	51.9			19.3							X			
	SP-4	52	-57	SM				19.2										
	SP-5	54.5	-60	SM	15.8			20.4										
	SP-6	57	-62	SM	17.6			19.5							X			
	SP-7	59.5	-65	SM	13.8			18.4										
	SP-8	62	-67	SP-SM	11.4			19.8							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
CB-74	SP-1	0.5	-41	CH	90.3			50.9								42	70	28
	ST-1	5	-45	CH	98.8		2.84	20.0	107.3	128.8				X	X			
	ST-2	7.5	-48	CL	74.7		3.00	19.9	106.0	127.1	1.66	2.9				17	38	21
	ST-3	10	-50	CL	85.7		2.84	21.2	103.8	125.8	2.87	2.7						
	SP-2	13	-53	CL	67.9			24.8							X			
	ST-4	15	-55	CL	59.5		2.17	21.8	103.3	125.8	0.92	3.3				13	31	18
	SP-3	18	-58	CL	78.7			24.5							X			
	ST-5	20	-60	CL	87.1		1.67	23.8	99.9	123.7	2.55	3.3	10			15	34	19
	ST-6	22.5	-63	CL			1.67	26.0	93.5	117.8								
	SP-4	25.5	-66	SP-SM	9.4			21.8										
	SP-5	28	-68	SM	10.9			21.2							X			
	SP-6	30.5	-71	SM	18.6			20.1										
CB-75	SP-1	0.5	-43	CH	91.8			27.9							X	38	62	24
	ST-1	2.5	-45	CH	94.6		2.84	26.7	96.6	122.4	3.62	4.1	2		X			
	ST-2	5	-47	CH	94.3		2.84	26.4	96.4	121.8	2.23	3.9				45	68	23
	ST-3	7.5	-50	CH			3.00	22.5	104.8	128.4				X				
	ST-4	10	-52	CH	85.0		3.00	20.6	106.3	128.2	3.74	14.5				31	51	20
	ST-5	12.5	-55	CH	89.9		3.00	20.6	106.0	127.8	4.08	10.3				30	52	22
	SP-2	15.5	-58	SM	16.5			23.3							X			
	SP-3	18	-60	SM	24.5			24.7										
	SP-4	20.5	-63	SM	17.3			21.6							X			
	SP-5	23	-65	SM	11.3			18.9										
	SP-6	25.5	-68	SM	12.1			18.0							X			
	SP-7	28	-70	SM	13.5			17.5										
CB-76	SP-1	0.5	-44	CH	96.3			50.5							X	43	77	34
	ST-1	2.5	-46	CH	97.7		2.34	28.4	93.5	120.1	2.18	2.6	2			51	77	26
	ST-2	5	-48	CH	97.4		2.34	27.9	94.5	120.9	2.88	6.8				42	66	24
	ST-3	7.5	-51	CH	96.6		3.00	27.3	97.2	123.7				X		43	67	24
	ST-4	10	-53	CL			0.83	23.9	97.1	120.3								
	SP-2	13	-56	CL	56.1			19.2							X			
	SP-3	15.5	-59	SM	19.4			23.3										
	SP-4	18	-61	SM	21.9			21.5							X			
	SP-5	20.5	-64	SP-SM	10.1			21.5										
	SP-6	23	-66	SM	26.1			20.5							X			
	SP-7	25.5	-69	SM	16.9			20.3										
	SP-8	28	-71	SM	20.0			23.8							X			
VB-01	J-1	0	-13	SP-SM	8.3			21.9							X			
	J-2	1	-14	SP-SM	13.1			19.6							X			
VB-02	J-1	0	-13	SP-SM	9.2			18.7							X			
	J-2	1	-14	SP-SM				16.8										
	J-3	2	-15	SP-SM	6.3			20.4							X			
	J-4	3	-16	SP-SM				20.5										
	J-5	4	-17	SM				20.4										
	J-6	5	-18	SM	20.9			19.8							X			
VB-03	T-1	0	-13	SC	33.9	1.2		32.3							X			
	T-2	1	-14	SC		0.8		27.1										
	J-3	2	-15	SP-SM	7.6			22.7										
	J-4	3	-16	SP-SM	15.8			20.6							X			

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-04	T-1	0	-12	SC	26.6	0.4		26.8							X			
	T-2	1	-13	SC		0.4		27.0										
	T-3	2	-14	SC	6.8	1.2		22.4										
	T-4	3	-15	SC	15.4	0.6		24.8							X			
	J-5	4	-16	SM				23.6										
	J-6	5	-17	SM	16.2			22.1										
	J-7	6	-18	SM	22.1			20.4							X			
VB-05	J-1	0	-12	SC	28.0			33.1							X	7	27	20
	J-2	1	-13	SC				33.1										
	T-3	2	-14	SP-SM	10.3	0.4		23.4							X			
	J-4	3	-15	SP-SM	8.7			22.3										
	J-5	4	-16	SP-SM				19.5										
	J-6	5	-17	SP-SM	8.3			23.6							X			
	J-7	6	-18	SP-SM				21.5										
	J-8	7	-19	CL	72.6			42.9								31	48	17
	J-9	8	-20	SP-SM				24.1										
	J-10	9	-21	SP-SM	7.1			21.8							X			
VB-06	T-1	0	-12	SC	25.3	0.9		28.7							X			
	T-2	1	-13	SP-SM	6.7	0.8		23.0										
	J-3	2	-14	SP-SM	5.6			20.9							X			
	J-4	3	-15	SP	4.4			21.8										
	J-5	4	-16	SP	3.3			21.3							X			
VB-07	T-1	0	-12	SC	26.1	0.8		31.9							X			
	T-2	1	-13	SC	24.7	0.4		30.3										
	T-3	2	-14	SP-SM	57.3	0.4		37.3							X			
	J-4	3	-15	SP-SM	6.4			221.3										
	J-5	4	-16	SP-SM				20.9										
	J-6	5	-17	SP-SM	3.1			22.8							X			
VB-08	T-1	0	-12	SC	33.7	0.4		35.0							X			
	T-2	1	-13	SC	20.2	0.4		28.2										
	J-3	2	-14	SP-SM	11.4			21.2							X			
	J-4	3	-15	SC	39.6			26.1										
	J-5	4	-16	SC	56.4			26.9							X			
VB-09	T-1	0	-12	SC	45.8	0.6		44.6							X			
	T-2	1	-13	SC	31.8	0.8		34.9										
	T-3	2	-14	SP-SM	9.6	0.8		25.3							X			
	J-4	3	-15	SP-SM	8.7			20.8							X			
VB-10	T-1	0	-12	SC	35.0	0.2		37.7							X			
	T-2	1	-13	SC	21.0	0.4		20.7										
	T-3	2	-14	SM	27.3	0.4		23.5										
	J-4	3	-15	SM	26.1			22.4							X			
VB-11	T-1	0	-12	SC	49.5	0.2		55.3							X			
	T-2	1	-13	SC	35.0	0.6		28.7										
	T-3	2	-14	SC	27.1	0.6		27.5										
	T-4	3	-15	SC	24.1	0.6		27.4							X			
	T-5	4	-16	SC	23.1	0.4		25.8										
	T-6	5	-17	SC	25.3	0.4		25.7										
	T-7	6	-18	SC	19.0	0.2		25.2							X			
VB-12	J-1	0	-12	SP-SM	6.8			25.2							X			
	J-2	1	-13	SP-SM	8.4			21.0										
	J-3	2	-14	SP-SM	11.2			21.0							X			
	T-4	3	-15	CL	80.2	0.7		24.5										
	T-5	4	-16	SC	74.4	0.6		37.5							X			
	T-6	5	-17	CL	43.6	0.6		43.1										

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-13	T-1	0	-12	CL	65.1	0.2		47.3							X			
	T-2	1	-13	SC	15.2	0.3		28.5										
	J-3	2	-14	SP-SM	5.1			20.8							X			
	J-4	3	-15	SP-SM	10.0			20.4										
VB-14	T-1	0	-13	CH	74.2	0.8		64.5							X	36	52	16
	T-2	1	-14	CH	66.8	0.8		71.3										
	T-3	2	-15	CH		0.9		60.5										
	T-4	3	-16	CH	69.5	0.8		57.7										
	T-5	4	-17	CH		0.9		43.3										
	T-6	5	-18	CH		1.2		36.0										
	T-7	6	-19	CH	81.2	0.8		55.6								37	54	17
VB-15	T-1	0	-11	CH	67.9	0.8		68.4							X	45	65	20
	T-2	1	-12	CH	74.6	0.6		78.0										
	T-3	2	-13	CH		0.4		28.6										
	T-4	3	-14	SC	21.9	0.4		24.3								22	42	20
VB-16	T-1	0	-11	CH	56.4	0.6		69.5							X	67	89	22
	T-2	1	-12	CH	61.6	0.6		68.9										
	T-3	2	-13	CH	58.8	0.6		61.2										
	T-4	3	-14	SC	20.5	0.6		26.6								29	45	16
	T-5	4	-15	SC	13.8	0.9		27.1							X			
	J-6	5	-16	SP-SM	9.7			22.9										
	J-7	6	-17	SP-SM	9.2			22.4							X			
	J-8	7	-18	SP-SM	12.0			22.0										
	J-9	8	-19	SP-SM	8.8			23.0							X			
VB-17	T-1	0	-10	SC	34.8	0.6		47.0								55	80	25
	T-2	1	-11	SC		0.8		31.0										
	T-3	2	-12	SM	42.8	0.8		28.9										
	T-4	3	-13	ML	66.6	0.6		27.3							X			
	J-5	4	-14	ML	68.3			22.0										
	J-6	5	-15	ML	72.8			23.4							X			
VB-18	T-1	0	-11	CH	79.1	0.4		79.5								55	77	22
	T-2	1	-12	SC	44.2	0.6		49.3										
	T-3	2	-13	SM	17.4	0.4		27.6							X			
	J-4	3	-14	SM	60.4			19.4										
	J-5	4	-15	SM	14.0			22.7							X			
VB-19	T-1	0	-11	CL	82.9	0.4		115.3							X			
	T-2	1	-12	SC	47.8	0.4		49.7								21	44	23
	T-3	2	-13	SC	40.0	1		37.9										
	T-4	3	-14	SC		0.4		51.8										
	T-5	4	-15	SC		0.4		26.9										
	T-6	5	-16	SC	26.2	0.2		27.9										
	T-7	6	-17	SC	30.4	0.4		36.8								17	30	13
	J-8	7	-18	SC	37.0			39.0							X			
VB-20	T-1	0	-11	CH	90.5	0.5		86.6							X	59	79	20
	T-2	1	-12	CH	63.7	0.5		56.3										
	T-3	2	-13	CH		0.9		53.9										
	T-4	3	-14	CH	66.7	0.7		50.5										
	T-5	4	-15	CH		0.5		49.0										
	T-6	5	-16	CH		0.5		53.5										
	T-7	6	-17	SC	47.0	0.7		43.6										
	T-8	7	-18	SC		0.9		45.3										
	T-9	8	-19	CL	53.1	0.9		48.3										
	T-10	9	-20	SC		0.8		50.8										
	T-11	10	-21	SC	44.1	0.8		37.7							X	27	41	14
VB-21	T-1	0	-9	SC	48.2	0.1		62.2							X	16	35	19
	J-2	1	-10	SC	30.0			53.4										
	J-3	2	-11	SC	27.2			54.4										
	J-4	3	-12	GM	25.2			43.9							X	6	32	26

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-22	T-1	0	-8	SC	40.1	0.5		47.5							X	20	45	25
	T-2	1	-9	CL		0.5		39.1										
	T-3	2	-10	CL	76.2	0.6		32.7										
	T-4	3	-11	CL		0.9		31.8										
	T-5	4	-12	SC-SM	33.3	0.5		29.2								7	27	20
	T-6	5	-13	CL		0.8		32.1										
	T-7	6	-14	CL	50.6	0.6		36.4										
	T-8	7	-15	CL		0.9		40.6										
	T-9	8	-16	CL		0.8		51.5										
	J-10	9	-17	CH	60.4			51.6							X	37	61	24
VB-23	T-1	0	-9	SC	46.0	0.4		54.0								61	84	23
	T-2	1	-10	SC		0.4		52.4										
	J-3	2	-11	SC	47.9			46.3										
	T-4	2.5	-12	CH	86.2	0.8		45.6										
	T-5	3	-12	CH	51.4	0.6		49.8								39	58	19
	T-6	4	-13	CH		0.6		43.7										
	T-7	5	-14	SC-SM	29.7	0.4		29.4										
	T-8	6	-15	SC-SM		0.6		29.6										
	T-9	7	-16	SC-SM	37.9	0.4		31.6								6	27	21
VB-24	T-1	0	-10	CH	57.2	0.9		49.8								40	64	24
	T-2	1	-11	CH		0.9		56.0										
	J-3	2	-12	CH	59.5			57.0										
	T-4	3	-13	CH		0.9		41.8										
	T-5	4	-14	CH		0.6		50.1										
	T-6	5	-15	CL	52.0	0.8		41.8								30	43	13
	T-7	6	-16	CL		0.9		41.4										
	T-8	7	-17	CL	63.4	0.6		45.8										
	T-9	8	-18	CL		0.9		44.6										
	T-10	9	-19	CL	60.4	0.8		42.6								31	46	15
VB-25	T-1	0	-10	CH	56.5	0.6		57.8								42	64	22
	T-2	1	-11	CH		0.4		53.7										
	J-3	2	-12	CH	55.9	0.6		55.8										
	T-4	3	-13	CH		0.6		58.1										
	T-5	4	-14	SC	47.4	0.8		44.9								41	58	17
	T-6	5	-15	CH		0.6		42.0										
	T-7	6	-16	CH	52.1	0.8		43.6										
	T-8	7	-17	CH		0.6		44.4										
	T-9	8	-18	CL	51.3	0.6		38.6								26	42	16
VB-26	T-1	0	-6	SC	38.5	1.1		36.1							X			
	J-2	1	-7	SC				48.0										
	J-3	2	-8	SC	30.2			40.9										
	T-4	3	-9	SC		0.8		26.4										
	T-5	4	-10	SC	28.1	0.6		30.2							X			
	T-6	5	-11	CH		1.0		32.9										
	T-7	6	-12	CH	53.9	0.9		37.6										
	T-8	7	-13	CH		0.8		38.5										
	T-9	8	-14	CH	58.8	1.0		37.8							X			
	T-10	9	-15	CH		1.0		37.6										
	T-11	10	-16	CH	50.4	1.2		39.8										
	T-12	11	-17	CH		1.2		45.8										
	T-13	12	-18	CH	73.0	1.0		46.0							X			

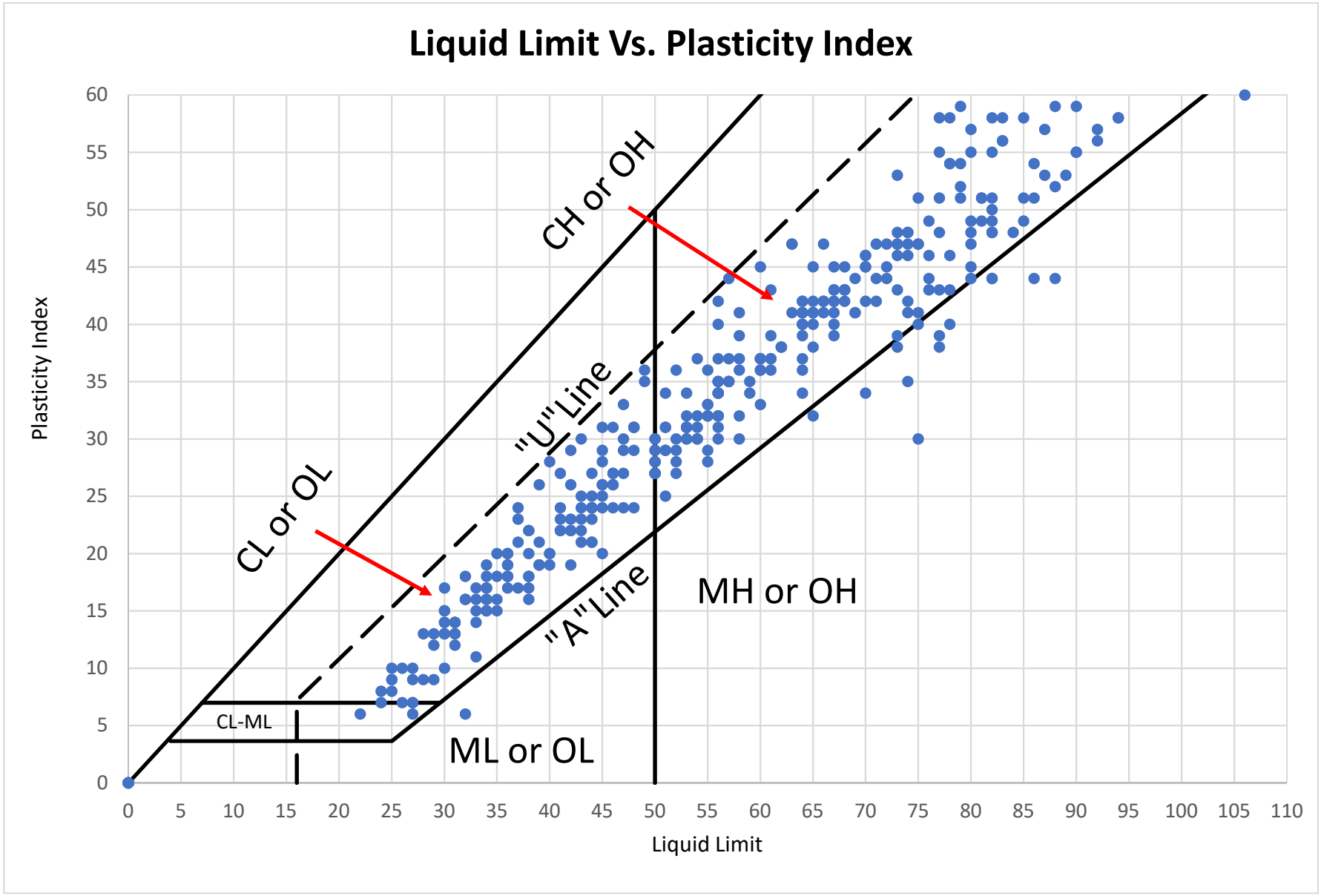
Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-27	J-1	0	-7	SC	29.8			43.3							X			
	J-2	1	-8	SC				29.8										
	T-3	2	-9	SC	24.6	0.6		28.4										
	T-4	3	-10	CL	62.3	0.6		39.3							X			
	T-5	4	-11	CL		0.6		37.1										
	T-6	5	-12	CL	69.5	0.6		31.7										
	T-7	6	-13	CL		0.4		31.0										
	T-8	7	-14	CL	51.0	0.6		35.9							X			
	T-9	8	-15	CL		0.6		36.9										
	T-10	9	-16	CL	66.3	0.6		30.3										
	T-11	10	-17	CL		0.8		31.4										
	T-12	11	-18	CL	60.1	0.7		29.5							X			
VB-28	T-1	0	-5	SC	36.9	0.1		53.8								23	37	14
	T-2	1	-6	CL		0.2		35.1										
	T-3	2	-7	CL		0.4		31.7										
	T-4	3	-8	CL	61.3	1.0		21.9								10	26	16
VB-29	J-1	0	-5	CH	97.1			165.0								73	96	23
	J-2	1	-6	CH				100.2										
	J-3	2	-7	SC				41.9										
	J-4	3	-8	SC	21.7			38.2								14	33	19
	J-5	4	-9	SC	38.3			44.0										
	J-6	5	-10	SC	48.5			45.0										
	T-7	6	-11	CL	92.2	0.8		32.0							X			
VB-30	J-1	0	-7	CH	73.5			110.5								58	77	19
	T-2	1	-8	SC		0.2		38.0										
	T-3	2	-9	SC	25.1	0.5		38.6										
	T-4	3	-10	SC		0.6		42.0										
	T-5	4	-11	SC		0.6		38.2										
	T-6	5	-12	SC	35.2	0.4		33.0								24	41	17
VB-31	T-1	0	-6	SC	27.6			47.2								43	61	18
	T-2	1	-7	SC				43.8										
	T-3	2	-8	CL	50.5	0.6		31.5								36	49	13
VB-32	J-1	0	-5	CH	89.2			116.0								73	96	23
	J-2	1	-6	CH				93.6										
	J-3	2	-7	CH	59.1			78.9										
	J-4	3	-8	CH				37.8										
	J-5	4	-9	CH				39.0										
	T-6	4.5	-10	CH	76.8	0.8		26.6								34	51	17
VB-33	J-1	2	-8	CH	87.5			137.3								66	87	21
	J-2	3	-9	CH				101.7										
	J-3	4	-10	CH				104.7										
	T-4	5	-11	SC	46.4	0.6		62.5								35	49	14
	T-5	6	-12	SC		0.4		44.4										
	T-6	7	-13	SC	43.3	0.6		49.5										
	T-7	8	-14	CL		0.6		55.1										
	T-8	9	-15	CL	56.2	0.6		57.6								31	48	17
	T-9	10	-16	CL		0.8		56.5										
	T-10	11	-17	CL	56.5	0.6		52.3										
	T-11	12	-18	CL		0.8		49.4										
	T-12	13	-19	SC	49.9	0.6		49.9										

Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-34	J-1	0	-5	CH	97.3			156.9								95	120	25
	J-2	1	-6	CH				150.2										
	J-3	2	-7	CH				129.2										
	T-4	3	-8	SC	47.7	0.2		93.4								31	45	14
	T-5	4	-9	SC		0.2		78.9										
	T-6	5	-10	CL	69.7	0.2		86.7										
	T-7	6	-11	CL		0.3		46.7										
	T-8	7	-12	CL	52.2	0.6		44.1								26	39	13
	T-9	8	-13	CL		0.4		49.8										
	T-10	9	-14	CH	66.3	0.4		56.6										
	T-11	10	-15	CH		0.4		56.7										
	T-12	11	-16	CH	75.3	0.6		62.3								40	56	16
	T-13	12	-17	CH		0.6		69.8										
	T-14	13	-18	CH		0.6		63.1										
	T-15	14	-18.8	CH	80.5	1.0		65.2								47	63	16
VB-35	J-1	0	-6	CH	96.7			92.9								81	108	27
	T-2	1	-7	CH		0.2		136.0										
	T-3	2	-8	CH	93.0	0.2		127.8										
	T-4	3	-9	CH		0.4		92.5										
	T-5	4	-10	CL	71.6	0.4		43.3								33	47	14
	T-6	5	-11	CL		0.6		50.5										
	T-7	6	-12	CH	69.2	0.4		58.2										
	T-8	7	-13	CH		0.6		61.8										
	T-9	8	-14	CH	77.6	0.6		65.2								37	56	19
	T-10	9	-15	CH		0.6		65.3										
	T-11	10	-16	CH	83.4	0.6		70.2										
	T-12	11	-17	CH		0.8		71.0										
	T-13	12	-18	CH	87.2	0.6		74.7								63	81	18
	T-14	13	-19	CH		0.8		73.5										
	T-15	14	-20	CH	83.4	0.8		71.2										
	T-16	15	-21	CH		0.8		83.4										
	T-17	16	-22	CH	82.9	0.6		66.7								42	71	29
VB-36	T-1	0	-6	CH	85.4	0.2		89.1										
	J-2	1	-7	CH				128.3										
	T-3	2	-8	CH	99.2	0.4		136.5										
	T-4	3	-9	CH		0.4		129.3								72	87	15
	J-5	4	-10	CH	98.5			134.9										
	J-6	5	-11	CH				127.8								53	73	20
	T-7	6	-12	CH	68.7	0.4		65.4										
	T-8	7	-13	CH		0.4		57.8										
	T-9	8	-14	CH	81.6	0.4		62.4										
	T-10	9	-15	CH		0.6		67.1								91	115	24
	T-11	10	-16	CH	83.4	0.6		73.2										
	T-12	11	-17	CH		0.4		79.6										
	T-13	12	-18	CH	90.4	0.4		74.5								63	82	19
VB-37	T-1	0	-6	CH	97.6	0.2		117.9								58	78	20
	T-2	1	-7	CH		0.2		133.2										
	T-3	2	-8	CH	57.4	0.4		49.4										
	T-4	3	-9	CH		0.4		77.7										
	T-5	4	-10	CH	66.1	0.5		43.1								58	83	25
	T-6	5	-11	CH		0.4		46.2										
	T-7	6	-12	CH	60.8	0.6		46.2										
	T-8	7	-13	CH		0.3		48.1										
	T-9	8	-14	CH	88.6	0.6		64.8								47	63	16
	T-10	9	-15	CH		0.4		64.0										
	T-11	10	-16	CH		0.6		65.8										
	T-12	11	-17	CH	94.2	0.8		66.7										
	T-13	12	-18	CH		0.6		64.8										
	T-14	13	-19	CH	97.7	0.6		74.3								54	78	24

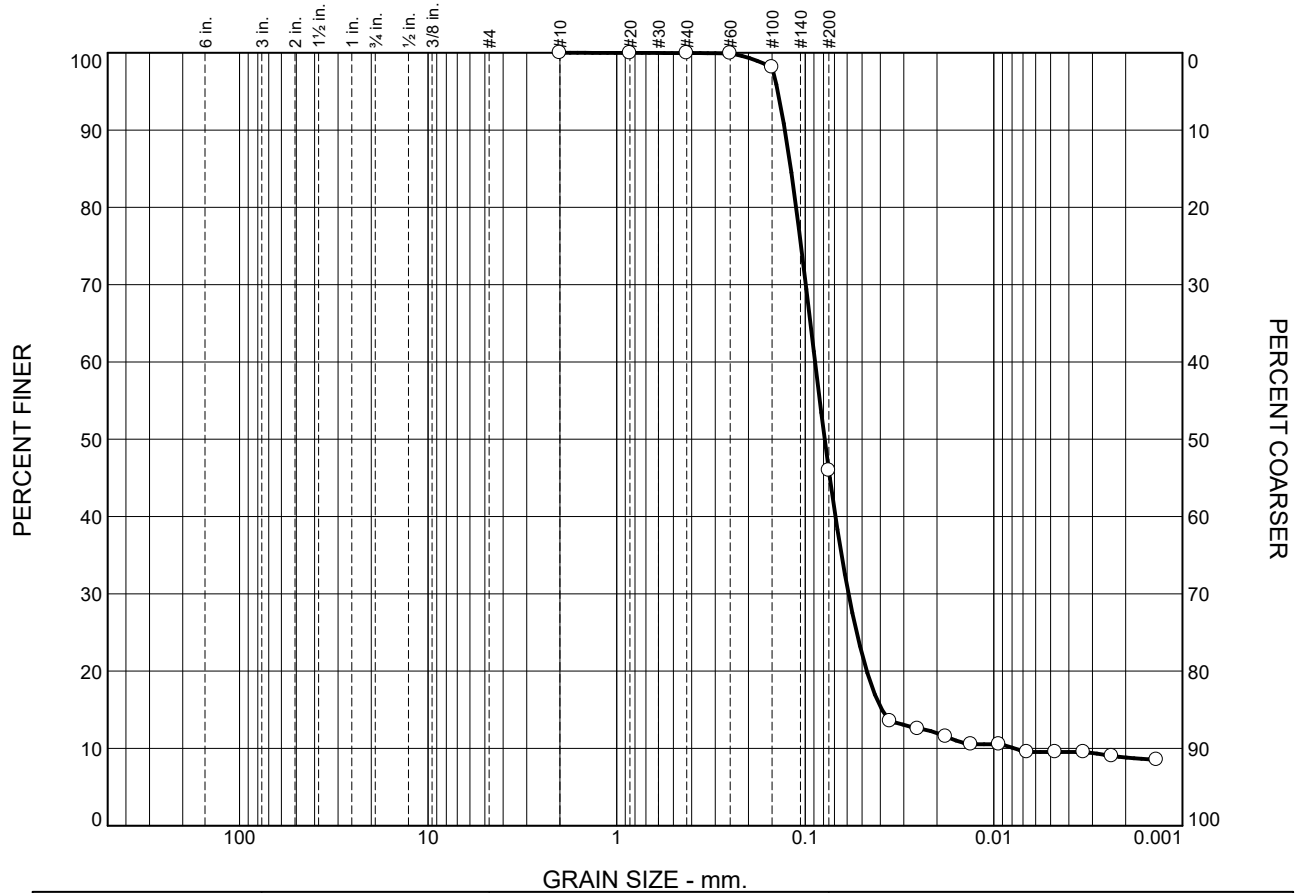
Location	Sample Number	Depth	MLLW El.	USCS	Passing Sieve No. 200	TORVANE Shear St.	Pocket Pen Shear St.	Moisture Content	Dry Unit Weight	Total Unit Weight	UU/UC Shear St.	UU/UC Failure Strain	UU Confining Pressure	CU Triaxial	Sieve Analysis and/or Hydrometer	PI	LL	PL
--	--	ft	ft	--	%	ksf	ksf	%	pcf	pcf	ksf	%	psi	--	--	--	--	--
VB-38	T-1	0	-6	CH	98.9	0.2		135.2								65	84	19
	T-2	1	-7	CH		0.2		134.1										
	T-3	2	-8	CH		0.4		75.3										
	T-4	3	-9	CL	61.4	0.4		58.8								29	42	13
	T-5	4	-10	CL		0.4		37.4										
	T-6	5	-11	CL	52.7	0.7		37.8										
	T-7	6	-12	CL		0.5		34.9										
	T-8	7	-13	CL	56.8	0.8		35.0								24	37	13
VB-39	T-1	0	-6	CH	74.0	0.2		65.1								45	60	15
	T-2	1	-7	CH		0.3		88.6										
	T-3	2	-8	CH	55.0	0.4		47.6										
	T-4	3	-9	CH		0.1		60.5										
	T-5	4	-10	CL	51.2	0.5		34.9								28	40	12
	T-6	5	-11	CL		0.4		34.7										
	T-7	6	-12	CL	67.2	0.5		43.0										
	J-8	7	-13	CL				42.9										
	T-9	8	-14	CH	78.5	0.6		91.9								47	66	19
	T-10	9	-15	CH		0.8		62.8										
	T-11	10	-16	CH	94.0	0.6		71.5										
	T-12	11	-17	CH		0.8		77.1										
	T-13	12	-18	CH	96.6	0.6		73.3										
	T-14	13	-19	CH	97.1	0.8		77.2								67	92	25
VB-40	T-1	0	-5	CH	95.4	0.4		104.0								65	97	32
	T-2	1	-6	CH		0.2		118.5										
	T-3	2	-7	CH	82.8	0.2		83.1										
	T-4	3	-8	CH		0.5		44.8										
	T-5	4	-9	CH	62.4	0.4		50.6								44	57	13
	T-6	5	-10	CL		0.6		41.0										
	T-7	6	-11	CL		0.7		39.7										
	T-8	7	-12	CL	57.7	0.8		40.3								18	32	14
	T-9	8	-13	CL		0.6		48.2										
	T-10	9	-14	CH		0.8		63.1										
	T-11	10	-15	CH	84.8	0.8		59.6								42	56	14

Tolunay-Wong Engineers, Inc.

Boring	Sample Number	Sample Depth (ft)	Soil Type	USCS	-200%	LL	PI	Specimen	Initial WC (%)	At Test WC (%)	Effective Cell Pressure (psi)	Dry Unit Weight (pcf)	Total Stress		Effective Stress	
													Cohesion (tsf)	Friction Angle (Φ)	Cohesion (tsf)	Friction Angle (Φ)
CB-03	ST-2	5-7	FAT CLAY	CH	90.3	67	43	1	14.3	48.4	2.0	88.0	0.012	14.7	0.001	28.9
								2	14.3	48.4	3.0					
								3	14.3	48.4	5.0					
CB-04	ST-4	10-12	FAT CLAY	CH	99.9	75	47	1	40.0	34.1	2.0	81.8	0.071	16.3	0.070	27.4
								2	40.0	34.1	4.0					
								3	40.0	34.1	8.0					
CB-05	ST-2	10-12	ELASTIC SILT	MH	99.6	86	44	1	58.8	54.5	2.0	99.6	0.046	14.9	0.043	26.8
								2	58.8	54.5	4.0					
								3	58.8	54.5	8.0					
CB-06	ST-5	15-17	ELASTIC SILT	MH	99.8	70	34	1	54.2	50.8	3.0	66.7	0.070	13.8	0.046	26.3
								2	54.2	50.8	6.0					
								3	54.2	50.8	12.0					
CB-07	ST-3	10-12	FAT CLAY	CH	99.9	80	44	1	54.0	55.7	2.0	69.2	0.094	17.7	0.076	35.5
								2	54.0	55.7	4.0					
								3	54.0	55.7	8.0					
CB-08	ST-4	10-12	FAT CLAY	CH	99.8	85	51	1	50.9	53.5	2.0	69.8	0.168	12.5	0.166	25.9
								2	50.9	53.5	4.0					
								3	50.9	53.5	8.0					
CB-10	ST-1	10-12	FAT CLAY	CH	94.2	56	34	1	29.1	30.2	2.0	91.0	0.081	23.9	0.119	27.7
								2	29.1	30.2	4.0					
								3	29.1	30.2	8.0					
CB-11	ST-1	12.5-14.45	FAT CLAY	CH	97.7	90	59	1	50.7	39.5	5.0	72.5	0.170	10.8	0.122	24.1
								2	50.7	39.5	10.0					
								3	50.7	39.5	20.0					
CB-18	ST-2	10-12	LEAN CLAY	CL	87.8	34	16	1	23.9	22.0	2.0	99.6	0.096	24.3	0.073	39.1
								2	23.9	22.0	4.0					
								3	23.9	22.0	8.0					
CB-21	ST-2	25-27	FAT CLAY with SAND	CH	82.7	60	33	1	38.4	32.2	5.0	83.2	0.173	11.4	0.103	24.3
								2	38.4	32.2	10.0					
								3	38.4	32.2	20.0					
CB-22	ST-4	30-32	FAT CLAY	CH	99.5	58	32	1	45.5	46.3	6.0	74.8	0.128	16.1	0.058	22.7
								2	45.5	46.3	12.0					
								3	45.5	46.3	24.0					
CB-23	ST-3	35-37	LEAN CLAY	CL	99.1	36	19	1	42.4	38.2	7.0	78.2	0.216	8.7	0.172	19.5
								2	42.4	38.2	14.0					
								3	42.4	38.2	28.0					
CB-24	ST-5	15-17	FAT CLAY	CH	99.2	56	32	1	33.8	25.4	3.0	88	0.096	21.0	0.100	26.8
								2	33.8	25.4	6.0					
								3	33.8	25.4	12.0					
CB-32	ST-7	30-32	LEAN CLAY	CL	95.4	42	22	1	32.4	29.7	6.0	90	0.087	18.7	0.110	26.5
								2	32.4	29.7	12.0					
								3	32.4	29.7	24.0					
CB-33	ST-4	26-28	FAT CLAY	CH	96.1	50	30	1	37.9	26.0	5.0	84.9	0.077	24.9	0.076	34.1
								2	37.9	26.0	10.0					
								3	37.9	26.0	20.0					
CB-34	ST-4	32.5-34.5	LEAN CLAY	CL	99.1	46	27	1	30.2	27.2	6.0	92.4	0.149	15.8	0.105	26.6
								2	30.2	27.2	12.0					
								3	30.2	27.2	24.0					
CB-38	ST-1	32.5-34.5	LEAN CLAY	CL	98.6	43	23	1	38.3	32.1	6.0	83.5	0.132	19.0	0.169	28.0
								2	38.3	32.1	12.0					
								3	38.3	32.1	24.0					
CB-40	ST-3	25-27	FAT CLAY	CH	91.5	72	44	1	37.6	38.8	5.0	83.3	0.210	14.9	0.118	23.7
								2	37.6	38.8	10.0					
								3	37.6	38.8	20.0					
CB-42	ST-4	27-29	FAT CLAY	CH	99.0	73	43	1	44.3	45.9	6.0	76.9	0.234	14.7	0.242	22.4
								2	44.3	45.9	12.0					
								3	44.3	45.9	24.0					
CB-44	ST-1	25-27	FAT CLAY	CH	73.0	55	36	1	30.4	29.9	5.0	92.6	0.094	16.9	0.065	23.8
								2	30.4	29.9	10.0					
								3	30.4	29.9	20.0					
CB-52	ST-1	20-22	FAT CLAY	CH	96.6	73	47	1	30.4	29.7	4.0	91.6	0.115	17.9	0.115	21.4
								2	30.4	29.7	8.0					
								3	30.4	29.7	16.0					
CB-59	ST-3	27.5-29.5	SANDY LEAN CLAY	CL	59.9	31	14	1	18.0	19.8	5.0	108.4	0.173	27.2	0.194	27.5
								2	18.0	19.8	10.0					
								3	18.0	19.8	20.0					
CB-60	ST-4	22-24	FAT CLAY	CH	85.2	67	42	1	26.5	30.1	5.0	97.3	0.058	19.1	0.022	26.5
								2	26.5	30.1	10.0					
								3	26.5	30.1	20.0					
CB-61	ST-5	40-42	FAT CLAY	CH	92.8	53	34	1	23.3	21.3	7.0	99.8	0.158	11.4	0.122	16.6
								2	23.3	21.3	14.0					
								3	23.3	21.3	28.0					
CB-62	ST-2	37.5-39.5	FAT CLAY with SAND	CH	81.3	58	37	1	28.4	23.7	7.0	95.9	0.202	20.5	0.194	28.2
								2	28.4	23.7	14.0					
								3	28.4	23.7	28.0					
CB-63	ST-5	25-27	LEAN CLAY with SAND	CL	81.8	45	26	1	16.7	18.4	5.0	110.3	0.266	25.0	0.194	32.1
								2	16.7	18.4	10.0					
								3	16.7	18.4	20.0					
CB-65	ST-1	29-31	FAT CLAY	CH	88.9	75	40	1	65.2	43.2	6.0	61.7	0.026	13.3	0.002	30.0
								2	65.2	43.2	12.0					
								3	65.2	43.2	24.0					
CB-67	ST-4	35-37	LEAN CLAY with SAND	CL	79.4	42	19	1	40.9	28.9	7.0	78.3	0.181	9.7	0.099	25.6
								2	40.9	28.9	14.0					
								3	40.9	28.9	28.0					
CB-68	ST-1	21-23	FAT CLAY with SAND	CH	79.7	64	39	1	63.6	46.9	4.0	62.3	0.054	10.0	0.000	28.0
								2	63.6	46.9	8.0					
								3	63.6	46.9	16.0					
CB-69	ST-3	35-37	FAT CLAY with SAND	CH	72.7	63	41	1	24.0	23.3	7.0	101.8	0.245	22.8	0.210	29.9
								2	24.0	23.3	14.0					
								3	24.0	23.3	28.0					
CB-70	ST-5	30-32	FAT CLAY	CH	97.7	94	58	1	38.8	38.1	6.0	83.3	0.046	15.5	0.040	21.6
								2	38.8	38.1	12.0					
								3	38.8	38.1	24.0					
CB-73	ST-2	14-16	SANDY LEAN CLAY	CL	64.5	38	22	1	19.1	20.0	5.0	107.9	0.102	27.5	0.068	37.6
								2	19.1	20.0	8.0					
								3	19.1	20.0	14.0					
CB-74	ST-1	5-7	FAT CLAY	CH	98.8	70	42	1	20.0	19.1	2.0	107.3	0.134	17.4	0.100	28.9
								2	20.0	19.1	4.0					
								3	20.0	19.1	8.0					
CB-75	ST-3	7.5-9.5	FAT CLAY	CH	85.0	51	31	1	22.5	23.4	2.0	104.8	0.135	20.7	0.092	35.6
								2	22.5	23.4	4.0					
								3	22.5	23.4	8.0					
CB-76	ST-3	7.5-9.5	FAT CLAY	CH	96.6	67	43	1	27.3	28.5	2.0	97.2	0.151	16.6	0.137	25.7
								2	27.3	28.5	4.0					
								3	27.3	28.5	8.0					


Liquid Limit Vs. Plasticity Index
Plasticity Index
Liquid Limit
CH or OH
"U" Line
CL or OL
"A" Line
MH or OH
CL-ML
ML or OL
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	54.0	36.5	9.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-01	SP-2	2.5	Gray SILTY CLAYEY SAND	SC

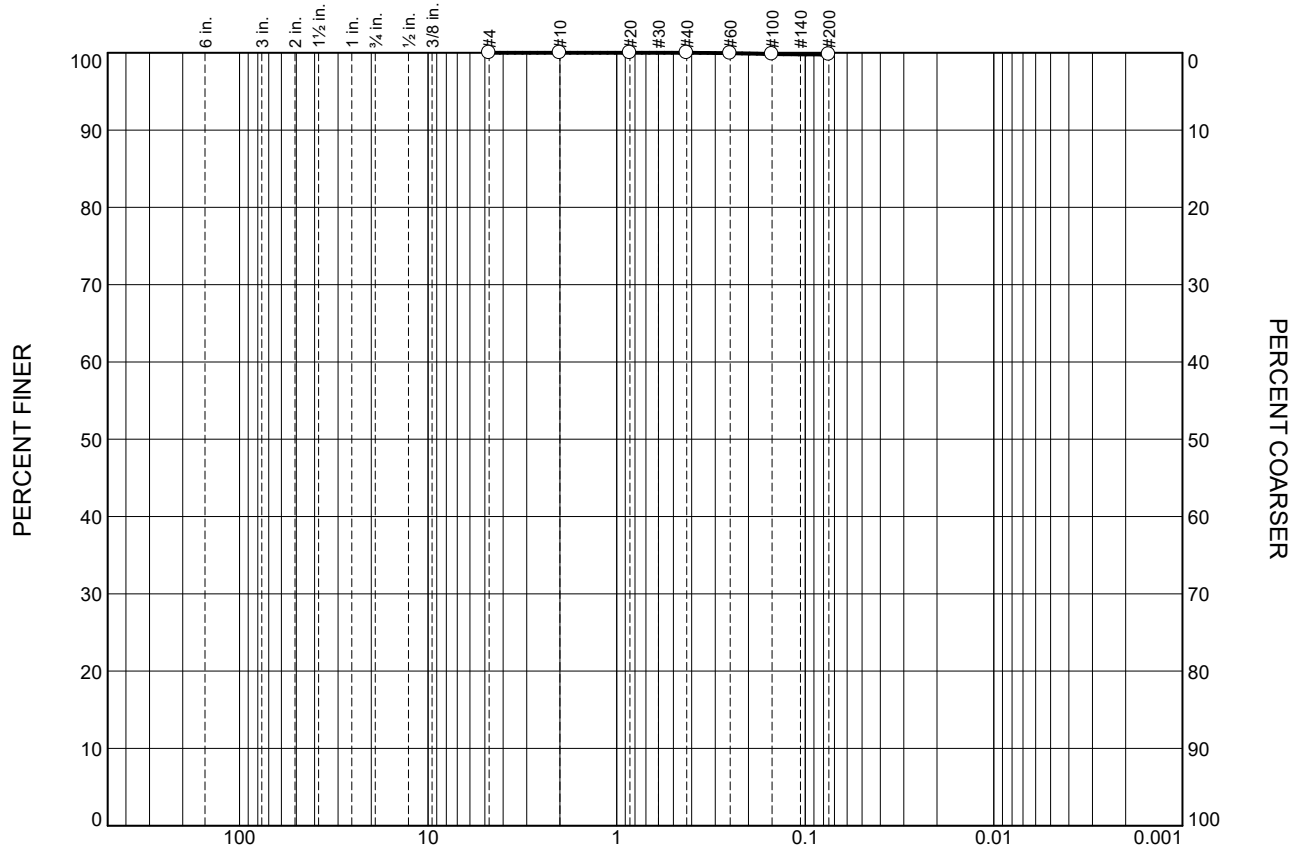
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.2	99.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-01	ST-1	5	FAT CLAY (CH),gray	CH

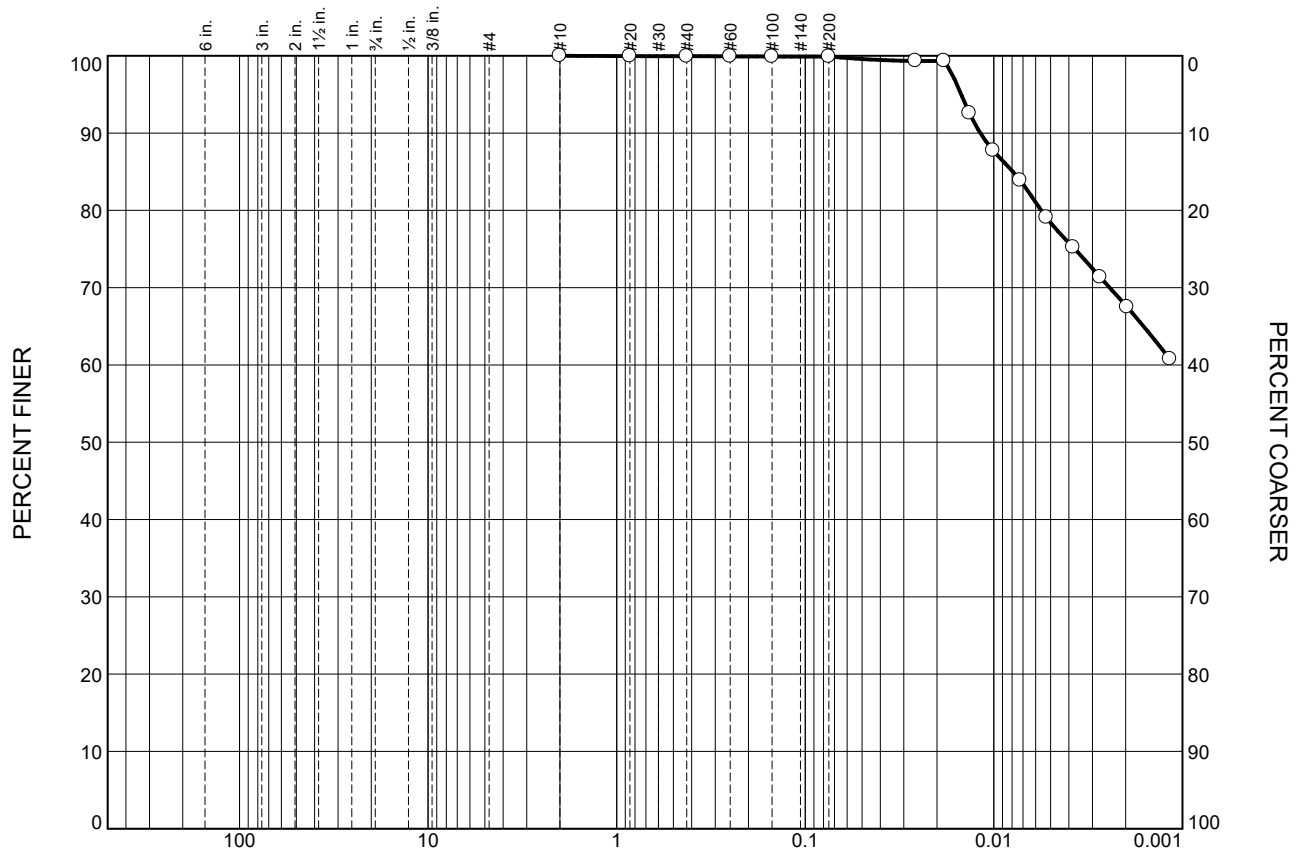
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.0	21.5	78.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-01	ST-3	10	Gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

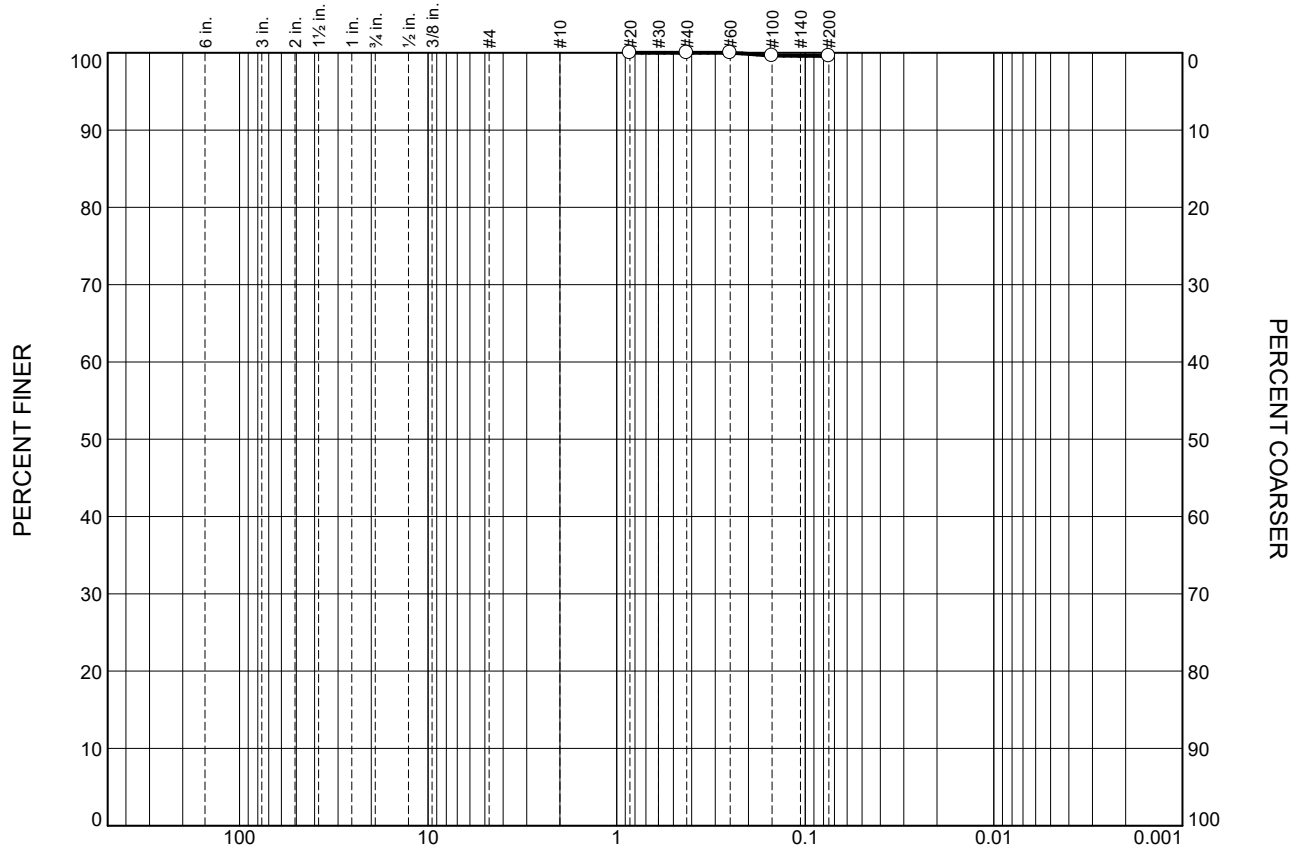
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	99.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-01	ST-5	15	Light gray FAT CLAY	CH

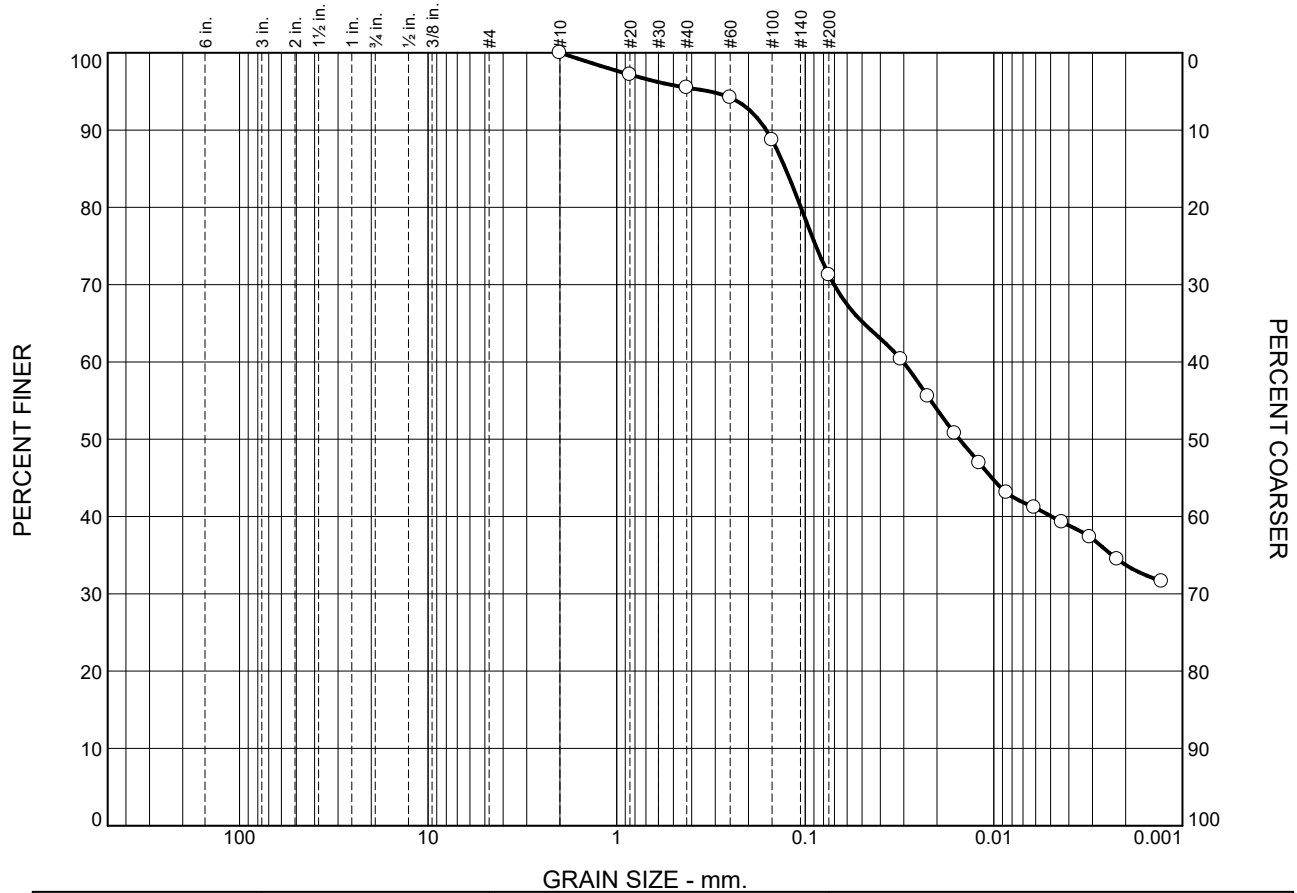
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.5	24.2	31.2	40.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-02	SP-1	0.5	LEAN CLAY WITH SAND (CL), dark gray	CL

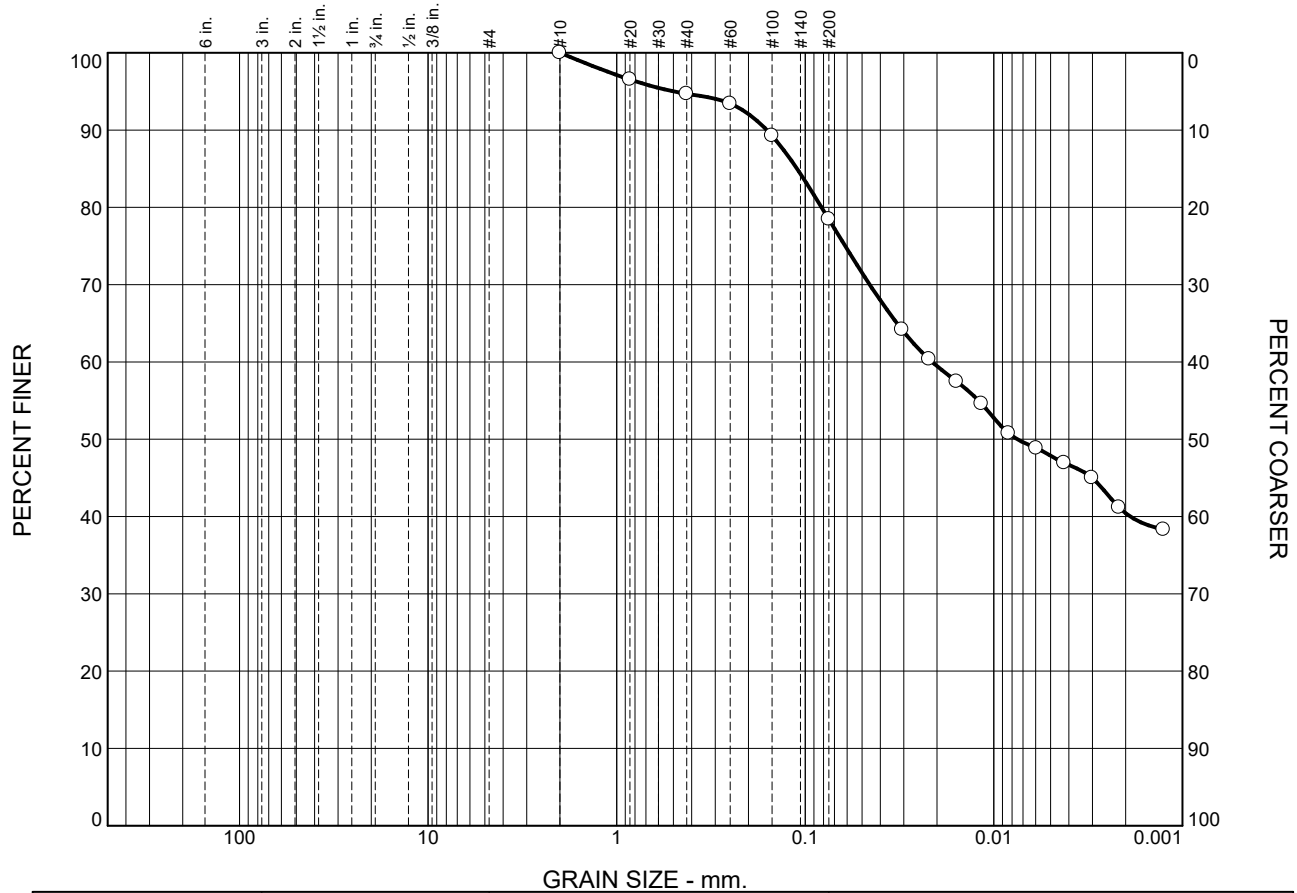
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.3	16.2	30.6	47.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-02	SP-2	2.5	Tan LEAN CLAY with SAND	CL

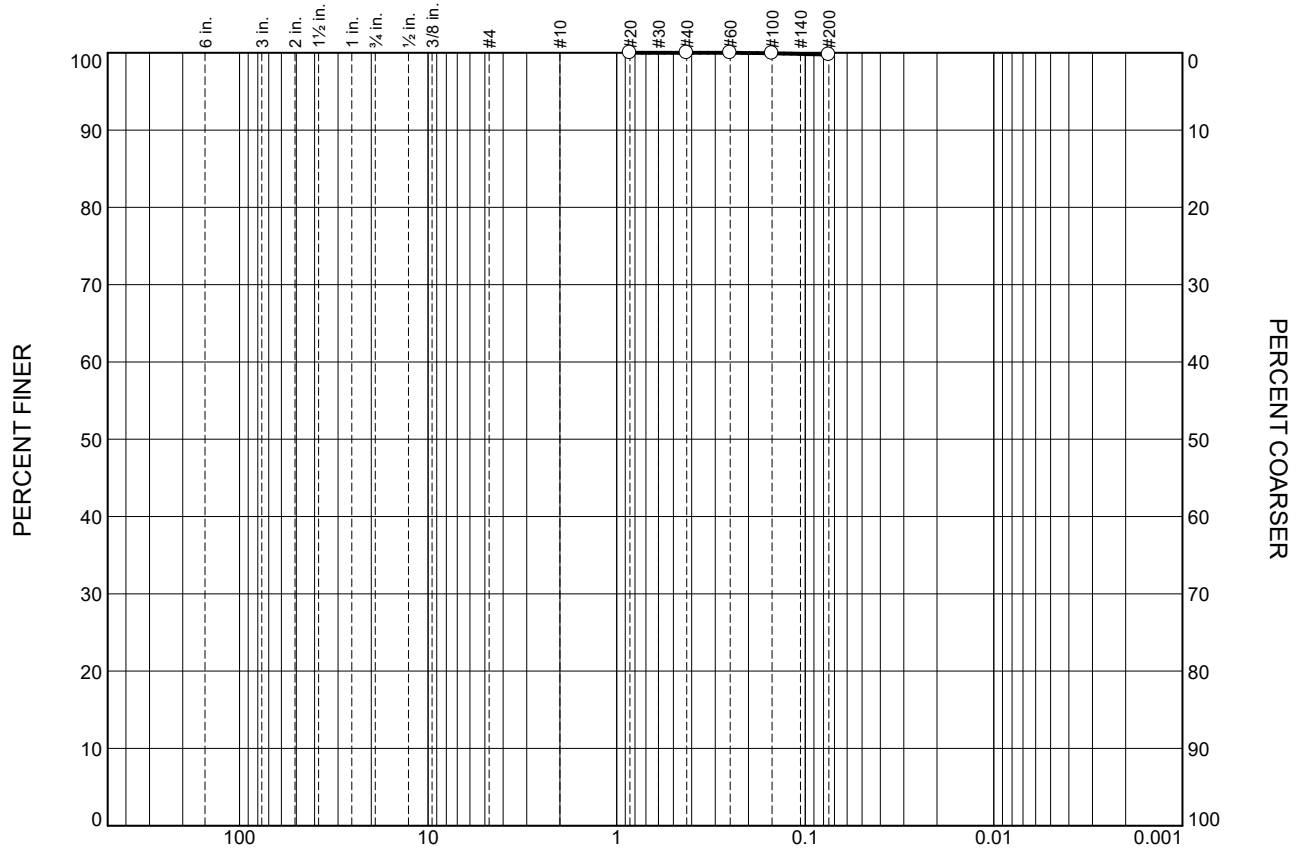
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.2	99.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-02	ST-2	7.5	Tan and gray FAT CLAY	CH

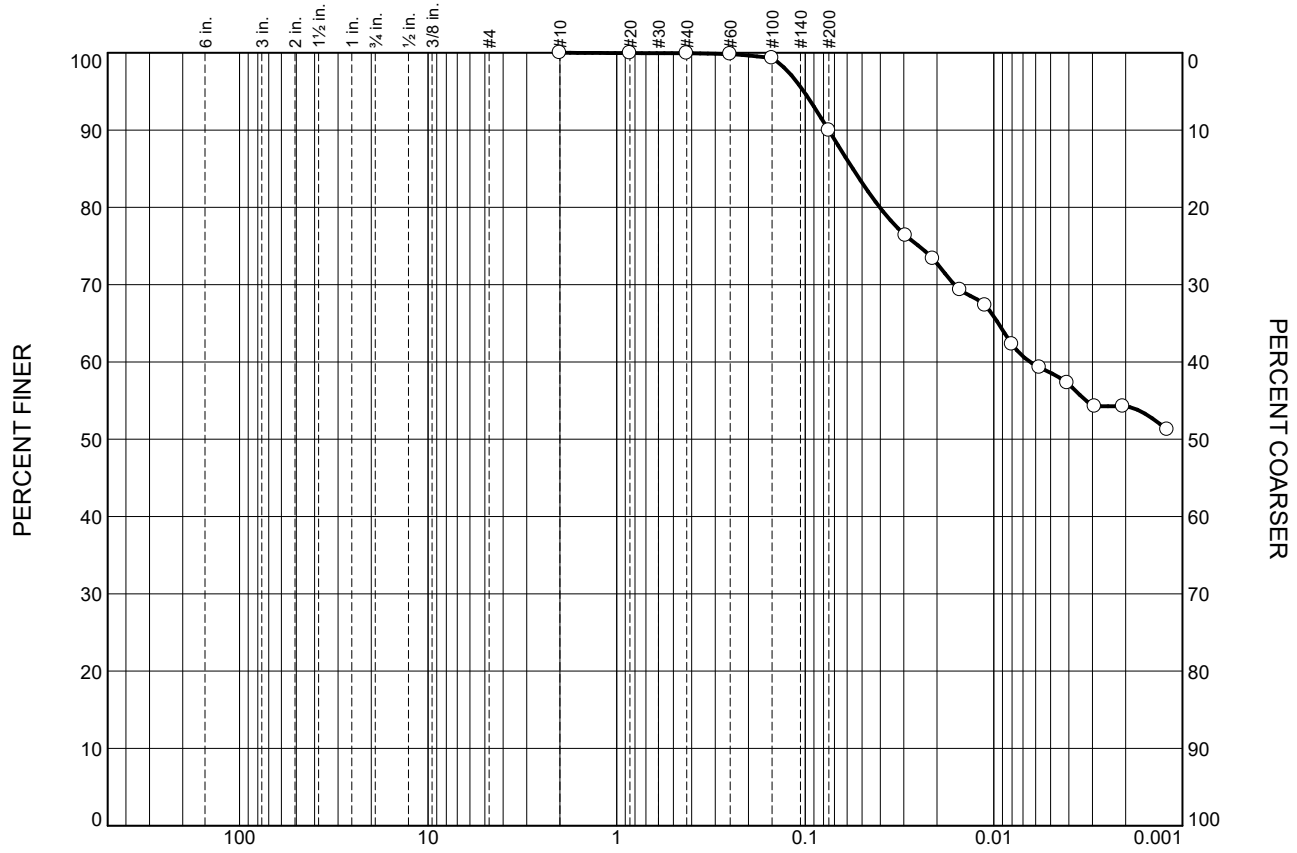
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	9.9	31.4	58.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-03	SP-1	0.5	FAT CLAY (CH), gray	CH

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.4	13.3	70.6	15.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-03	SP-2	17.5	SILTY SAND (SM), gray	SM

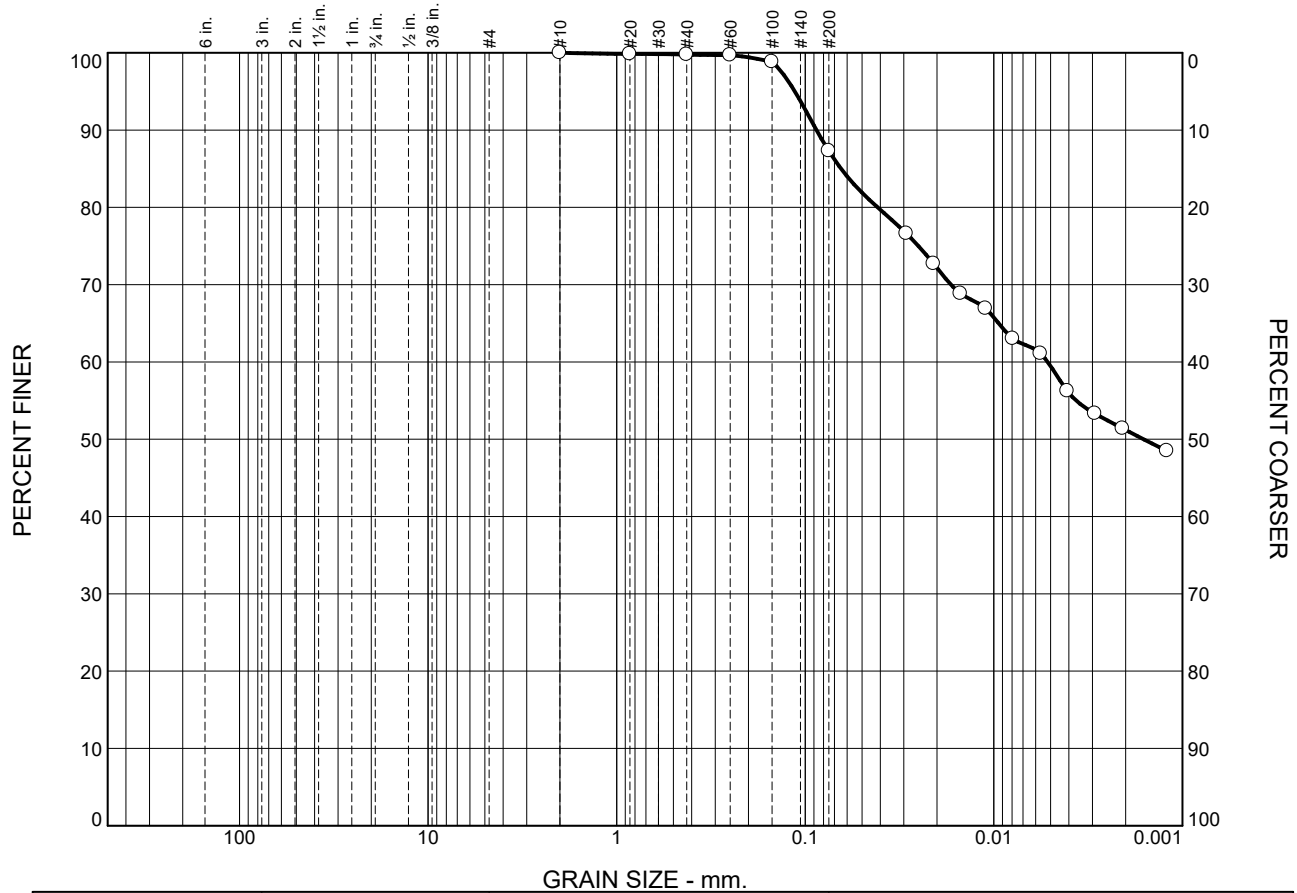
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	12.5	27.8	59.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-03	ST-1	2.5	Brown FAT CLAY	CH

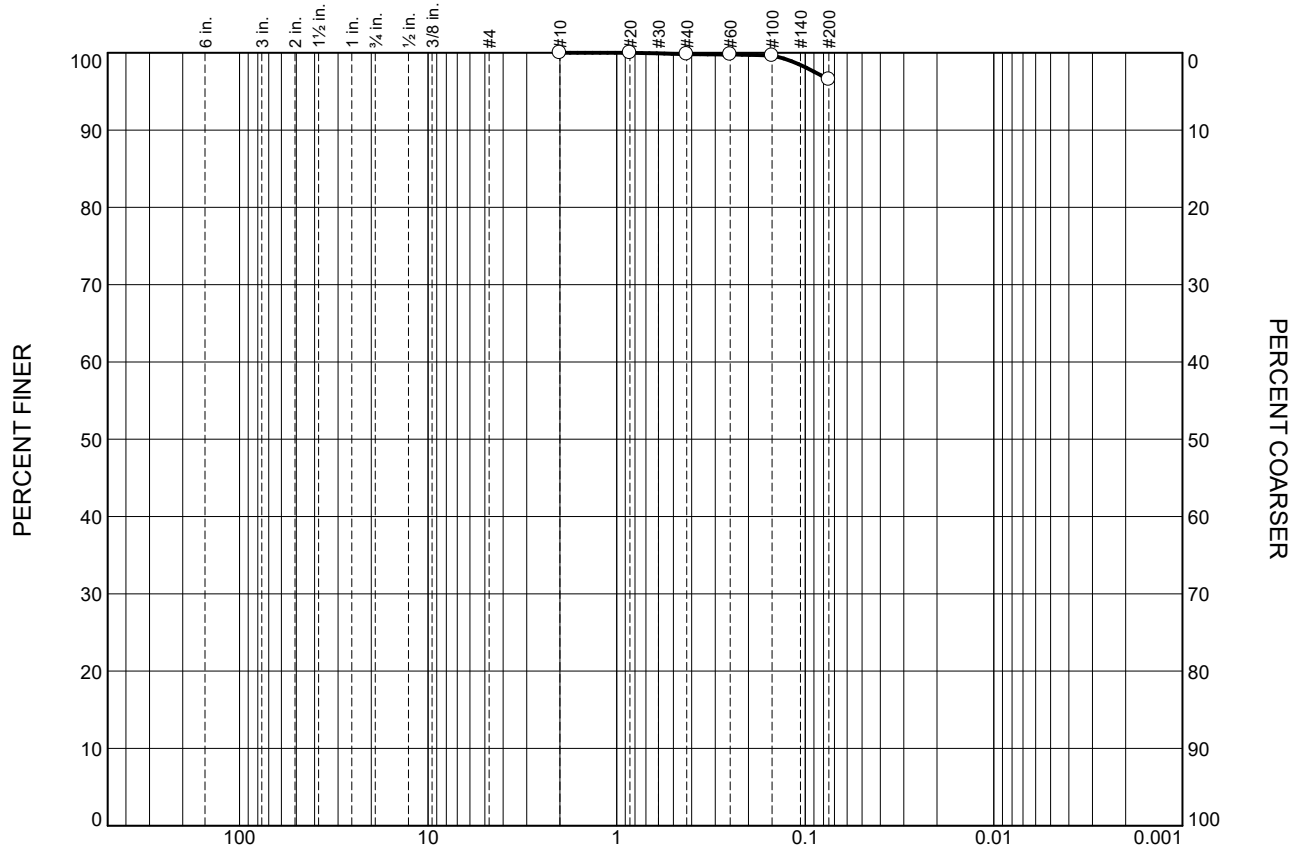
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	3.3	96.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-03	ST-3	7.5	Gray FAT CLAY	CH

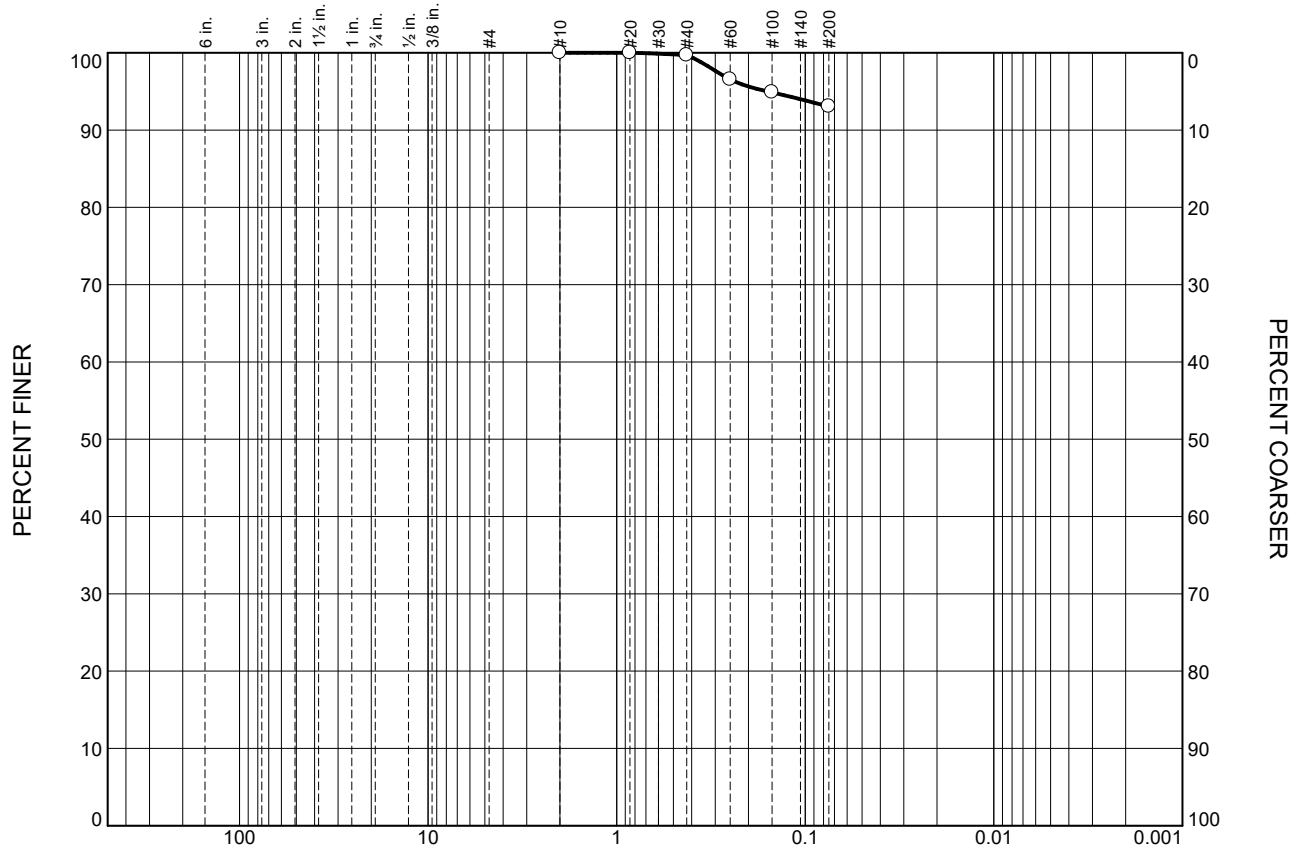
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	6.6	93.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-03	ST-5	12.5	Gray FAT CLAY; shell fragments	CH

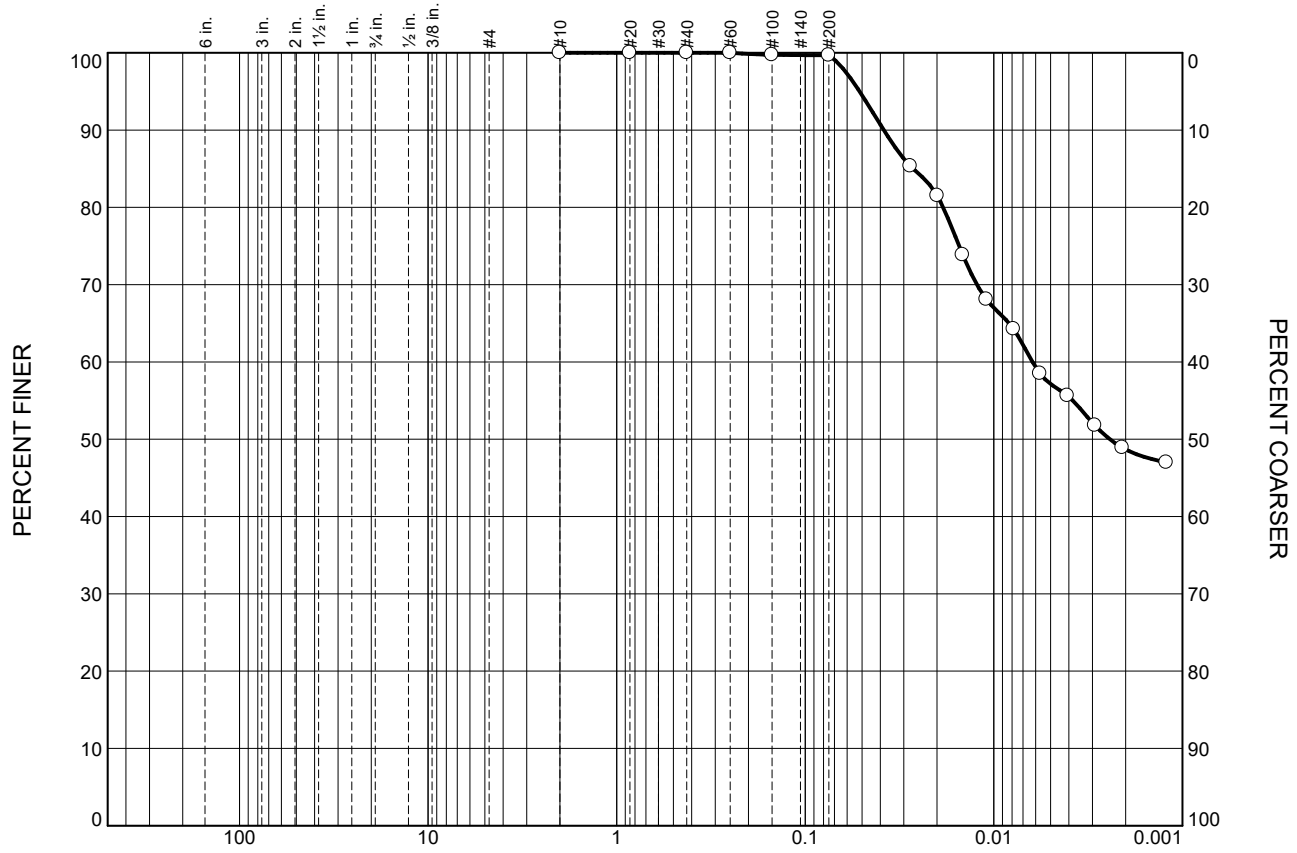
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.3	42.6	57.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-04	ST-1	2.5	Tan FAT CLAY	CL

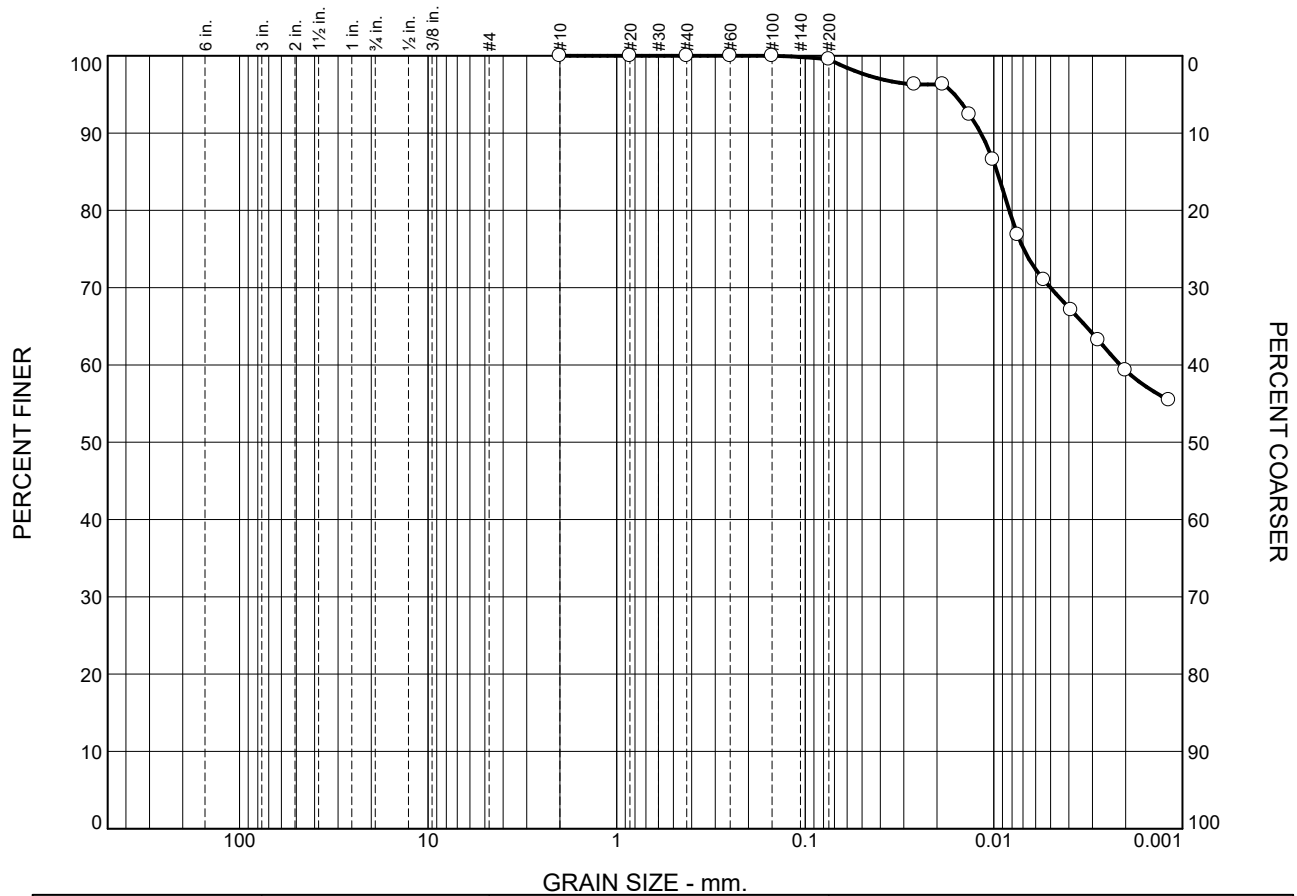
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	29.6	70.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-04	ST-3	7.5	Tan FAT CLAY	CH

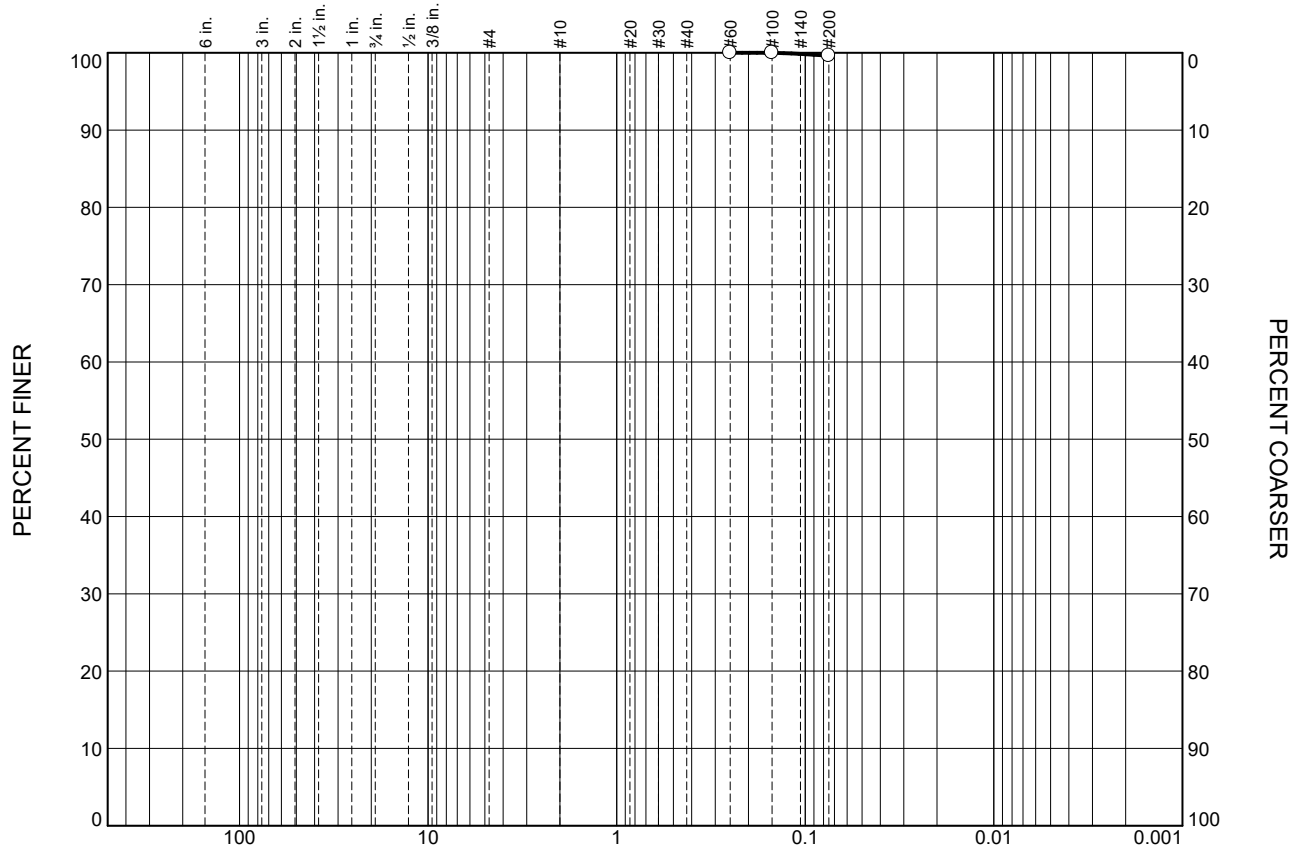
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	99.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-04	ST-6	15	Gray FAT CLAY	CH

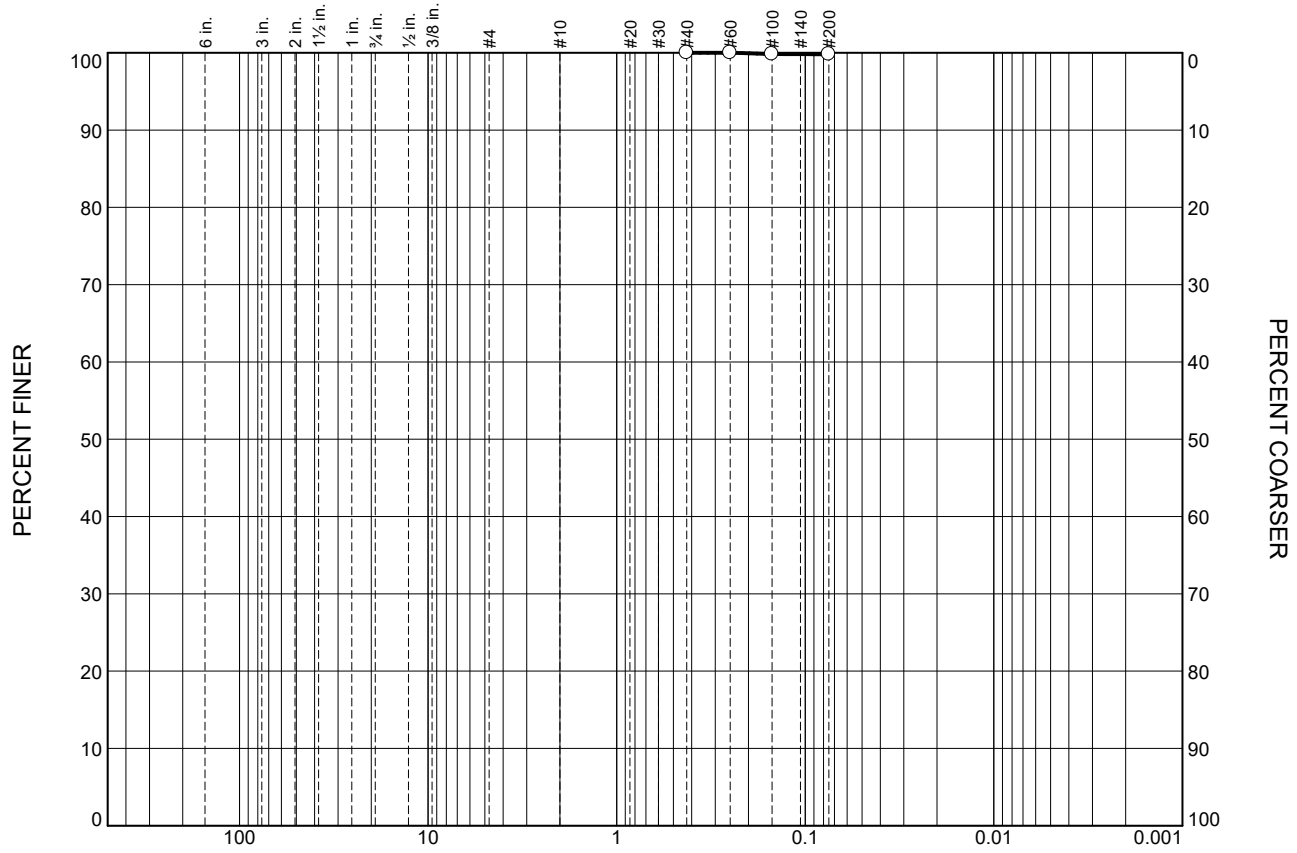
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.2	99.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-04	ST-8	20	Gray FAT CLAY	CH

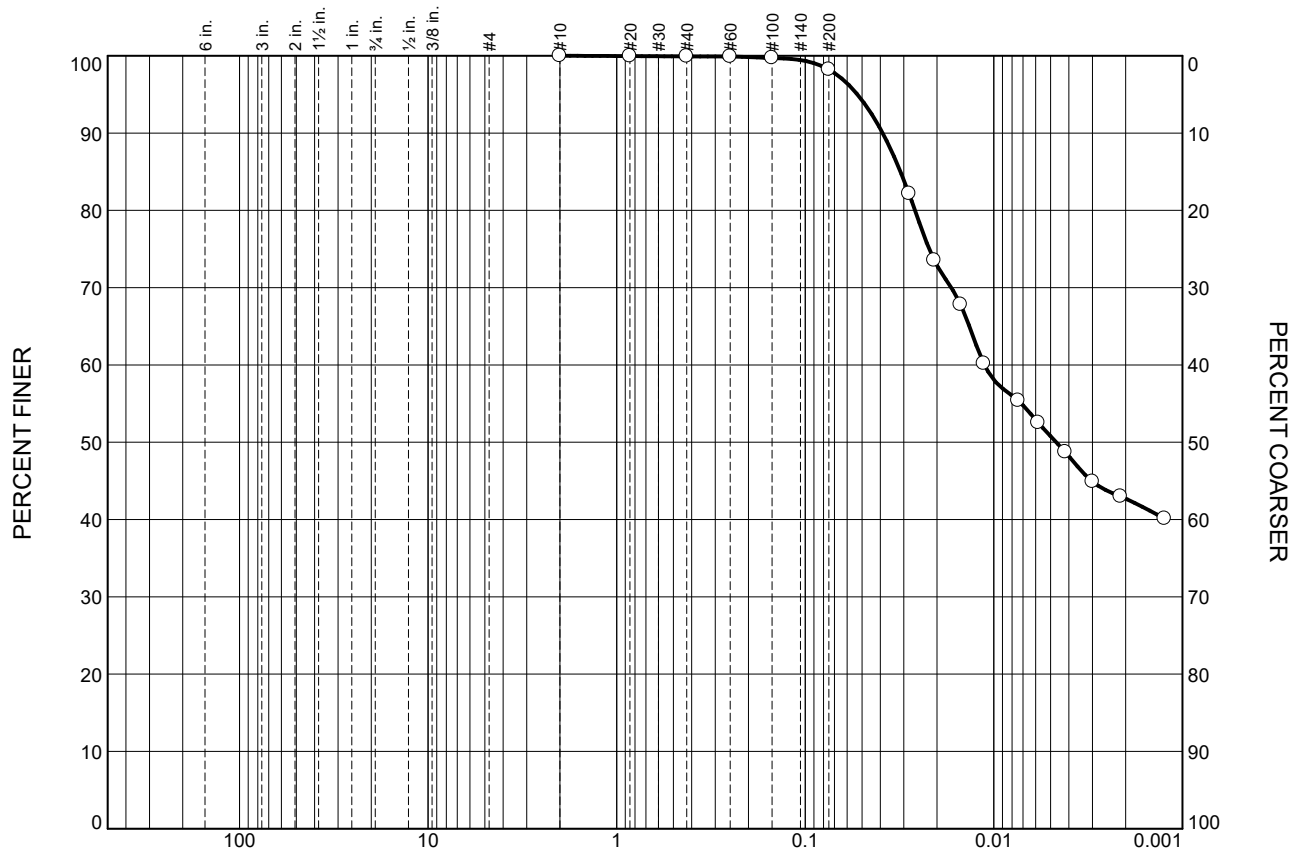
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	1.7	47.4	50.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-05	SP-2	2.5	Gray and brown FAT CLAY	CH

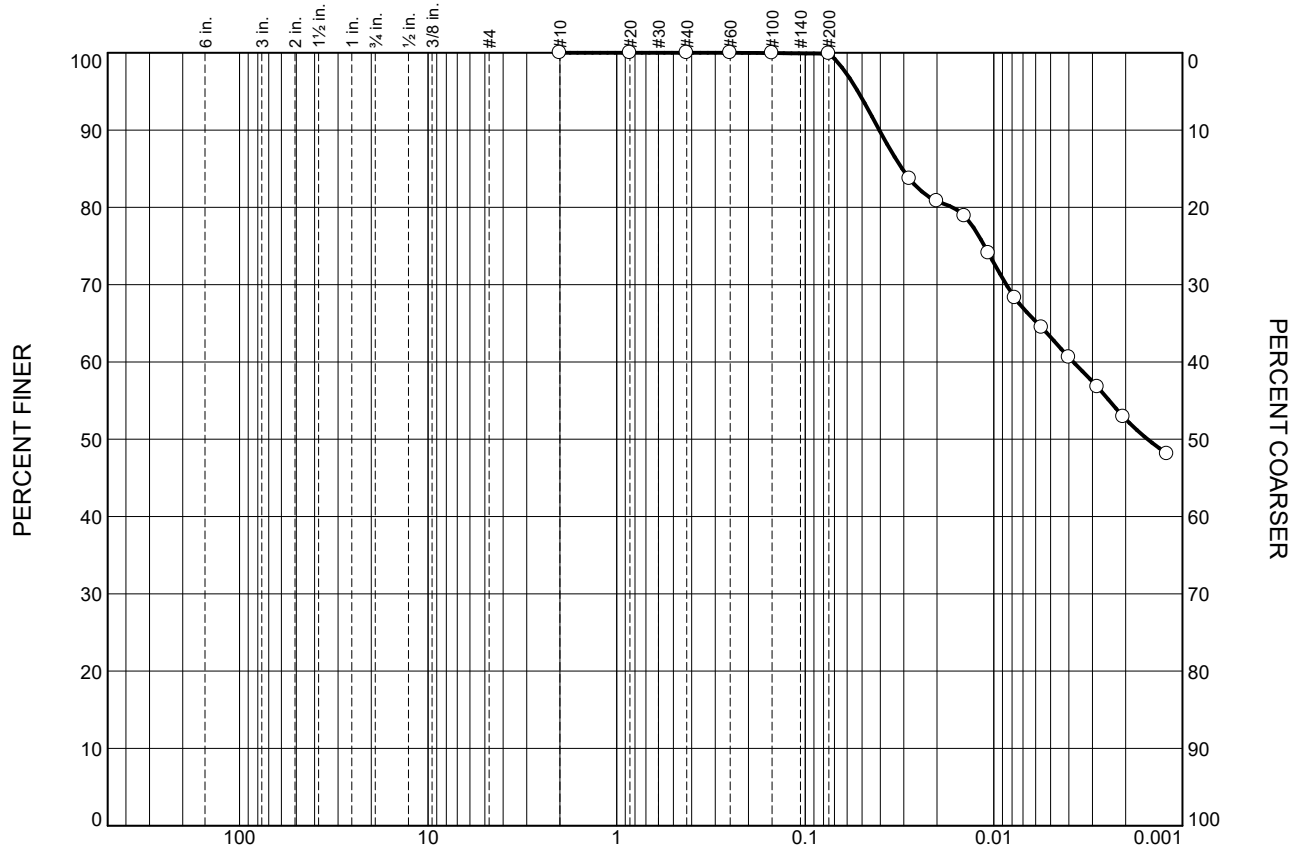
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.1	36.7	63.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-05	SP-3	5	Gray FAT CLAY	CH

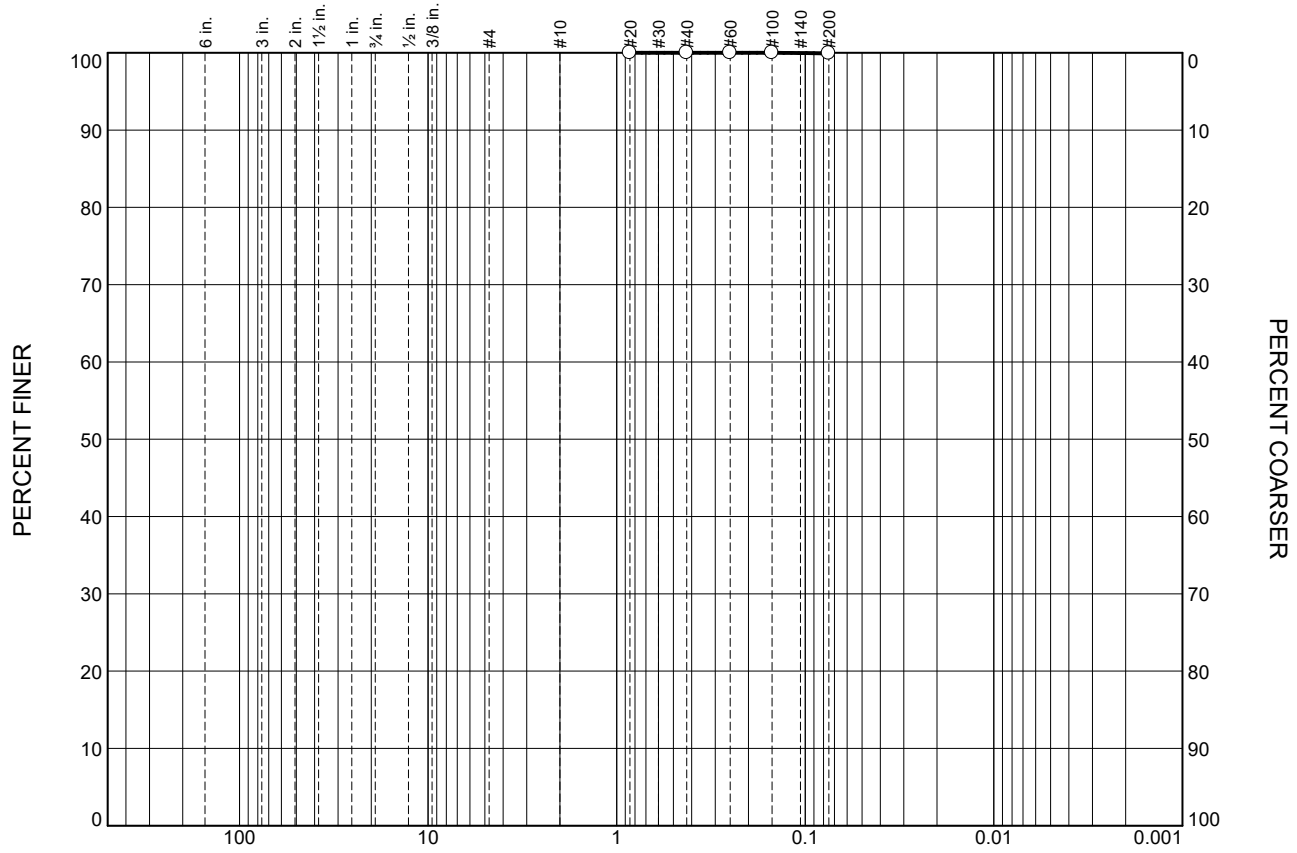
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.1	99.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-05	ST-4	15	Gray FAT CLAY	MH

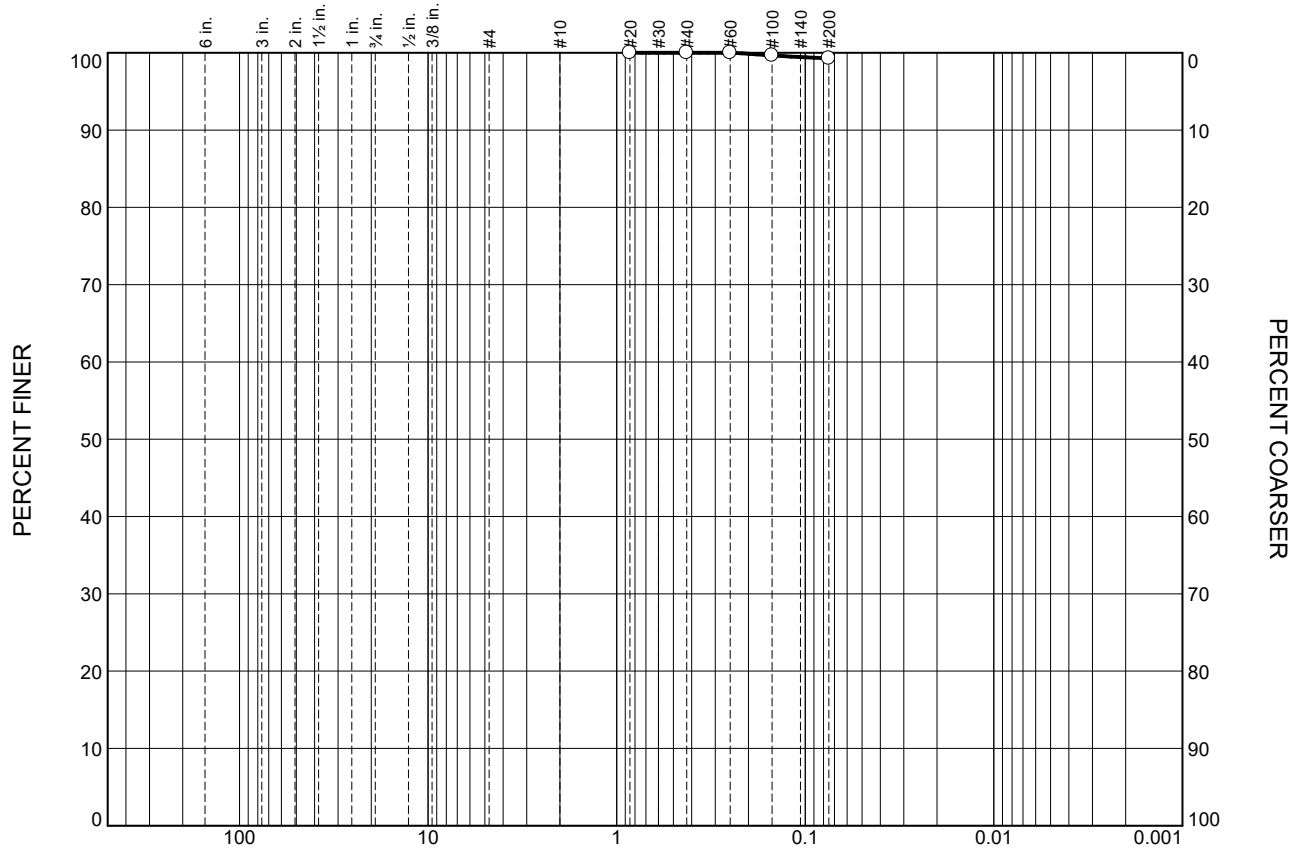
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.7	99.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-05	ST-6	20	Gray FAT CLAY	MH

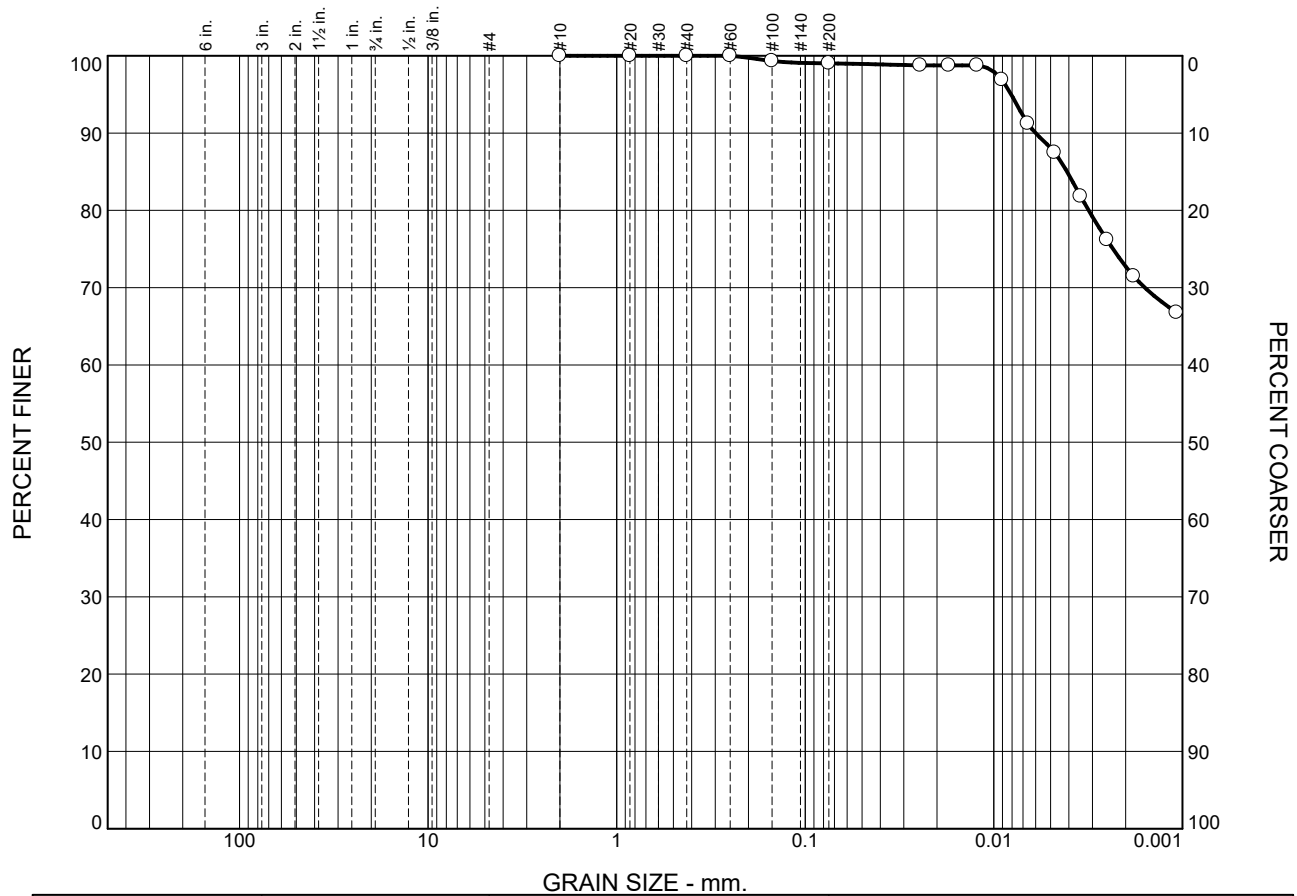
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	1.0	10.9	88.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-06	SP-2	12.5	Gray FAT CLAY	MH

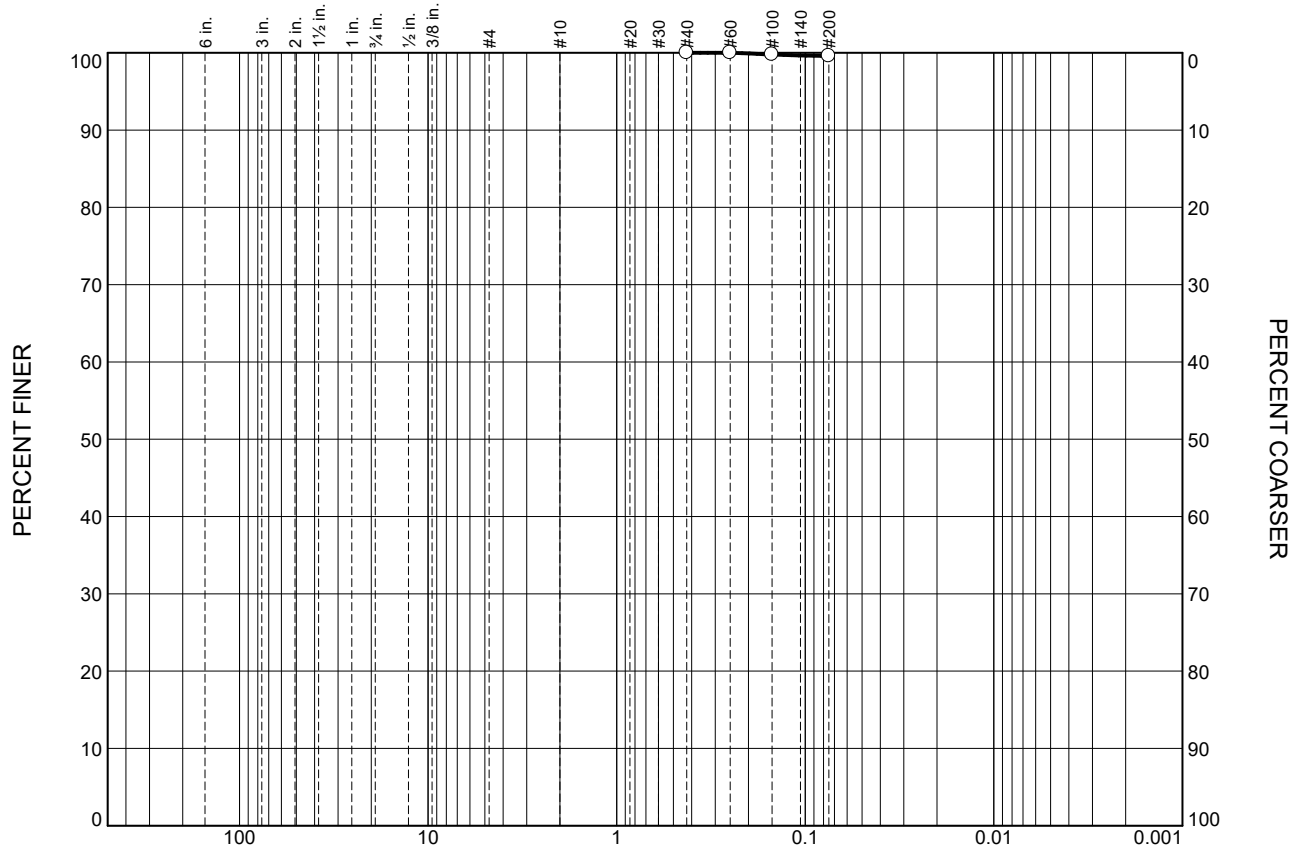
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	99.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-06	SP-3	22.5	Gray FAT CLAY	MH

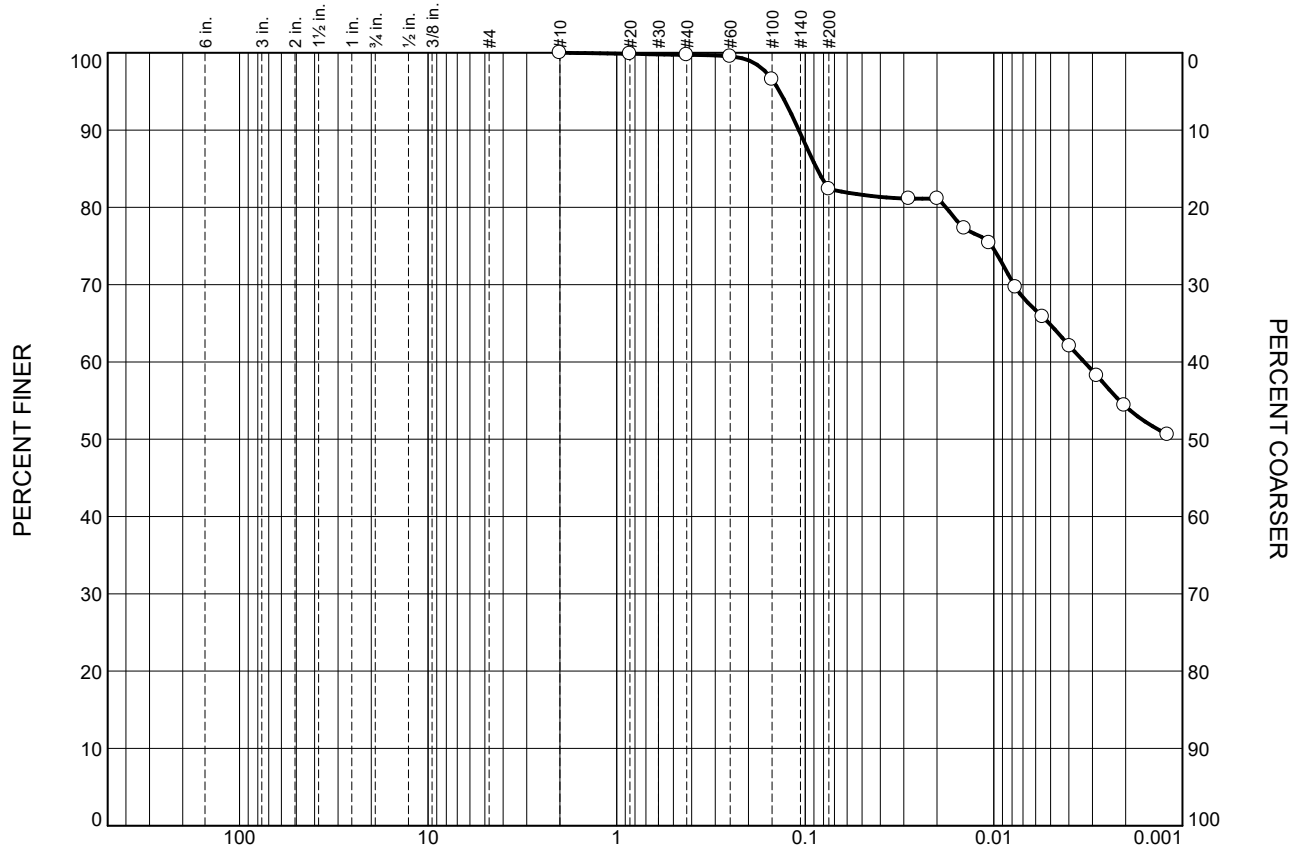
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	17.3	17.6	64.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-06	ST-1	2.5	FAT CLAY WITH SAND (CH), gray	CH

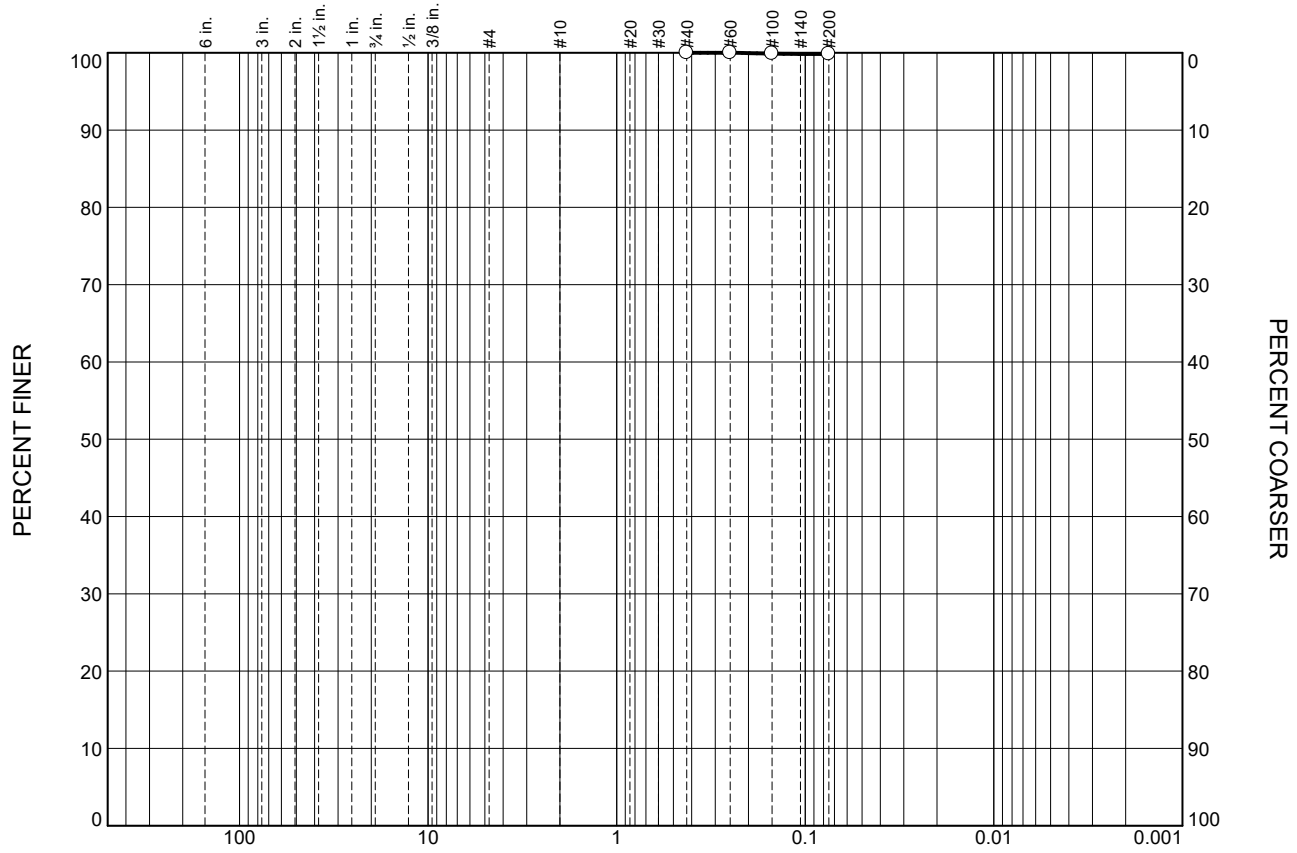
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.2	99.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-06	ST-6	17.5	Gray FAT CLAY	MH

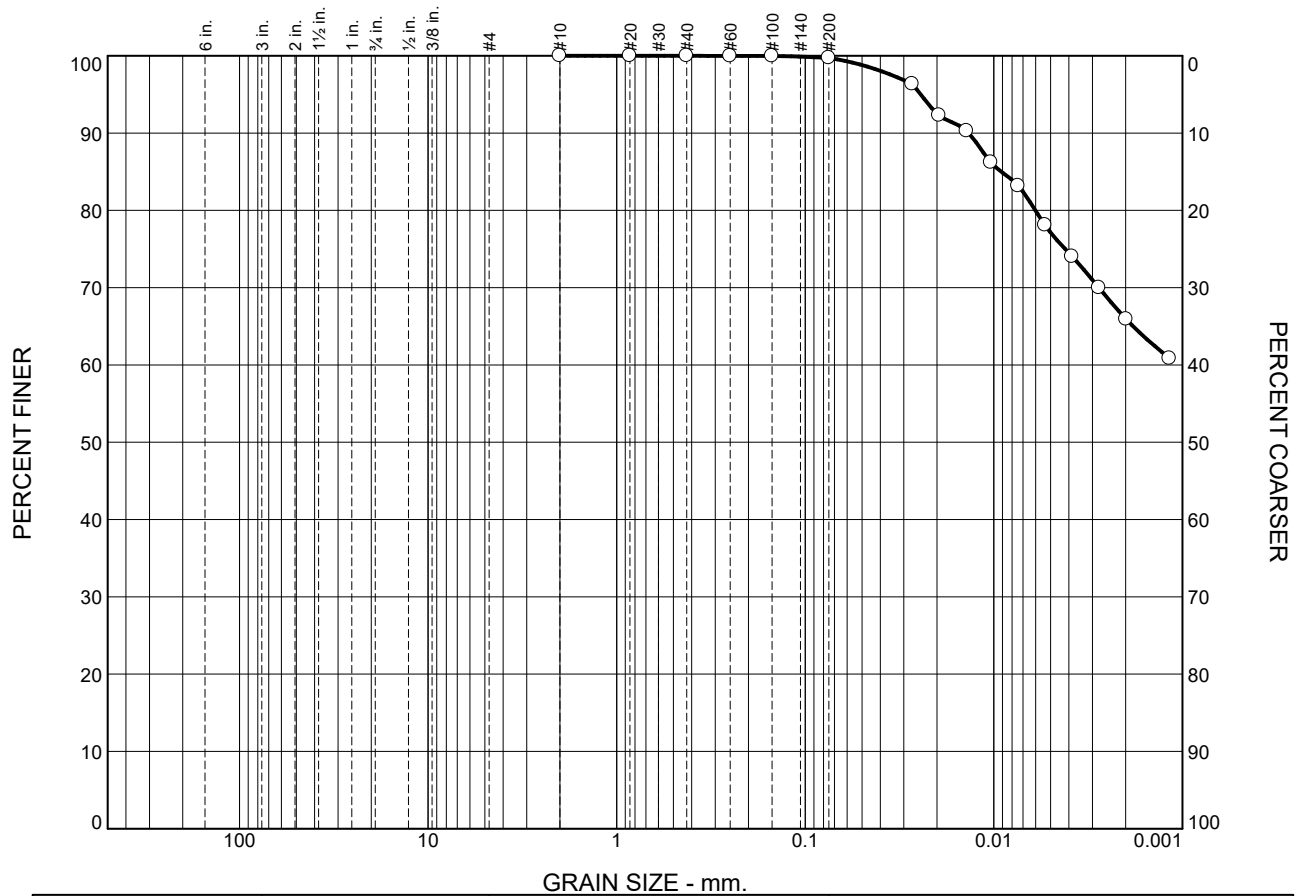
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.3	22.6	77.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-07	SP-2	2.5	FAT CLAY (CH), gray	CH

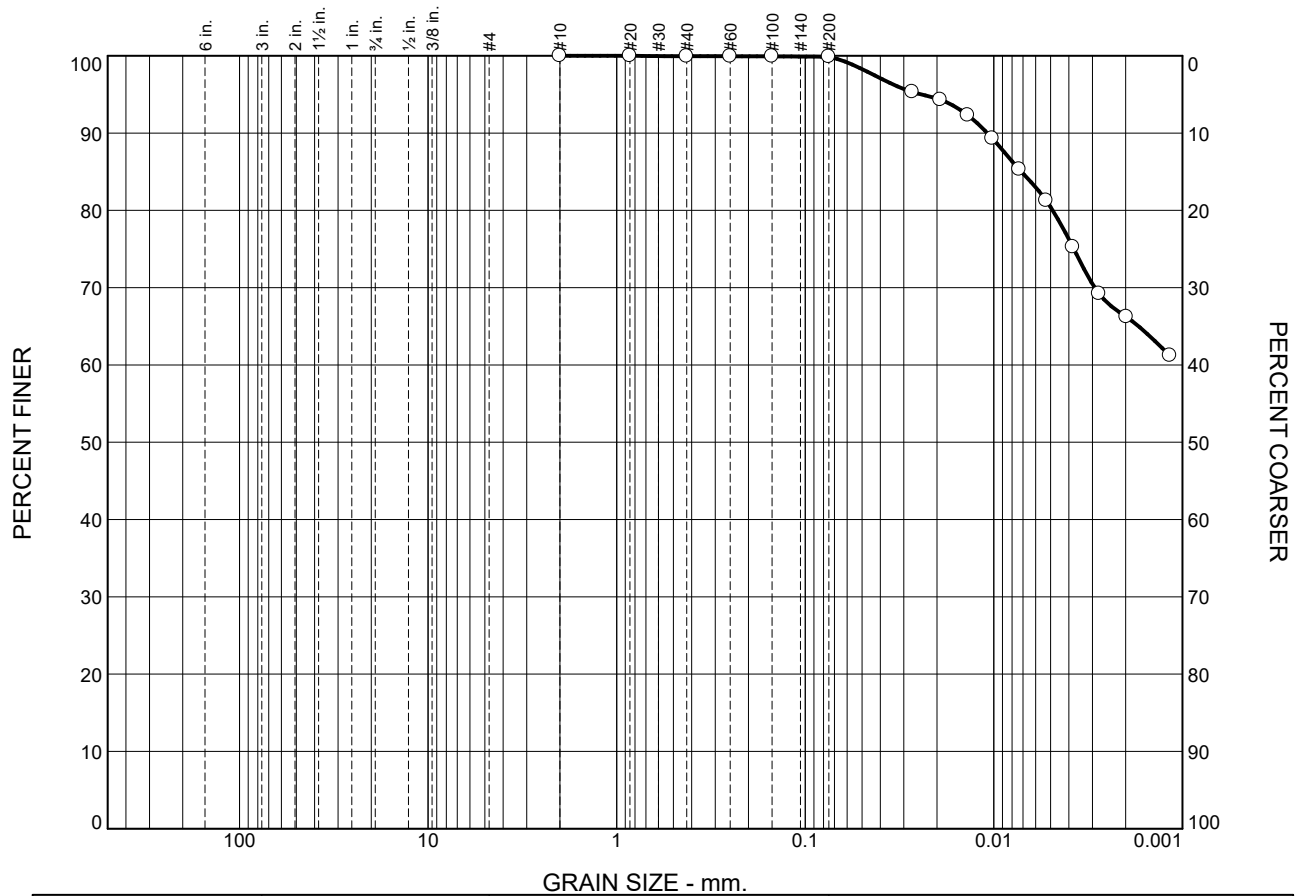
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.0	19.5	80.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-07	ST-3	10	Dark gray FAT CLAY	CH

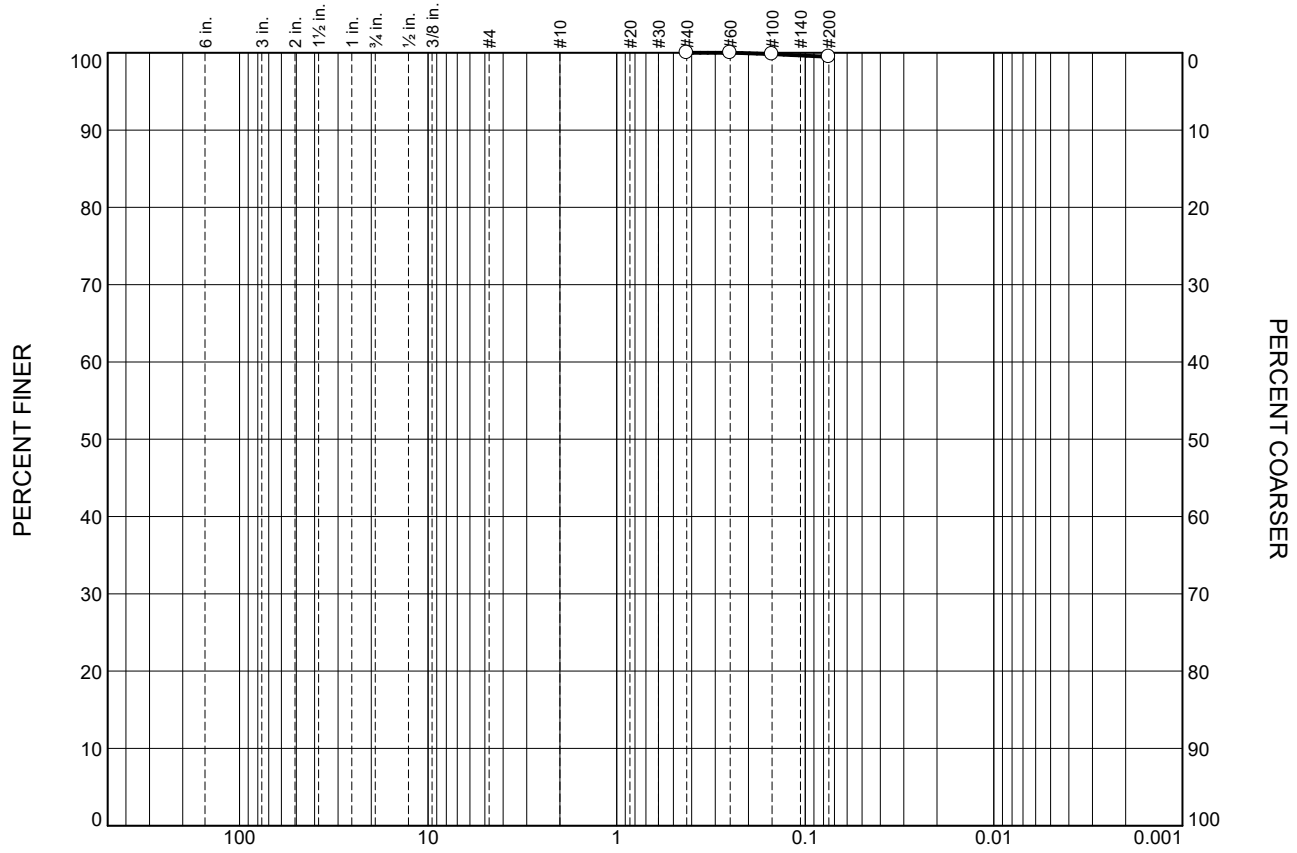
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.5	99.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-07	ST-6	17.5	Dark gray FAT CLAY	CH

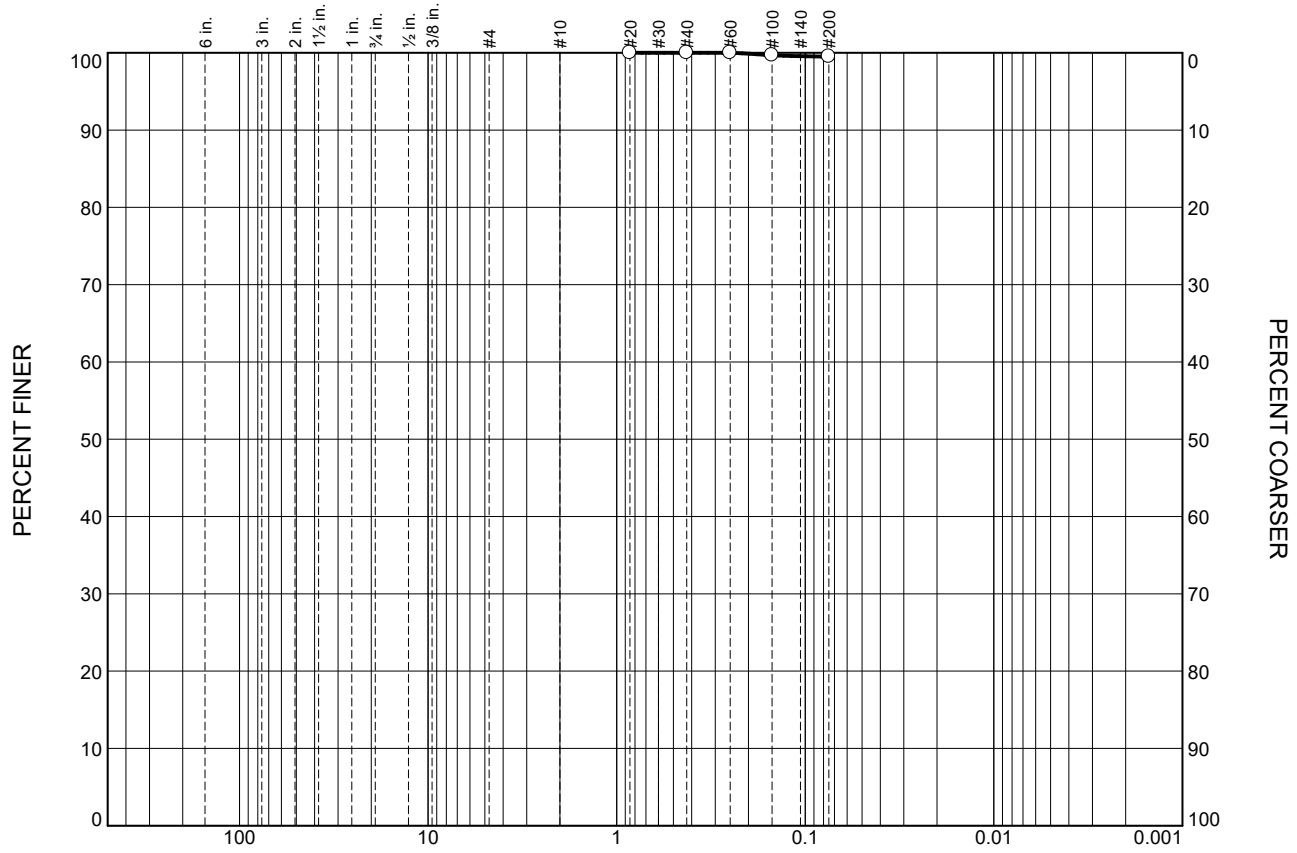
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.5	99.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-07	ST-8	22.5	Dark gray FAT CLAY	CH

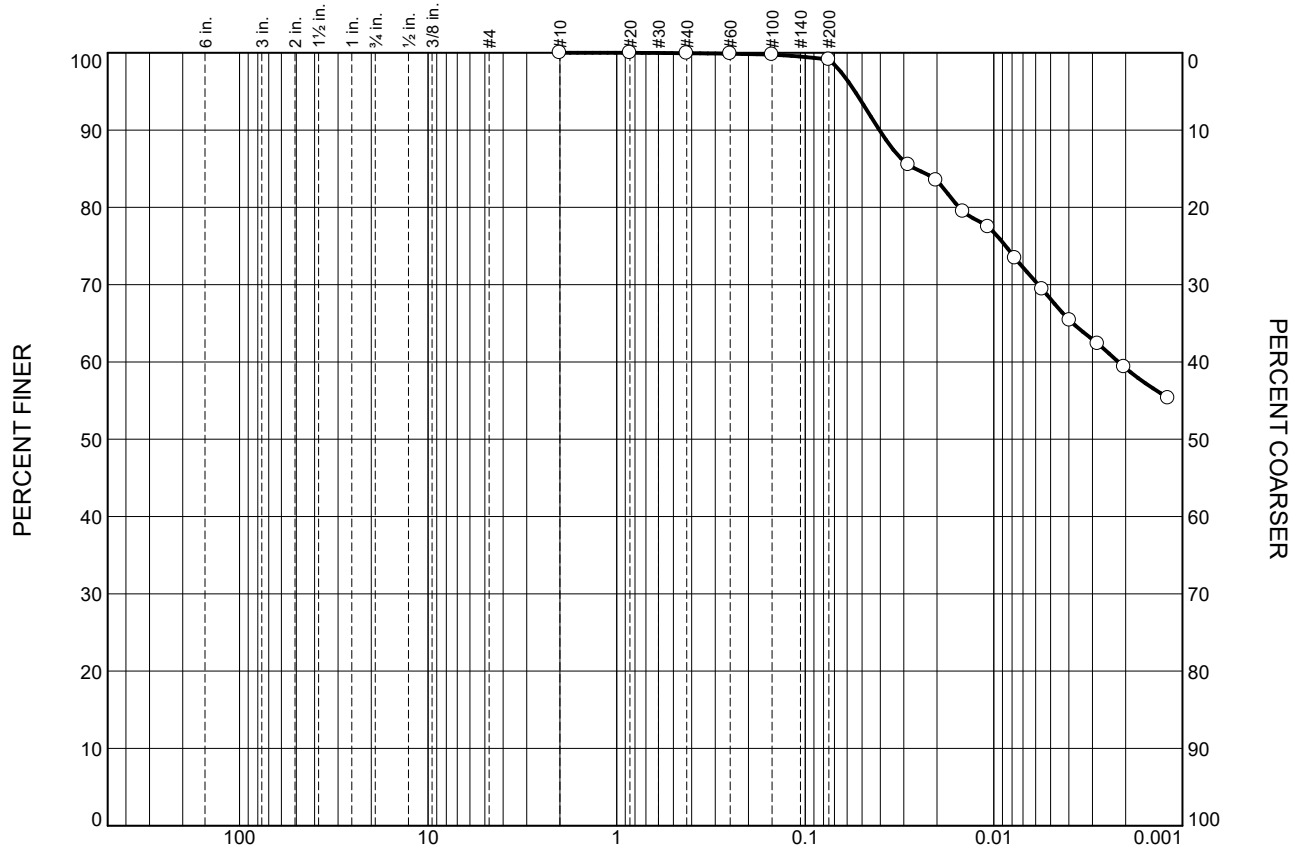
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.8	31.0	68.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-08	ST-1	2.5	Dark gray FAT CLAY; shell fragments	CH

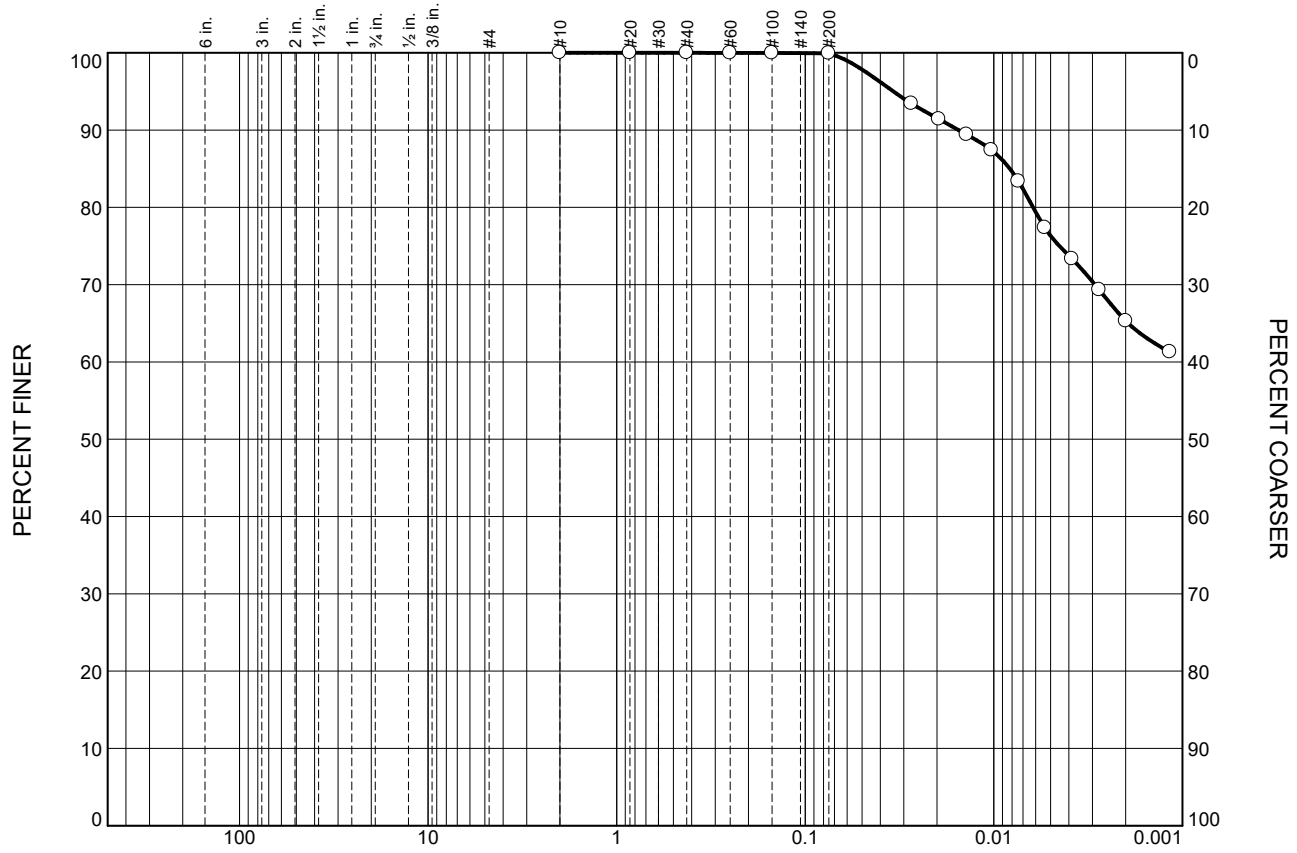
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.1	23.6	76.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-08	ST-5	12.5	Dark gray FAT CLAY	CH

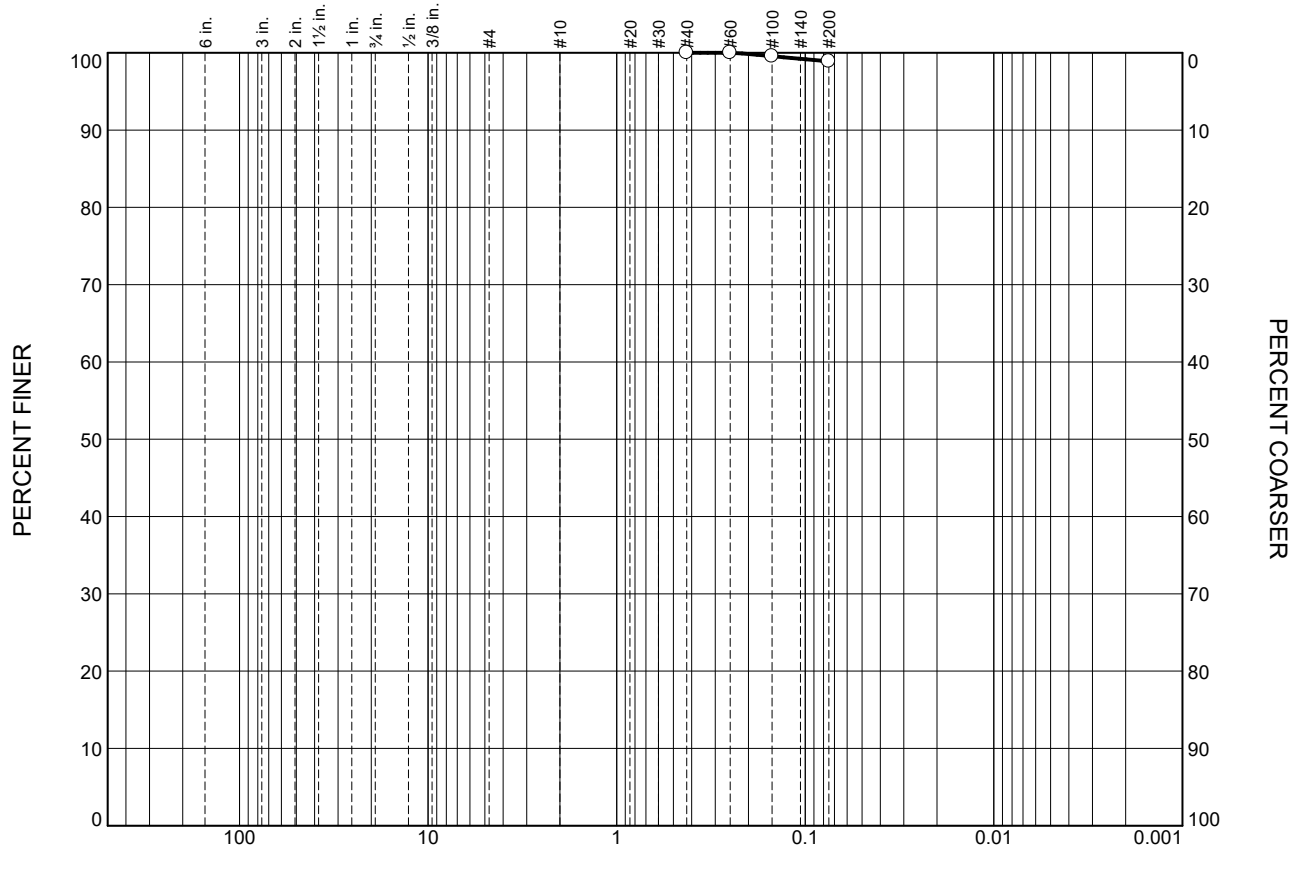
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	1.1	98.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-08	ST-8	20	Dark gray FAT CLAY	CH

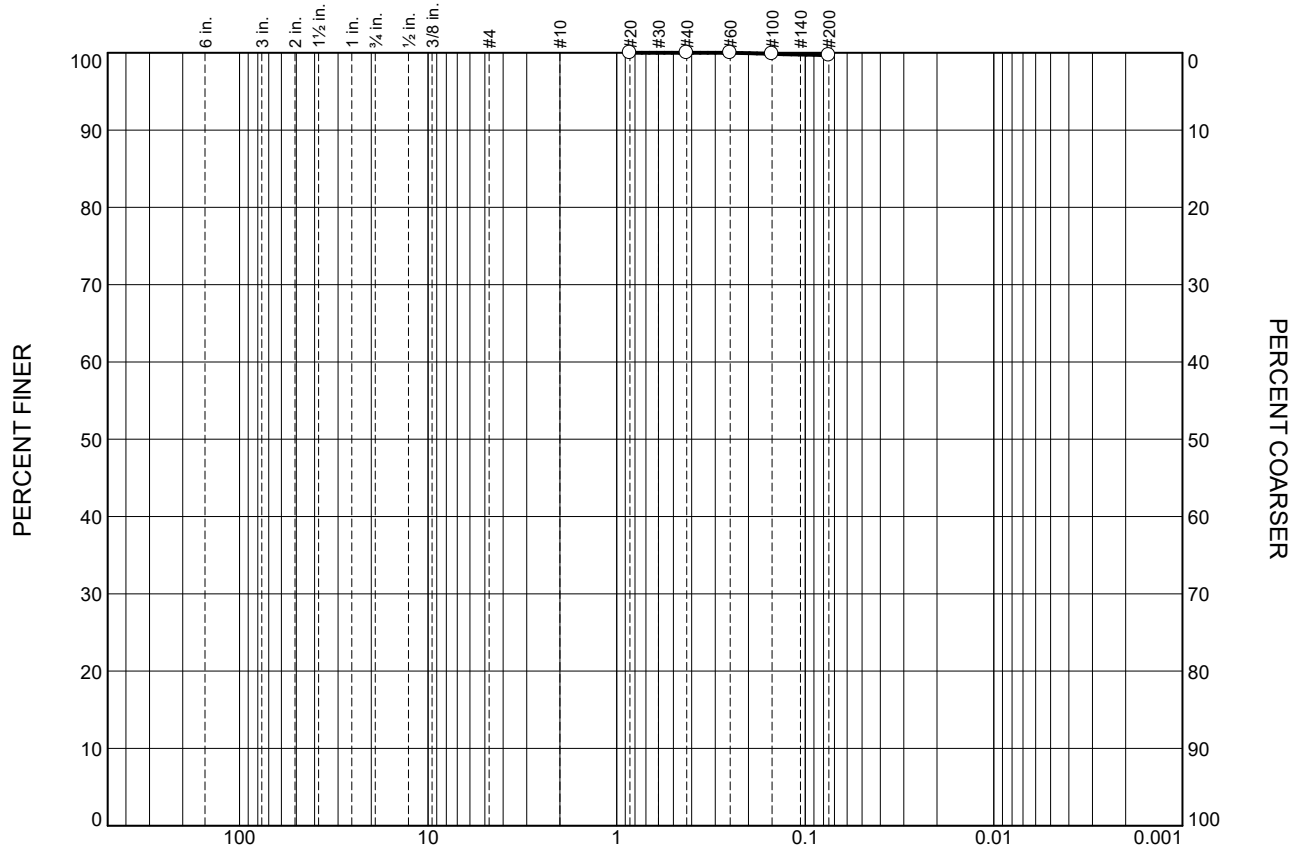
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.3	99.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-08	ST-10	25	Dark gray LEAN CLAY	CH

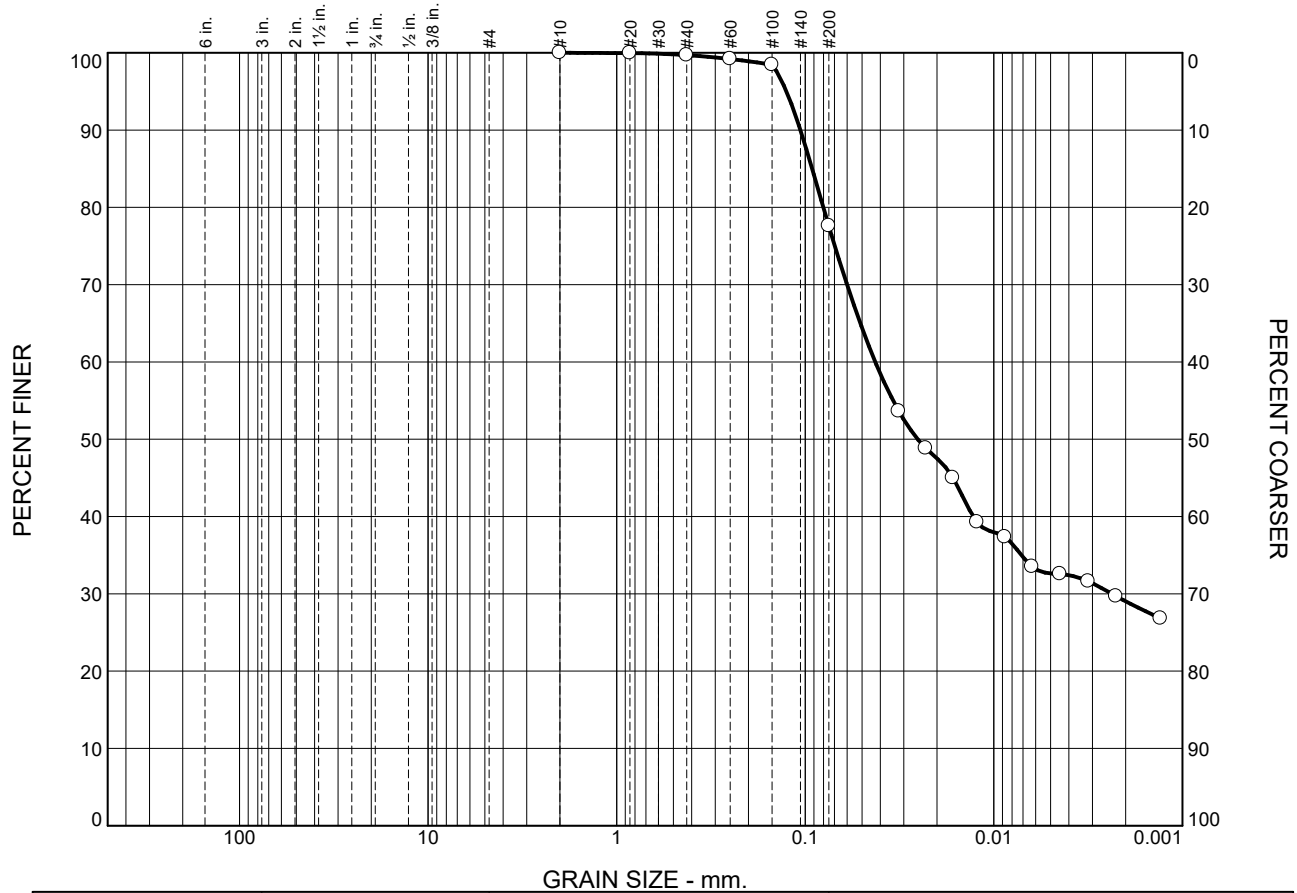
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	22.1	45.0	32.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-09	ST-1	3	LEAN CLAY WITH SAND (CL), dark brown	CL

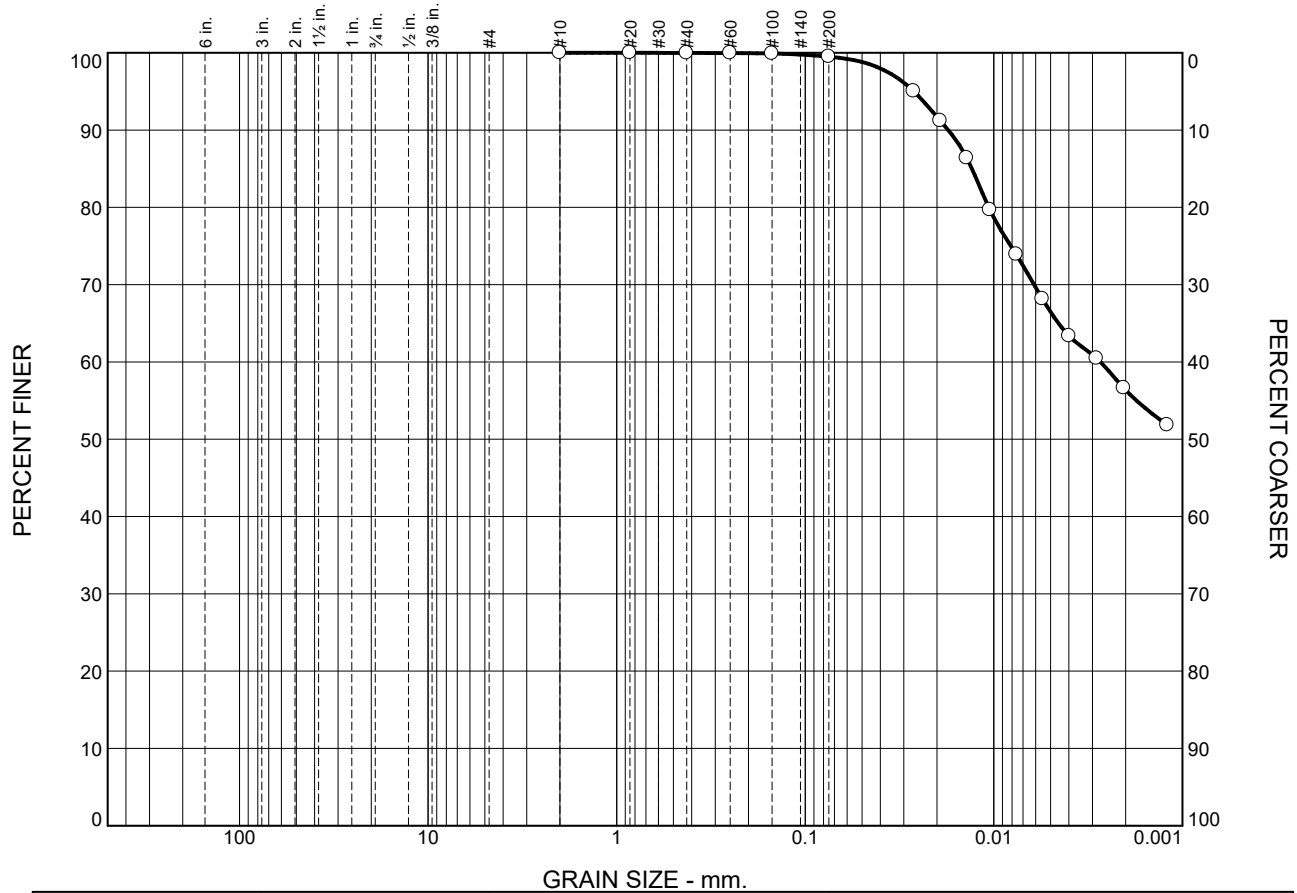
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.5	33.0	66.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-09	ST-4	10.5	Gray FAT CLAY; sand partings	CH

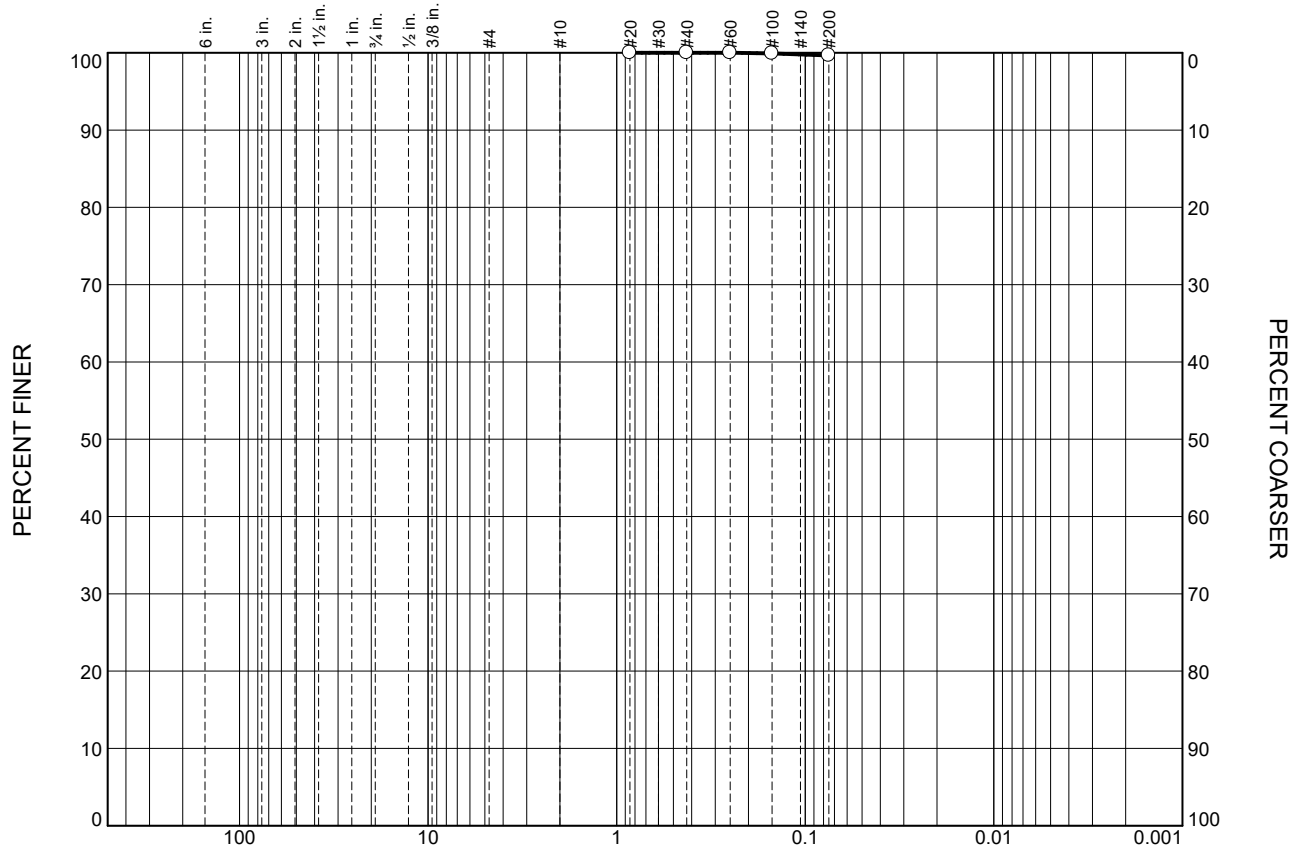
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	99.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-09	ST-7	18	Tan and light gray FAT CLAY	CH

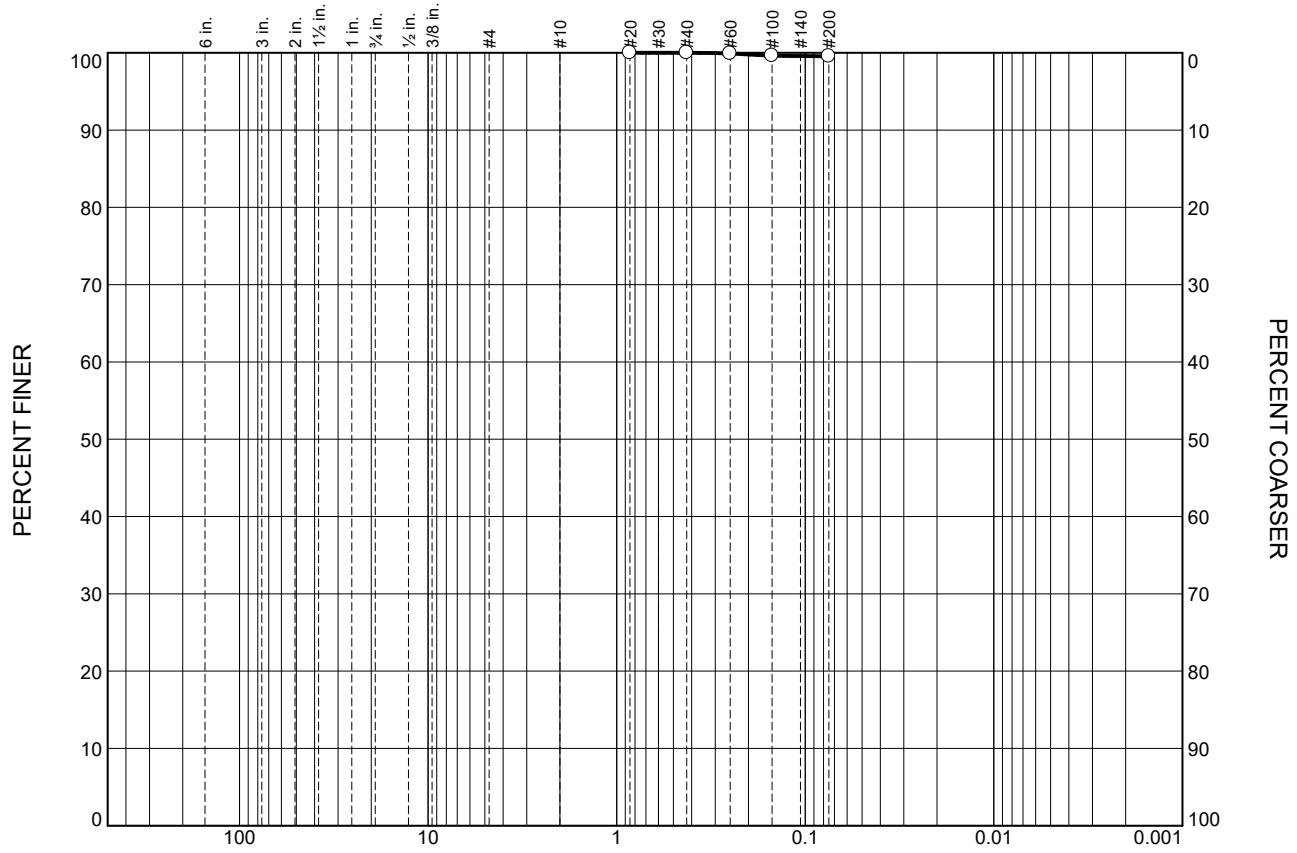
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.5	99.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-09	ST-10	25.5	FAT CLAY (CH), gray	CH

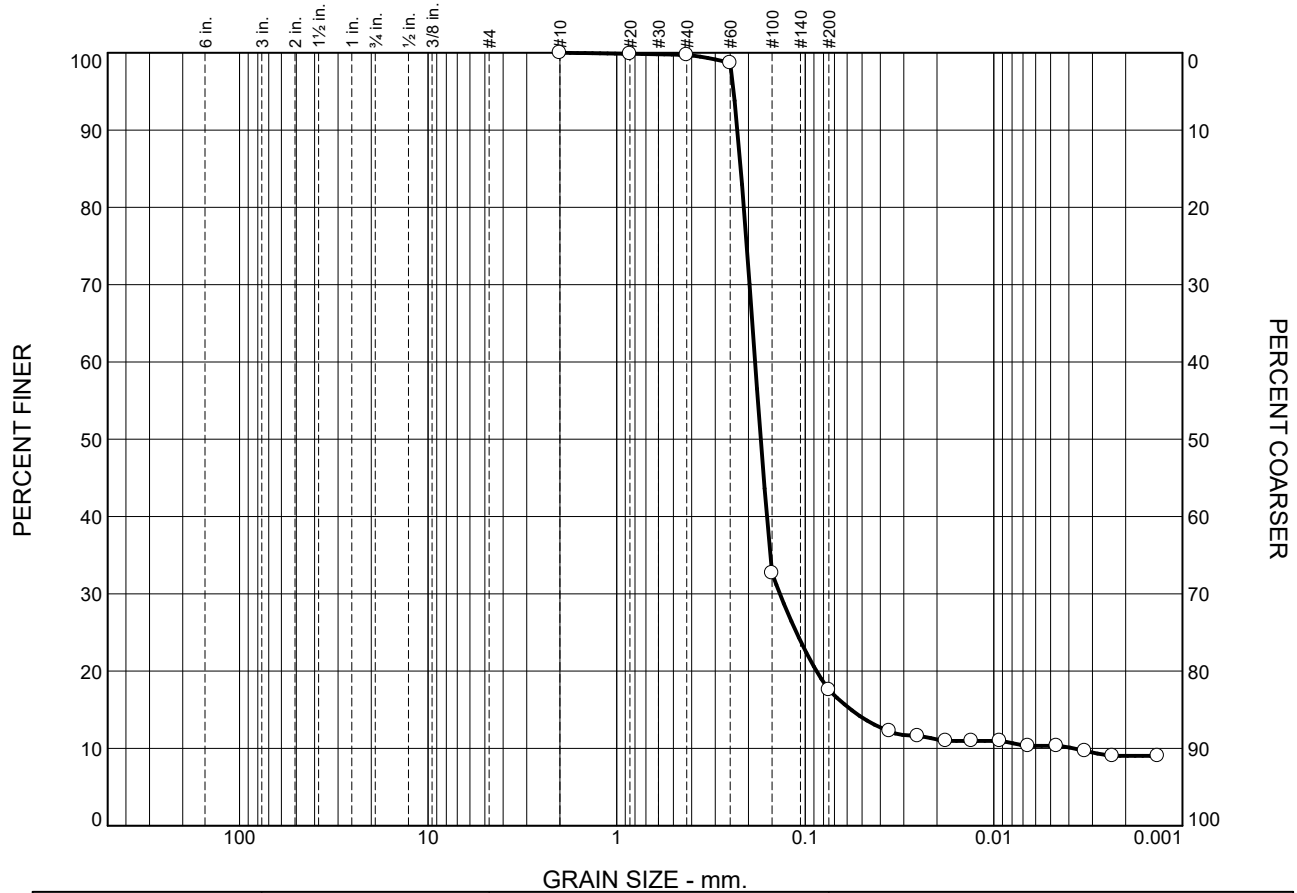
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	82.1	7.3	10.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-10	SP-1	0.5	SILTY SAND (SM), gray	SM

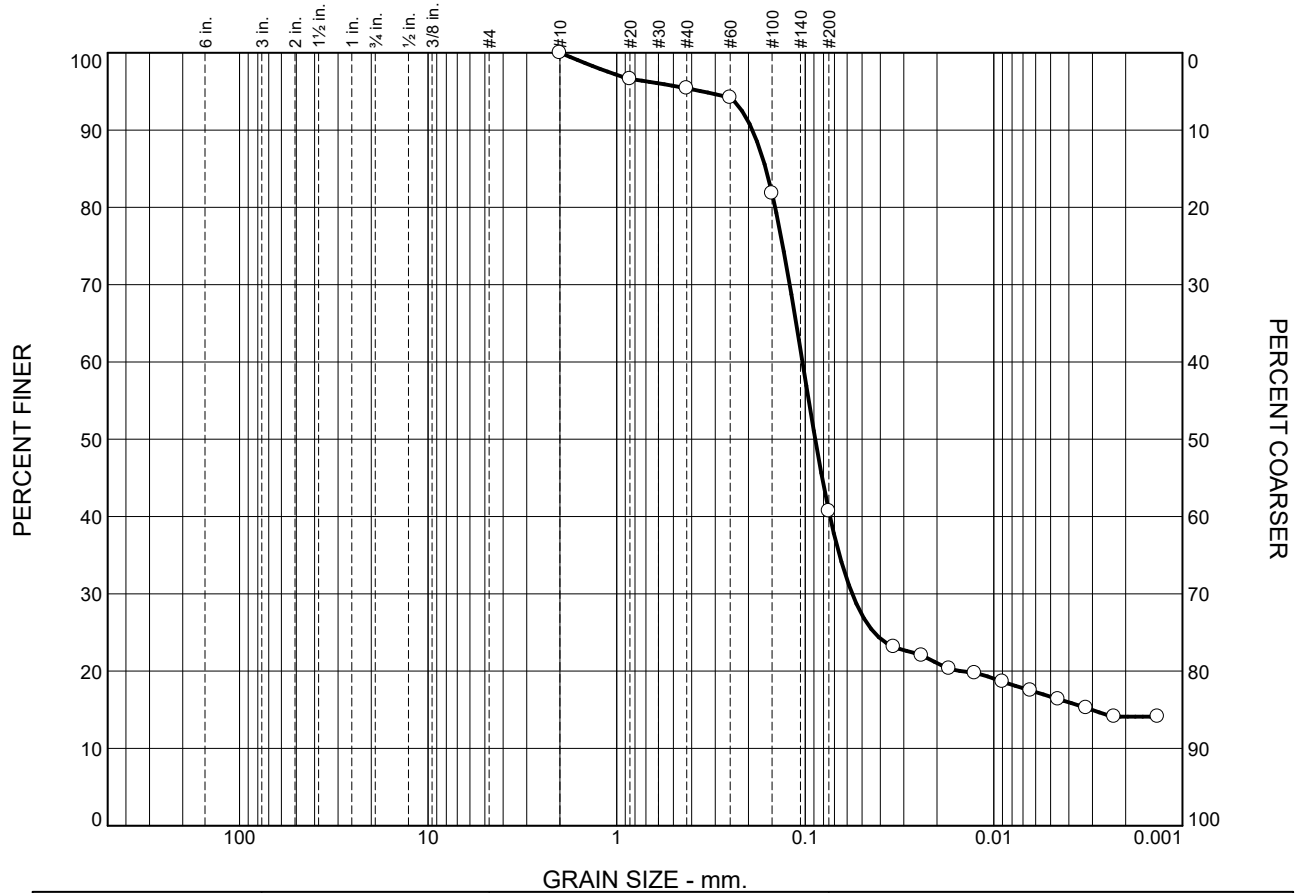
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.6	54.7	24.0	16.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-10	SP-2	5	CLAYEY SAND (SC), gray & reddishbrown	SC

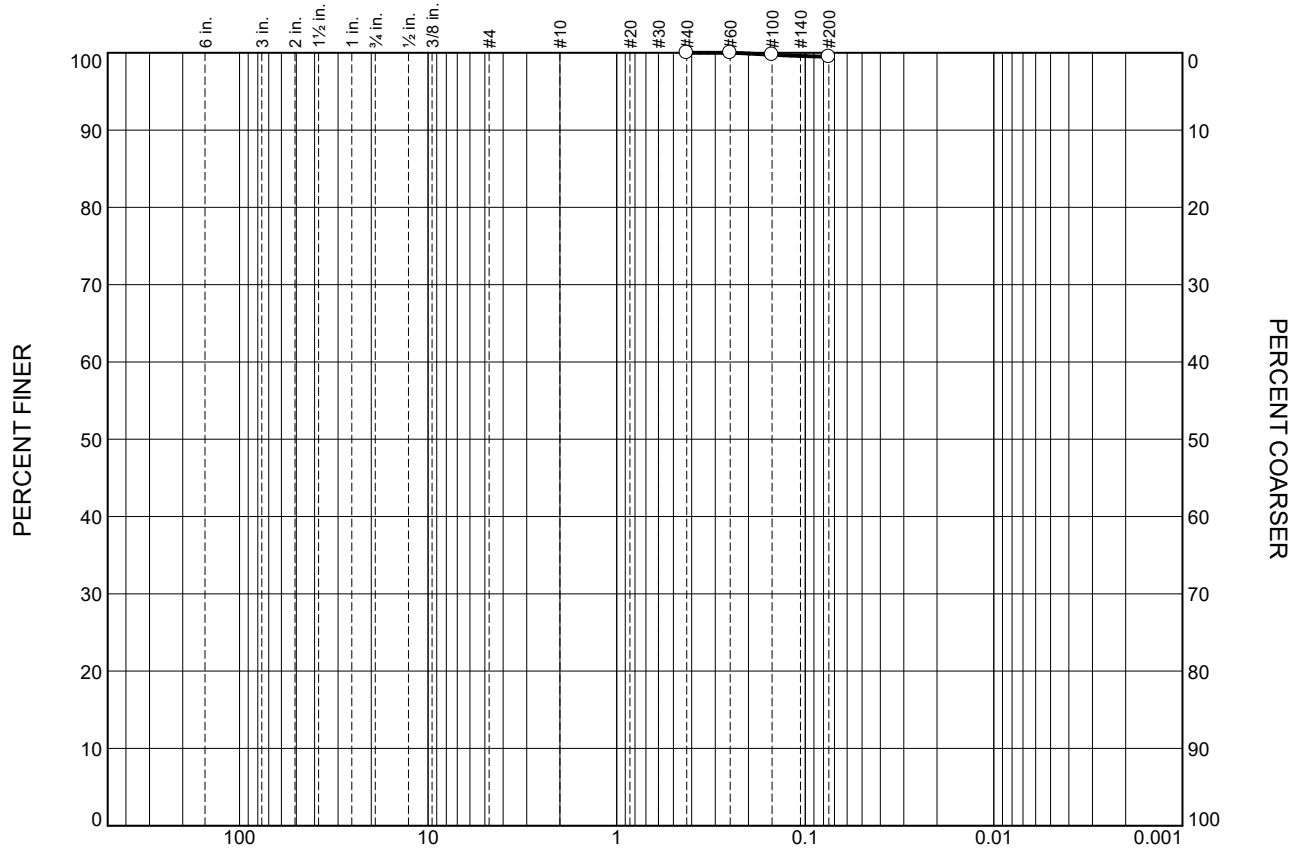
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.5	99.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-10	SP-3	27.5	Brown FAT CLAY; sand pockets	CH

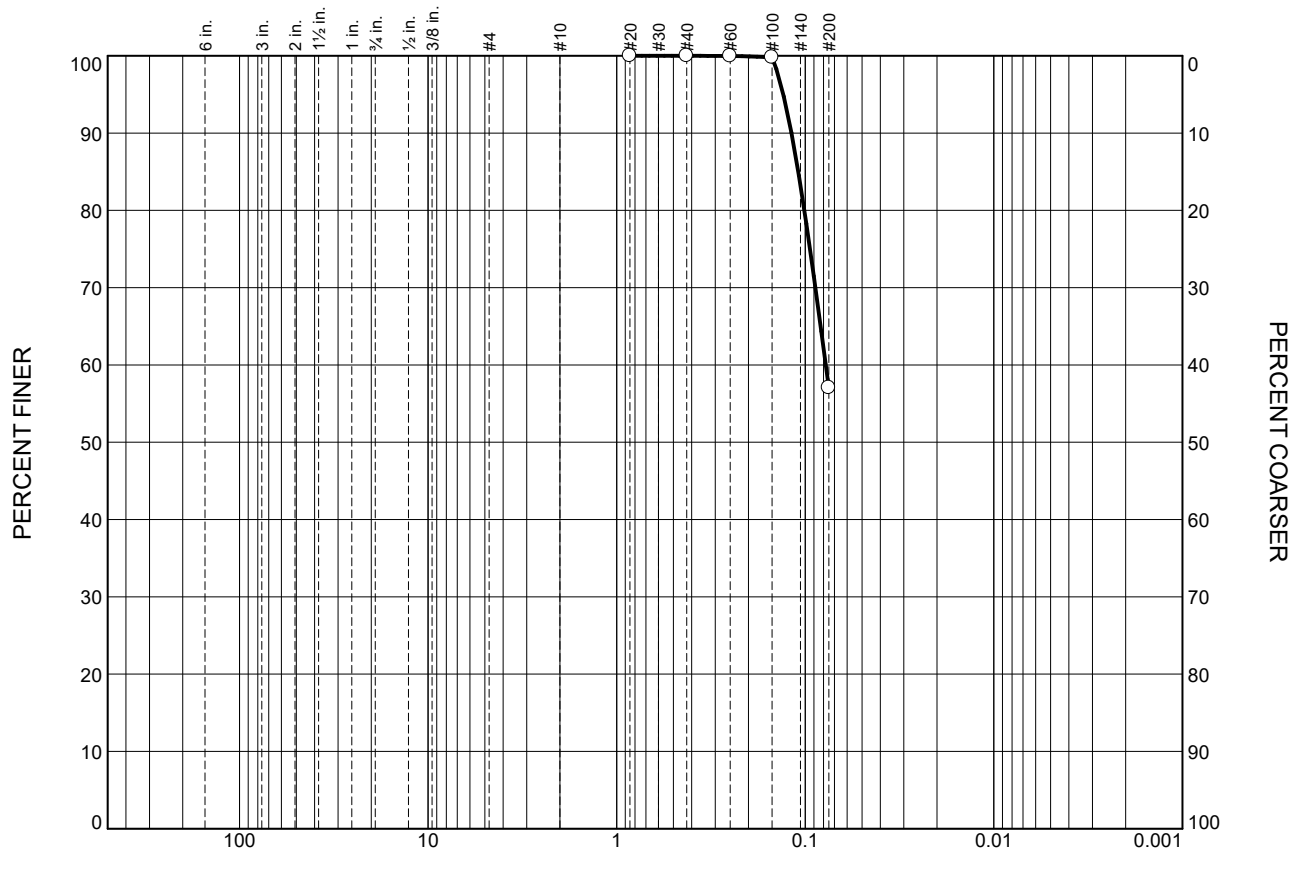
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	43.0	57.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-10	SP-4	32.5	SANDY SILT (ML), brown	ML

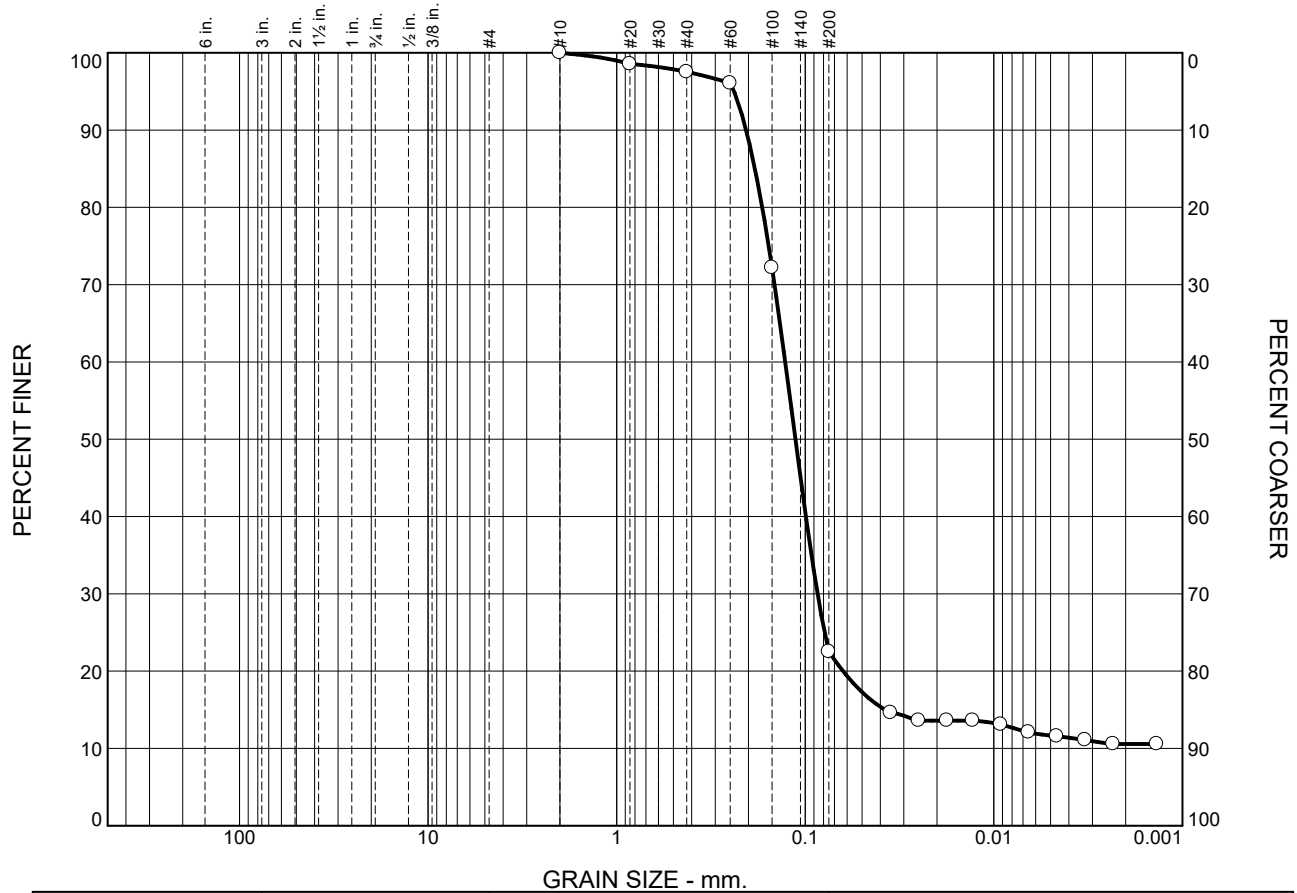
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.5	75.0	10.8	11.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-11	SP-1	0.5	SILTY SAND (SM), gray	SM

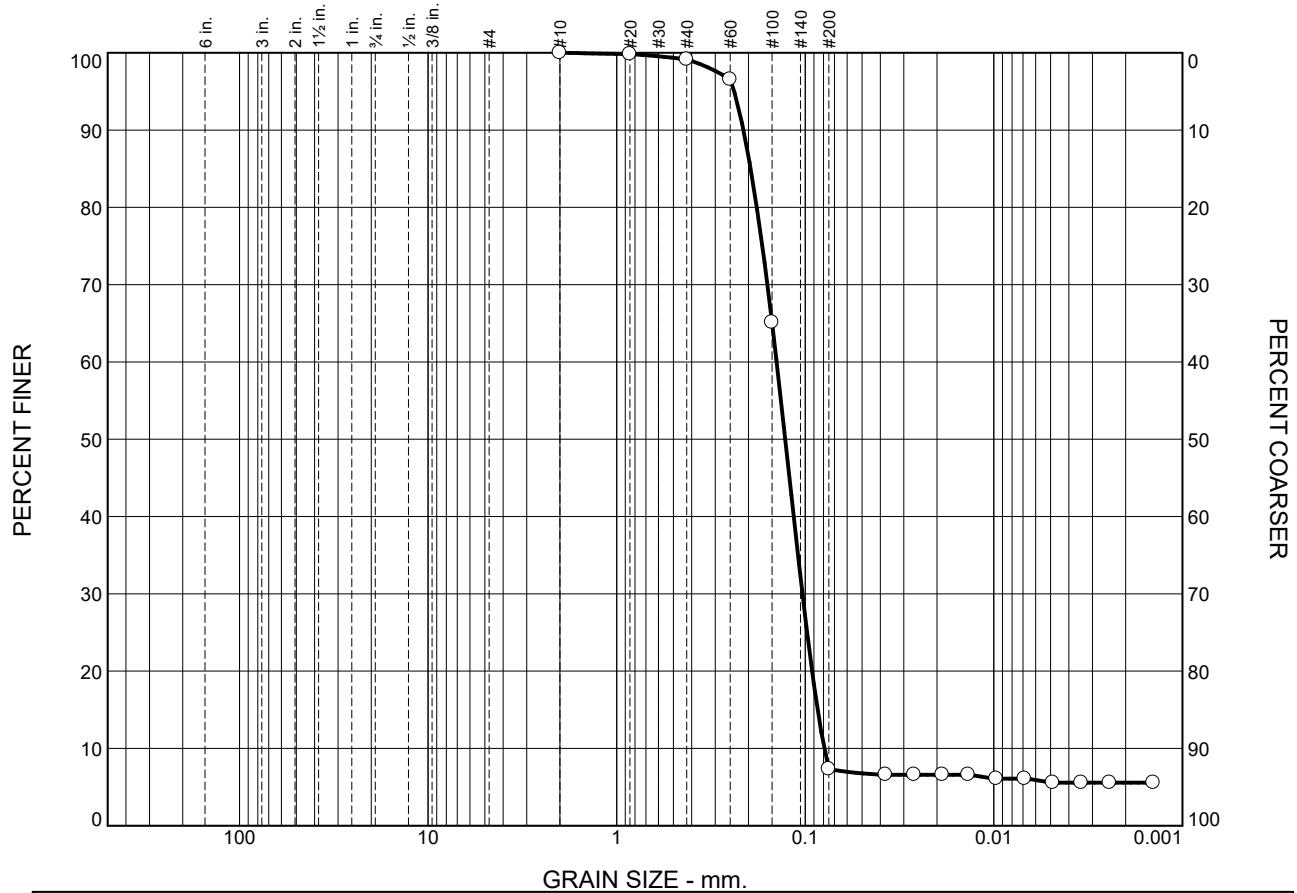
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	91.8	1.7	5.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-11	SP-2	5	POORLY GRADED SAND WITH SILT (SP-SM), gray	SP-SM

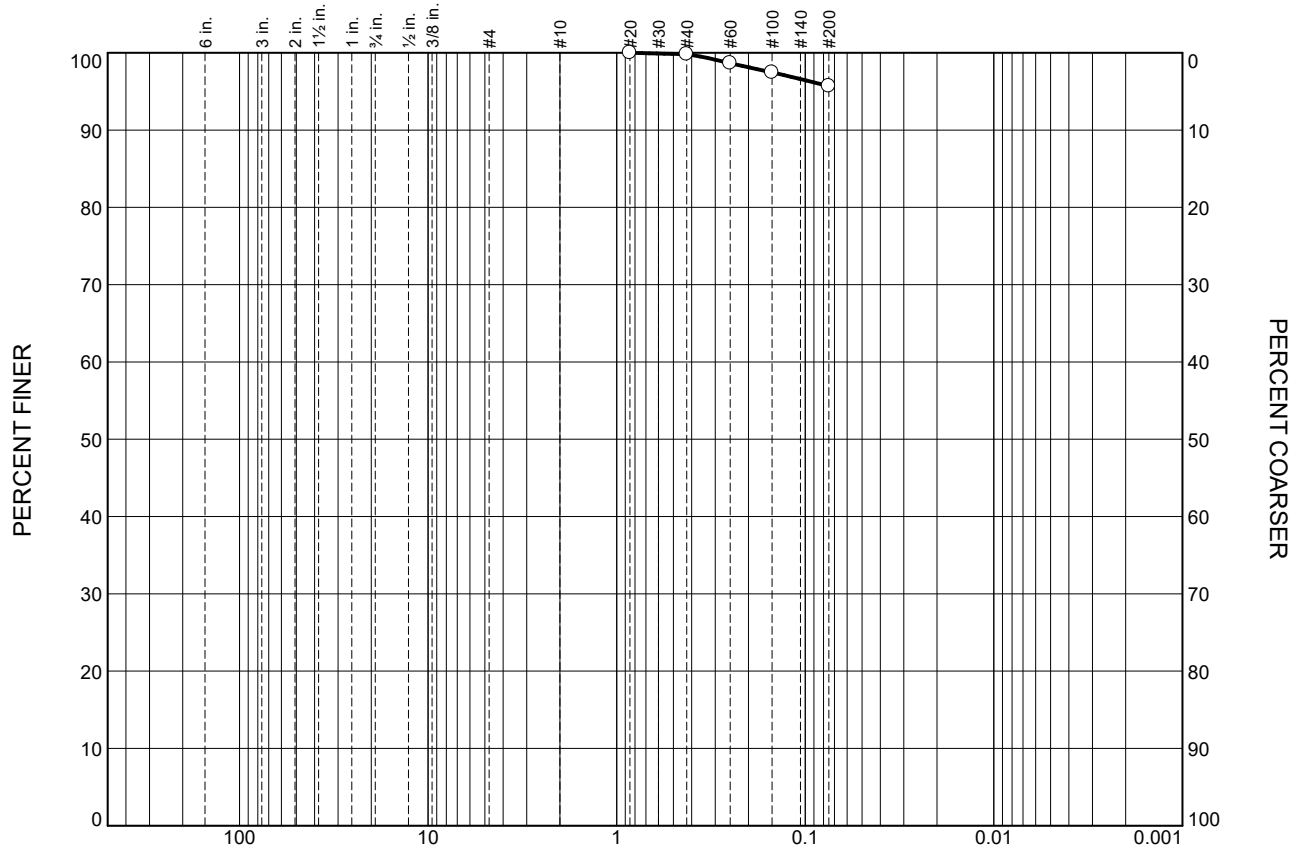
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	4.1	95.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-11	SP-6	17.5	Tan FAT CLAY	CH

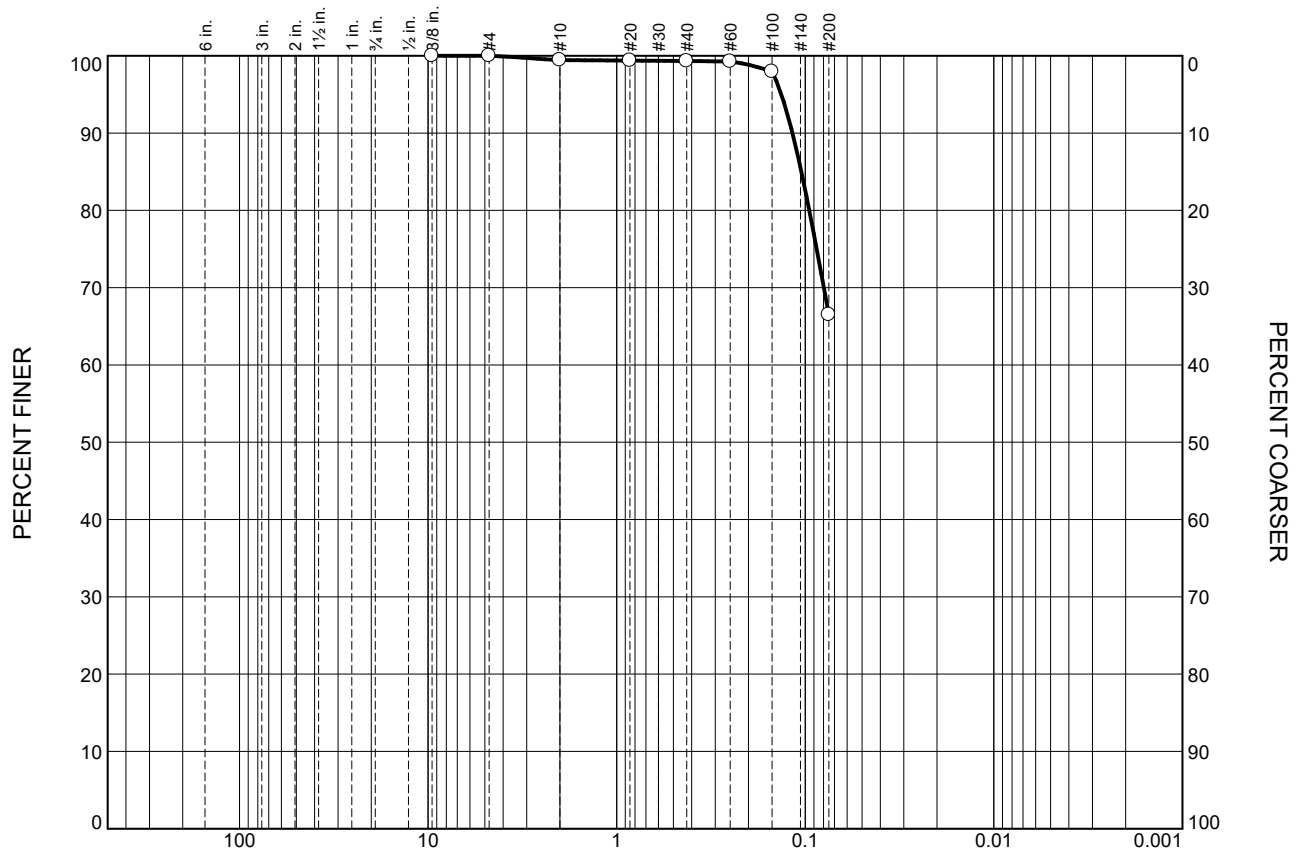
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.6	0.1	32.8	66.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-11	ST-6	30	SANDY LEAN CLAY (CL), gray	CL

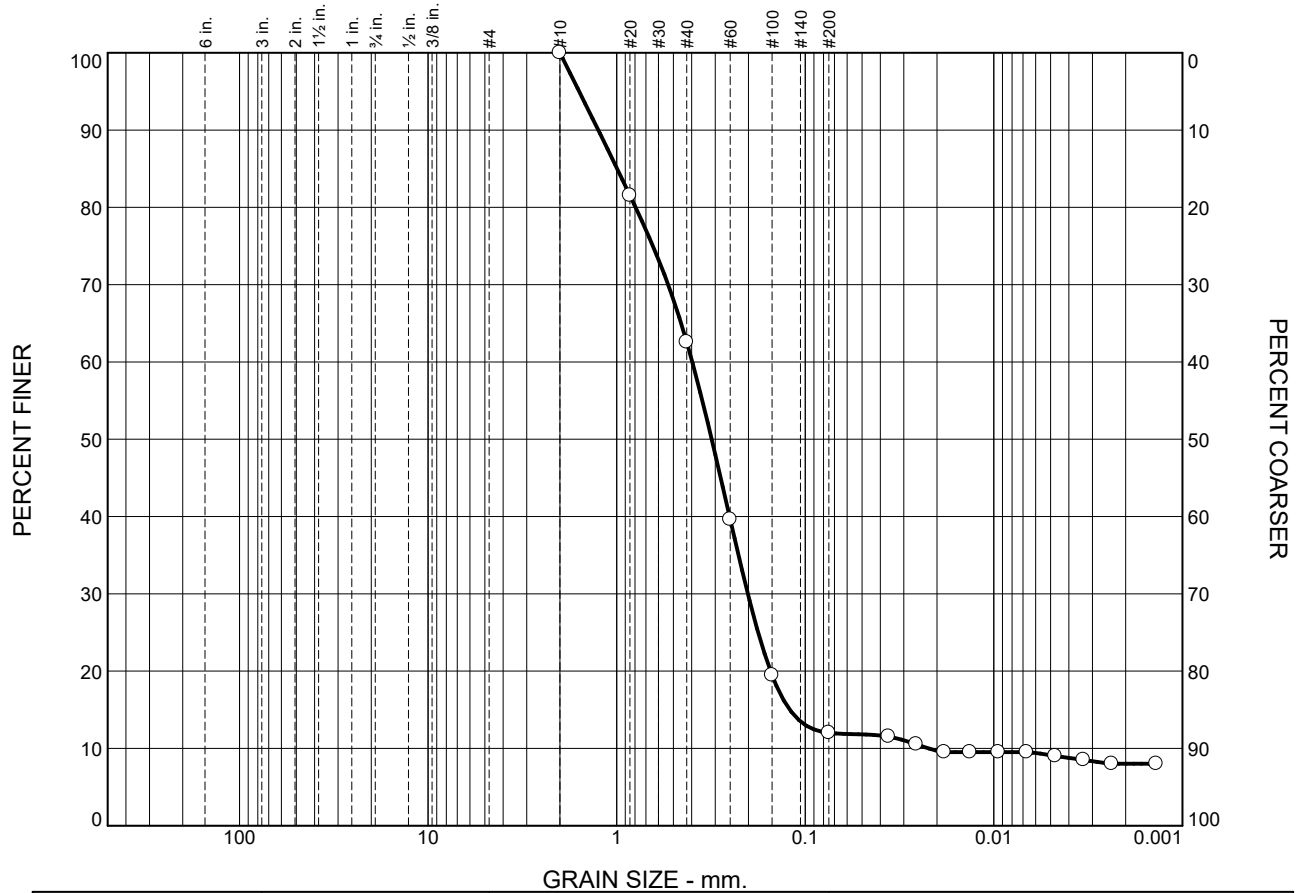
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	37.4	50.6	2.9	9.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-12	SP-1	0.5	Brown SILTY SAND	SM

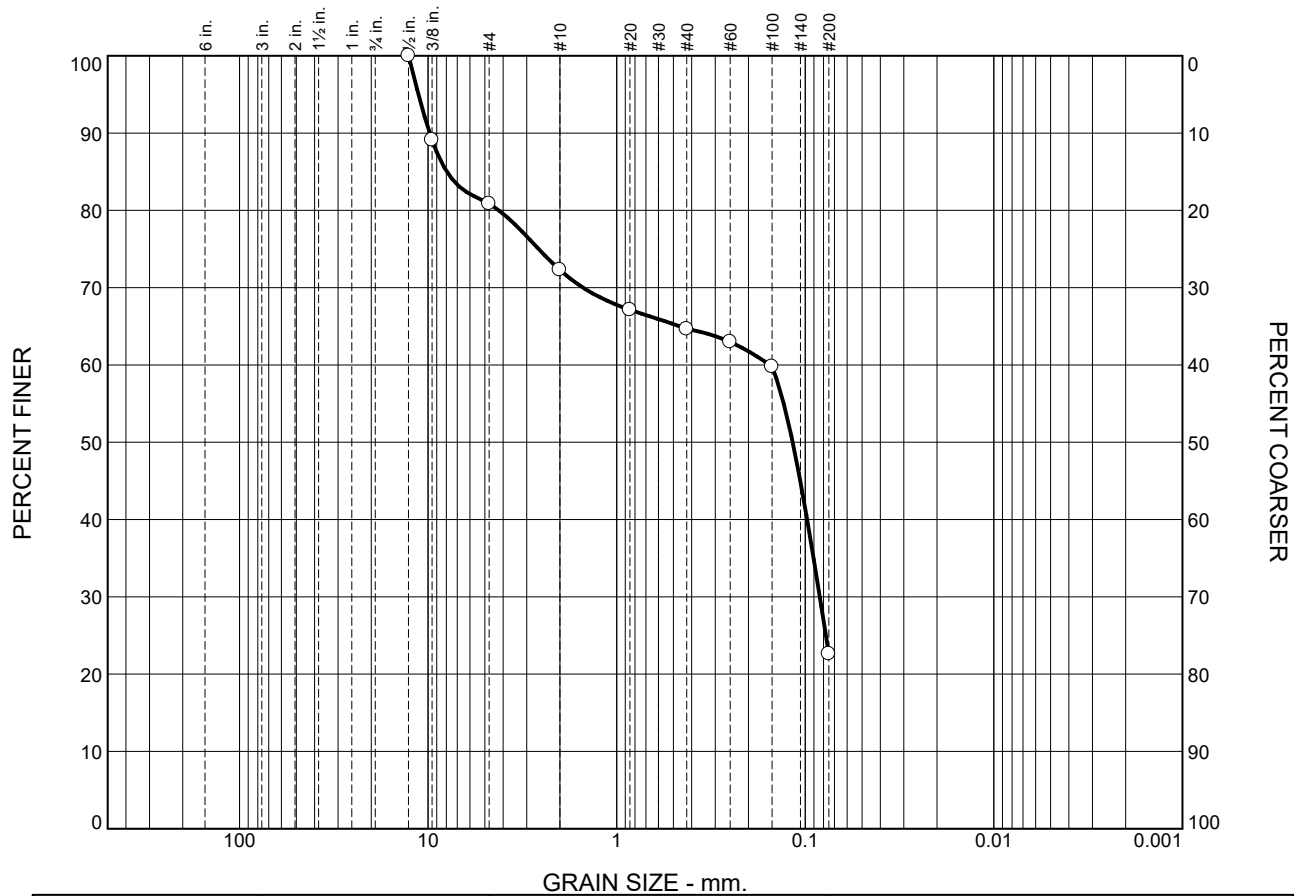
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	19.1	8.6	7.7	42.0	22.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-12	SP-4	10	Gray and brown SILTY SAND with GRAVEL	SM

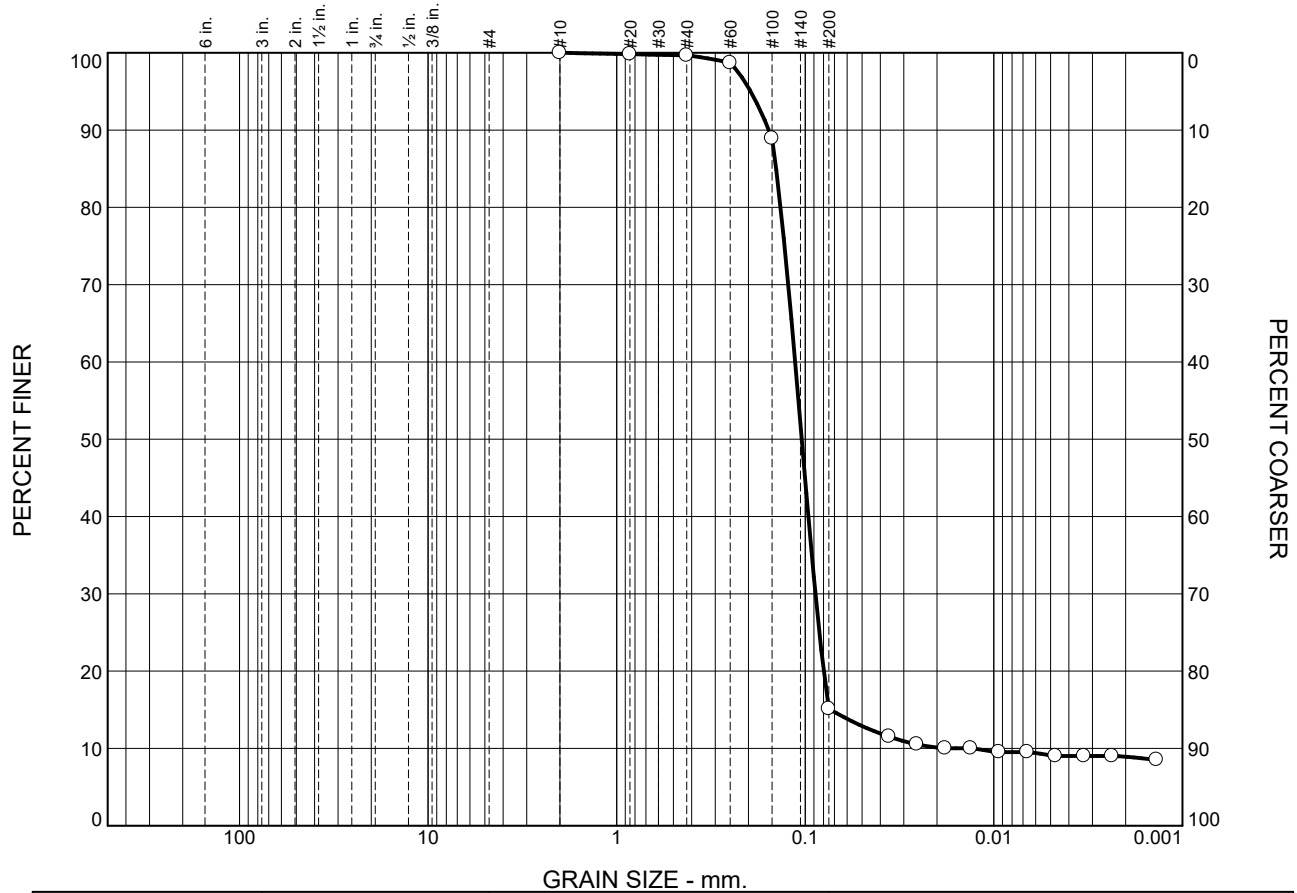
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	84.6	6.0	9.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-12	SP-6	15	Brown SILTY SAND	SM

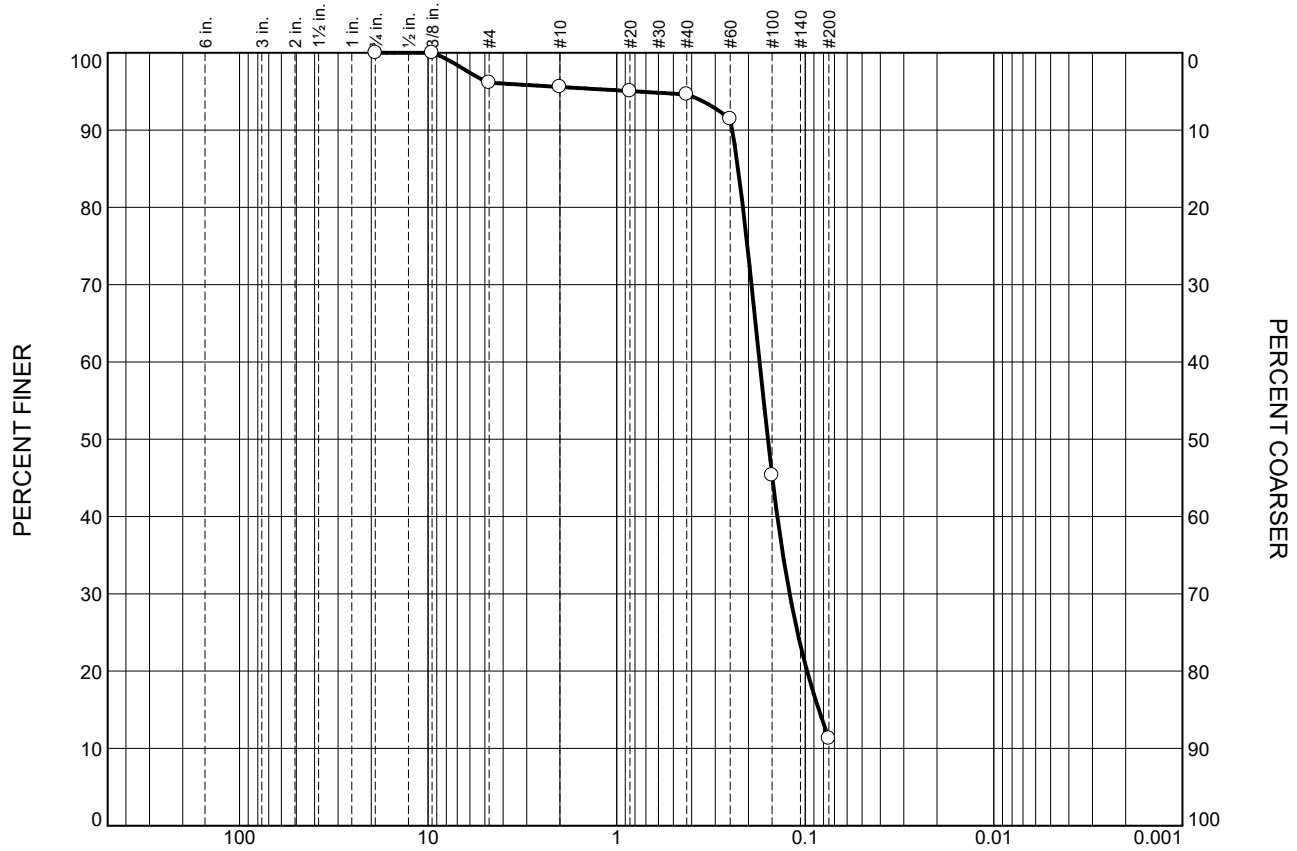
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.9	0.5	1.0	83.3	11.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-12	SP-9	22.5	Brown poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	14.5	66.5	5.3	13.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-13	SP-1	0.5	Brown CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				3.2	4.0	73.5	11.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-13	SP-3	5.5	Brown poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	9.9	76.5	6.0	7.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-13	SP-5	10.5	Brown SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.4	2.3	19.5	50.9	26.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-13	SP-7	15.5	Brown and gray CLAYEY SAND	SC

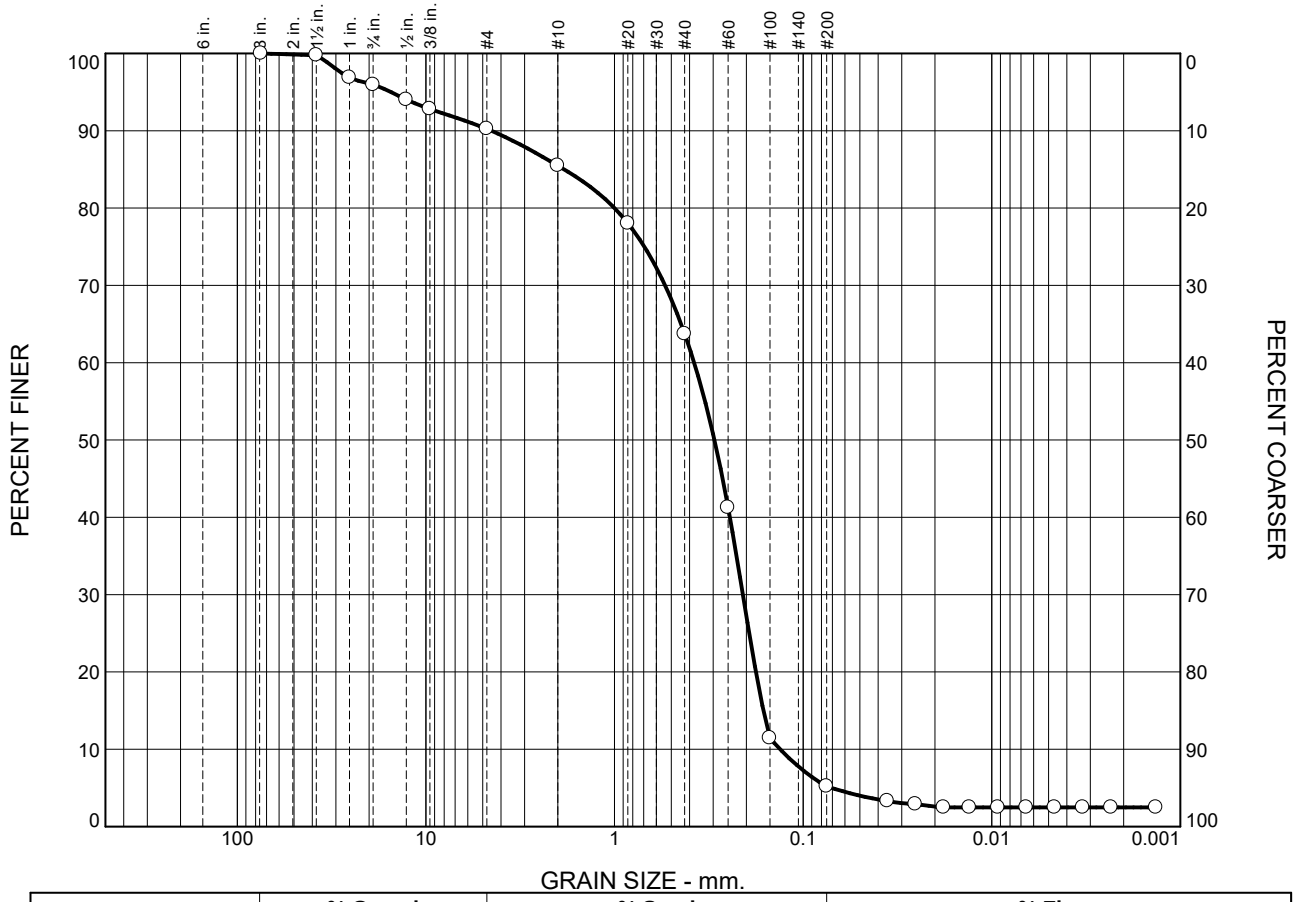
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.0	5.8	4.7	21.8	58.5	2.7	2.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-14	-	0	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

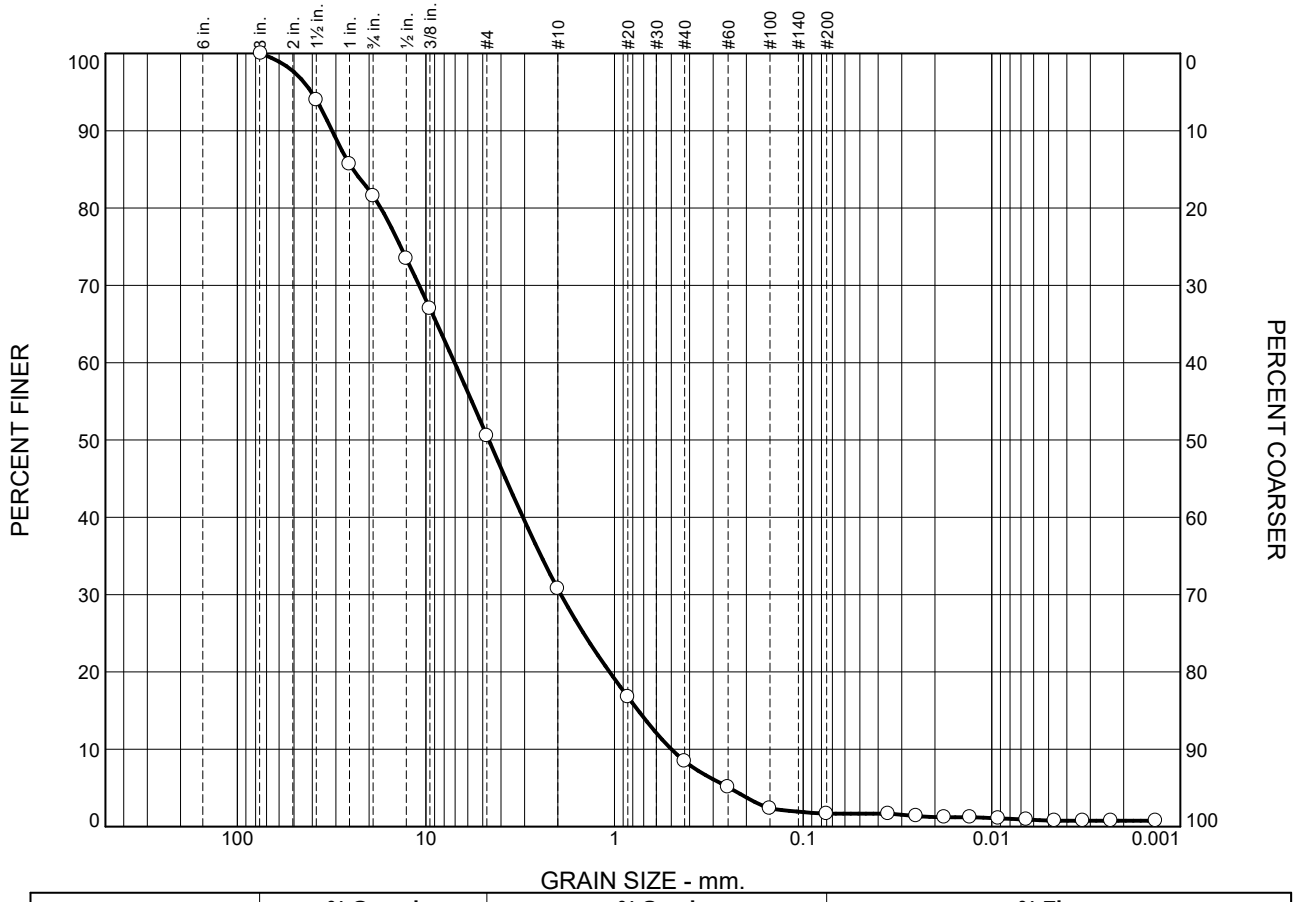
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	18.4	31.1	19.7	22.3	6.8	0.9	0.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-15	-	0	WELL GRADED GRAVEL with SAND (GW)	GW

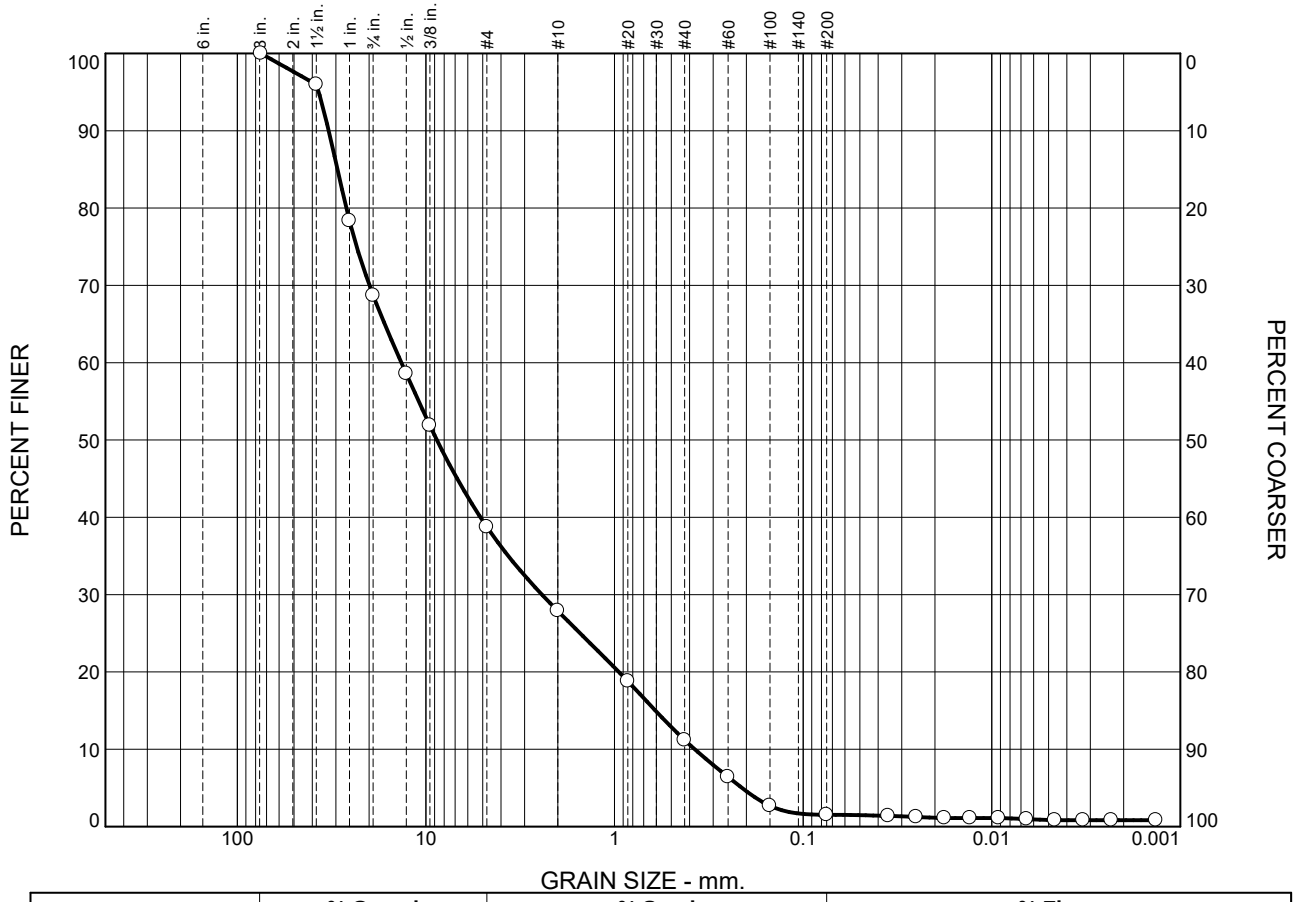
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	31.3	30.0	10.8	16.7	9.7	0.7	0.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-16	-	0	WELL GRADED GRAVEL with SAND	GW

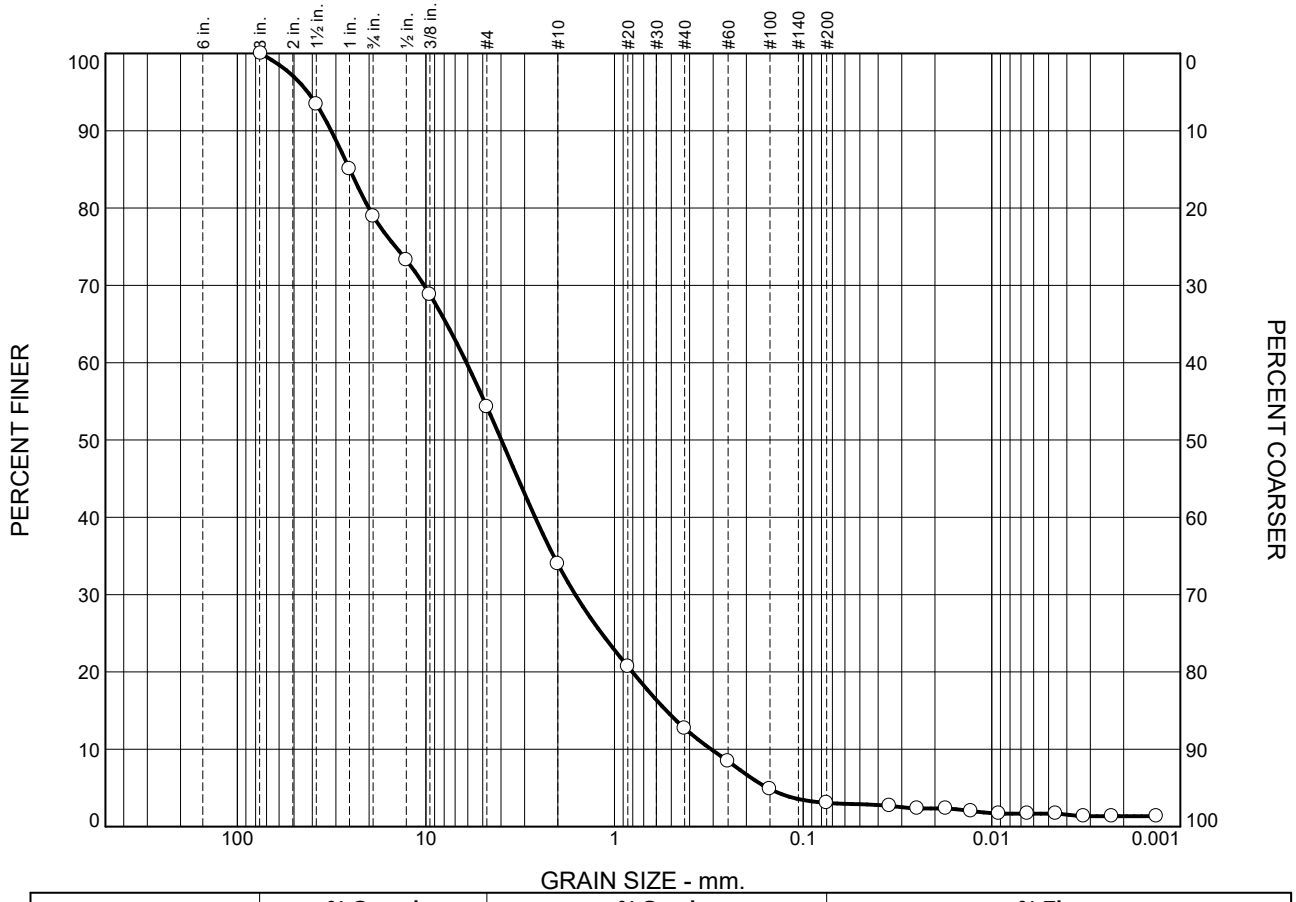
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	21.0	24.7	20.3	21.3	9.6	1.4	1.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-17	-	0	WELL GRADED SAND with GRAVEL	SW

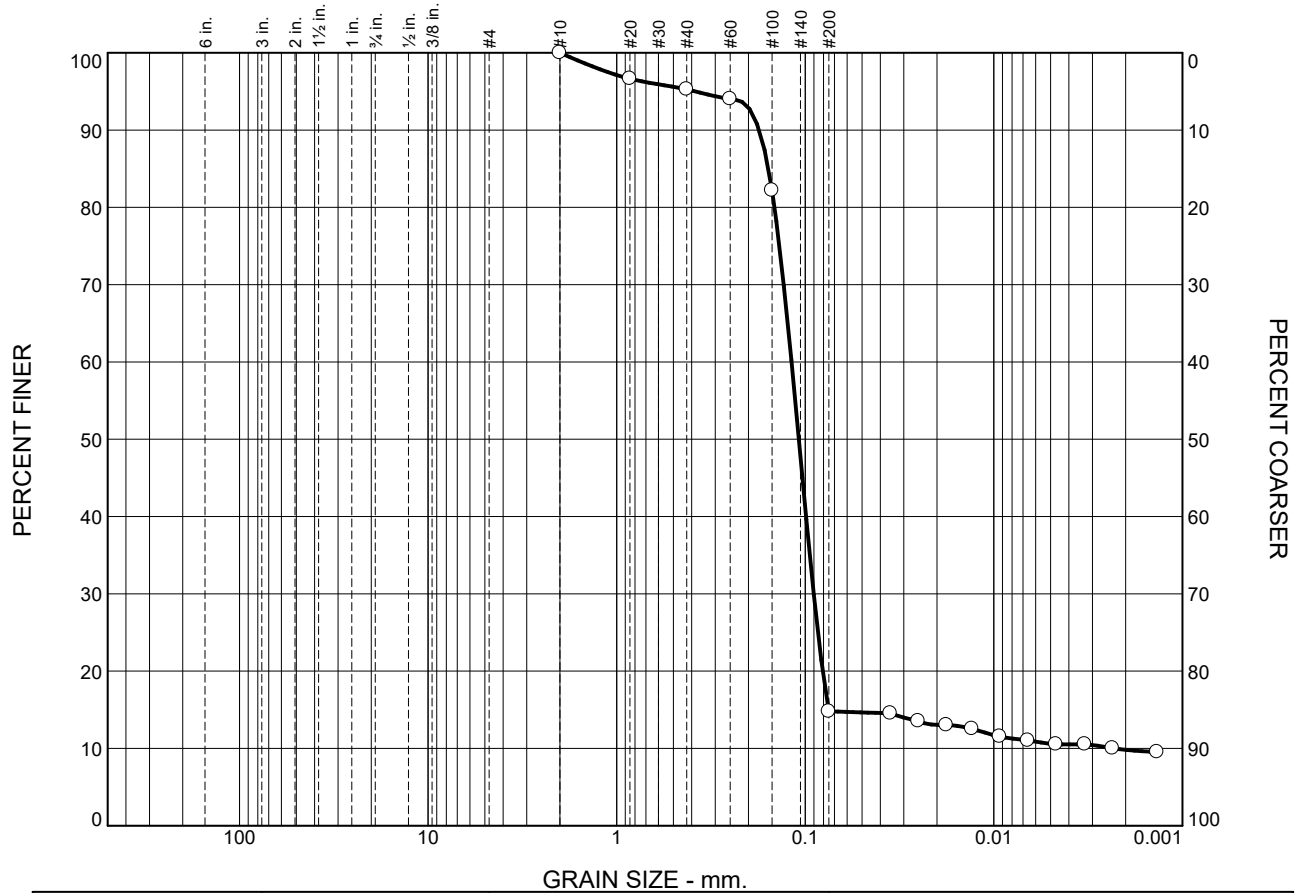
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.7	80.5	4.2	10.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-18	SP-1	0.5	Bray and brown SILTY CLAYEY SAND	SM

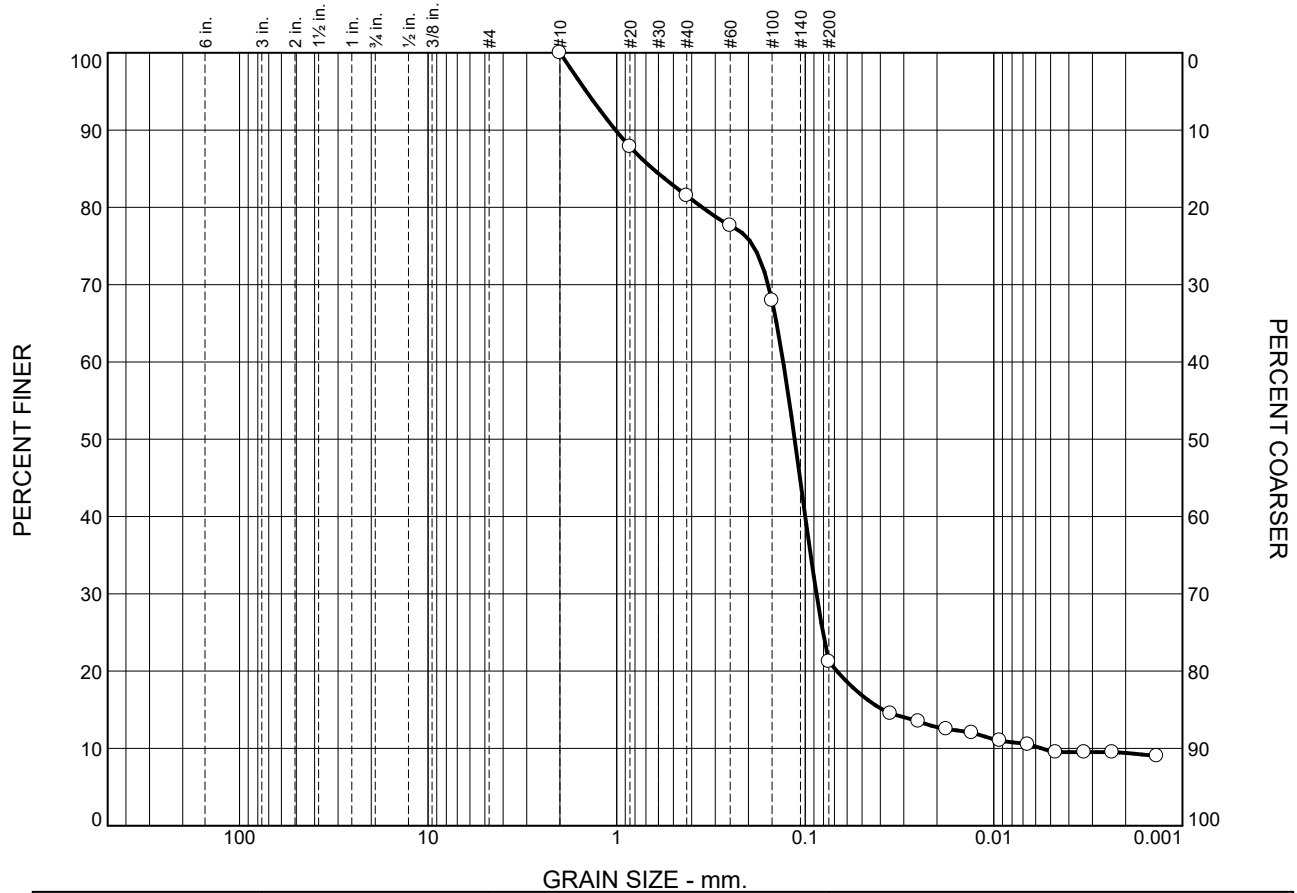
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	18.5	60.3	11.5	9.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-18	SP-2	3	Gray SILTY SAND	SM

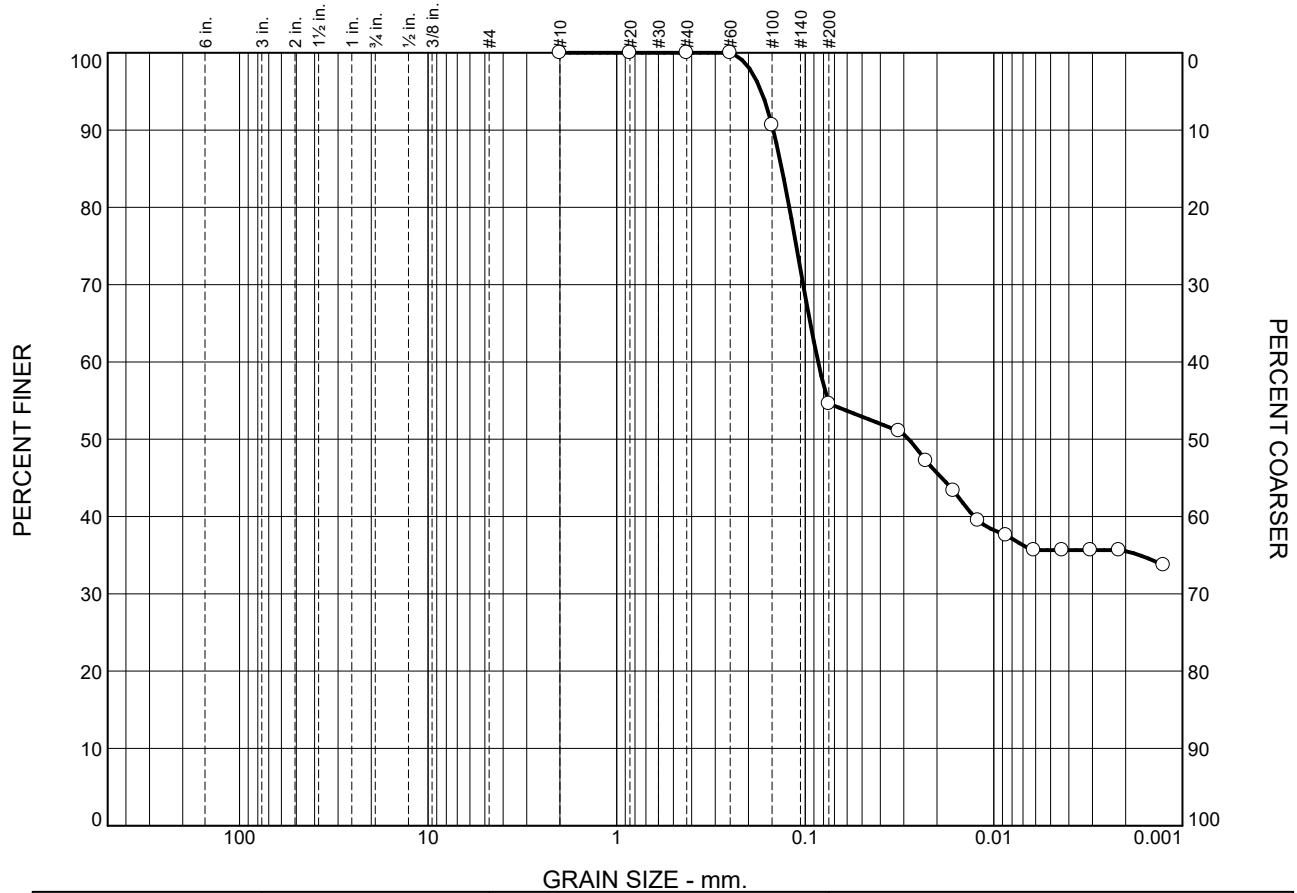
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	45.4	19.0	35.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-19	SP-2	5	Tan LEAN CLAY with SAND; shell fragments	SC

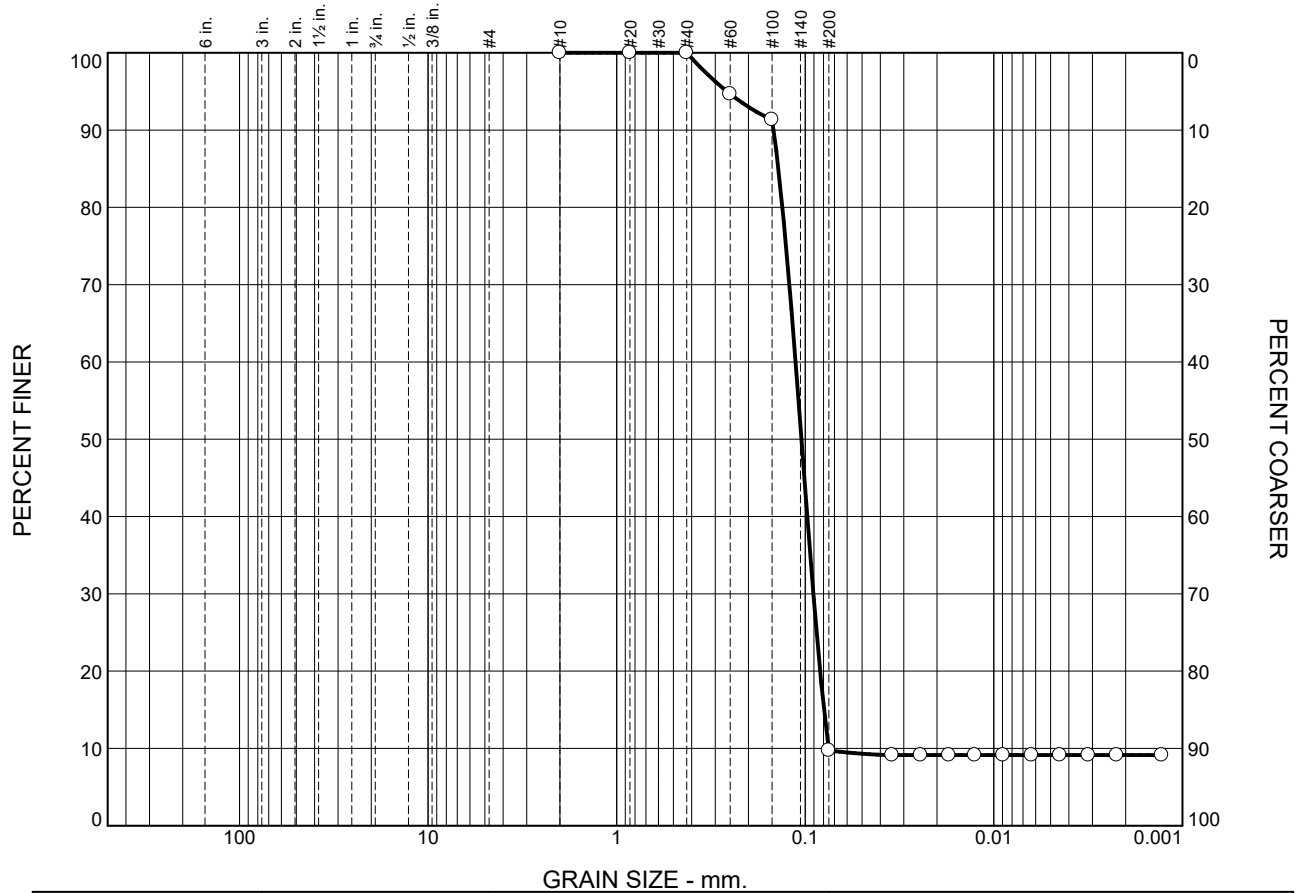
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	90.3	0.6	9.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-19	SP-3	10	Tan poorly graded SAND with SILT	SC

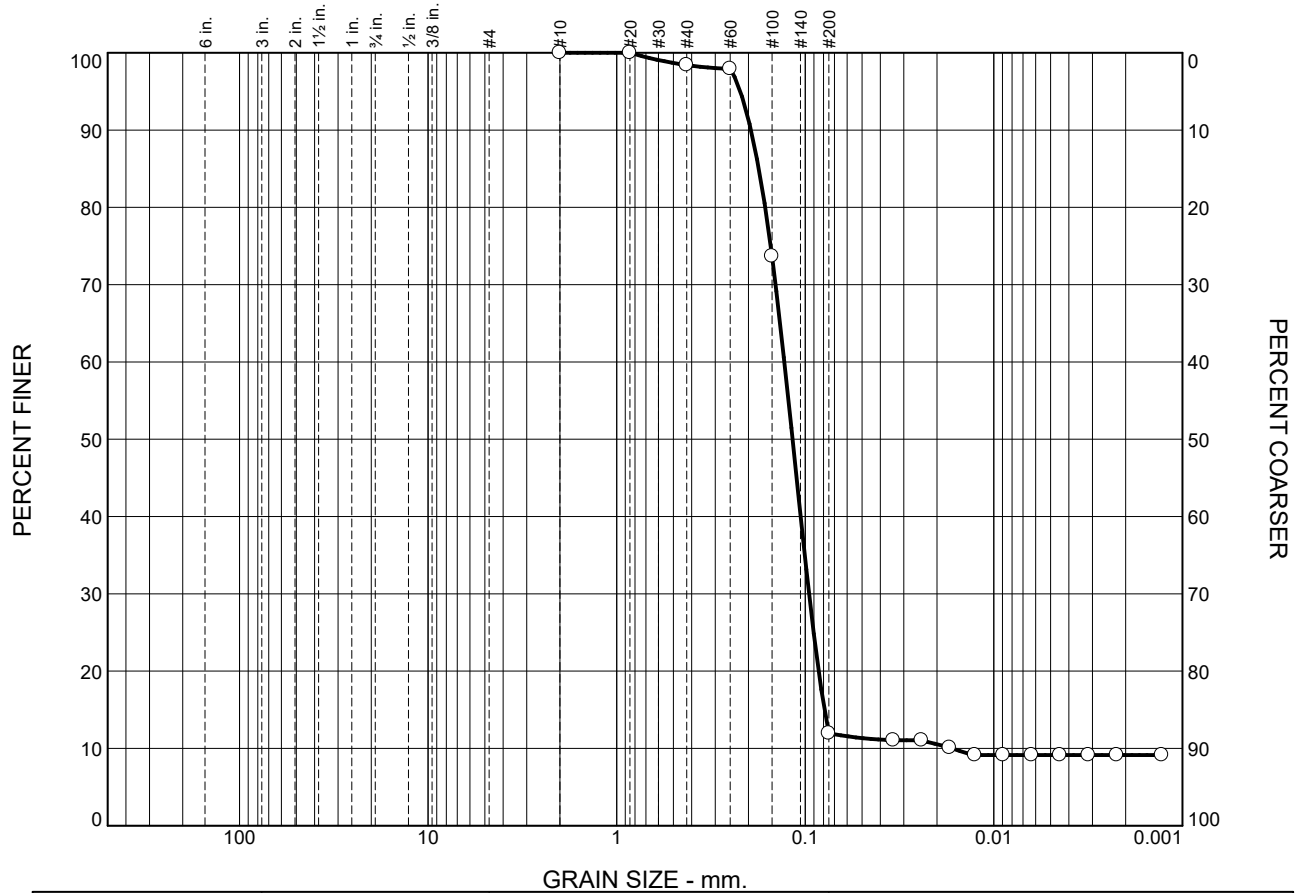
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.6	86.5	2.8	9.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-19	SP-5	17.5	Tan poorly graded SAND with SILT	SC

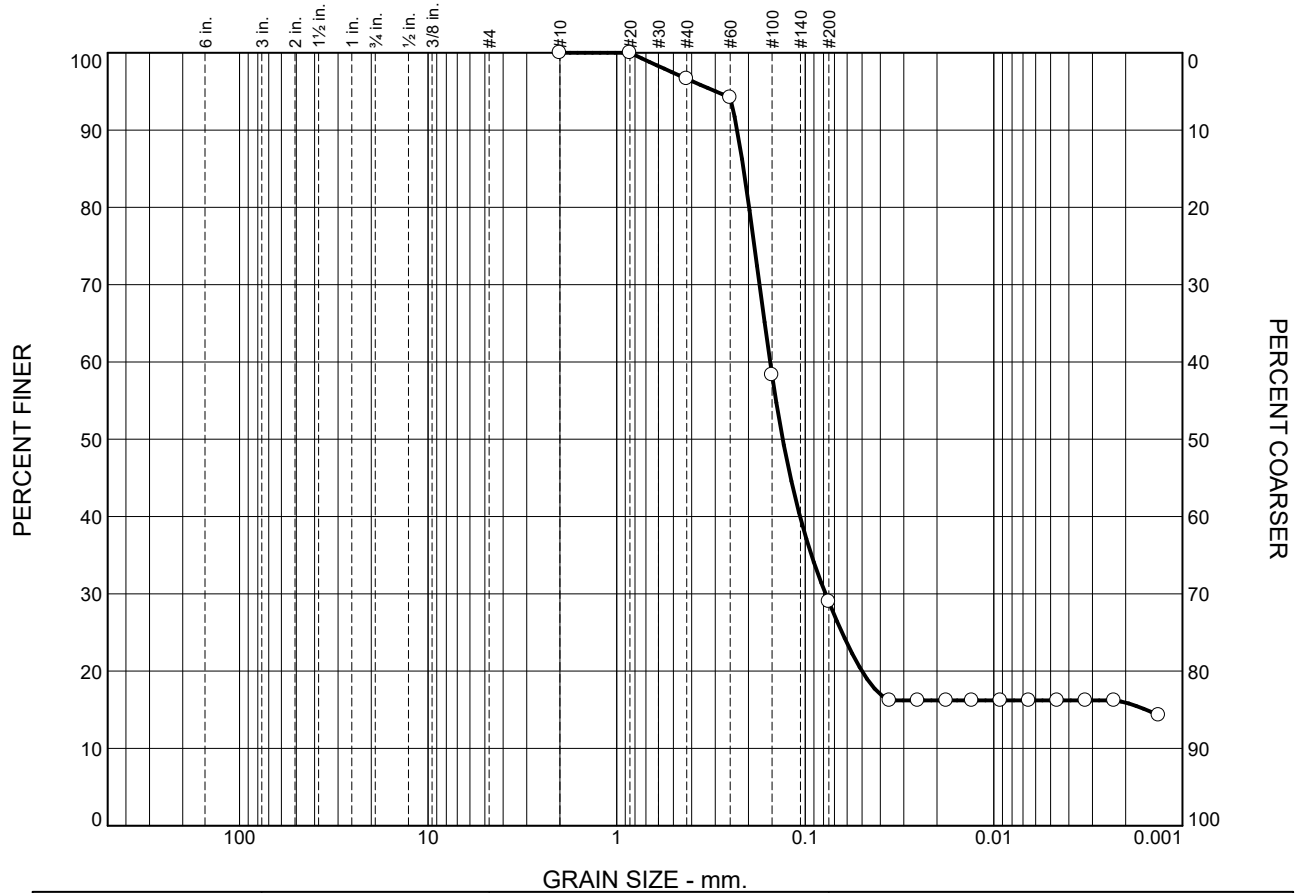
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	3.4	67.6	12.8	16.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-19	SP-8	25	Tan SILTY SAND	SC

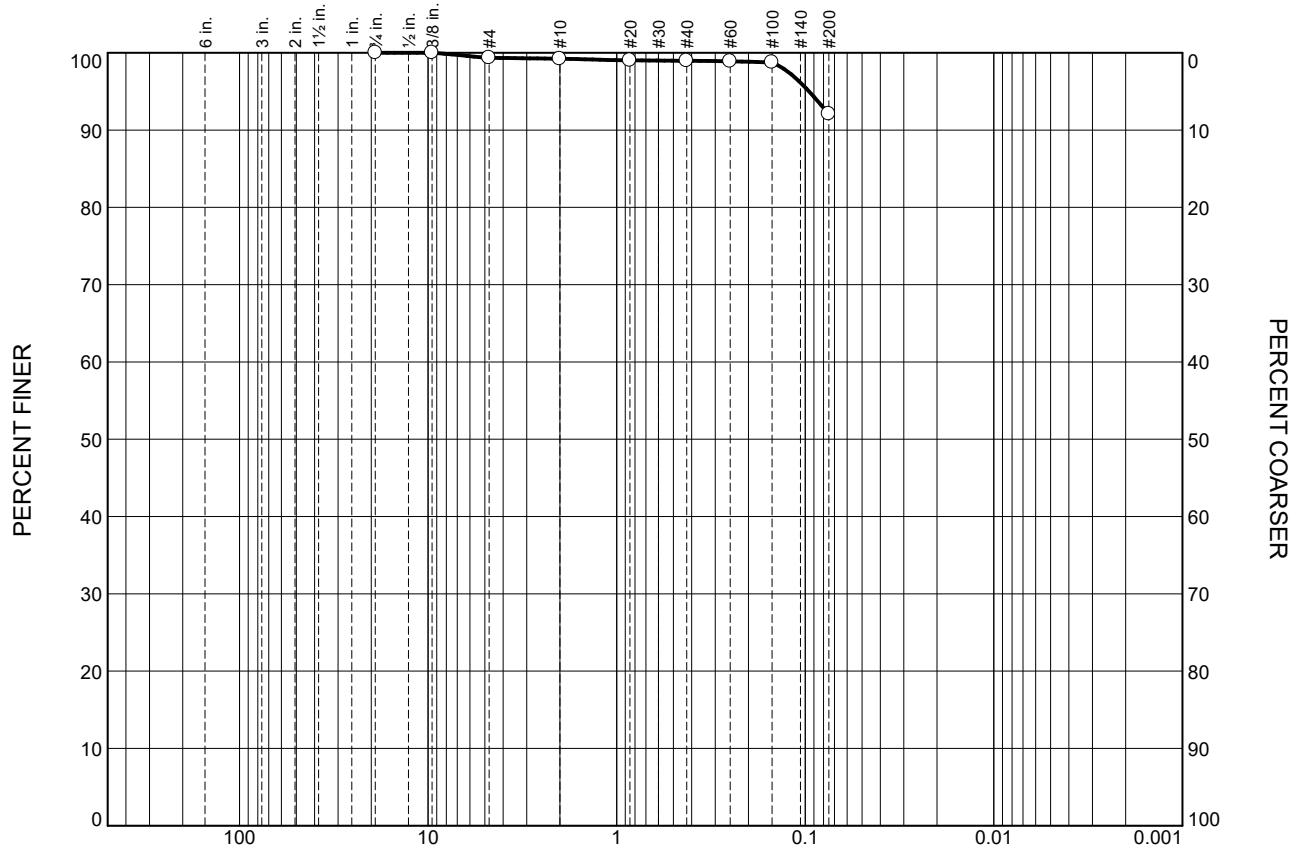
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.7	0.1	0.2	6.9	92.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-19	SP-10	32.5	Reddish-brown FAT CLAY	SC

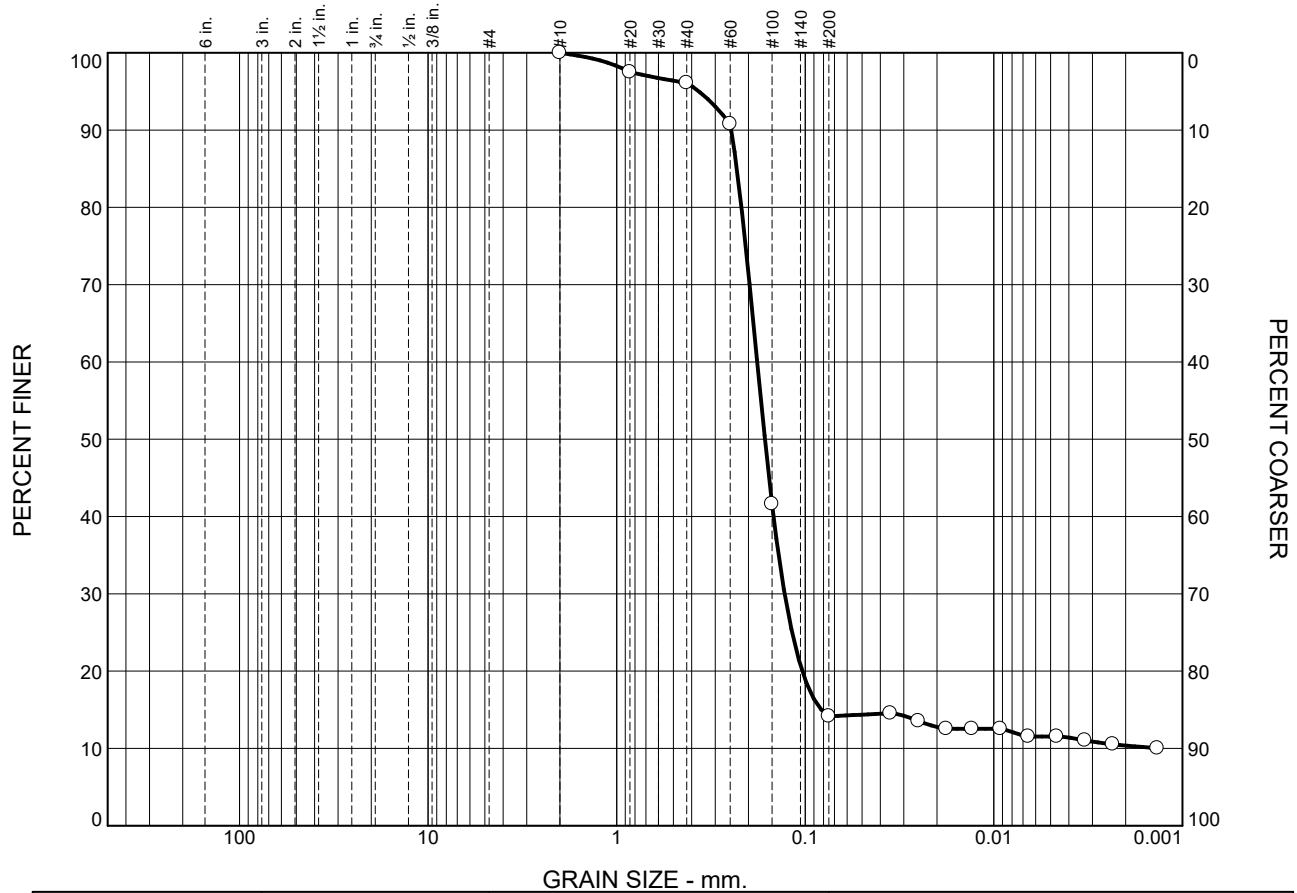
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	3.9	82.0	2.6	11.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-20	SP-2	10.5	Brown SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.5	2.2	3.8	83.0	10.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-20	SP-4	18	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.6	82.5	3.4	9.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-20	SP-7	25.5	Brown SILTY SAND	SM

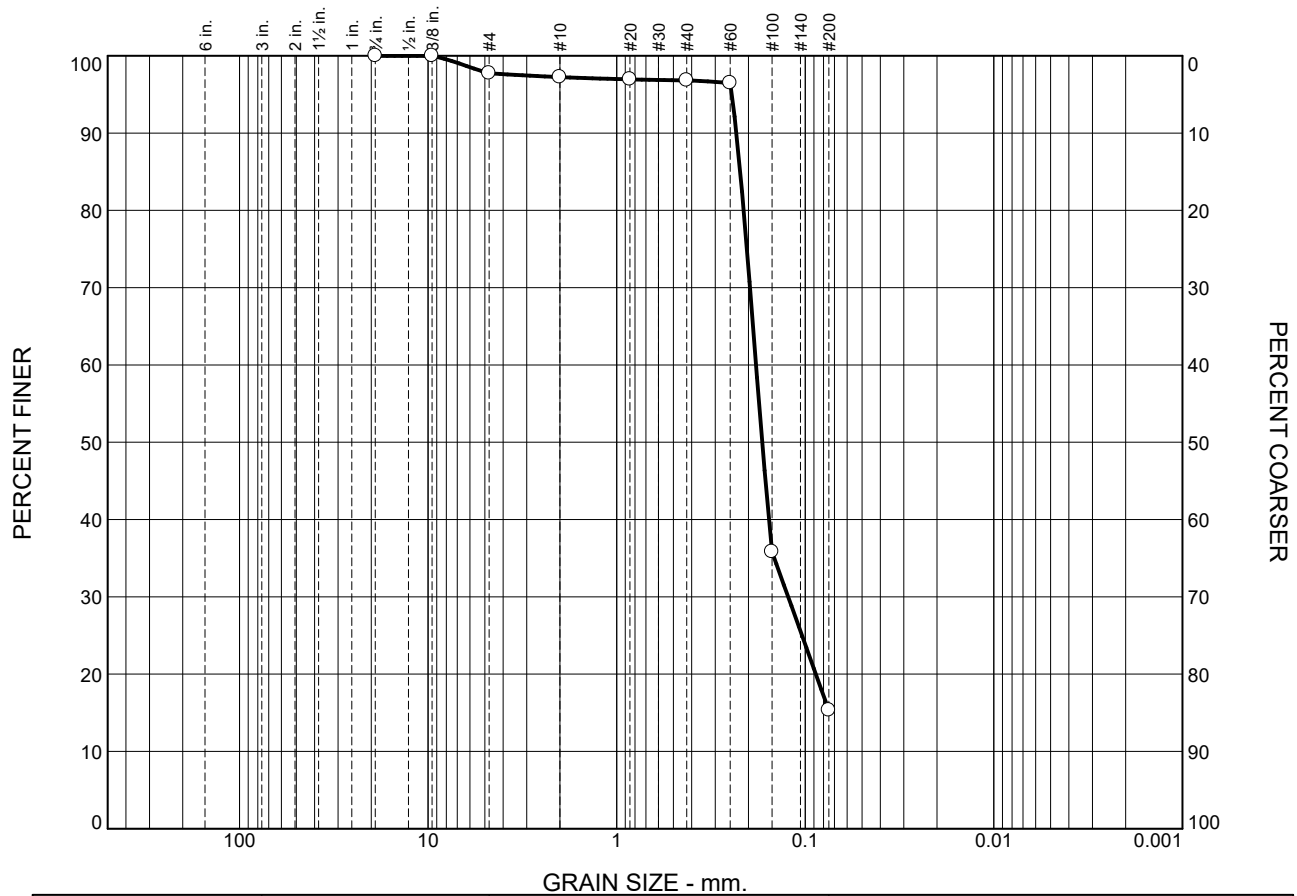
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.5	0.4	81.5	15.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-20	SP-11	35.5	Tan SILTY SAND	SM

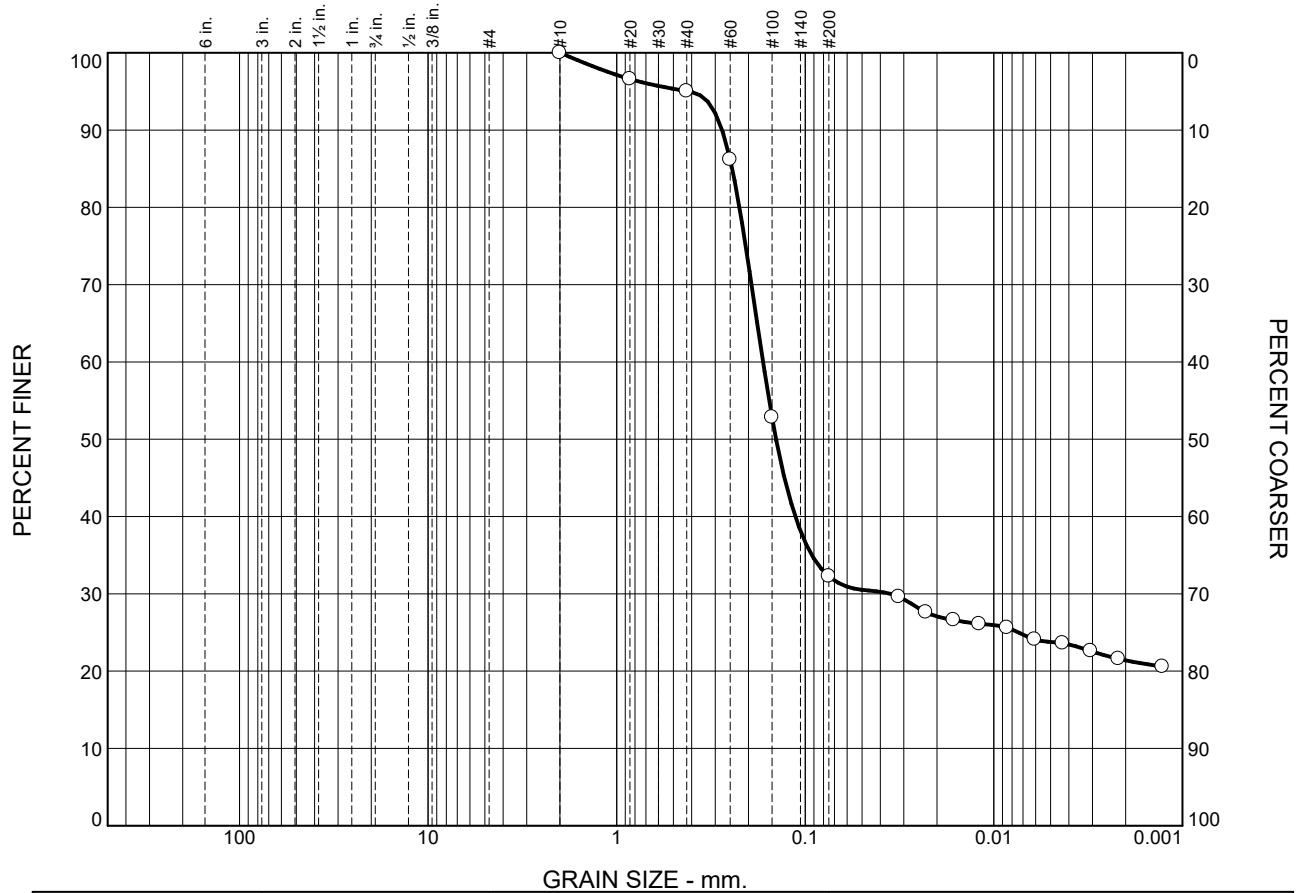
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.0	62.7	8.5	23.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-21	SP-1	0.5	Gray and brown CLAYEY SAND	SC

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.1	3.1	2.9	74.0	12.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-21	SP-2	10.5	Tan and gray SILTY SAND	SM

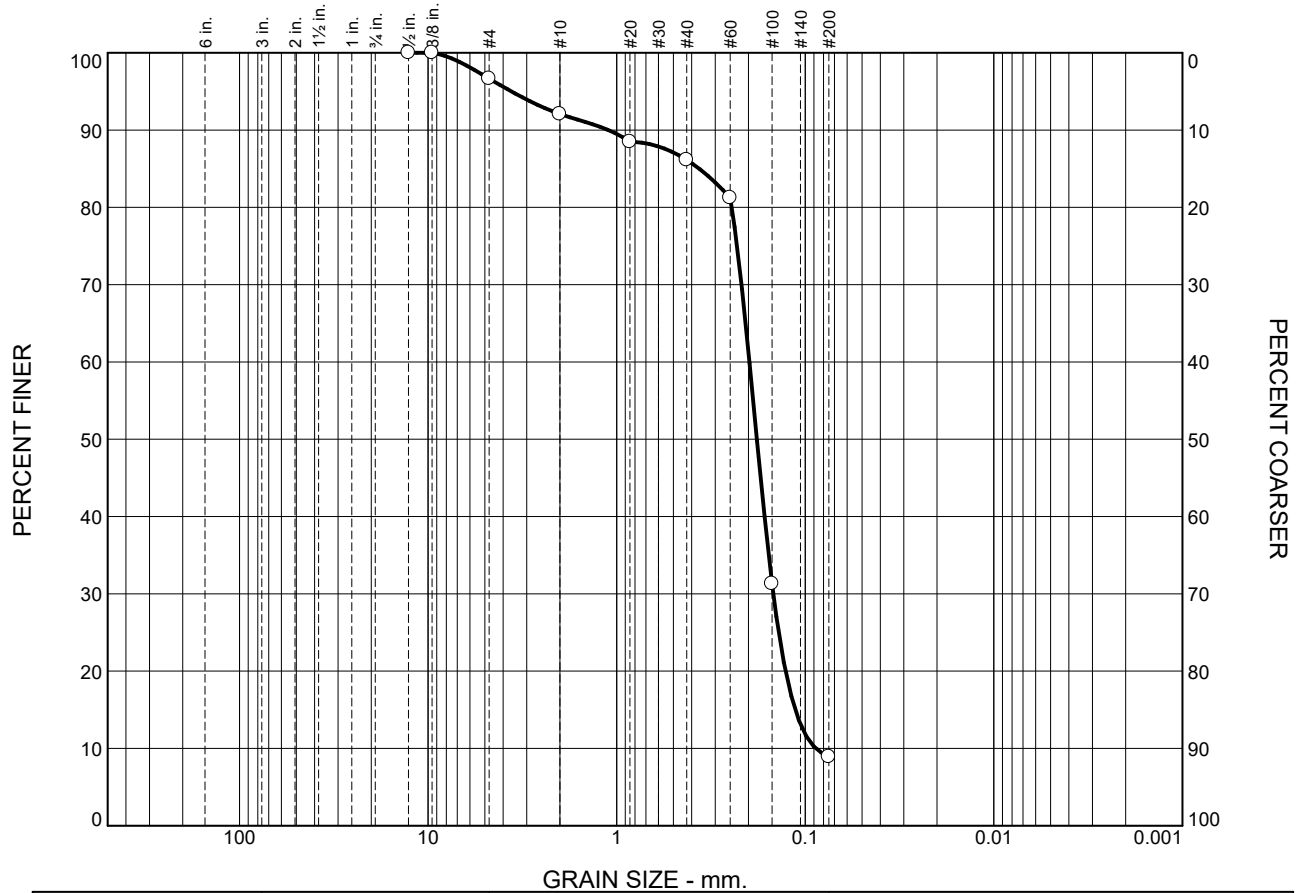
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.3	4.6	6.0	77.2	8.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-21	SP-3	15.5	Brown poorly graded SAND with SILT	SP-SM

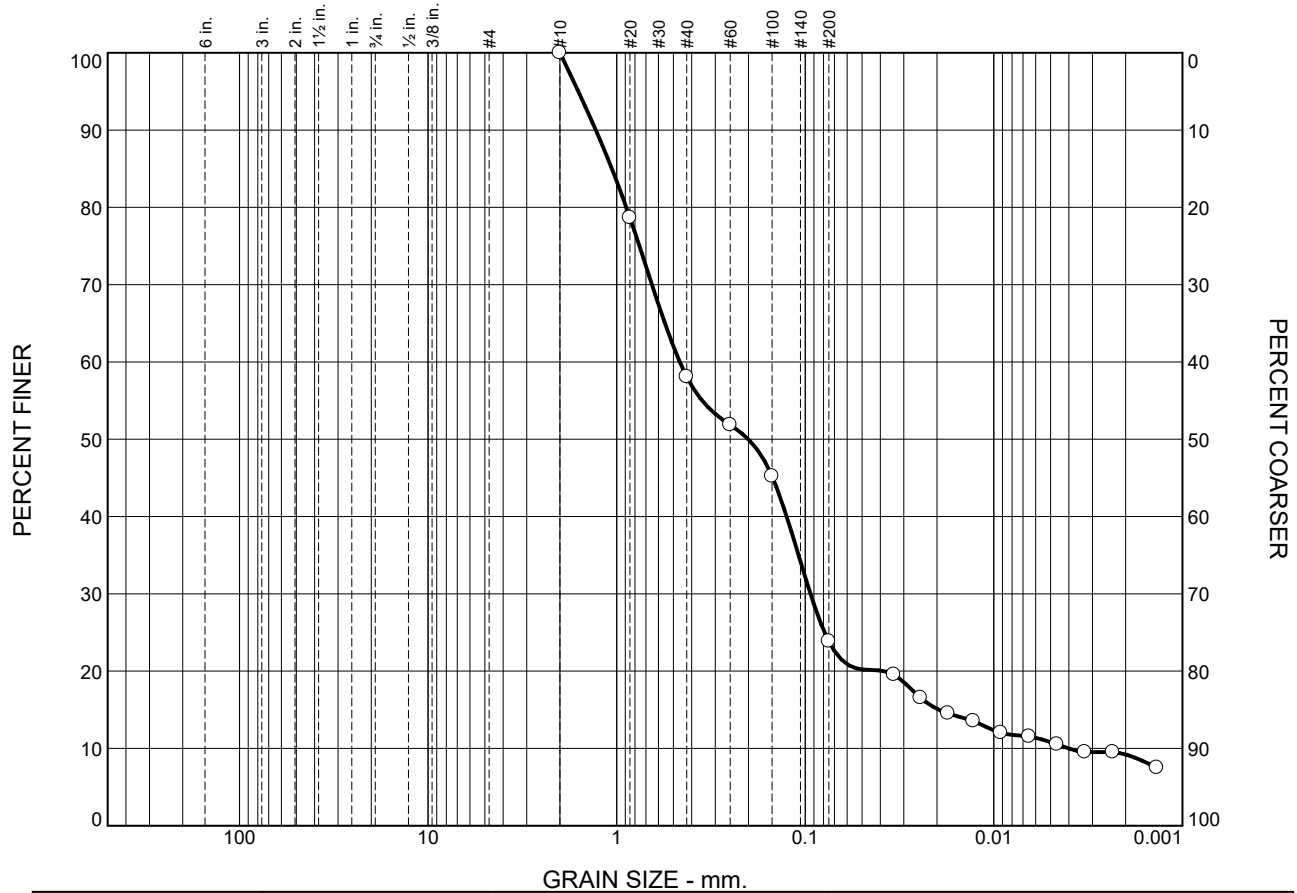
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	41.9	34.3	13.0	10.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-21	SP-5	20.5	Tan SILTY SAND	SM

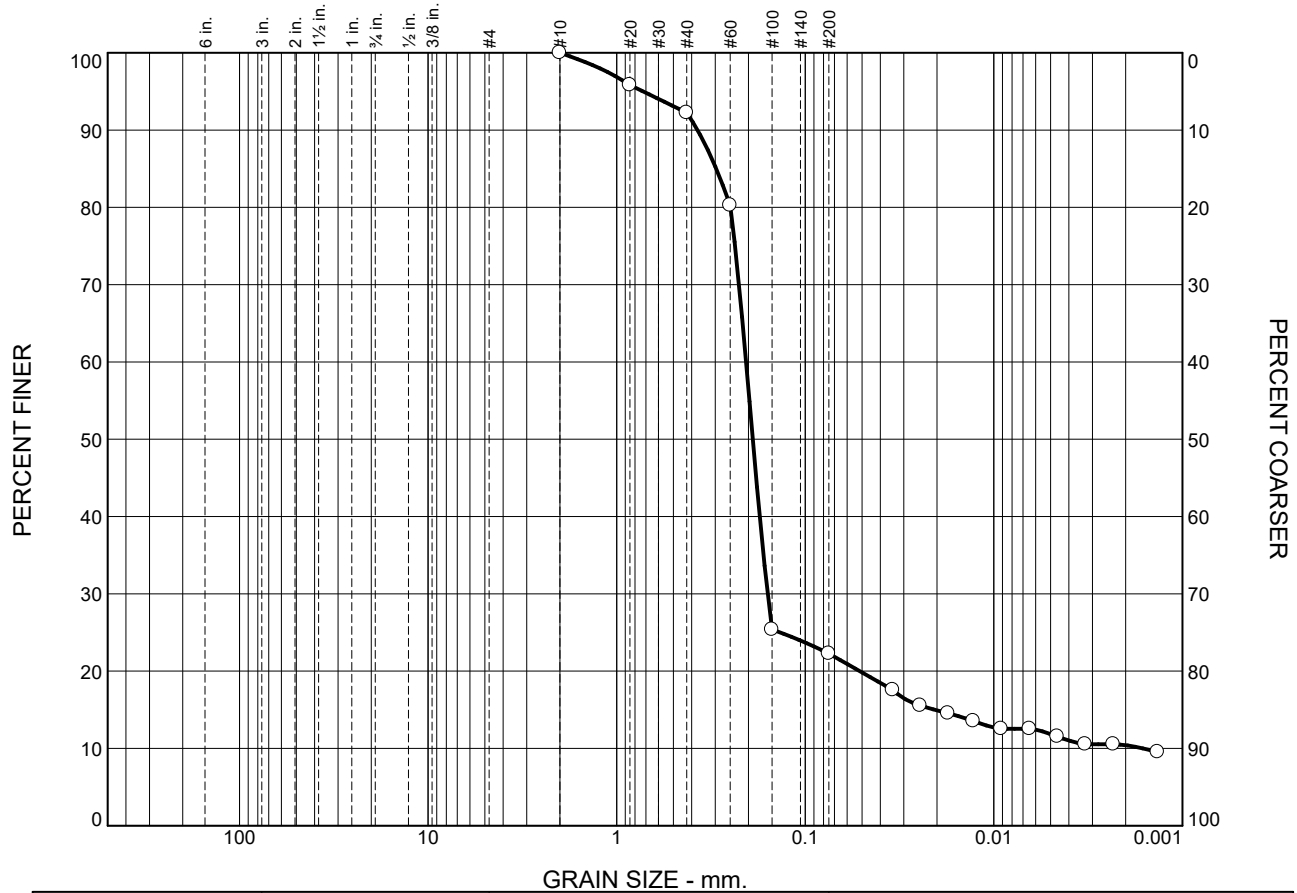
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	7.8	69.9	10.4	11.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-22	SP-1	0.5	Gray SILTY CLAYEY SAND	SM

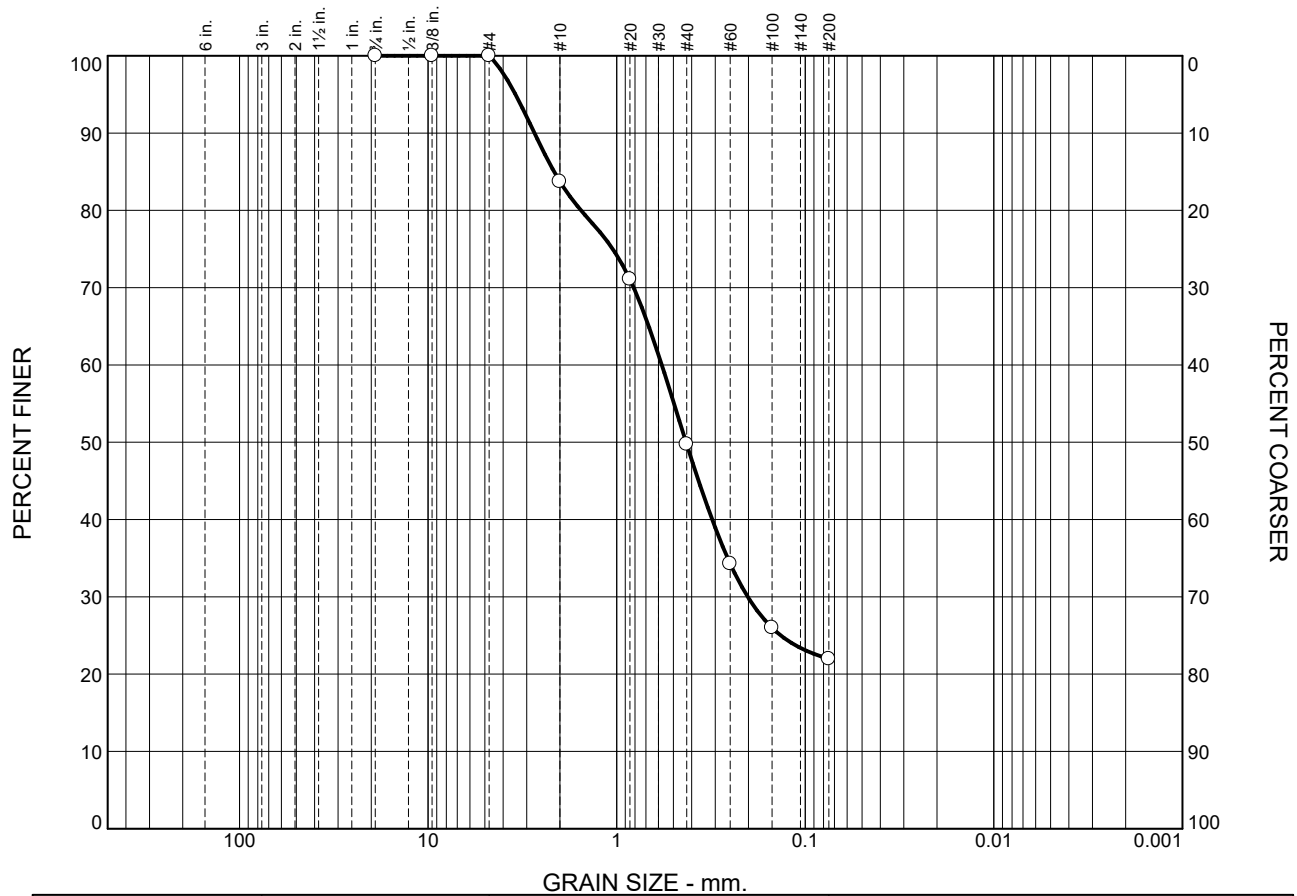
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	16.3	34.0	27.8	21.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-22	SP-2	5.5	Light gray and tan SILTY CLAYEY SAND	SM

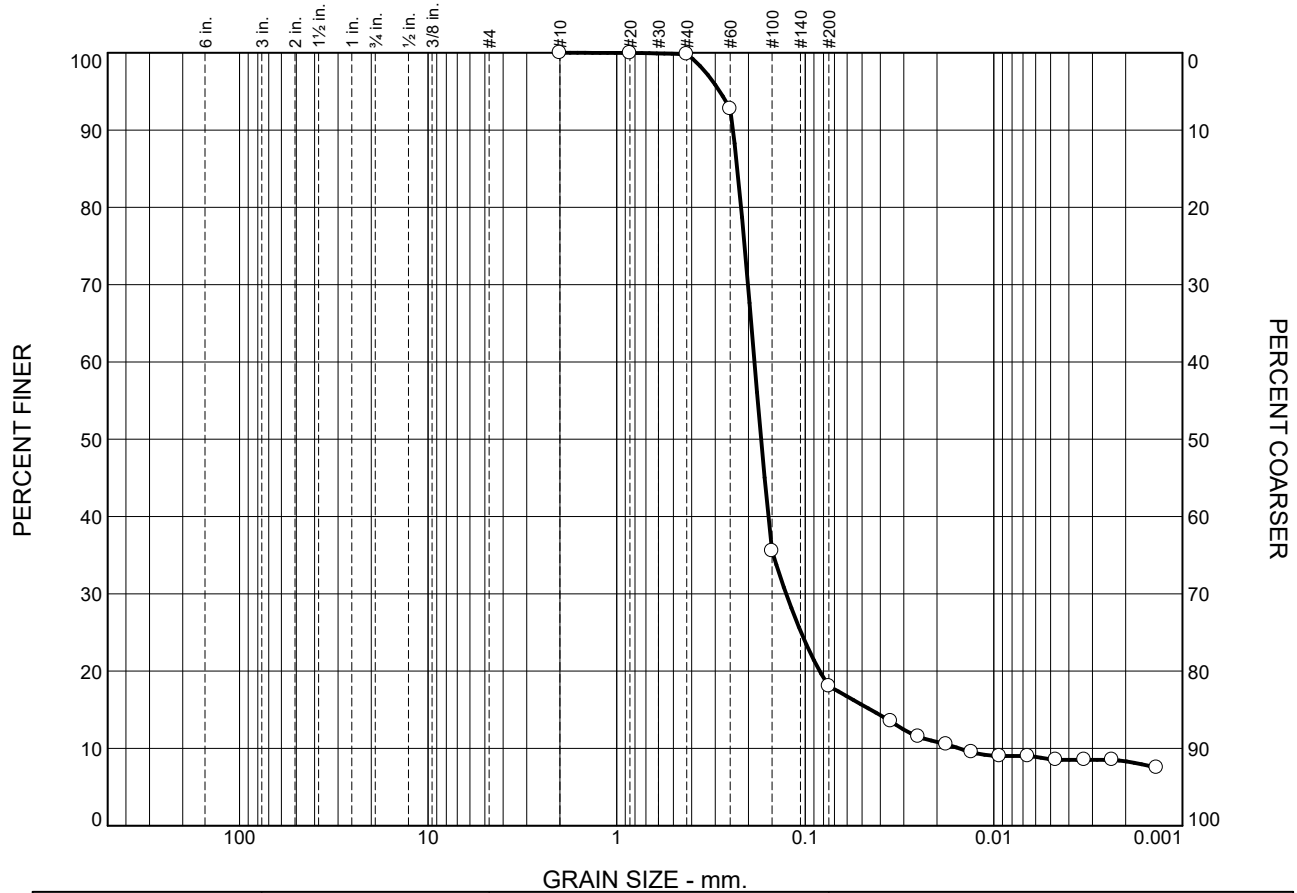
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	81.7	9.5	8.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-22	SP-3	10.5	Tan poorly graded SAND with SILT	SM

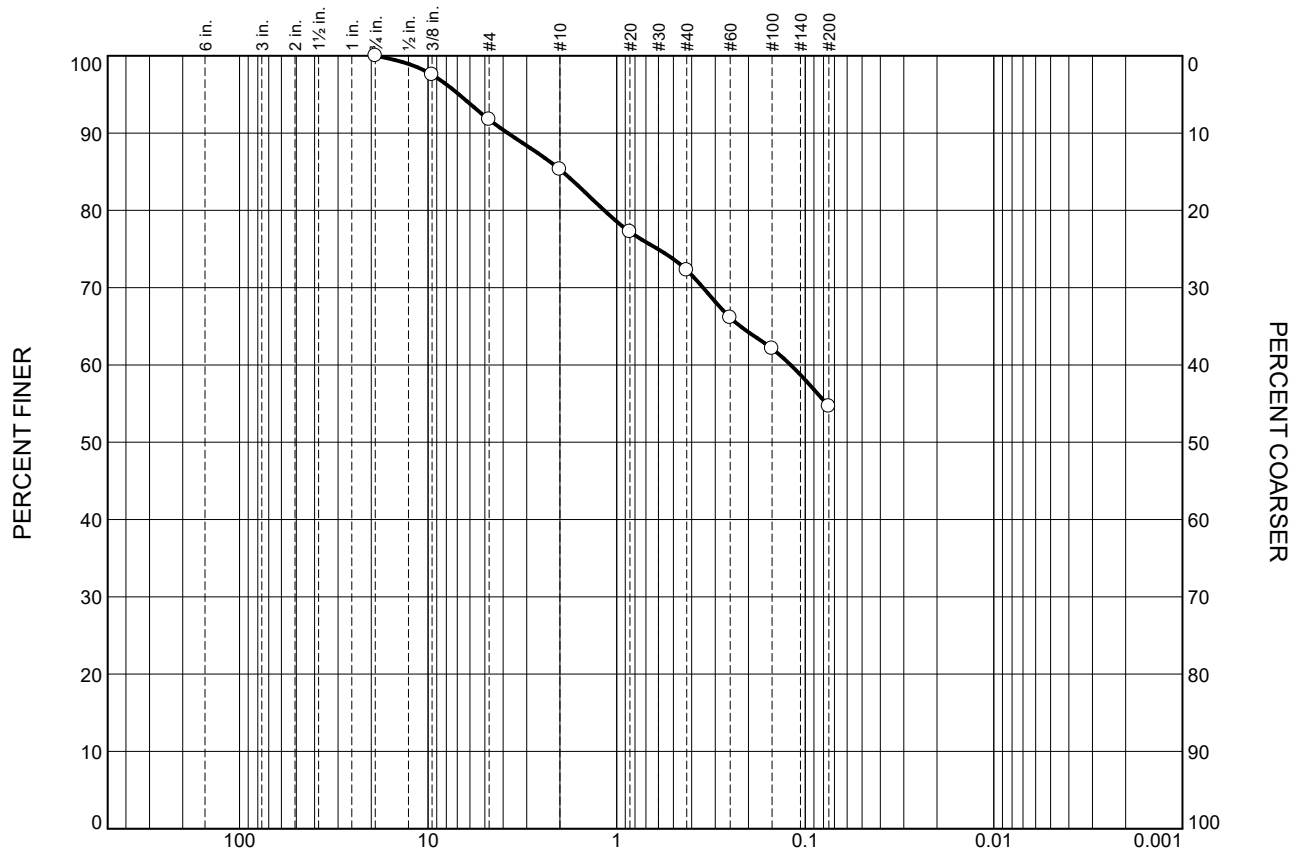
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	8.3	6.4	13.0	17.7	54.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-22	SP-5	20.5	Brown SANDY LEAN CLAY; shell fragments	CL

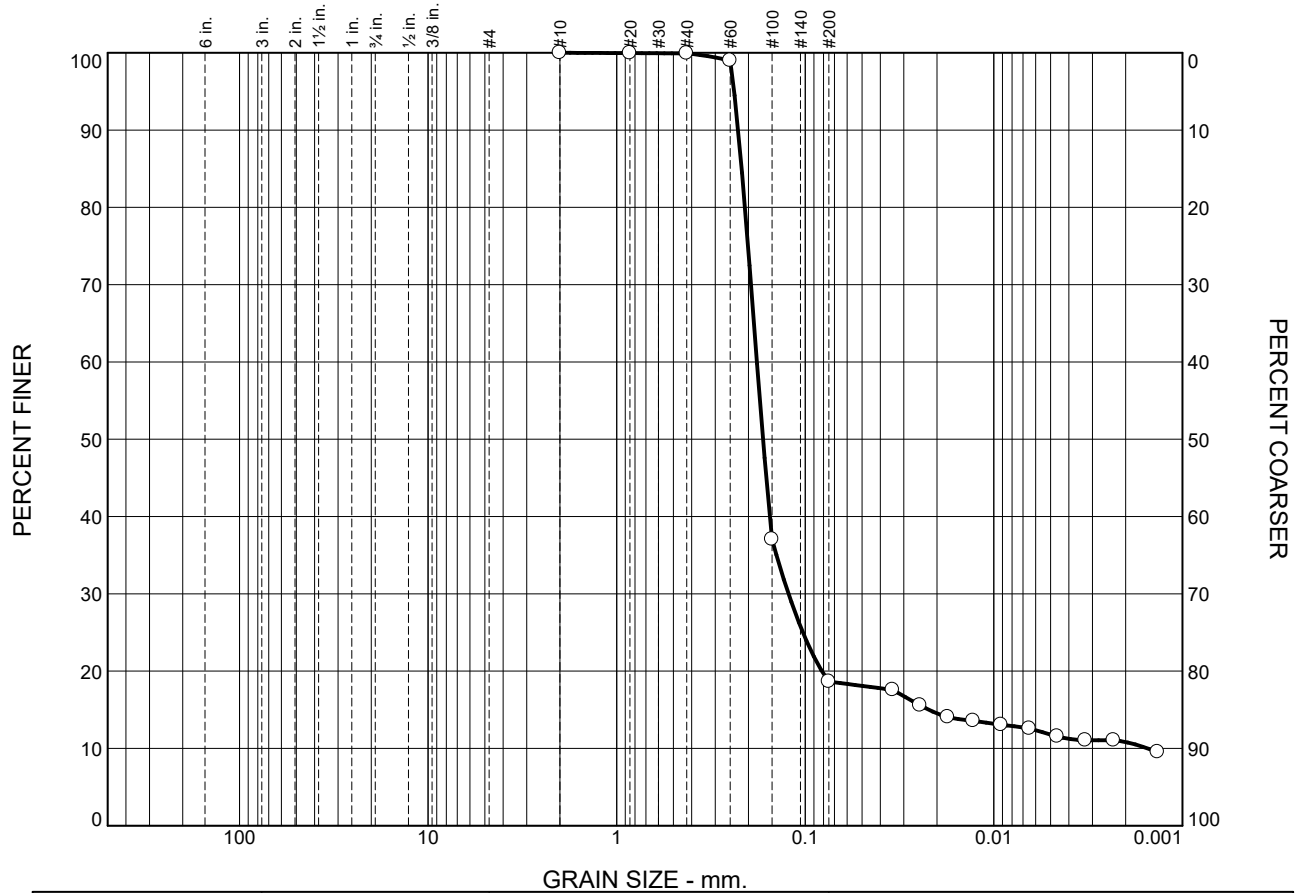
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	81.3	6.8	11.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-23	SP-1	0.5	Gray SILTY SAND	SM

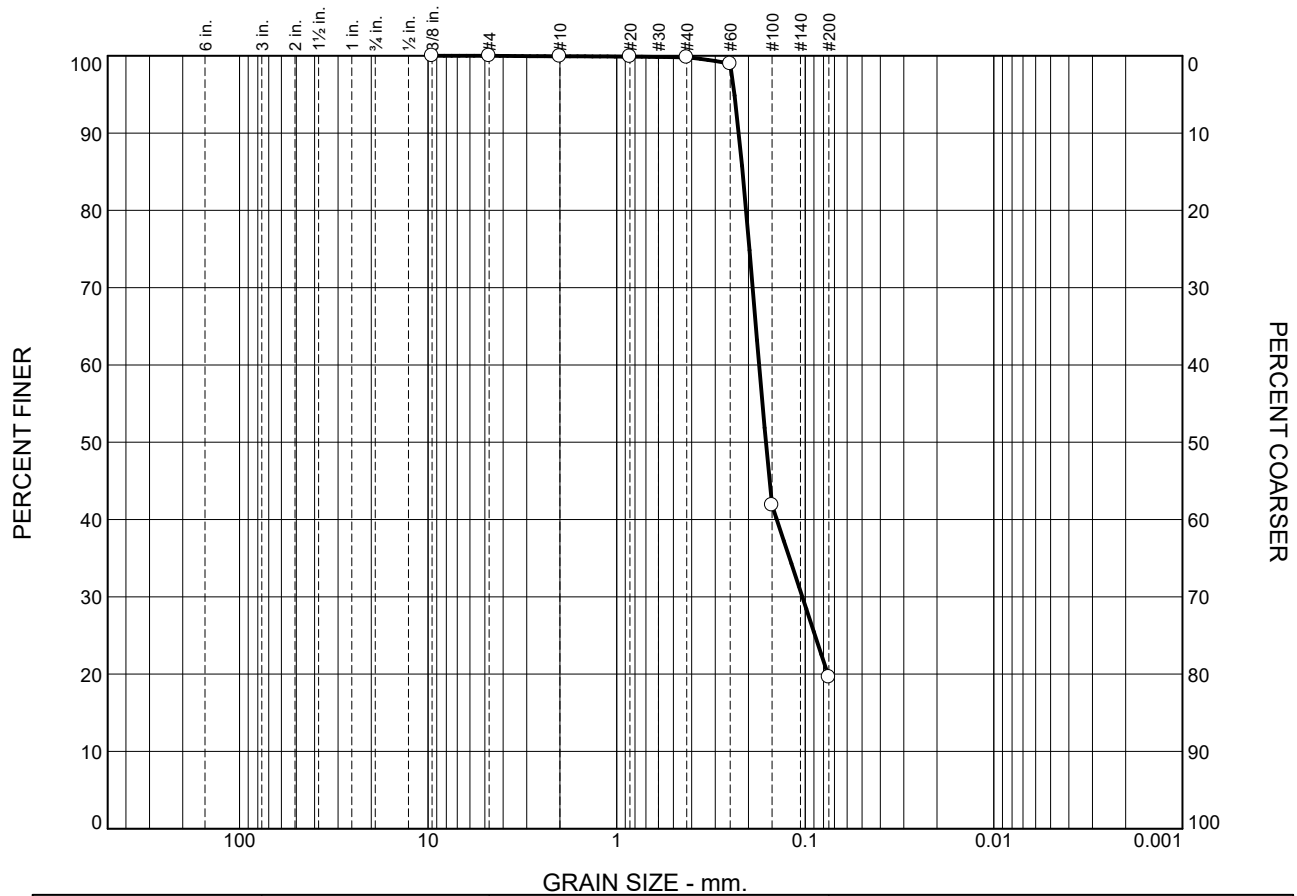
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.1	80.2	19.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-23	SP-2	5.5	Light gray and tan SILTY CLAYEY SAND	SM

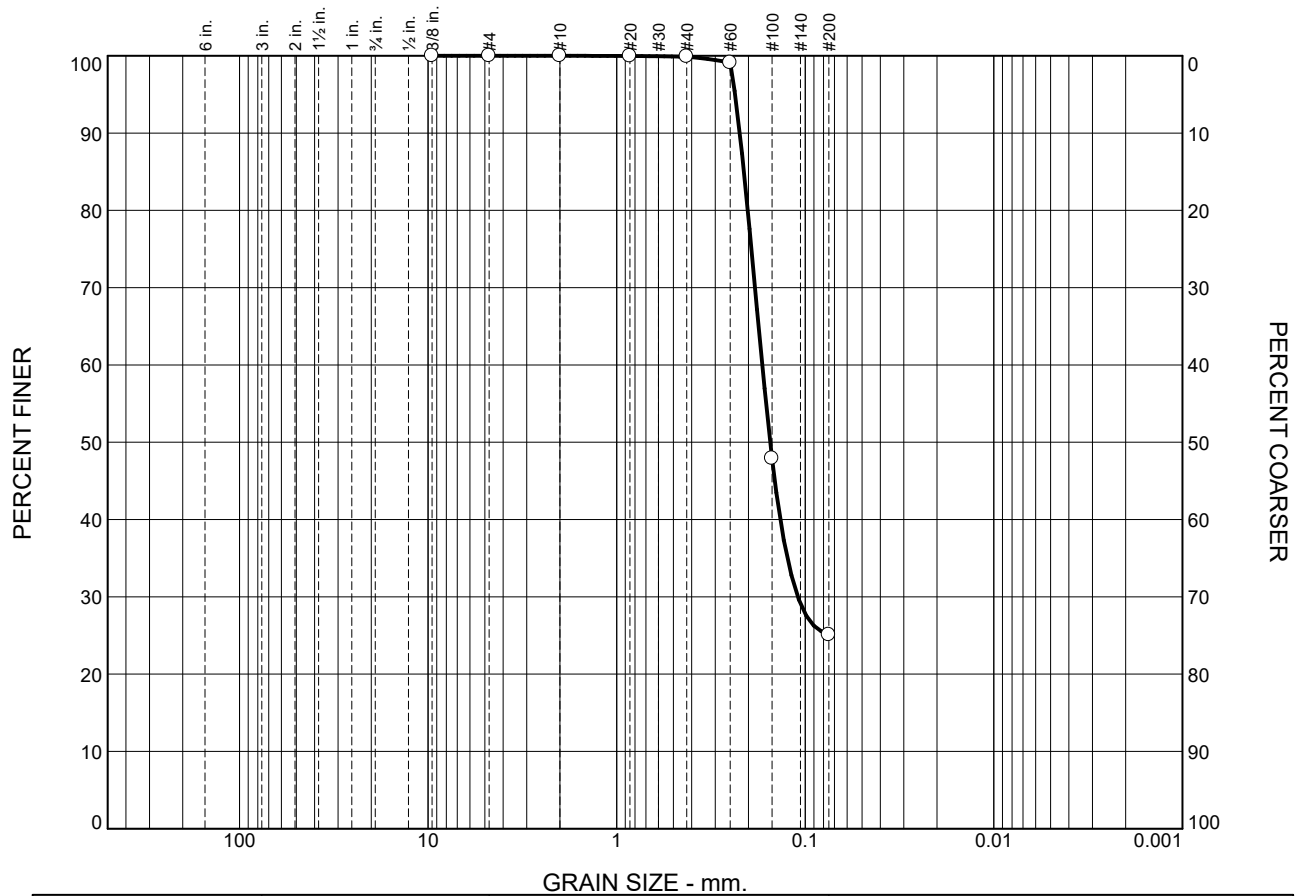
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	74.8	25.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-23	SP-3	10.5	Gray and brown SILTY CLAYEY SAND	SM

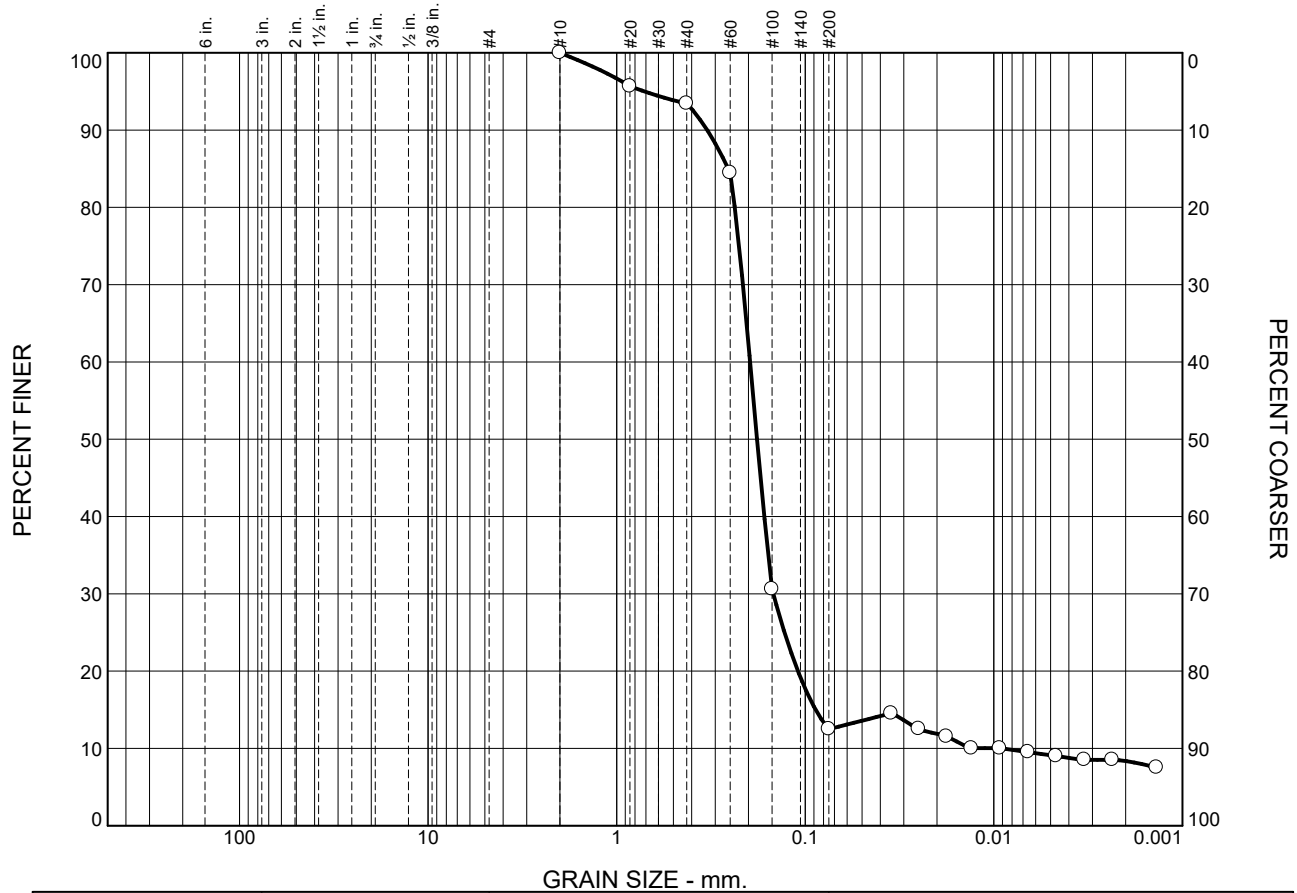
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	6.6	80.9	3.4	9.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-23	SP-4	15.5	Gray poorly graded SAND with SILT	SM

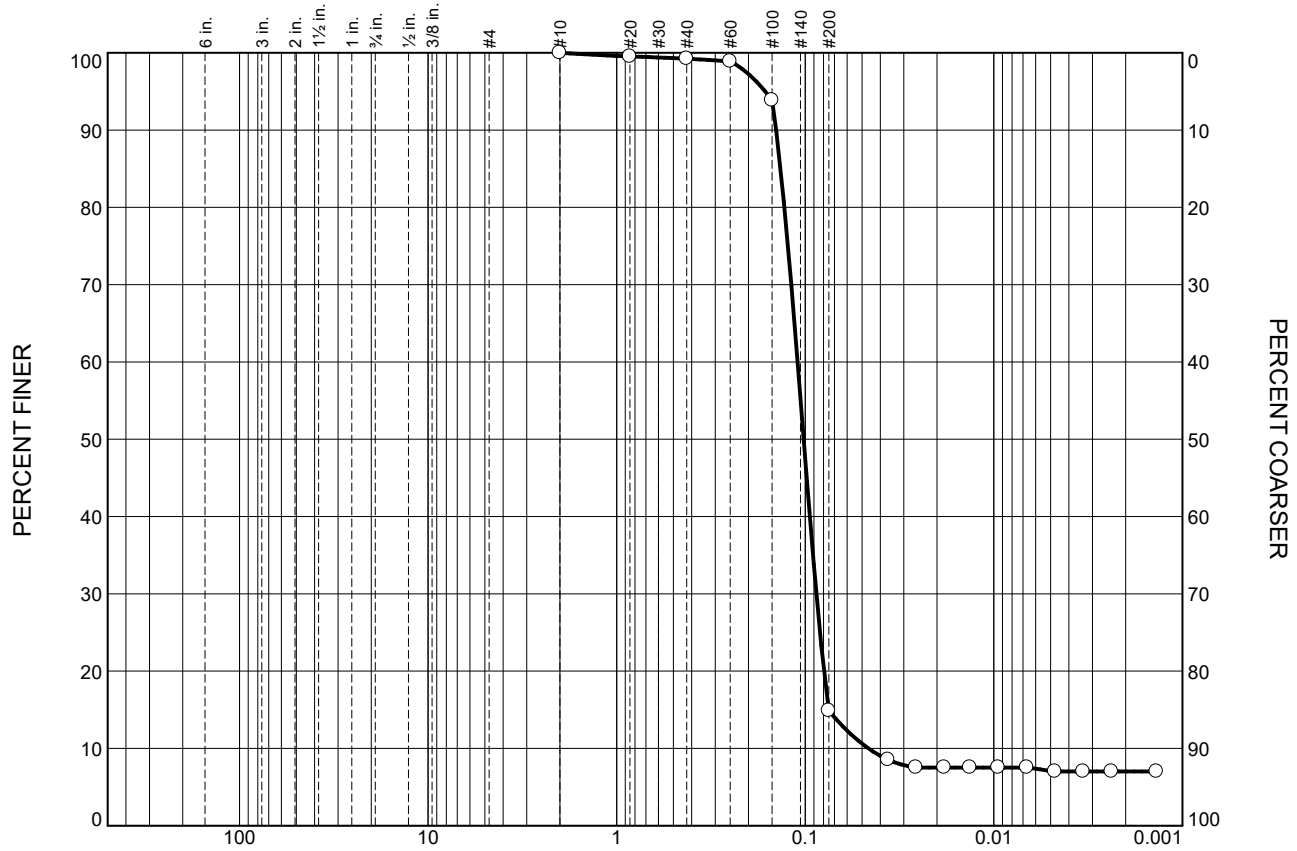
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.8	84.3	7.8	7.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-24	SP-1	0.5	Brown SILTY SAND	SM

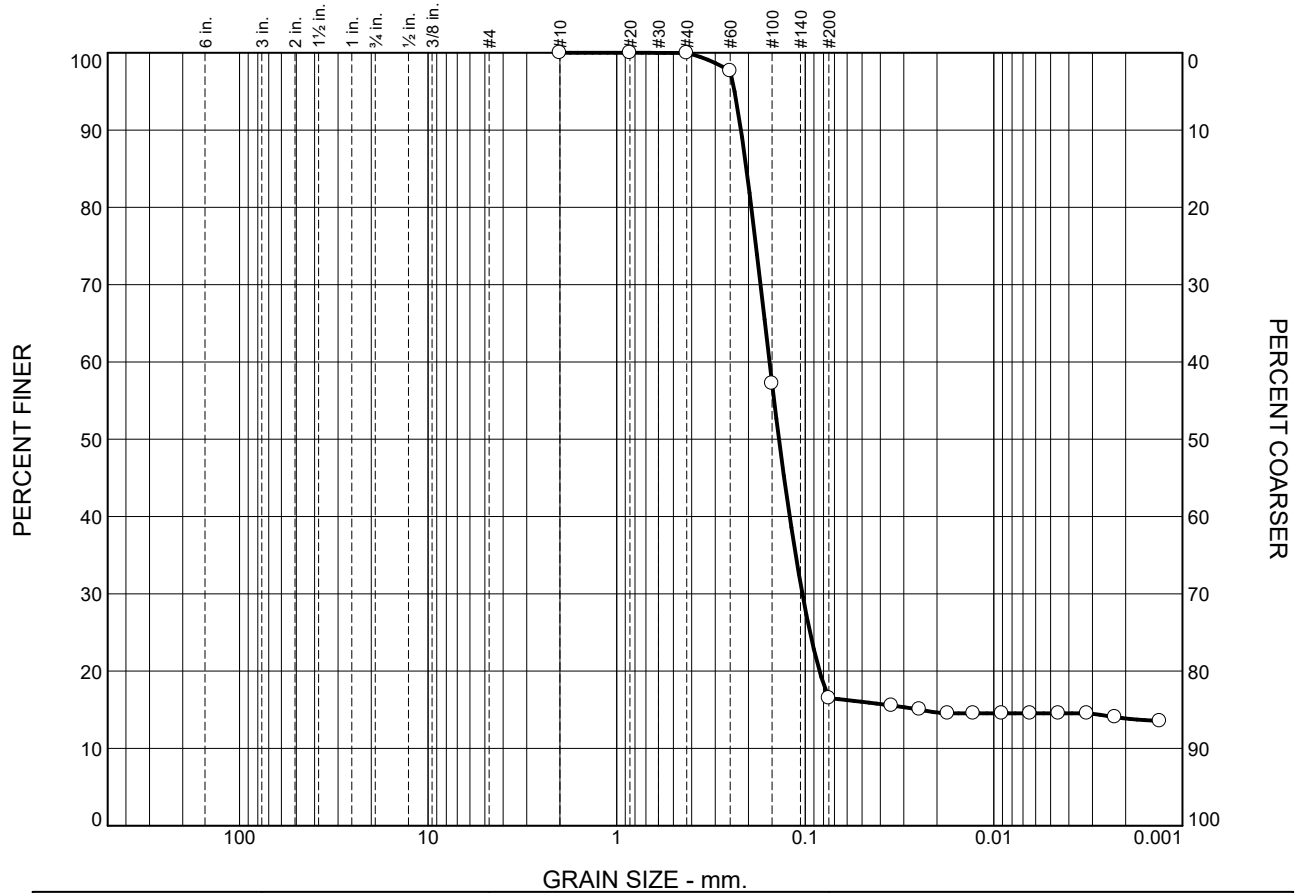
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	83.5	2.0	14.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-24	SP-2	30.5	Gray CLAYEY SAND	SM

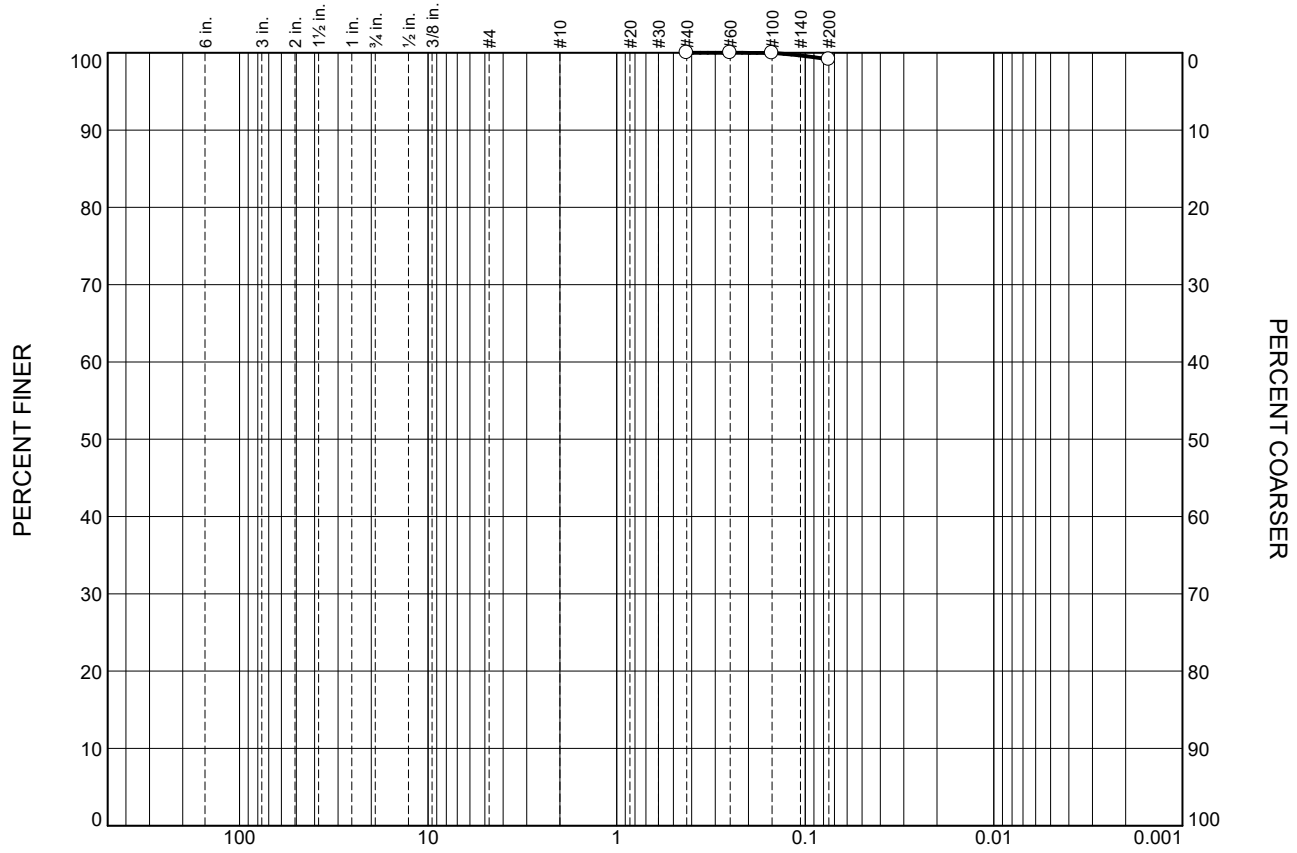
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.9	99.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-24	ST-3	10	Brown FAT CLAY	CL

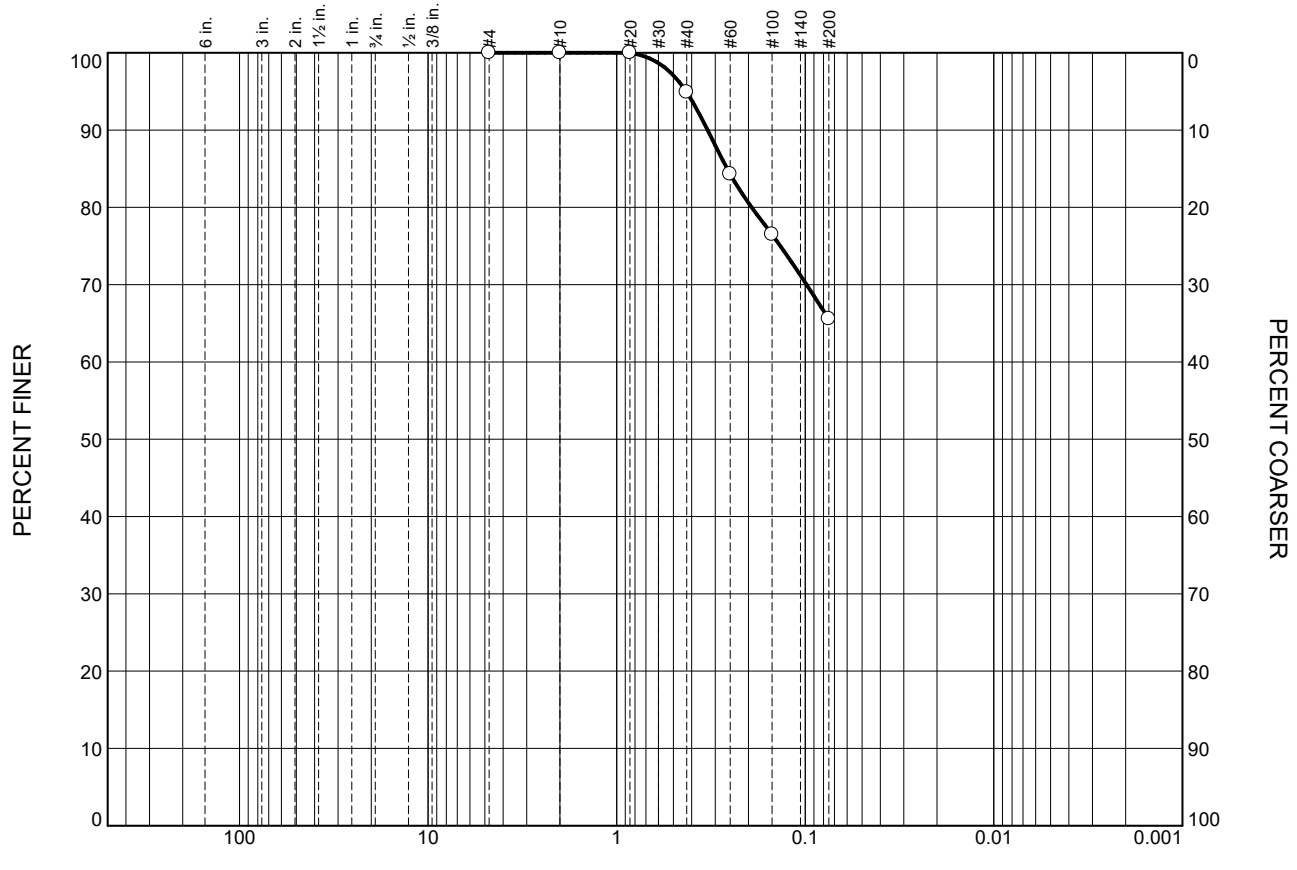
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.1	29.3	65.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-24	ST-6	17.5	Brown and gray SANDY LEAN CLAY	CH

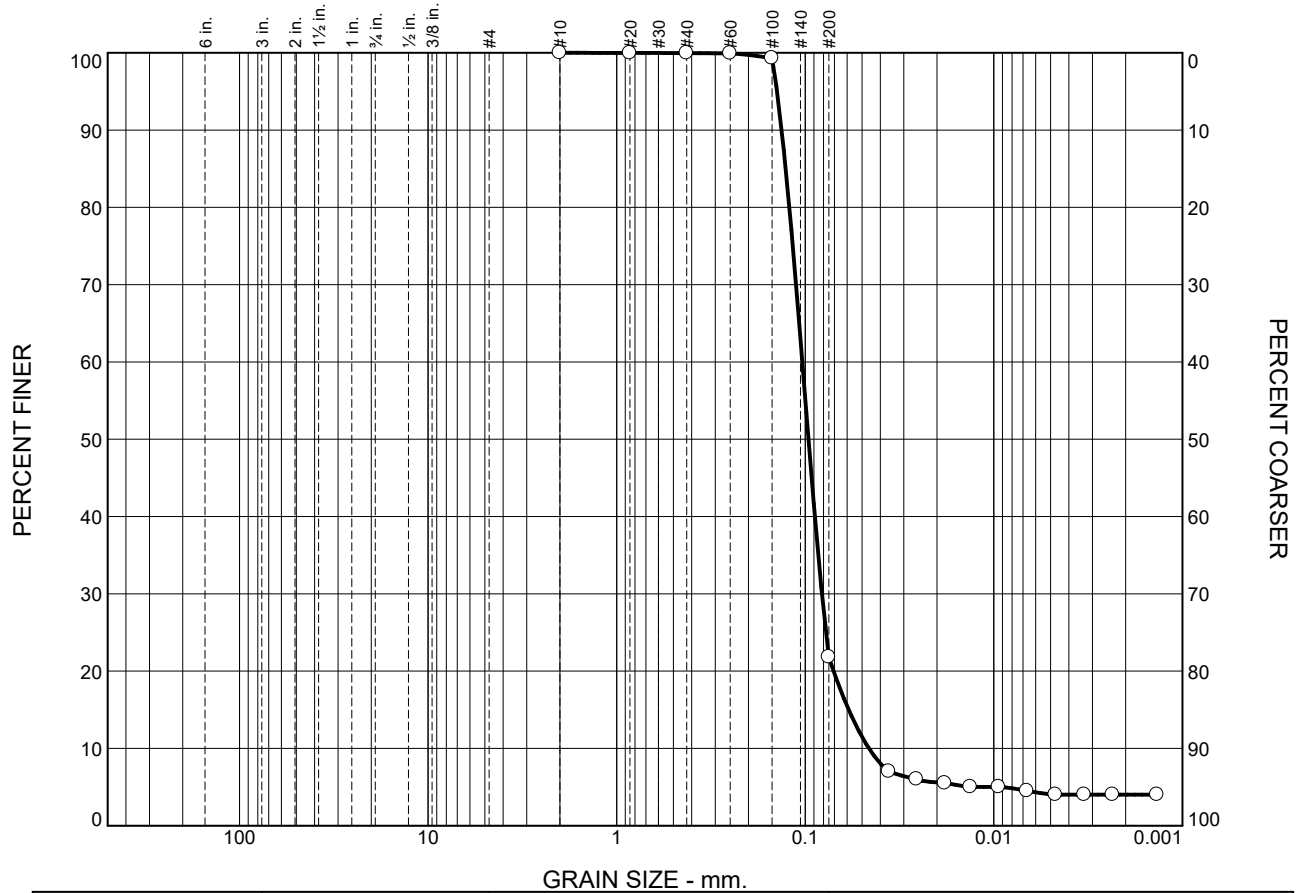
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	78.2	17.7	4.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-25	SP-1	0.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.3	0.7	1.0	81.4	15.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-25	SP-4	36.5	Gray SILTY SAND (SM)	SM

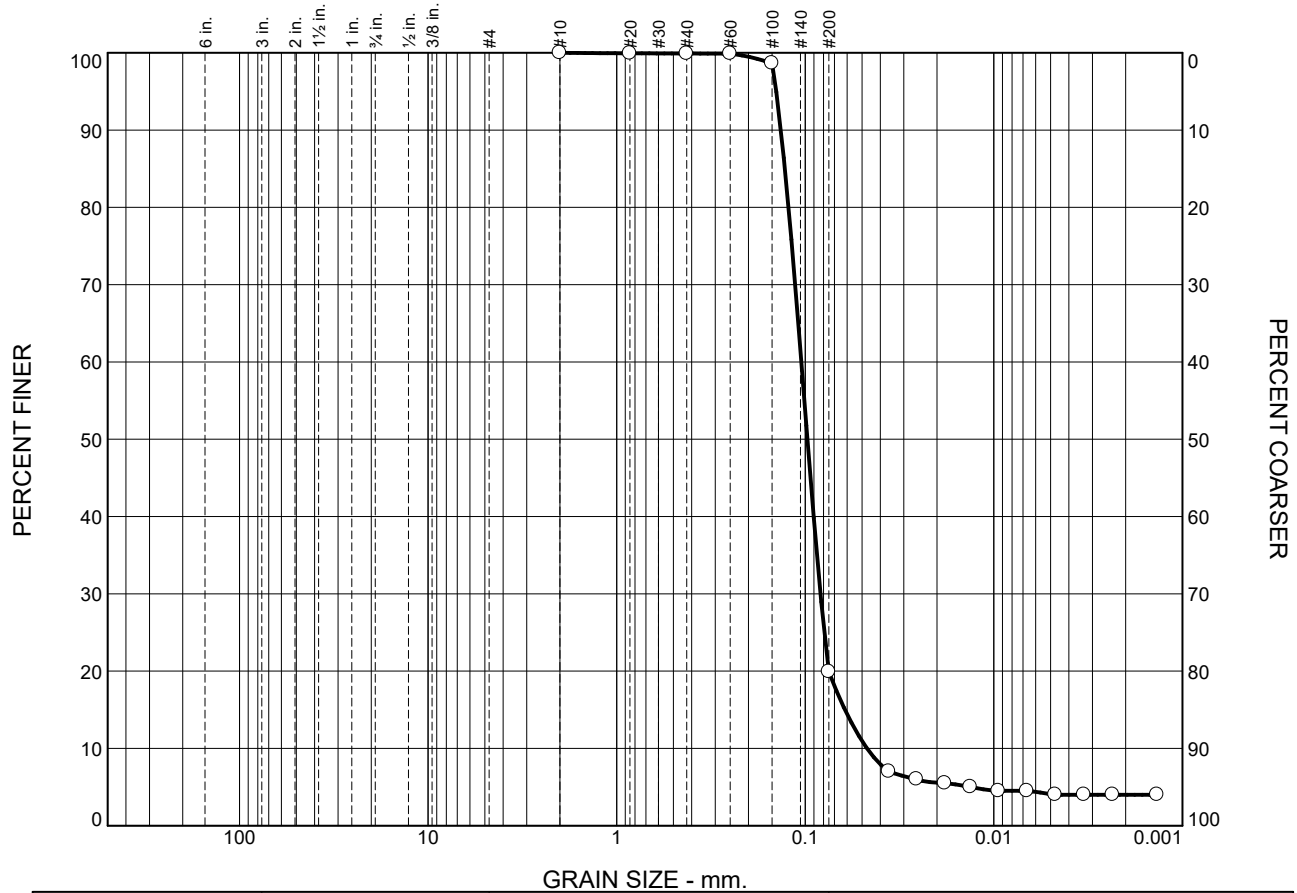
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	80.0	15.8	4.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-26	SP-2	6.5	Brown SILTY SAND (SM)	SM

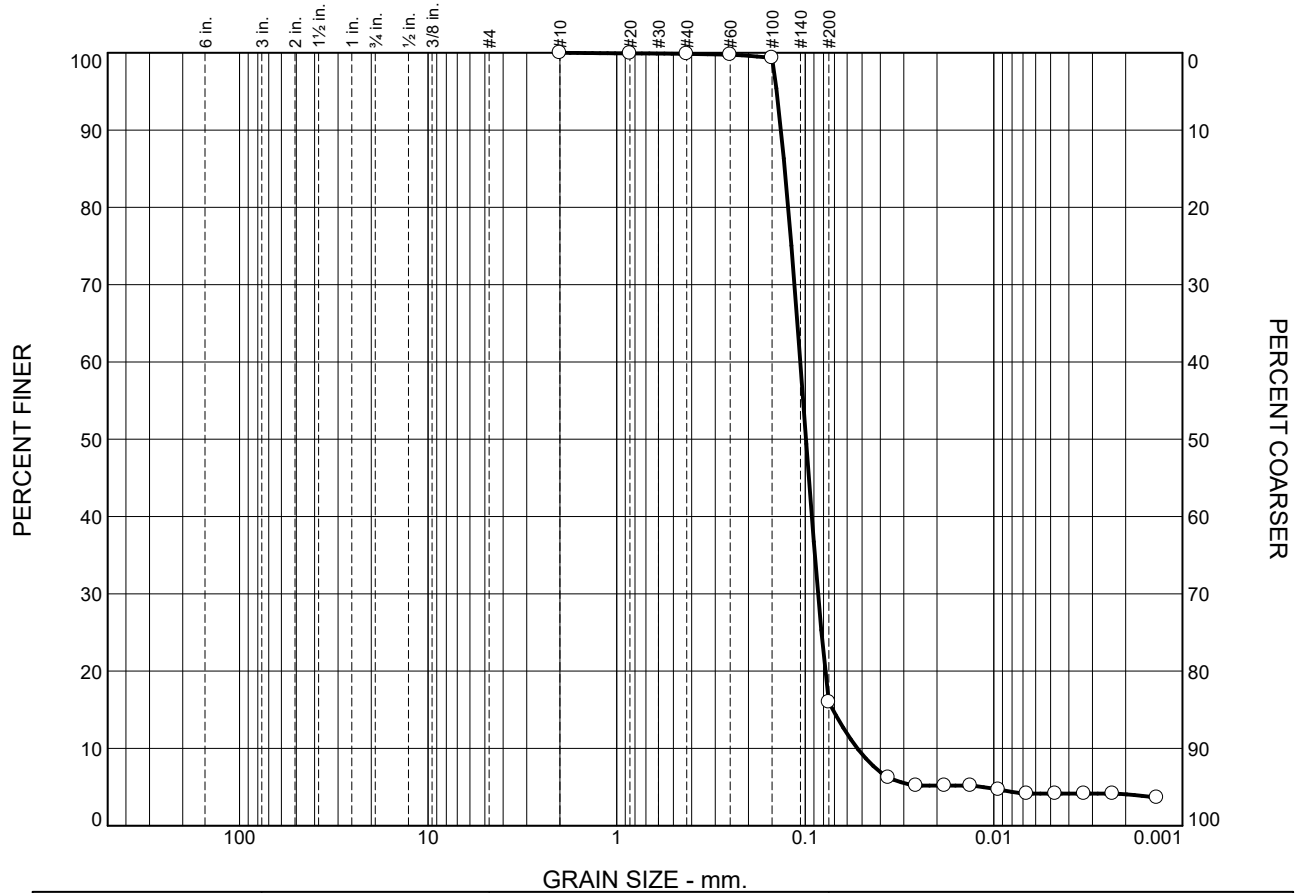
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	83.9	11.8	4.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-26	SP-6	14.5	Brown SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	82.1	17.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-26	SP-8	18.5	Brown and gray SILTY SAND	SM

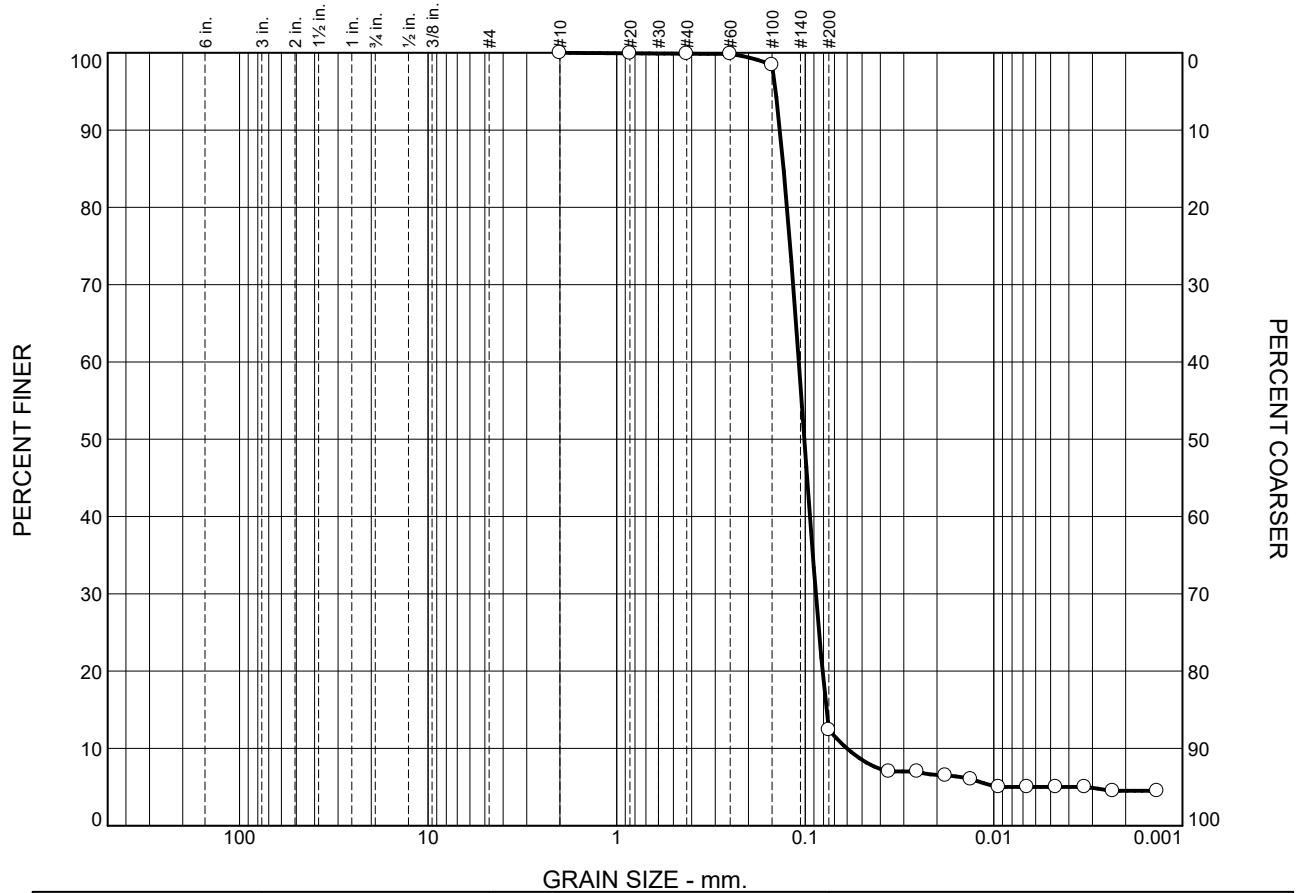
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	87.5	7.4	5.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-27	SP-1	0.5	Gray SILTY SAND	SM

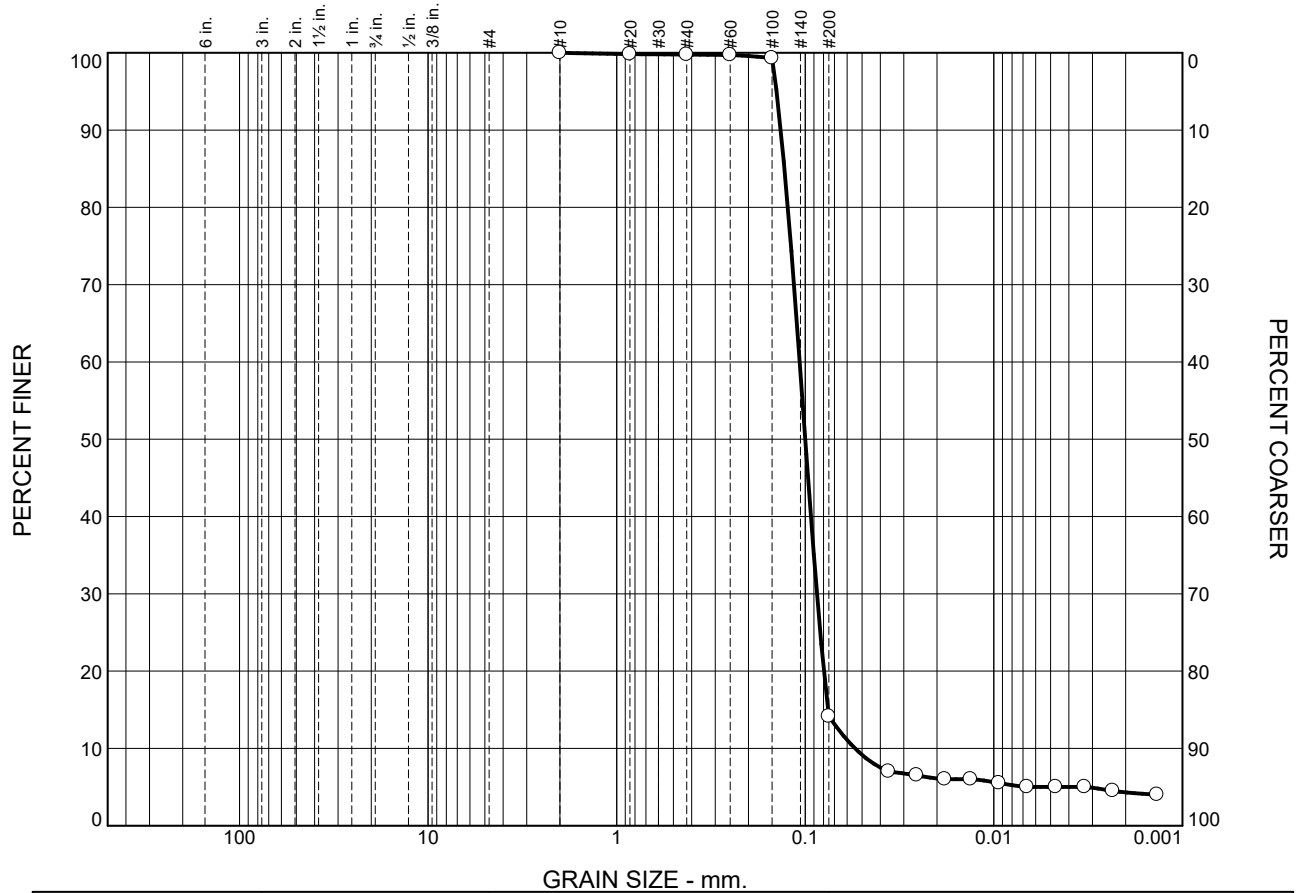
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	85.7	9.1	5.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-27	SP-3	4.5	Brown SILTY SAND	SM

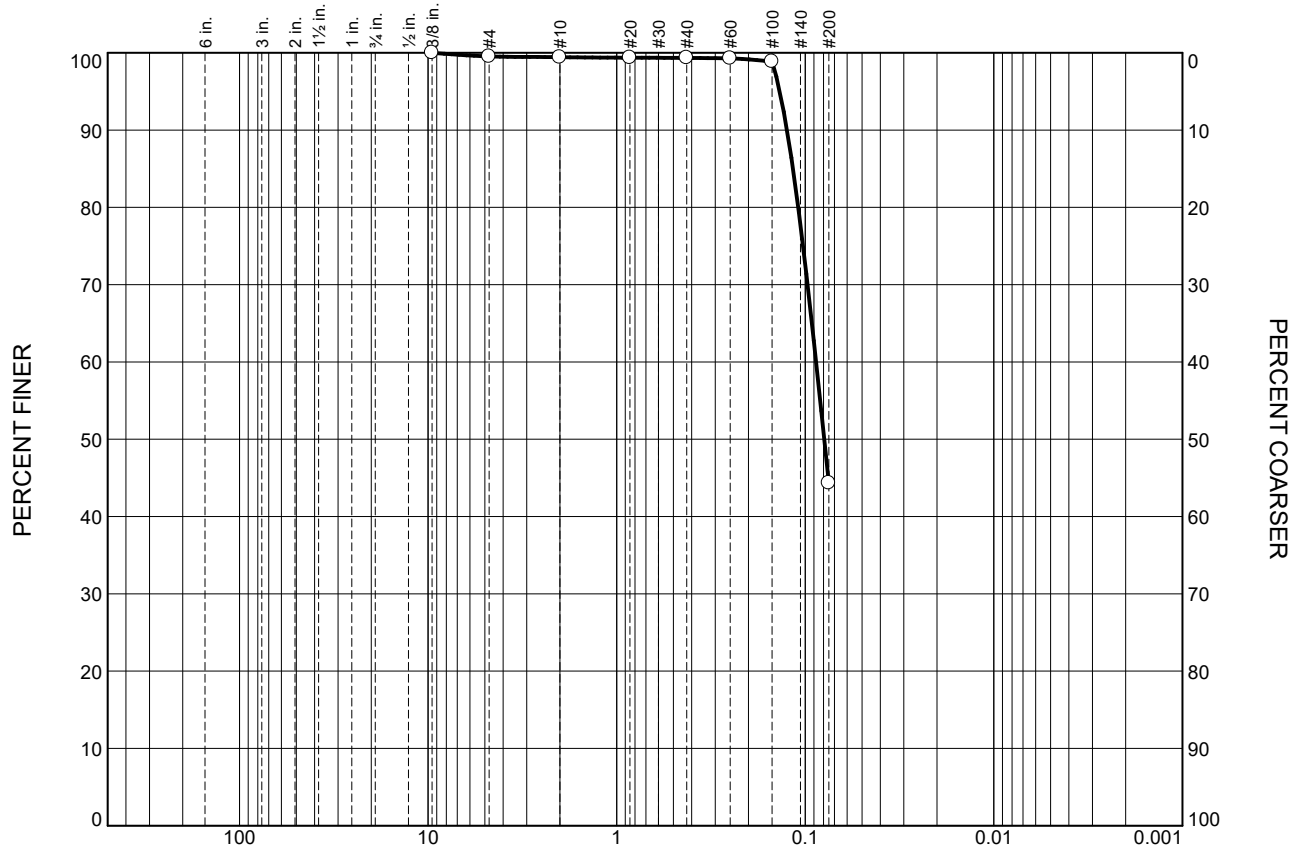
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.5	0.1	0.1	55.0	44.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-27	SP-6	10.5	Brown CLAYEY SAND	SC

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	46.6	53.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-27	SP-10	18.5	Brown SANDY SILTY CLAY (CL-ML)	CL

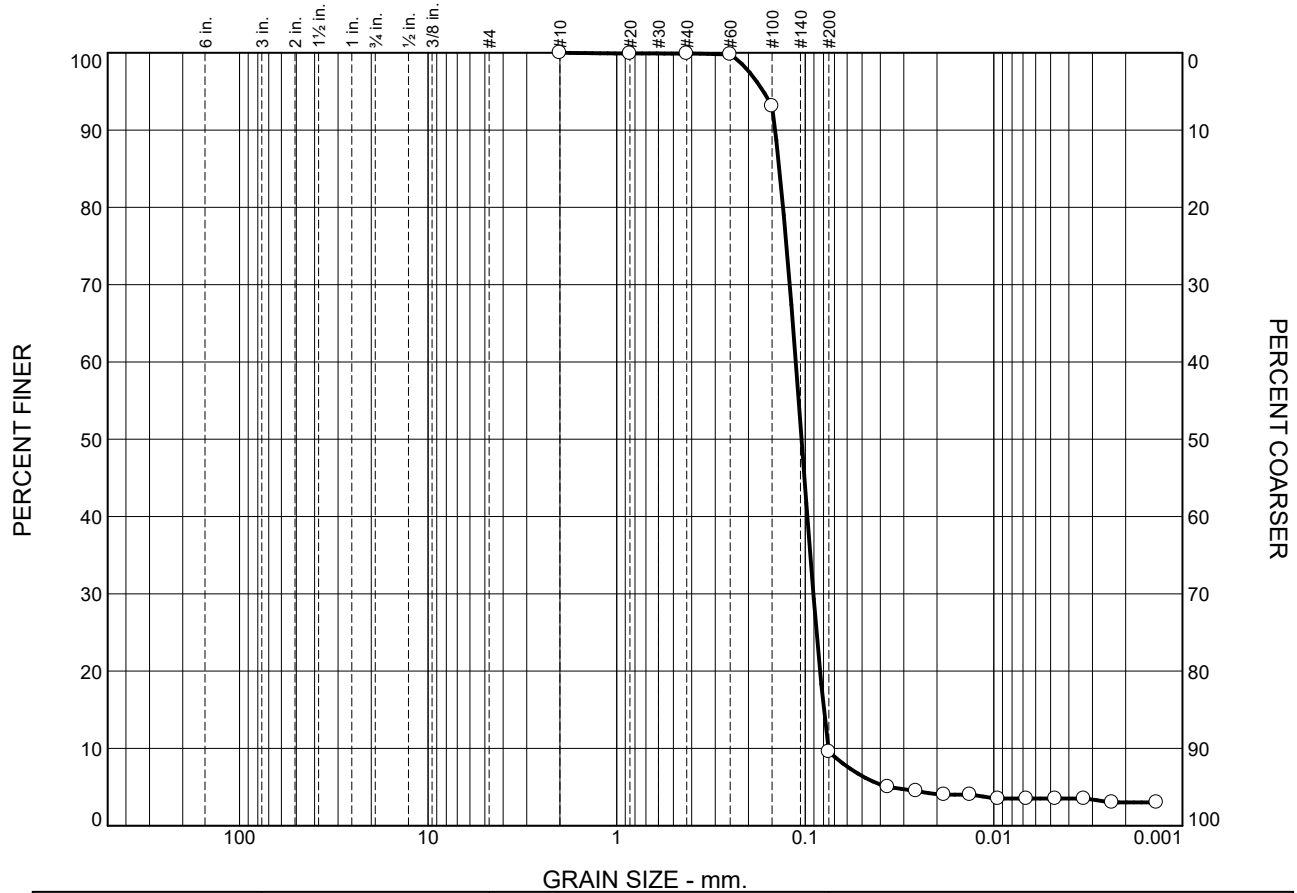
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	90.3	6.1	3.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-28	SP-1	0.5	Brown POORLY GRADED SAND with SILT (SP-SM)	SP-SM

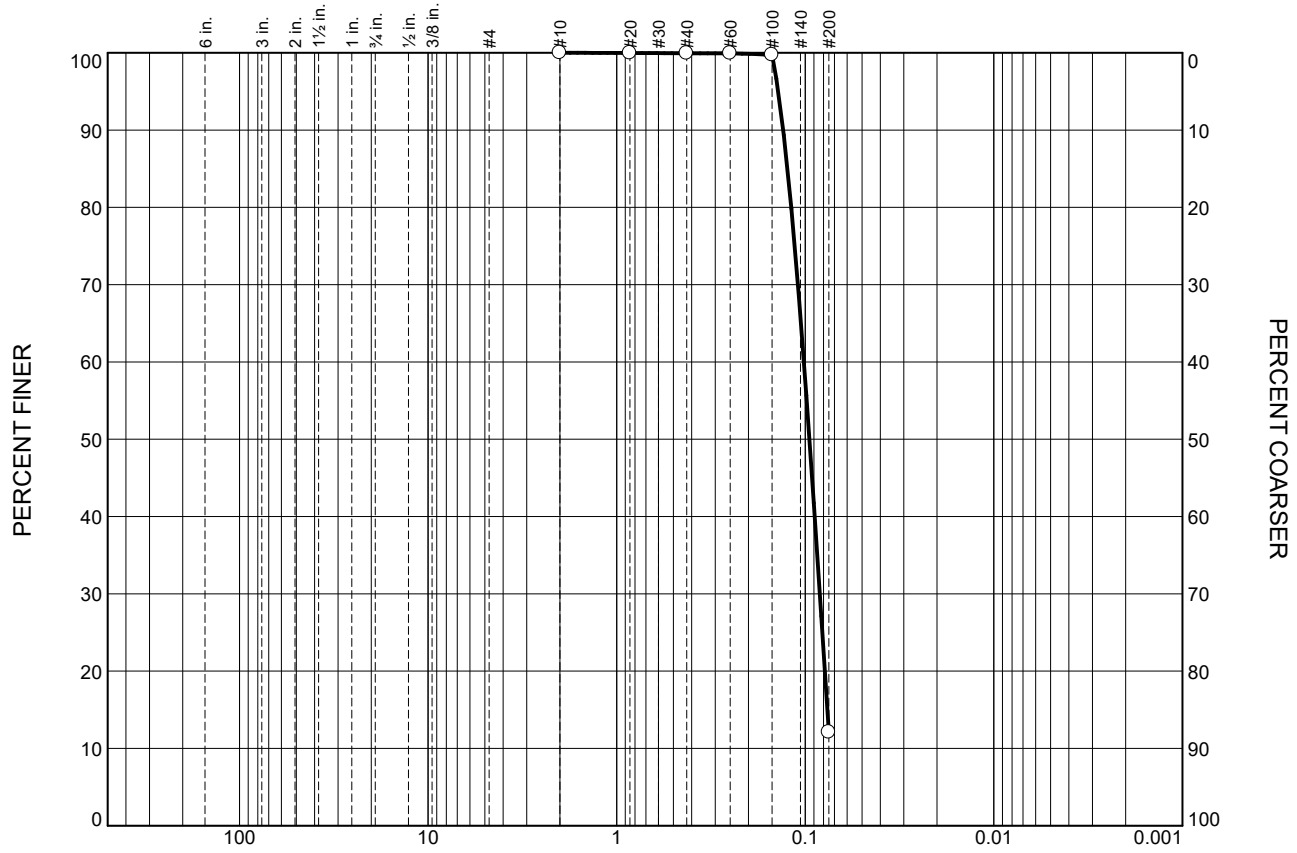
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	87.8	12.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-28	SP-4	6.5	Brown SILTY SAND	SM

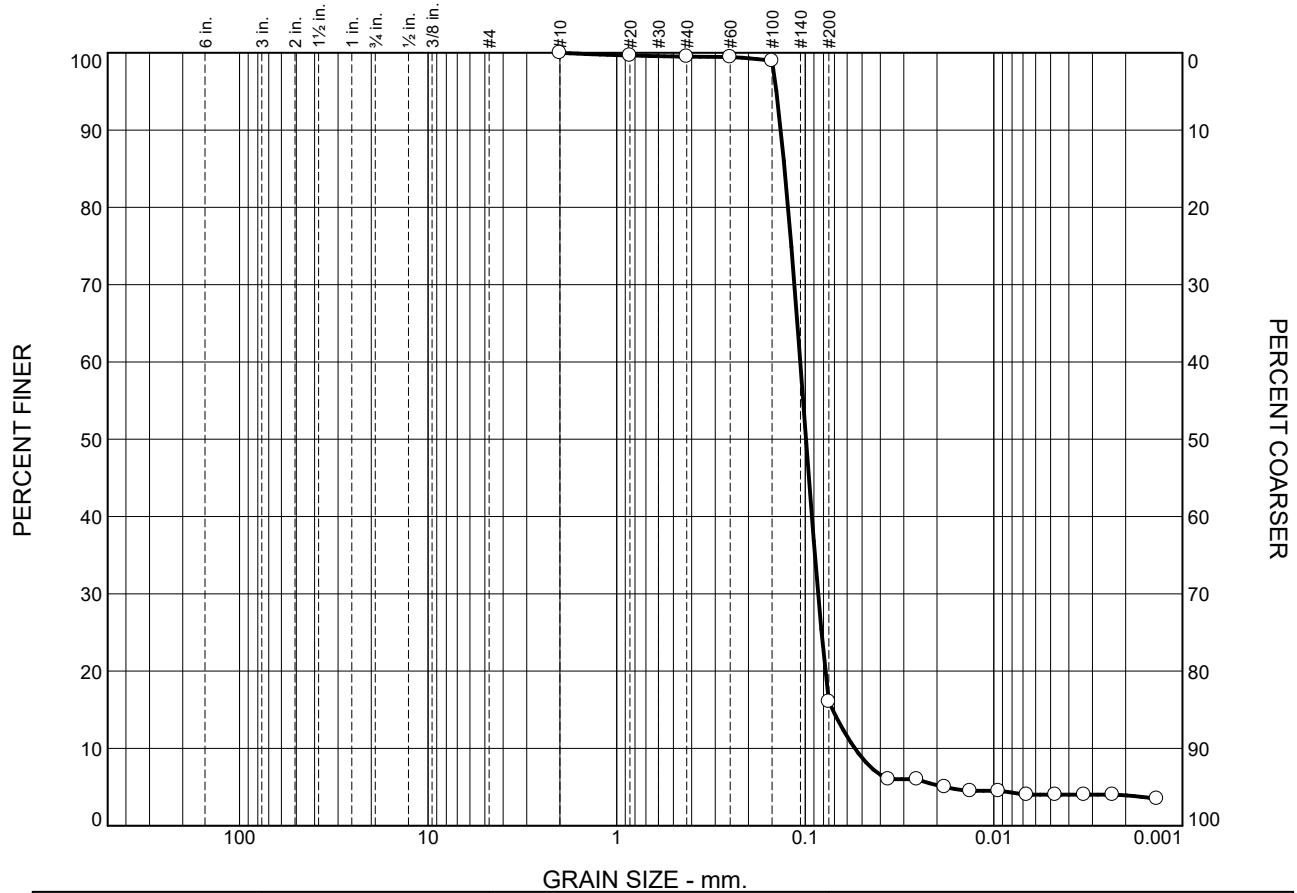
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	83.4	12.1	4.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-28	SP-7	12.5	Brown SILTY SAND	SM

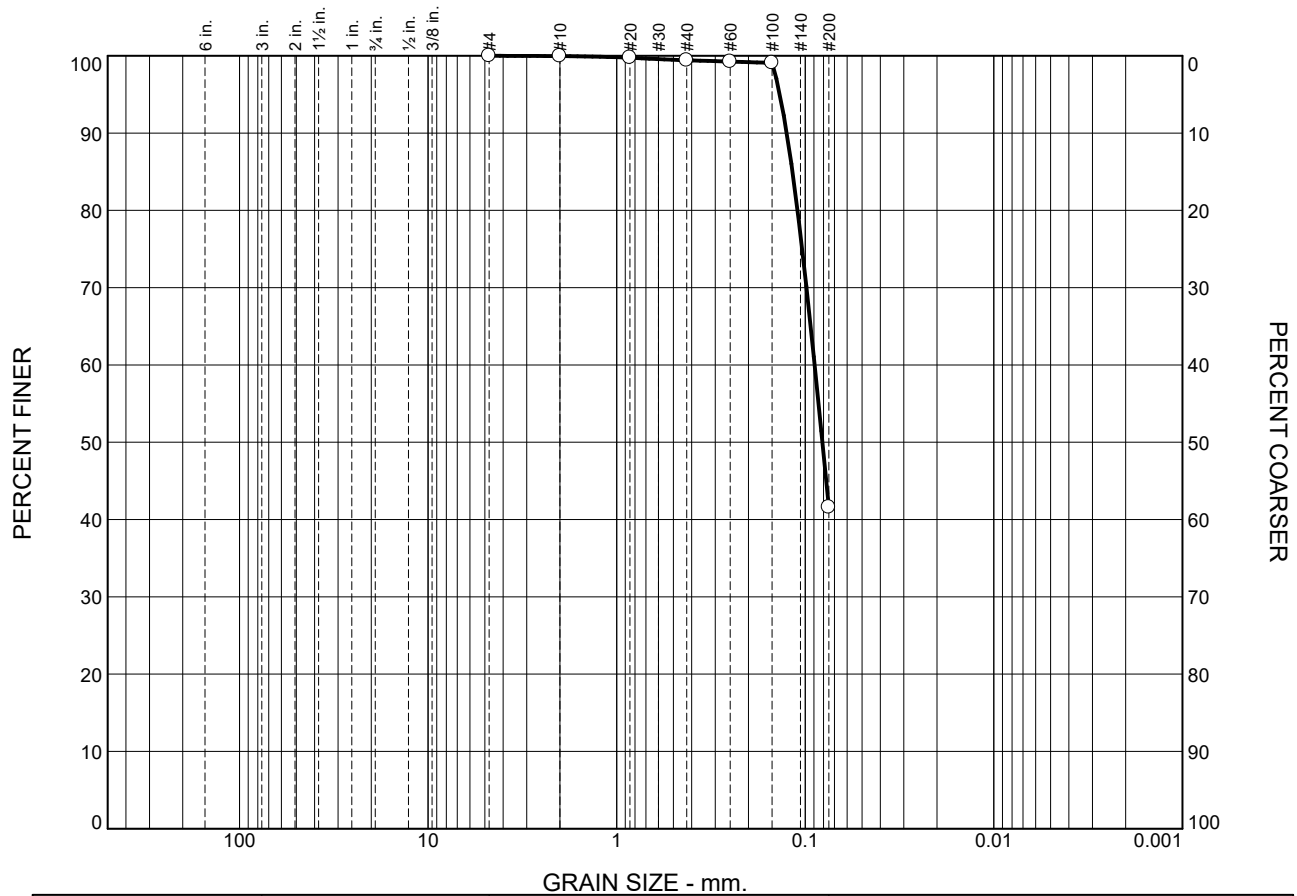
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.6	57.8	41.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-28	SP-13	26.5	Brown CLAYEY SAND	SC

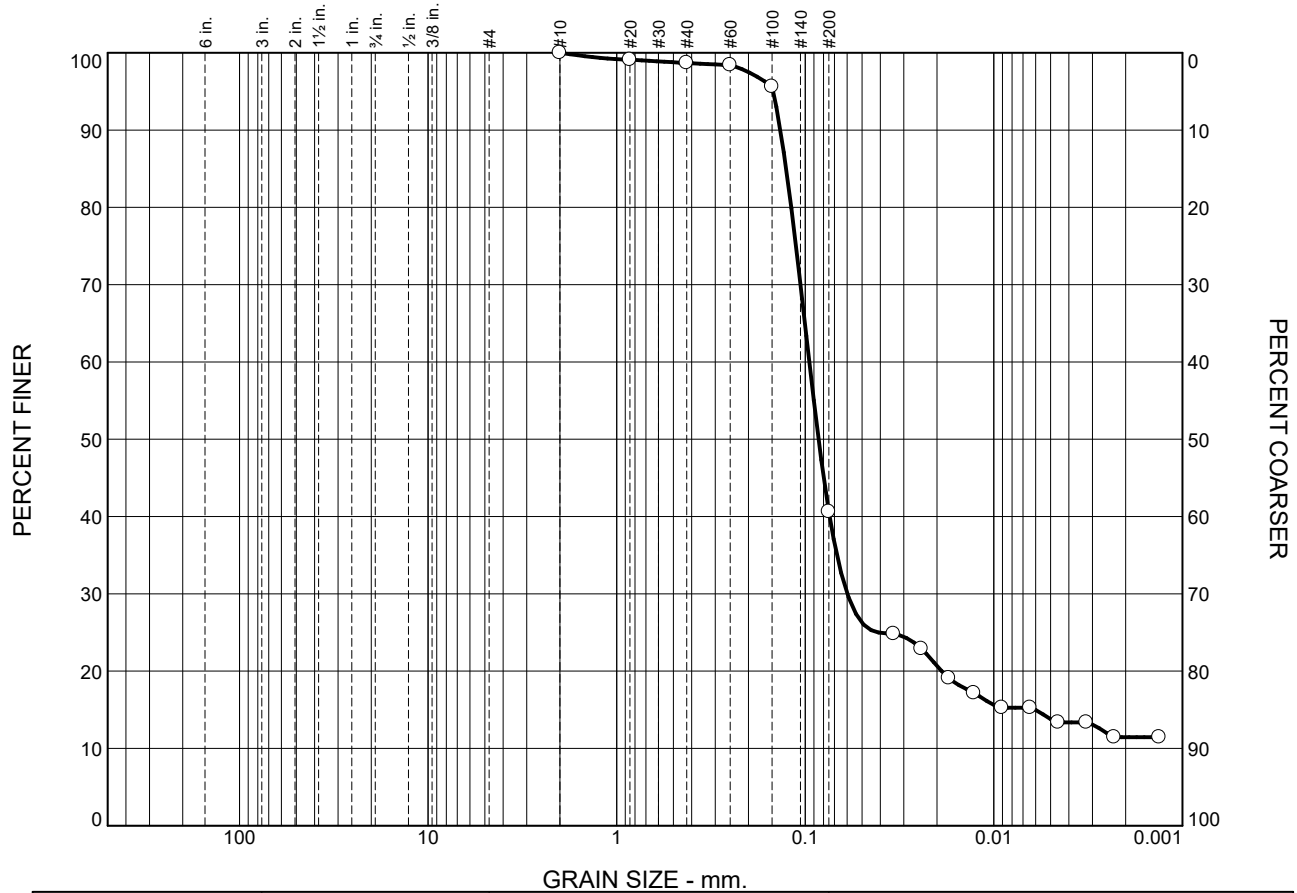
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.3	58.1	26.8	13.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-29	SP-2	2.5	Gray FAT CLAY (CH)	SC

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	0.3	82.4	17.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-29	SP-3	4.5	Brown SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	85.6	14.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-29	SP-7	12.5	Tan SILTY SAND (SM)	SM

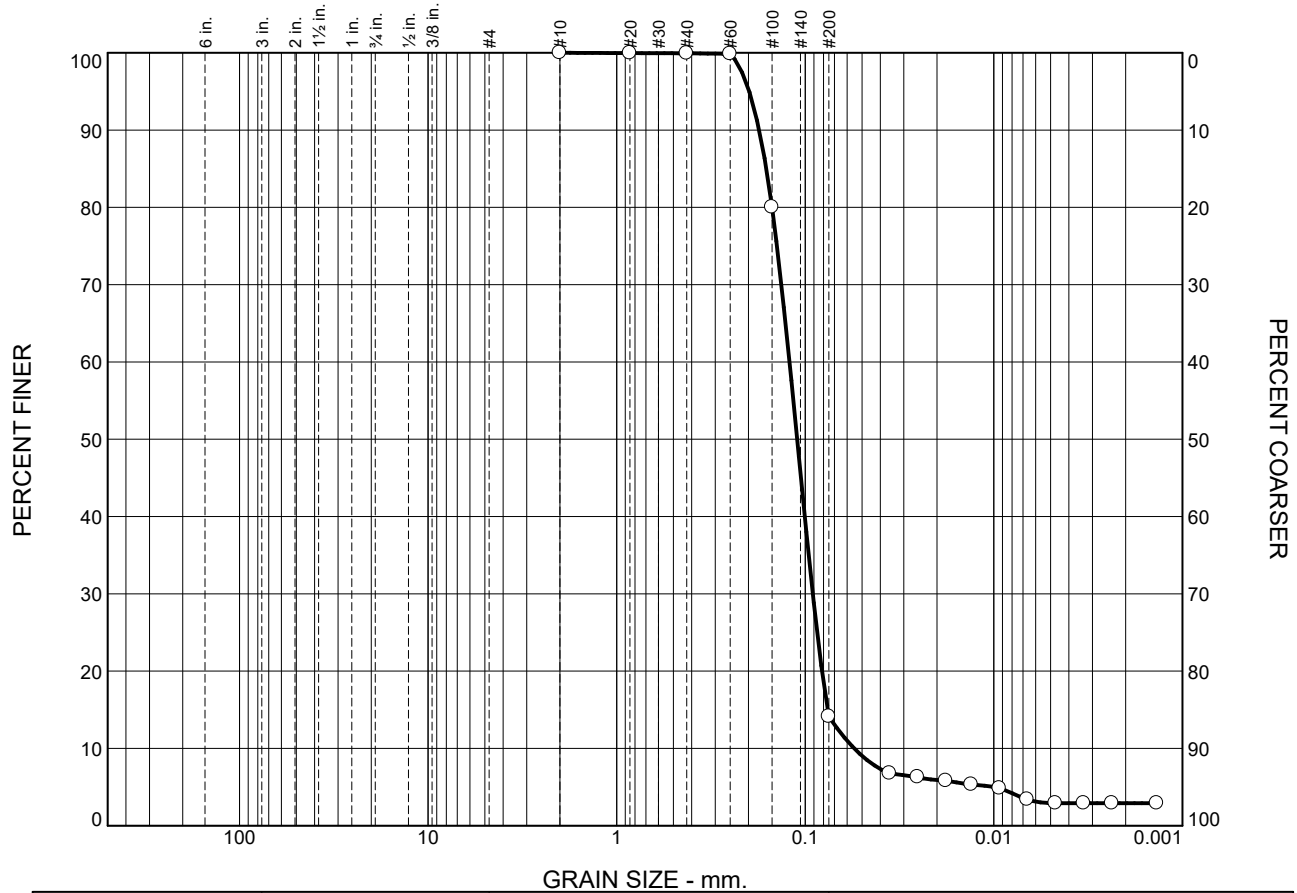
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	85.8	11.2	2.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-29	SP-16	42.5	Gray SILTY SAND (SM)	SM

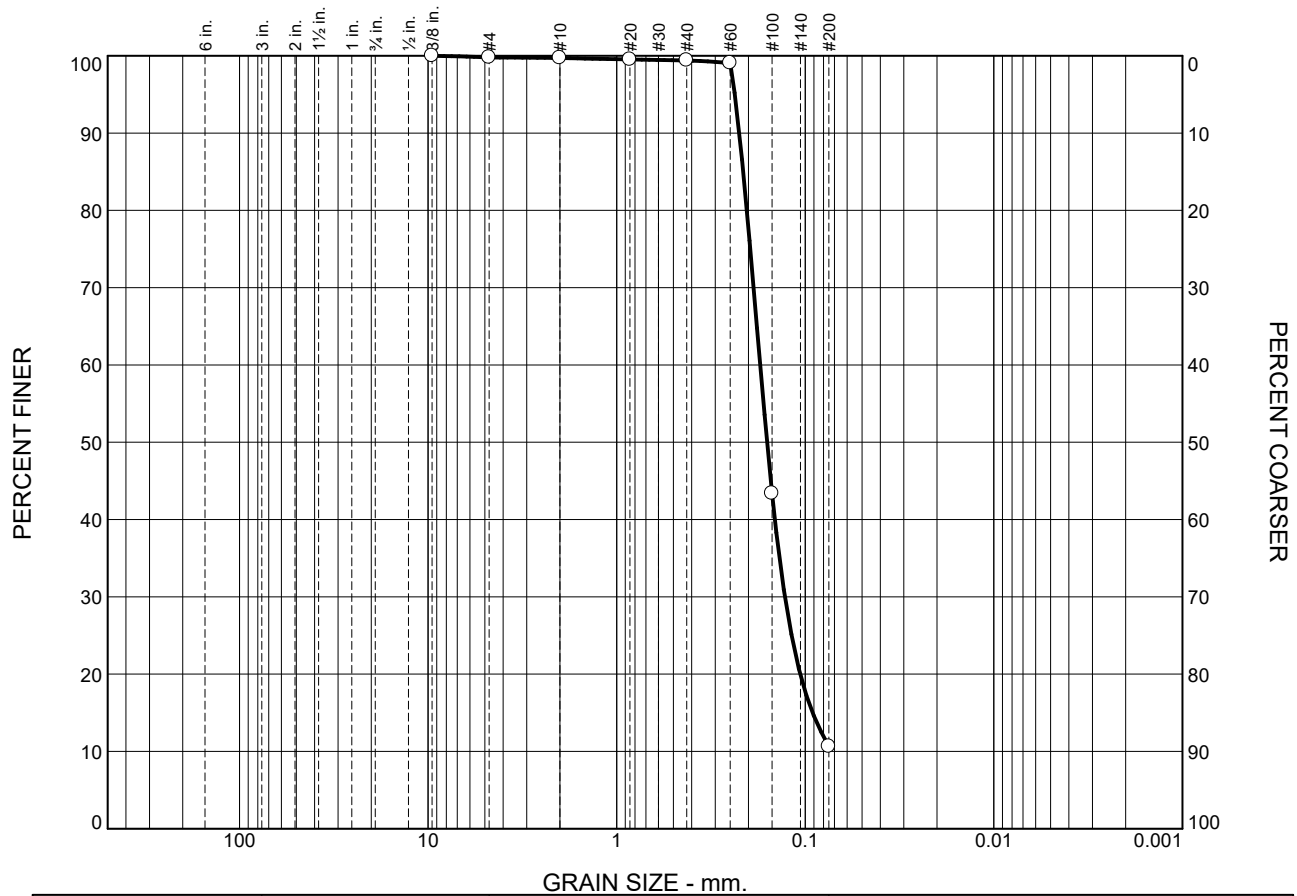
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.2	0.1	0.3	88.8	10.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-29	SP-20	50.5	Gray and tan POORLY GRADED SAND with SILT (SP-SM)	SP-SM

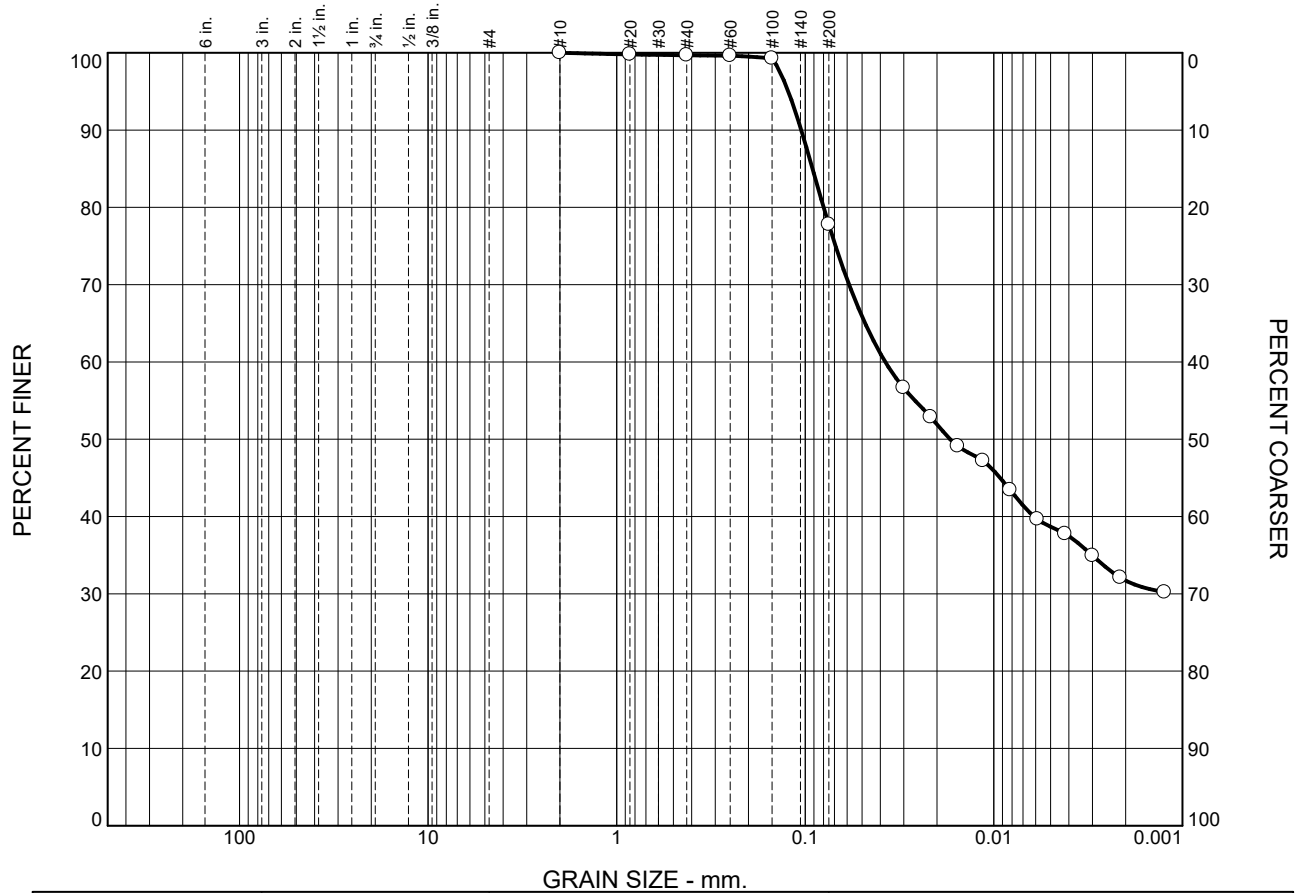
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	21.9	39.1	38.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-30	SP-1	0.5	Reddishbrown FAT CLAY with SAND (CH)	CH

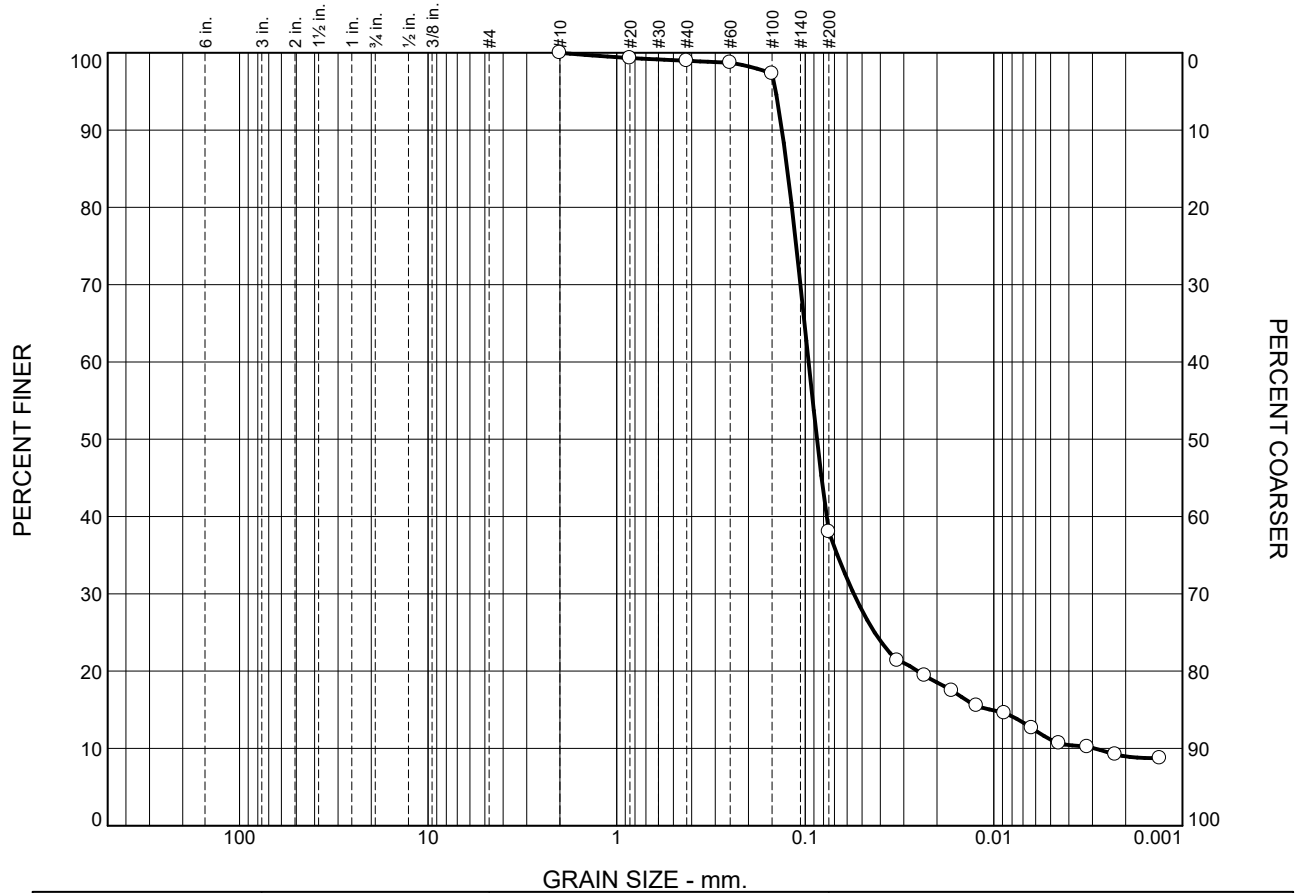
Tolunay-Wong Engineers, Inc.

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	61.0	26.9	11.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-30	SP-3	4.5	Brown SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

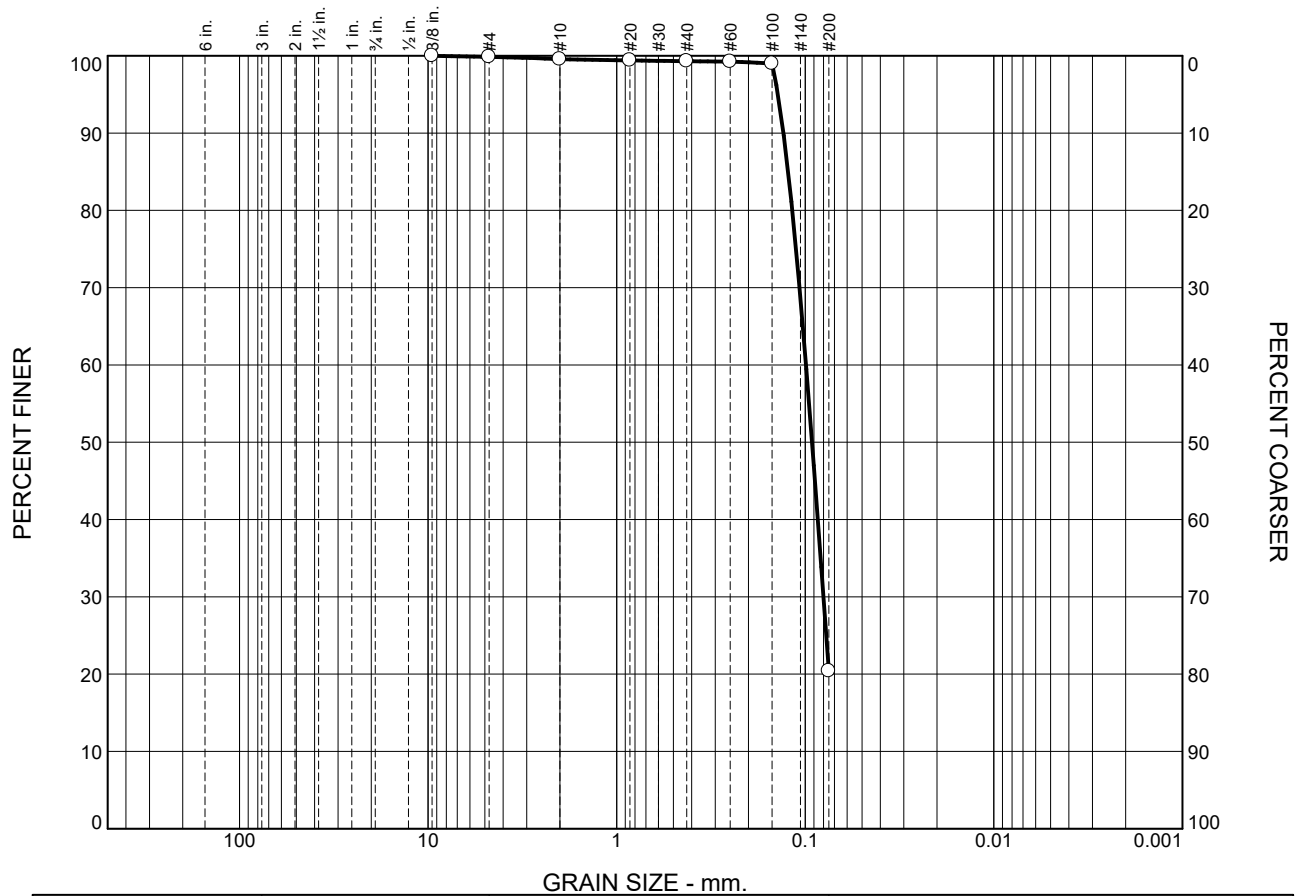
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.3	0.3	78.9	20.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-30	SP-5	8.5	Brown SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

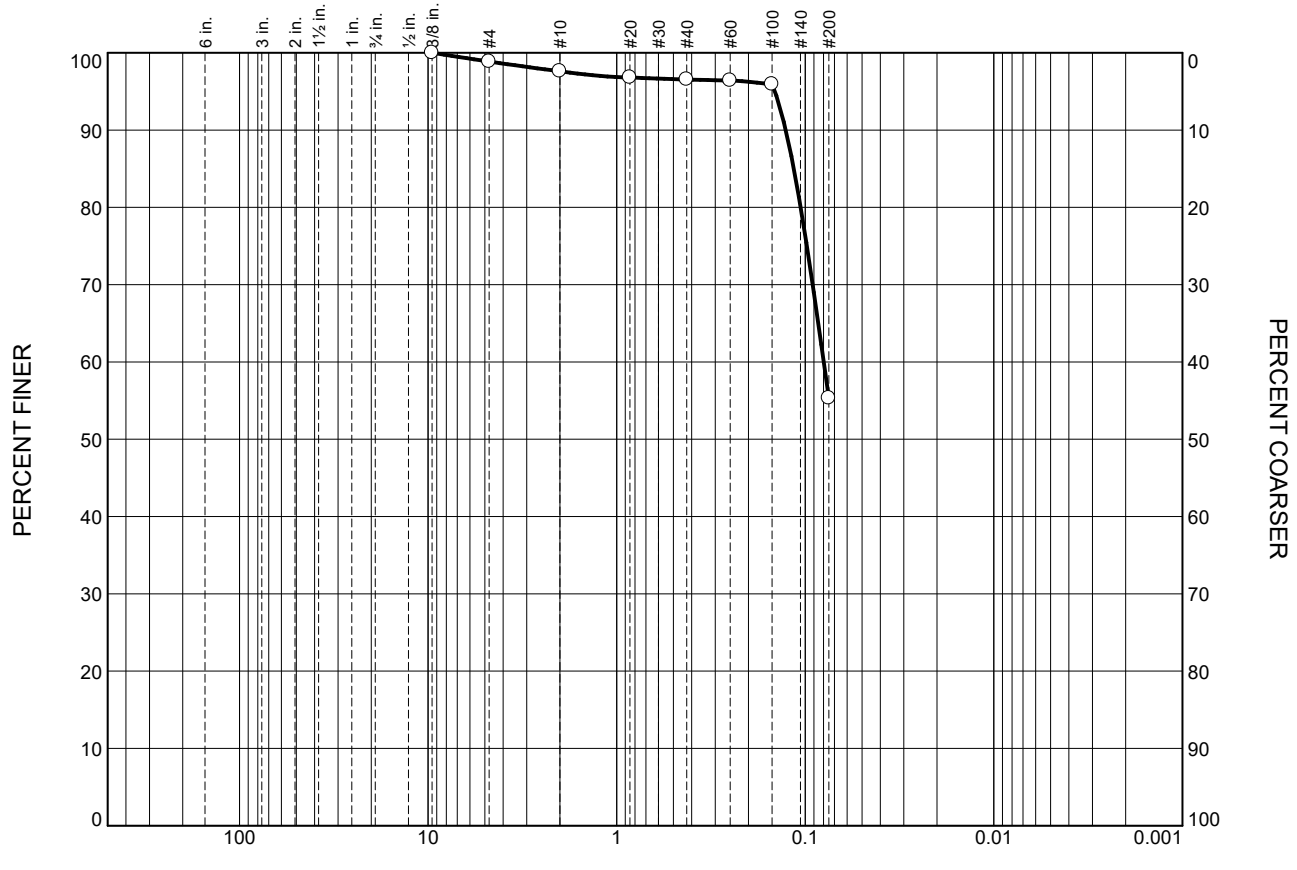
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.1	1.3	1.1	41.2	55.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-30	SP-9	16.5	Gray SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

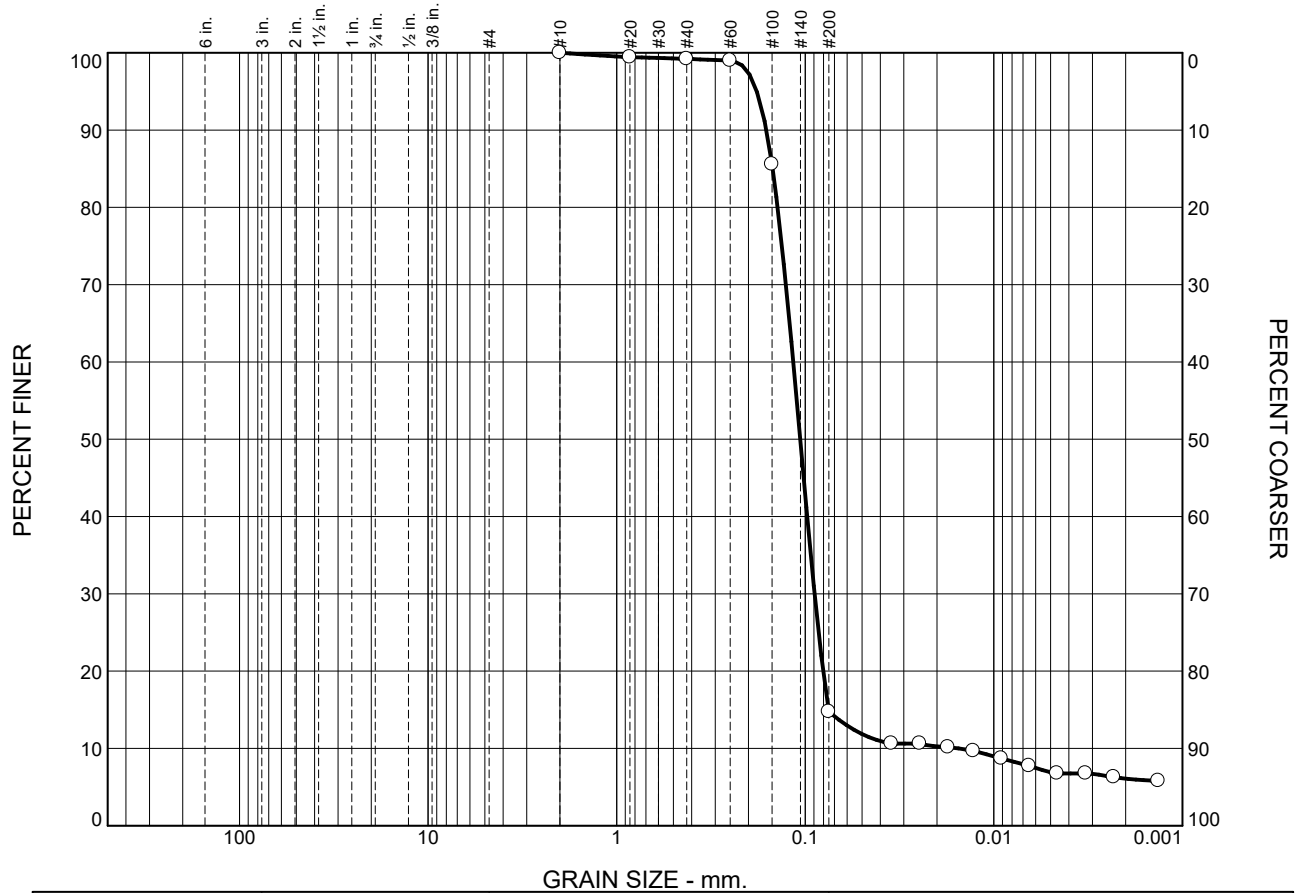
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.8	84.4	7.9	6.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-31	SP-1	0.5	Tan SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

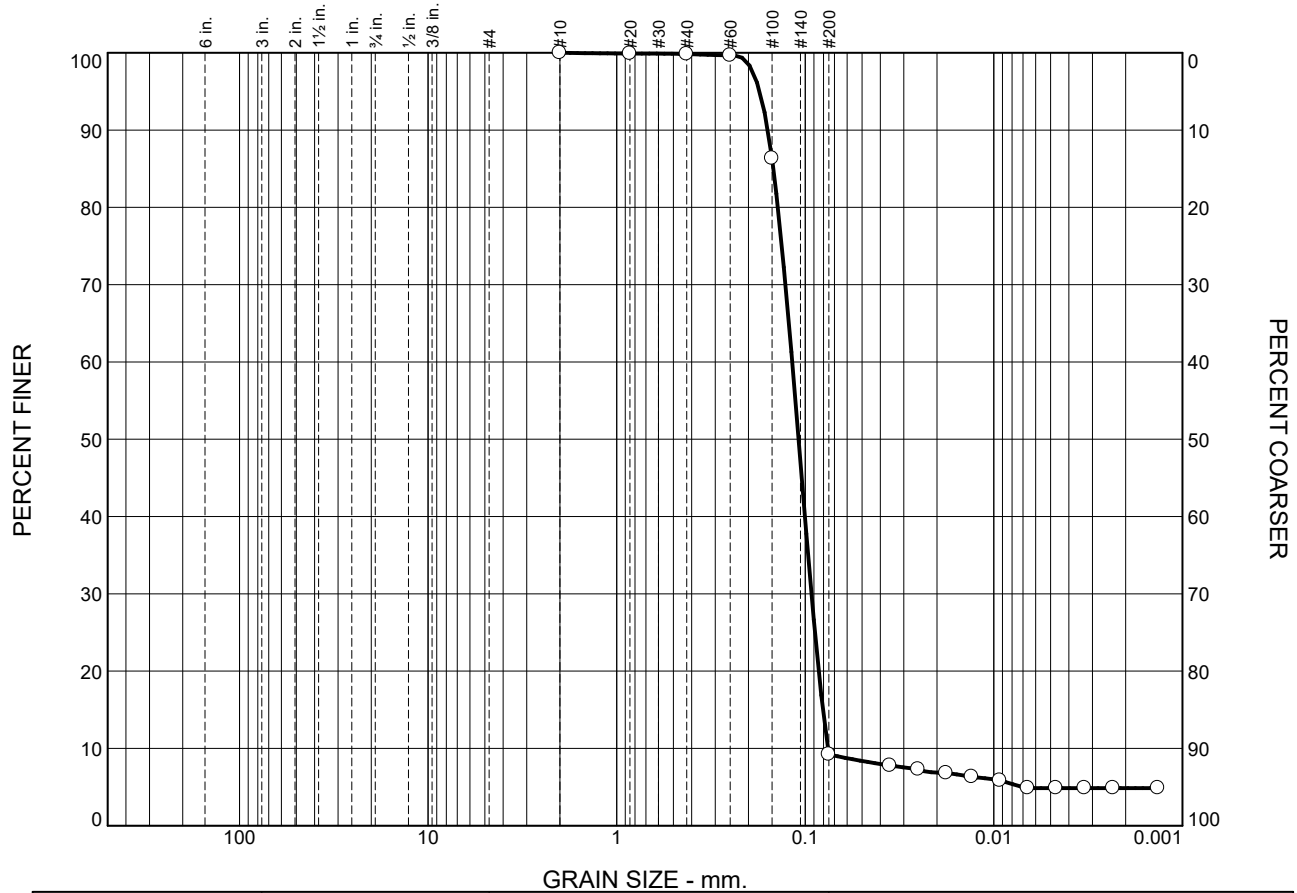
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	90.6	4.3	4.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-31	SP-3	4.5	Brown POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

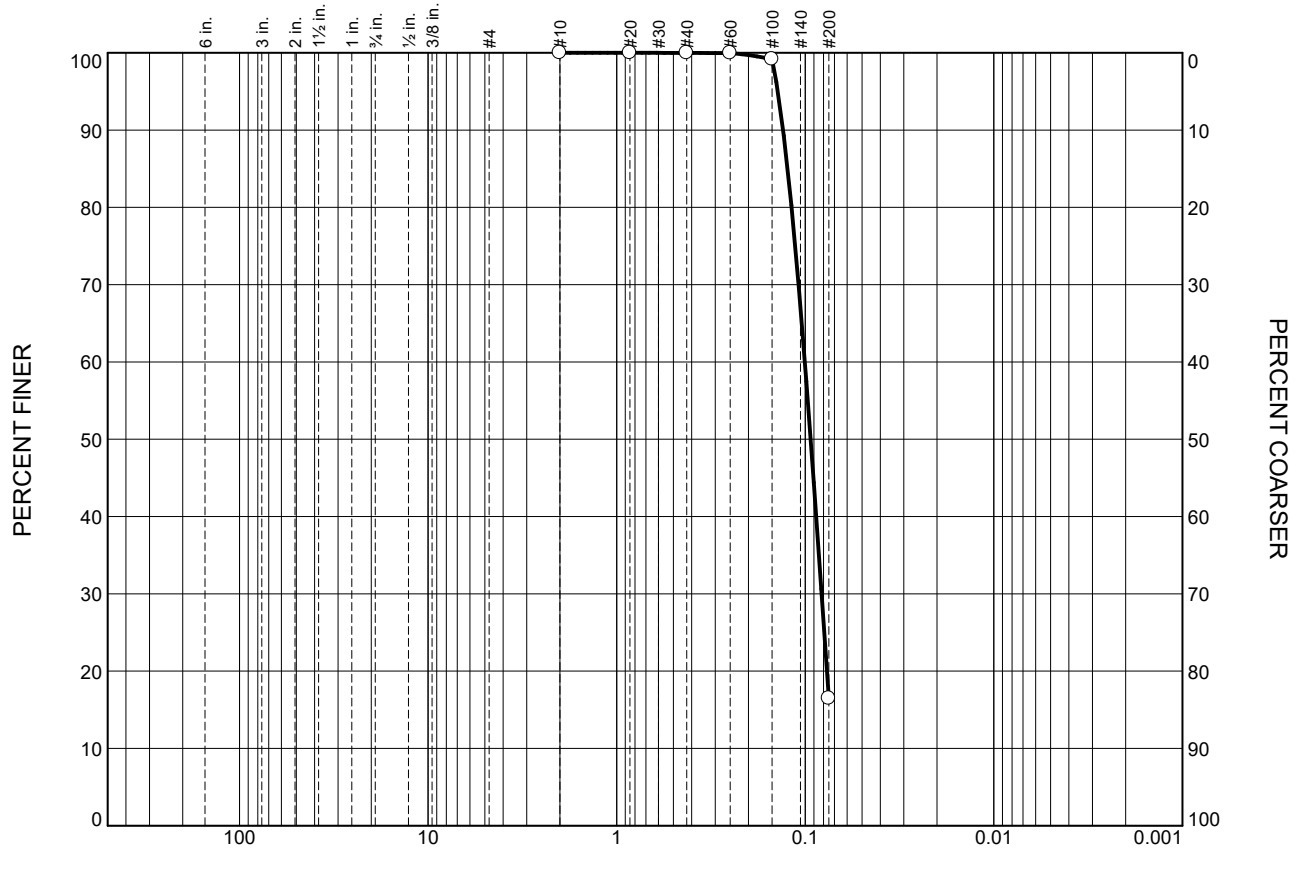
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	83.5	16.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-31	SP-5	8.5	Brown SILTY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	53.9	45.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-31	SP-12	22.5	Brown SILTY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

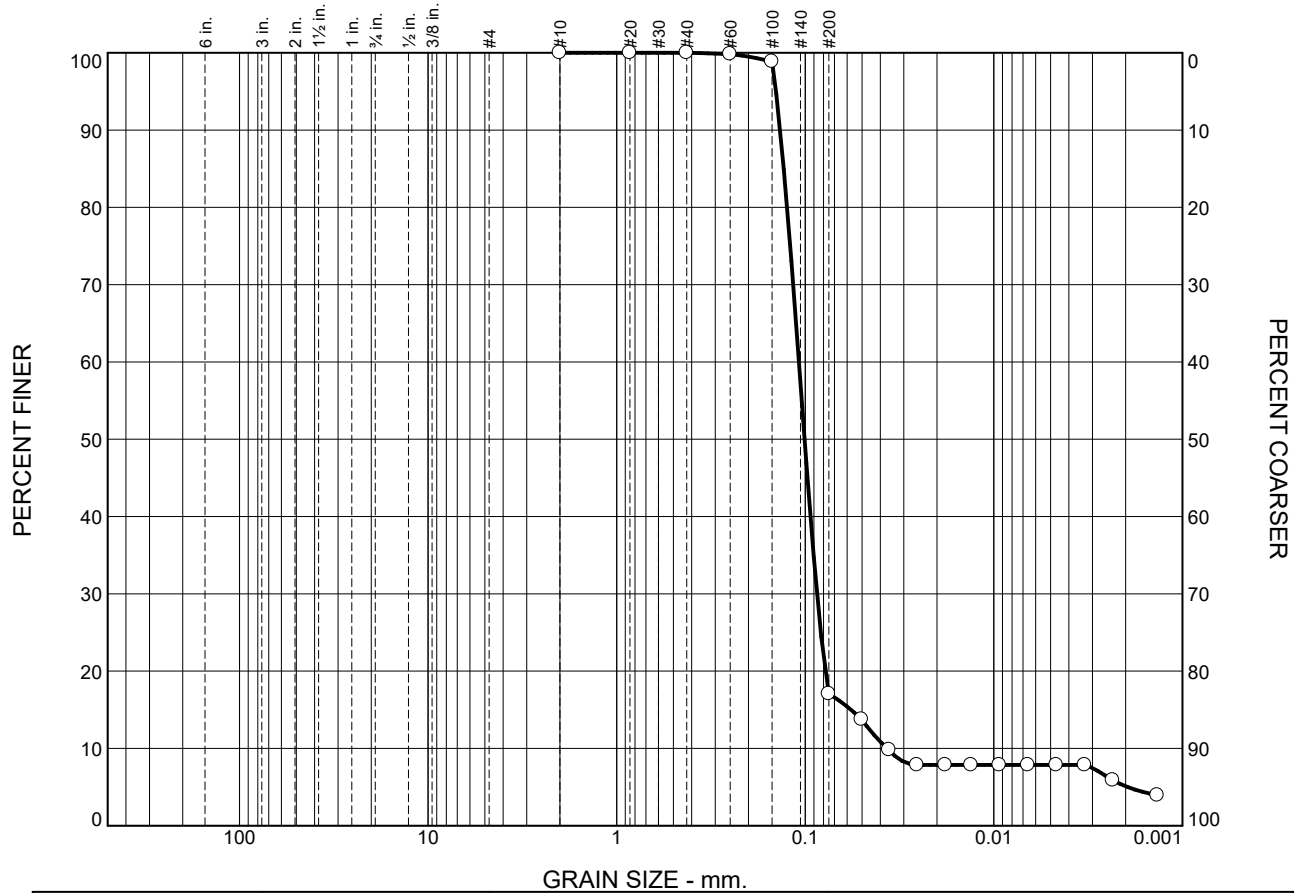
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	82.9	9.2	7.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-1	0.5	Brown and gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

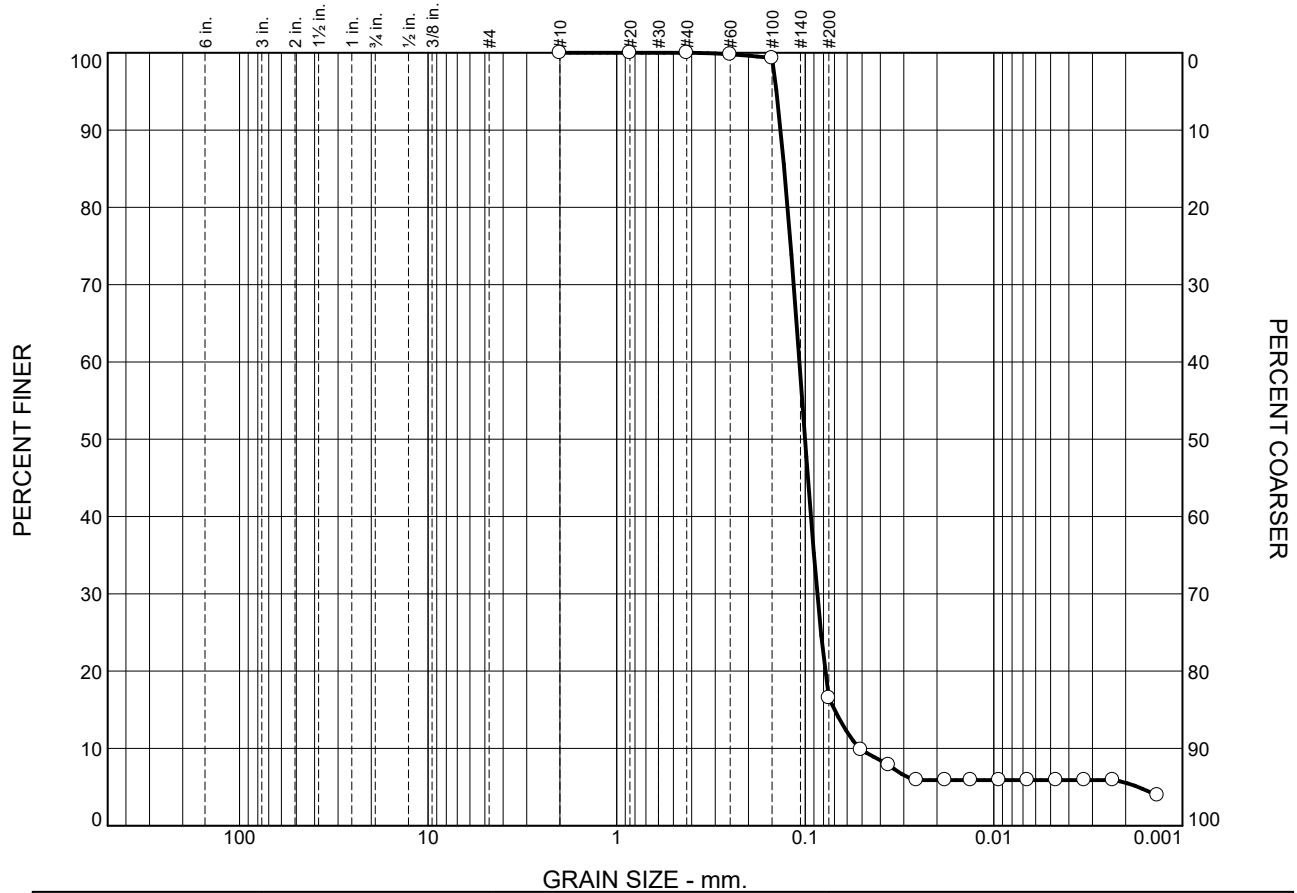
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	83.5	10.6	5.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-2	2.5	Tan and gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

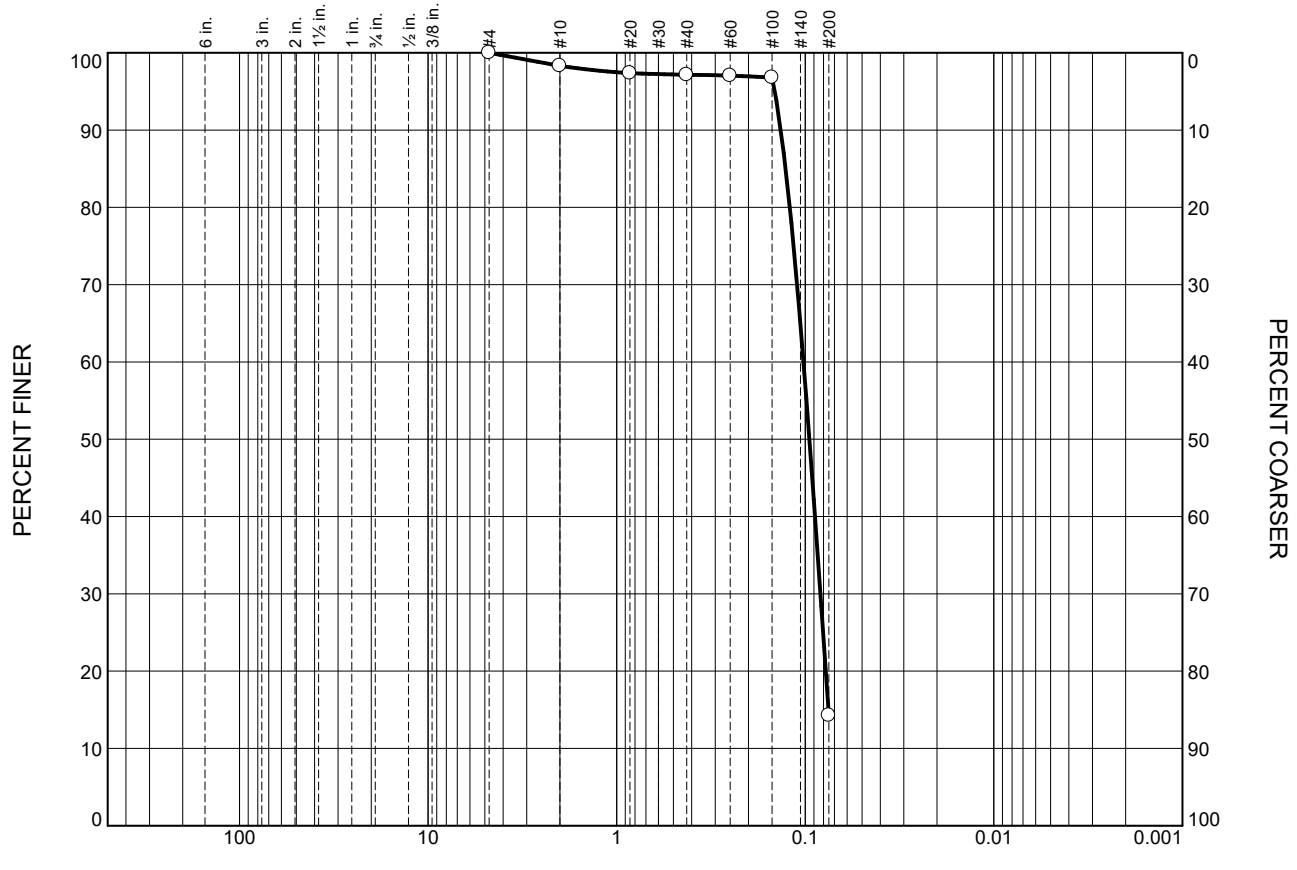
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.7	1.2	82.8	14.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-5	8.5	Gray and tan SILTY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

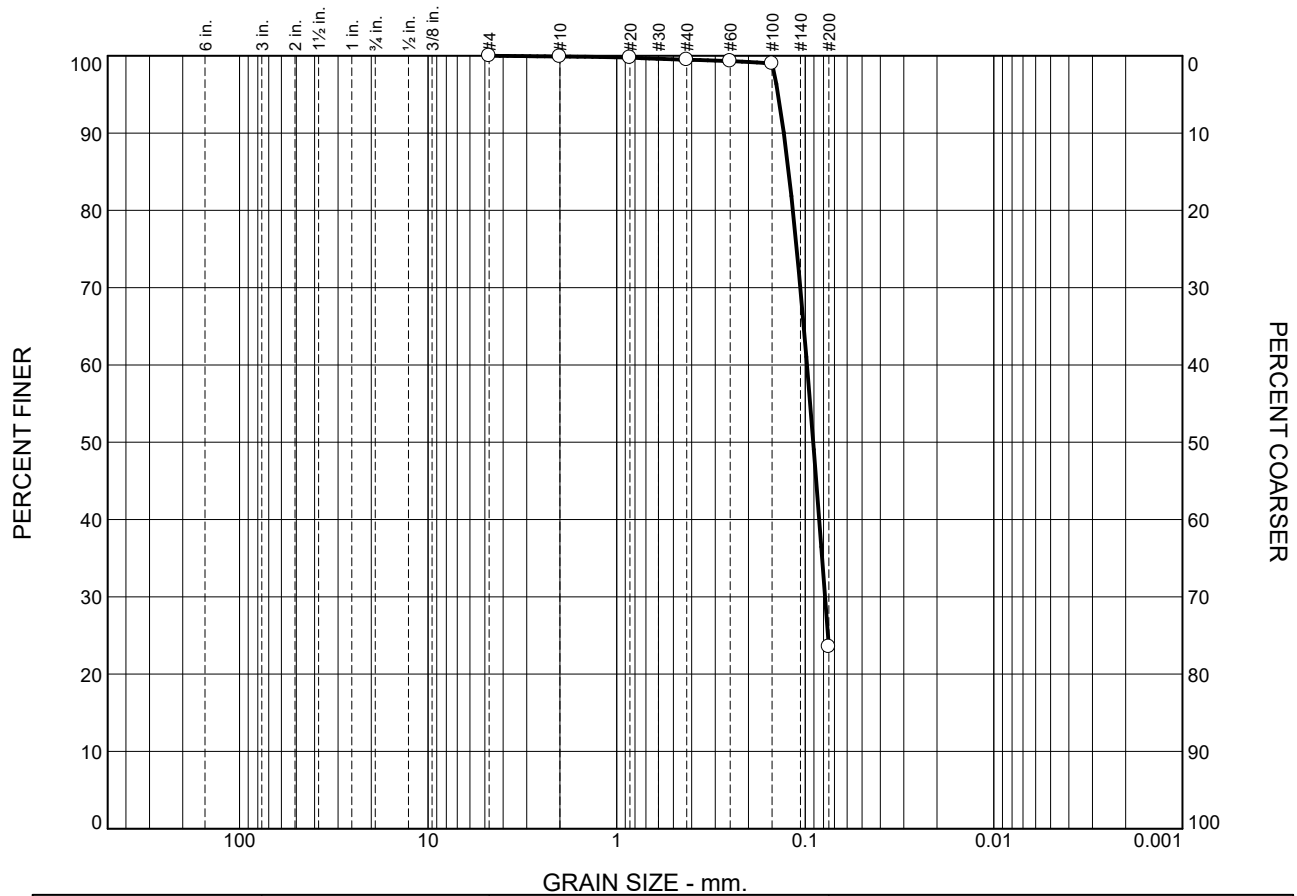
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.4	76.0	23.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-8	14.5	Gray SILTY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

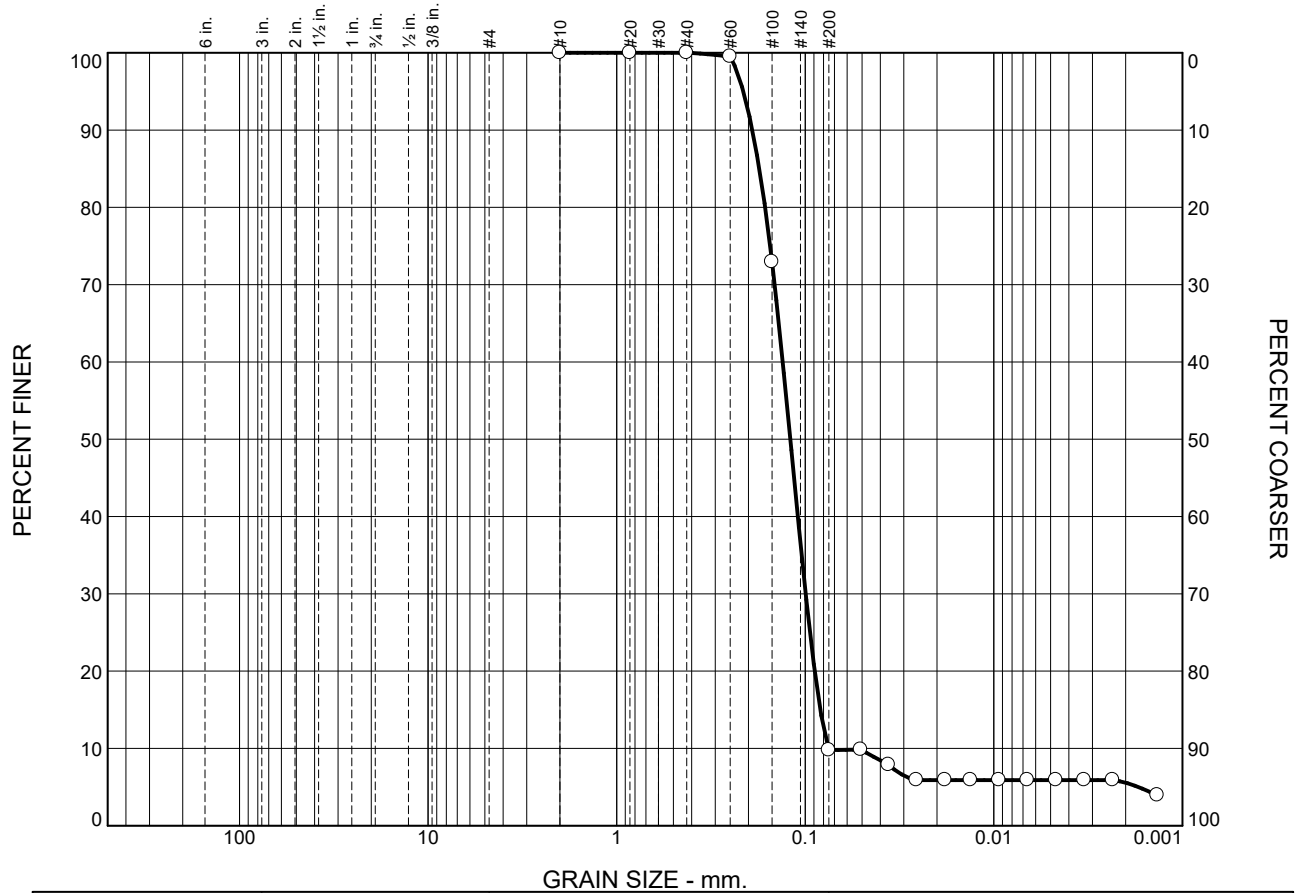
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	90.2	3.9	5.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-10	34.5	Gray POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

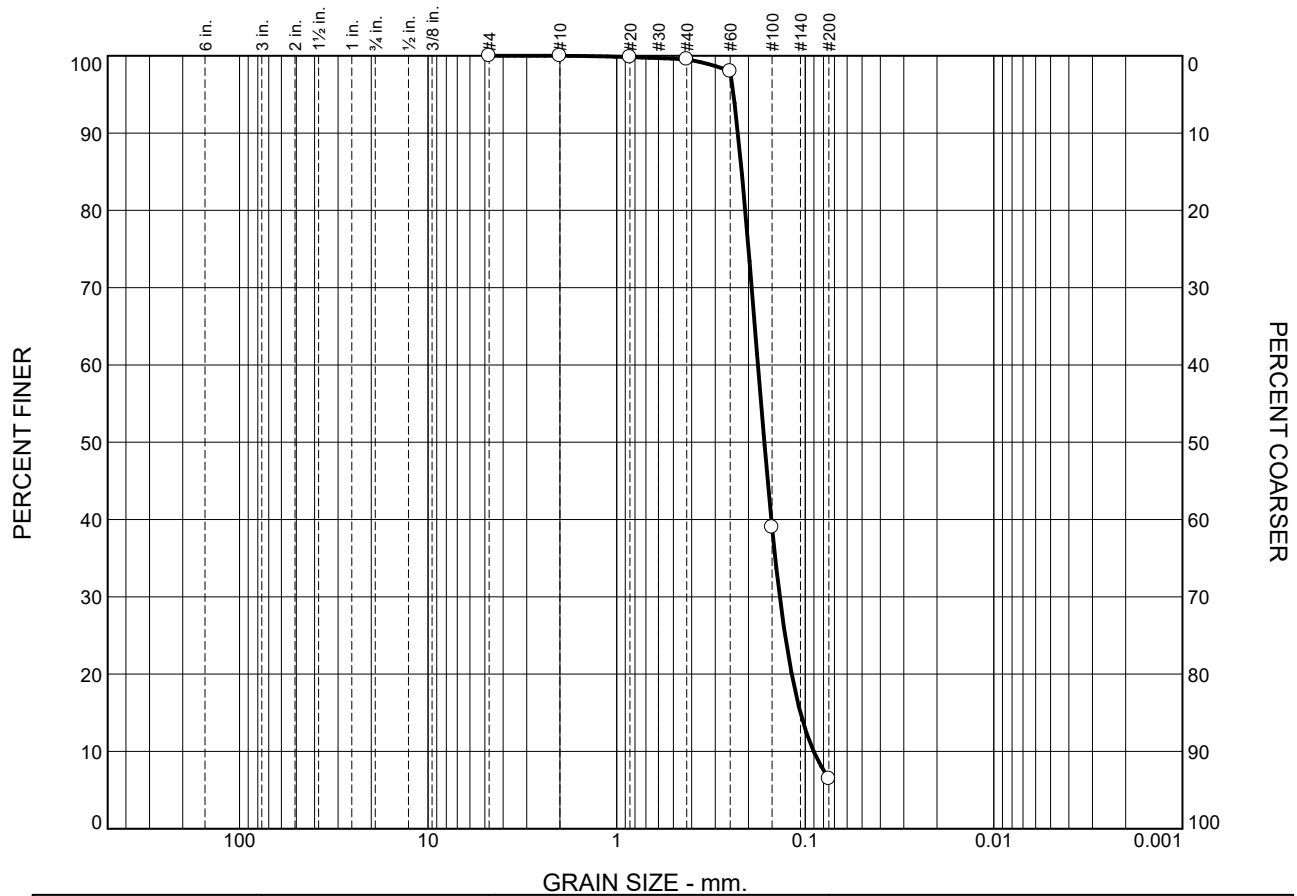
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	93.0	6.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-32	SP-12	38.5	Gray poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

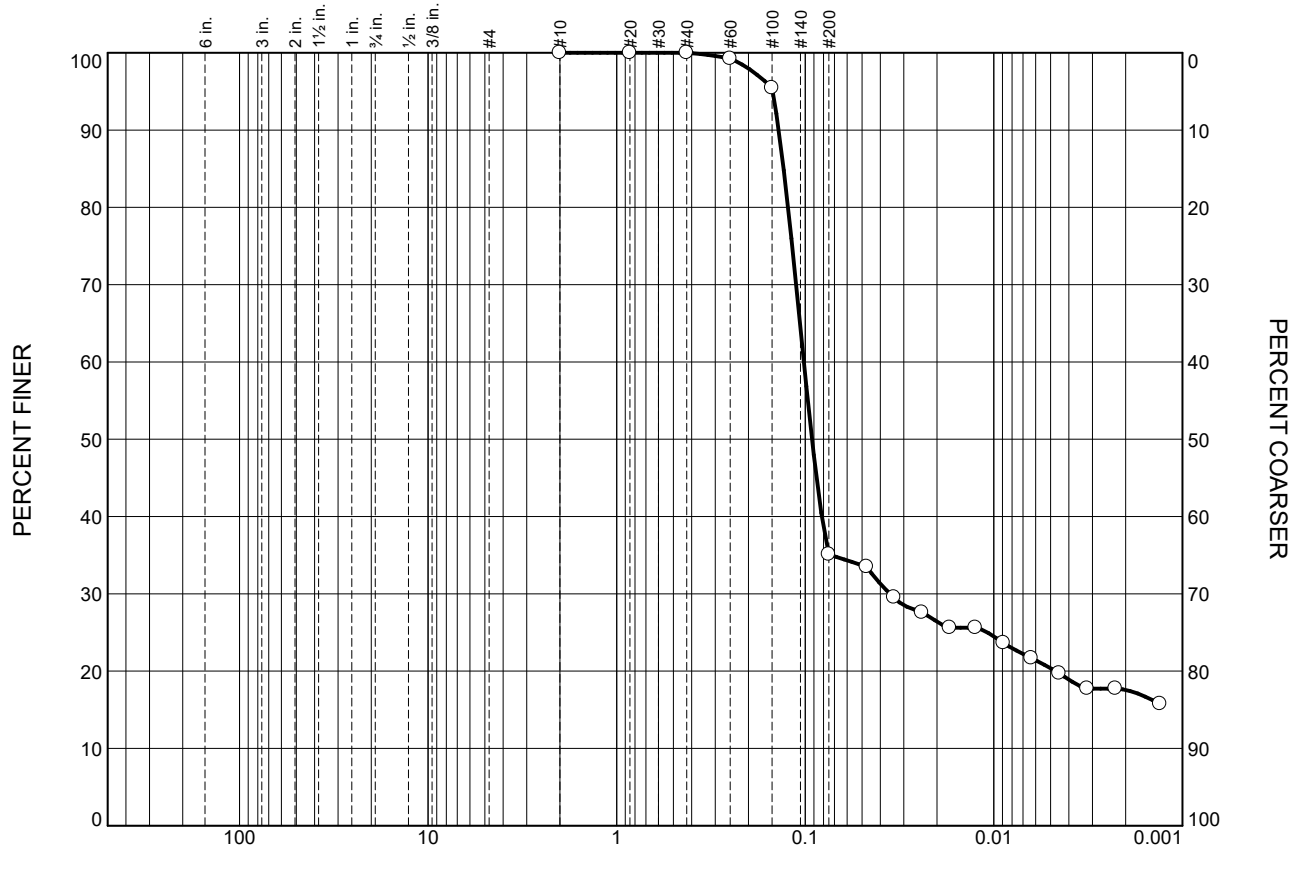
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	64.9	14.7	20.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-33	SP-1	0.5	Tan CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

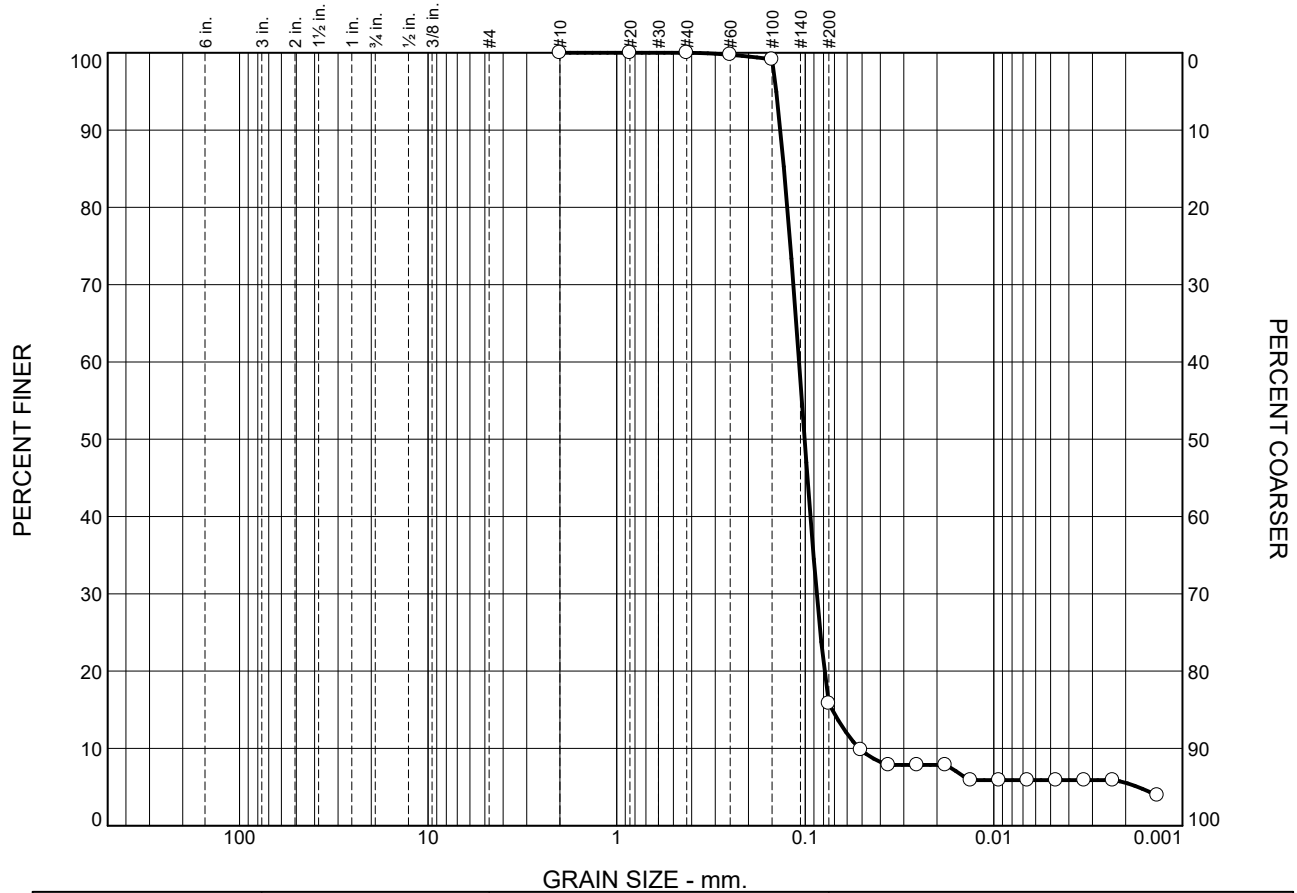
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	84.2	9.9	5.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-33	SP-2	2.5	Tan SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

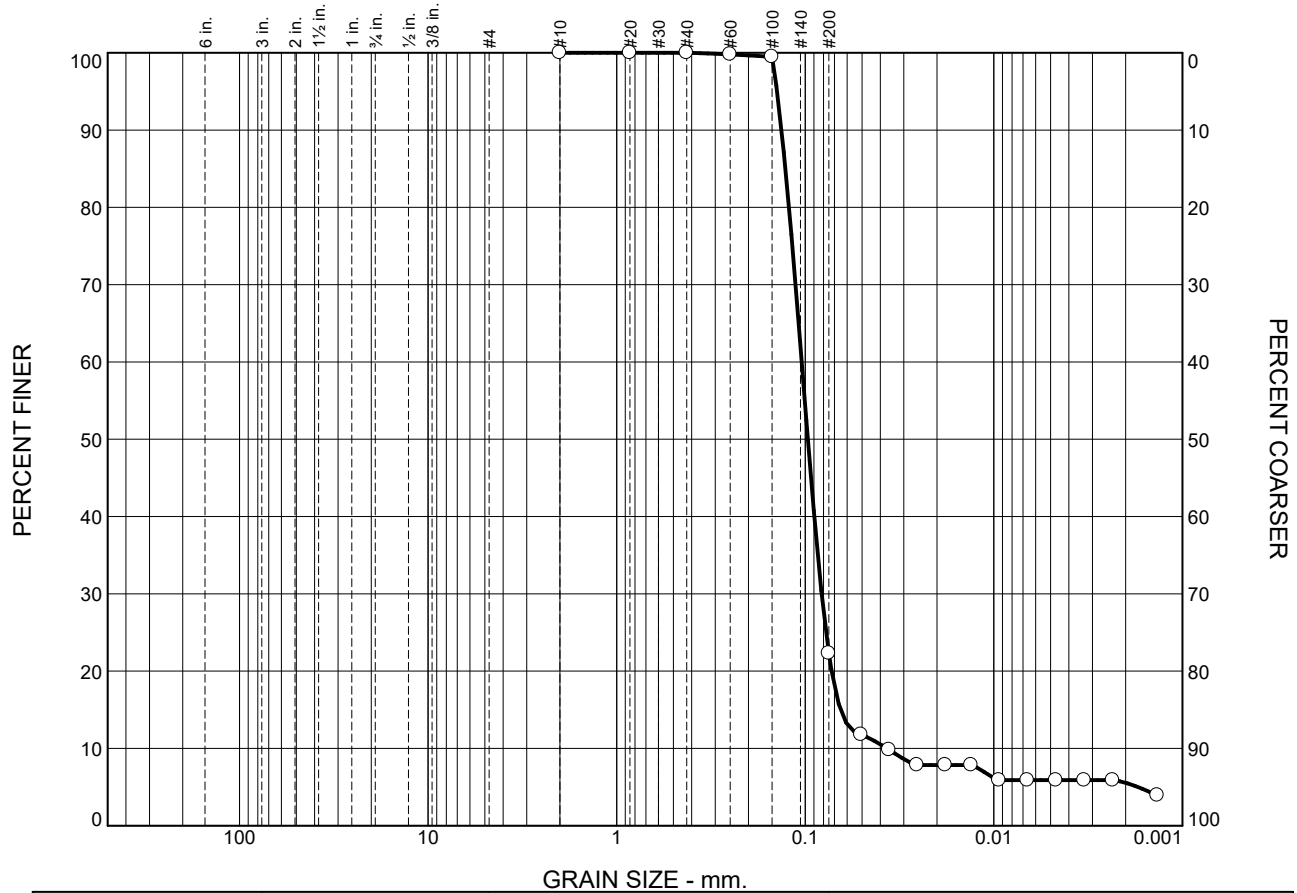
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	77.7	16.4	5.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-33	SP-5	8.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

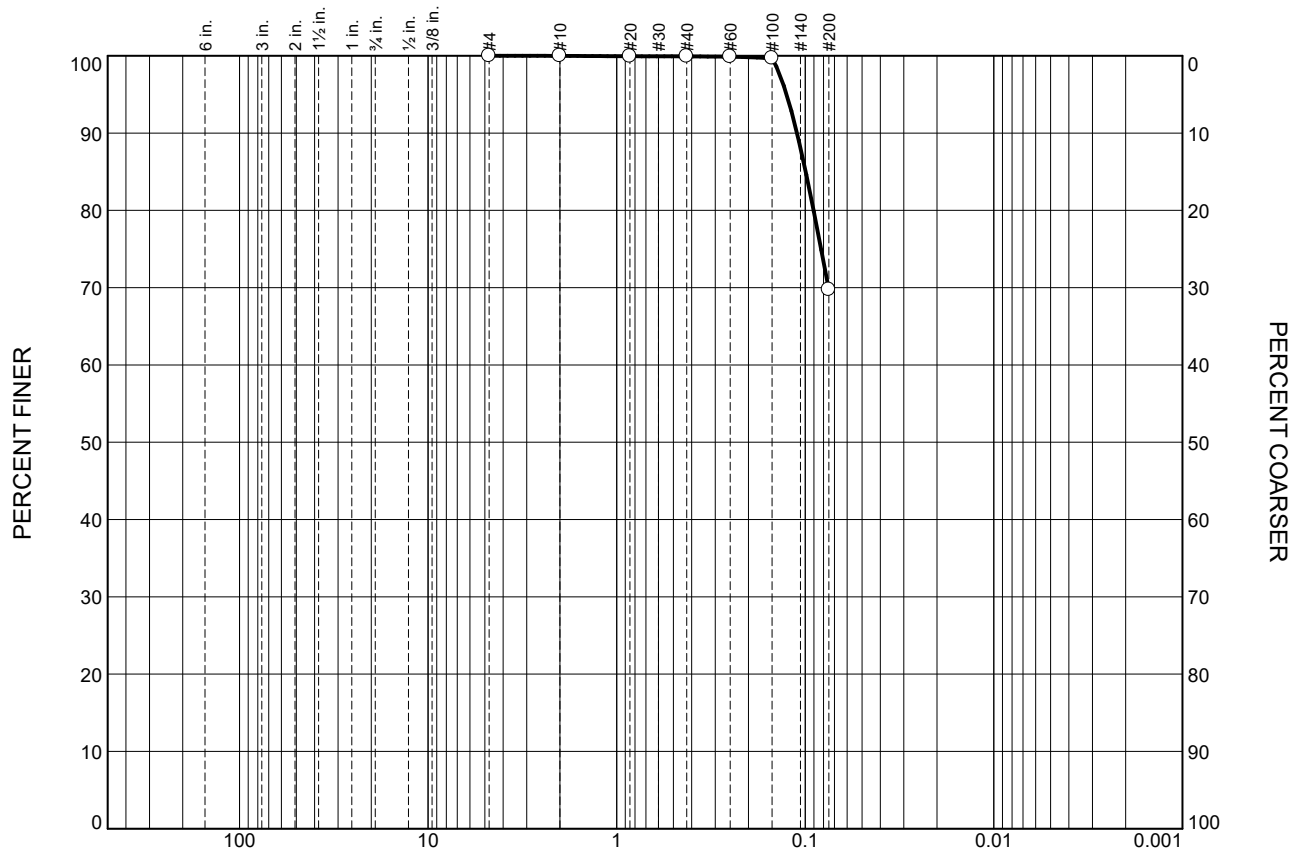
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	30.1	69.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-33	SP-8	14.5	Brown SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

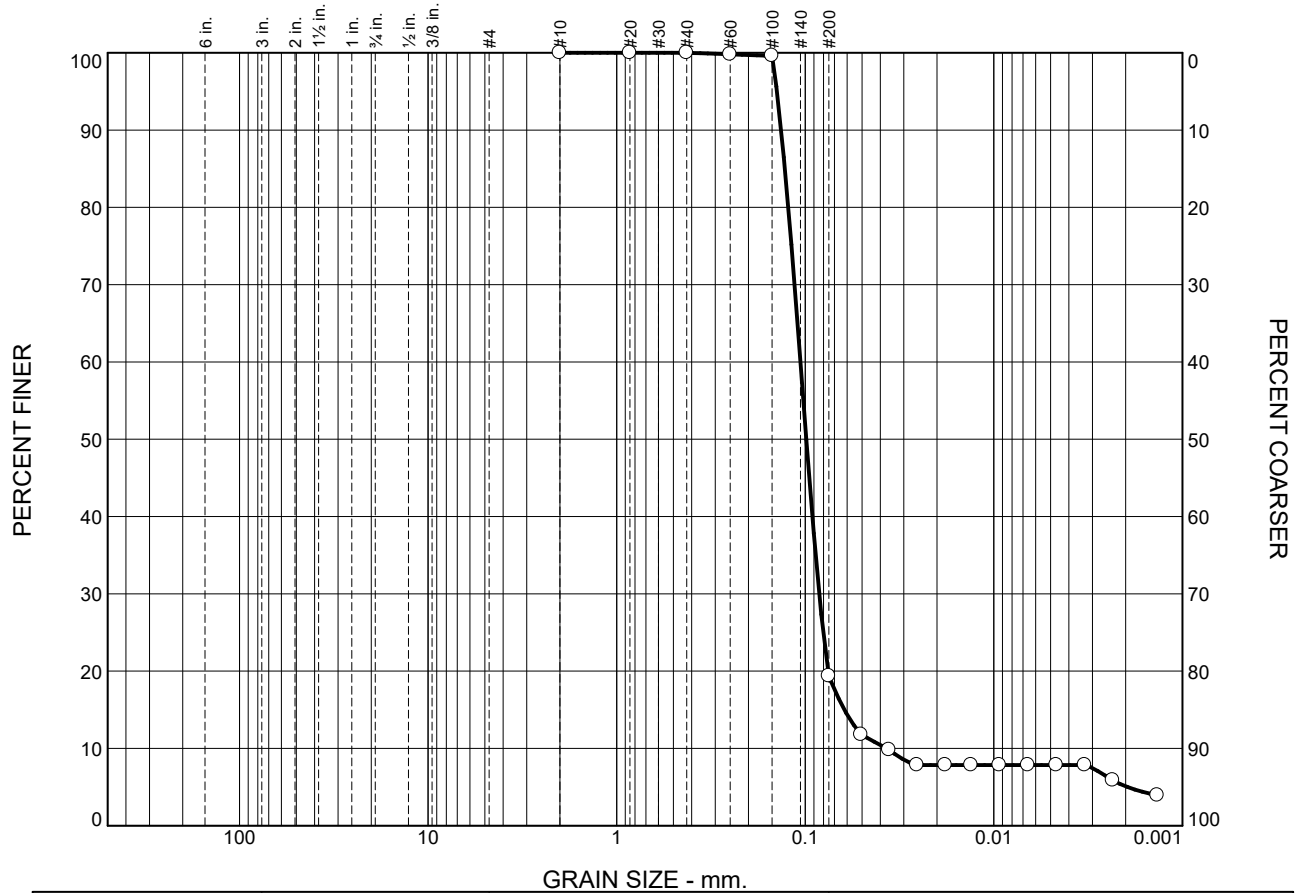
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	80.6	11.6	7.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-34	SP-1	0.5	Brown SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

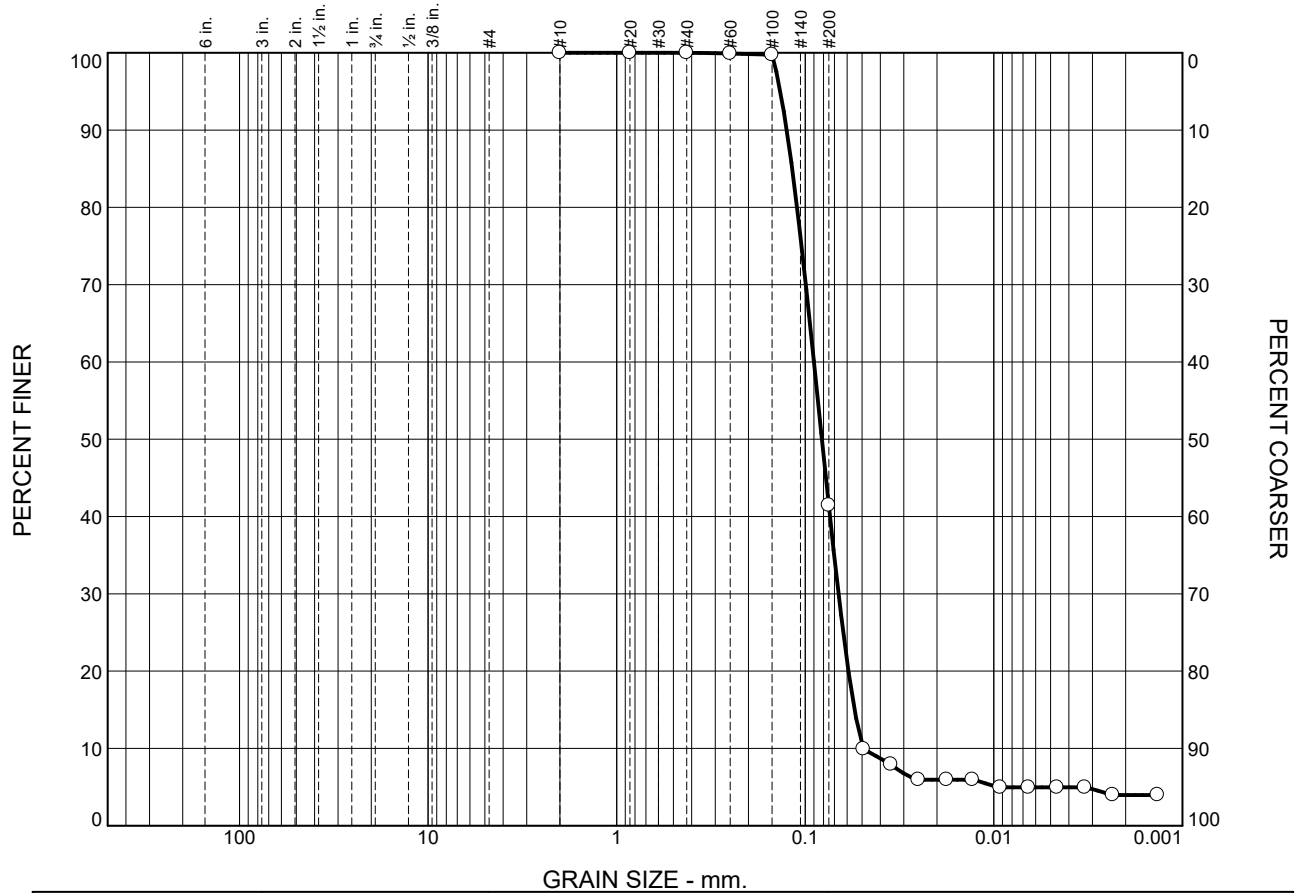
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	58.6	36.4	5.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-34	SP-3	4.5	Brown CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

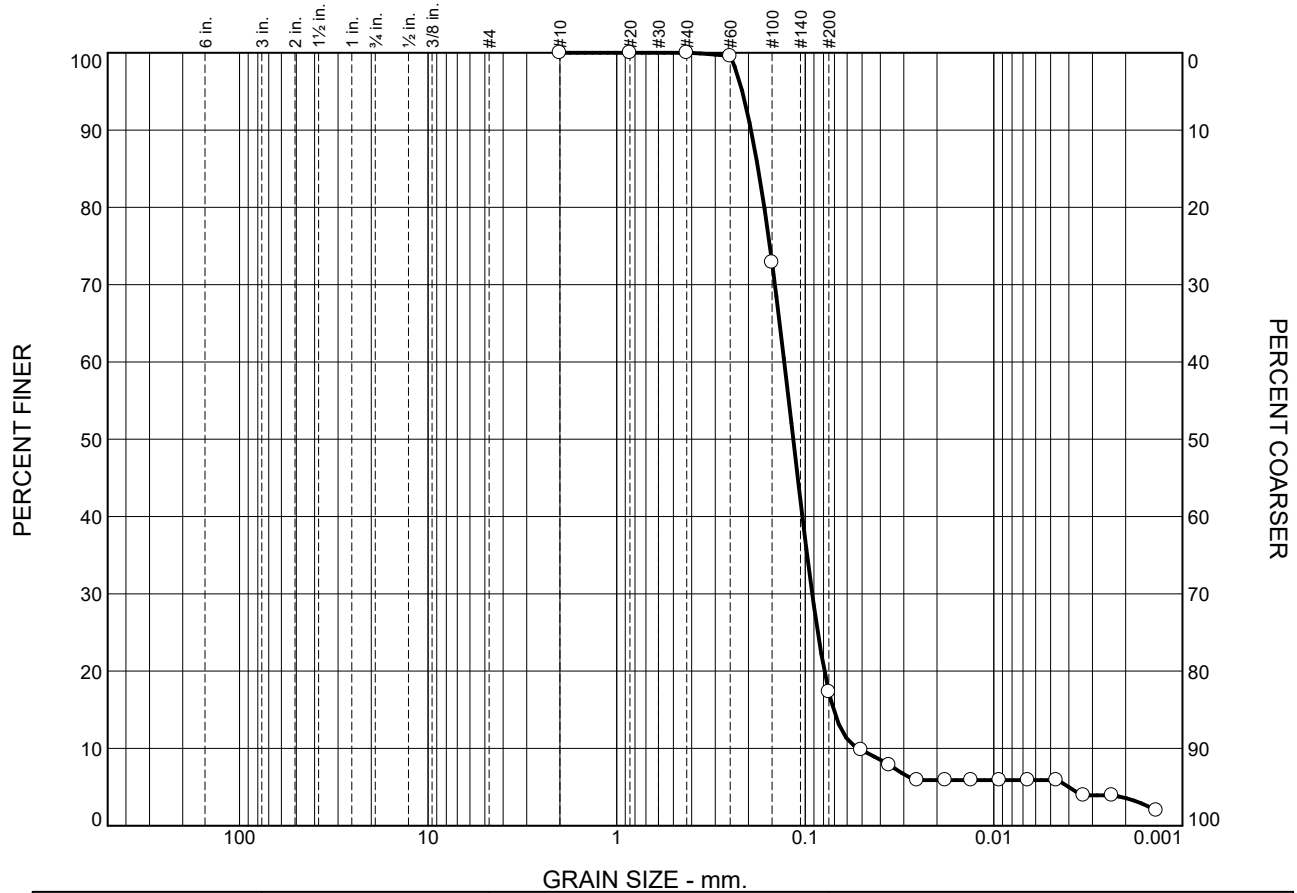
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	82.7	11.4	5.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-34	SP-6	25.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

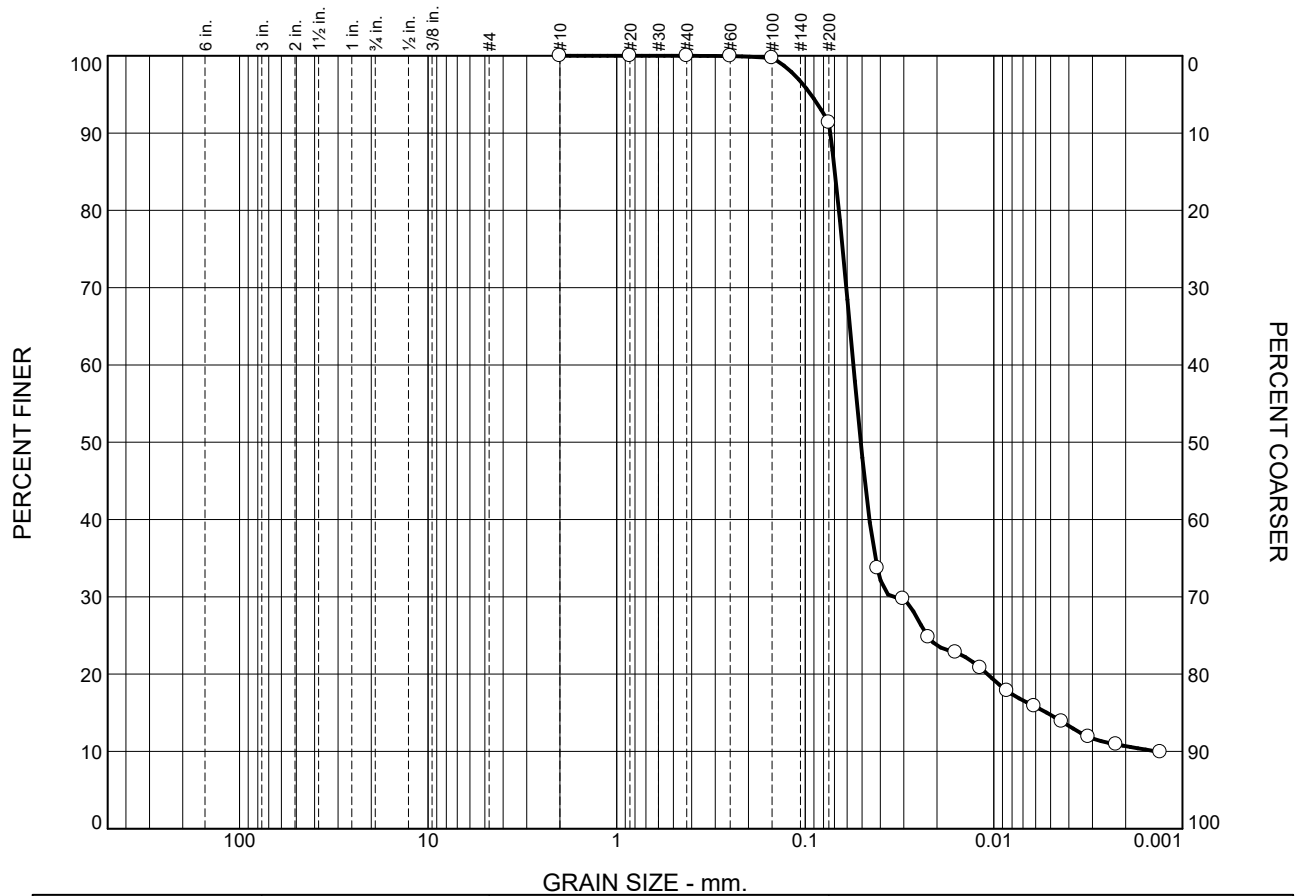
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	8.6	76.7	14.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-35	SP-2	5.5	Tan SILT CLAY	ML

Tolunay-Wong Engineers, Inc.

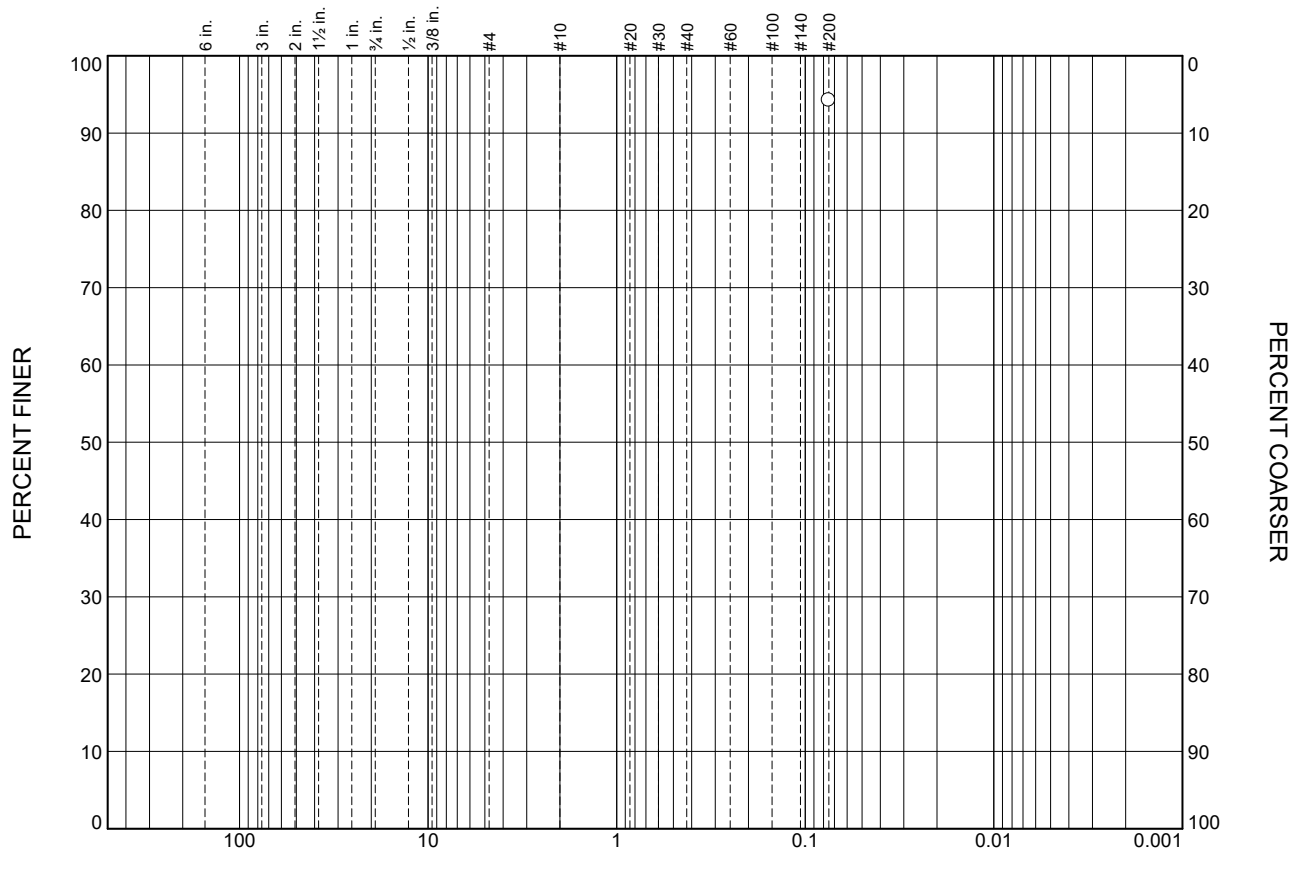
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							94.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-35	SP-3	10.5		ML

Tolunay-Wong Engineers, Inc.

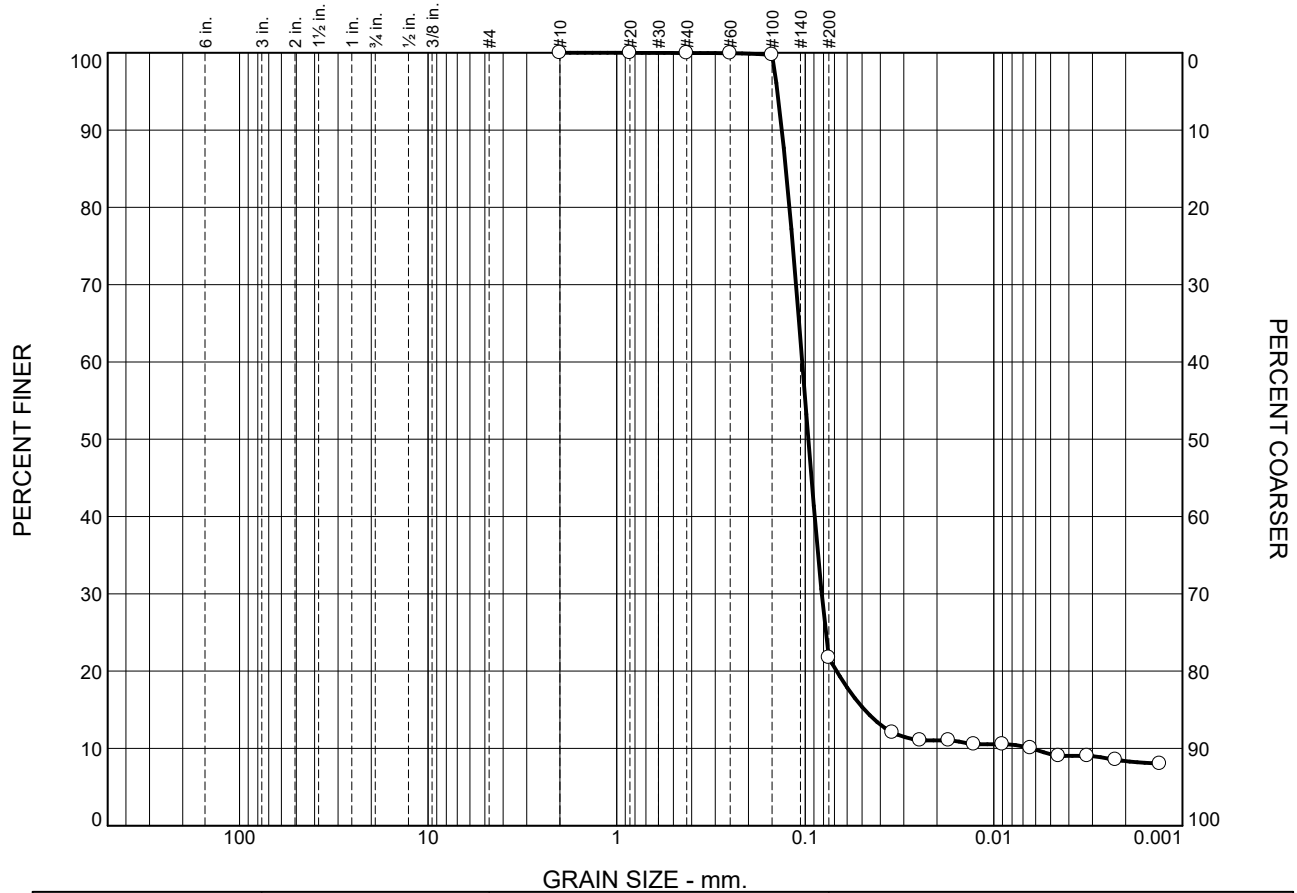
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	78.3	12.5	9.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-36	SP-1	0.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

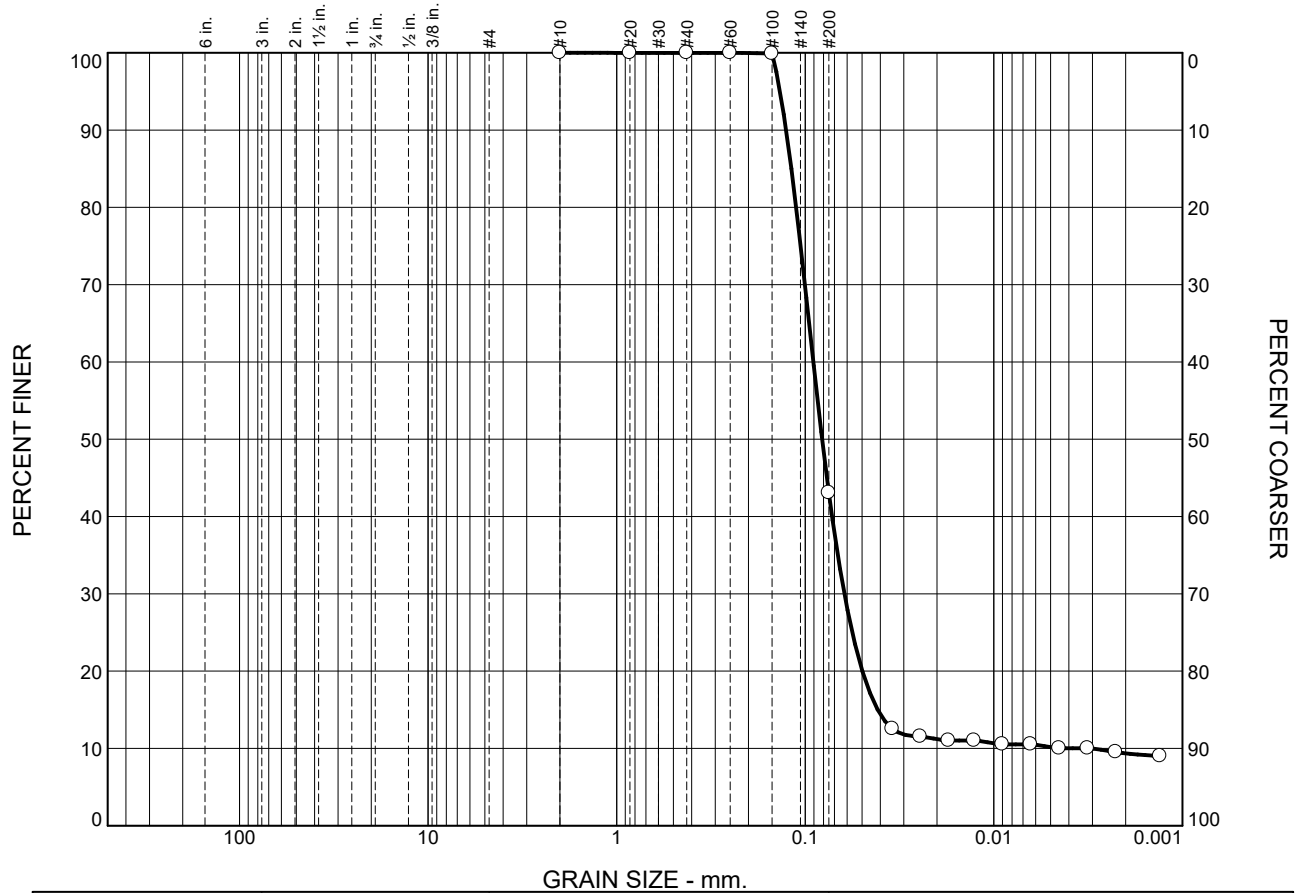
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	56.9	32.9	10.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-36	SP-2	5.5	Tan SILTY SAND; clay balls	SM

Tolunay-Wong Engineers, Inc.

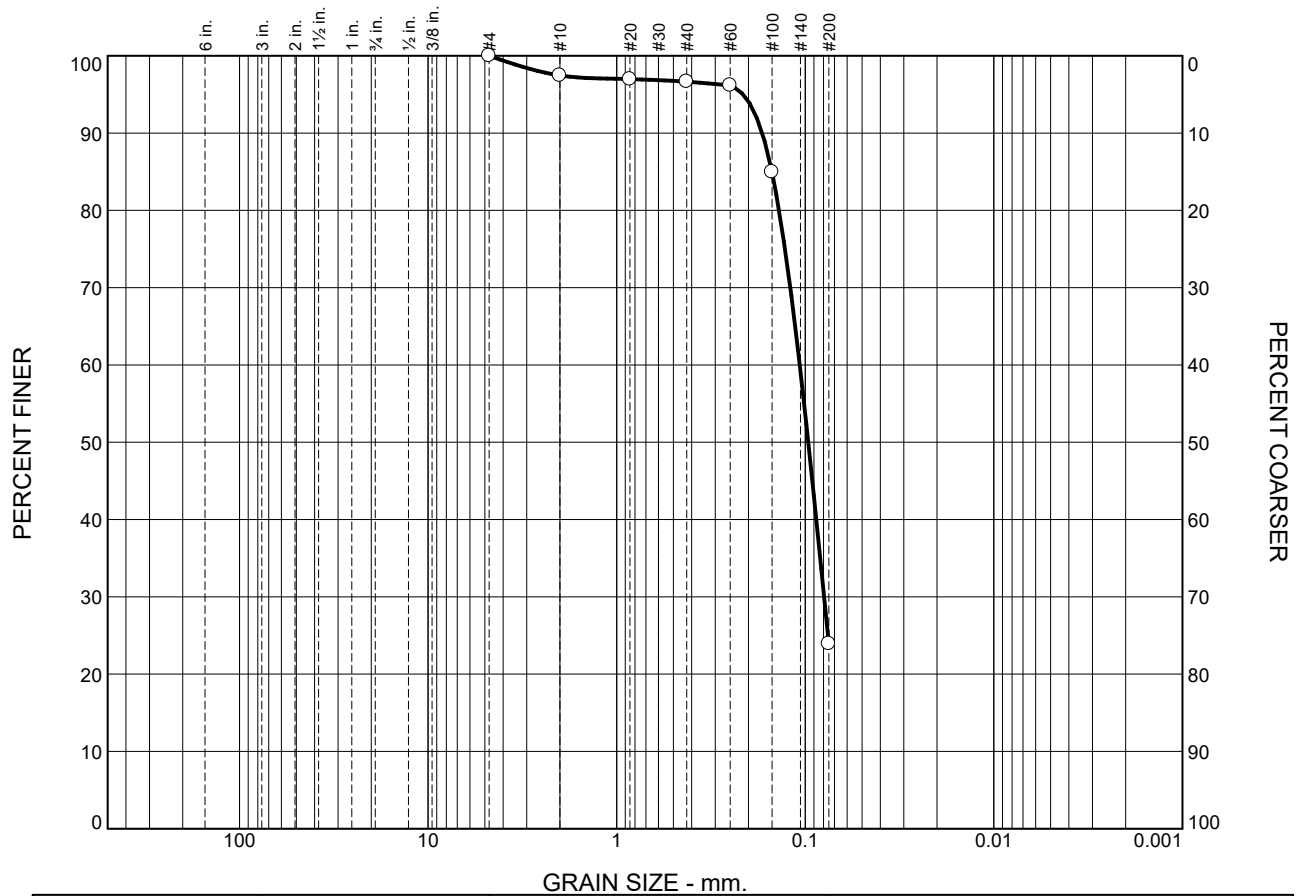
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	2.5	0.9	72.7	23.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-36	SP-7	30.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

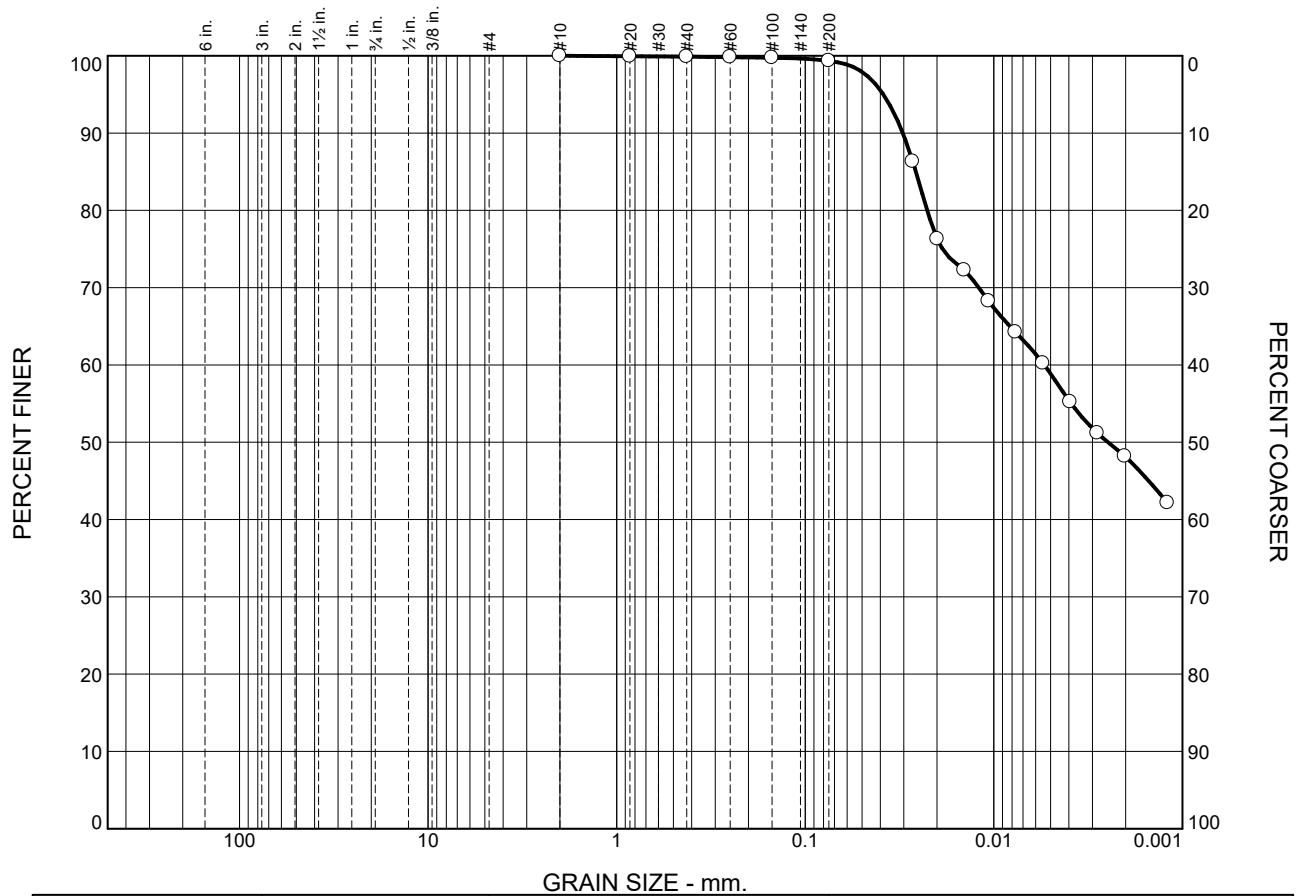
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	0.6	40.4	58.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-36	SP-10	38	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

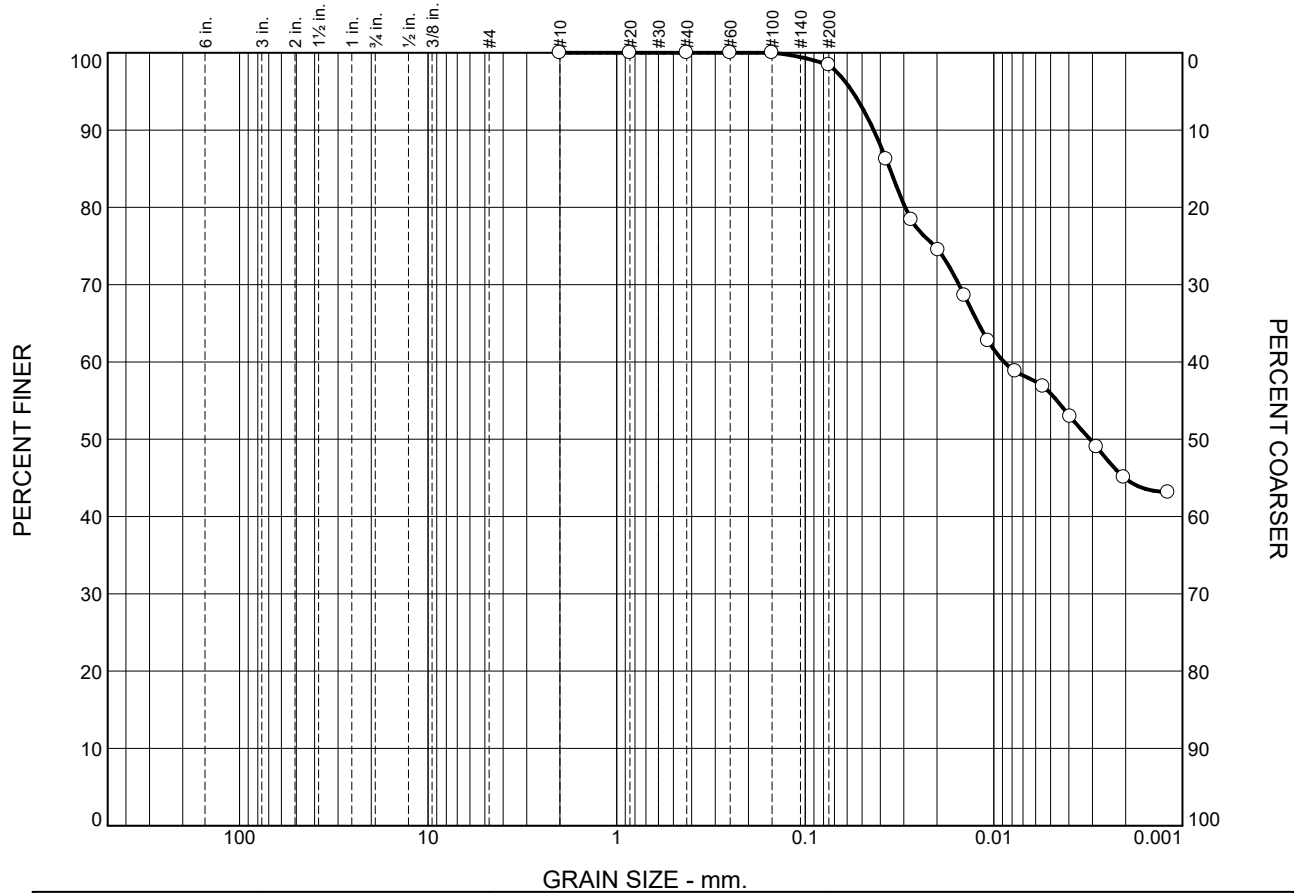
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	1.6	42.5	55.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-37	SP-2	4.5	Brown LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

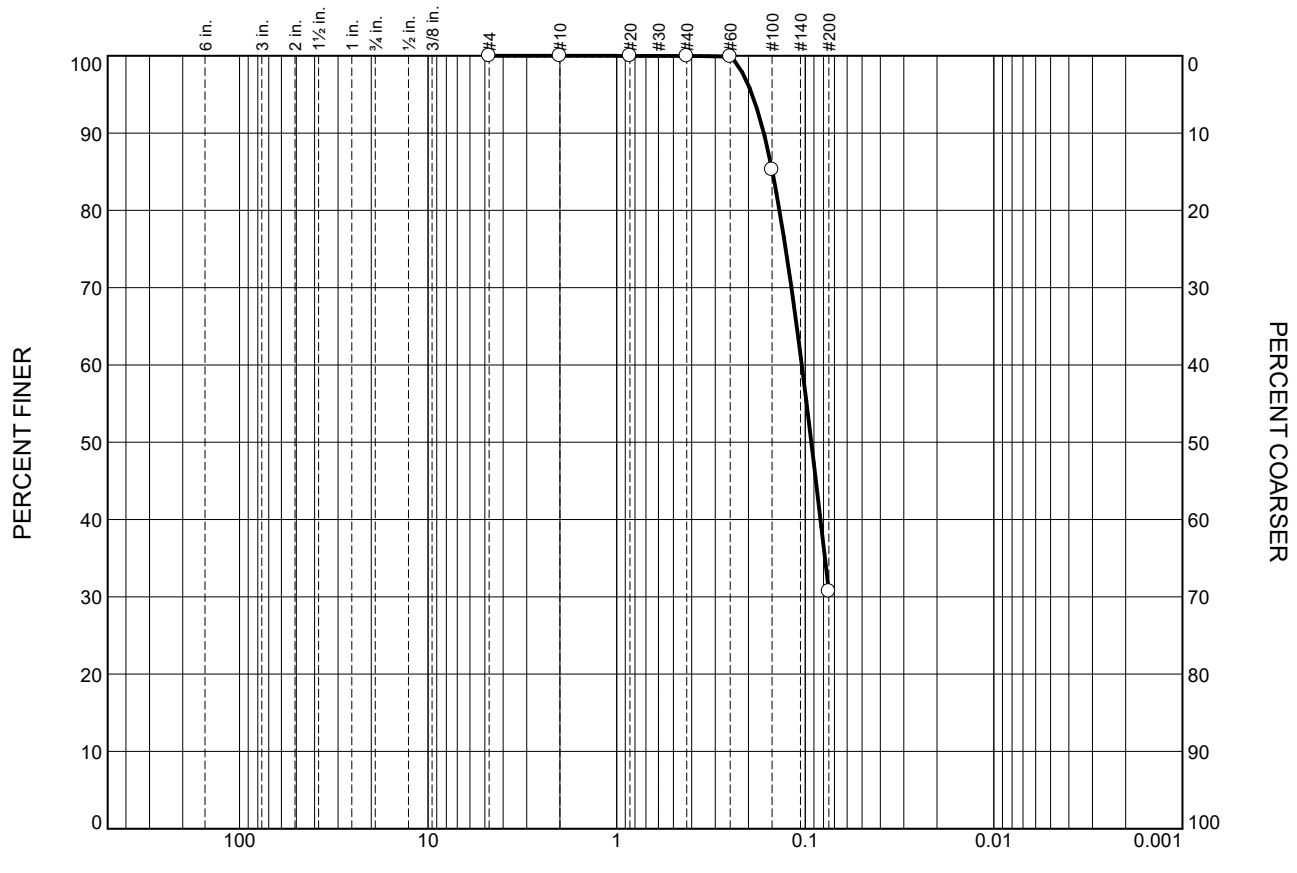
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	69.3	30.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-37	SP-4	21.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

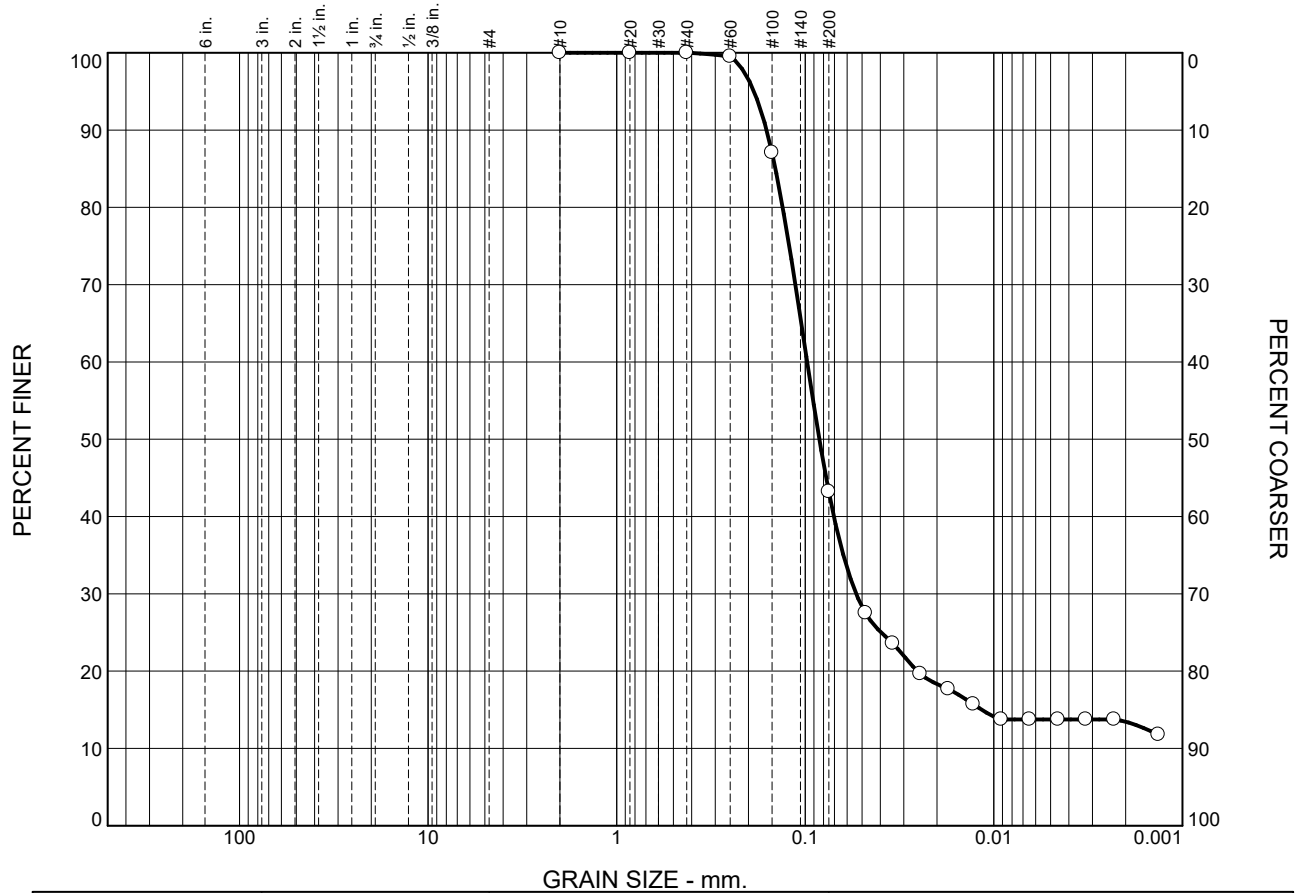
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	56.8	29.5	13.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-37	SP-6	26.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	61.4	38.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-37	SP-8	31.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	63.0	25.2	11.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-38	SP-1	0.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

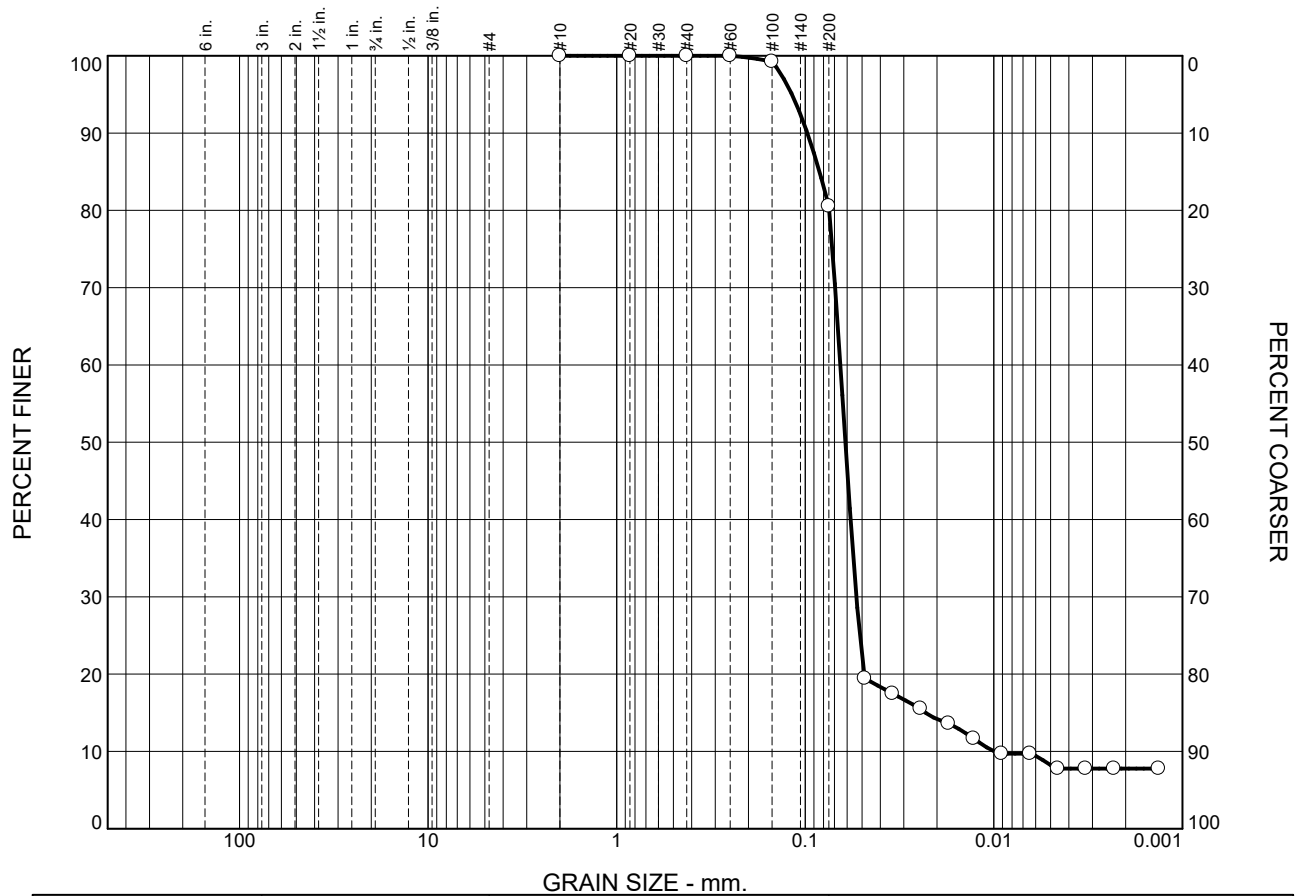
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	19.5	72.3	8.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-38	SP-3	10.5	Gray SILT with SAND (ML)	ML

Tolunay-Wong Engineers, Inc.

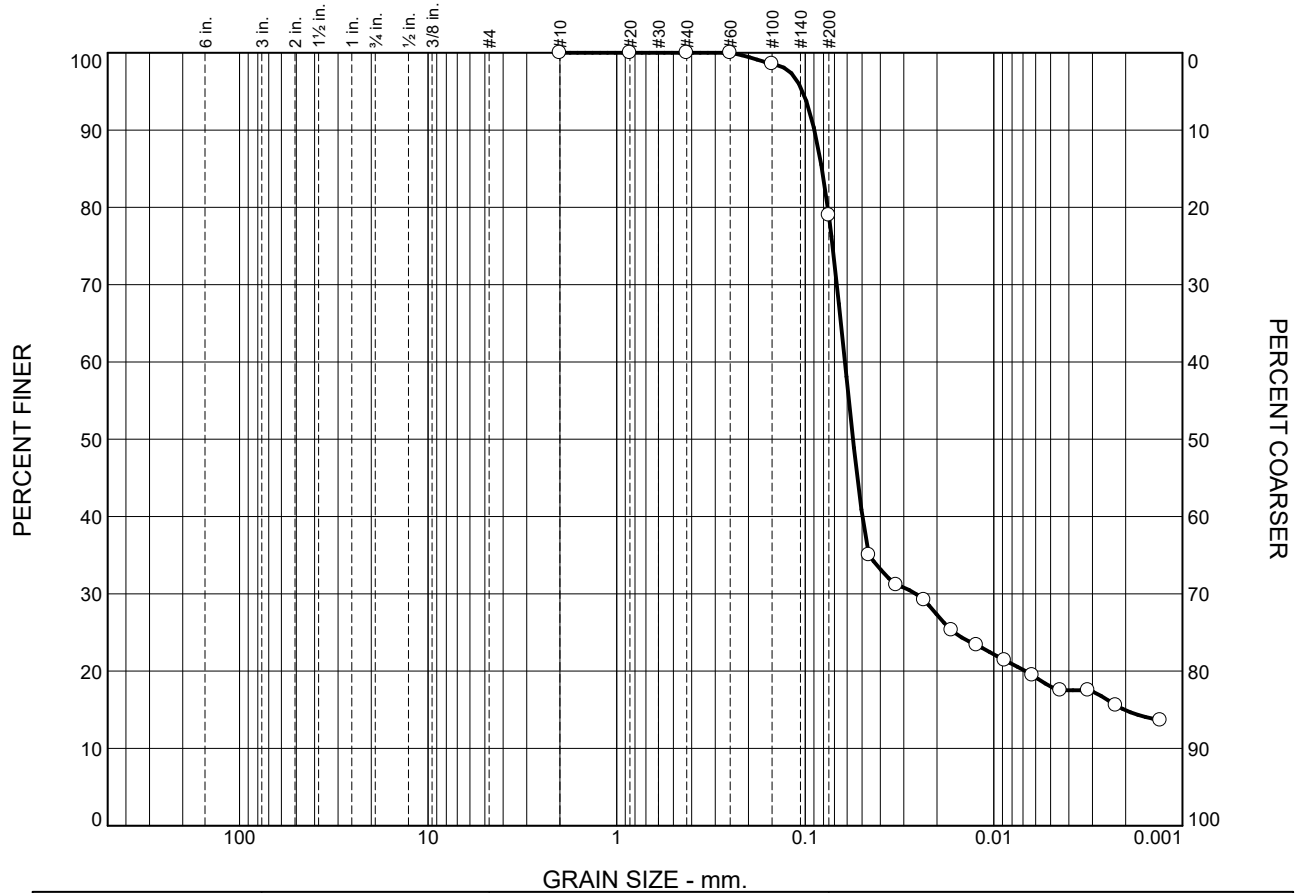
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	21.0	61.0	18.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-38	SP-6	25.5	Tan SILTY CLAY	CL

Tolunay-Wong Engineers, Inc.

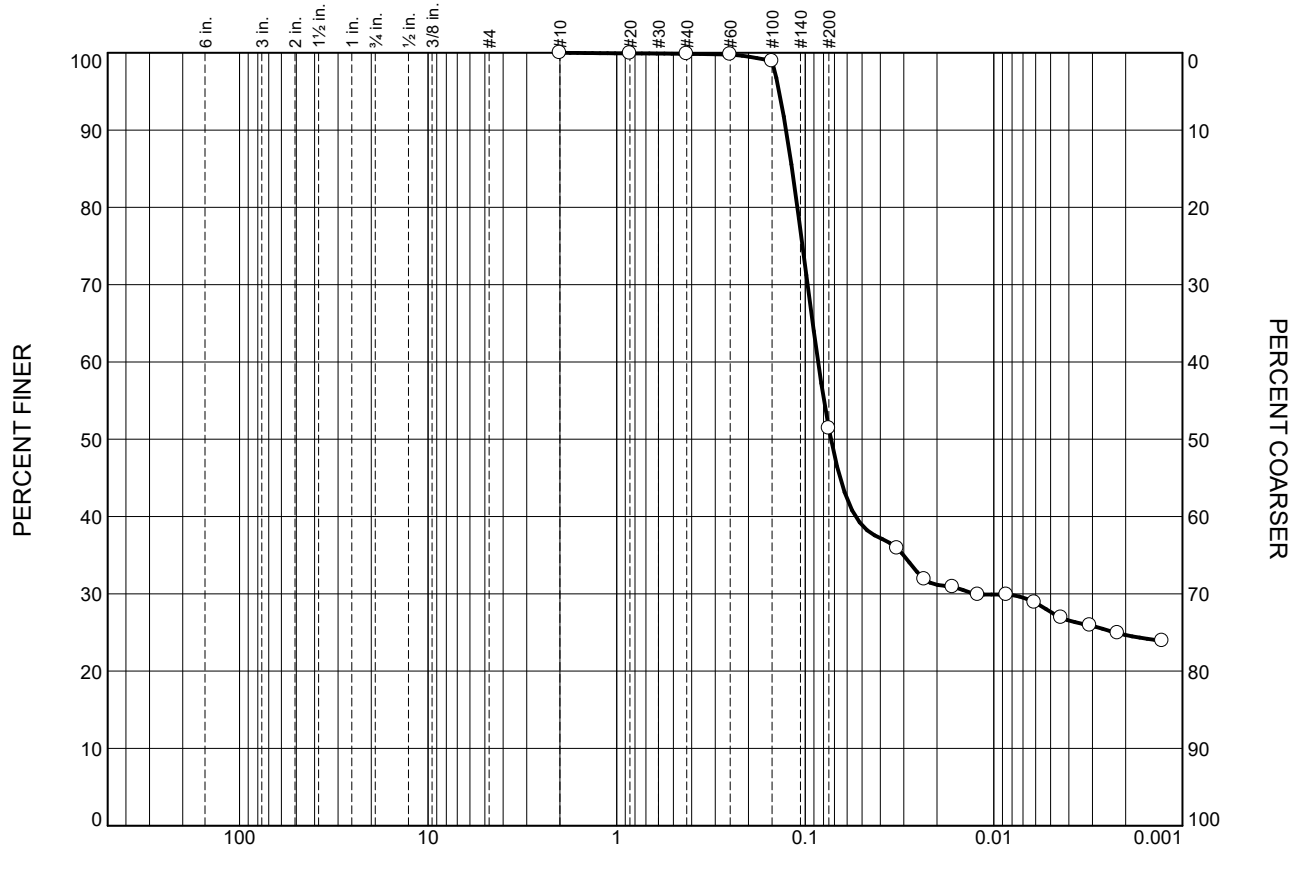
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	48.5	23.7	27.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-39	SP-2	5.5	Tan SANDY FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

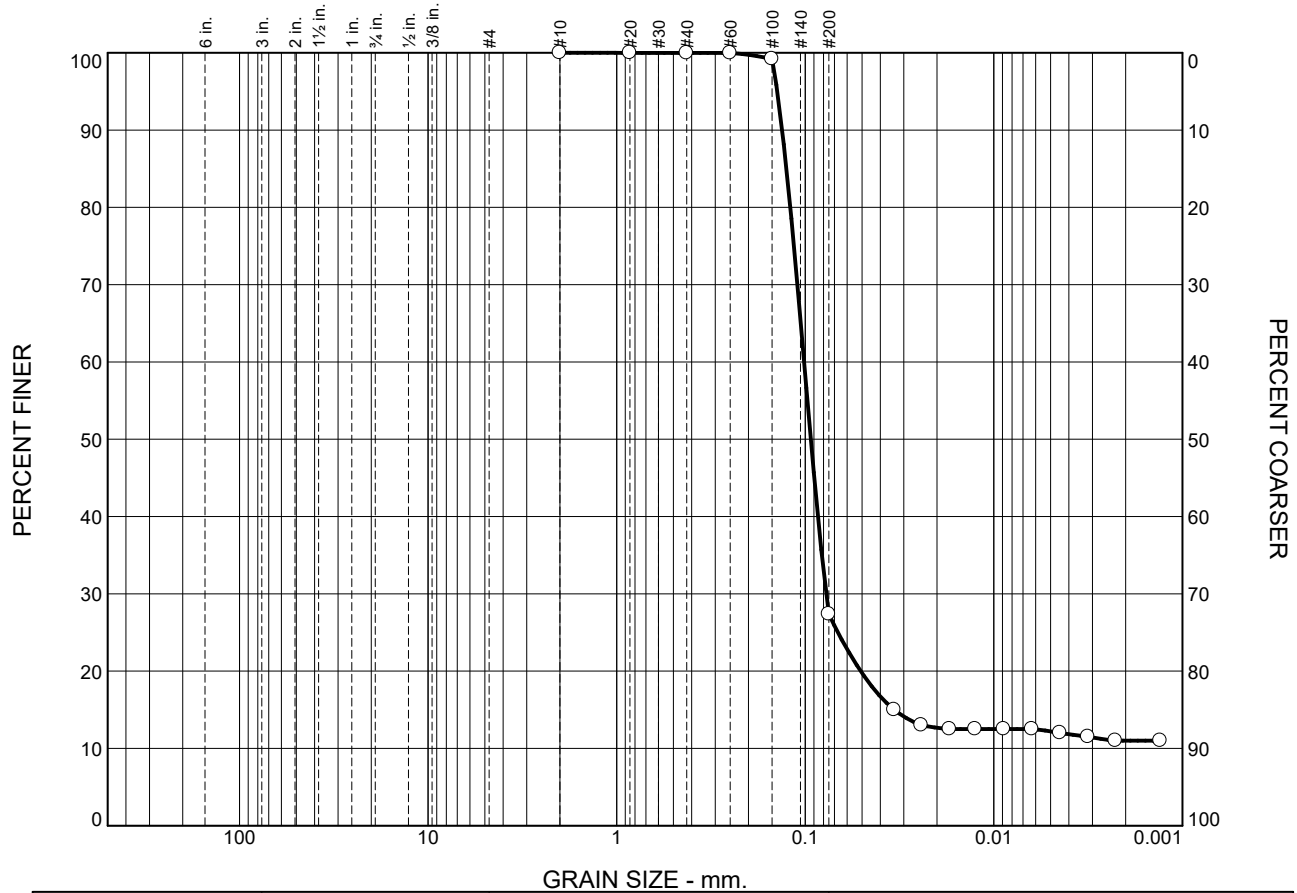
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	72.6	15.2	12.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-39	SP-5	32.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

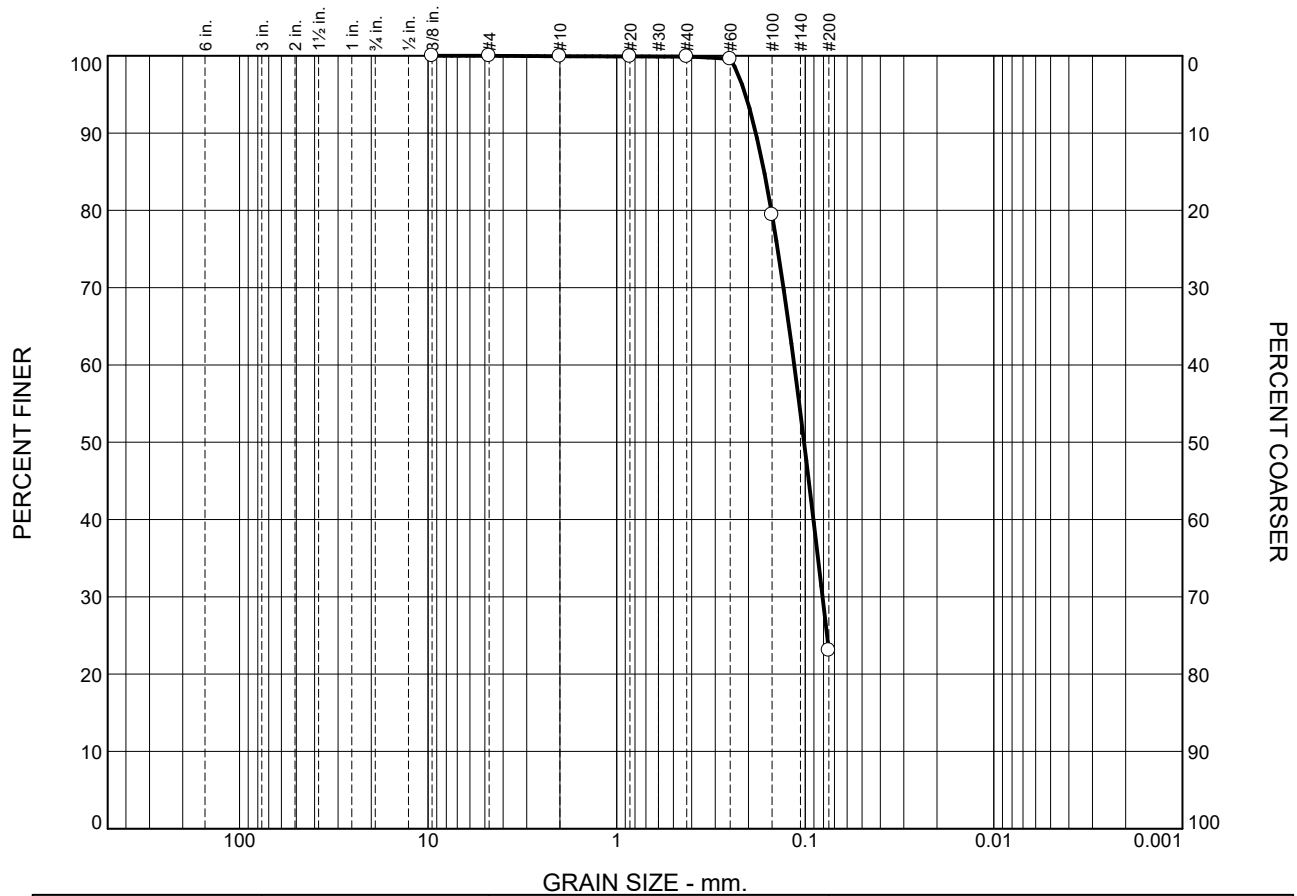
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.0	76.8	23.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-39	SP-7	37.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

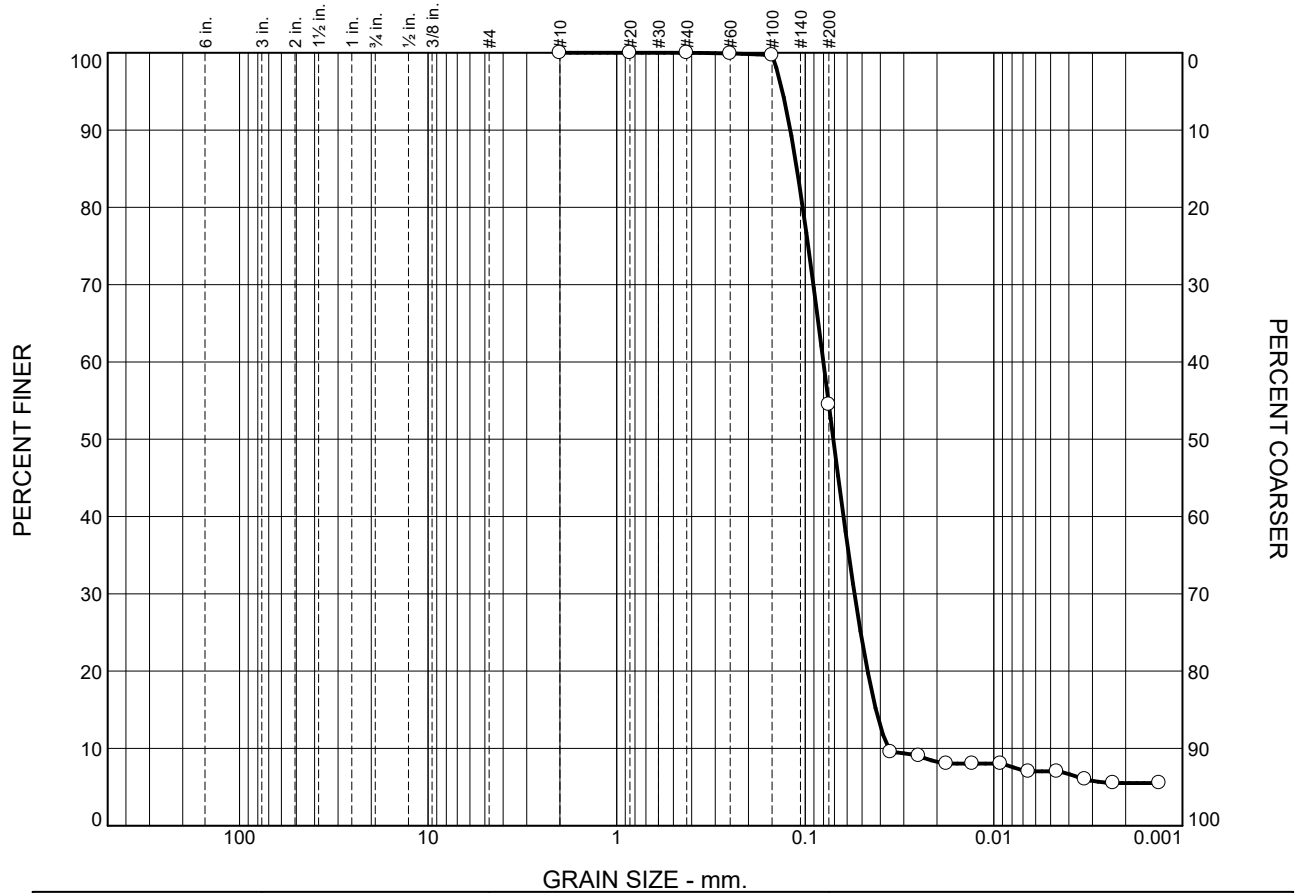
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	45.5	47.5	7.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-40	SP-1	0.5	Brown SANDY LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

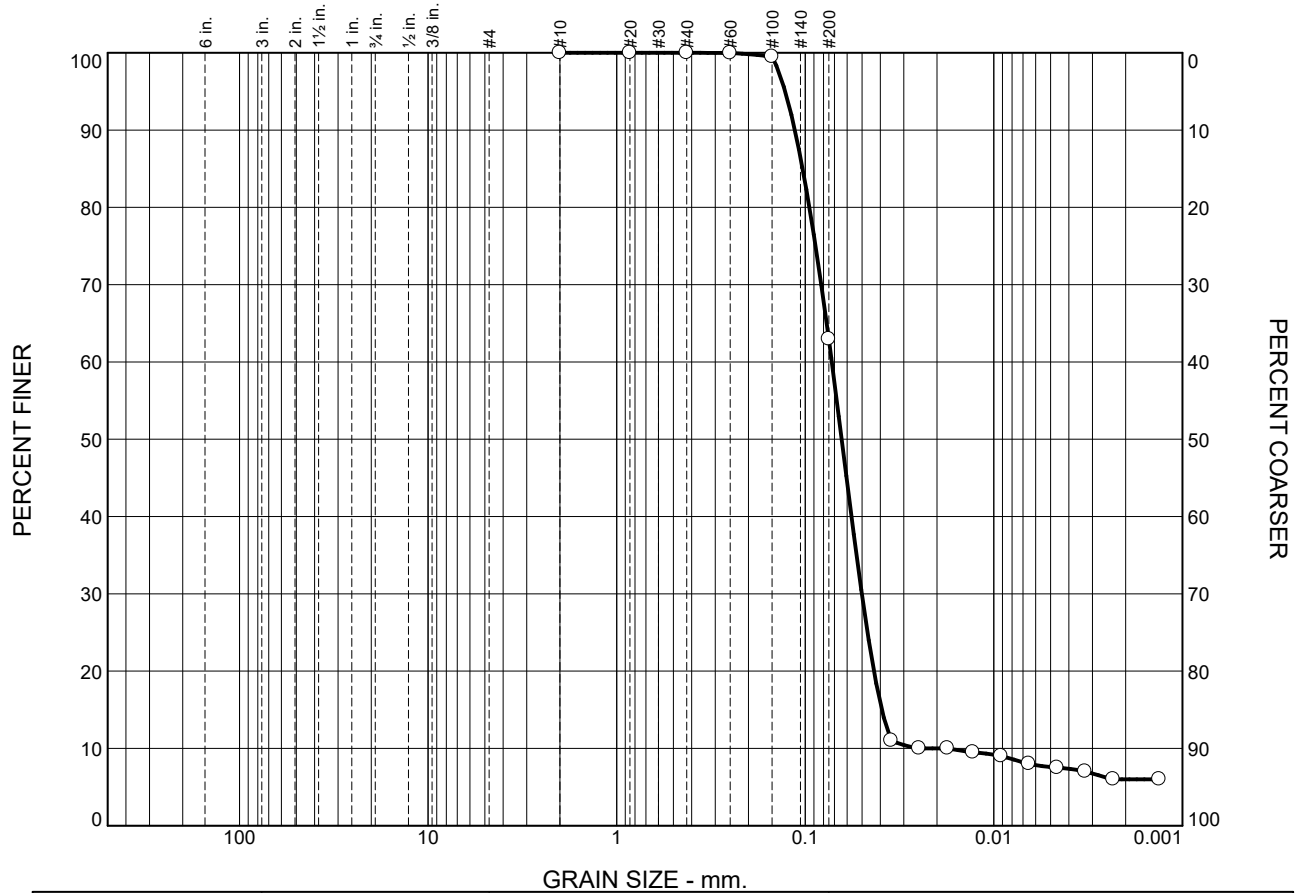
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	37.0	55.4	7.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-40	SP-3	20.5	Gray SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

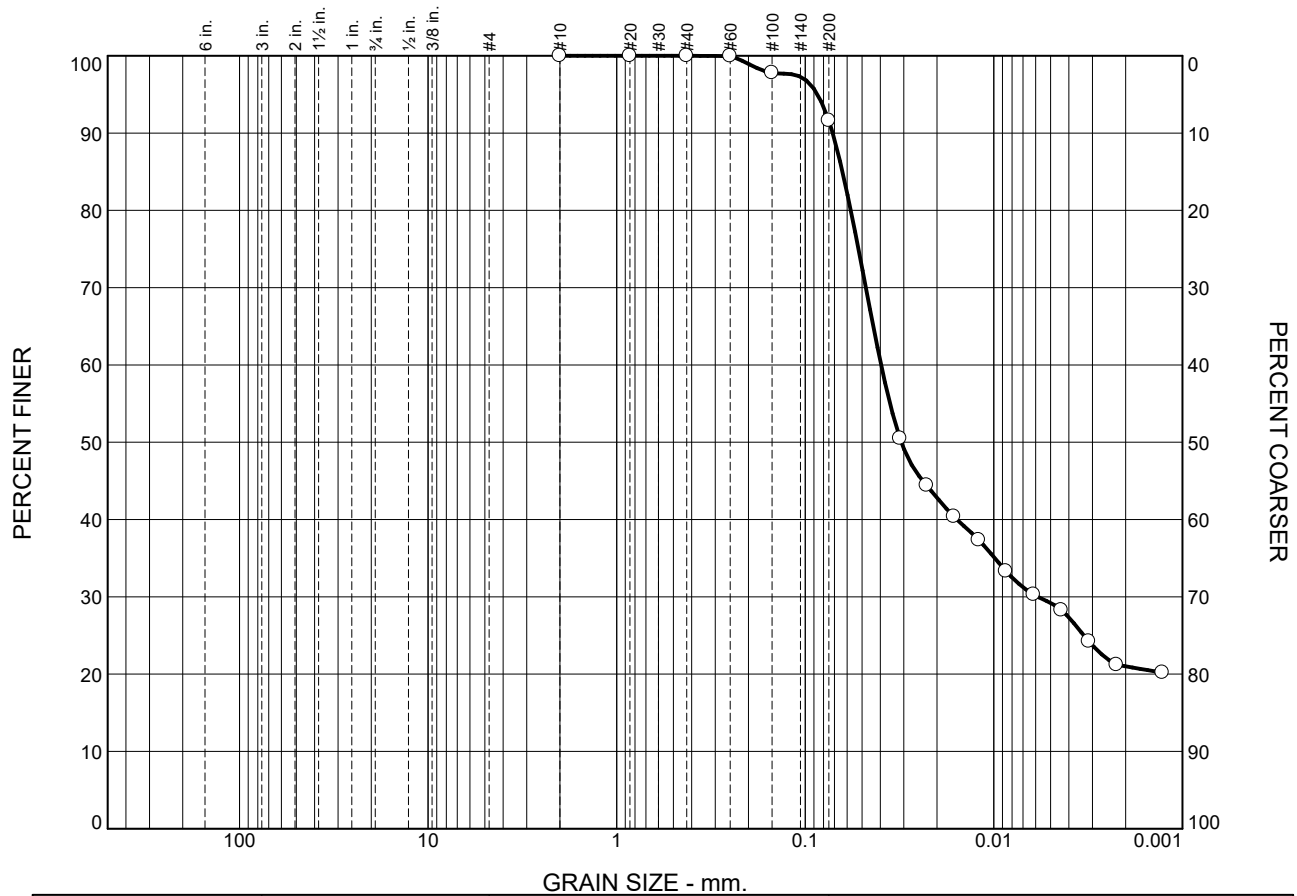
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	8.4	62.4	29.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-40	ST-1	5	Brown LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

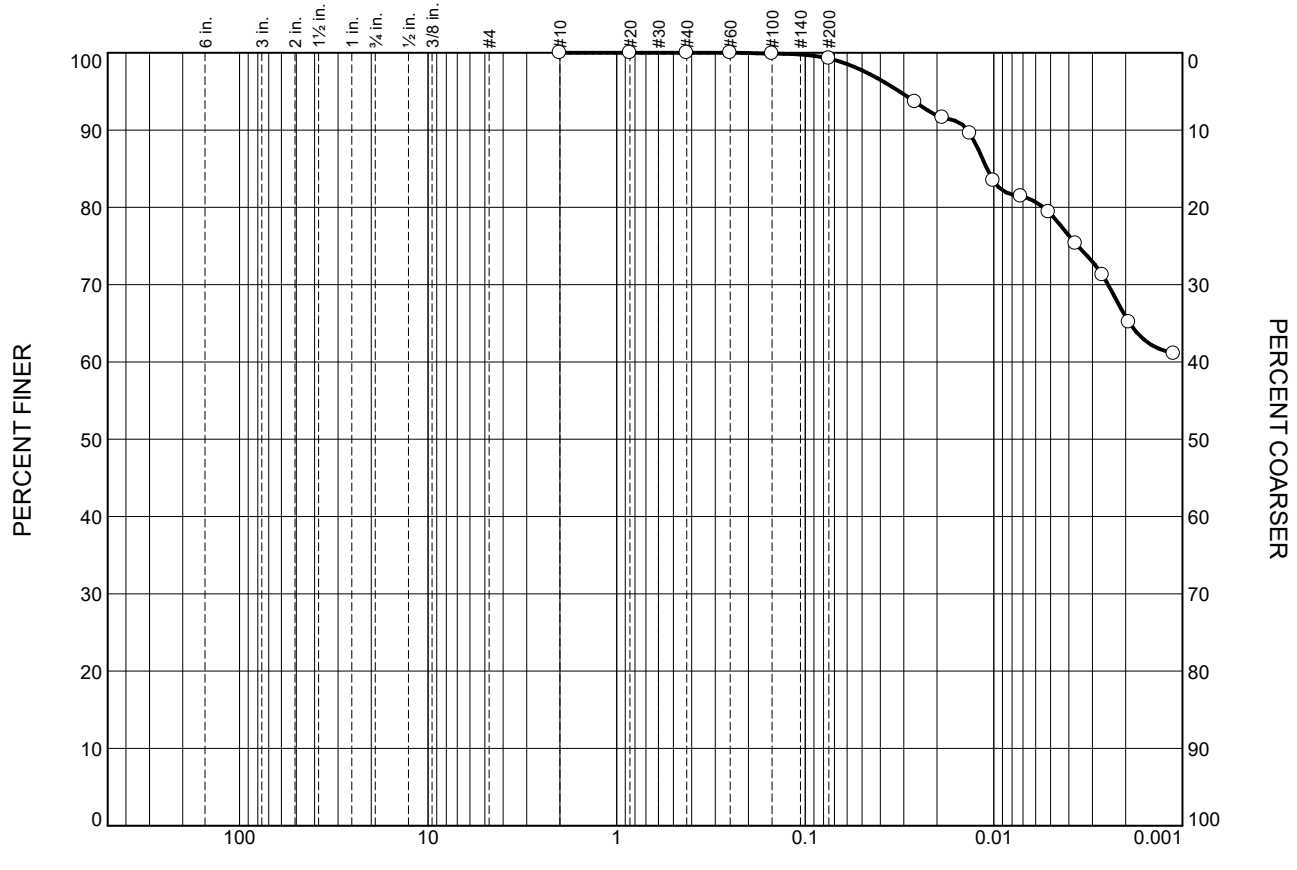
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.7	20.2	79.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-40	ST-7	34.5	Brown FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

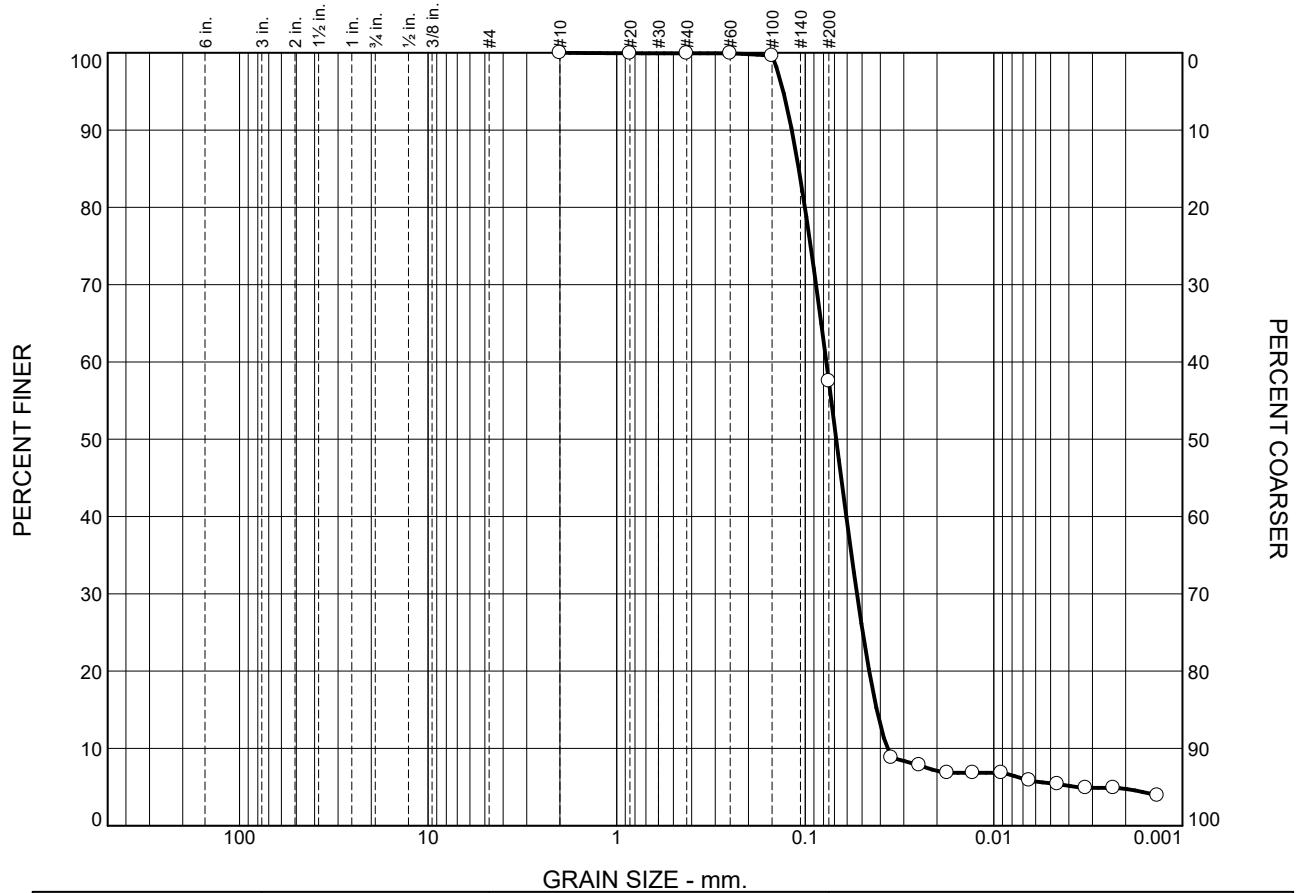
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	42.4	52.0	5.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-41	SP-1	0.5	Brown SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	45.2	45.7	9.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-41	SP-3	10.5	Brown SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

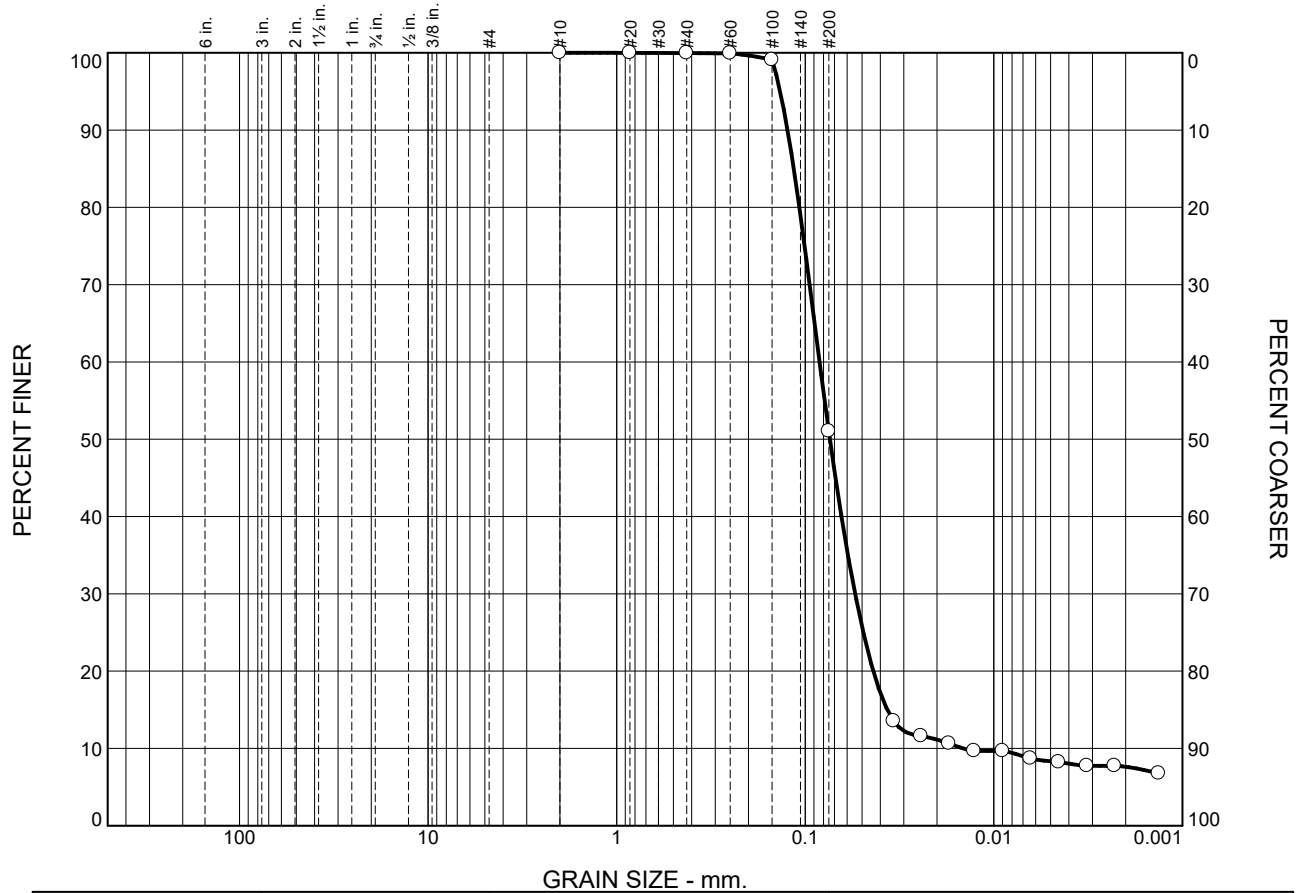
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	49.0	42.7	8.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-41	SP-5	20.5	Reddish-brown SANDY SILT	ML

Tolunay-Wong Engineers, Inc.

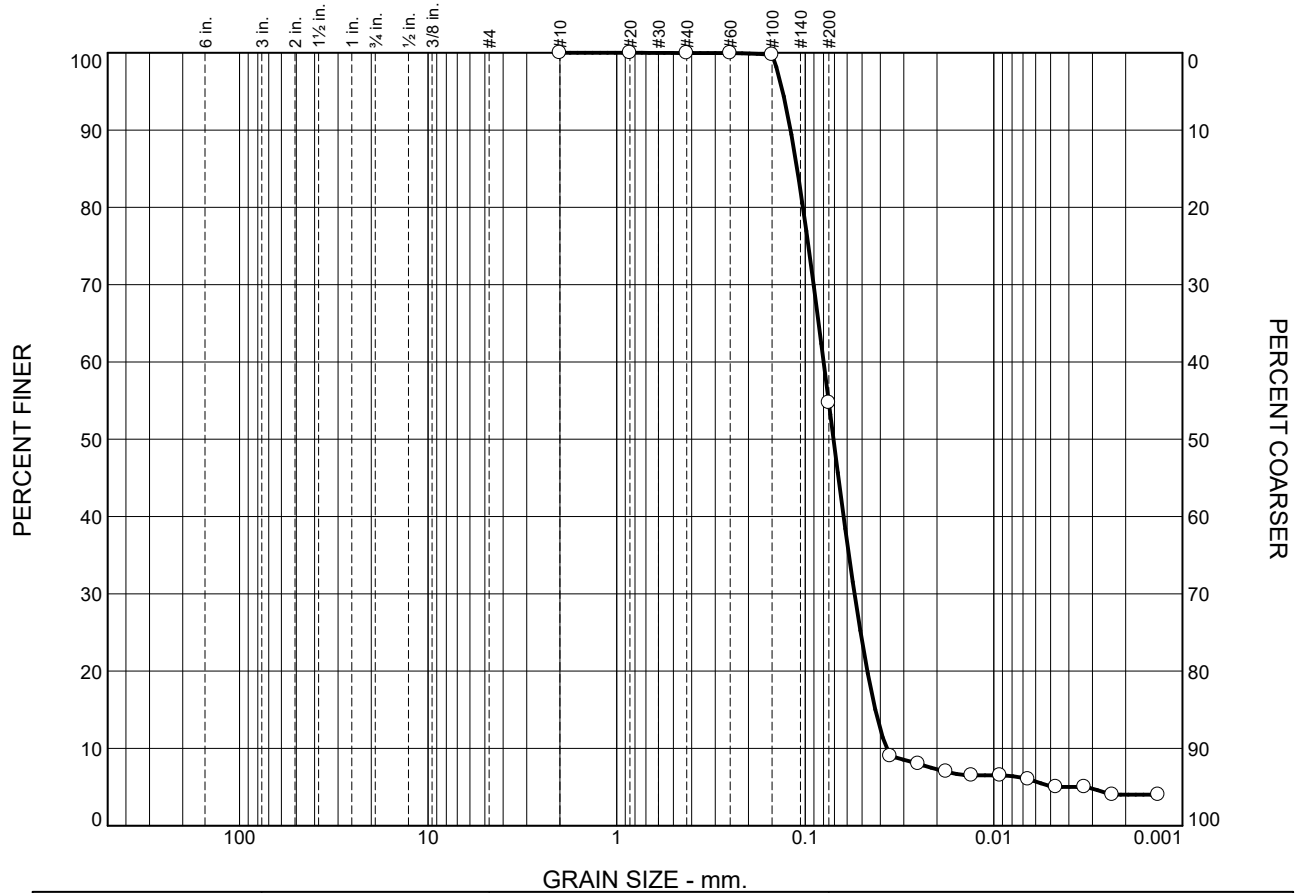
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	45.3	49.6	5.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-42	SP-1	0.5	Brown SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	70.5	19.0	10.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-42	SP-3	10.5	Brown SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

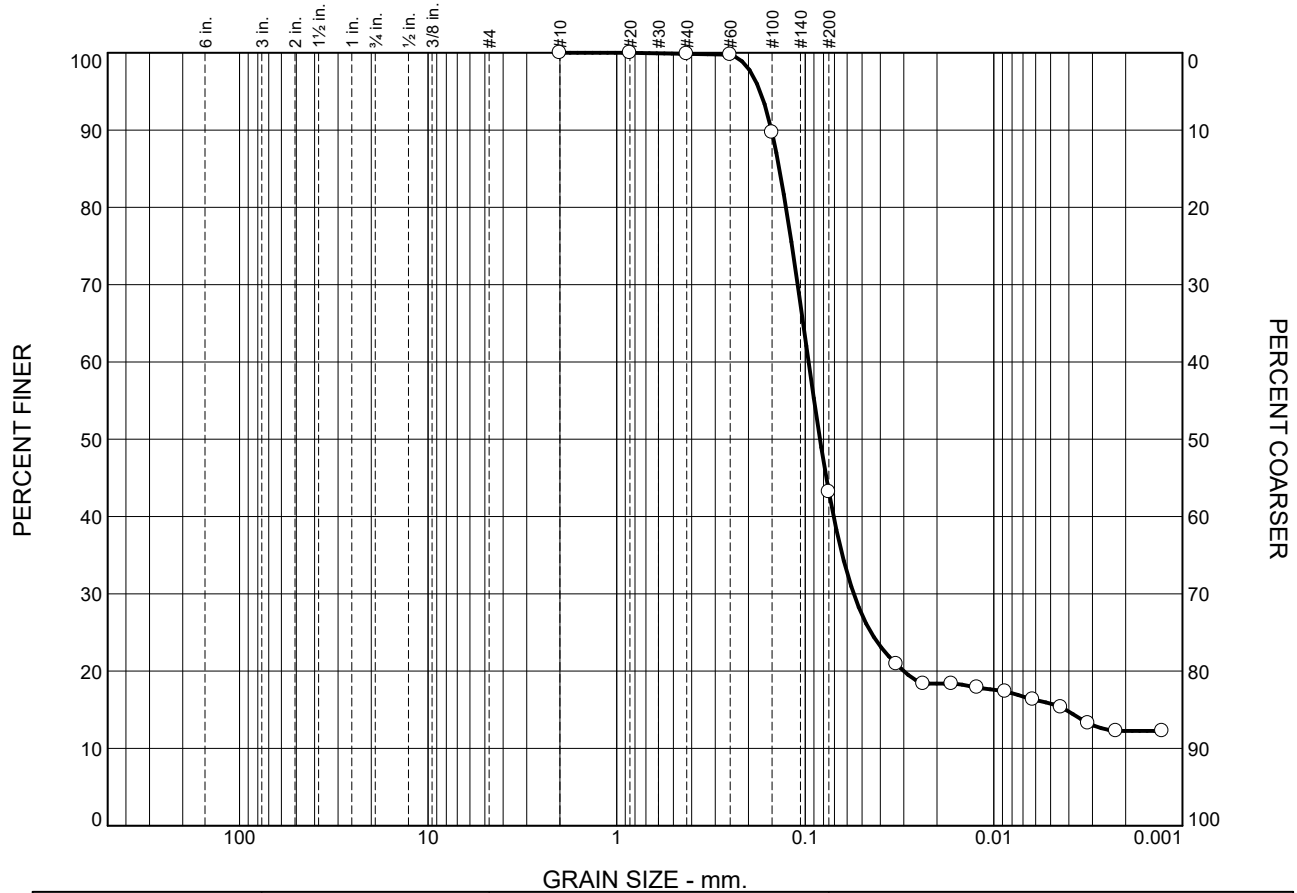
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	56.7	27.4	15.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-42	SP-5	37.5	Gray CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

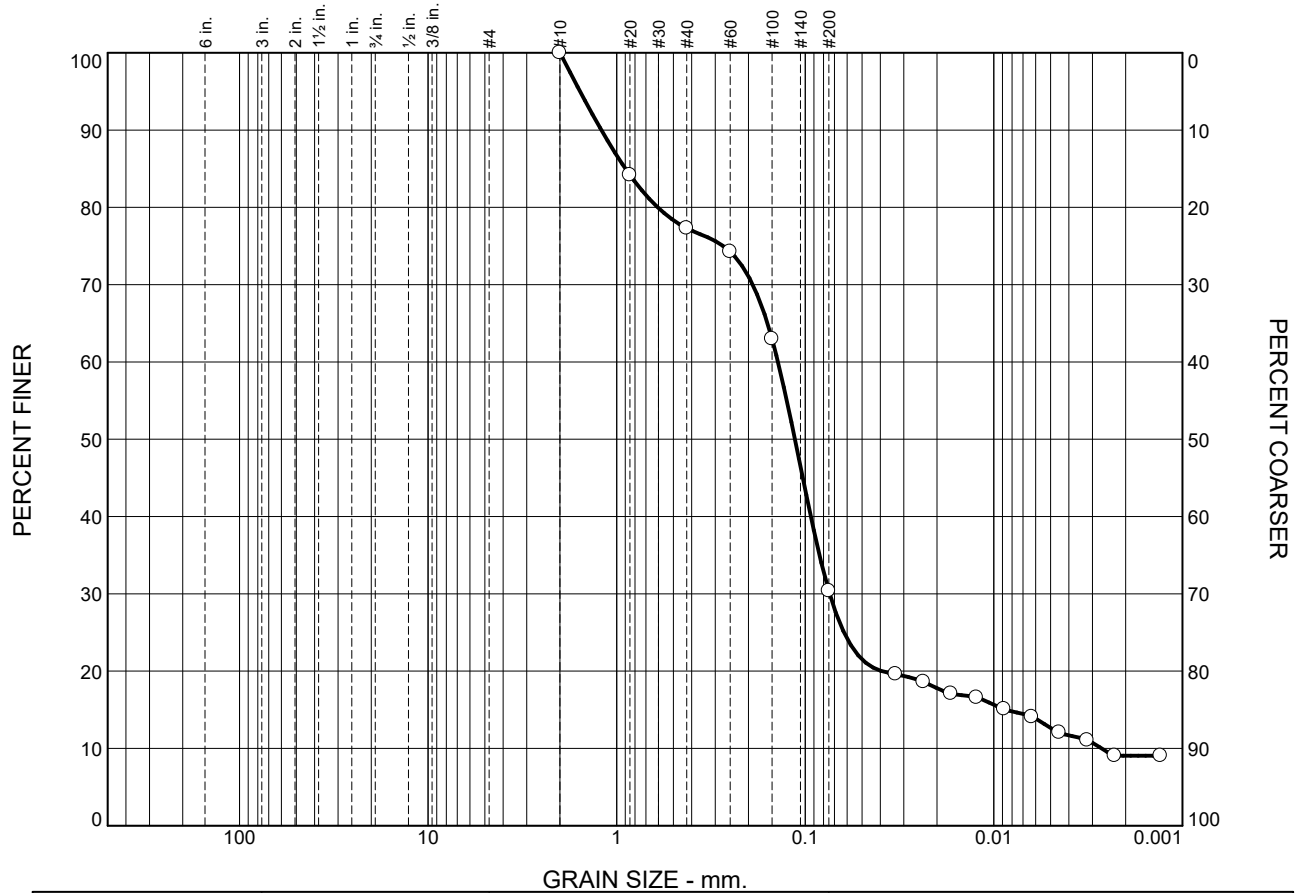
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	22.7	46.9	17.7	12.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-42	SP-8	45	Tan SILTY SAND; clay balls	SC

Tolunay-Wong Engineers, Inc.

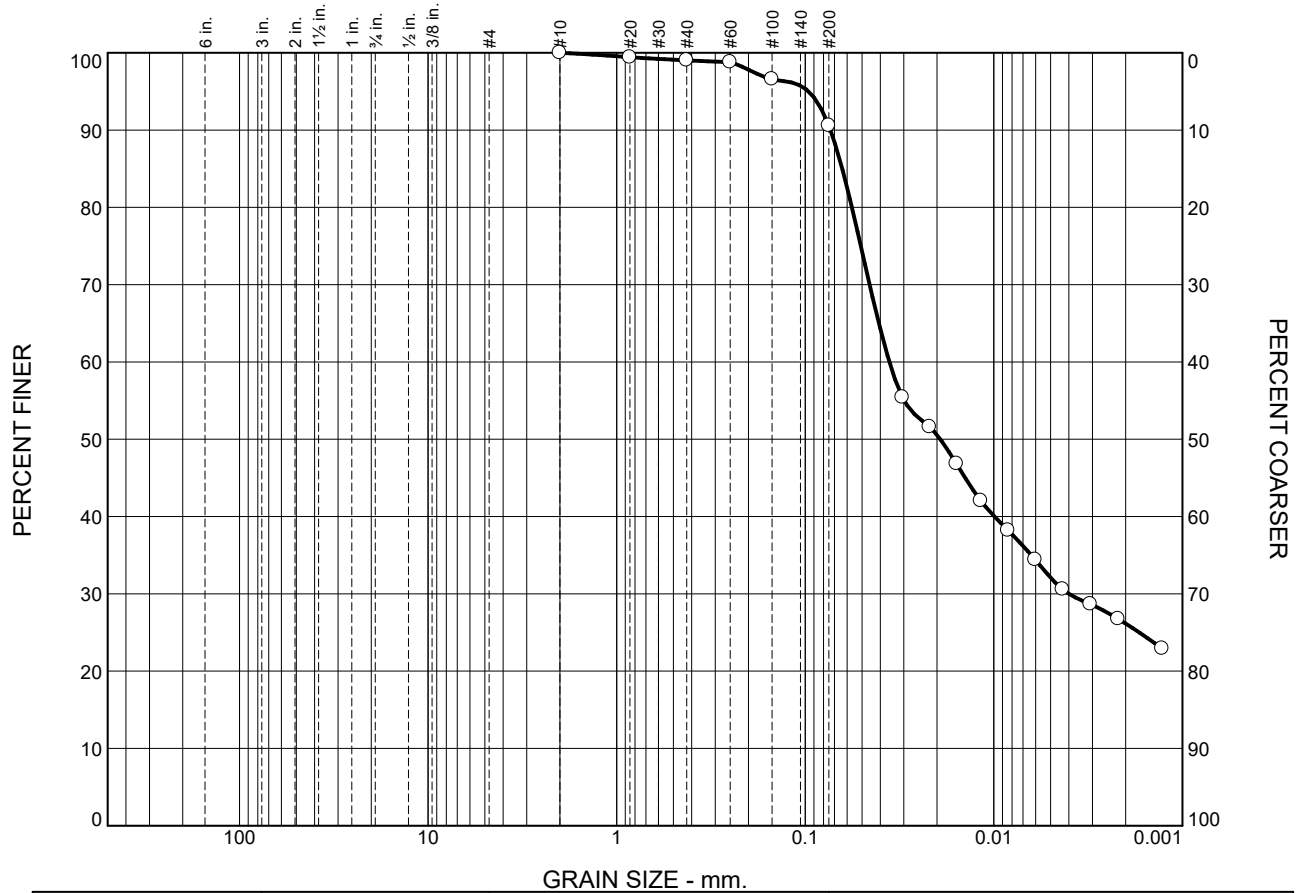
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	8.4	58.5	32.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-43	SP-1	0.5	Brown LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

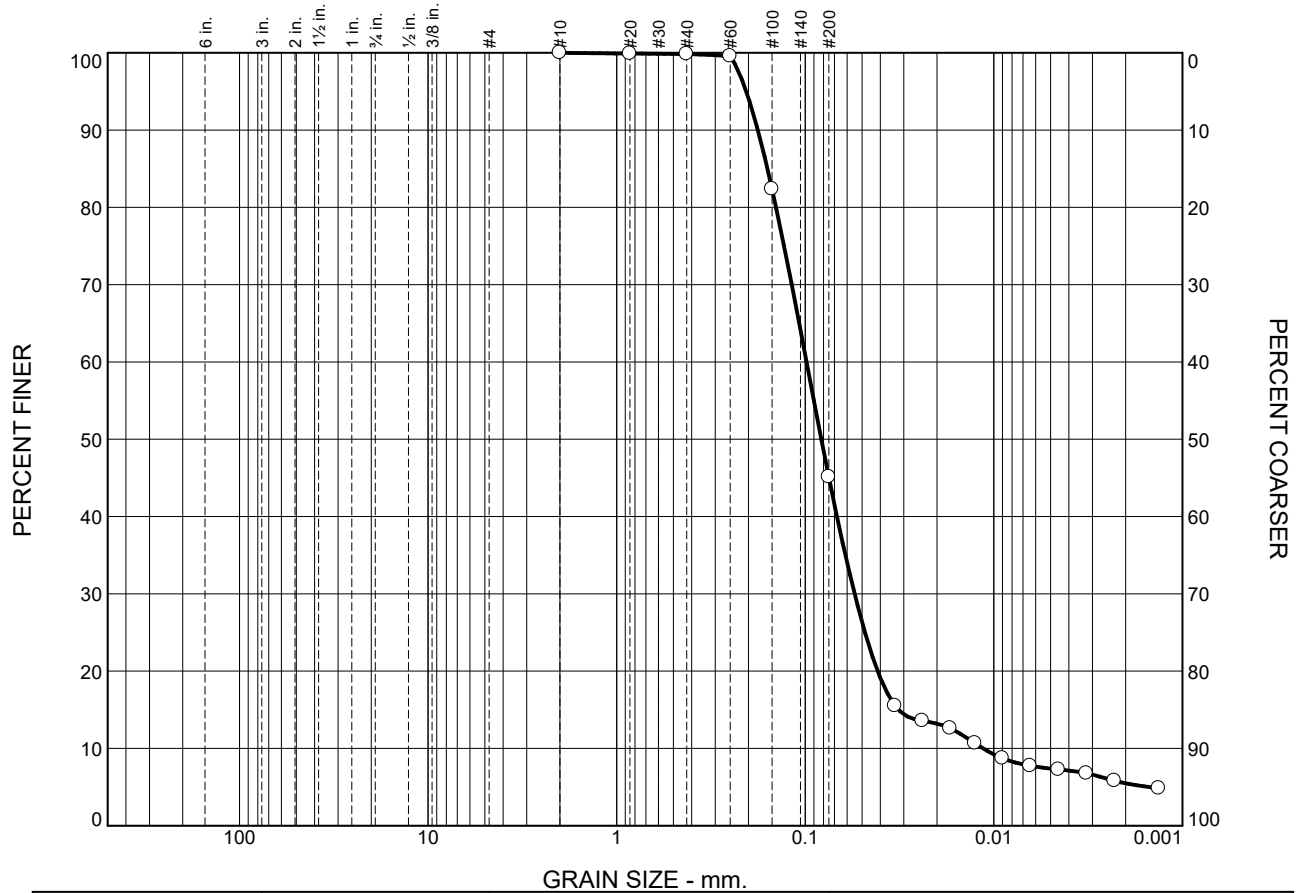
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	54.7	37.7	7.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-43	SP-2	5.5	Brown SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

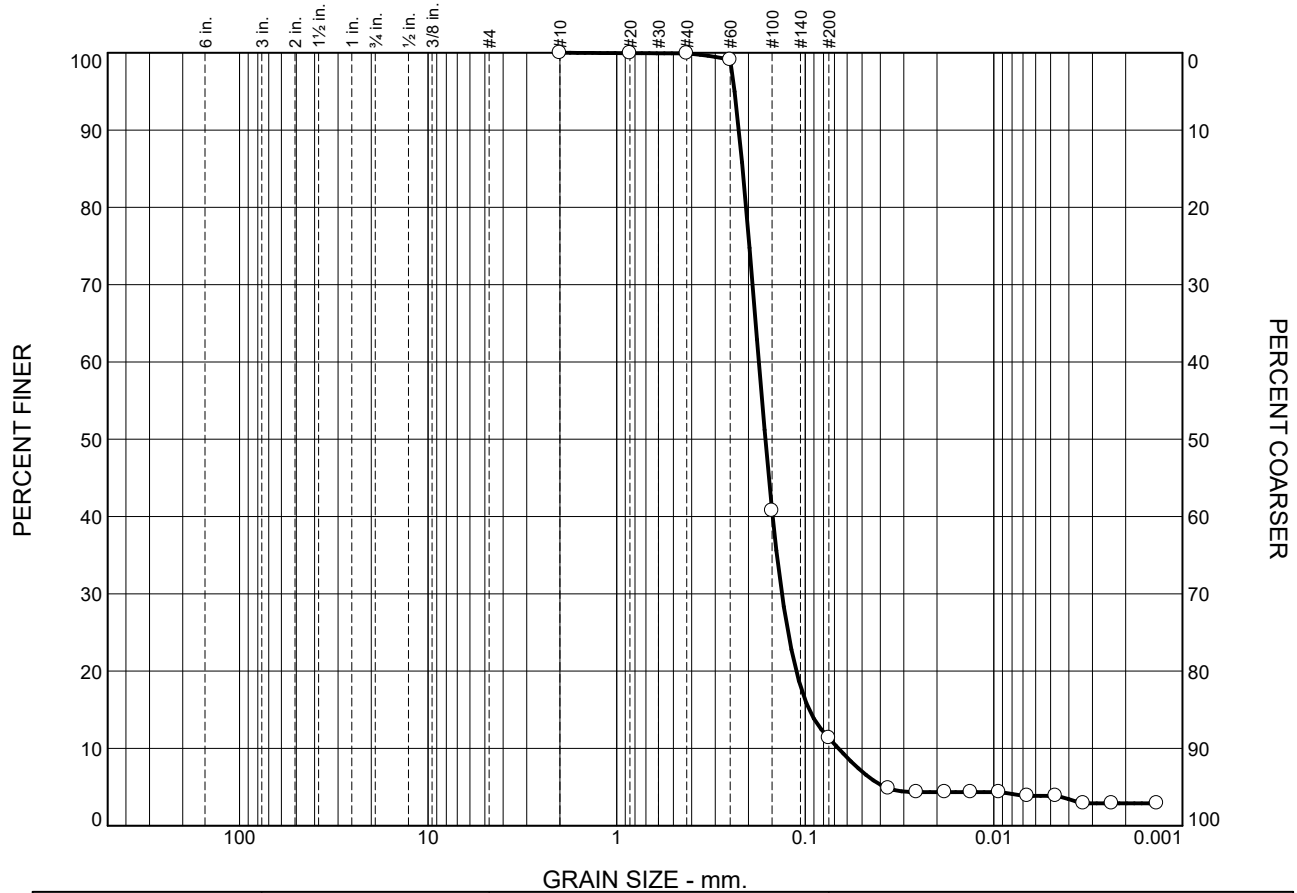
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	88.5	7.5	3.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-43	SP-4	15.5	Brown POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

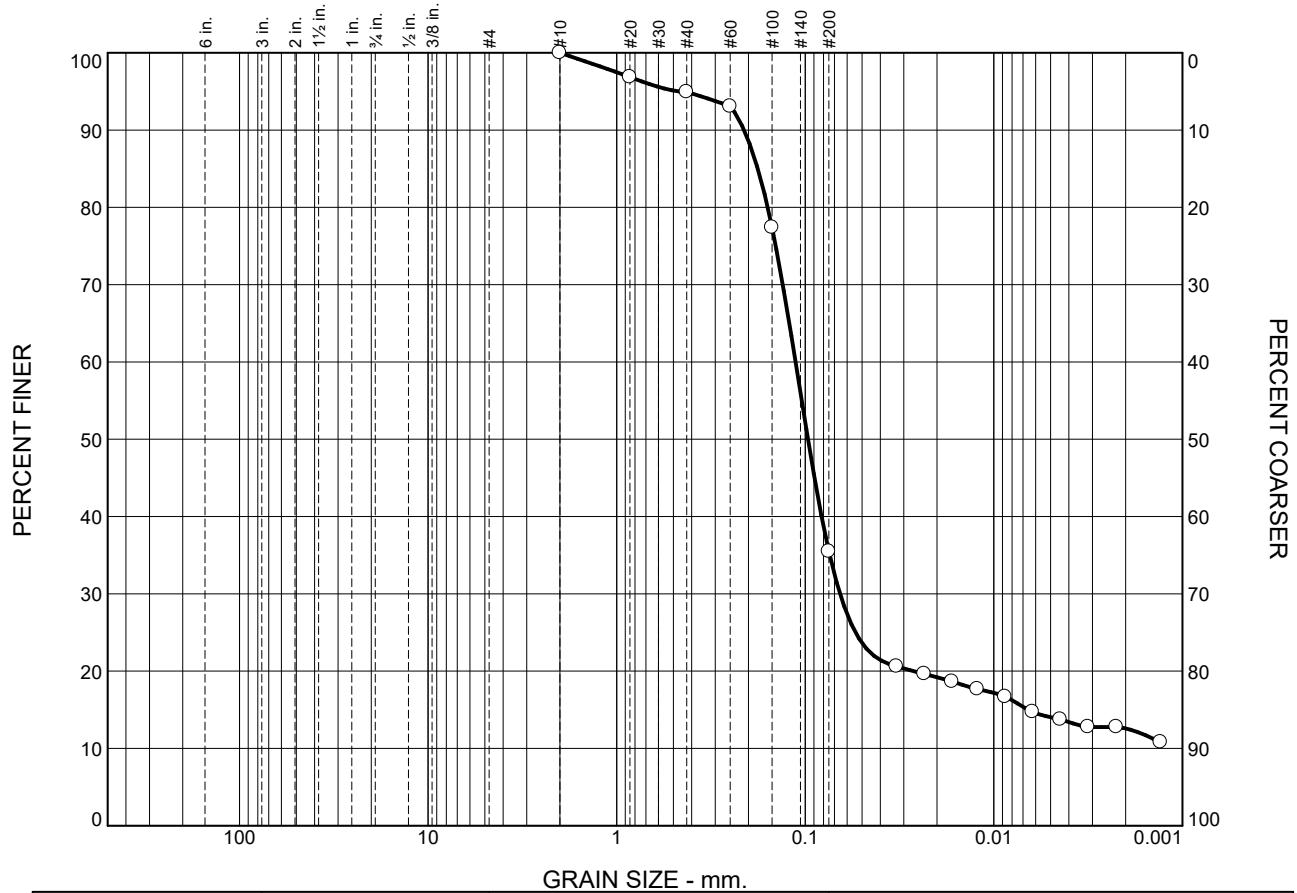
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.1	59.4	21.5	14.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-43	SP-6	30	Gray CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

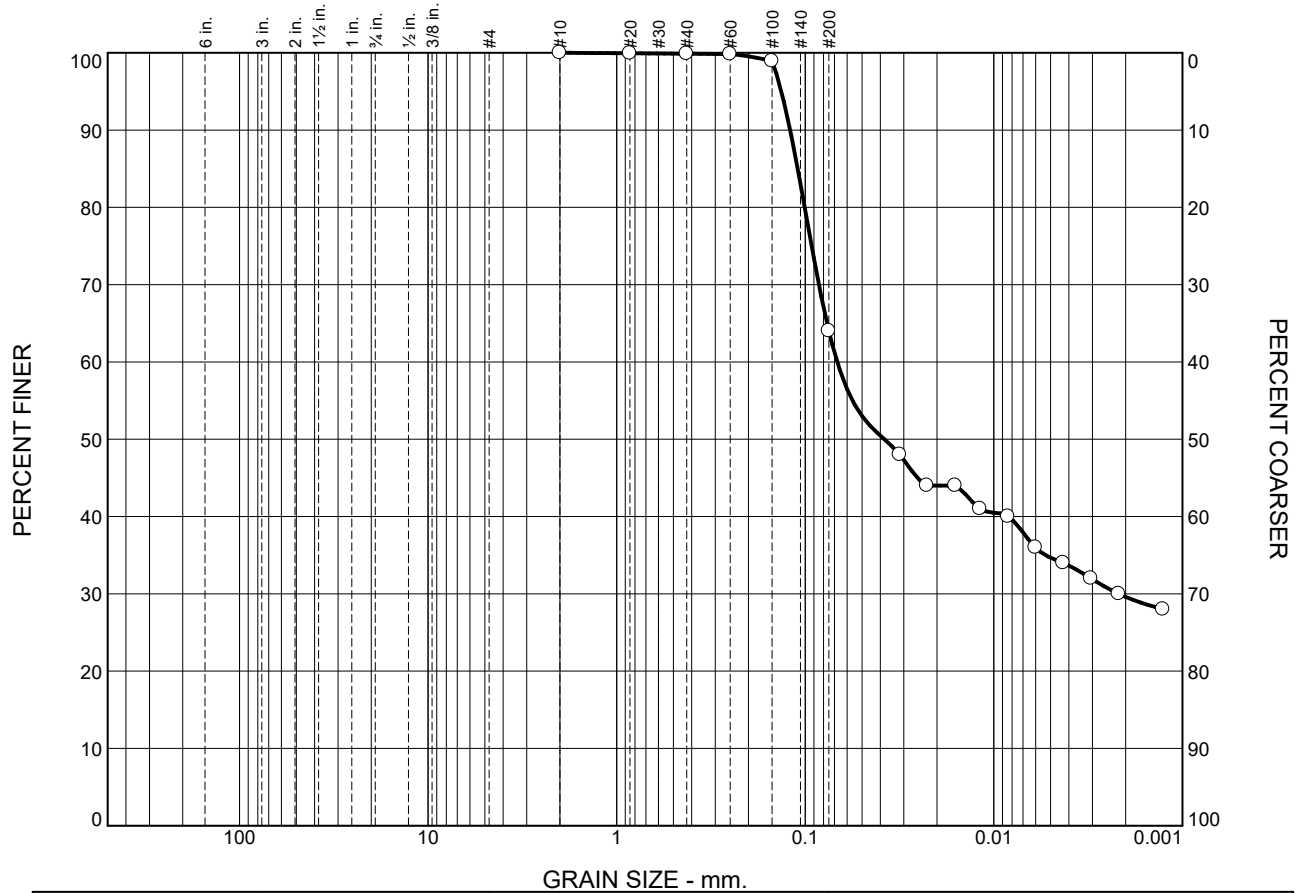
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	35.9	29.3	34.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-44	SP-1	0.5	Gray SANDY LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

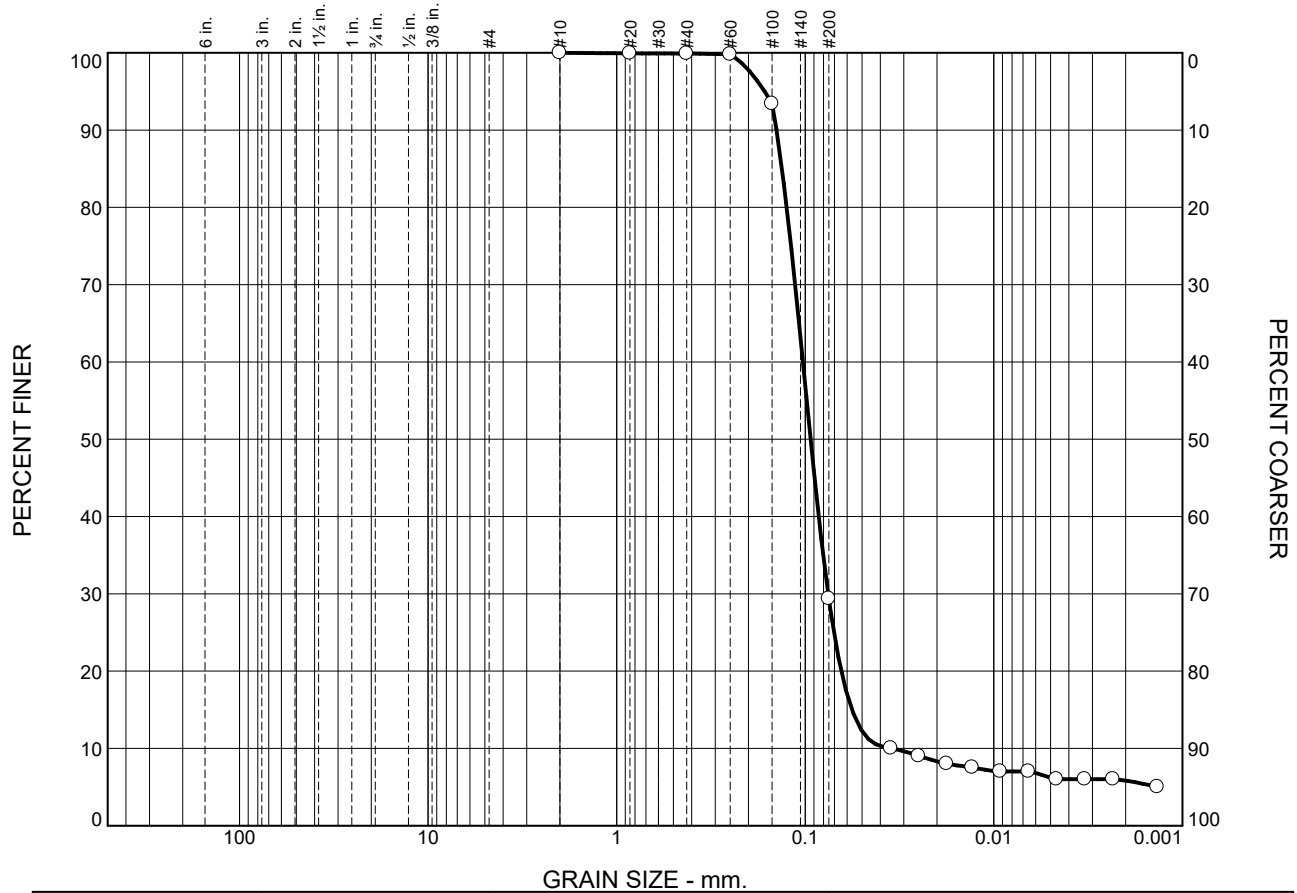
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	70.5	23.2	6.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-44	SP-3	10.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

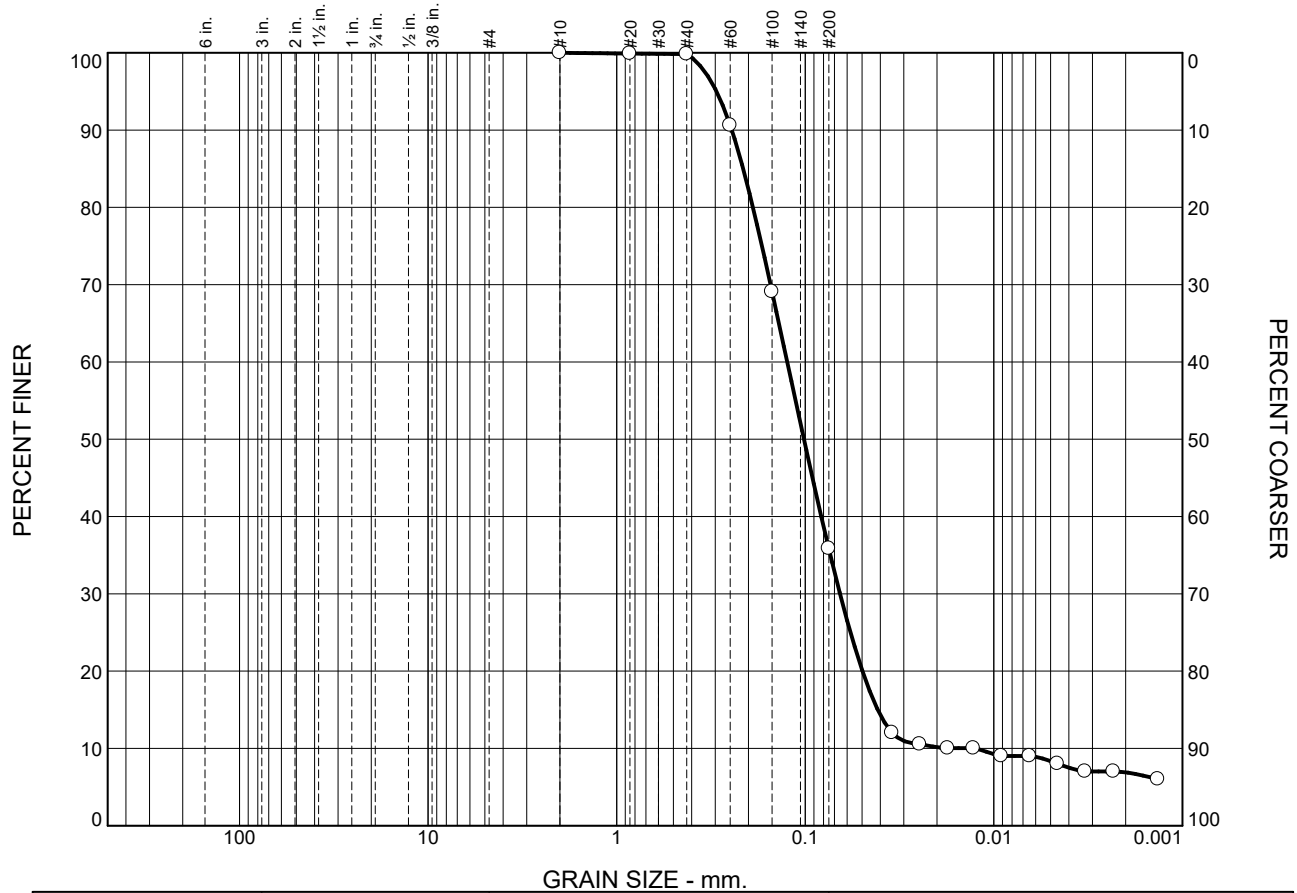
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	63.9	27.6	8.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-44	SP-4	15.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

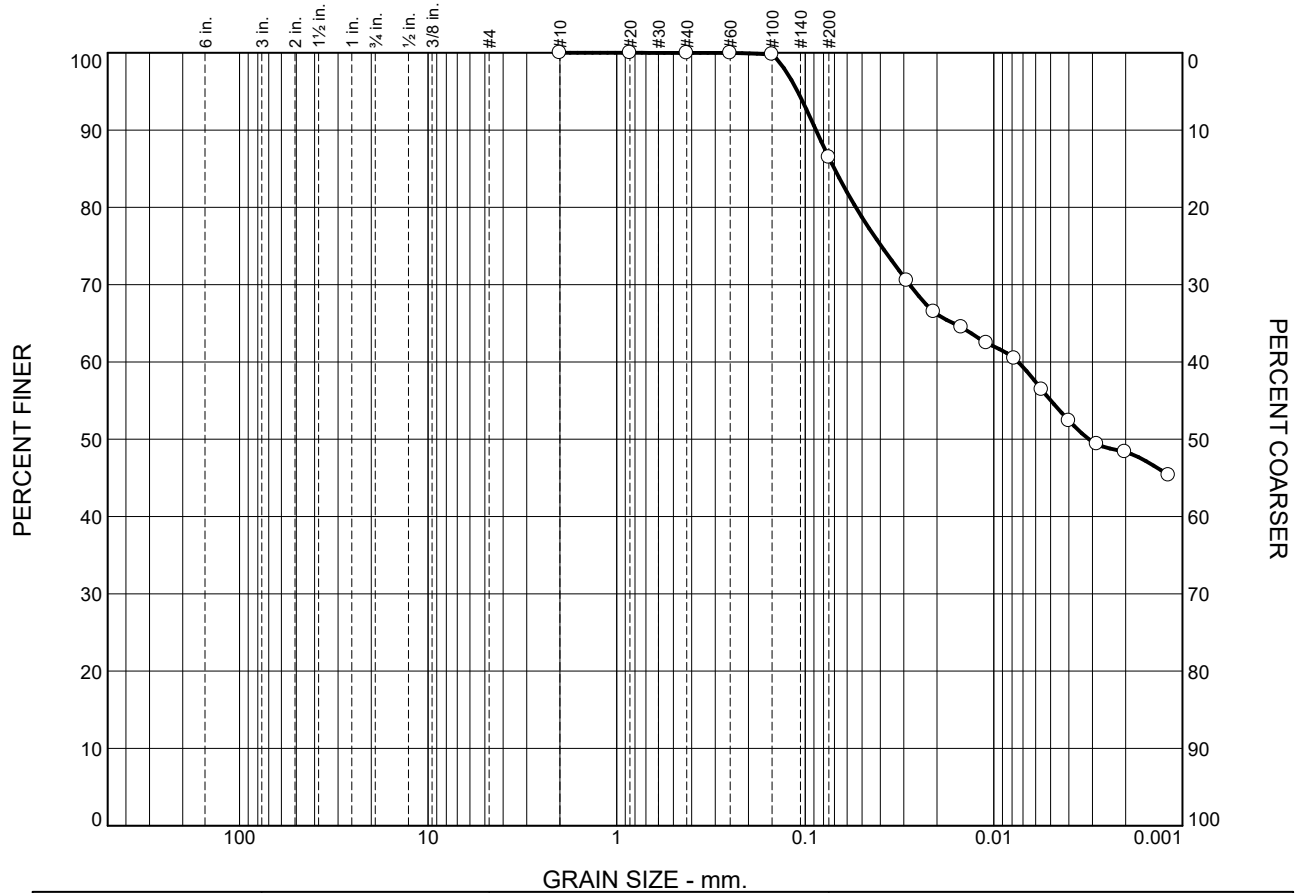
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	13.5	31.5	55.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-45	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

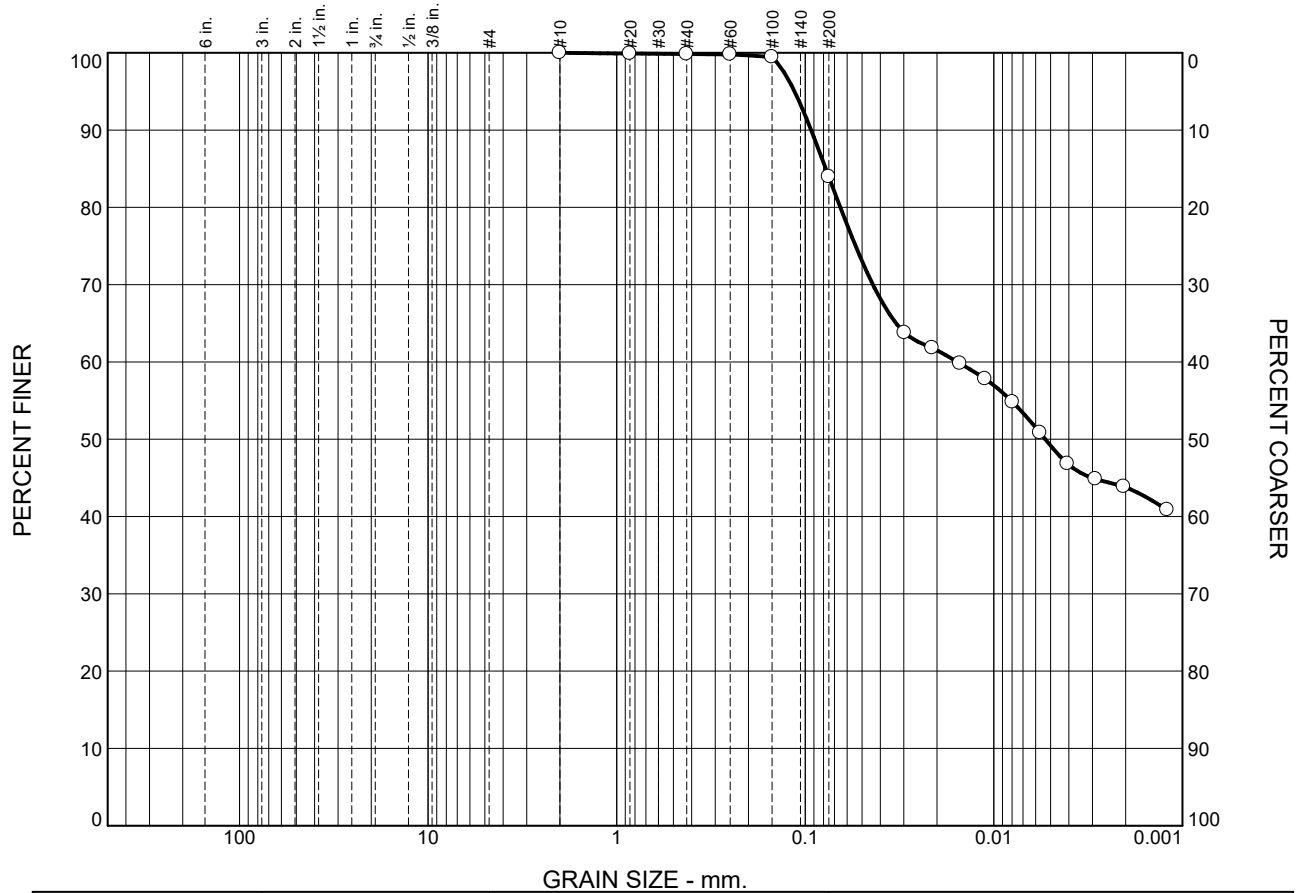
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	15.8	34.8	49.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-45	ST-1	10	Gray FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

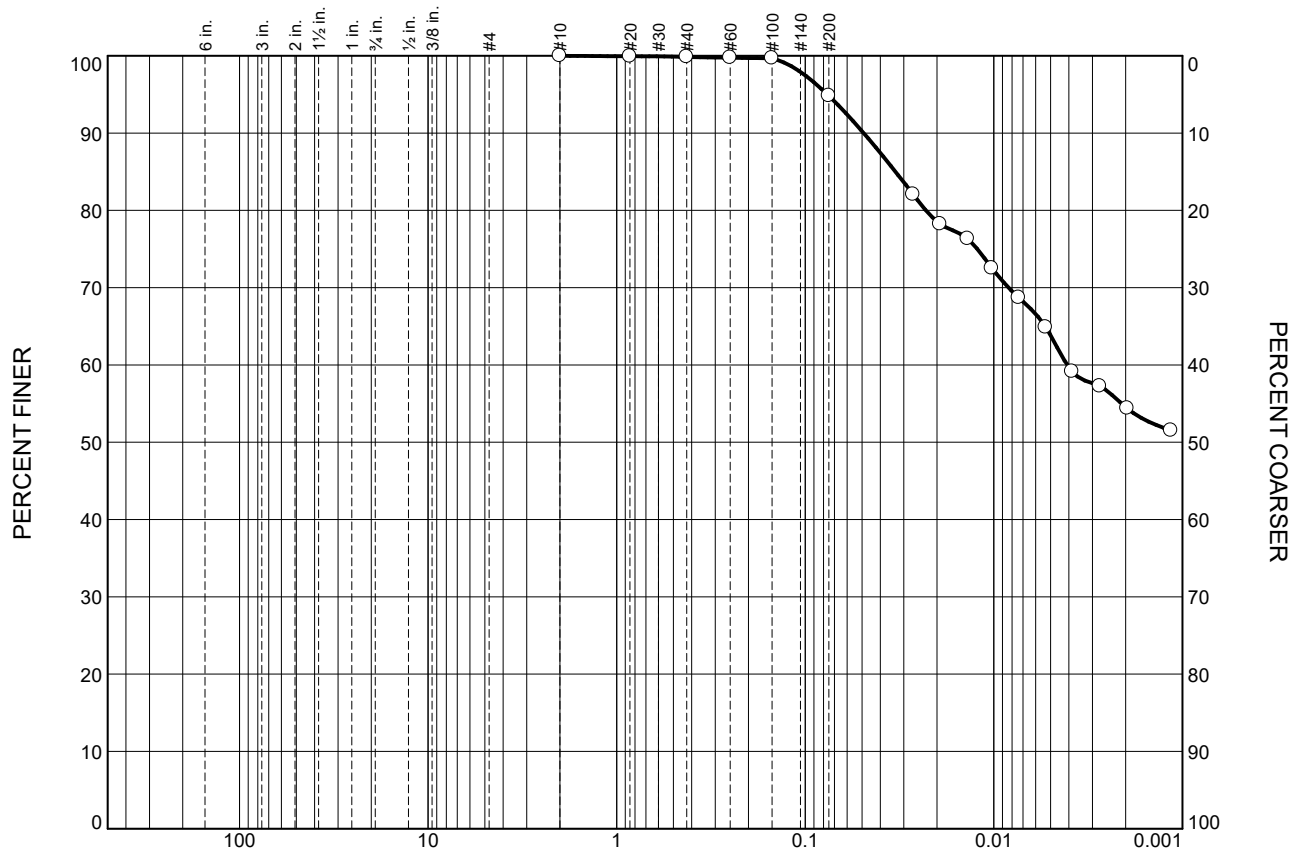
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	5.0	31.0	63.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-46	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

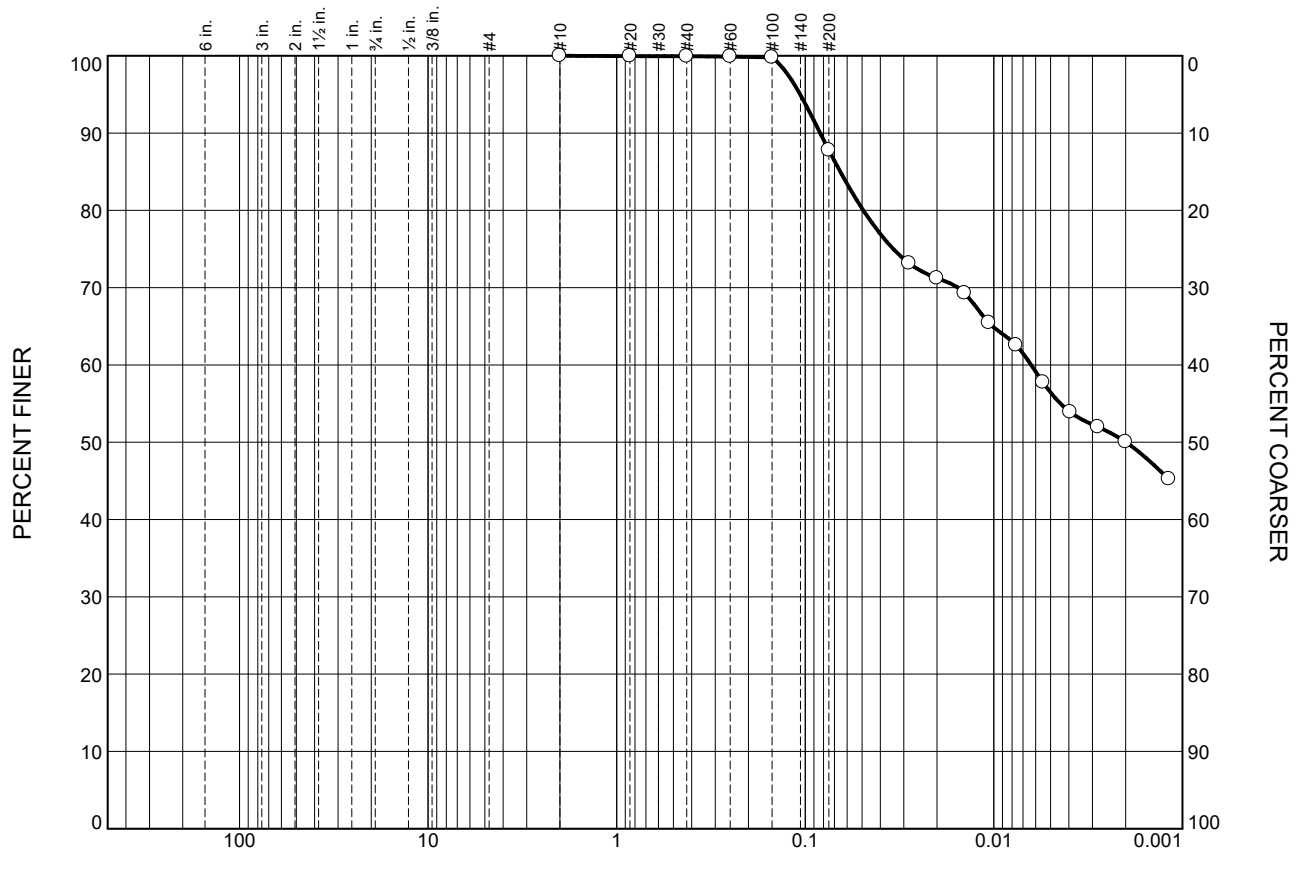
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	12.1	31.4	56.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-46	SP-3	10.5	Tan FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

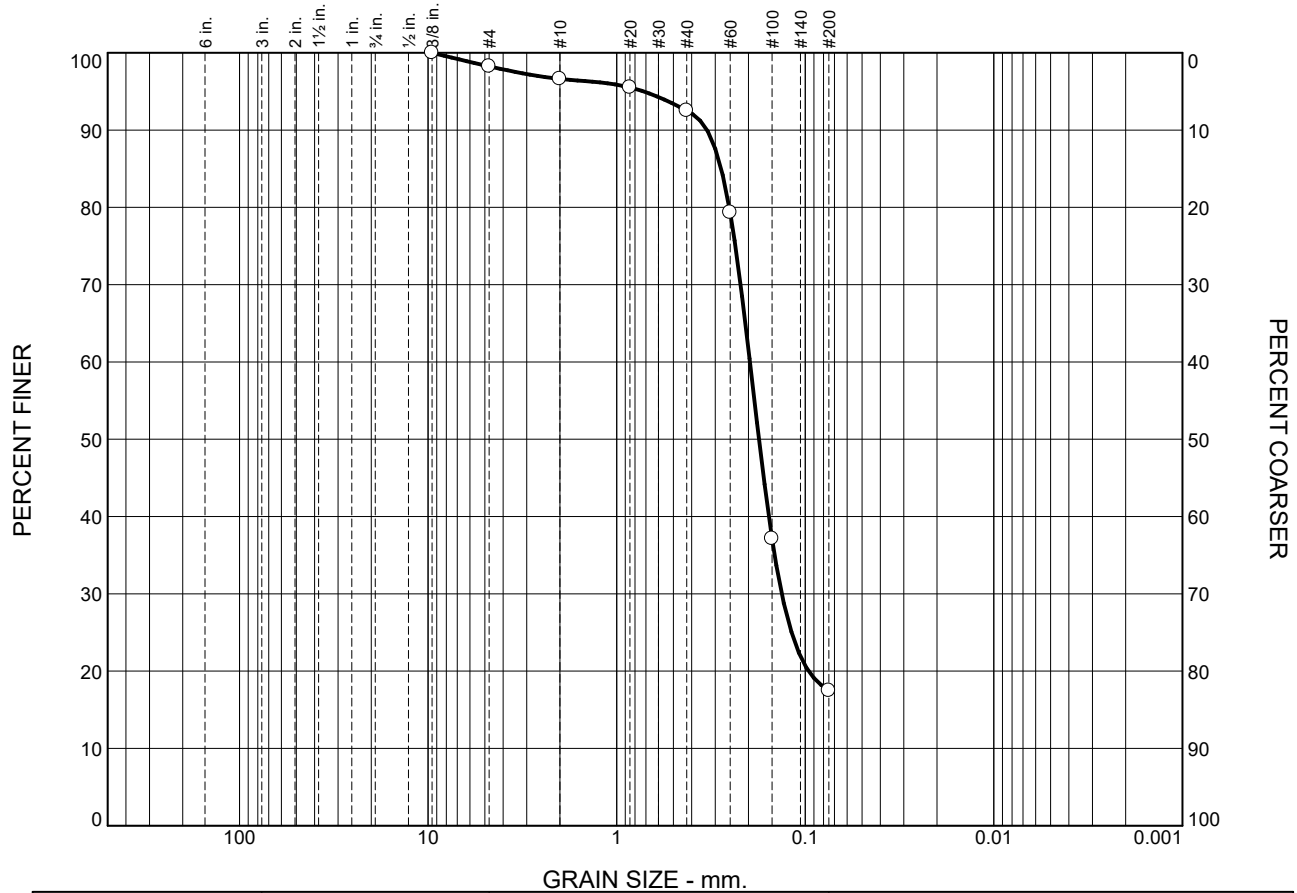
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				1.6	4.1	75.0	17.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-46	SP-13	45.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

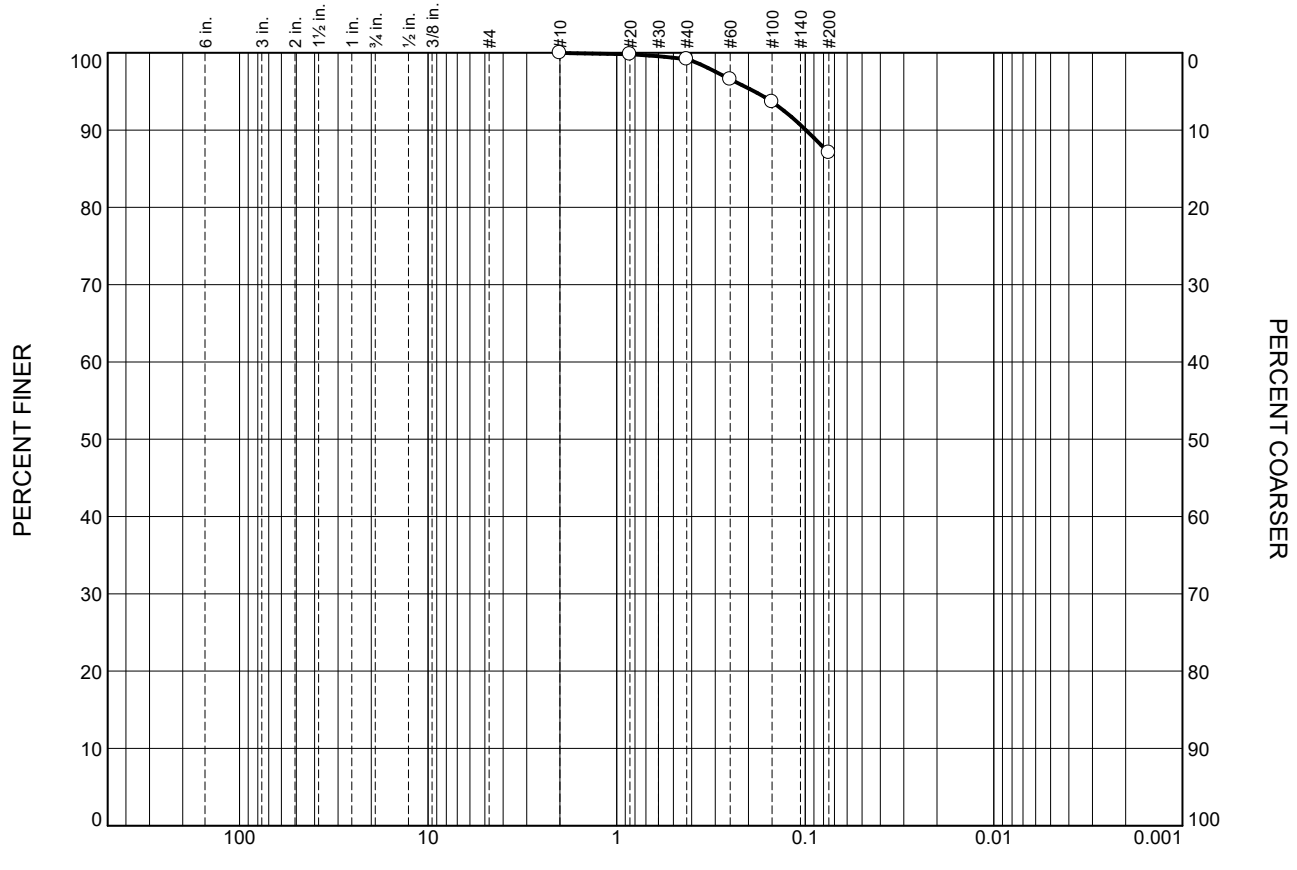
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○					0.8	12.1	87.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-46	SP-16	52.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

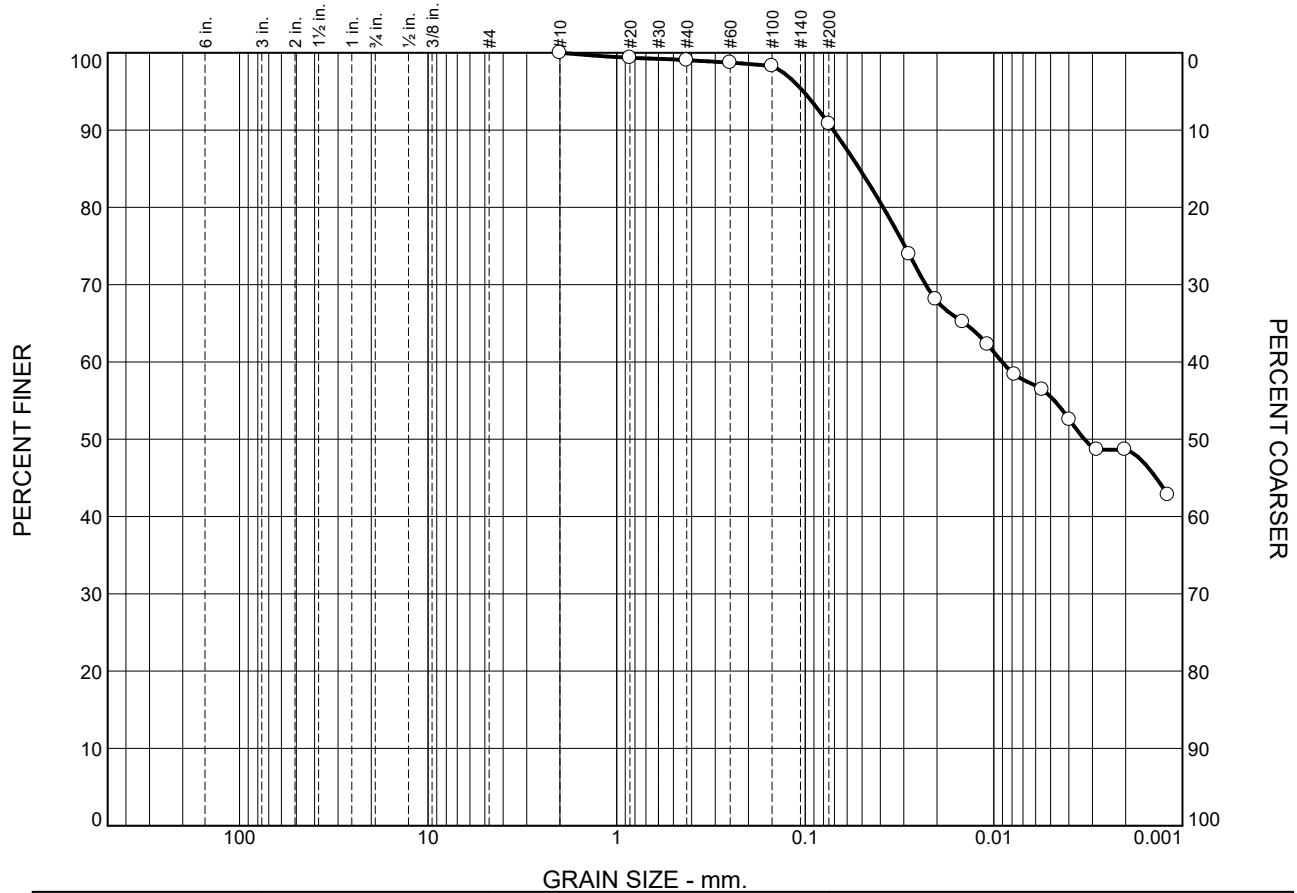
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	8.2	35.3	55.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-47	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

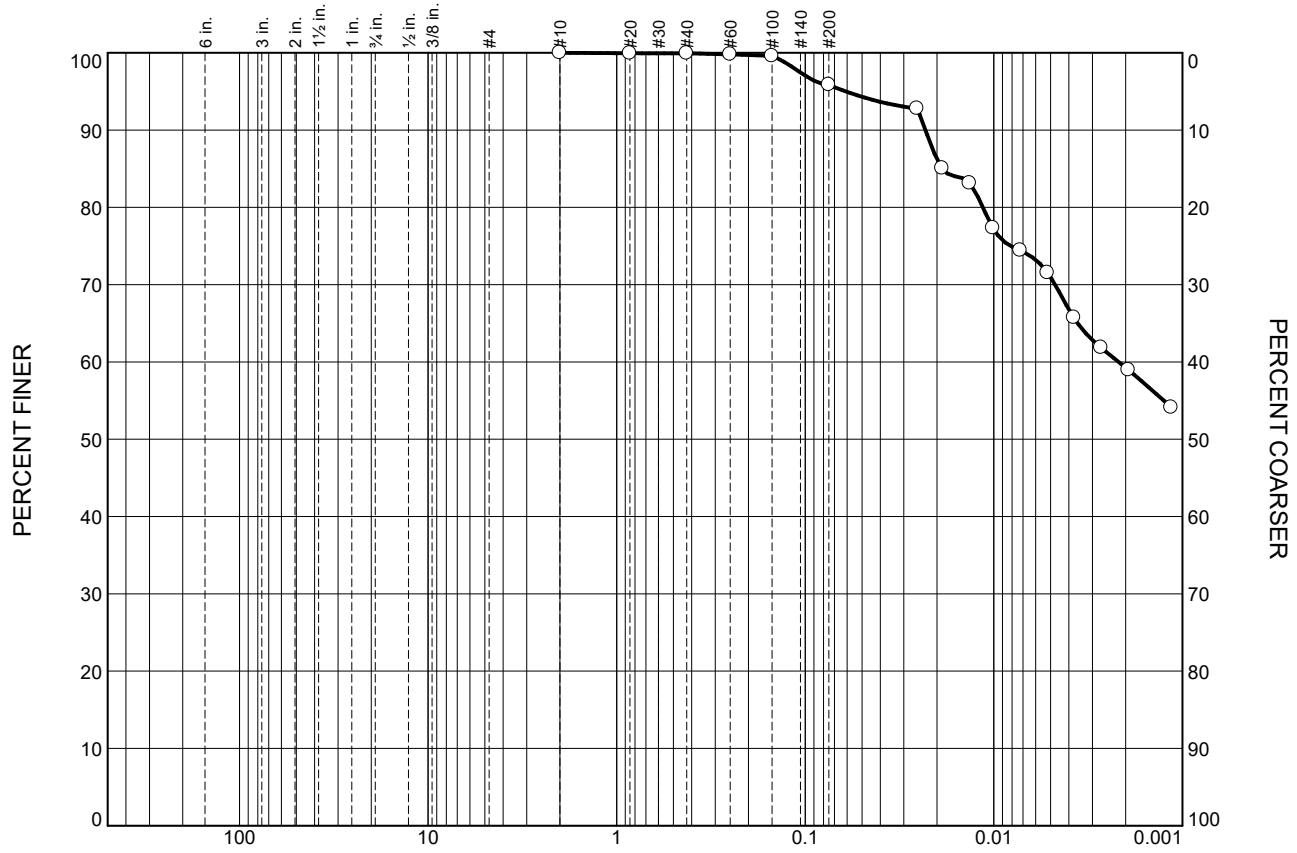
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	4.0	24.9	71.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-47	SP-3	10.5	Brown FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

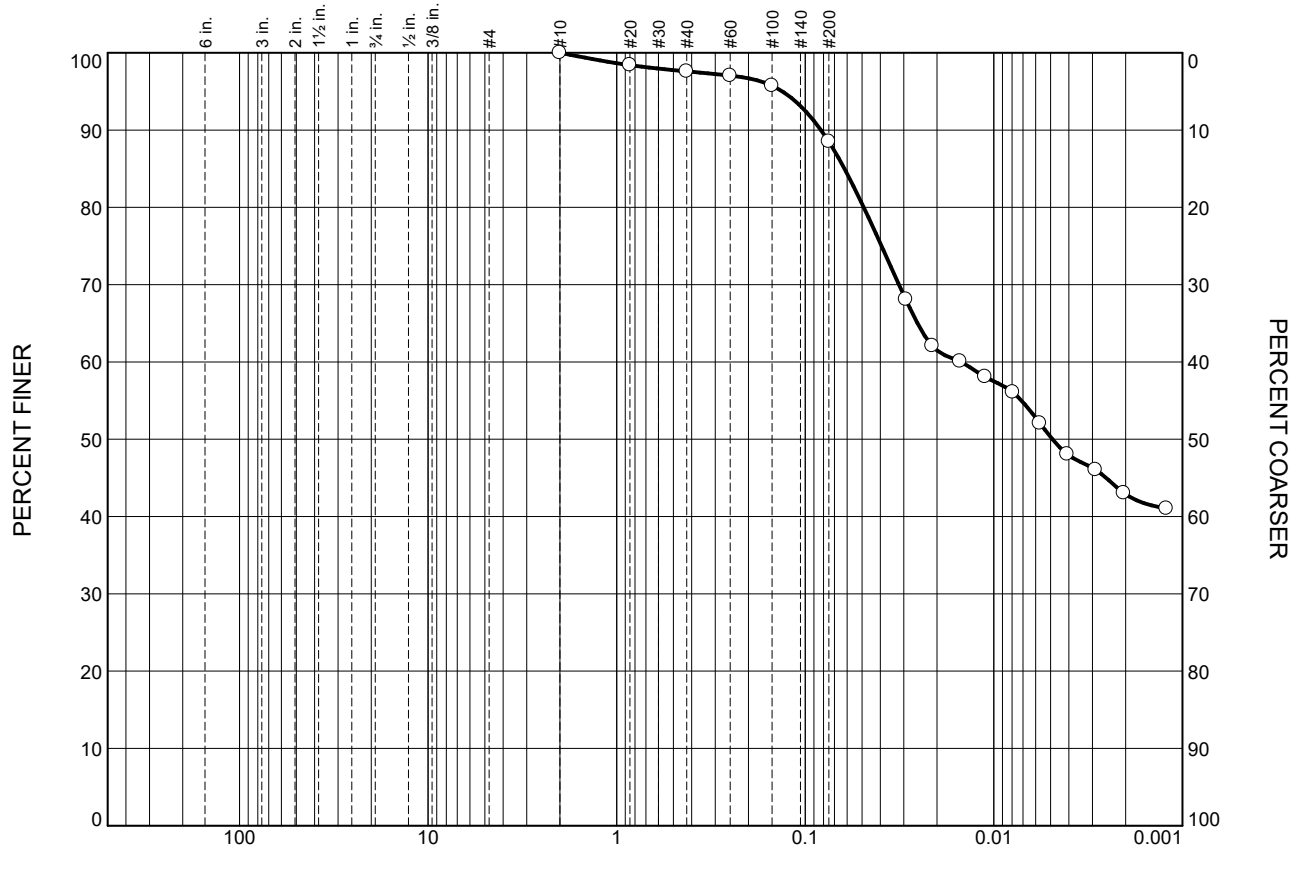
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.4	9.1	38.2	50.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-48	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

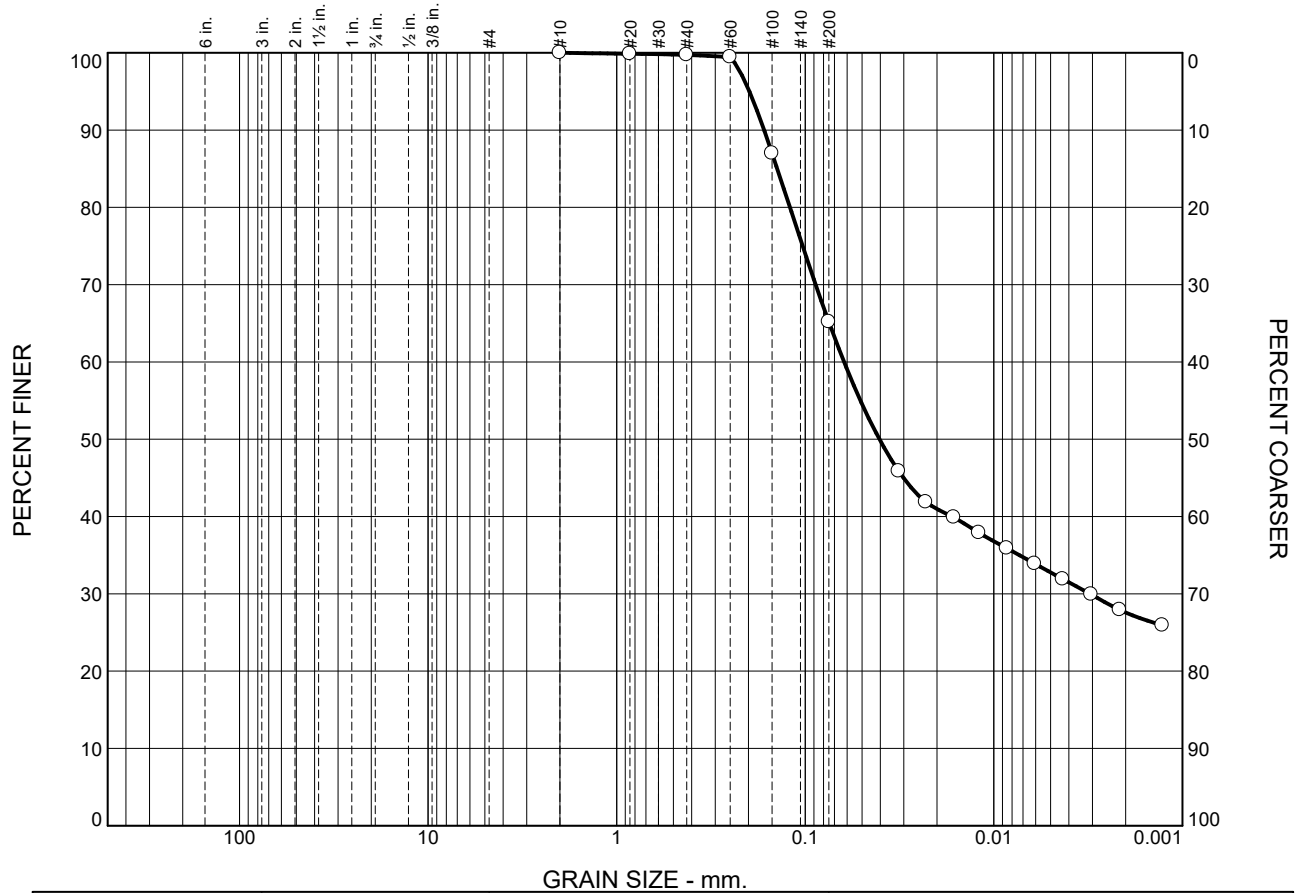
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	34.5	32.4	32.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-48	SP-4	15.5	Gray SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

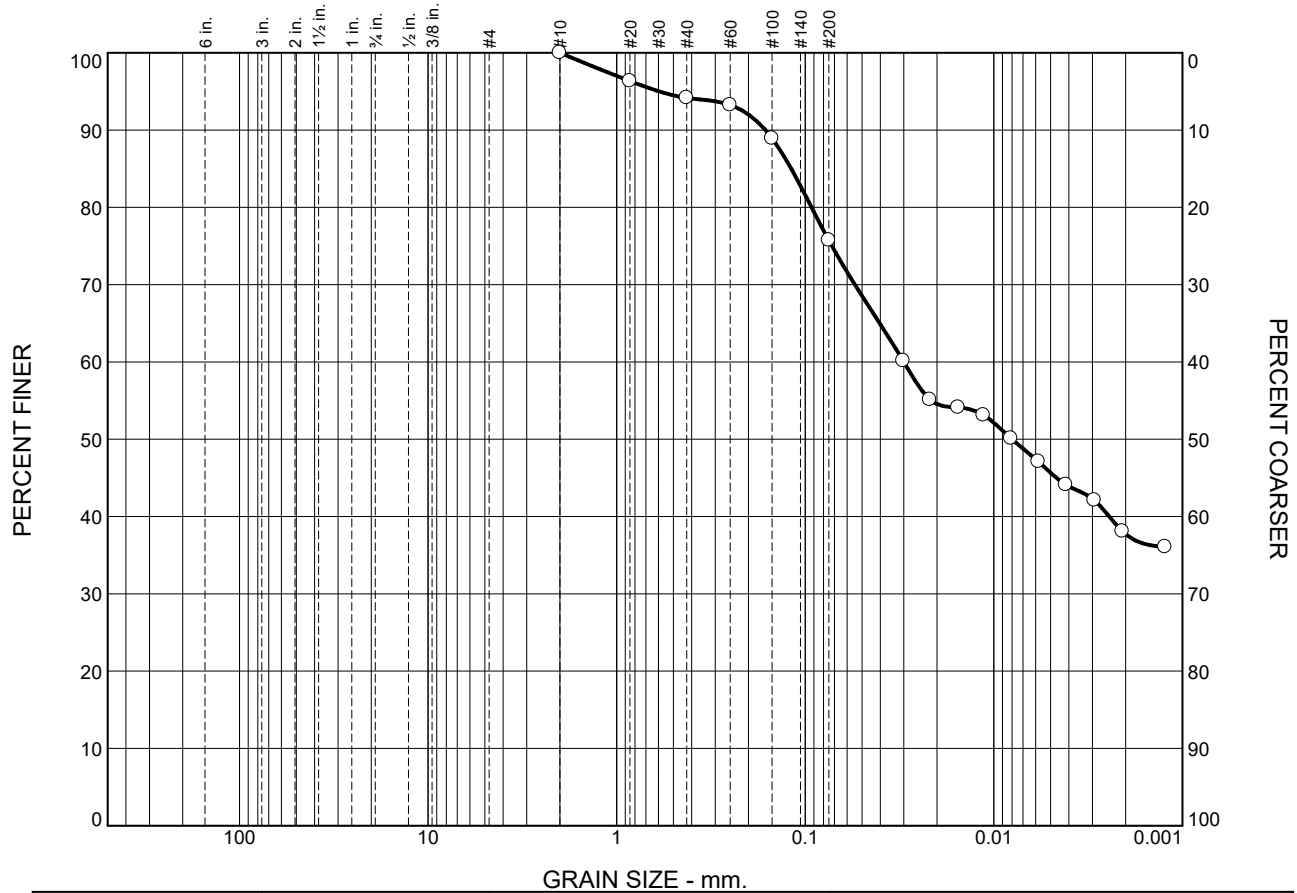
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.8	18.5	30.0	45.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-49	SP-1	0.5	Gray and brown FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

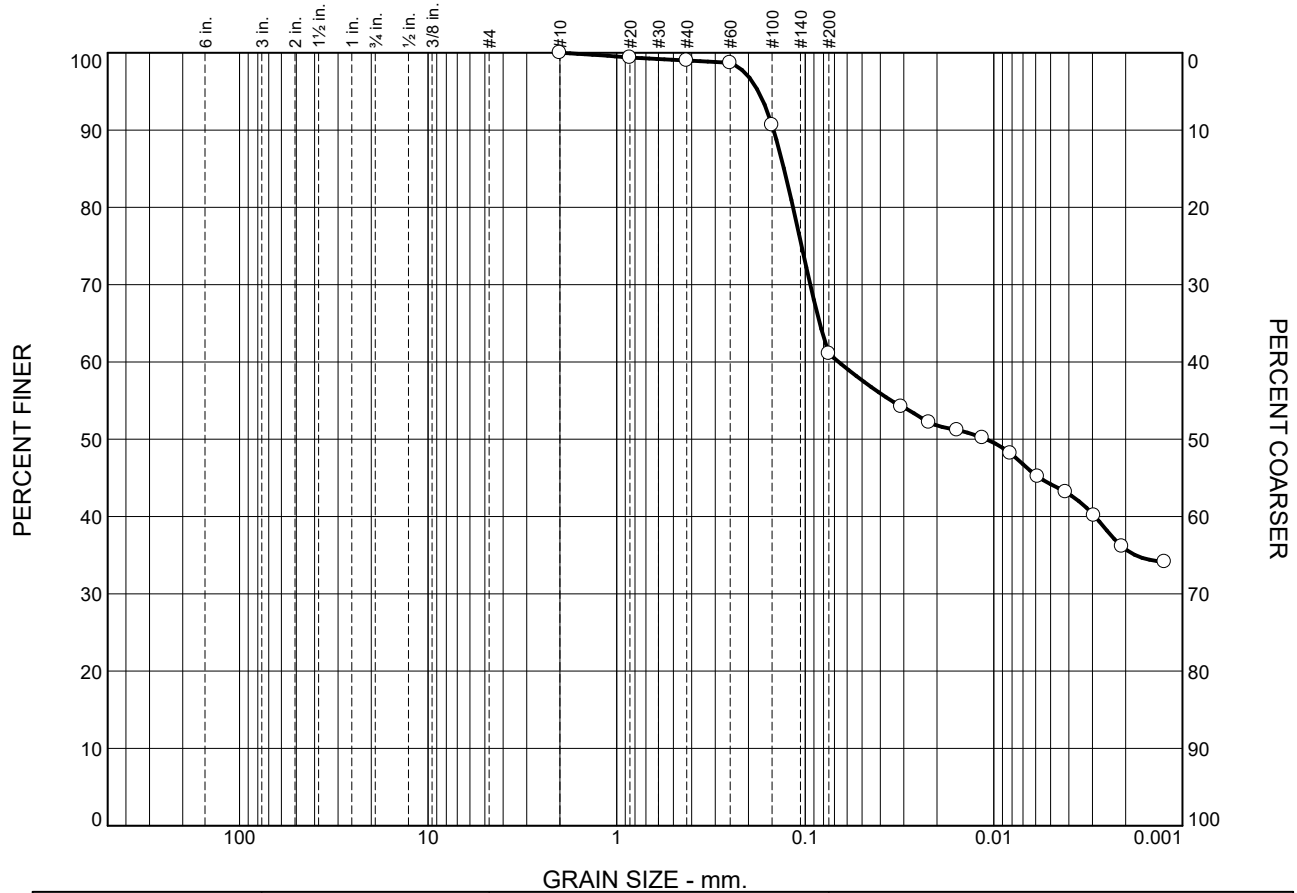
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	37.9	16.9	44.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-49	SP-3	10.5	Gray and brown SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

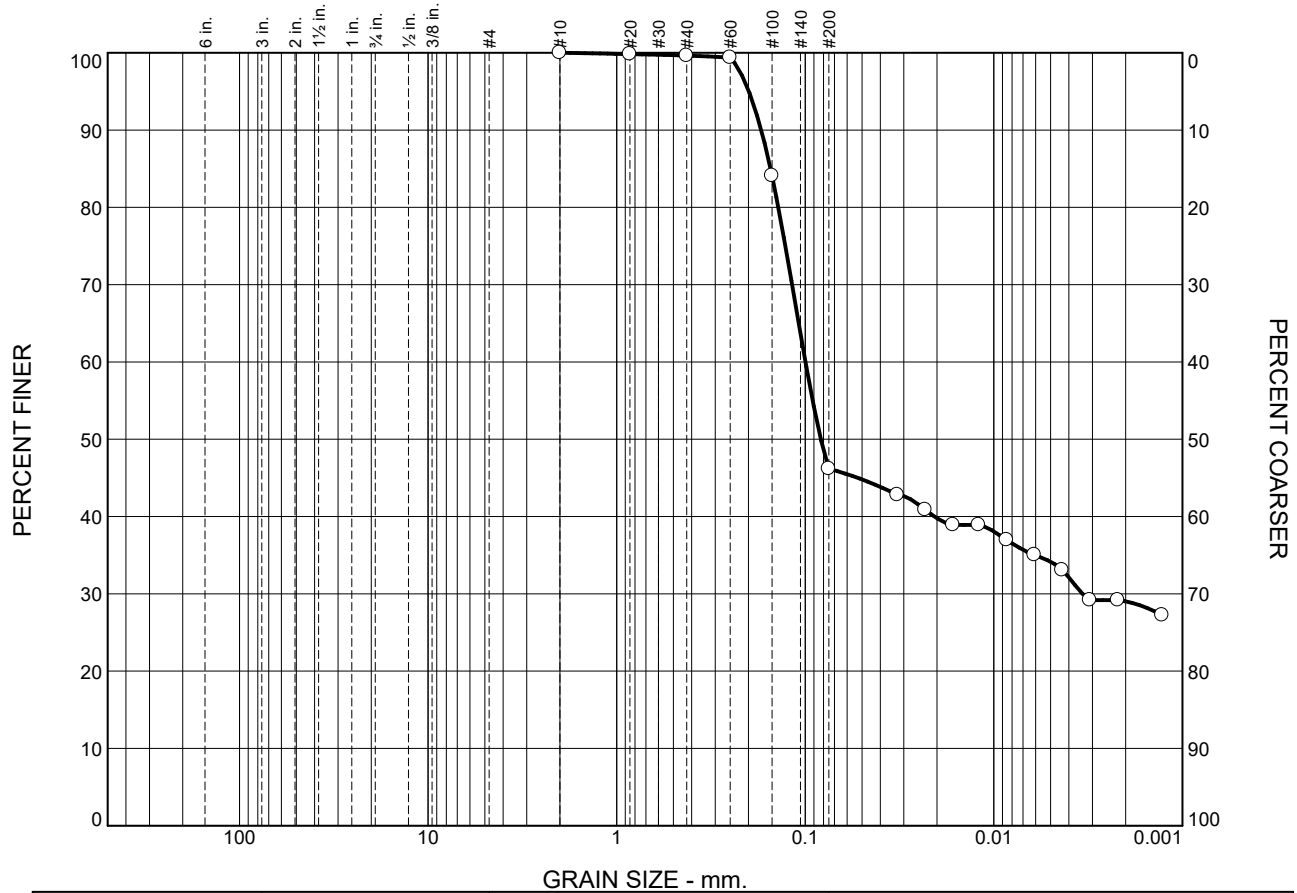
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	53.4	12.0	34.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-50	SP-2	5.5	Gray CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

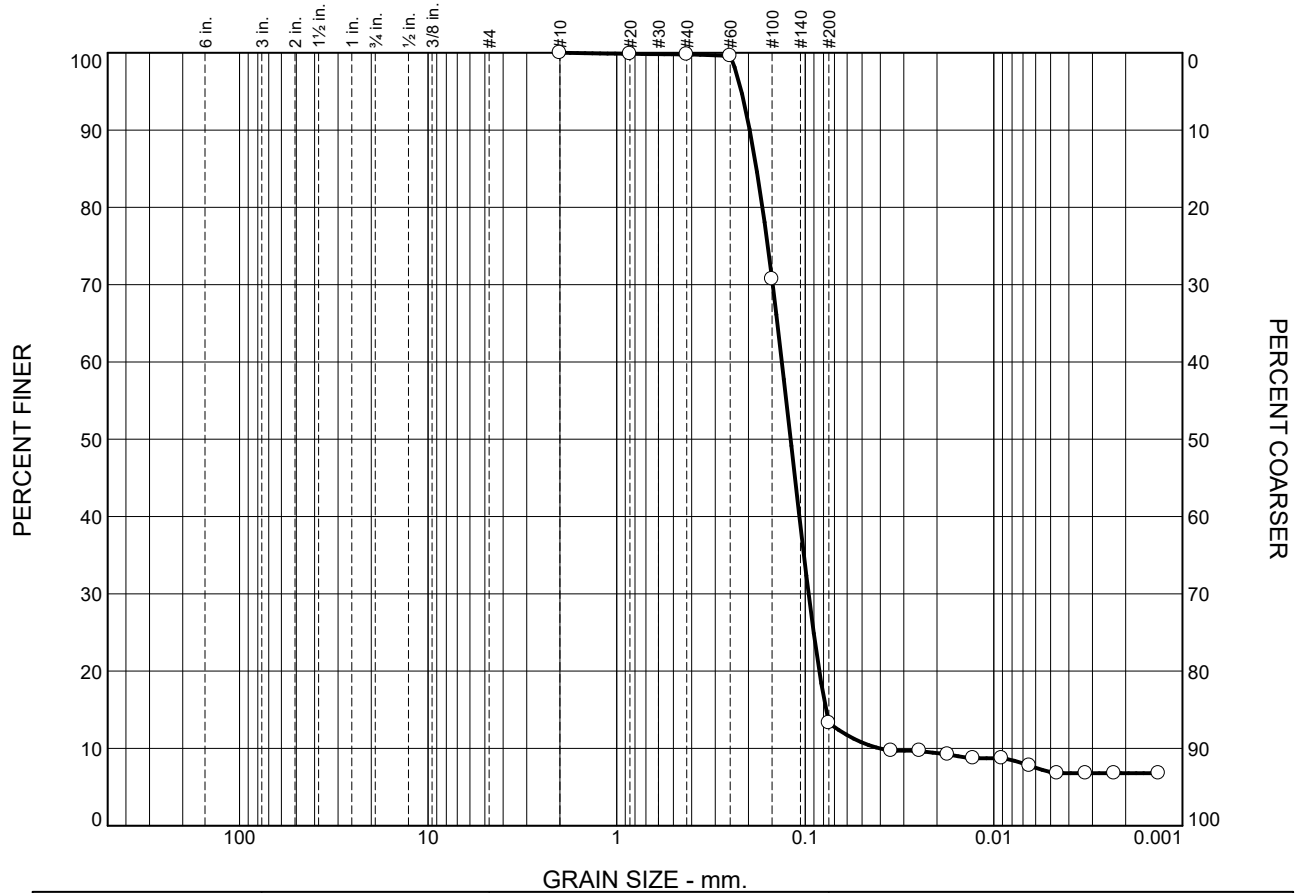
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	86.5	6.4	6.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-50	SP-4	15.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

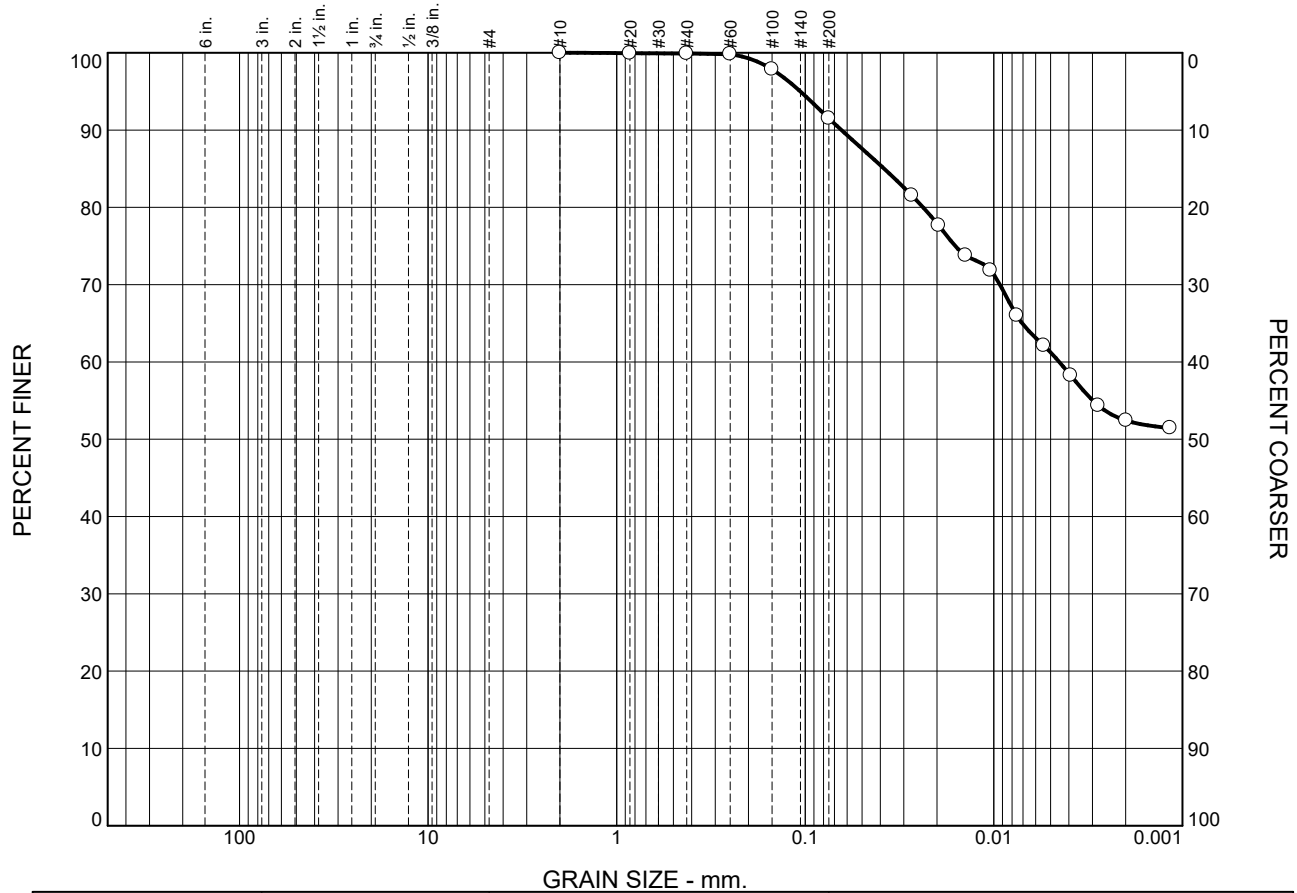
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	8.4	30.3	61.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-51	SP-2	5.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

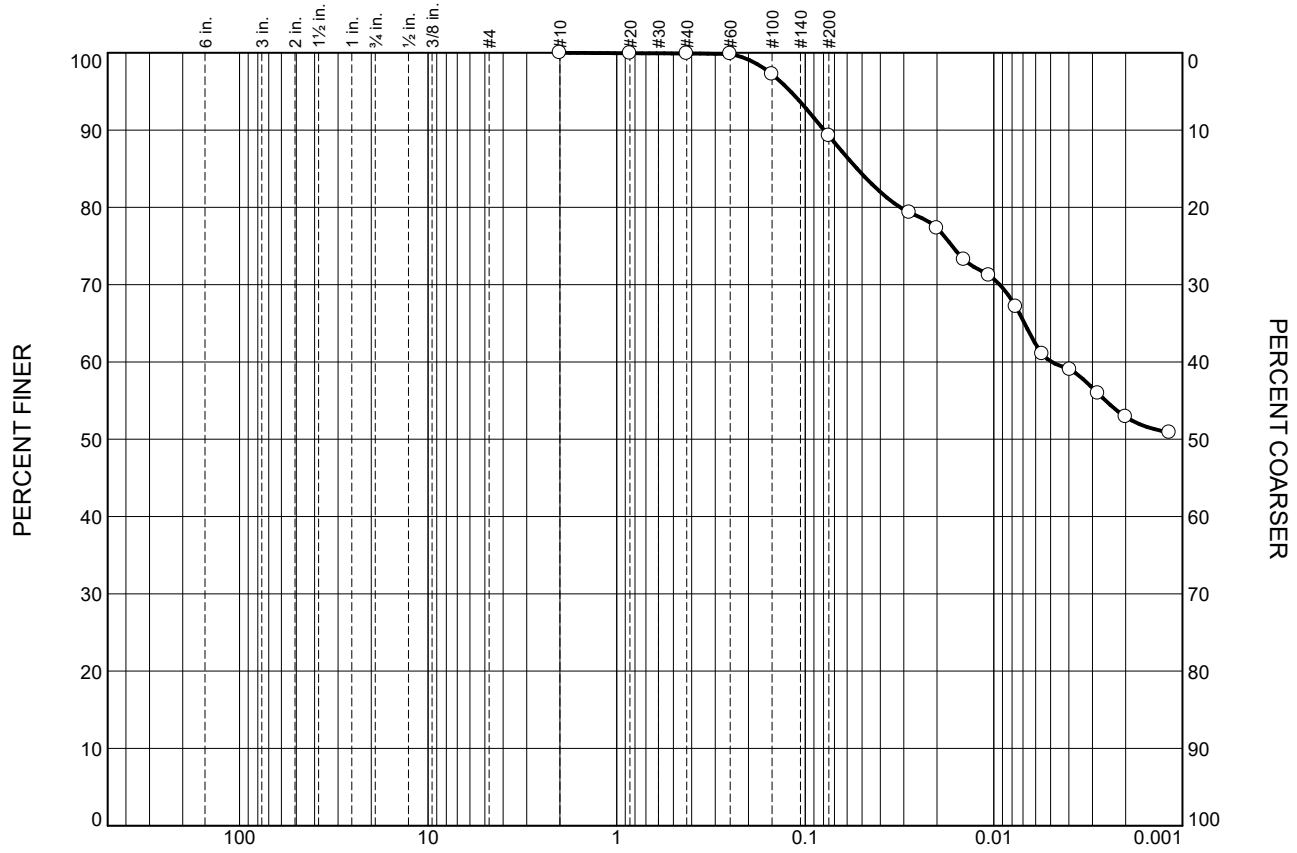
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	10.6	29.2	60.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-51	SP-3	10.5	Gray and brown FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

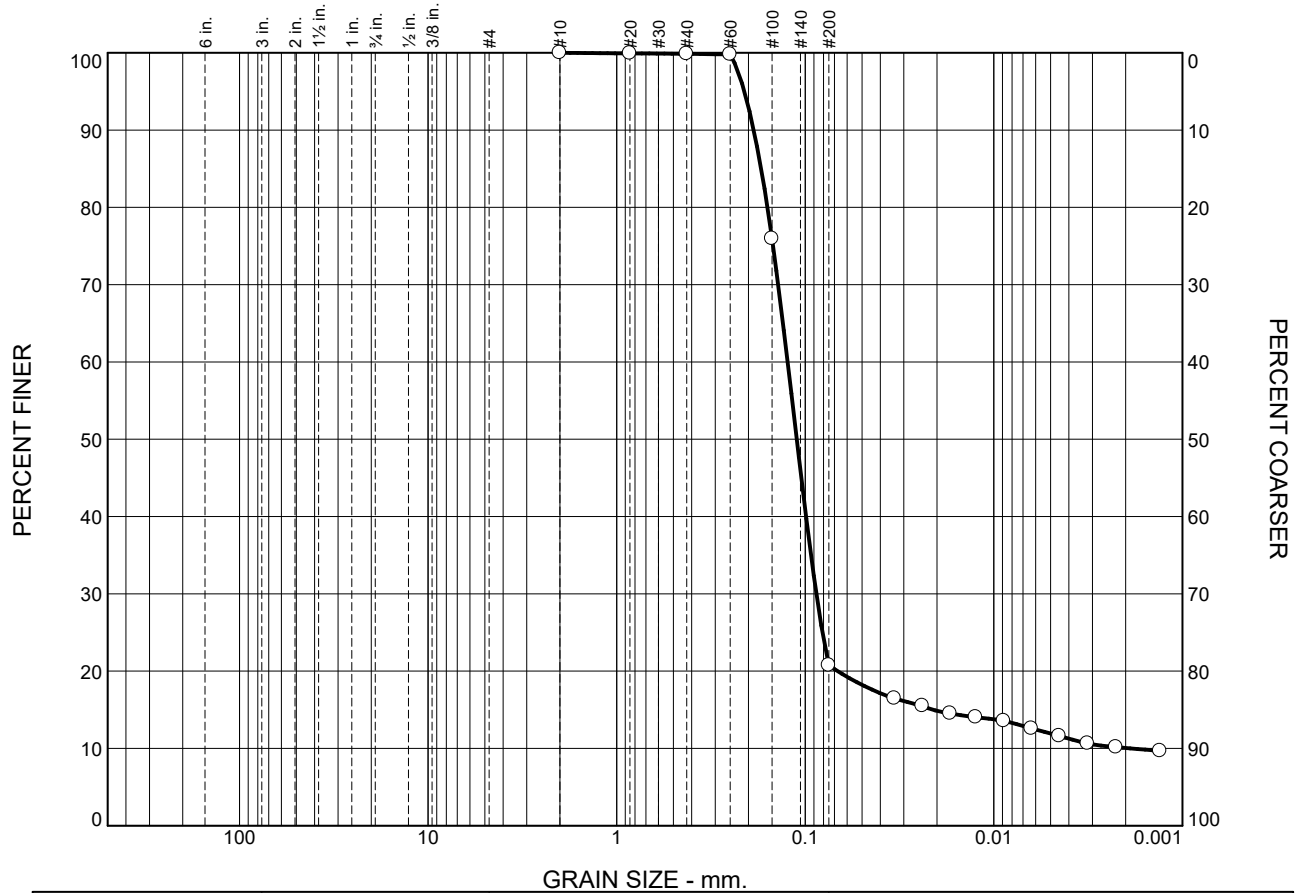
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	79.2	8.8	11.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-51	SP-8	38	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

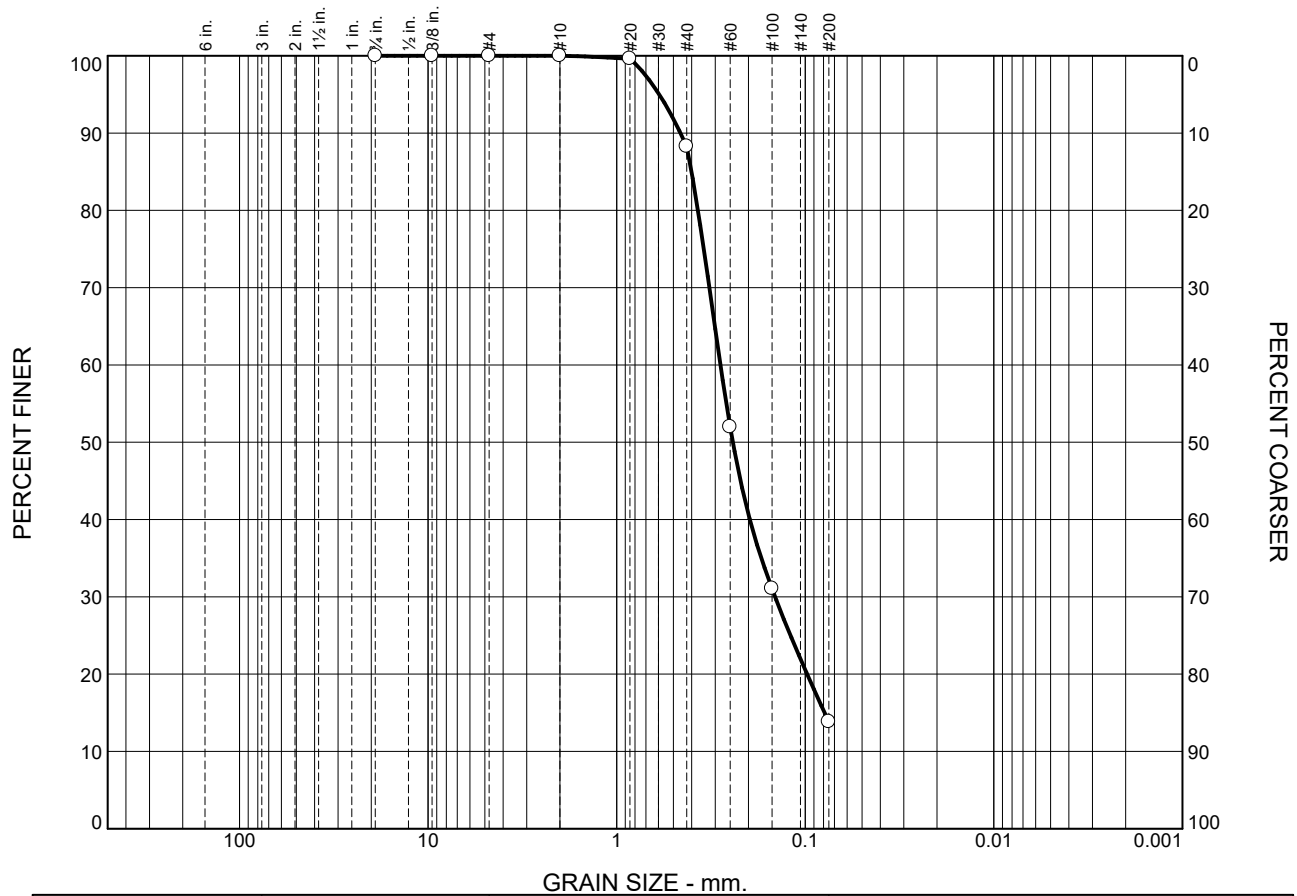
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	11.7	74.5	13.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-51	SP-14	53	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

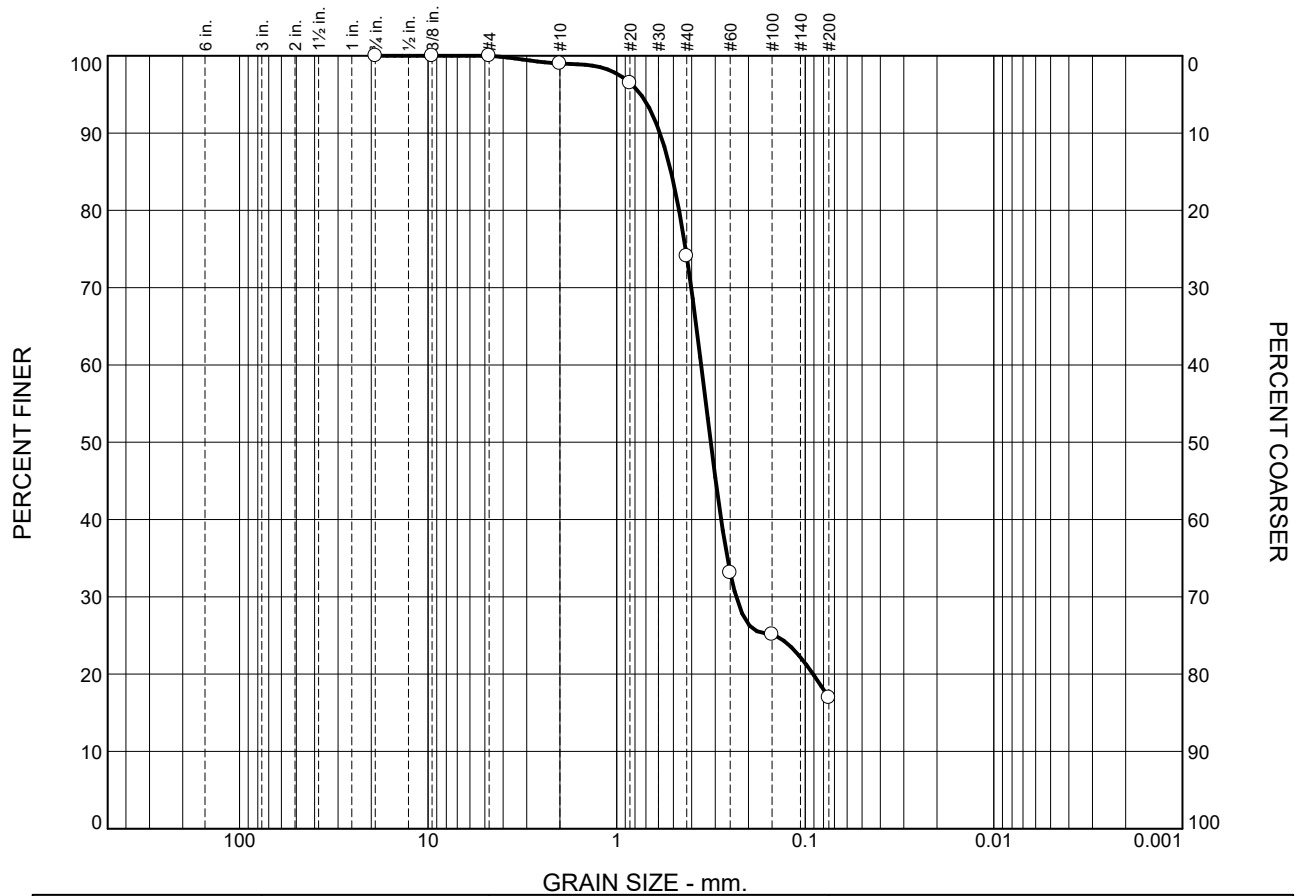
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.0	24.9	57.1	17.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-51	SP-18	63	Gray and brown SILTY SAND; clay balls	SM

Tolunay-Wong Engineers, Inc.

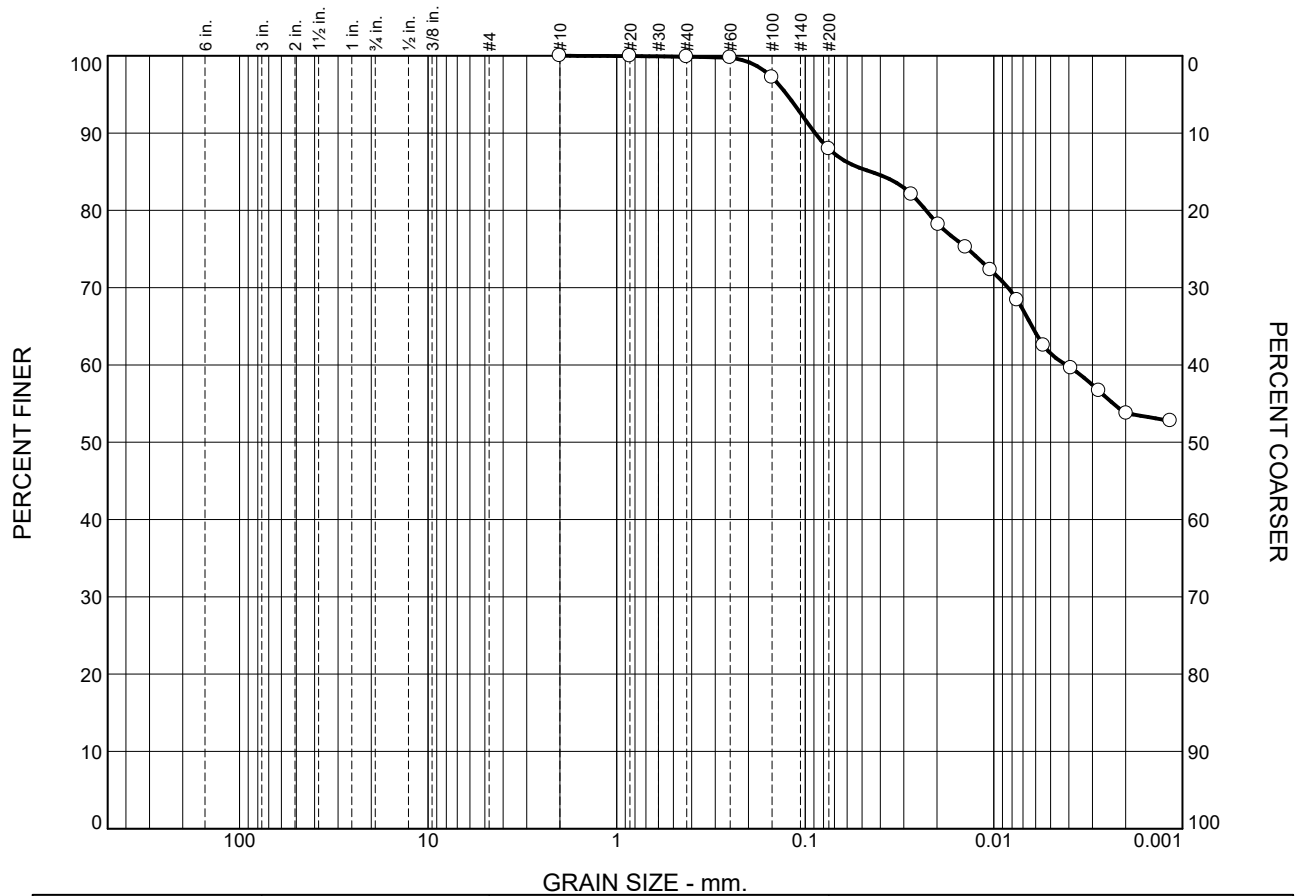
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	11.9	26.5	61.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-52	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

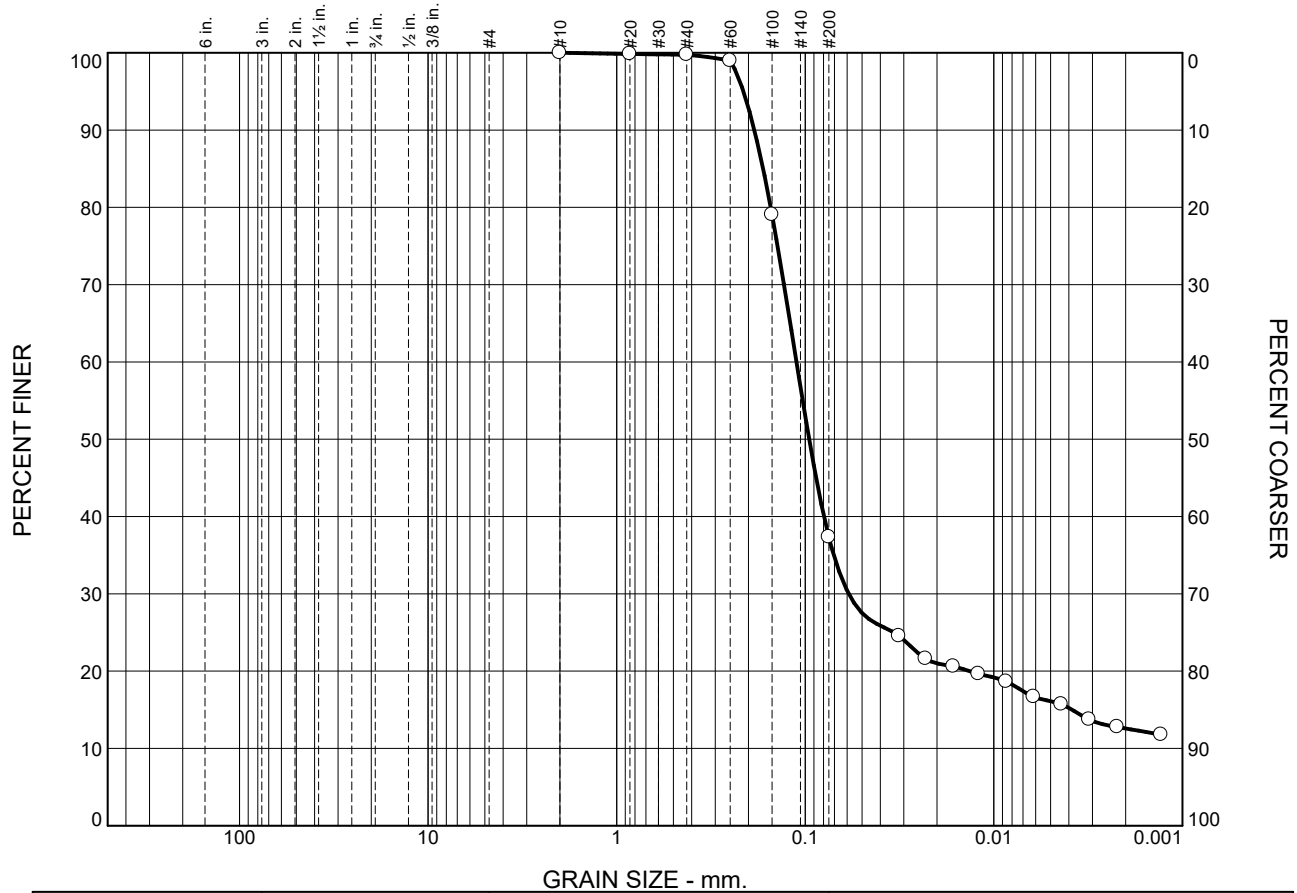
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	62.3	21.3	16.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-52	SP-5	13	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

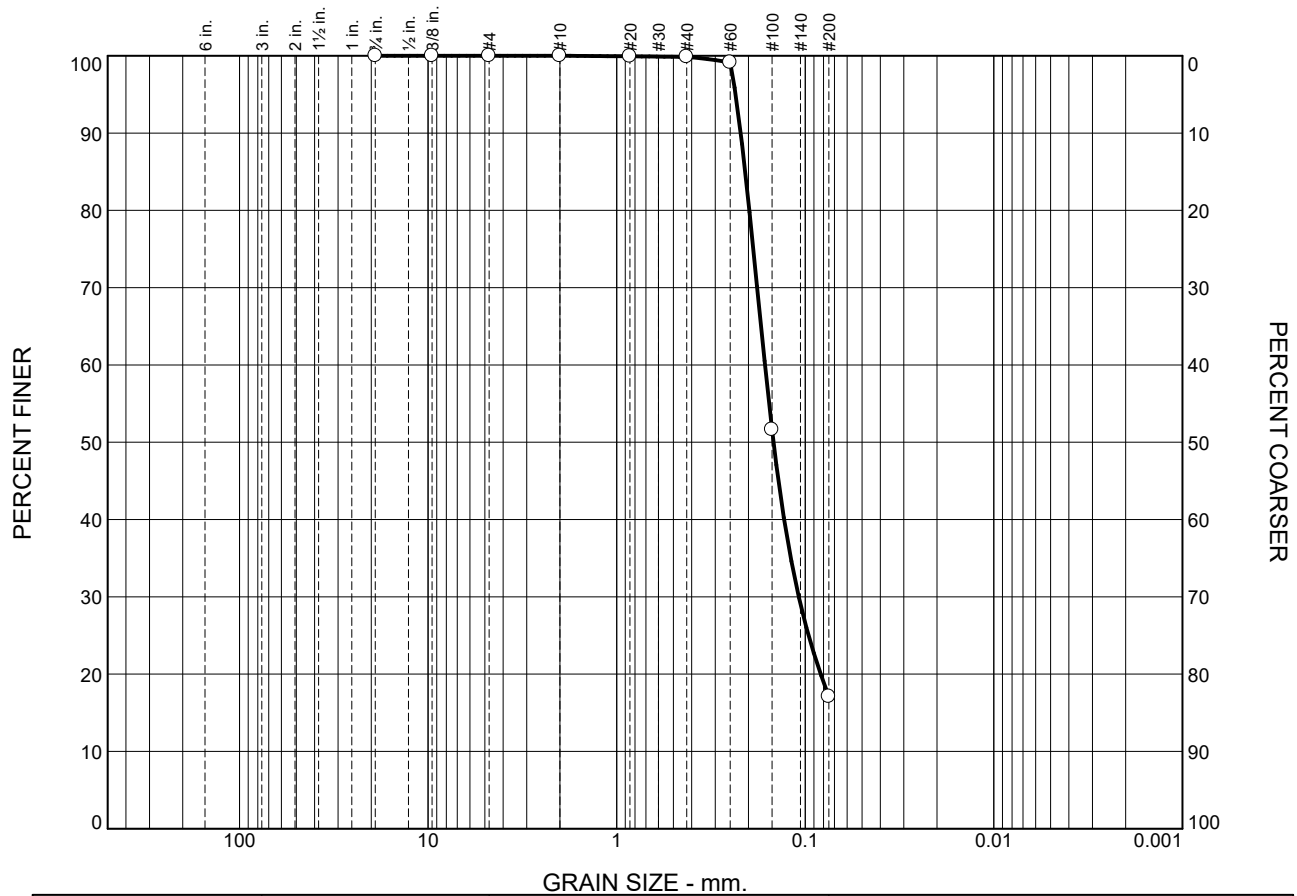
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	82.8	17.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-52	SP-7	18.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

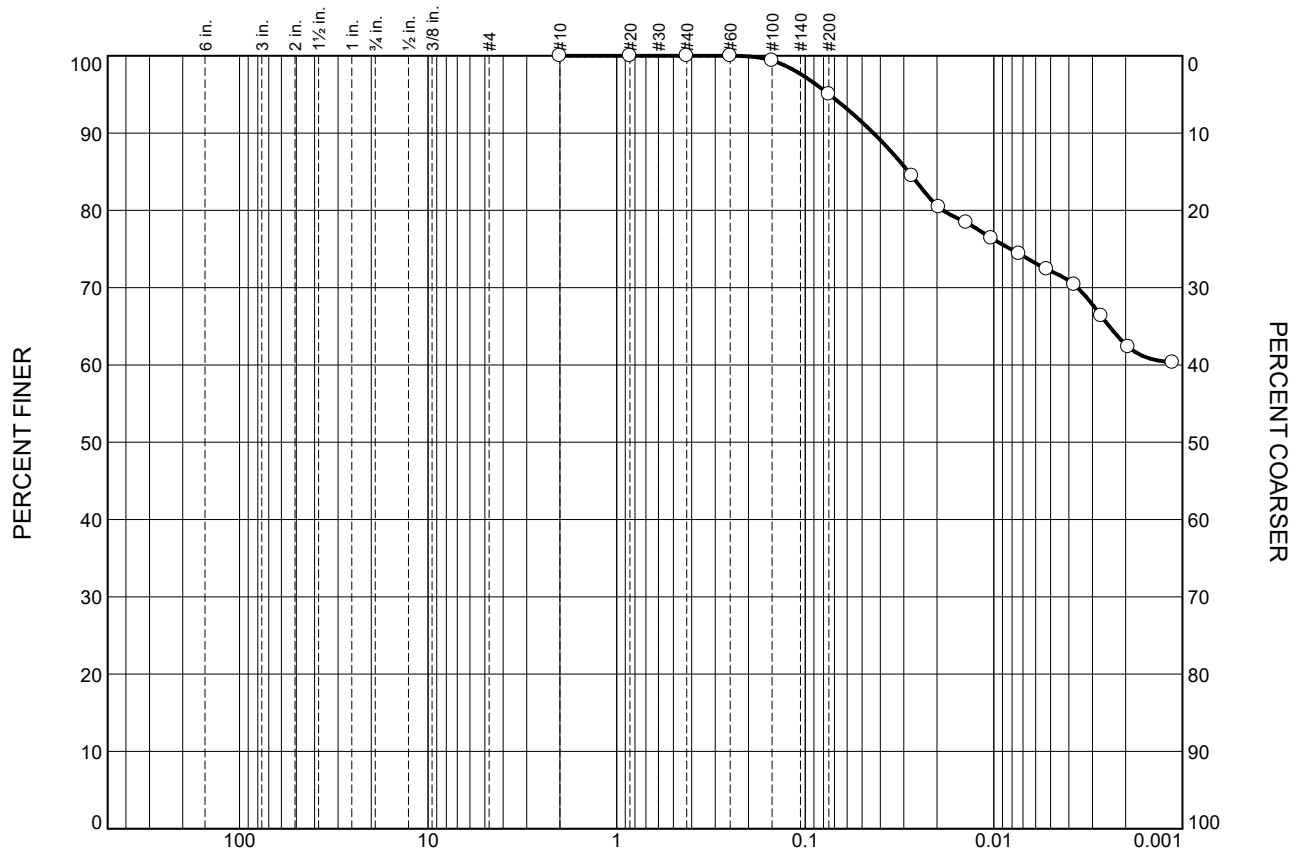
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	5.0	22.8	72.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-53	SP-1	0.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

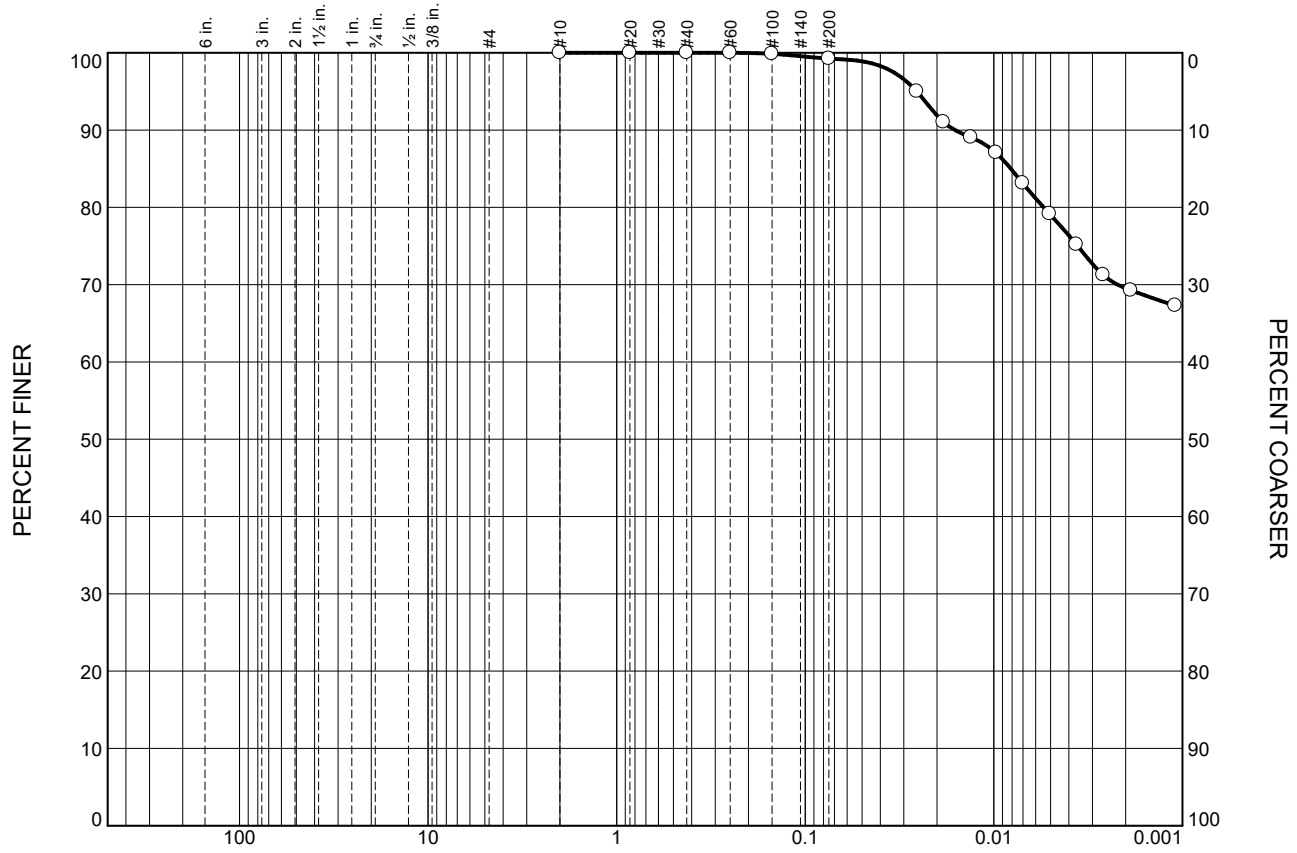
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.7	20.3	79.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-53	SP-10	35	Tan FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

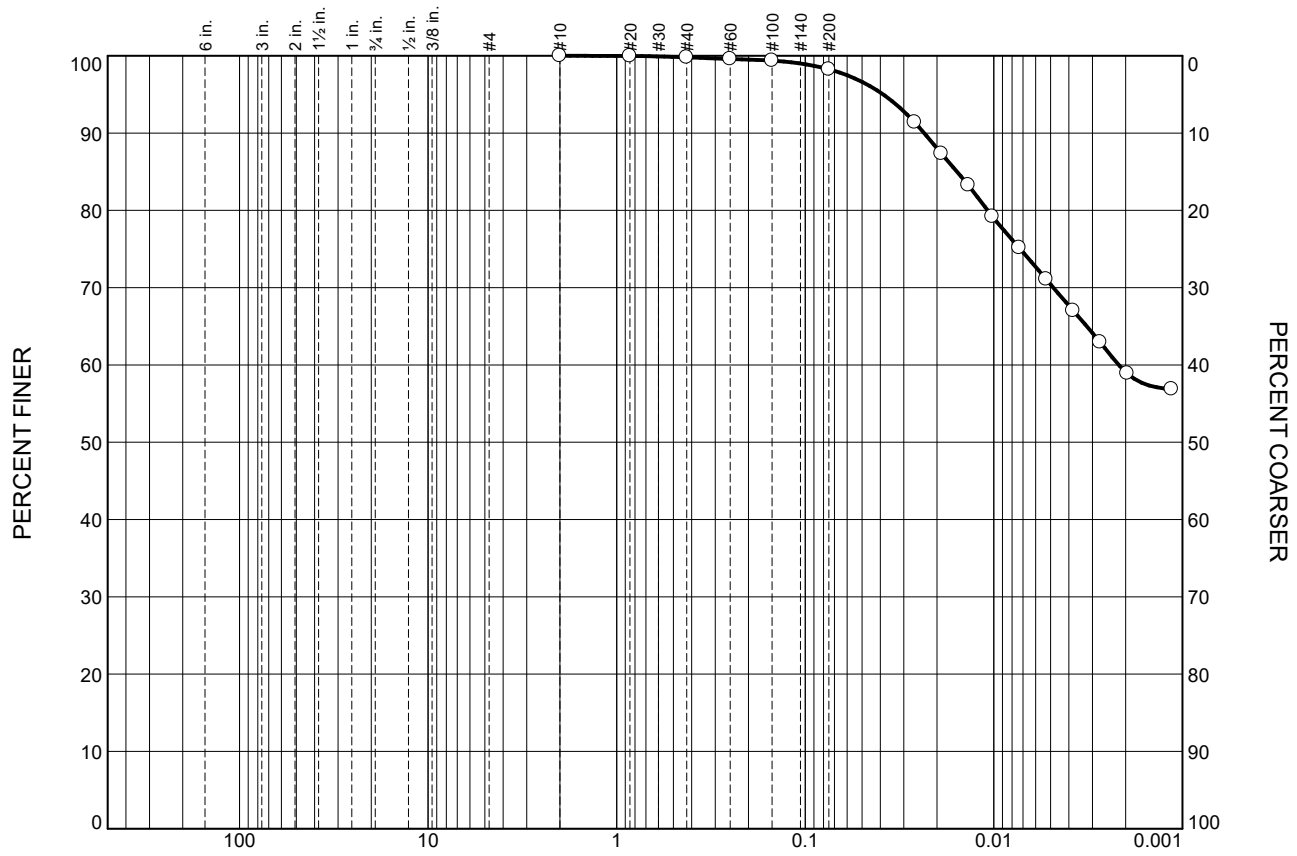
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	1.5	27.9	70.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-54	SP-10	40.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

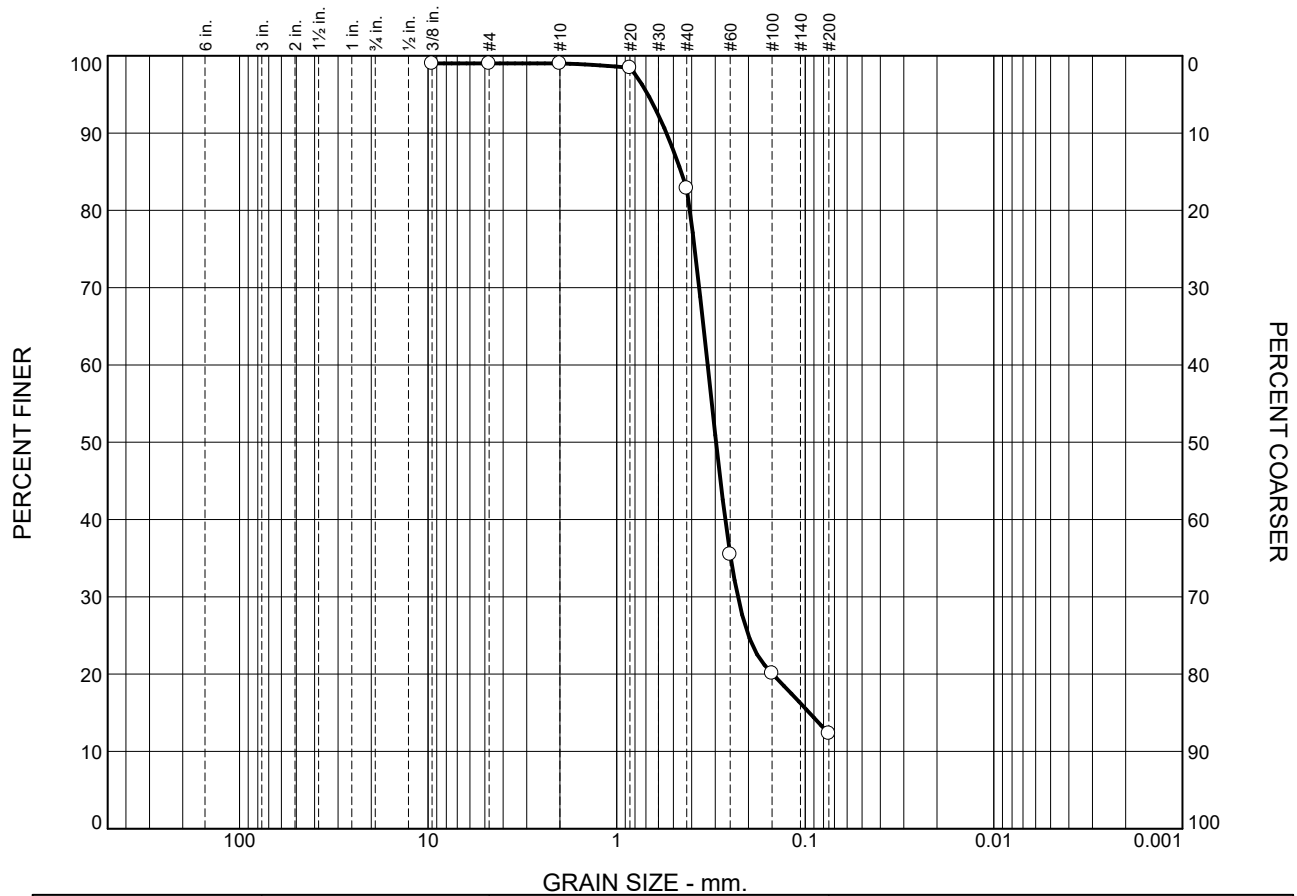
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.0	16.2	70.5	12.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-54	SP-12	53	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

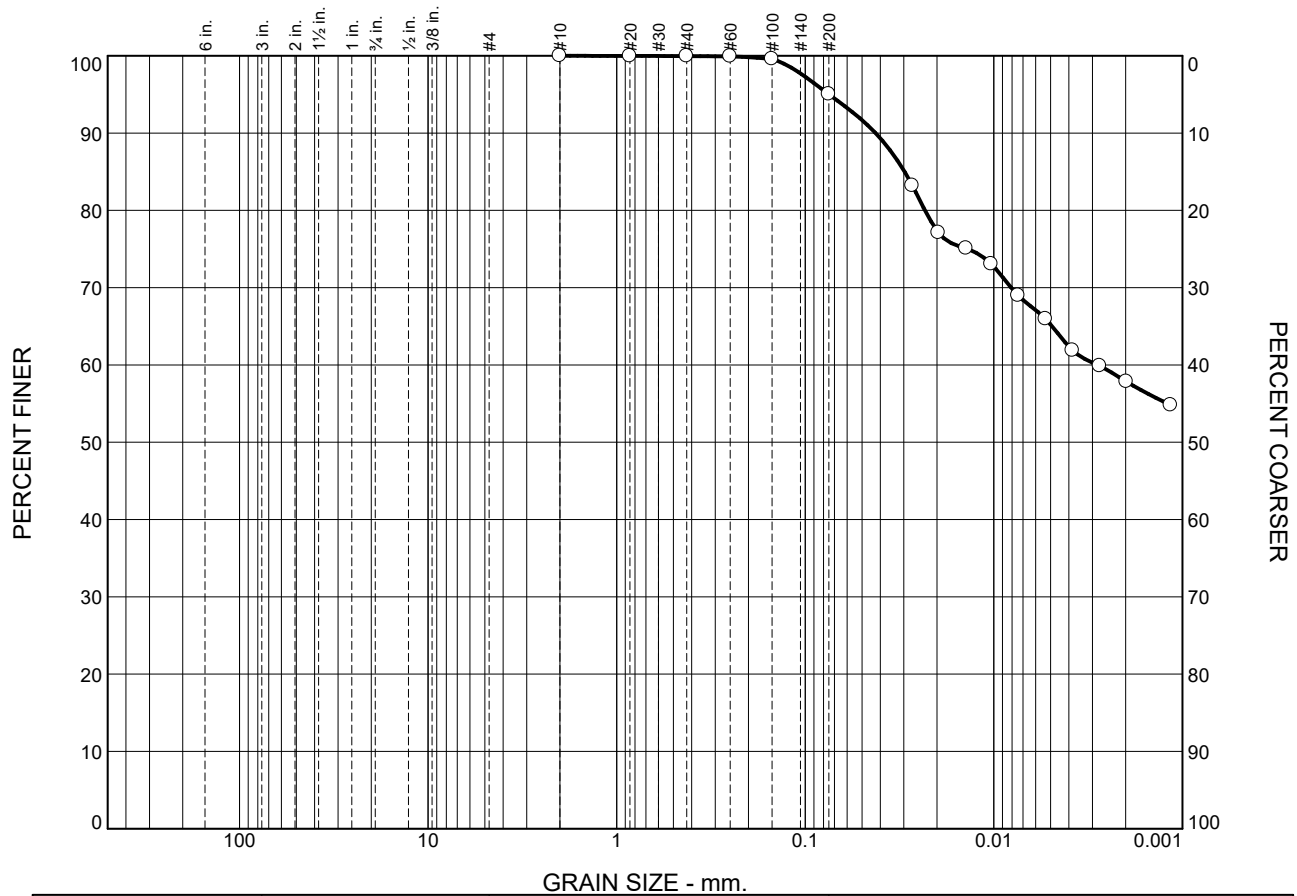
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	5.0	29.8	65.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-55	SP-2	5.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

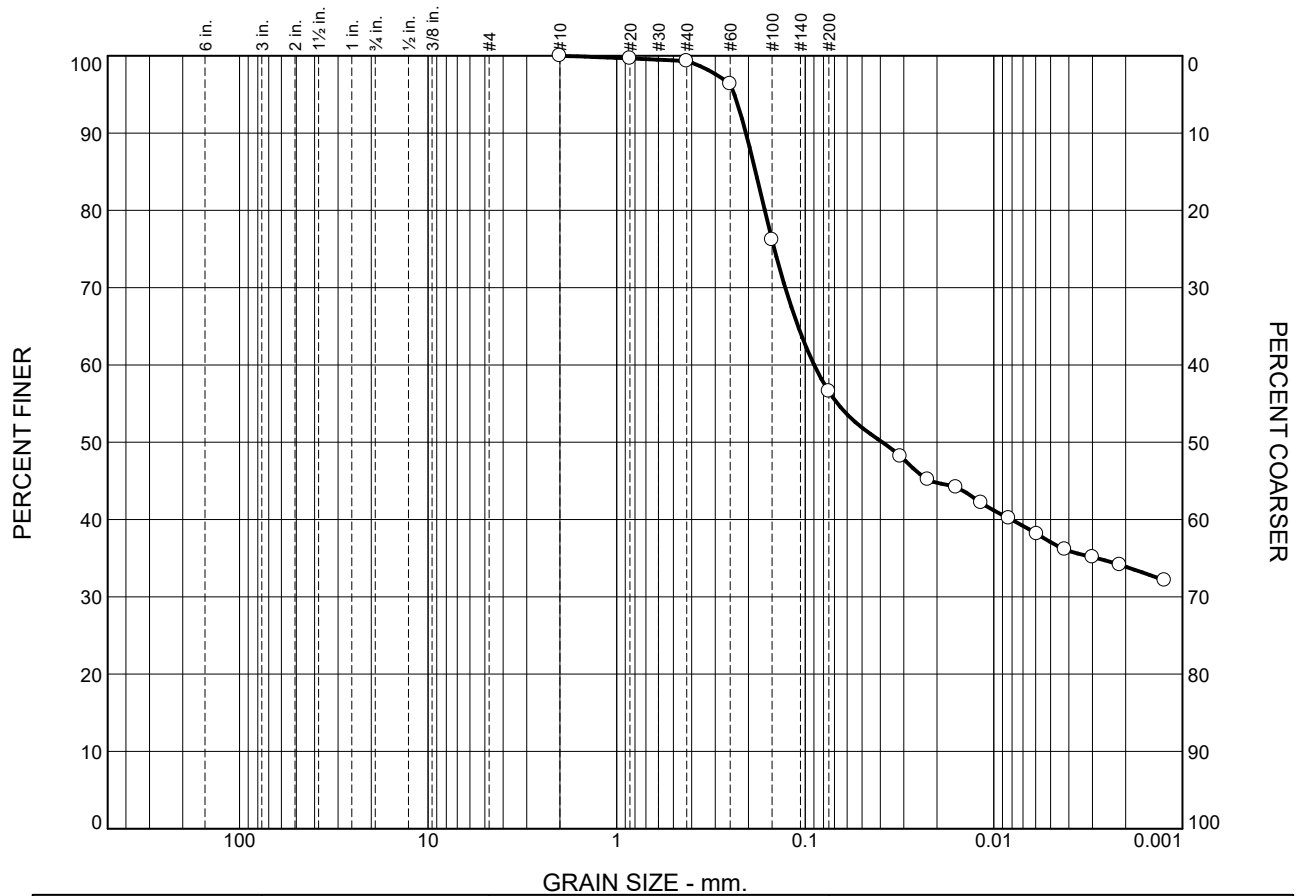
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.7	42.7	19.5	37.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-55	SP-7	20	Gray SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

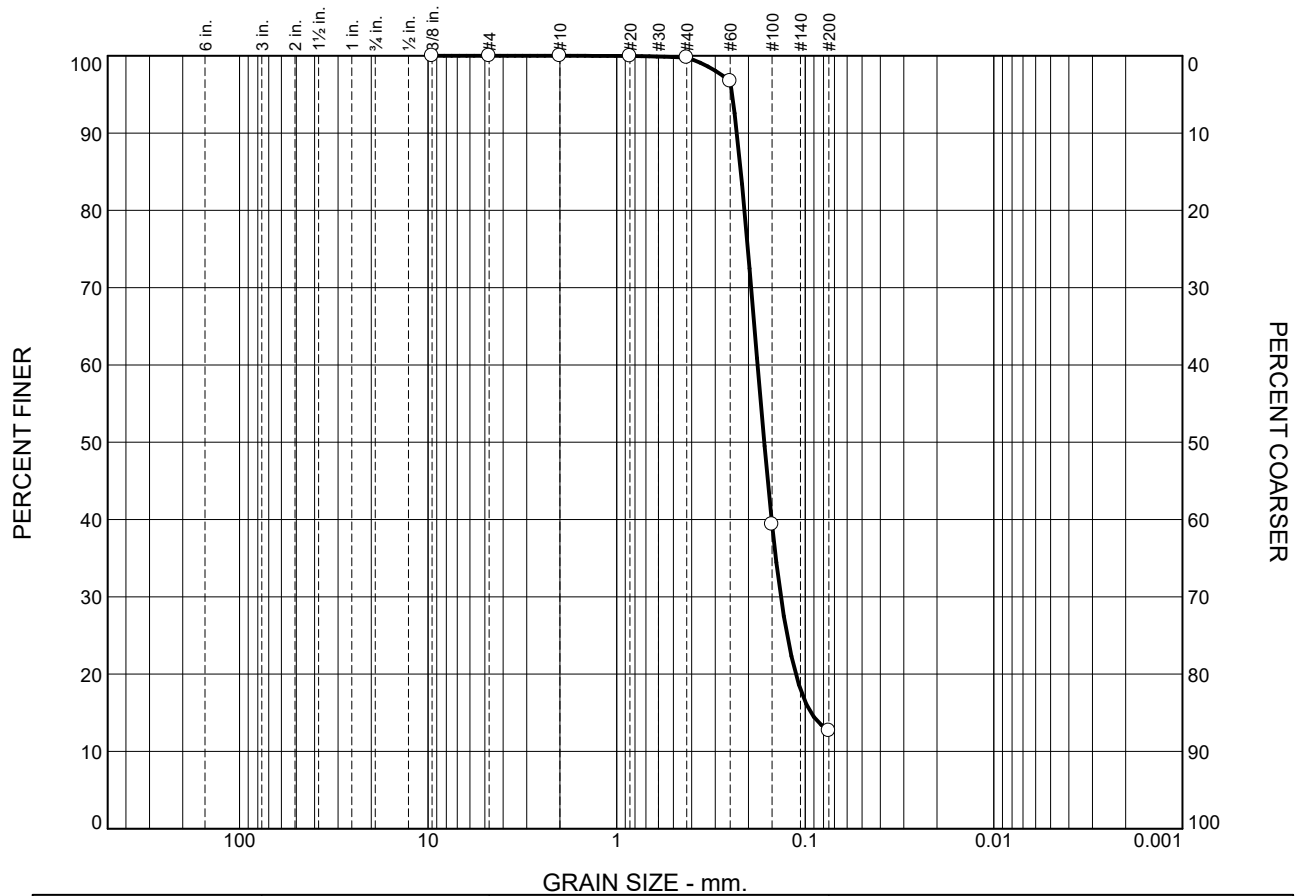
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	87.1	12.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-55	SP-8	22.5	Gray SILT SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	7.0	87.6	5.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-55	SP-10	27.5	Gray POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

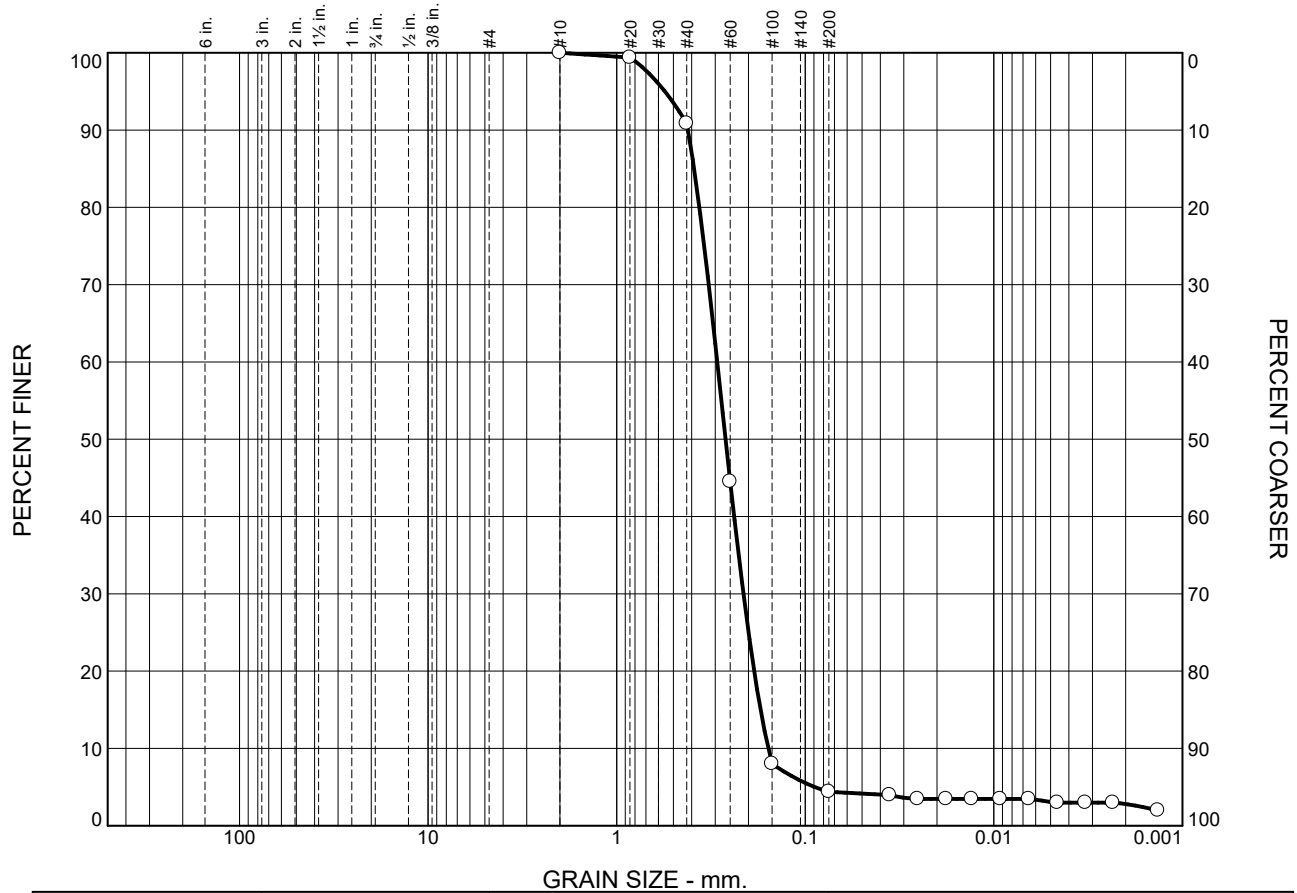
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	9.1	86.5	1.3	3.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-55	SP-12	32.5	Tan poorly graded SAND	SP

Tolunay-Wong Engineers, Inc.

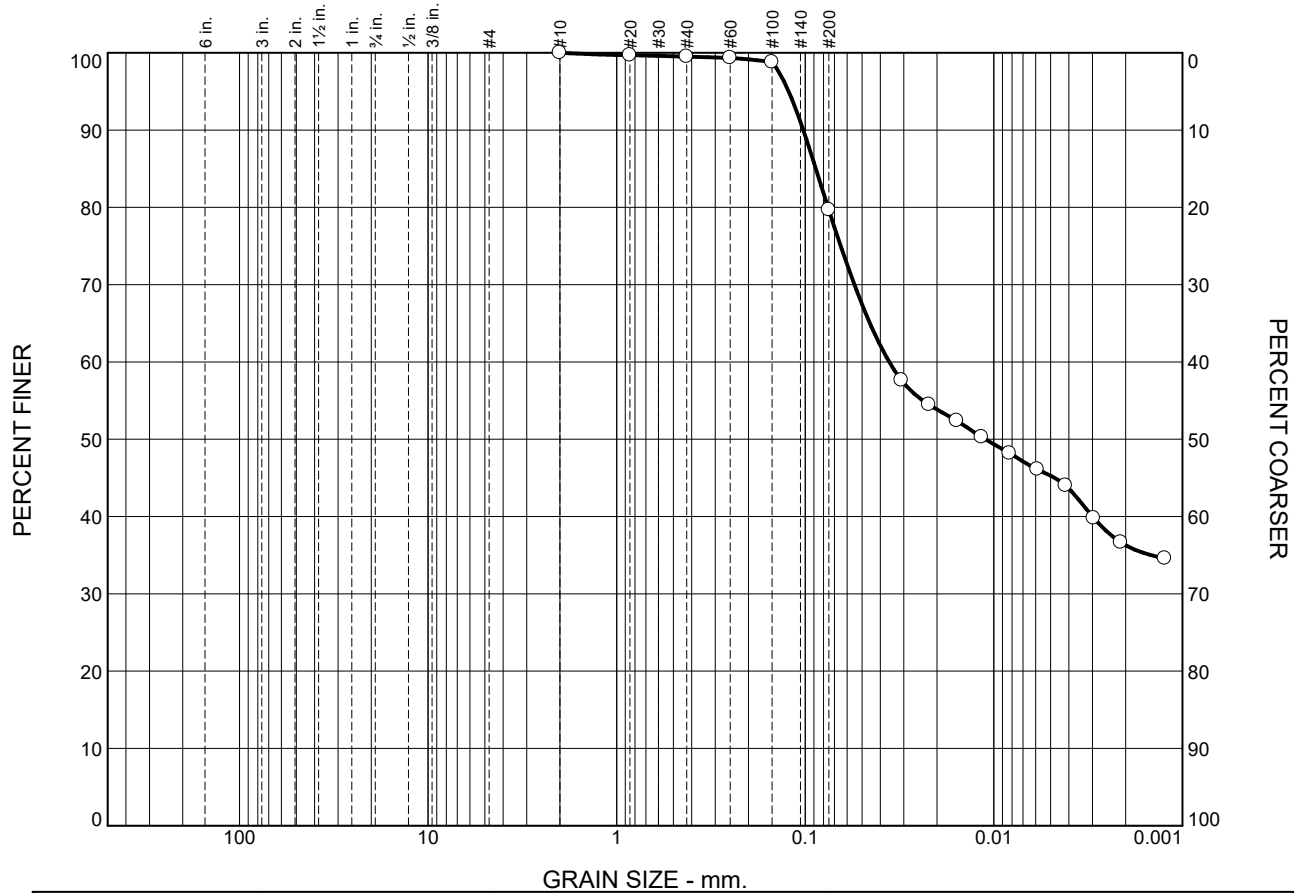
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	19.8	34.4	45.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-56	SP-2	5.5	Gray FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

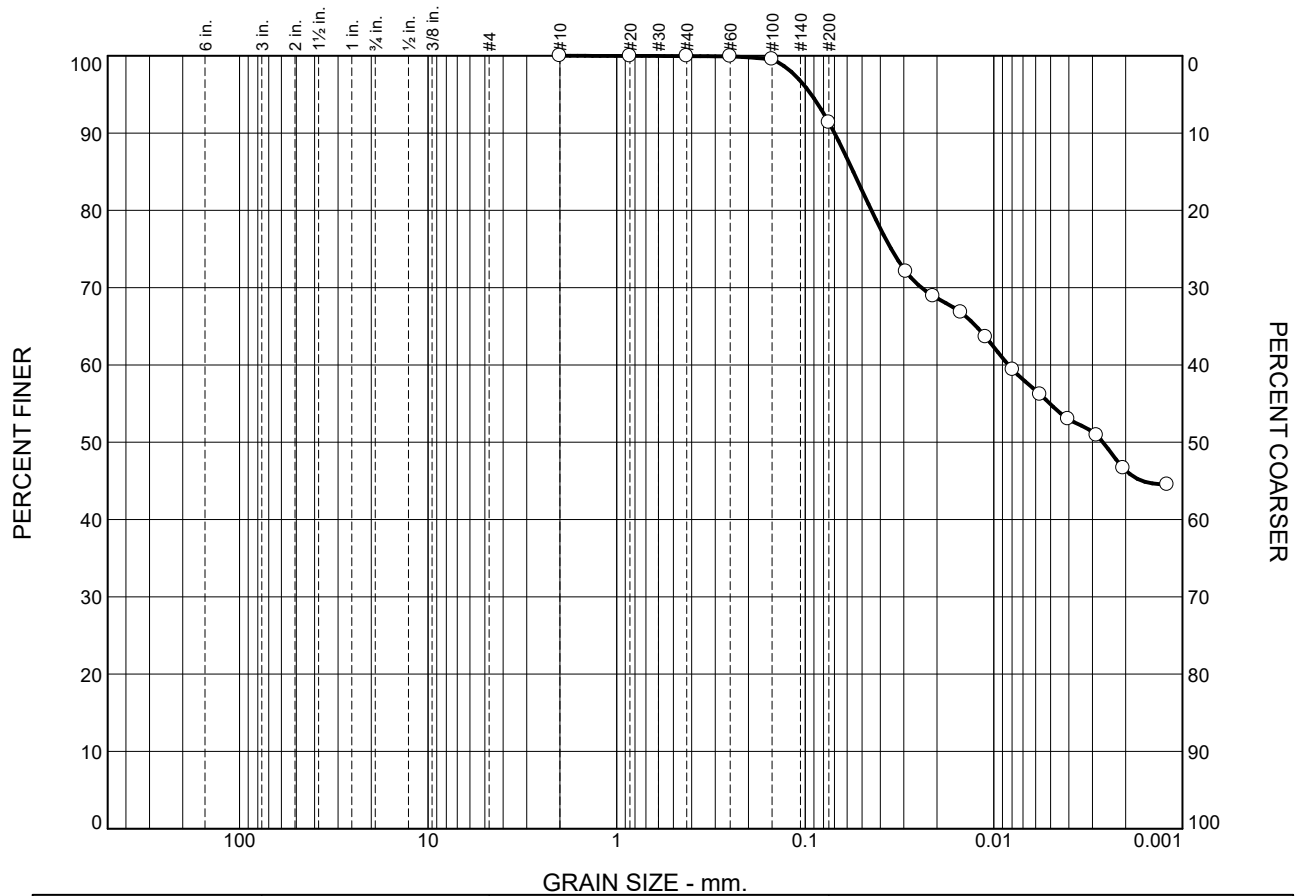
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	8.6	36.5	54.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-56	SP-5	20.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

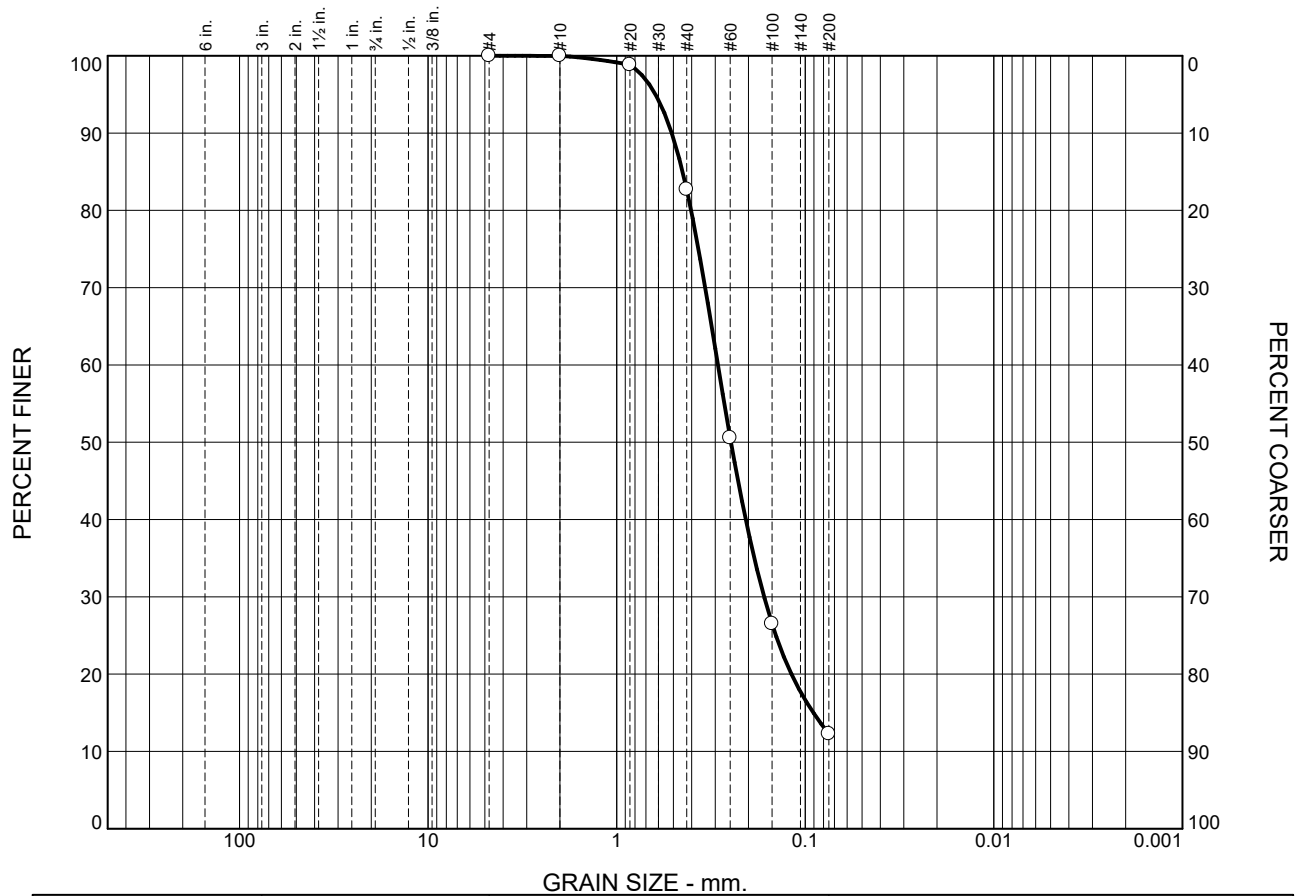
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	17.3	70.5	12.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-56	SP-6	50.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

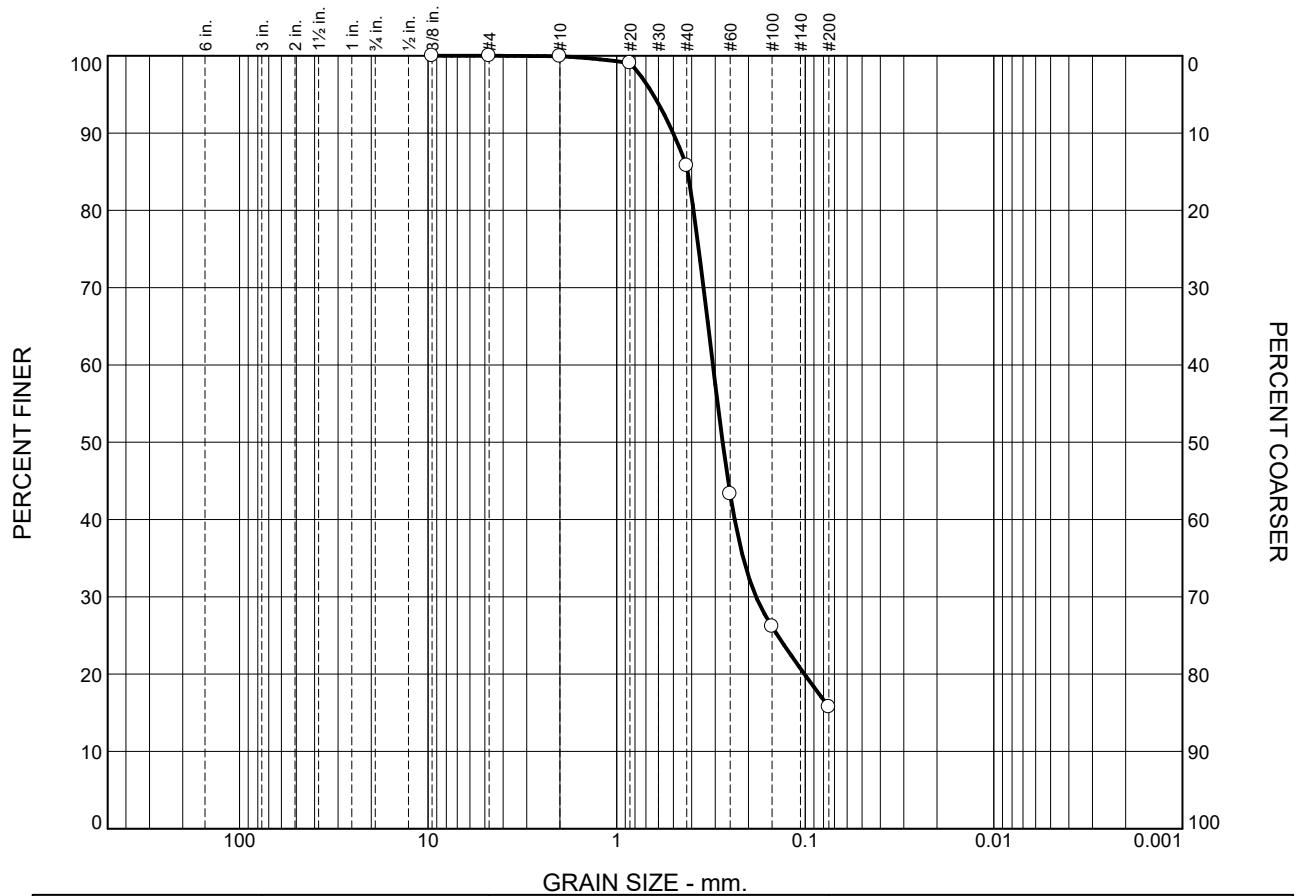
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	14.1	70.0	15.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-56	SP-8	55.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

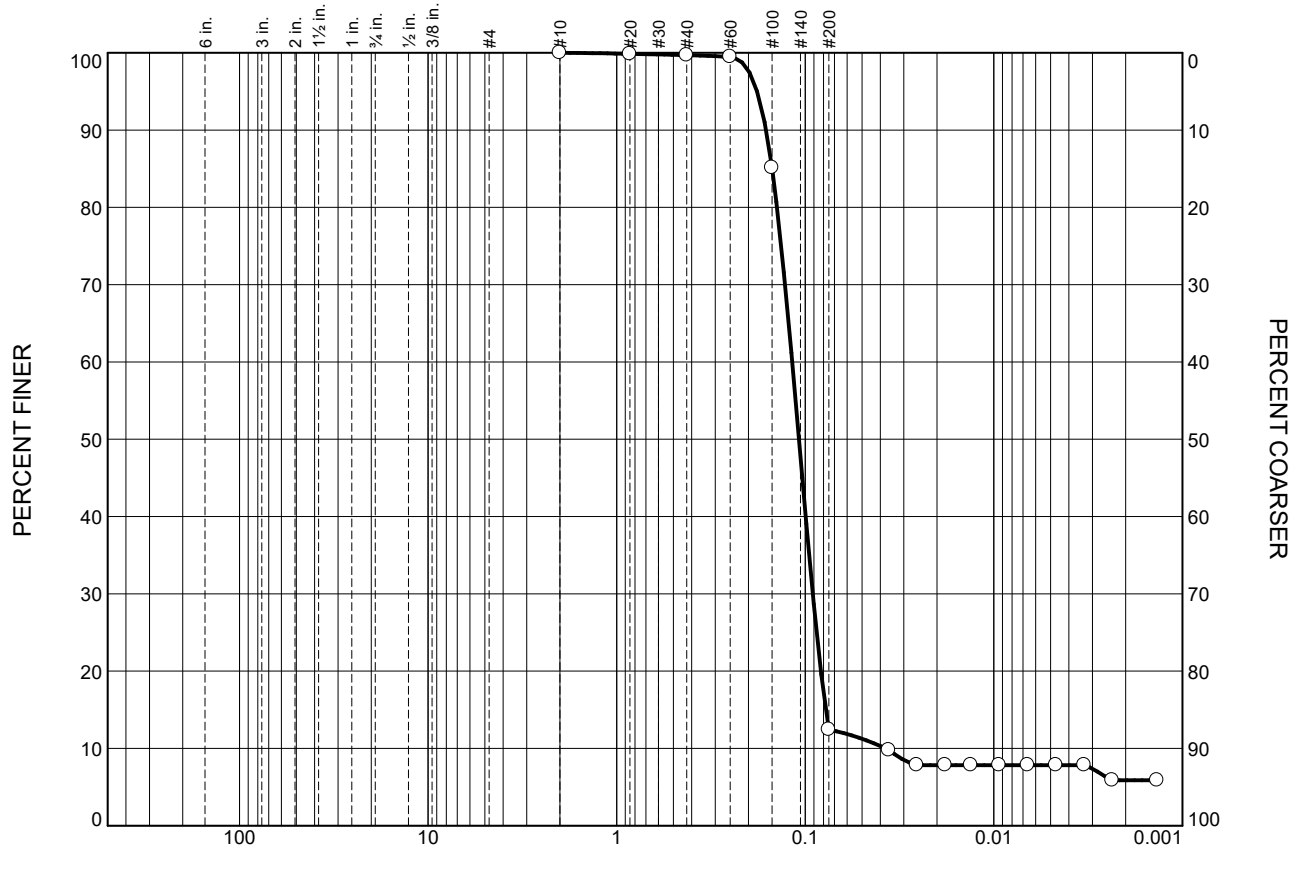
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	87.3	4.6	7.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-57	SP-2	5.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

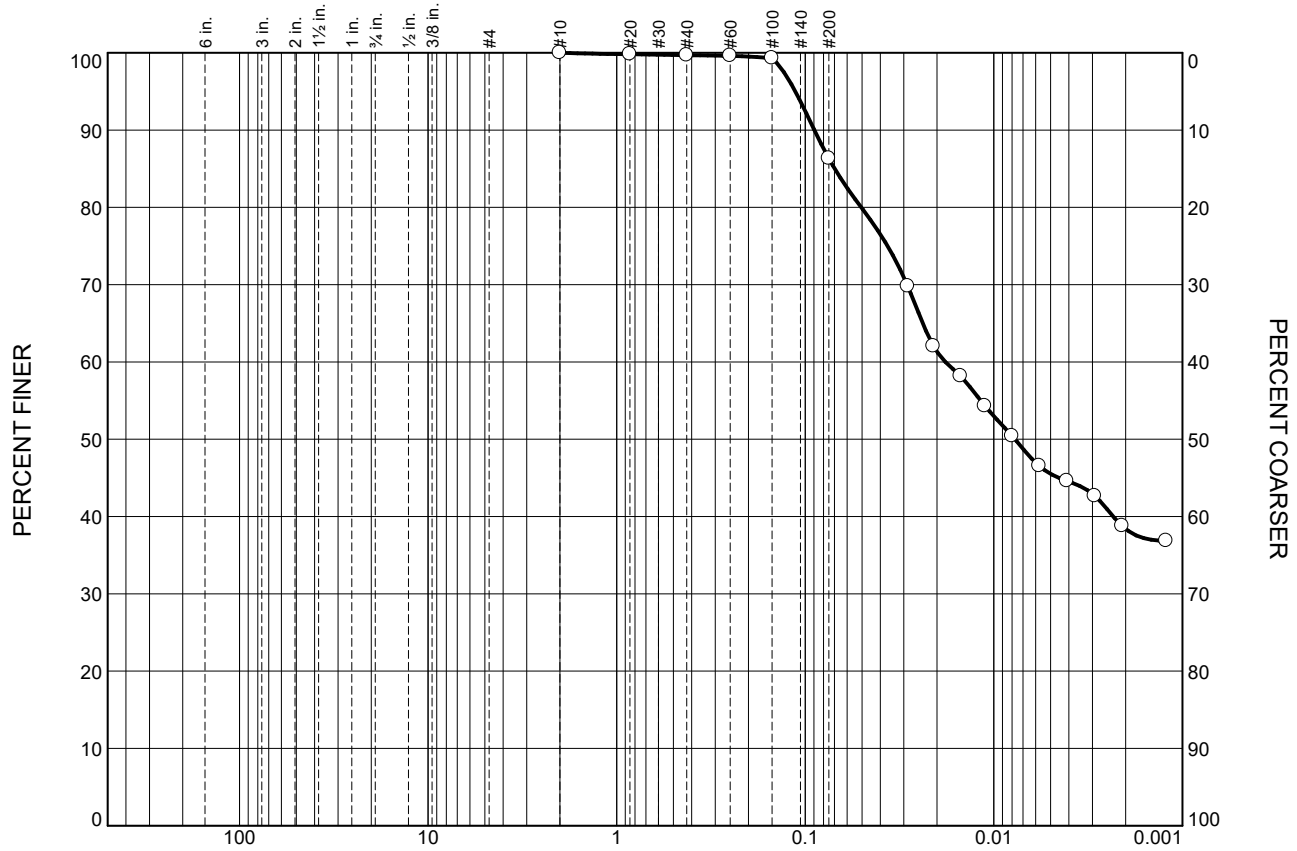
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	13.4	40.8	45.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-57	SP-4	15.5	Tan FAT CLAY; shell fragments	CH

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	74.7	8.9	15.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-57	SP-10	35	Tan SILTY SAND	SC

Tolunay-Wong Engineers, Inc.

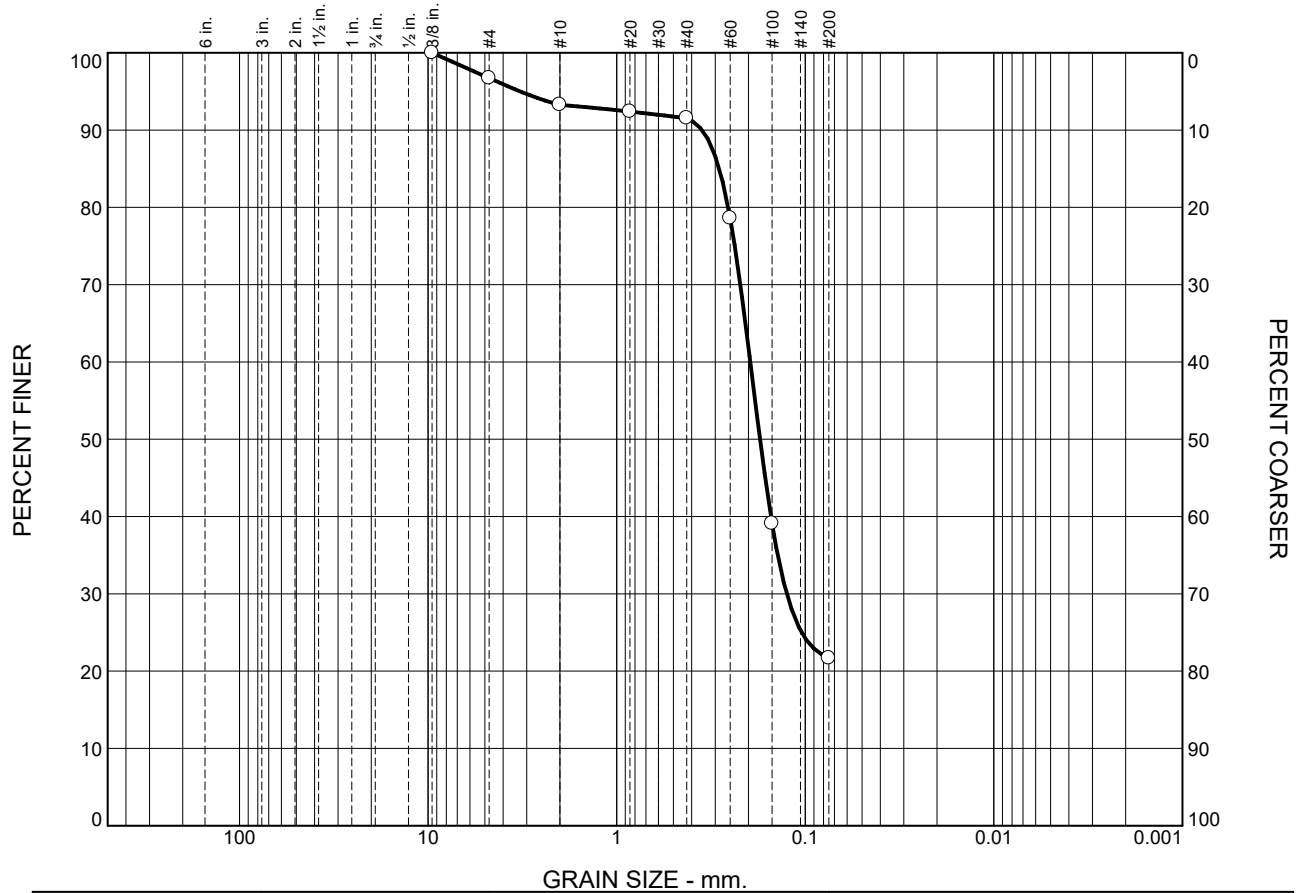
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.3	3.4	1.8	69.8	21.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-57	SP-15	47.5	Tan SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

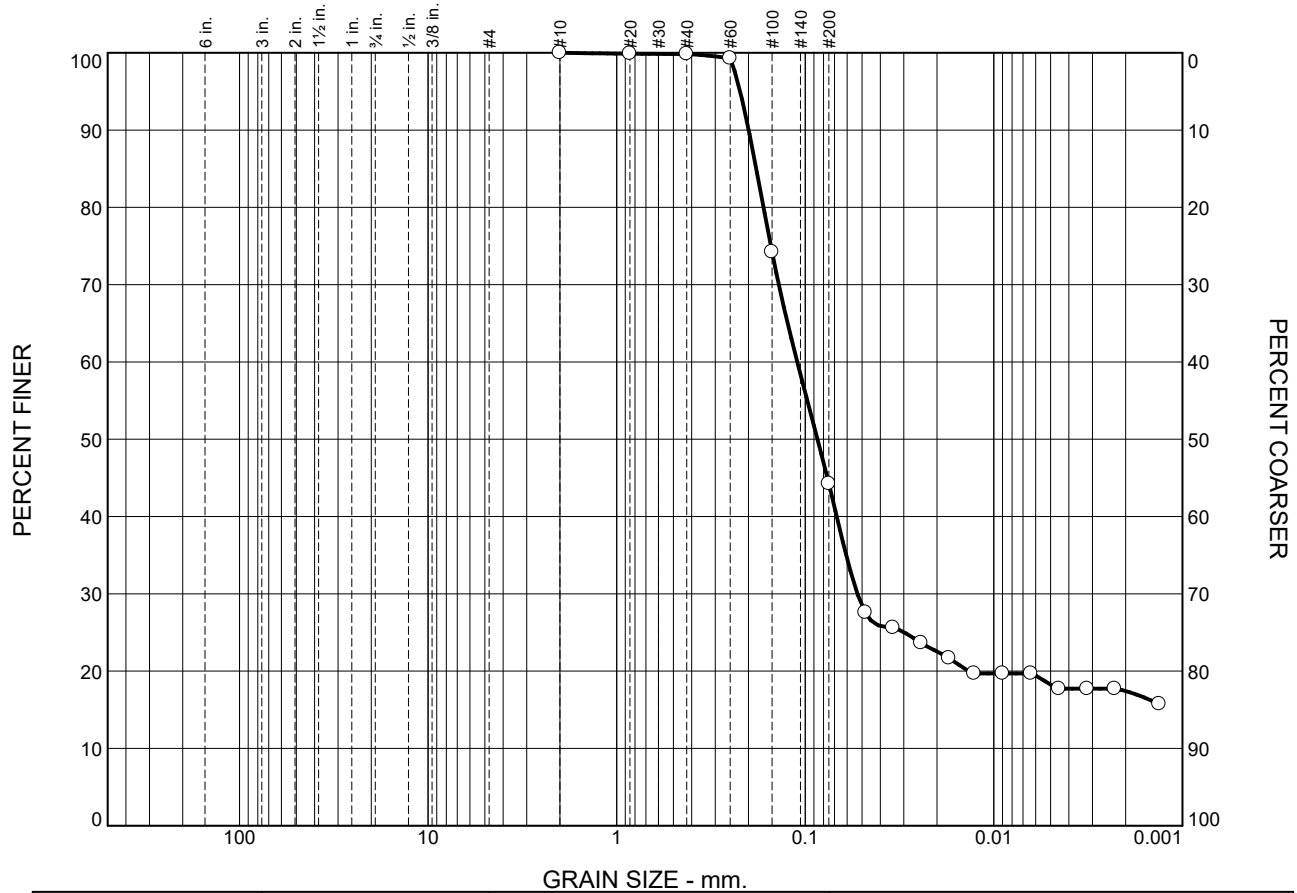
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	55.5	26.1	18.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-58	SP-2	5	Gray CLAYEY SAND	SC

Tolunay-Wong Engineers, Inc.

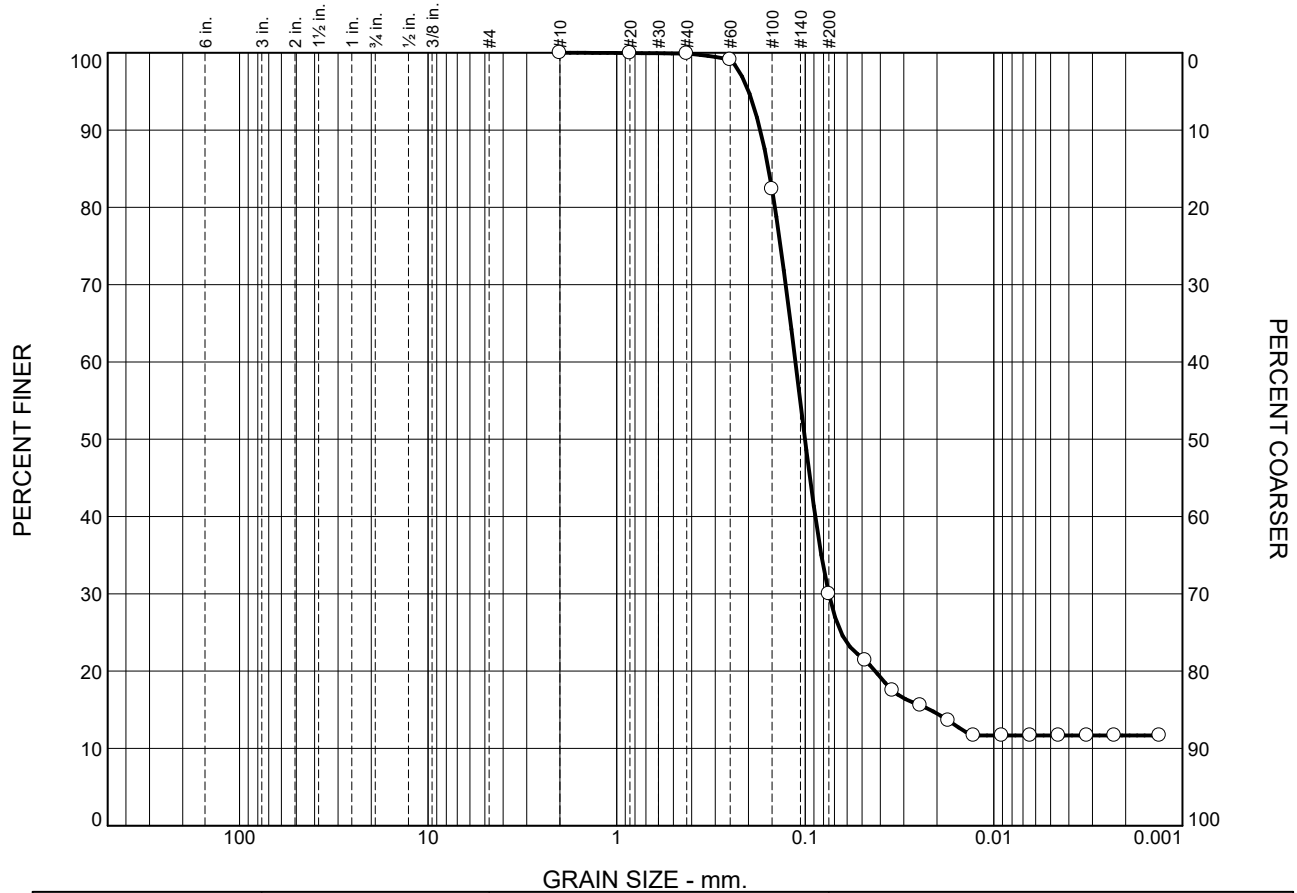
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	69.9	18.3	11.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-58	SP-6	25	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

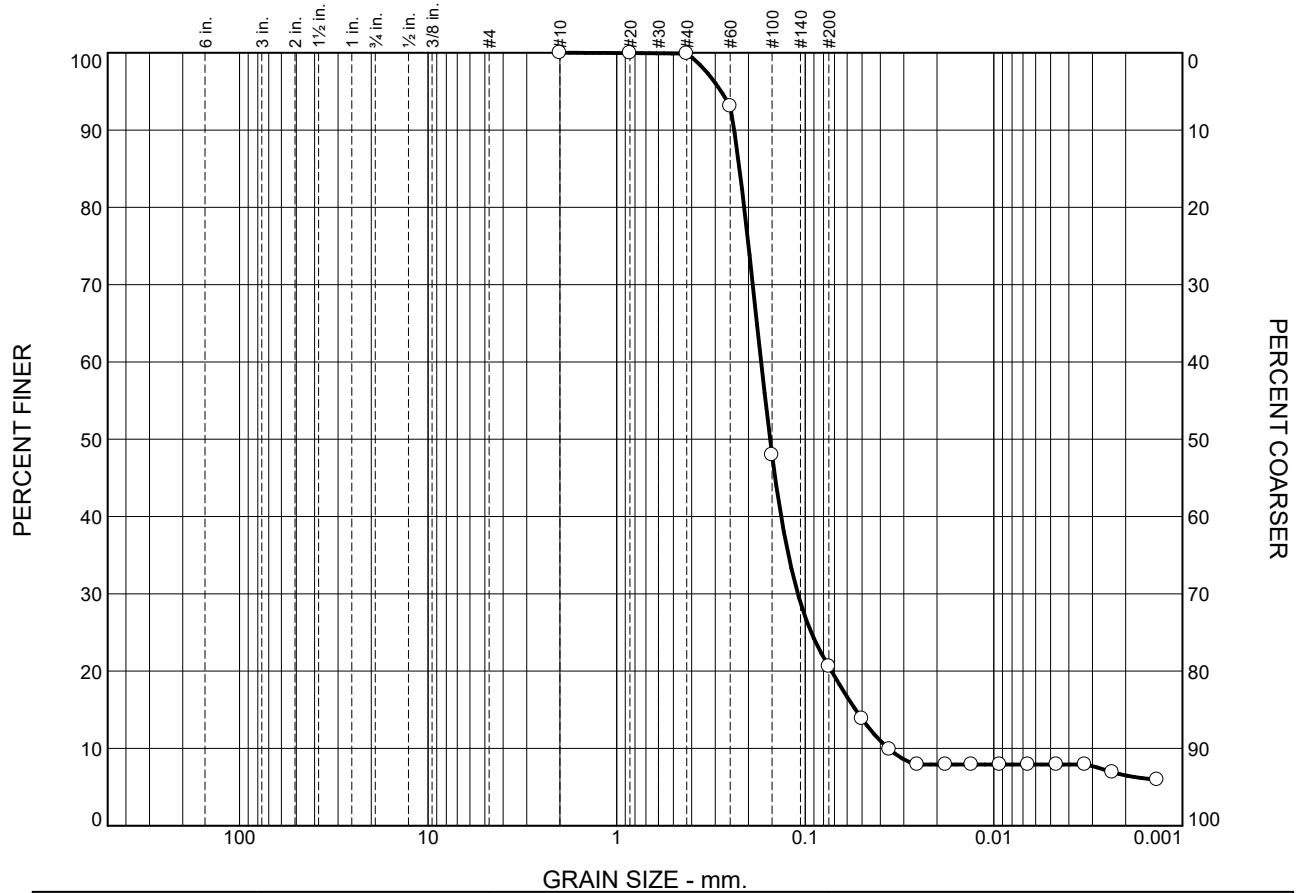
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	79.3	12.7	7.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-58	SP-11	40	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

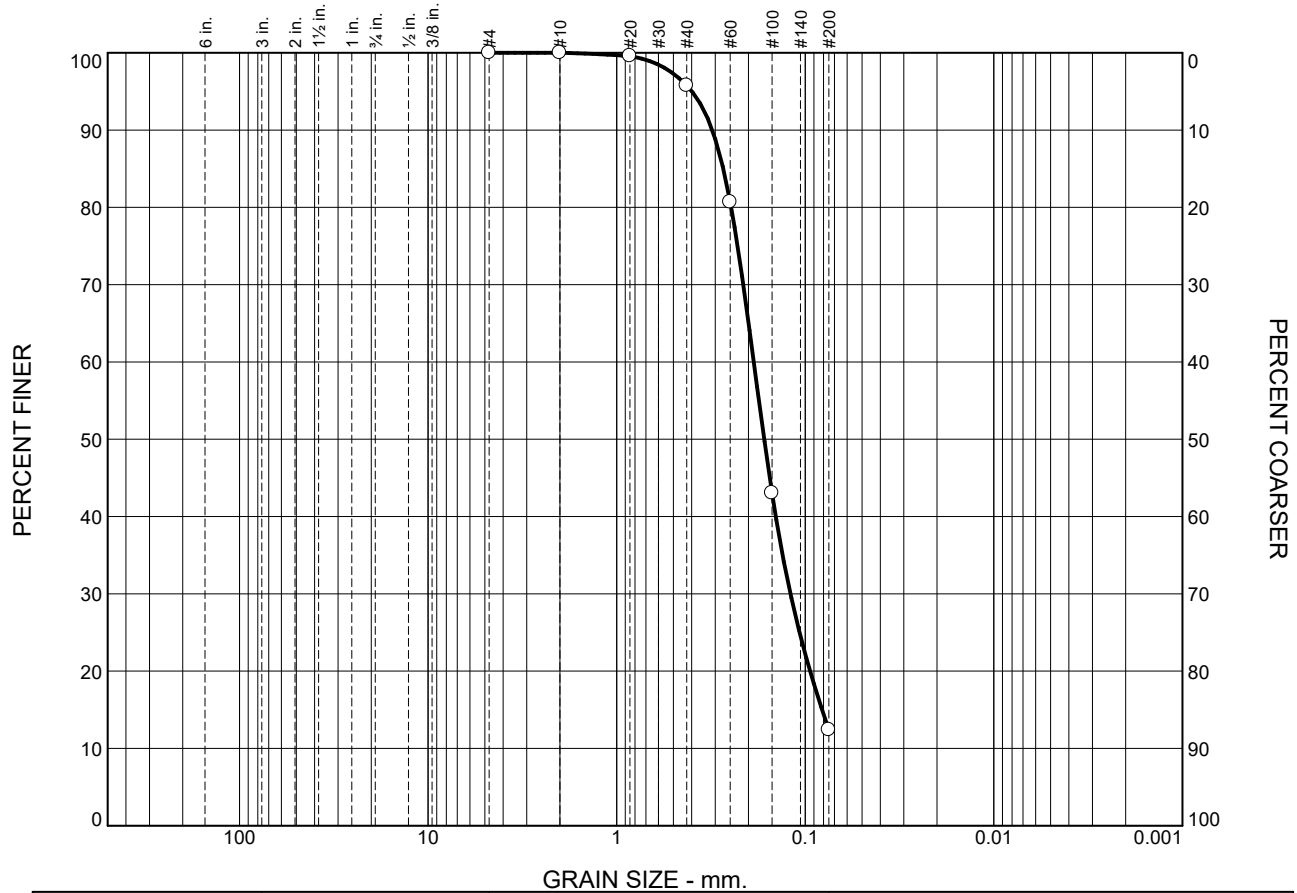
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.2	83.4	12.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-58	SP-15	55	Gray and tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

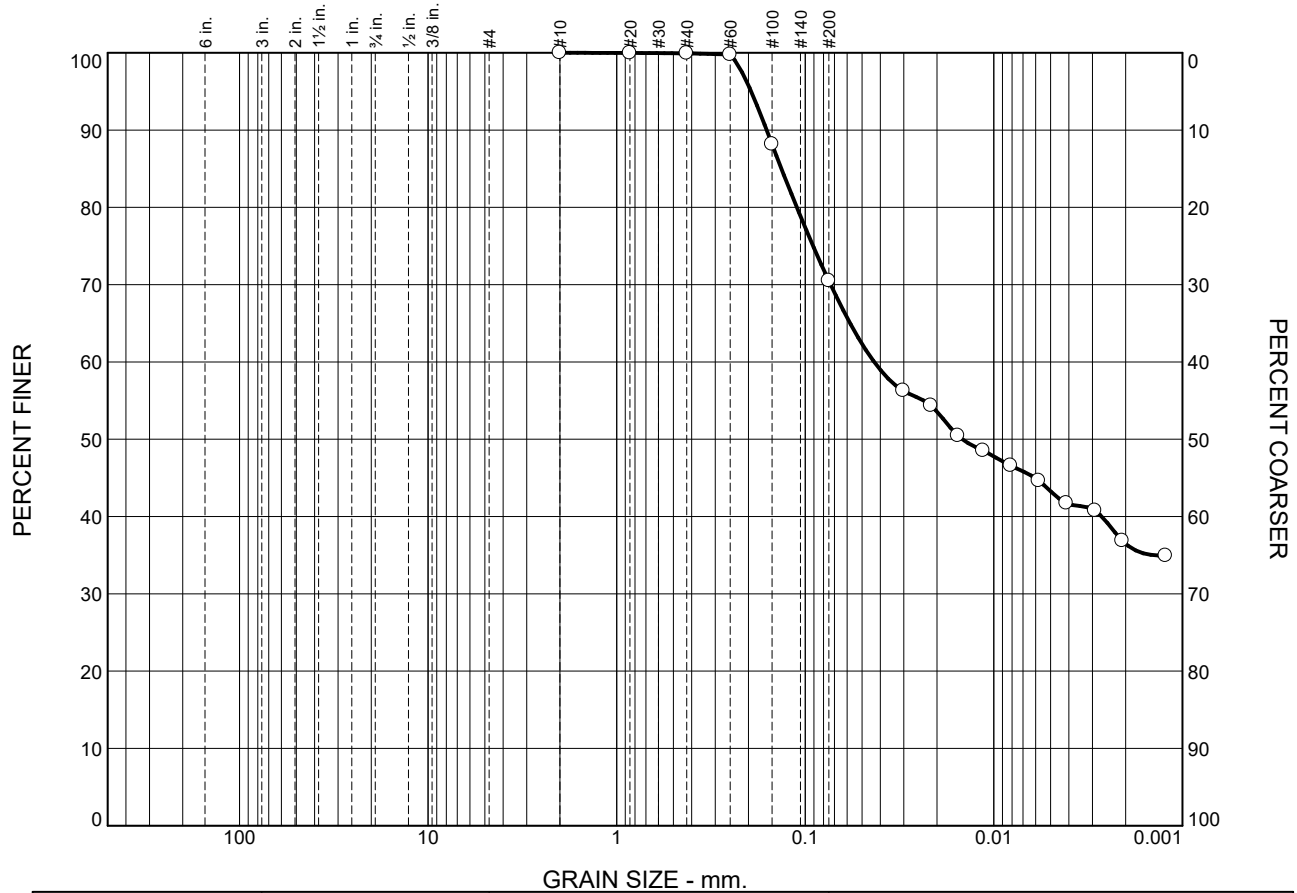
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	29.4	27.2	43.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-59	SP-1	0.5	Gray FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

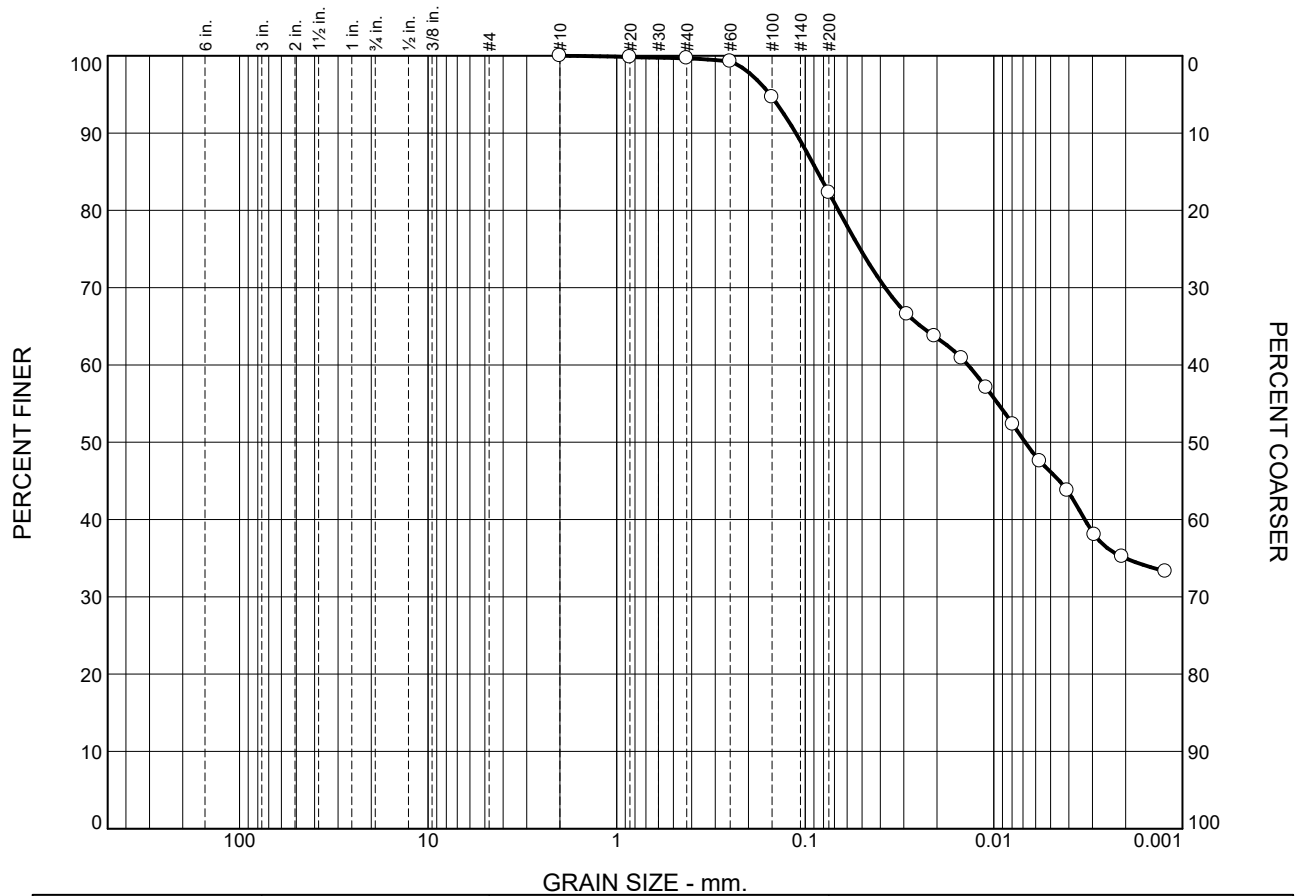
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	17.4	36.1	46.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-59	SP-4	15.5	Tan FAT CLAY with SAND	CH

Tolunay-Wong Engineers, Inc.

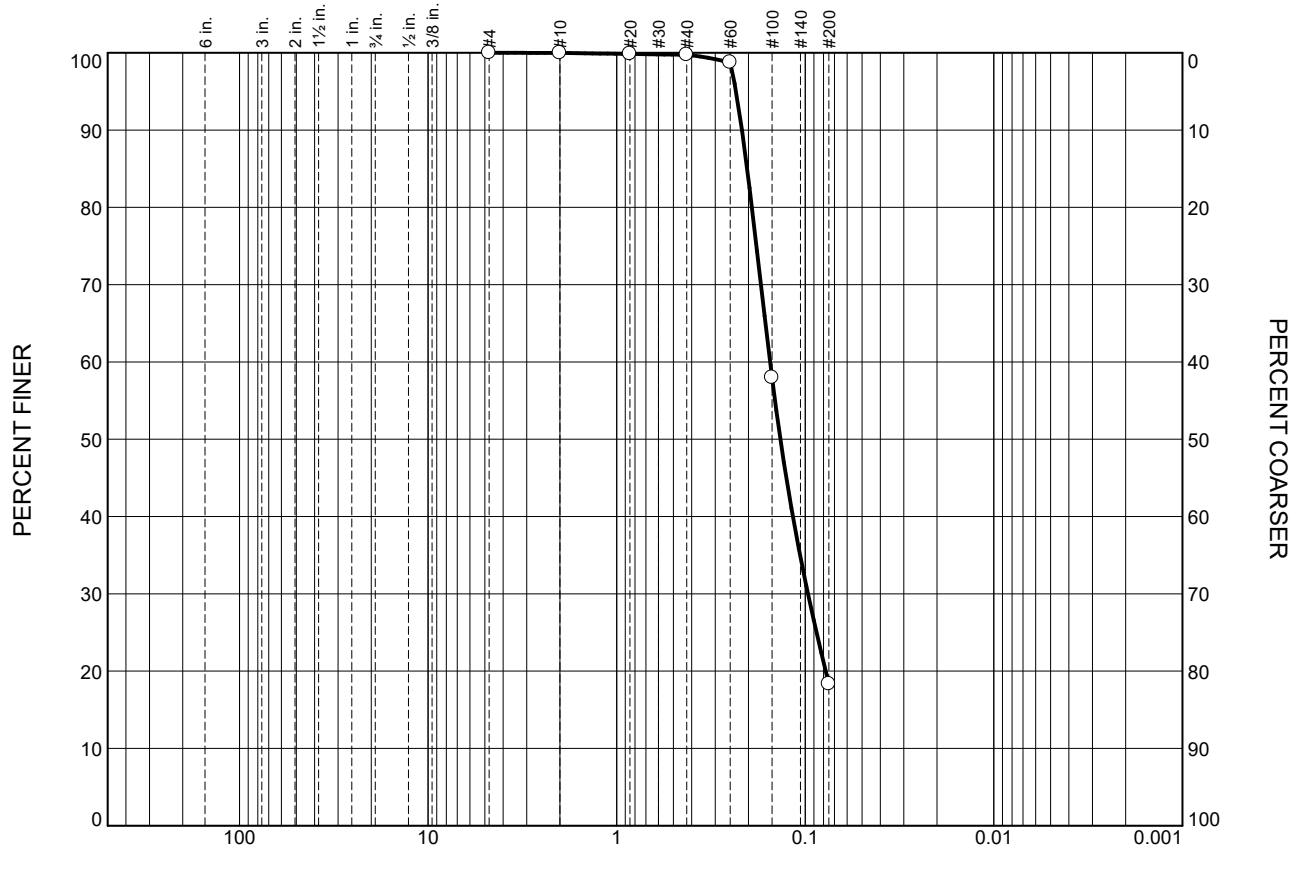
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	81.4	18.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-59	SP-5	33	Gray and tan SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

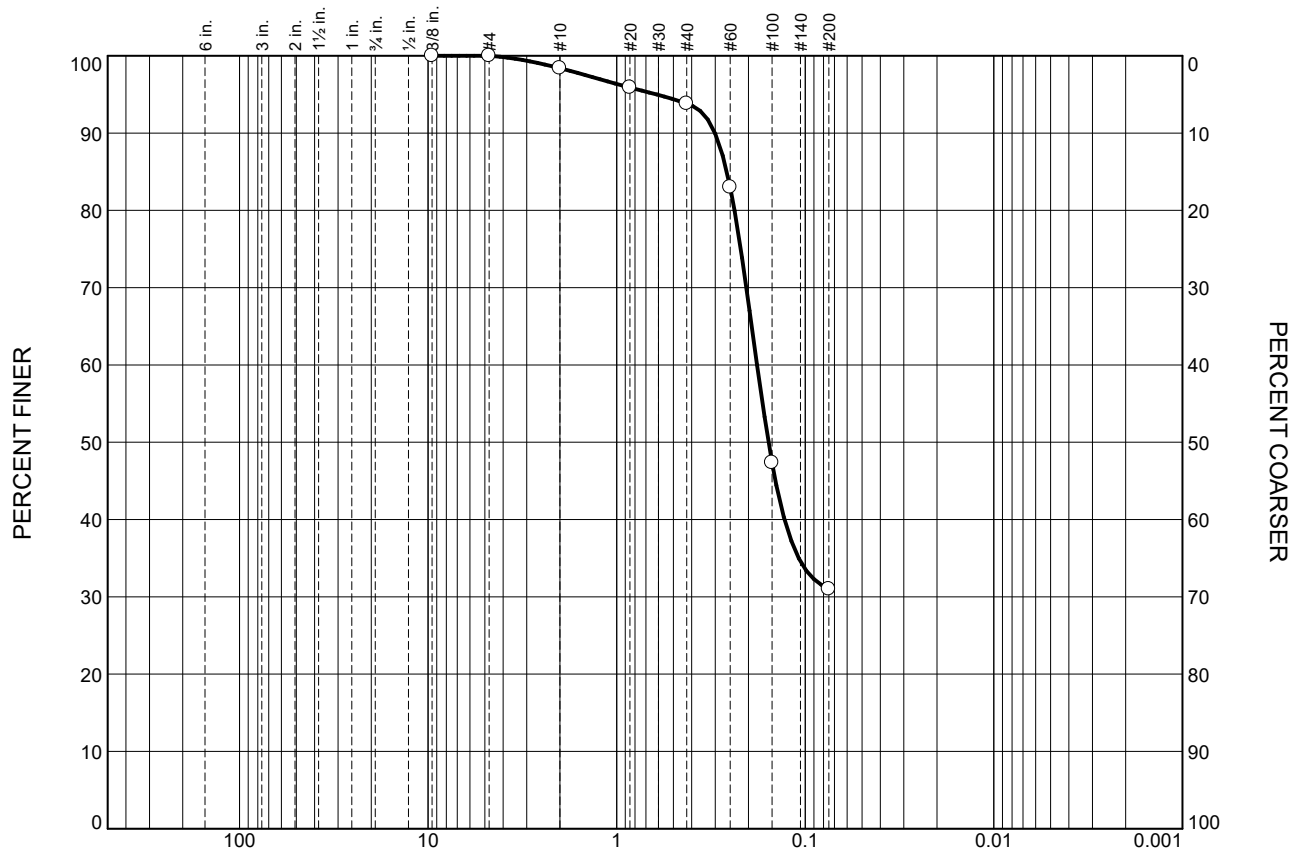
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.6	4.6	62.8	31.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-59	SP-7	38	Tan CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

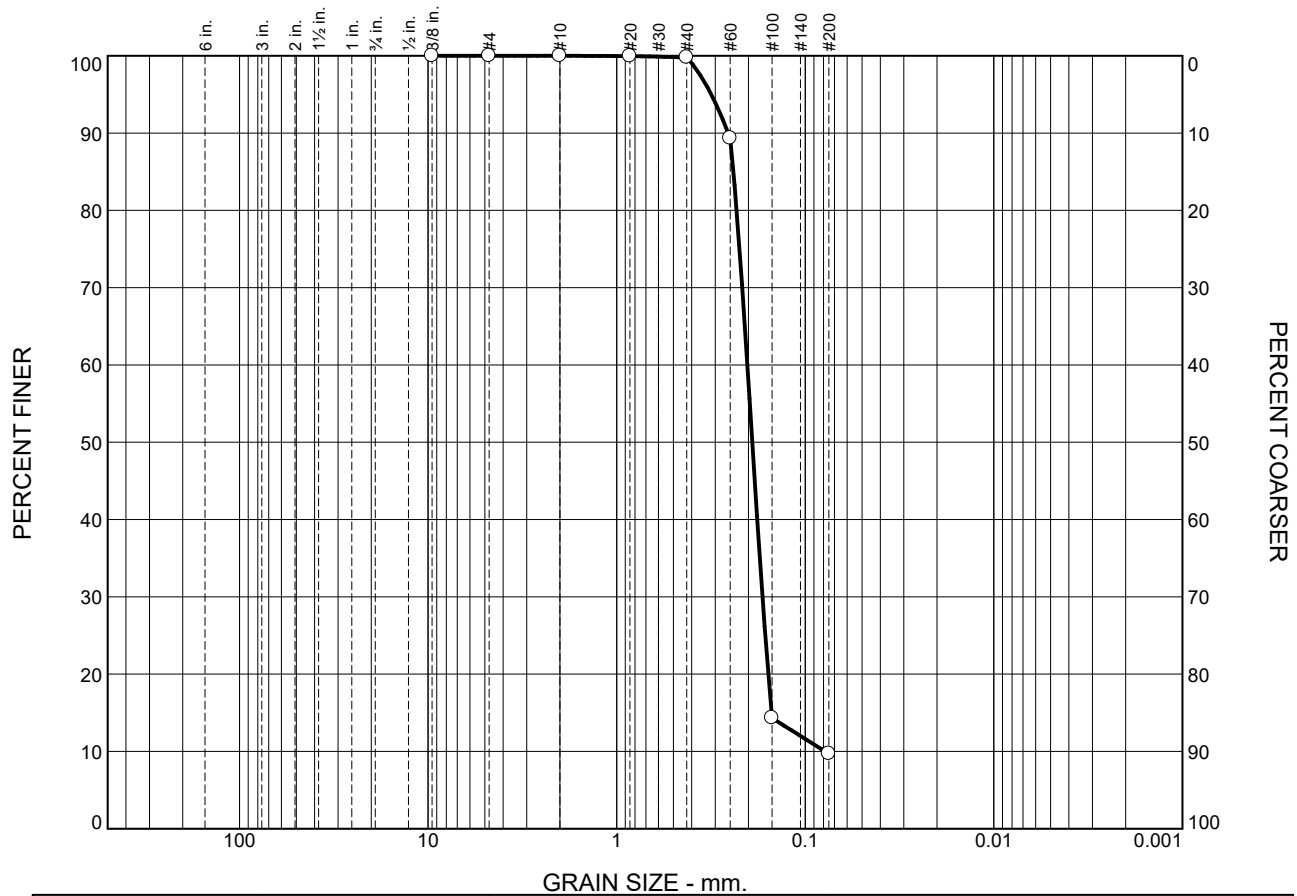
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	90.1	9.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-59	SP-9	43	Tan POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

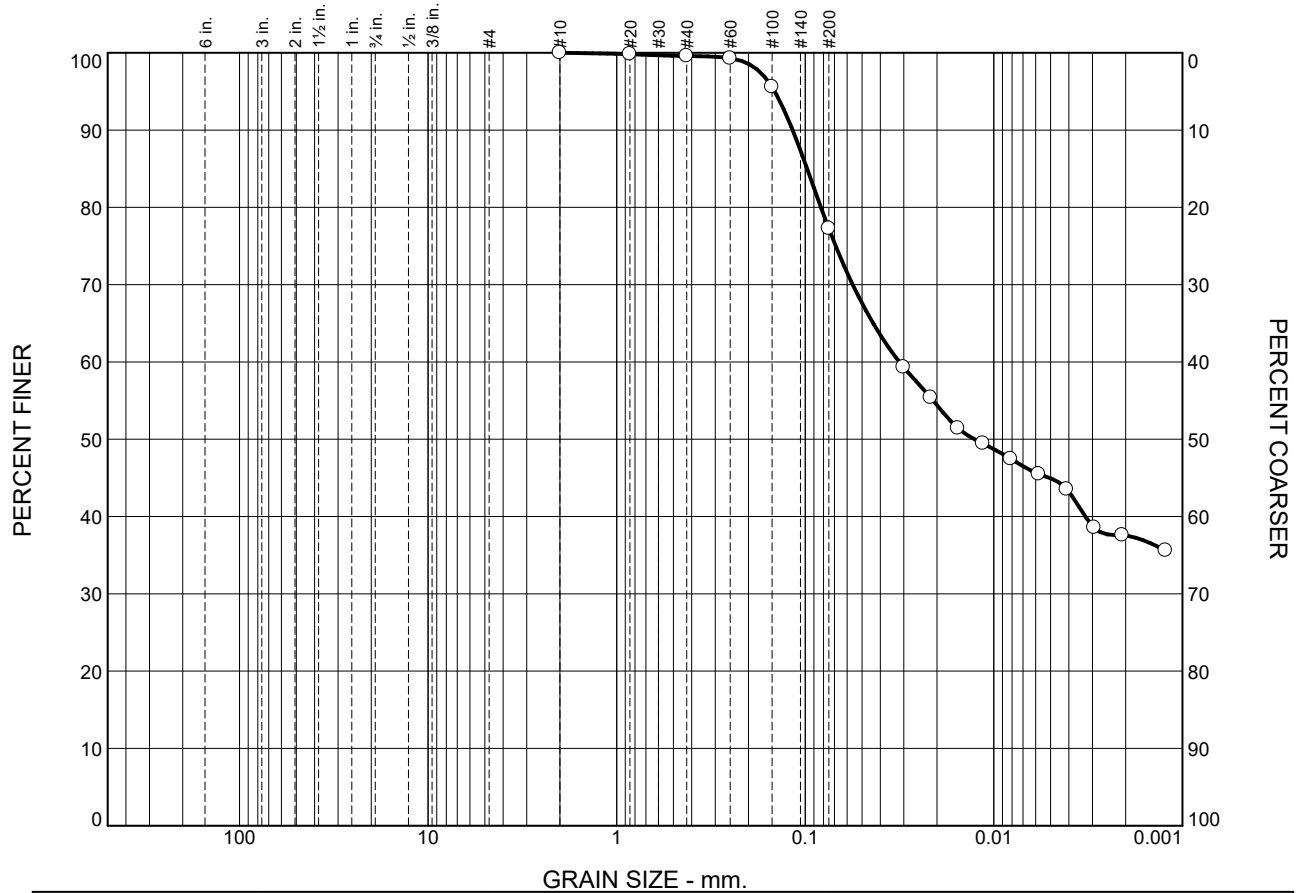
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	22.3	32.3	45.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-60	SP-1	0.5	Gray FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

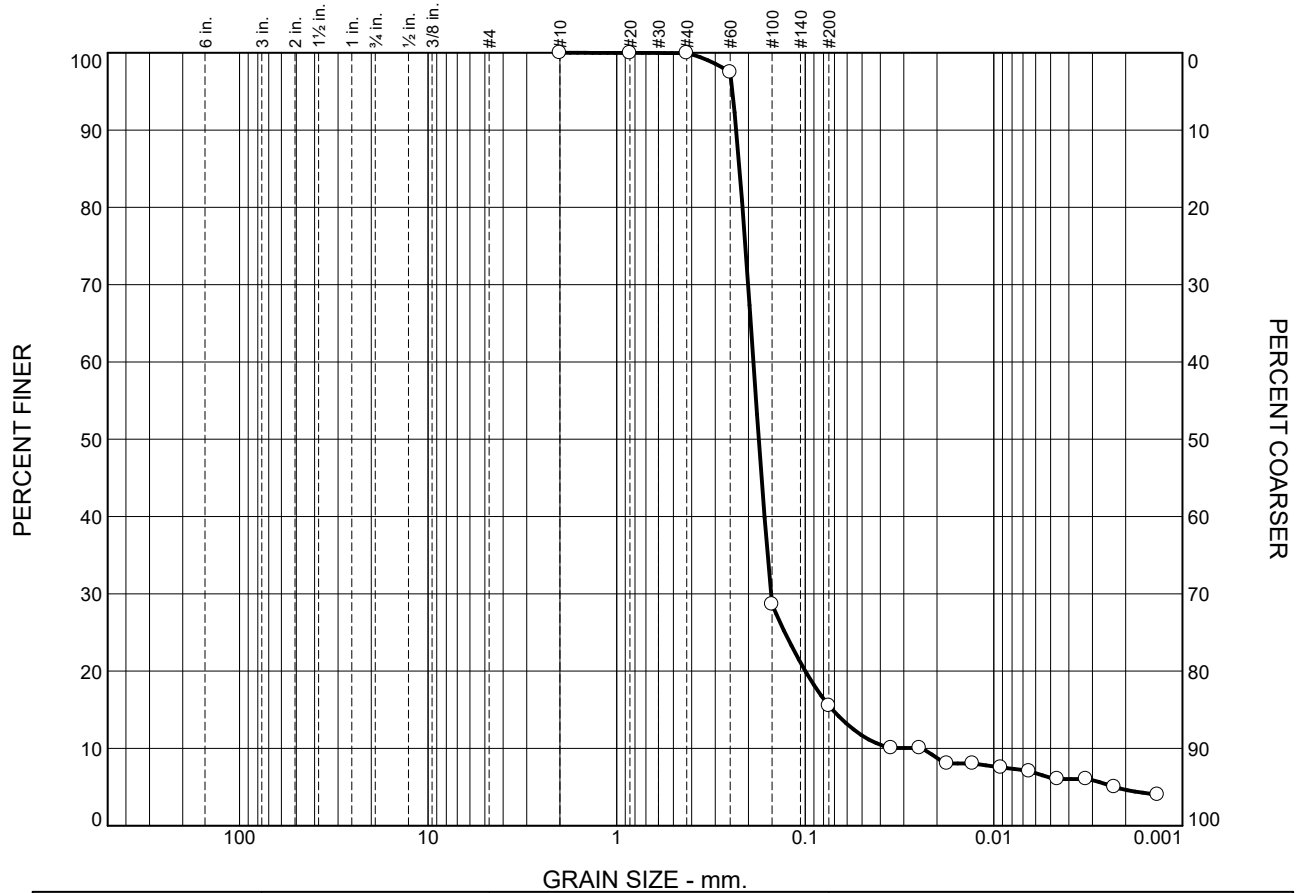
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	84.5	9.3	6.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-60	SP-3	34.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

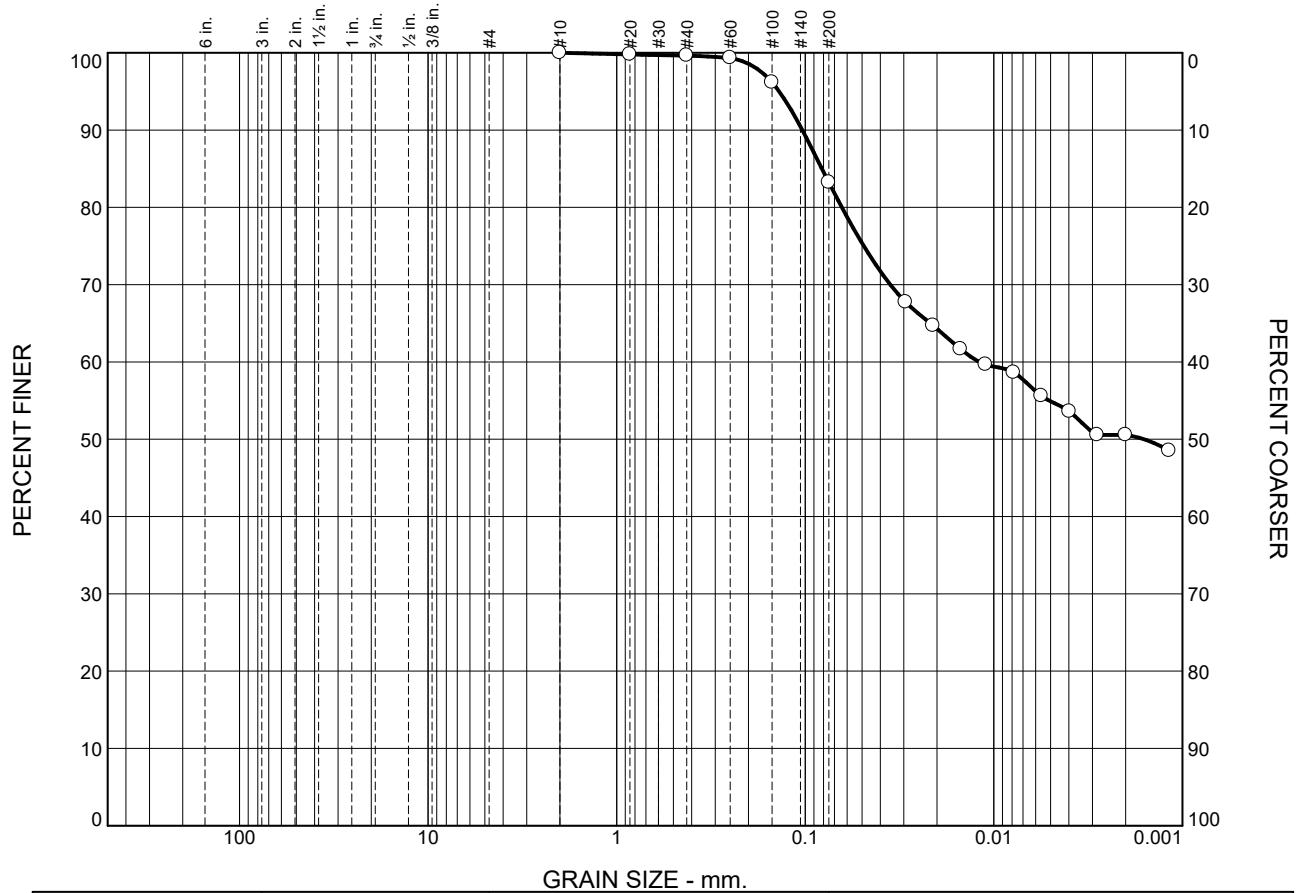
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	16.4	28.3	54.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-60	ST-1	10	Gray and tan FAT CLAY with SAND; calcareous	CH

Tolunay-Wong Engineers, Inc.

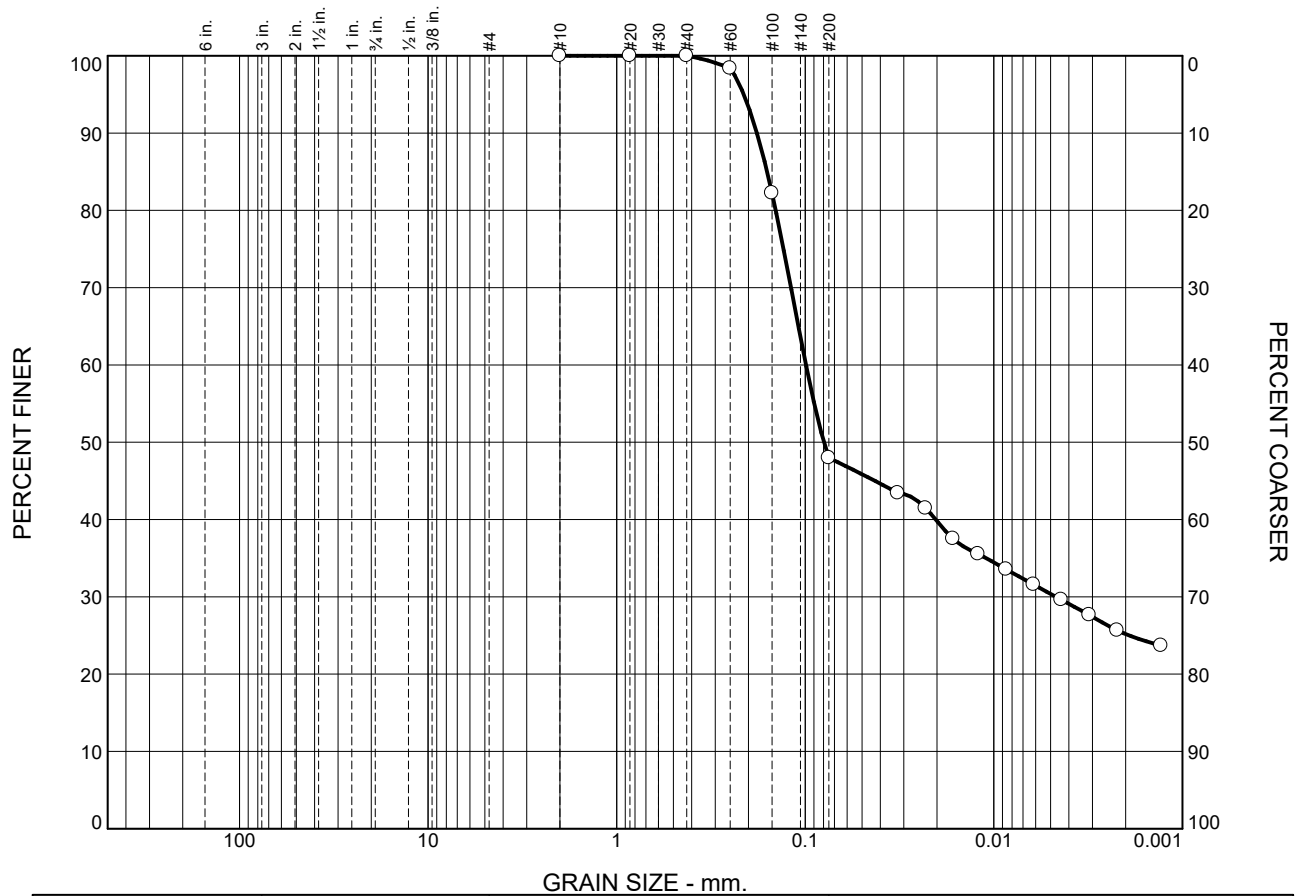
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	52.0	17.6	30.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-61	SP-5	20.5	Tan SANDY LEAN CLAY	SC

Tolunay-Wong Engineers, Inc.

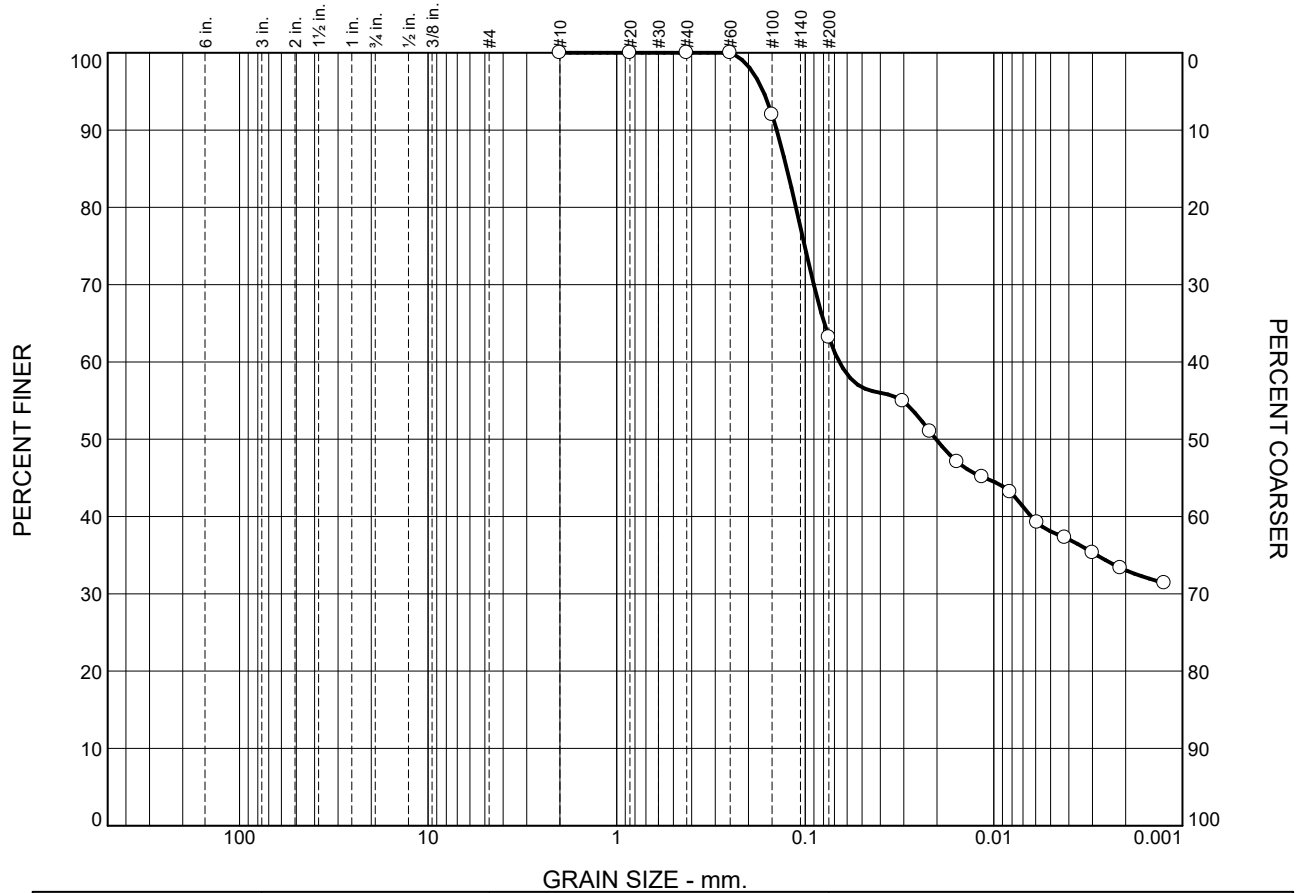
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	36.8	25.1	38.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-62	SP-3	10.5	Gray SANDY LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	82.0	6.2	11.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-62	SP-5	20.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

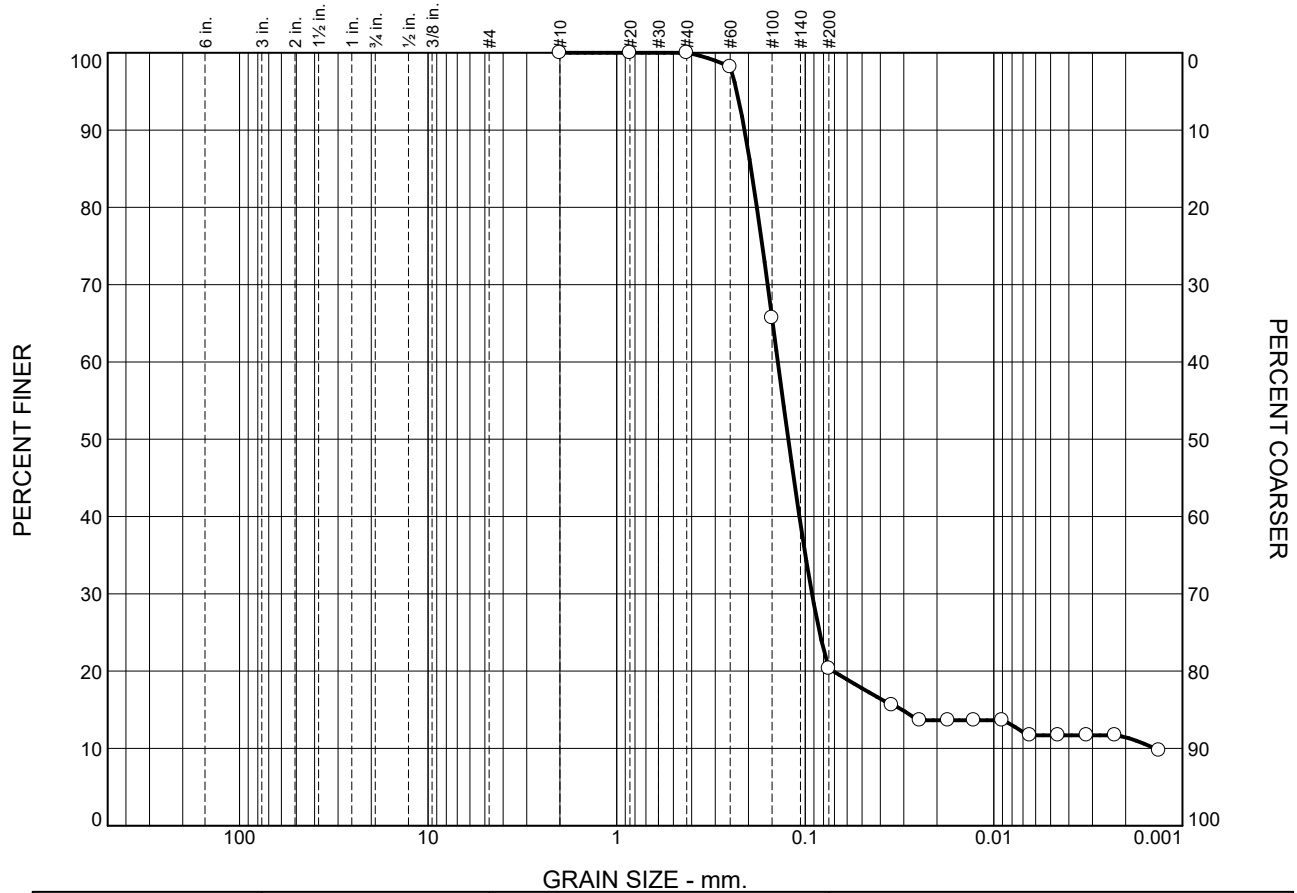
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	79.7	8.6	11.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-62	SP-6	25.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

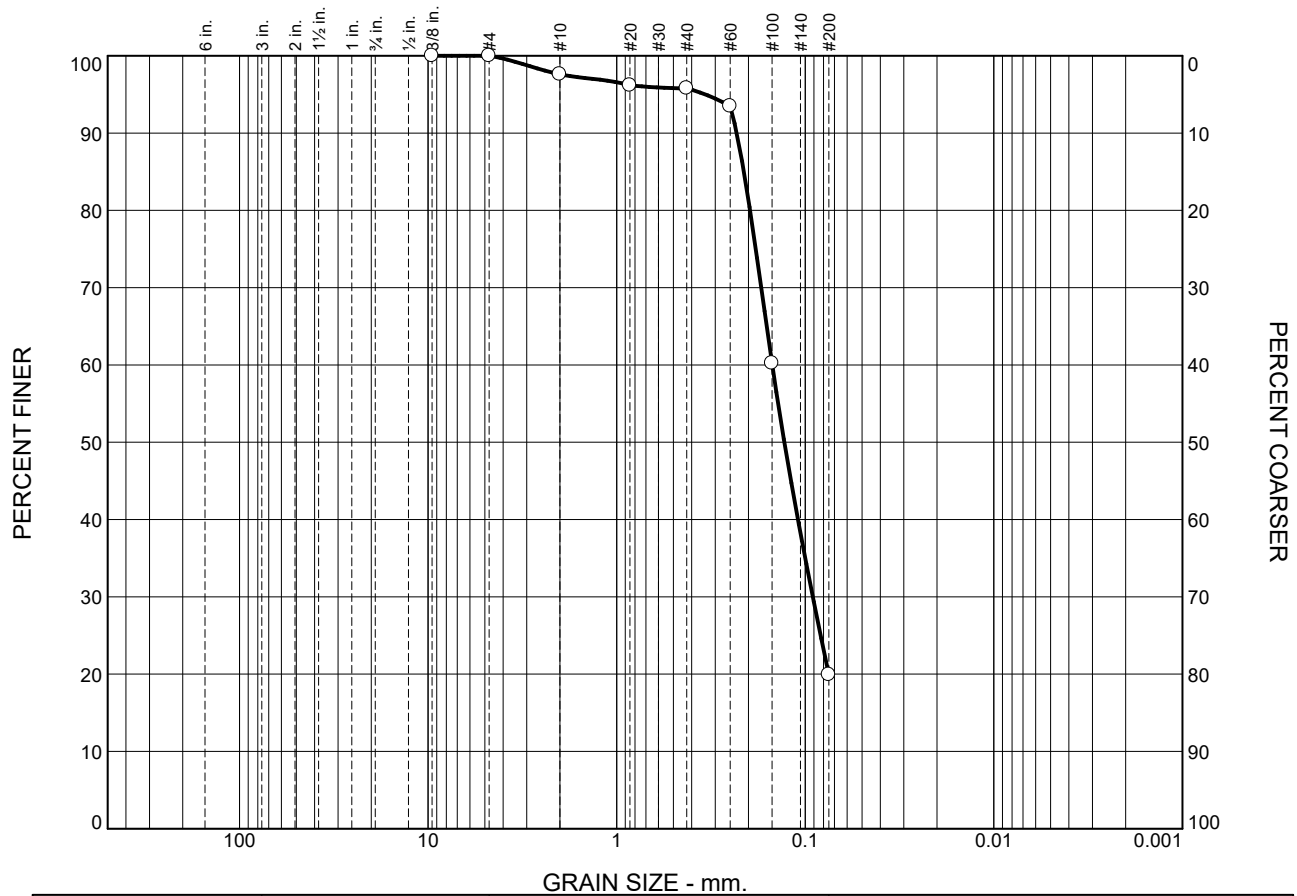
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	2.4	1.8	75.9	19.9	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-62	SP-7	30.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

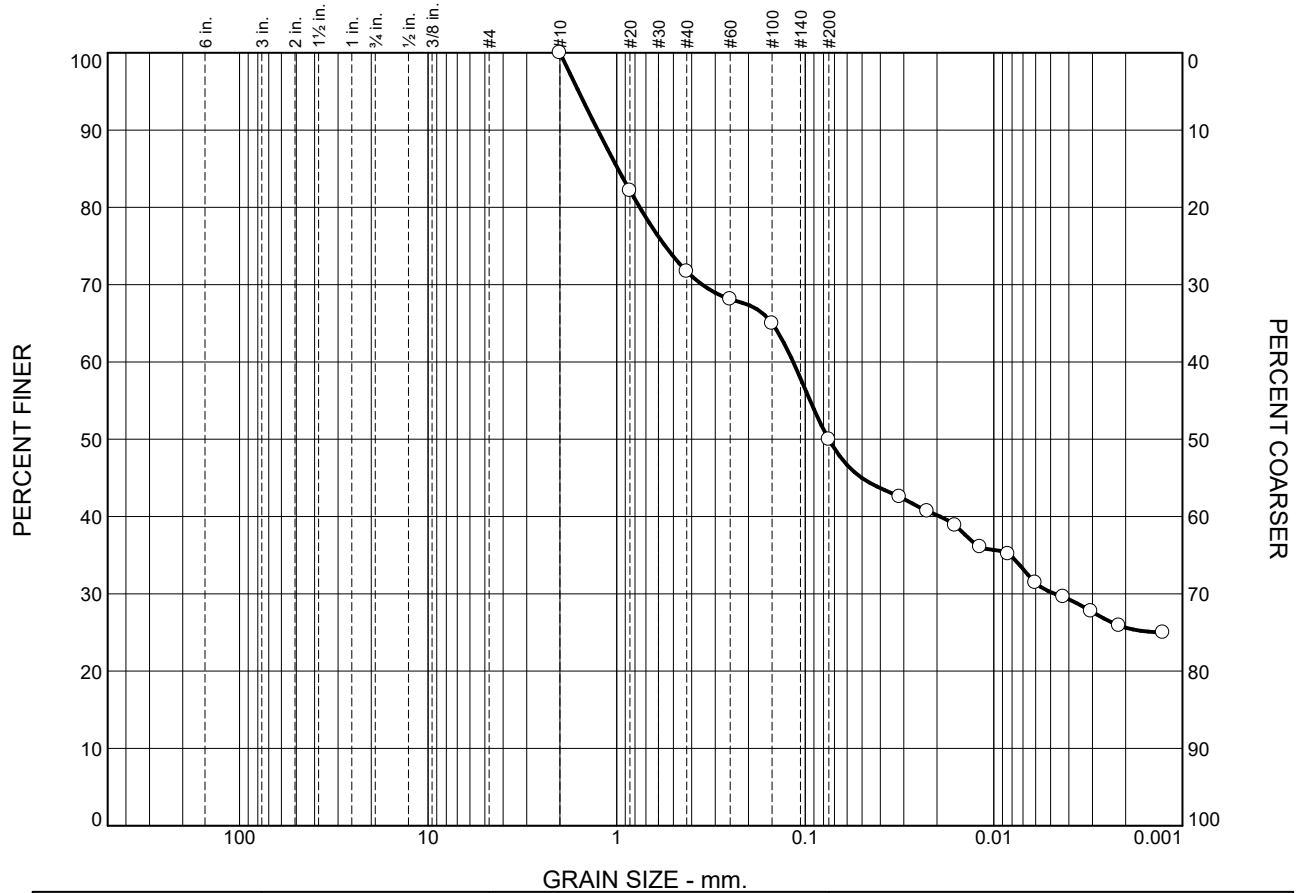
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	28.3	21.7	19.8	30.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-63	SP-1	0	Gray LEAN CLAY with SAND (CL)	CL

Tolunay-Wong Engineers, Inc.

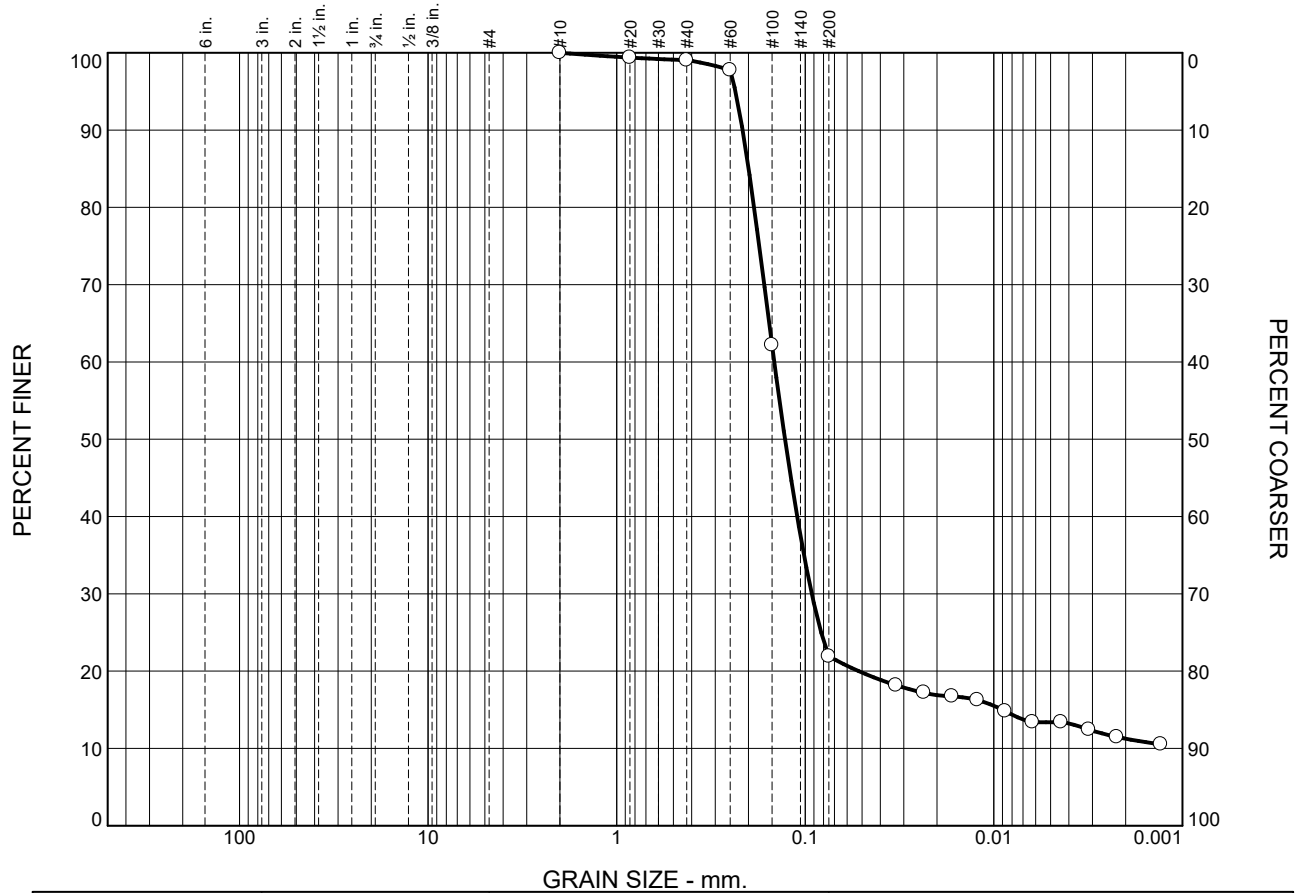
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	77.1	8.5	13.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-63	SP-2	5	Gray SILTY CLAYEY SAND	CL

Tolunay-Wong Engineers, Inc.

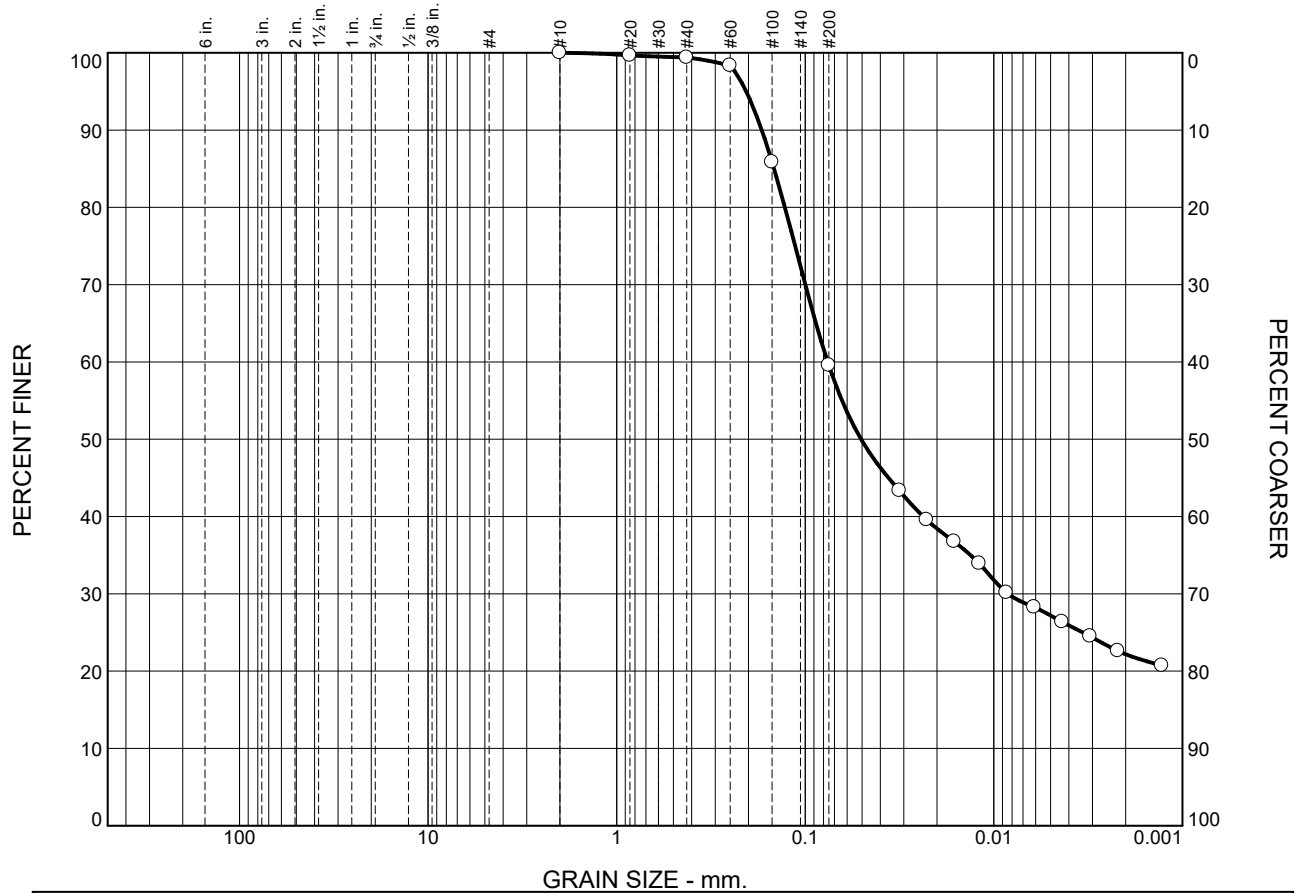
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.6	39.8	32.4	27.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-63	SP-3	10	Tan SANDY LEAN CLAY	CL

Tolunay-Wong Engineers, Inc.

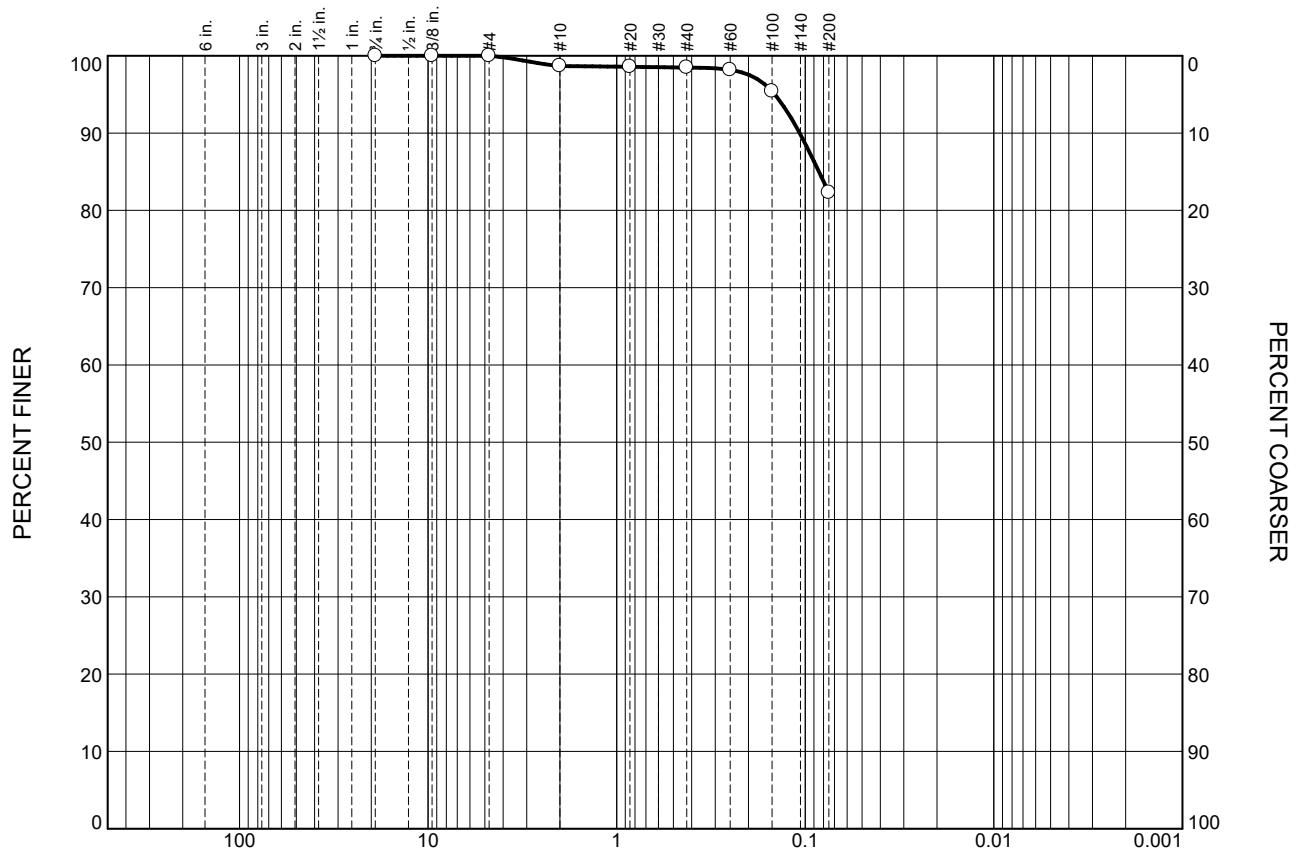
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.3	0.2	16.2	82.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-63	SP-4	12.5	Gray and tan LEAN CLAY with SAND	CL

Tolunay-Wong Engineers, Inc.

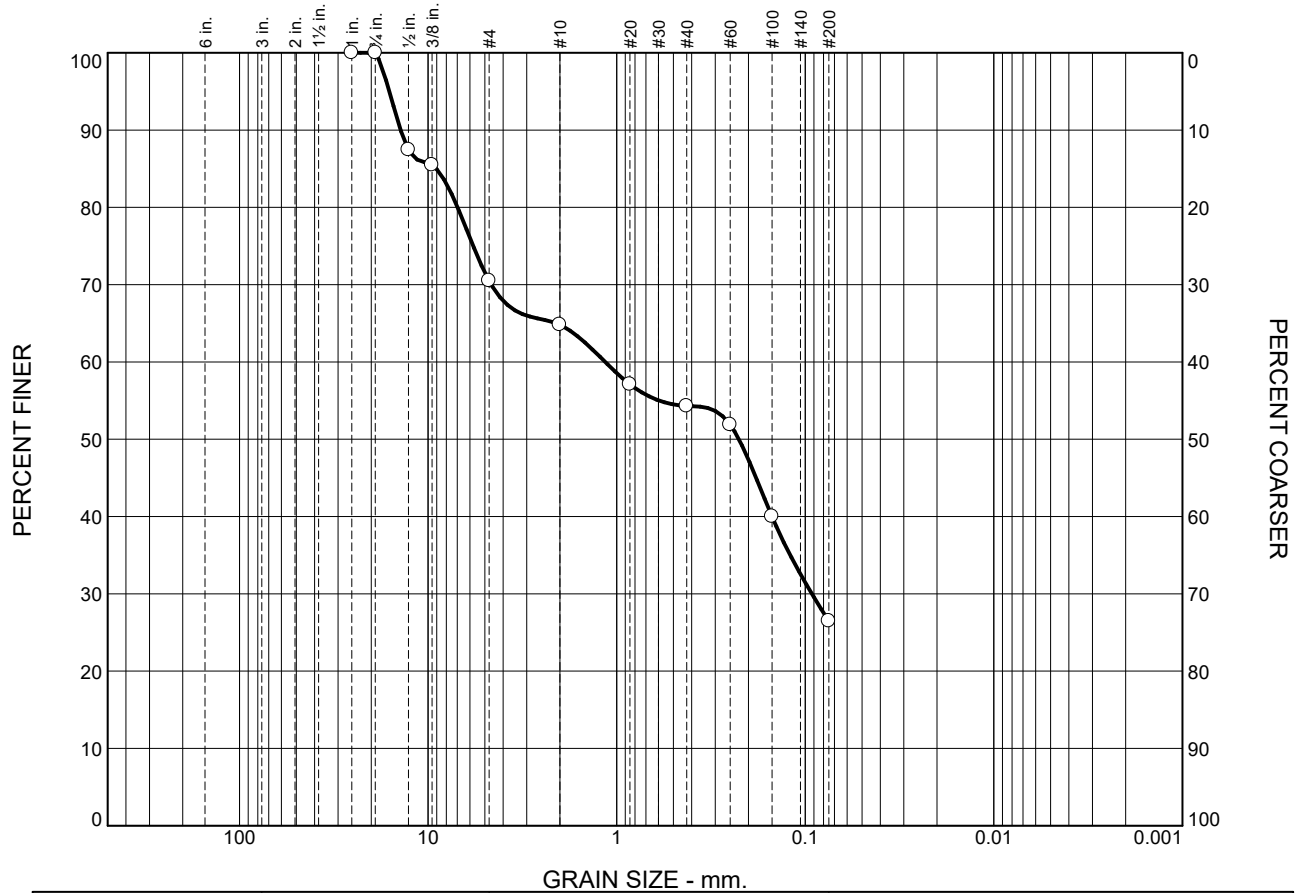
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	29.5	5.7	10.5	27.8	26.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-64	SP-2	5.5	Gray SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

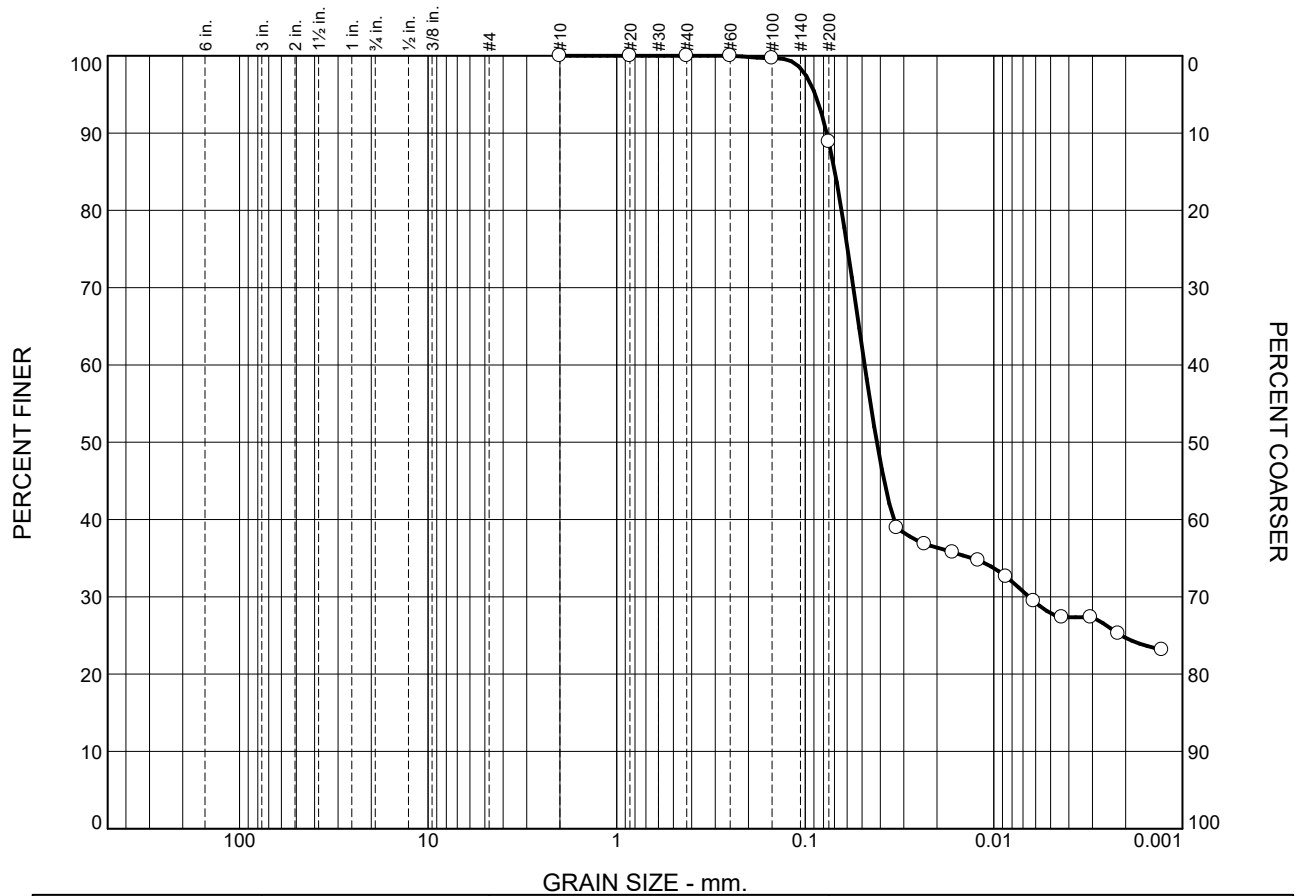
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	11.1	61.0	27.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-64	SP-3	10.5	Gray FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

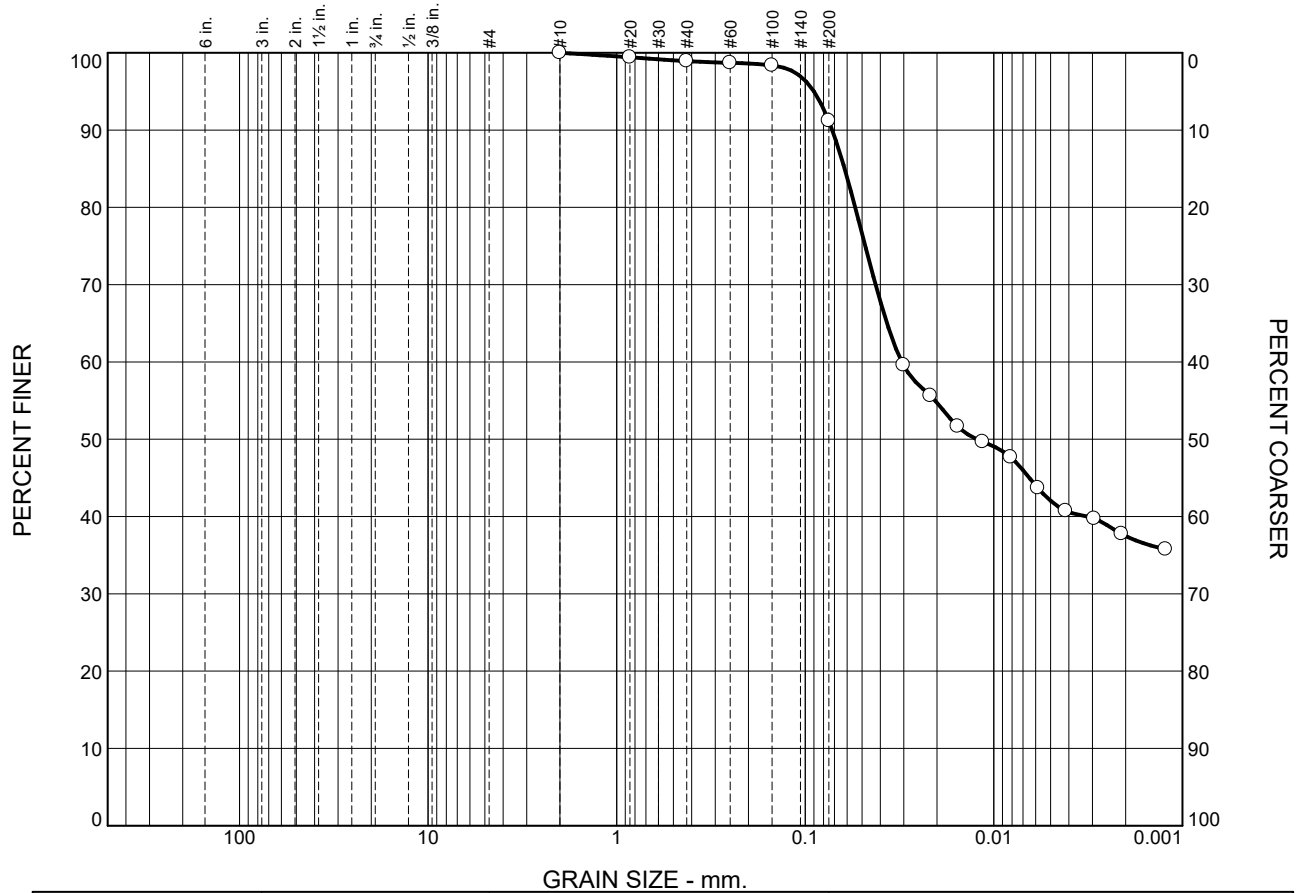
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.1	7.7	49.2	42.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-64	SP-6	25.5	Gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

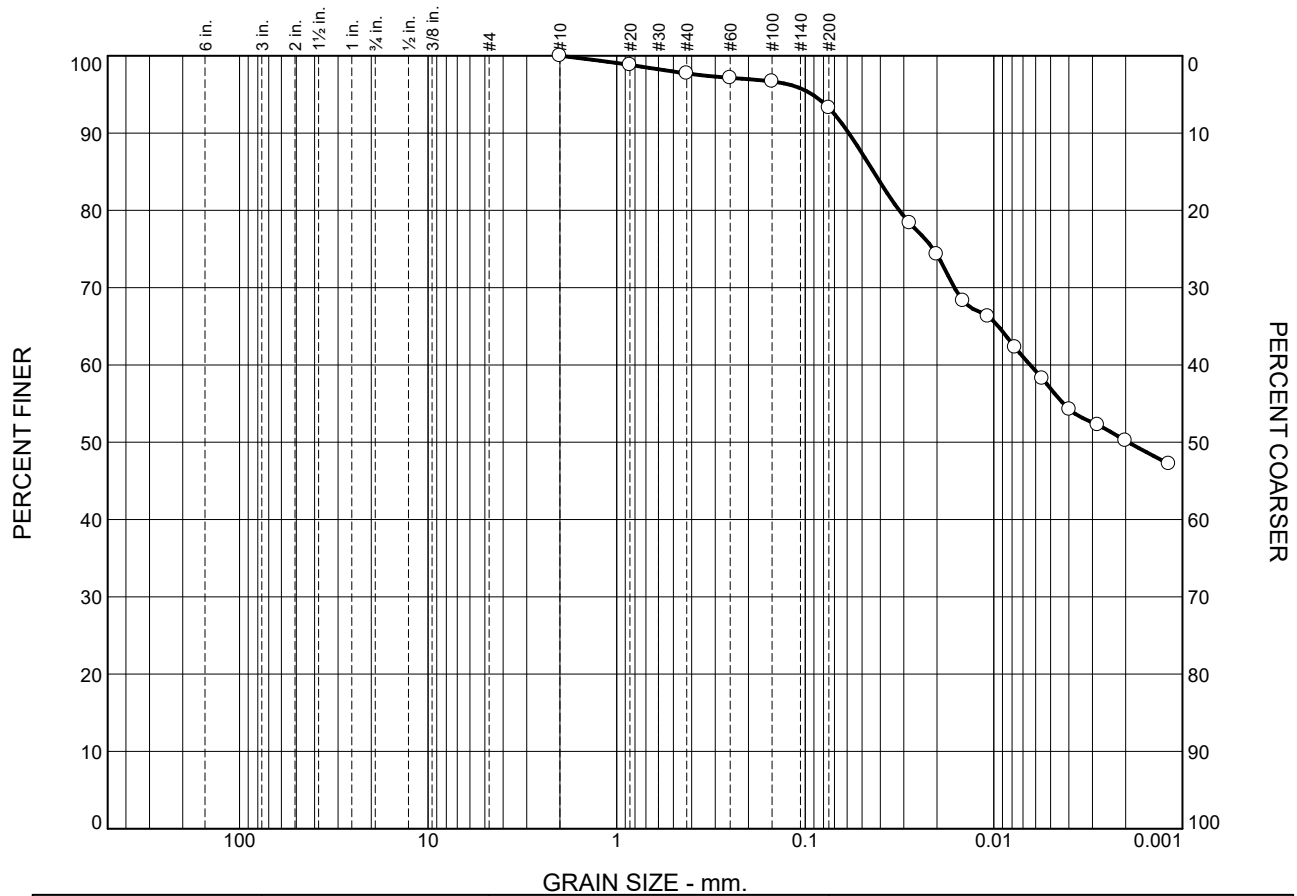
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.3	4.4	36.4	56.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-64	SP-9	35.5	Gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

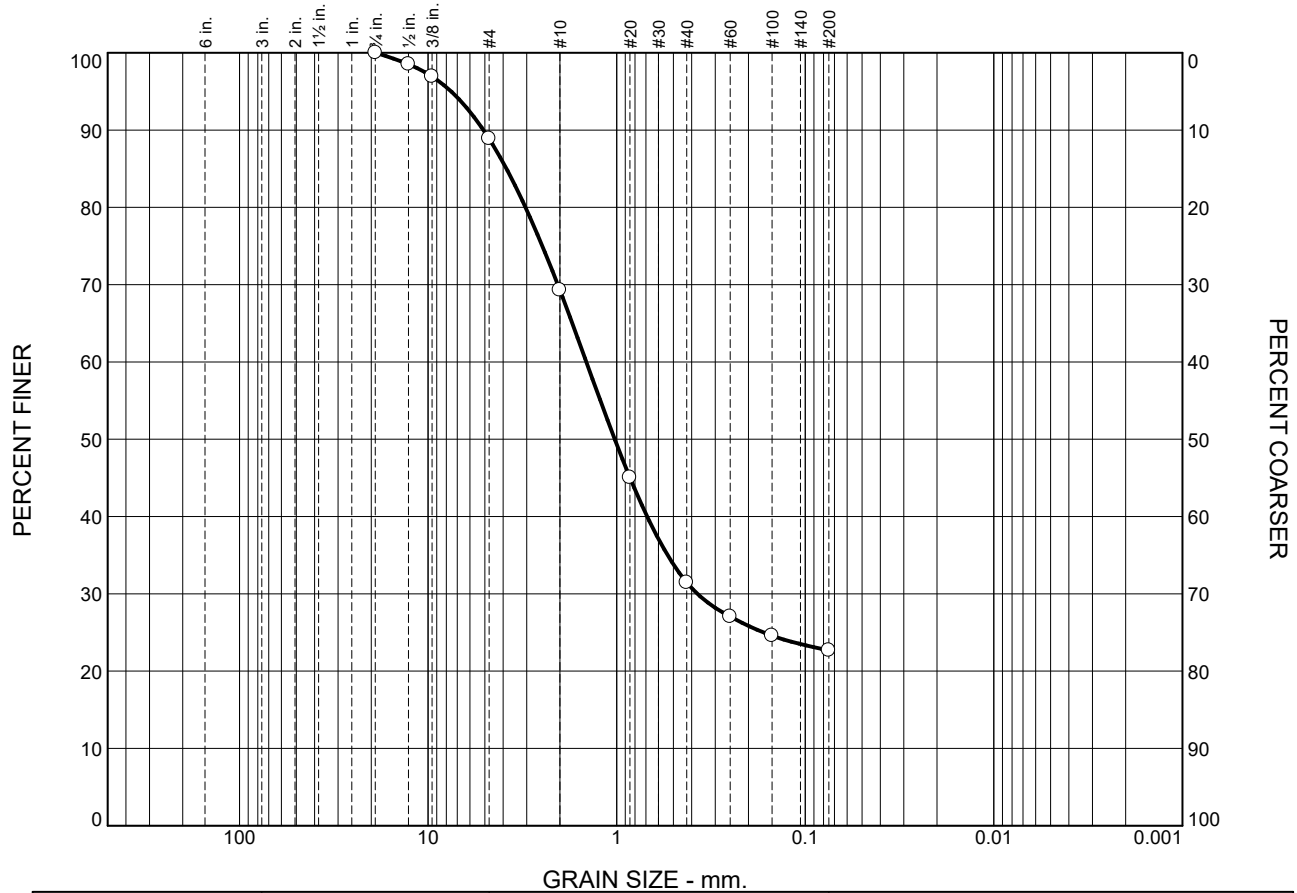
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	11.1	19.6	37.8	8.8	22.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-65	SP-2	4.5	Gray CLAYEY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

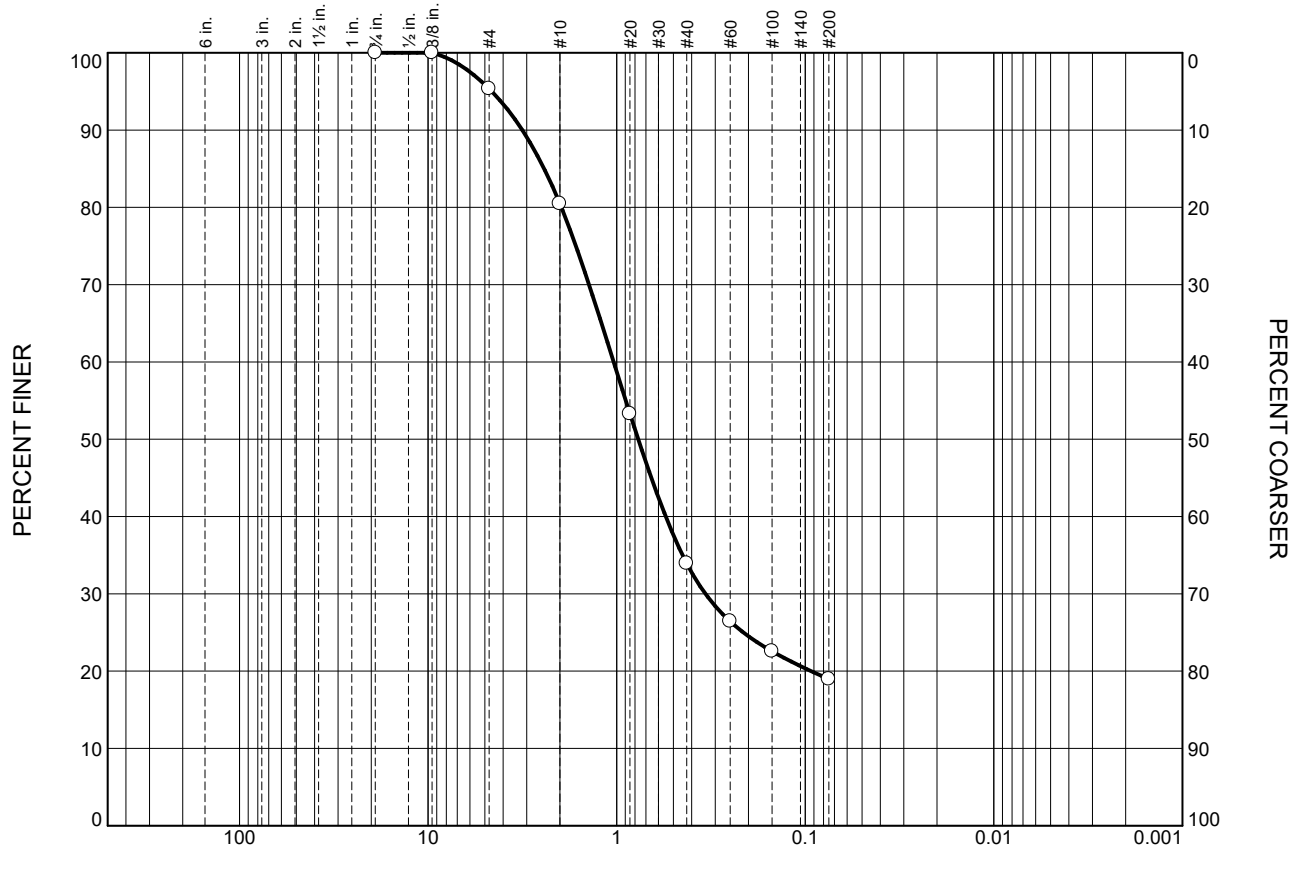
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	4.6	14.9	46.6	14.9	19.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-65	SP-3	9.5	Gray CLAYEY SAND; shell fragments	SM

Tolunay-Wong Engineers, Inc.

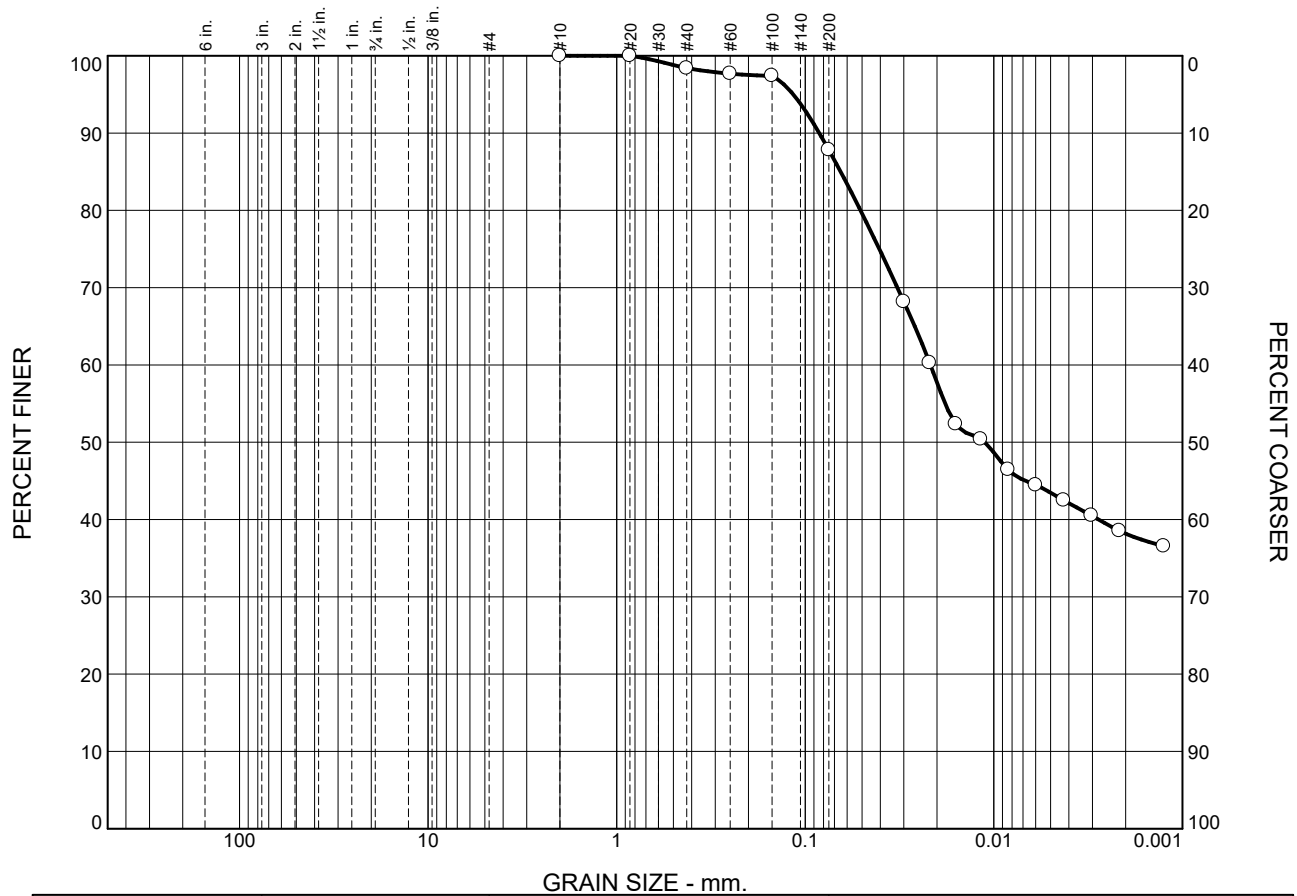
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.6	10.6	44.3	43.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-65	SP-4	14.5	Gray FAT CLAY; shell fragments	CH

Tolunay-Wong Engineers, Inc.

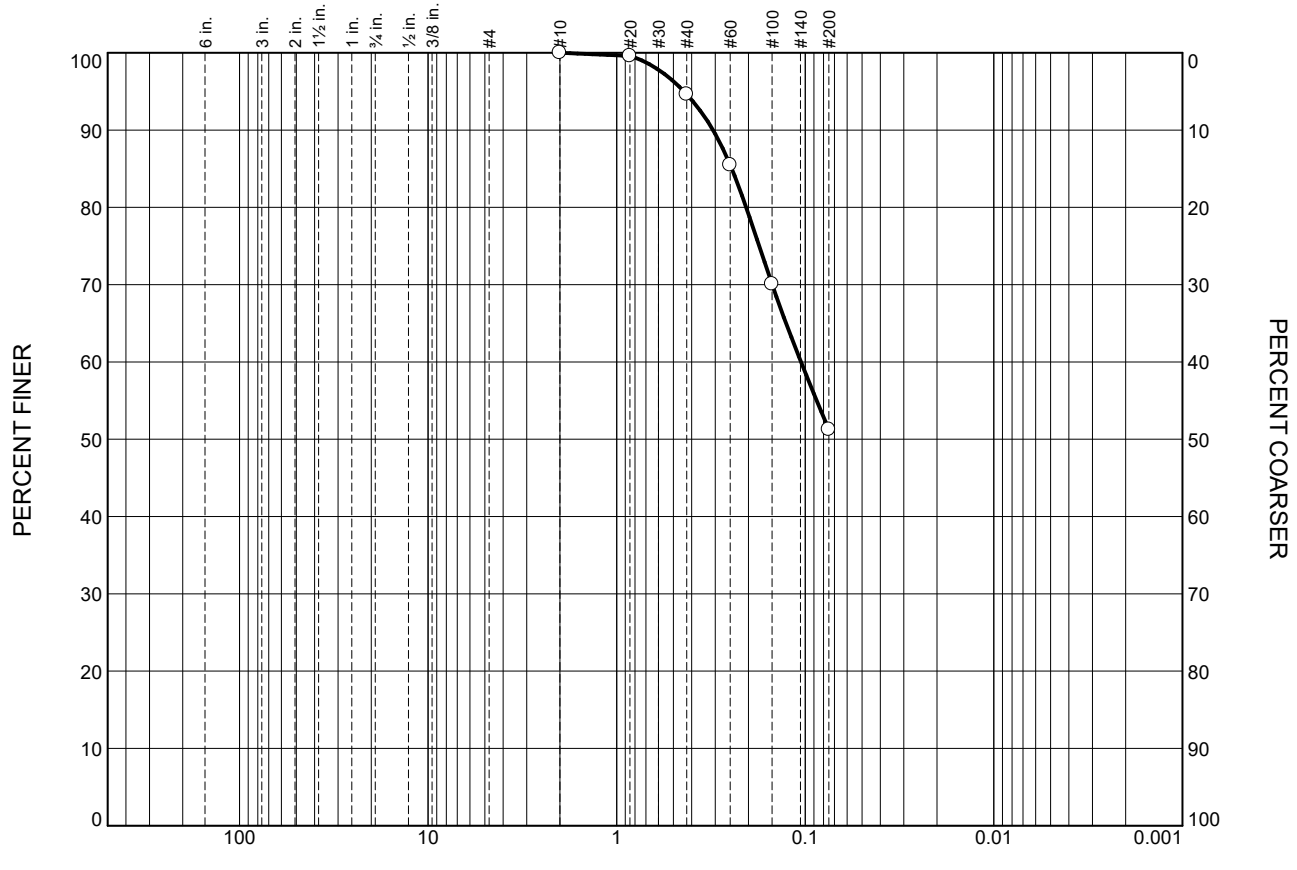
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.4	43.3	51.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-66	SP-6	23	Gray SANDY LEAN CLAY	CL

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.7	92.9	5.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-66	SP-12	40.5	Tan and gray poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.8	53.5	41.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-66	SP-14	45.5	Tan and gray CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

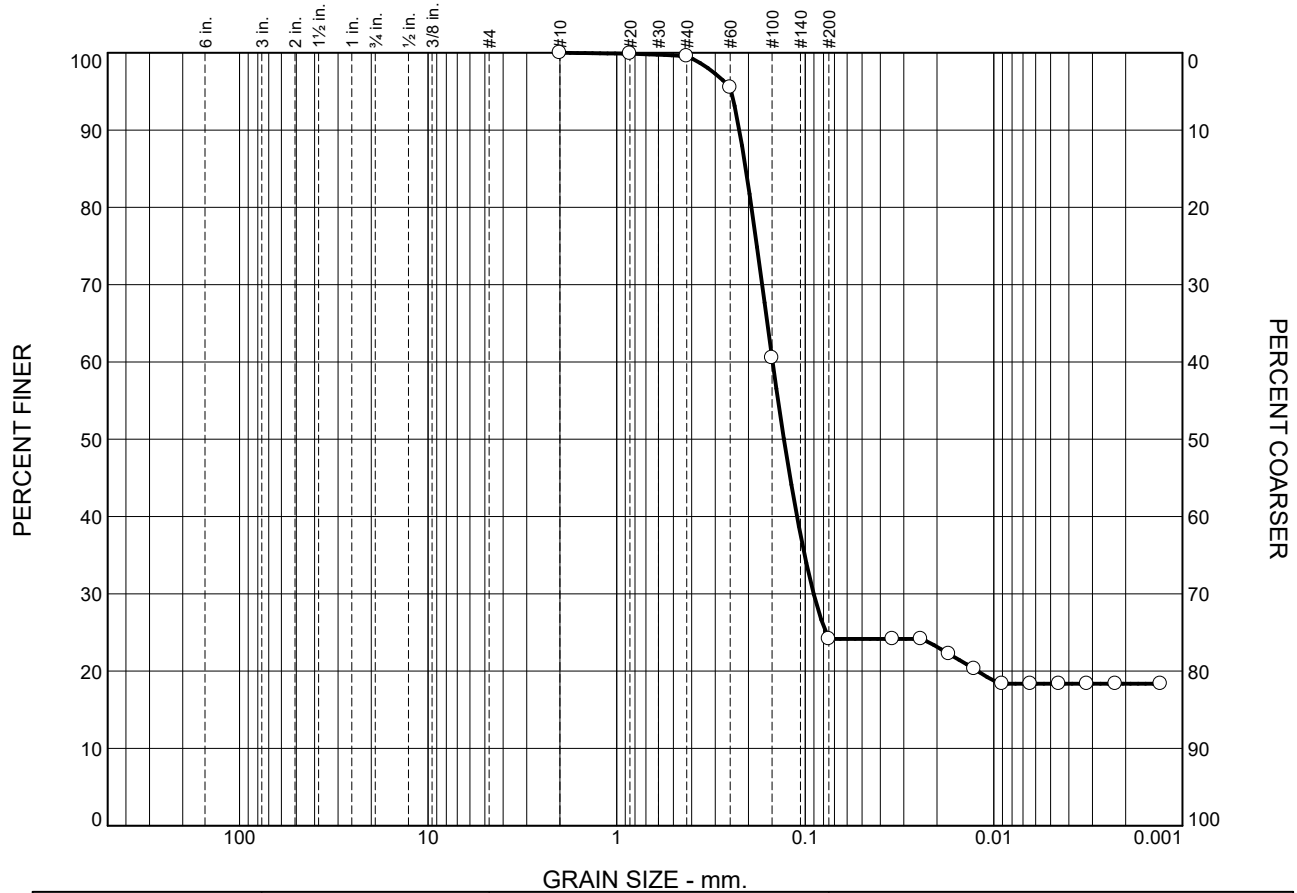
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	75.4	5.8	18.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-67	SP-6	45.5	Gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

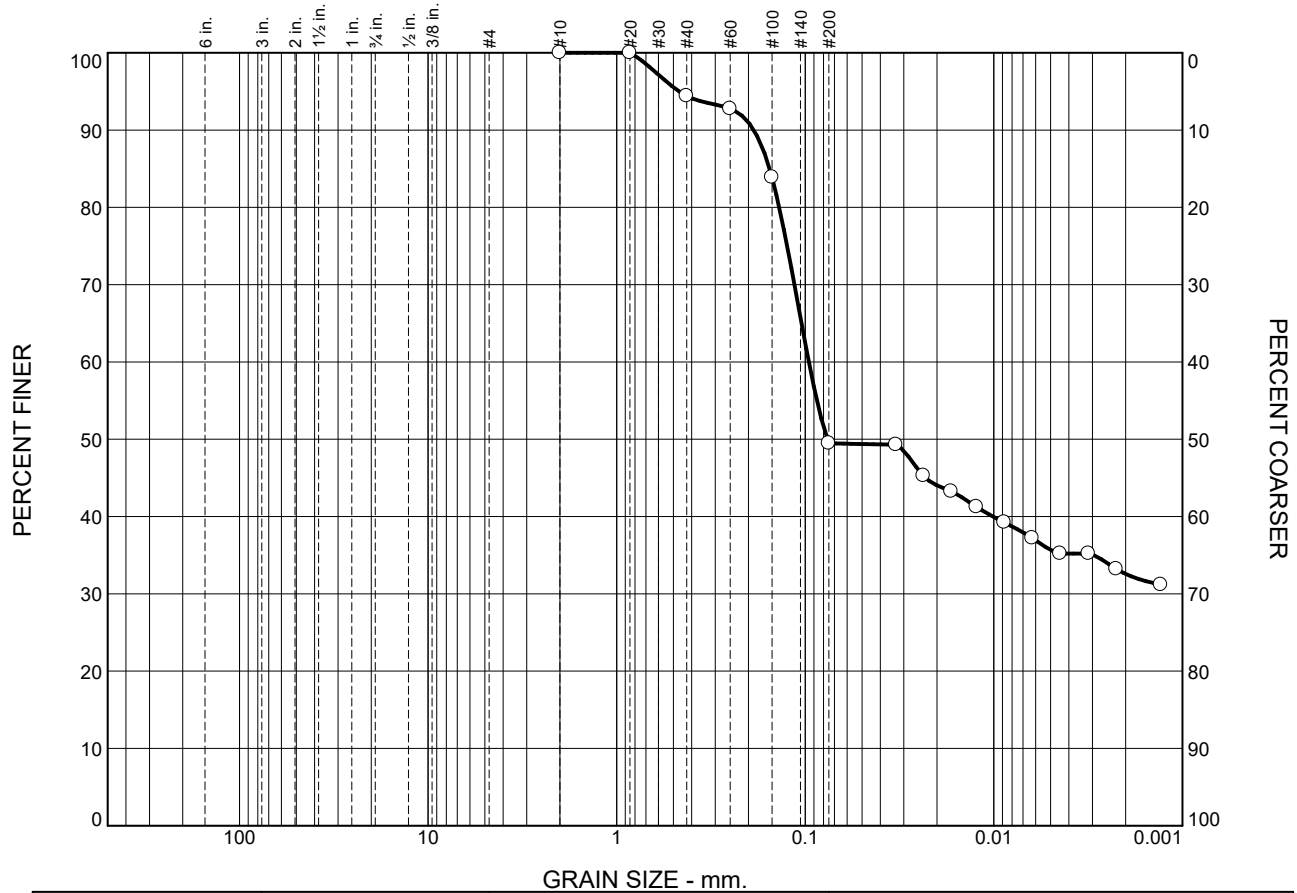
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.6	44.9	13.8	35.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-68	SP-1	0.5	Tan CLAYEY SAND; shell fragments	SC

Tolunay-Wong Engineers, Inc.

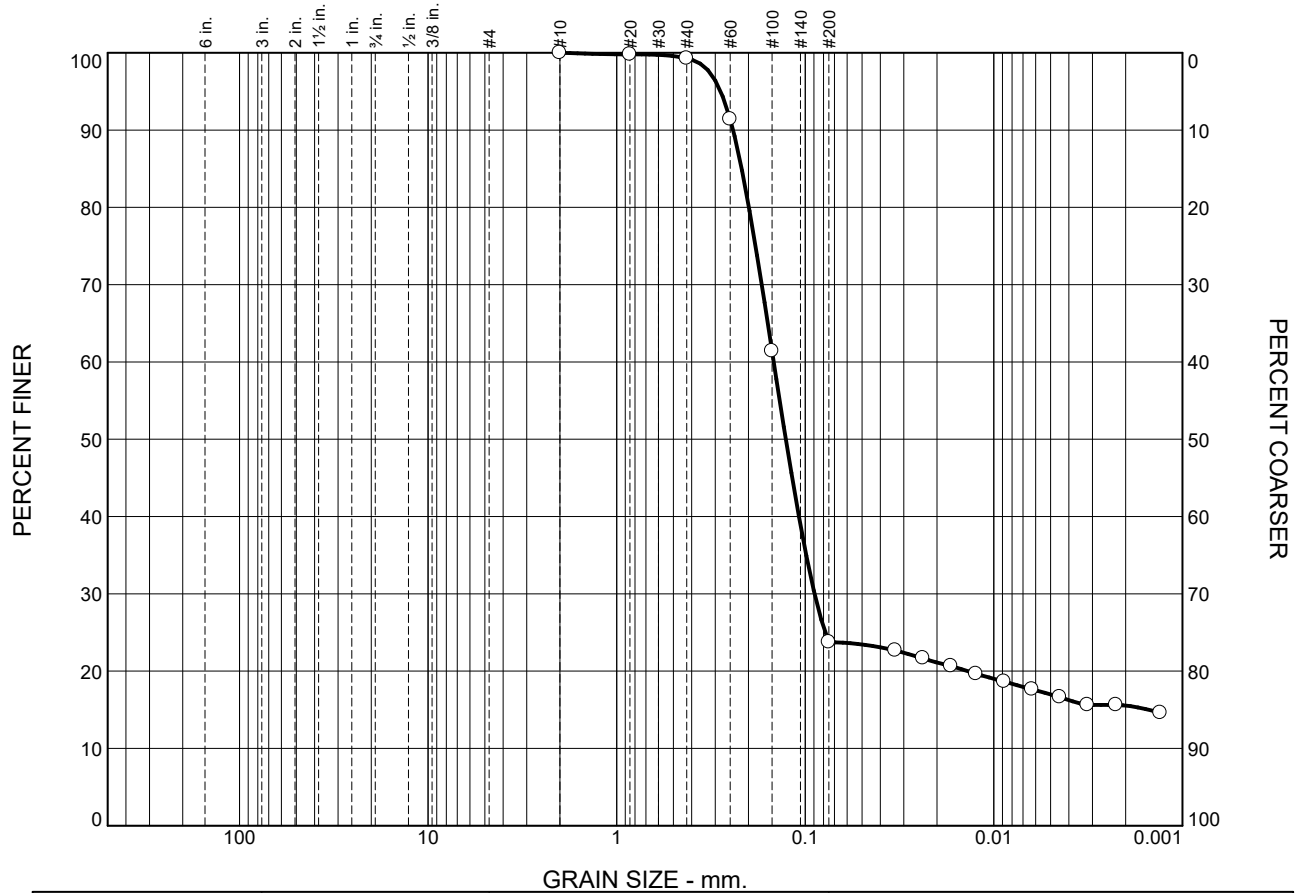
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.7	75.6	6.7	17.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-68	SP-6	43.5	Gray and tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.8	89.6	8.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-68	SP-9	51	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

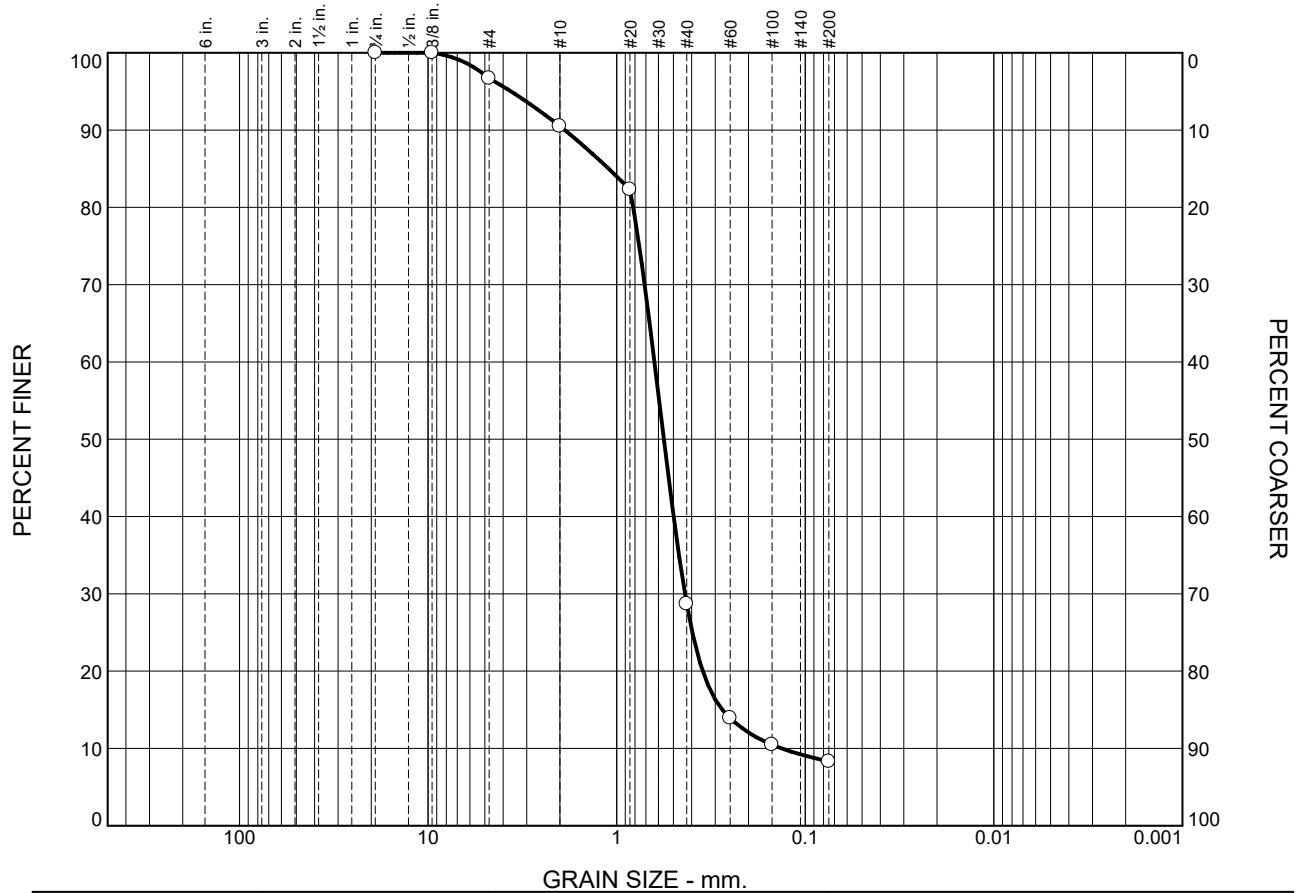
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.3	6.2	61.8	20.4	8.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-68	SP-11	56	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.3	60.1	10.9	26.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-69	SP-1	0.5	Dark gray CLAYEY SAND; sand and shell fragments	SC

Tolunay-Wong Engineers, Inc.

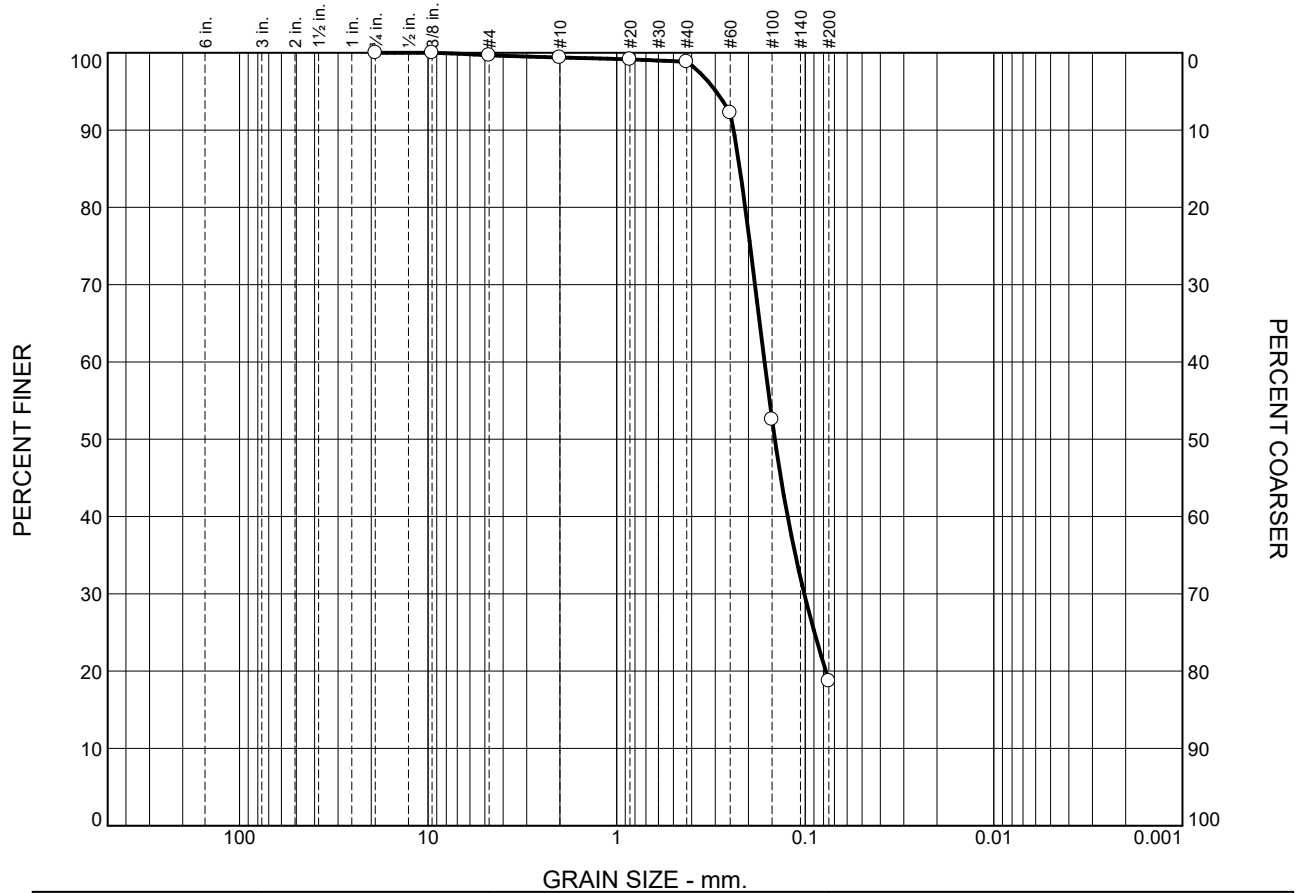
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	0.3	0.6	80.1	18.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-69	SP-5	30.5	Tan CLAYEY SAND	SC

Tolunay-Wong Engineers, Inc.

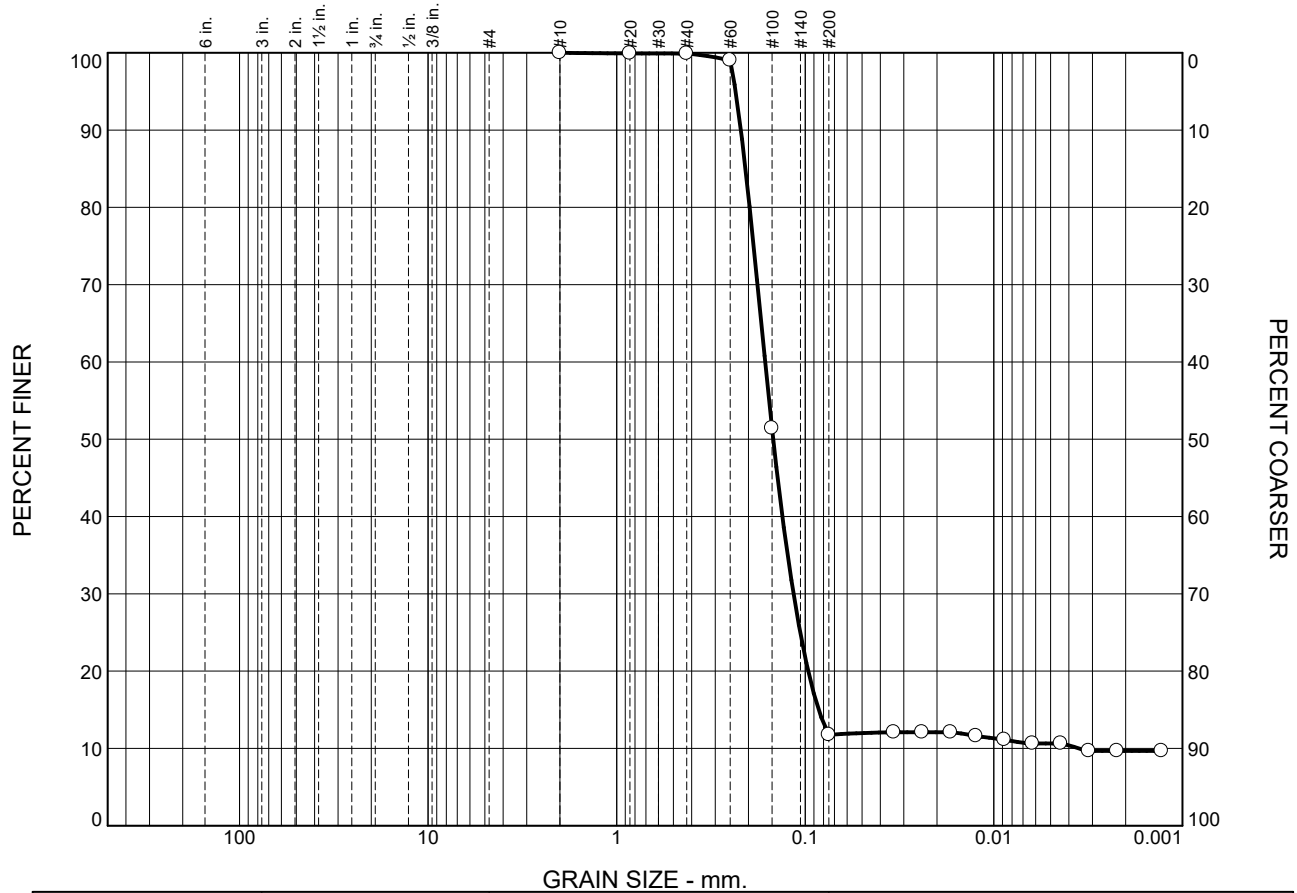
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	88.1	1.2	10.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-69	SP-6	43	Gray and tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

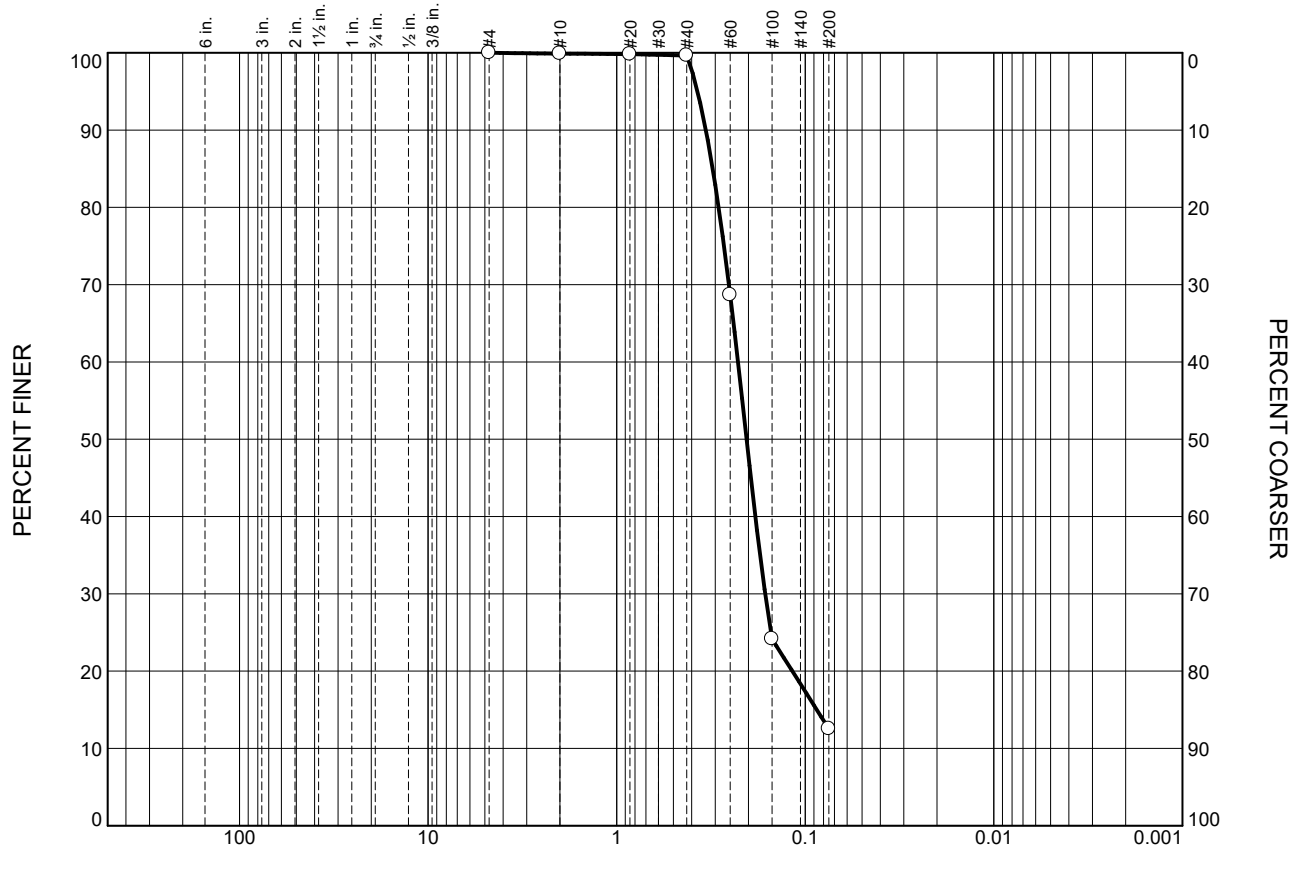
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.3	87.1	12.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-69	SP-8	48	Tan SILTY CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

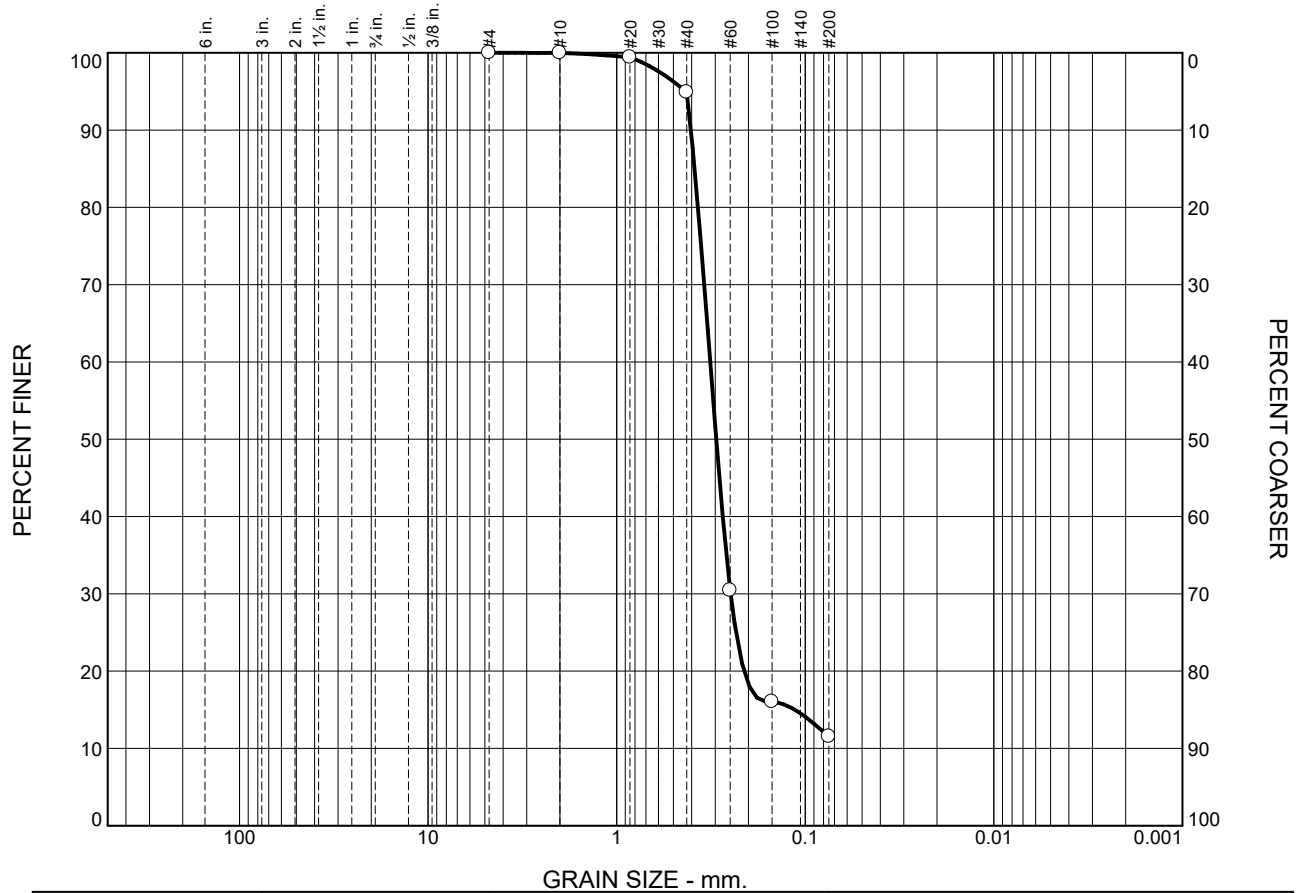
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	5.1	83.4	11.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-69	SP-10	53	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

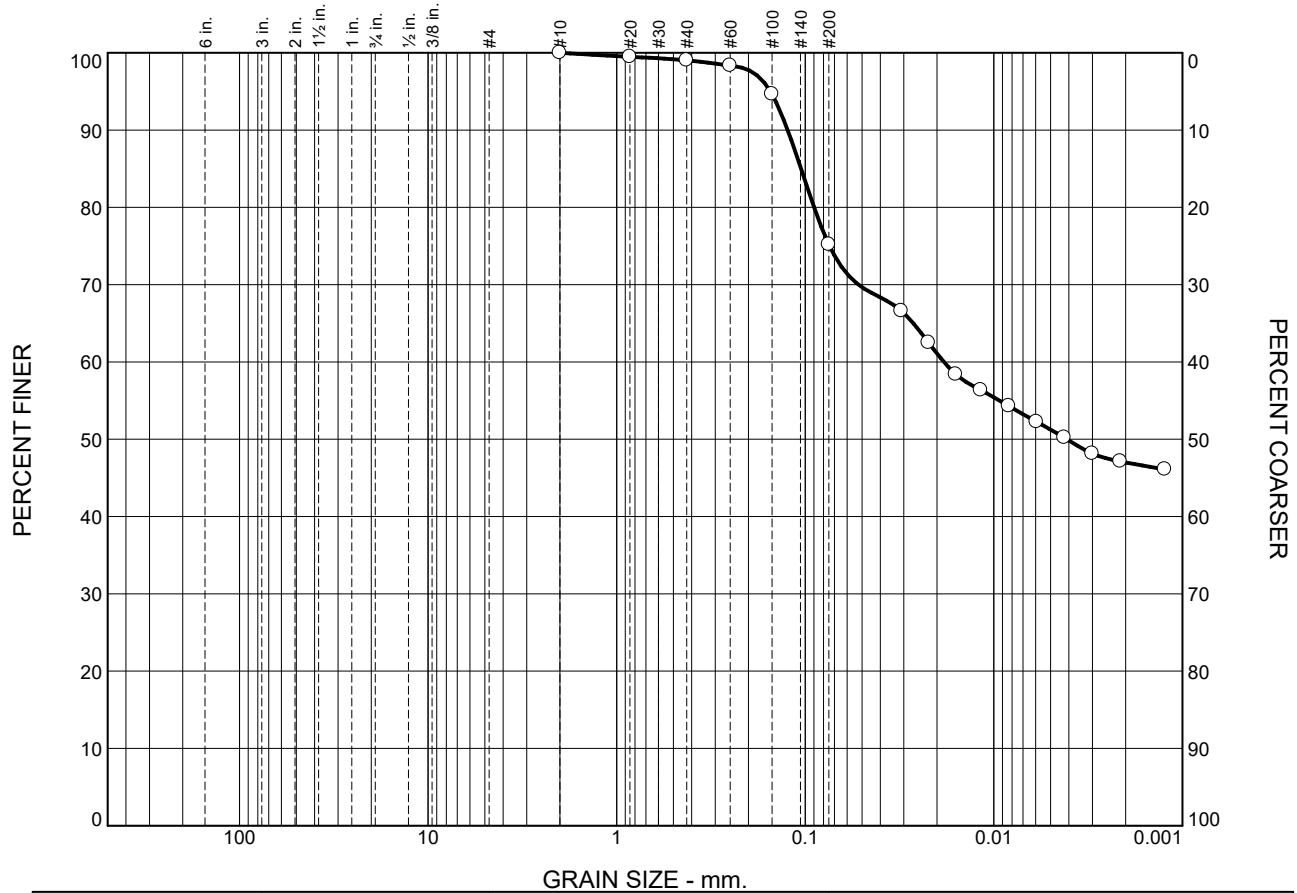
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.0	23.8	24.0	51.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-70	SP-1	0.5	Dark gray FAT CLAY with SAND; shell fragments	CH

Tolunay-Wong Engineers, Inc.

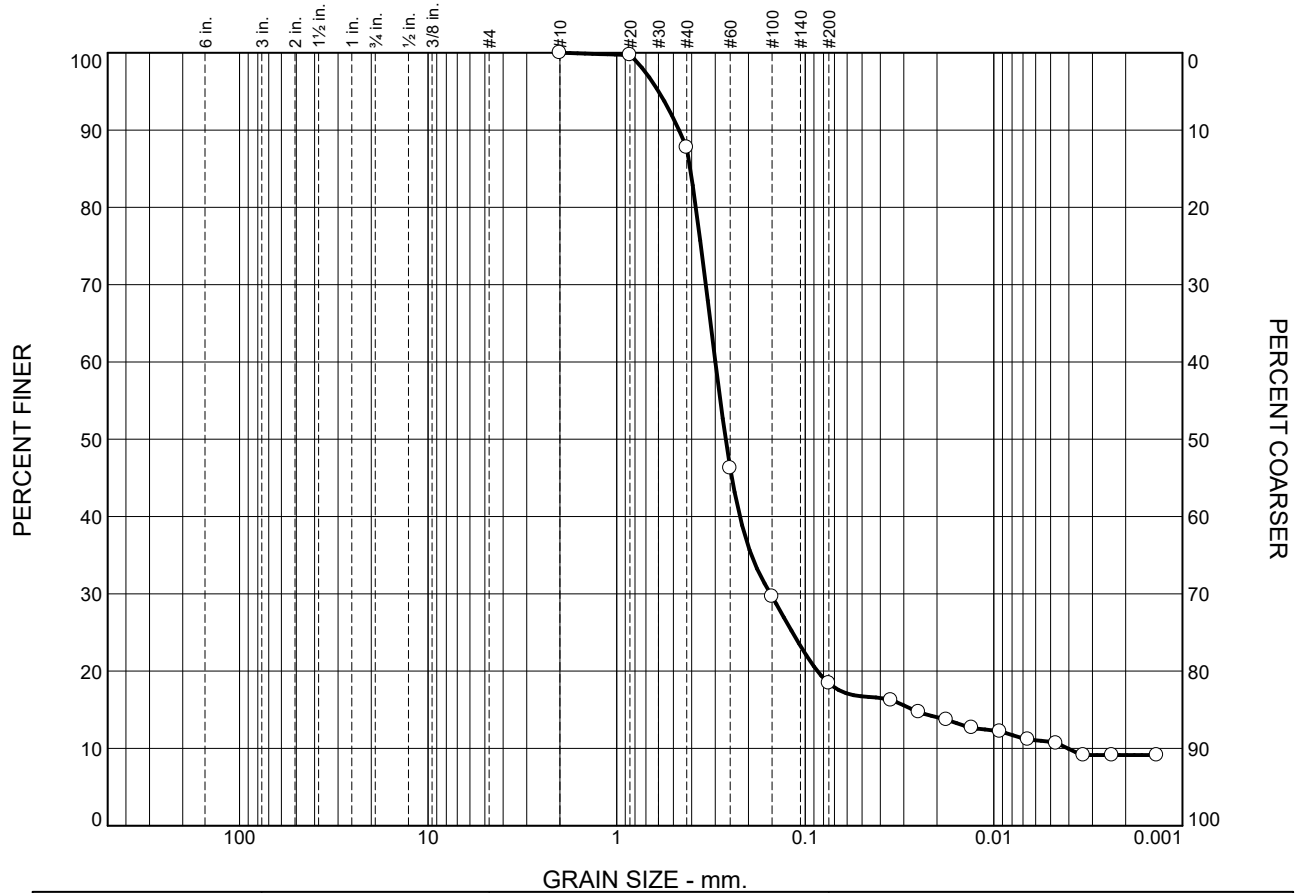
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	12.3	69.3	7.6	10.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-70	SP-3	45.5	Tan SILTY SAND; claycalls	SM

Tolunay-Wong Engineers, Inc.

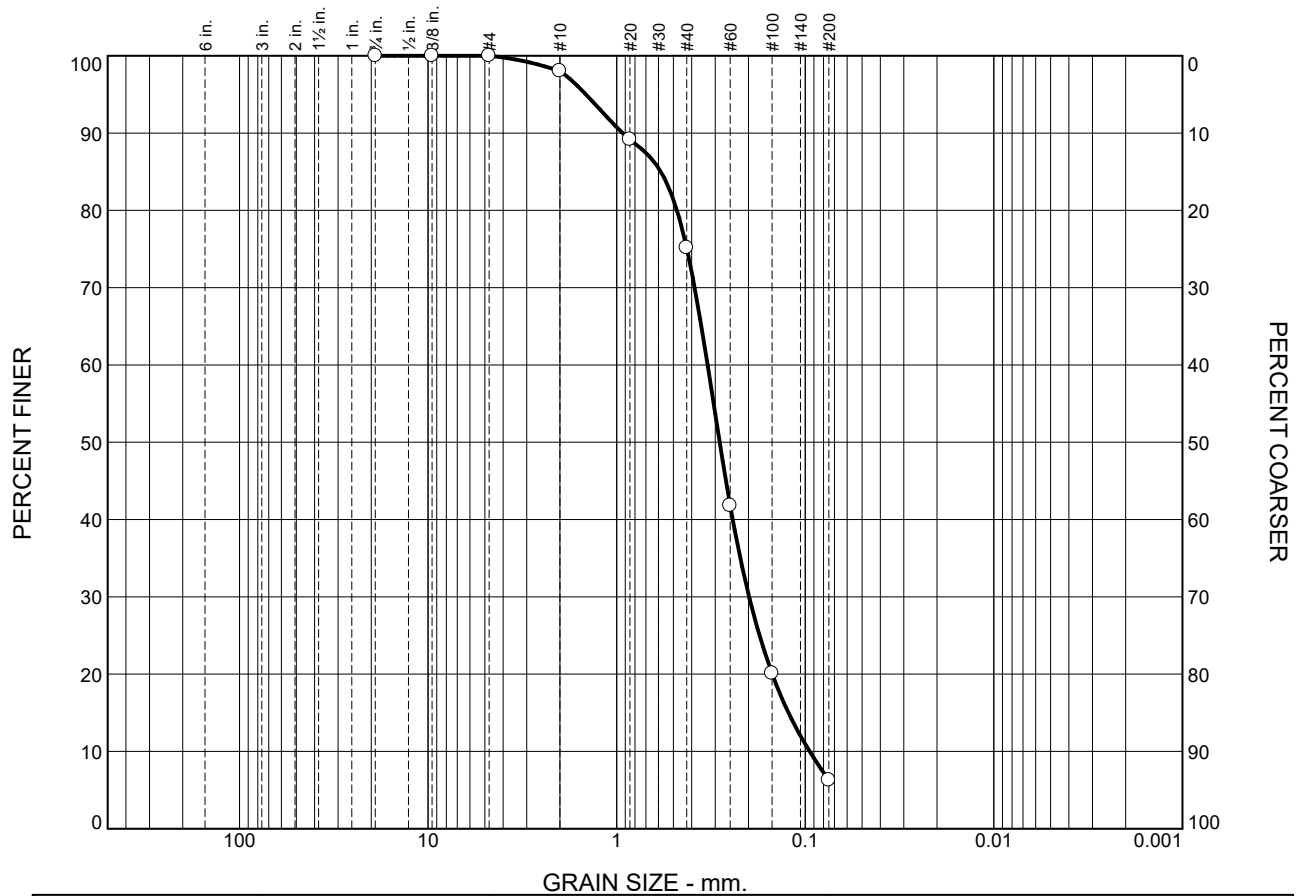
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	2.0	22.8	68.9	6.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-70	SP-6	53	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

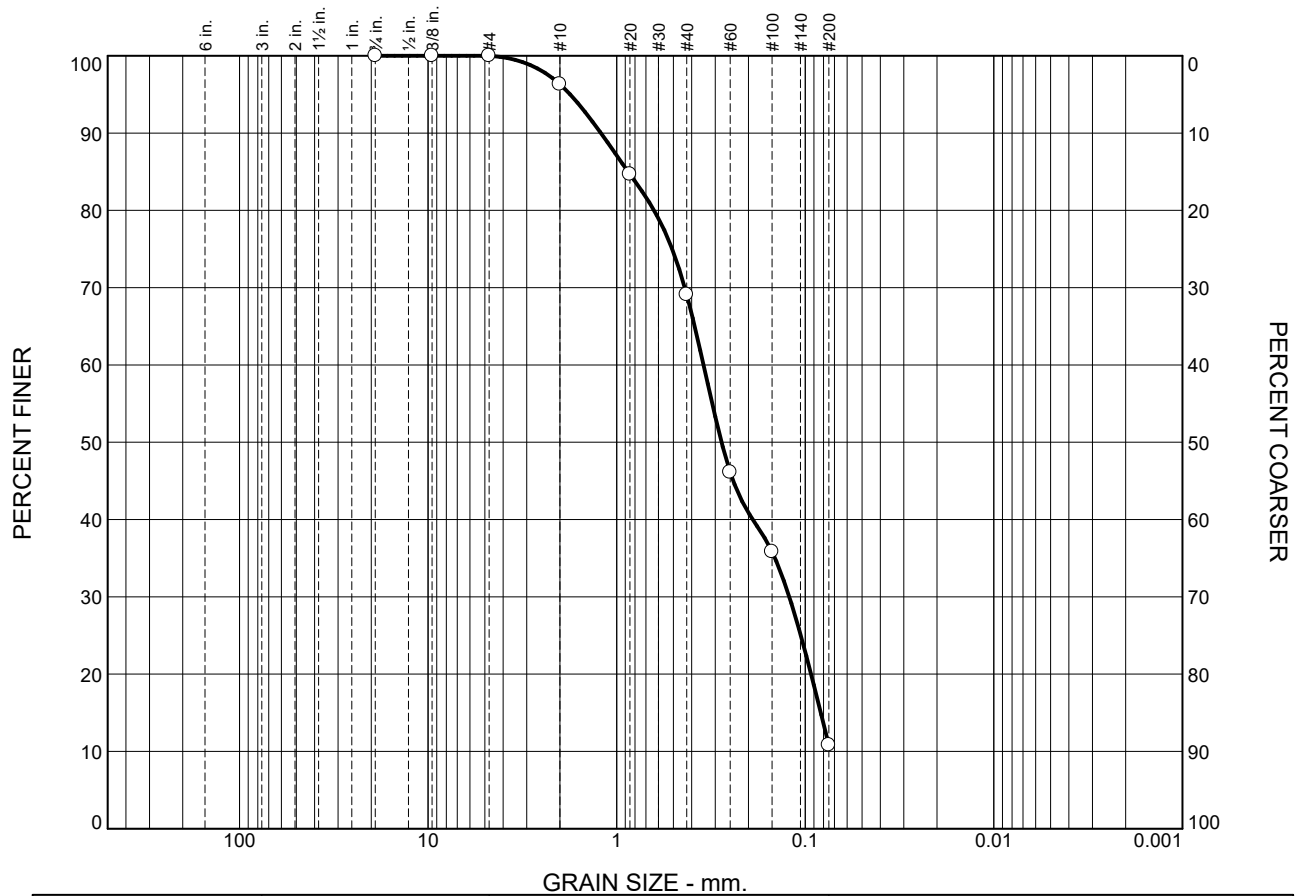
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	3.7	27.2	58.3	10.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-70	SP-8	58	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

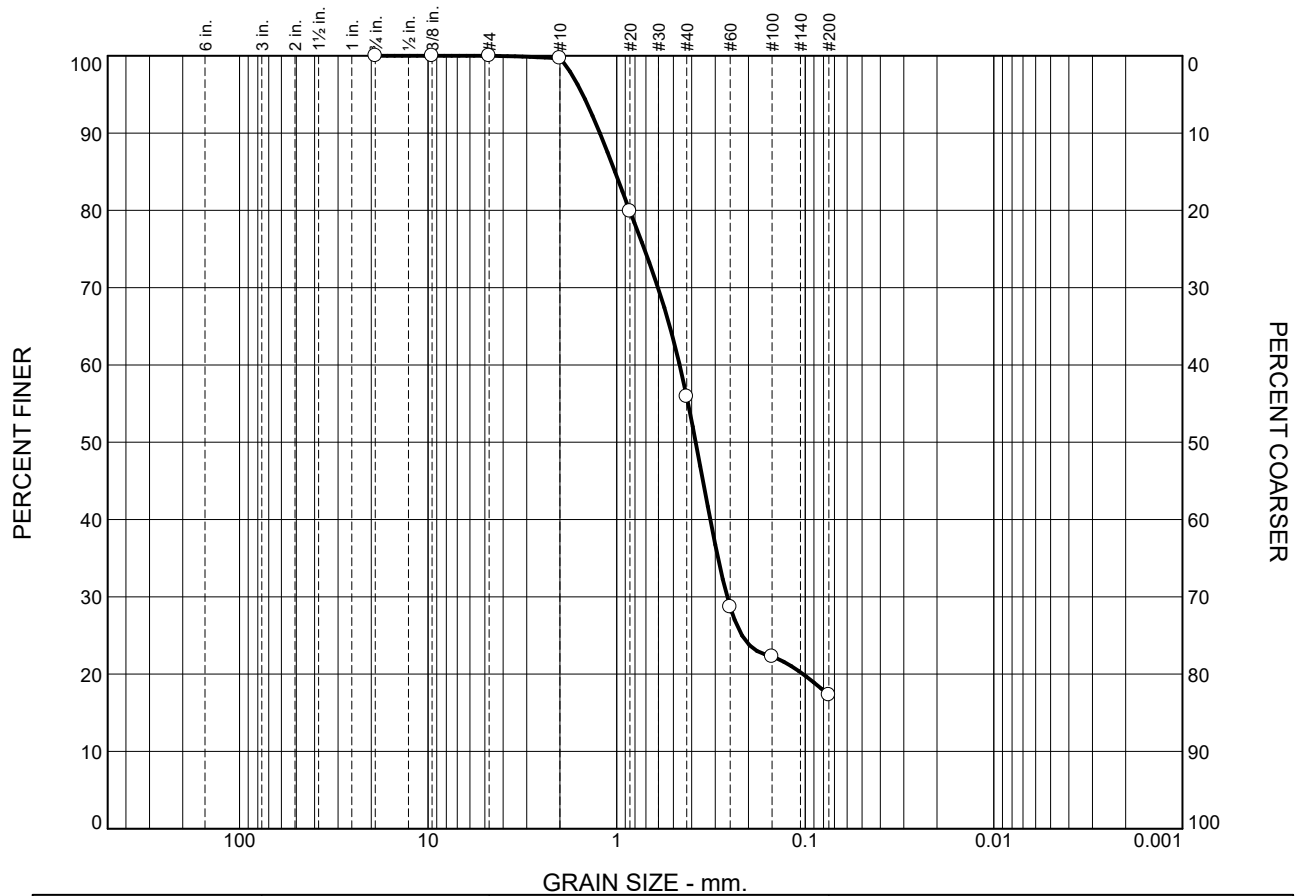
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	43.8	38.6	17.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-70	SP-11	65.5	Tan SILTY CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

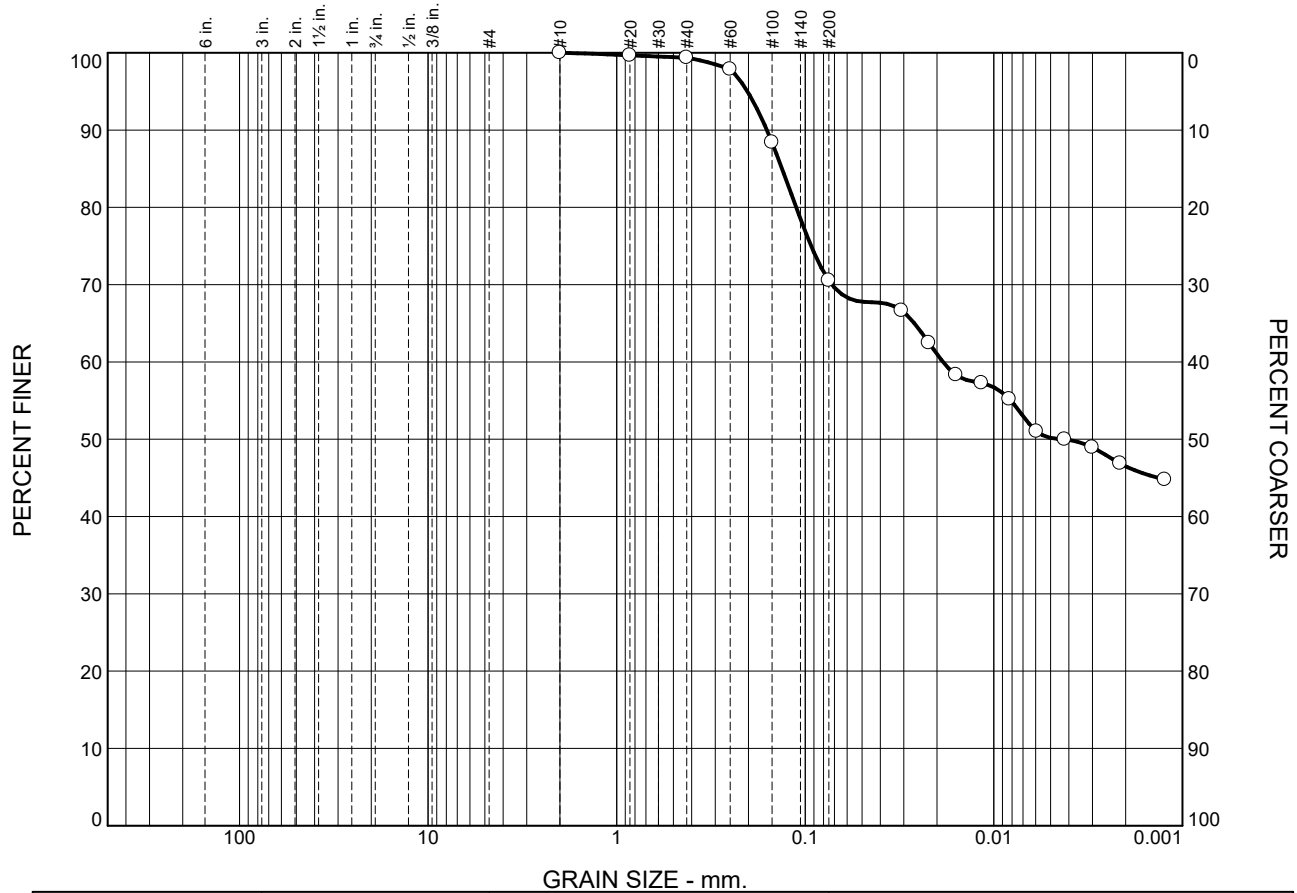
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.6	28.9	20.3	50.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-71	SP-1	0.5	Dark gray FAT CLAY with SAND; shell fragments	CH

Tolunay-Wong Engineers, Inc.

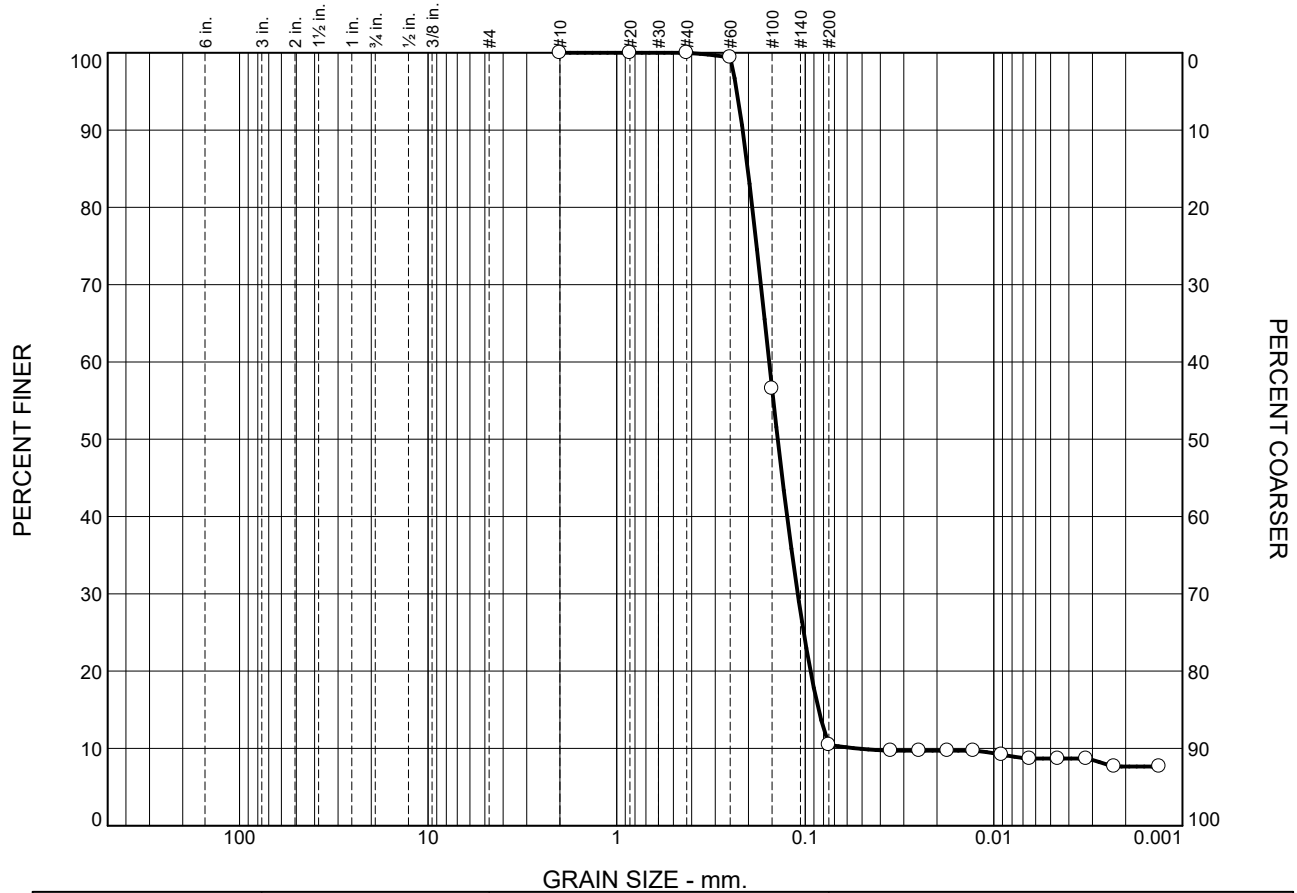
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	89.5	1.8	8.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-71	SP-3	42.5	Tan SILTY CLAYEY SAND	SP-SM

Tolunay-Wong Engineers, Inc.

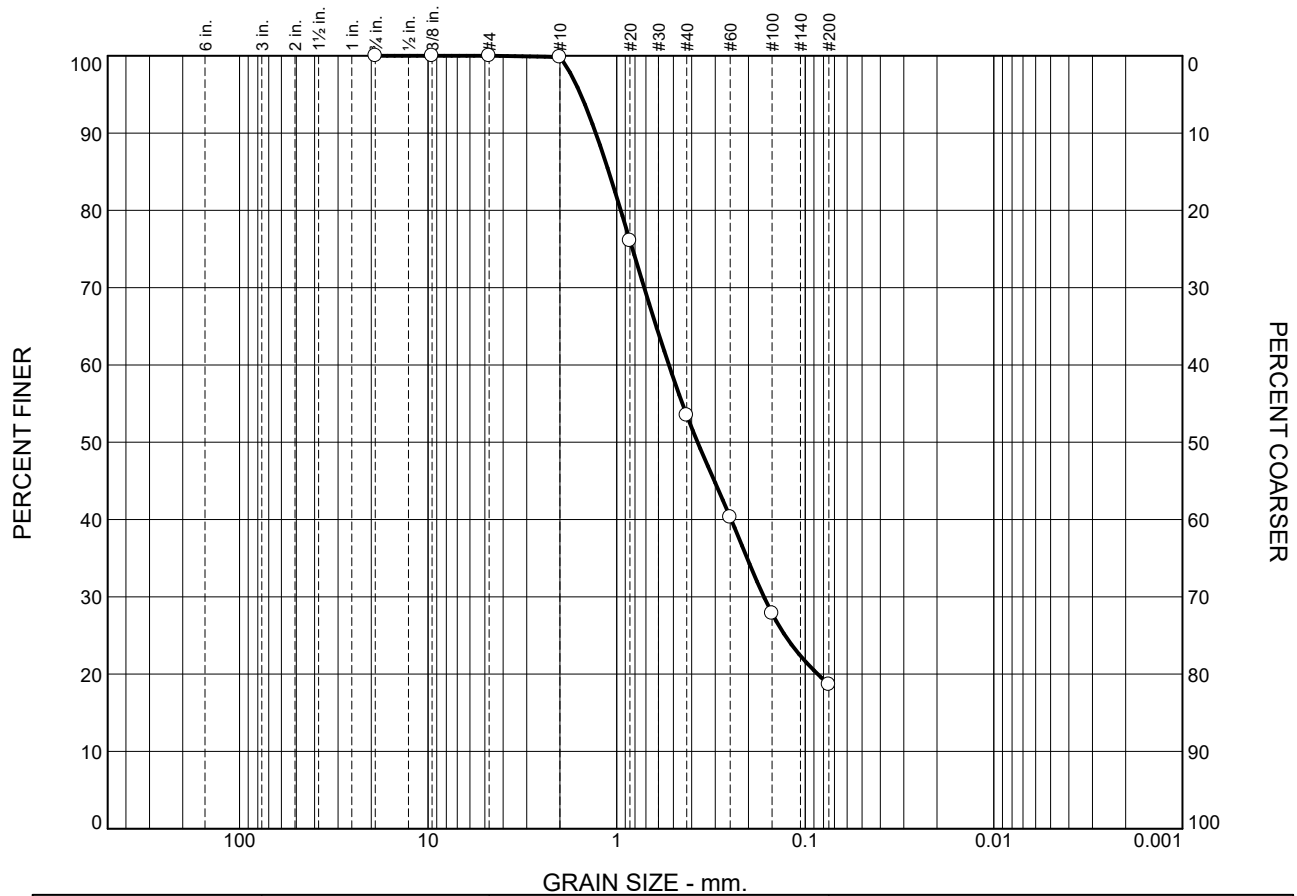
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	46.3	34.8	18.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-71	SP-6	50	Tan SILTY CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

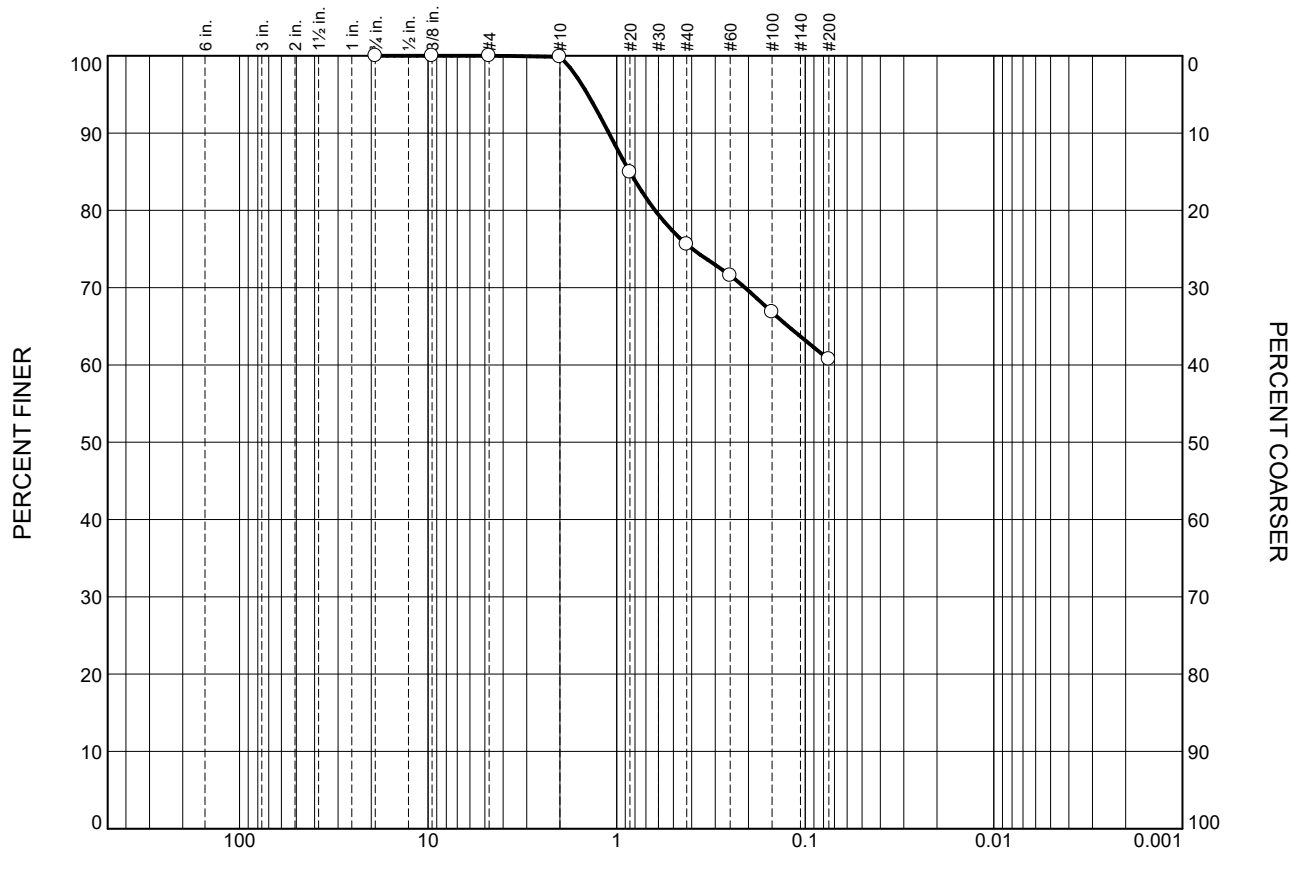
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	24.3	14.9	60.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-71	SP-9	57.5	Tan SANDY LEAN CLAY	CL

Tolunay-Wong Engineers, Inc.

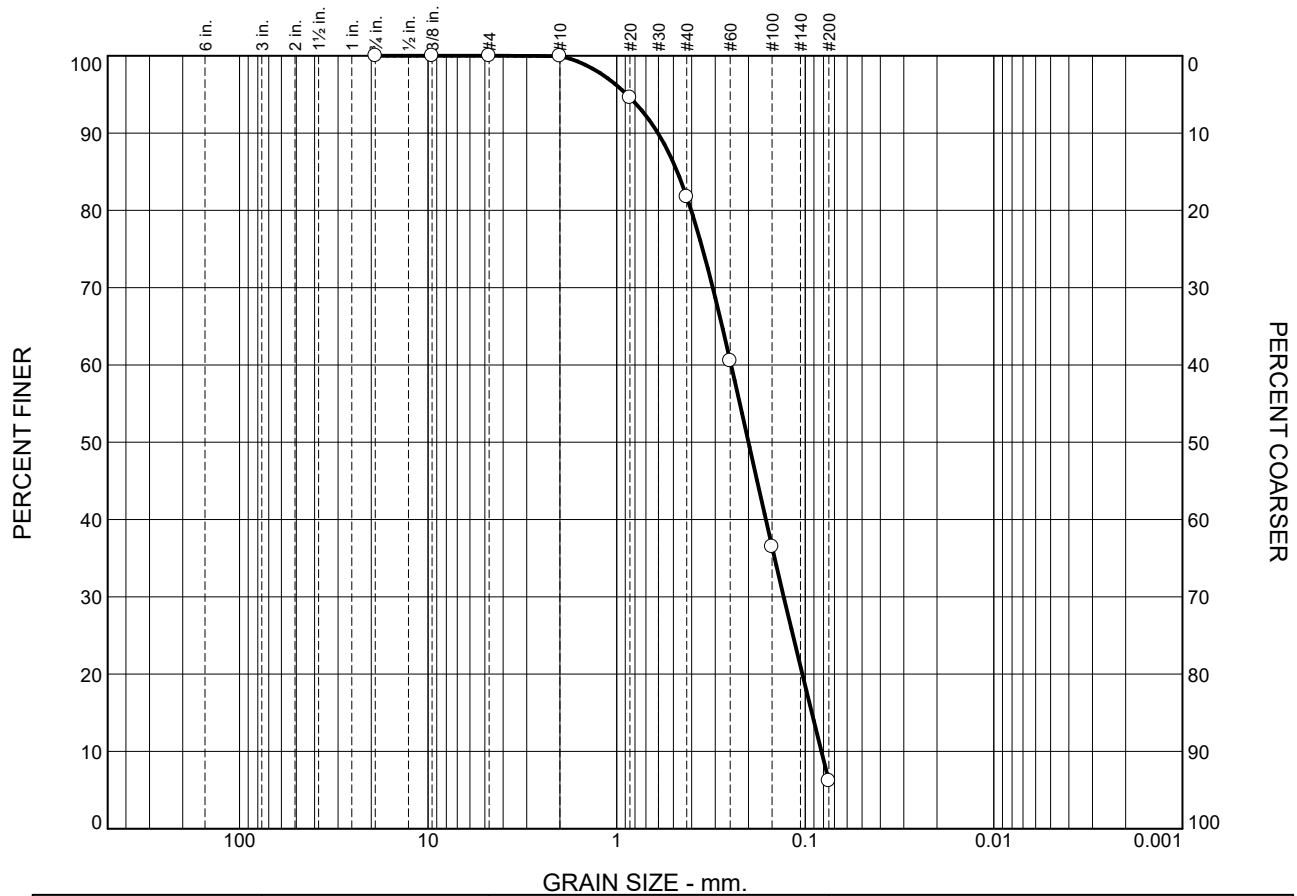
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	18.2	75.6	6.2	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-71	SP-11	62.5	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

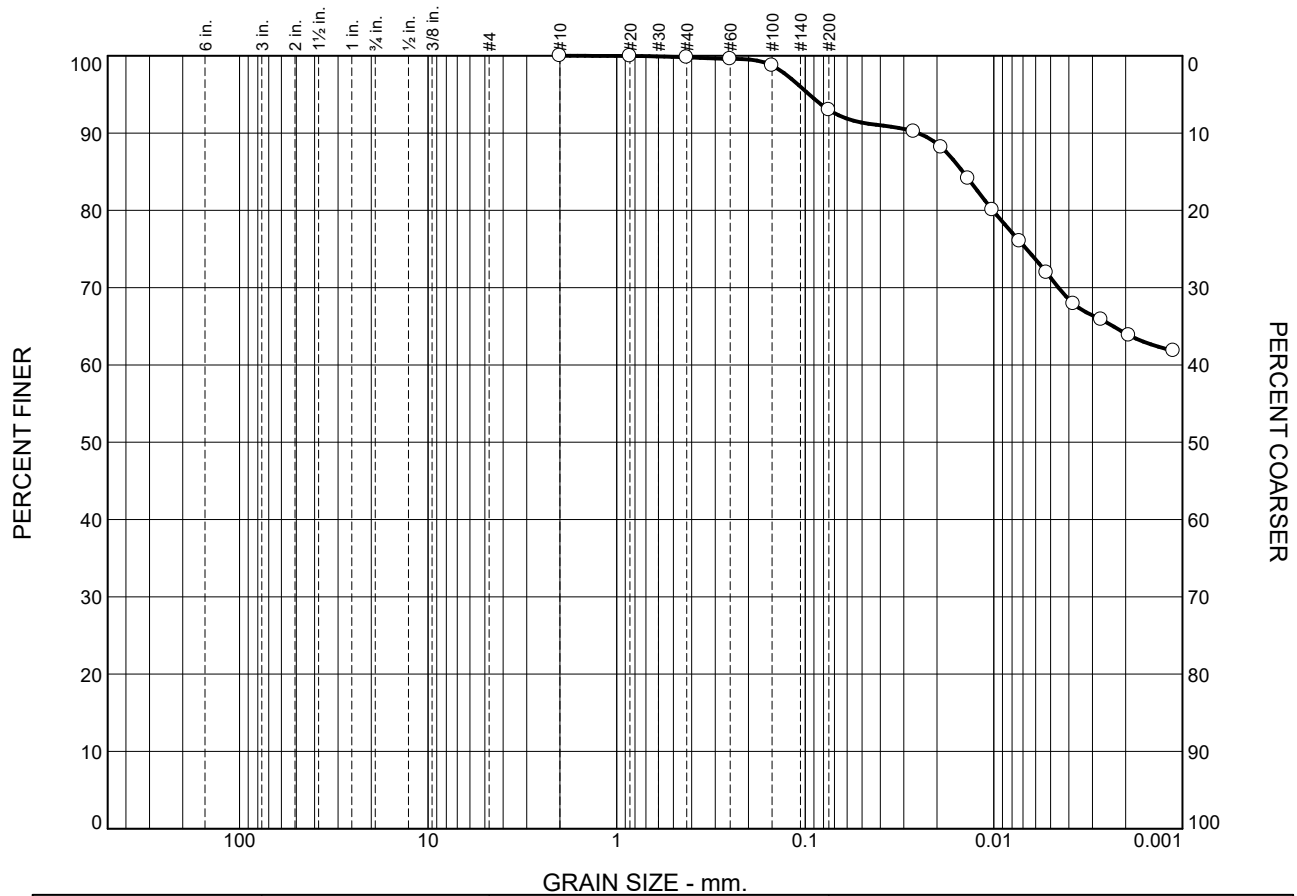
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	6.8	21.7	71.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-72	SP-1	0.5	Gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

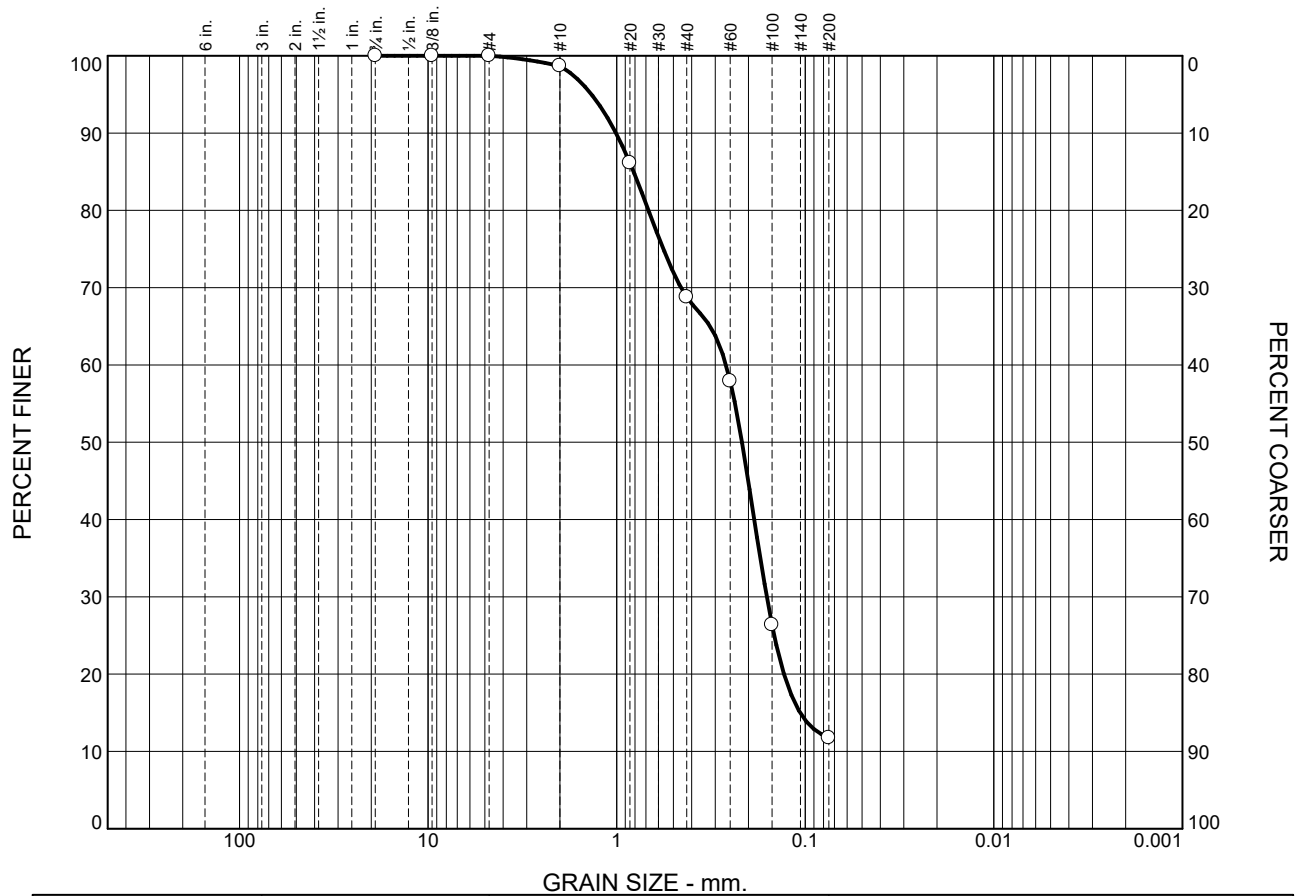
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	1.3	29.9	57.1	11.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-72	SP-2	40.5	Brown poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

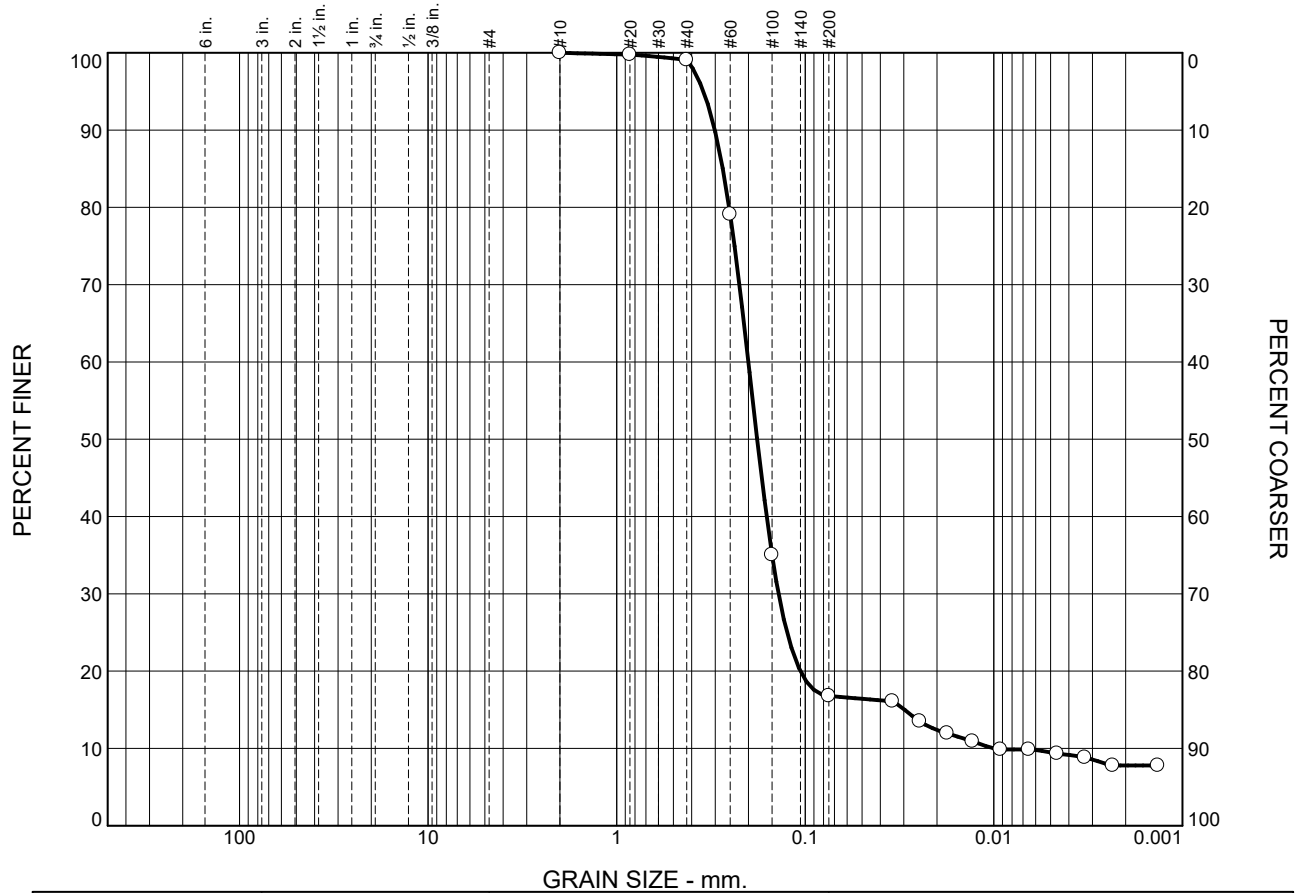
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.9	82.3	7.3	9.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-72	SP-5	48	Tan poorly graded SAND with SILT	SM

Tolunay-Wong Engineers, Inc.

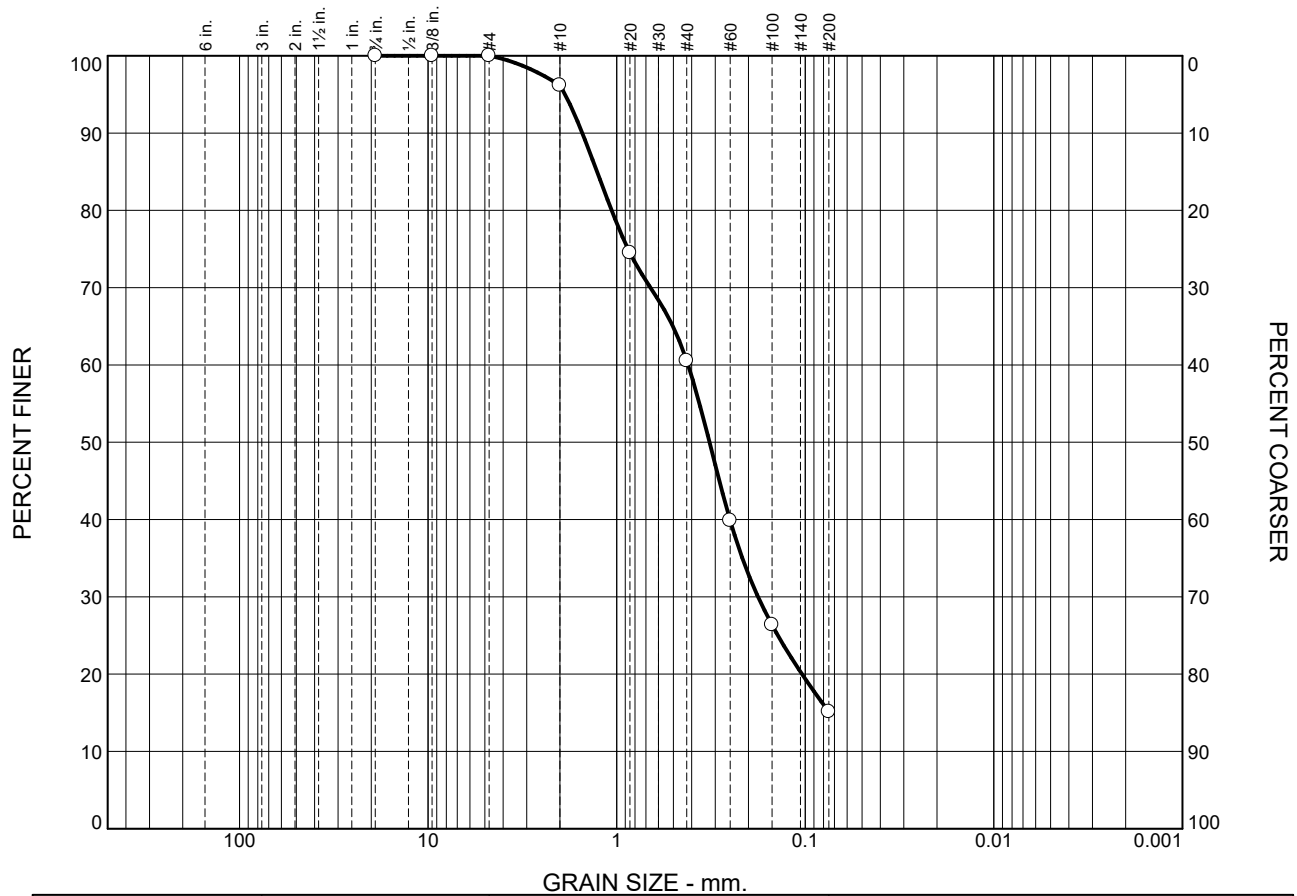
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	3.8	35.7	45.4	15.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-72	SP-8	55.5	Brown SILTY CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

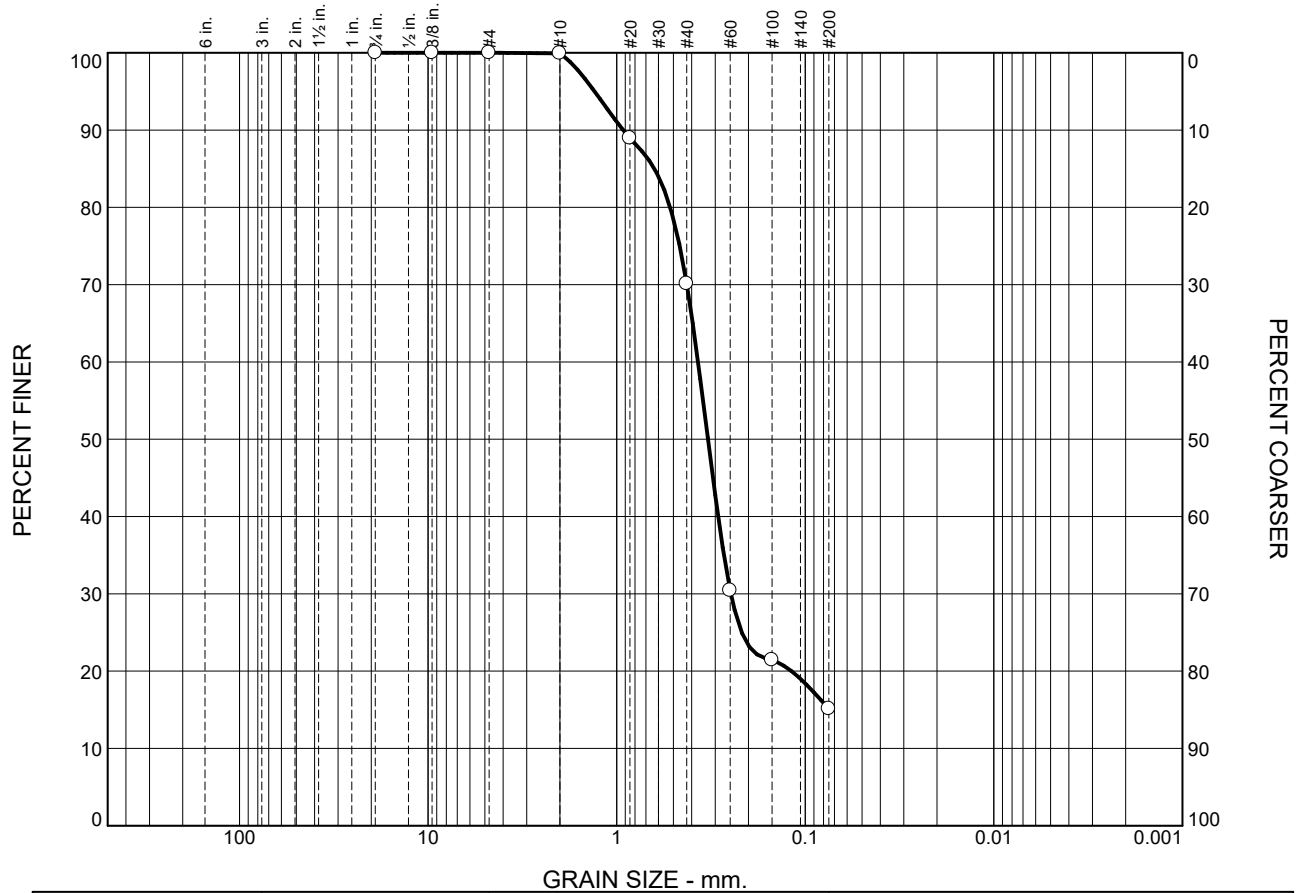
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	29.8	55.0	15.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-72	SP-10	60.5	Tan SILTY CLAYEY SAND	SM

Tolunay-Wong Engineers, Inc.

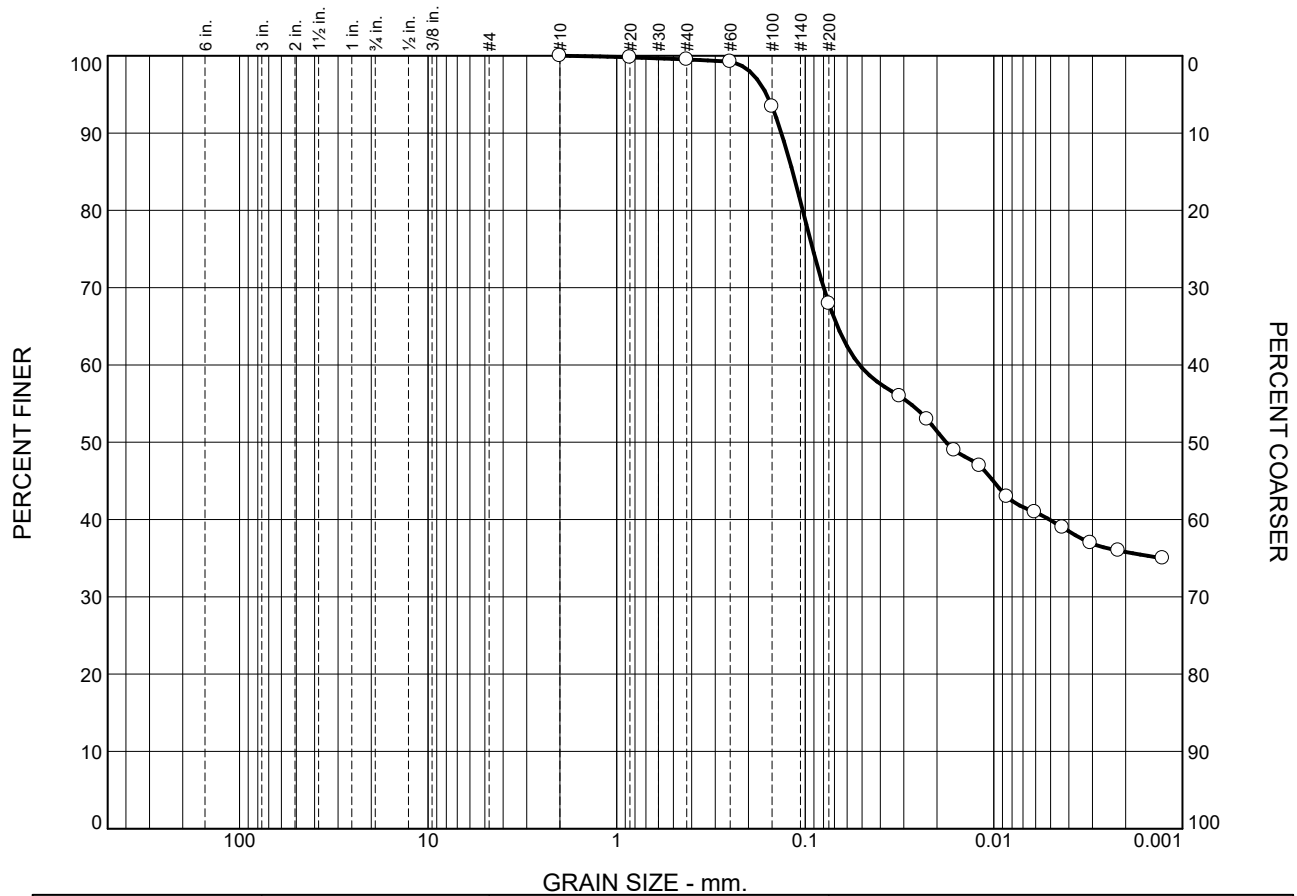
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	31.6	28.0	39.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-73	SP-1	0.5	Gray LEAN CLAY with SAND; shell fragments	CL

Tolunay-Wong Engineers, Inc.

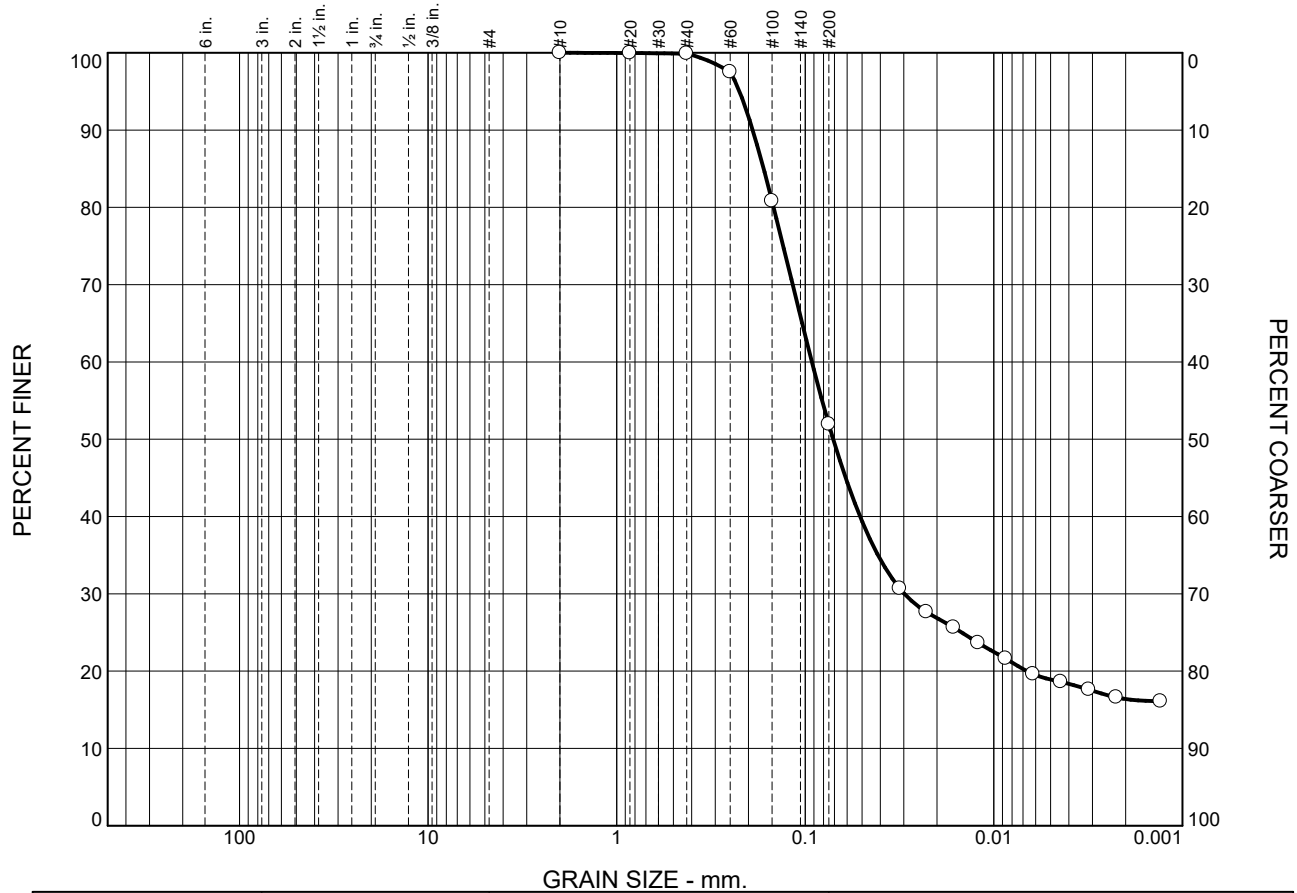
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	48.0	33.0	18.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-73	SP-3	49.5	Light gray SANDY SILT	SM

Tolunay-Wong Engineers, Inc.

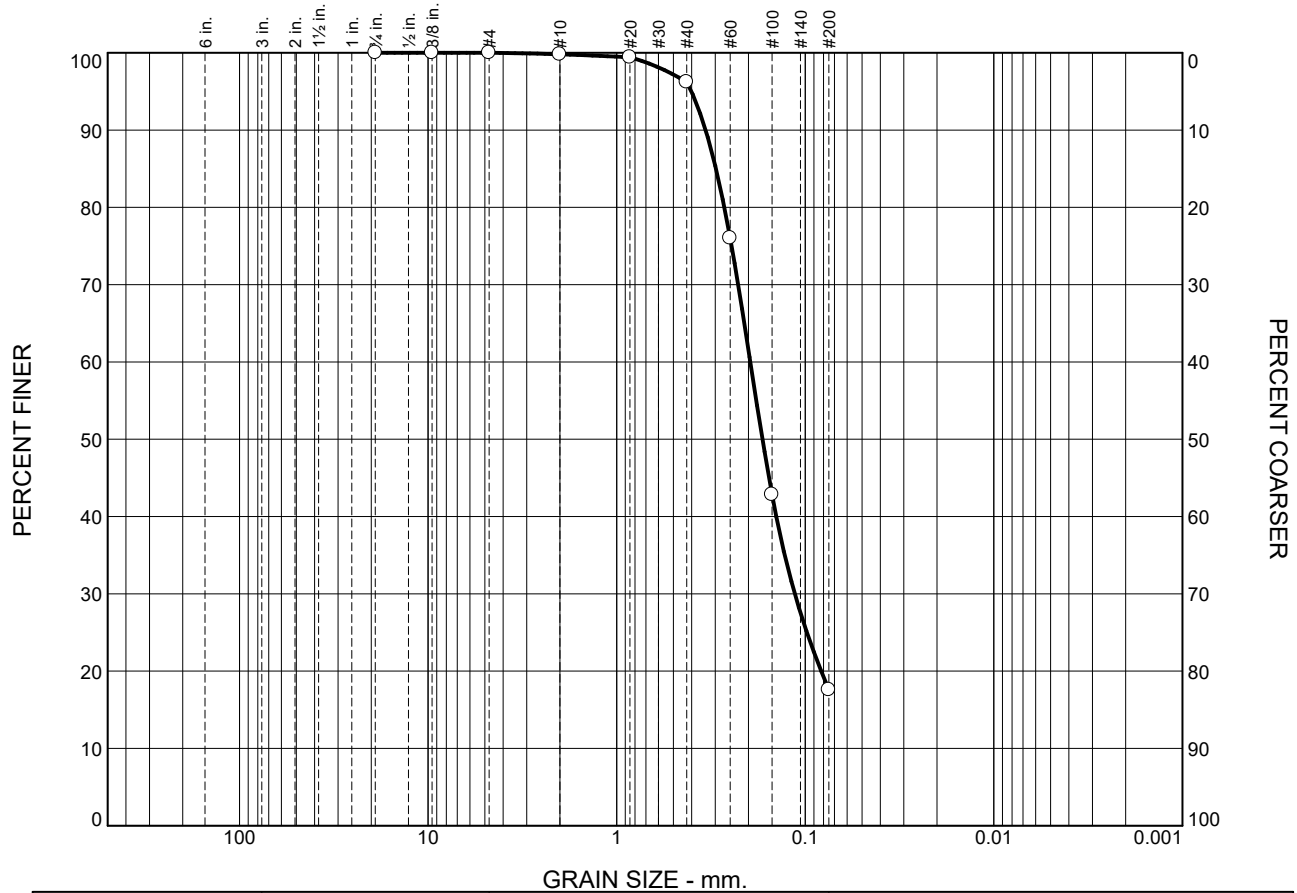
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	3.6	78.6	17.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-73	SP-6	57	Tan and gray SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

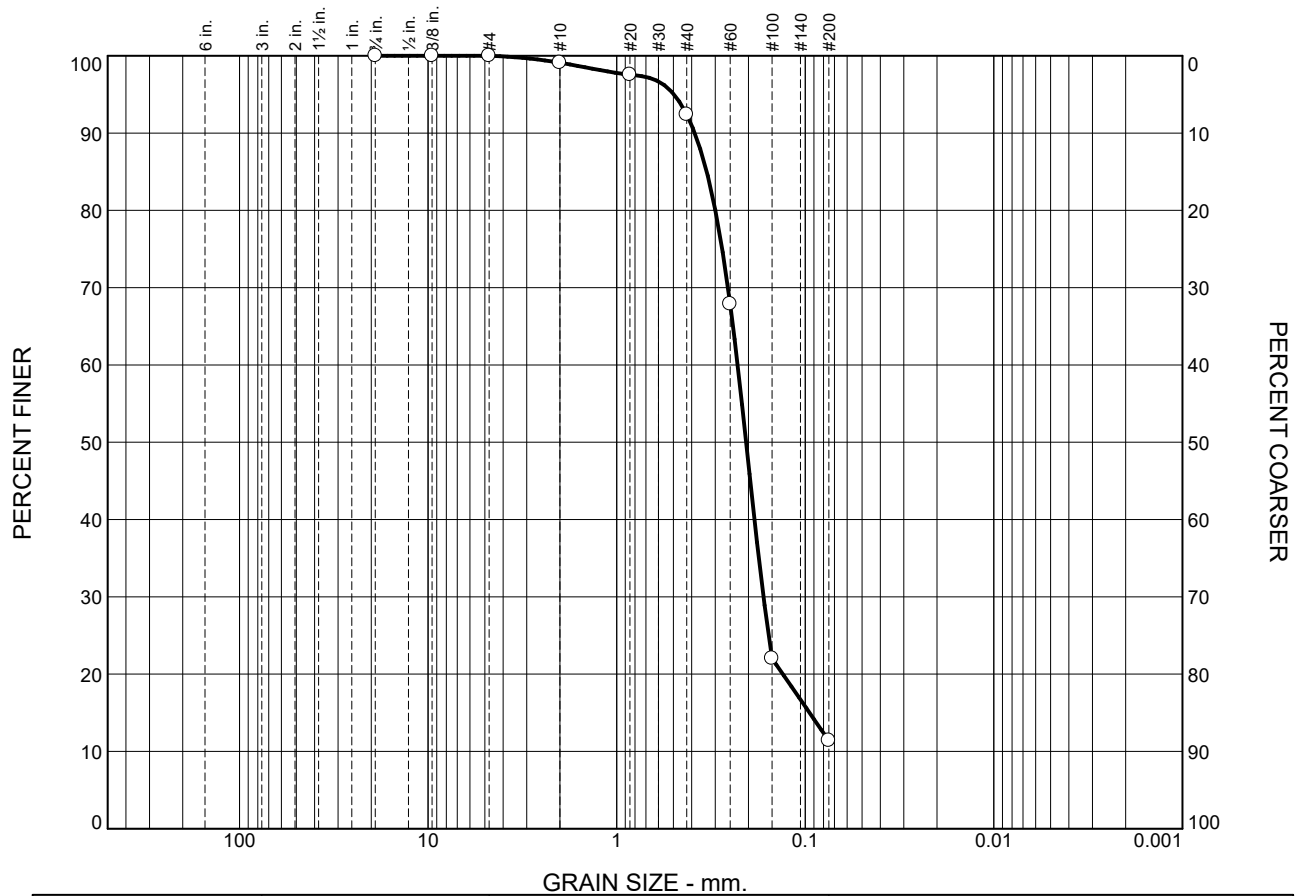
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.9	6.7	81.0	11.4	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-73	SP-8	62	Tan poorly graded SAND with SILT	SP-SM

Tolunay-Wong Engineers, Inc.

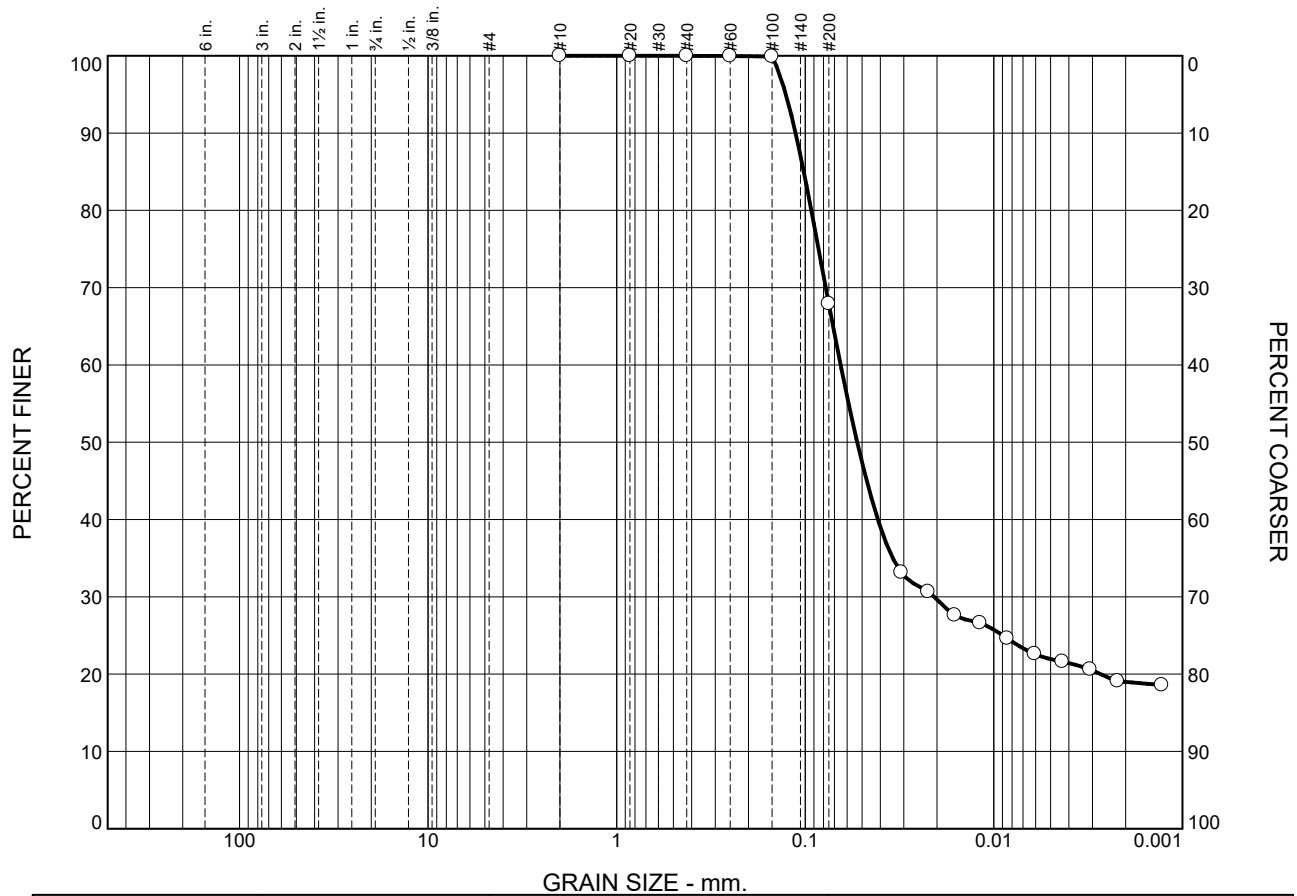
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	32.1	46.0	21.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-74	SP-2	13	Tan and gray SANDY SILT; fat clay seams	CL

Tolunay-Wong Engineers, Inc.

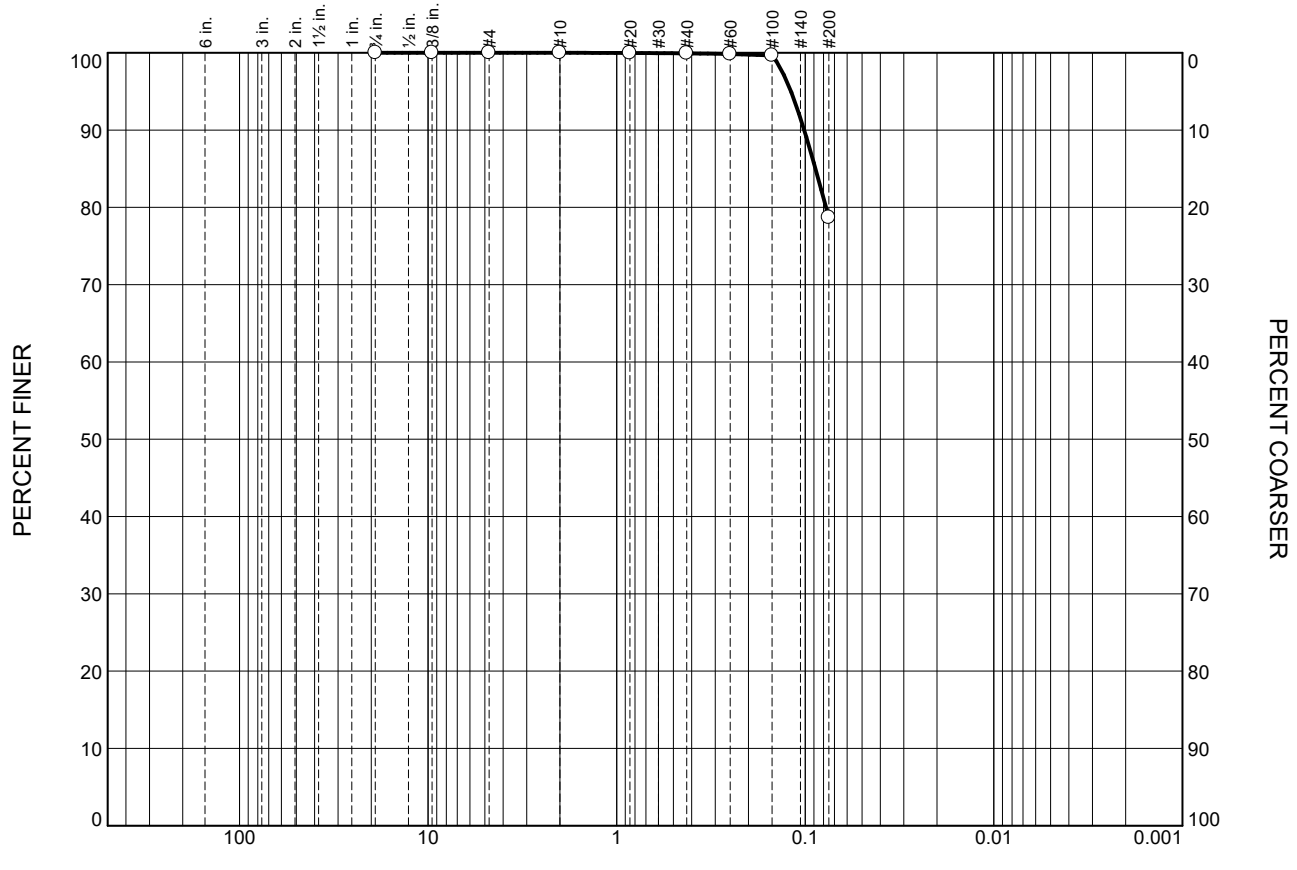
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	21.2	78.7	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-74	SP-3	18	Tan and gray LEAN CLAY with SAND	CL

Tolunay-Wong Engineers, Inc.

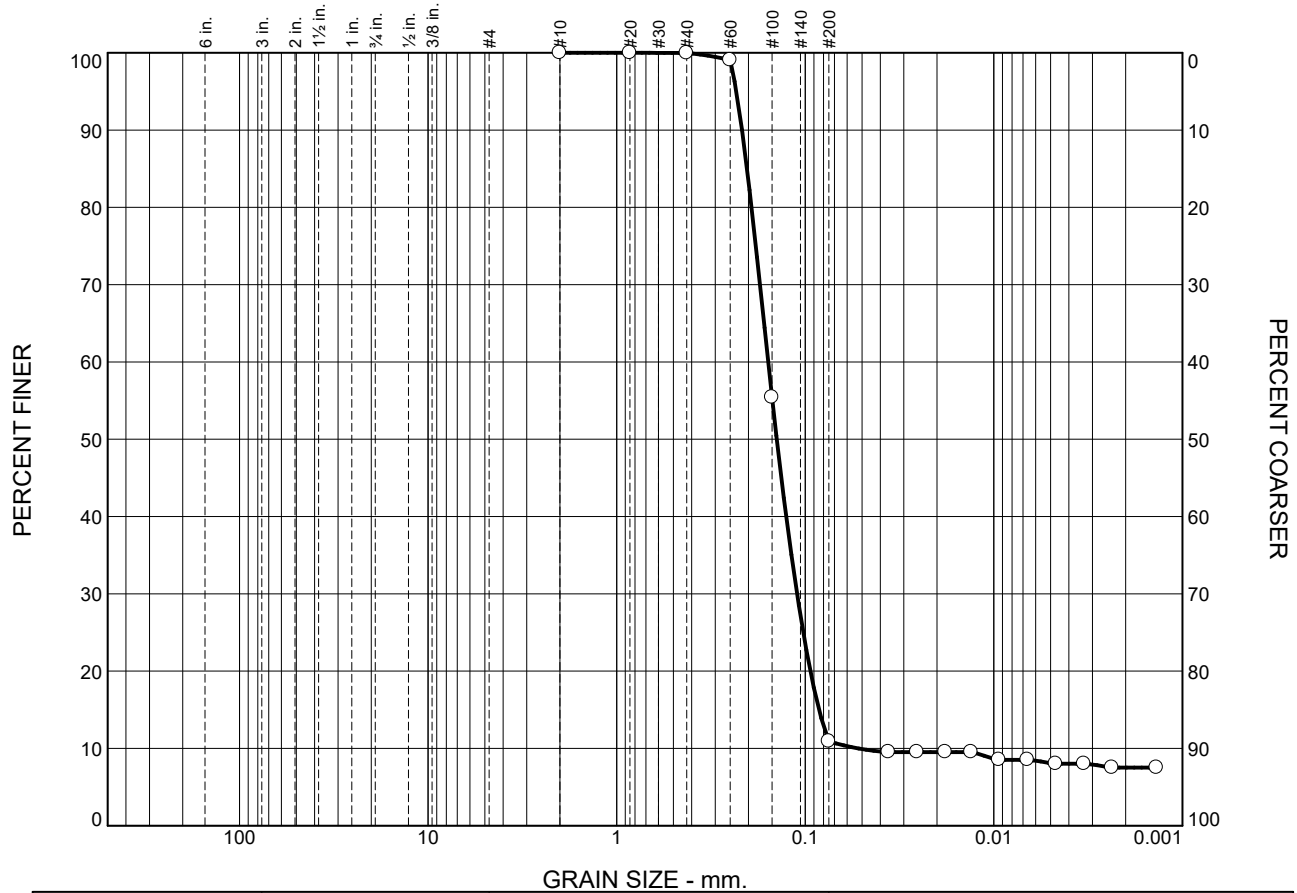
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	89.1	2.8	8.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-74	SP-5	28	Tan poorly graded SAND with SILT	SM

Tolunay-Wong Engineers, Inc.

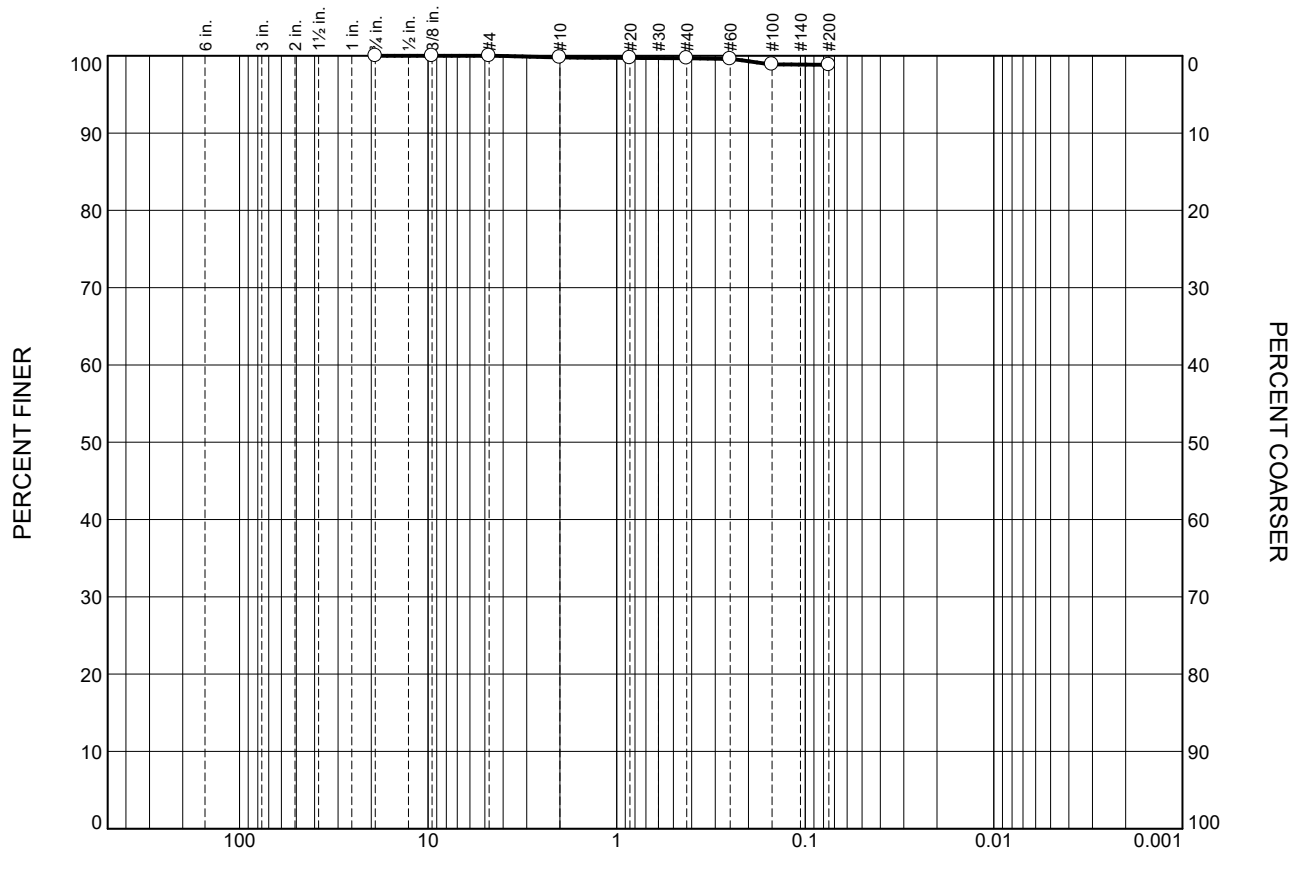
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	0.1	0.9	98.8	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-74	ST-1	5	Gray and brown FAT CLAY; calcareous	CH

Tolunay-Wong Engineers, Inc.

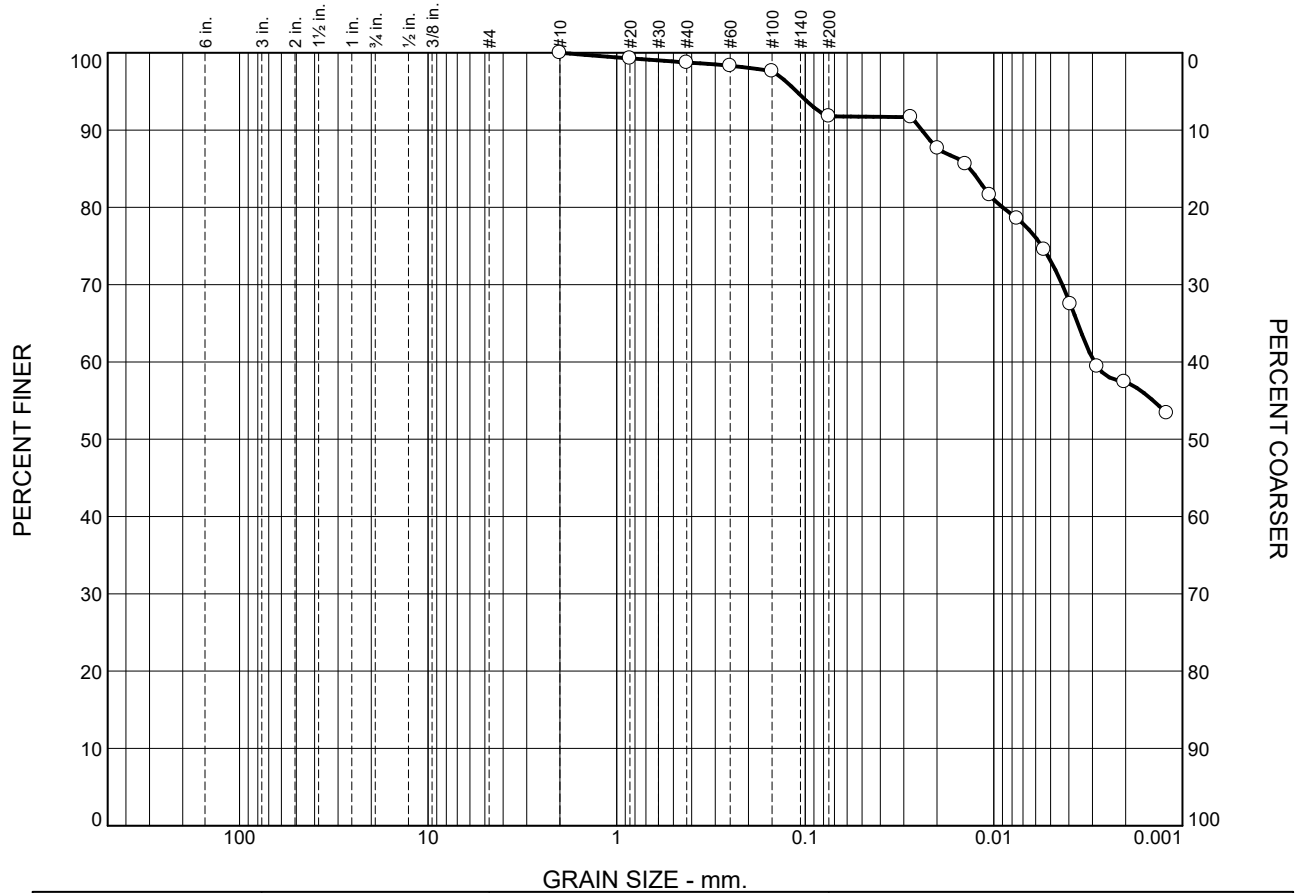
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.3	6.9	18.7	73.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-75	SP-1	0.5	Tan and gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

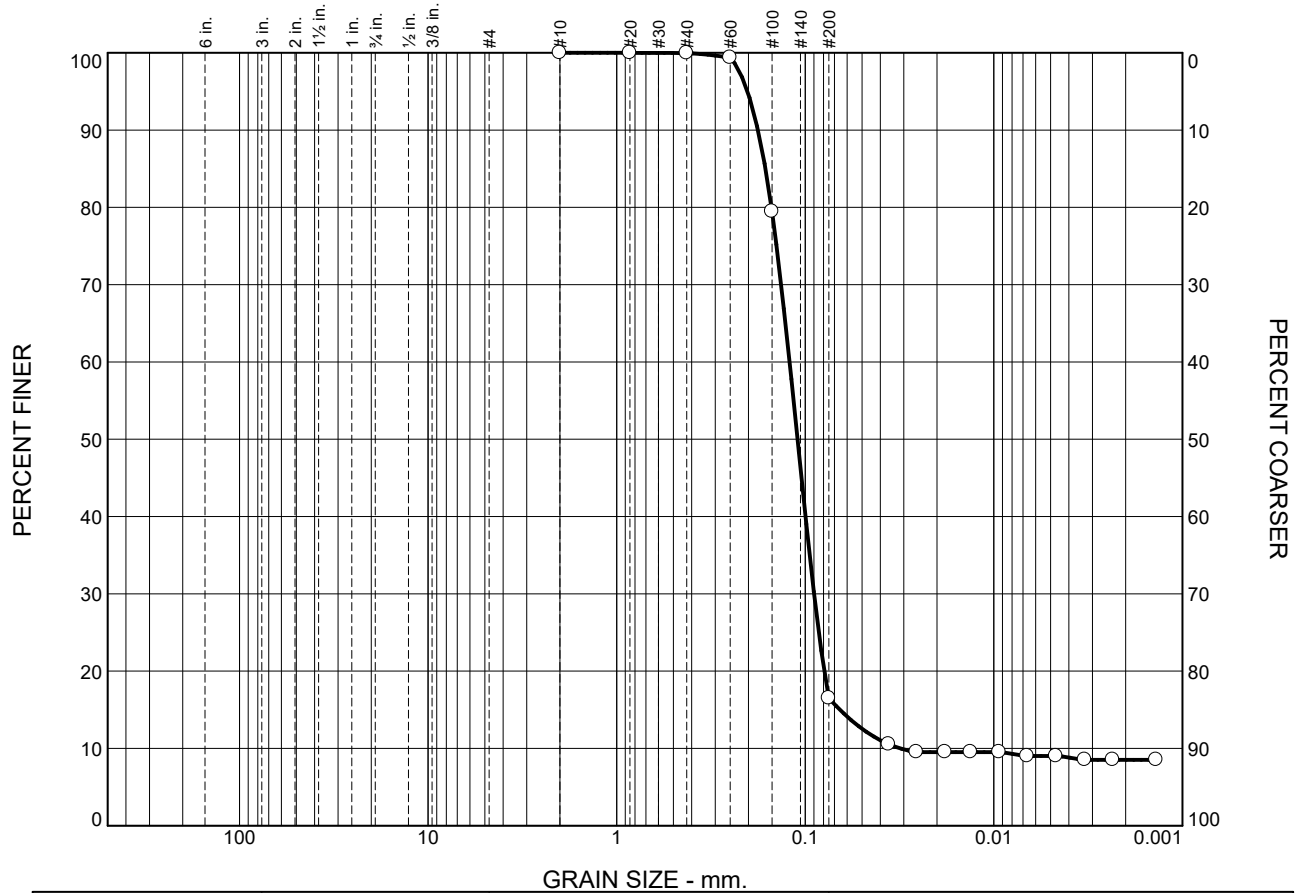
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	83.5	7.5	9.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-75	SP-2	15.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

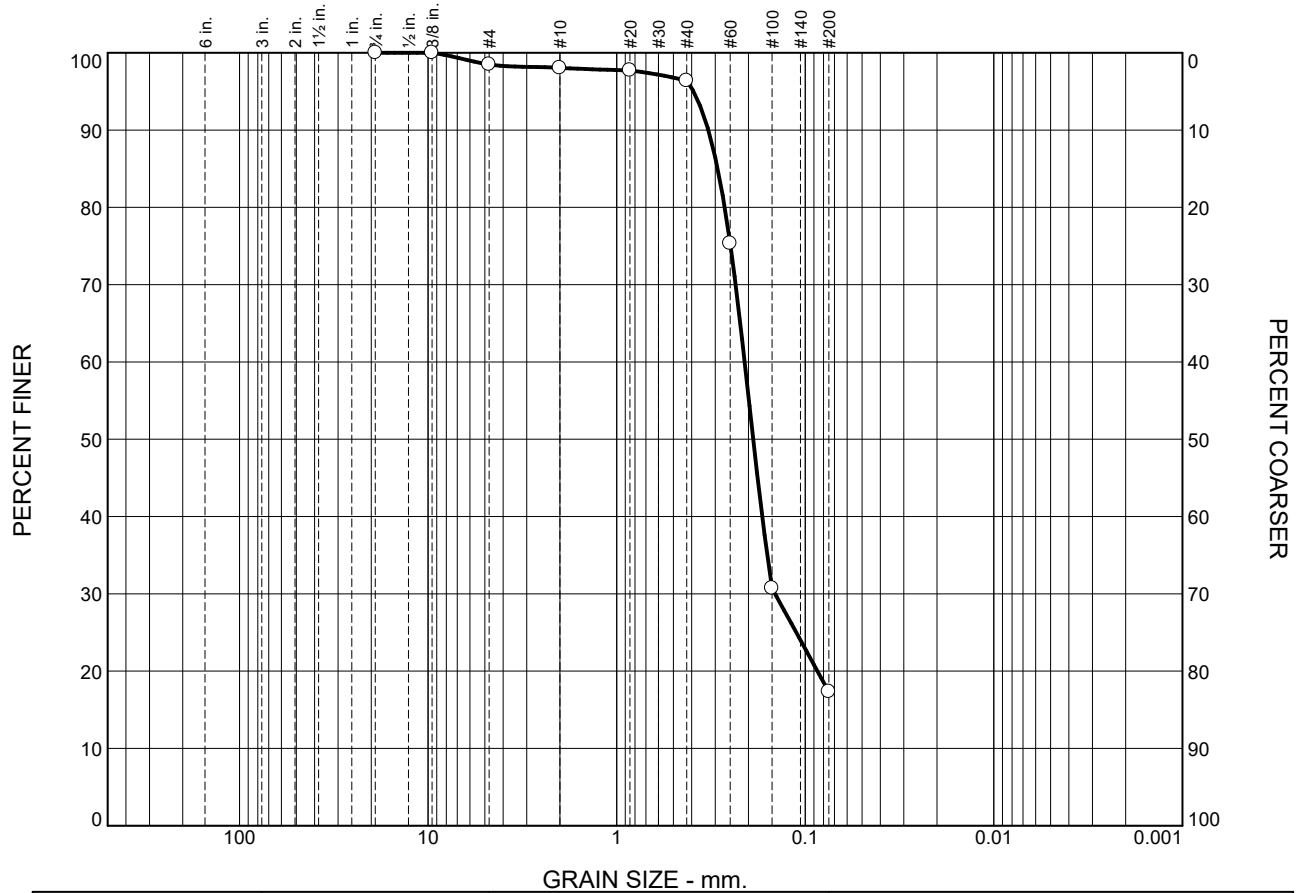
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.5	0.5	1.6	79.1	17.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-75	SP-4	20.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

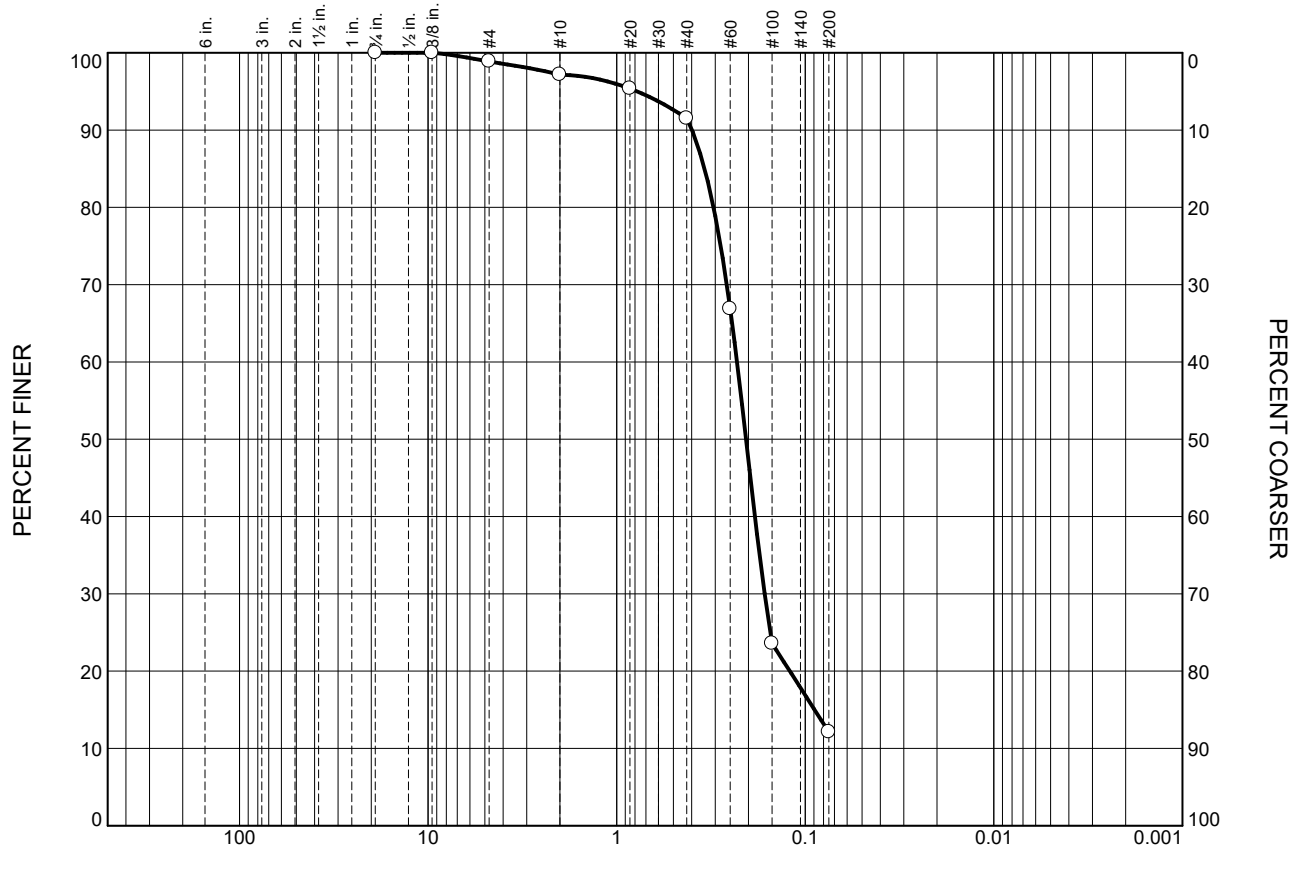
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.1	1.7	5.7	79.4	12.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-75	SP-6	25.5	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

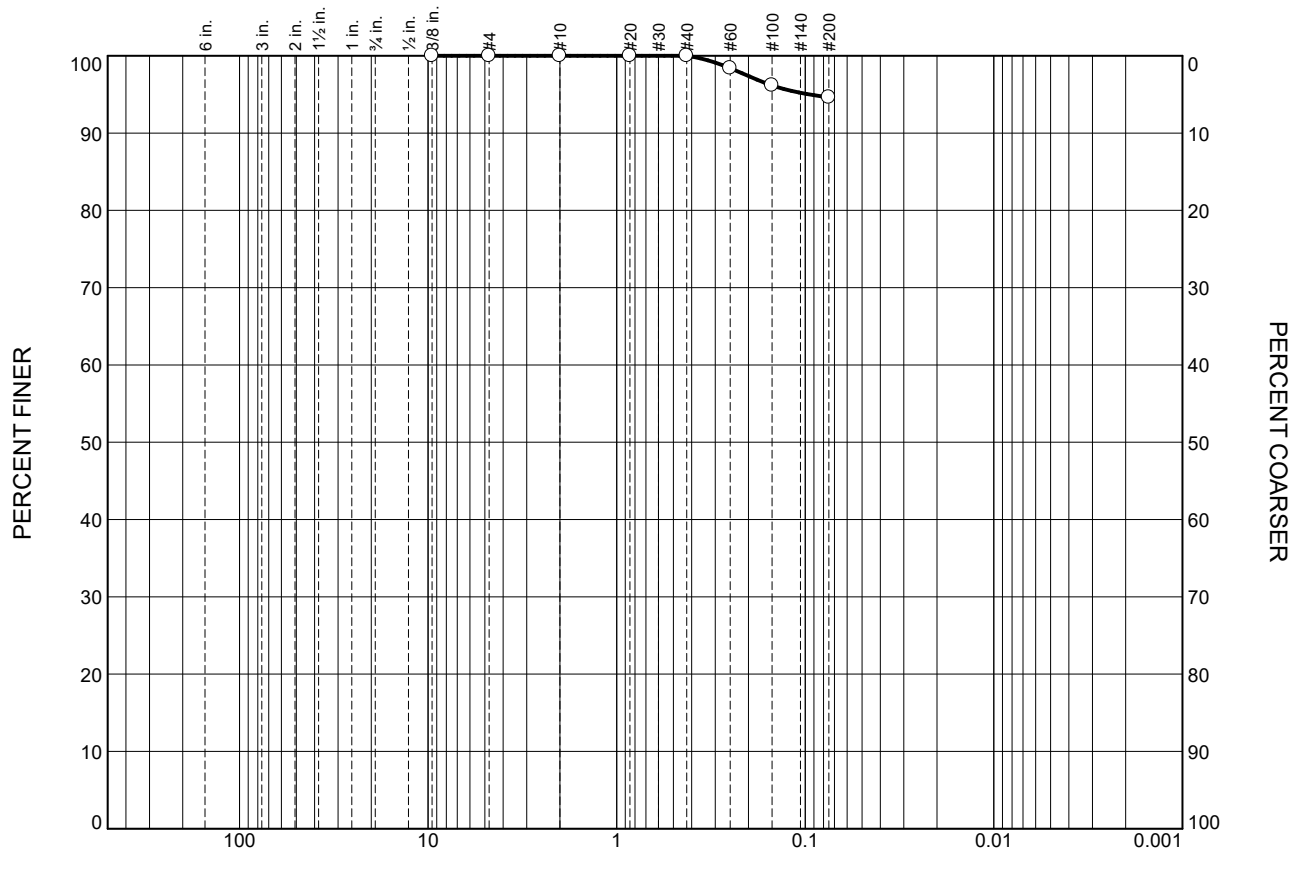
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	5.4	94.6	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-75	ST-1	2.5	Tan and gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

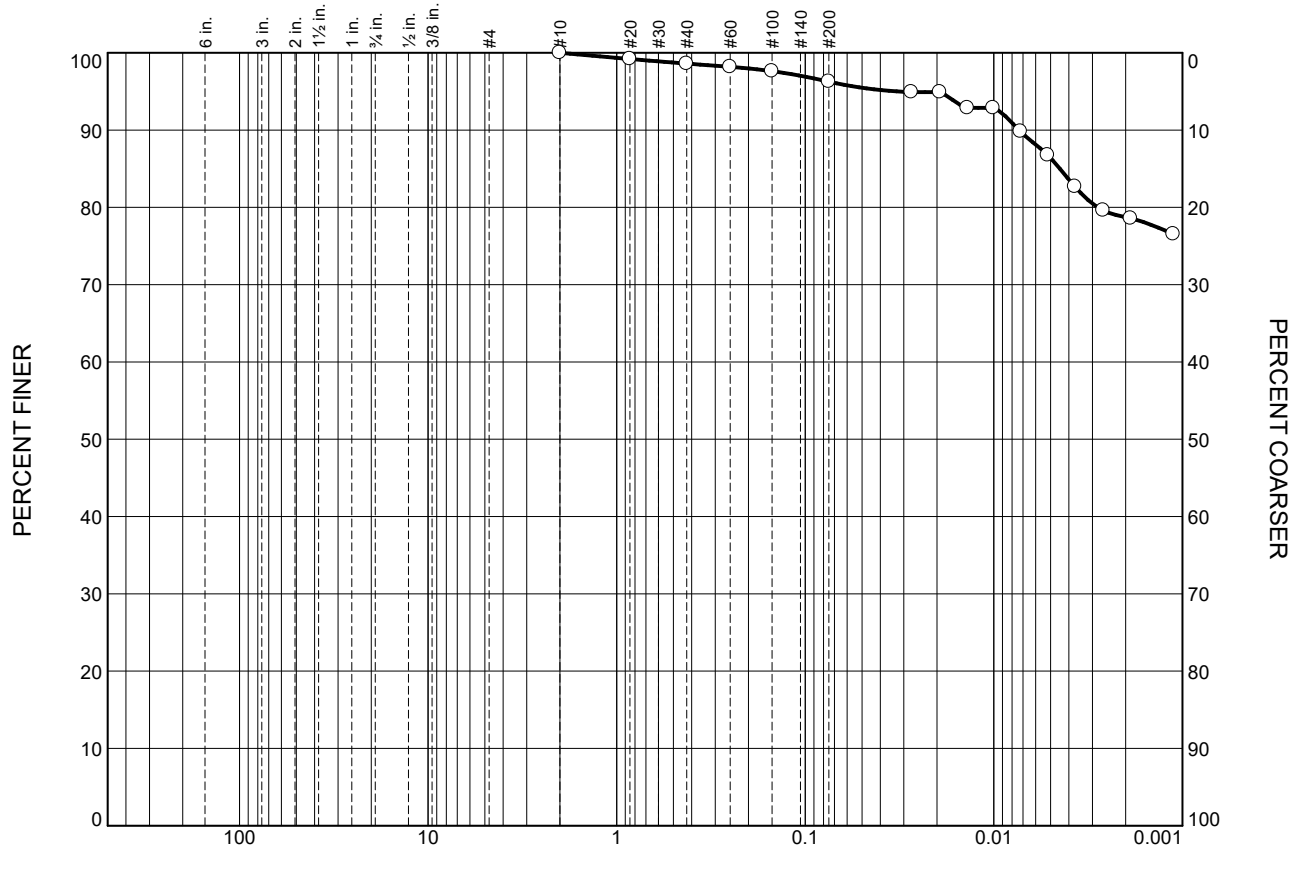
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.4	2.3	9.9	86.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-76	SP-1	0.5	Tan and gray FAT CLAY	CH

Tolunay-Wong Engineers, Inc.

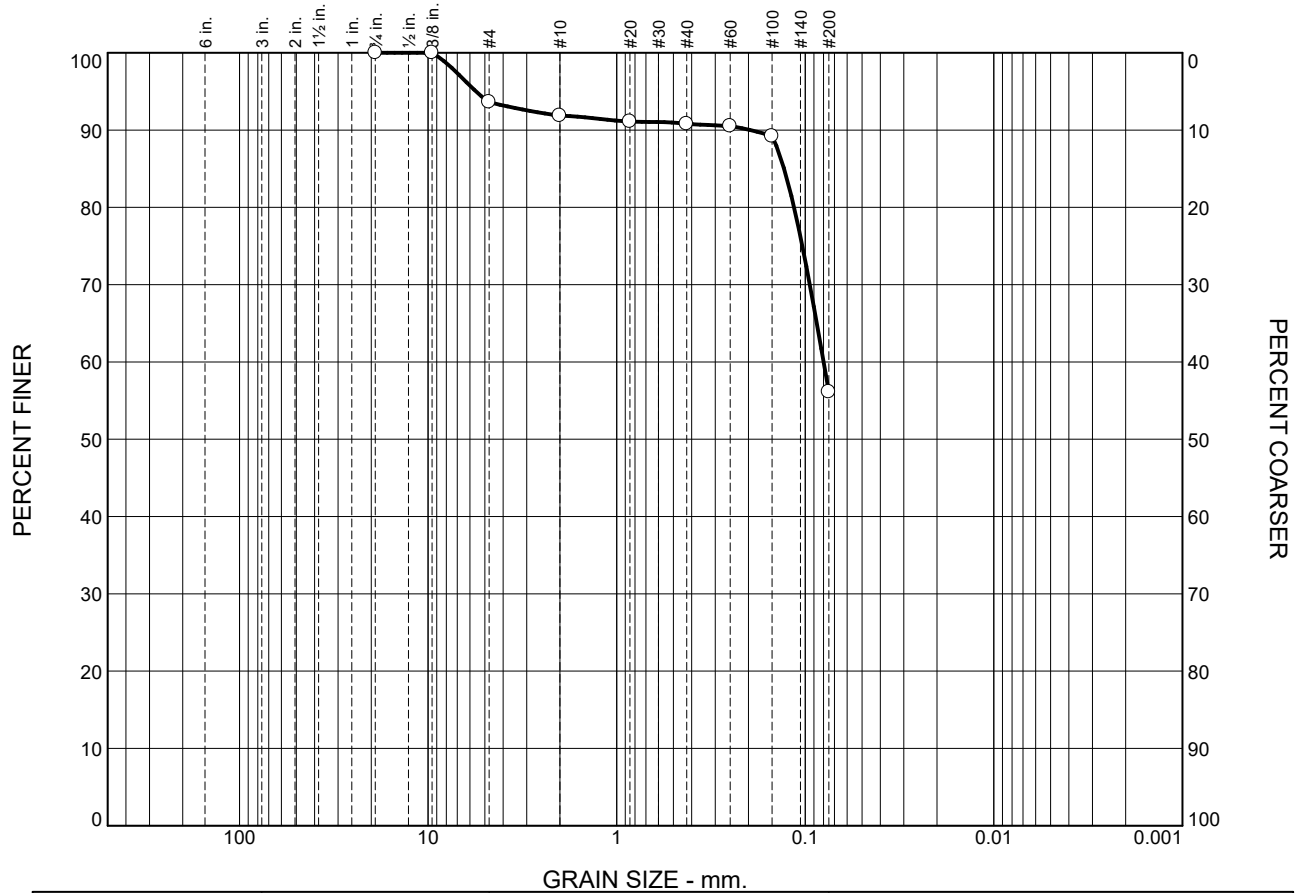
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	6.4	1.7	1.1	34.7	56.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-76	SP-2	13	Tan SANDY SILT	CL

Tolunay-Wong Engineers, Inc.

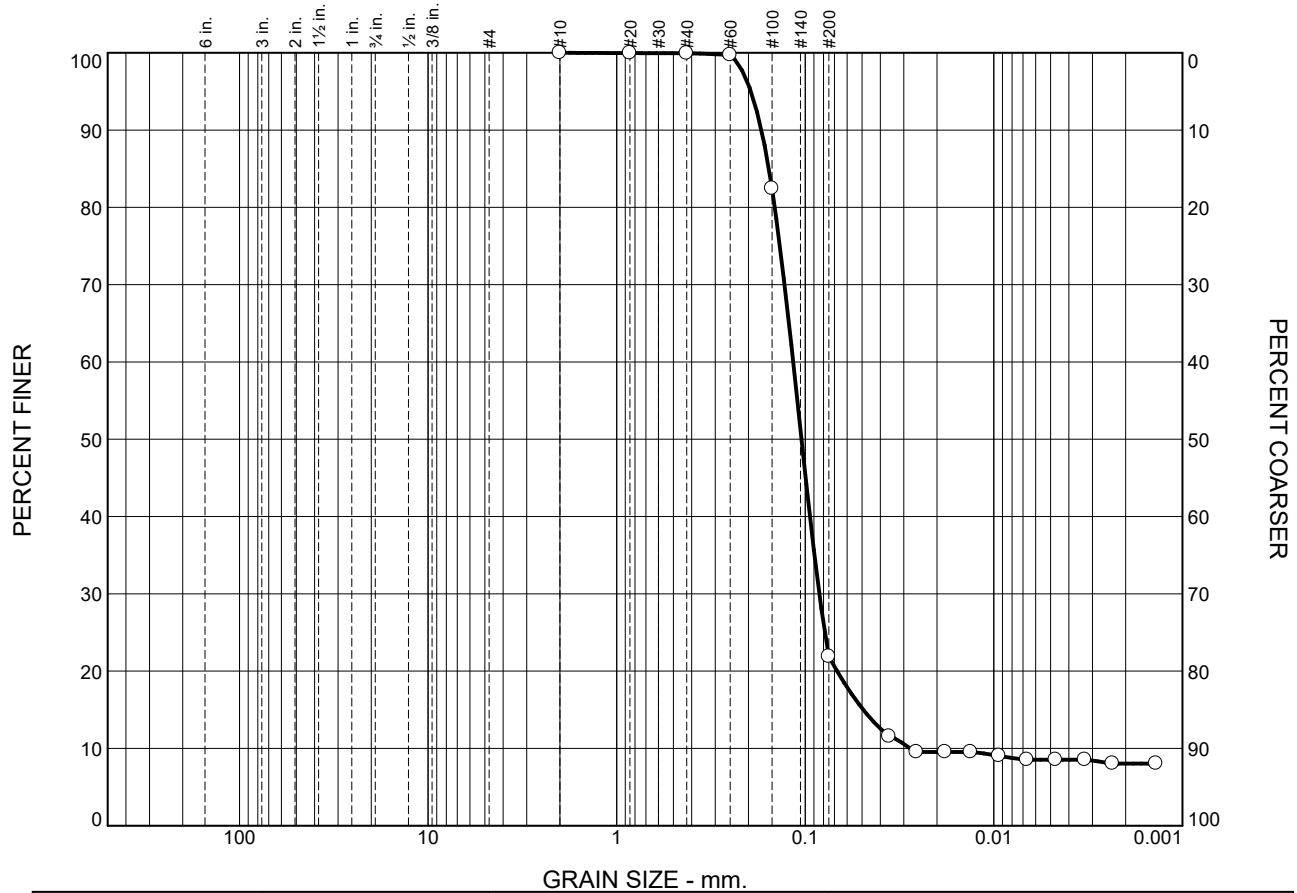
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	78.0	13.4	8.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-76	SP-4	18	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

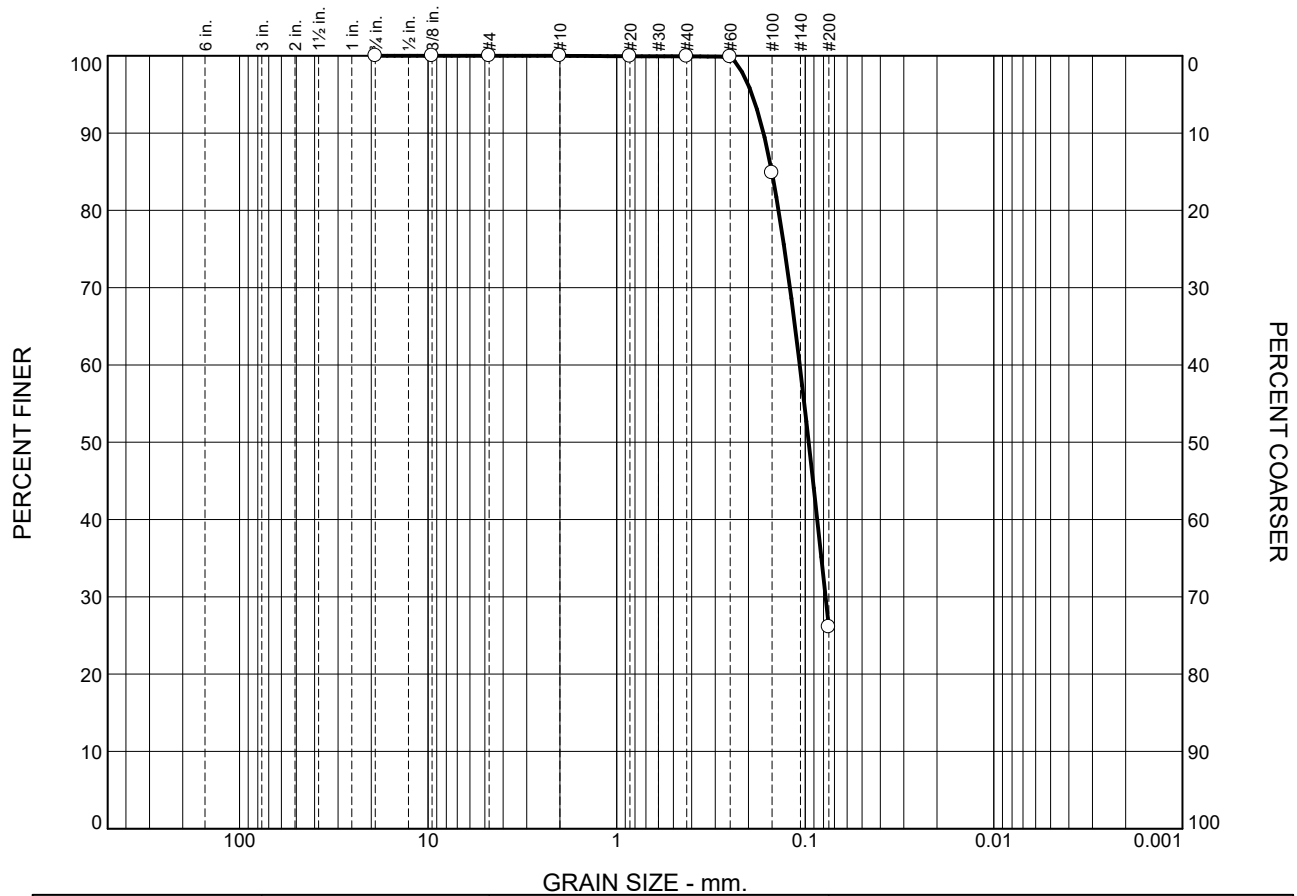
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	73.8	26.1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-76	SP-6	23	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	80.0	20.0	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	CB-76	SP-8	28	Tan SILTY SAND	SM

Tolunay-Wong Engineers, Inc.

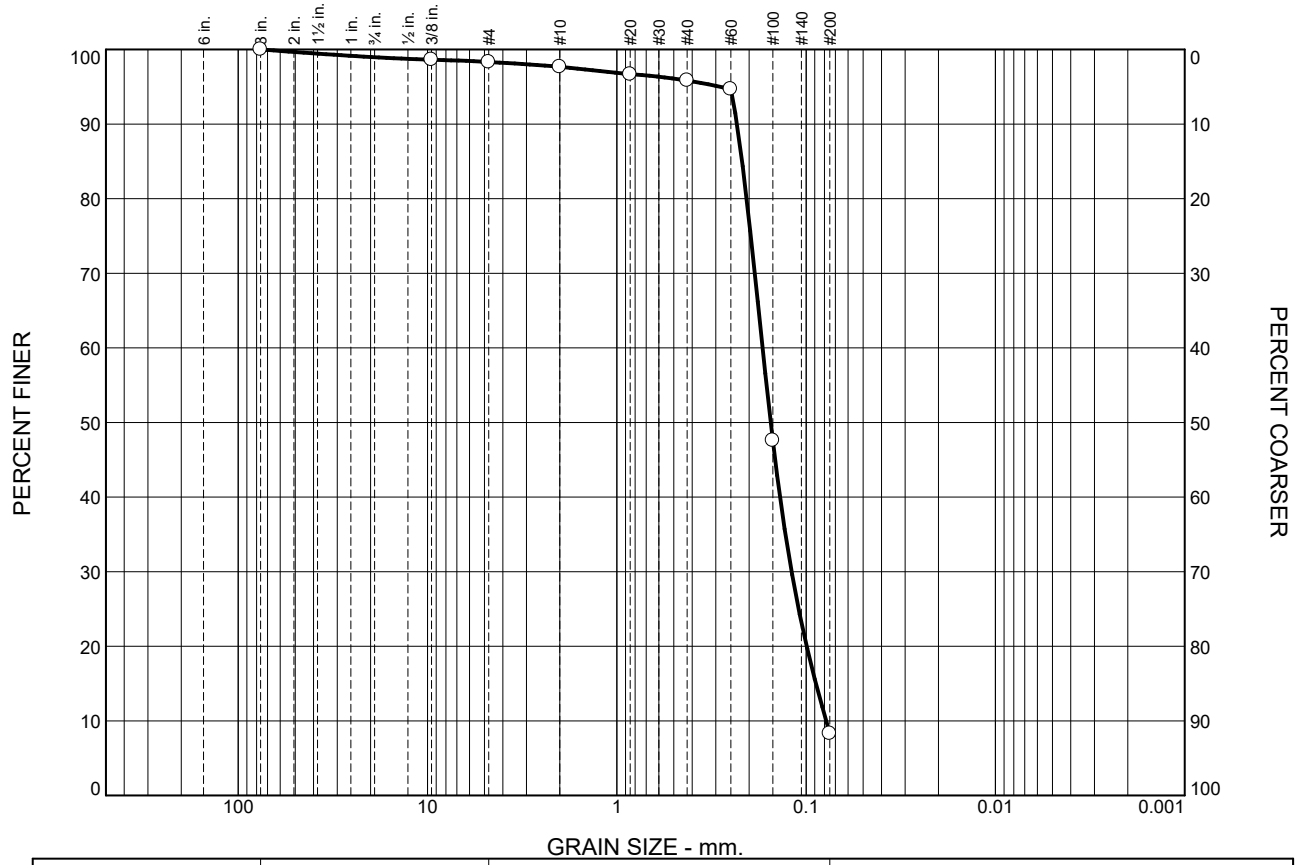
Beaumont, TX

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Project No.: 21.14.223 **Figure**

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.0	0.7	0.6	1.9	87.5	8.3	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-01	J-1	0	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

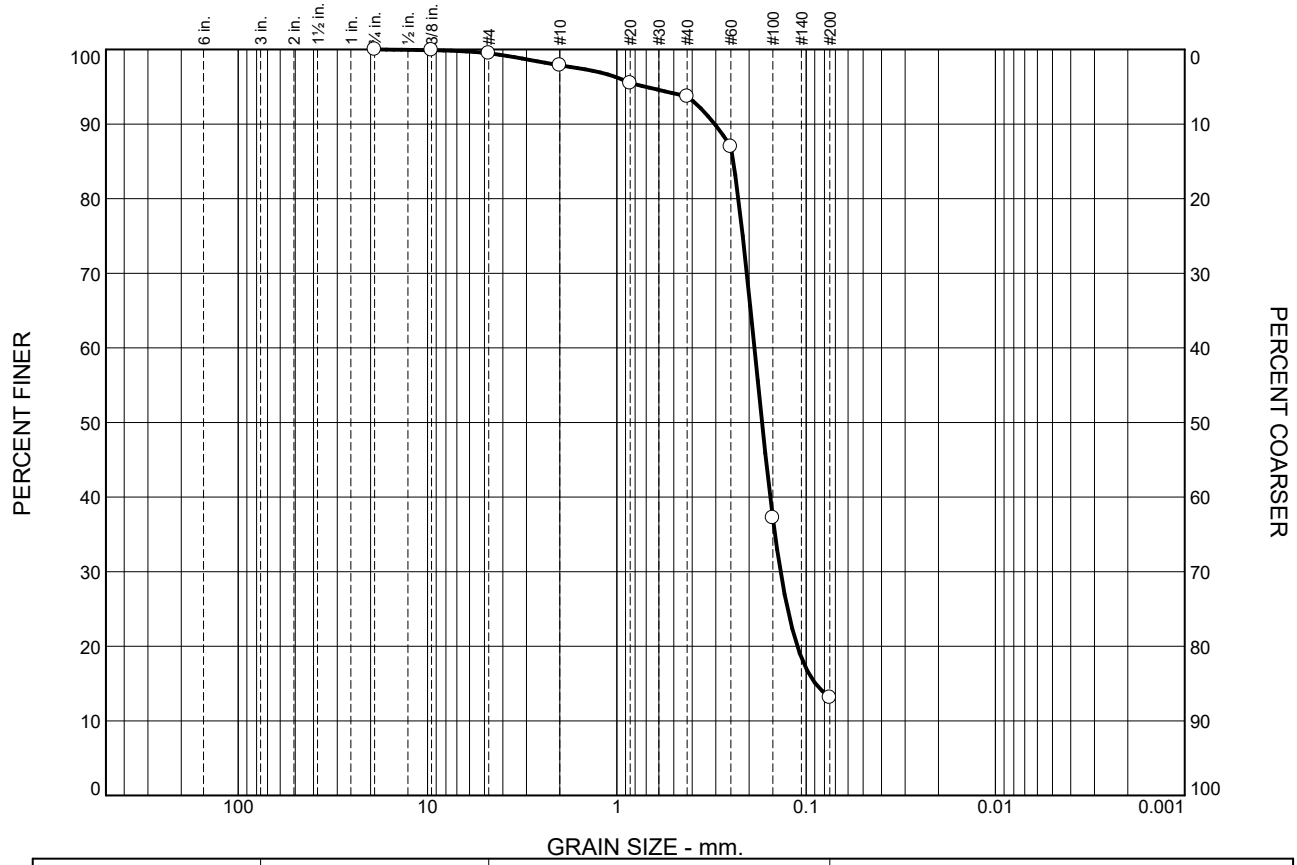
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.5	1.6	4.2	80.6	13.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-01	J-2	1	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

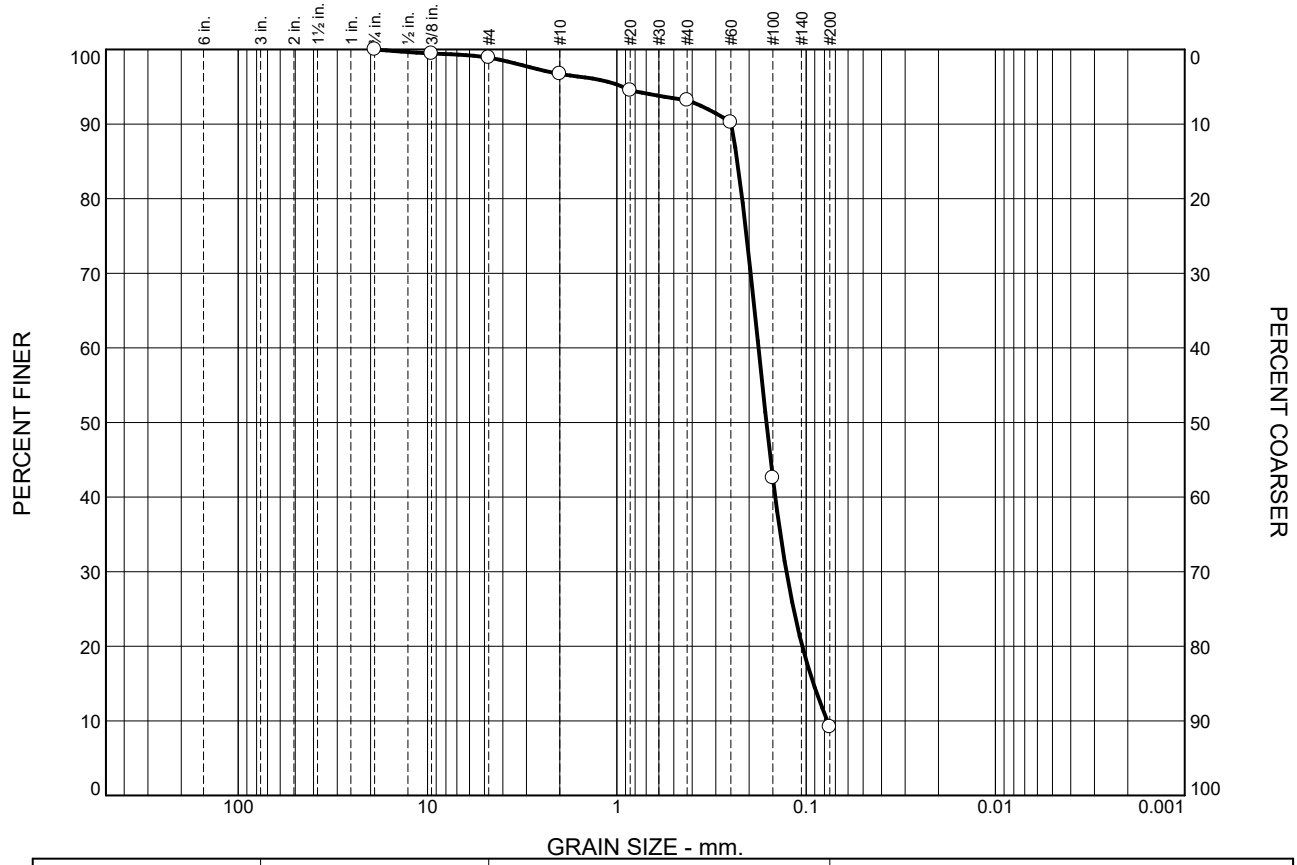
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	1.1	2.2	3.5	84.0	9.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-02	J-1	0	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

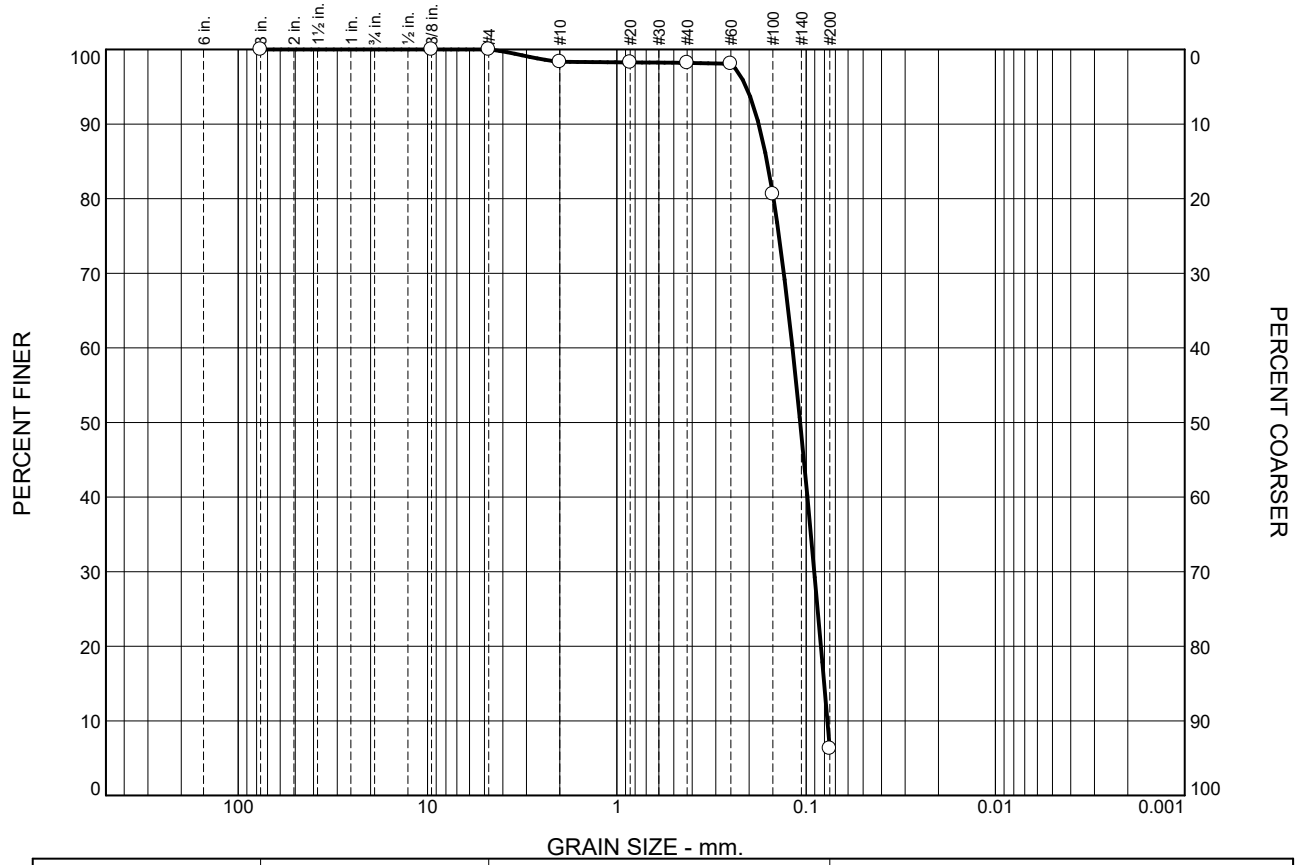
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Checked By: J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	1.7	0.1	91.9	6.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-02	J-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

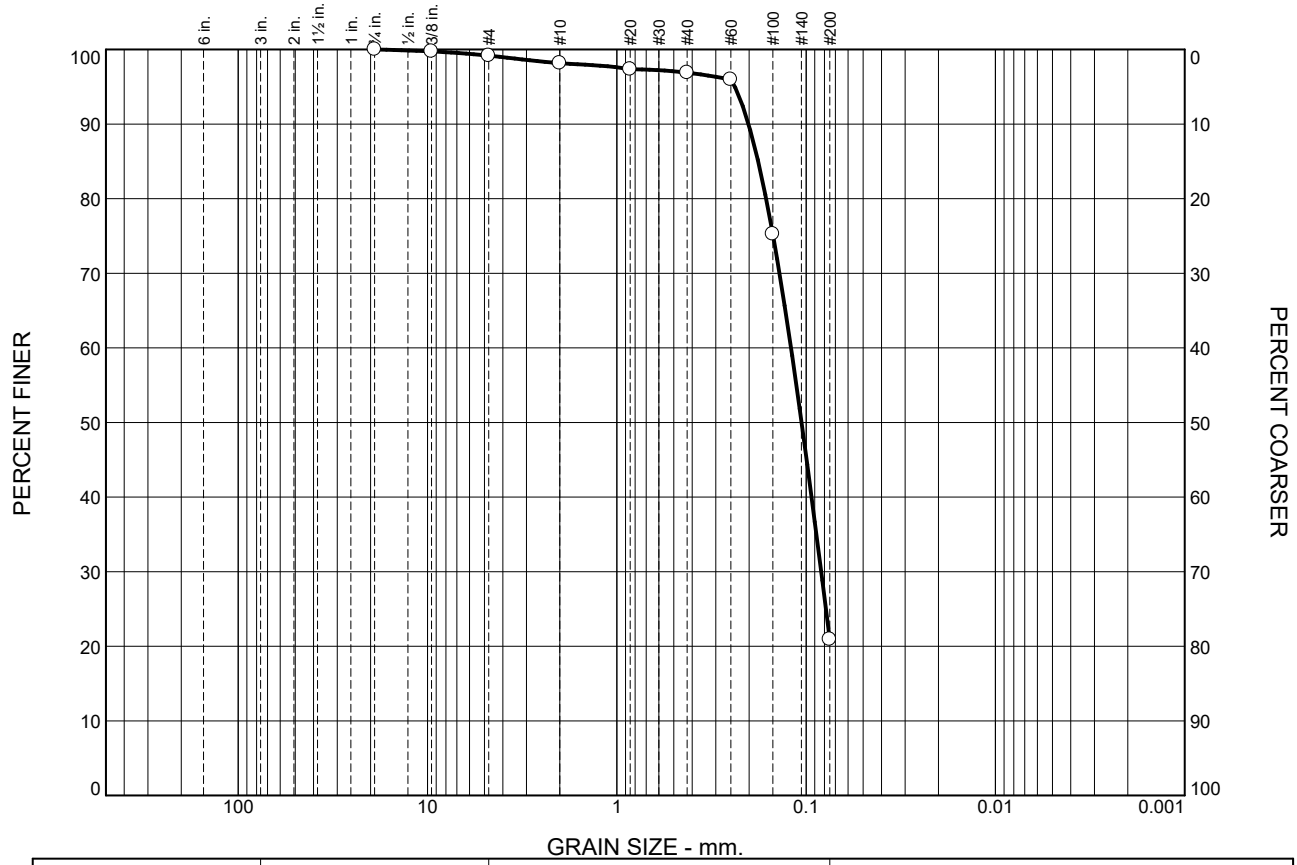
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.8	1.0	1.3	76.0	20.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-02	J-6	5	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

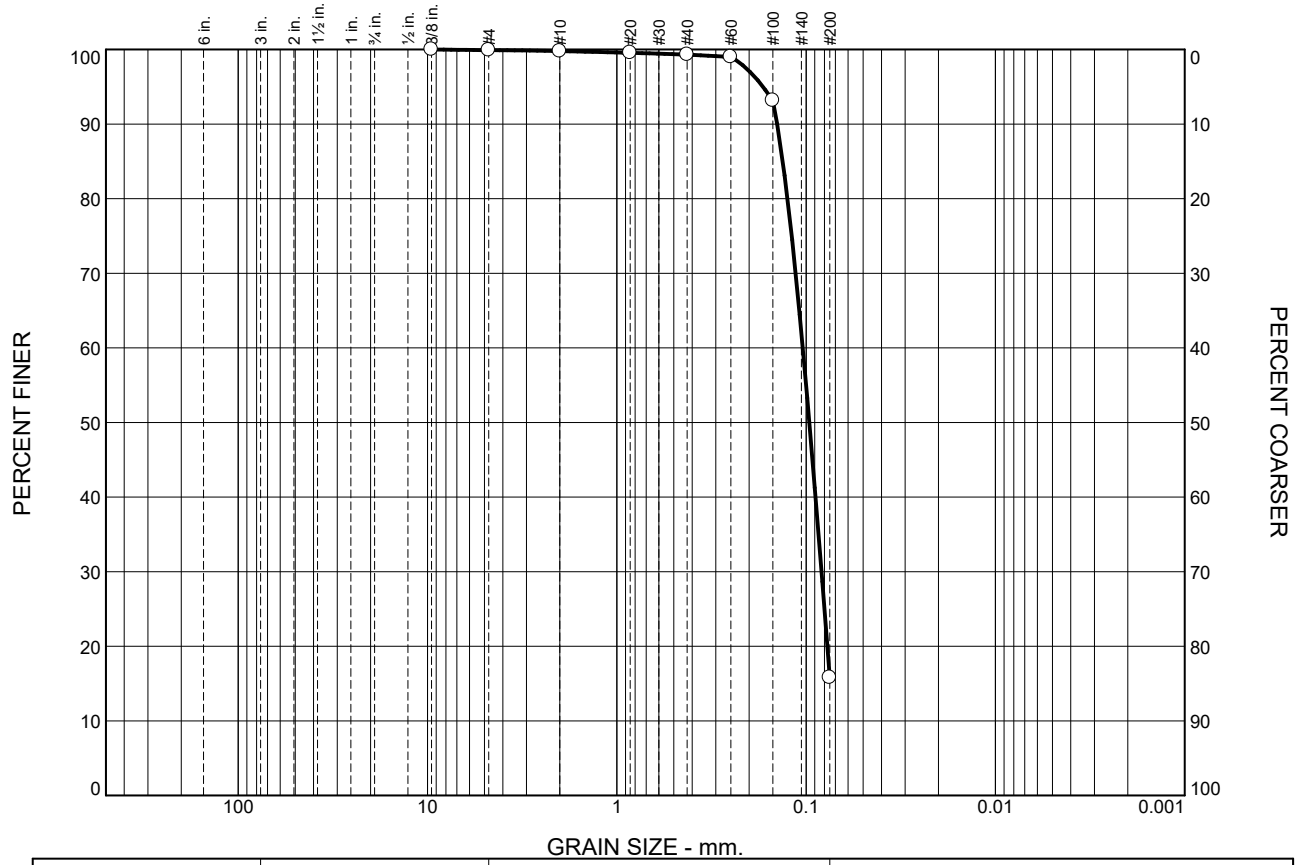
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.1	0.1	0.5	83.5	15.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-03	J-4	3	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

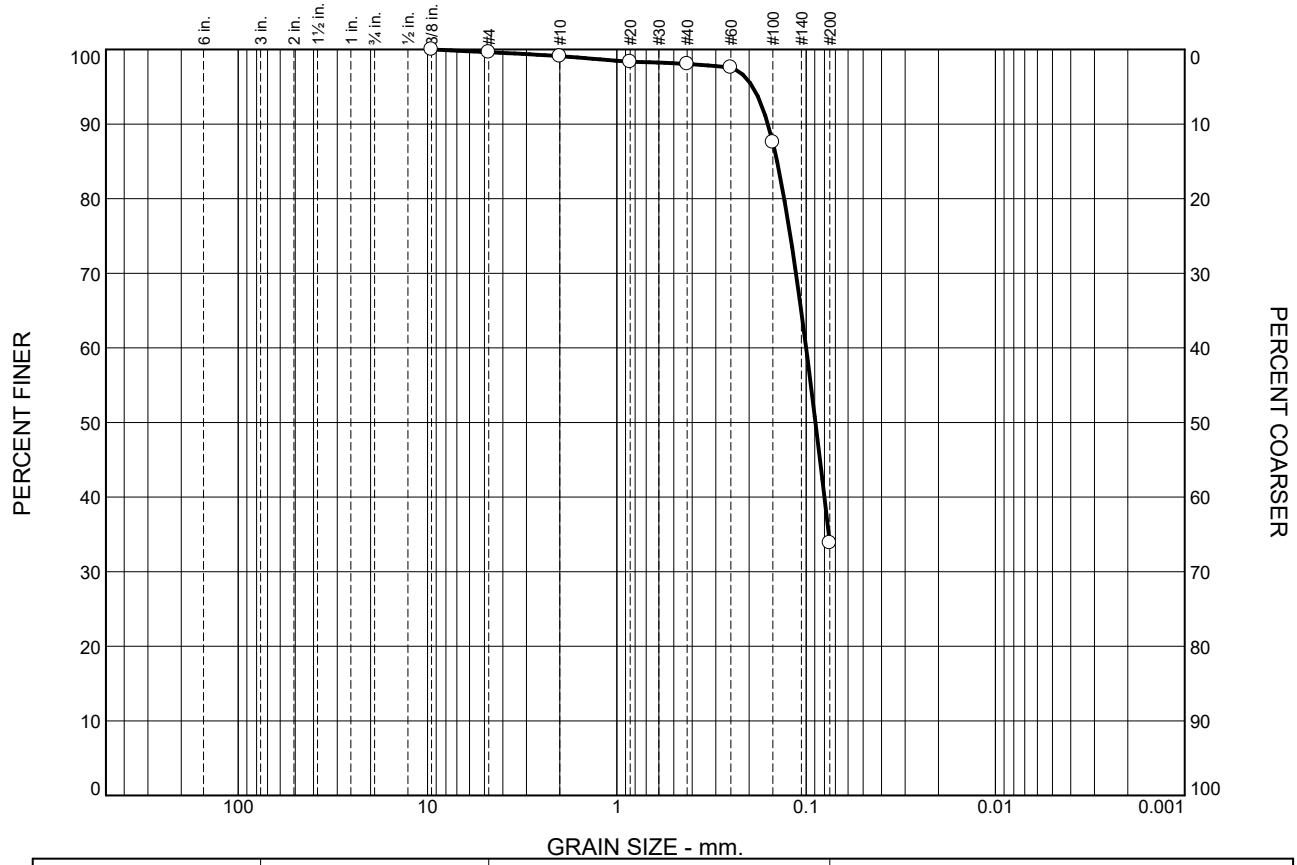
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.4	0.5	1.1	64.1	33.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-03	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

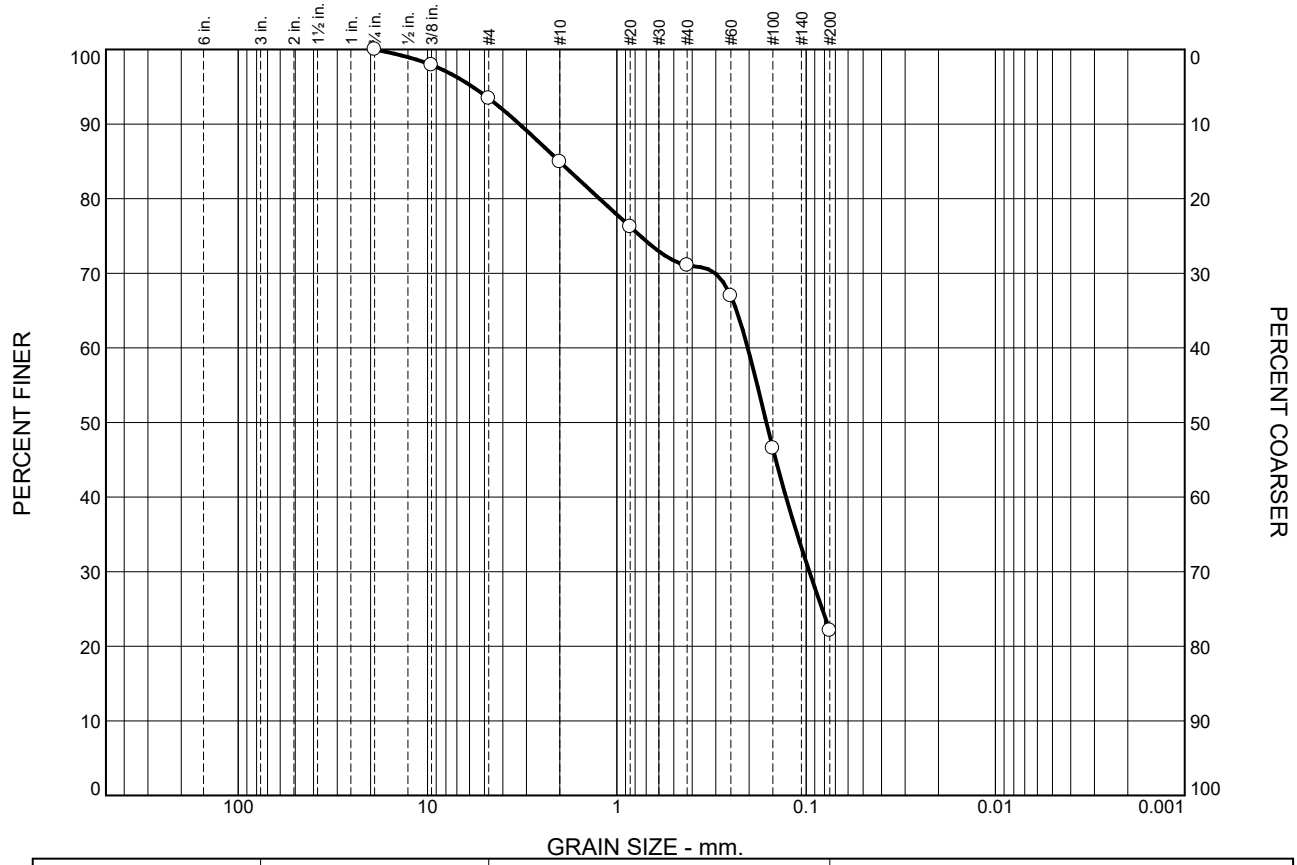
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	6.5	8.6	13.8	49.0	22.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-04	J-7	6	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

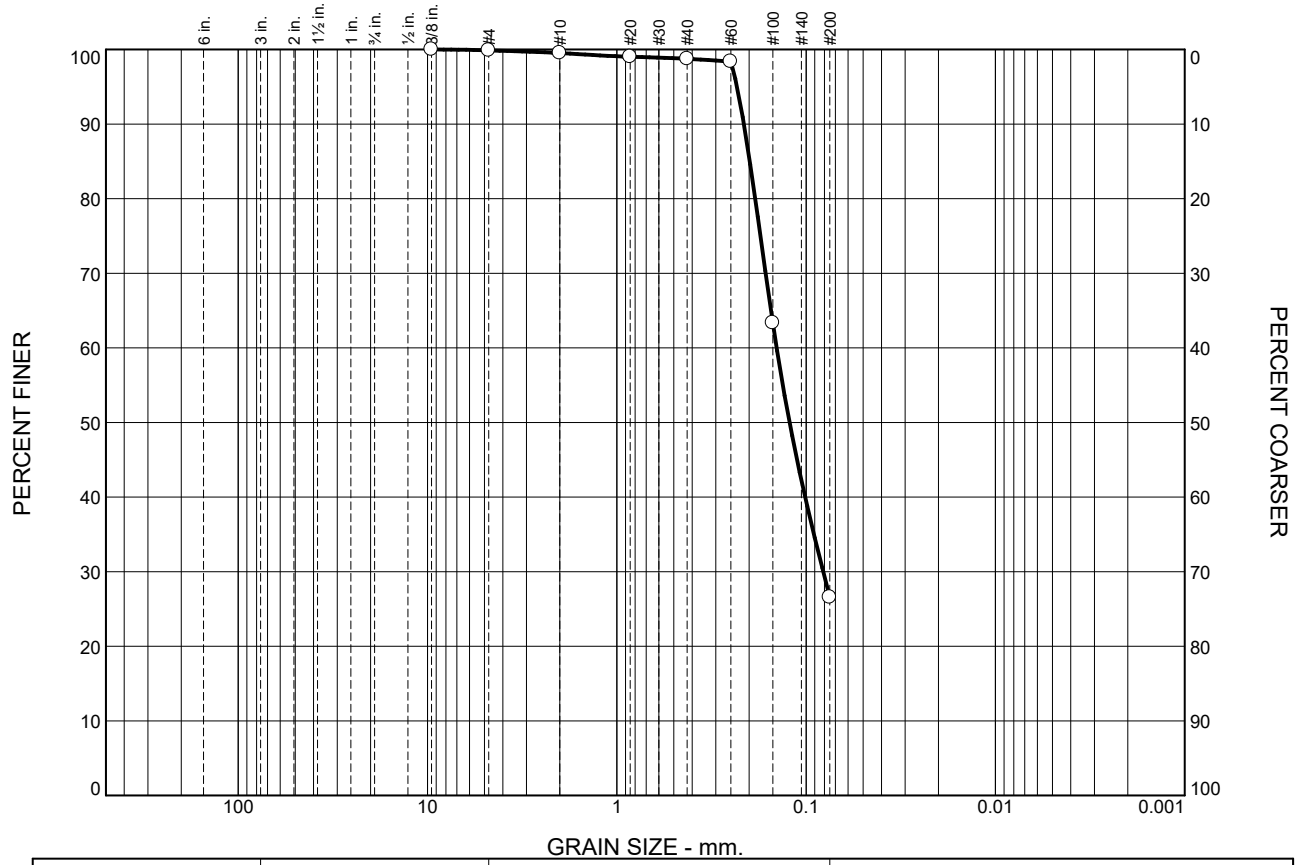
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.1	0.4	0.8	72.1	26.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-04	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	84.5	15.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-04	T-4	3	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

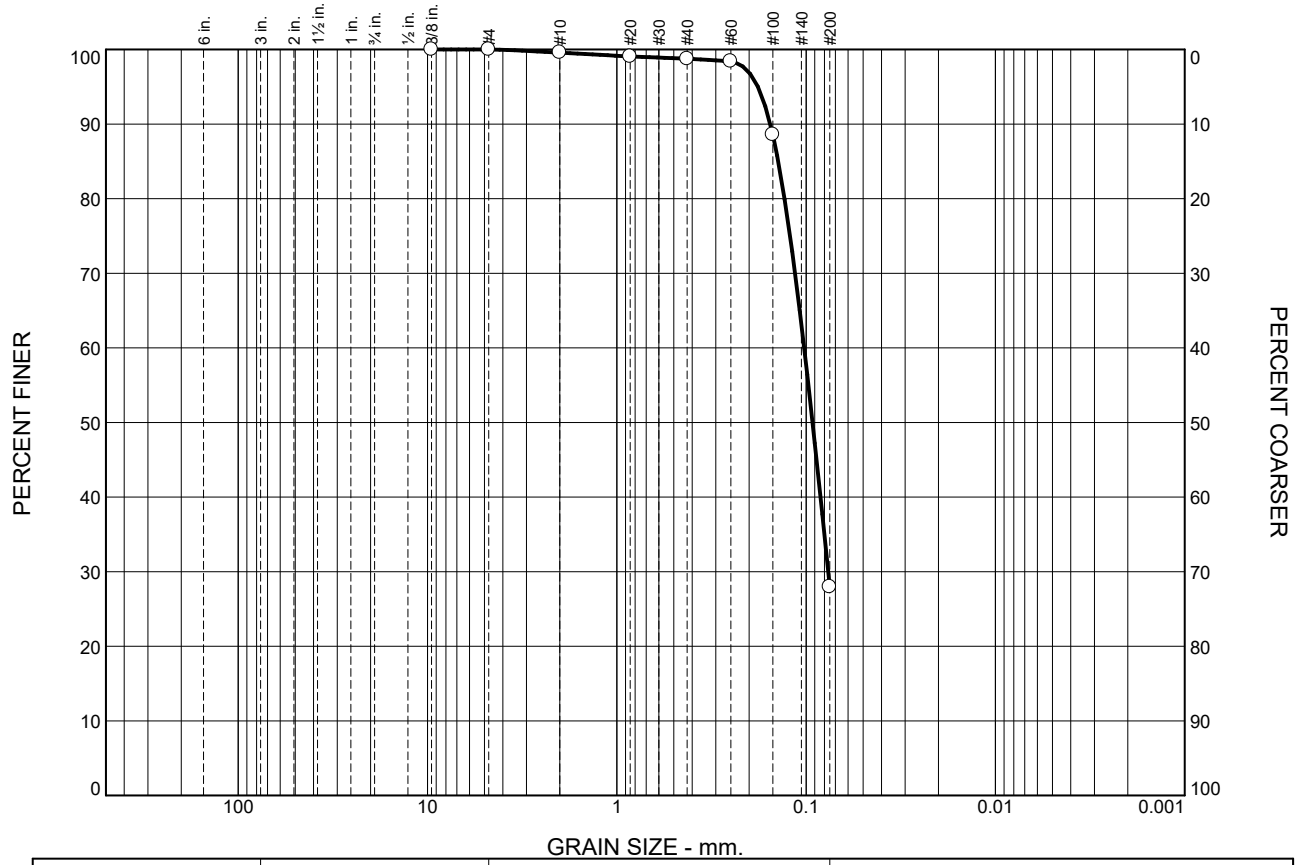
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.4	0.9	70.7	28.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-05	J-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

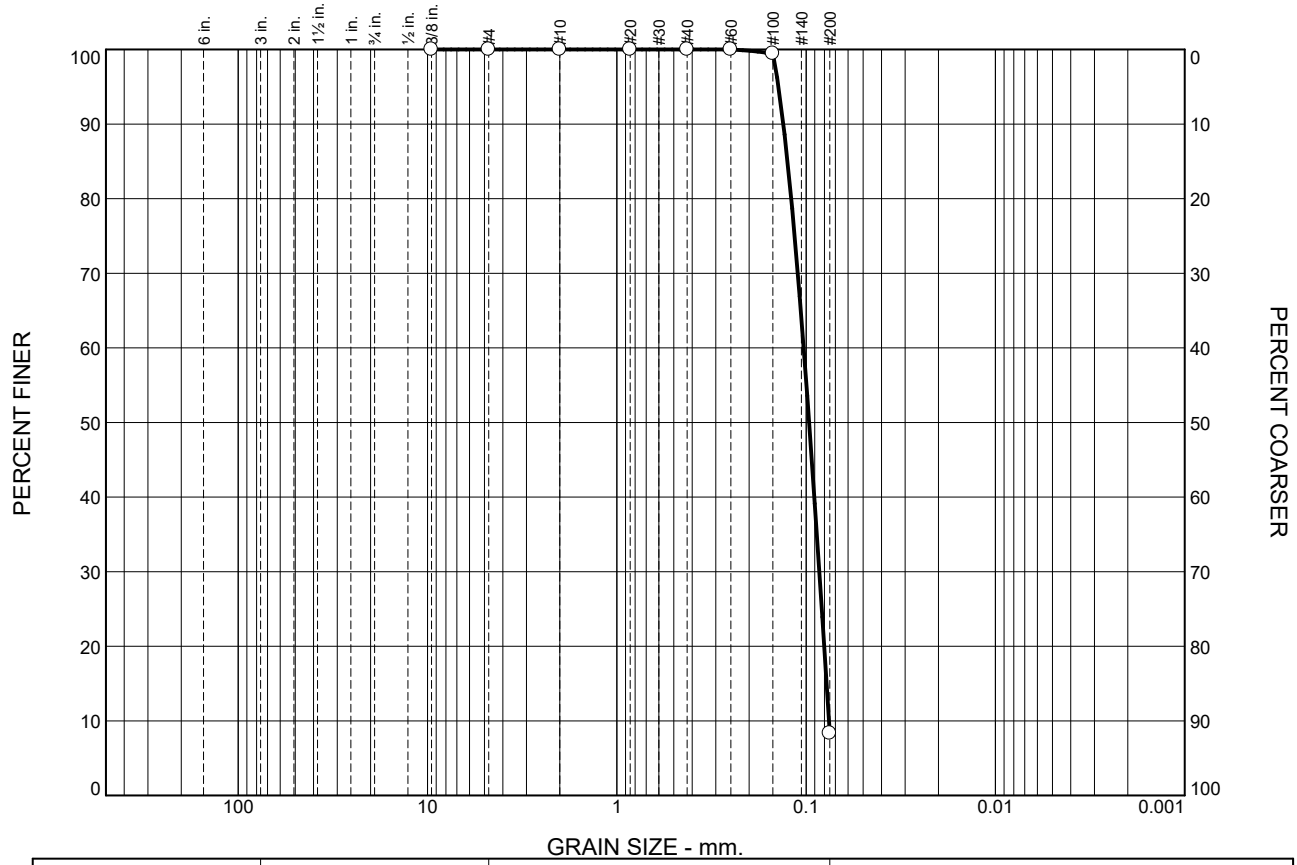
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	91.7	8.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-05	J-6	5	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

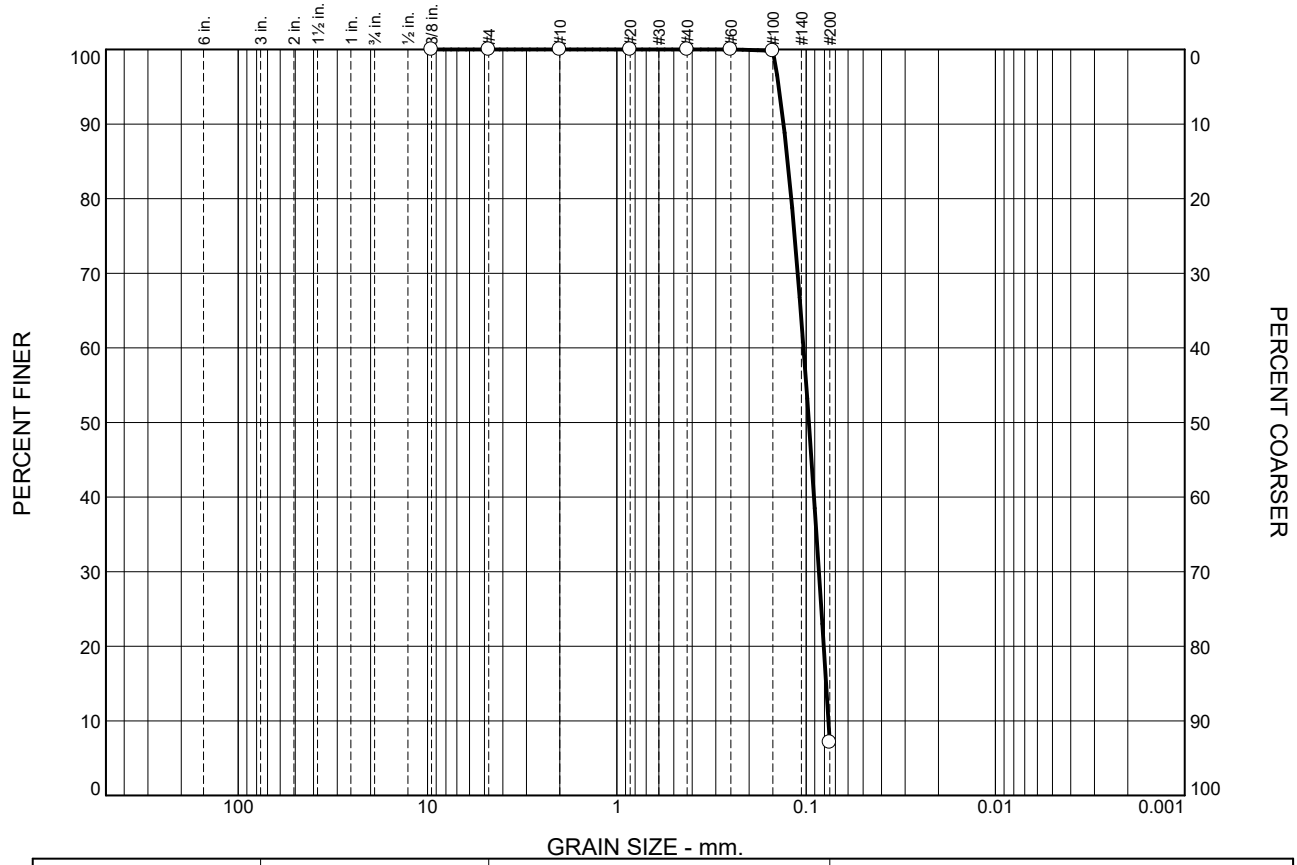
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	92.9	7.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-05	J-10	9	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	89.6	10.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-05	T-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

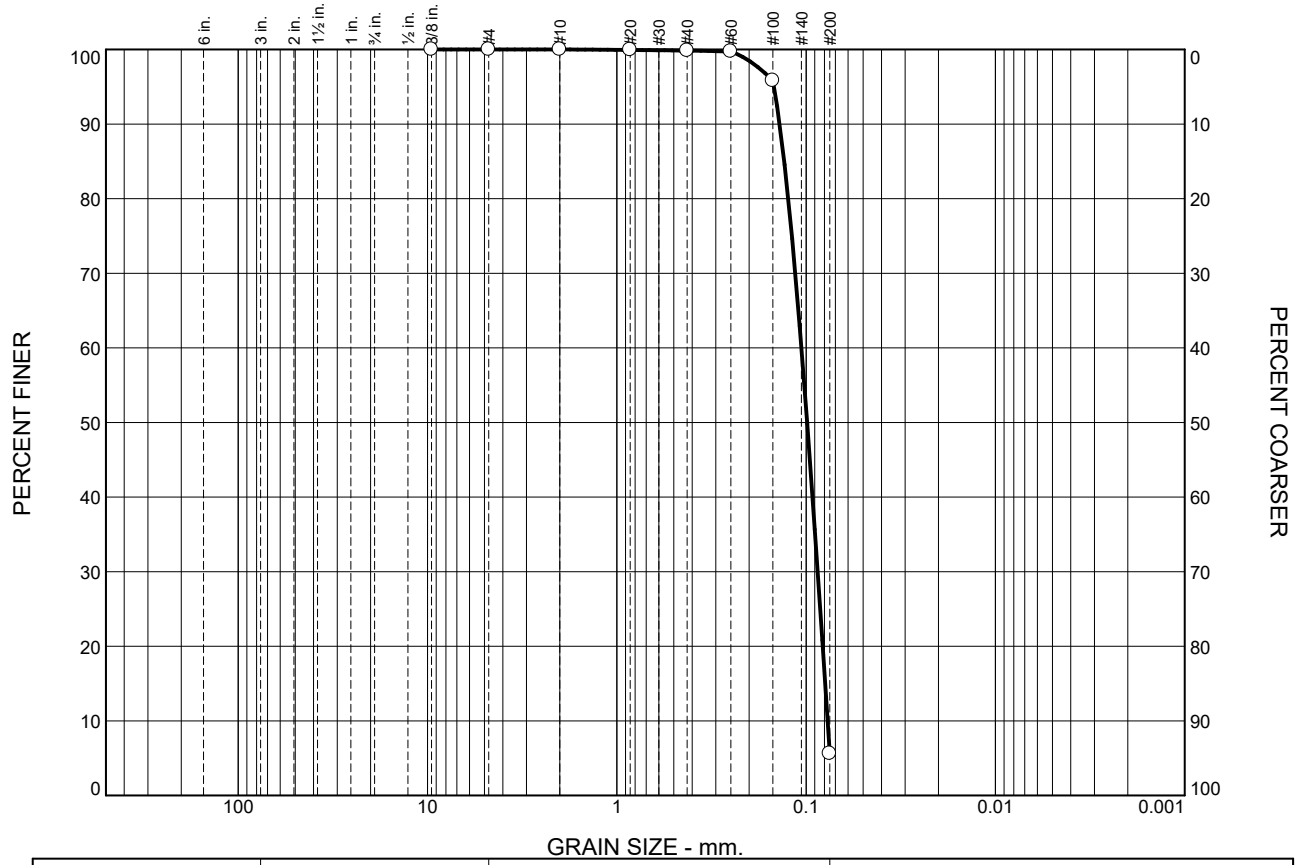
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.2	94.2	5.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-06	J-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

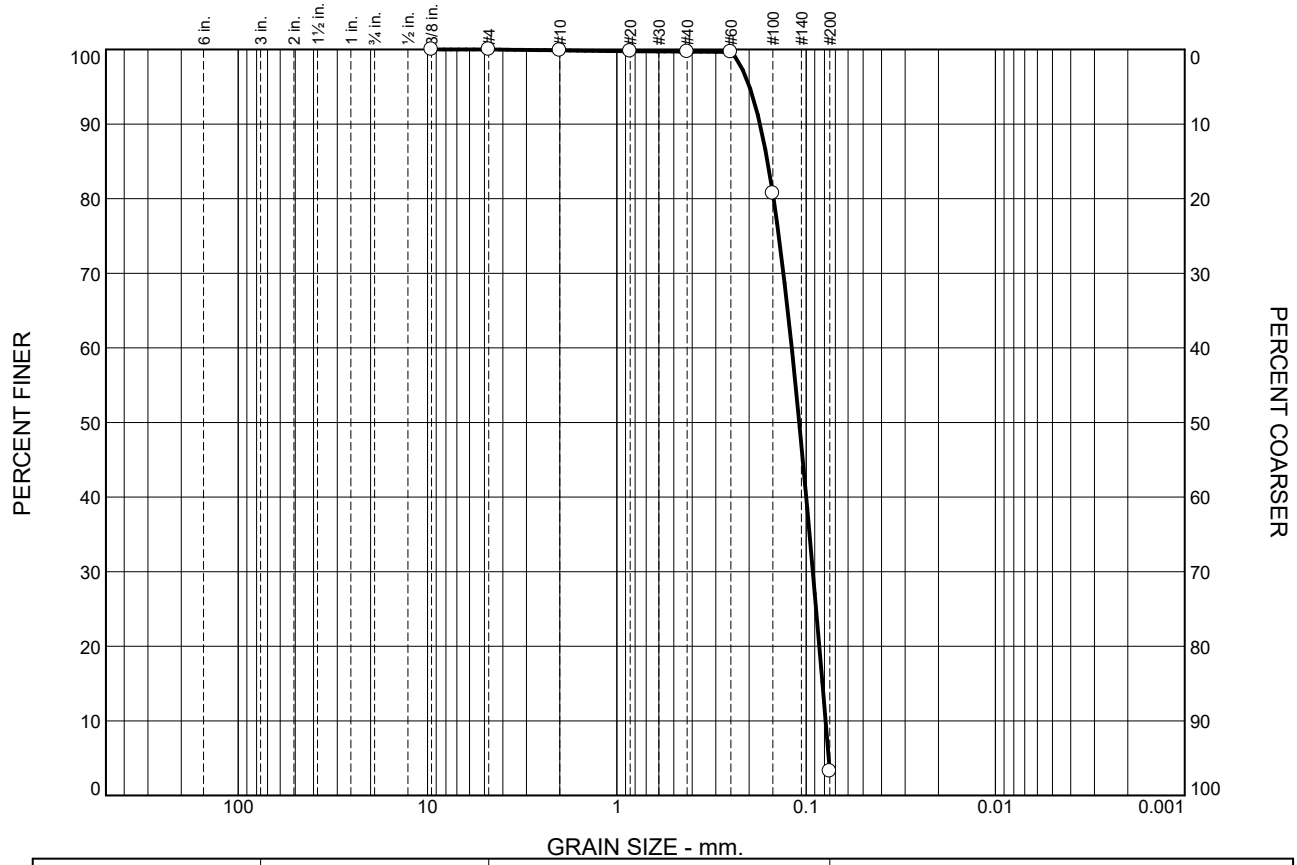
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	0.2	96.4	3.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-06	J-5	4	POORLY GRADED SAND (SP)	SP

Tolunay-Wong Engineers, Inc.

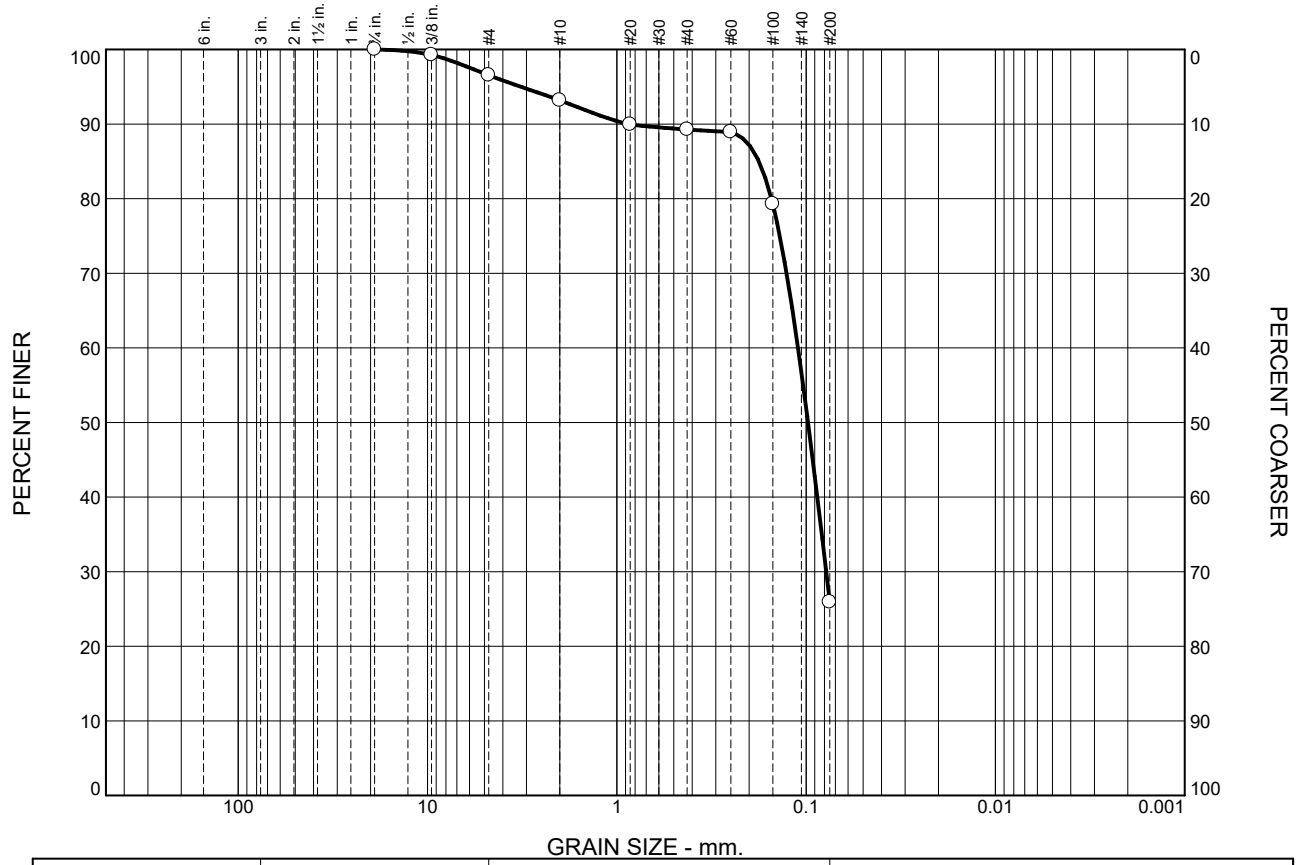
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	3.5	3.3	3.9	63.4	25.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-06	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

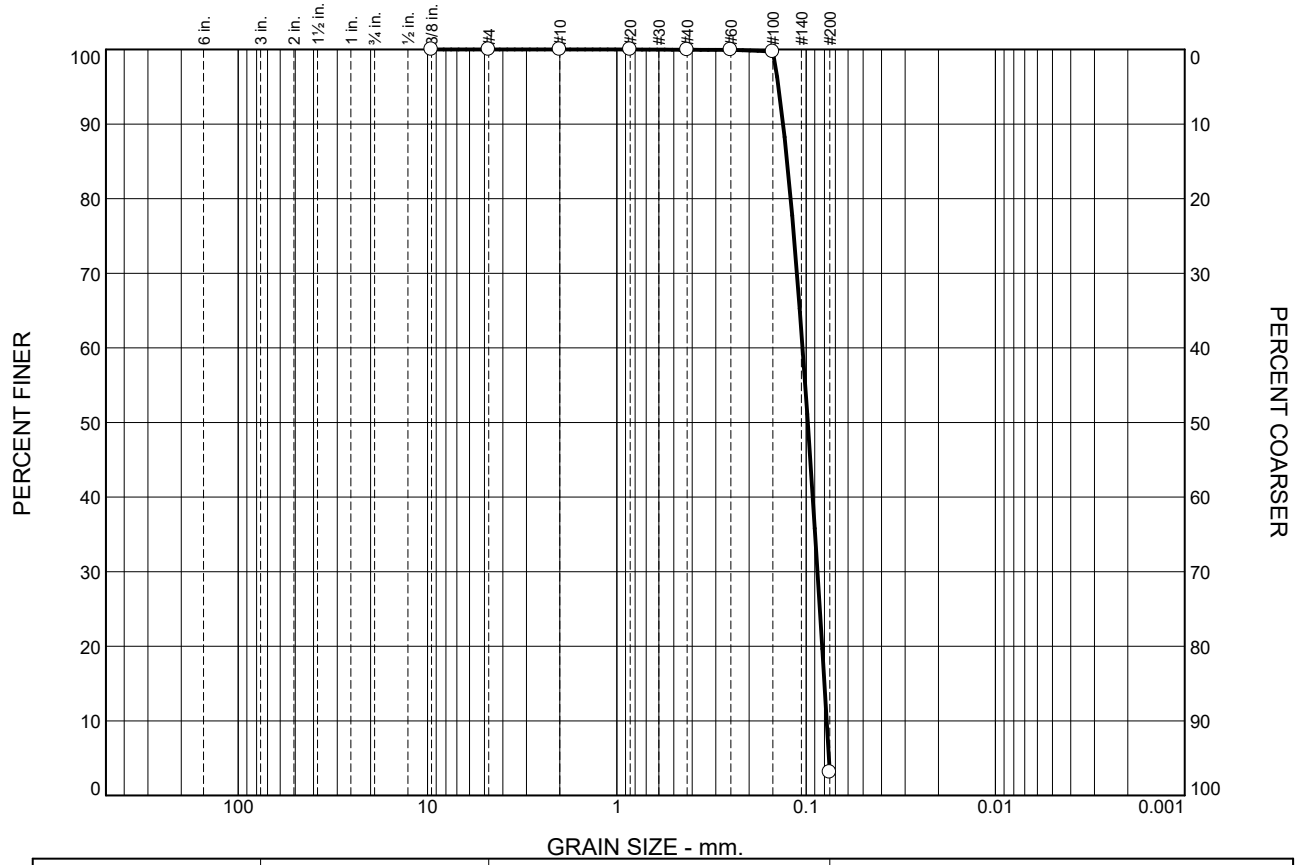
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	96.9	3.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-07	J-6	5	POORLY GRADED SAND (SP)	SP

Tolunay-Wong Engineers, Inc.

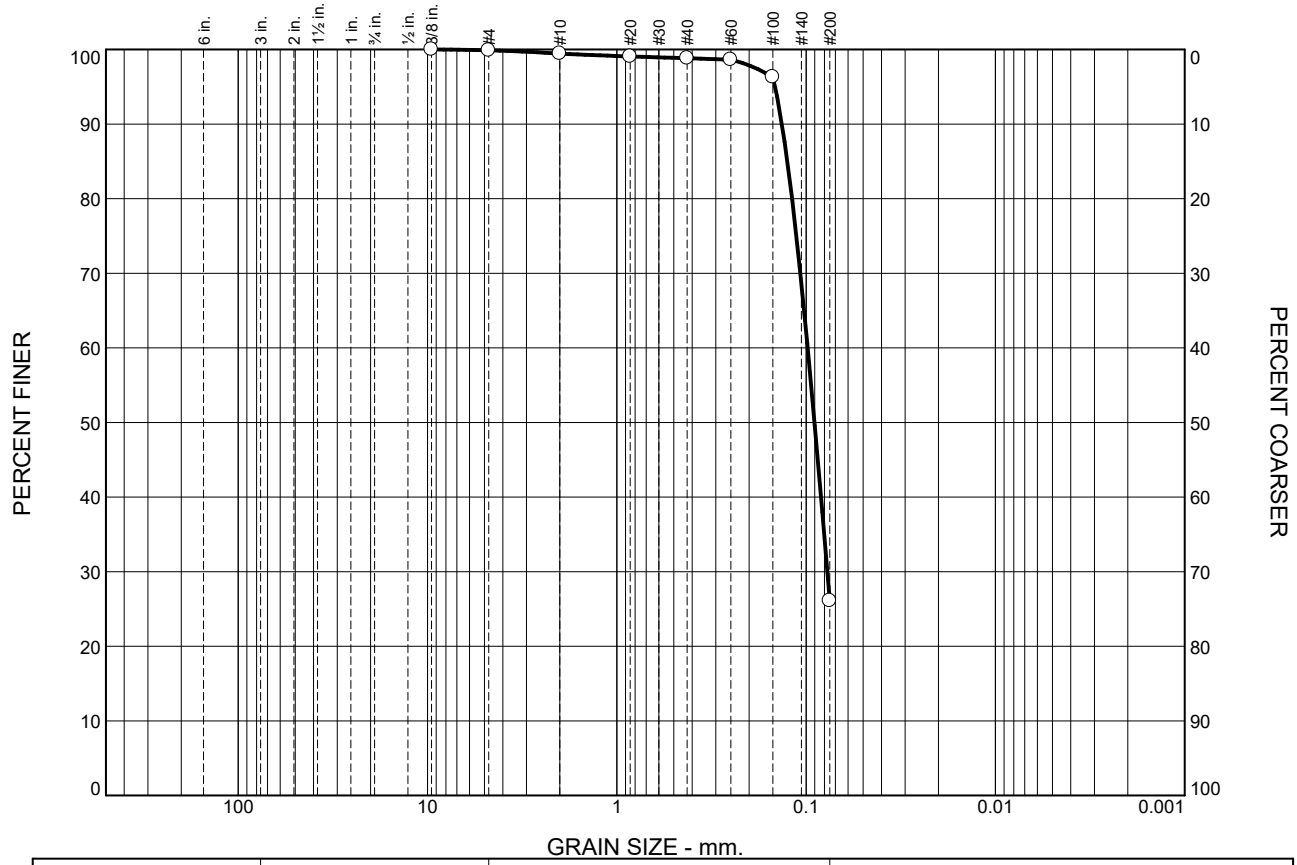
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.1	0.5	0.6	72.7	26.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-07	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

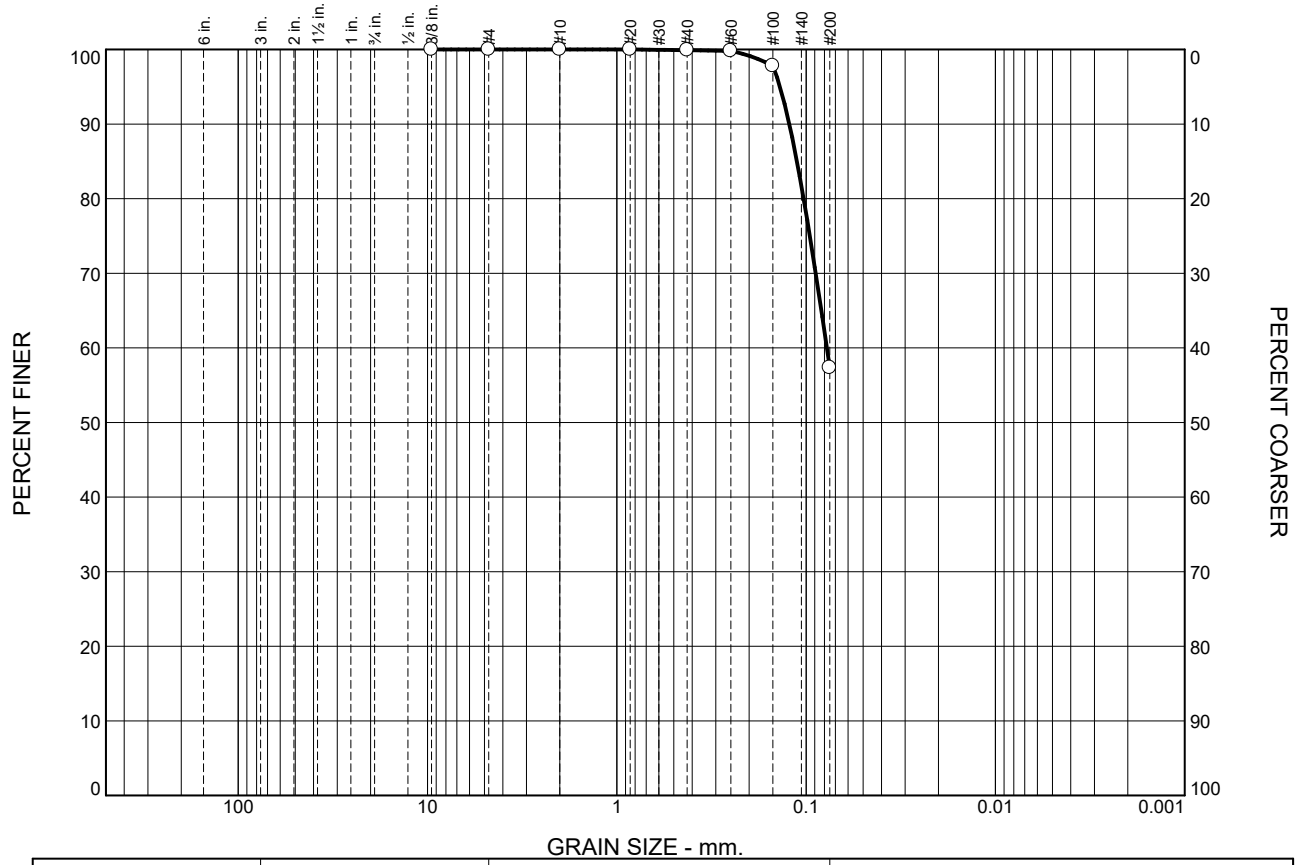
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	42.6	57.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-07	T-3	2	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

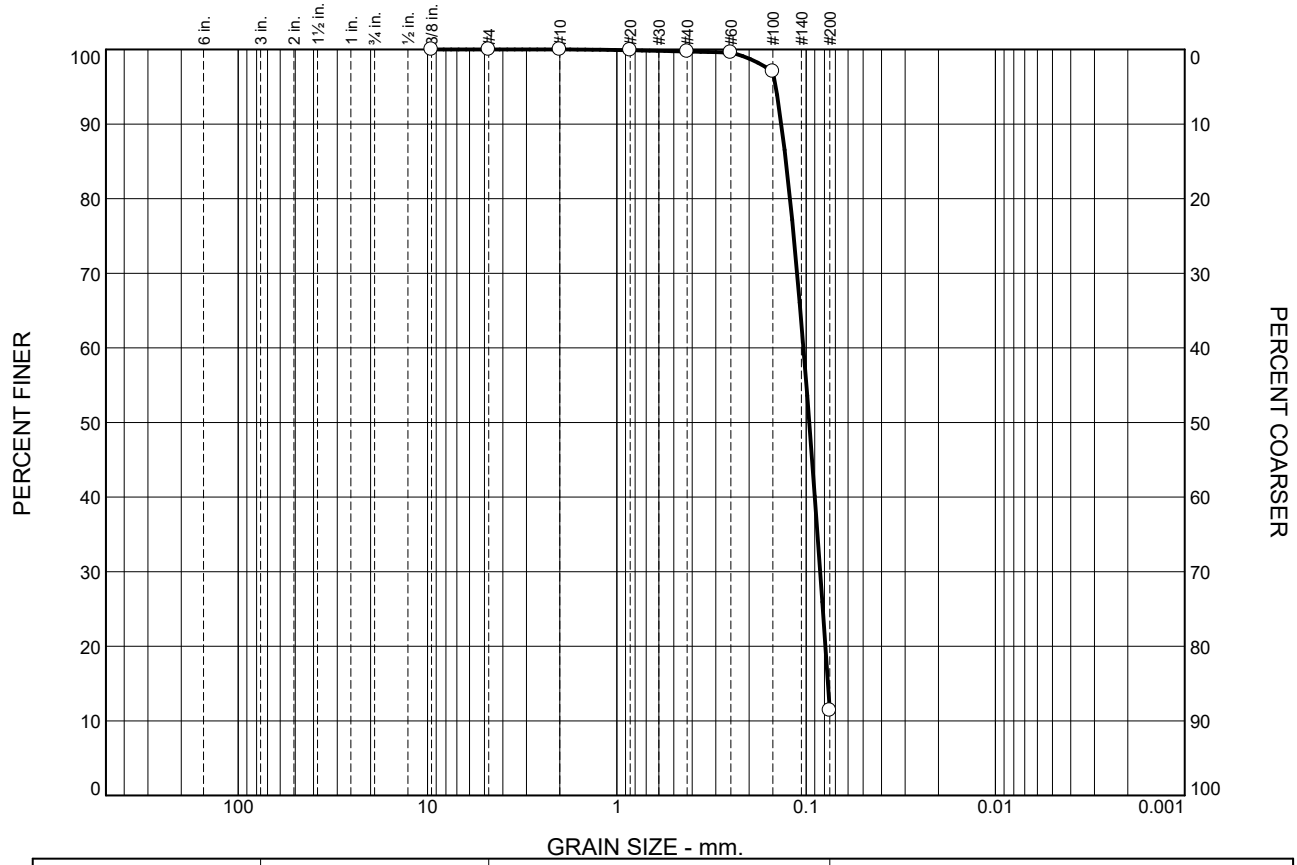
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.3	88.3	11.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-08	J-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

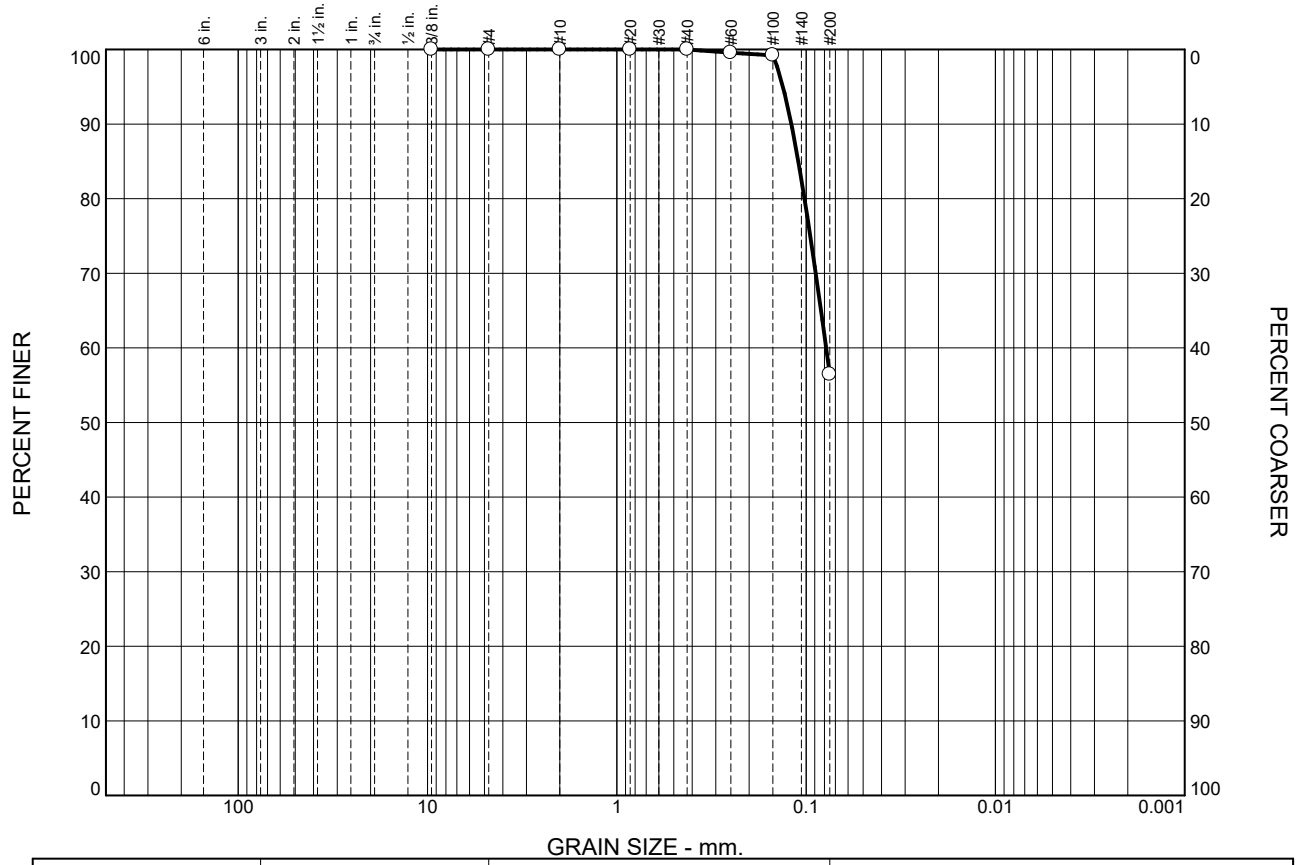
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	43.6	56.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-08	J-5	4	SANDY LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

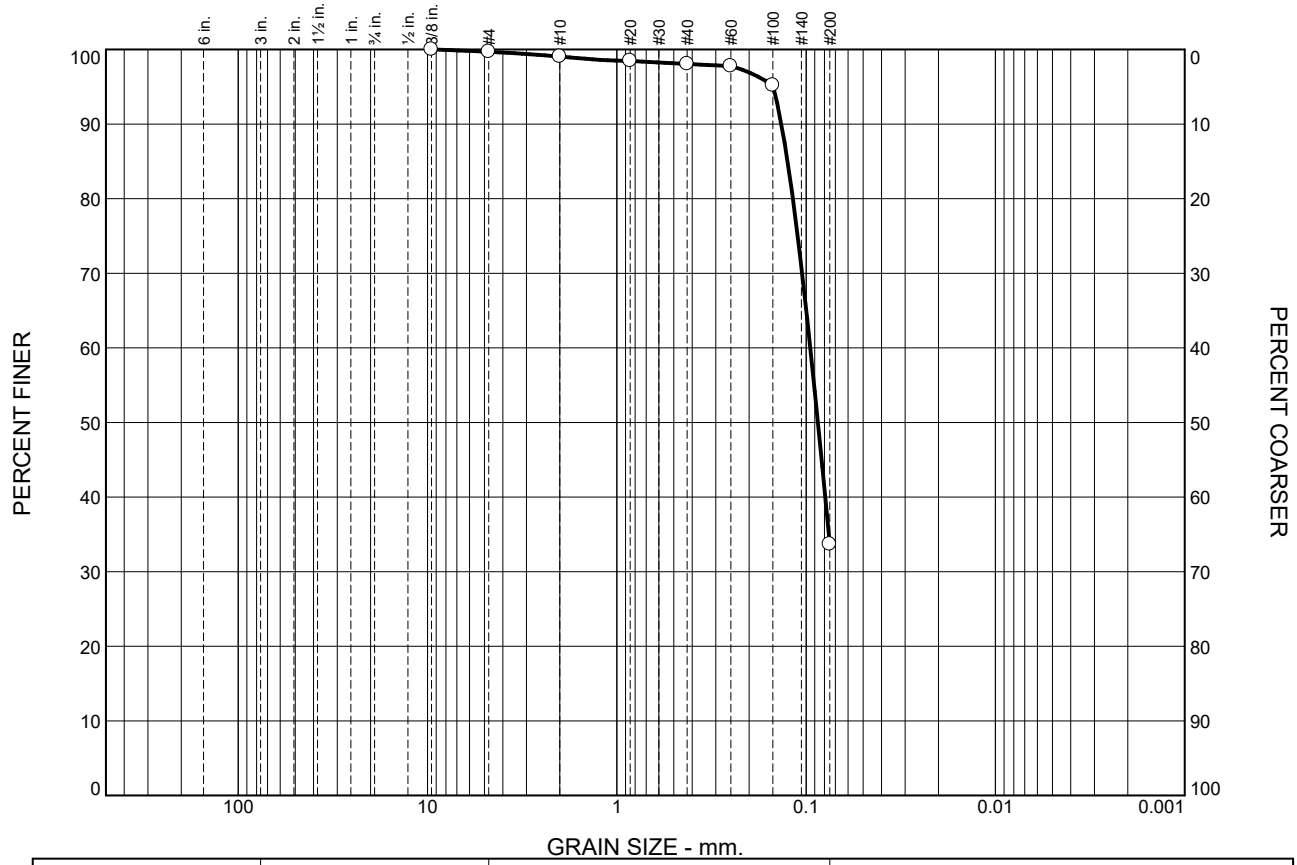
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.3	0.7	0.9	64.4	33.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-08	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

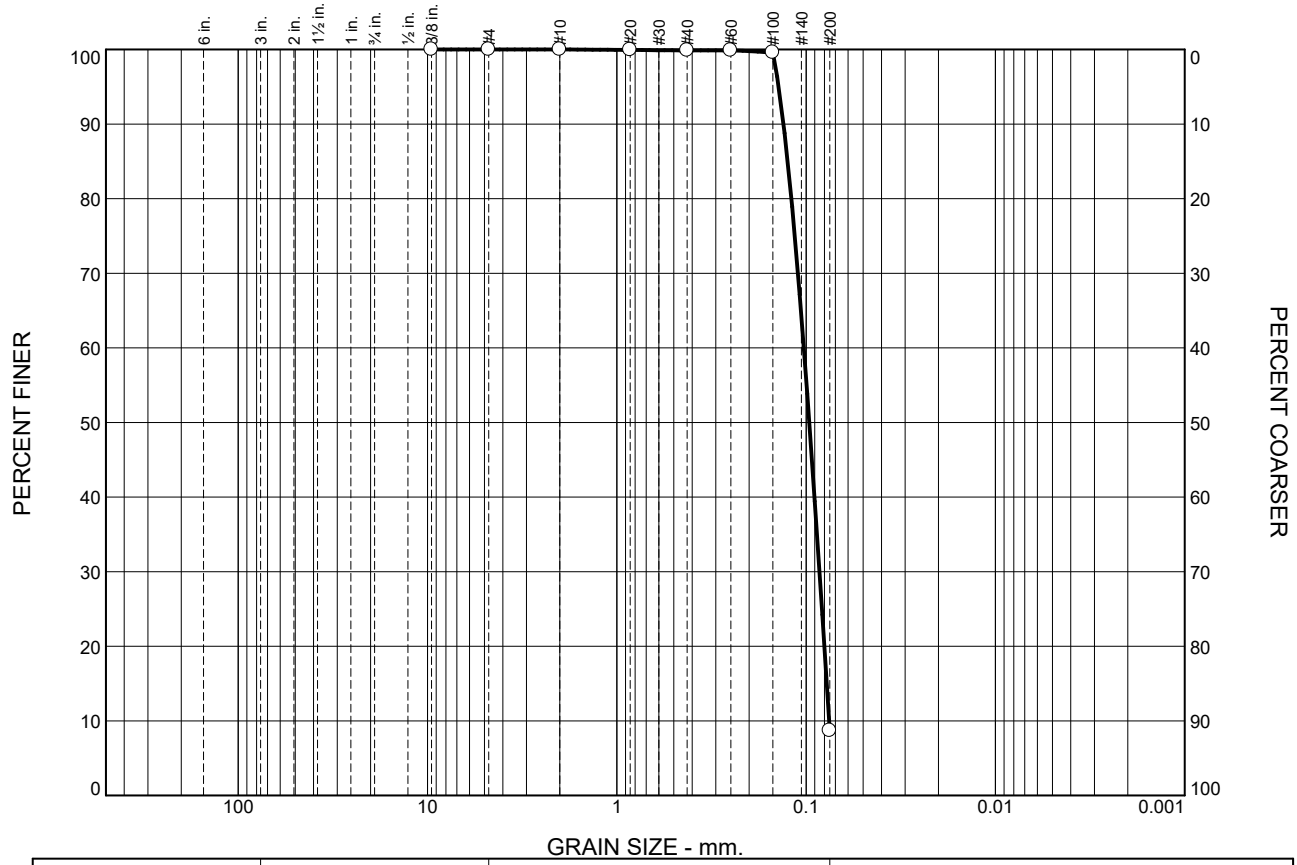
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	91.2	8.7

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-09	J-4	3	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

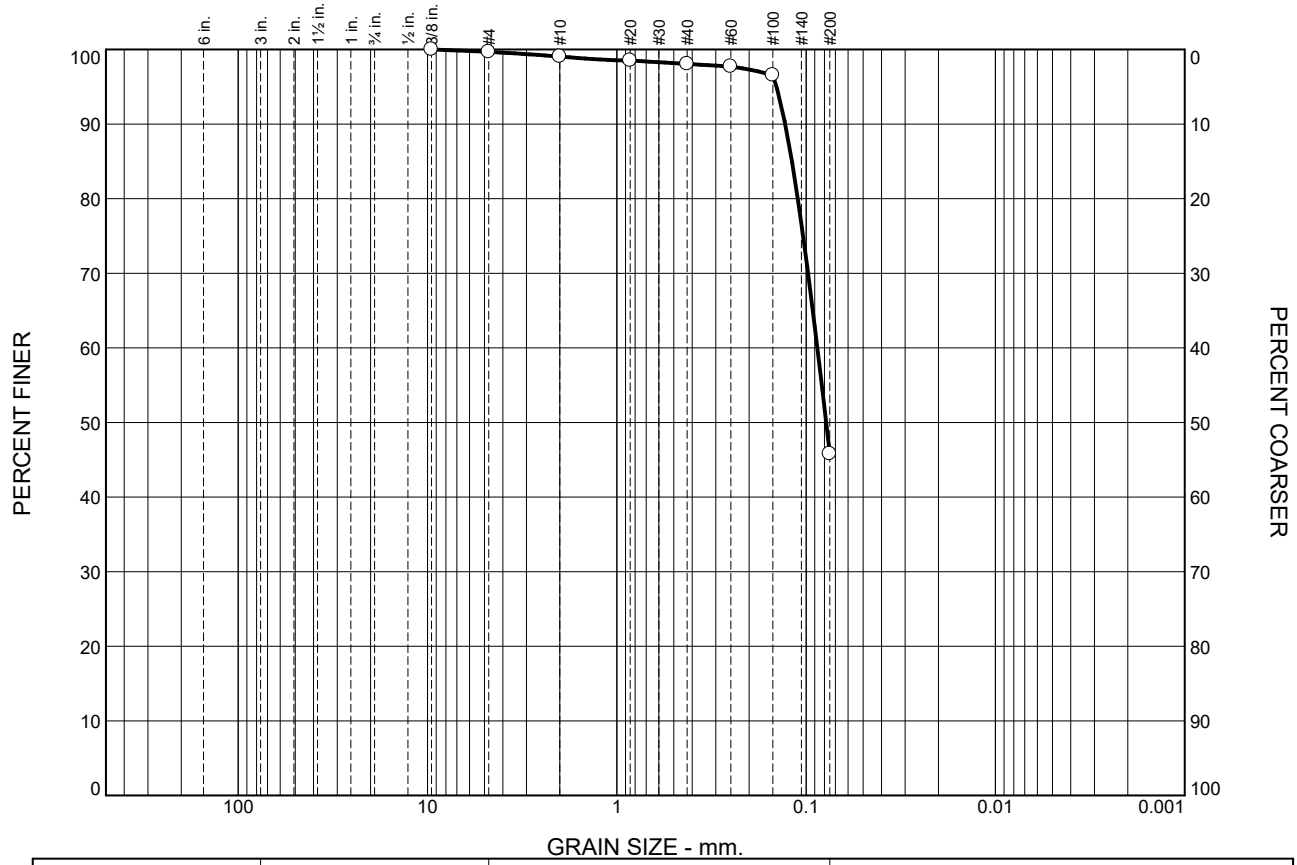
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.3	0.6	1.0	52.3	45.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-09	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

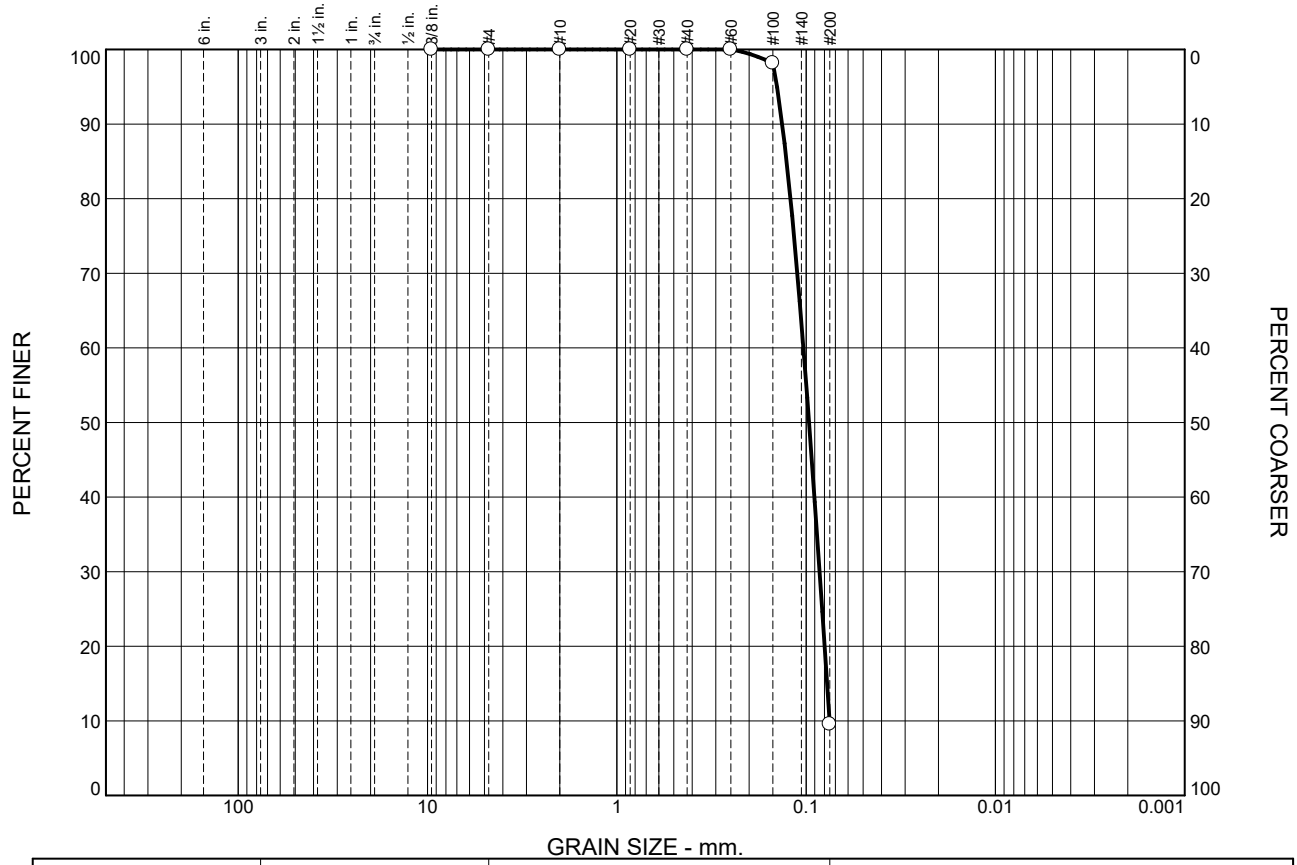
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	90.4	9.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-09	T-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	83.9	16.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-10	J-4	3	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

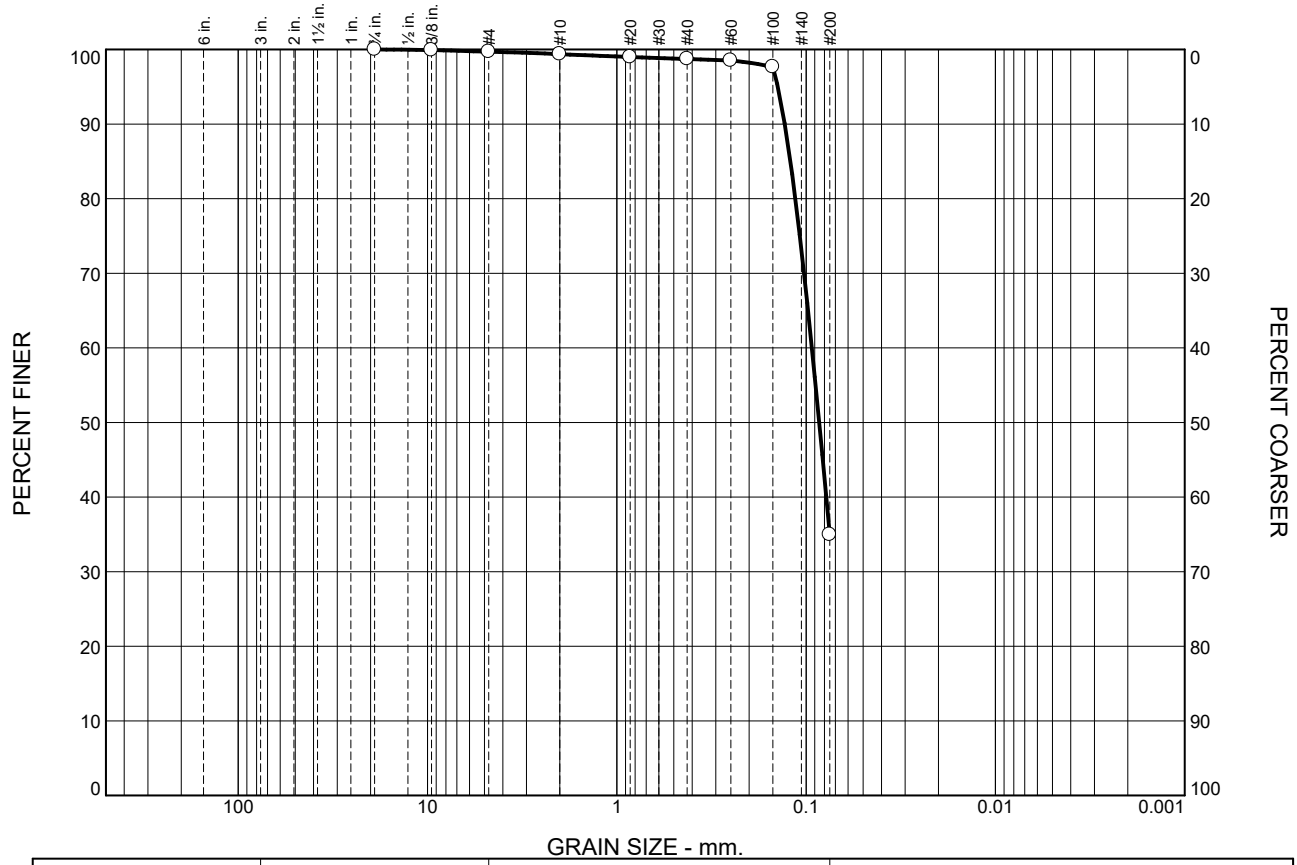
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.3	0.3	0.7	63.7	35.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-10	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

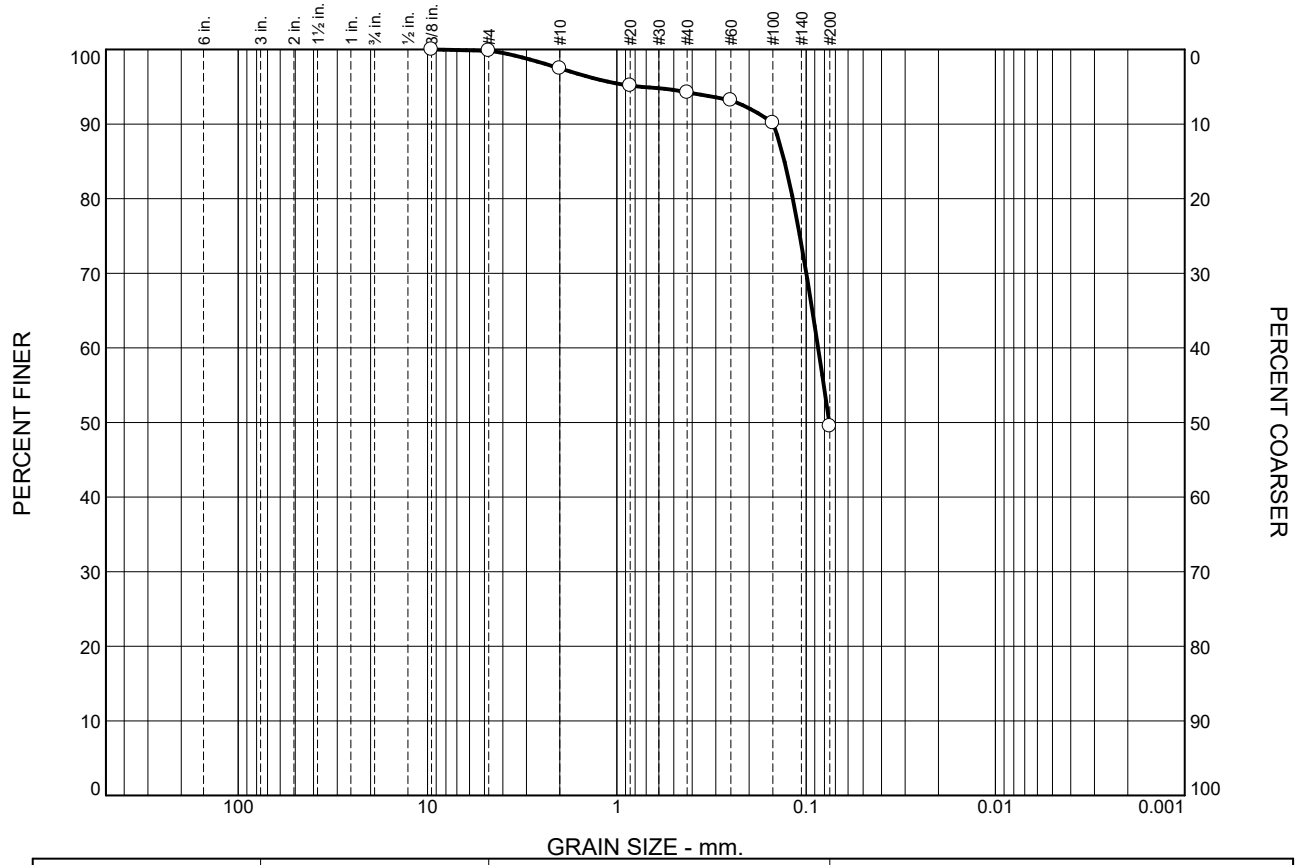
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.2	2.3	3.3	44.7	49.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-11	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

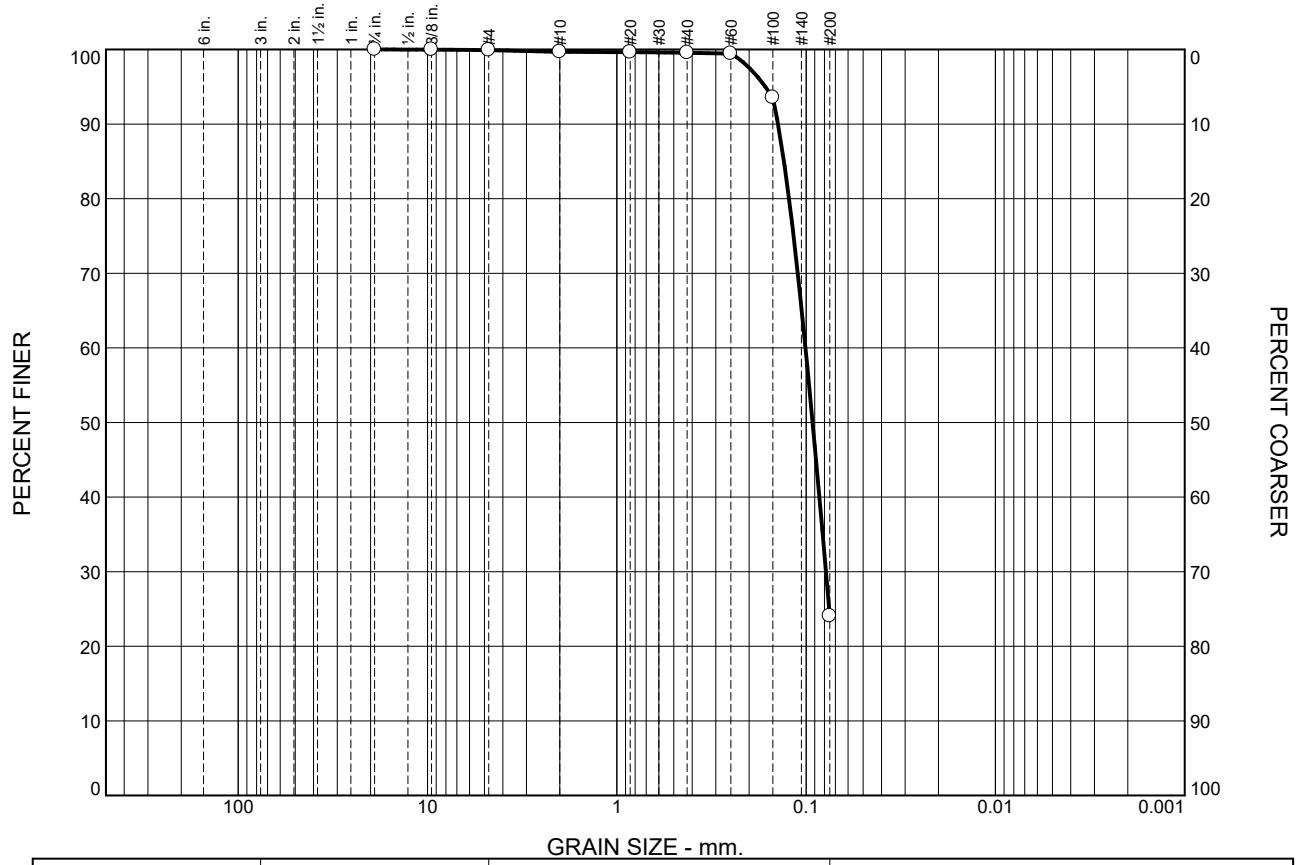
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.1	0.2	0.1	75.5	24.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-11	T-4	3	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

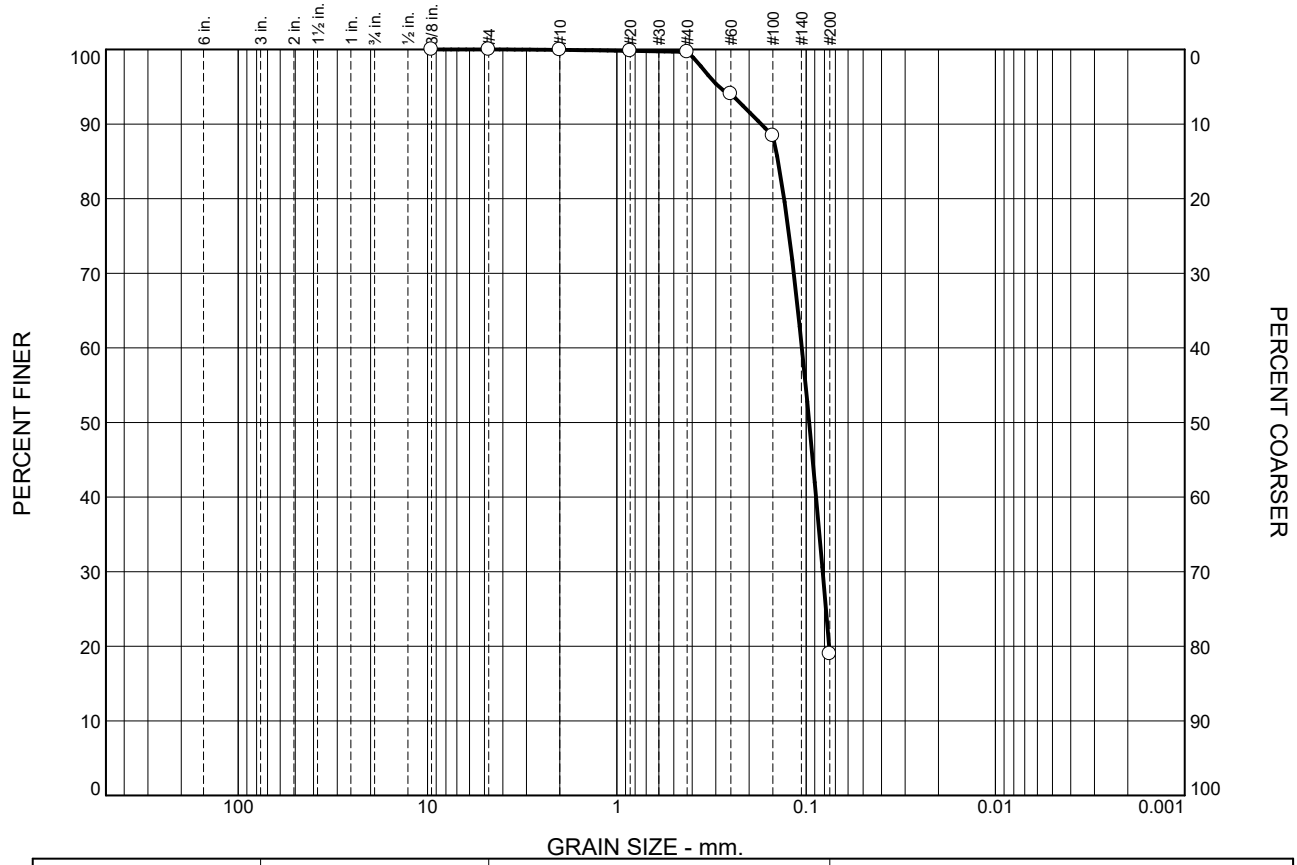
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	0.2	80.7	19.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-11	T-7	6	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

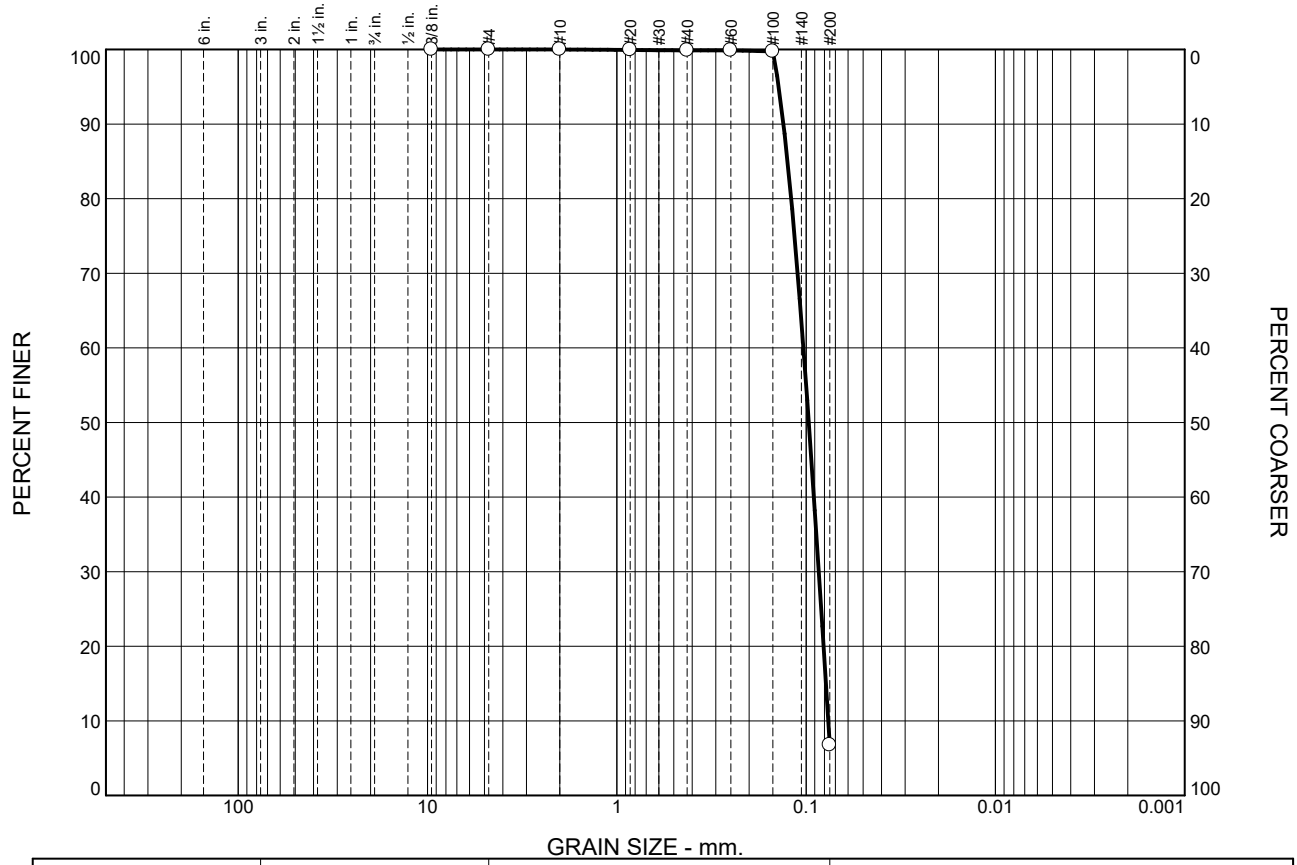
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	93.1	6.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-12	J-1	0	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	88.8	11.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-12	J-3	2	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

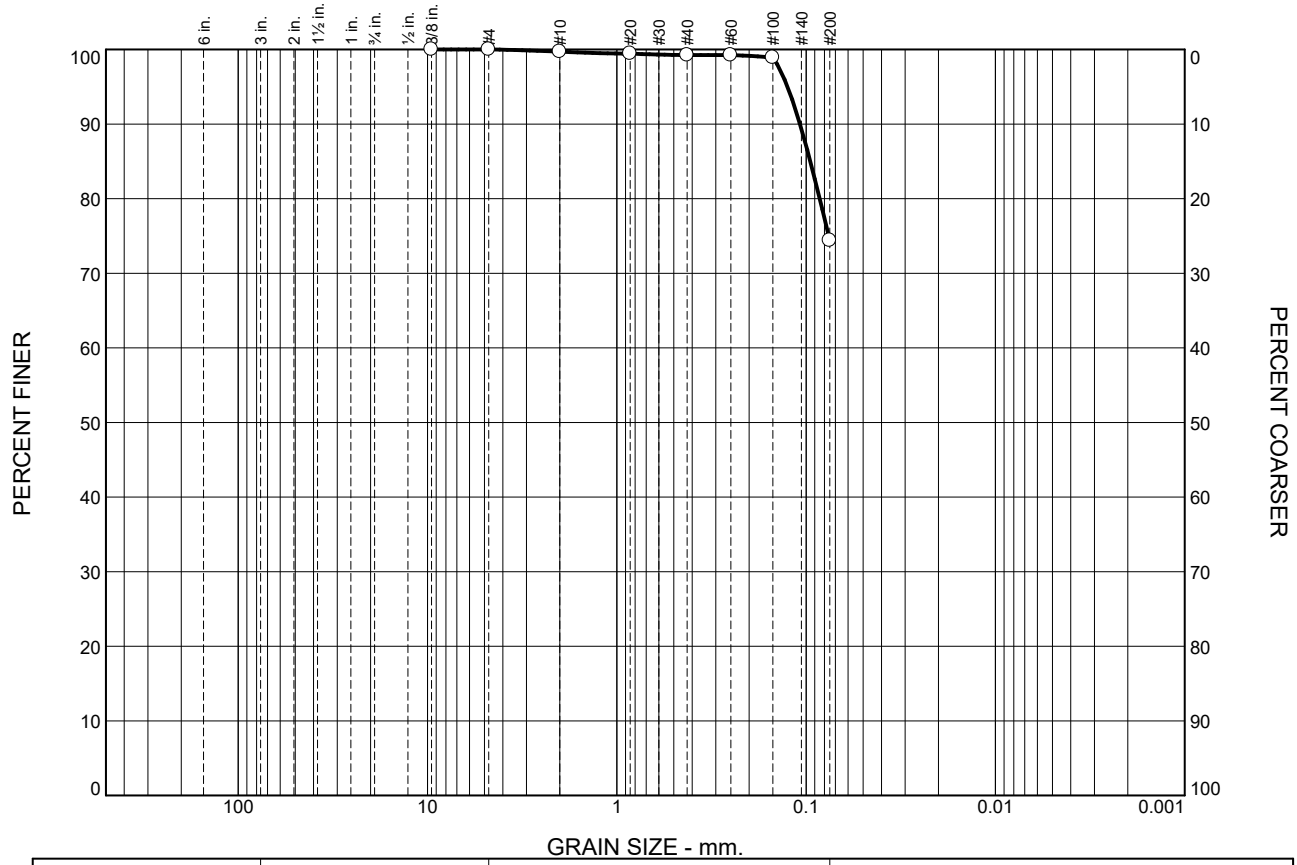
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.3	0.5	24.8	74.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-12	T-5	4	LEAN CLAY with SAND (CL)	CL

Tolunay-Wong Engineers, Inc.

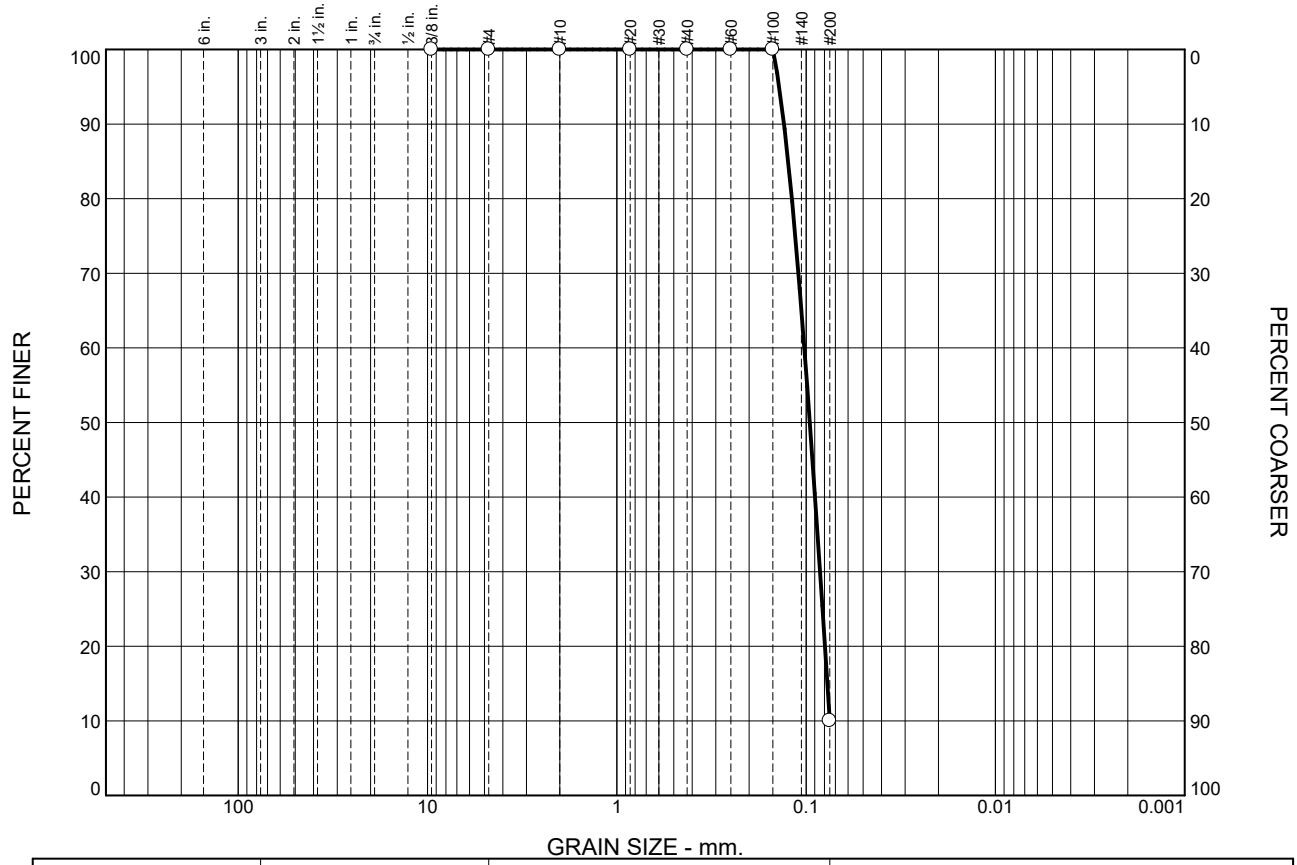
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	90.0	10.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-13	J-4	3	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

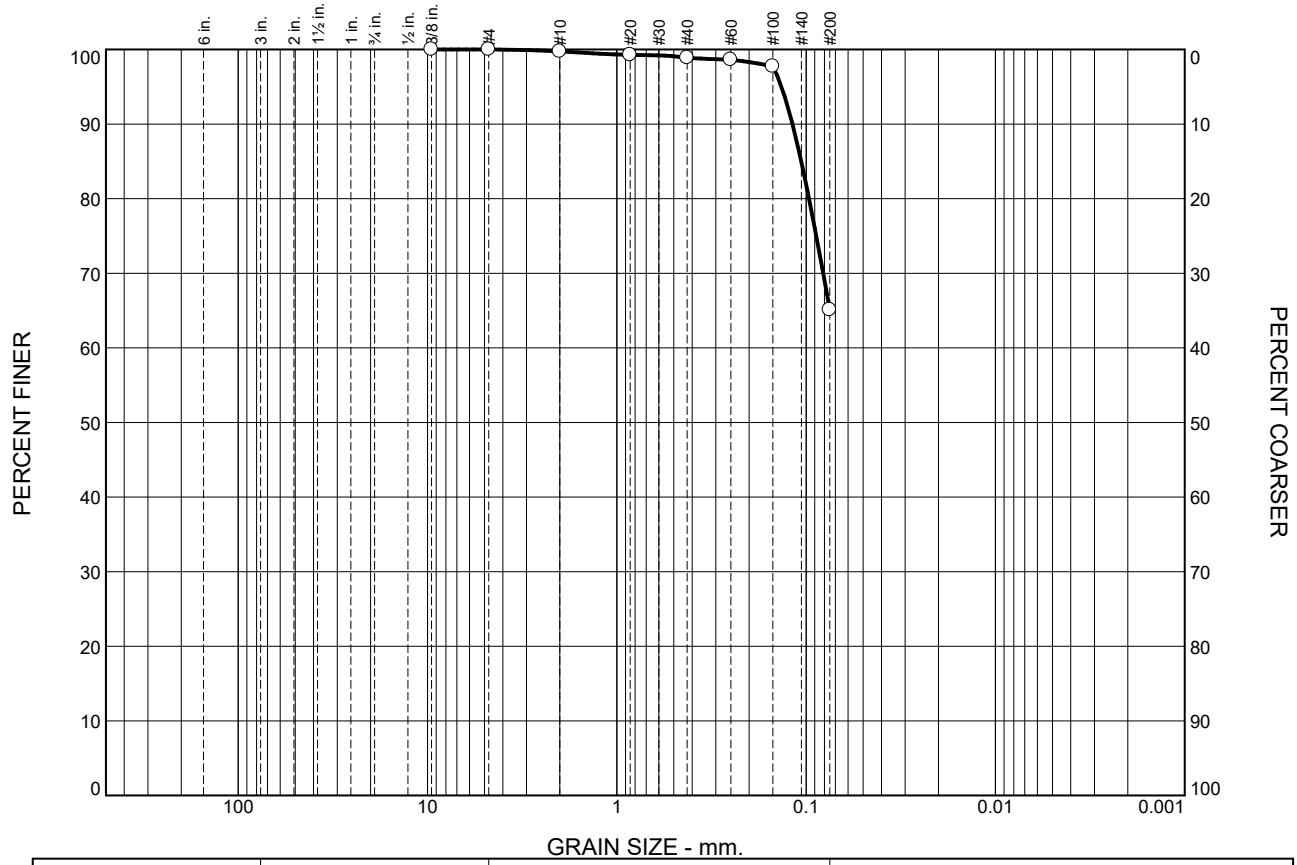
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.3	0.8	33.8	65.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-13	T-1	0	SANDY LEAN CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

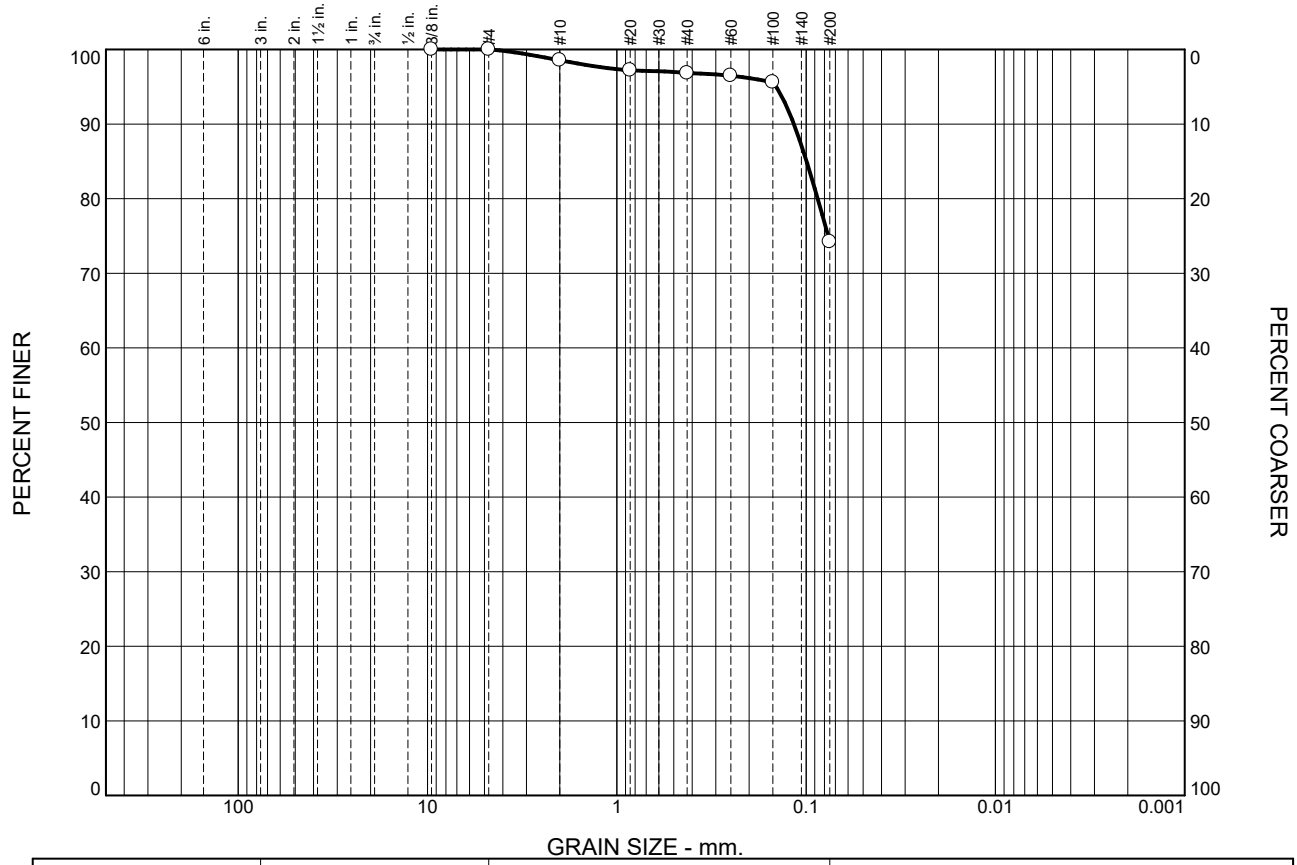
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	1.5	1.7	22.6	74.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-14	T-1	0	FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

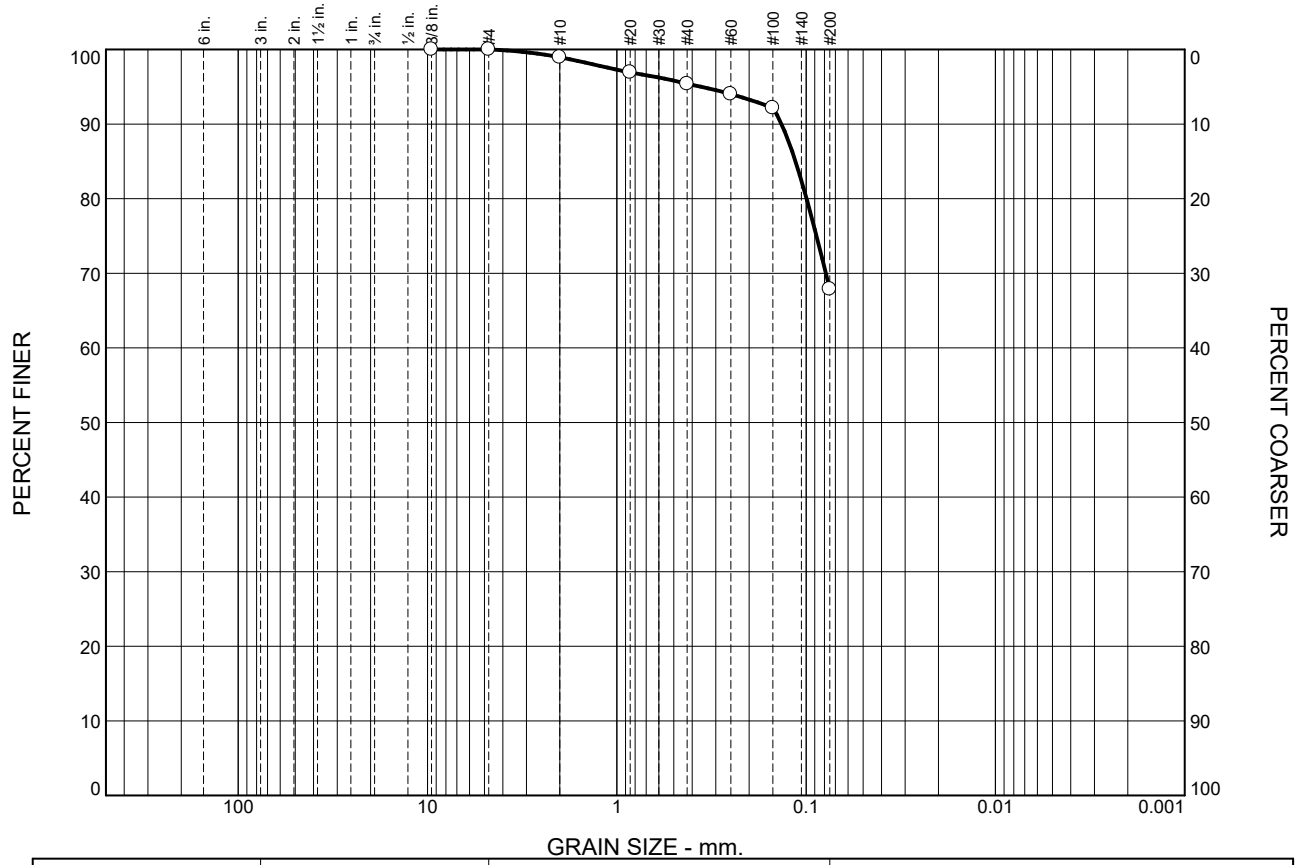
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	1.0	3.6	27.5	67.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-15	T-1	0	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

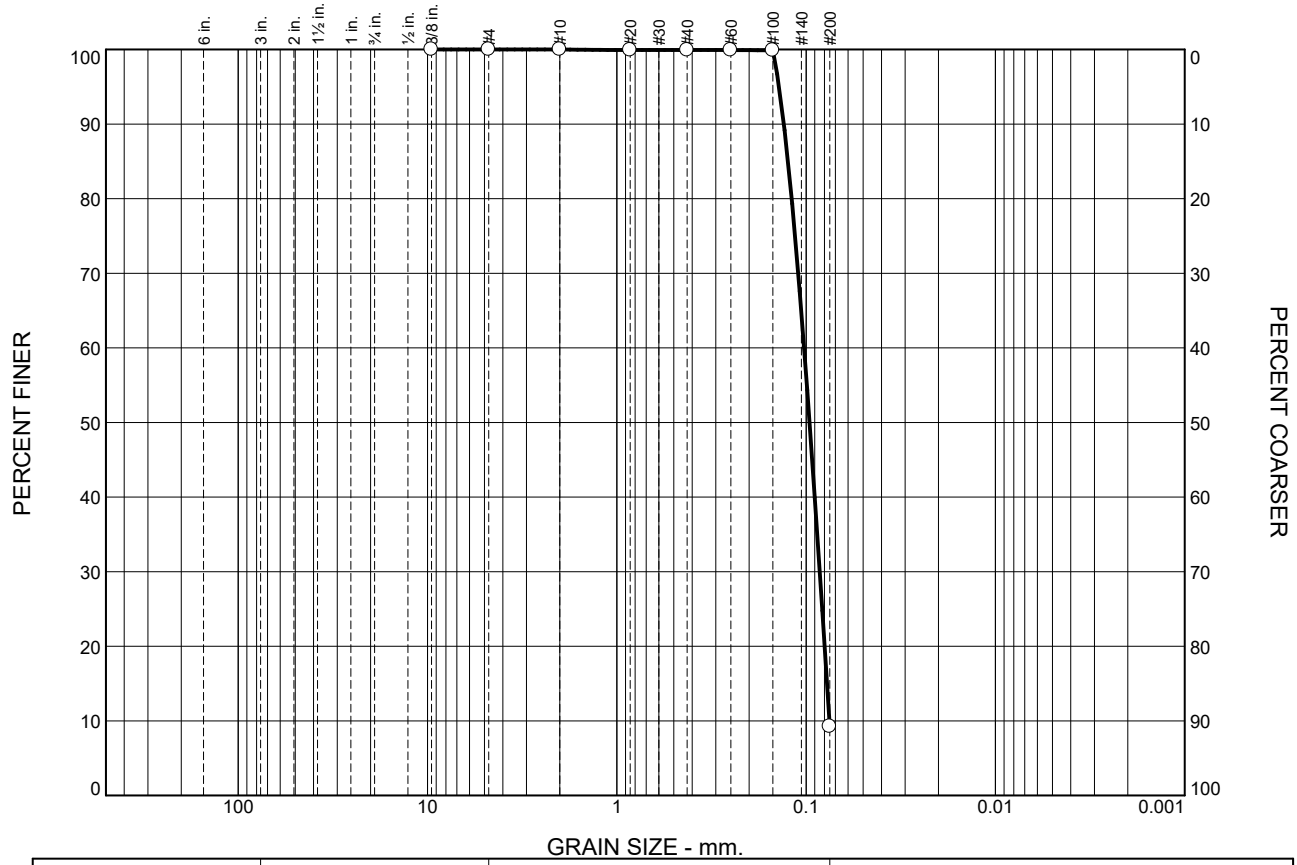
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.1	90.7	9.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-16	J-7	6	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

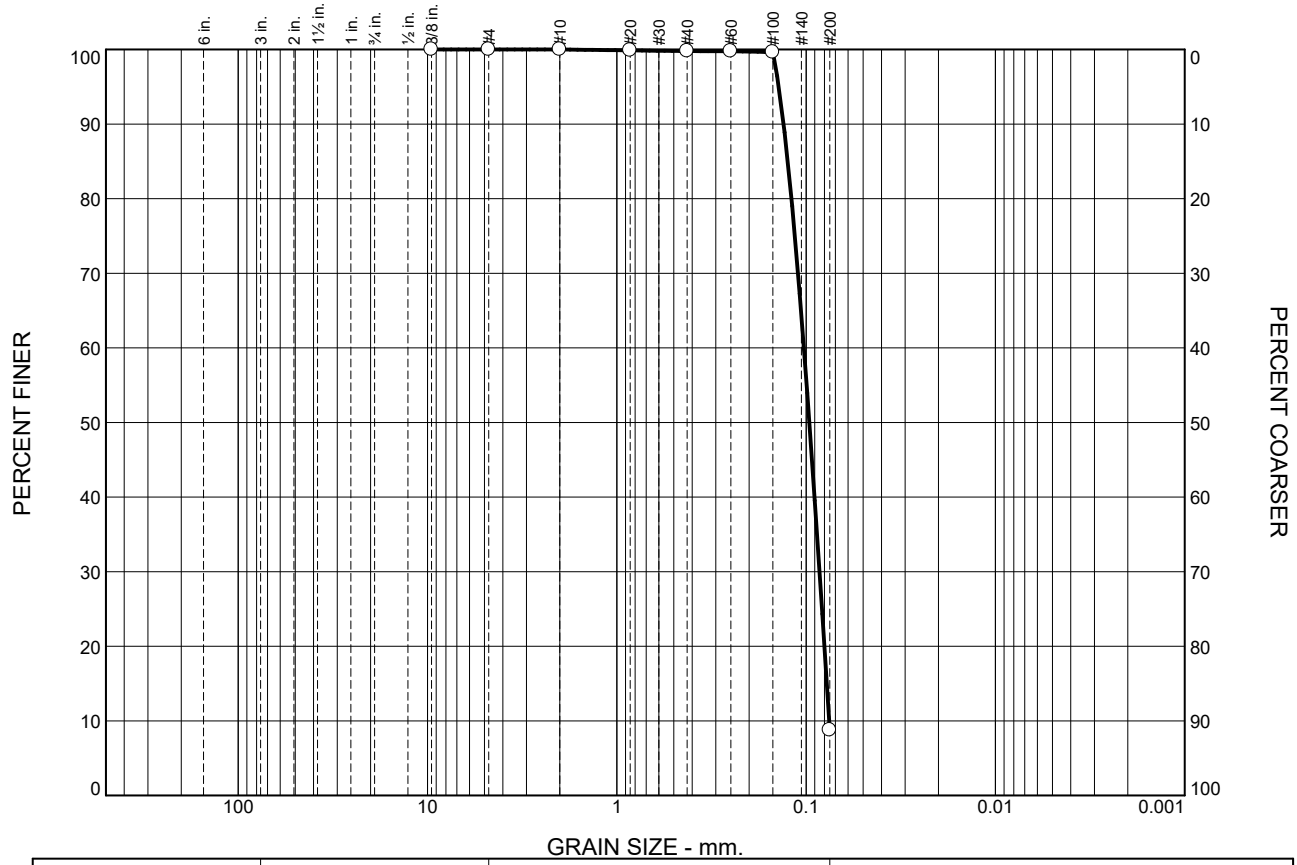
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.2	91.0	8.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-16	J-9	8	POORLY GRADED SAND with SILT (SP-SM)	SP-SM

Tolunay-Wong Engineers, Inc.

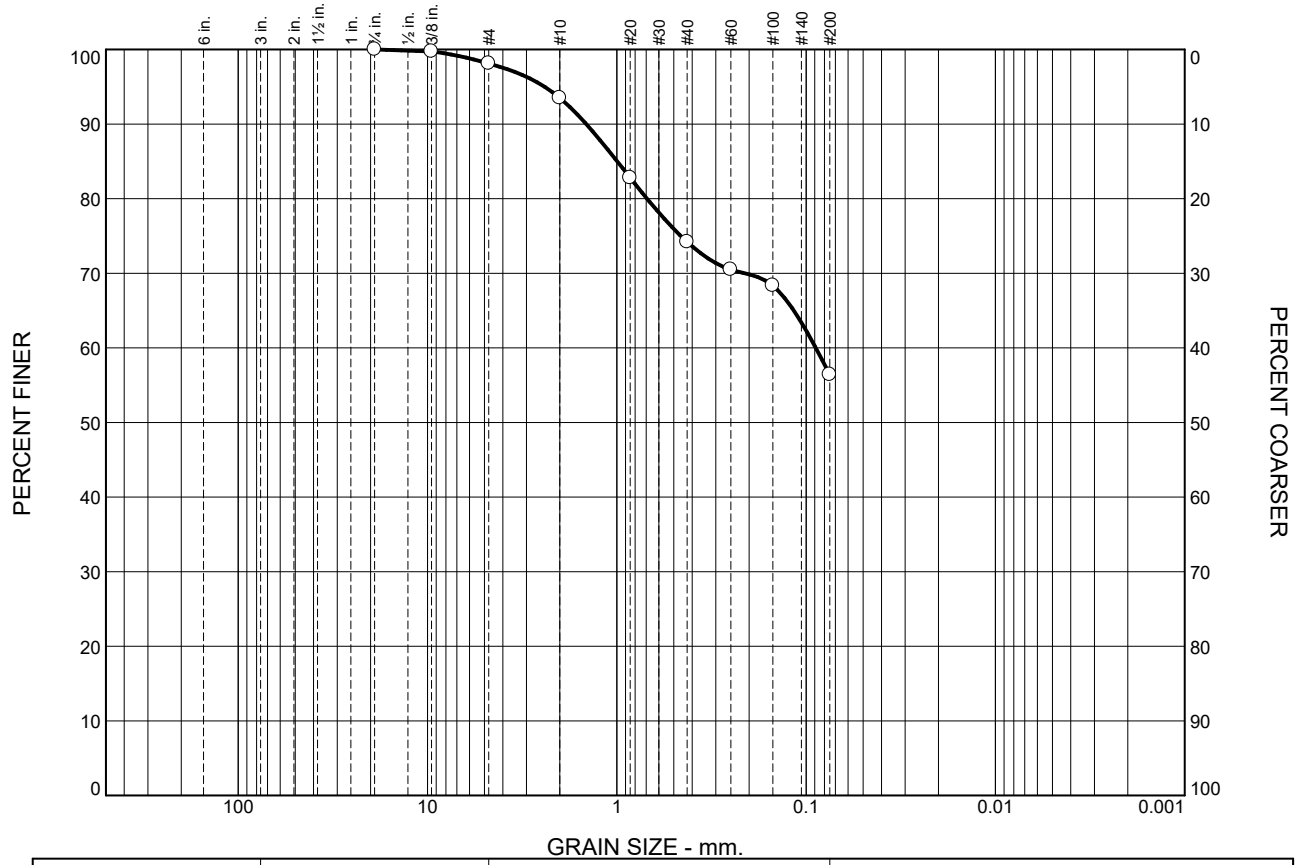
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	1.9	4.6	19.3	17.8	56.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-16	T-1	0	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

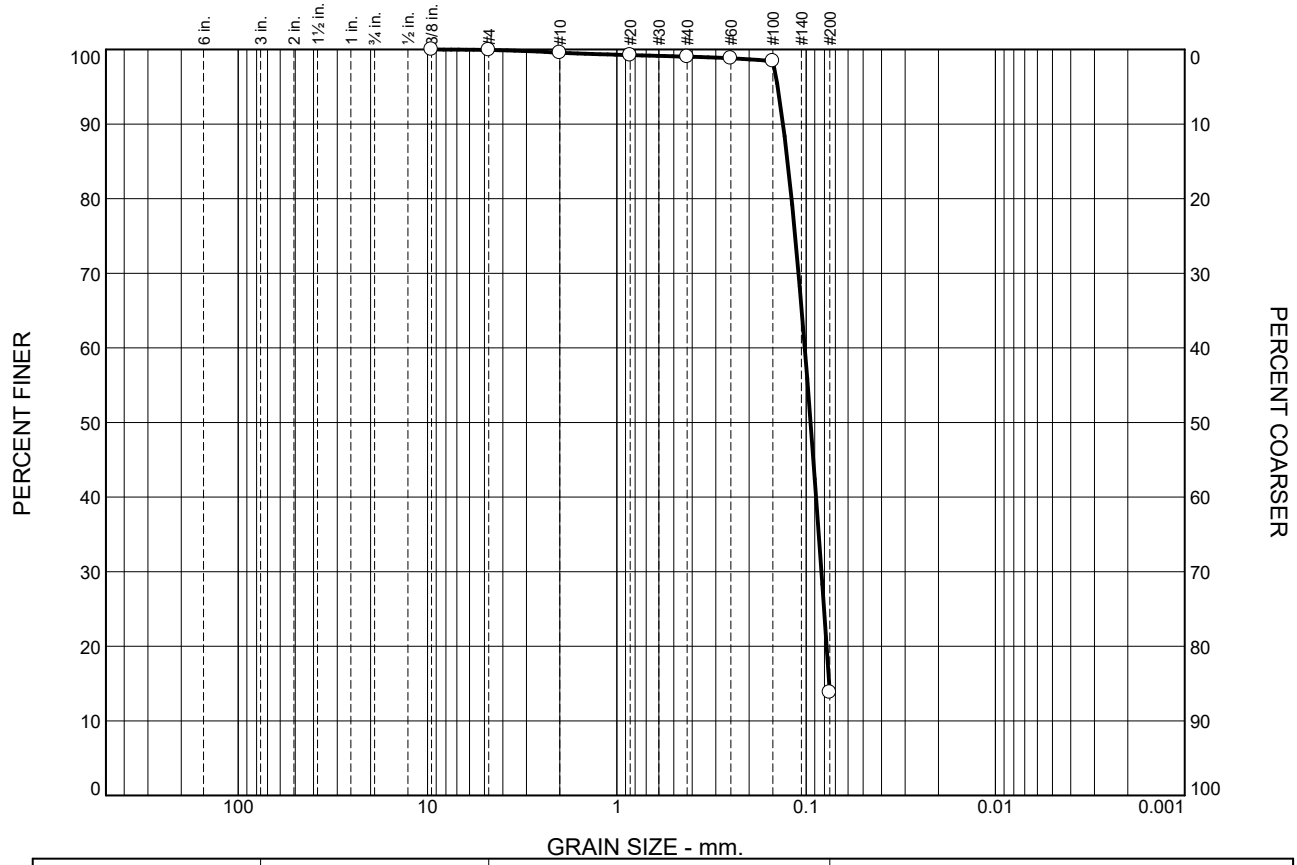
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.1	0.4	0.5	85.2	13.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-16	T-5	4	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

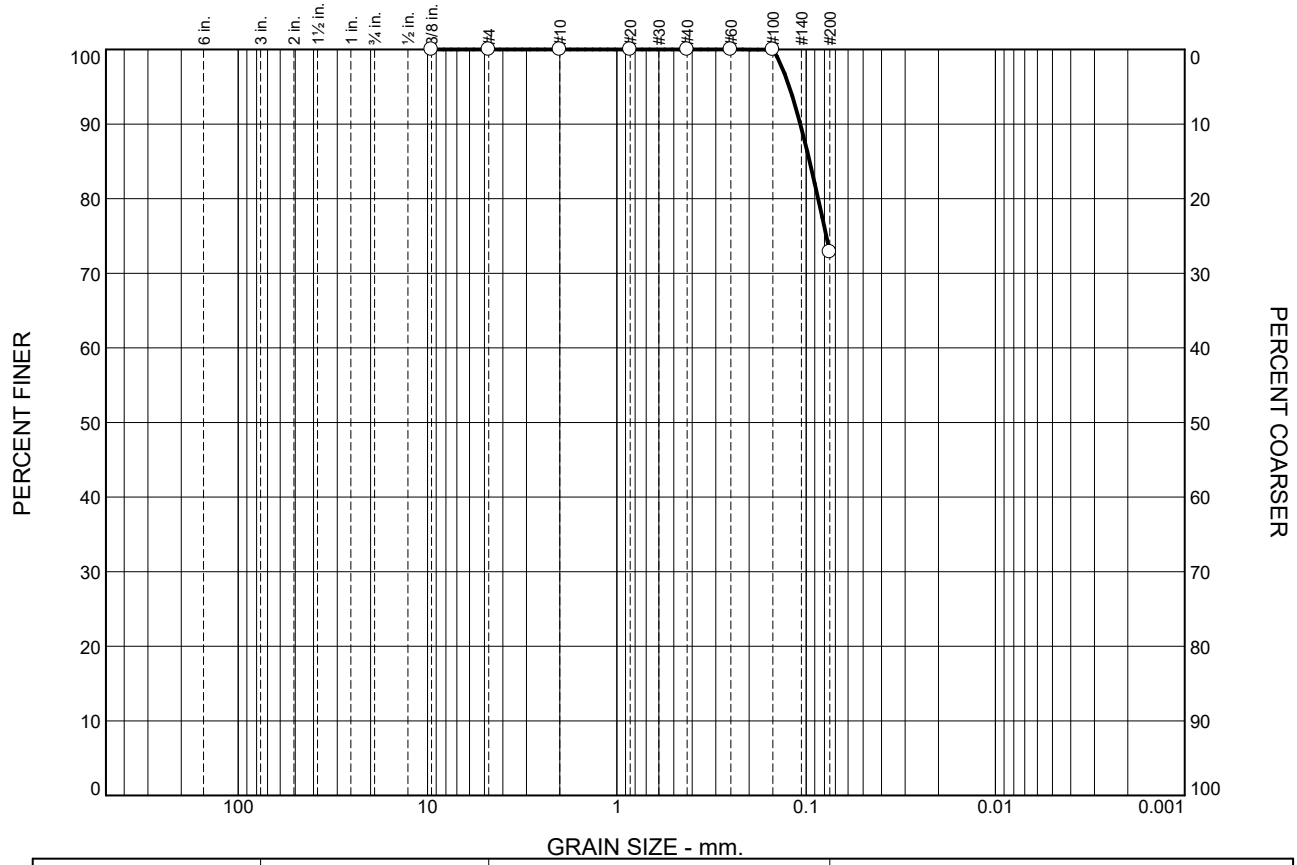
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.0	27.2	72.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-17	J-6	5	SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.3	34.1	65.6

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-17	T-4	3	SANDY SILT (ML)	ML

Tolunay-Wong Engineers, Inc.

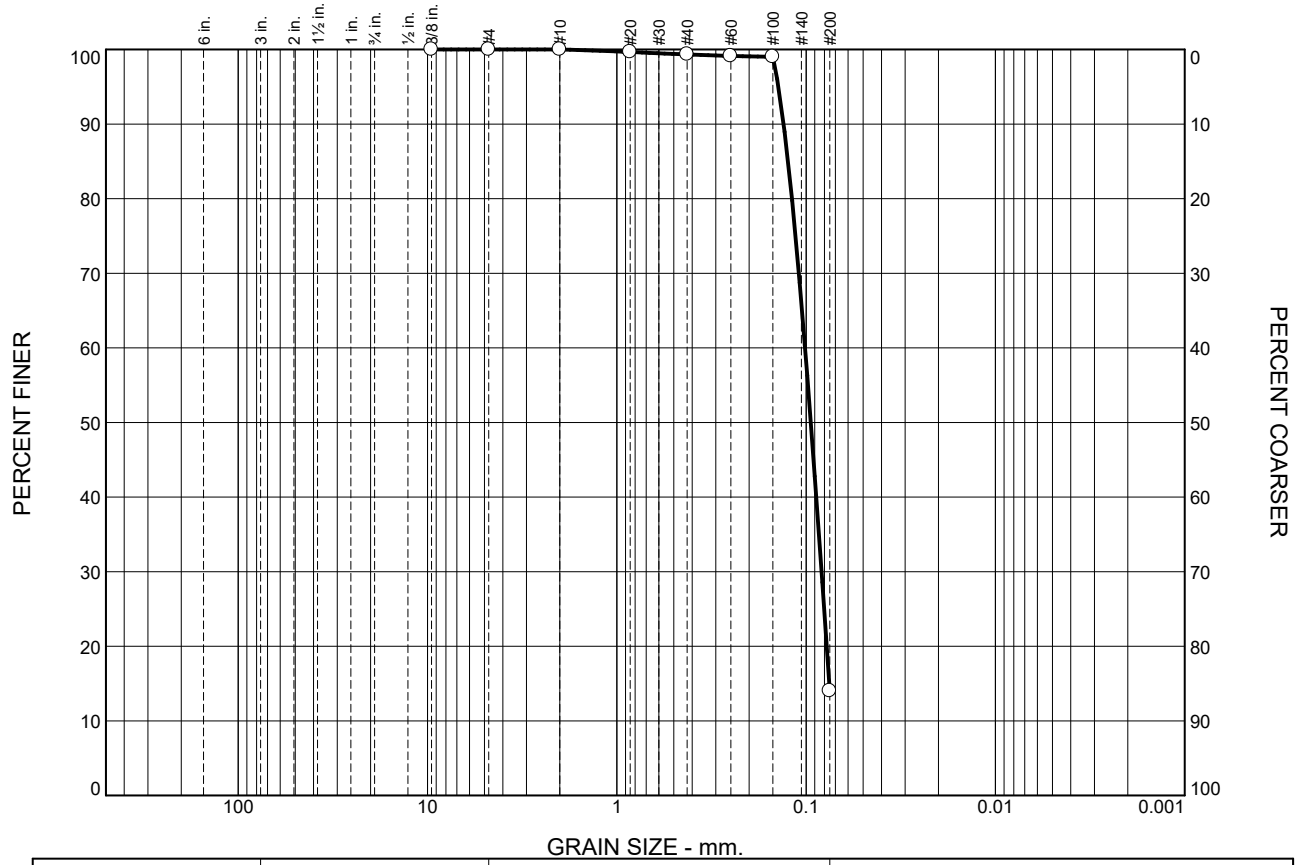
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.7	85.3	14.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-18	J-5	4	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

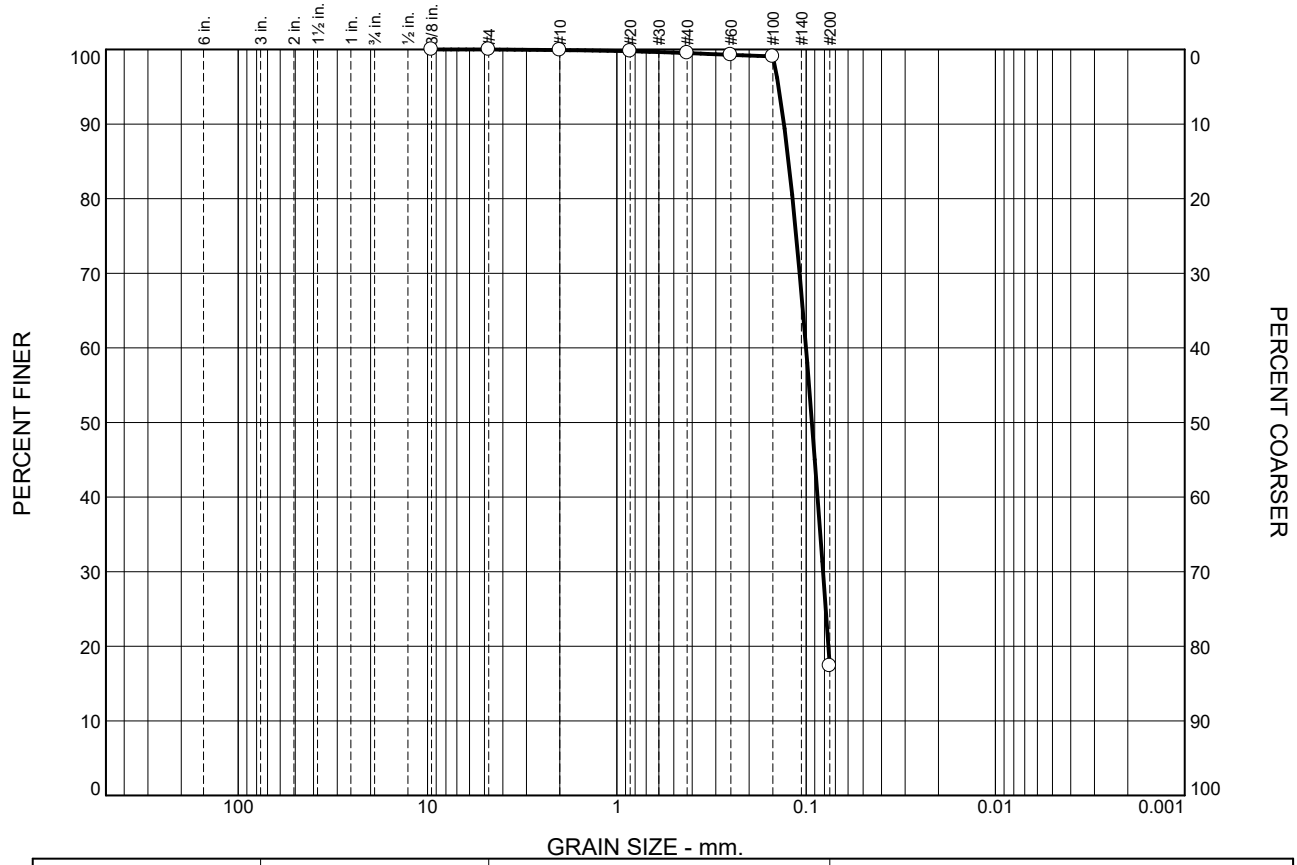
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	0.4	82.1	17.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-18	T-3	2	SILTY SAND (SM)	SM

Tolunay-Wong Engineers, Inc.

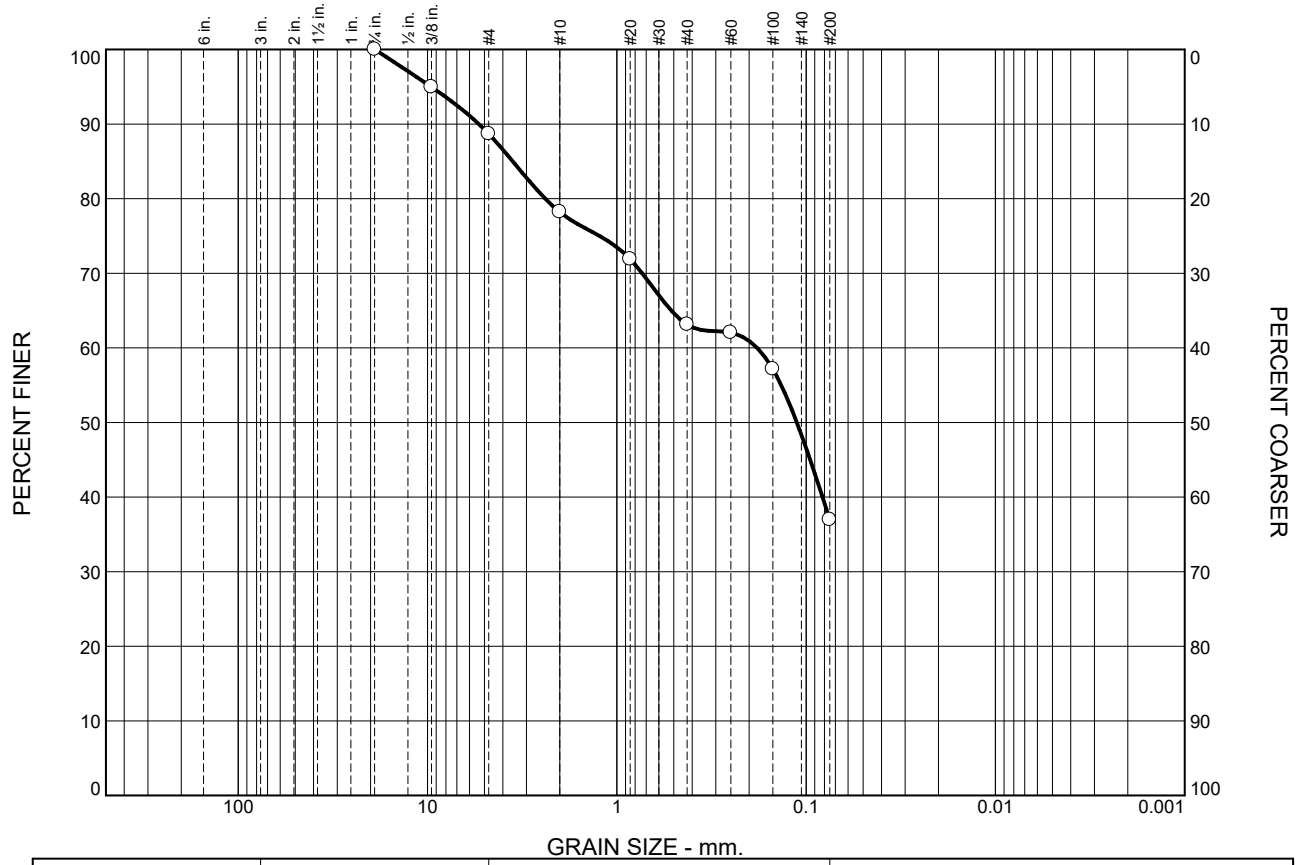
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	11.3	10.5	15.1	26.1	37.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-19	J-8	7	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

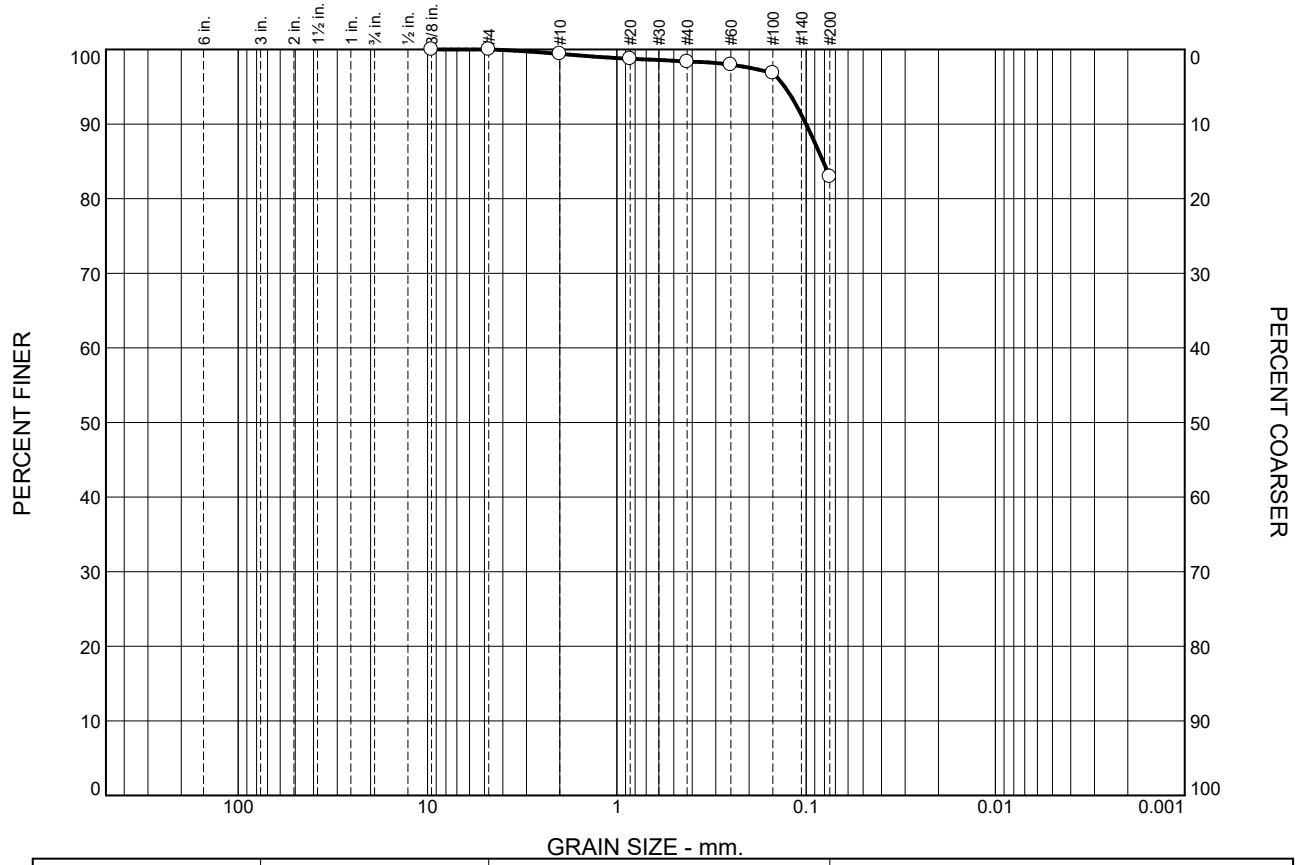
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.6	1.0	15.5	82.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-19	T-1	0	LEAN CLAY with SAND (CL)	CL

Tolunay-Wong Engineers, Inc.

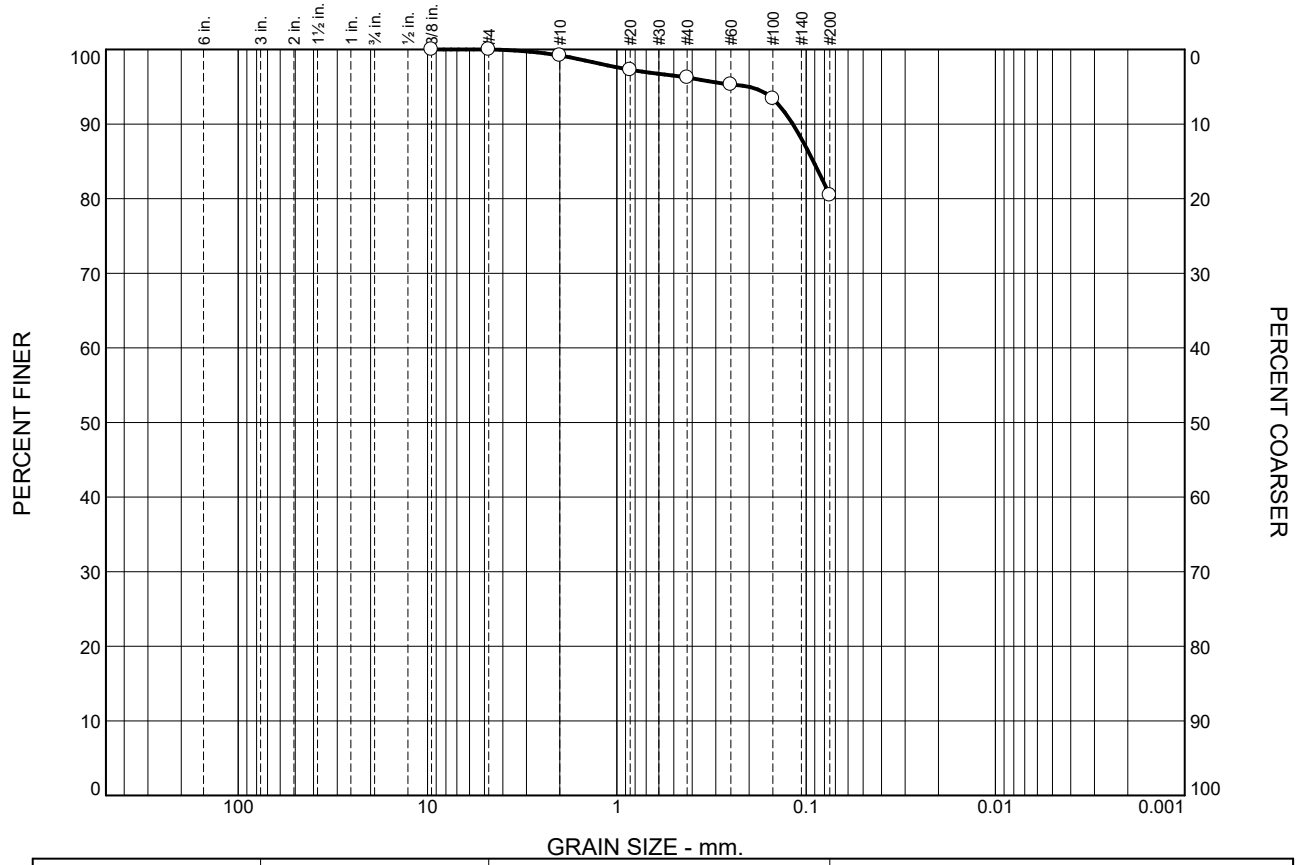
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.8	3.0	15.7	80.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-20	T-1	0	FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

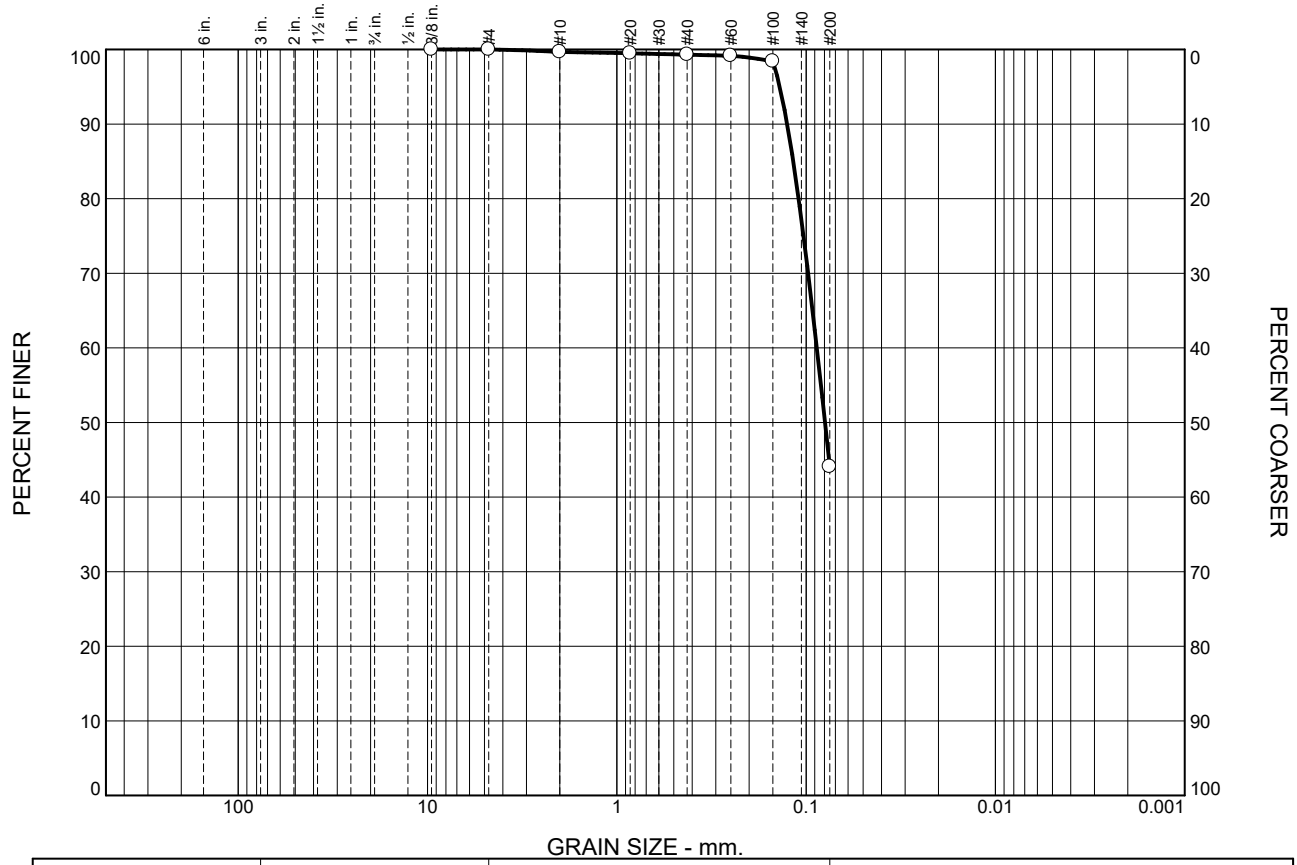
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.3	0.4	55.2	44.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-20	T-11	10	LEAN SANDY CLAY (CL)	CL

Tolunay-Wong Engineers, Inc.

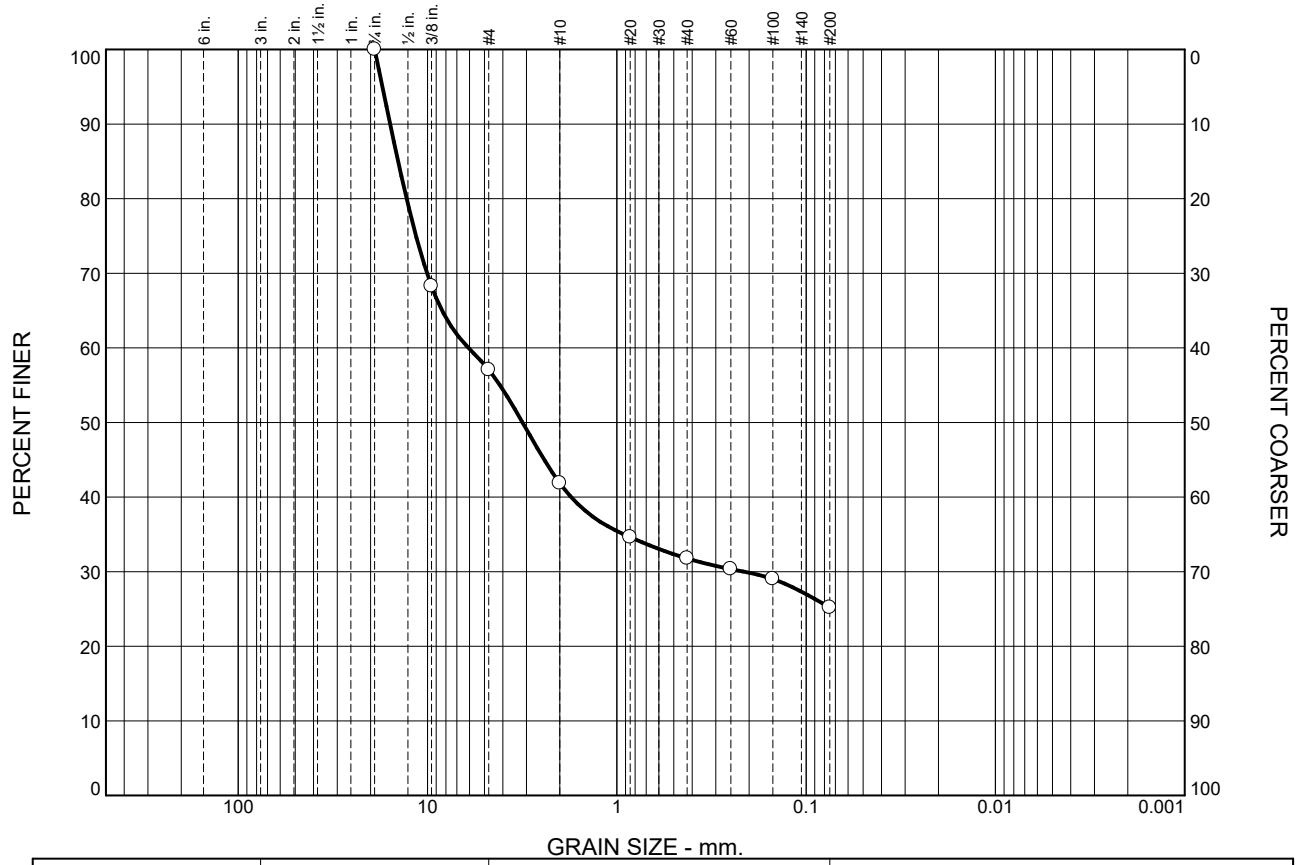
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	42.9	15.2	10.1	6.6	25.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-21	J-4	3	SILTY GRAVEL with SAND (GM)	GM

Tolunay-Wong Engineers, Inc.

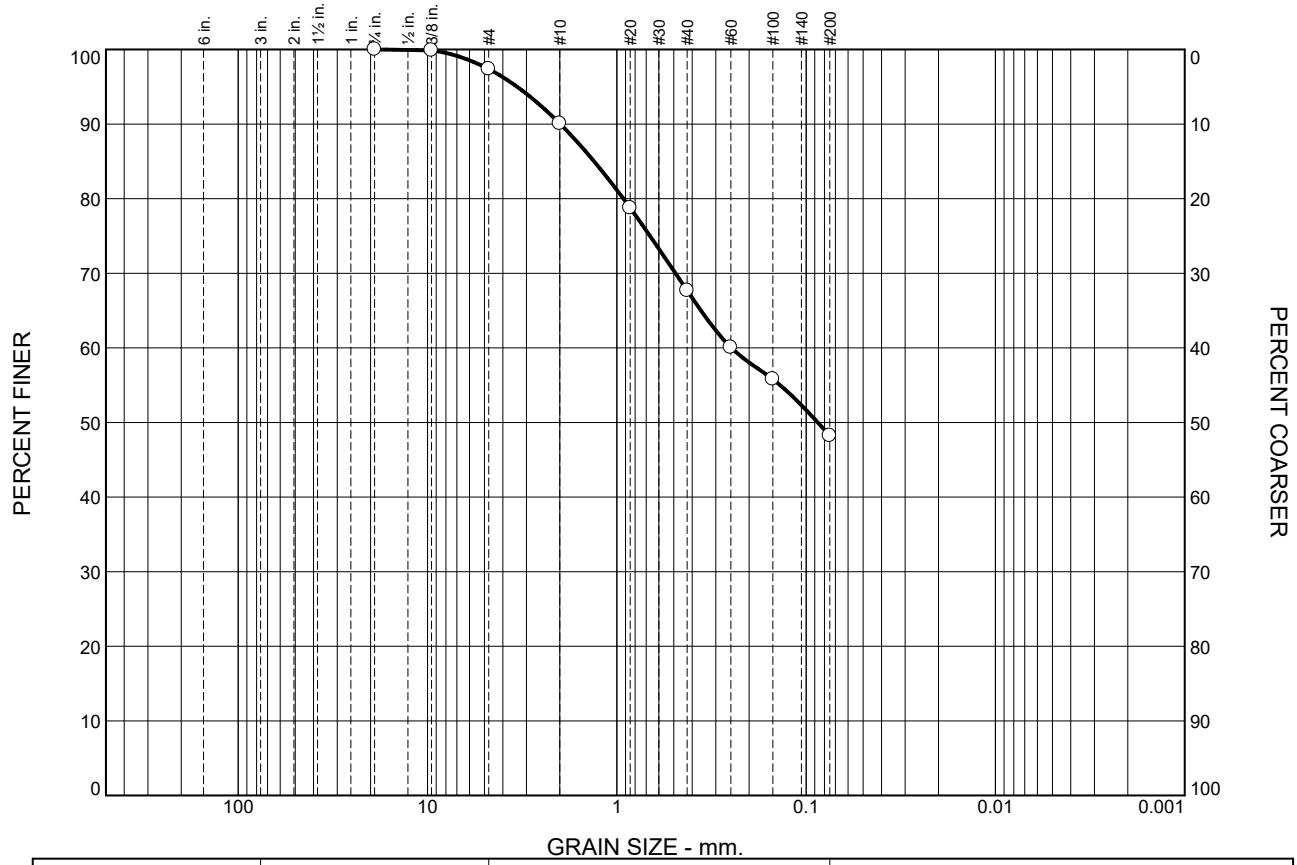
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	2.6	7.3	22.4	19.5	48.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-21	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

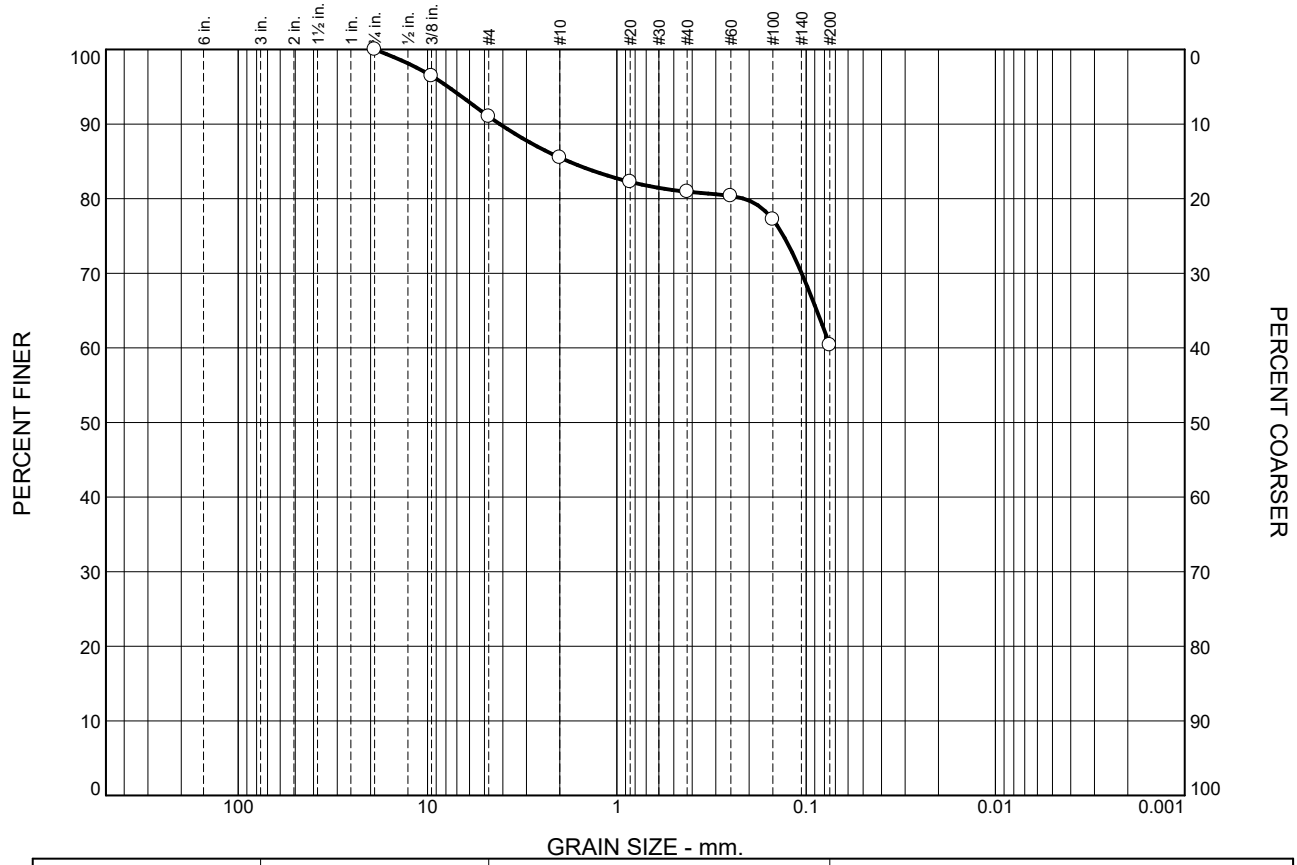
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	9.0	5.5	4.6	20.5	60.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-22	J-10	9	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

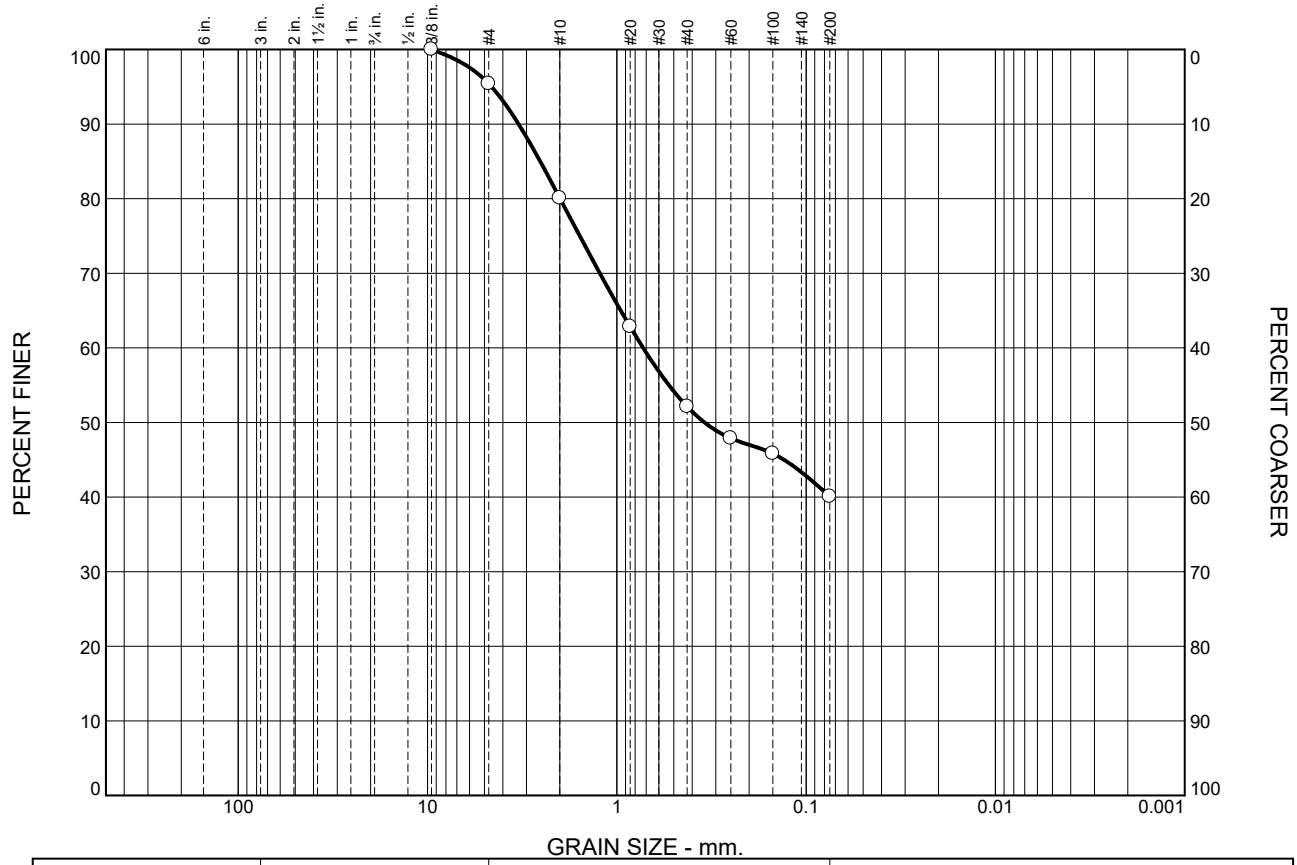
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	4.6	15.3	28.0	12.0	40.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-22	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

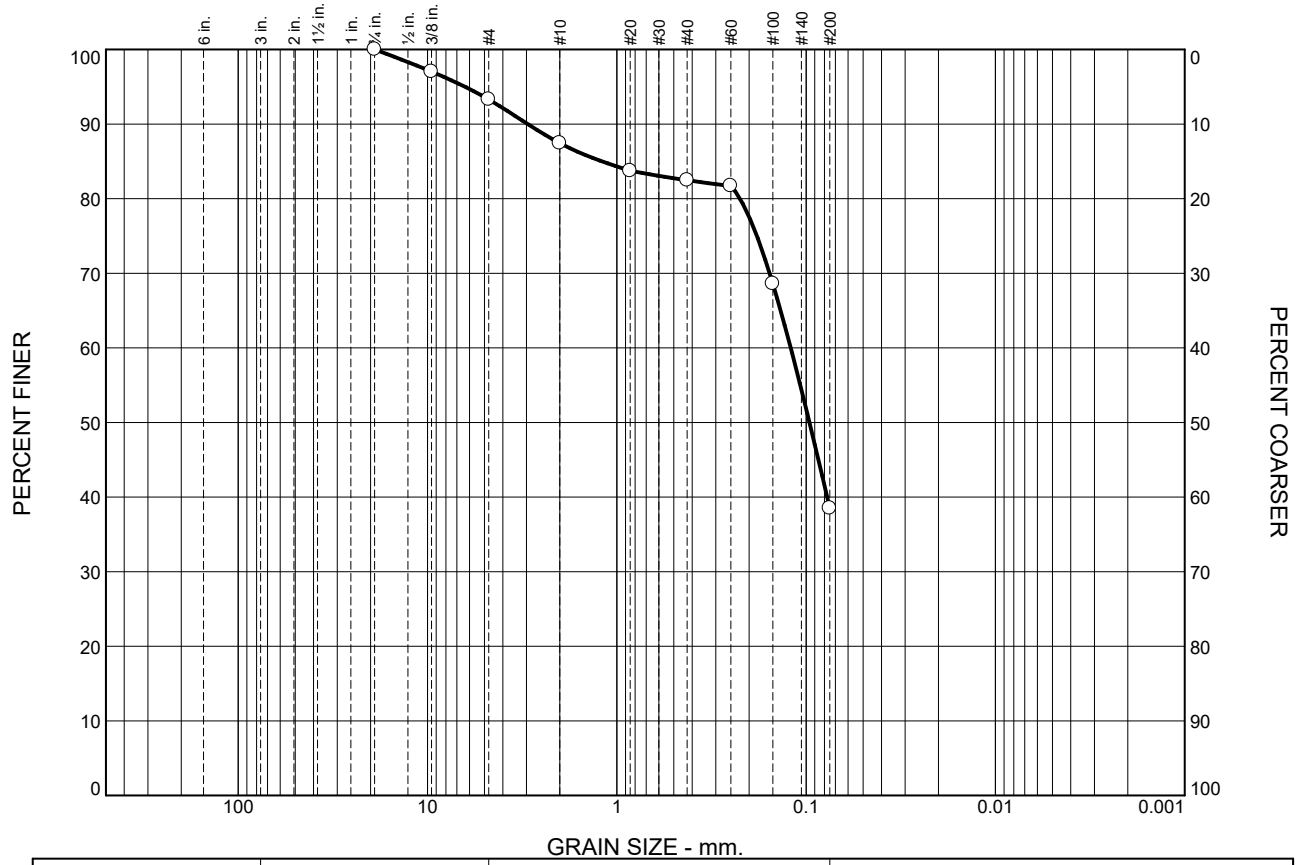
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	6.7	5.9	4.9	44.0	38.5

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-26	T-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

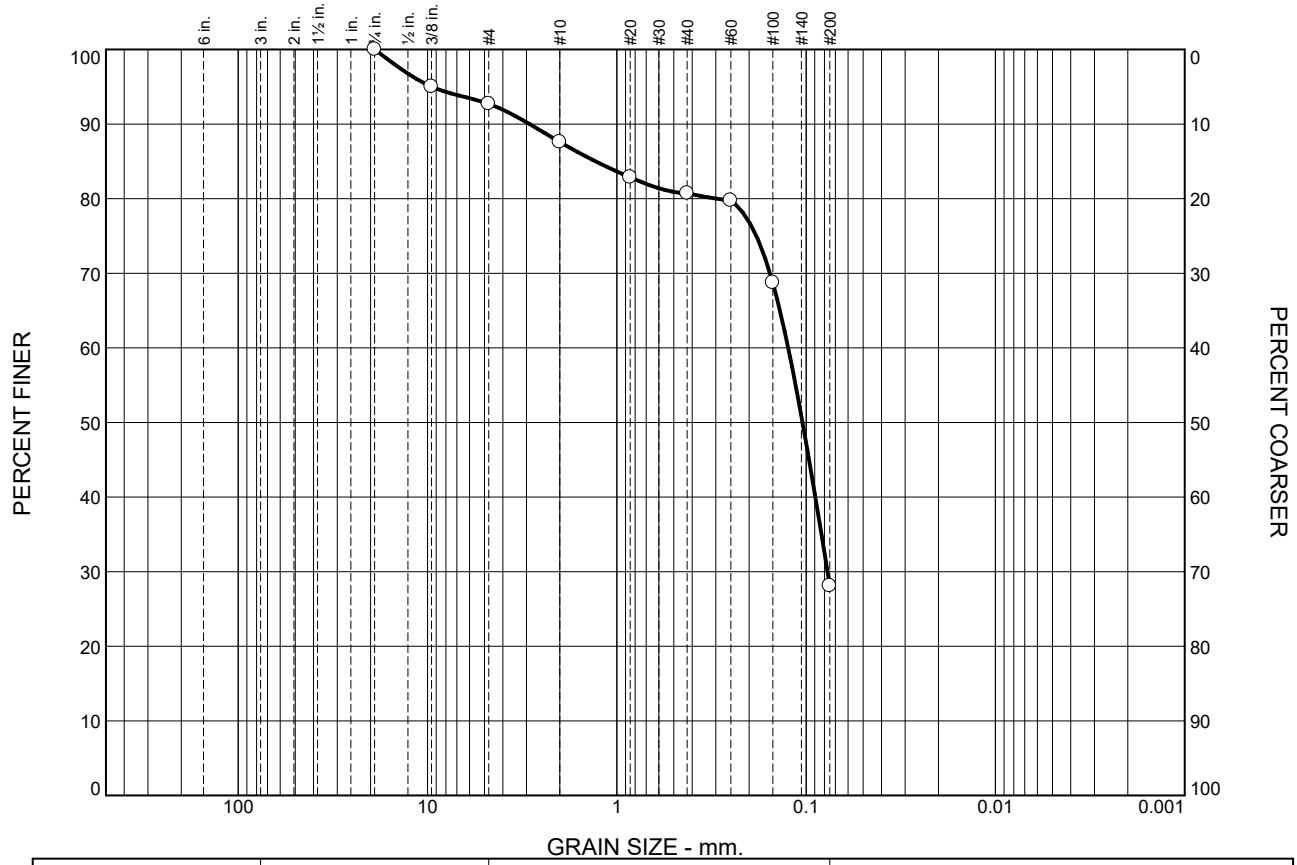
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	7.3	5.1	6.9	52.6	28.1

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-26	T-5	4	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

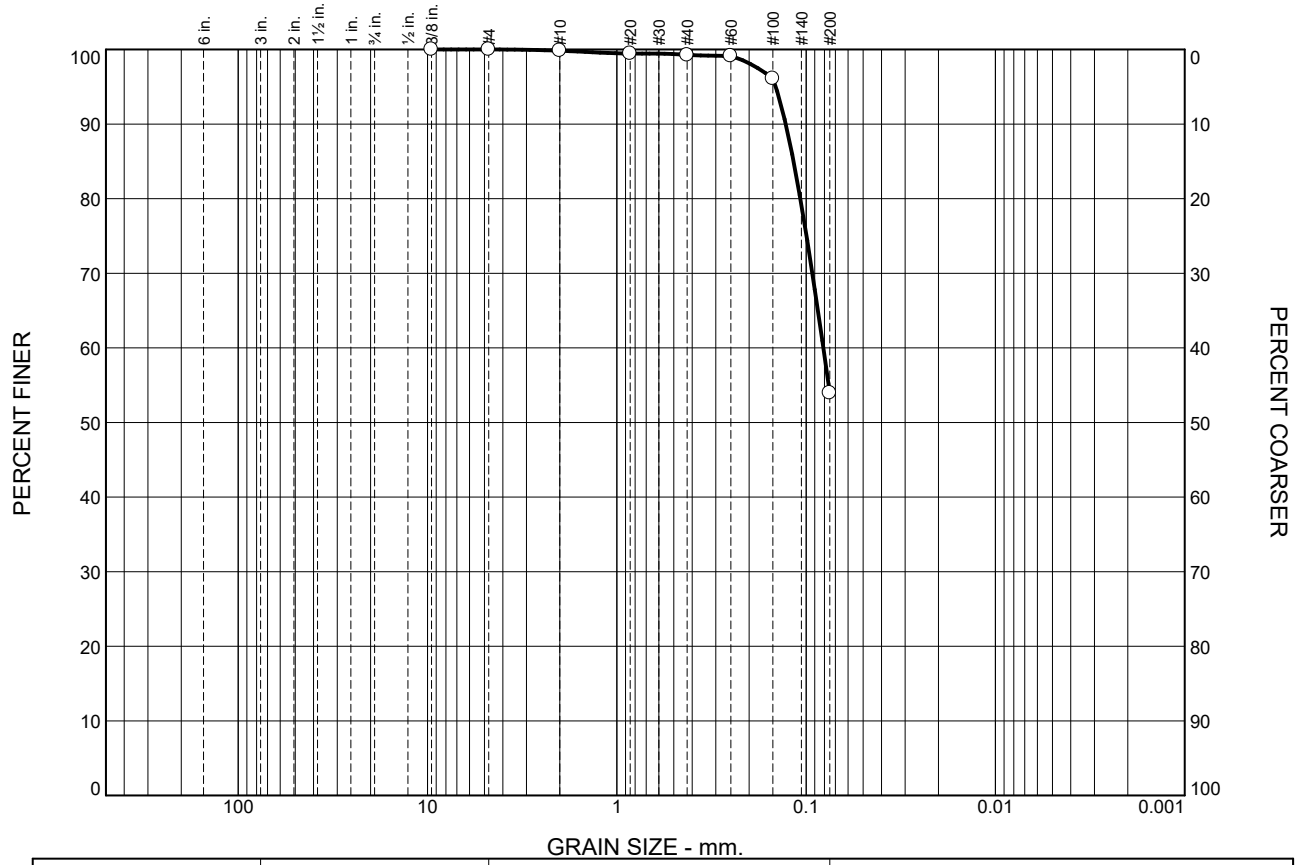
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.2	0.6	45.3	53.9

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-26	T-9	8	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

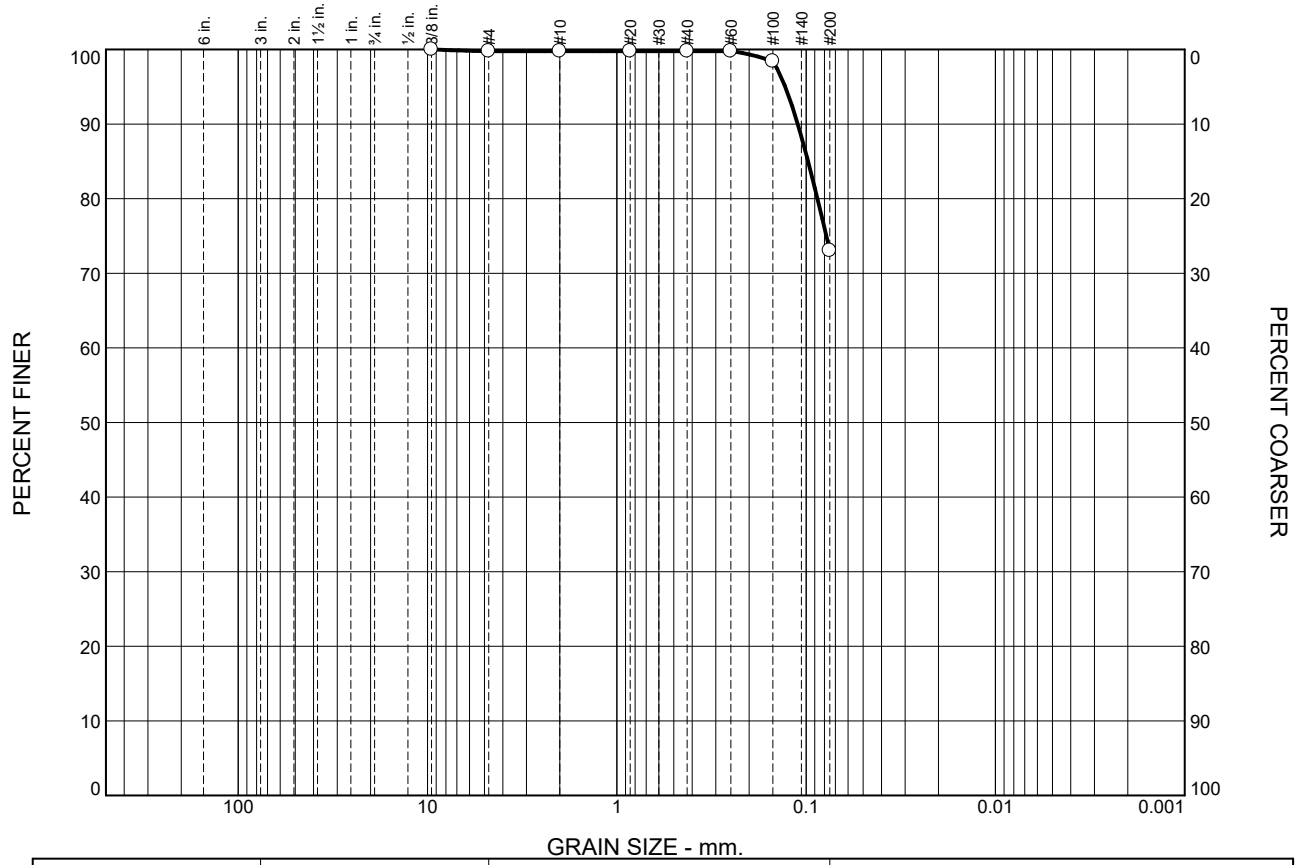
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.2	0.0	0.0	26.8	73.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-26	T-13	12	FAT CLAY with SAND (CH)	CH

Tolunay-Wong Engineers, Inc.

Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	10.6	4.1	4.2	51.3	29.8

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-27	J-1	0	CLAYEY SAND (SC)	SC

Tolunay-Wong Engineers, Inc.

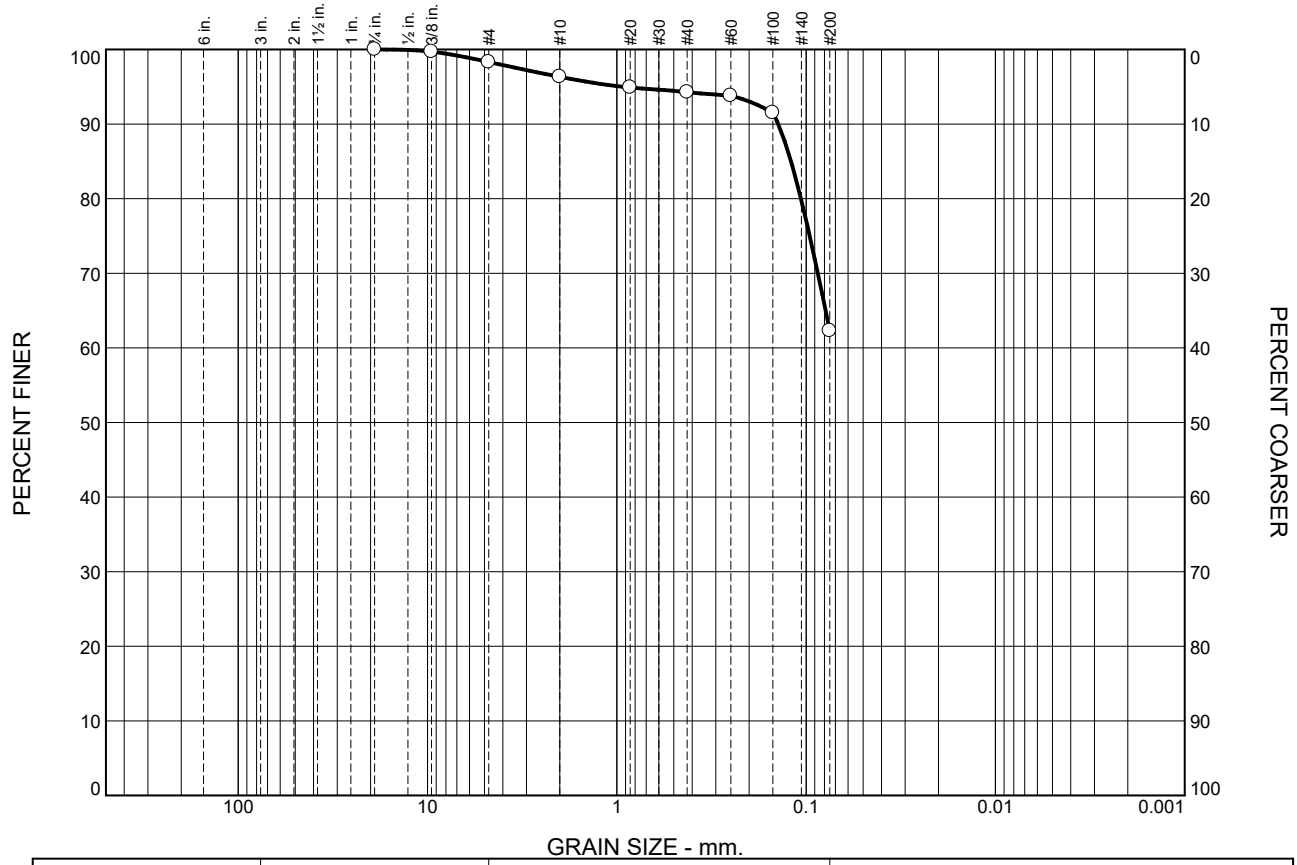
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	1.7	2.0	2.0	32.0	62.3

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-27	T-4	3	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

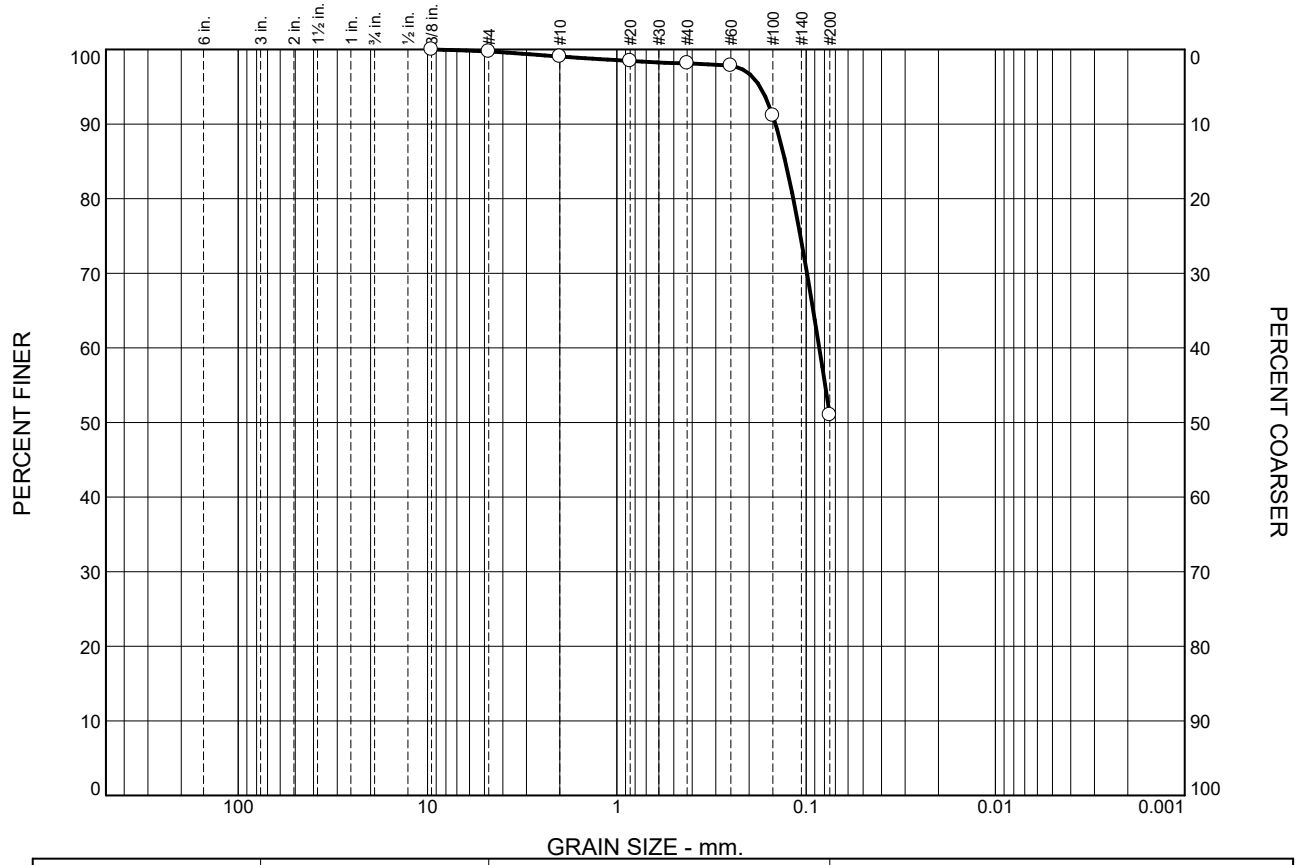
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.3	0.6	0.9	47.2	51.0

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-27	T-8	7	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

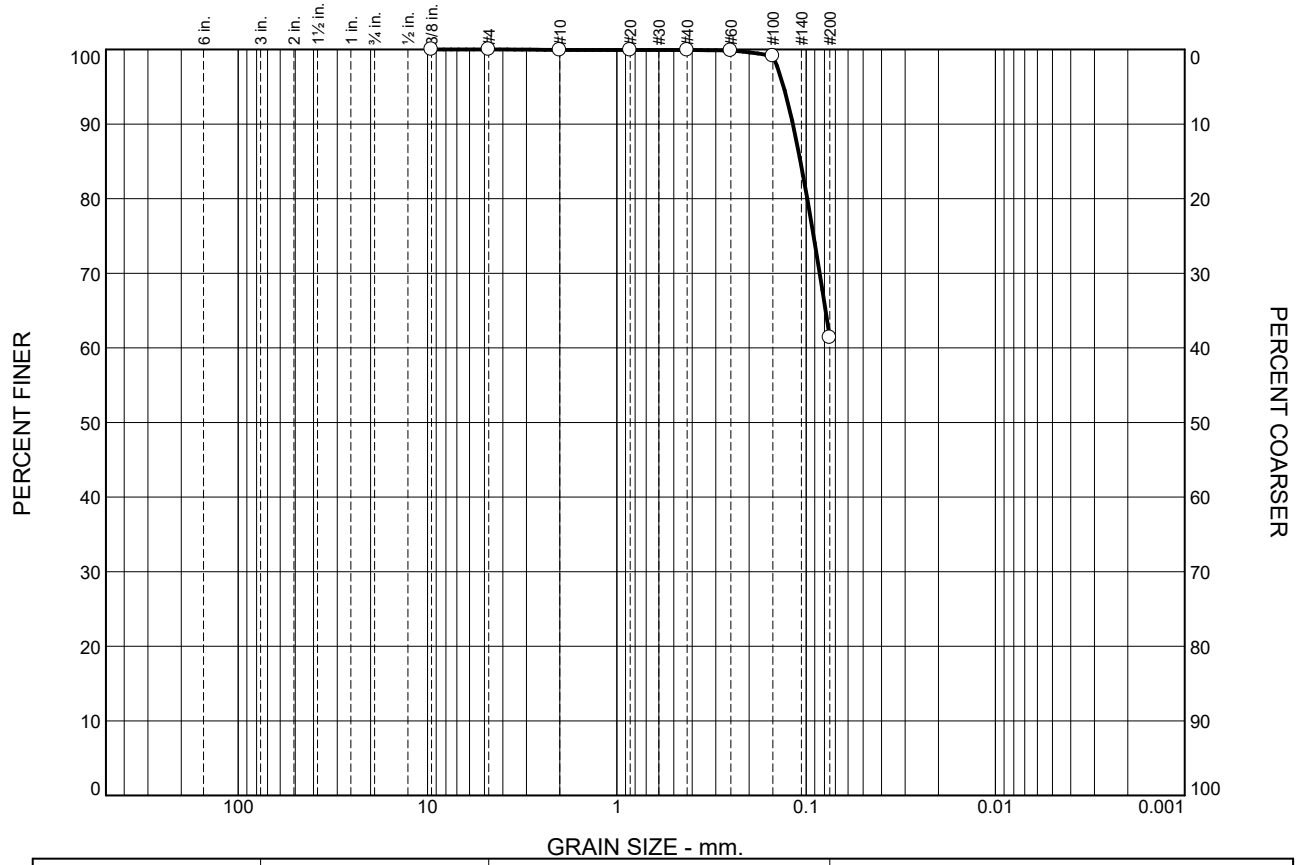
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	0.0	38.5	61.4

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-27	T-12	11	SANDY FAT CLAY (CH)	CH

Tolunay-Wong Engineers, Inc.

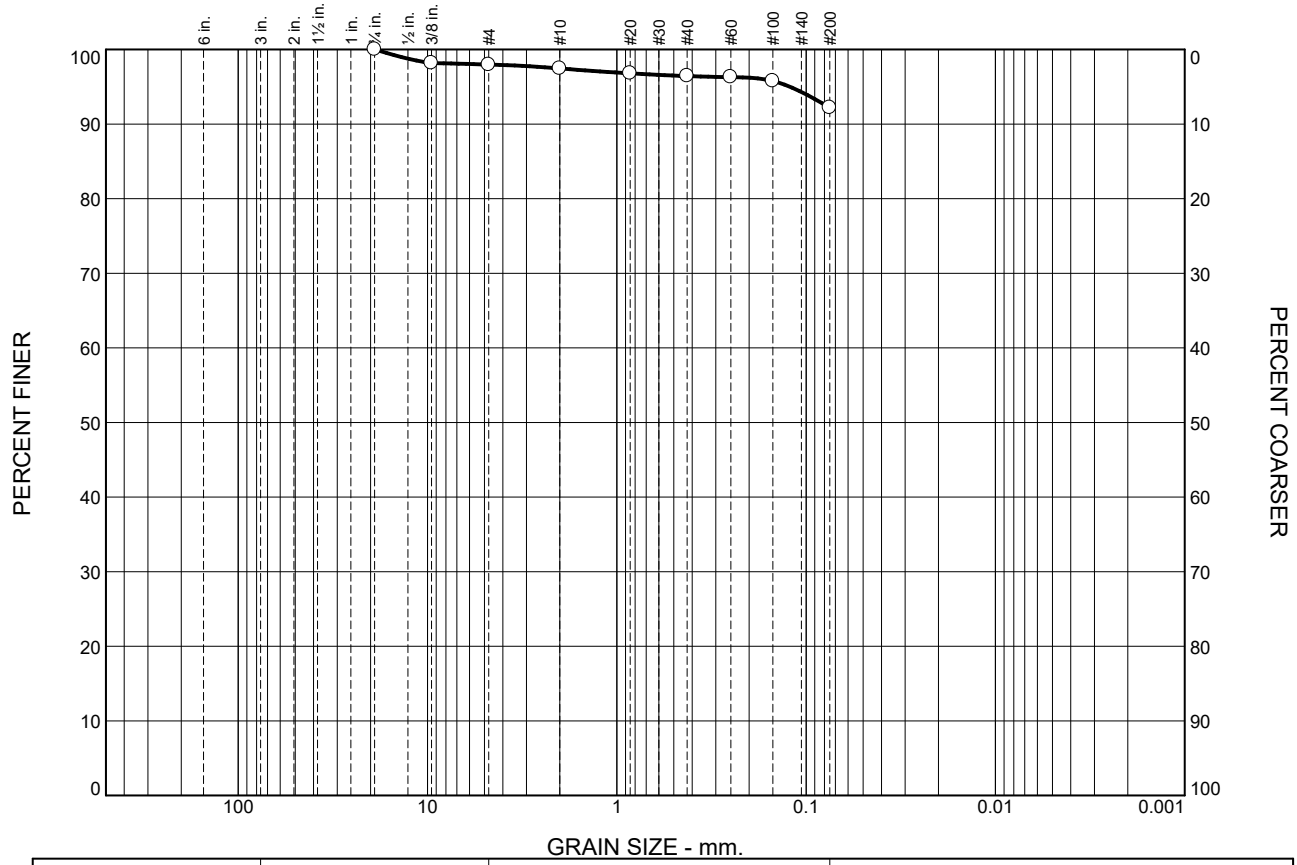
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke

ASTM D422 Hydrometer Analysis



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	2.0	0.5	1.1	4.2	92.2

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	VB-29	T-7	6	FAT CLAY (CH)	CH

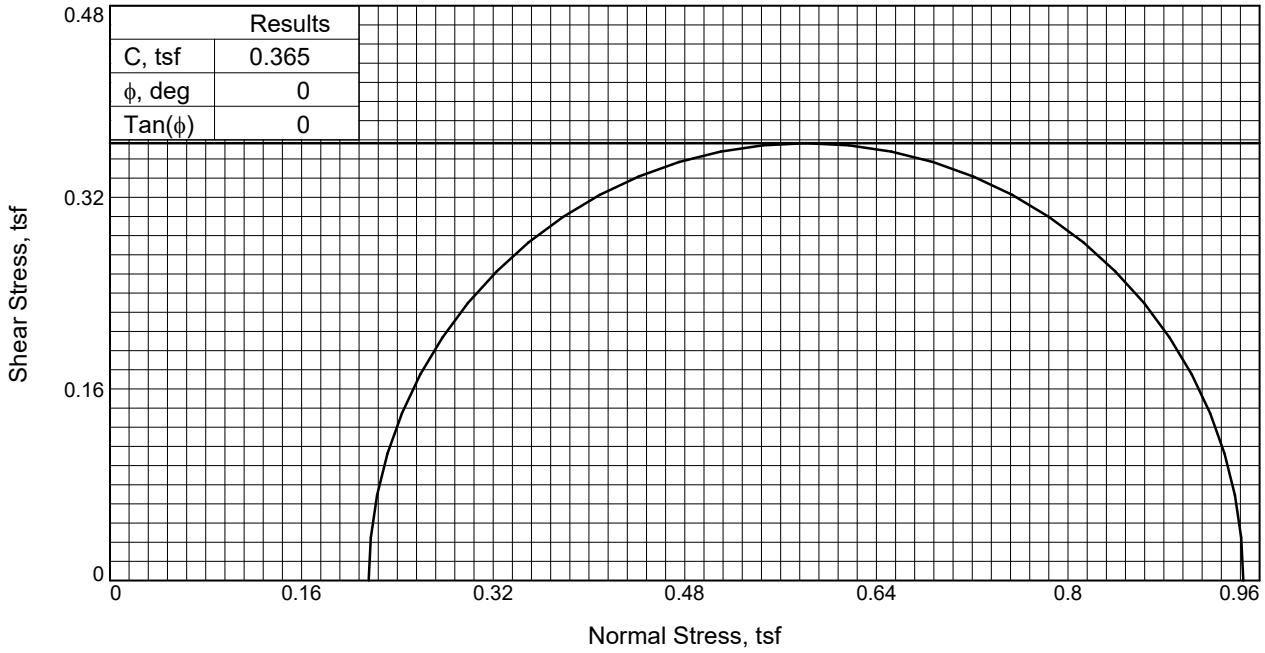
Tolunay-Wong Engineers, Inc.

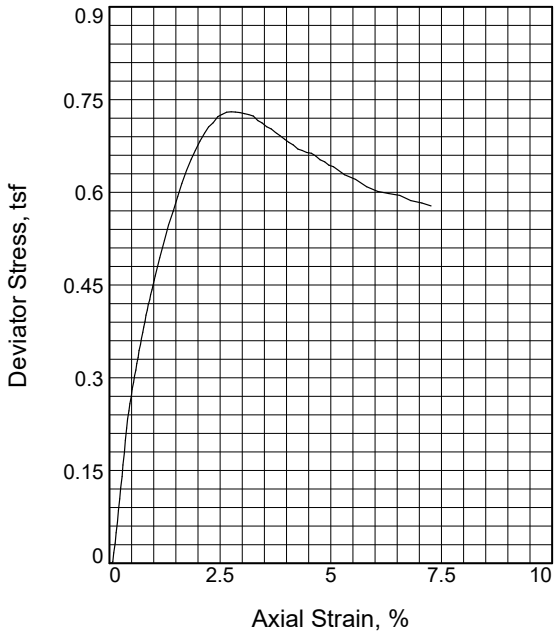
Client: CPA/USACE

Project: MATAGORDA SHIP CHANNEL/Placement Areas

Project No.: 21.14.223 **Figure**

Tested By: N. Avila **Checked By:** J. O'Burke





Sample No.		1
Initial	Water Content, %	58.9
	Dry Density, pcf	65.6
	Saturation, %	99.0
	Void Ratio	1.6659
	Diameter, in.	2.85
	Height, in.	5.77
At Test	Water Content, %	52.4
	Dry Density, pcf	65.6
	Saturation, %	88.0
	Void Ratio	1.6659
	Diameter, in.	2.85
	Height, in.	5.77
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		0.73
Strain, %		2.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.95
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: FAT CLAY (CH),gray

LL= 92 **PL=** 35 **PI=** 57

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

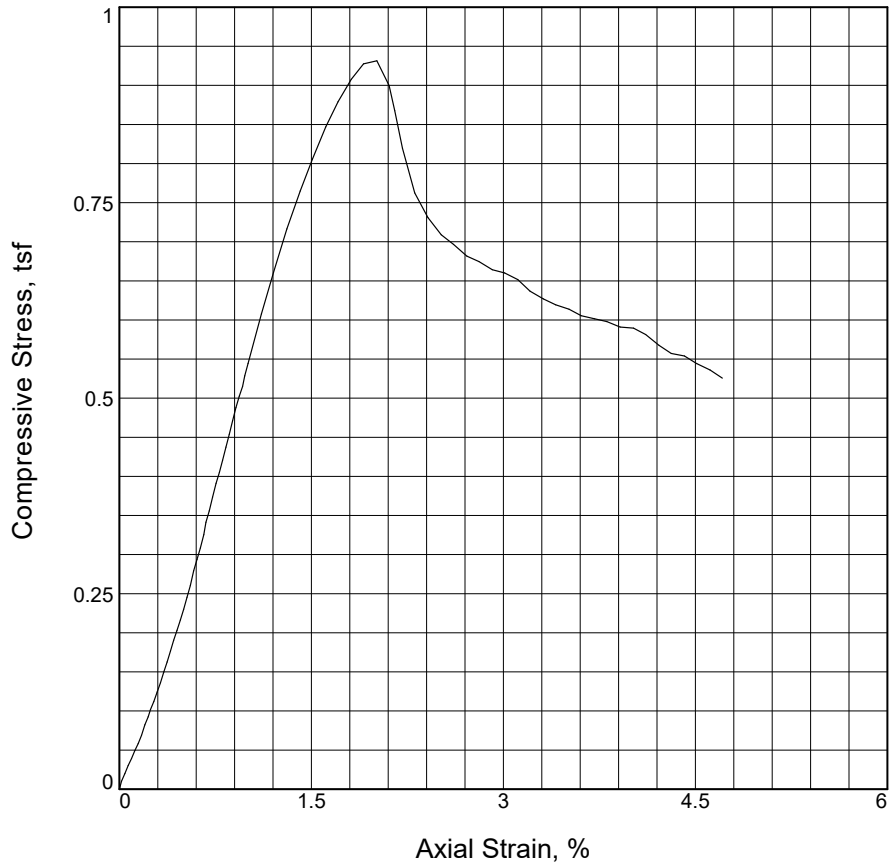
Source of Sample: CB-01 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 10/28/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.931			
Undrained shear strength, tsf	0.466			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	57.7			
Wet density, pcf	104.9			
Dry density, pcf	66.5			
Saturation, %	99.2			
Void ratio	1.6274			
Specimen diameter, in.	2.88			
Specimen height, in.	5.76			
Height/diameter ratio	2.00			

Description: Gray FAT CLAY

LL = 80	**PL =** 32	**PI =** 48	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

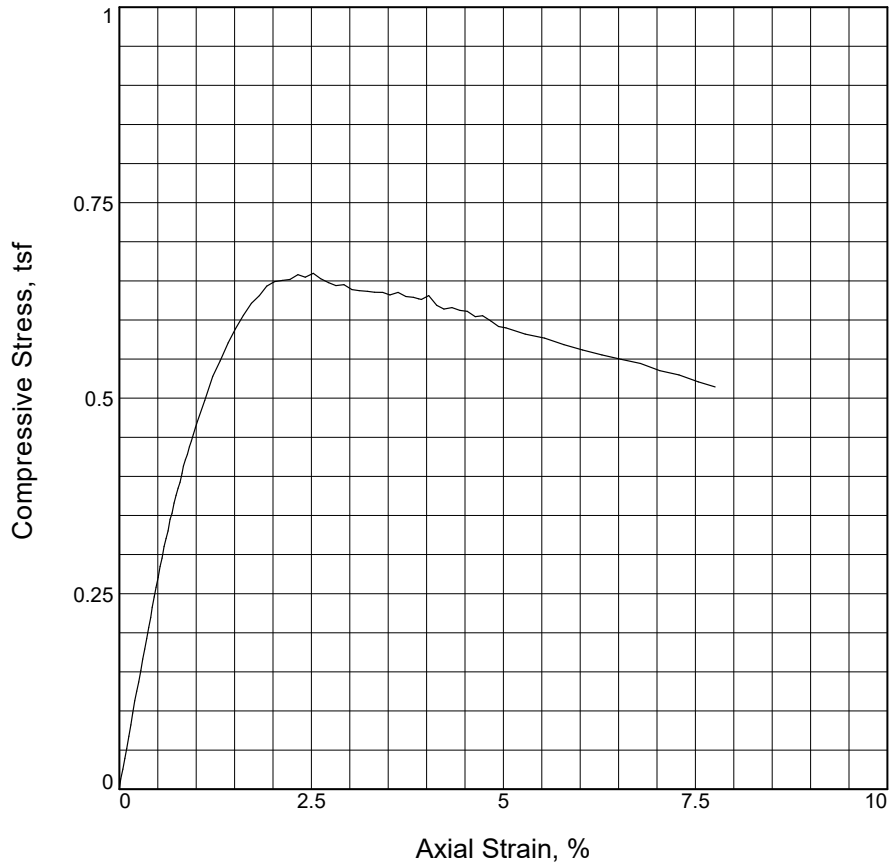
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-01 **Depth:** 7.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.660			
Undrained shear strength, tsf	0.330			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	53.7			
Wet density, pcf	104.5			
Dry density, pcf	68.0			
Saturation, %	98.0			
Void ratio	1.4779			
Specimen diameter, in.	2.85			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

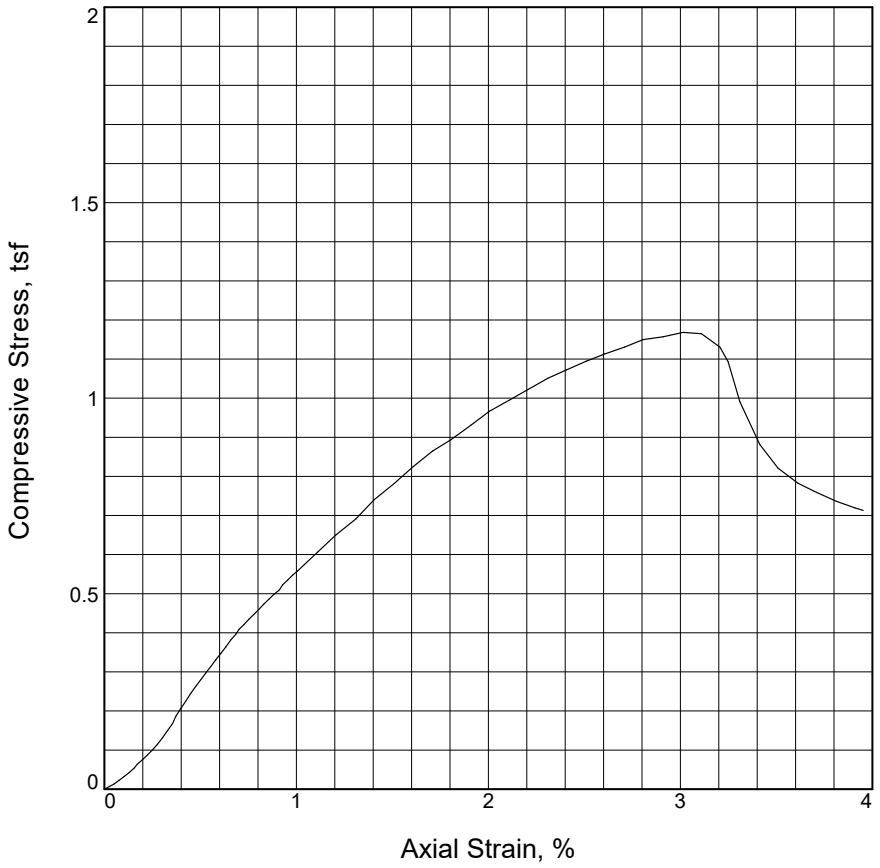
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-01 **Depth:** 10
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.168			
Undrained shear strength, tsf	0.584			
Failure strain, %	3.0			
Strain rate, %/min.	1.00			
Water content, %	55.9			
Wet density, pcf	104.2			
Dry density, pcf	66.8			
Saturation, %	99.2			
Void ratio	1.5219			
Specimen diameter, in.	2.88			
Specimen height, in.	5.73			
Height/diameter ratio	1.99			

Description: Gray FAT CLAY

LL = 86	**PL =** 35	**PI =** 51	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

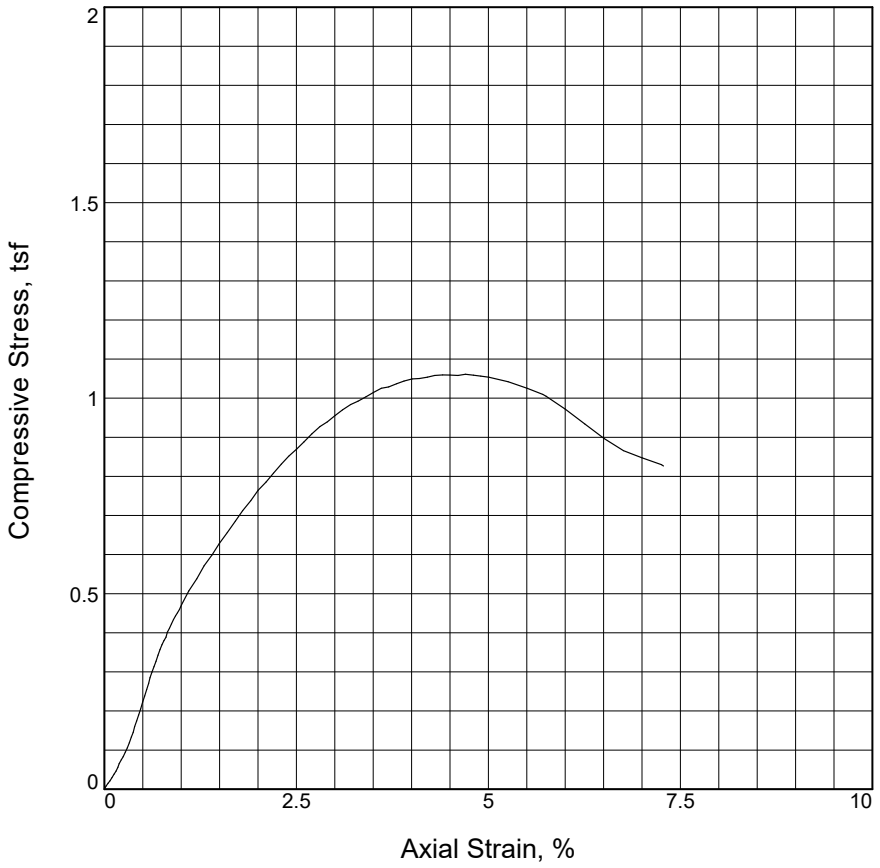
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-01 **Depth:** 12.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.061			
Undrained shear strength, tsf	0.531			
Failure strain, %	4.7			
Strain rate, %/min.	1.00			
Water content, %	44.5			
Wet density, pcf	112.1			
Dry density, pcf	77.5			
Saturation, %	98.0			
Void ratio	1.2948			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Light gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

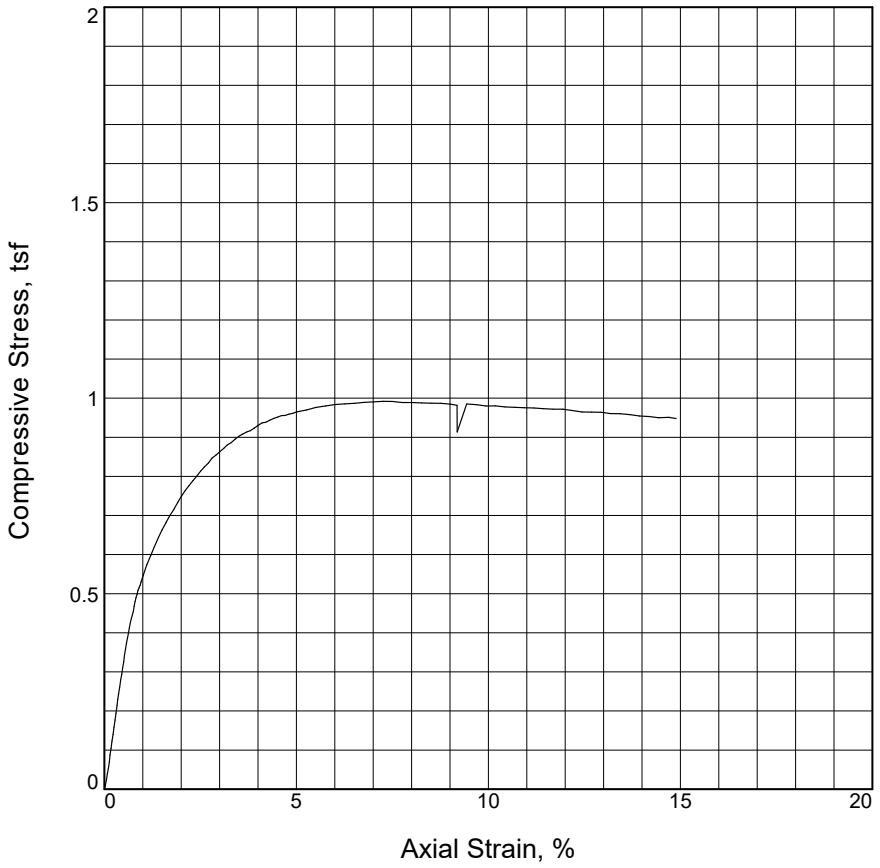
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-01 **Depth:** 15
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.992			
Undrained shear strength, tsf	0.496			
Failure strain, %	7.3			
Strain rate, %/min.	1.00			
Water content, %	38.3			
Wet density, pcf	114.9			
Dry density, pcf	83.1			
Saturation, %	98.8			
Void ratio	1.0651			
Specimen diameter, in.	2.87			
Specimen height, in.	5.77			
Height/diameter ratio	2.01			

Description: FAT CLAY (CH),brown and gray

LL = 80	**PL =** 33	**PI =** 47	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

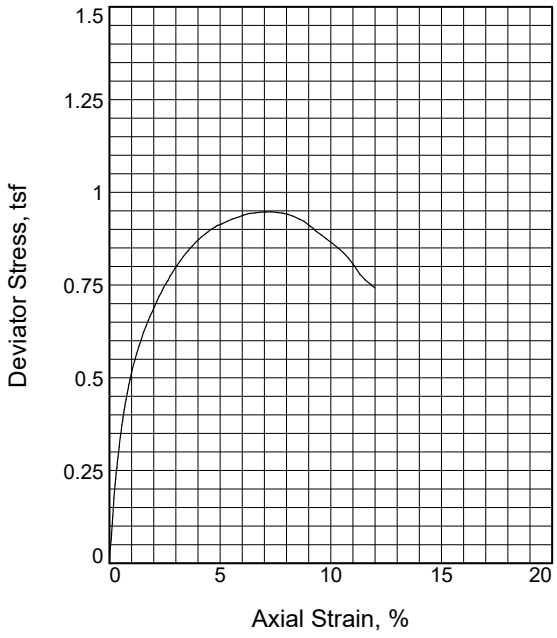
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-02 **Depth:** 5
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	40.2
	Dry Density, pcf	81.1
	Saturation, %	99.0
	Void Ratio	1.1157
	Diameter, in.	2.88
	Height, in.	5.72
At Test	Water Content, %	36.3
	Dry Density, pcf	81.1
	Saturation, %	89.4
	Void Ratio	1.1157
	Diameter, in.	2.88
	Height, in.	5.72
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		0.95
Strain, %		7.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.16
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan and gray FAT CLAY

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

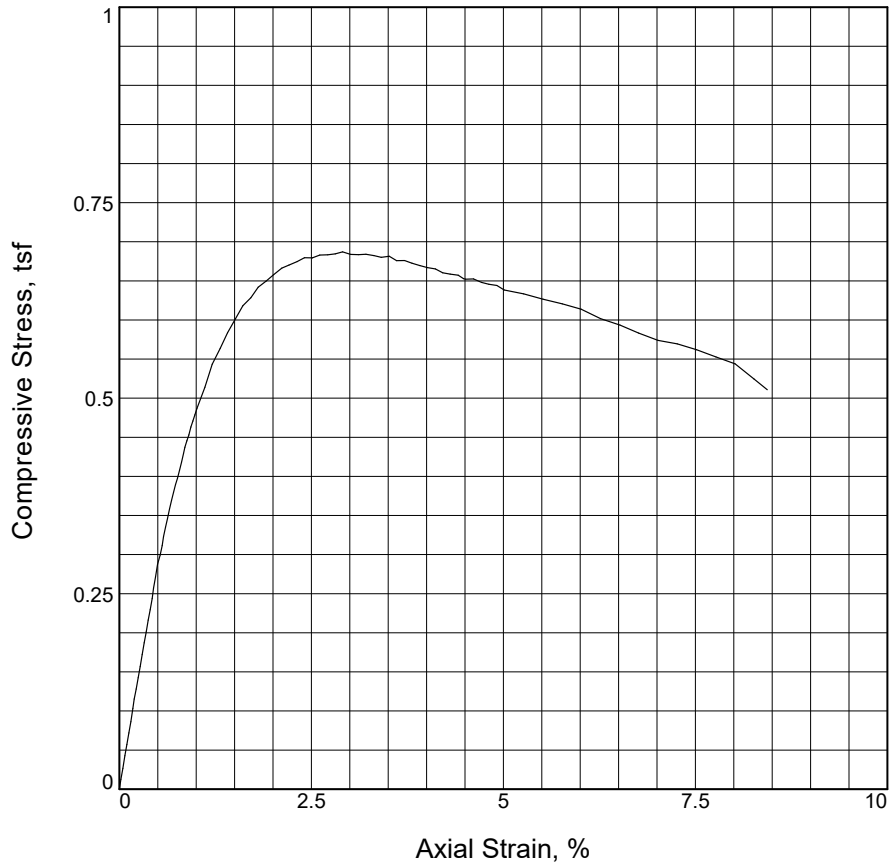
Source of Sample: CB-02 **Depth:** 7.5

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 10/28/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.687			
Undrained shear strength, tsf	0.344			
Failure strain, %	2.9			
Strain rate, %/min.	1.00			
Water content, %	49.0			
Wet density, pcf	107.6			
Dry density, pcf	72.2			
Saturation, %	99.2			
Void ratio	1.3344			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY

LL = 82	**PL =** 32	**PI =** 50	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

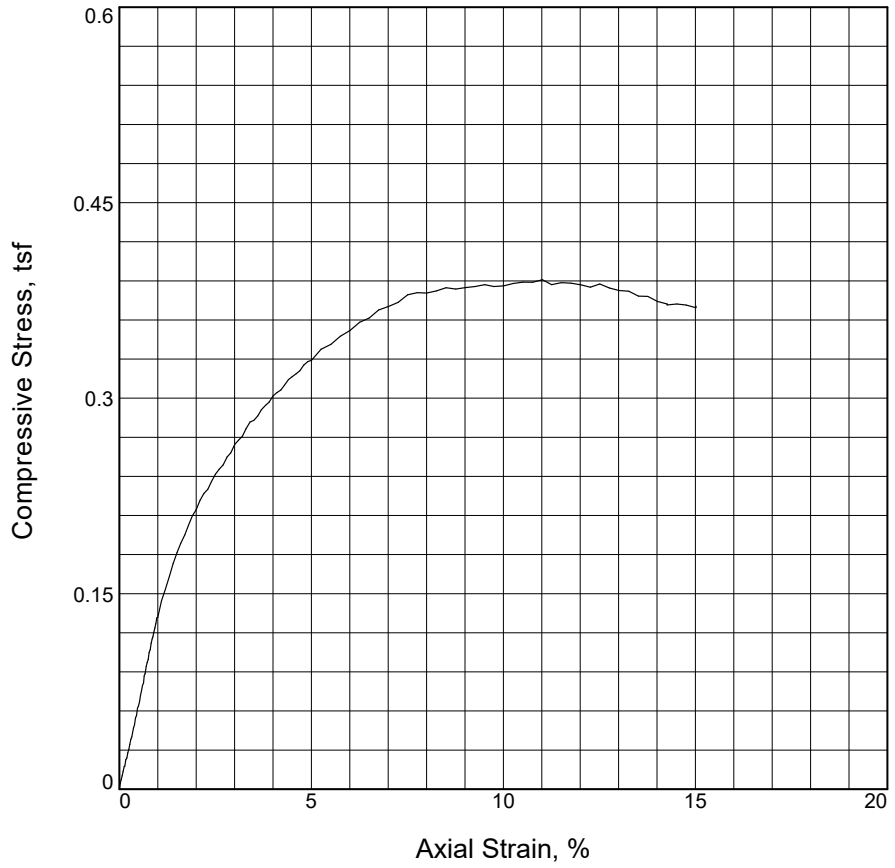
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-02 **Depth:** 10
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.391			
Undrained shear strength, tsf	0.195			
Failure strain, %	11.0			
Strain rate, %/min.	1.00			
Water content, %	53.0			
Wet density, pcf	106.6			
Dry density, pcf	69.6			
Saturation, %	98.3			
Void ratio	1.5100			
Specimen diameter, in.	2.88			
Specimen height, in.	5.68			
Height/diameter ratio	1.97			

Description: Gray FAT CLAY

LL = 73	**PL =** 27	**PI =** 46	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

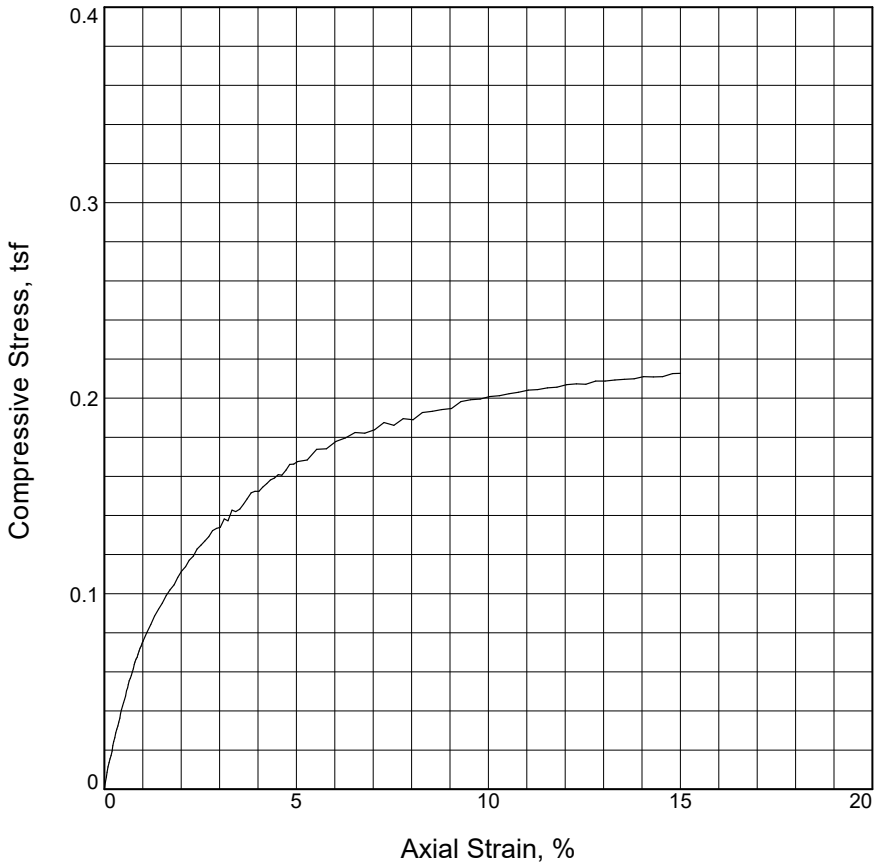
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-02 **Depth:** 15
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.213			
Undrained shear strength, tsf	0.106			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	54.3			
Wet density, pcf	107.7			
Dry density, pcf	69.8			
Saturation, %	100.0			
Void ratio	1.5482			
Specimen diameter, in.	2.83			
Specimen height, in.	5.75			
Height/diameter ratio	2.04			

Description: Brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

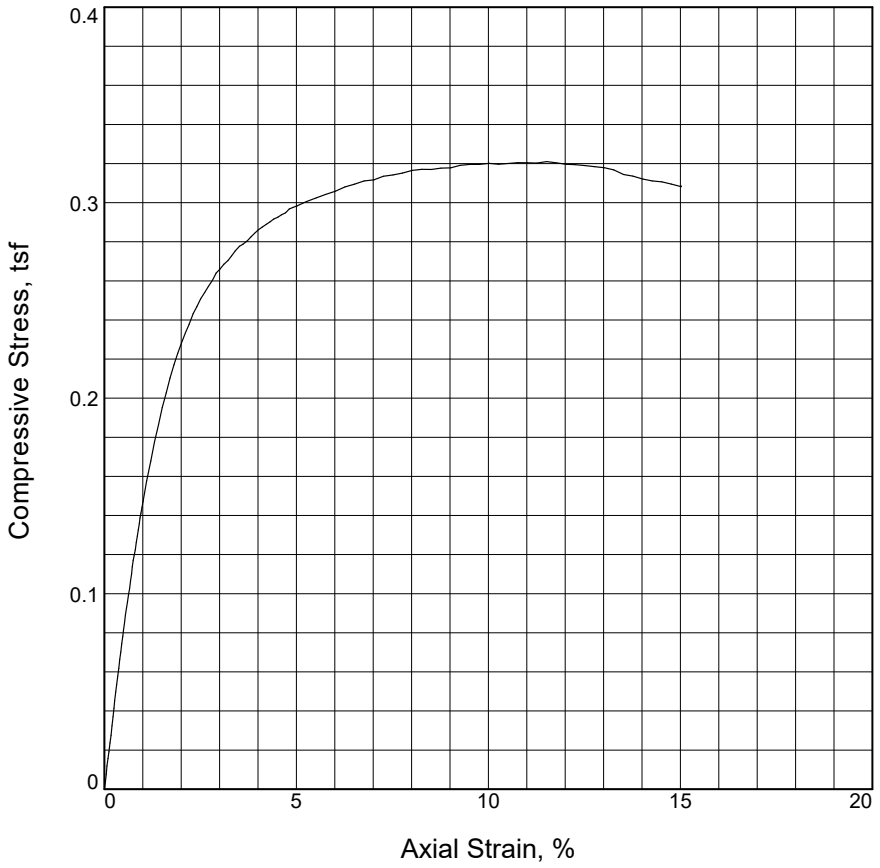
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-03 **Depth:** 2.5
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.321			
Undrained shear strength, tsf	0.160			
Failure strain, %	11.5			
Strain rate, %/min.	1.00			
Water content, %	62.7			
Wet density, pcf	101.7			
Dry density, pcf	62.5			
Saturation, %	99.9			
Void ratio	1.6957			
Specimen diameter, in.	2.87			
Specimen height, in.	5.74			
Height/diameter ratio	2.00			

Description: Gray FAT CLAY; shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

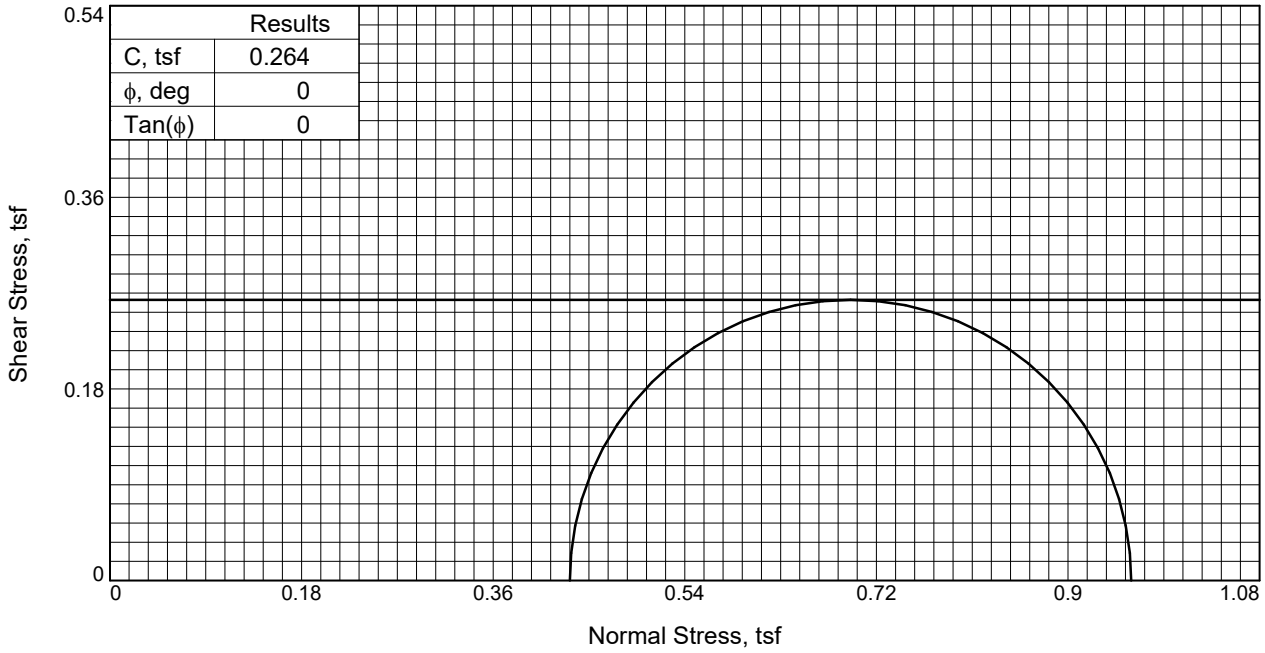
Figure _____

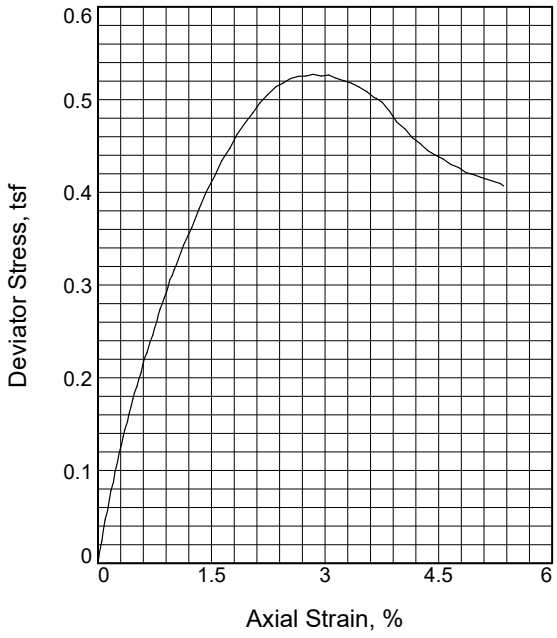
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-03 **Depth:** 12.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	63.2
	Dry Density, pcf	63.1
	Saturation, %	99.0
	Void Ratio	1.8200
	Diameter, in.	2.88
	Height, in.	5.76
At Test	Water Content, %	60.0
	Dry Density, pcf	63.1
	Saturation, %	94.0
	Void Ratio	1.8200
	Diameter, in.	2.88
	Height, in.	5.76
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		6.00
Fail. Stress, tsf		0.53
Strain, %		2.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.96
σ_3 Failure, tsf		0.43

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY; sand pockets

LL= 70 **PL=** 25 **PI=** 45

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

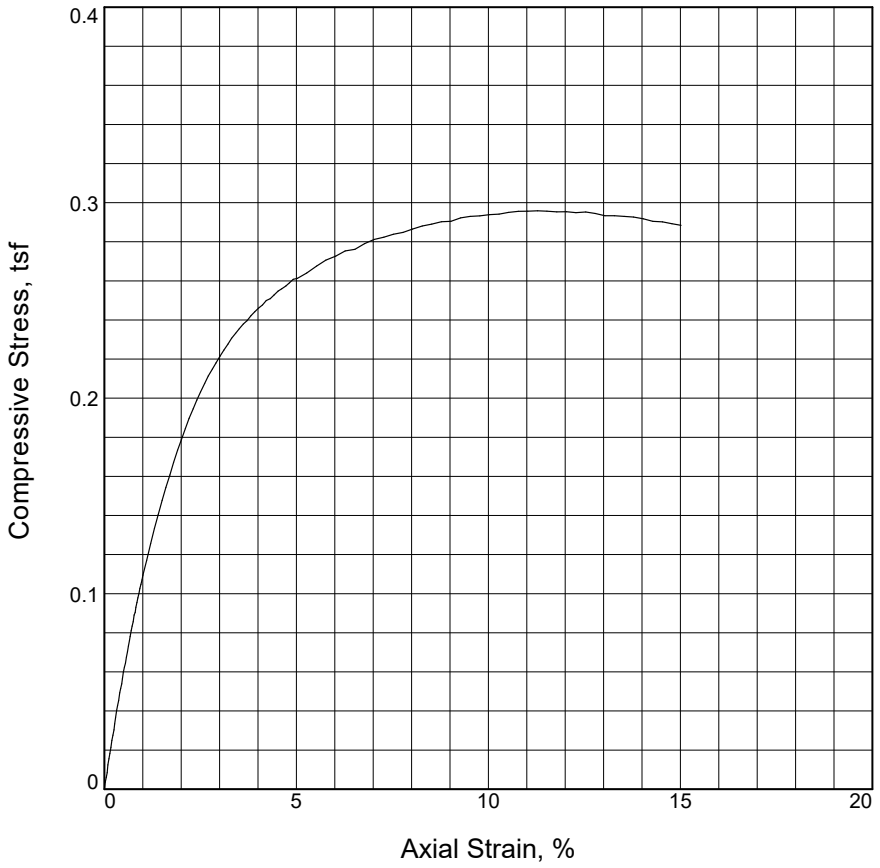
Source of Sample: CB-03 **Depth:** 15

Sample Number: ST-6

Proj. No.: 21.14.223 **Date Sampled:** 10/29/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.296			
Undrained shear strength, tsf	0.148			
Failure strain, %	11.3			
Strain rate, %/min.	1.00			
Water content, %	56.4			
Wet density, pcf	105.8			
Dry density, pcf	67.7			
Saturation, %	99.7			
Void ratio	1.5834			
Specimen diameter, in.	2.85			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

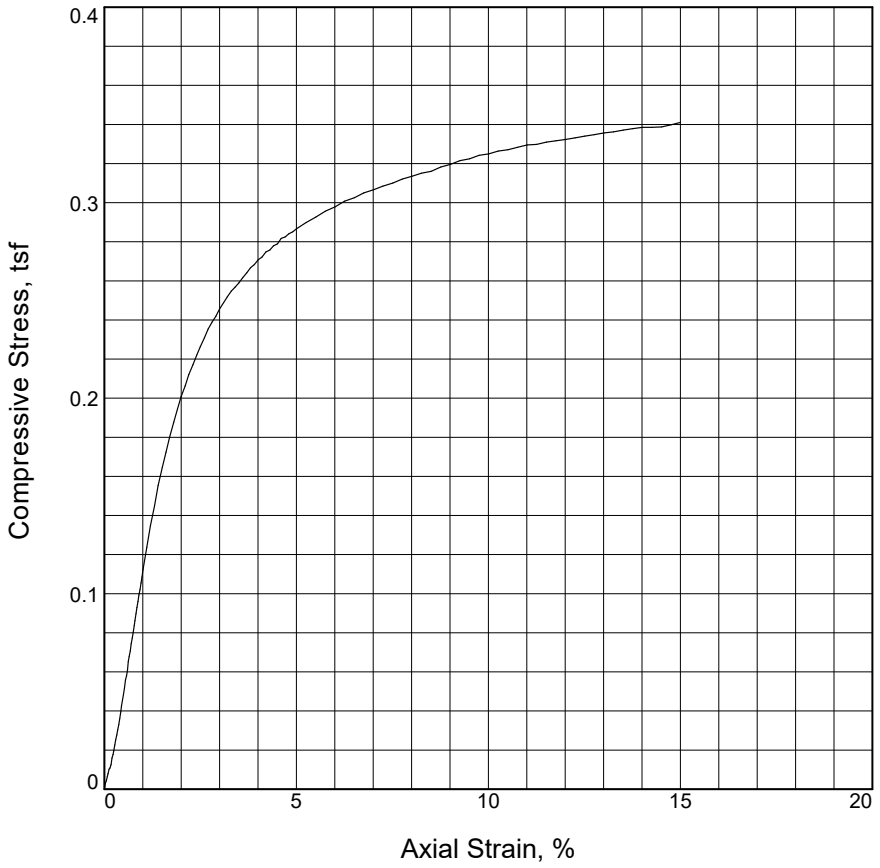
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-03 **Depth:** 7.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.341			
Undrained shear strength, tsf	0.171			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	53.4			
Wet density, pcf	106.5			
Dry density, pcf	69.5			
Saturation, %	99.7			
Void ratio	1.4714			
Specimen diameter, in.	2.85			
Specimen height, in.	5.71			
Height/diameter ratio	2.00			

Description: Gray FAT CLAY; shell fragments

LL = 65	**PL =** 24	**PI =** 41	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

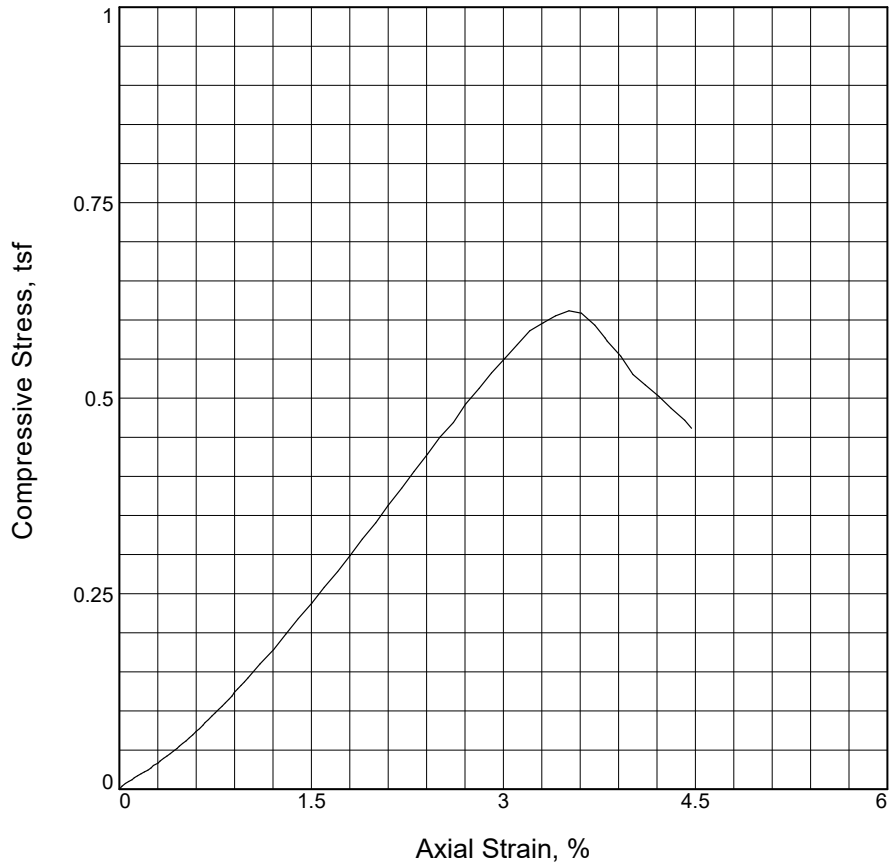
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-03 **Depth:** 10
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.612			
Undrained shear strength, tsf	0.306			
Failure strain, %	3.5			
Strain rate, %/min.	1.00			
Water content, %	32.0			
Wet density, pcf	115.8			
Dry density, pcf	87.8			
Saturation, %	93.8			
Void ratio	0.9207			
Specimen diameter, in.	2.25			
Specimen height, in.	4.59			
Height/diameter ratio	2.04			

Description: Tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

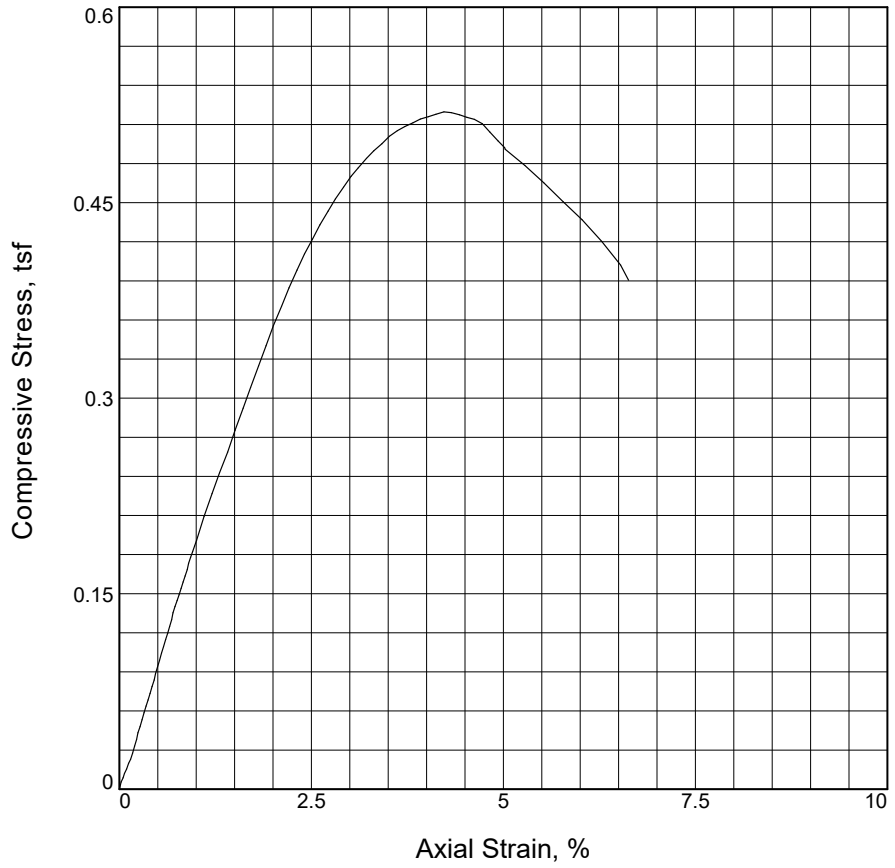
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-04 **Depth:** 2.5
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.520			
Undrained shear strength, tsf	0.260			
Failure strain, %	4.2			
Strain rate, %/min.	1.00			
Water content, %	35.2			
Wet density, pcf	110.4			
Dry density, pcf	81.7			
Saturation, %	89.3			
Void ratio	1.0637			
Specimen diameter, in.	2.24			
Specimen height, in.	4.87			
Height/diameter ratio	2.17			

Description: Tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/26/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

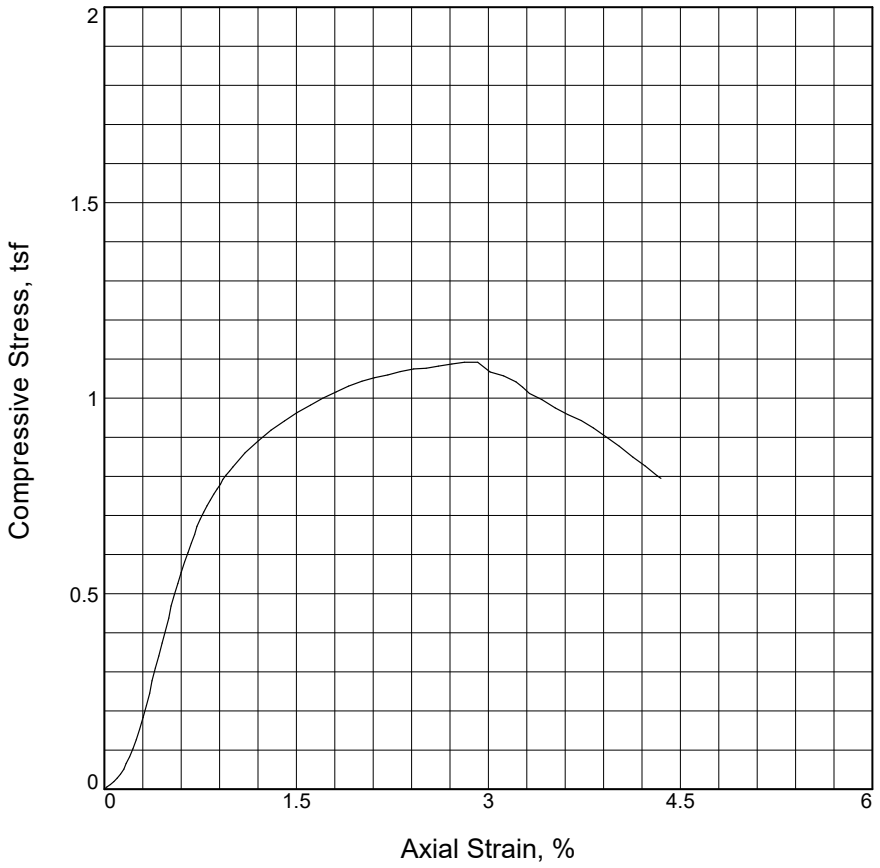
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-04 **Depth:** 7.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.092			
Undrained shear strength, tsf	0.546			
Failure strain, %	2.8			
Strain rate, %/min.	1.00			
Water content, %	41.0			
Wet density, pcf	112.9			
Dry density, pcf	80.0			
Saturation, %	98.5			
Void ratio	1.1457			
Specimen diameter, in.	2.83			
Specimen height, in.	5.70			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

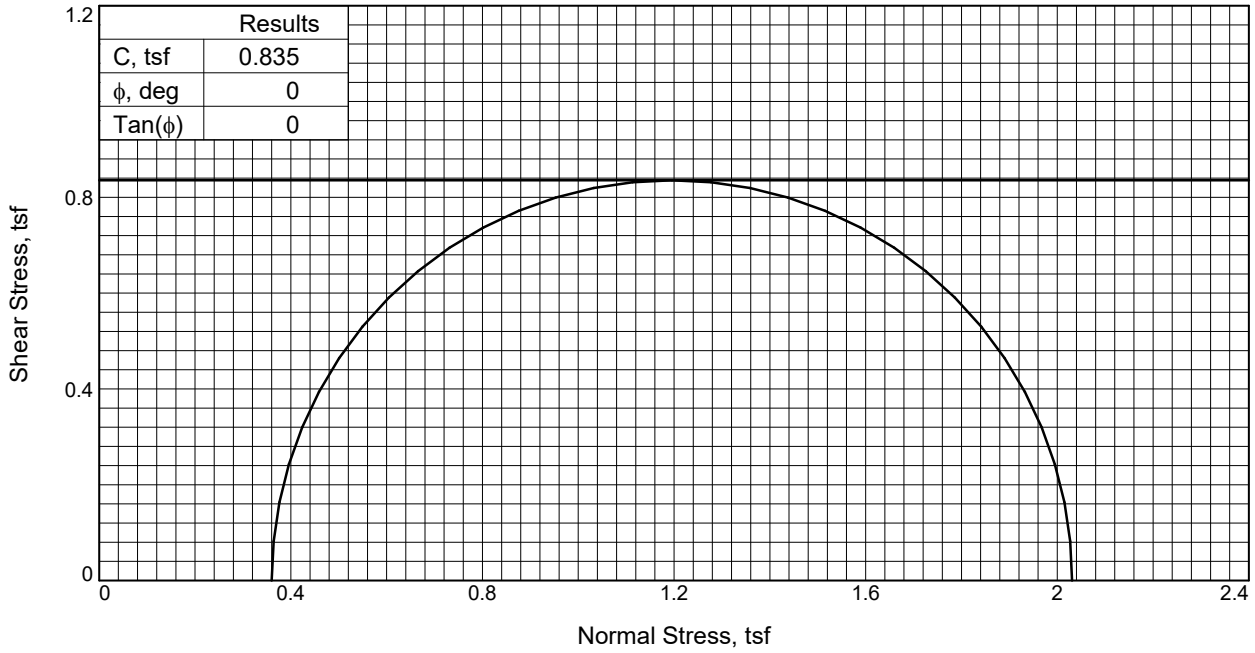
Figure _____

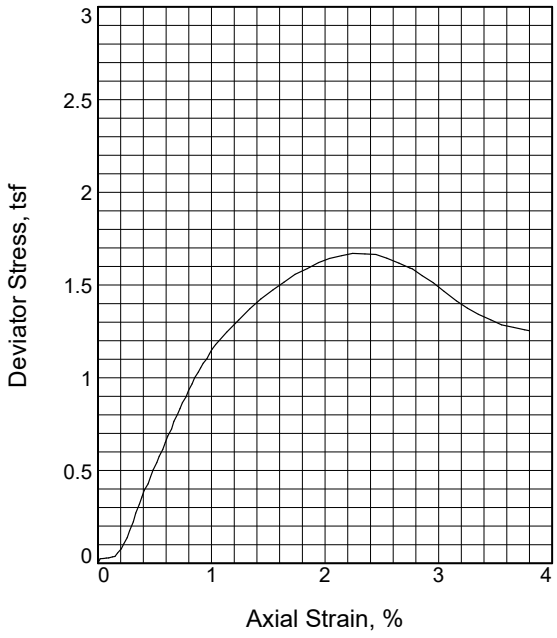
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-04 **Depth:** 15
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	42.3
	Dry Density, pcf	80.4
	Saturation, %	99.3
	Void Ratio	1.2140
	Diameter, in.	2.85
	Height, in.	5.71
At Test	Water Content, %	40.0
	Dry Density, pcf	80.4
	Saturation, %	94.0
	Void Ratio	1.2140
	Diameter, in.	2.85
	Height, in.	5.71
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		5.00
Fail. Stress, tsf		1.67
Strain, %		2.2
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.03
σ_3 Failure, tsf		0.36

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

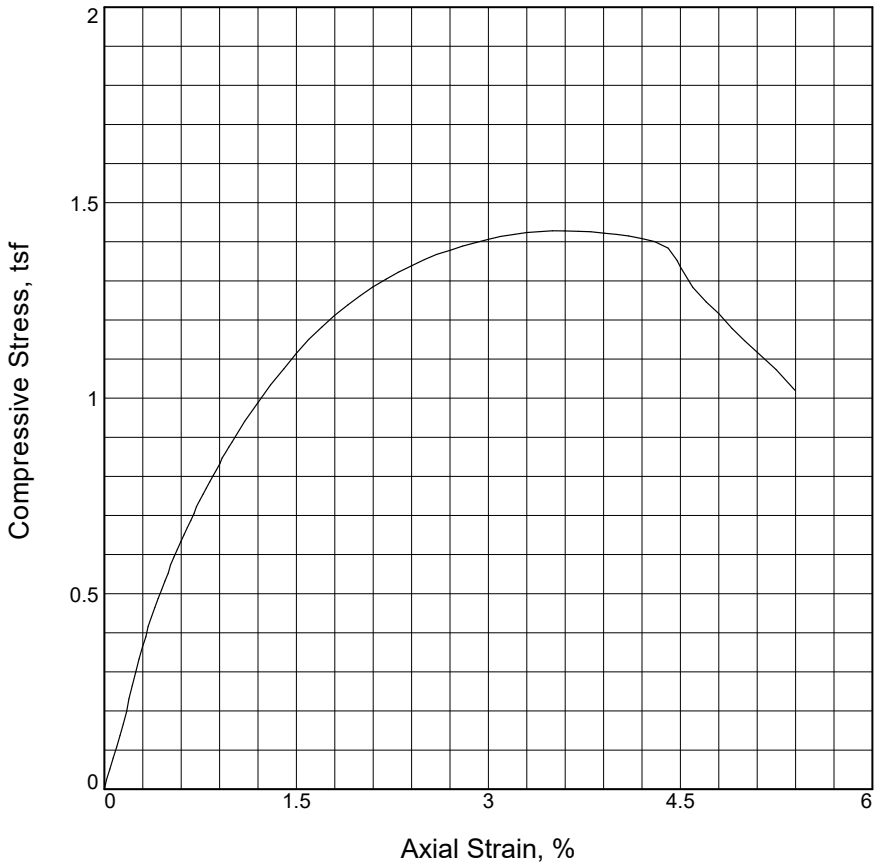
Source of Sample: CB-04 **Depth:** 12.5

Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 11/1/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.428			
Undrained shear strength, tsf	0.714			
Failure strain, %	3.5			
Strain rate, %/min.	1.00			
Water content, %	46.3			
Wet density, pcf	110.8			
Dry density, pcf	75.8			
Saturation, %	99.1			
Void ratio	1.3075			
Specimen diameter, in.	2.83			
Specimen height, in.	5.71			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

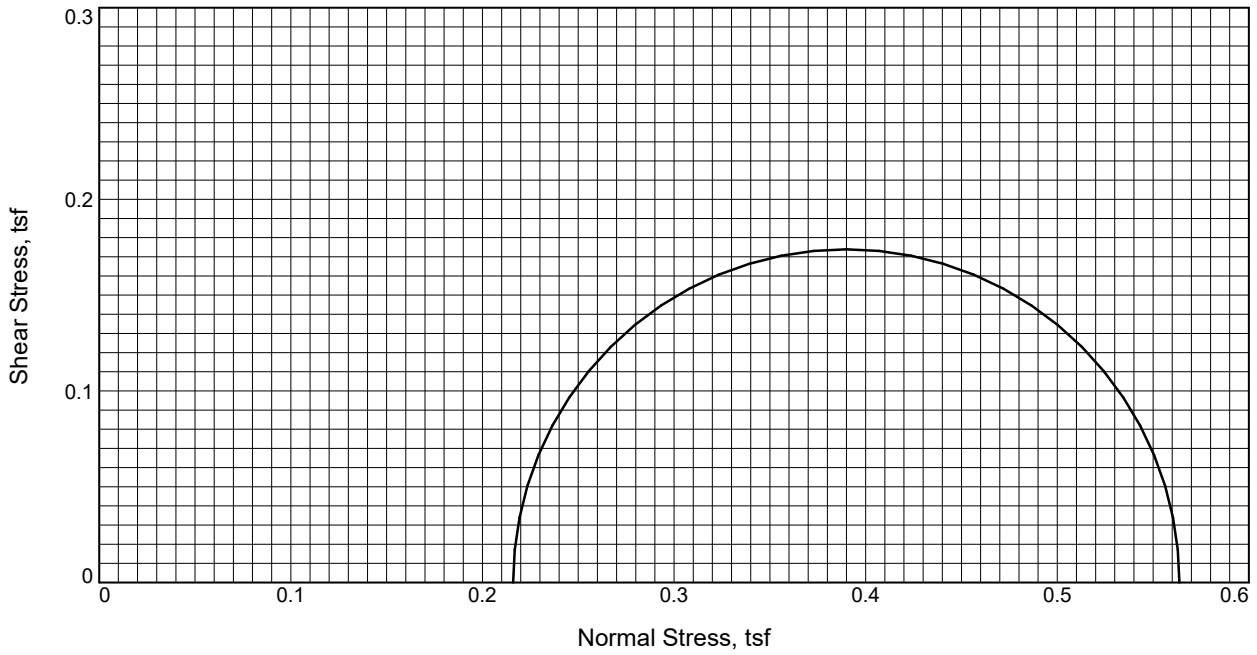
Figure _____

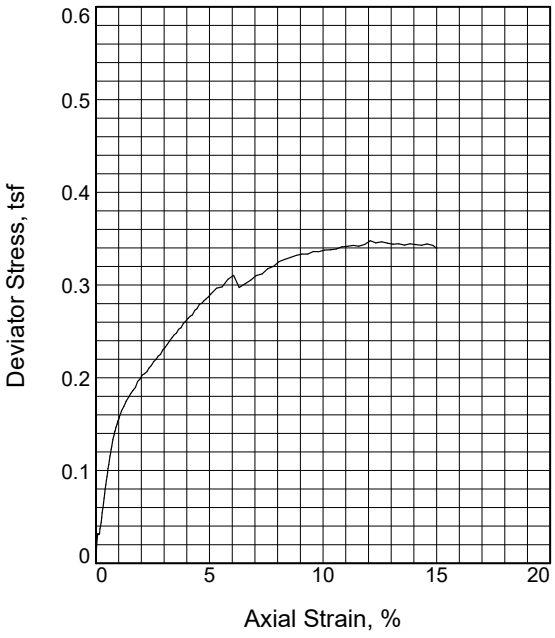
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-04 **Depth:** 20
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	59.5
	Dry Density, pcf	65.8
	Saturation, %	99.6
	Void Ratio	1.7034
	Diameter, in.	2.63
	Height, in.	5.56
At Test	Water Content, %	55.7
	Dry Density, pcf	65.8
	Saturation, %	93.2
	Void Ratio	1.7034
	Diameter, in.	2.63
	Height, in.	5.56
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		0.35
Strain, %		12.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.56
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained
Sample Type: Undisturbed
Description: ELASTIC SILT (MH), gray

LL= 86 **PL=** 42 **PI=** 44
Assumed Specific Gravity= 2.85
Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

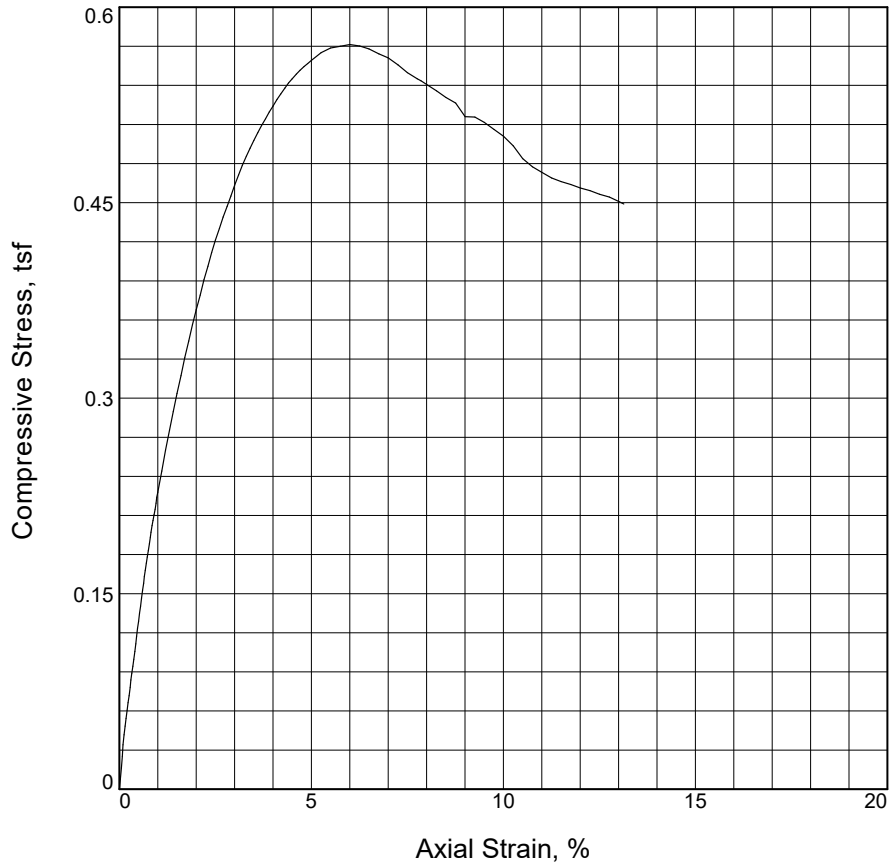
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 7.5
Sample Number: ST-1
Proj. No.: 21.14.223 **Date Sampled:** 11/1/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.571			
Undrained shear strength, tsf	0.286			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	58.4			
Wet density, pcf	105.7			
Dry density, pcf	66.7			
Saturation, %	99.9			
Void ratio	1.6665			
Specimen diameter, in.	2.80			
Specimen height, in.	5.74			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

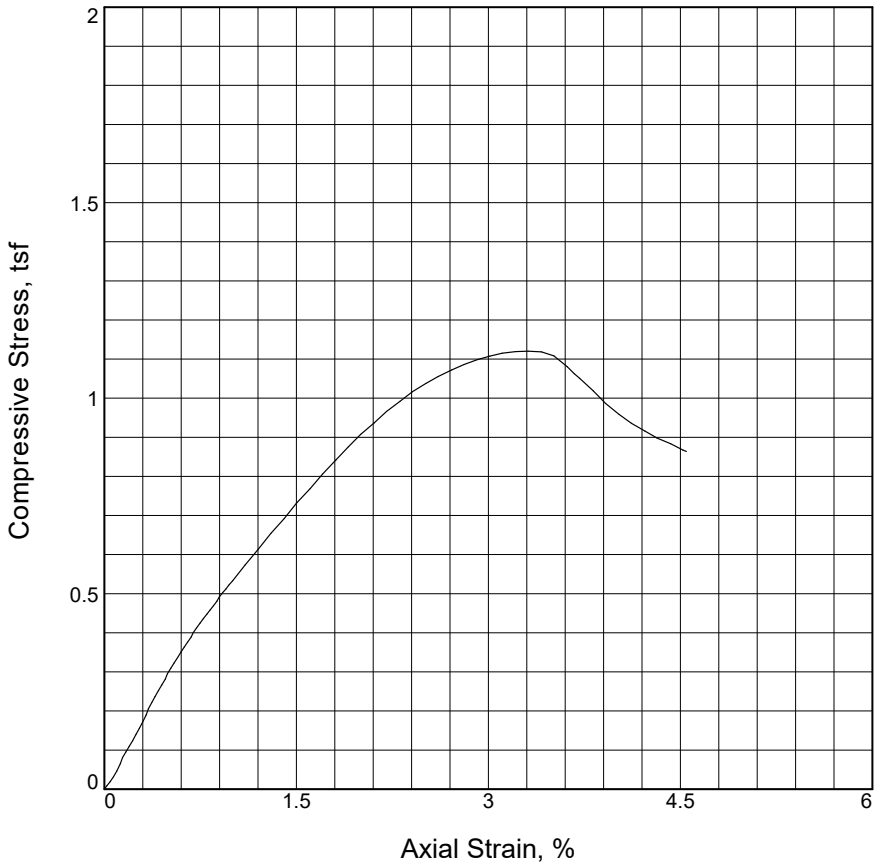
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 15
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.120			
Undrained shear strength, tsf	0.560			
Failure strain, %	3.3			
Strain rate, %/min.	1.00			
Water content, %	59.1			
Wet density, pcf	105.2			
Dry density, pcf	66.1			
Saturation, %	99.7			
Void ratio	1.6902			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL = 78	**PL =** 38	**PI =** 40	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

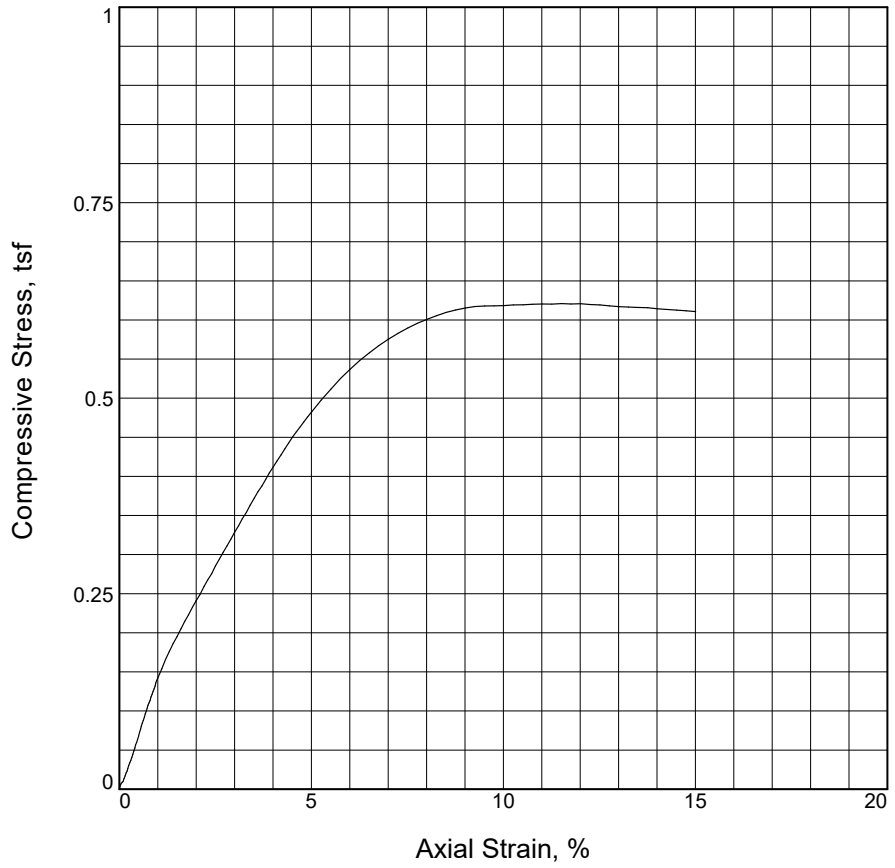
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 17.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.621			
Undrained shear strength, tsf	0.310			
Failure strain, %	11.5			
Strain rate, %/min.	1.00			
Water content, %	36.7			
Wet density, pcf	114.6			
Dry density, pcf	83.8			
Saturation, %	97.9			
Void ratio	1.0113			
Specimen diameter, in.	2.77			
Specimen height, in.	5.71			
Height/diameter ratio	2.06			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

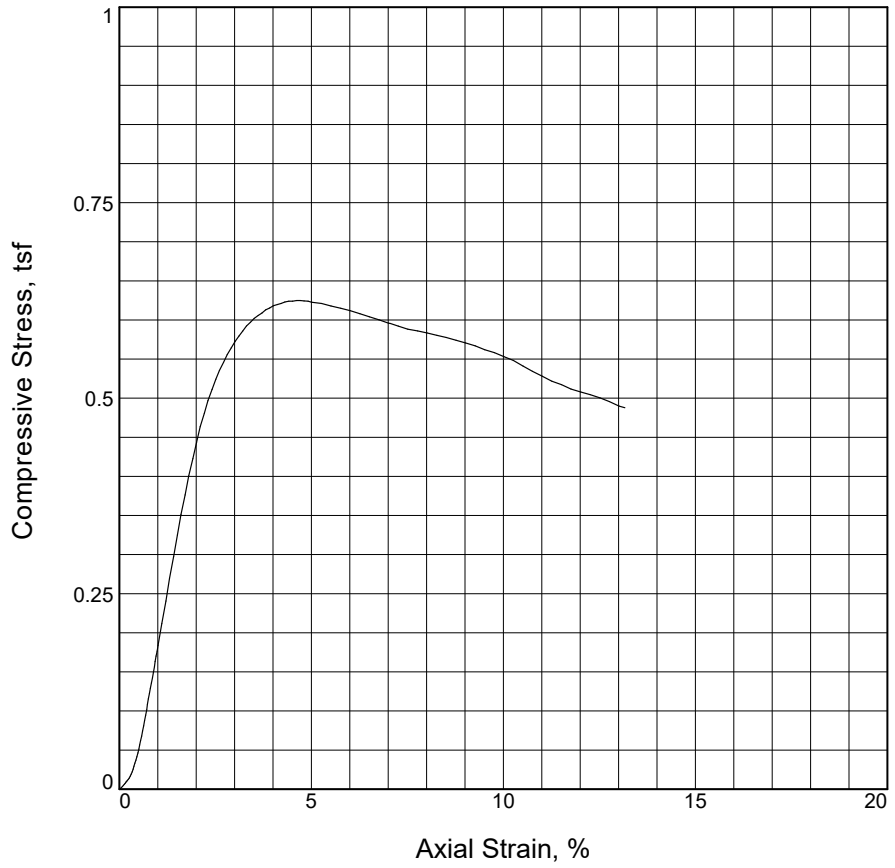
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 20
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.625			
Undrained shear strength, tsf	0.312			
Failure strain, %	4.7			
Strain rate, %/min.	1.00			
Water content, %	56.8			
Wet density, pcf	104.3			
Dry density, pcf	66.5			
Saturation, %	98.9			
Void ratio	1.5807			
Specimen diameter, in.	2.82			
Specimen height, in.	5.74			
Height/diameter ratio	2.03			

Description: Gray FAT CLAY

LL = 77	**PL =** 38	**PI =** 39	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

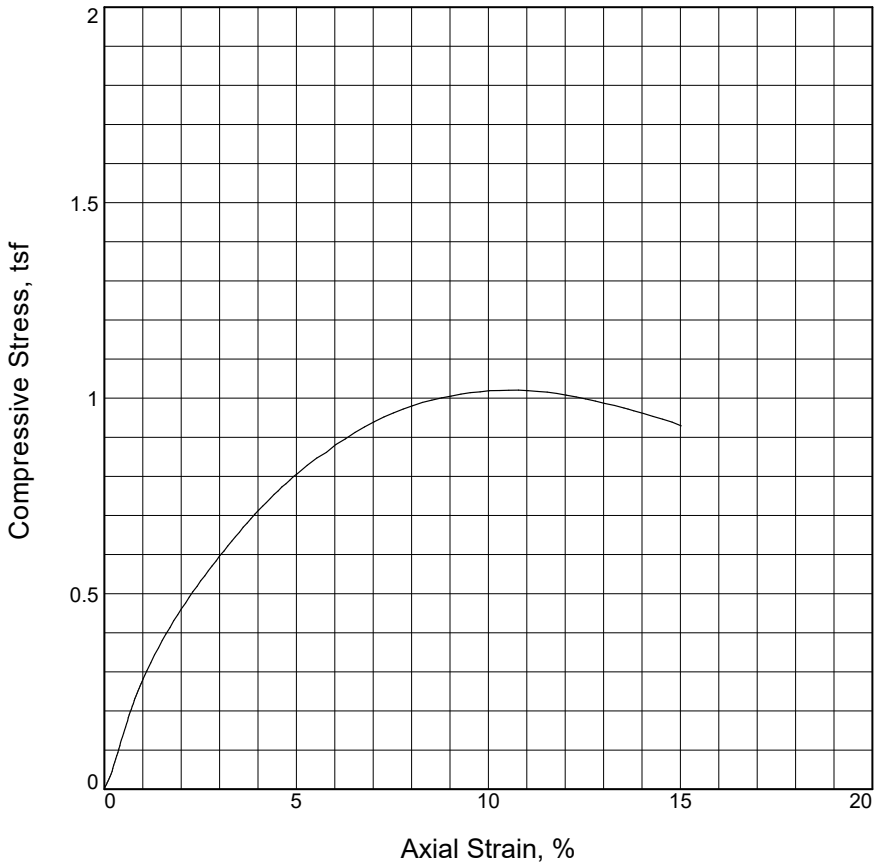
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 12.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.021			
Undrained shear strength, tsf	0.510			
Failure strain, %	10.8			
Strain rate, %/min.	1.00			
Water content, %	54.5			
Wet density, pcf	102.7			
Dry density, pcf	66.5			
Saturation, %	95.8			
Void ratio	1.5345			
Specimen diameter, in.	2.82			
Specimen height, in.	5.67			
Height/diameter ratio	2.01			

Description: FAT CLAY (CH), gray

LL = 74	**PL =** 39	**PI =** 35	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

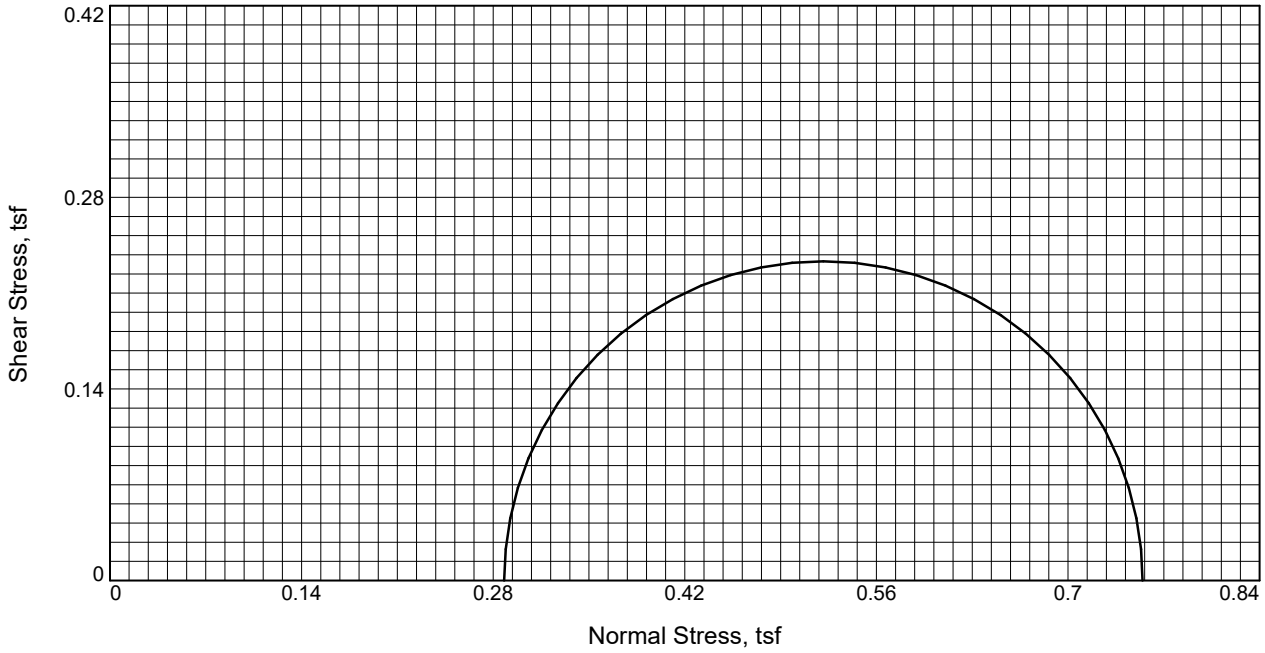
Figure _____

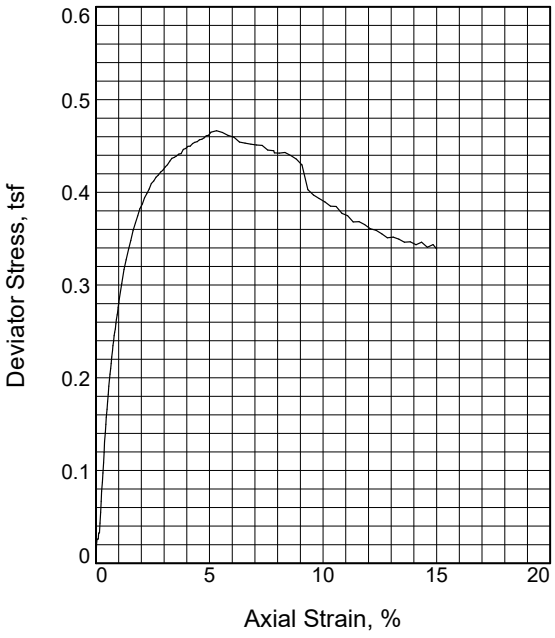
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-06 **Depth:** 7.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	58.3
	Dry Density, pcf	65.2
	Saturation, %	99.5
	Void Ratio	1.5832
	Diameter, in.	2.83
	Height, in.	5.79
At Test	Water Content, %	51.7
	Dry Density, pcf	65.2
	Saturation, %	88.2
	Void Ratio	1.5832
	Diameter, in.	2.82
	Height, in.	5.79
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		4.00
Fail. Stress, tsf		0.47
Strain, %		5.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.75
σ_3 Failure, tsf		0.29

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: ELASTIC SILT (ML), gray

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

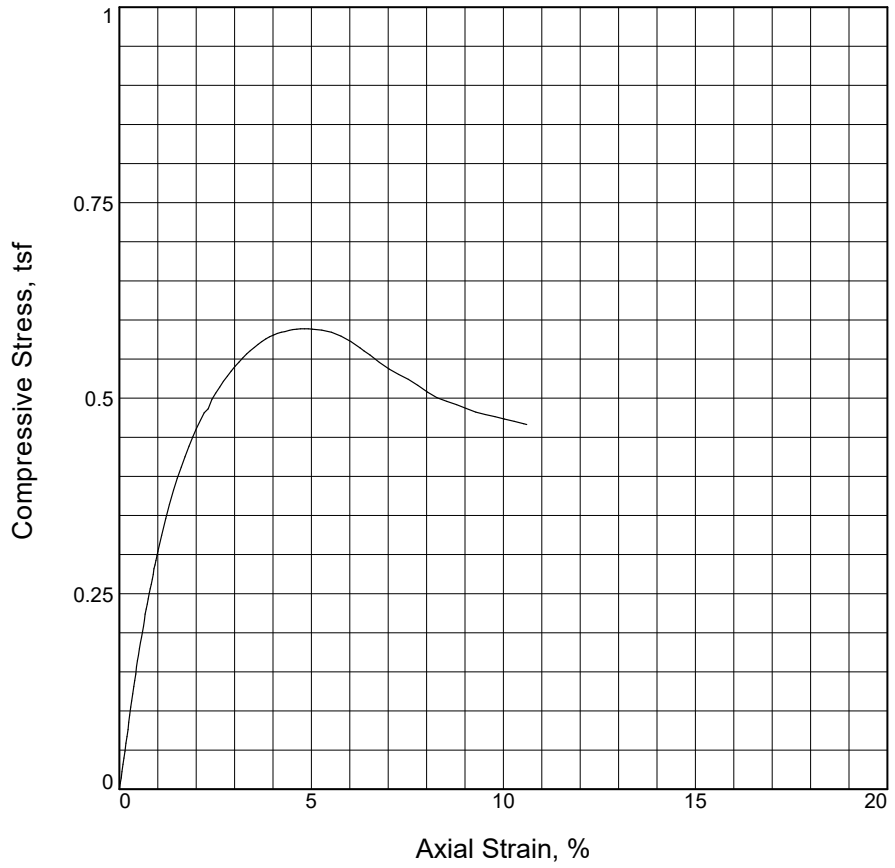
Source of Sample: CB-06 **Depth:** 10

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/1/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.589			
Undrained shear strength, tsf	0.294			
Failure strain, %	4.7			
Strain rate, %/min.	1.00			
Water content, %	42.9			
Wet density, pcf	103.4			
Dry density, pcf	72.3			
Saturation, %	87.1			
Void ratio	1.3300			
Specimen diameter, in.	2.87			
Specimen height, in.	5.79			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/1/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

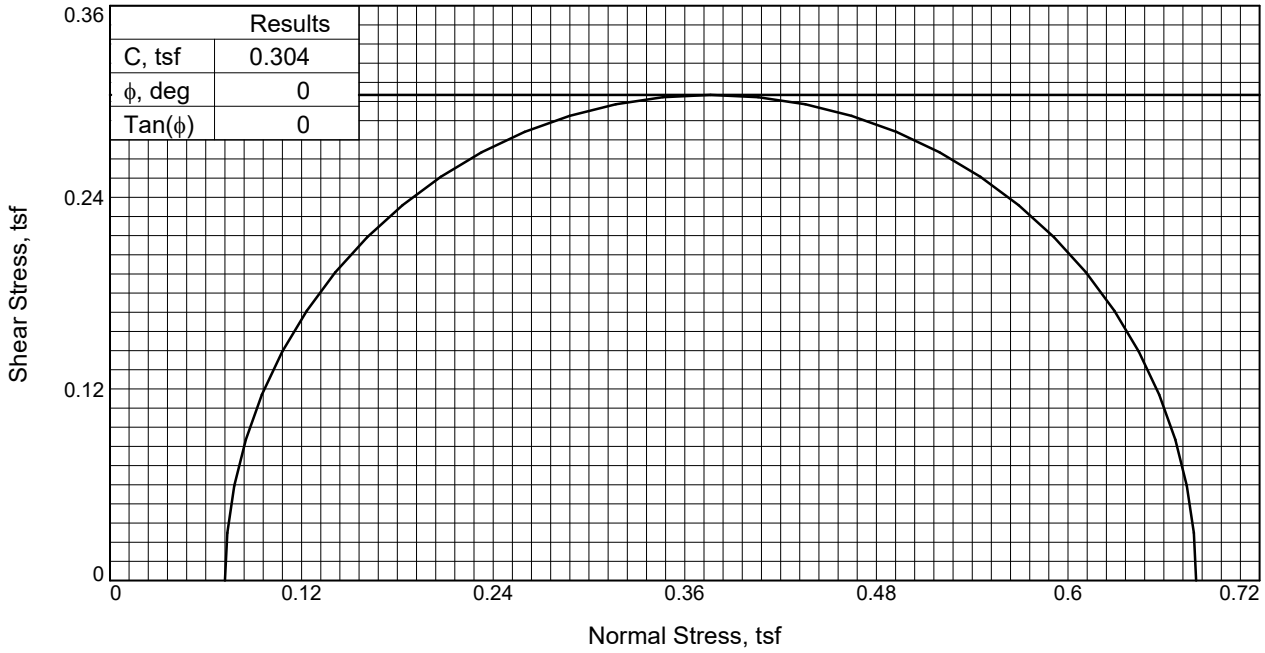
Figure _____

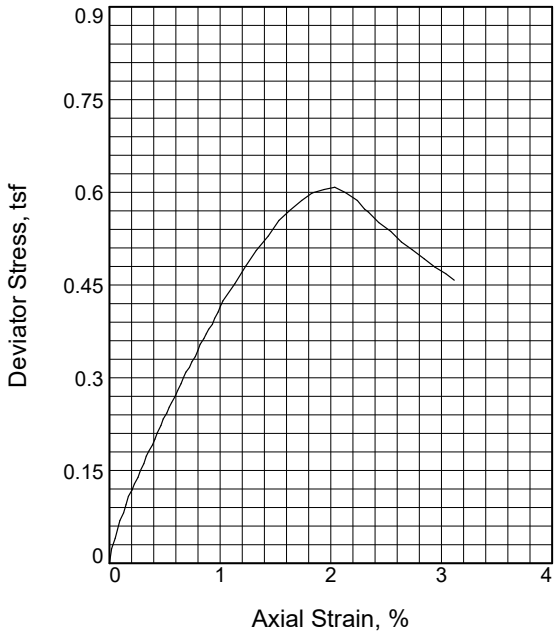
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-06 **Depth:** 17.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	60.9
	Dry Density, pcf	64.3
	Saturation, %	99.2
	Void Ratio	1.7193
	Diameter, in.	2.83
	Height, in.	5.84
At Test	Water Content, %	59.8
	Dry Density, pcf	64.3
	Saturation, %	97.3
	Void Ratio	1.7193
	Diameter, in.	2.83
	Height, in.	5.84
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		1.00
Fail. Stress, tsf		0.61
Strain, %		2.0
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.68
σ_3 Failure, tsf		0.07

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Dark gray FAT CLAY

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D2850
Failure type: 60 degree

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

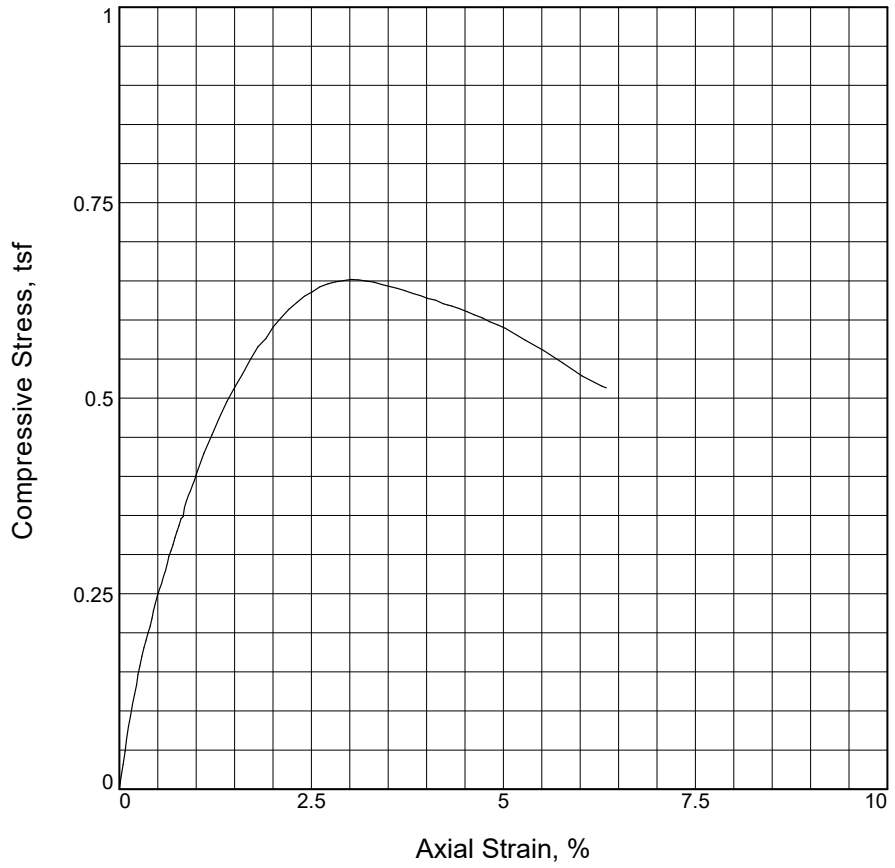
Source of Sample: CB-07 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 10/29/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.652			
Undrained shear strength, tsf	0.326			
Failure strain, %	3.0			
Strain rate, %/min.	1.00			
Water content, %	61.0			
Wet density, pcf	102.9			
Dry density, pcf	63.9			
Saturation, %	99.5			
Void ratio	1.6868			
Specimen diameter, in.	2.81			
Specimen height, in.	5.84			
Height/diameter ratio	2.07			

Description: Dark gray FAT CLAY

LL = 80	**PL =** 36	**PI =** 44	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

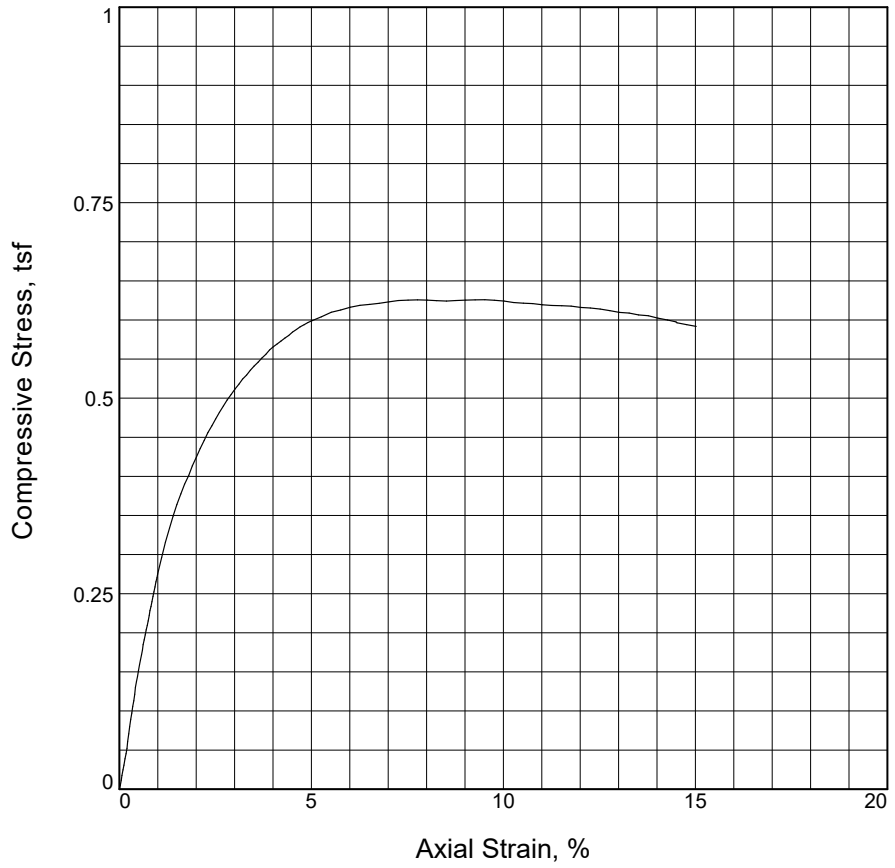
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-07 **Depth:** 7.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.626			
Undrained shear strength, tsf	0.313			
Failure strain, %	9.5			
Strain rate, %/min.	1.00			
Water content, %	46.5			
Wet density, pcf	109.9			
Dry density, pcf	75.0			
Saturation, %	97.9			
Void ratio	1.3303			
Specimen diameter, in.	2.83			
Specimen height, in.	5.74			
Height/diameter ratio	2.03			

Description: Dark gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

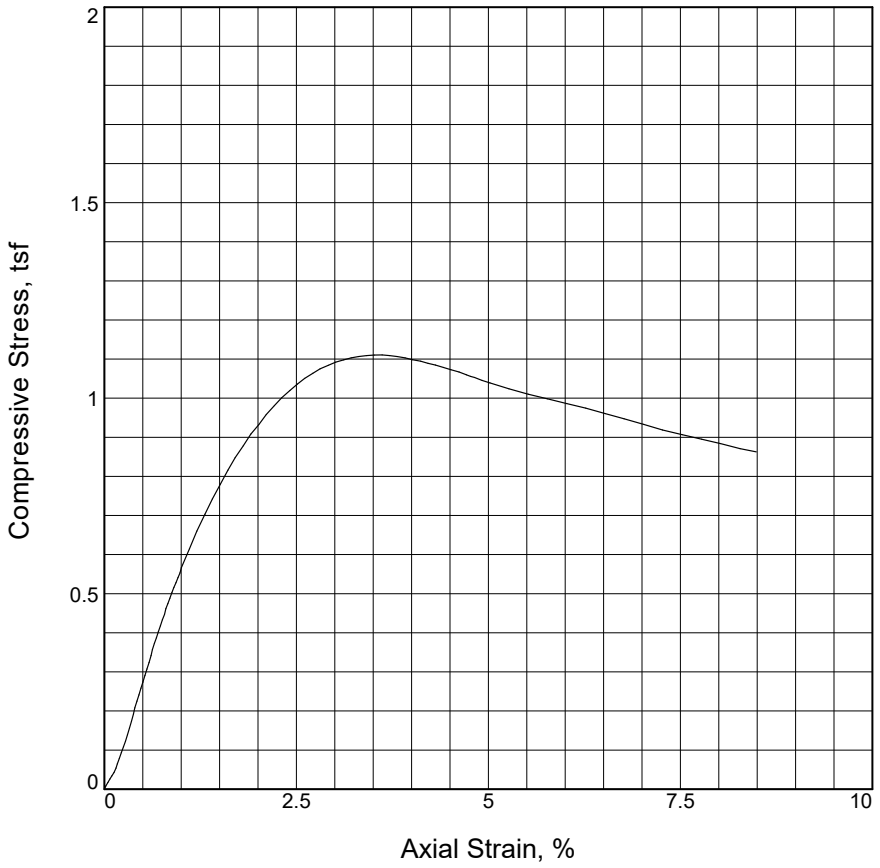
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-07 **Depth:** 17.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.111			
Undrained shear strength, tsf	0.555			
Failure strain, %	3.6			
Strain rate, %/min.	1.00			
Water content, %	45.9			
Wet density, pcf	109.7			
Dry density, pcf	75.2			
Saturation, %	99.7			
Void ratio	1.2427			
Specimen diameter, in.	2.82			
Specimen height, in.	5.84			
Height/diameter ratio	2.07			

Description: Dark gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

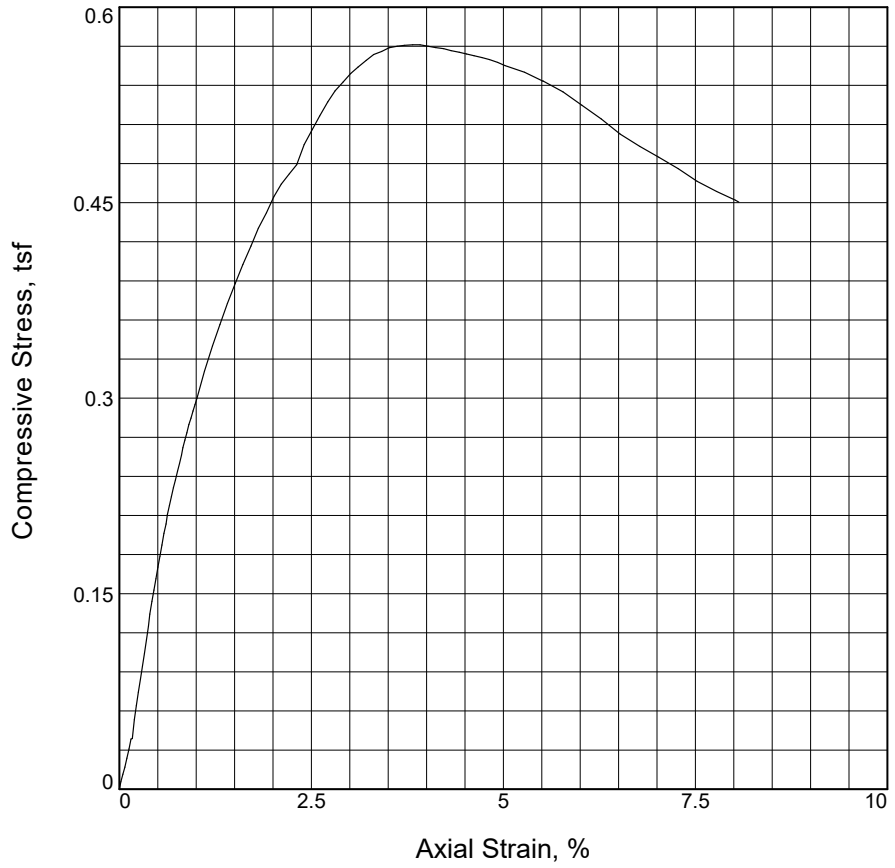
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-07 **Depth:** 22.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.571			
Undrained shear strength, tsf	0.286			
Failure strain, %	3.8			
Strain rate, %/min.	1.00			
Water content, %	53.0			
Wet density, pcf	102.2			
Dry density, pcf	66.8			
Saturation, %	93.9			
Void ratio	1.5236			
Specimen diameter, in.	2.86			
Specimen height, in.	5.80			
Height/diameter ratio	2.03			

Description: Dark gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/29/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

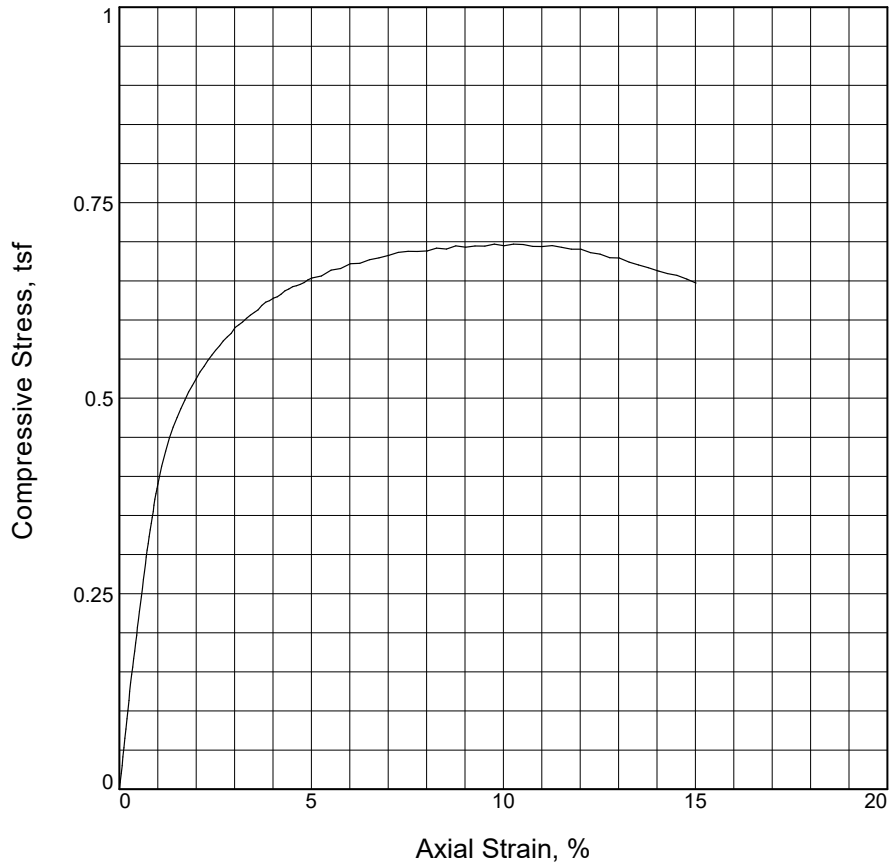
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-07 **Depth:** 12.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.697			
Undrained shear strength, tsf	0.349			
Failure strain, %	9.8			
Strain rate, %/min.	1.00			
Water content, %	41.0			
Wet density, pcf	108.9			
Dry density, pcf	77.2			
Saturation, %	93.7			
Void ratio	1.1823			
Specimen diameter, in.	2.84			
Specimen height, in.	5.84			
Height/diameter ratio	2.06			

Description: Dark gray FAT CLAY; shell fragments

LL = 69	**PL =** 28	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

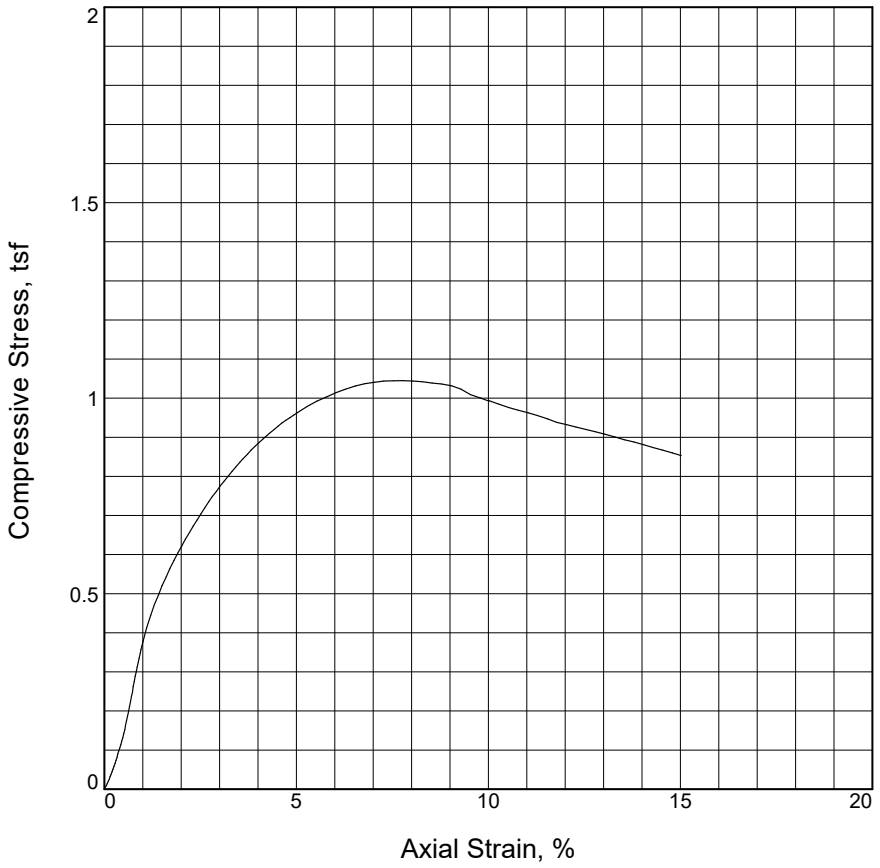
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 2.5
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.045			
Undrained shear strength, tsf	0.522			
Failure strain, %	7.8			
Strain rate, %/min.	1.00			
Water content, %	34.1			
Wet density, pcf	116.1			
Dry density, pcf	86.6			
Saturation, %	97.3			
Void ratio	0.9471			
Specimen diameter, in.	2.84			
Specimen height, in.	5.85			
Height/diameter ratio	2.06			

Description: Dark gray FAT CLAY

LL = 60	**PL =** 23	**PI =** 37	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

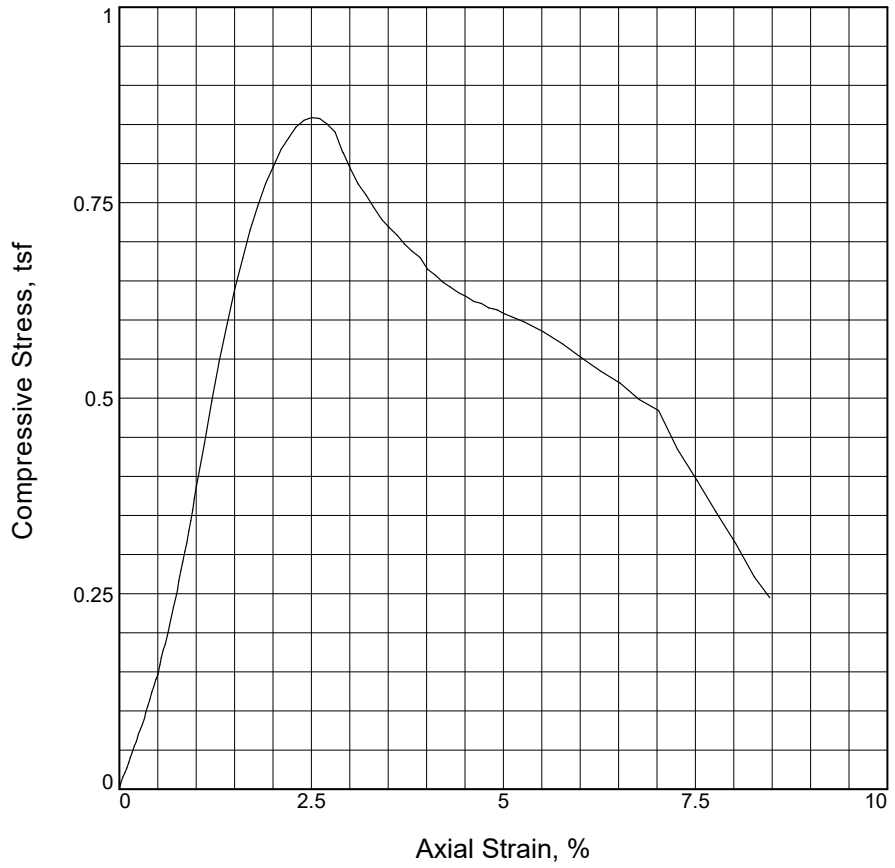
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 7.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.859			
Undrained shear strength, tsf	0.429			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	56.5			
Wet density, pcf	105.7			
Dry density, pcf	67.5			
Saturation, %	99.6			
Void ratio	1.5885			
Specimen diameter, in.	2.83			
Specimen height, in.	5.84			
Height/diameter ratio	2.06			

Description: Dark gray FAT CLAY

LL = 85	**PL =** 34	**PI =** 51	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

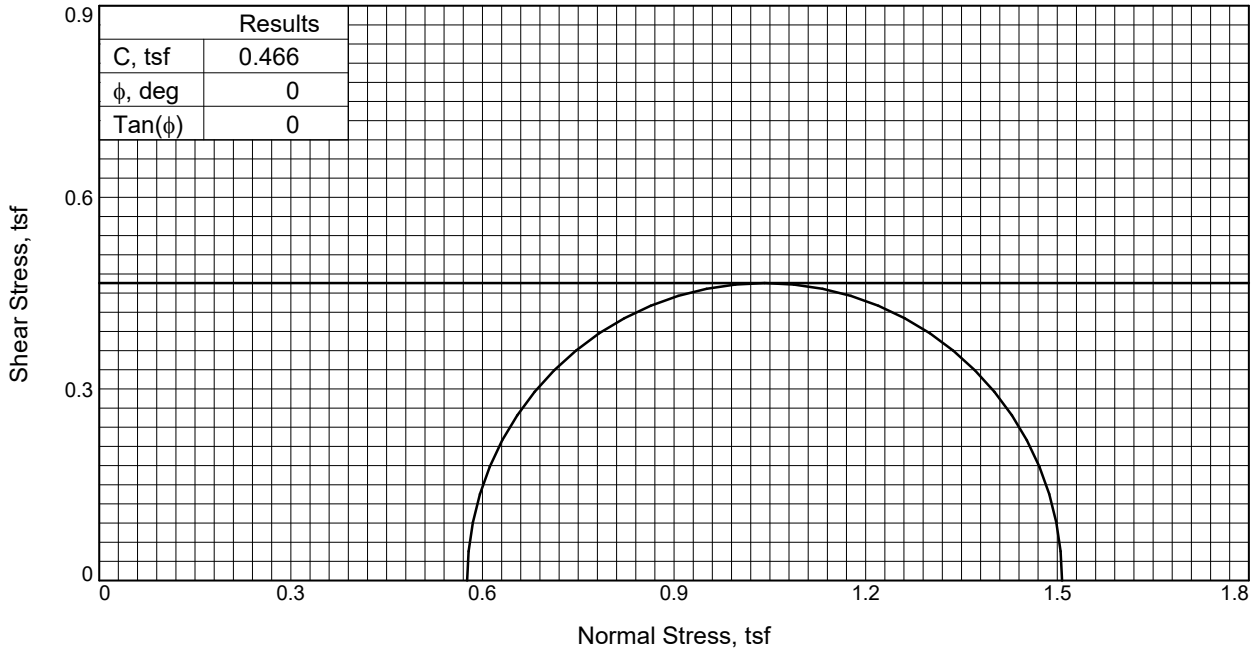
Figure _____

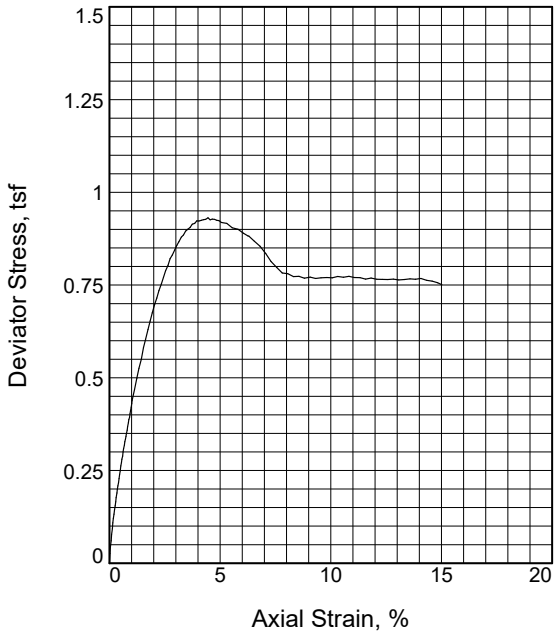
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 15
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	38.6
	Dry Density, pcf	84.5
	Saturation, %	99.7
	Void Ratio	1.1045
	Diameter, in.	2.81
	Height, in.	5.81
At Test	Water Content, %	37.2
	Dry Density, pcf	84.5
	Saturation, %	96.0
	Void Ratio	1.1045
	Diameter, in.	2.81
	Height, in.	5.81
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		0.93
Strain, %		4.5
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.51
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Dark gray FAT CLAY

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

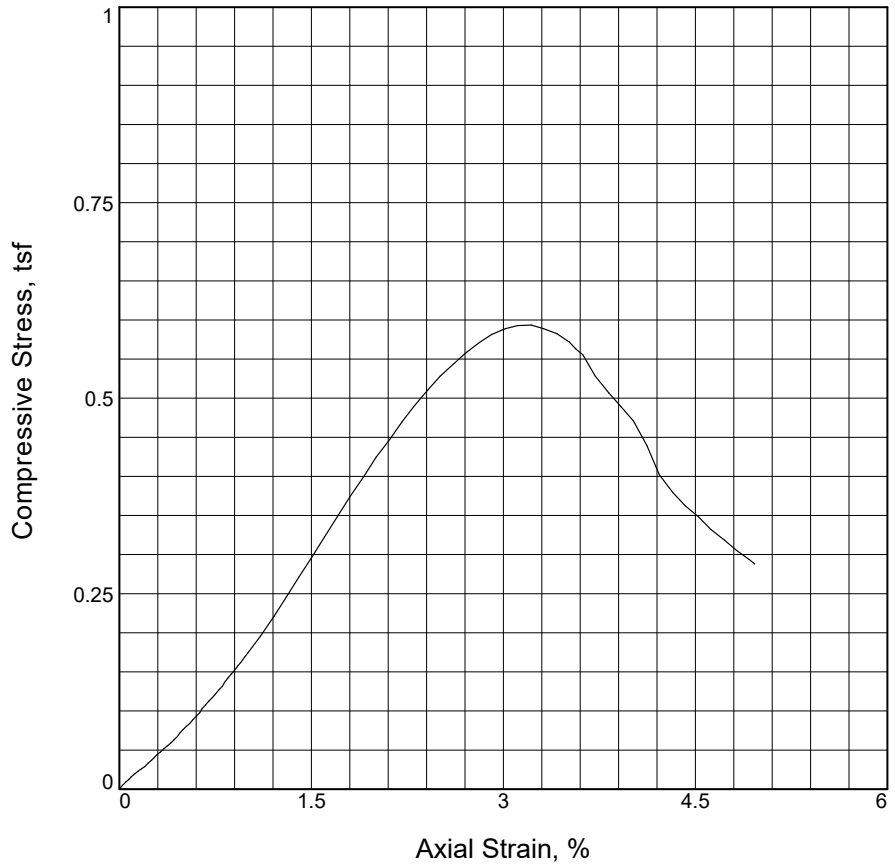
Source of Sample: CB-08 **Depth:** 20

Sample Number: ST-8

Proj. No.: 21.14.223 **Date Sampled:** 10/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.593			
Undrained shear strength, tsf	0.297			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	34.3			
Wet density, pcf	120.1			
Dry density, pcf	89.4			
Saturation, %	98.8			
Void ratio	0.9893			
Specimen diameter, in.	2.82			
Specimen height, in.	5.77			
Height/diameter ratio	2.05			

Description: SANDY LEAN CLAY (CL), gray

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

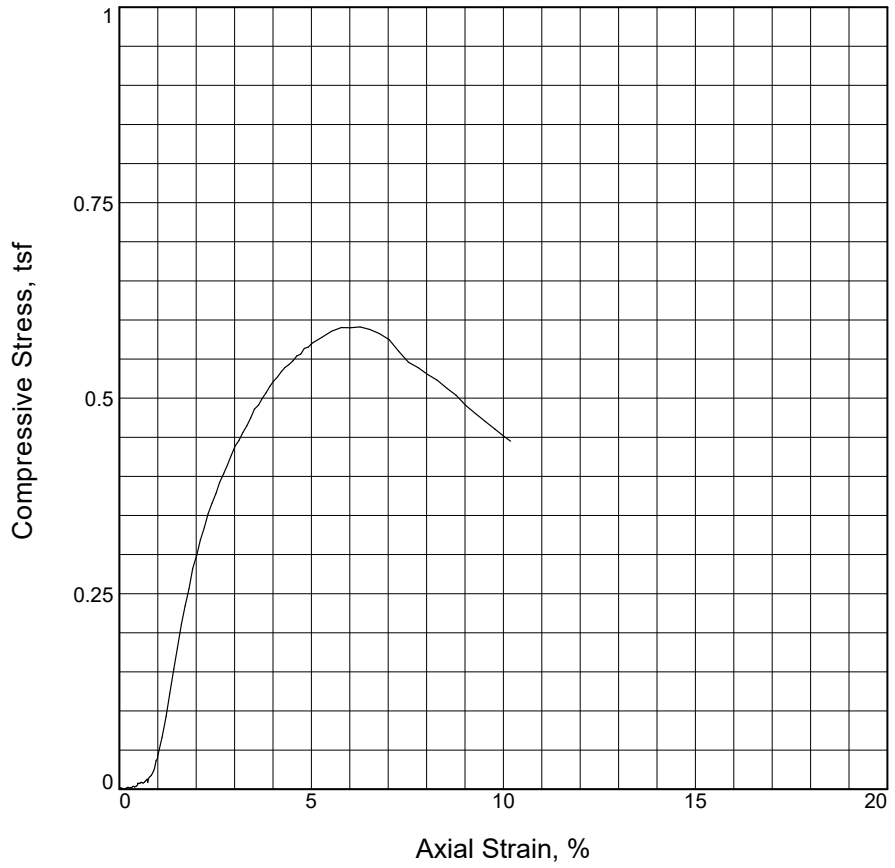
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 27.5
Sample Number: ST-11

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.591			
Undrained shear strength, tsf	0.296			
Failure strain, %	6.3			
Strain rate, %/min.	1.00			
Water content, %	27.4			
Wet density, pcf	122.2			
Dry density, pcf	95.9			
Saturation, %	97.6			
Void ratio	0.7573			
Specimen diameter, in.	2.87			
Specimen height, in.	5.72			
Height/diameter ratio	2.00			

Description: LEAN CLAY WITH SAND (CL), dark brown

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

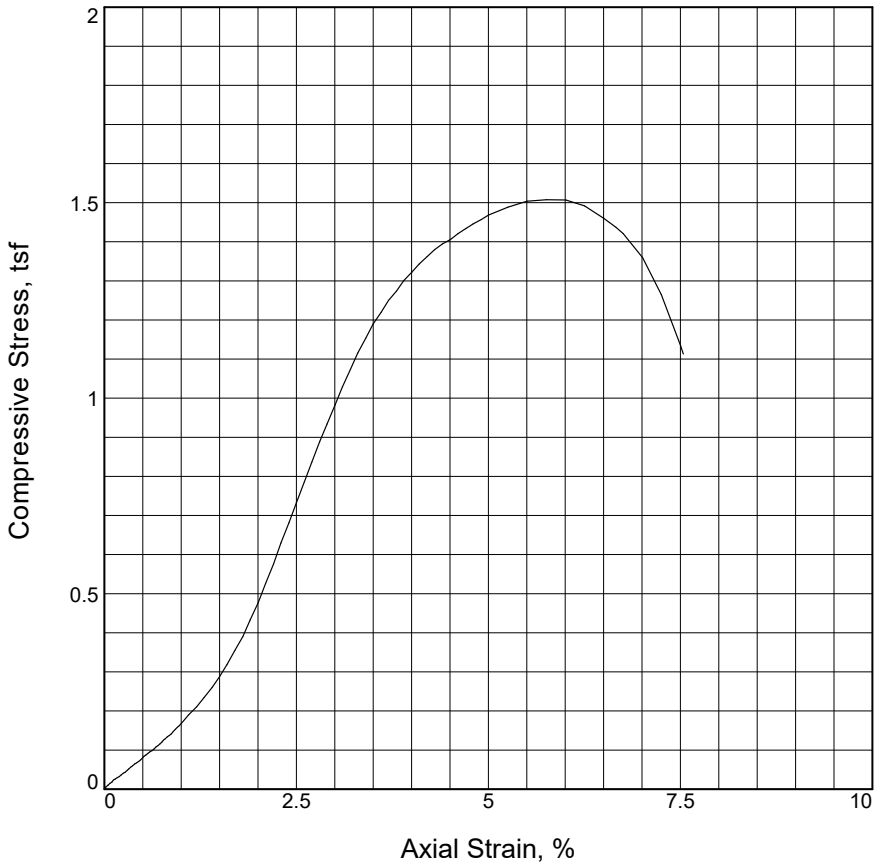
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-09 **Depth:** 3
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.507			
Undrained shear strength, tsf	0.754			
Failure strain, %	5.8			
Strain rate, %/min.	1.00			
Water content, %	36.1			
Wet density, pcf	114.9			
Dry density, pcf	84.4			
Saturation, %	97.9			
Void ratio	0.9967			
Specimen diameter, in.	2.86			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY; sand partings

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

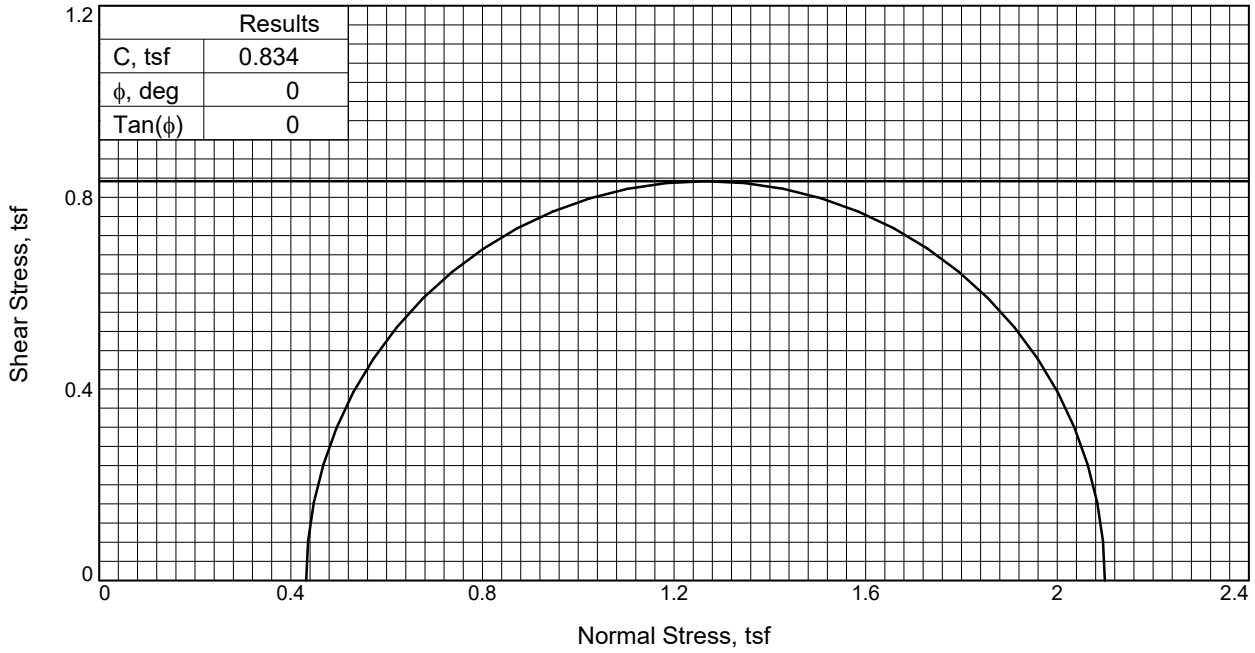
Figure _____

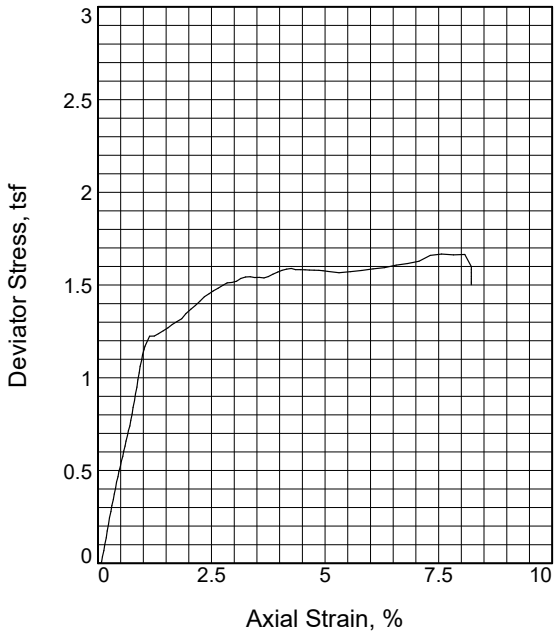
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-09 **Depth:** 10.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	31.2
	Dry Density, pcf	88.5
	Saturation, %	93.0
	Void Ratio	0.9046
	Diameter, in.	2.85
	Height, in.	5.73
At Test	Water Content, %	34.1
	Dry Density, pcf	88.5
	Saturation, %	101.7
	Void Ratio	0.9046
	Diameter, in.	2.85
	Height, in.	5.73
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		6.00
Fail. Stress, tsf		1.67
Strain, %		7.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.10
σ_3 Failure, tsf		0.43

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Brown and gray FAT CLAY; calcareous deposits

LL= 78 **PL=** 35 **PI=** 43

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

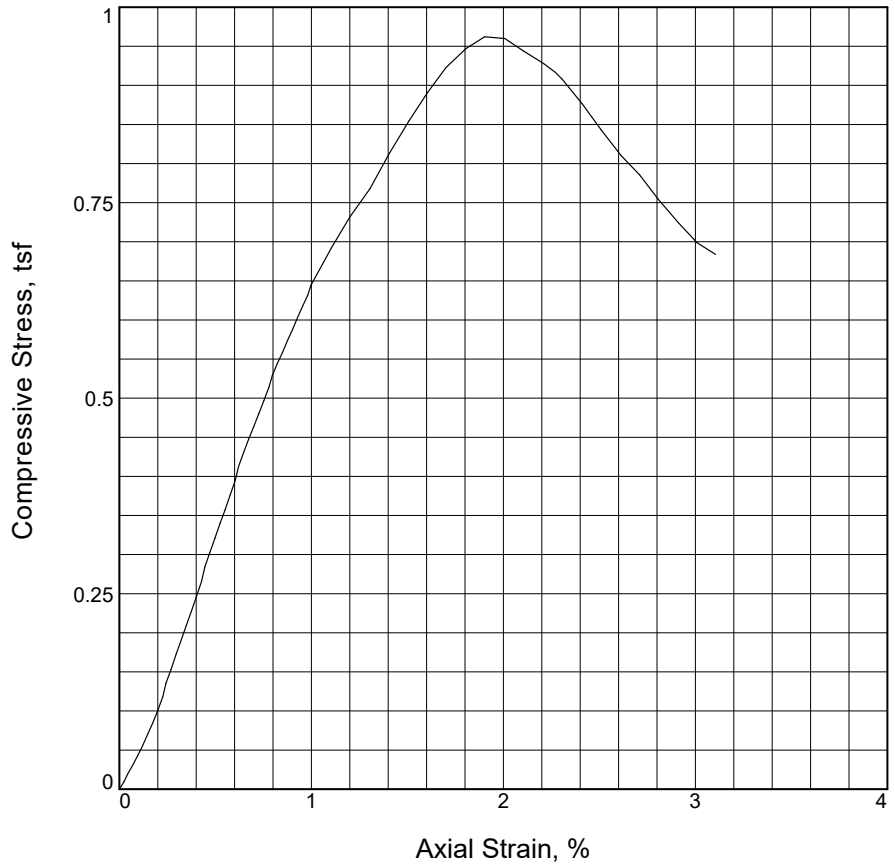
Source of Sample: CB-09 **Depth:** 15.5

Sample Number: ST-6

Proj. No.: 21.14.223 **Date Sampled:** 10/26/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.962			
Undrained shear strength, tsf	0.481			
Failure strain, %	1.9			
Strain rate, %/min.	1.00			
Water content, %	28.2			
Wet density, pcf	116.1			
Dry density, pcf	90.5			
Saturation, %	88.4			
Void ratio	0.8620			
Specimen diameter, in.	2.89			
Specimen height, in.	5.75			
Height/diameter ratio	1.99			

Description: FAT CLAY (CH), gray

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/22/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

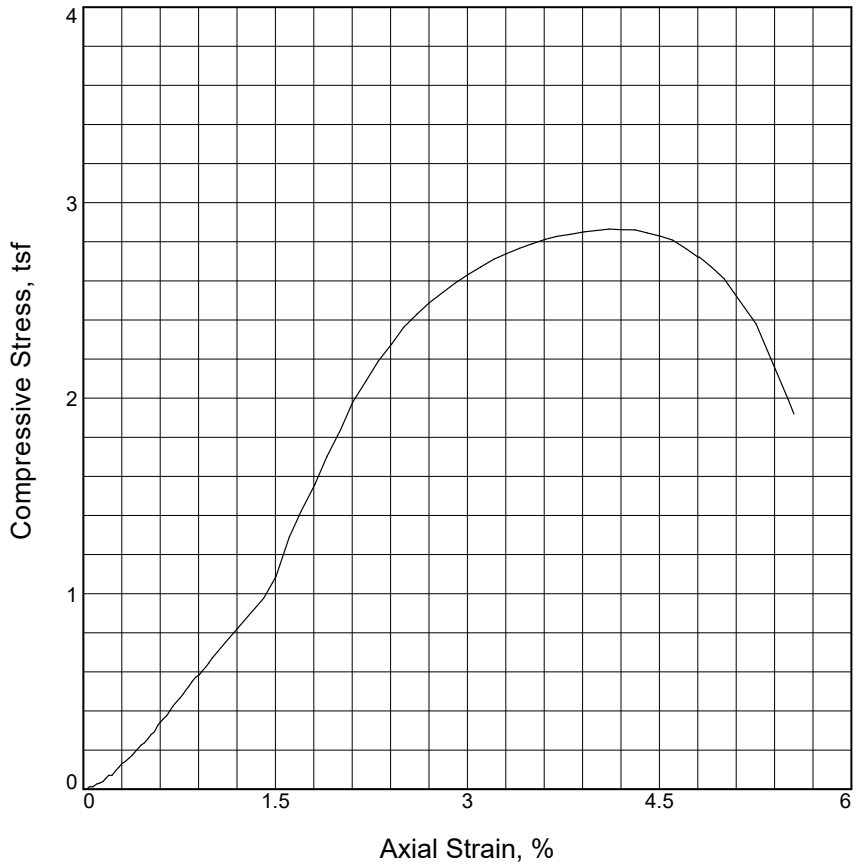
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-09 **Depth:** 25.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.865			
Undrained shear strength, tsf	1.432			
Failure strain, %	4.1			
Strain rate, %/min.	1.00			
Water content, %	36.8			
Wet density, pcf	116.1			
Dry density, pcf	84.8			
Saturation, %	98.8			
Void ratio	1.0237			
Specimen diameter, in.	2.83			
Specimen height, in.	5.71			
Height/diameter ratio	2.01			

Description: Tan and light gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/28/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

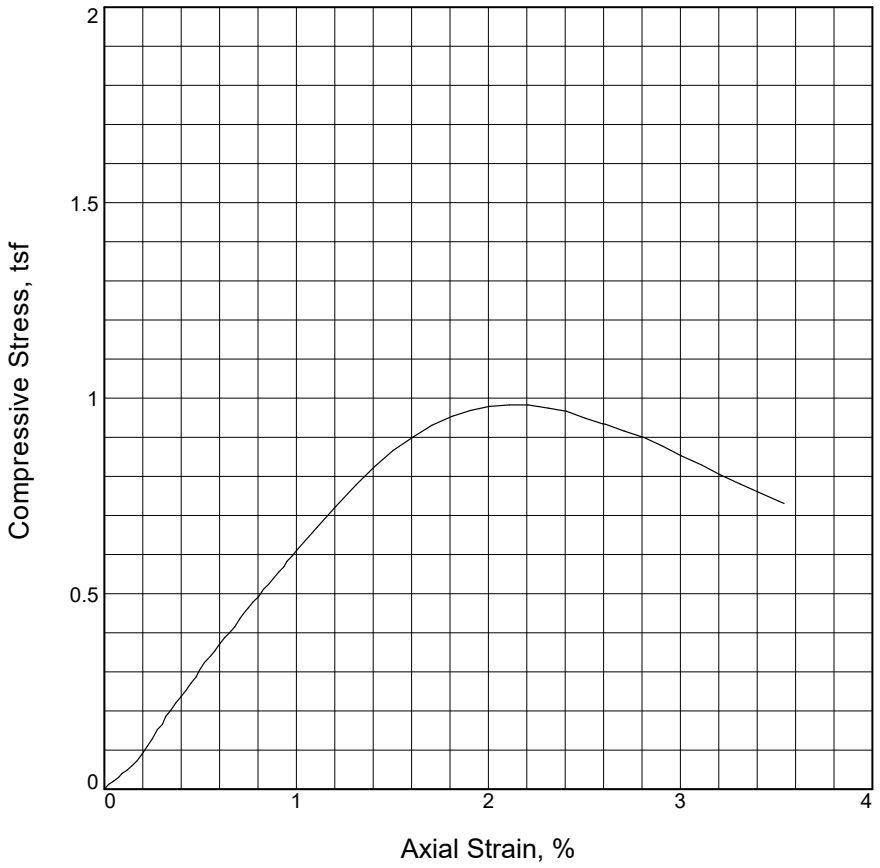
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-09 **Depth:** 18
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.983			
Undrained shear strength, tsf	0.491			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	27.3			
Wet density, pcf	121.4			
Dry density, pcf	95.4			
Saturation, %	96.1			
Void ratio	0.7669			
Specimen diameter, in.	2.83			
Specimen height, in.	5.83			
Height/diameter ratio	2.06			

Description: Tan LEAN CLAY; sand seams

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undidturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

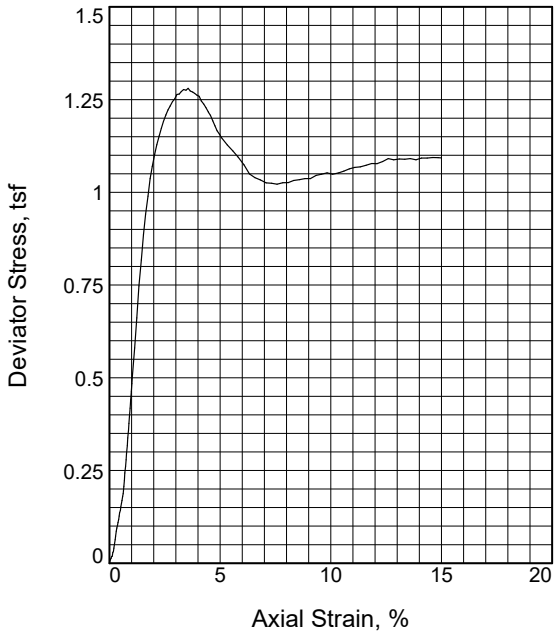
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-10 **Depth:** 12.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	36.2
	Dry Density, pcf	83.6
	Saturation, %	96.4
	Void Ratio	1.0156
	Diameter, in.	2.85
	Height, in.	5.85
At Test	Water Content, %	30.6
	Dry Density, pcf	83.6
	Saturation, %	81.3
	Void Ratio	1.0156
	Diameter, in.	2.85
	Height, in.	5.85
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		6.00
Fail. Stress, tsf		1.28
Strain, %		3.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.71
σ_3 Failure, tsf		0.43

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

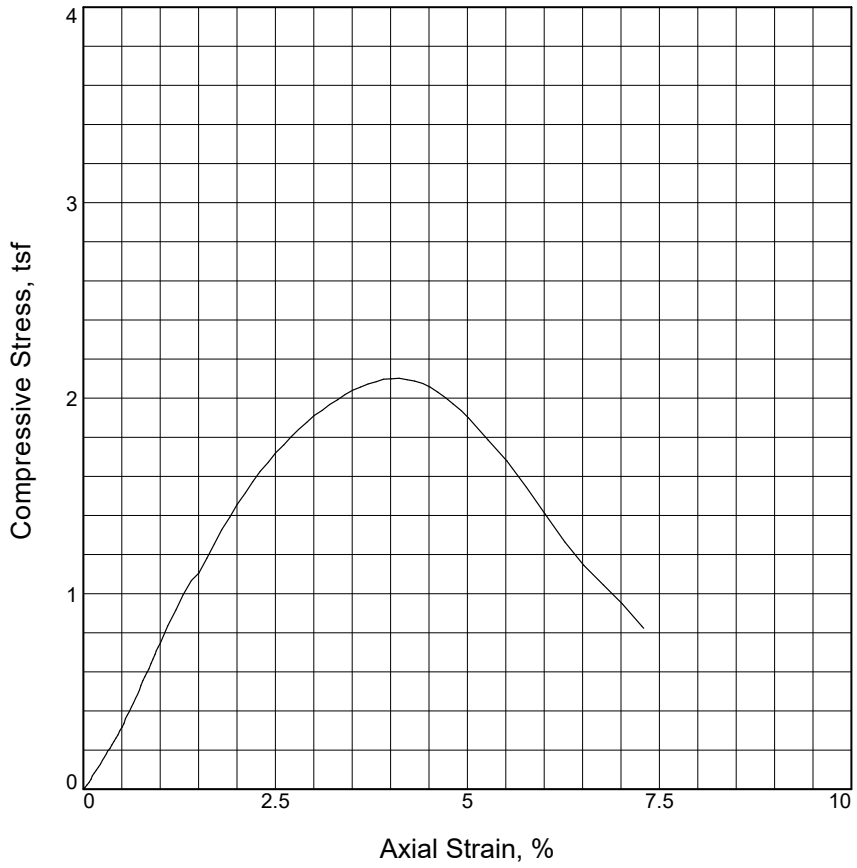
Source of Sample: CB-10 **Depth:** 15

Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 10/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.102			
Undrained shear strength, tsf	1.051			
Failure strain, %	4.1			
Strain rate, %/min.	1.00			
Water content, %	27.5			
Wet density, pcf	118.5			
Dry density, pcf	92.9			
Saturation, %	91.4			
Void ratio	0.8138			
Specimen diameter, in.	2.85			
Specimen height, in.	5.83			
Height/diameter ratio	2.05			

Description: Tan and gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

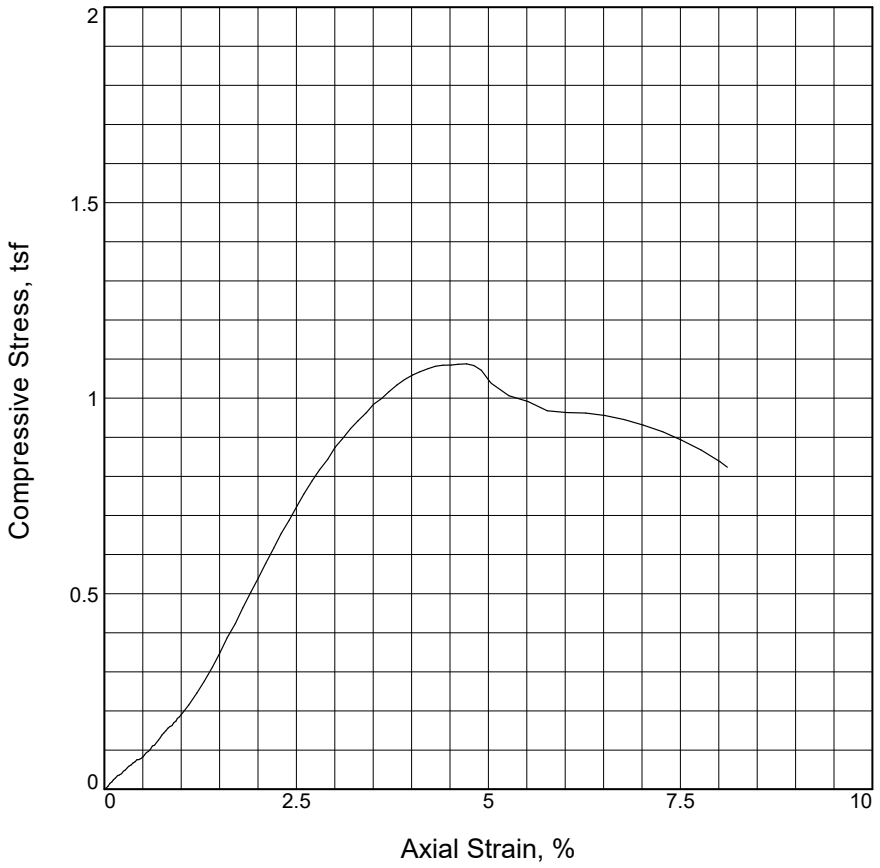
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-10 **Depth:** 22.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.088			
Undrained shear strength, tsf	0.544			
Failure strain, %	4.7			
Strain rate, %/min.	1.00			
Water content, %	27.3			
Wet density, pcf	125.2			
Dry density, pcf	98.4			
Saturation, %	98.5			
Void ratio	0.7772			
Specimen diameter, in.	2.84			
Specimen height, in.	5.80			
Height/diameter ratio	2.04			

Description: LEAN CLAY (CL), brown

LL = 43	**PL =** 22	**PI =** 21	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

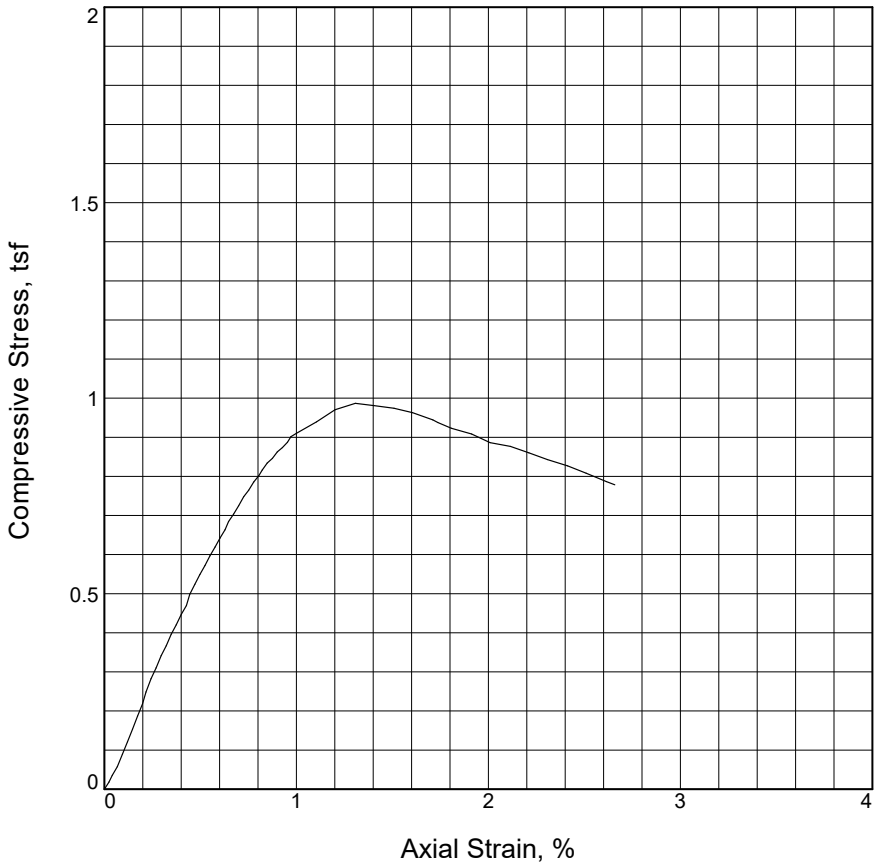
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-10 **Depth:** 30
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.987			
Undrained shear strength, tsf	0.493			
Failure strain, %	1.3			
Strain rate, %/min.	1.00			
Water content, %	32.4			
Wet density, pcf	116.6			
Dry density, pcf	88.0			
Saturation, %	95.7			
Void ratio	0.9145			
Specimen diameter, in.	2.85			
Specimen height, in.	5.82			
Height/diameter ratio	2.04			

Description: Tan FAT CLAY

LL = 88	**PL =** 29	**PI =** 59	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

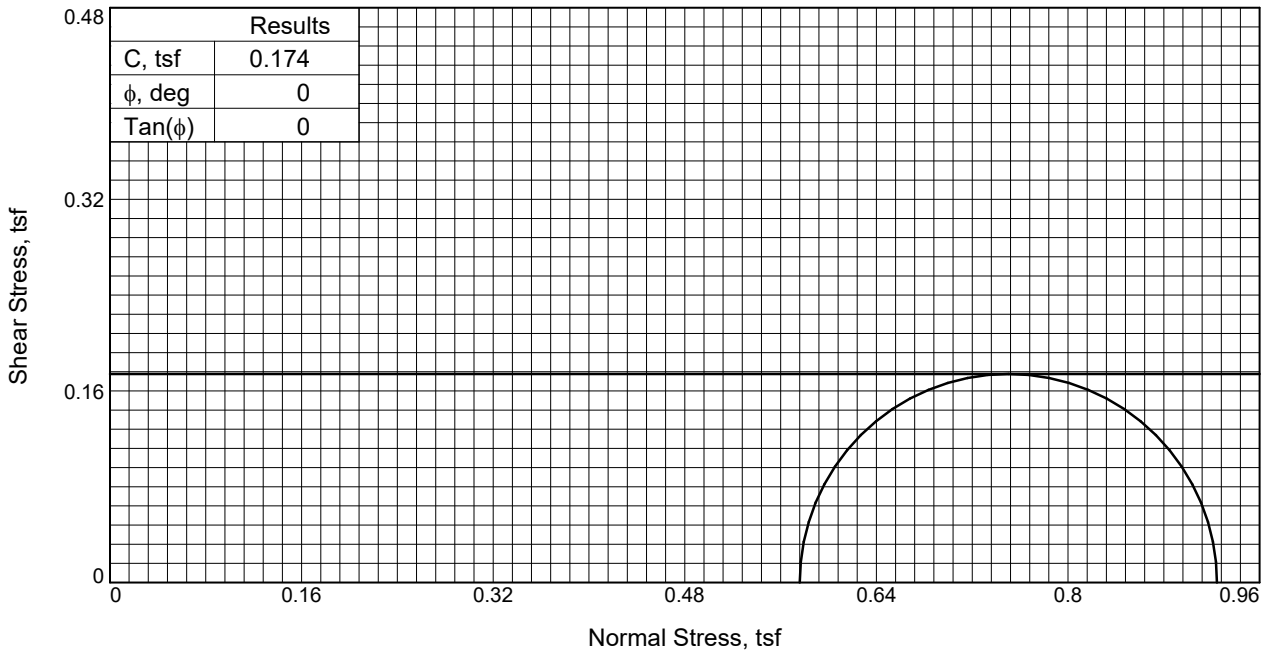
Figure _____

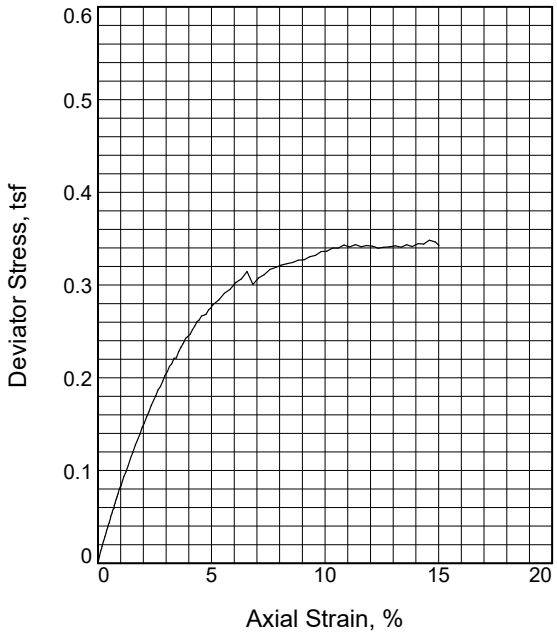
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-10 **Depth:** 17.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	30.0
	Dry Density, pcf	89.2
	Saturation, %	91.1
	Void Ratio	0.8890
	Diameter, in.	2.81
	Height, in.	5.83
At Test	Water Content, %	31.4
	Dry Density, pcf	89.2
	Saturation, %	95.5
	Void Ratio	0.8890
	Diameter, in.	2.81
	Height, in.	5.83
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		0.35
Strain, %		14.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.92
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: LEAN CLAY WITH SAND (CL), gray

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

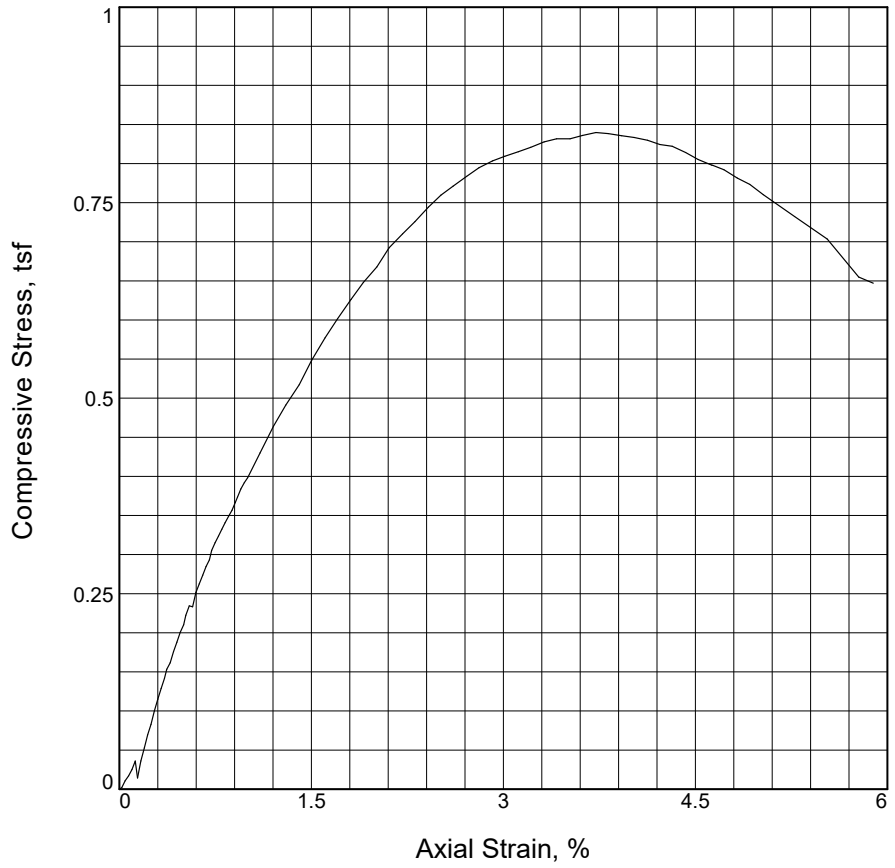
Source of Sample: CB-11 **Depth:** 20

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 10/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.840			
Undrained shear strength, tsf	0.420			
Failure strain, %	3.7			
Strain rate, %/min.	1.00			
Water content, %	23.3			
Wet density, pcf	127.0			
Dry density, pcf	103.0			
Saturation, %	99.0			
Void ratio	0.6369			
Specimen diameter, in.	2.83			
Specimen height, in.	5.81			
Height/diameter ratio	2.05			

Description: Brown LEAN CLAY with SAND; sand pockets

LL = 47	**PL =** 17	**PI =** 30	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

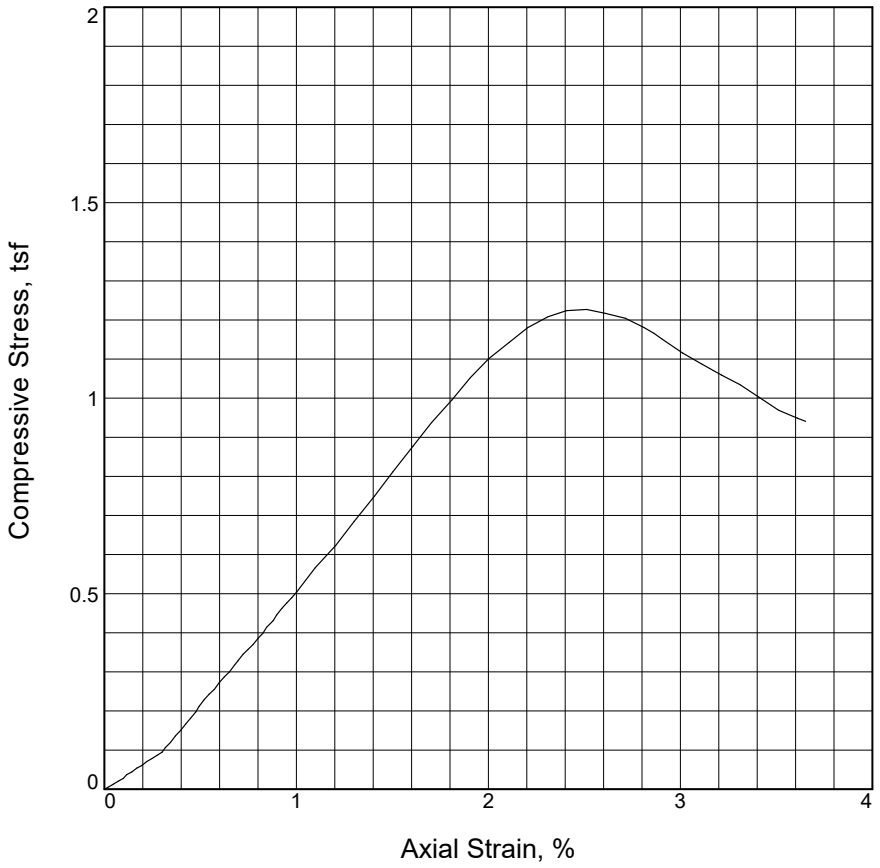
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-11 **Depth:** 22.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.227			
Undrained shear strength, tsf	0.613			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	17.9			
Wet density, pcf	133.1			
Dry density, pcf	112.9			
Saturation, %	97.8			
Void ratio	0.4929			
Specimen diameter, in.	2.85			
Specimen height, in.	5.80			
Height/diameter ratio	2.04			

Description: Tan LEAN CLAY with SAND

LL = 30	**PL =** 15	**PI =** 15	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

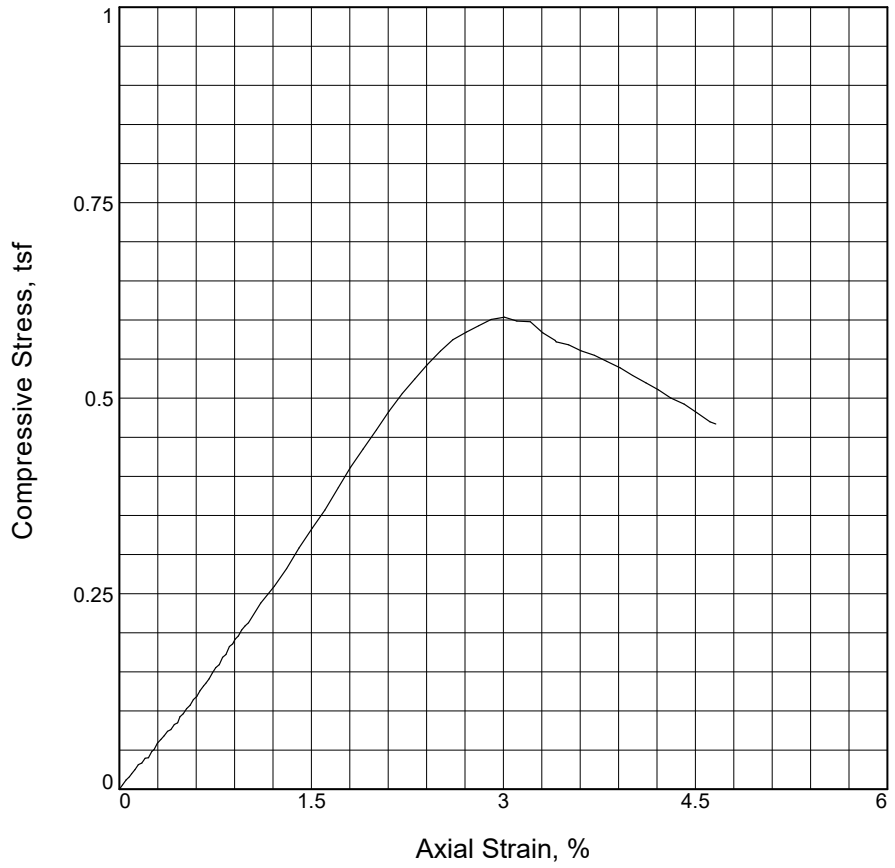
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-11 **Depth:** 27.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.604			
Undrained shear strength, tsf	0.302			
Failure strain, %	3.0			
Strain rate, %/min.	1.00			
Water content, %	17.5			
Wet density, pcf	127.2			
Dry density, pcf	108.2			
Saturation, %	84.9			
Void ratio	0.5575			
Specimen diameter, in.	2.88			
Specimen height, in.	5.82			
Height/diameter ratio	2.02			

Description: SANDY LEAN CLAY (CL), gray

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

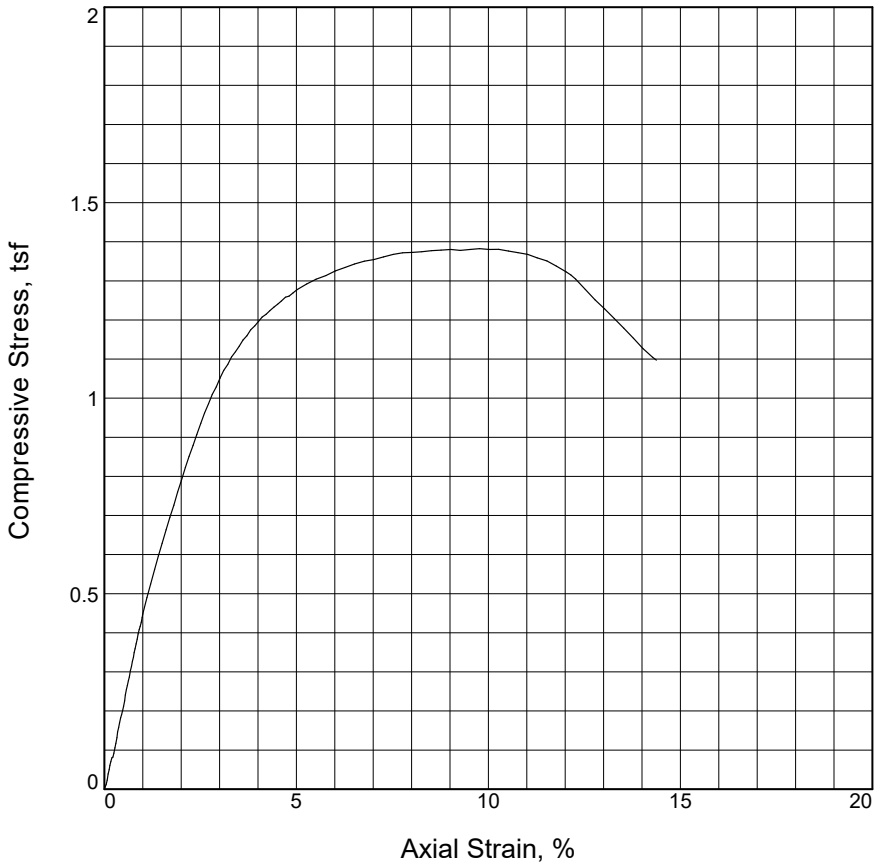
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-11 **Depth:** 30
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.382			
Undrained shear strength, tsf	0.691			
Failure strain, %	9.8			
Strain rate, %/min.	1.00			
Water content, %	23.1			
Wet density, pcf	128.3			
Dry density, pcf	104.3			
Saturation, %	98.1			
Void ratio	0.6468			
Specimen diameter, in.	2.84			
Specimen height, in.	5.83			
Height/diameter ratio	2.05			

Description: Tan LEAN CLAY with SAND; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 10/31/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

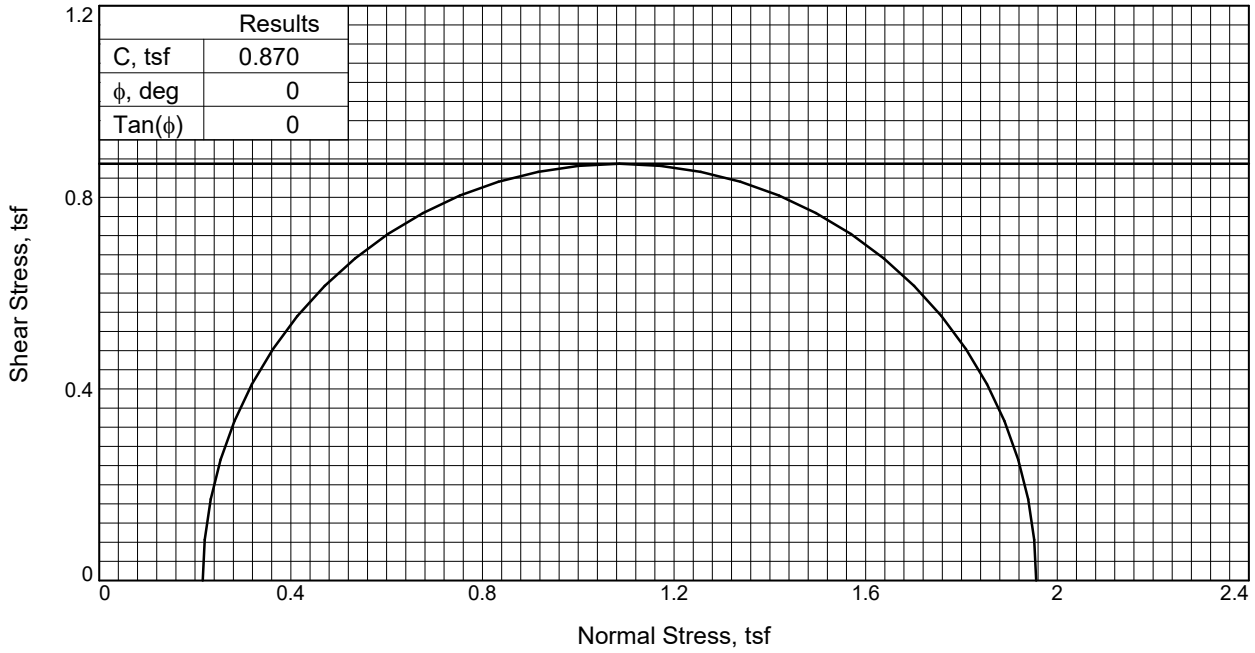
Figure _____

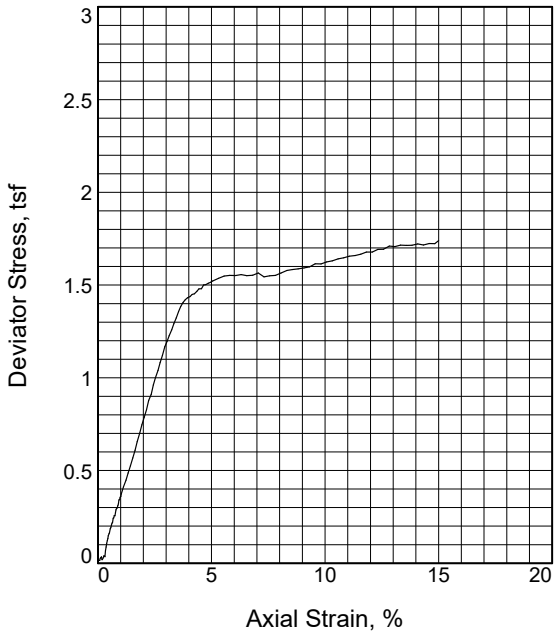
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-11 **Depth:** 25
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	19.7
	Dry Density, pcf	106.4
	Saturation, %	91.2
	Void Ratio	0.5837
	Diameter, in.	2.87
	Height, in.	5.73
At Test	Water Content, %	20.9
	Dry Density, pcf	106.4
	Saturation, %	96.5
	Void Ratio	0.5837
	Diameter, in.	2.87
	Height, in.	5.73
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		1.74
Strain, %		15.0
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.96
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray LEAN CLAY with SAND

LL= 34 **PL=** 17 **PI=** 17

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

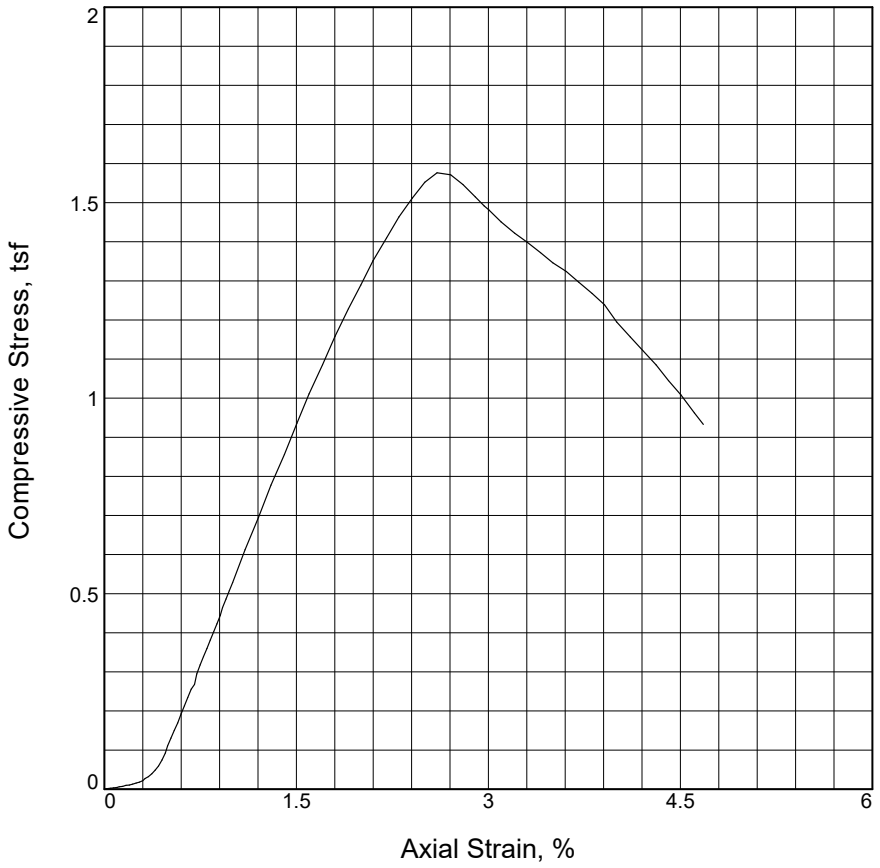
Source of Sample: CB-18 **Depth:** 7.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/6/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.576			
Undrained shear strength, tsf	0.788			
Failure strain, %	2.6			
Strain rate, %/min.	1.00			
Water content, %	21.5			
Wet density, pcf	126.1			
Dry density, pcf	103.8			
Saturation, %	93.1			
Void ratio	0.6241			
Specimen diameter, in.	2.88			
Specimen height, in.	5.77			
Height/diameter ratio	2.00			

Description: Brown and gray LEAN CLAY with SAND

LL = 47	**PL =** 18	**PI =** 29	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/6/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

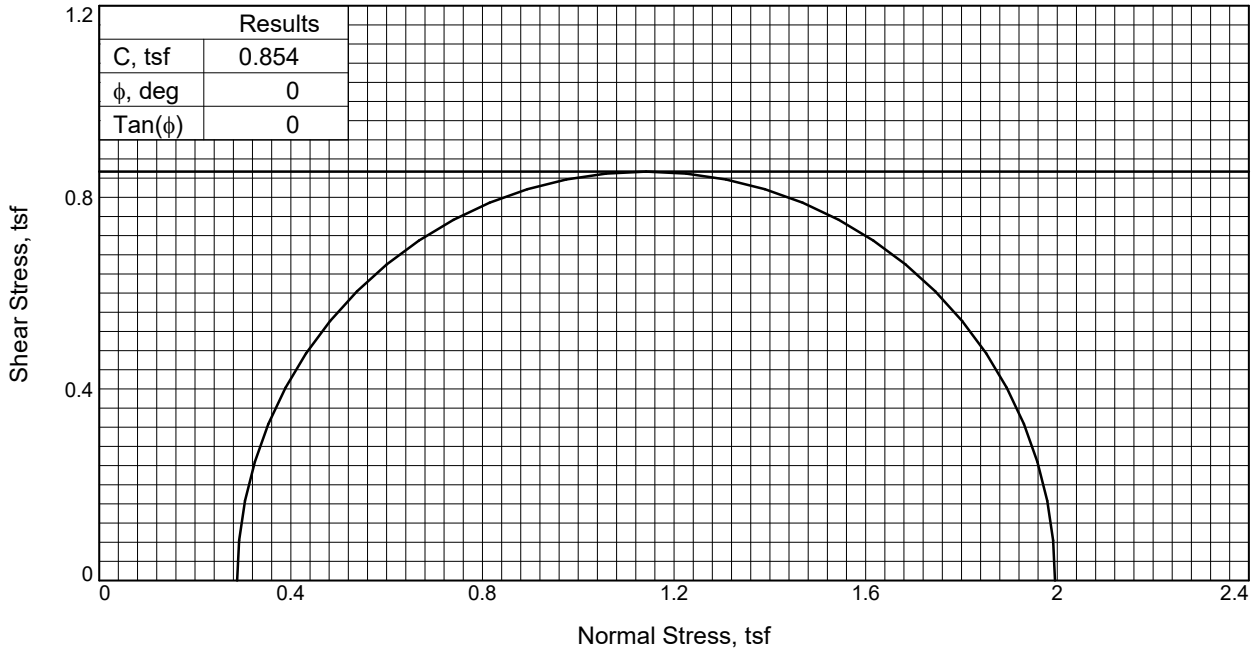
Figure _____

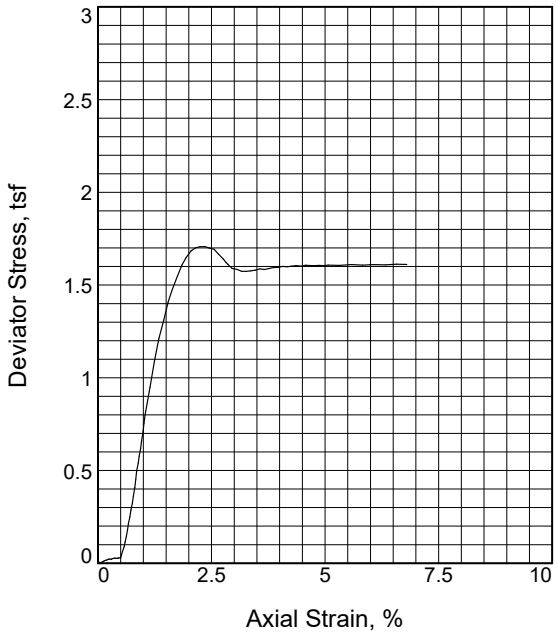
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-18 **Depth:** 12.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	25.9
	Dry Density, pcf	98.4
	Saturation, %	98.1
	Void Ratio	0.7124
	Diameter, in.	2.90
	Height, in.	5.91
At Test	Water Content, %	26.4
	Dry Density, pcf	98.4
	Saturation, %	100.0
	Void Ratio	0.7124
	Diameter, in.	2.90
	Height, in.	5.91
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		4.00
Fail. Stress, tsf		1.71
Strain, %		2.4
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.00
σ_3 Failure, tsf		0.29

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown and gray FAT CLAY; silt pockets

LL= 66 **PL=** 24 **PI=** 42

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

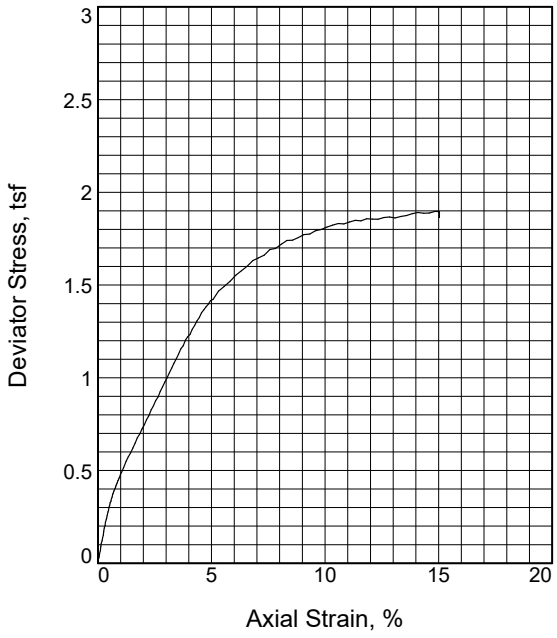
Source of Sample: CB-19 **Depth:** 30

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 12/1/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	19.9
	Dry Density, pcf	110.2
	Saturation, %	98.2
	Void Ratio	0.5573
	Diameter, in.	2.89
	Height, in.	5.35
At Test	Water Content, %	17.4
	Dry Density, pcf	110.2
	Saturation, %	85.9
	Void Ratio	0.5573
	Diameter, in.	2.89
	Height, in.	5.35
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		1.90
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.04
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan and gray SANDY LEAN CLAY

LL= 37 **PL=** 16 **PI=** 21

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

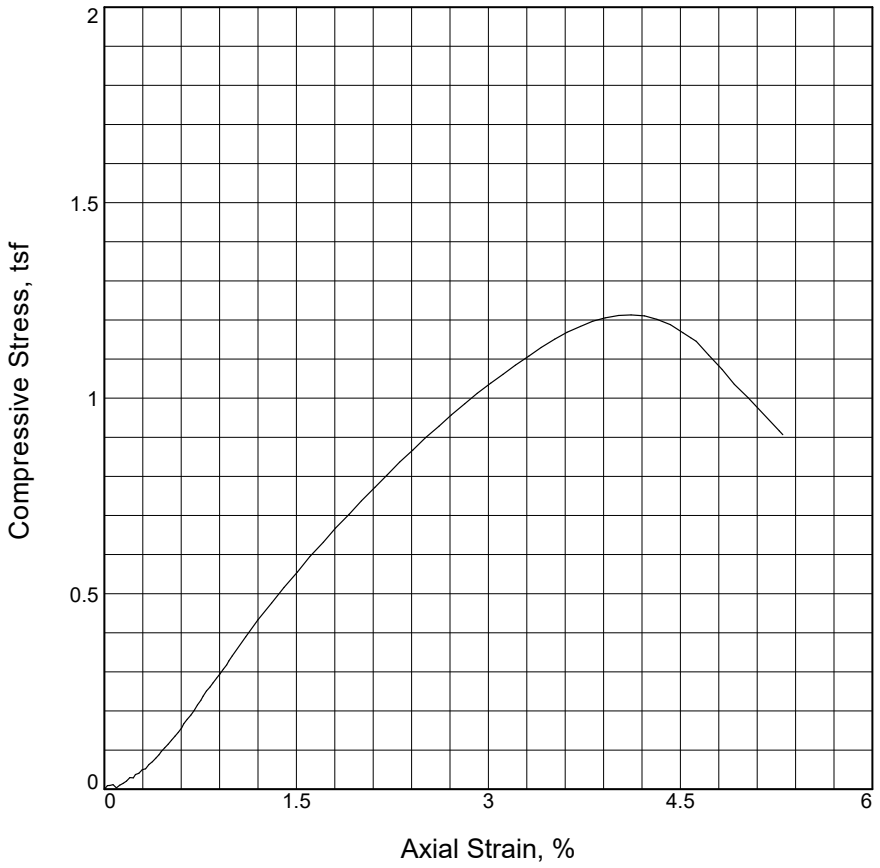
Source of Sample: CB-20 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/5/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.213			
Undrained shear strength, tsf	0.606			
Failure strain, %	4.1			
Strain rate, %/min.	1.00			
Water content, %	28.8			
Wet density, pcf	122.0			
Dry density, pcf	94.7			
Saturation, %	99.9			
Void ratio	0.7796			
Specimen diameter, in.	2.90			
Specimen height, in.	5.73			
Height/diameter ratio	1.98			

Description: Brown FAT CLAY

LL = 50	**PL =** 22	**PI =** 28	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/5/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

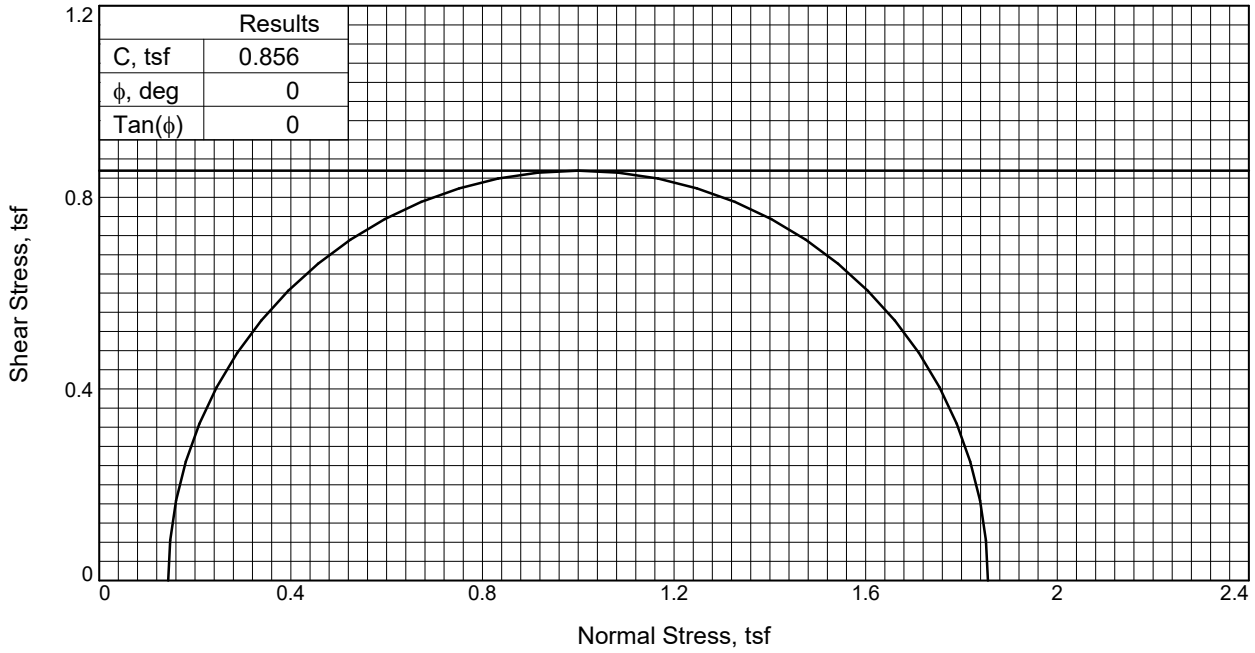
Figure _____

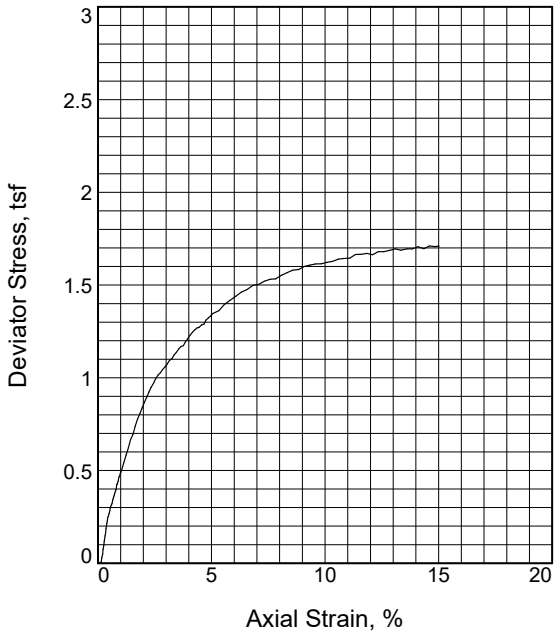
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-20 **Depth:** 42.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	13.1
	Dry Density, pcf	119.2
	Saturation, %	82.1
	Void Ratio	0.4399
	Diameter, in.	2.89
	Height, in.	5.75
At Test	Water Content, %	16.0
	Dry Density, pcf	119.2
	Saturation, %	100.0
	Void Ratio	0.4399
	Diameter, in.	2.89
	Height, in.	5.75
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		1.71
Strain, %		14.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.86
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray CLAYEY SAND; gravel

LL= 25 **PL=** 17 **PI=** 8

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

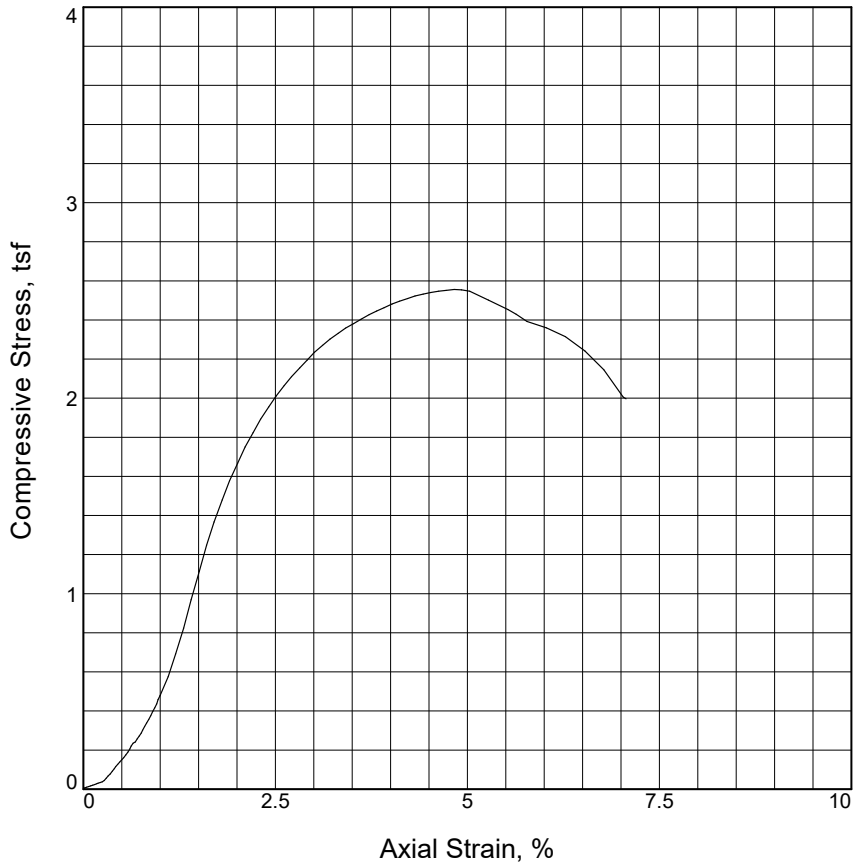
Source of Sample: CB-21 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/5/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.556			
Undrained shear strength, tsf	1.278			
Failure strain, %	4.8			
Strain rate, %/min.	1.00			
Water content, %	23.4			
Wet density, pcf	127.0			
Dry density, pcf	103.0			
Saturation, %	99.1			
Void ratio	0.6370			
Specimen diameter, in.	2.88			
Specimen height, in.	5.76			
Height/diameter ratio	2.00			

Description: Reddish-brown and gray FAT CLAY

LL = 52	**PL =** 24	**PI =** 28	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/5/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

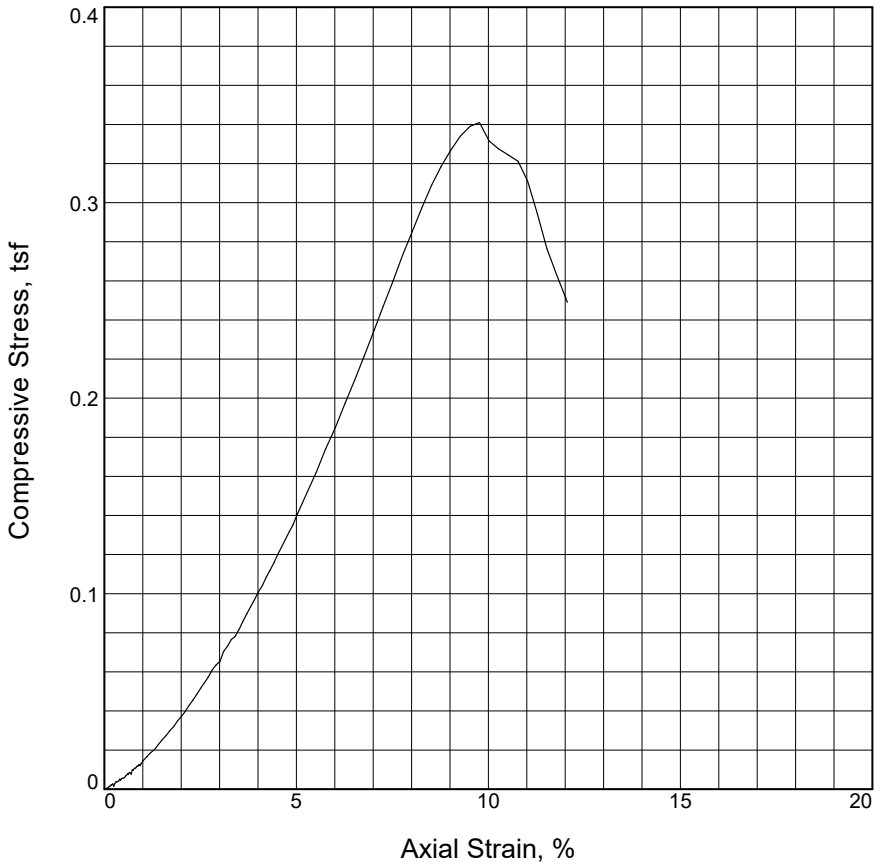
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-21 **Depth:** 32.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.341			
Undrained shear strength, tsf	0.170			
Failure strain, %	9.8			
Strain rate, %/min.	1.00			
Water content, %	23.4			
Wet density, pcf	129.4			
Dry density, pcf	104.9			
Saturation, %	98.3			
Void ratio	0.6659			
Specimen diameter, in.	2.88			
Specimen height, in.	5.42			
Height/diameter ratio	1.88			

Description: Gray and brown LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/5/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

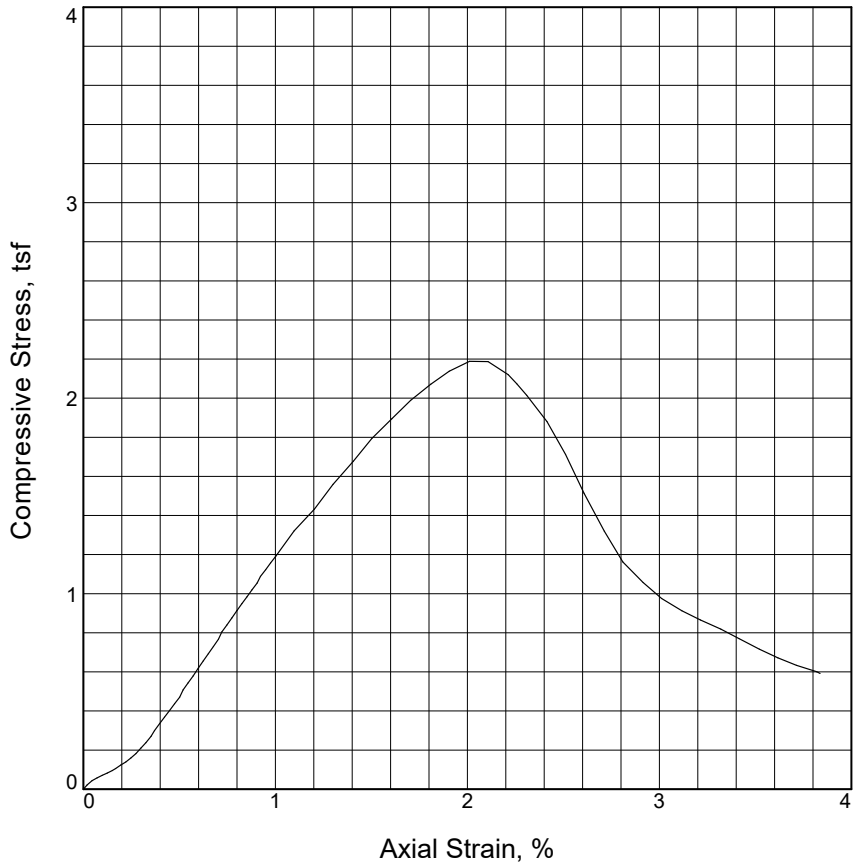
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-21 **Depth:** 37.5
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.189			
Undrained shear strength, tsf	1.094			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	23.7			
Wet density, pcf	123.6			
Dry density, pcf	100.0			
Saturation, %	93.1			
Void ratio	0.6863			
Specimen diameter, in.	2.91			
Specimen height, in.	5.75			
Height/diameter ratio	1.97			

Description: Reddish-brown and gray LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/5/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

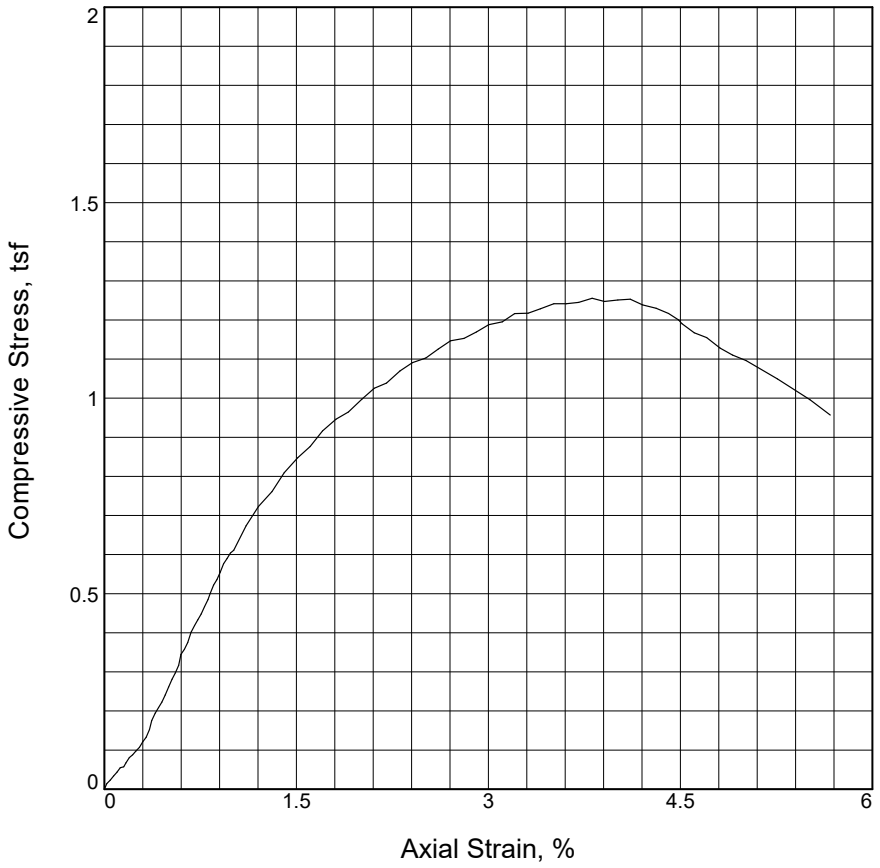
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-21 **Depth:** 42.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.255			
Undrained shear strength, tsf	0.628			
Failure strain, %	3.8			
Strain rate, %/min.	1.00			
Water content, %	27.5			
Wet density, pcf	120.3			
Dry density, pcf	94.3			
Saturation, %	94.4			
Void ratio	0.7869			
Specimen diameter, in.	2.88			
Specimen height, in.	5.72			
Height/diameter ratio	1.98			

Description: Gray LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/5/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

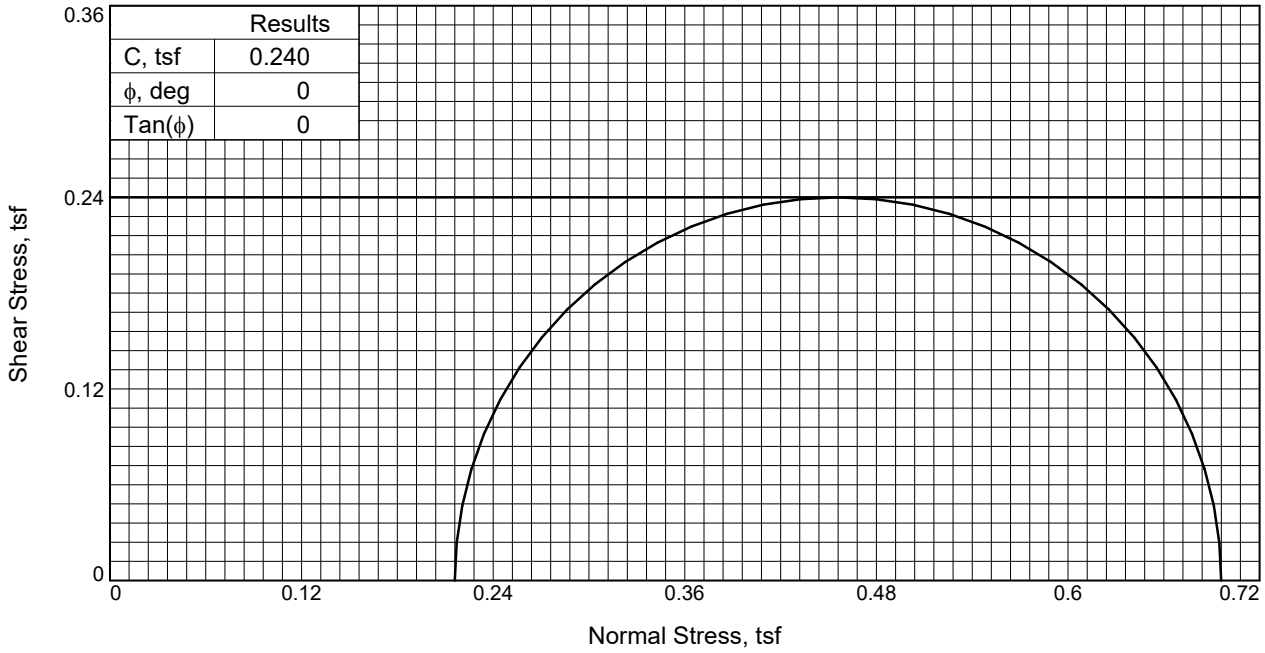
Figure _____

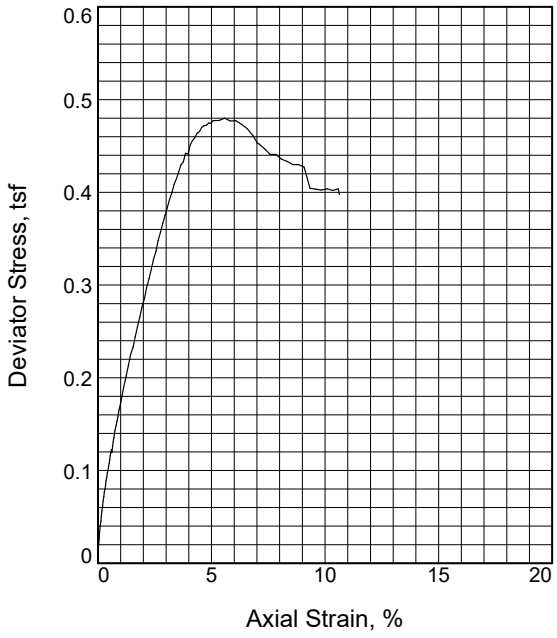
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-21 **Depth:** 27.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	41.5
	Dry Density, pcf	80.6
	Saturation, %	99.5
	Void Ratio	1.1691
	Diameter, in.	2.83
	Height, in.	5.78
At Test	Water Content, %	37.8
	Dry Density, pcf	80.6
	Saturation, %	90.6
	Void Ratio	1.1691
	Diameter, in.	2.83
	Height, in.	5.78
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		0.48
Strain, %		5.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.70
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained
Sample Type: Undisturbed
Description: Brown FAT CLAY

LL= 50 **PL=** 23 **PI=** 27
Assumed Specific Gravity= 2.80
Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

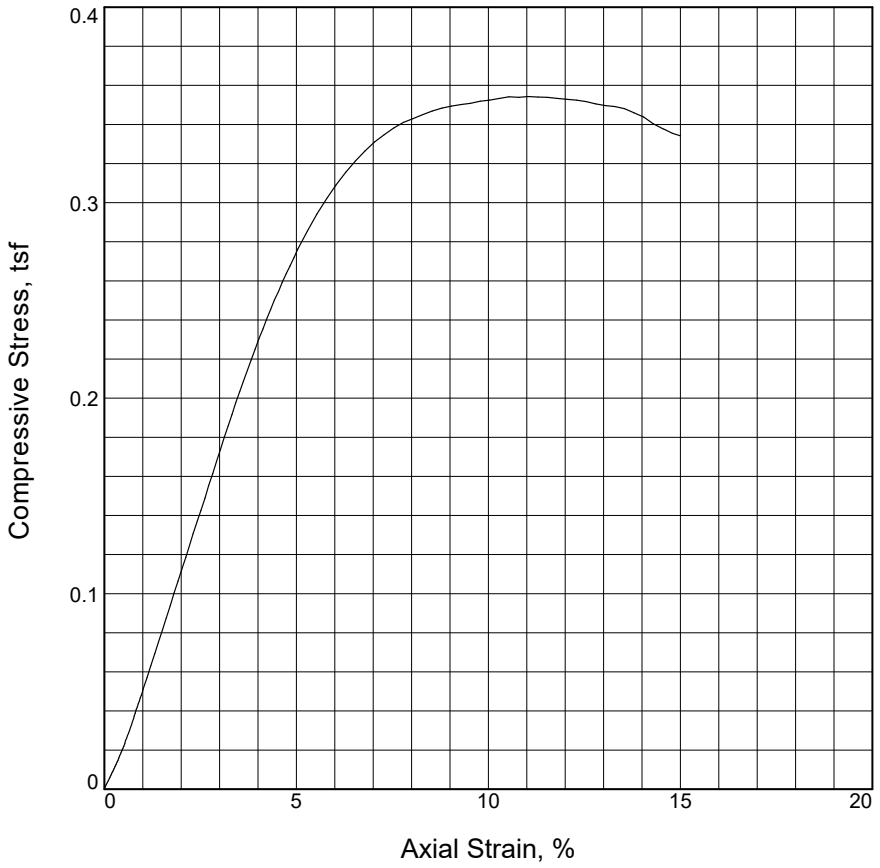
Source of Sample: CB-22 **Depth:** 22.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/9/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.354			
Undrained shear strength, tsf	0.177			
Failure strain, %	11.0			
Strain rate, %/min.	1.00			
Water content, %	42.3			
Wet density, pcf	113.5			
Dry density, pcf	79.8			
Saturation, %	99.4			
Void ratio	1.1913			
Specimen diameter, in.	2.88			
Specimen height, in.	5.71			
Height/diameter ratio	1.99			

Description: Brown FAT CLAY; silt parting

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

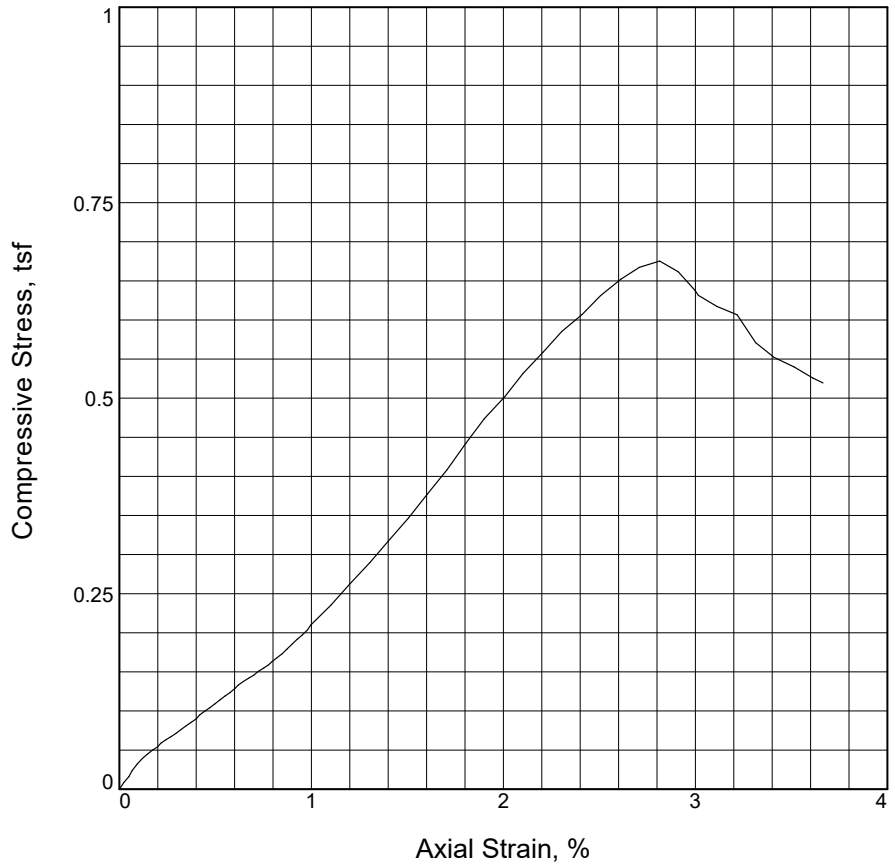
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-22 **Depth:** 27.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.675			
Undrained shear strength, tsf	0.338			
Failure strain, %	2.8			
Strain rate, %/min.	1.00			
Water content, %	20.3			
Wet density, pcf	127.5			
Dry density, pcf	105.9			
Saturation, %	92.9			
Void ratio	0.5911			
Specimen diameter, in.	2.87			
Specimen height, in.	5.73			
Height/diameter ratio	2.00			

Description: Brown LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

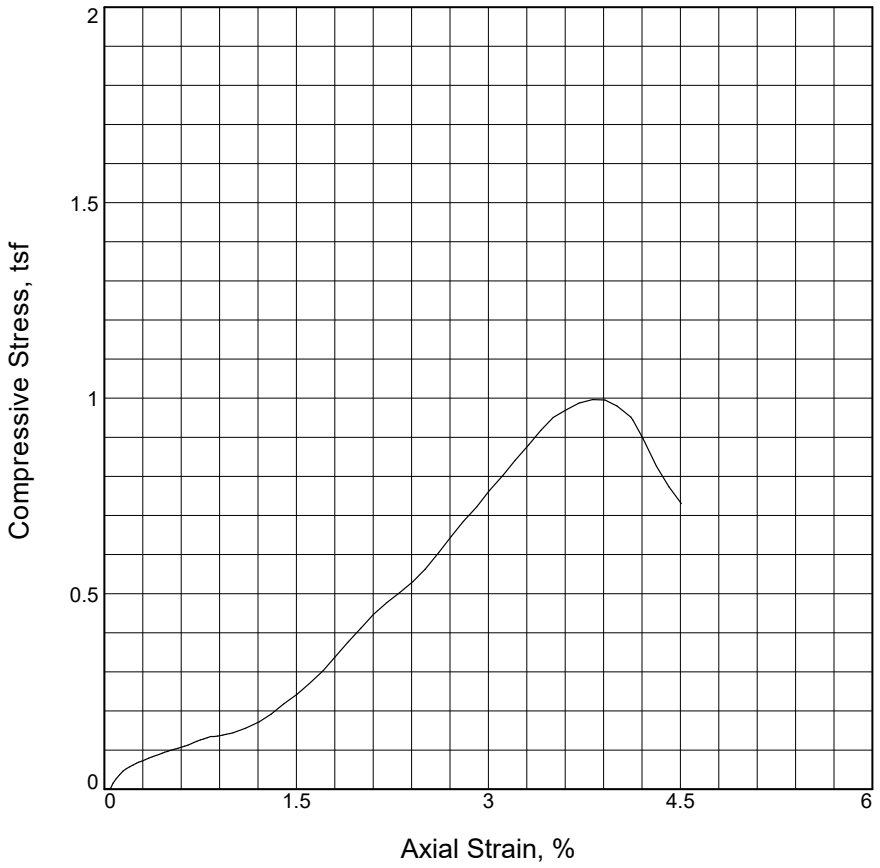
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-22 **Depth:** 40
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.996			
Undrained shear strength, tsf	0.498			
Failure strain, %	3.8			
Strain rate, %/min.	1.00			
Water content, %	25.8			
Wet density, pcf	124.0			
Dry density, pcf	98.6			
Saturation, %	98.2			
Void ratio	0.7098			
Specimen diameter, in.	2.91			
Specimen height, in.	5.55			
Height/diameter ratio	1.91			

Description: Light gray FAT CLAY; silt partings

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

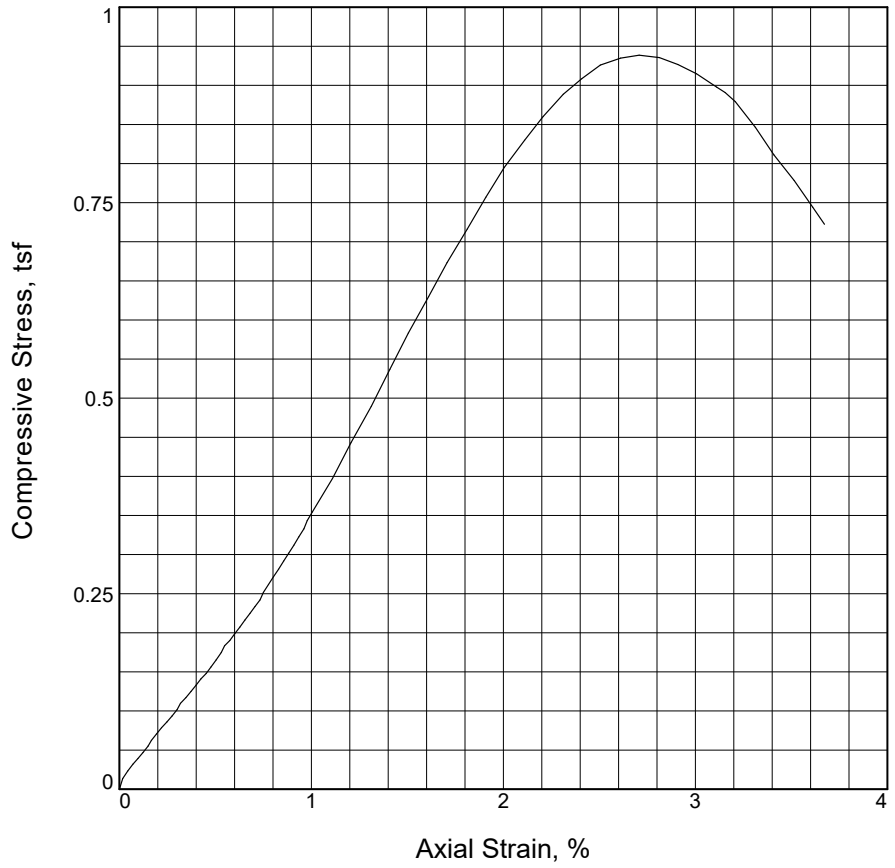
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-22 **Depth:** 45
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.939			
Undrained shear strength, tsf	0.469			
Failure strain, %	2.7			
Strain rate, %/min.	1.00			
Water content, %	21.0			
Wet density, pcf	127.4			
Dry density, pcf	105.3			
Saturation, %	94.4			
Void ratio	0.6000			
Specimen diameter, in.	2.90			
Specimen height, in.	5.32			
Height/diameter ratio	1.84			

Description: Brown LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

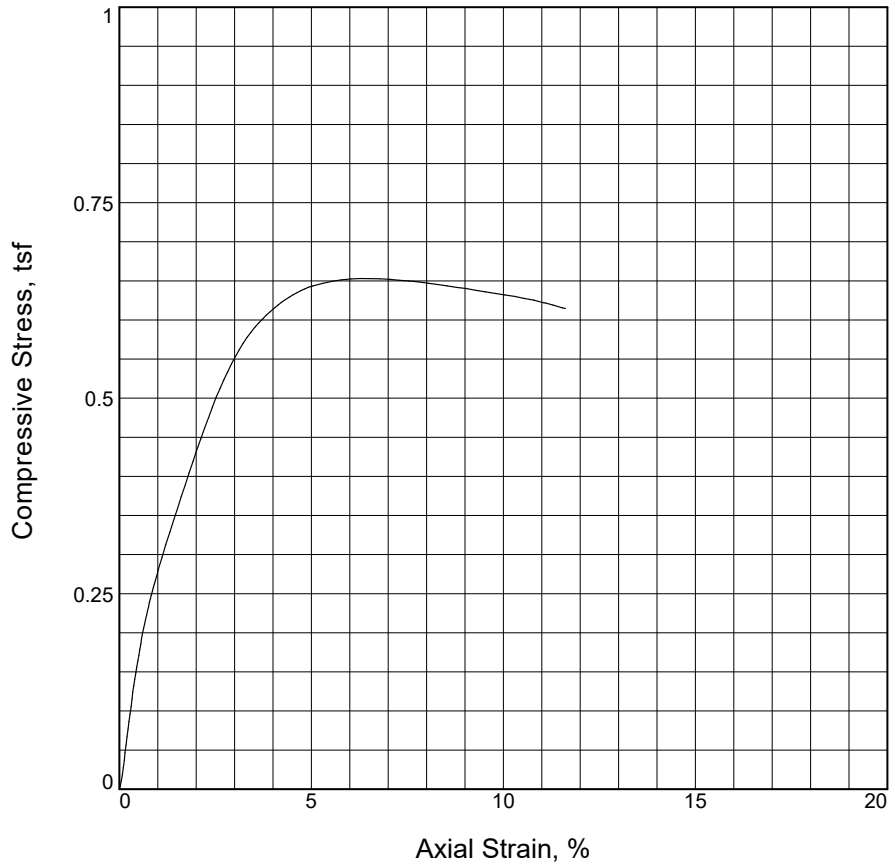
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-22 **Depth:** 35
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.653			
Undrained shear strength, tsf	0.327			
Failure strain, %	6.3			
Strain rate, %/min.	1.00			
Water content, %	39.2			
Wet density, pcf	112.4			
Dry density, pcf	80.8			
Saturation, %	97.4			
Void ratio	1.0871			
Specimen diameter, in.	2.87			
Specimen height, in.	5.73			
Height/diameter ratio	2.00			

Description: Reddish-brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/9/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

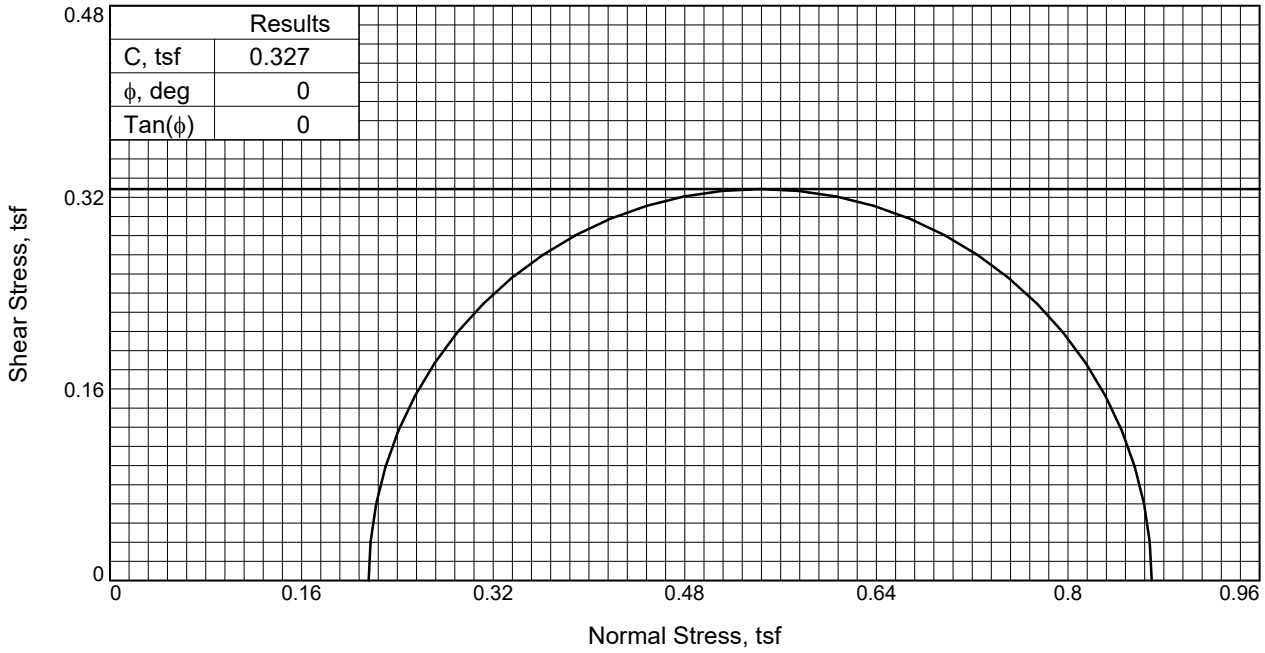
Figure _____

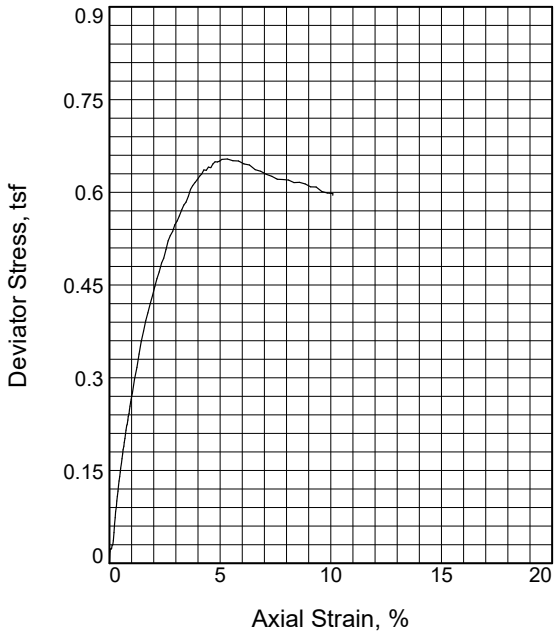
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 25
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	35.1
	Dry Density, pcf	83.2
	Saturation, %	90.8
	Void Ratio	1.0634
	Diameter, in.	2.88
	Height, in.	5.71
At Test	Water Content, %	38.7
	Dry Density, pcf	83.2
	Saturation, %	100.0
	Void Ratio	1.0634
	Diameter, in.	2.88
	Height, in.	5.71
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		3.00
Fail. Stress, tsf		0.65
Strain, %		5.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.87
σ_3 Failure, tsf		0.22

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Brown and reddish-brown FAT CLAY

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

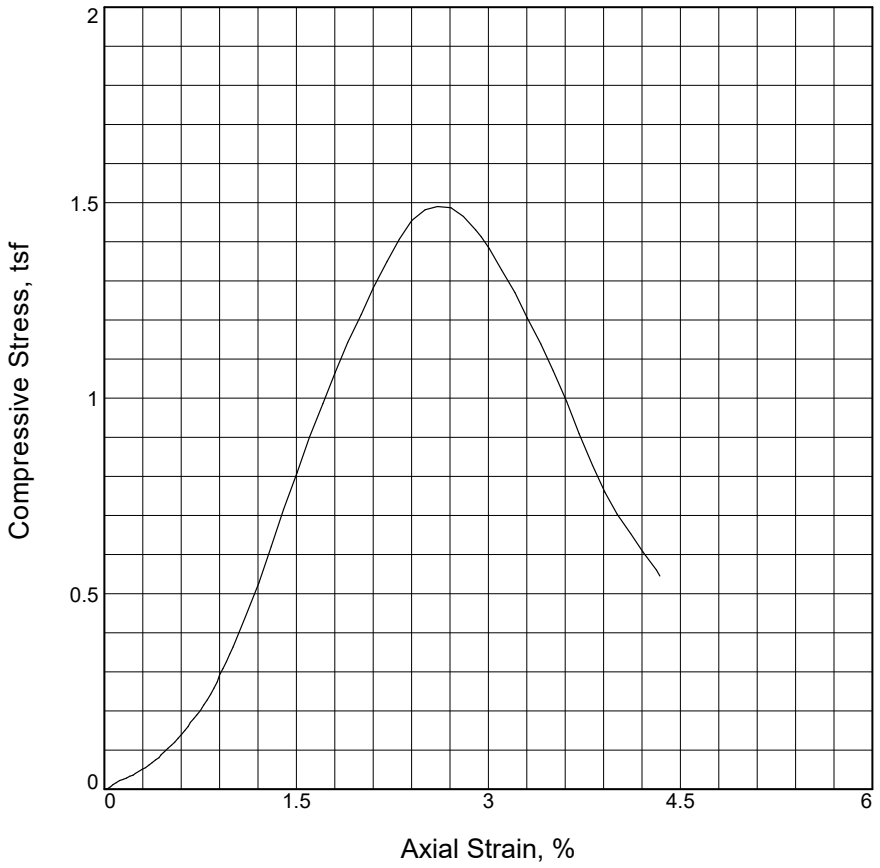
Source of Sample: CB-23 **Depth:** 30

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/9/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.490			
Undrained shear strength, tsf	0.745			
Failure strain, %	2.6			
Strain rate, %/min.	1.00			
Water content, %	19.1			
Wet density, pcf	126.3			
Dry density, pcf	106.0			
Saturation, %	87.4			
Void ratio	0.5895			
Specimen diameter, in.	2.91			
Specimen height, in.	5.74			
Height/diameter ratio	1.97			

Description: Tan LEAN CLAY with SAND

LL = 46	**PL =** 20	**PI =** 26	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/9/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

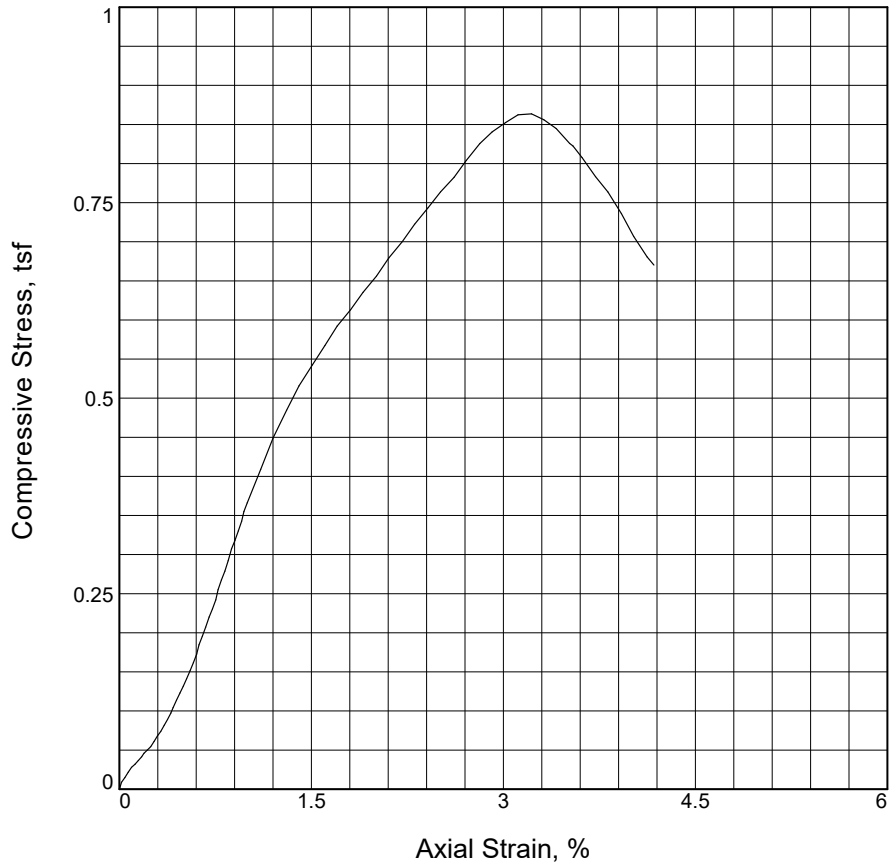
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 42.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.864			
Undrained shear strength, tsf	0.432			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	26.8			
Wet density, pcf	114.9			
Dry density, pcf	90.6			
Saturation, %	84.1			
Void ratio	0.8596			
Specimen diameter, in.	2.89			
Specimen height, in.	4.72			
Height/diameter ratio	1.63			

Description: Tan and gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/9/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

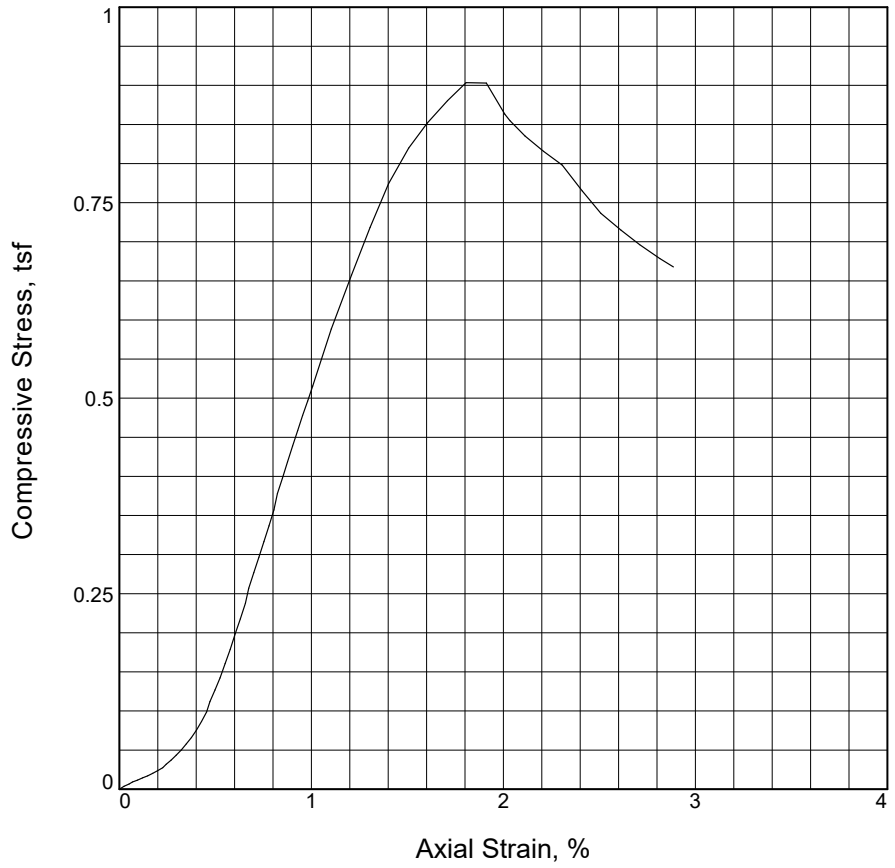
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 47.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.903			
Undrained shear strength, tsf	0.452			
Failure strain, %	1.8			
Strain rate, %/min.	1.00			
Water content, %	22.9			
Wet density, pcf	126.8			
Dry density, pcf	103.1			
Saturation, %	97.6			
Void ratio	0.6347			
Specimen diameter, in.	2.89			
Specimen height, in.	5.75			
Height/diameter ratio	1.99			

Description: Light gray LEAN CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/9/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

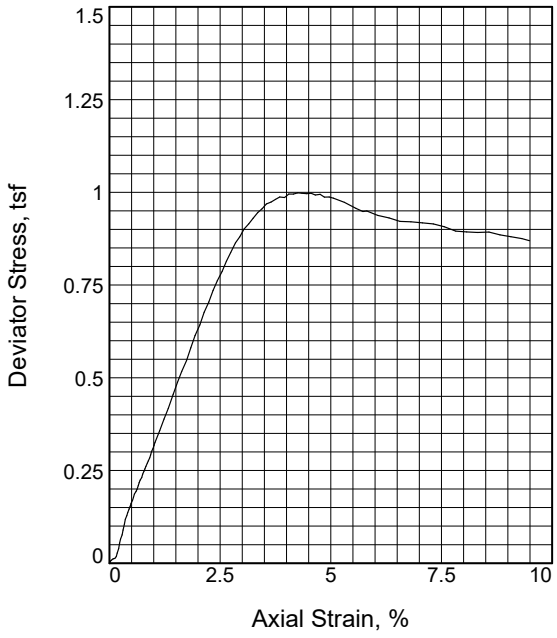
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 37.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	33.4
	Dry Density, pcf	86.8
	Saturation, %	95.7
	Void Ratio	0.9420
	Diameter, in.	2.83
	Height, in.	5.71
At Test	Water Content, %	24.1
	Dry Density, pcf	86.8
	Saturation, %	69.2
	Void Ratio	0.9420
	Diameter, in.	2.83
	Height, in.	5.71
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		1.00
Strain, %		4.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.14
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Brown LEAN CLAY

LL= 38 **PL=** 18 **PI=** 20

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

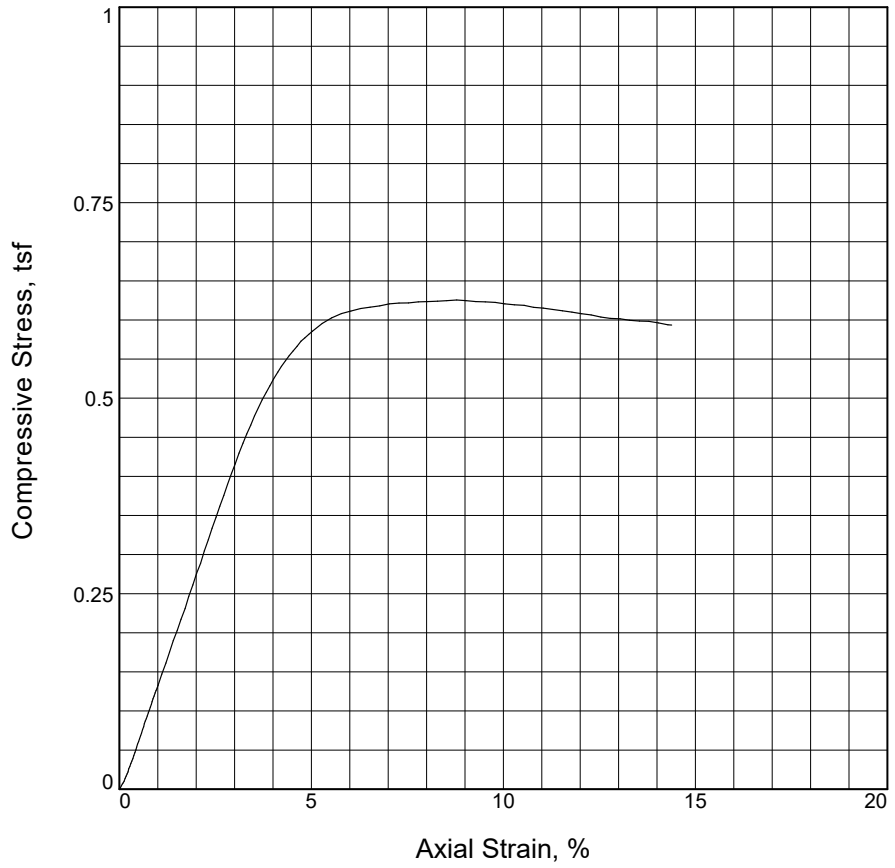
Source of Sample: CB-24 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/11/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.626			
Undrained shear strength, tsf	0.313			
Failure strain, %	8.8			
Strain rate, %/min.	1.00			
Water content, %	33.7			
Wet density, pcf	119.7			
Dry density, pcf	89.6			
Saturation, %	99.1			
Void ratio	0.9515			
Specimen diameter, in.	2.85			
Specimen height, in.	5.73			
Height/diameter ratio	2.01			

Description: Brown FAT CLAY; part lean clay

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

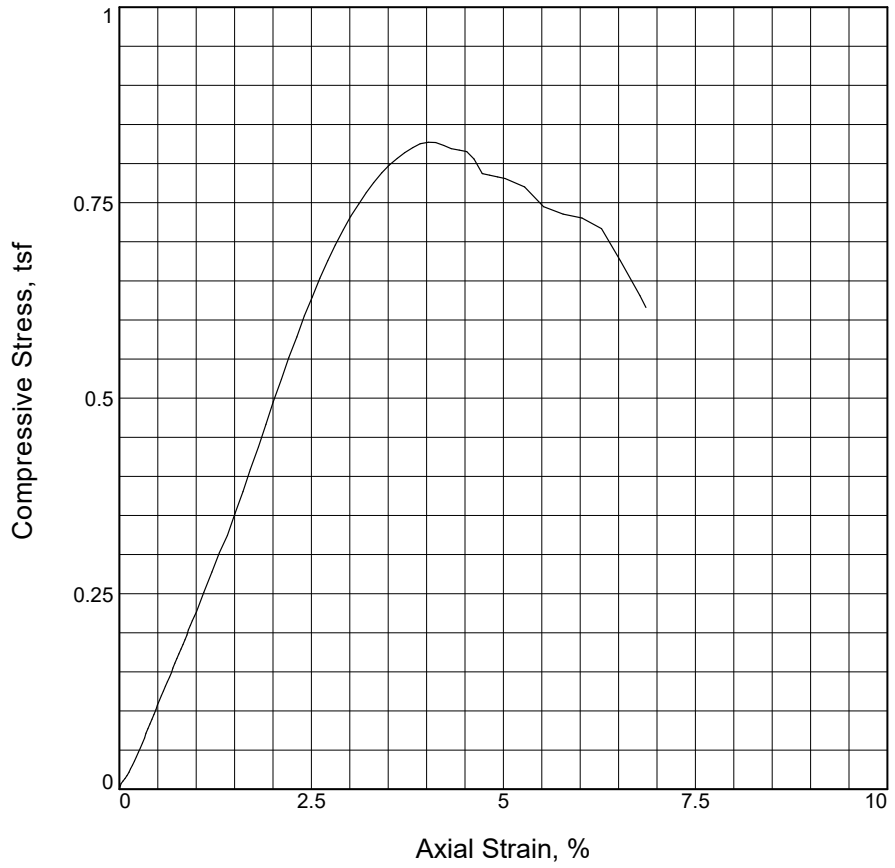
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-24 **Depth:** 7.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.827			
Undrained shear strength, tsf	0.414			
Failure strain, %	4.0			
Strain rate, %/min.	1.00			
Water content, %	41.4			
Wet density, pcf	111.2			
Dry density, pcf	78.7			
Saturation, %	97.9			
Void ratio	1.1427			
Specimen diameter, in.	2.84			
Specimen height, in.	5.71			
Height/diameter ratio	2.01			

Description: Brown FAT CLAY; sand seams

LL = 56	**PL =** 24	**PI =** 32	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

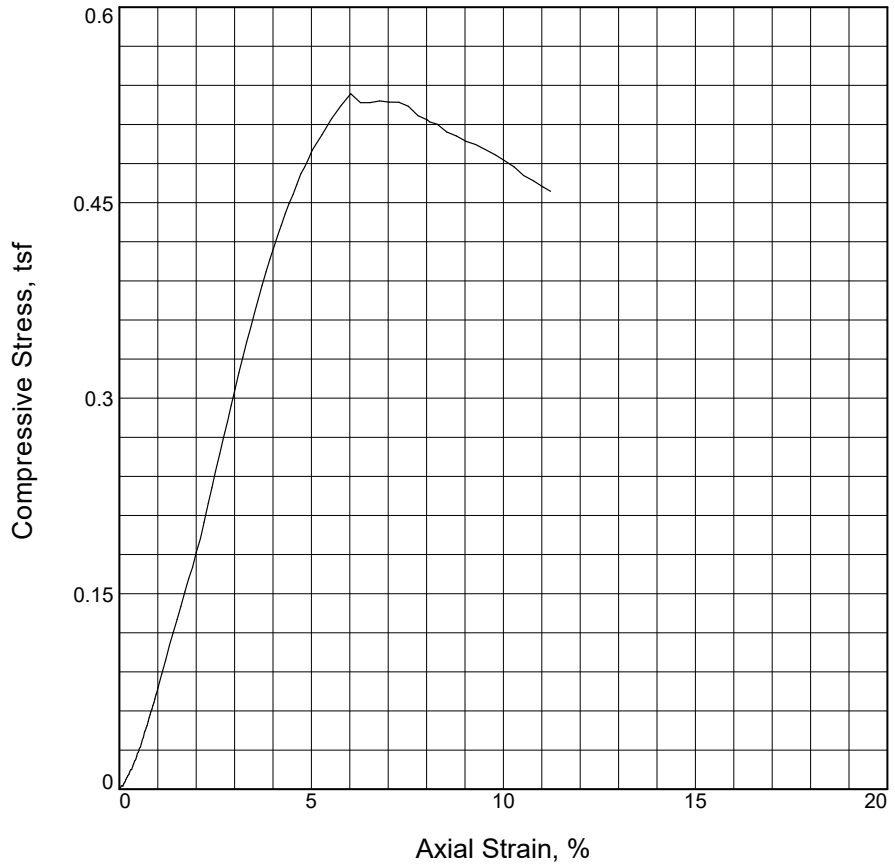
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-24 **Depth:** 12.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.534			
Undrained shear strength, tsf	0.267			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	24.9			
Wet density, pcf	124.7			
Dry density, pcf	99.8			
Saturation, %	97.7			
Void ratio	0.6886			
Specimen diameter, in.	2.88			
Specimen height, in.	5.67			
Height/diameter ratio	1.97			

Description: Brown and gray SANDY LEAN CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

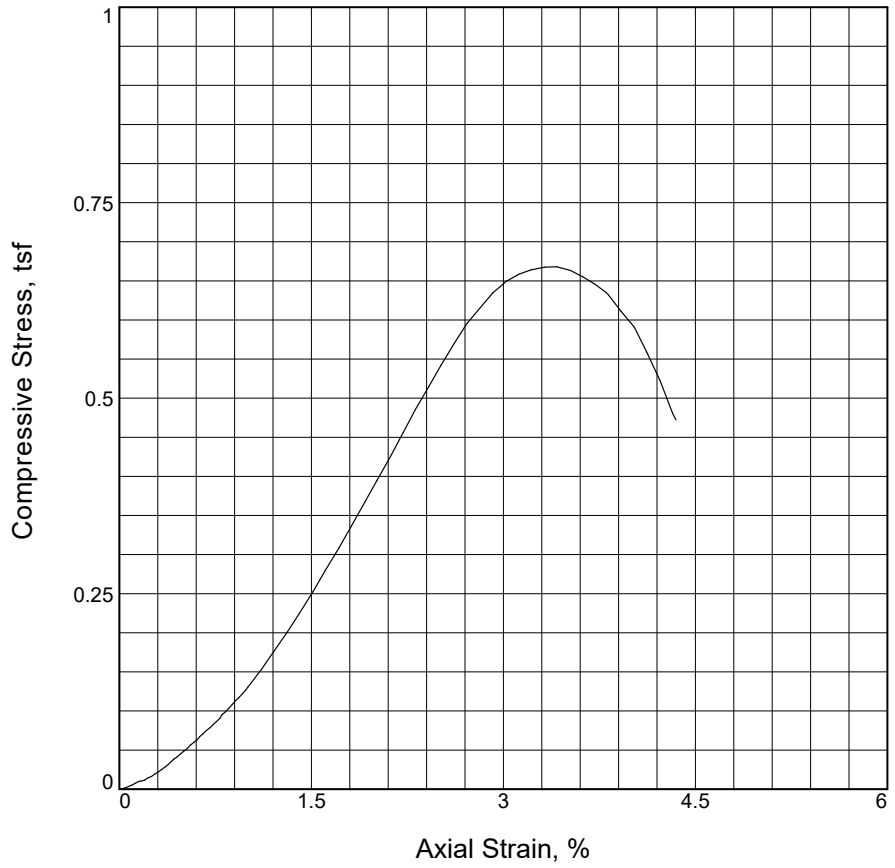
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-24 **Depth:** 17.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.668			
Undrained shear strength, tsf	0.334			
Failure strain, %	3.4			
Strain rate, %/min.	1.00			
Water content, %	21.7			
Wet density, pcf	128.0			
Dry density, pcf	105.2			
Saturation, %	97.3			
Void ratio	0.6023			
Specimen diameter, in.	2.87			
Specimen height, in.	5.70			
Height/diameter ratio	1.98			

Description: Gray CLAYEY SAND

LL = 46	**PL =** 22	**PI =** 24	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

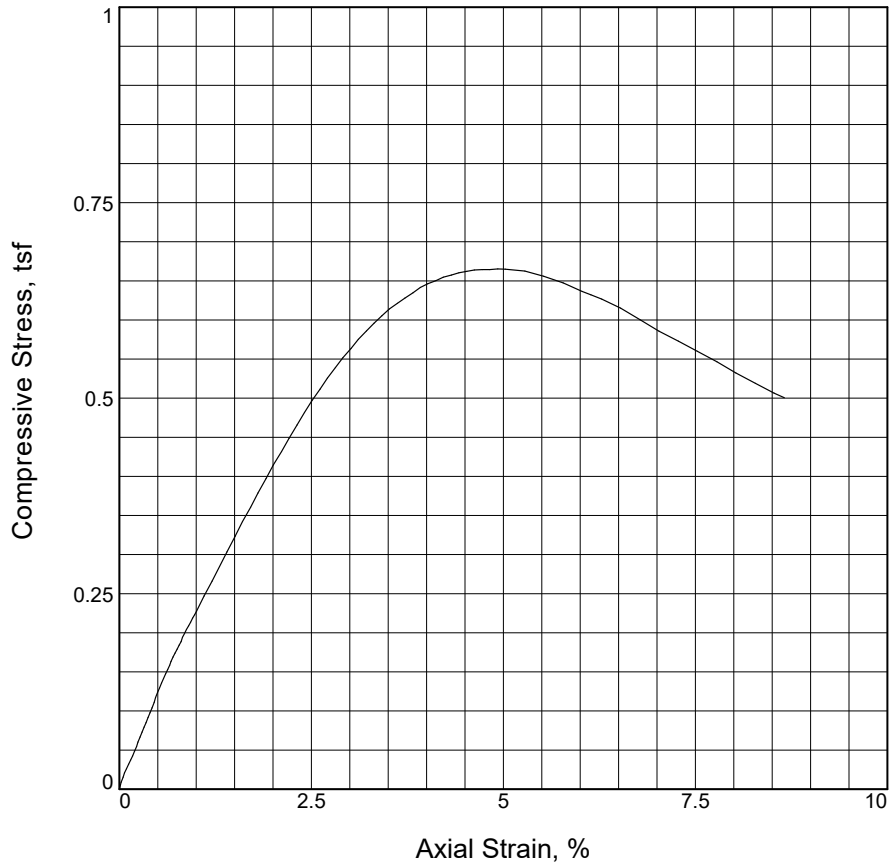
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-24 **Depth:** 27.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.665			
Undrained shear strength, tsf	0.333			
Failure strain, %	4.9			
Strain rate, %/min.	1.00			
Water content, %	32.6			
Wet density, pcf	122.1			
Dry density, pcf	92.1			
Saturation, %	99.7			
Void ratio	0.9314			
Specimen diameter, in.	2.83			
Specimen height, in.	5.70			
Height/diameter ratio	2.01			

Description: Brown LEAN CLAY with SAND

LL = 39	**PL =** 20	**PI =** 19	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

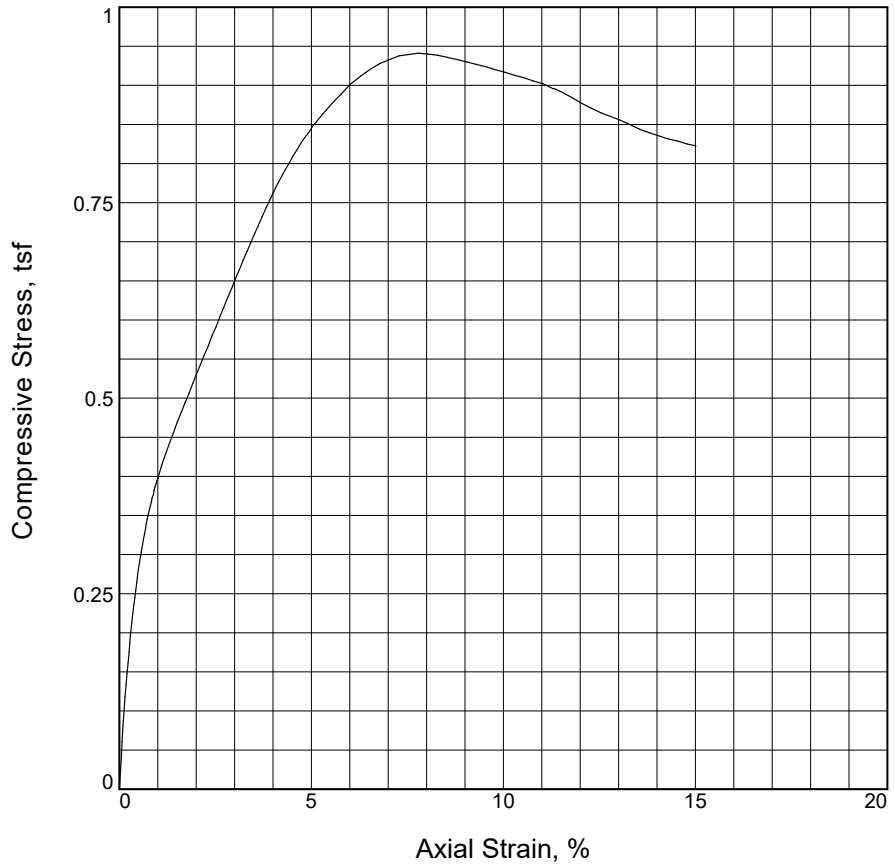
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-25 **Depth:** 6
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.941			
Undrained shear strength, tsf	0.471			
Failure strain, %	7.8			
Strain rate, %/min.	1.00			
Water content, %	36.8			
Wet density, pcf	112.7			
Dry density, pcf	82.4			
Saturation, %	95.0			
Void ratio	1.0456			
Specimen diameter, in.	2.85			
Specimen height, in.	5.76			
Height/diameter ratio	2.02			

Description: Brown FAT CLAY

LL = 56	**PL =** 25	**PI =** 31	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

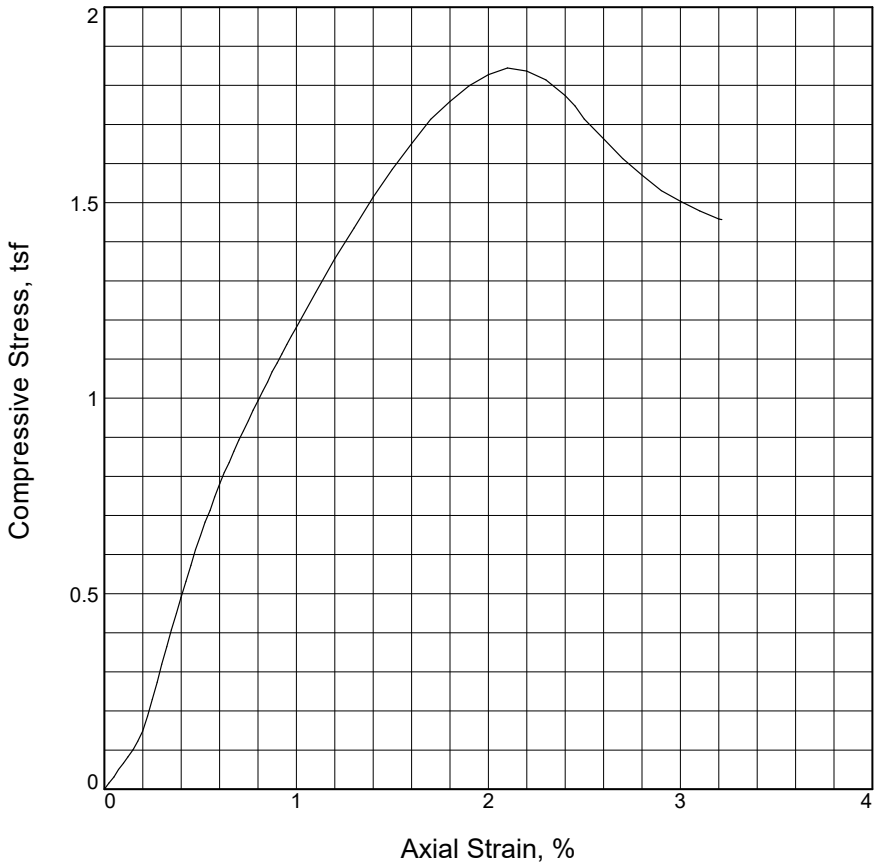
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-25 **Depth:** 22
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.844			
Undrained shear strength, tsf	0.922			
Failure strain, %	2.1			
Strain rate, %/min.	0.25			
Water content, %	40.5			
Wet density, pcf	112.3			
Dry density, pcf	79.9			
Saturation, %	98.6			
Void ratio	1.1086			
Specimen diameter, in.	2.88			
Specimen height, in.	5.75			
Height/diameter ratio	2.00			

Description: Brown and gray FAT CLAY

LL = 65	**PL =** 24	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

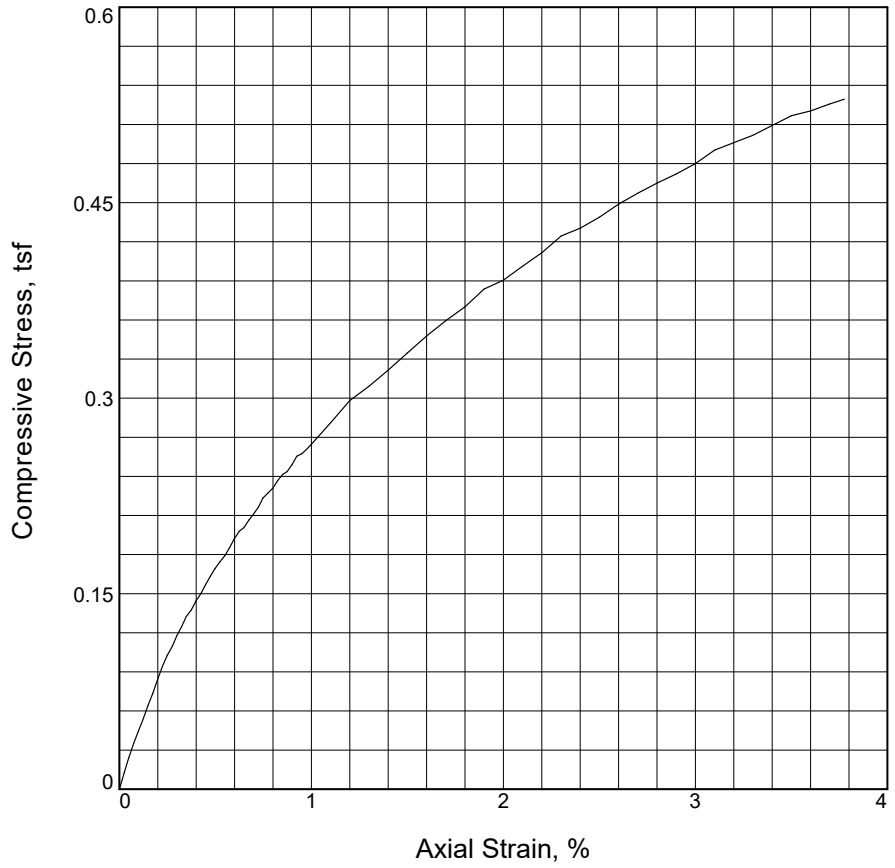
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-25 **Depth:** 30
Sample Number: ST-13

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.529			
Undrained shear strength, tsf	0.265			
Failure strain, %	3.8			
Strain rate, %/min.	0.25			
Water content, %	35.2			
Wet density, pcf	115.1			
Dry density, pcf	85.1			
Saturation, %	96.9			
Void ratio	0.9803			
Specimen diameter, in.	2.83			
Specimen height, in.	5.77			
Height/diameter ratio	2.04			

Description: Brown FAT CLAY; sand pockets

LL = 54	**PL =** 24	**PI =** 30	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

Figure _____

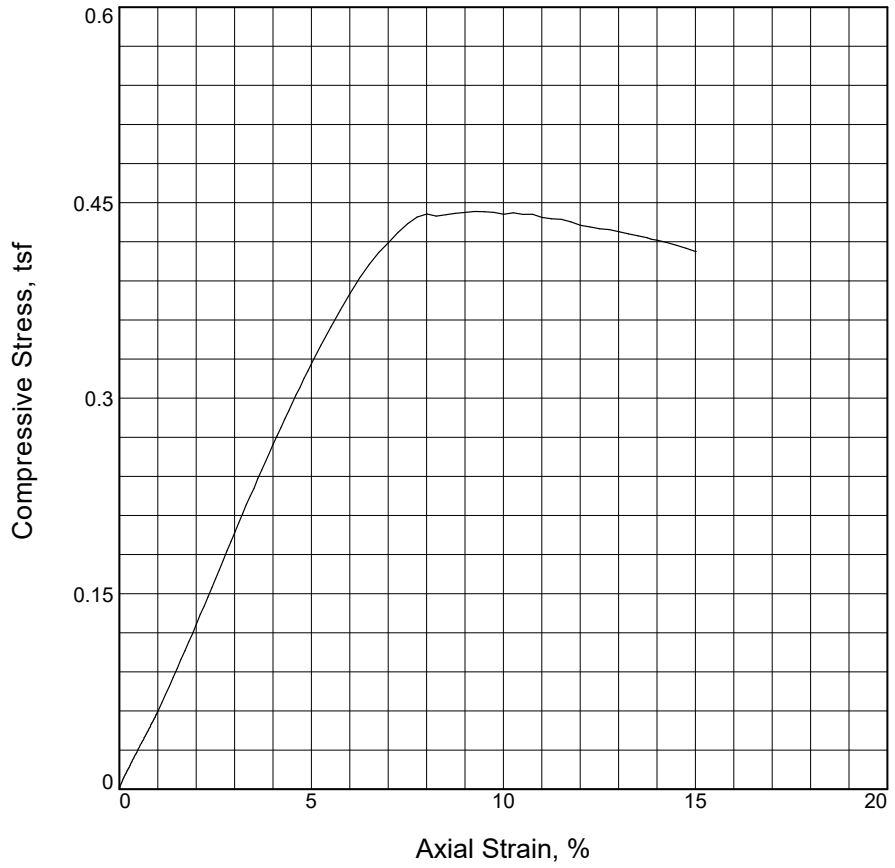
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-25 **Depth:** 12
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.443			
Undrained shear strength, tsf	0.222			
Failure strain, %	9.3			
Strain rate, %/min.	1.00			
Water content, %	31.6			
Wet density, pcf	119.5			
Dry density, pcf	90.8			
Saturation, %	99.6			
Void ratio	0.8573			
Specimen diameter, in.	2.88			
Specimen height, in.	5.68			
Height/diameter ratio	1.97			

Description: Brown FAT CLAY; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

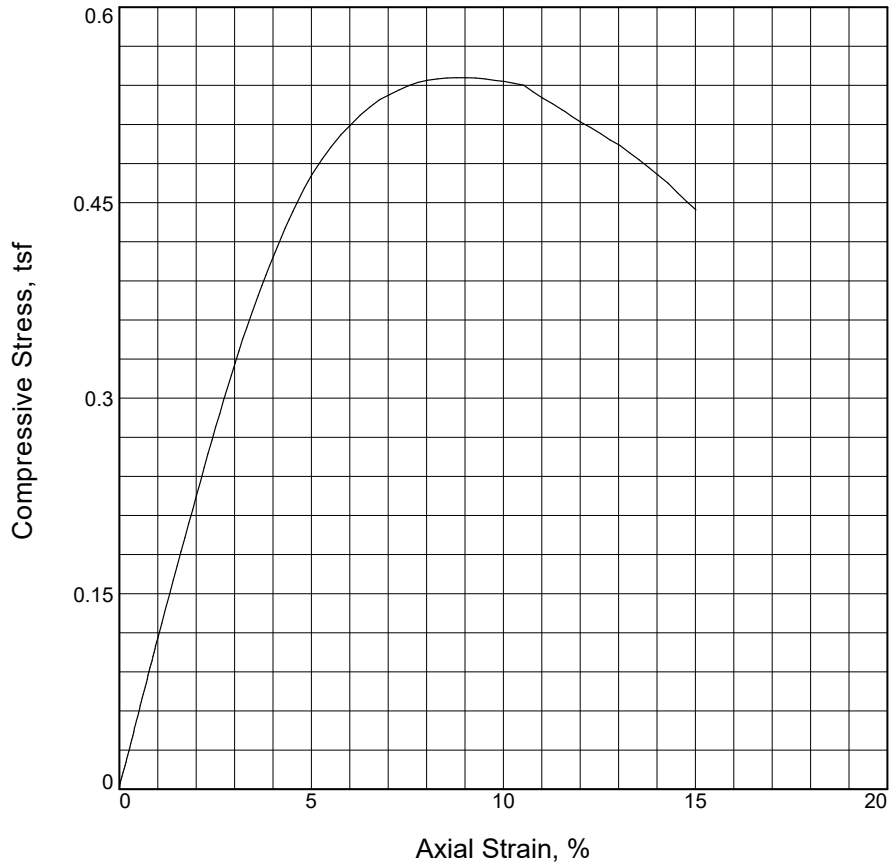
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-26 **Depth:** 22
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.546			
Undrained shear strength, tsf	0.273			
Failure strain, %	8.8			
Strain rate, %/min.	1.00			
Water content, %	29.5			
Wet density, pcf	114.4			
Dry density, pcf	88.3			
Saturation, %	87.7			
Void ratio	0.9079			
Specimen diameter, in.	2.90			
Specimen height, in.	5.77			
Height/diameter ratio	1.99			

Description: Brown FAT CLAY; sand seams

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/23/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

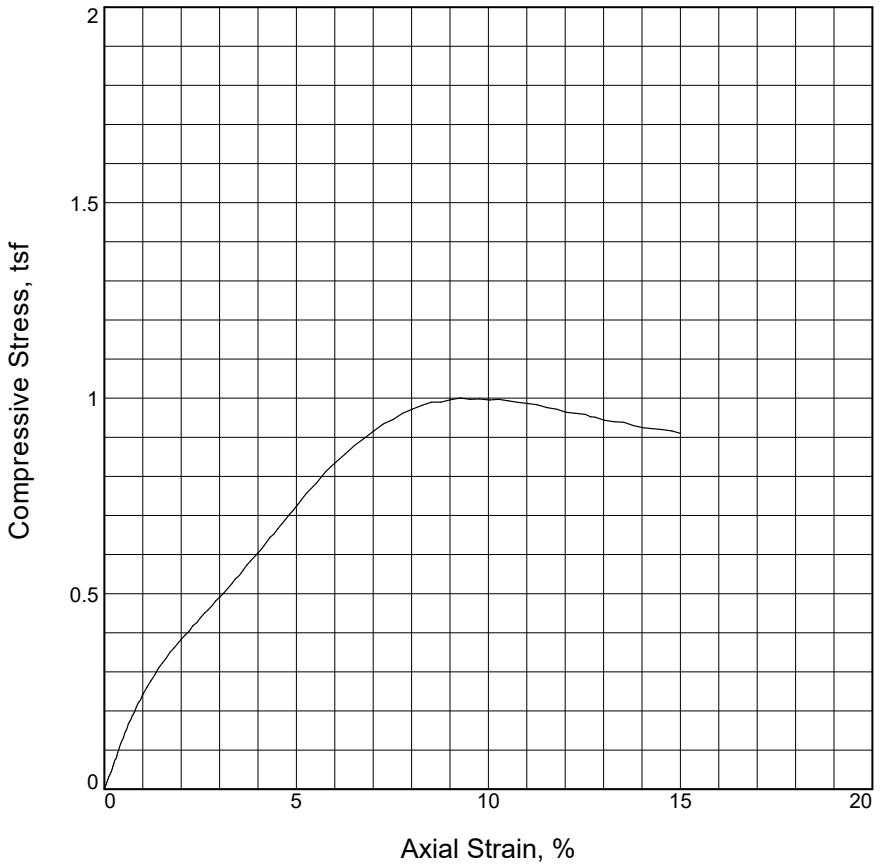
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-26 **Depth:** 30
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.001			
Undrained shear strength, tsf	0.500			
Failure strain, %	9.3			
Strain rate, %/min.	1.00			
Water content, %	30.4			
Wet density, pcf	119.6			
Dry density, pcf	91.7			
Saturation, %	98.1			
Void ratio	0.8380			
Specimen diameter, in.	2.89			
Specimen height, in.	5.72			
Height/diameter ratio	1.98			

Description: Brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

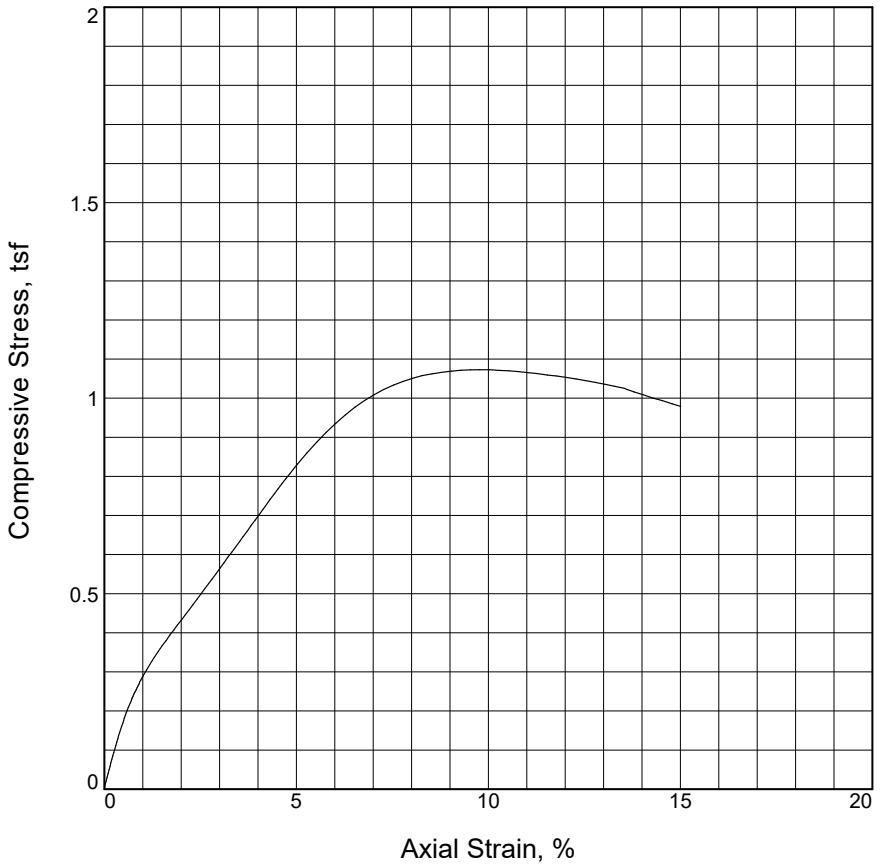
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-26 **Depth:** 38
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.073			
Undrained shear strength, tsf	0.536			
Failure strain, %	10.0			
Strain rate, %/min.	1.00			
Water content, %	31.7			
Wet density, pcf	120.2			
Dry density, pcf	91.3			
Saturation, %	98.9			
Void ratio	0.8810			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Gray and brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

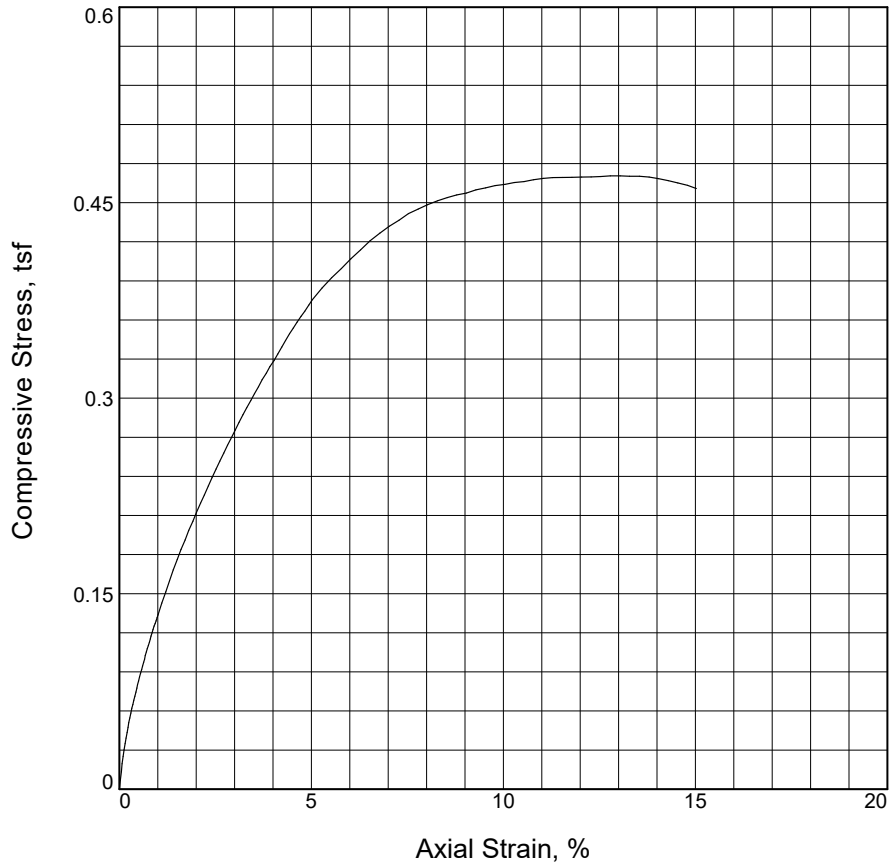
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-26 **Depth:** 45
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.471			
Undrained shear strength, tsf	0.235			
Failure strain, %	12.8			
Strain rate, %/min.	1.00			
Water content, %	45.7			
Wet density, pcf	111.6			
Dry density, pcf	76.6			
Saturation, %	99.8			
Void ratio	1.2809			
Specimen diameter, in.	2.87			
Specimen height, in.	5.71			
Height/diameter ratio	1.99			

Description: Brown FAT CLAY(CH), sand pockets

LL = 58	**PL =** 28	**PI =** 30	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/20/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

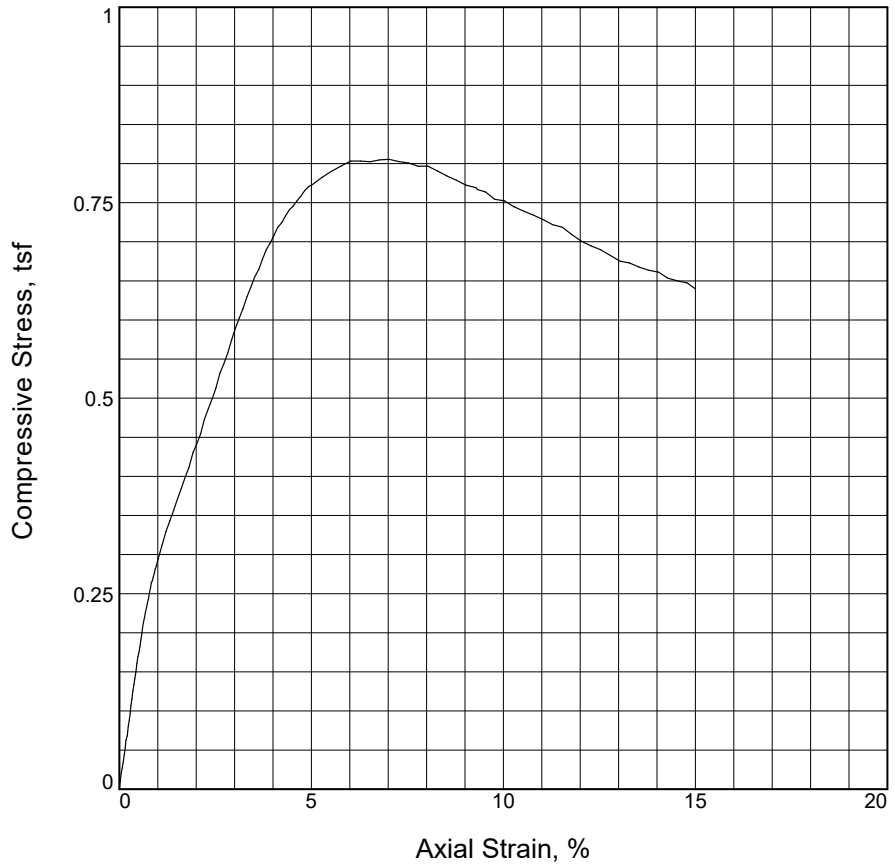
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-27 **Depth:** 24
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.805			
Undrained shear strength, tsf	0.403			
Failure strain, %	7.0			
Strain rate, %/min.	1.00			
Water content, %	36.9			
Wet density, pcf	114.7			
Dry density, pcf	83.8			
Saturation, %	98.4			
Void ratio	1.0123			
Specimen diameter, in.	2.88			
Specimen height, in.	5.73			
Height/diameter ratio	1.99			

Description: Brown FAT CLAY; shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

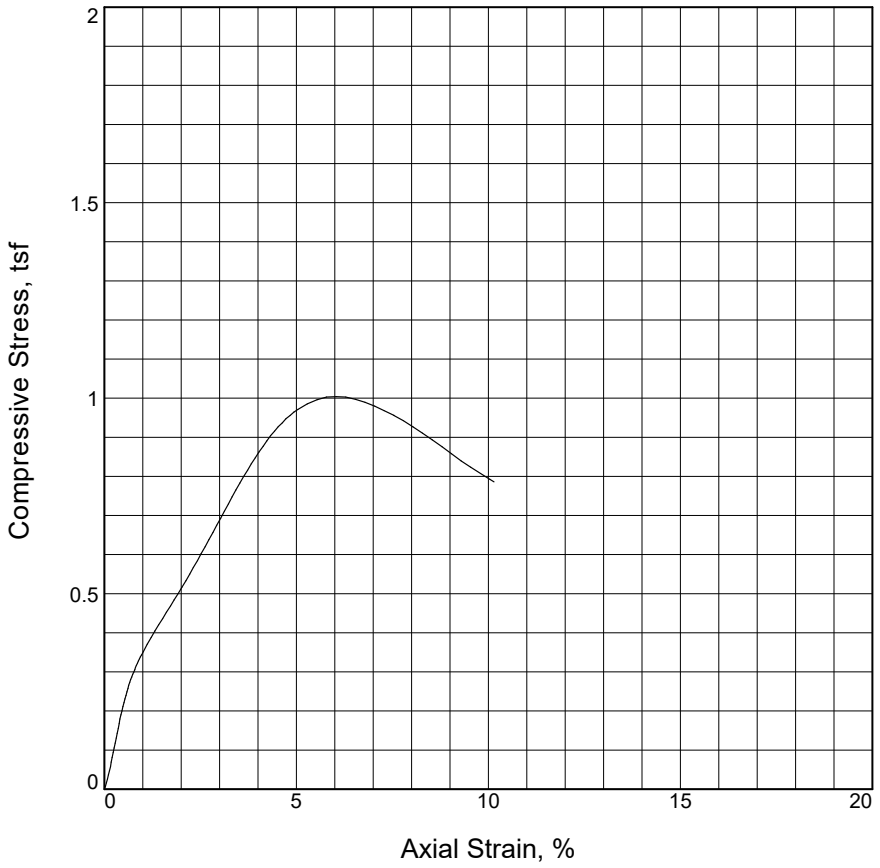
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-27 **Depth:** 32
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.004			
Undrained shear strength, tsf	0.502			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	33.0			
Wet density, pcf	116.0			
Dry density, pcf	87.2			
Saturation, %	95.6			
Void ratio	0.9326			
Specimen diameter, in.	2.87			
Specimen height, in.	5.74			
Height/diameter ratio	2.00			

Description: Brown FAT CLAY; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

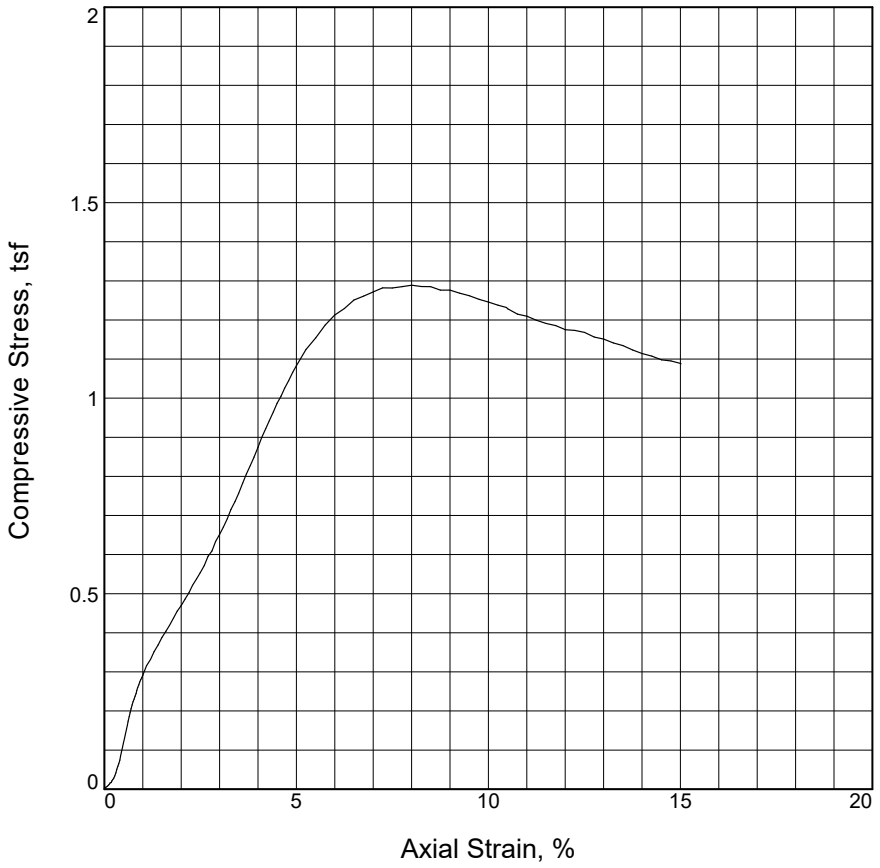
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-27 **Depth:** 38
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.289			
Undrained shear strength, tsf	0.644			
Failure strain, %	8.0			
Strain rate, %/min.	1.00			
Water content, %	34.6			
Wet density, pcf	119.8			
Dry density, pcf	89.0			
Saturation, %	98.8			
Void ratio	0.9992			
Specimen diameter, in.	2.87			
Specimen height, in.	5.75			
Height/diameter ratio	2.00			

Description: Gray FAT CLAY; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

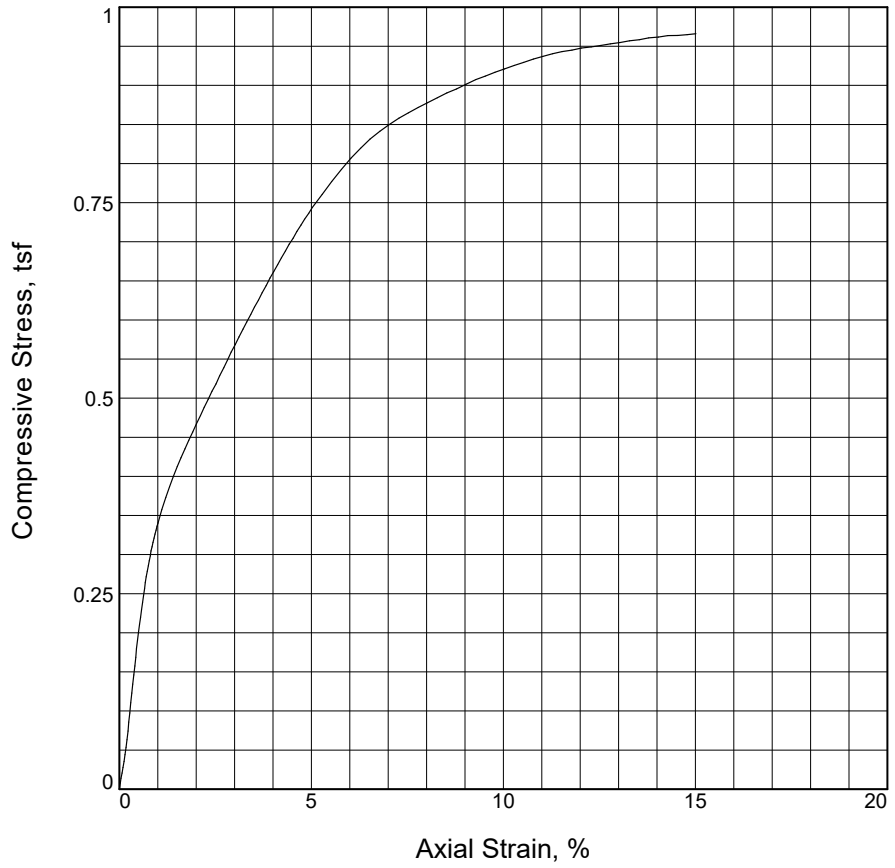
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-27 **Depth:** 44
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.966			
Undrained shear strength, tsf	0.483			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	38.1			
Wet density, pcf	116.3			
Dry density, pcf	84.2			
Saturation, %	99.1			
Void ratio	1.0768			
Specimen diameter, in.	2.87			
Specimen height, in.	5.78			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL = 61	**PL =** 25	**PI =** 36	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/20/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

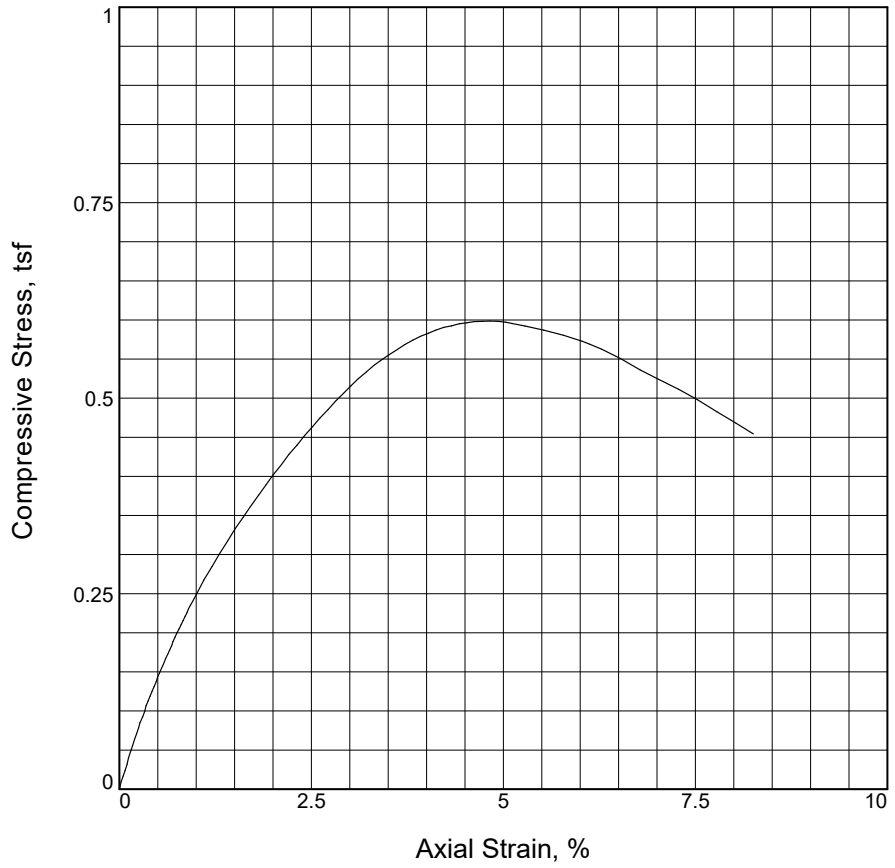
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-27 **Depth:** 48
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.599			
Undrained shear strength, tsf	0.299			
Failure strain, %	4.8			
Strain rate, %/min.	1.00			
Water content, %	29.3			
Wet density, pcf	117.7			
Dry density, pcf	91.0			
Saturation, %	92.8			
Void ratio	0.8520			
Specimen diameter, in.	2.87			
Specimen height, in.	5.79			
Height/diameter ratio	2.02			

Description: Brown FAT CLAY; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

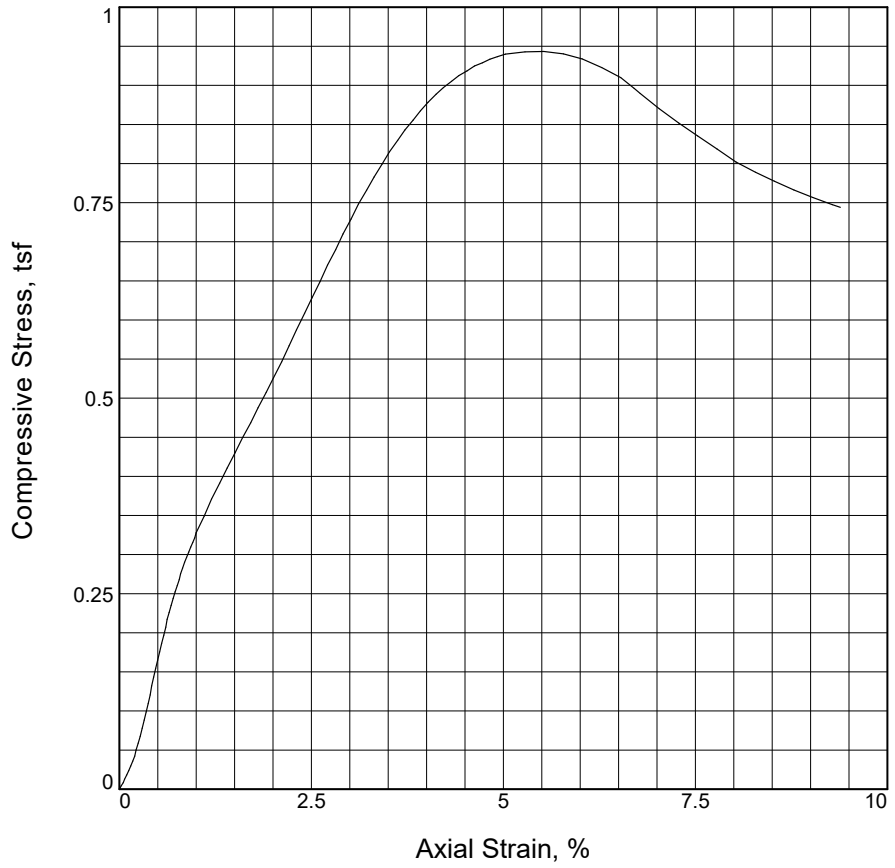
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-28 **Depth:** 22
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.943			
Undrained shear strength, tsf	0.472			
Failure strain, %	5.5			
Strain rate, %/min.	1.00			
Water content, %	35.9			
Wet density, pcf	115.6			
Dry density, pcf	85.1			
Saturation, %	98.9			
Void ratio	0.9811			
Specimen diameter, in.	2.87			
Specimen height, in.	5.74			
Height/diameter ratio	2.00			

Description: Brown FAT CLAY; sand seams

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

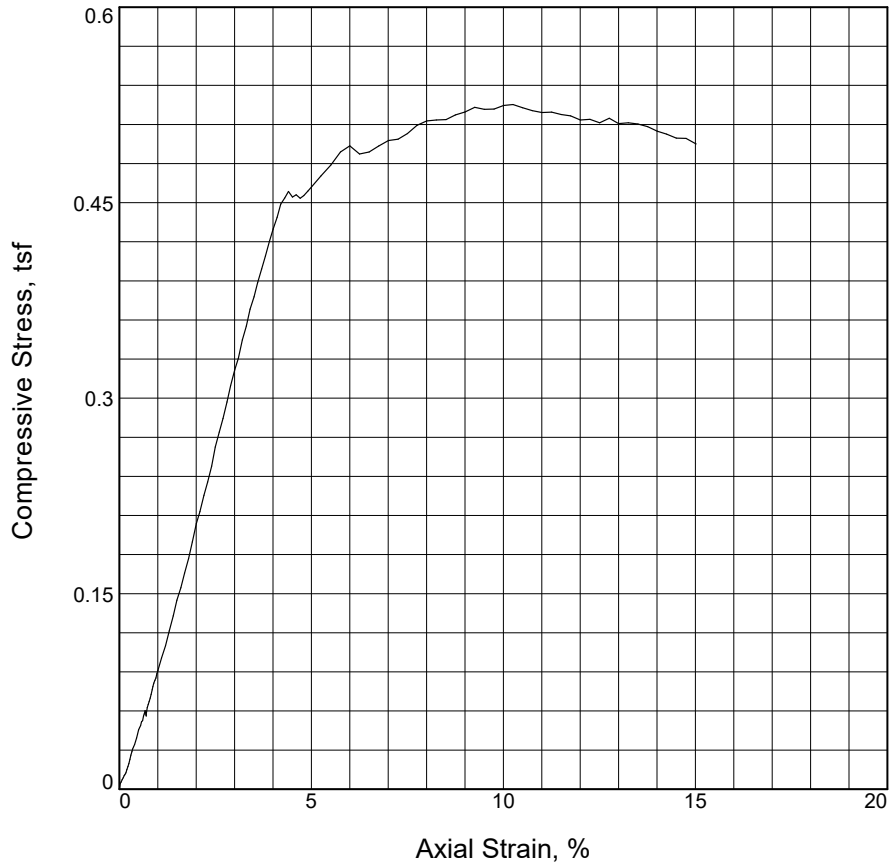
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-28 **Depth:** 30
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.525			
Undrained shear strength, tsf	0.263			
Failure strain, %	10.3			
Strain rate, %/min.	1.00			
Water content, %	31.8			
Wet density, pcf	123.0			
Dry density, pcf	93.3			
Saturation, %	99.9			
Void ratio	0.9070			
Specimen diameter, in.	2.83			
Specimen height, in.	5.73			
Height/diameter ratio	2.03			

Description: Brown FAT CLAY; sand pockets

LL =	**PL =**	**PI =**	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

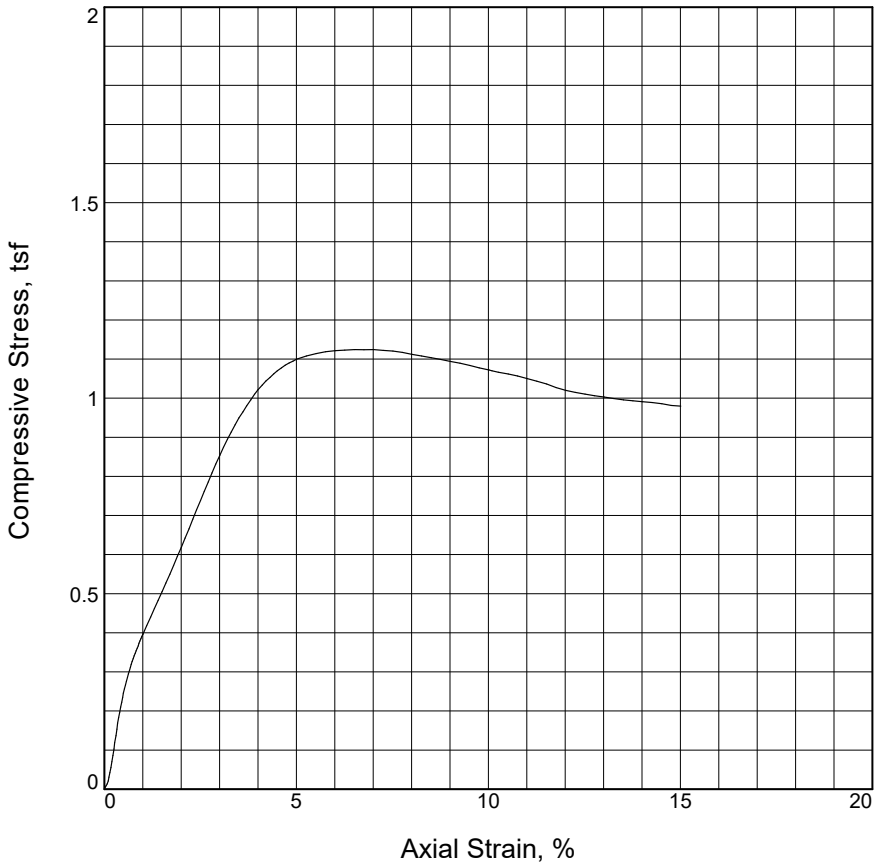
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-28 **Depth:** 36
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.124			
Undrained shear strength, tsf	0.562			
Failure strain, %	6.5			
Strain rate, %/min.	1.00			
Water content, %	34.4			
Wet density, pcf	118.3			
Dry density, pcf	88.1			
Saturation, %	99.5			
Void ratio	0.9496			
Specimen diameter, in.	2.85			
Specimen height, in.	5.77			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/26/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

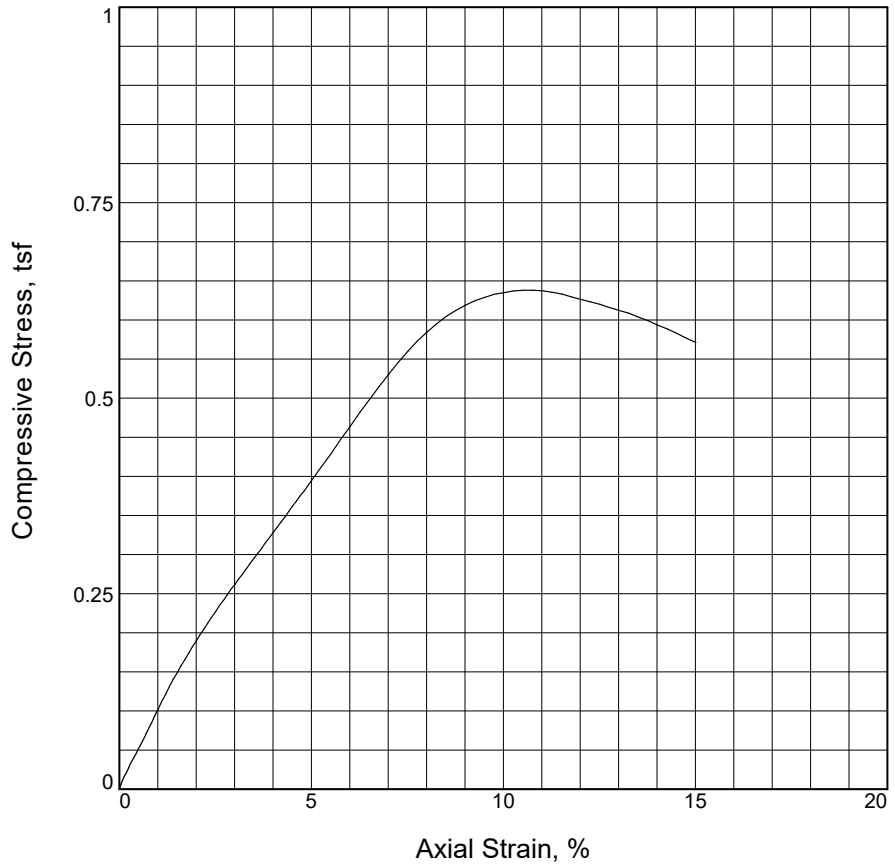
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-28 **Depth:** 46
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.638			
Undrained shear strength, tsf	0.319			
Failure strain, %	10.8			
Strain rate, %/min.	1.00			
Water content, %	31.7			
Wet density, pcf	117.9			
Dry density, pcf	89.5			
Saturation, %	97.0			
Void ratio	0.8824			
Specimen diameter, in.	2.85			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Reddish-brown LEAN CLAY; sand and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

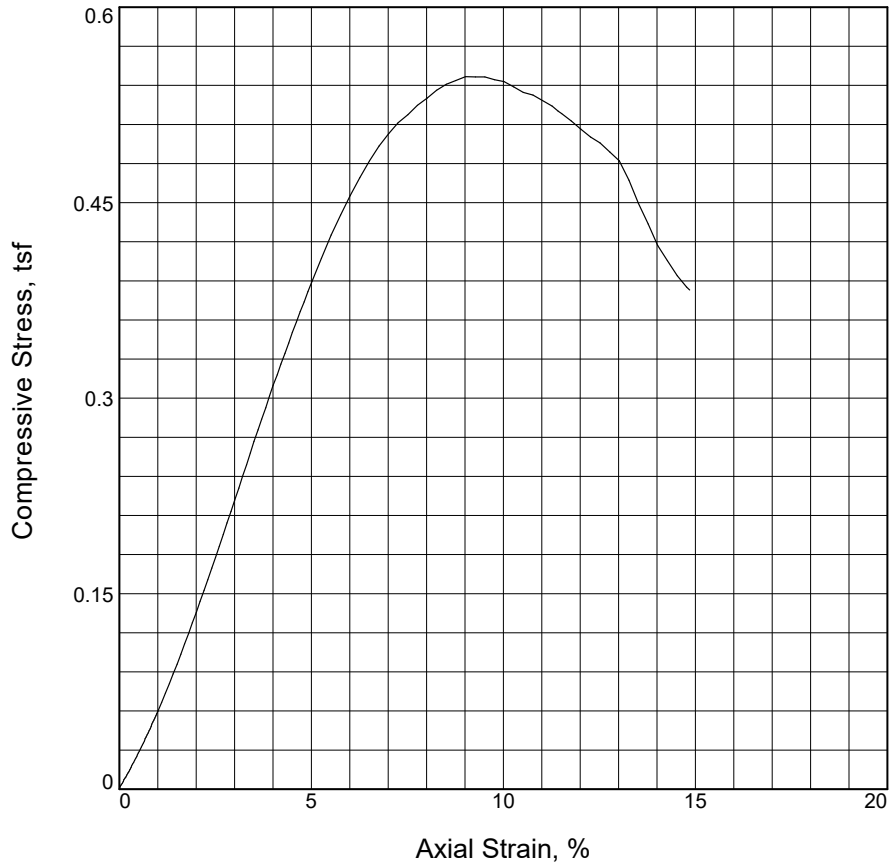
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-29 **Depth:** 28
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.547			
Undrained shear strength, tsf	0.273			
Failure strain, %	9.0			
Strain rate, %/min.	1.00			
Water content, %	27.1			
Wet density, pcf	123.8			
Dry density, pcf	97.4			
Saturation, %	97.9			
Void ratio	0.7627			
Specimen diameter, in.	2.85			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Reddish-brown LEAN CLAY; sand and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

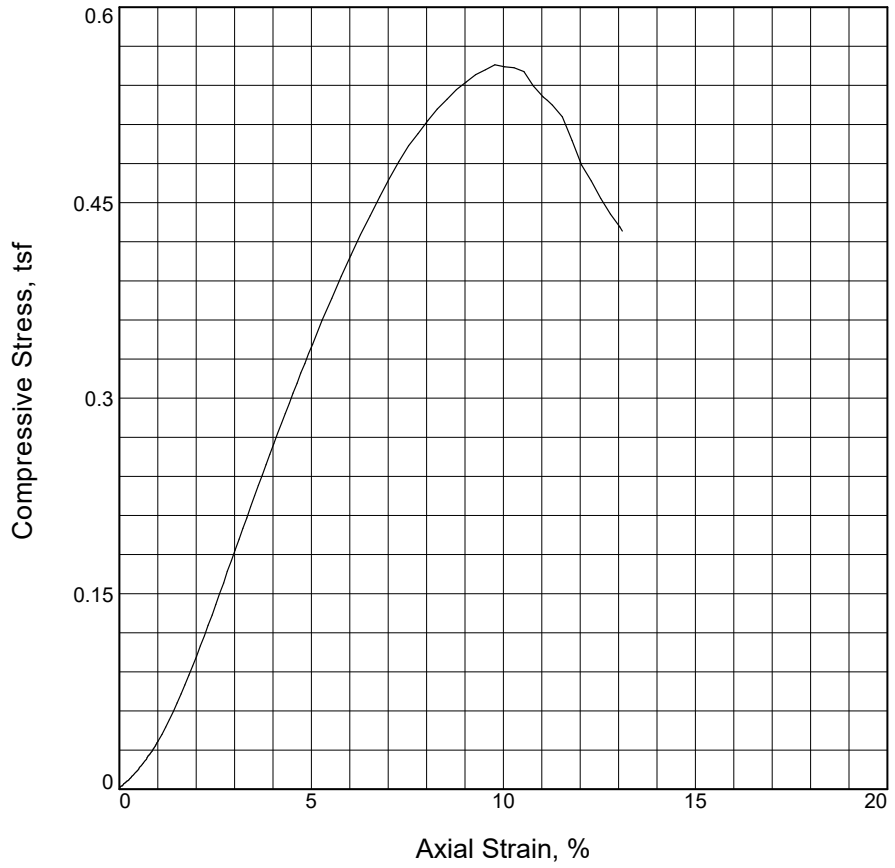
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-29 **Depth:** 30
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.556			
Undrained shear strength, tsf	0.278			
Failure strain, %	9.8			
Strain rate, %/min.	1.00			
Water content, %	27.8			
Wet density, pcf	122.2			
Dry density, pcf	95.6			
Saturation, %	98.5			
Void ratio	0.7627			
Specimen diameter, in.	2.83			
Specimen height, in.	5.72			
Height/diameter ratio	2.02			

Description: Reddish-brown LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

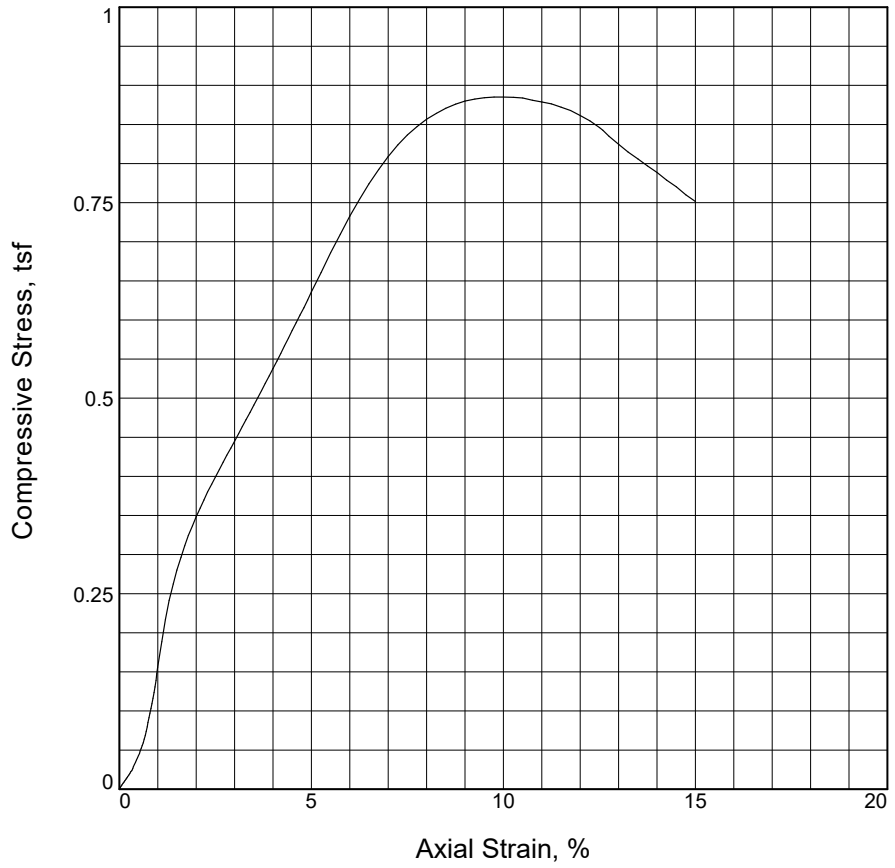
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-29 **Depth:** 34
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.885			
Undrained shear strength, tsf	0.443			
Failure strain, %	10.0			
Strain rate, %/min.	1.00			
Water content, %	39.8			
Wet density, pcf	114.8			
Dry density, pcf	82.2			
Saturation, %	98.7			
Void ratio	1.1277			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Reddish-brown FAT CLAY; shells and gravel

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/24/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

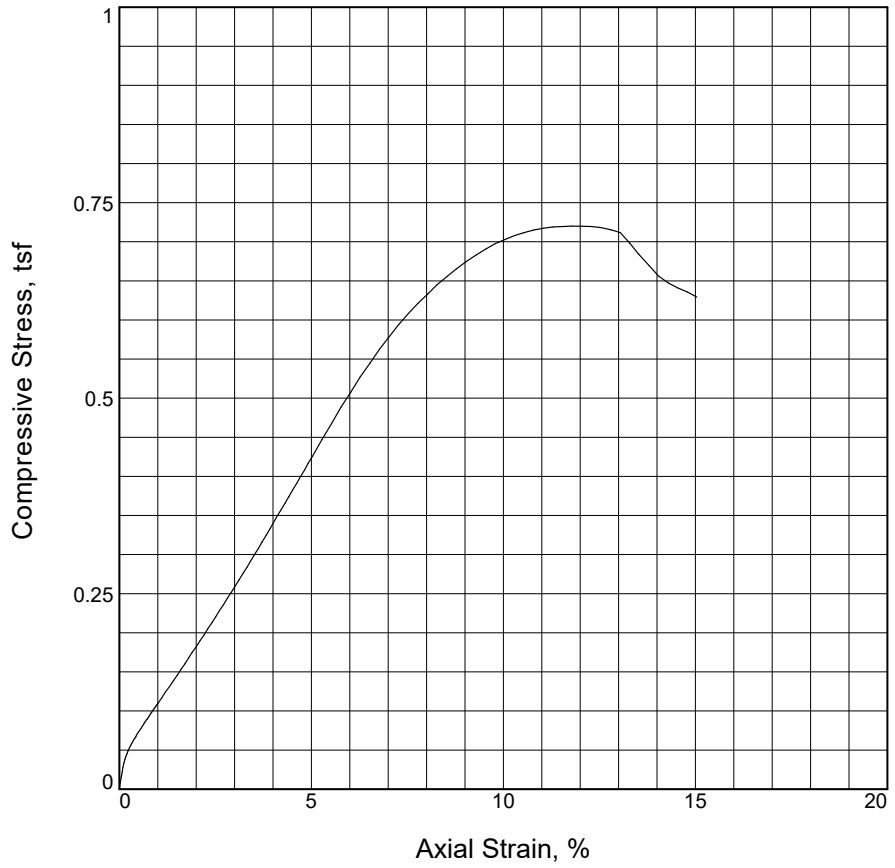
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-29 **Depth:** 38
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.720			
Undrained shear strength, tsf	0.360			
Failure strain, %	11.8			
Strain rate, %/min.	1.00			
Water content, %	29.5			
Wet density, pcf	122.5			
Dry density, pcf	94.6			
Saturation, %	99.5			
Void ratio	0.8147			
Specimen diameter, in.	2.84			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Reddishbrown LEAN CLAY (CL)

LL = 40	**PL =** 20	**PI =** 20	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

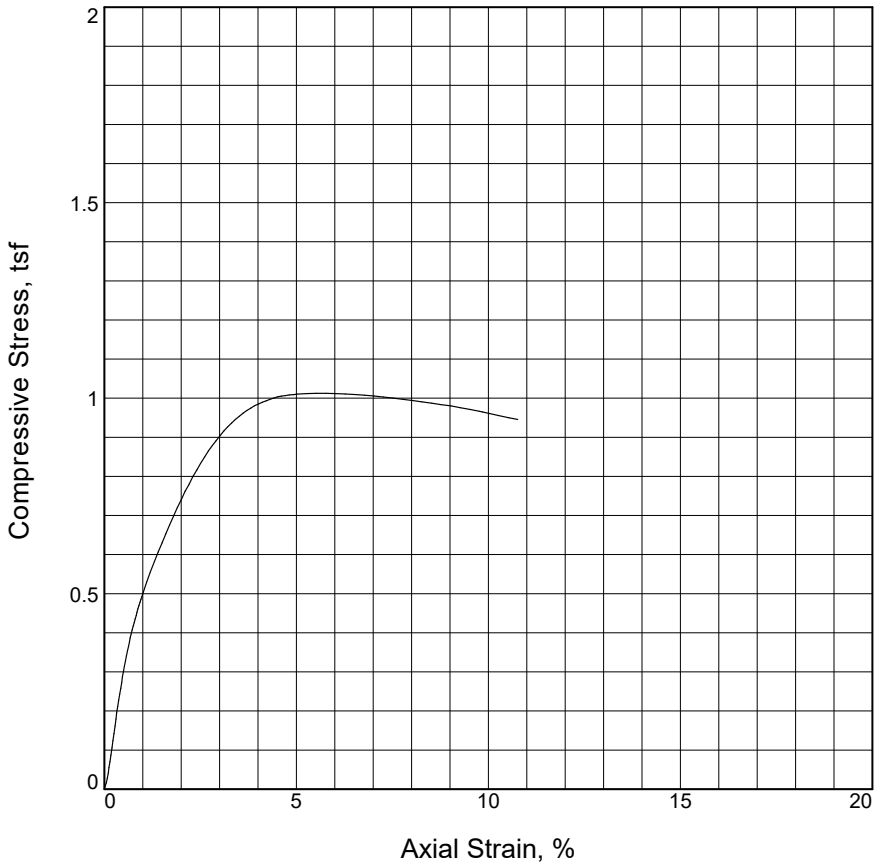
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-30 **Depth:** 26
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.013			
Undrained shear strength, tsf	0.506			
Failure strain, %	5.8			
Strain rate, %/min.	1.00			
Water content, %	37.5			
Wet density, pcf	116.6			
Dry density, pcf	84.8			
Saturation, %	98.8			
Void ratio	1.0614			
Specimen diameter, in.	2.84			
Specimen height, in.	5.92			
Height/diameter ratio	2.08			

Description: Reddish-brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

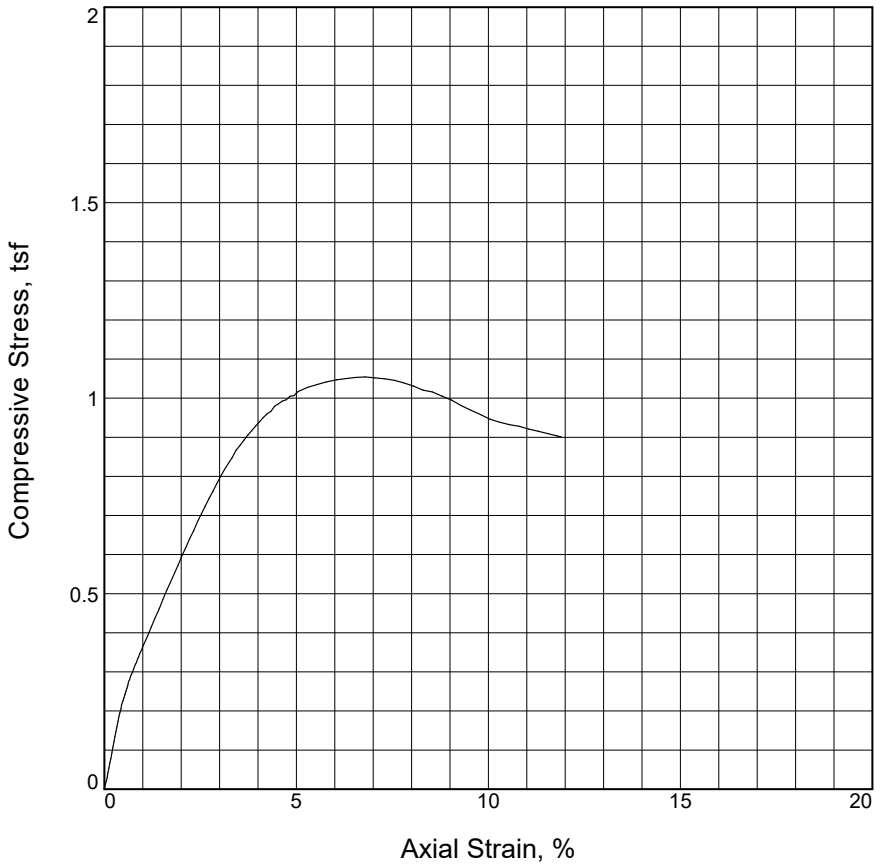
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-30 **Depth:** 32
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.054			
Undrained shear strength, tsf	0.527			
Failure strain, %	6.8			
Strain rate, %/min.	1.00			
Water content, %	35.1			
Wet density, pcf	117.4			
Dry density, pcf	86.9			
Saturation, %	98.9			
Void ratio	0.9749			
Specimen diameter, in.	2.83			
Specimen height, in.	5.88			
Height/diameter ratio	2.08			

Description: Reddish-brown FAT CLAY; sand and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

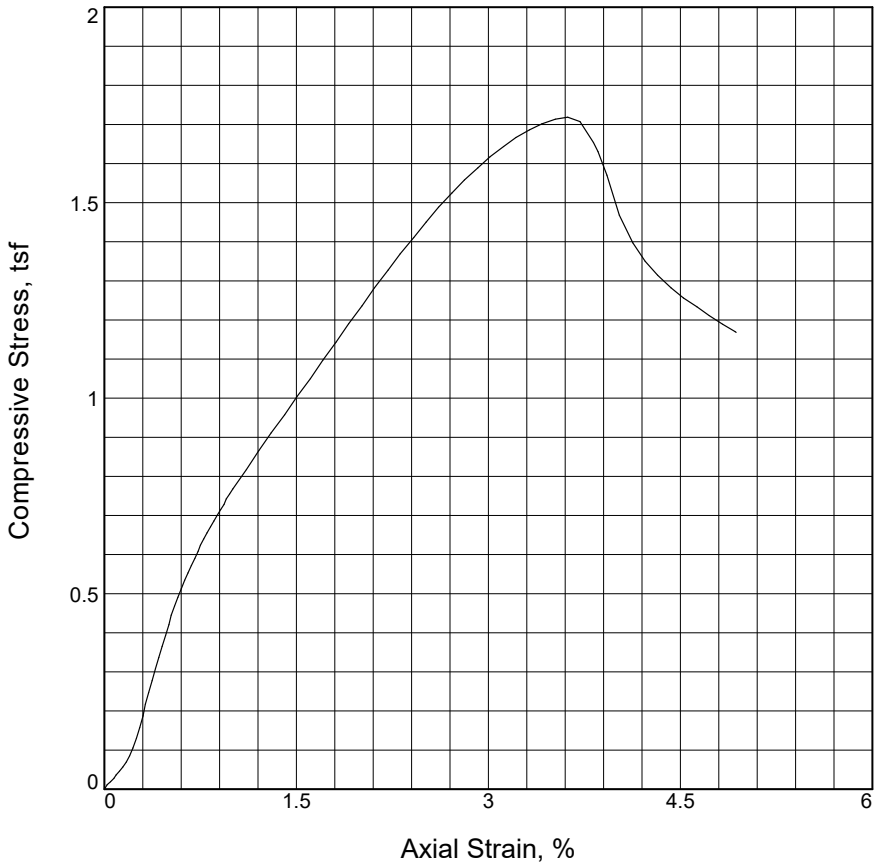
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-30 **Depth:** 38
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.719			
Undrained shear strength, tsf	0.859			
Failure strain, %	3.6			
Strain rate, %/min.	1.00			
Water content, %	48.6			
Wet density, pcf	106.9			
Dry density, pcf	71.9			
Saturation, %	97.7			
Void ratio	1.3434			
Specimen diameter, in.	2.86			
Specimen height, in.	5.91			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

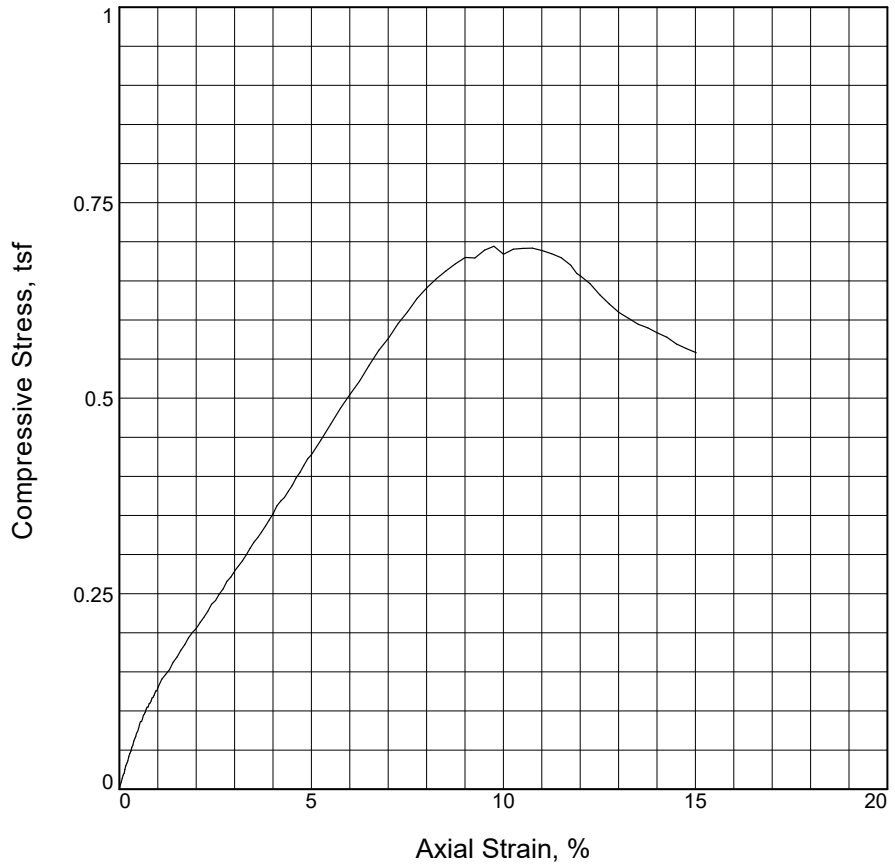
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-30 **Depth:** 44
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.694			
Undrained shear strength, tsf	0.347			
Failure strain, %	9.8			
Strain rate, %/min.	1.00			
Water content, %	32.8			
Wet density, pcf	120.2			
Dry density, pcf	90.5			
Saturation, %	98.5			
Void ratio	0.9312			
Specimen diameter, in.	2.82			
Specimen height, in.	5.85			
Height/diameter ratio	2.08			

Description: Reddish-brown FAT CLAY; sand and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

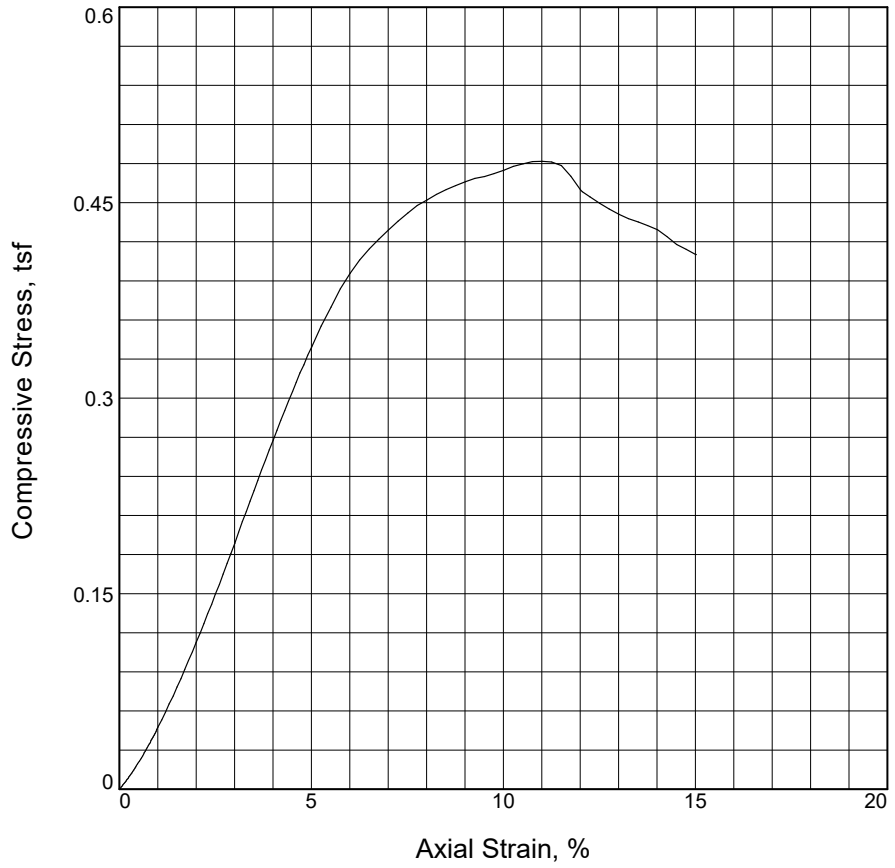
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-31 **Depth:** 26
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.482			
Undrained shear strength, tsf	0.241			
Failure strain, %	11.0			
Strain rate, %/min.	1.00			
Water content, %	30.5			
Wet density, pcf	120.7			
Dry density, pcf	92.5			
Saturation, %	98.0			
Void ratio	0.8551			
Specimen diameter, in.	2.85			
Specimen height, in.	5.77			
Height/diameter ratio	2.03			

Description: Reddish-brown LEAN CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

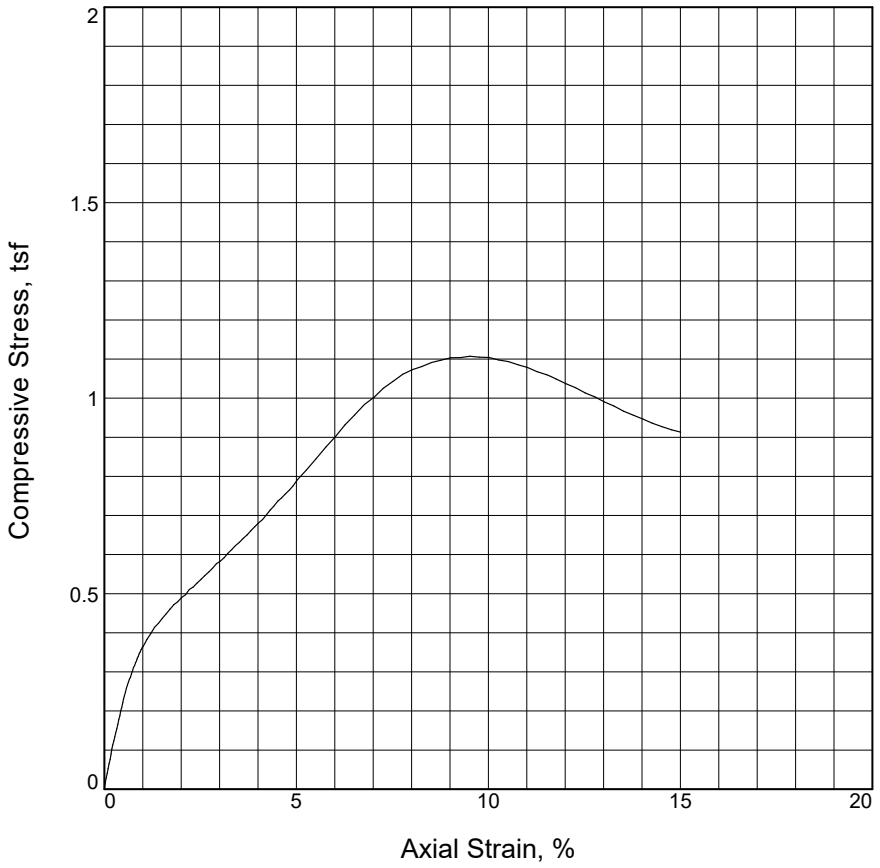
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-31 **Depth:** 32
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.107			
Undrained shear strength, tsf	0.554			
Failure strain, %	9.5			
Strain rate, %/min.	1.00			
Water content, %	37.8			
Wet density, pcf	115.7			
Dry density, pcf	83.9			
Saturation, %	99.5			
Void ratio	1.0453			
Specimen diameter, in.	2.86			
Specimen height, in.	5.90			
Height/diameter ratio	2.06			

Description: Brown LEAN CLAY; sand and shell fragments

LL = 43	**PL =** 21	**PI =** 22	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

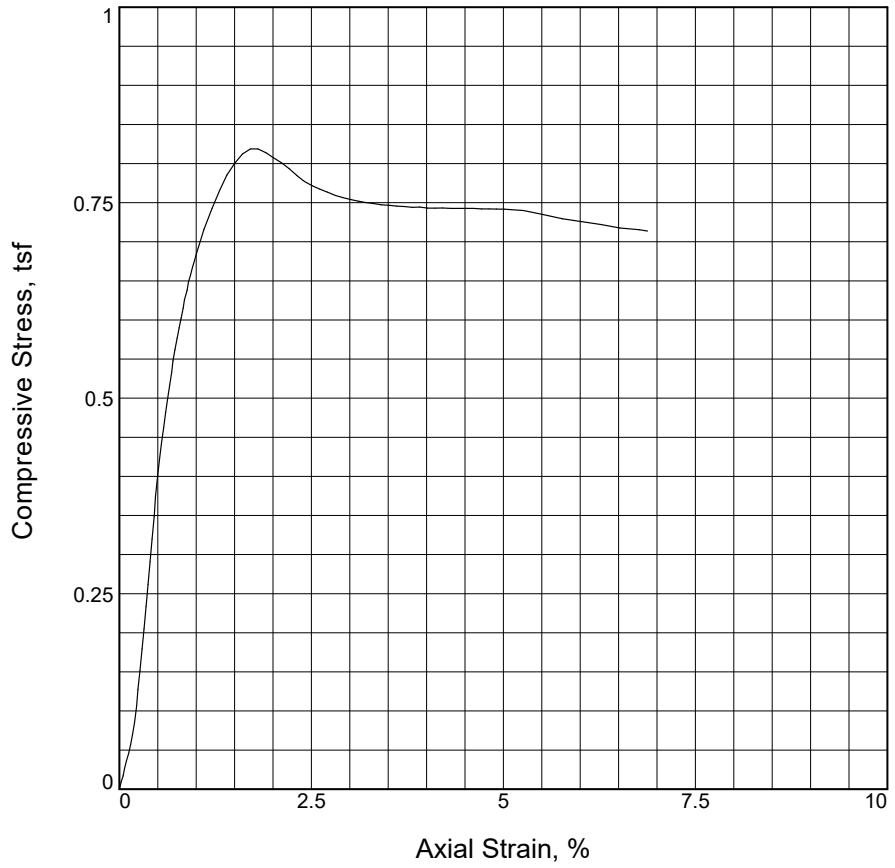
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-31 **Depth:** 42
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.819			
Undrained shear strength, tsf	0.409			
Failure strain, %	1.7			
Strain rate, %/min.	1.00			
Water content, %	55.4			
Wet density, pcf	107.1			
Dry density, pcf	68.9			
Saturation, %	99.8			
Void ratio	1.5817			
Specimen diameter, in.	2.85			
Specimen height, in.	5.90			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY

LL = 88	**PL =** 36	**PI =** 52	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/25/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

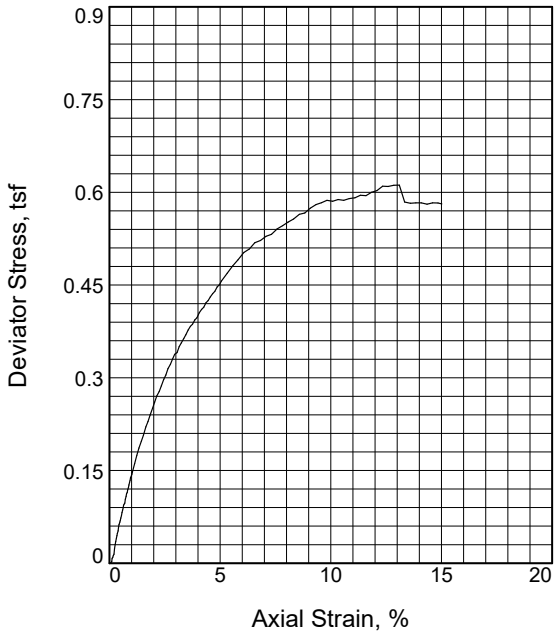
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-31 **Depth:** 50
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	31.3
	Dry Density, pcf	90.5
	Saturation, %	98.2
	Void Ratio	0.8618
	Diameter, in.	2.88
	Height, in.	5.85
At Test	Water Content, %	31.6
	Dry Density, pcf	90.5
	Saturation, %	99.0
	Void Ratio	0.8618
	Diameter, in.	2.88
	Height, in.	5.85
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		7.00
Fail. Stress, tsf		0.61
Strain, %		13.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.12
σ_3 Failure, tsf		0.50

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown and gray FAT CLAY; sand seams

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

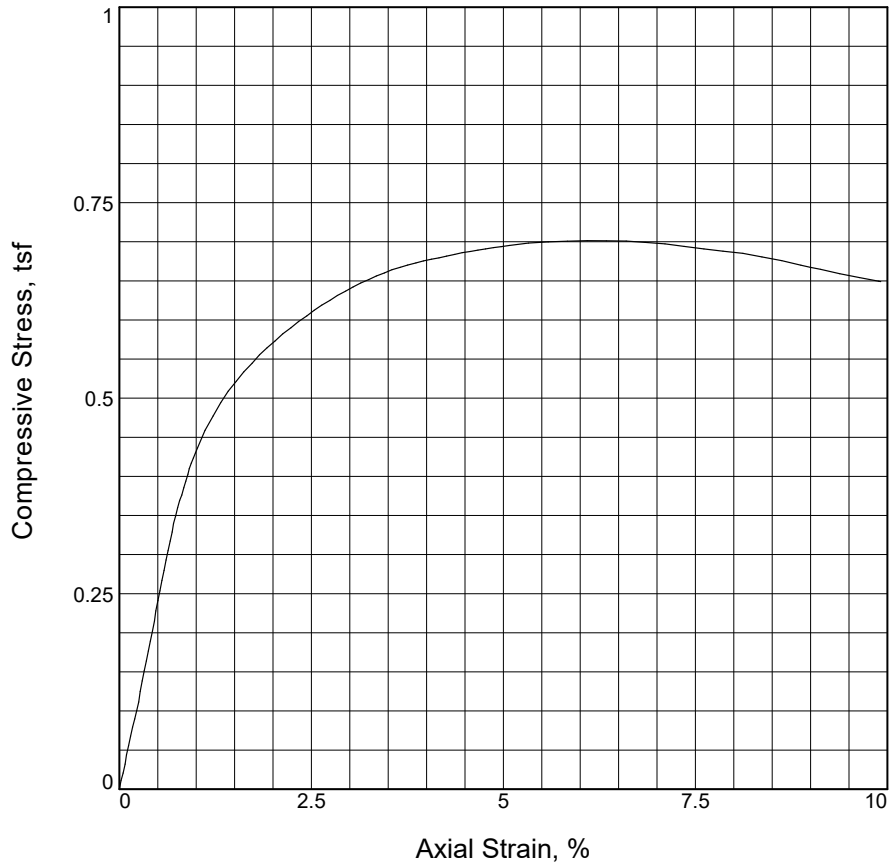
Source of Sample: CB-32 **Depth:** 18

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 7/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.701			
Undrained shear strength, tsf	0.351			
Failure strain, %	6.1			
Strain rate, %/min.	1.00			
Water content, %	34.1			
Wet density, pcf	118.6			
Dry density, pcf	88.4			
Saturation, %	99.6			
Void ratio	0.9417			
Specimen diameter, in.	2.90			
Specimen height, in.	5.86			
Height/diameter ratio	2.02			

Description: Reddish-brown LEAN CLAY; sand pockets and shell fragments

LL = 42	**PL =** 20	**PI =** 22	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: 45 degree

Figure _____

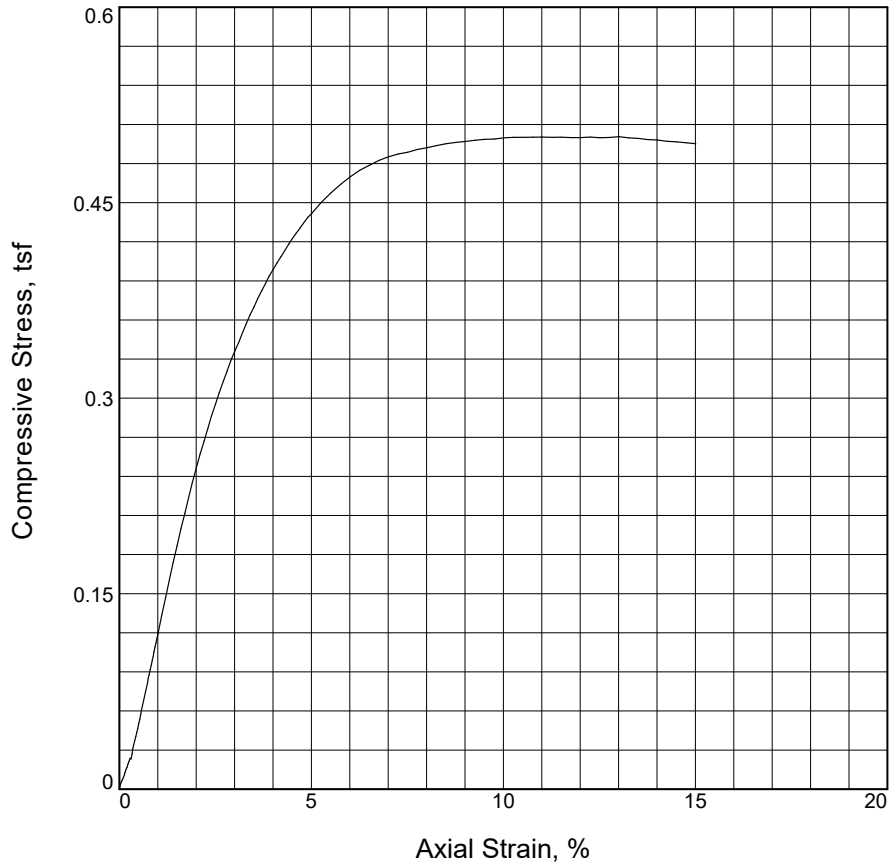
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-32 **Depth:** 28
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.501			
Undrained shear strength, tsf	0.250			
Failure strain, %	13.0			
Strain rate, %/min.	1.00			
Water content, %	30.9			
Wet density, pcf	118.3			
Dry density, pcf	90.4			
Saturation, %	96.4			
Void ratio	0.8649			
Specimen diameter, in.	2.85			
Specimen height, in.	5.92			
Height/diameter ratio	2.08			

Description: Reddish-brown and gray FAT CLAY; sand pockets and seams

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

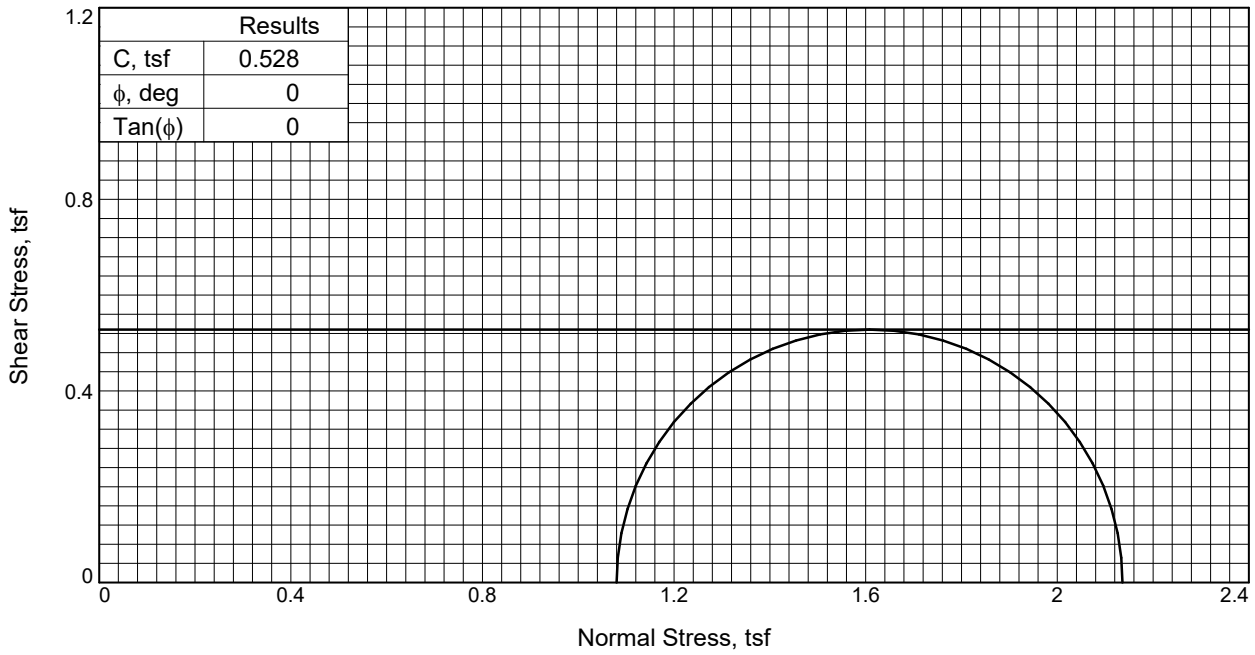
Figure _____

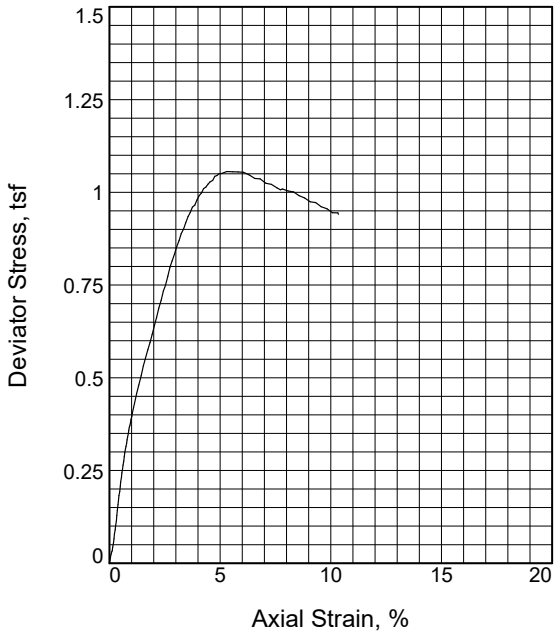
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-33 **Depth:** 32
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	36.3
	Dry Density, pcf	85.1
	Saturation, %	99.8
	Void Ratio	0.9814
	Diameter, in.	2.86
	Height, in.	5.90
At Test	Water Content, %	33.2
	Dry Density, pcf	85.1
	Saturation, %	91.2
	Void Ratio	0.9814
	Diameter, in.	2.86
	Height, in.	5.90
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		15.00
Fail. Stress, tsf		1.06
Strain, %		5.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.14
σ_3 Failure, tsf		1.08

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray and brown FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: 60 degree

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

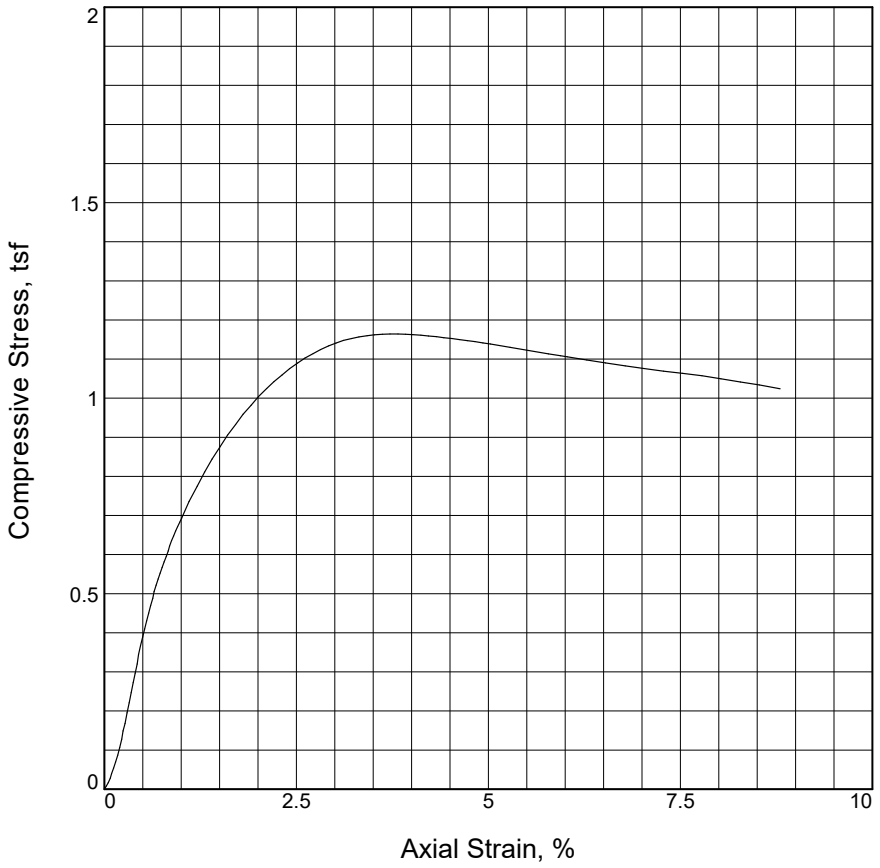
Source of Sample: CB-33 **Depth:** 38

Sample Number: ST-10

Proj. No.: 21.14.223 **Date Sampled:** 7/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.164			
Undrained shear strength, tsf	0.582			
Failure strain, %	3.7			
Strain rate, %/min.	1.00			
Water content, %	38.2			
Wet density, pcf	113.7			
Dry density, pcf	82.3			
Saturation, %	98.5			
Void ratio	1.0482			
Specimen diameter, in.	2.85			
Specimen height, in.	5.93			
Height/diameter ratio	2.08			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

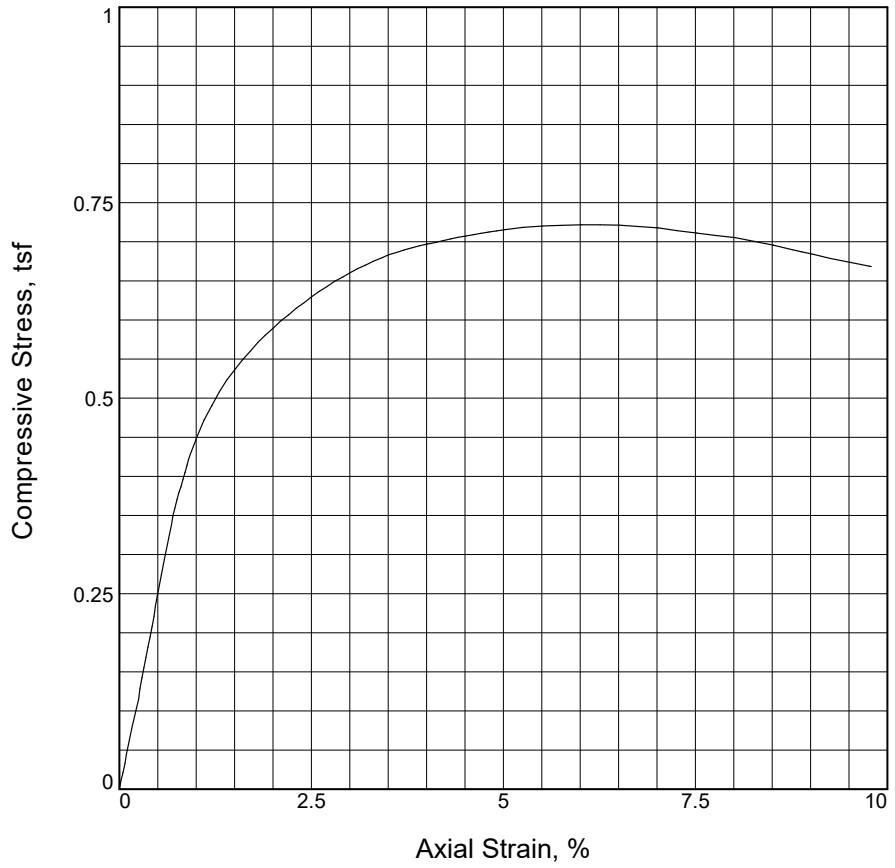
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-33 **Depth:** 44
Sample Number: ST-13

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.722			
Undrained shear strength, tsf	0.361			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	52.3			
Wet density, pcf	106.4			
Dry density, pcf	69.8			
Saturation, %	99.9			
Void ratio	1.4134			
Specimen diameter, in.	2.86			
Specimen height, in.	5.93			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY; shell fragments

LL = 90	**PL =** 35	**PI =** 55	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

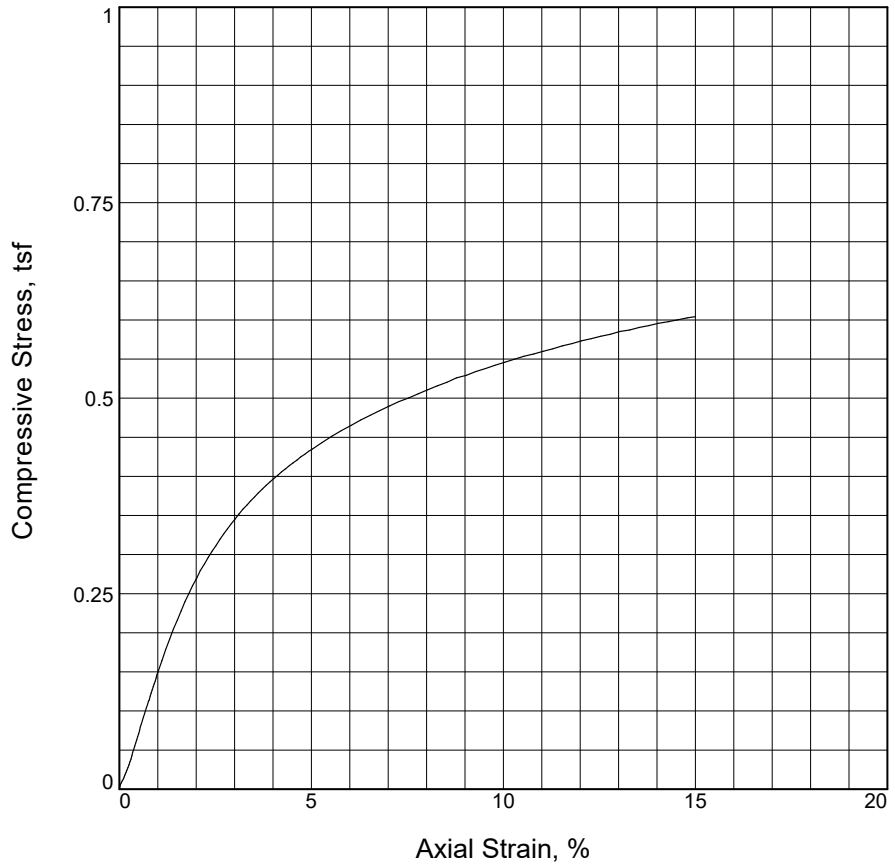
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-33 **Depth:** 50
Sample Number: ST-16

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.604			
Undrained shear strength, tsf	0.302			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	35.0			
Wet density, pcf	118.3			
Dry density, pcf	87.6			
Saturation, %	98.4			
Void ratio	0.9945			
Specimen diameter, in.	2.79			
Specimen height, in.	5.92			
Height/diameter ratio	2.12			

Description: Gray LEAN CLAY; sand pockets

LL = 46	**PL =** 19	**PI =** 27	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

Figure _____

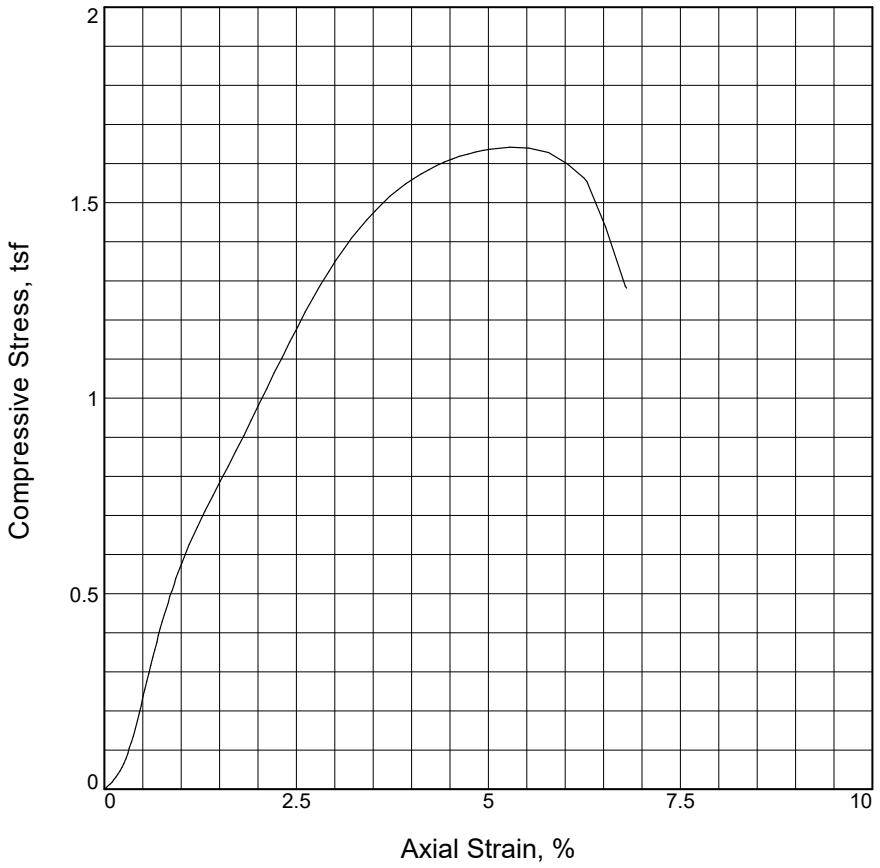
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-34 **Depth:** 35
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.642			
Undrained shear strength, tsf	0.821			
Failure strain, %	5.3			
Strain rate, %/min.	1.00			
Water content, %	43.1			
Wet density, pcf	110.0			
Dry density, pcf	76.9			
Saturation, %	97.6			
Void ratio	1.1916			
Specimen diameter, in.	2.88			
Specimen height, in.	5.90			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY; shell fragments

LL = 72	**PL =** 27	**PI =** 45	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/29/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

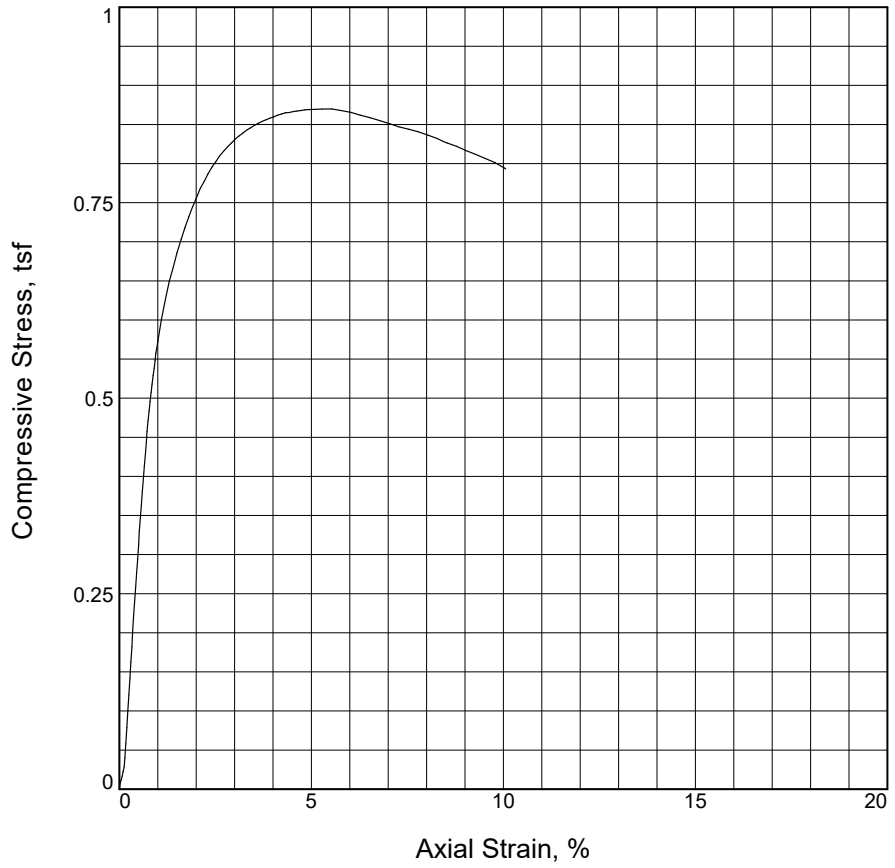
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-34 **Depth:** 42.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.870			
Undrained shear strength, tsf	0.435			
Failure strain, %	5.5			
Strain rate, %/min.	1.00			
Water content, %	52.2			
Wet density, pcf	104.2			
Dry density, pcf	68.5			
Saturation, %	96.4			
Void ratio	1.4614			
Specimen diameter, in.	2.88			
Specimen height, in.	5.94			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY; shell fragments

LL = 91	**PL =** 30	**PI =** 61	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

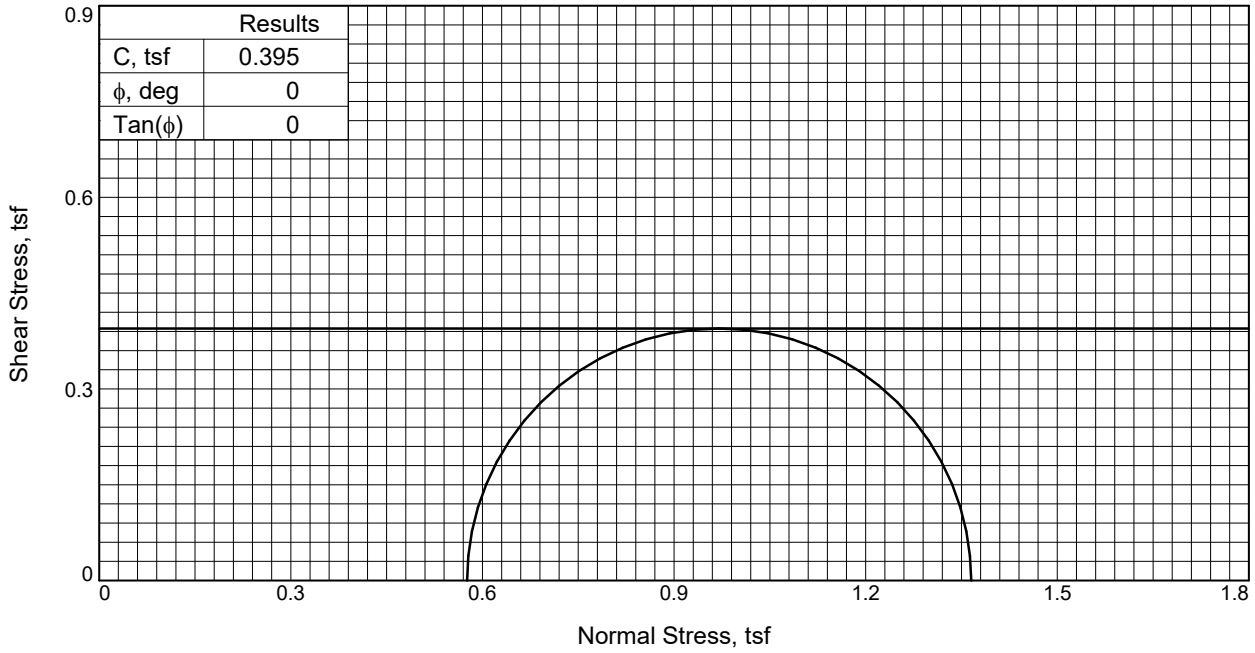
Figure _____

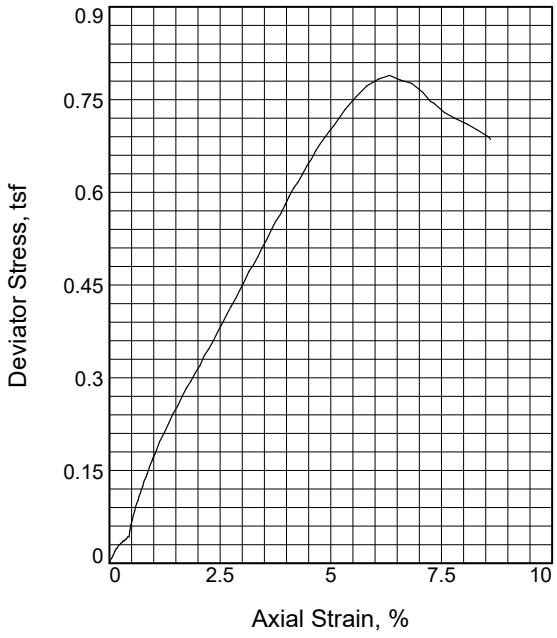
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-34 **Depth:** 47.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	37.6
	Dry Density, pcf	82.3
	Saturation, %	96.7
	Void Ratio	1.0488
	Diameter, in.	2.89
	Height, in.	5.92
At Test	Water Content, %	36.2
	Dry Density, pcf	82.3
	Saturation, %	93.3
	Void Ratio	1.0488
	Diameter, in.	2.89
	Height, in.	5.92
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		0.79
Strain, %		6.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.37
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Brown FAT CLAY (CH)

LL= 73 **PL=** 34 **PI=** 39

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

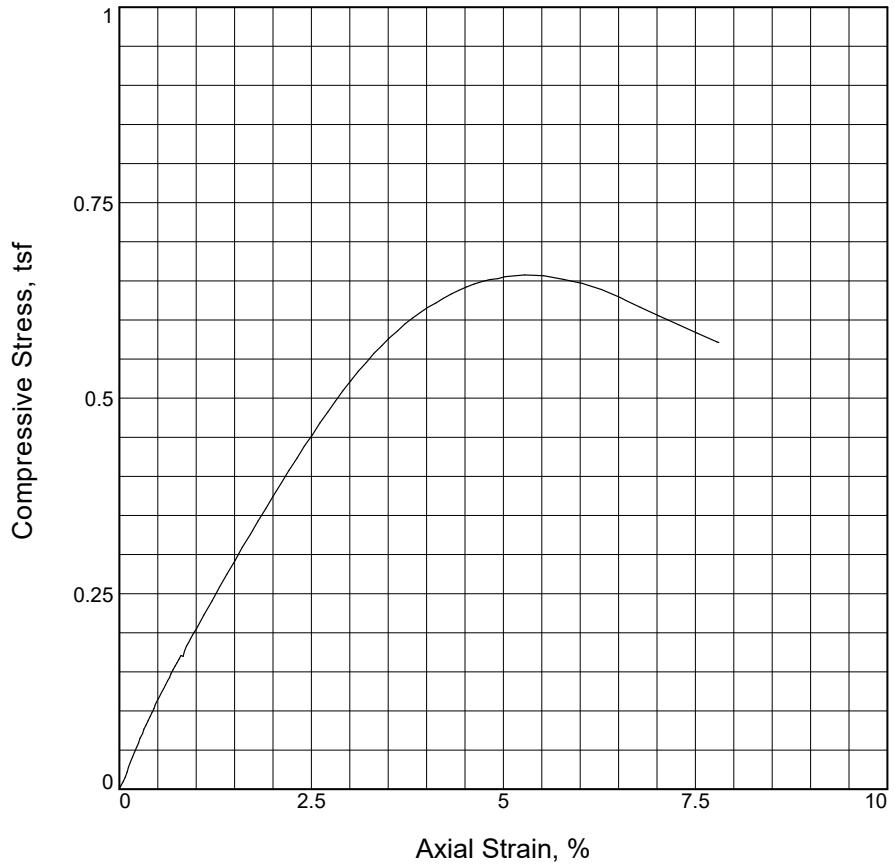
Source of Sample: CB-35 **Depth:** 20

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 7/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.658			
Undrained shear strength, tsf	0.329			
Failure strain, %	5.3			
Strain rate, %/min.	1.00			
Water content, %	33.7			
Wet density, pcf	117.8			
Dry density, pcf	88.1			
Saturation, %	99.8			
Void ratio	0.9133			
Specimen diameter, in.	2.89			
Specimen height, in.	5.88			
Height/diameter ratio	2.04			

Description: Tan and brown FAT CLAY with SAND; shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

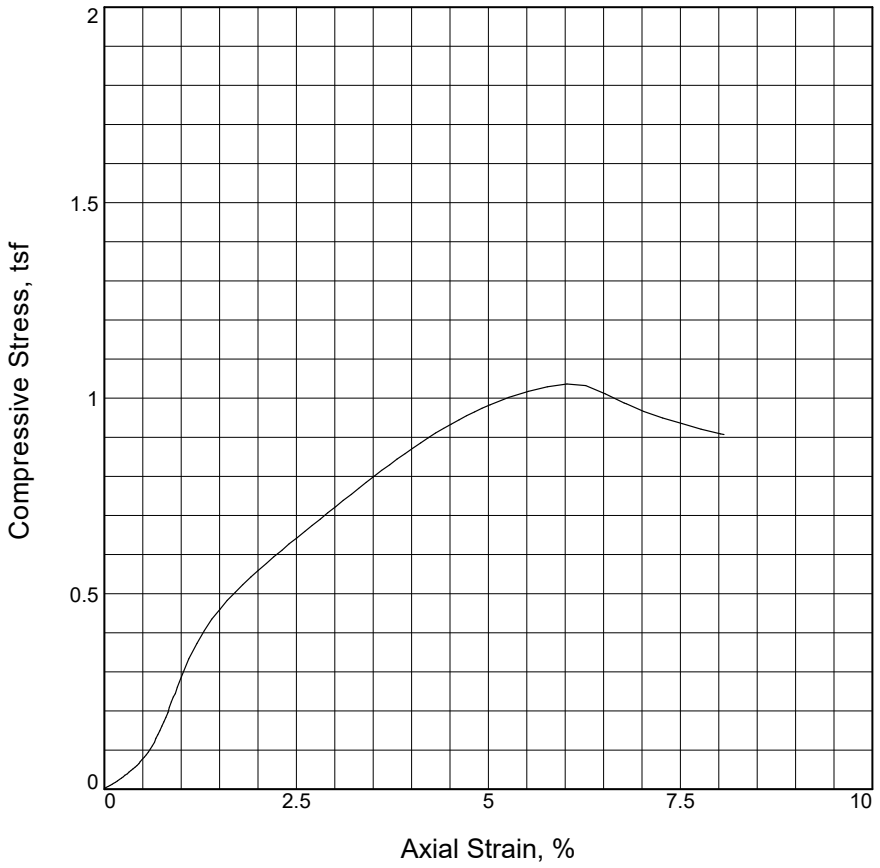
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-35 **Depth:** 25
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.036			
Undrained shear strength, tsf	0.518			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	39.2			
Wet density, pcf	111.2			
Dry density, pcf	79.9			
Saturation, %	95.4			
Void ratio	1.1097			
Specimen diameter, in.	2.88			
Specimen height, in.	5.87			
Height/diameter ratio	2.04			

Description: Gray FAT CLAY; sand seams and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

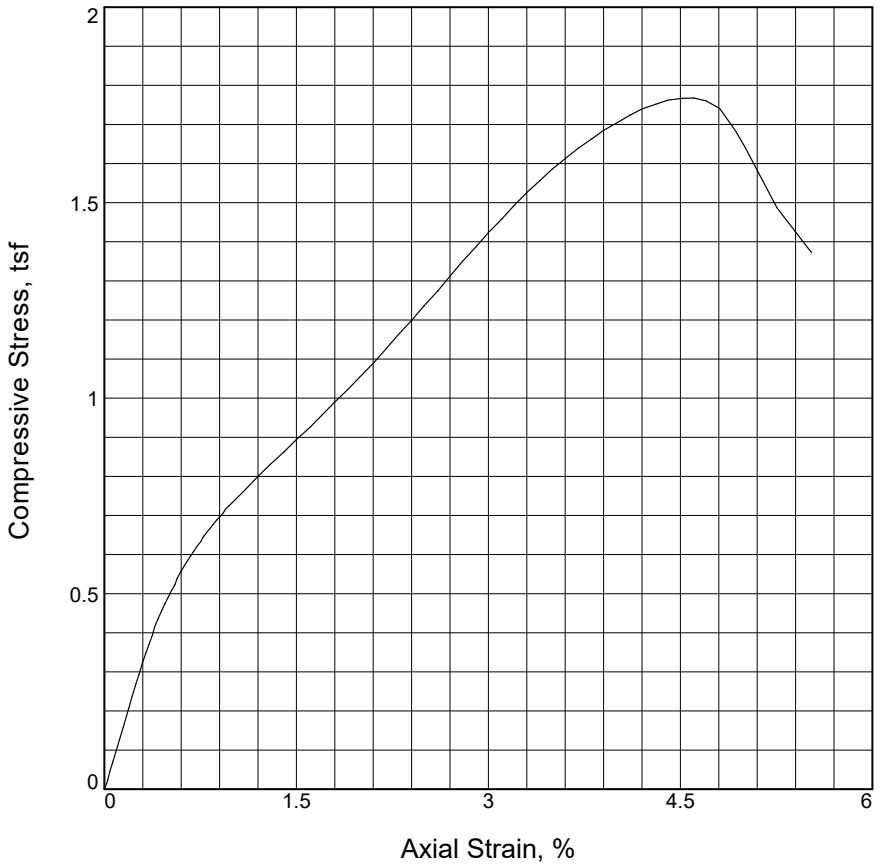
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-35 **Depth:** 29.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.768			
Undrained shear strength, tsf	0.884			
Failure strain, %	4.6			
Strain rate, %/min.	1.00			
Water content, %	45.6			
Wet density, pcf	106.3			
Dry density, pcf	73.0			
Saturation, %	94.1			
Void ratio	1.3076			
Specimen diameter, in.	2.88			
Specimen height, in.	5.95			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

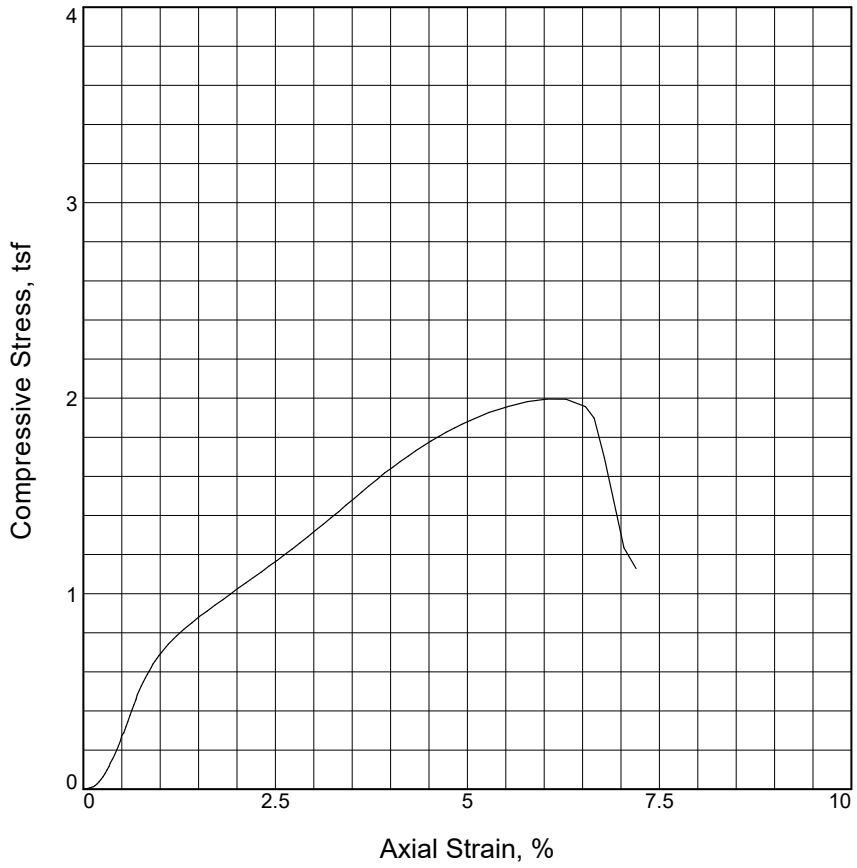
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-35 **Depth:** 44.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.996			
Undrained shear strength, tsf	0.998			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	49.1			
Wet density, pcf	106.9			
Dry density, pcf	71.7			
Saturation, %	98.1			
Void ratio	1.3502			
Specimen diameter, in.	2.88			
Specimen height, in.	5.89			
Height/diameter ratio	2.04			

Description: Gray FAT CLAY

LL = 90	**PL =** 35	**PI =** 55	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

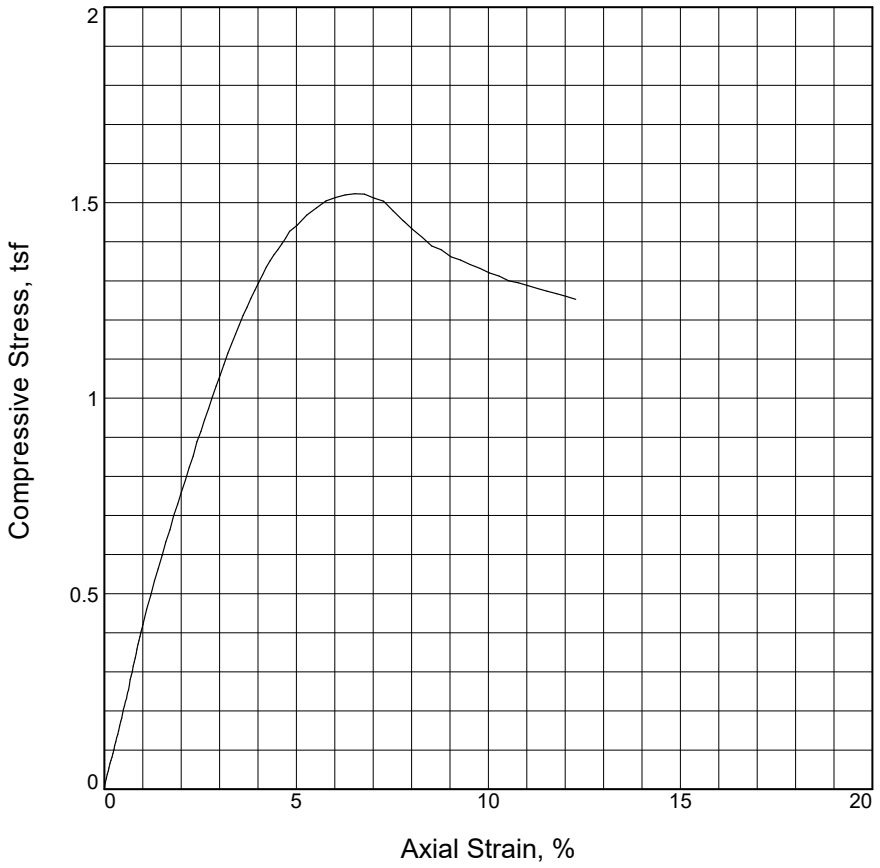
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-35 **Depth:** 52
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.523			
Undrained shear strength, tsf	0.761			
Failure strain, %	6.5			
Strain rate, %/min.	1.00			
Water content, %	36.2			
Wet density, pcf	117.6			
Dry density, pcf	86.3			
Saturation, %	99.0			
Void ratio	1.0246			
Specimen diameter, in.	2.83			
Specimen height, in.	5.88			
Height/diameter ratio	2.08			

Description: Gray FAT CLAY (CH)

LL = 55	**PL =** 22	**PI =** 33	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

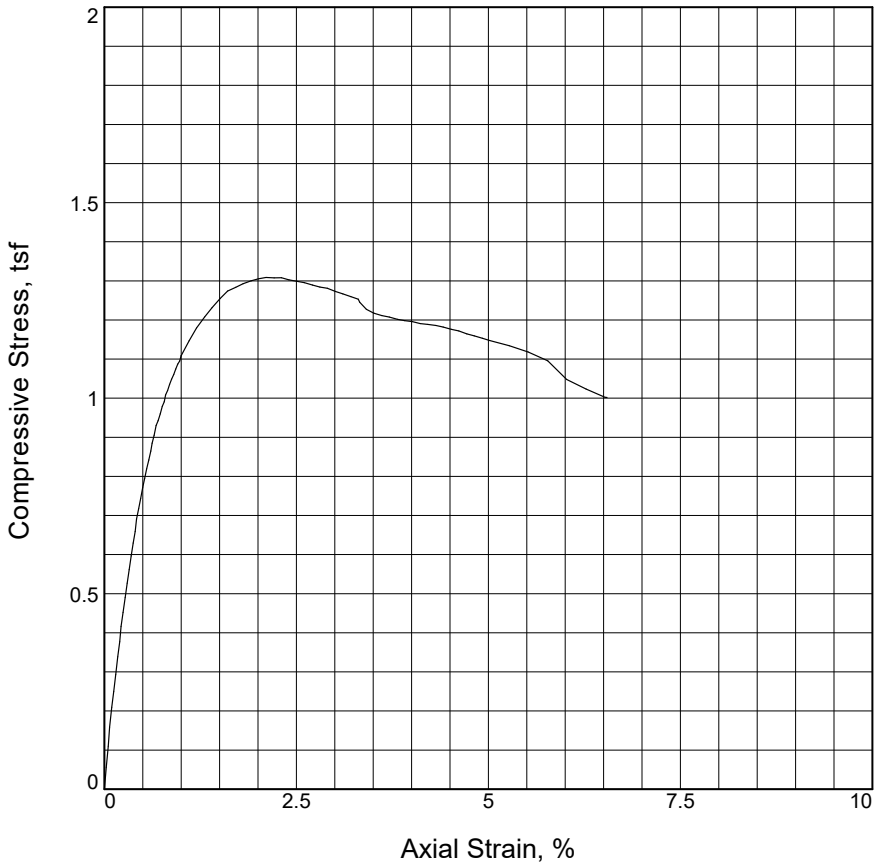
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-36 **Depth:** 40
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.309			
Undrained shear strength, tsf	0.654			
Failure strain, %	2.1			
Strain rate, %/min.	1.00			
Water content, %	45.1			
Wet density, pcf	108.8			
Dry density, pcf	75.0			
Saturation, %	97.6			
Void ratio	1.2476			
Specimen diameter, in.	2.84			
Specimen height, in.	5.88			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY

LL = 83	**PL =** 27	**PI =** 56	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

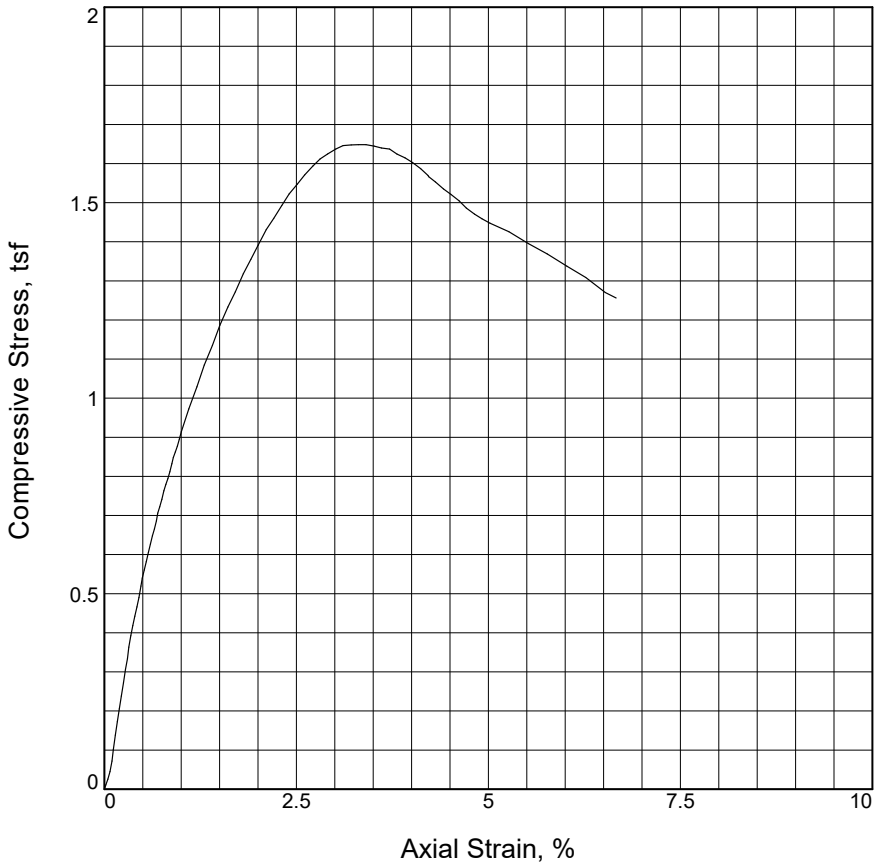
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-36 **Depth:** 47.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.648			
Undrained shear strength, tsf	0.824			
Failure strain, %	3.4			
Strain rate, %/min.	1.00			
Water content, %	42.8			
Wet density, pcf	108.5			
Dry density, pcf	76.0			
Saturation, %	94.9			
Void ratio	1.2178			
Specimen diameter, in.	2.84			
Specimen height, in.	5.86			
Height/diameter ratio	2.06			

Description: Gray FAT CLAY

LL = 85	**PL =** 27	**PI =** 58	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

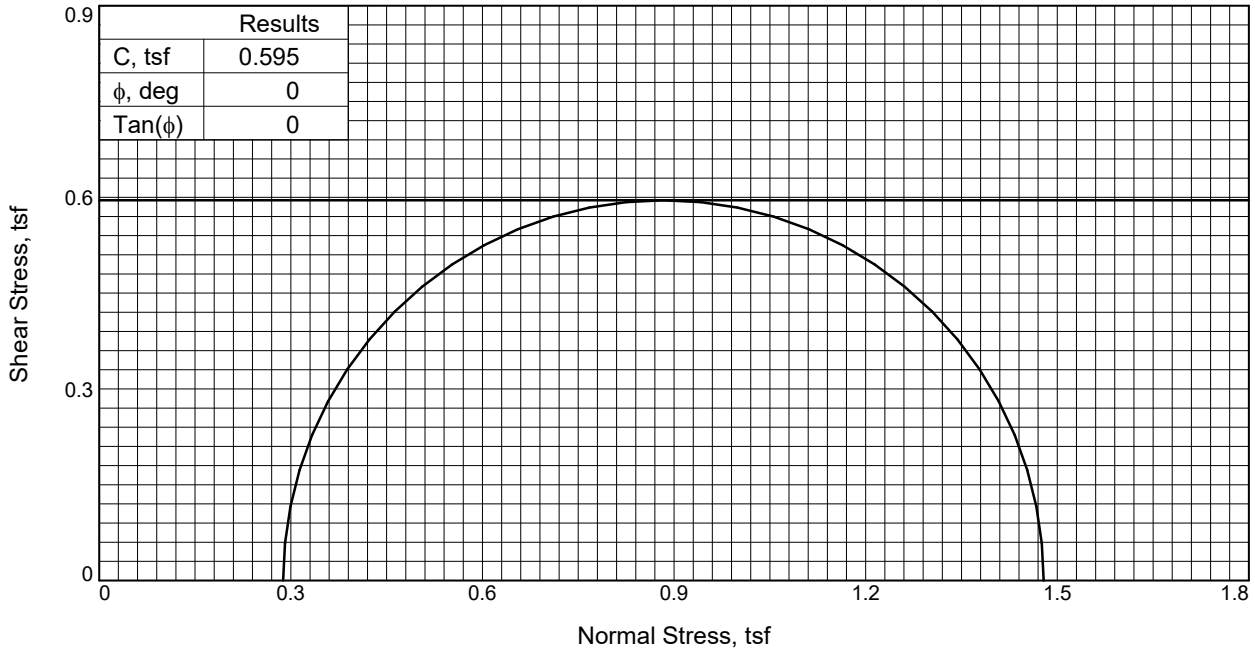
Figure _____

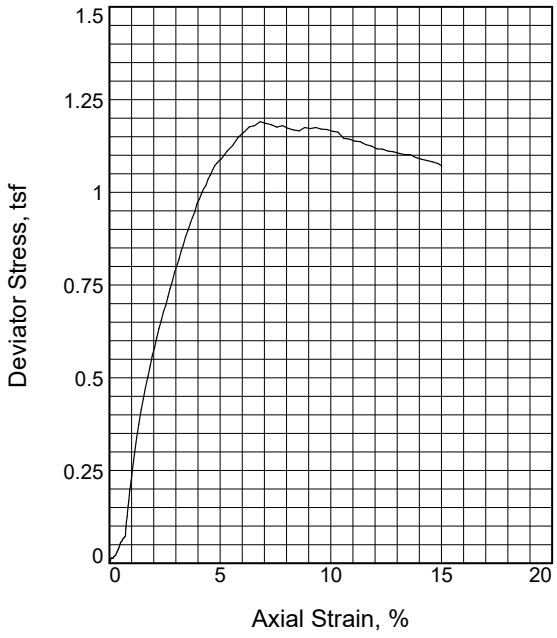
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-36 **Depth:** 52
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	25.0
	Dry Density, pcf	96.5
	Saturation, %	90.5
	Void Ratio	0.7475
	Diameter, in.	2.89
	Height, in.	5.92
At Test	Water Content, %	26.1
	Dry Density, pcf	96.5
	Saturation, %	94.3
	Void Ratio	0.7475
	Diameter, in.	2.89
	Height, in.	5.92
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		4.00
Fail. Stress, tsf		1.19
Strain, %		6.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.48
σ_3 Failure, tsf		0.29

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown and gray FAT CLAY with SAND; silt and sand pockets

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: 60 degree

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

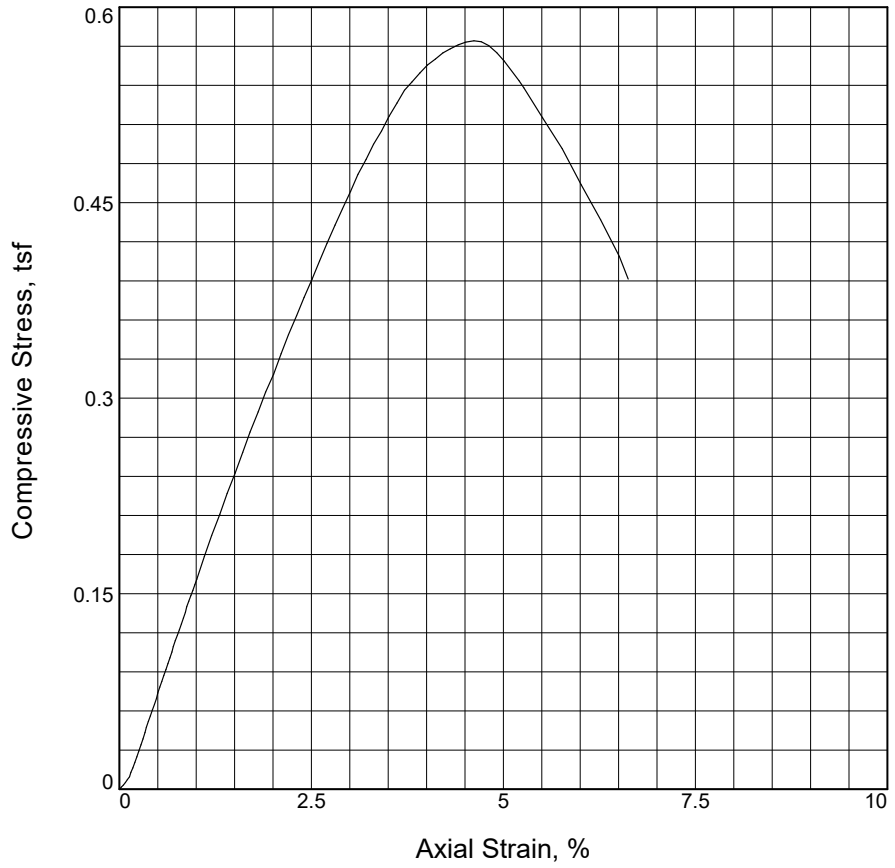
Source of Sample: CB-37 **Depth:** 9

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 7/31/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.574			
Undrained shear strength, tsf	0.287			
Failure strain, %	4.6			
Strain rate, %/min.	1.00			
Water content, %	23.9			
Wet density, pcf	124.9			
Dry density, pcf	100.8			
Saturation, %	95.9			
Void ratio	0.6723			
Specimen diameter, in.	2.88			
Specimen height, in.	5.88			
Height/diameter ratio	2.05			

Description: Brown SANDY FAT CLAY (CH)

LL = 53	**PL =** 22	**PI =** 31	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

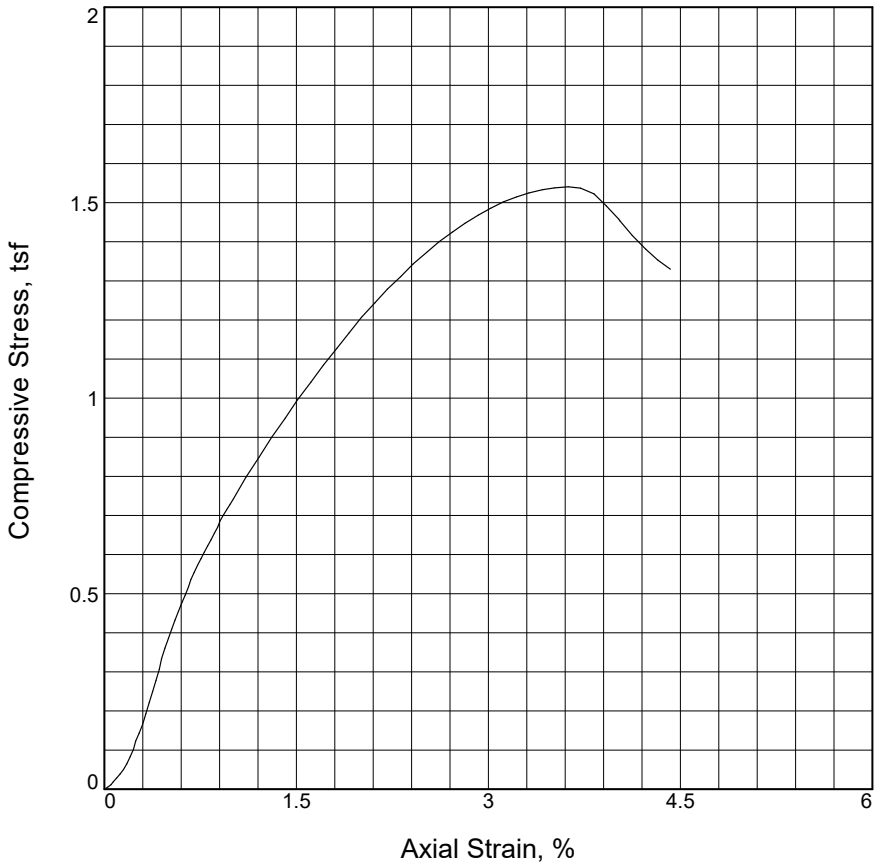
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-37 **Depth:** 14
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.541			
Undrained shear strength, tsf	0.770			
Failure strain, %	3.6			
Strain rate, %/min.	1.00			
Water content, %	39.1			
Wet density, pcf	110.9			
Dry density, pcf	79.7			
Saturation, %	94.8			
Void ratio	1.1139			
Specimen diameter, in.	2.88			
Specimen height, in.	5.88			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

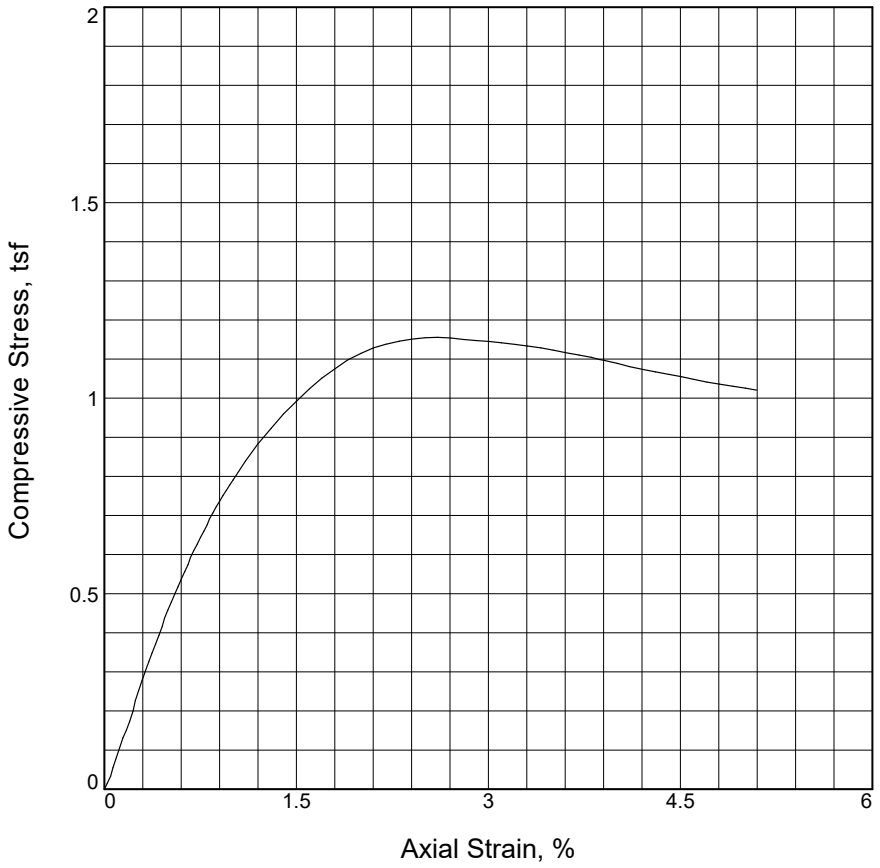
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-37 **Depth:** 38.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.156			
Undrained shear strength, tsf	0.578			
Failure strain, %	2.6			
Strain rate, %/min.	1.00			
Water content, %	50.6			
Wet density, pcf	107.1			
Dry density, pcf	71.1			
Saturation, %	99.7			
Void ratio	1.3712			
Specimen diameter, in.	2.87			
Specimen height, in.	5.96			
Height/diameter ratio	2.08			

Description: Gray FAT CLAY

LL = 75	**PL =** 34	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

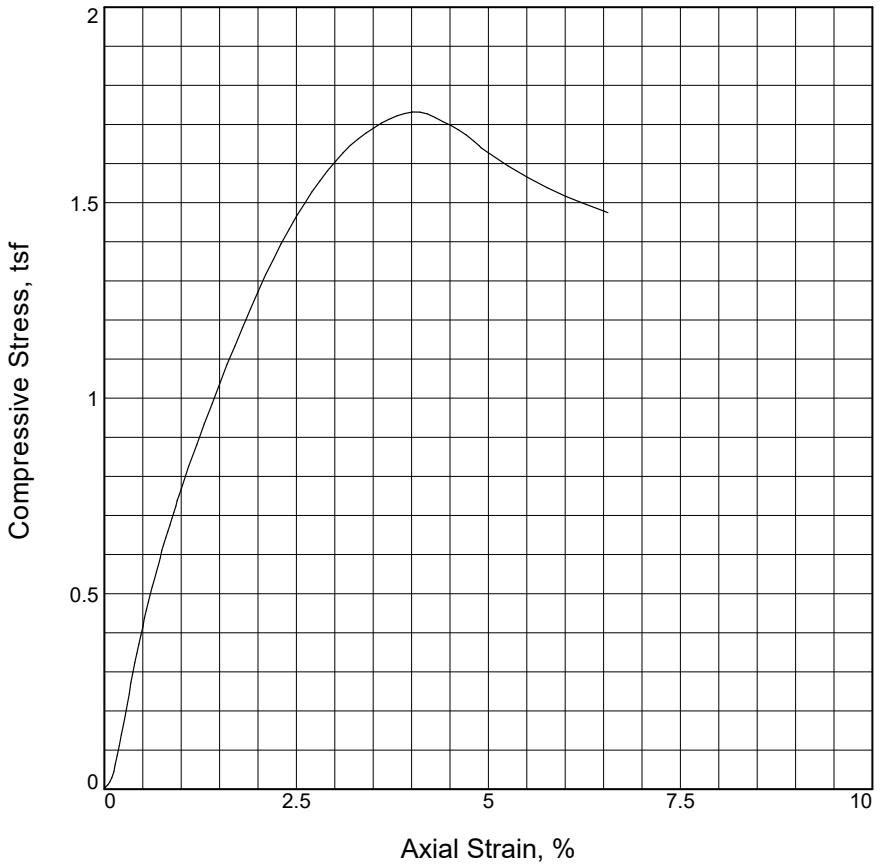
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-37 **Depth:** 43.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.732			
Undrained shear strength, tsf	0.866			
Failure strain, %	4.0			
Strain rate, %/min.	1.00			
Water content, %	35.7			
Wet density, pcf	113.4			
Dry density, pcf	83.6			
Saturation, %	94.8			
Void ratio	1.0160			
Specimen diameter, in.	2.89			
Specimen height, in.	5.91			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY (CH)

LL = 69	**PL =** 28	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

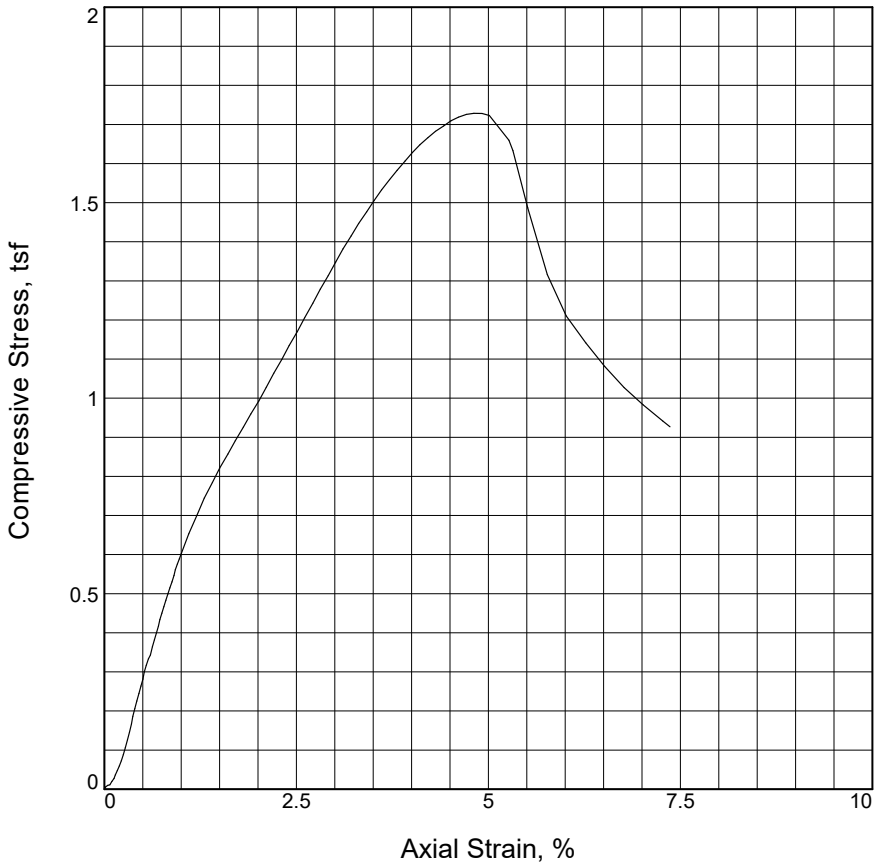
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-38 **Depth:** 37.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.728			
Undrained shear strength, tsf	0.864			
Failure strain, %	4.8			
Strain rate, %/min.	1.00			
Water content, %	44.3			
Wet density, pcf	110.7			
Dry density, pcf	76.7			
Saturation, %	99.9			
Void ratio	1.1976			
Specimen diameter, in.	2.88			
Specimen height, in.	5.92			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY

LL = 74	**PL =** 33	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

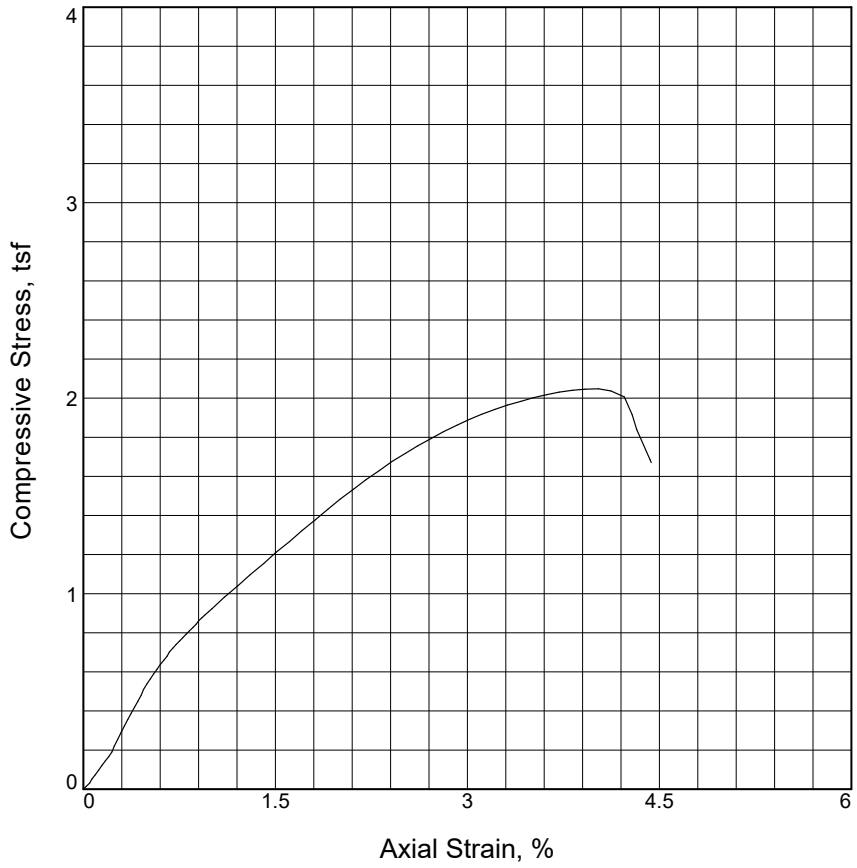
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-38 **Depth:** 45
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.048			
Undrained shear strength, tsf	1.024			
Failure strain, %	4.0			
Strain rate, %/min.	1.00			
Water content, %	49.8			
Wet density, pcf	106.4			
Dry density, pcf	71.0			
Saturation, %	98.0			
Void ratio	1.3727			
Specimen diameter, in.	2.88			
Specimen height, in.	5.92			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY

LL = 76	**PL =** 27	**PI =** 49	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 7/30/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

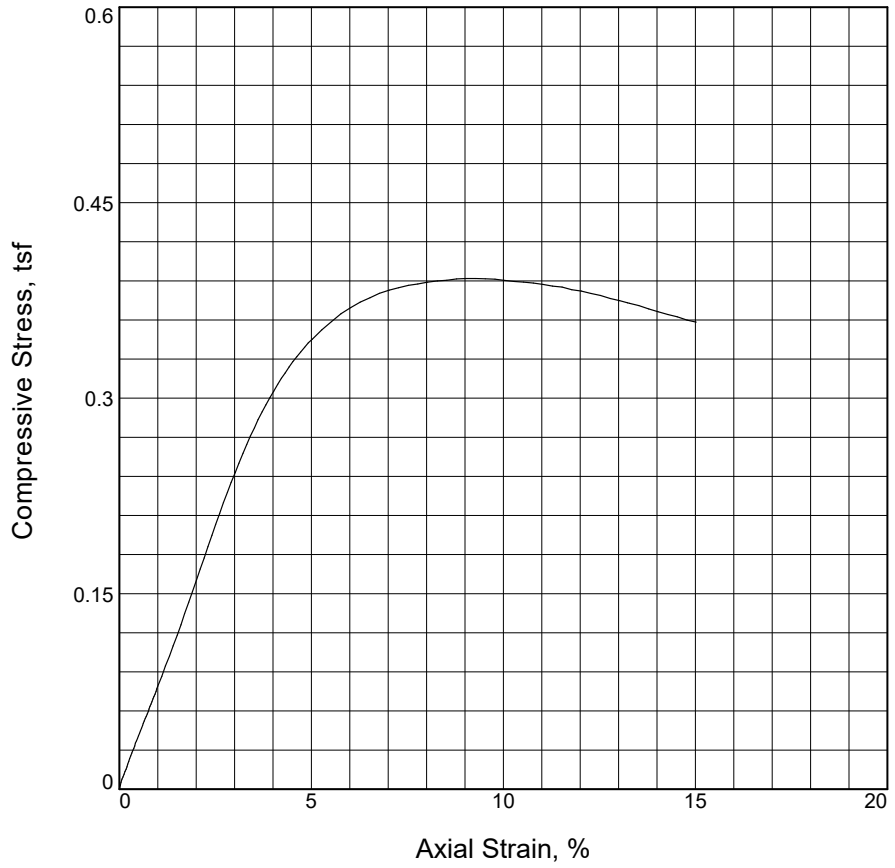
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-38 **Depth:** 52.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.392			
Undrained shear strength, tsf	0.196			
Failure strain, %	9.0			
Strain rate, %/min.	1.00			
Water content, %	23.6			
Wet density, pcf	124.5			
Dry density, pcf	100.7			
Saturation, %	94.7			
Void ratio	0.6730			
Specimen diameter, in.	2.75			
Specimen height, in.	5.76			
Height/diameter ratio	2.10			

Description: Gray SANDY LEAN CLAY (CL)

LL = 39	**PL =** 20	**PI =** 19	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/2/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

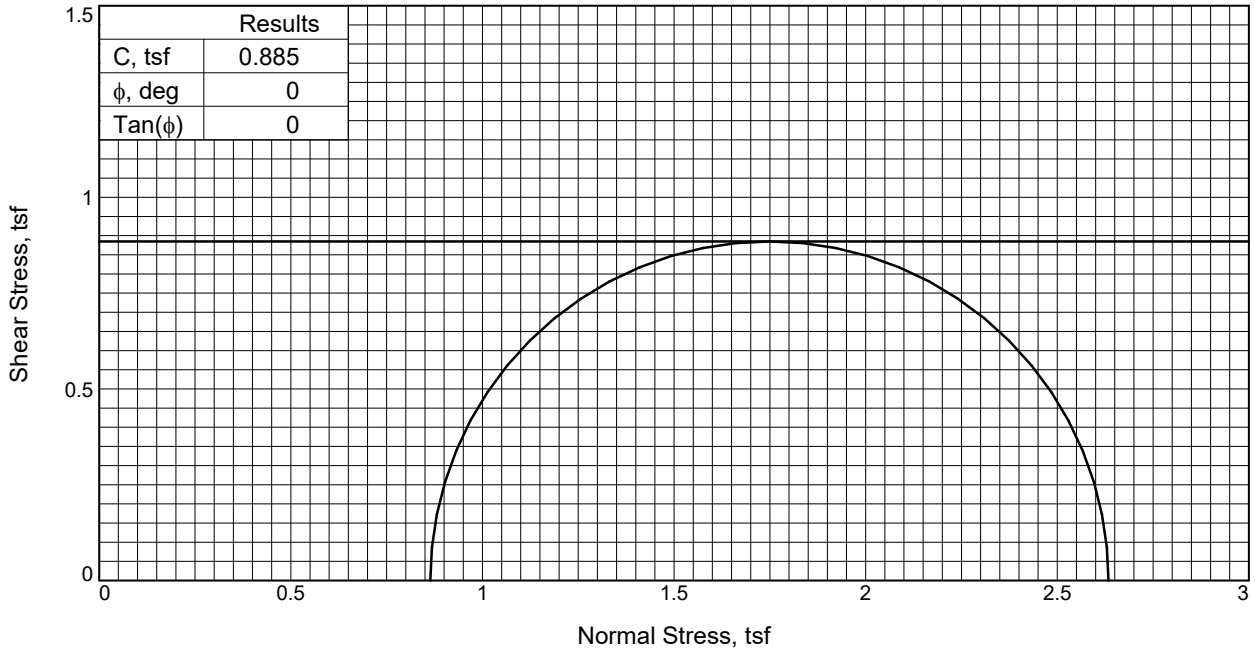
Figure _____

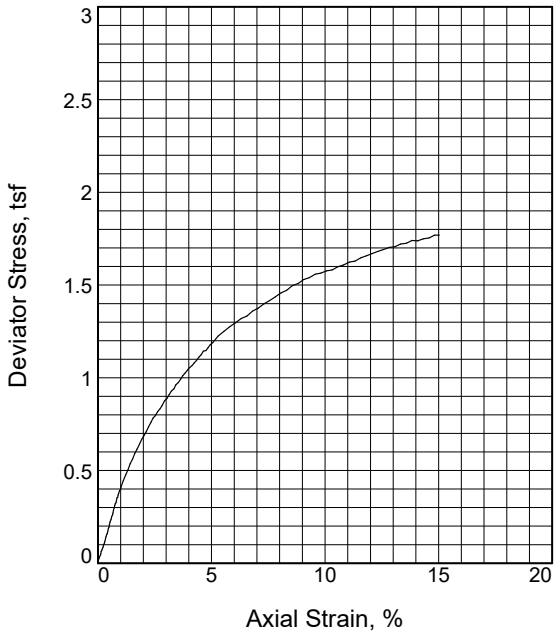
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-39 **Depth:** 25
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	21.1
	Dry Density, pcf	106.7
	Saturation, %	98.3
	Void Ratio	0.5791
	Diameter, in.	2.83
	Height, in.	5.86
At Test	Water Content, %	21.4
	Dry Density, pcf	106.7
	Saturation, %	99.7
	Void Ratio	0.5791
	Diameter, in.	2.83
	Height, in.	5.86
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		12.00
Fail. Stress, tsf		1.77
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.63
σ_3 Failure, tsf		0.86

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray CLAYEY SAND (SC)

LL= 42 **PL=** 19 **PI=** 23

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

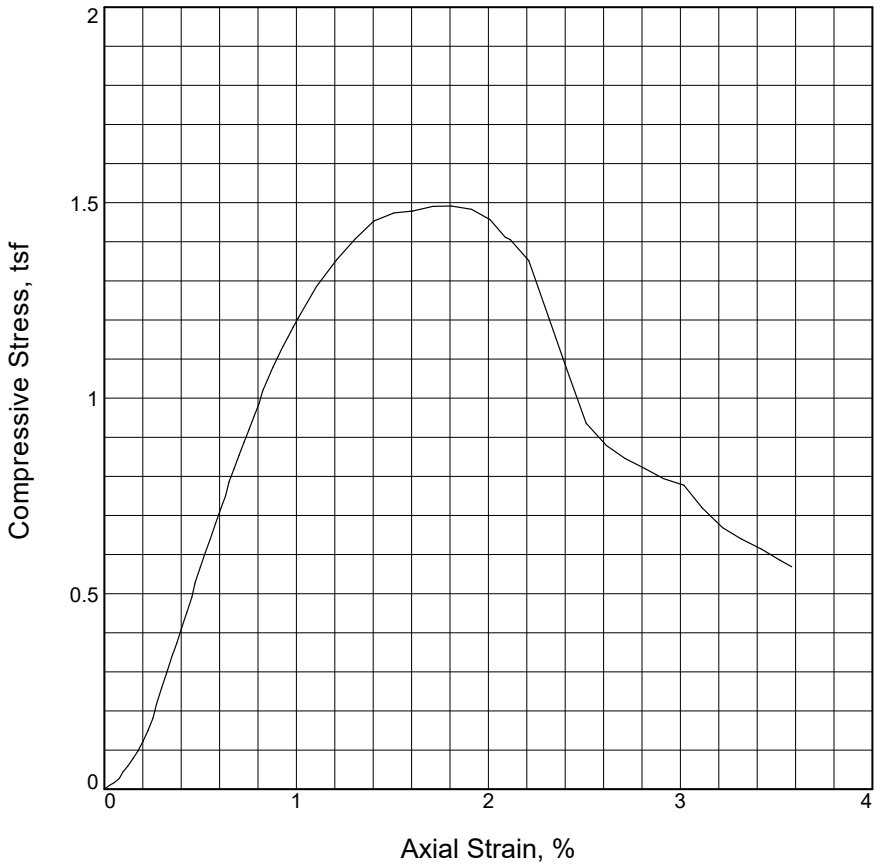
Source of Sample: CB-39 **Depth:** 29.5

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 8/2/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.492			
Undrained shear strength, tsf	0.746			
Failure strain, %	1.8			
Strain rate, %/min.	1.00			
Water content, %	30.6			
Wet density, pcf	122.1			
Dry density, pcf	93.5			
Saturation, %	98.5			
Void ratio	0.8701			
Specimen diameter, in.	2.80			
Specimen height, in.	5.89			
Height/diameter ratio	2.11			

Description: Gray and brown FAT CLAY

LL = 81	**PL =** 32	**PI =** 49	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/2/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

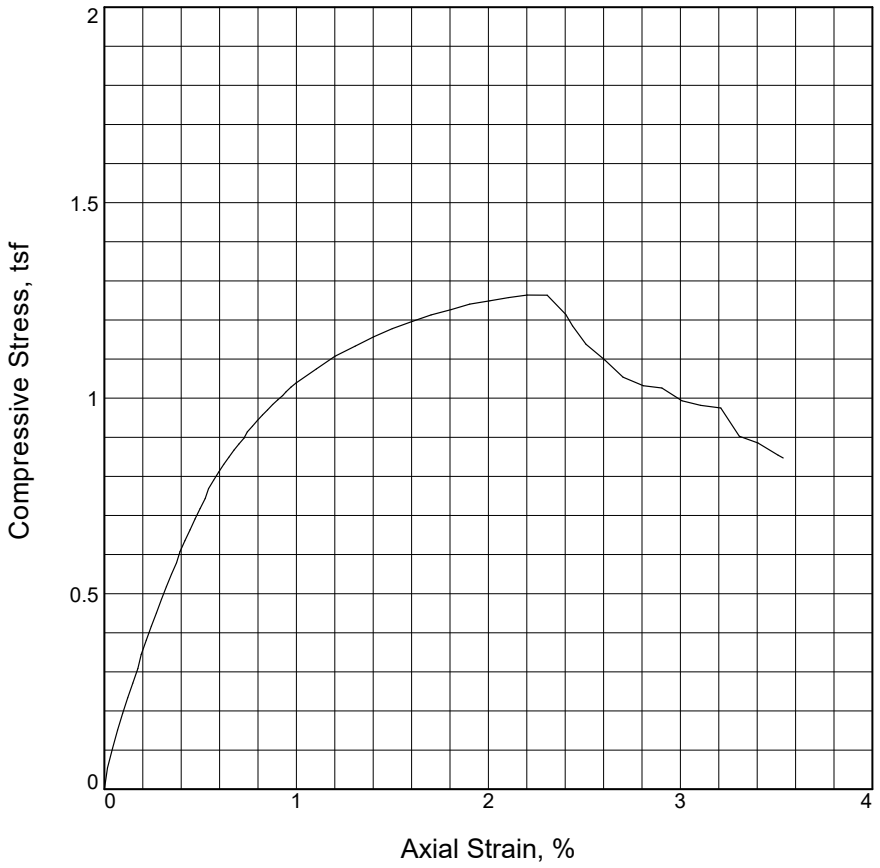
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-39 **Depth:** 42
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.264			
Undrained shear strength, tsf	0.632			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	39.7			
Wet density, pcf	114.1			
Dry density, pcf	81.7			
Saturation, %	99.1			
Void ratio	1.1007			
Specimen diameter, in.	2.83			
Specimen height, in.	5.86			
Height/diameter ratio	2.07			

Description: Gray and brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/2/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

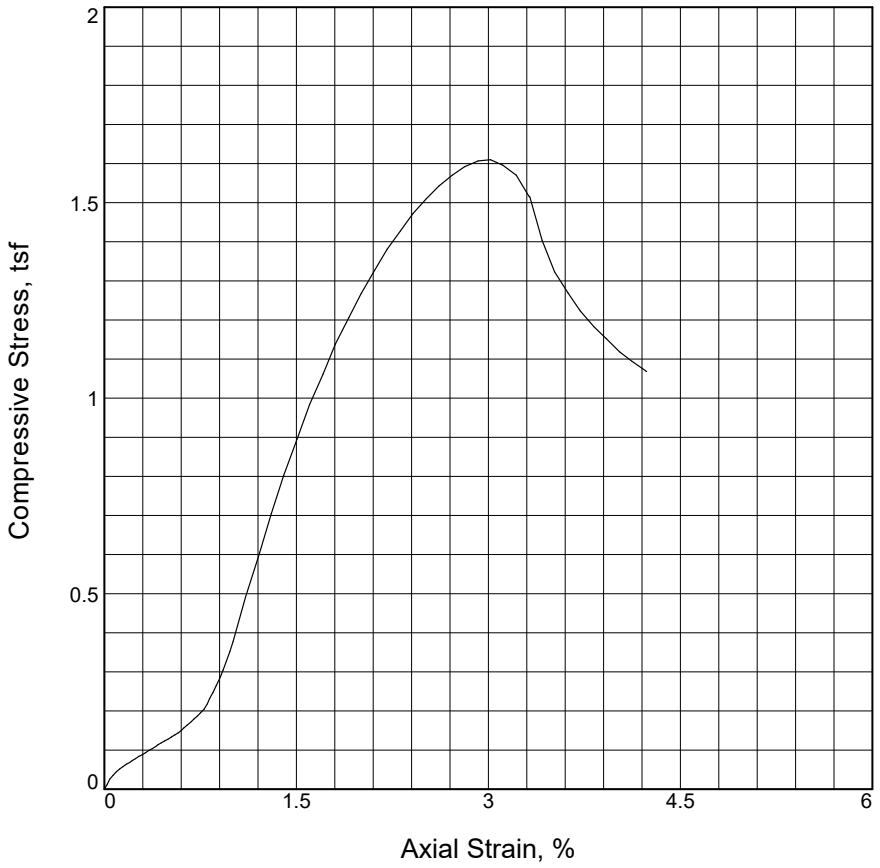
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-39 **Depth:** 47
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.610			
Undrained shear strength, tsf	0.805			
Failure strain, %	3.0			
Strain rate, %/min.	1.00			
Water content, %	48.9			
Wet density, pcf	109.6			
Dry density, pcf	73.6			
Saturation, %	99.7			
Void ratio	1.3745			
Specimen diameter, in.	2.85			
Specimen height, in.	5.77			
Height/diameter ratio	2.02			

Description: Brown FAT CLAY

LL = 82	**PL =** 34	**PI =** 48	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

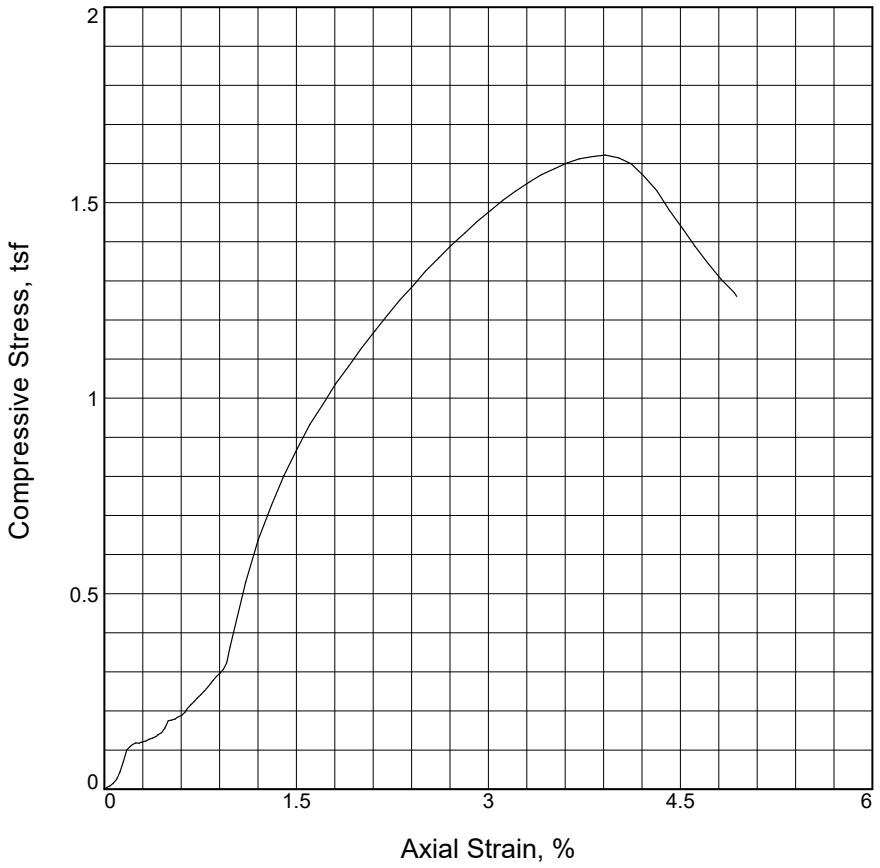
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-40 **Depth:** 34.5
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.622			
Undrained shear strength, tsf	0.811			
Failure strain, %	3.9			
Strain rate, %/min.	1.00			
Water content, %	47.1			
Wet density, pcf	107.9			
Dry density, pcf	73.3			
Saturation, %	97.9			
Void ratio	1.2989			
Specimen diameter, in.	2.86			
Specimen height, in.	5.78			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY (CH)

LL = 82	**PL =** 33	**PI =** 49	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

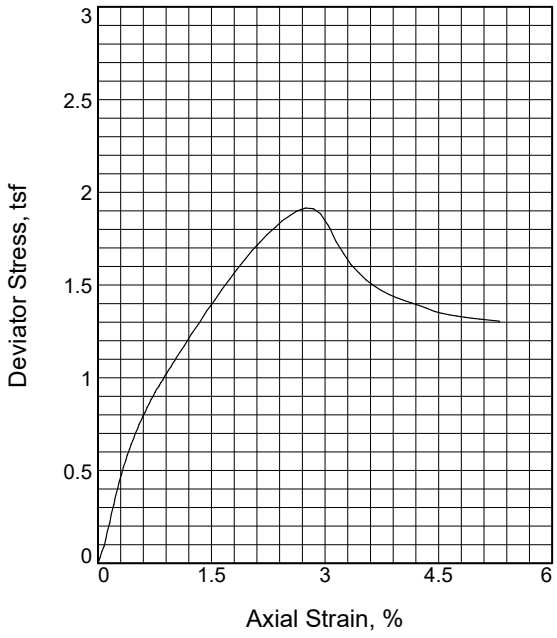
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-40 **Depth:** 39.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	43.9
	Dry Density, pcf	74.4
	Saturation, %	93.6
	Void Ratio	1.2648
	Diameter, in.	2.89
	Height, in.	5.75
At Test	Water Content, %	46.3
	Dry Density, pcf	74.4
	Saturation, %	98.9
	Void Ratio	1.2648
	Diameter, in.	2.89
	Height, in.	5.75
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		18.00
Fail. Stress, tsf		1.92
Strain, %		2.7
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		3.21
σ_3 Failure, tsf		1.30

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

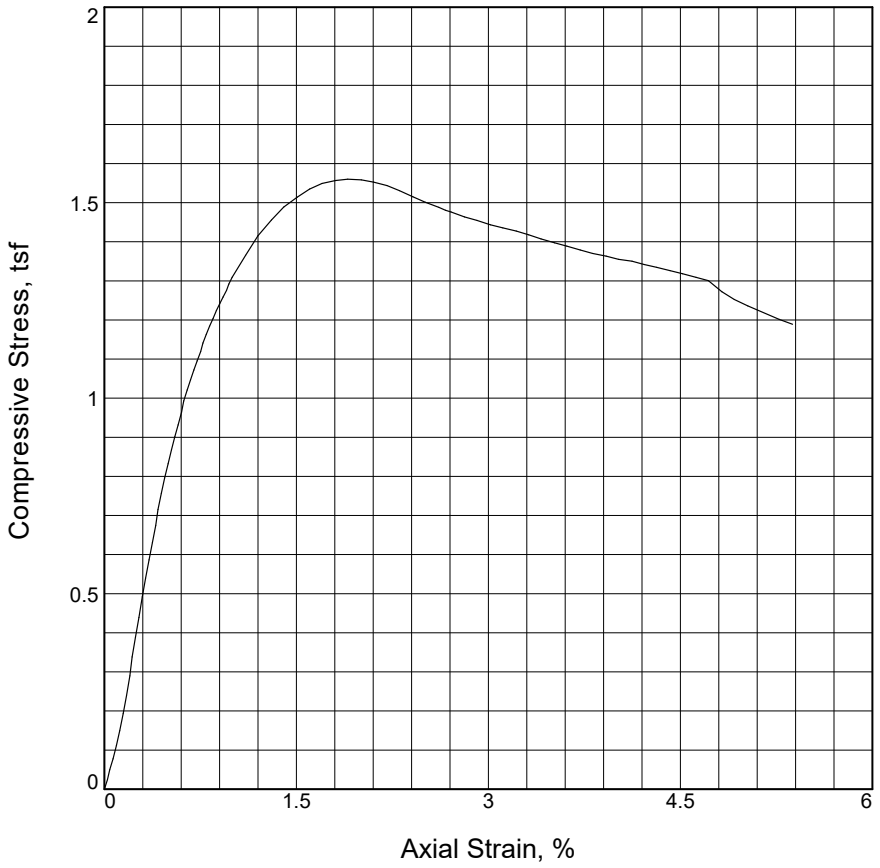
Source of Sample: CB-40 **Depth:** 44.5

Sample Number: ST-11

Proj. No.: 21.14.223 **Date Sampled:** 8/4/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.560			
Undrained shear strength, tsf	0.780			
Failure strain, %	1.9			
Strain rate, %/min.	1.00			
Water content, %	38.1			
Wet density, pcf	110.3			
Dry density, pcf	79.9			
Saturation, %	92.7			
Void ratio	1.1092			
Specimen diameter, in.	2.87			
Specimen height, in.	5.78			
Height/diameter ratio	2.02			

Description: Tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

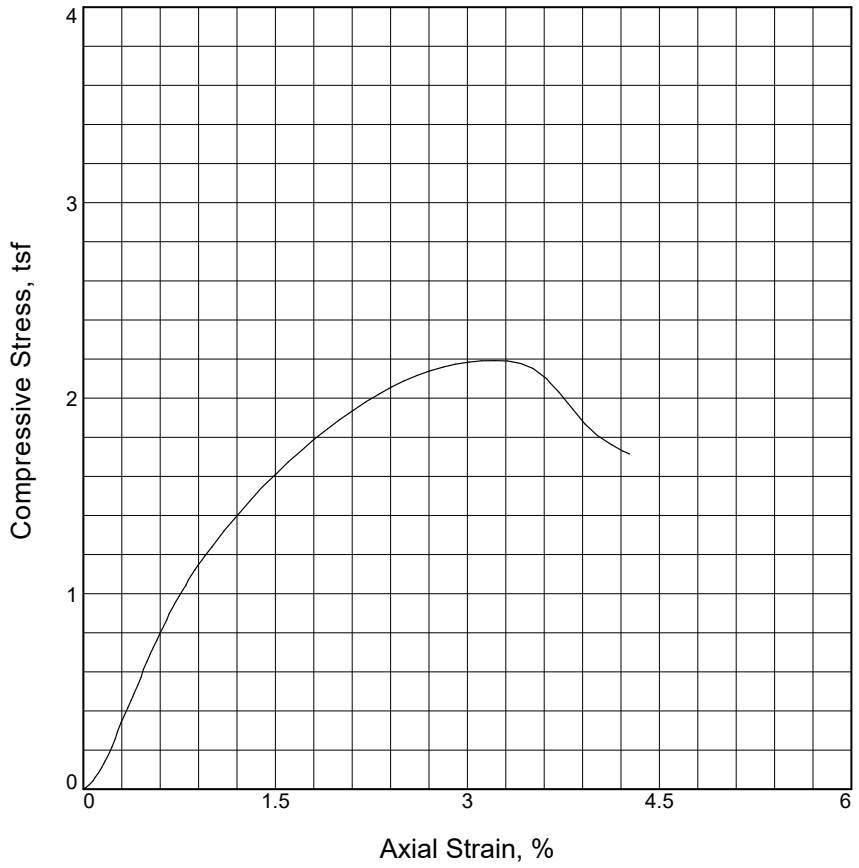
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-40 **Depth:** 47
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.192			
Undrained shear strength, tsf	1.096			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	39.6			
Wet density, pcf	113.2			
Dry density, pcf	81.1			
Saturation, %	99.1			
Void ratio	1.0776			
Specimen diameter, in.	2.87			
Specimen height, in.	5.76			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY

LL = 80	**PL =** 35	**PI =** 45	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

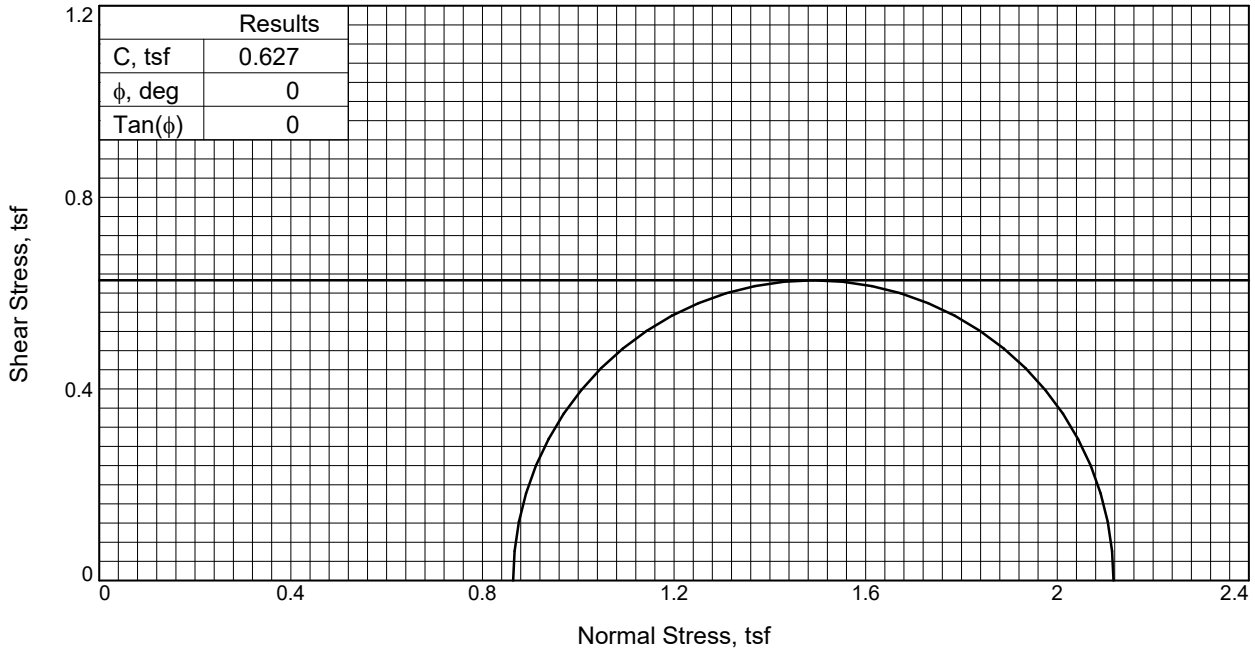
Figure _____

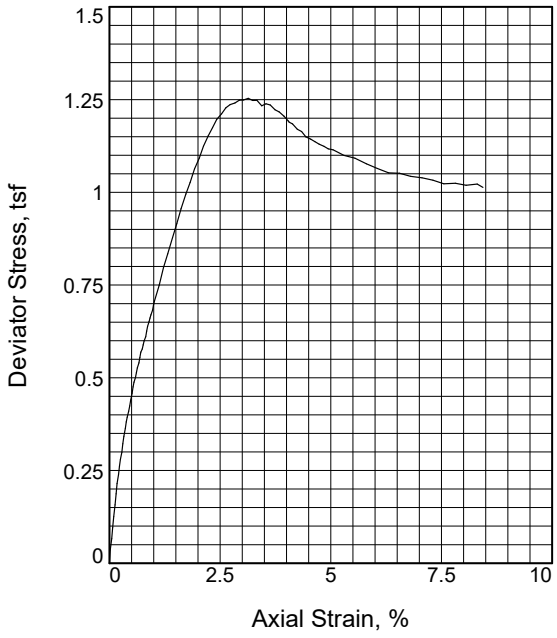
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-40 **Depth:** 49.5
Sample Number: ST-13

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	31.6
	Dry Density, pcf	87.5
	Saturation, %	92.2
	Void Ratio	0.9262
	Diameter, in.	2.84
	Height, in.	5.75
At Test	Water Content, %	26.0
	Dry Density, pcf	87.5
	Saturation, %	75.7
	Void Ratio	0.9262
	Diameter, in.	2.84
	Height, in.	5.75
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		12.00
Fail. Stress, tsf		1.25
Strain, %		3.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.12
σ_3 Failure, tsf		0.86

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY; shell fragments and sand pockets

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

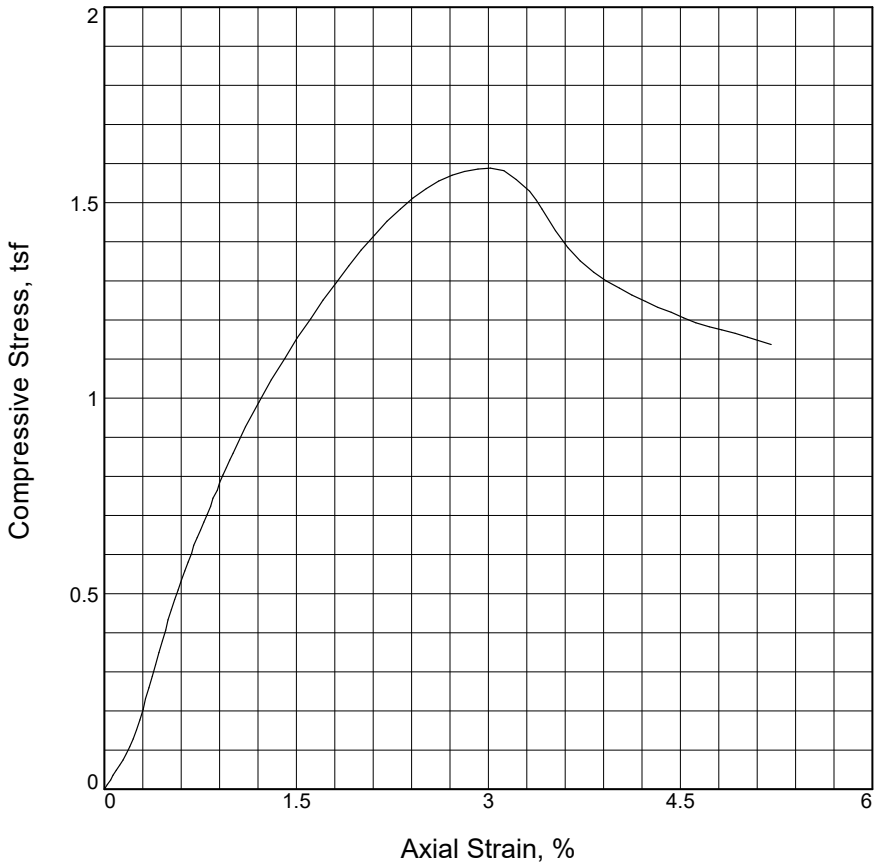
Source of Sample: CB-41 **Depth:** 30

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 8/4/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.588			
Undrained shear strength, tsf	0.794			
Failure strain, %	3.0			
Strain rate, %/min.	1.00			
Water content, %	43.5			
Wet density, pcf	112.7			
Dry density, pcf	78.5			
Saturation, %	99.4			
Void ratio	1.2260			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY (CH)

LL = 72	**PL =** 25	**PI =** 47	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/4/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

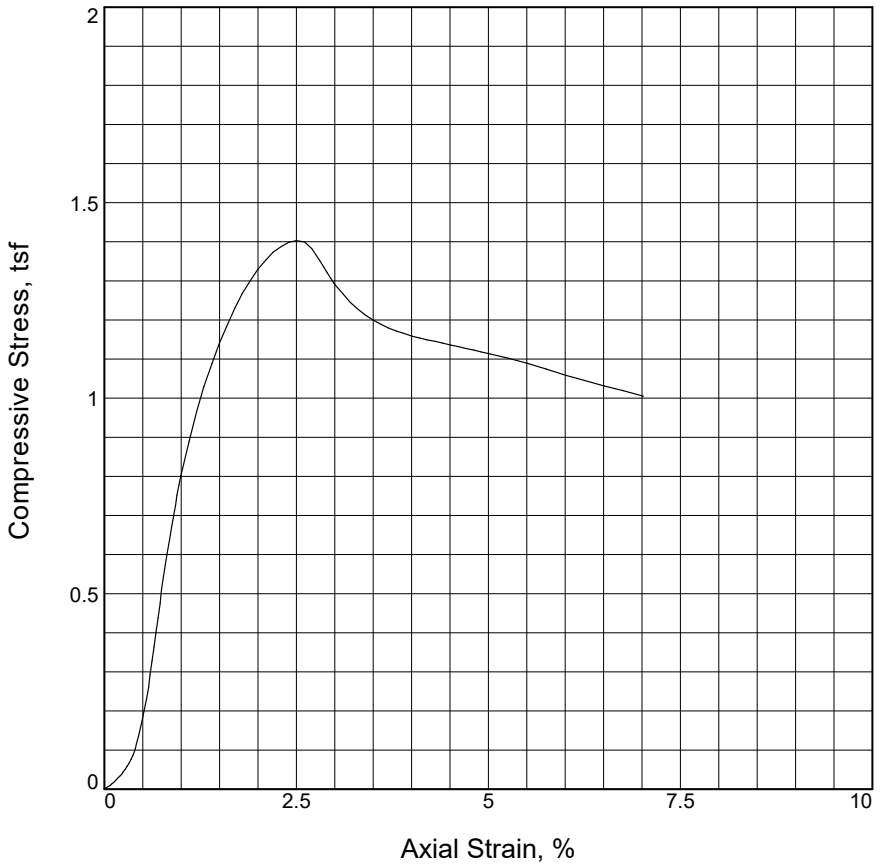
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-41 **Depth:** 35
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.403			
Undrained shear strength, tsf	0.702			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	48.3			
Wet density, pcf	107.2			
Dry density, pcf	72.3			
Saturation, %	97.9			
Void ratio	1.3308			
Specimen diameter, in.	2.87			
Specimen height, in.	5.76			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY; shell fragments

LL = 80	**PL =** 31	**PI =** 49	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/4/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

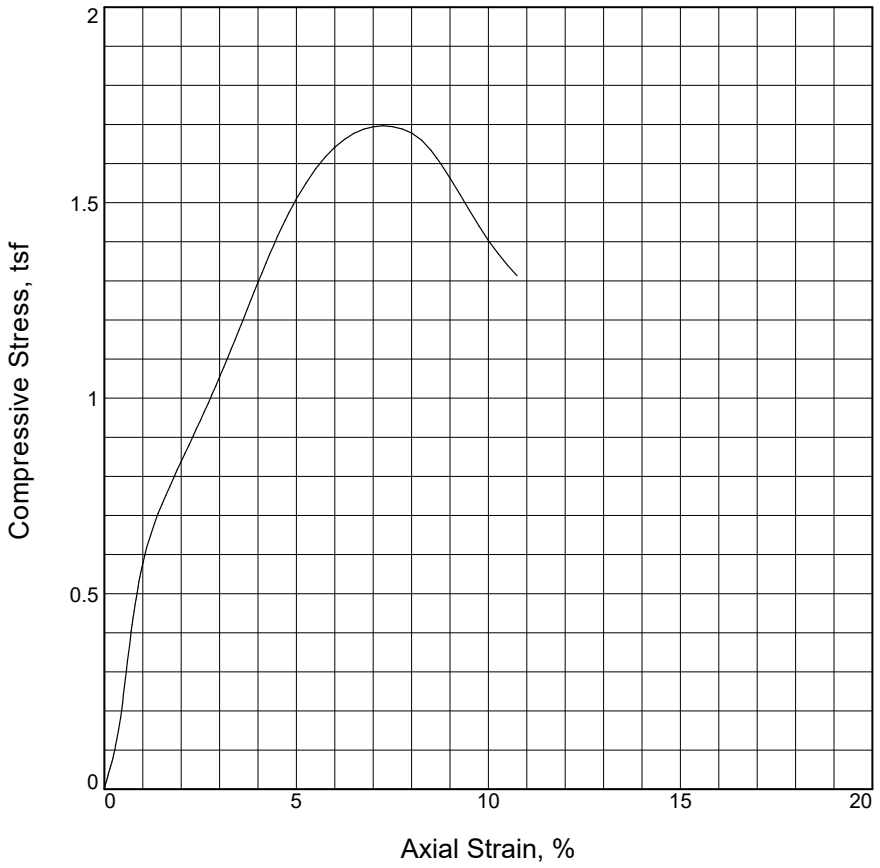
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-41 **Depth:** 42.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.697			
Undrained shear strength, tsf	0.848			
Failure strain, %	7.3			
Strain rate, %/min.	1.00			
Water content, %	43.5			
Wet density, pcf	110.5			
Dry density, pcf	77.0			
Saturation, %	98.8			
Void ratio	1.1897			
Specimen diameter, in.	2.86			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY; sand pockets and shell fragments

LL = 74	**PL =** 32	**PI =** 42	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/4/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

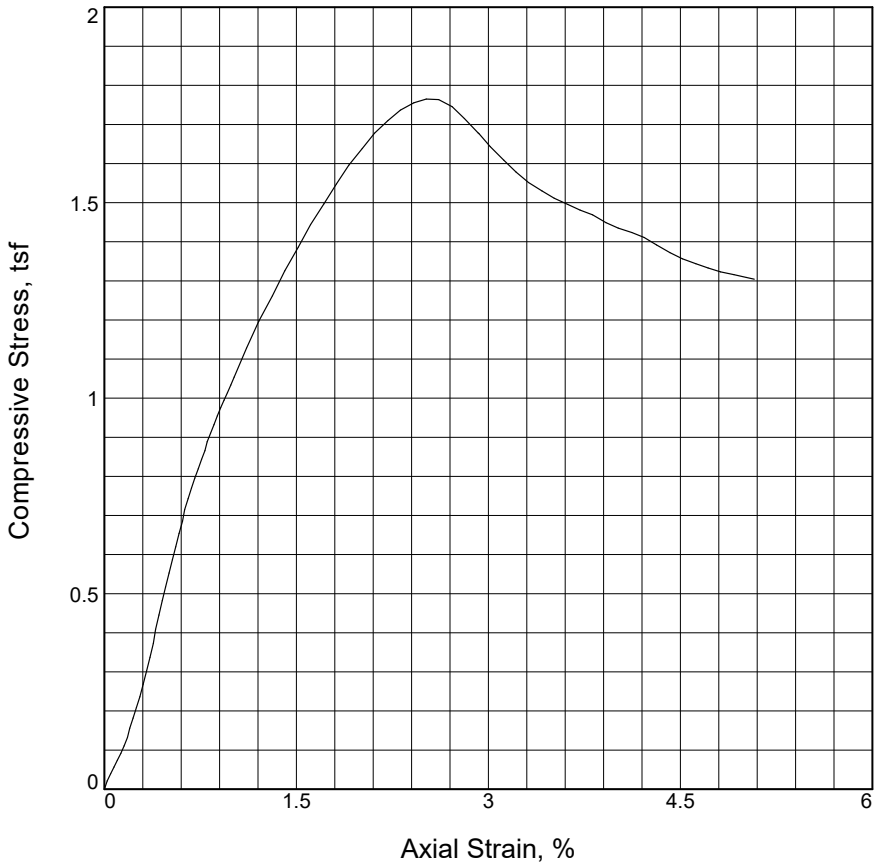
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-41 **Depth:** 47.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.765			
Undrained shear strength, tsf	0.883			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	43.9			
Wet density, pcf	108.7			
Dry density, pcf	75.5			
Saturation, %	96.3			
Void ratio	1.2313			
Specimen diameter, in.	2.87			
Specimen height, in.	5.75			
Height/diameter ratio	2.00			

Description: Gray FAT CLAY; shell fragments

LL = 87	**PL =** 34	**PI =** 53	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/4/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

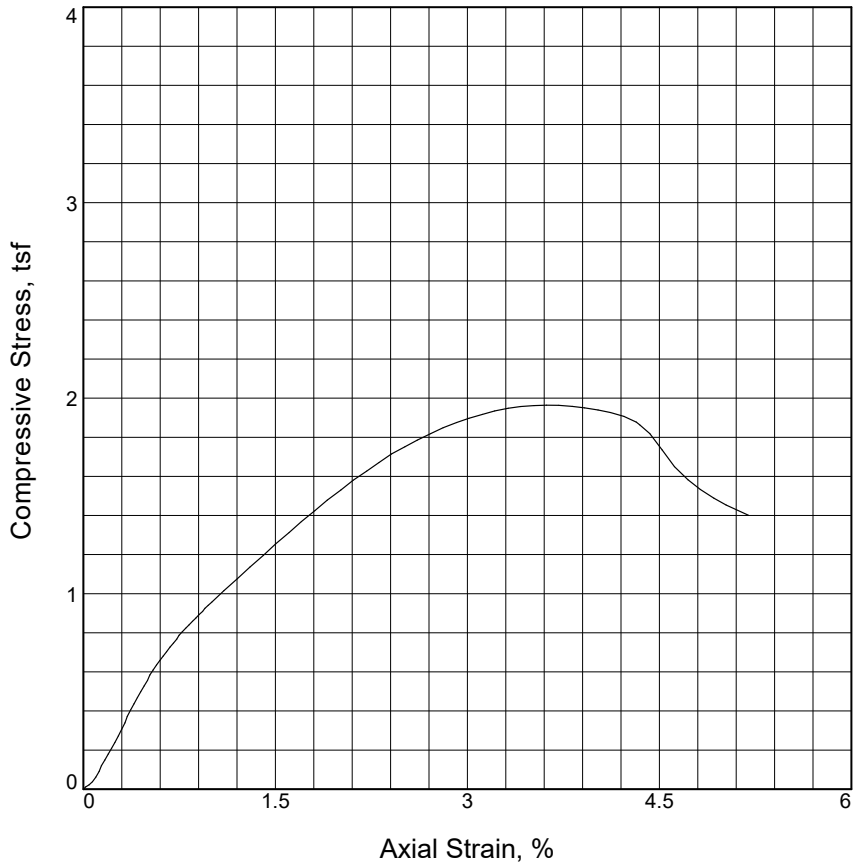
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-41 **Depth:** 52.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.964			
Undrained shear strength, tsf	0.982			
Failure strain, %	3.6			
Strain rate, %/min.	1.00			
Water content, %	38.6			
Wet density, pcf	111.8			
Dry density, pcf	80.6			
Saturation, %	95.7			
Void ratio	1.0901			
Specimen diameter, in.	2.87			
Specimen height, in.	5.78			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY (CH)

LL = 68	**PL =** 25	**PI =** 43	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

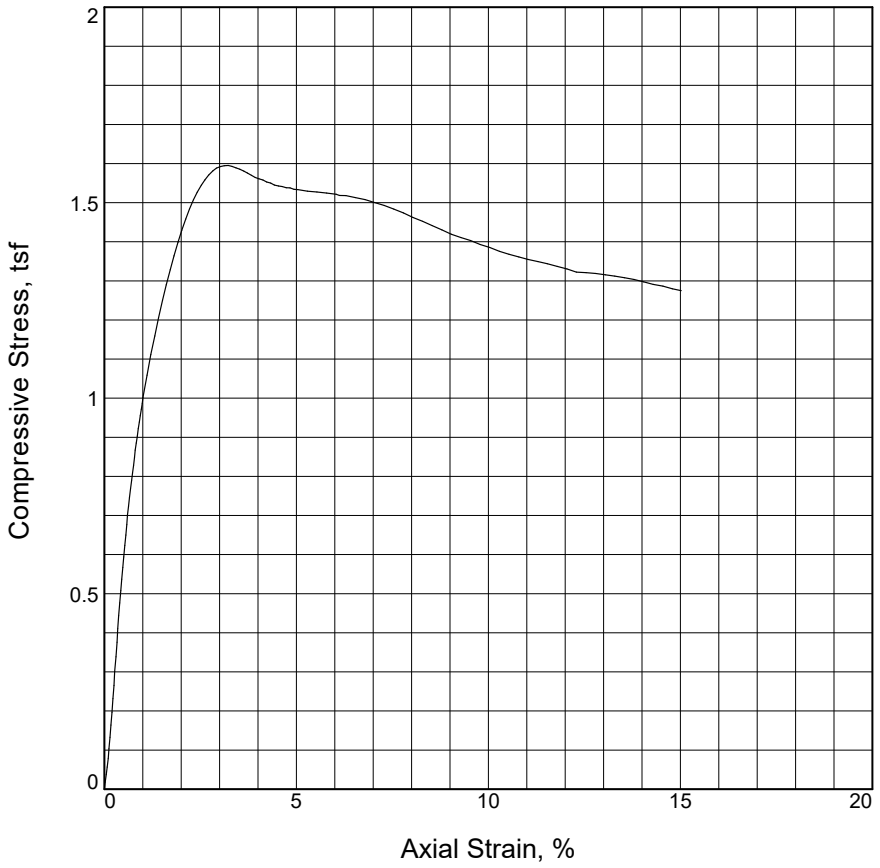
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-42 **Depth:** 20
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.595			
Undrained shear strength, tsf	0.798			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	27.1			
Wet density, pcf	119.0			
Dry density, pcf	93.6			
Saturation, %	91.3			
Void ratio	0.8002			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray LEAN CLAY with SAND (CL)

LL = 46	**PL =** 19	**PI =** 27	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

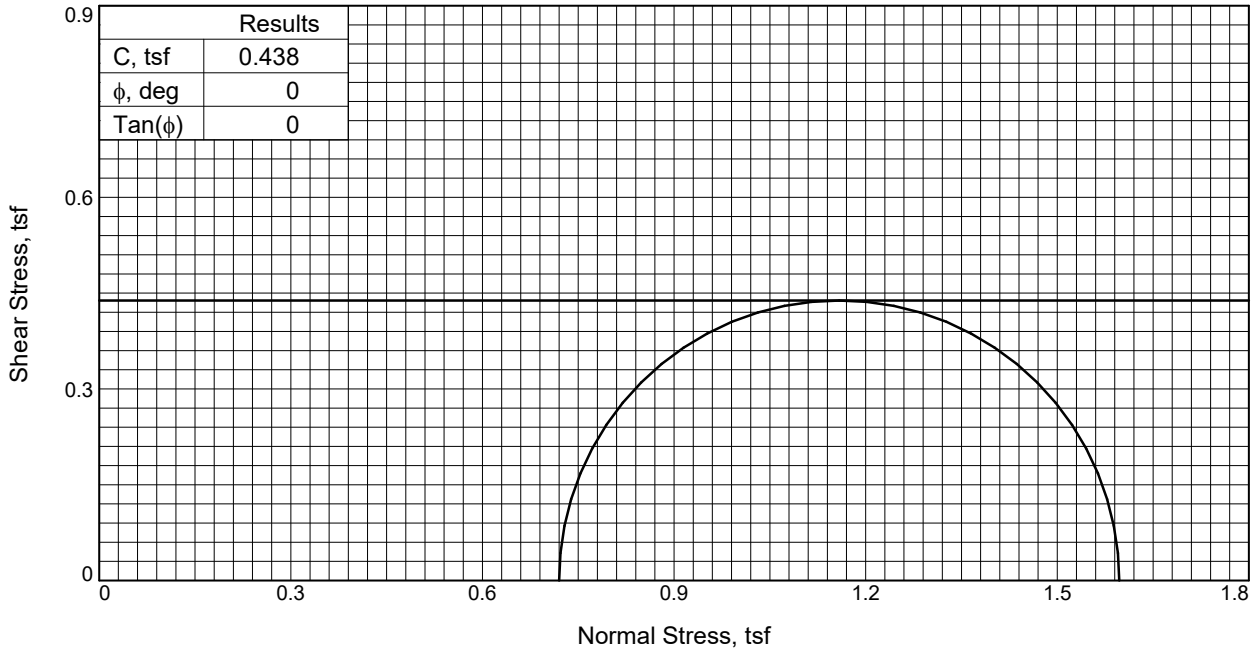
Figure _____

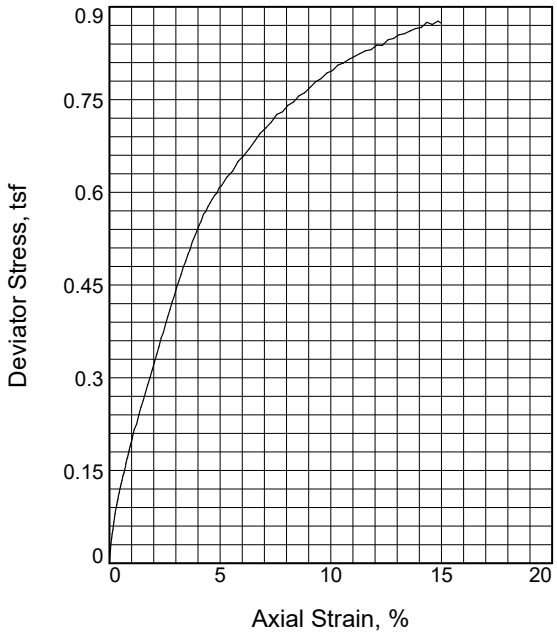
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-42 **Depth:** 34.5
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	28.3
	Dry Density, pcf	97.8
	Saturation, %	98.5
	Void Ratio	0.8194
	Diameter, in.	2.87
	Height, in.	5.74
At Test	Water Content, %	23.5
	Dry Density, pcf	97.8
	Saturation, %	81.8
	Void Ratio	0.8194
	Diameter, in.	2.87
	Height, in.	5.74
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		10.00
Fail. Stress, tsf		0.88
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.60
σ_3 Failure, tsf		0.72

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray and brown SANDY LEAN CLAY; shell fragments

LL= 33 **PL=** 16 **PI=** 17

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

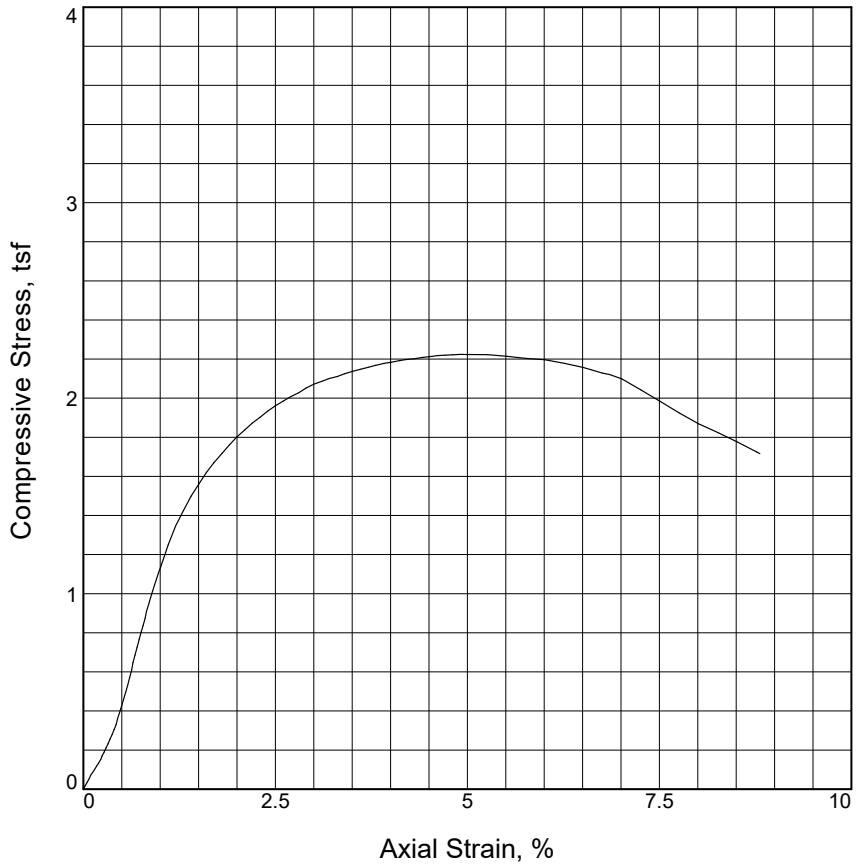
Source of Sample: CB-43 **Depth:** 25

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 8/5/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.224			
Undrained shear strength, tsf	1.112			
Failure strain, %	4.9			
Strain rate, %/min.	1.00			
Water content, %	22.7			
Wet density, pcf	129.0			
Dry density, pcf	105.1			
Saturation, %	98.7			
Void ratio	0.6334			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray and tan FAT CLAY with SAND (CH)

LL = 55	**PL =** 22	**PI =** 33	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/5/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

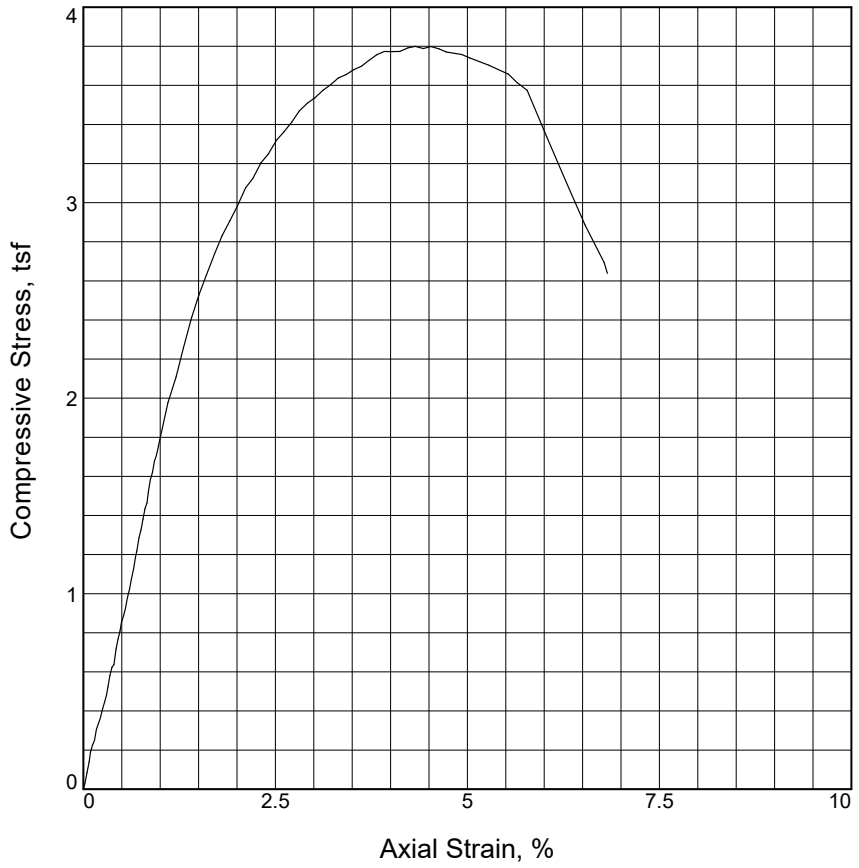
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-43 **Depth:** 32.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.799			
Undrained shear strength, tsf	1.900			
Failure strain, %	4.3			
Strain rate, %/min.	1.00			
Water content, %	25.3			
Wet density, pcf	124.8			
Dry density, pcf	99.6			
Saturation, %	98.8			
Void ratio	0.6923			
Specimen diameter, in.	1.96			
Specimen height, in.	4.71			
Height/diameter ratio	2.40			

Description: Red and tan FAT CLAY (CH)

LL = 65	**PL =** 25	**PI =** 40	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

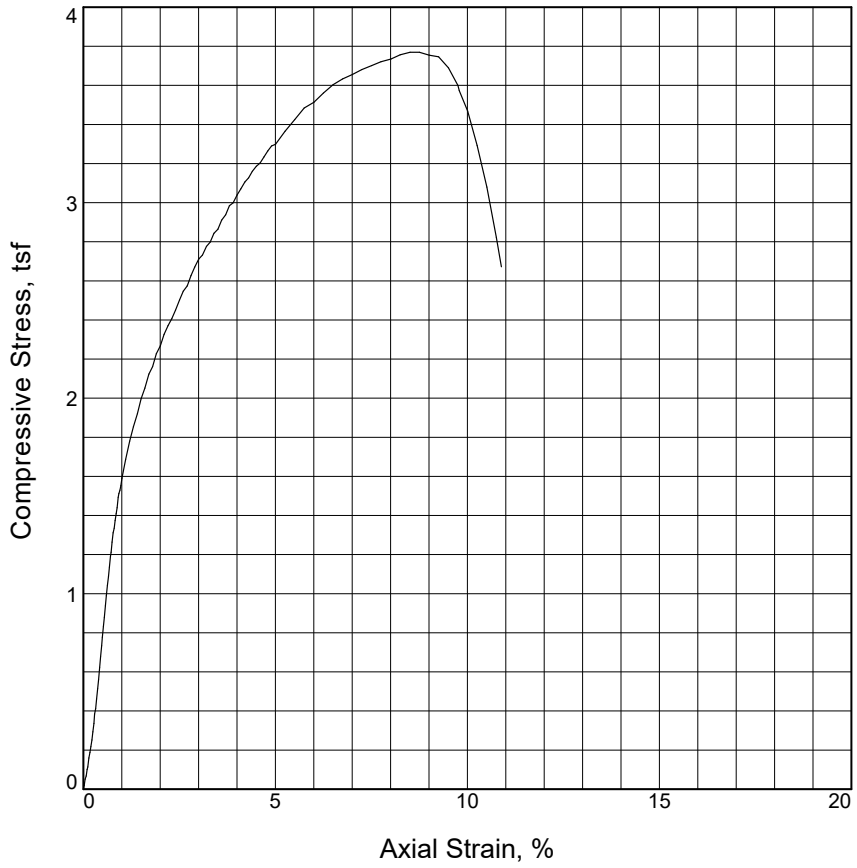
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-43 **Depth:** 40
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.770			
Undrained shear strength, tsf	1.885			
Failure strain, %	8.8			
Strain rate, %/min.	1.00			
Water content, %	20.2			
Wet density, pcf	128.4			
Dry density, pcf	106.8			
Saturation, %	94.5			
Void ratio	0.5777			
Specimen diameter, in.	1.96			
Specimen height, in.	4.53			
Height/diameter ratio	2.31			

Description: Red and tan FAT CLAY with SAND (CH)

LL = 51	**PL =** 20	**PI =** 31	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/6/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

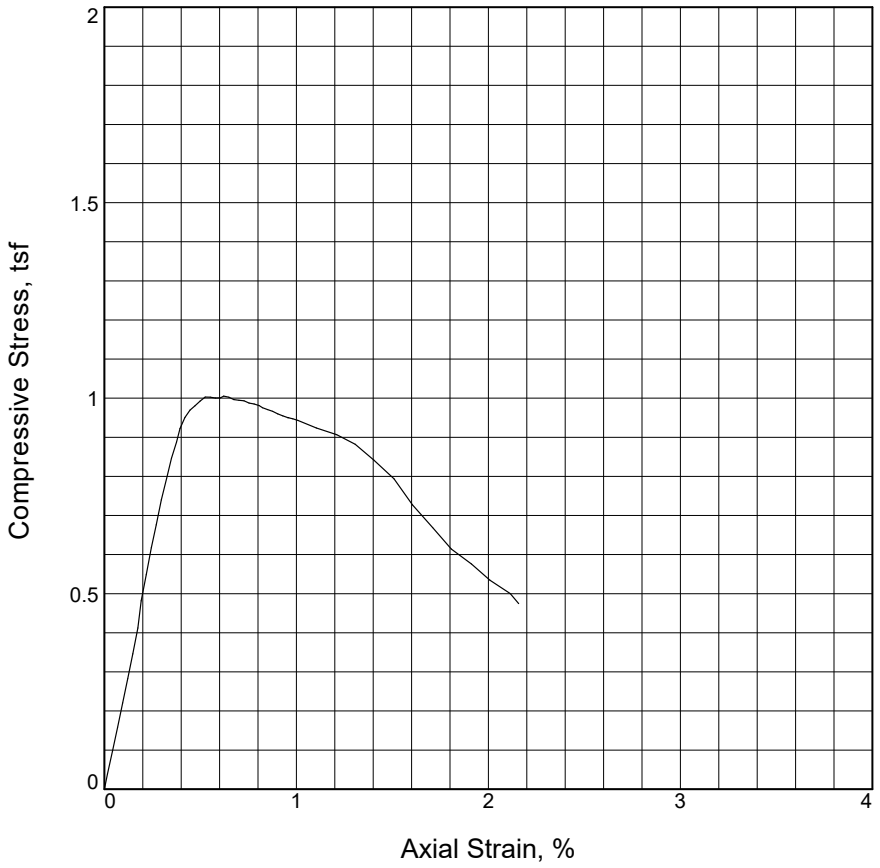
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-43 **Depth:** 47.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.005			
Undrained shear strength, tsf	0.503			
Failure strain, %	0.6			
Strain rate, %/min.	1.00			
Water content, %	30.3			
Wet density, pcf	117.2			
Dry density, pcf	89.9			
Saturation, %	93.5			
Void ratio	0.8748			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray SANDY FAT CLAY (CH)

LL = 78	**PL =** 24	**PI =** 54	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

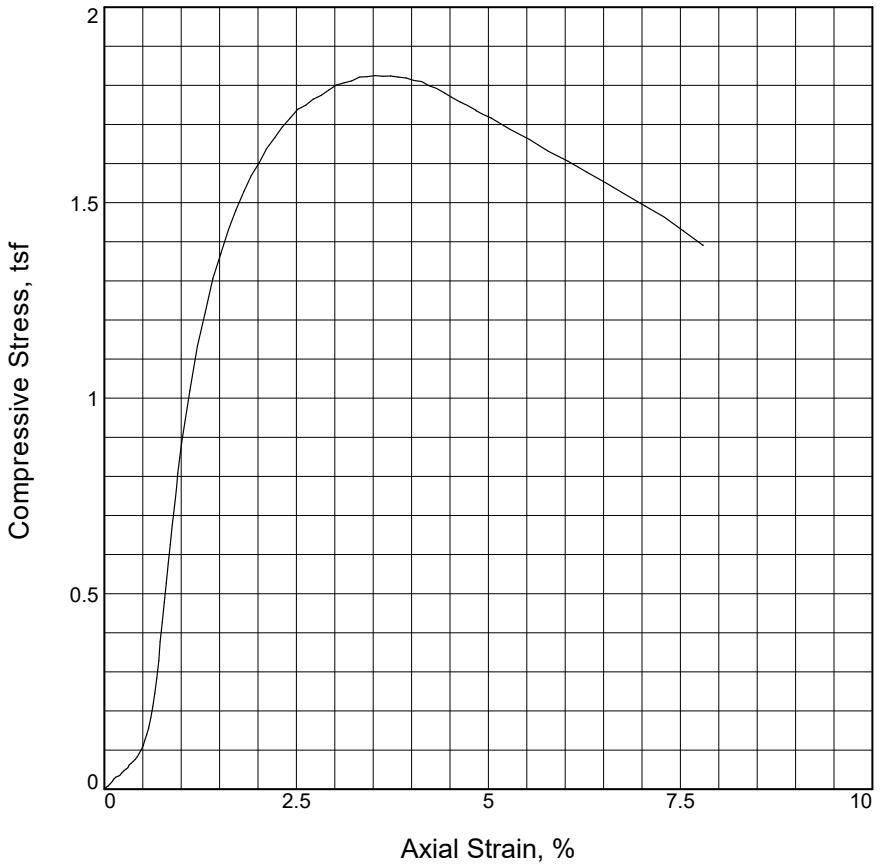
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-44 **Depth:** 29.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.825			
Undrained shear strength, tsf	0.913			
Failure strain, %	3.5			
Strain rate, %/min.	1.00			
Water content, %	30.4			
Wet density, pcf	120.0			
Dry density, pcf	92.0			
Saturation, %	98.8			
Void ratio	0.8314			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY with SAND (CH)

LL = 57	**PL =** 22	**PI =** 35	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

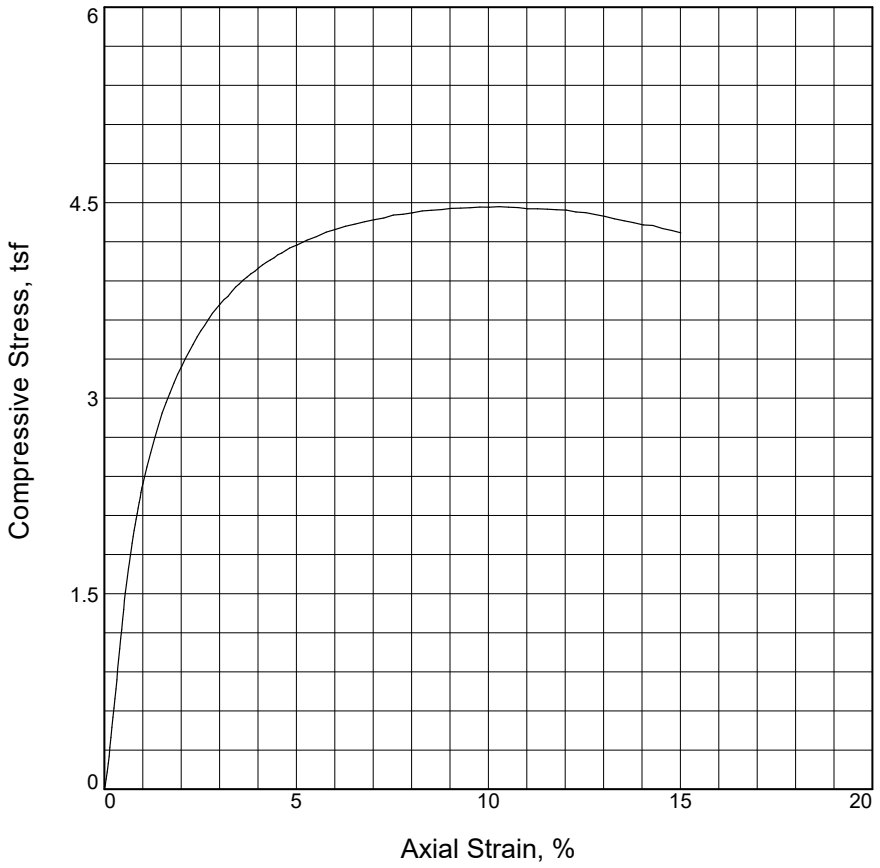
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-44 **Depth:** 37
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	4.470			
Undrained shear strength, tsf	2.235			
Failure strain, %	10.3			
Strain rate, %/min.	1.00			
Water content, %	20.9			
Wet density, pcf	129.5			
Dry density, pcf	107.2			
Saturation, %	98.3			
Void ratio	0.5728			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Tan and gray FAT CLAY with SAND

LL = 57	**PL =** 20	**PI =** 37	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

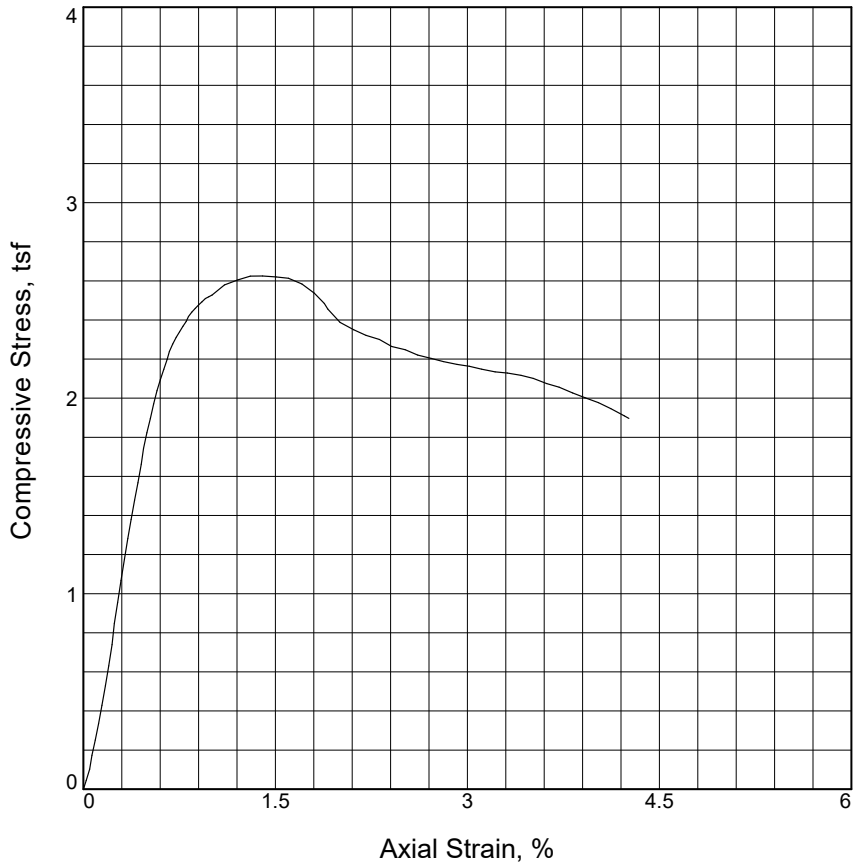
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-44 **Depth:** 44.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.625			
Undrained shear strength, tsf	1.312			
Failure strain, %	1.4			
Strain rate, %/min.	1.00			
Water content, %	31.6			
Wet density, pcf	121.1			
Dry density, pcf	92.0			
Saturation, %	98.4			
Void ratio	0.8998			
Specimen diameter, in.	2.86			
Specimen height, in.	5.76			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY (CH)

LL = 79	**PL =** 27	**PI =** 52	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/7/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

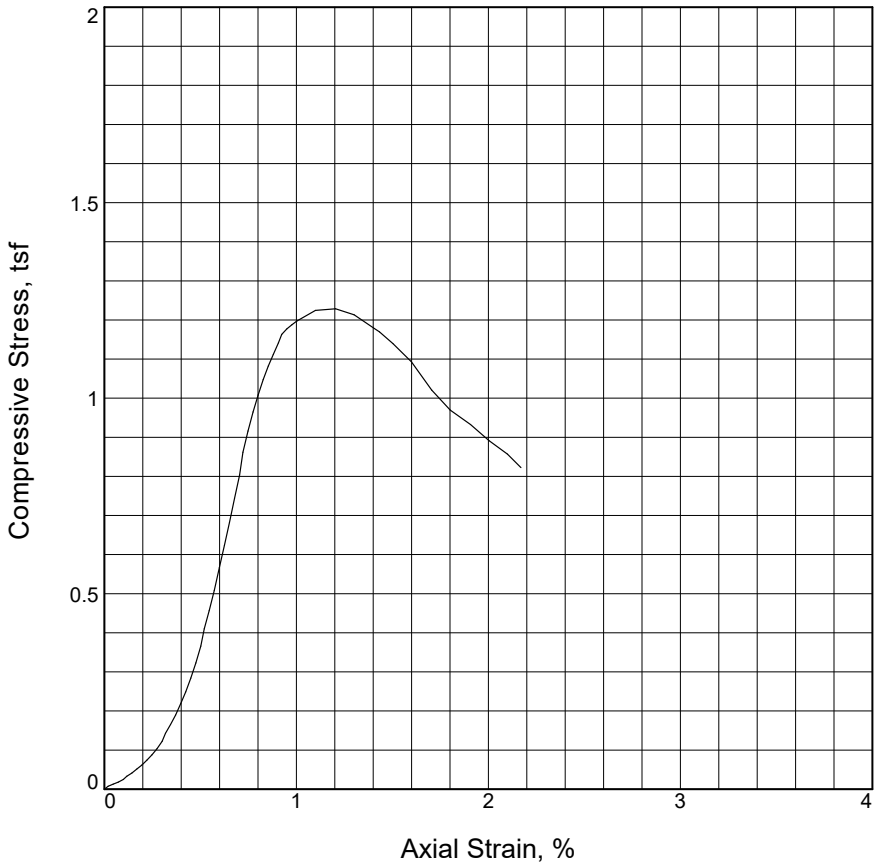
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-44 **Depth:** 52
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.229			
Undrained shear strength, tsf	0.614			
Failure strain, %	1.2			
Strain rate, %/min.	1.00			
Water content, %	29.2			
Wet density, pcf	119.5			
Dry density, pcf	92.4			
Saturation, %	95.8			
Void ratio	0.8233			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Tan FAT CLAY; calcareous

LL = 71	**PL =** 27	**PI =** 44	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/10/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

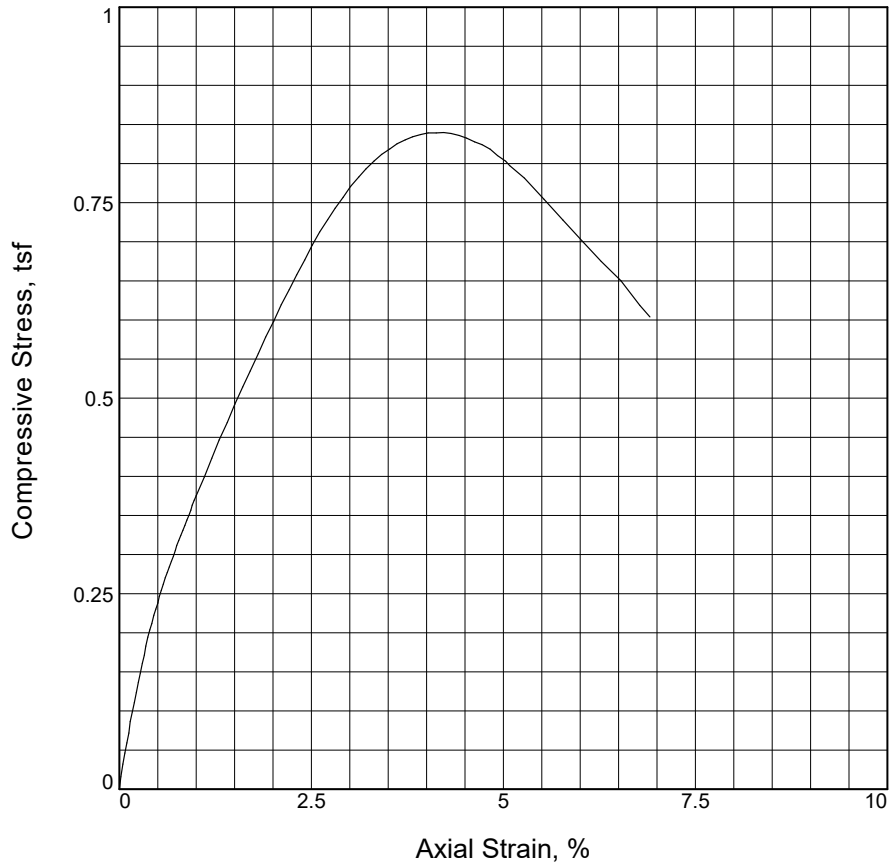
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-46 **Depth:** 54
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.840			
Undrained shear strength, tsf	0.420			
Failure strain, %	4.2			
Strain rate, %/min.	1.00			
Water content, %	73.9			
Wet density, pcf	96.3			
Dry density, pcf	55.4			
Saturation, %	97.6			
Void ratio	2.0450			
Specimen diameter, in.	2.85			
Specimen height, in.	5.72			
Height/diameter ratio	2.01			

Description: Brown FAT CLAY; sand pockets

LL = 106	**PL =** 46	**PI =** 60	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/10/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

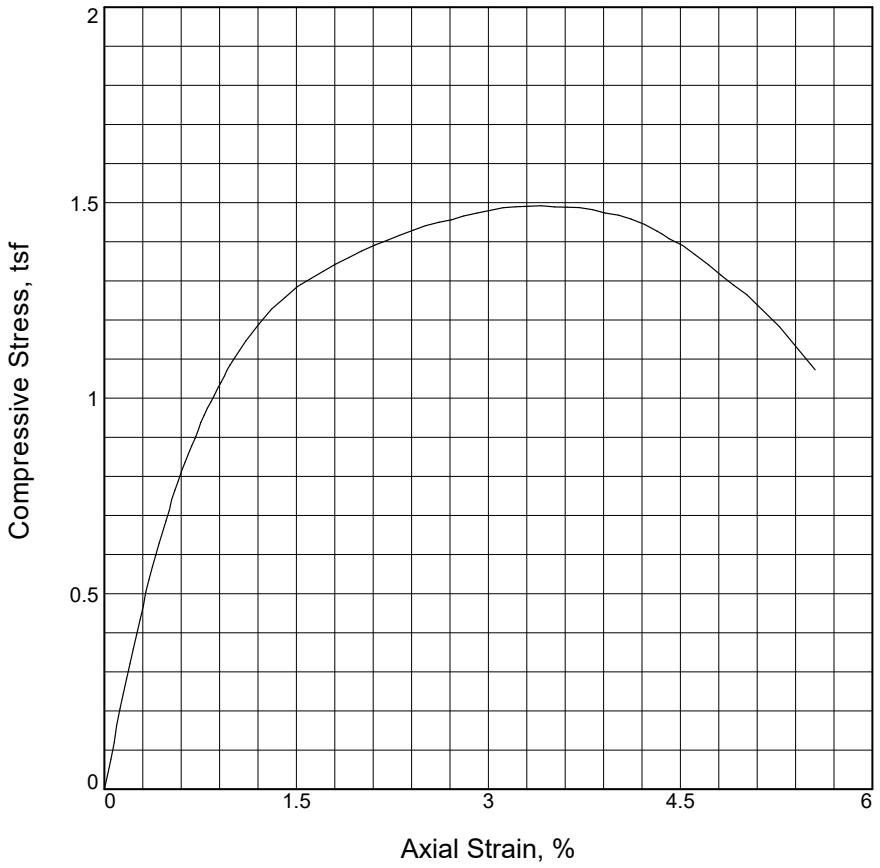
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-47 **Depth:** 47
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.492			
Undrained shear strength, tsf	0.746			
Failure strain, %	3.4			
Strain rate, %/min.	1.00			
Water content, %	23.5			
Wet density, pcf	127.9			
Dry density, pcf	103.6			
Saturation, %	98.2			
Void ratio	0.6571			
Specimen diameter, in.	2.83			
Specimen height, in.	5.89			
Height/diameter ratio	2.08			

Description: Gray FAT CLAY (CH)

LL = 56	**PL =** 22	**PI =** 34	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

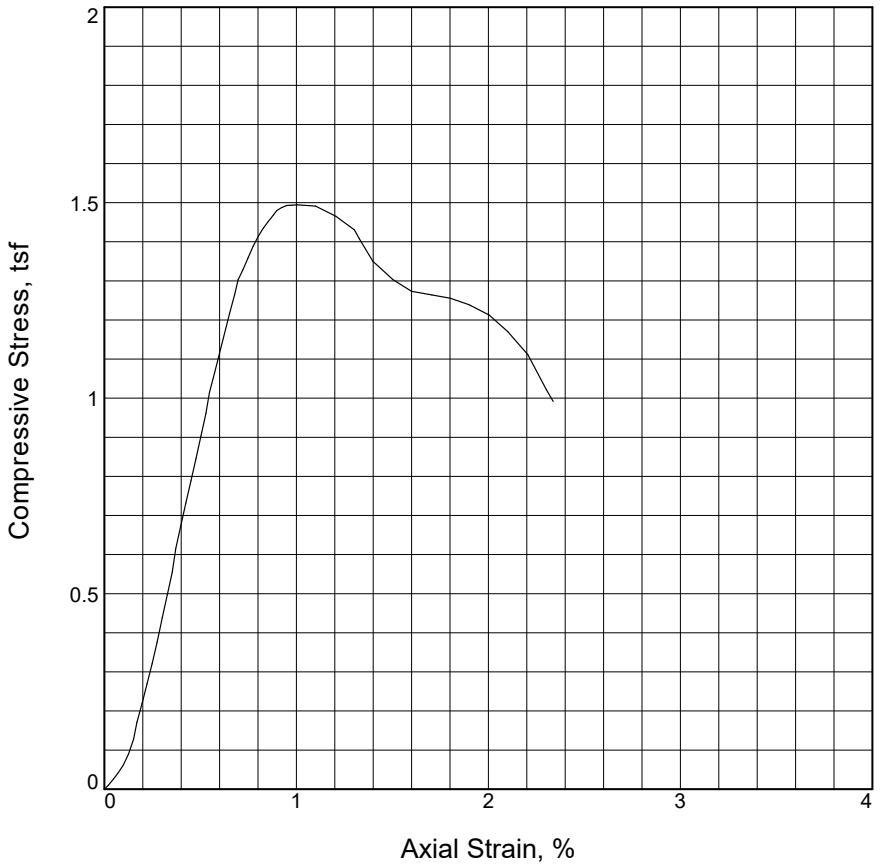
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-48 **Depth:** 30
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.495			
Undrained shear strength, tsf	0.747			
Failure strain, %	1.0			
Strain rate, %/min.	1.00			
Water content, %	27.3			
Wet density, pcf	125.6			
Dry density, pcf	98.6			
Saturation, %	99.1			
Void ratio	0.7726			
Specimen diameter, in.	2.83			
Specimen height, in.	5.86			
Height/diameter ratio	2.07			

Description: Gray and brown FAT CLAY with SAND

LL = 65	**PL =** 23	**PI =** 42	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

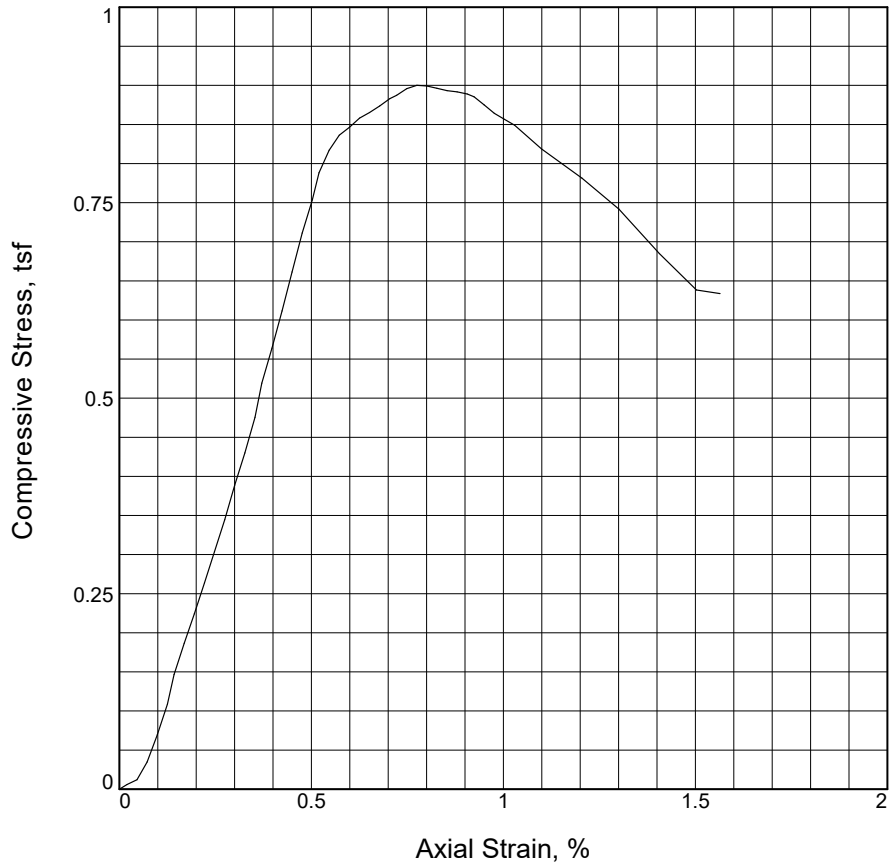
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-48 **Depth:** 42.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.900			
Undrained shear strength, tsf	0.450			
Failure strain, %	0.8			
Strain rate, %/min.	1.00			
Water content, %	38.1			
Wet density, pcf	115.3			
Dry density, pcf	83.5			
Saturation, %	99.2			
Void ratio	1.0572			
Specimen diameter, in.	2.85			
Specimen height, in.	5.88			
Height/diameter ratio	2.07			

Description: Gray and brown FAT CLAY

LL = 87	**PL =** 30	**PI =** 57	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

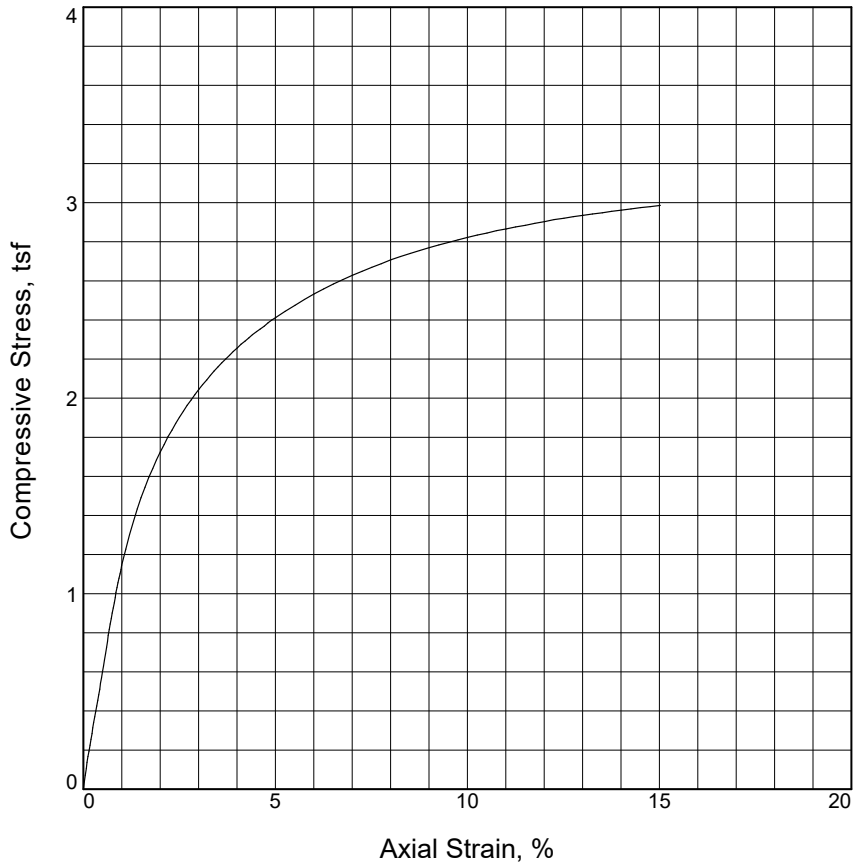
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-48 **Depth:** 52.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.986			
Undrained shear strength, tsf	1.493			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	21.3			
Wet density, pcf	130.5			
Dry density, pcf	107.5			
Saturation, %	98.4			
Void ratio	0.5963			
Specimen diameter, in.	2.83			
Specimen height, in.	5.86			
Height/diameter ratio	2.07			

Description: Reddishbrown and tan LEAN CLAY with SAND (CL)

LL = 47	**PL =** 20	**PI =** 27	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

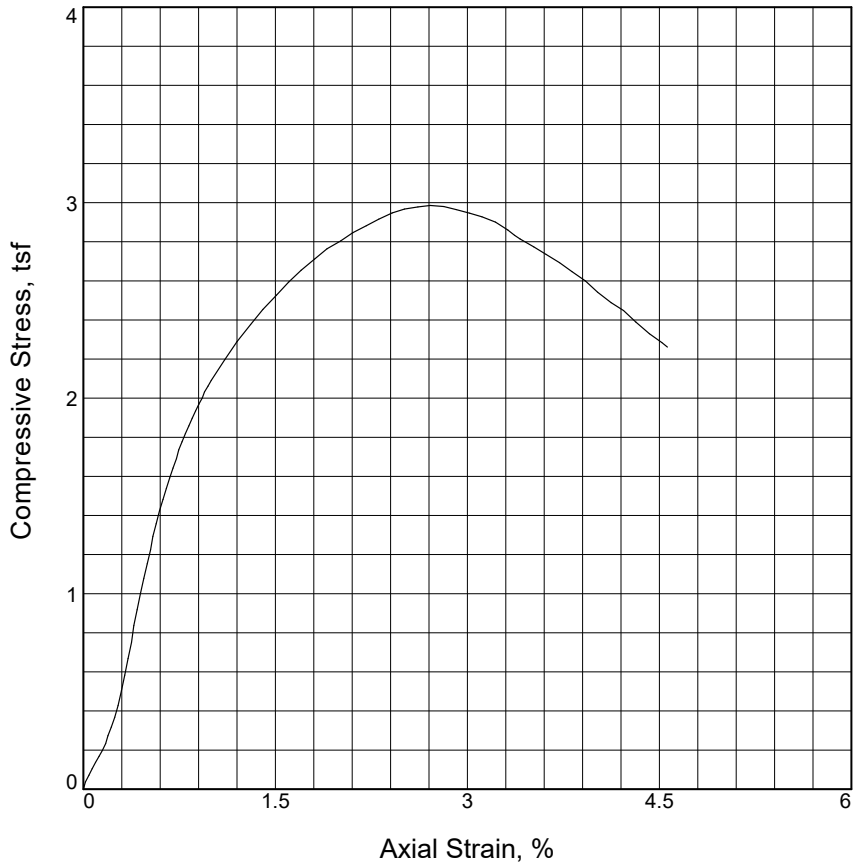
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-49 **Depth:** 25
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.986			
Undrained shear strength, tsf	1.493			
Failure strain, %	2.7			
Strain rate, %/min.	1.00			
Water content, %	27.7			
Wet density, pcf	125.2			
Dry density, pcf	98.0			
Saturation, %	99.2			
Void ratio	0.7830			
Specimen diameter, in.	2.86			
Specimen height, in.	5.85			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY (CH)

LL = 64	**PL =** 23	**PI =** 41	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

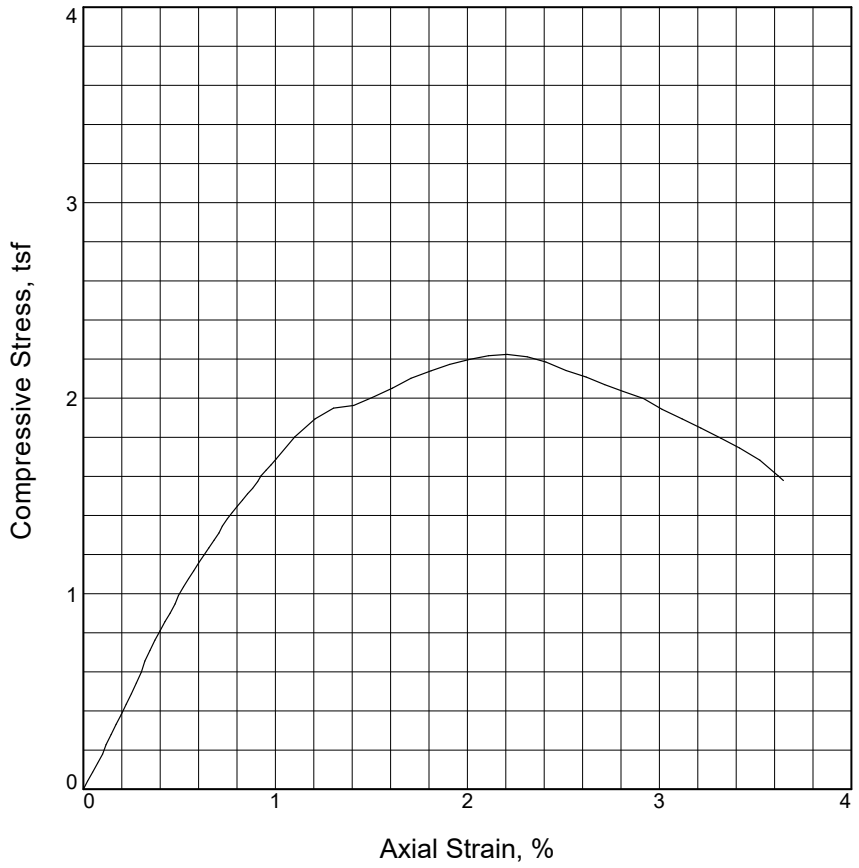
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-49 **Depth:** 32
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.224			
Undrained shear strength, tsf	1.112			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	17.8			
Wet density, pcf	12.2			
Dry density, pcf	10.4			
Saturation, %	3.2			
Void ratio	15.2234			
Specimen diameter, in.	2.85			
Specimen height, in.	5.88			
Height/diameter ratio	2.06			

Description: Gray FAT CLAY (CH)

LL = 60	**PL =** 23	**PI =** 37	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

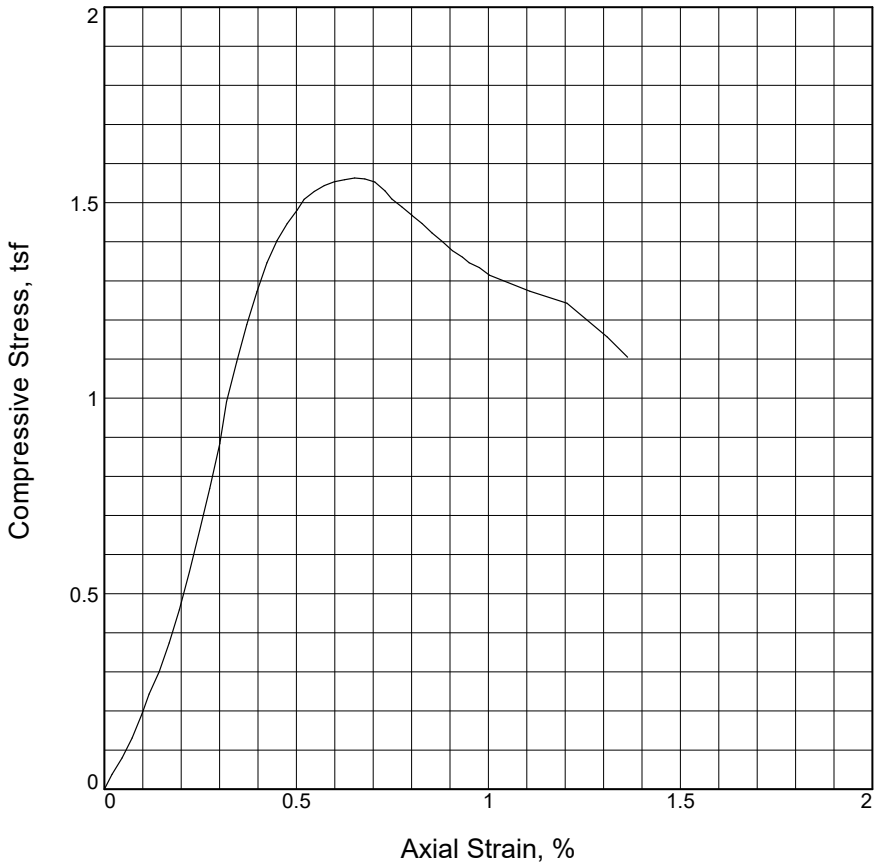
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-49 **Depth:** 39.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.563			
Undrained shear strength, tsf	0.782			
Failure strain, %	0.7			
Strain rate, %/min.	1.00			
Water content, %	32.6			
Wet density, pcf	120.5			
Dry density, pcf	90.9			
Saturation, %	98.9			
Void ratio	0.9232			
Specimen diameter, in.	2.81			
Specimen height, in.	5.88			
Height/diameter ratio	2.09			

Description: Brown and gray FAT CLAY; calcareous

LL = 56	**PL =** 22	**PI =** 34	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/13/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

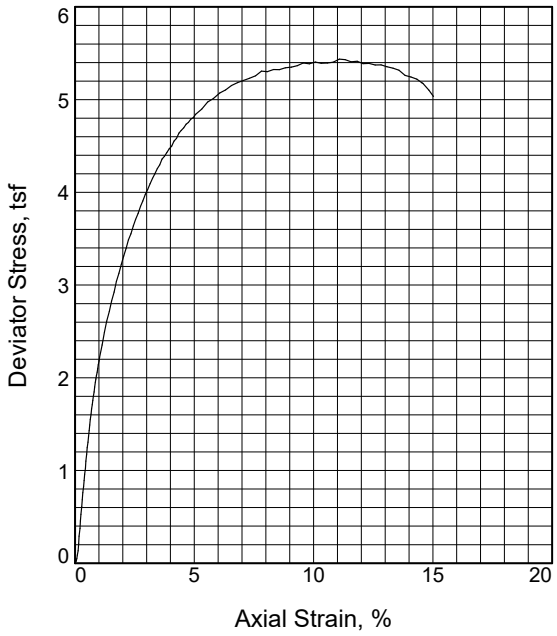
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-49 **Depth:** 47
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	17.2
	Dry Density, pcf	113.8
	Saturation, %	96.8
	Void Ratio	0.4806
	Diameter, in.	2.85
	Height, in.	5.73
At Test	Water Content, %	16.2
	Dry Density, pcf	113.8
	Saturation, %	90.8
	Void Ratio	0.4806
	Diameter, in.	2.85
	Height, in.	5.73
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		10.00
Fail. Stress, tsf		5.44
Strain, %		11.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		6.16
σ_3 Failure, tsf		0.72

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown and gray SANDY FAT CLAY; calcareous

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

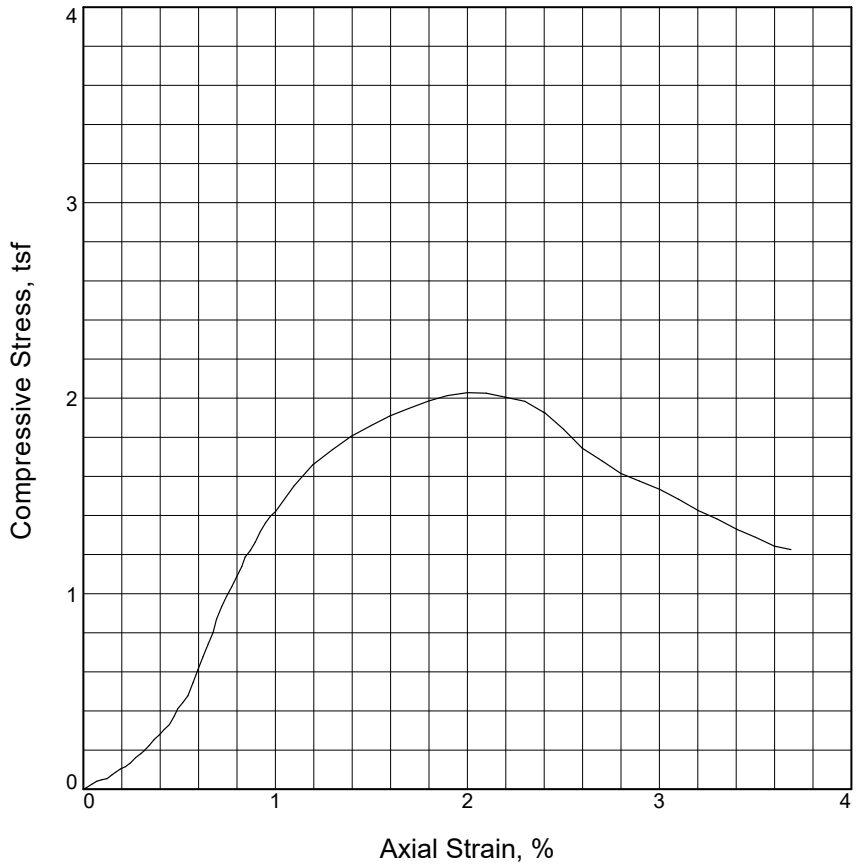
Source of Sample: CB-50 **Depth:** 25

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 8/14/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.028			
Undrained shear strength, tsf	1.014			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	27.8			
Wet density, pcf	123.9			
Dry density, pcf	96.9			
Saturation, %	99.1			
Void ratio	0.7718			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Reddish-brown FAT CLAY; calcareous and sand pockets

LL = 66	**PL =** 25	**PI =** 41	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

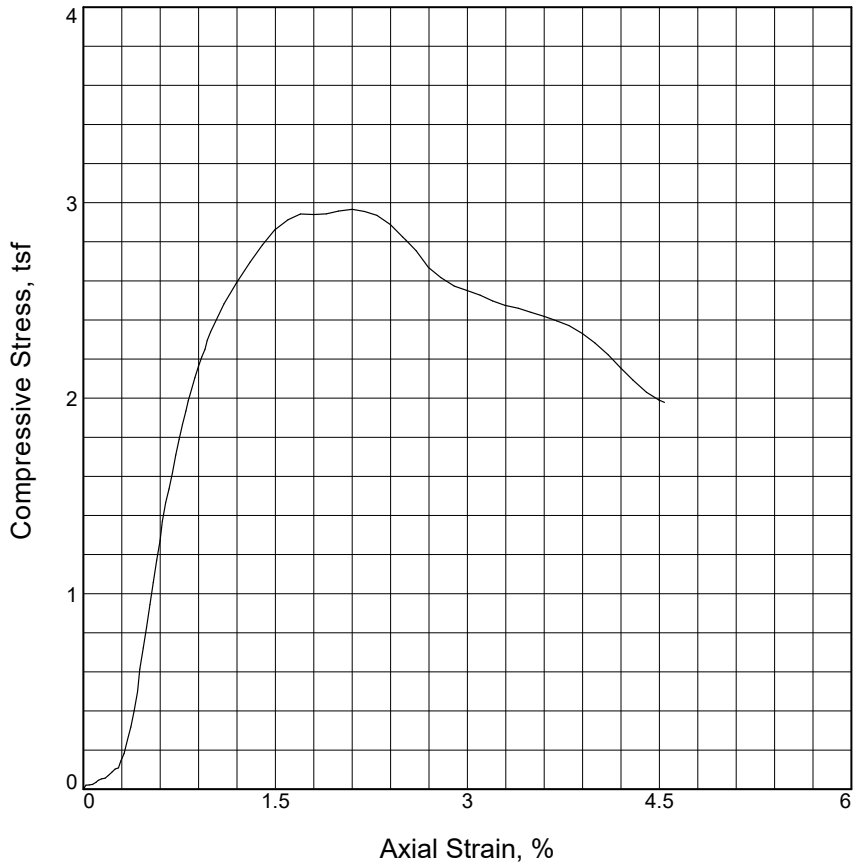
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-50 **Depth:** 32
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.966			
Undrained shear strength, tsf	1.483			
Failure strain, %	2.1			
Strain rate, %/min.	1.00			
Water content, %	20.7			
Wet density, pcf	129.4			
Dry density, pcf	107.2			
Saturation, %	97.7			
Void ratio	0.5717			
Specimen diameter, in.	2.86			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY with SAND (CH)

LL = 54	**PL =** 22	**PI =** 32	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

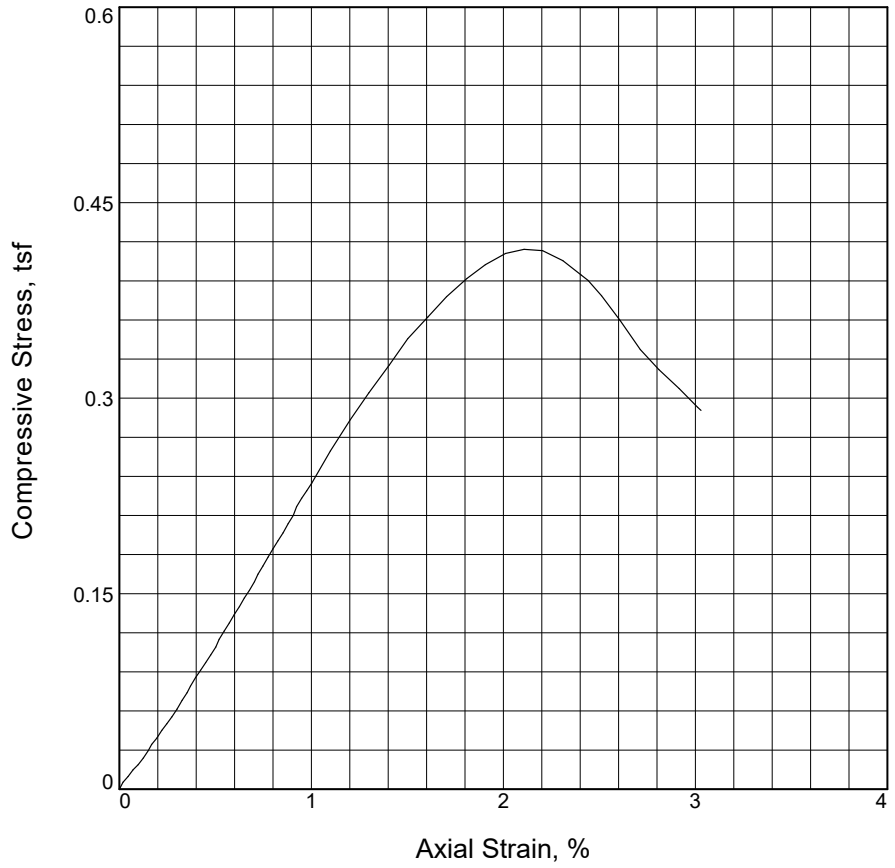
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-50 **Depth:** 39.5
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.414			
Undrained shear strength, tsf	0.207			
Failure strain, %	2.1			
Strain rate, %/min.	1.00			
Water content, %	20.5			
Wet density, pcf	122.0			
Dry density, pcf	101.2			
Saturation, %	83.1			
Void ratio	0.6651			
Specimen diameter, in.	1.98			
Specimen height, in.	4.84			
Height/diameter ratio	2.44			

Description: Gray CLAYEY SAND (SC)

LL = 30	**PL =** 17	**PI =** 13	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/11/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

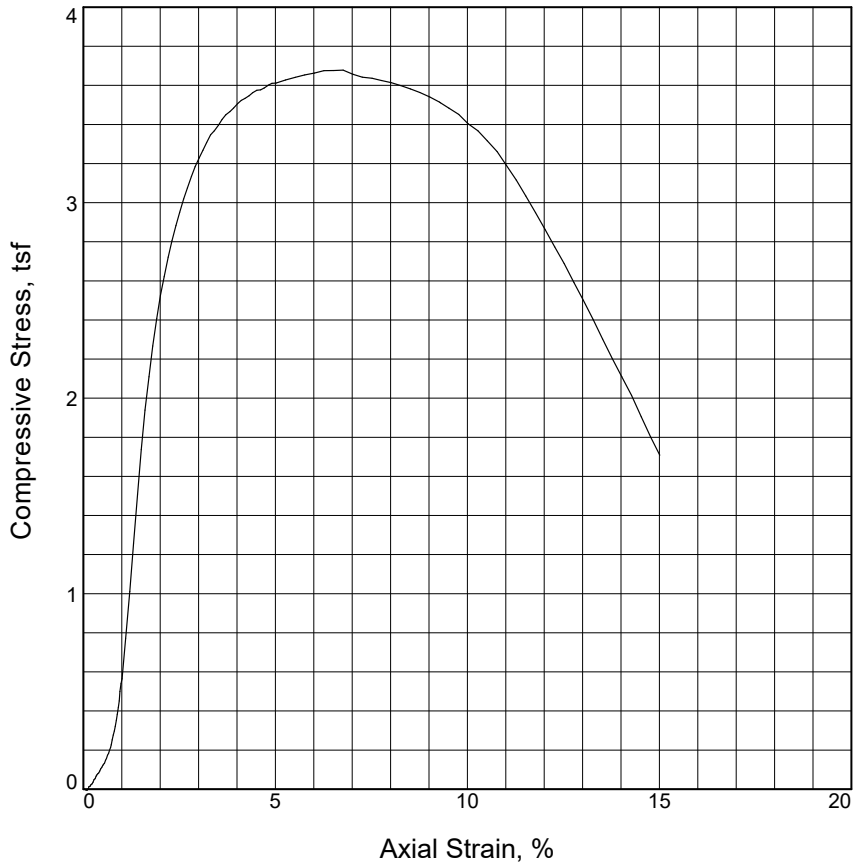
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-50 **Depth:** 49.5
Sample Number: ST-11

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.678			
Undrained shear strength, tsf	1.839			
Failure strain, %	6.8			
Strain rate, %/min.	1.00			
Water content, %	22.1			
Wet density, pcf	128.1			
Dry density, pcf	105.0			
Saturation, %	98.4			
Void ratio	0.6059			
Specimen diameter, in.	2.85			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Brown and tan LEAN CLAY (CL)

LL = 46	**PL =** 20	**PI =** 26	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/18/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

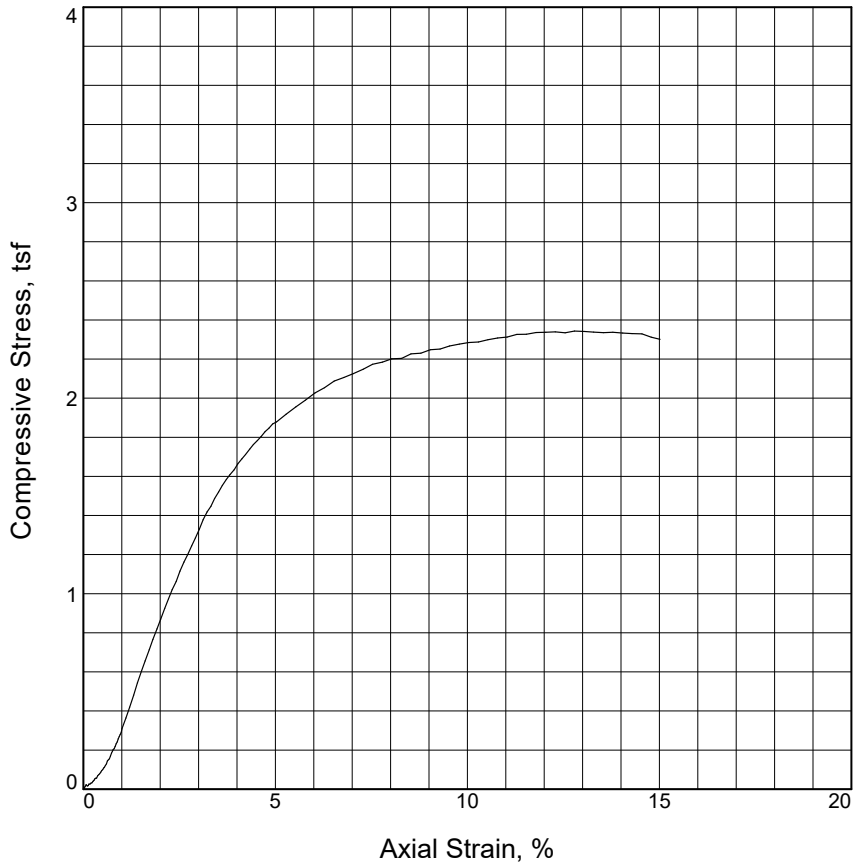
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-52 **Depth:** 25
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.343			
Undrained shear strength, tsf	1.172			
Failure strain, %	12.8			
Strain rate, %/min.	1.00			
Water content, %	19.4			
Wet density, pcf	130.7			
Dry density, pcf	109.5			
Saturation, %	97.0			
Void ratio	0.5397			
Specimen diameter, in.	2.84			
Specimen height, in.	5.73			
Height/diameter ratio	2.02			

Description: Reddish-brown LEAN CLAY; calcareous

LL = 30	**PL =** 17	**PI =** 13	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/18/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

Figure _____

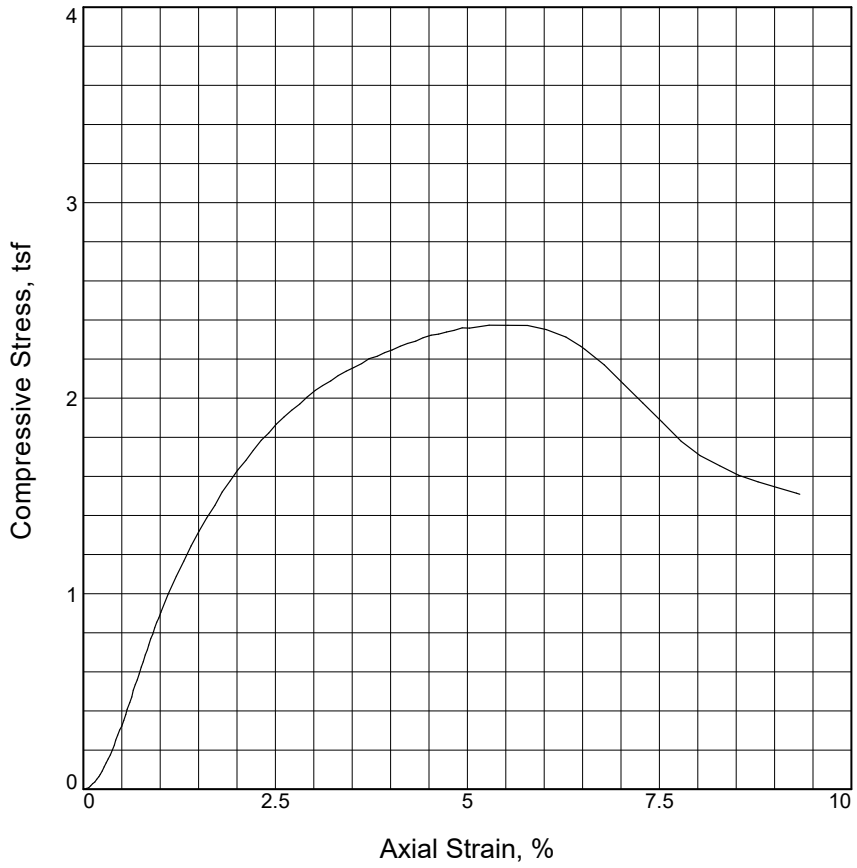
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-52 **Depth:** 30
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.373			
Undrained shear strength, tsf	1.187			
Failure strain, %	5.3			
Strain rate, %/min.	1.00			
Water content, %	20.7			
Wet density, pcf	128.9			
Dry density, pcf	106.8			
Saturation, %	96.6			
Void ratio	0.5781			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Reddish-brown FAT CLAY; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/18/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

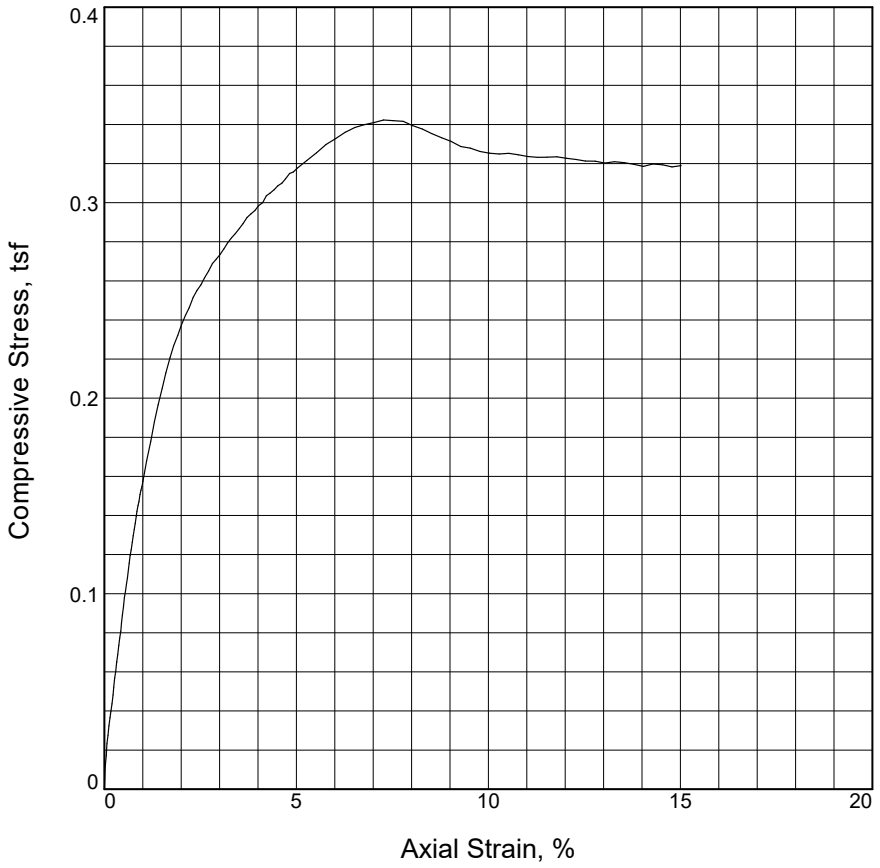
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-52 **Depth:** 32.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.342			
Undrained shear strength, tsf	0.171			
Failure strain, %	7.3			
Strain rate, %/min.	1.00			
Water content, %	60.2			
Wet density, pcf	100.7			
Dry density, pcf	62.9			
Saturation, %	96.7			
Void ratio	1.6807			
Specimen diameter, in.	2.90			
Specimen height, in.	5.85			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY; shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/16/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

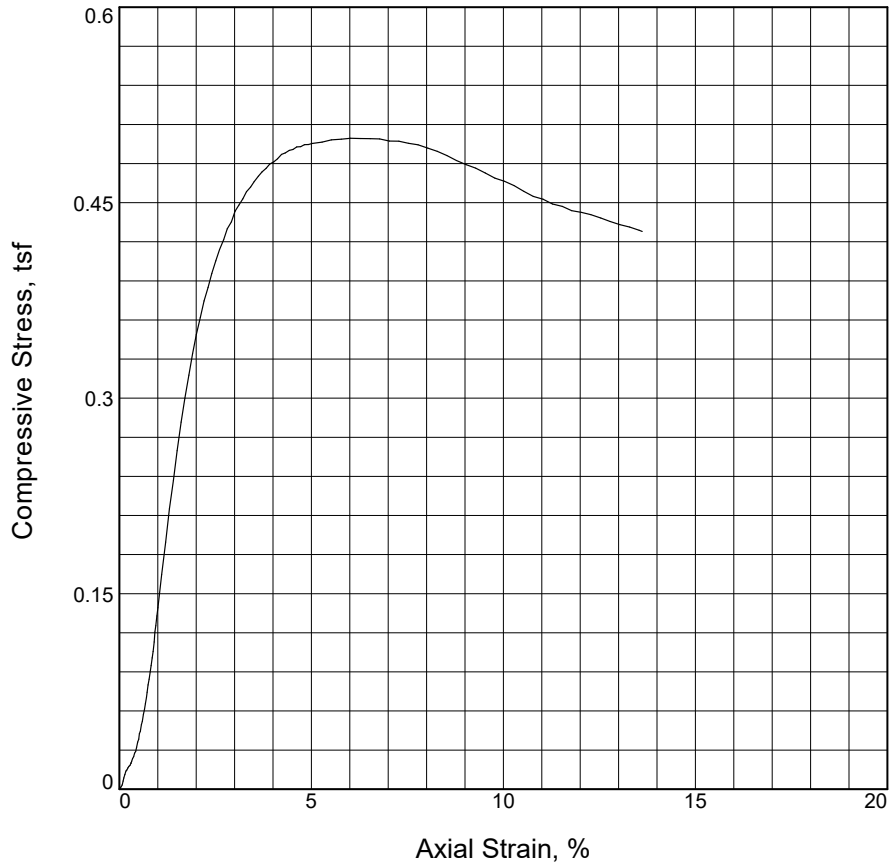
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-54 **Depth:** 42.5
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.499			
Undrained shear strength, tsf	0.250			
Failure strain, %	6.0			
Strain rate, %/min.	1.00			
Water content, %	58.0			
Wet density, pcf	104.7			
Dry density, pcf	66.2			
Saturation, %	99.1			
Void ratio	1.6390			
Specimen diameter, in.	2.82			
Specimen height, in.	5.91			
Height/diameter ratio	2.09			

Description: Gray FAT CLAY; shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/16/21
Remarks:

Test method: ASTM D2166
Failure type: 45 degree

Figure _____

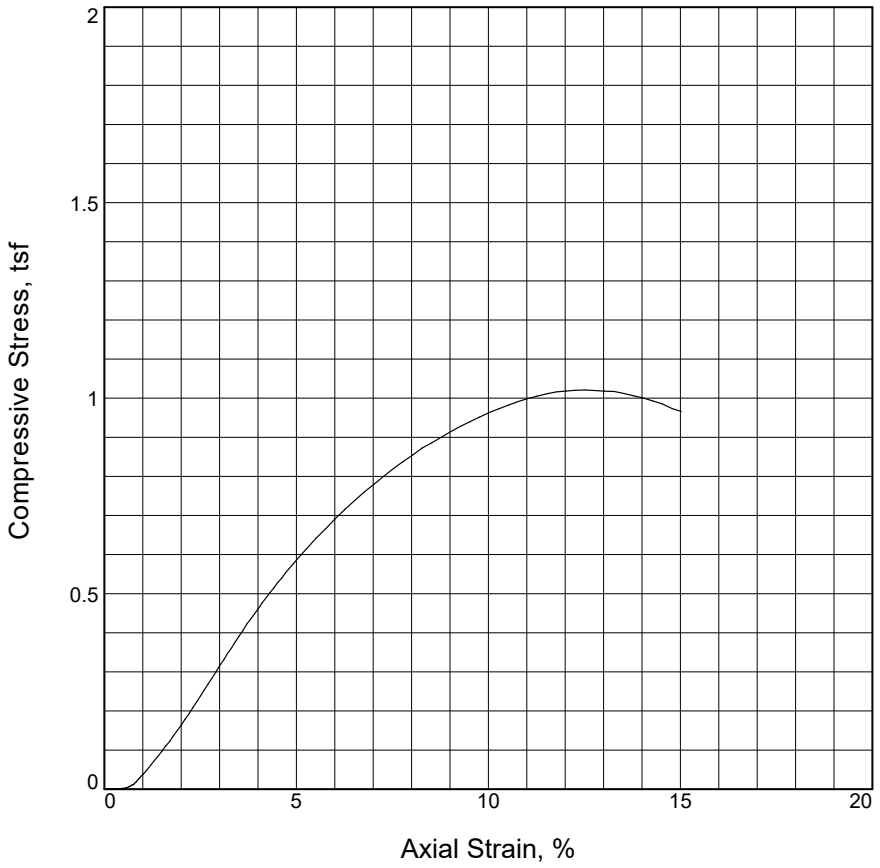
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-54 **Depth:** 47.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.021			
Undrained shear strength, tsf	0.510			
Failure strain, %	12.5			
Strain rate, %/min.	1.00			
Water content, %	20.6			
Wet density, pcf	128.6			
Dry density, pcf	106.7			
Saturation, %	95.8			
Void ratio	0.5803			
Specimen diameter, in.	2.85			
Specimen height, in.	5.91			
Height/diameter ratio	2.07			

Description: Gray SANDY LEAN CLAY (CL)

LL = 30	**PL =** 16	**PI =** 14	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/16/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

Figure _____

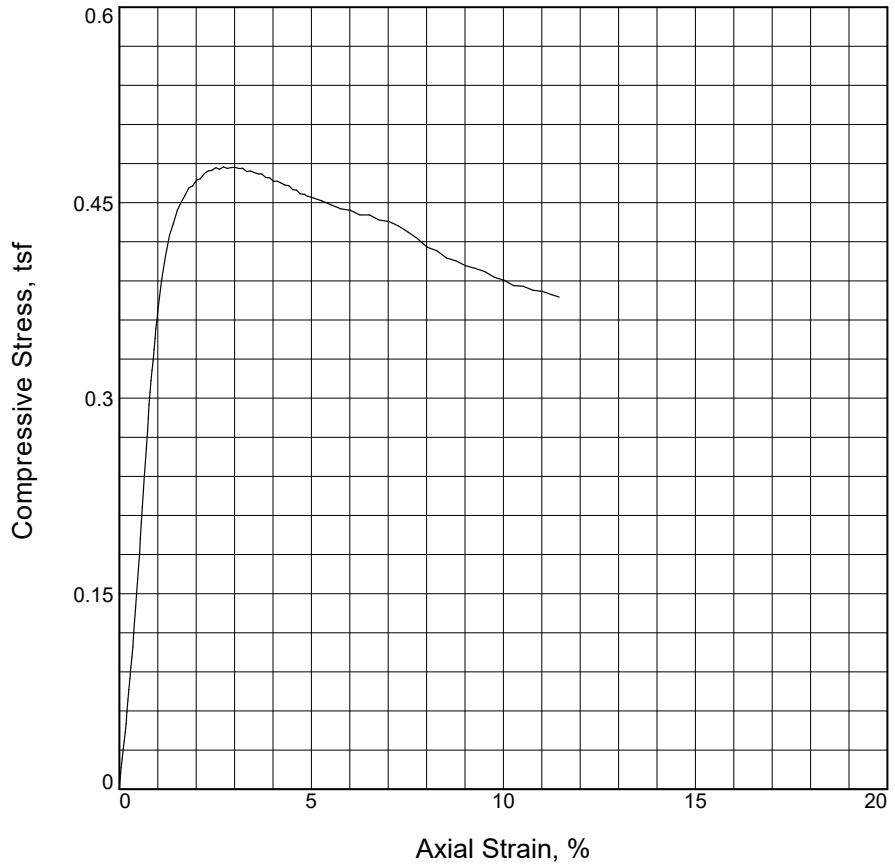
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-54 **Depth:** 57.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.477			
Undrained shear strength, tsf	0.239			
Failure strain, %	2.7			
Strain rate, %/min.	1.00			
Water content, %	60.3			
Wet density, pcf	100.9			
Dry density, pcf	63.0			
Saturation, %	97.0			
Void ratio	1.6767			
Specimen diameter, in.	2.84			
Specimen height, in.	5.73			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY; shell fragments

LL = 89	**PL =** 36	**PI =** 53	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/17/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

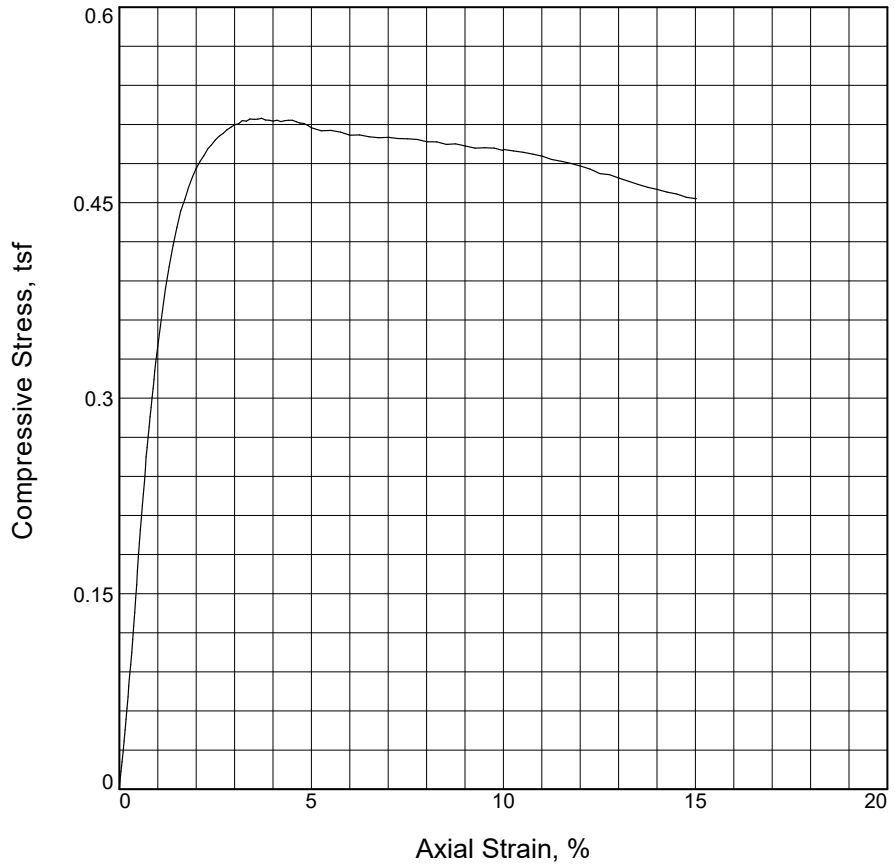
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-56 **Depth:** 32.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.515			
Undrained shear strength, tsf	0.257			
Failure strain, %	3.7			
Strain rate, %/min.	1.00			
Water content, %	62.4			
Wet density, pcf	103.8			
Dry density, pcf	63.9			
Saturation, %	99.7			
Void ratio	1.7847			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY (CH)

LL = 83	**PL =** 27	**PI =** 56	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/17/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

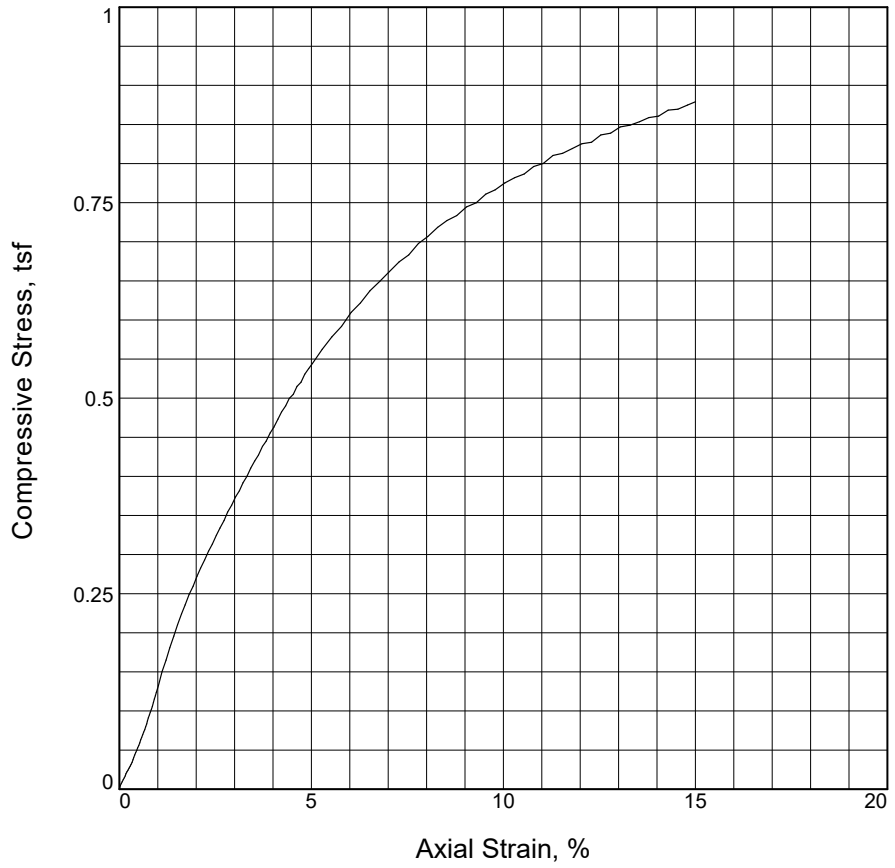
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-56 **Depth:** 40
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.879			
Undrained shear strength, tsf	0.440			
Failure strain, %	15.0			
Strain rate, %/min.	1.00			
Water content, %	20.6			
Wet density, pcf	129.0			
Dry density, pcf	106.9			
Saturation, %	96.7			
Void ratio	0.5763			
Specimen diameter, in.	2.88			
Specimen height, in.	5.66			
Height/diameter ratio	1.96			

Description: Gray CLAYEY SAND (SC)

LL = 36	**PL =** 16	**PI =** 20	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/16/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

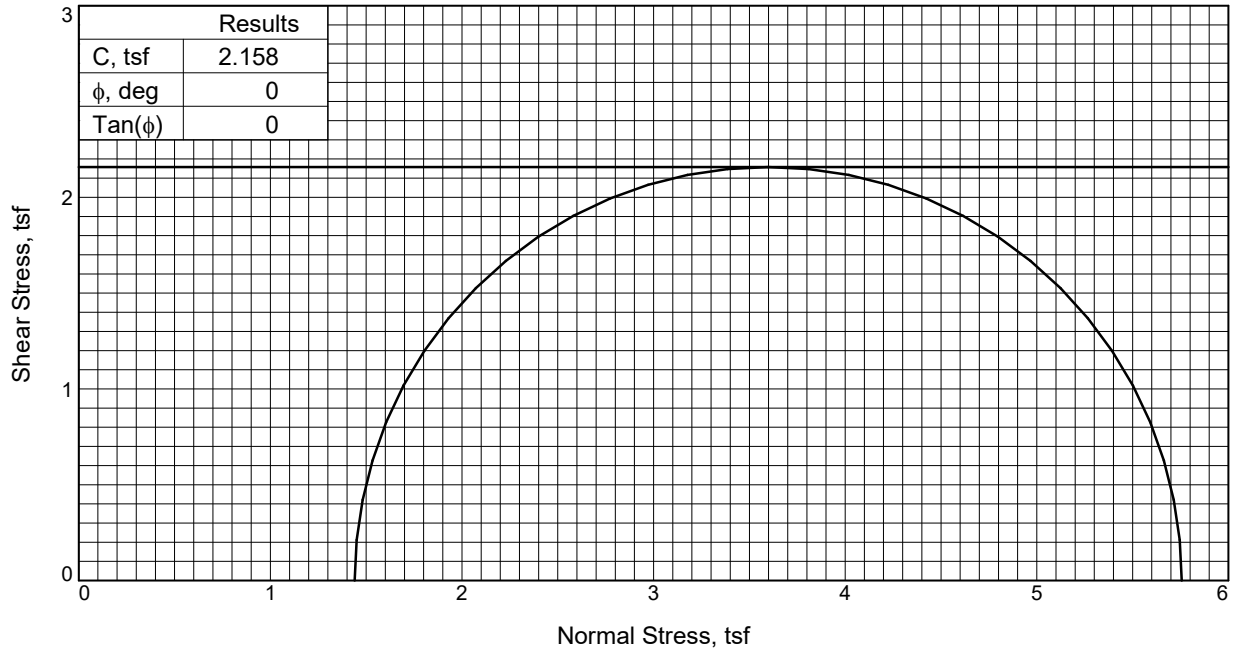
Figure _____

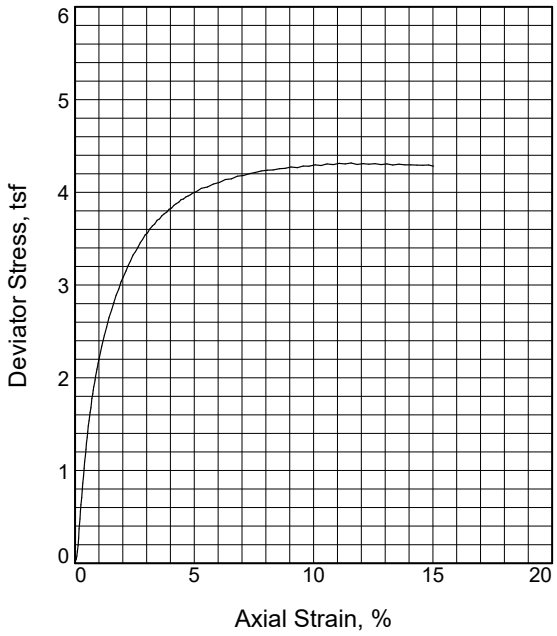
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-56 **Depth:** 47.5
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	21.8
	Dry Density, pcf	104.5
	Saturation, %	96.2
	Void Ratio	0.6135
	Diameter, in.	2.86
	Height, in.	5.88
At Test	Water Content, %	21.3
	Dry Density, pcf	104.5
	Saturation, %	93.7
	Void Ratio	0.6135
	Diameter, in.	2.86
	Height, in.	5.88
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		20.00
Fail. Stress, tsf		4.32
Strain, %		11.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		5.76
σ_3 Failure, tsf		1.44

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY with SAND (CH)

LL= 56 **PL=** 21 **PI=** 35

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

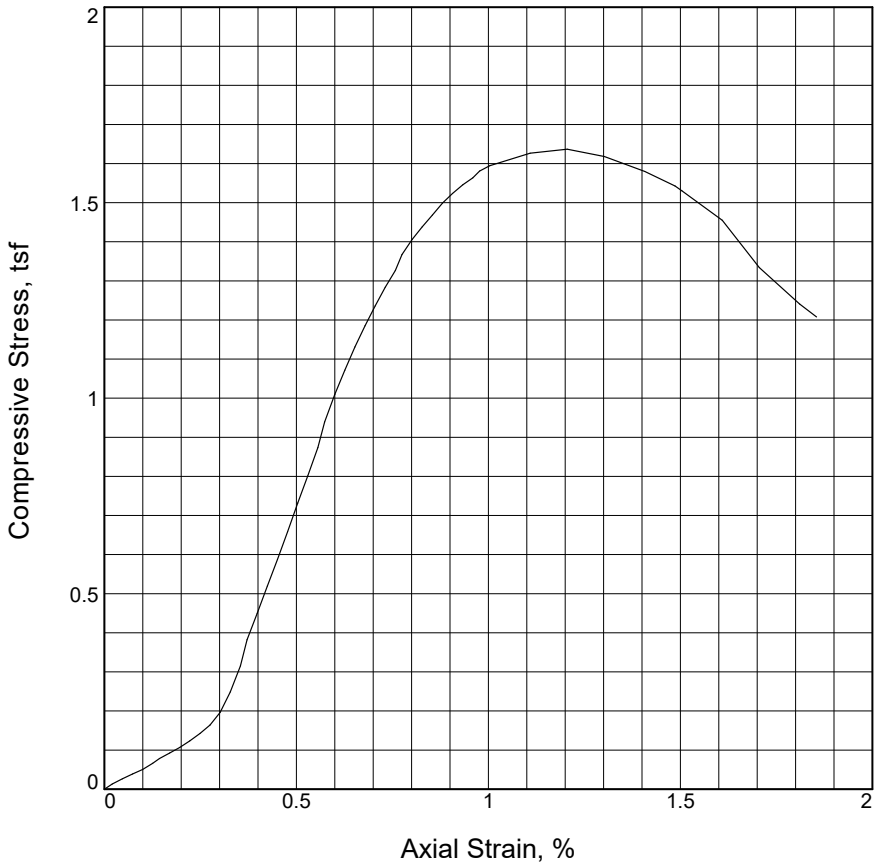
Source of Sample: CB-58 **Depth:** 52.5

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 8/18/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.637			
Undrained shear strength, tsf	0.818			
Failure strain, %	1.2			
Strain rate, %/min.	1.00			
Water content, %	19.3			
Wet density, pcf	128.5			
Dry density, pcf	107.7			
Saturation, %	92.3			
Void ratio	0.5656			
Specimen diameter, in.	2.88			
Specimen height, in.	5.90			
Height/diameter ratio	2.05			

Description: Gray and tan FAT CLAY with SAND (CH)

LL = 64	**PL =** 23	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/17/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

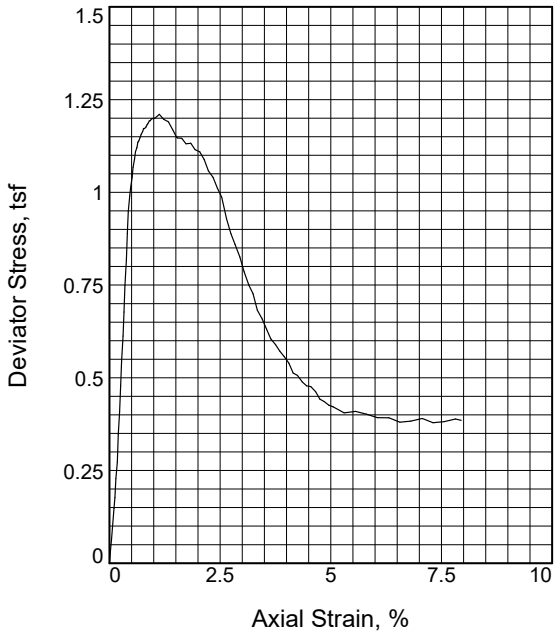
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-58 **Depth:** 57.5
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	30.3
	Dry Density, pcf	92.9
	Saturation, %	98.3
	Void Ratio	0.8488
	Diameter, in.	2.85
	Height, in.	5.73
At Test	Water Content, %	30.3
	Dry Density, pcf	92.9
	Saturation, %	98.2
	Void Ratio	0.8488
	Diameter, in.	2.85
	Height, in.	5.73
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		1.21
Strain, %		1.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.79
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan FAT CLAY (CH)

LL= 74 **PL=** 26 **PI=** 48

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

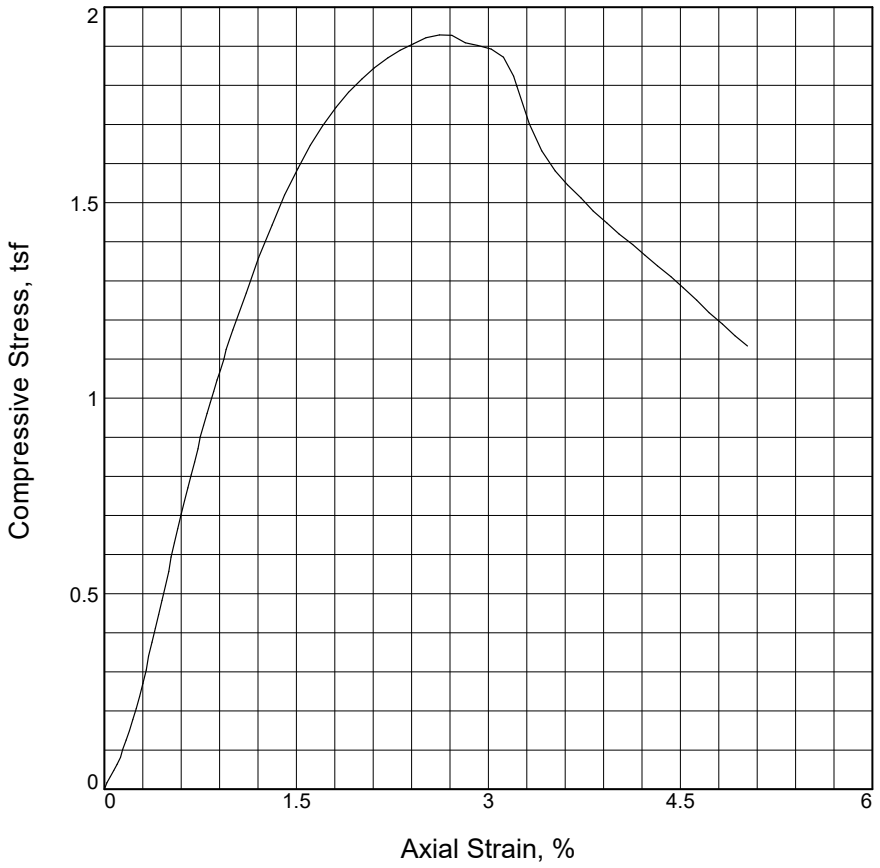
Source of Sample: CB-59 **Depth:** 20

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 8/20/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.929			
Undrained shear strength, tsf	0.964			
Failure strain, %	2.6			
Strain rate, %/min.	1.00			
Water content, %	27.2			
Wet density, pcf	120.9			
Dry density, pcf	95.1			
Saturation, %	94.9			
Void ratio	0.7730			
Specimen diameter, in.	2.86			
Specimen height, in.	5.73			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY with SAND (CH)

LL = 71	**PL =** 24	**PI =** 47	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

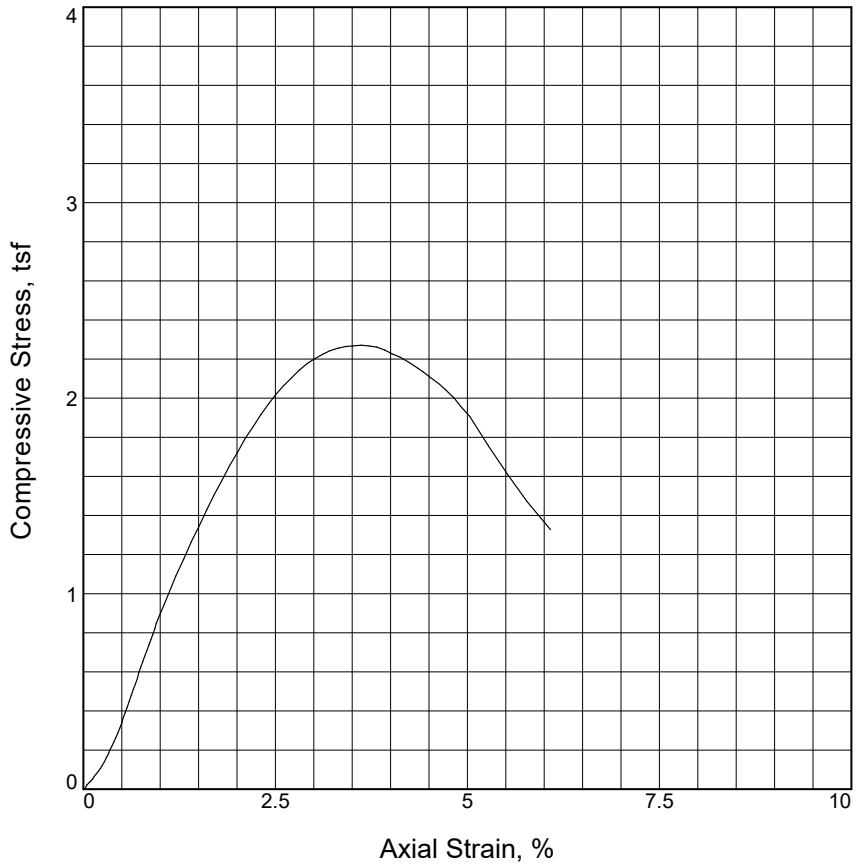
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-59 **Depth:** 25
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.271			
Undrained shear strength, tsf	1.136			
Failure strain, %	3.6			
Strain rate, %/min.	1.00			
Water content, %	15.9			
Wet density, pcf	134.7			
Dry density, pcf	116.2			
Saturation, %	95.5			
Void ratio	0.4501			
Specimen diameter, in.	2.88			
Specimen height, in.	5.73			
Height/diameter ratio	1.99			

Description: Gray and tan SANDY LEAN CLAY; calcareous

LL = 32	**PL =** 16	**PI =** 16	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

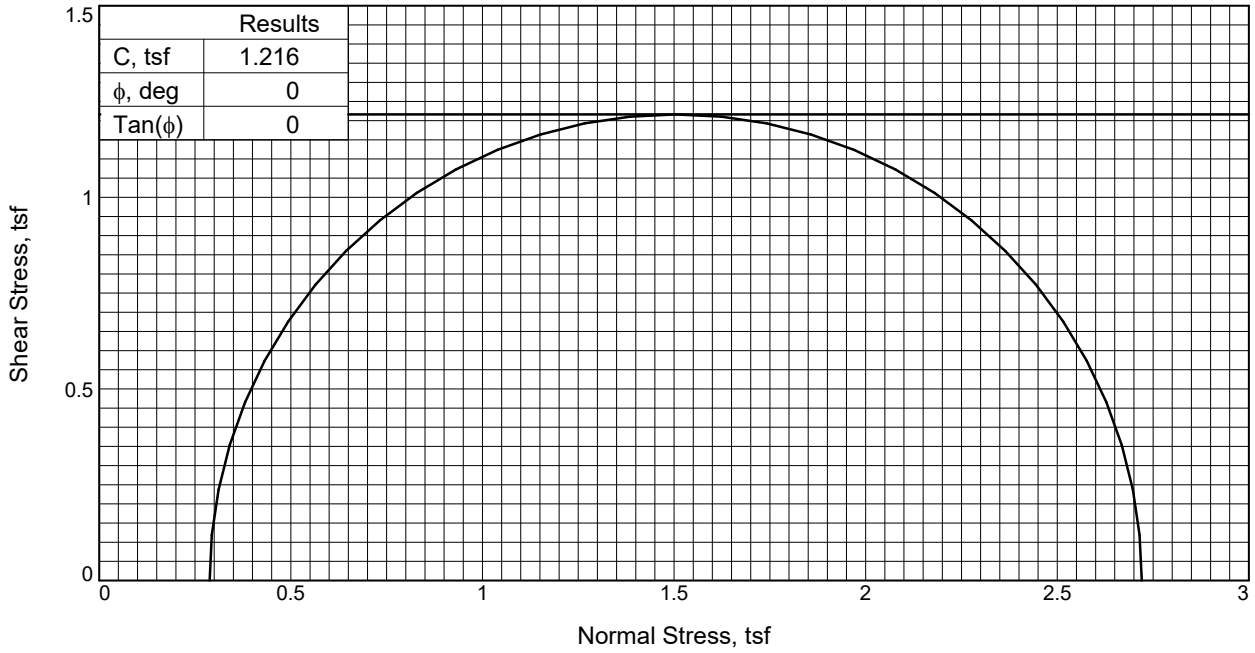
Figure _____

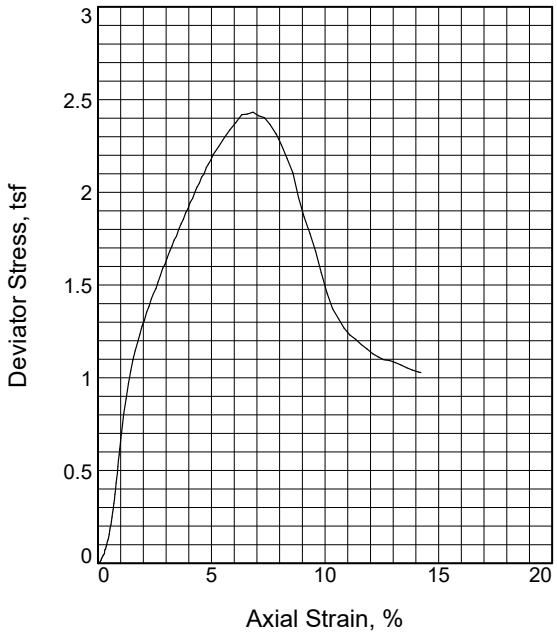
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-59 **Depth:** 30
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	26.6
	Dry Density, pcf	97.7
	Saturation, %	99.0
	Void Ratio	0.7247
	Diameter, in.	2.87
	Height, in.	5.75
At Test	Water Content, %	26.2
	Dry Density, pcf	97.7
	Saturation, %	97.5
	Void Ratio	0.7247
	Diameter, in.	2.87
	Height, in.	5.75
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		4.00
Fail. Stress, tsf		2.43
Strain, %		6.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.72
σ_3 Failure, tsf		0.29

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray and tan FAT CLAY with SAND; calcareous

LL= 73 **PL=** 26 **PI=** 47

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Vertical shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

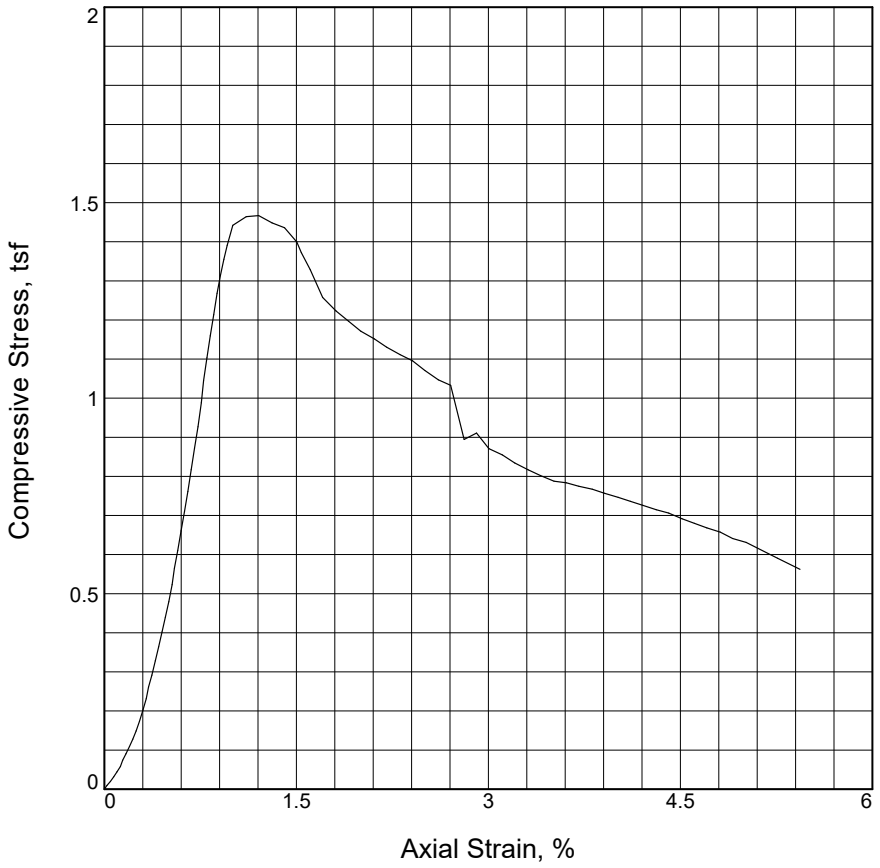
Source of Sample: CB-60 **Depth:** 10

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 8/20/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.467			
Undrained shear strength, tsf	0.733			
Failure strain, %	1.2			
Strain rate, %/min.	1.00			
Water content, %	20.8			
Wet density, pcf	128.6			
Dry density, pcf	106.5			
Saturation, %	96.4			
Void ratio	0.5834			
Specimen diameter, in.	2.87			
Specimen height, in.	5.73			
Height/diameter ratio	2.00			

Description: Tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

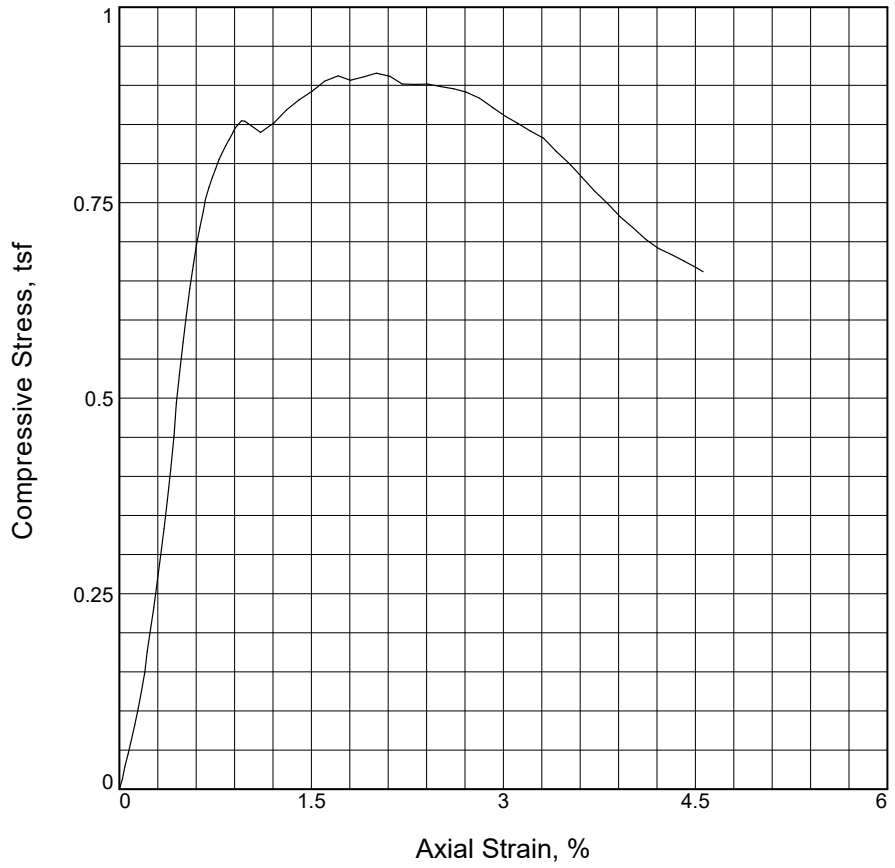
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-60 **Depth:** 15
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.916			
Undrained shear strength, tsf	0.458			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	11.2			
Wet density, pcf	127.9			
Dry density, pcf	115.0			
Saturation, %	64.8			
Void ratio	0.4651			
Specimen diameter, in.	2.89			
Specimen height, in.	5.73			
Height/diameter ratio	1.98			

Description: Tan and light gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

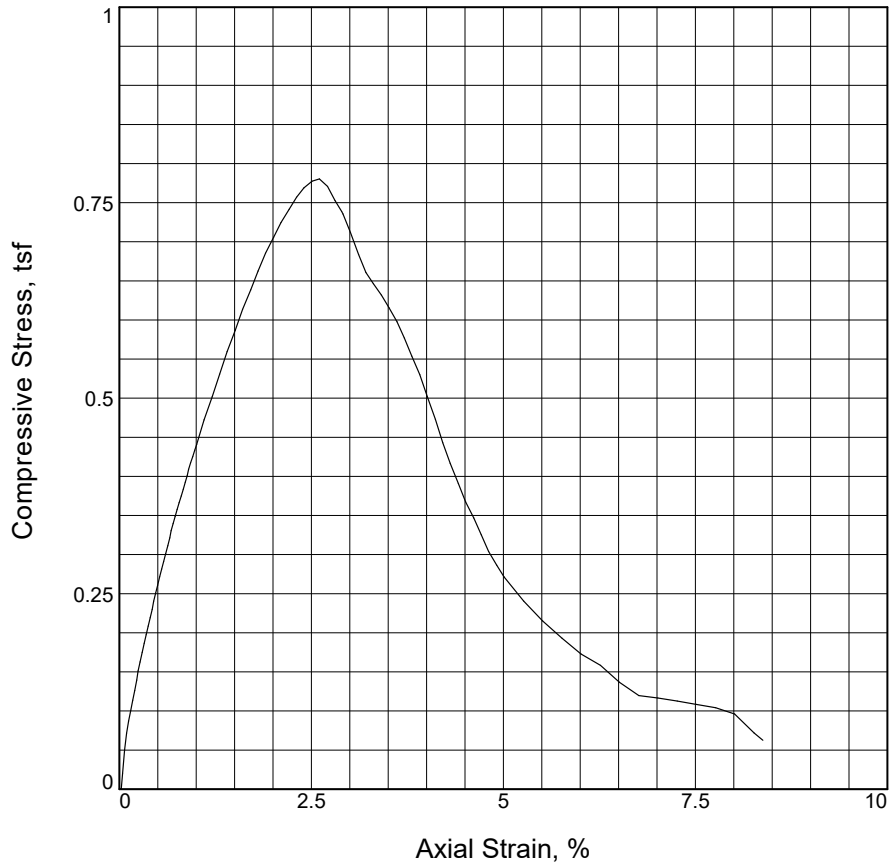
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-60 **Depth:** 27
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.780			
Undrained shear strength, tsf	0.390			
Failure strain, %	2.6			
Strain rate, %/min.	1.00			
Water content, %	12.2			
Wet density, pcf	128.6			
Dry density, pcf	114.6			
Saturation, %	70.0			
Void ratio	0.4707			
Specimen diameter, in.	2.89			
Specimen height, in.	5.72			
Height/diameter ratio	1.98			

Description: Tan and light gray CLAYEY SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

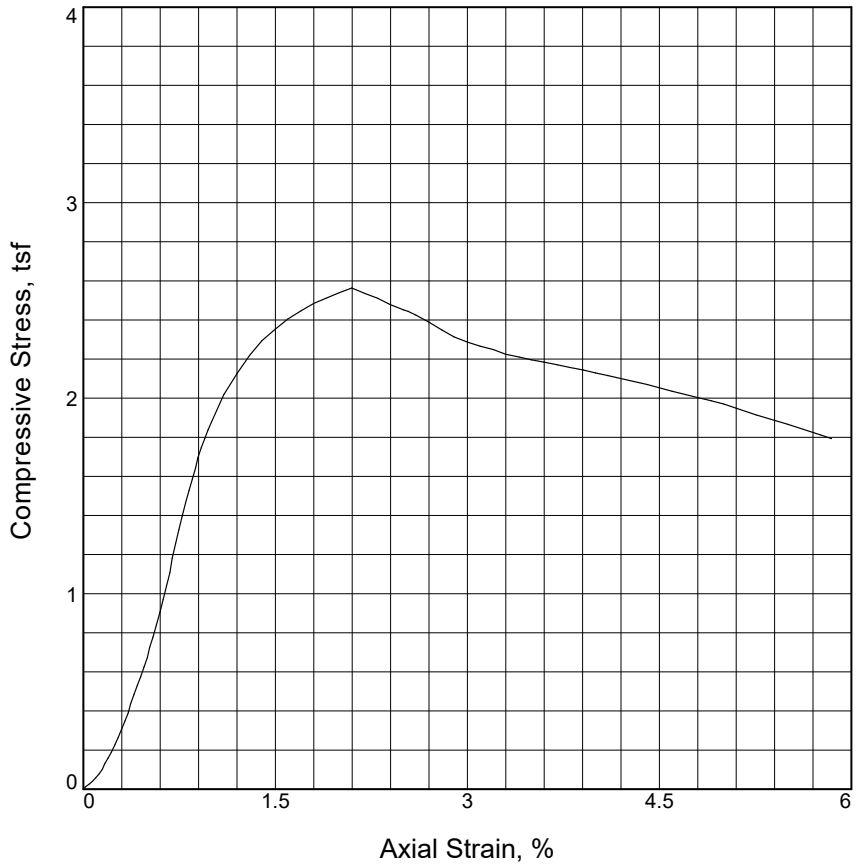
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-60 **Depth:** 39.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.563			
Undrained shear strength, tsf	1.282			
Failure strain, %	2.1			
Strain rate, %/min.	1.00			
Water content, %	27.1			
Wet density, pcf	123.0			
Dry density, pcf	96.8			
Saturation, %	98.7			
Void ratio	0.7412			
Specimen diameter, in.	2.86			
Specimen height, in.	5.73			
Height/diameter ratio	2.00			

Description: Tan FAT CLAY (CH)

LL = 79	**PL =** 28	**PI =** 51	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/20/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

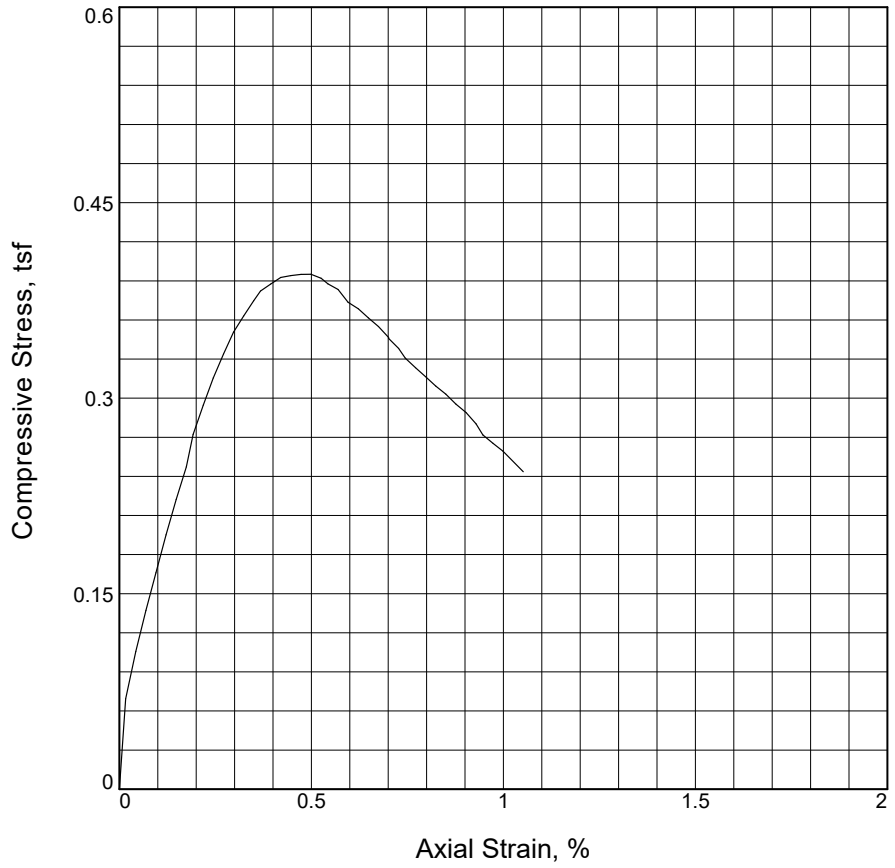
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-60 **Depth:** 44.5
Sample Number: ST-12

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.395			
Undrained shear strength, tsf	0.198			
Failure strain, %	0.5			
Strain rate, %/min.	1.00			
Water content, %	29.4			
Wet density, pcf	121.3			
Dry density, pcf	93.8			
Saturation, %	99.4			
Void ratio	0.7969			
Specimen diameter, in.	2.87			
Specimen height, in.	5.92			
Height/diameter ratio	2.07			

Description: Tan and gray FAT CLAY; ferrous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/21/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

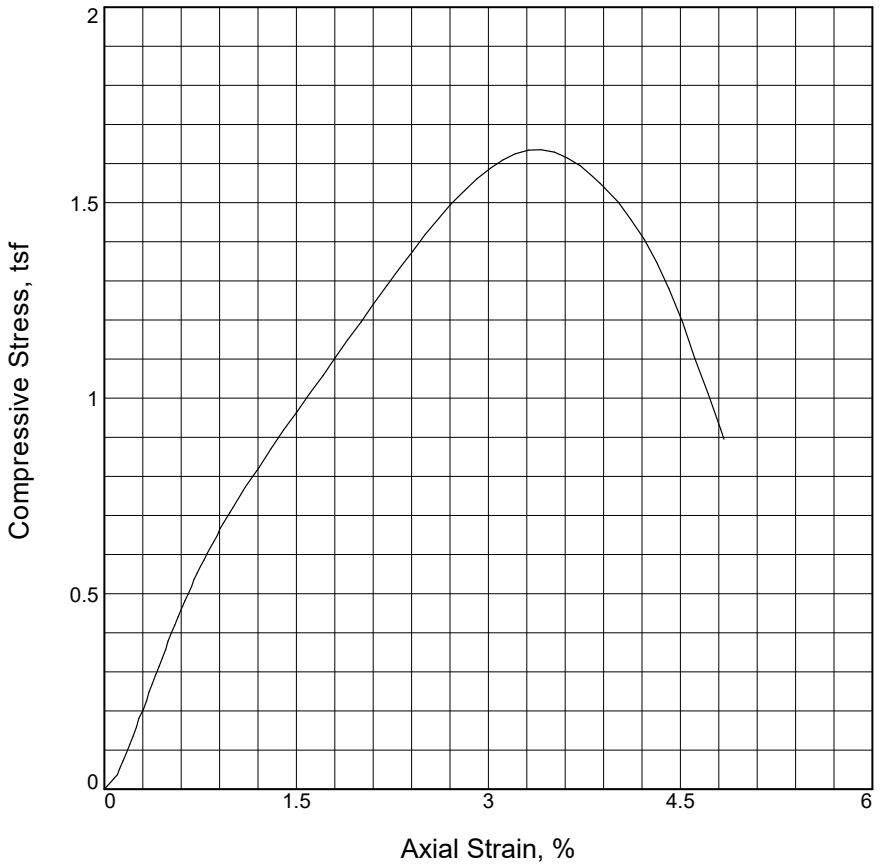
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-61 **Depth:** 25
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.635			
Undrained shear strength, tsf	0.818			
Failure strain, %	3.4			
Strain rate, %/min.	1.00			
Water content, %	21.5			
Wet density, pcf	127.5			
Dry density, pcf	105.0			
Saturation, %	95.8			
Void ratio	0.6058			
Specimen diameter, in.	2.88			
Specimen height, in.	5.90			
Height/diameter ratio	2.05			

Description: Gray and tan LEAN CLAY with SAND (CL)

LL = 34	**PL =** 15	**PI =** 19	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

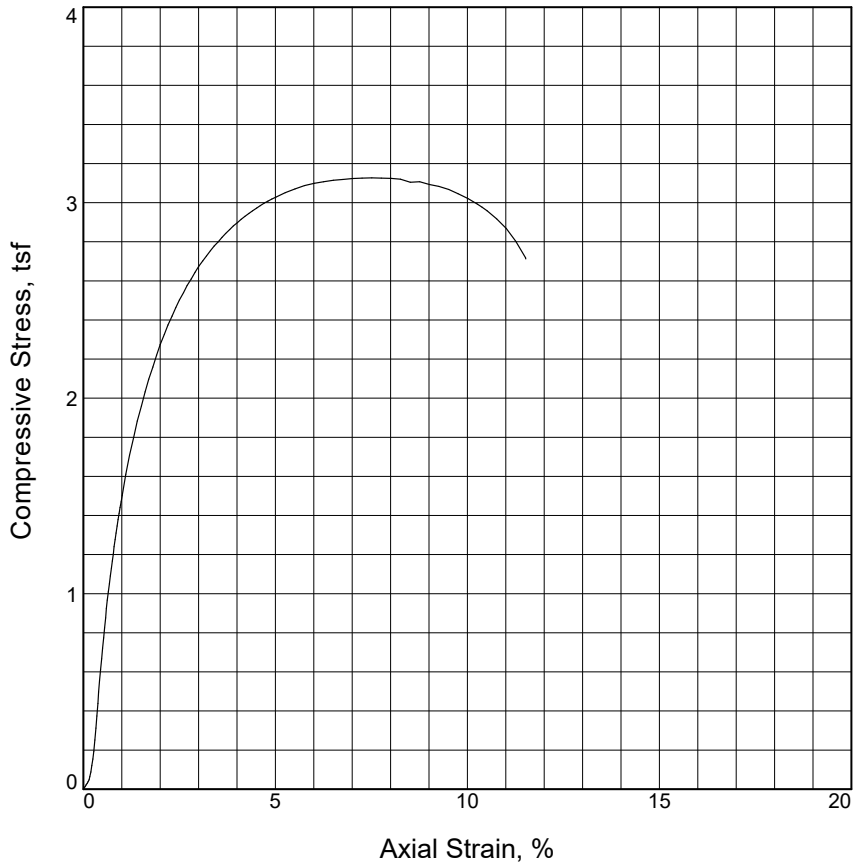
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-61 **Depth:** 30
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.127			
Undrained shear strength, tsf	1.563			
Failure strain, %	7.5			
Strain rate, %/min.	1.00			
Water content, %	18.6			
Wet density, pcf	127.4			
Dry density, pcf	107.4			
Saturation, %	88.4			
Void ratio	0.5694			
Specimen diameter, in.	2.86			
Specimen height, in.	5.93			
Height/diameter ratio	2.07			

Description: Tan and gray LEAN CLAY with SAND (CL)

LL = 38	**PL =** 16	**PI =** 22	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

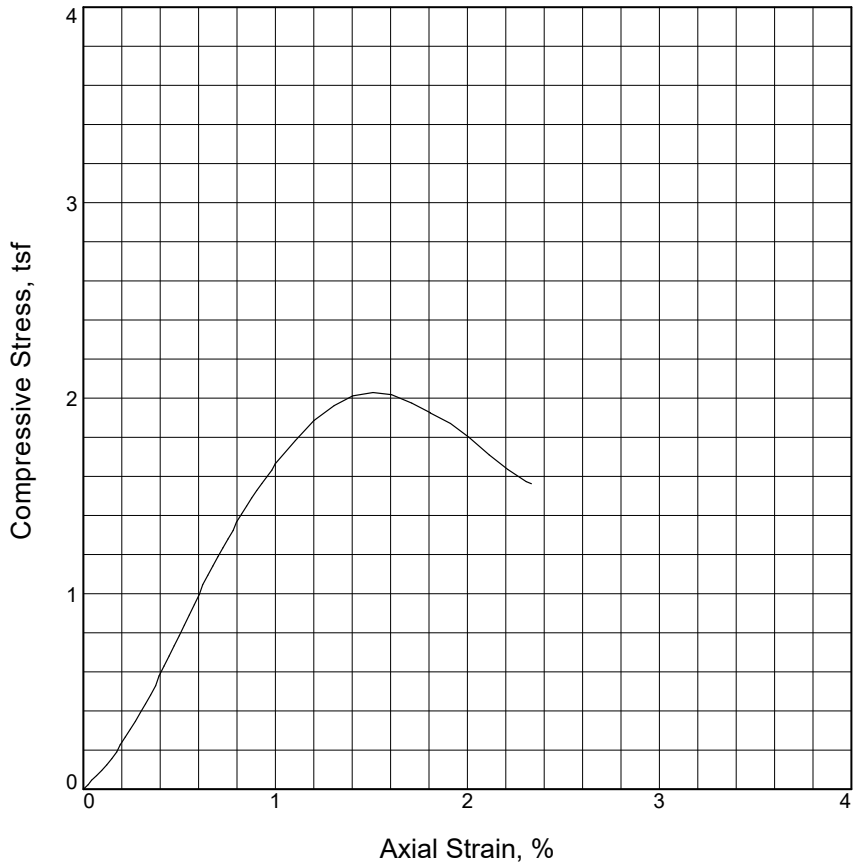
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-61 **Depth:** 37.5
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.029			
Undrained shear strength, tsf	1.014			
Failure strain, %	1.5			
Strain rate, %/min.	1.00			
Water content, %	24.4			
Wet density, pcf	124.7			
Dry density, pcf	100.3			
Saturation, %	96.7			
Void ratio	0.6806			
Specimen diameter, in.	2.88			
Specimen height, in.	5.93			
Height/diameter ratio	2.06			

Description: Reddish-brown and gray FAT CLAY

LL = 53	**PL =** 19	**PI =** 34	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

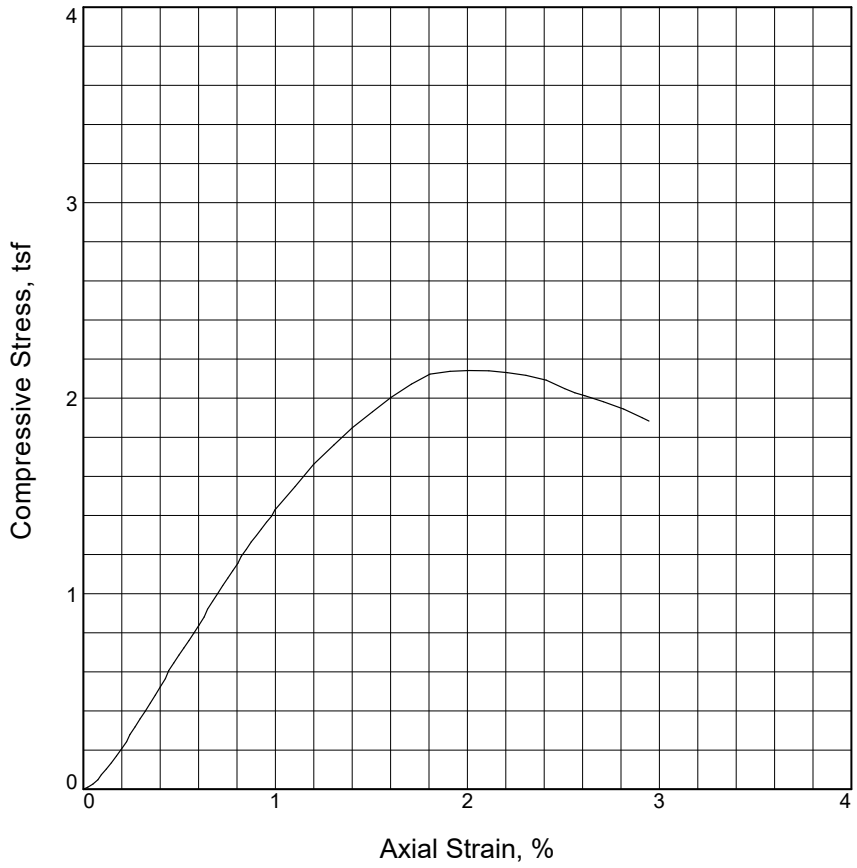
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-61 **Depth:** 45
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.142			
Undrained shear strength, tsf	1.071			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	23.7			
Wet density, pcf	122.8			
Dry density, pcf	99.3			
Saturation, %	91.7			
Void ratio	0.6972			
Specimen diameter, in.	2.89			
Specimen height, in.	5.93			
Height/diameter ratio	2.05			

Description: Gray FAT CLAY (CH)

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

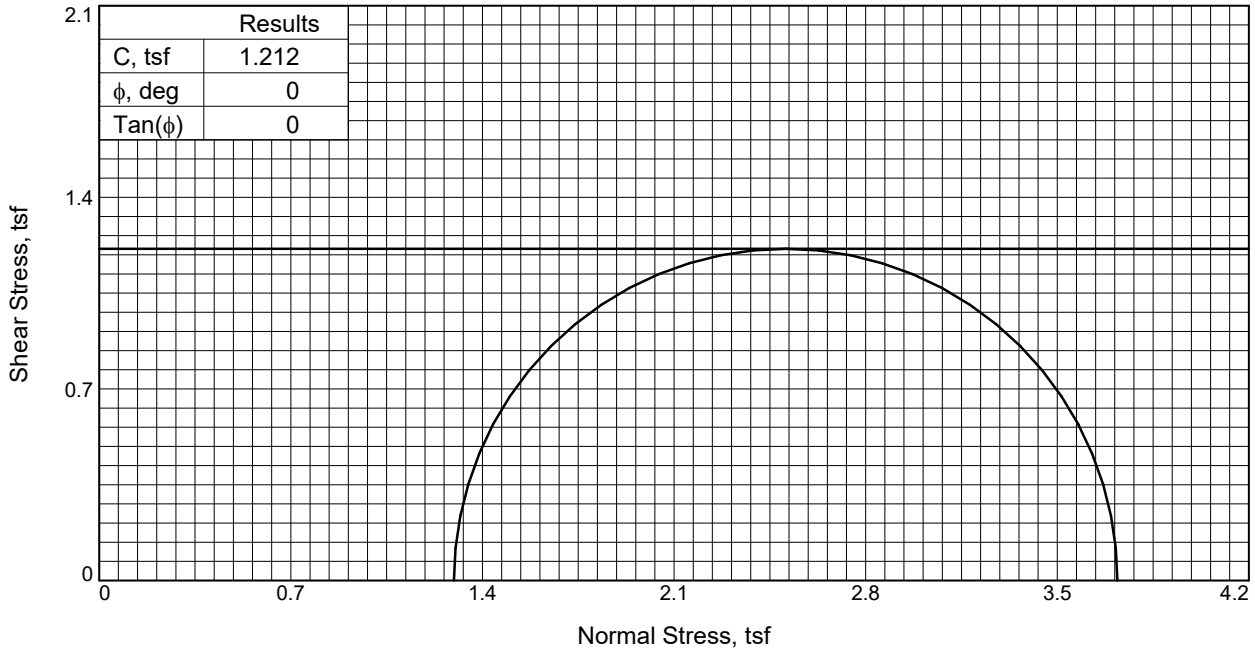
Figure _____

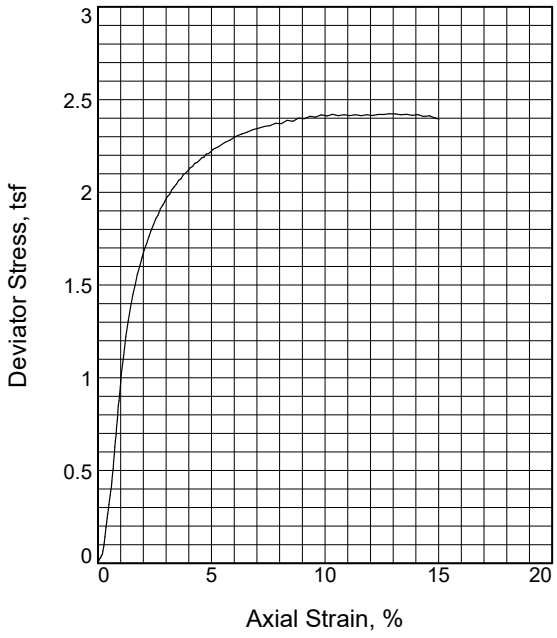
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-62 **Depth:** 40
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	26.1
	Dry Density, pcf	99.7
	Saturation, %	99.2
	Void Ratio	0.7226
	Diameter, in.	2.88
	Height, in.	5.89
At Test	Water Content, %	23.3
	Dry Density, pcf	99.7
	Saturation, %	88.6
	Void Ratio	0.7226
	Diameter, in.	2.88
	Height, in.	5.89
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		18.00
Fail. Stress, tsf		2.42
Strain, %		12.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		3.72
σ_3 Failure, tsf		1.30

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray SANDY LEAN CLAY (CL)

LL= 45 **PL=** 17 **PI=** 28

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Vertical shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

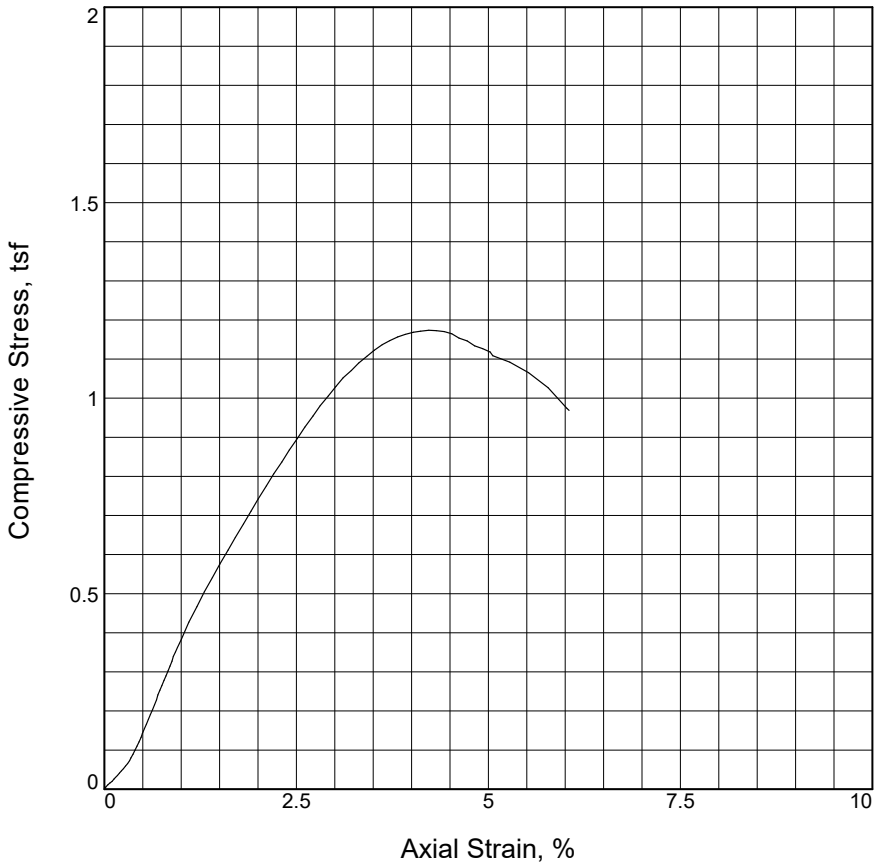
Source of Sample: CB-62 **Depth:** 45

Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 8/24/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.174			
Undrained shear strength, tsf	0.587			
Failure strain, %	4.2			
Strain rate, %/min.	1.00			
Water content, %	19.6			
Wet density, pcf	129.4			
Dry density, pcf	108.2			
Saturation, %	94.8			
Void ratio	0.5585			
Specimen diameter, in.	2.87			
Specimen height, in.	5.89			
Height/diameter ratio	2.05			

Description: Tan and gray SANDY LEAN CLAY; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

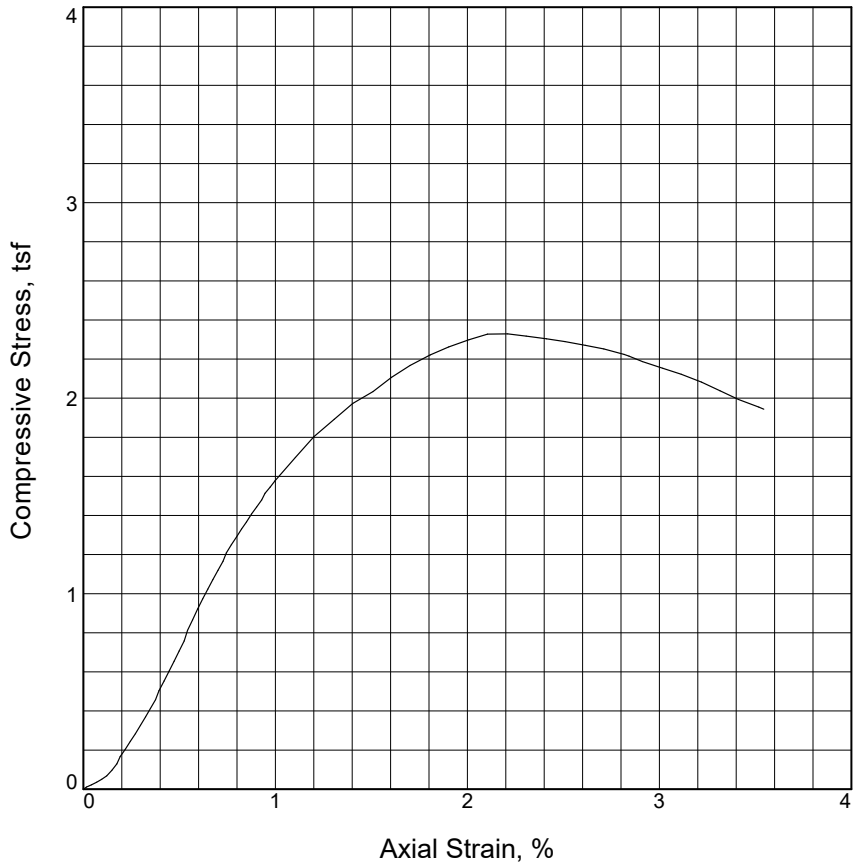
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-62 **Depth:** 47.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.329			
Undrained shear strength, tsf	1.164			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	22.7			
Wet density, pcf	124.7			
Dry density, pcf	101.6			
Saturation, %	93.0			
Void ratio	0.6582			
Specimen diameter, in.	2.88			
Specimen height, in.	5.90			
Height/diameter ratio	2.05			

Description: Reddish-brown and gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

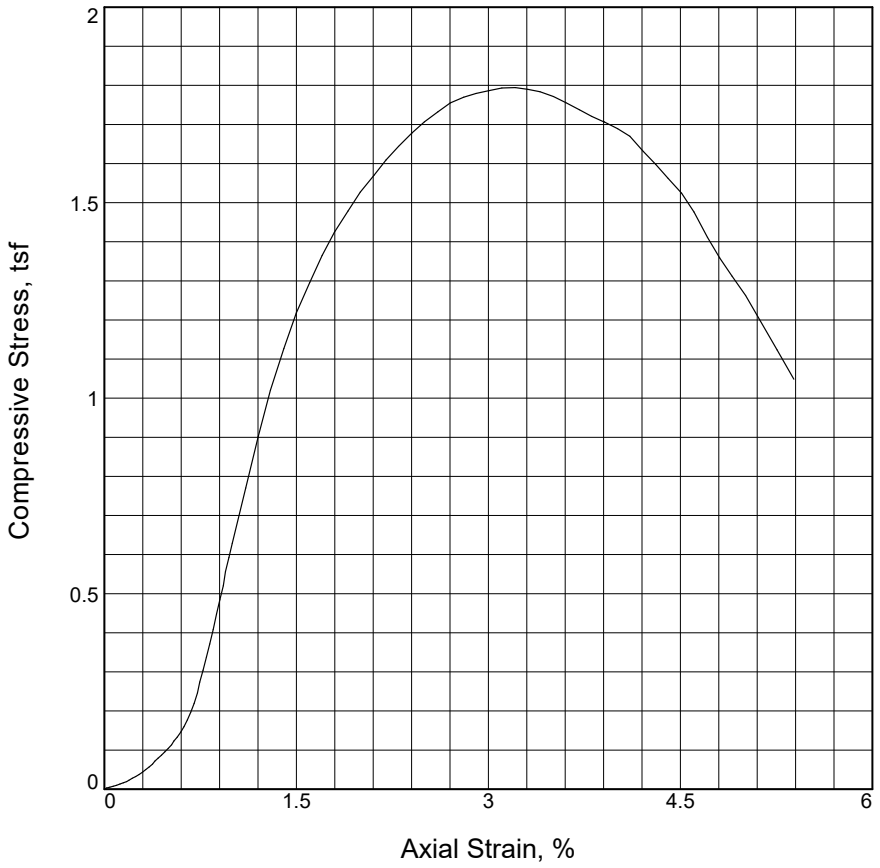
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-62 **Depth:** 52.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.794			
Undrained shear strength, tsf	0.897			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	31.4			
Wet density, pcf	121.7			
Dry density, pcf	92.6			
Saturation, %	99.0			
Void ratio	0.8874			
Specimen diameter, in.	2.86			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Gray FAT CLAY with SAND; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

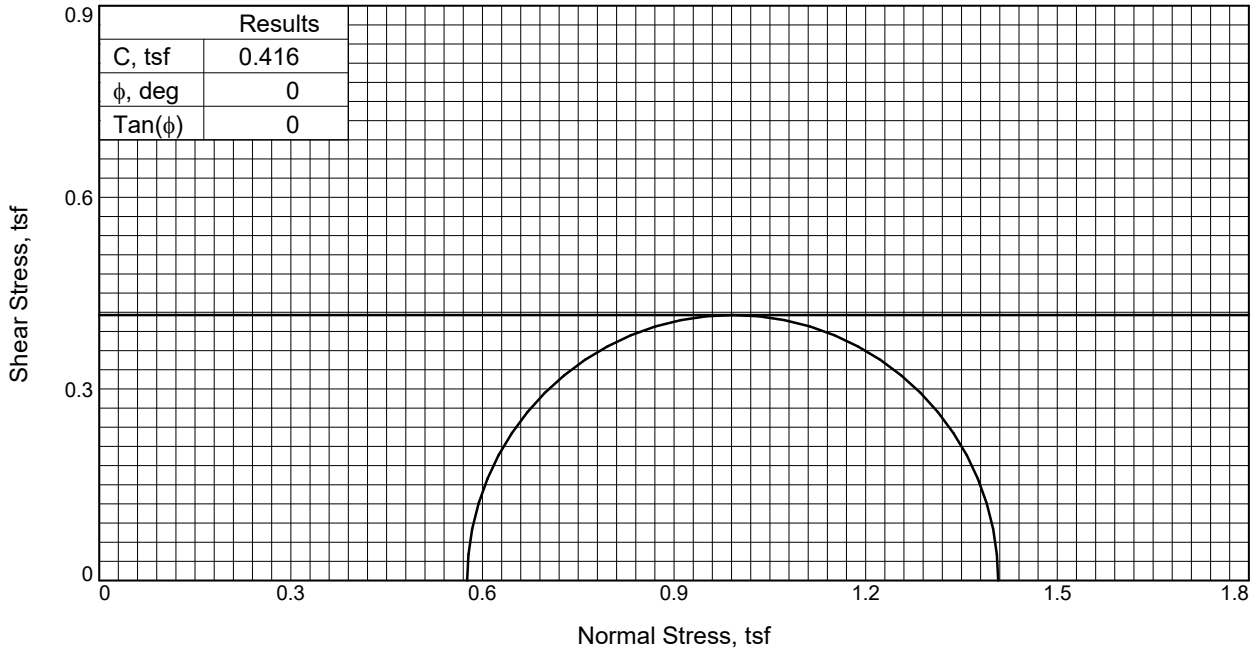
Figure _____

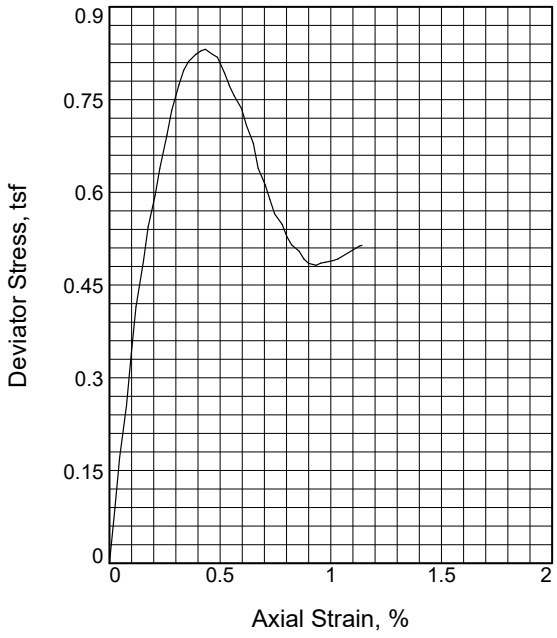
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-63 **Depth:** 15
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	27.2
	Dry Density, pcf	96.8
	Saturation, %	99.0
	Void Ratio	0.7409
	Diameter, in.	2.85
	Height, in.	5.74
At Test	Water Content, %	26.3
	Dry Density, pcf	96.8
	Saturation, %	95.7
	Void Ratio	0.7409
	Diameter, in.	2.85
	Height, in.	5.74
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		0.83
Strain, %		0.4
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.41
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan FAT CLAY; sand pocket and calcareous

LL= 70 **PL=** 24 **PI=** 46

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickendided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

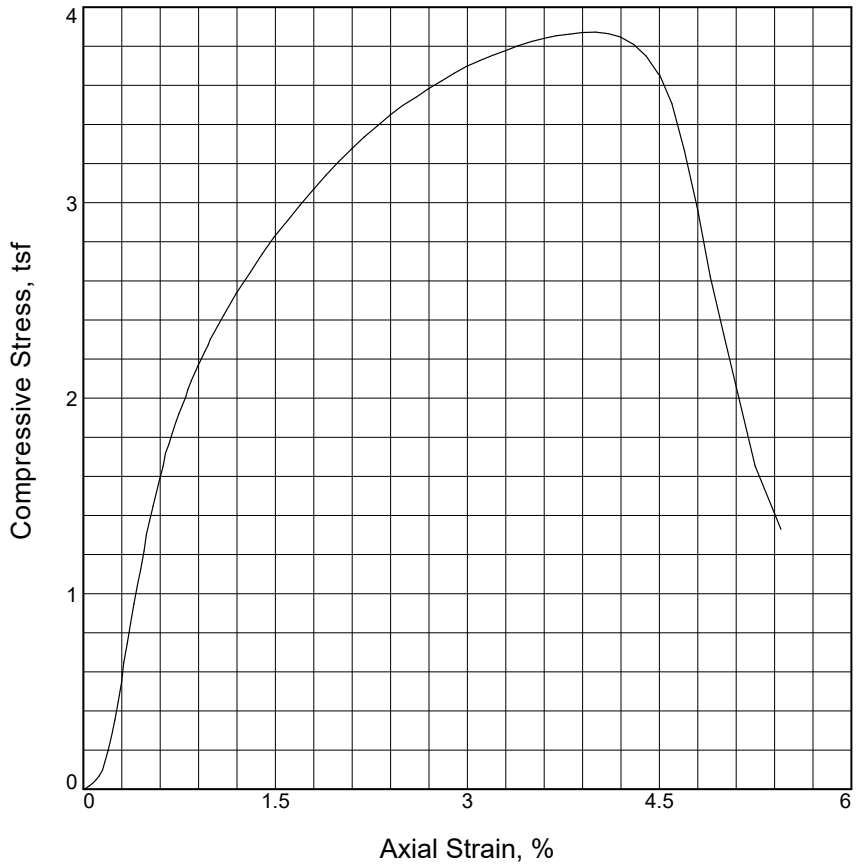
Source of Sample: CB-63 **Depth:** 20

Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 8/24/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.872			
Undrained shear strength, tsf	1.936			
Failure strain, %	4.0			
Strain rate, %/min.	1.00			
Water content, %	18.3			
Wet density, pcf	130.3			
Dry density, pcf	110.2			
Saturation, %	93.2			
Void ratio	0.5297			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Tan LEAN CLAY with SAND; calcareous

LL = 48	**PL =** 17	**PI =** 31	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

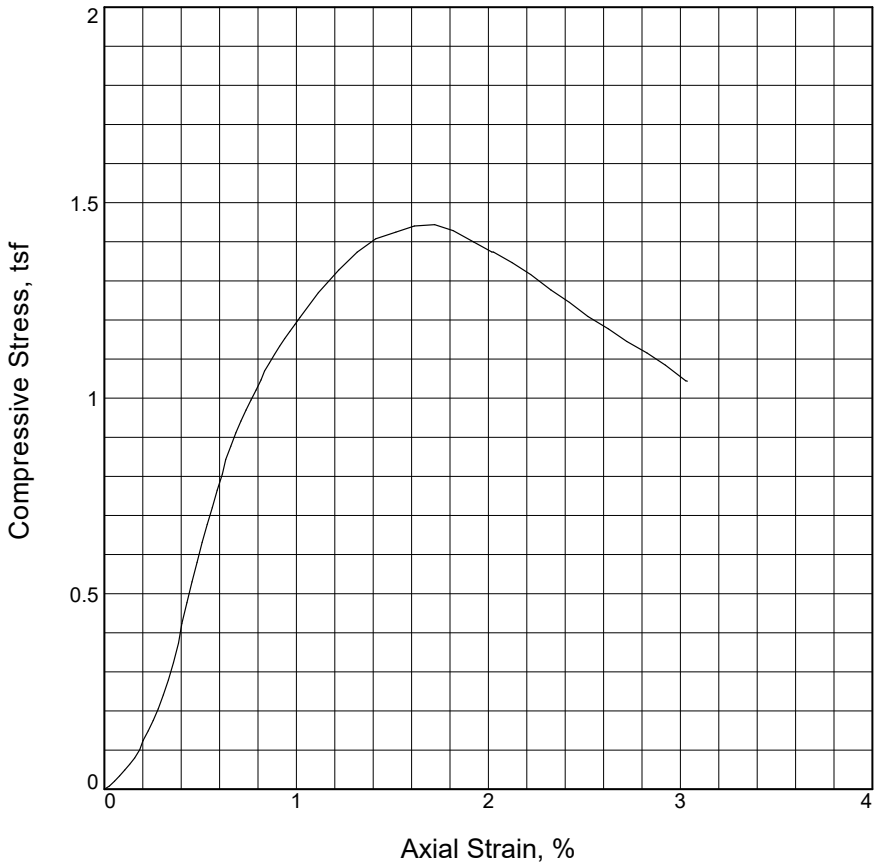
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-63 **Depth:** 32.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.444			
Undrained shear strength, tsf	0.722			
Failure strain, %	1.7			
Strain rate, %/min.	1.00			
Water content, %	19.5			
Wet density, pcf	128.3			
Dry density, pcf	107.3			
Saturation, %	92.4			
Void ratio	0.5710			
Specimen diameter, in.	2.87			
Specimen height, in.	5.75			
Height/diameter ratio	2.01			

Description: Tan and brown FAT CLAY with SAND; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 8/24/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

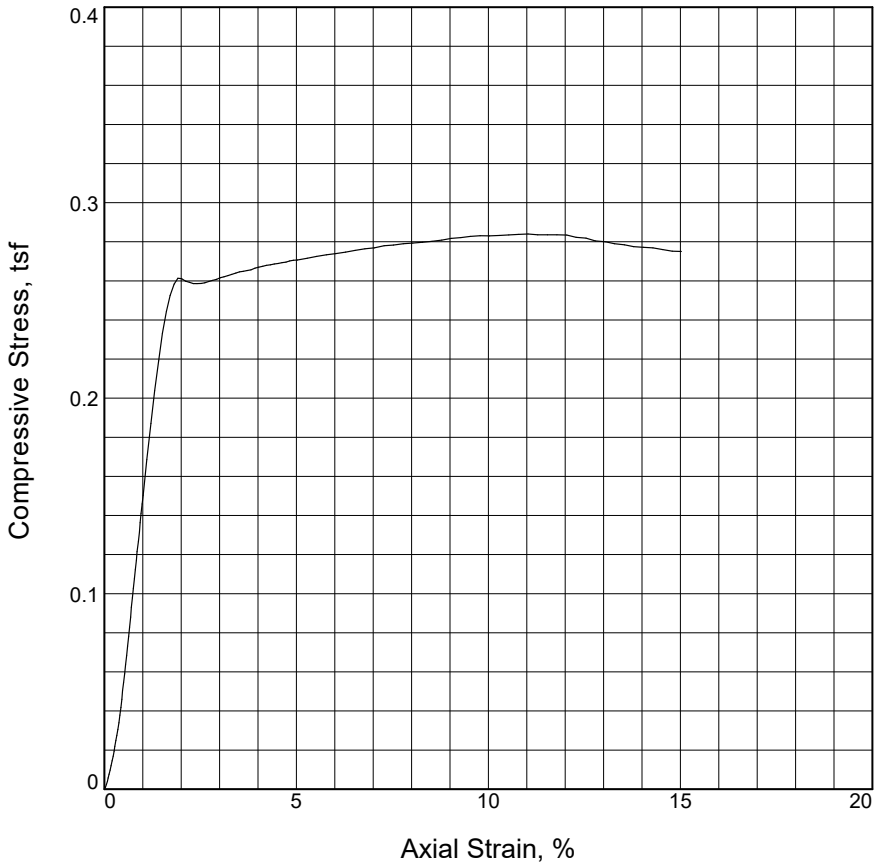
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-63 **Depth:** 35
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.284			
Undrained shear strength, tsf	0.142			
Failure strain, %	11.0			
Strain rate, %/min.	1.00			
Water content, %	69.1			
Wet density, pcf	99.9			
Dry density, pcf	59.1			
Saturation, %	99.8			
Void ratio	1.9047			
Specimen diameter, in.	2.85			
Specimen height, in.	5.88			
Height/diameter ratio	2.06			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

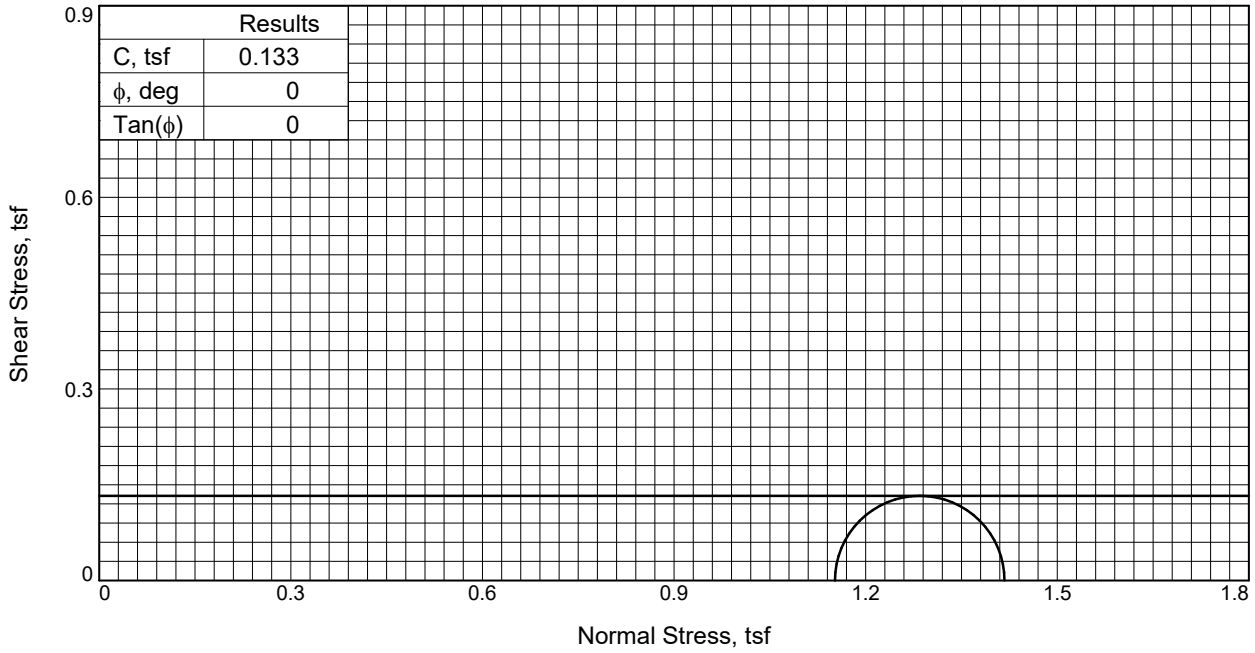
Figure _____

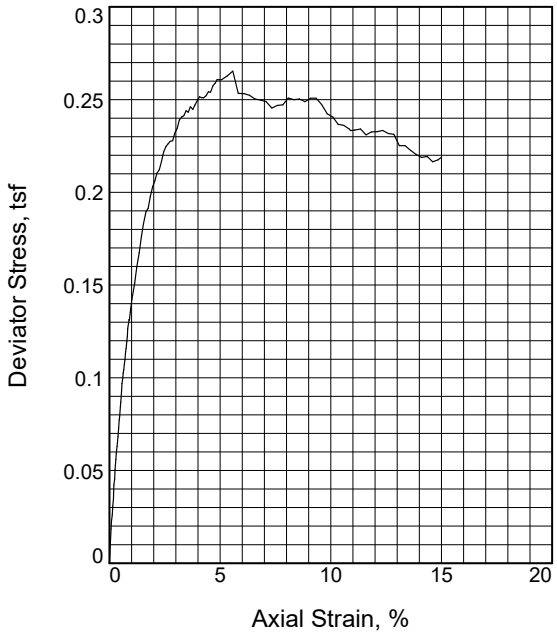
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-65 **Depth:** 39
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	67.5
	Dry Density, pcf	59.3
	Saturation, %	98.9
	Void Ratio	1.8423
	Diameter, in.	2.83
	Height, in.	5.86
At Test	Water Content, %	62.3
	Dry Density, pcf	59.3
	Saturation, %	91.2
	Void Ratio	1.8423
	Diameter, in.	2.83
	Height, in.	5.86
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		16.00
Fail. Stress, tsf		0.27
Strain, %		5.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.42
σ_3 Failure, tsf		1.15

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray FAT CLAY; sand pockets and shell fragments

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

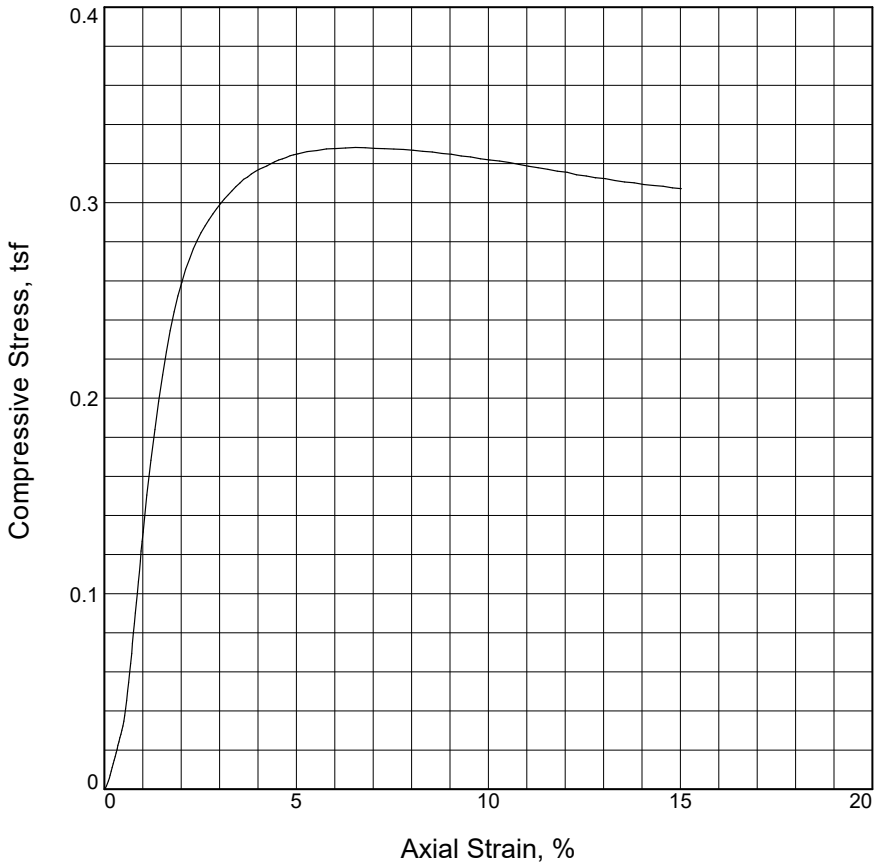
Source of Sample: CB-65 **Depth:** 41.5

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/11/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.328			
Undrained shear strength, tsf	0.164			
Failure strain, %	6.5			
Strain rate, %/min.	1.00			
Water content, %	62.7			
Wet density, pcf	100.2			
Dry density, pcf	61.6			
Saturation, %	97.4			
Void ratio	1.7373			
Specimen diameter, in.	2.86			
Specimen height, in.	5.92			
Height/diameter ratio	2.07			

Description: Gray FAT CLAY

LL = 95	**PL =** 29	**PI =** 66	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

Figure _____

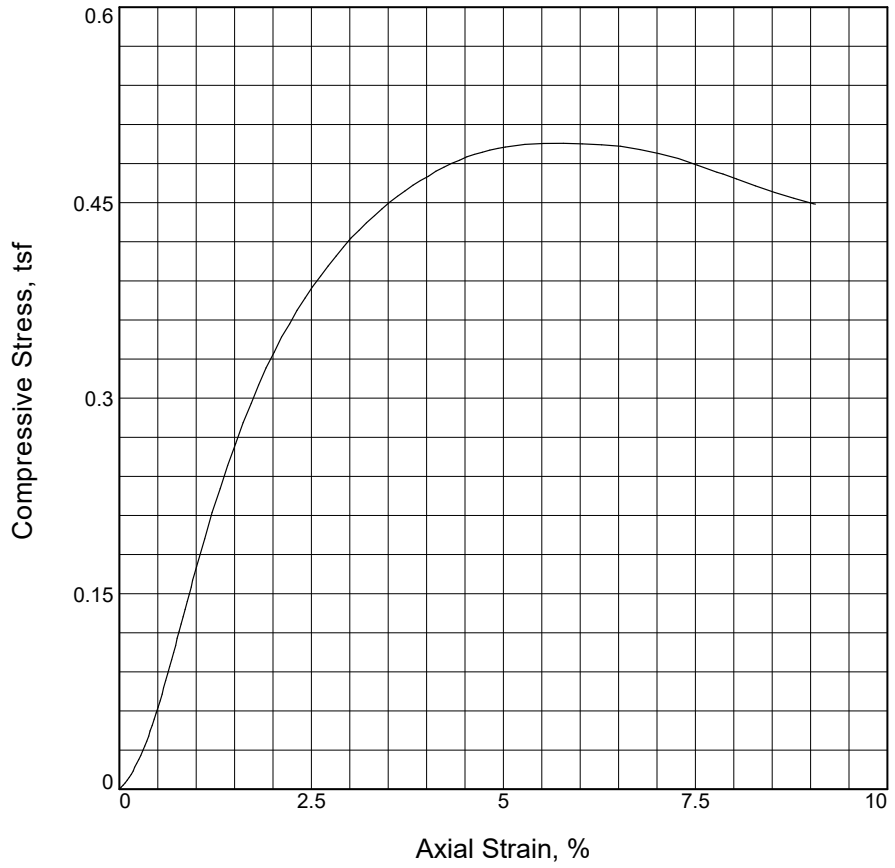
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-65 **Depth:** 46.5
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.496			
Undrained shear strength, tsf	0.248			
Failure strain, %	5.8			
Strain rate, %/min.	1.00			
Water content, %	61.4			
Wet density, pcf	101.1			
Dry density, pcf	62.6			
Saturation, %	98.1			
Void ratio	1.6905			
Specimen diameter, in.	2.90			
Specimen height, in.	5.85			
Height/diameter ratio	2.02			

Description: Gray FAT CLAY

LL = 82	**PL =** 27	**PI =** 55	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

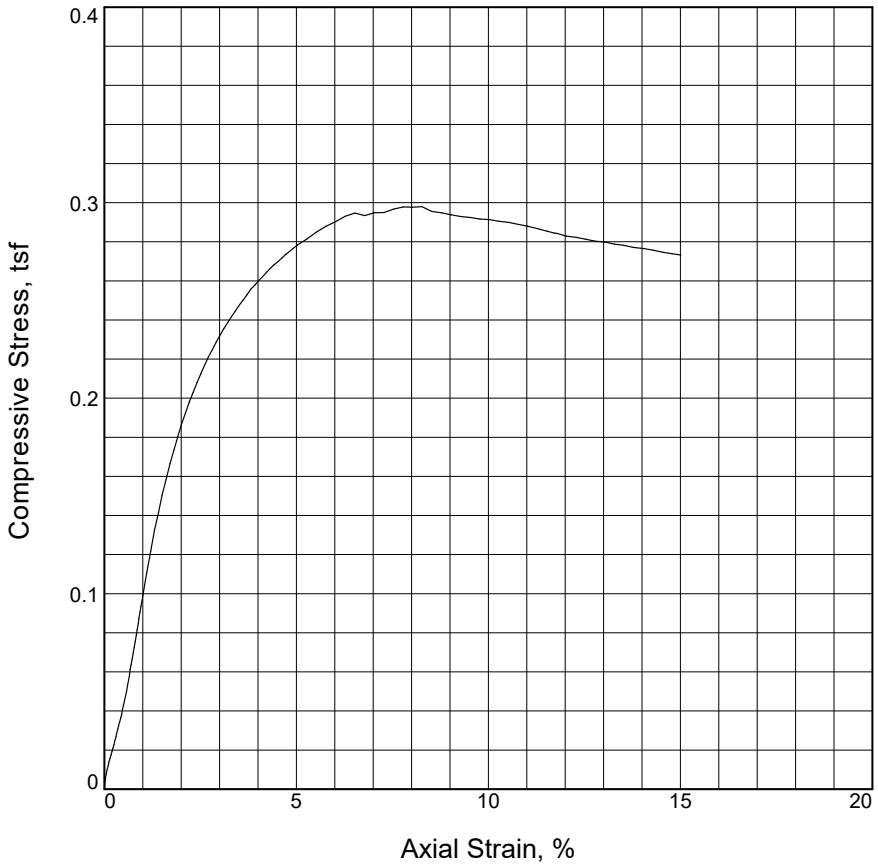
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-65 **Depth:** 54
Sample Number: ST-9

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.298			
Undrained shear strength, tsf	0.149			
Failure strain, %	8.3			
Strain rate, %/min.	1.00			
Water content, %	37.9			
Wet density, pcf	117.6			
Dry density, pcf	85.2			
Saturation, %	99.4			
Void ratio	1.0871			
Specimen diameter, in.	2.83			
Specimen height, in.	5.89			
Height/diameter ratio	2.08			

Description: Gray SANDY FAT CLAY; sand pockets and shell fragments

LL = 67	**PL =** 25	**PI =** 42	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/11/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

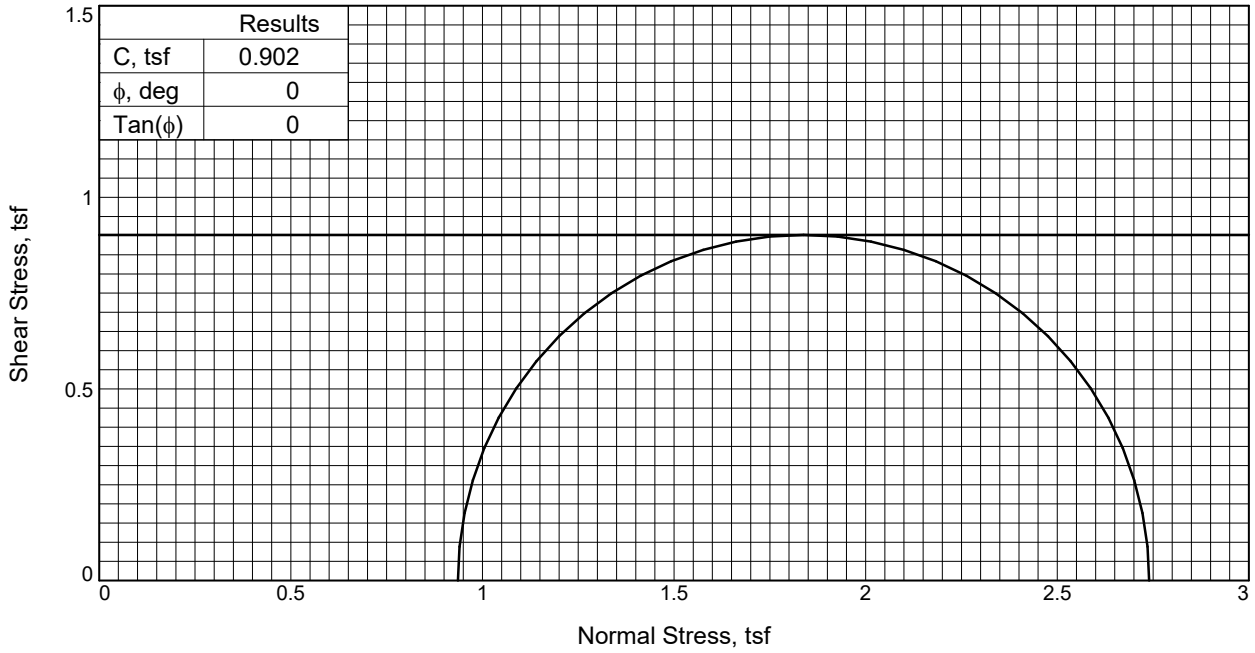
Figure _____

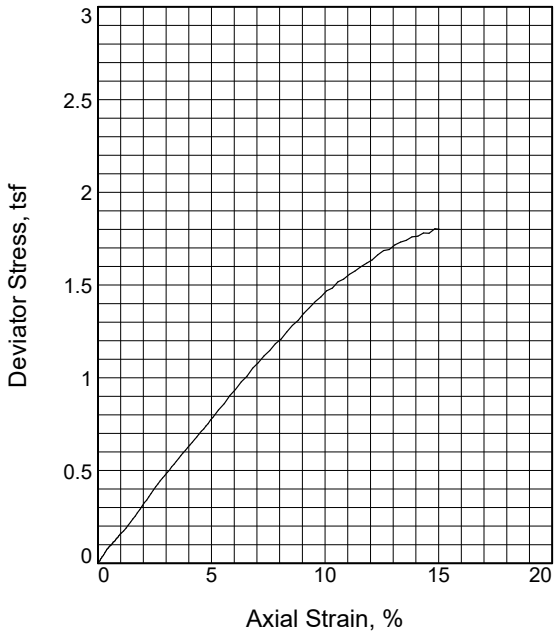
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-65 **Depth:** 64
Sample Number: ST-13

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	19.7
	Dry Density, pcf	109.7
	Saturation, %	98.8
	Void Ratio	0.5370
	Diameter, in.	2.90
	Height, in.	5.85
At Test	Water Content, %	17.7
	Dry Density, pcf	109.7
	Saturation, %	88.8
	Void Ratio	0.5370
	Diameter, in.	2.90
	Height, in.	5.85
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		13.00
Fail. Stress, tsf		1.80
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.74
σ_3 Failure, tsf		0.94

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray SANDY LEAN CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

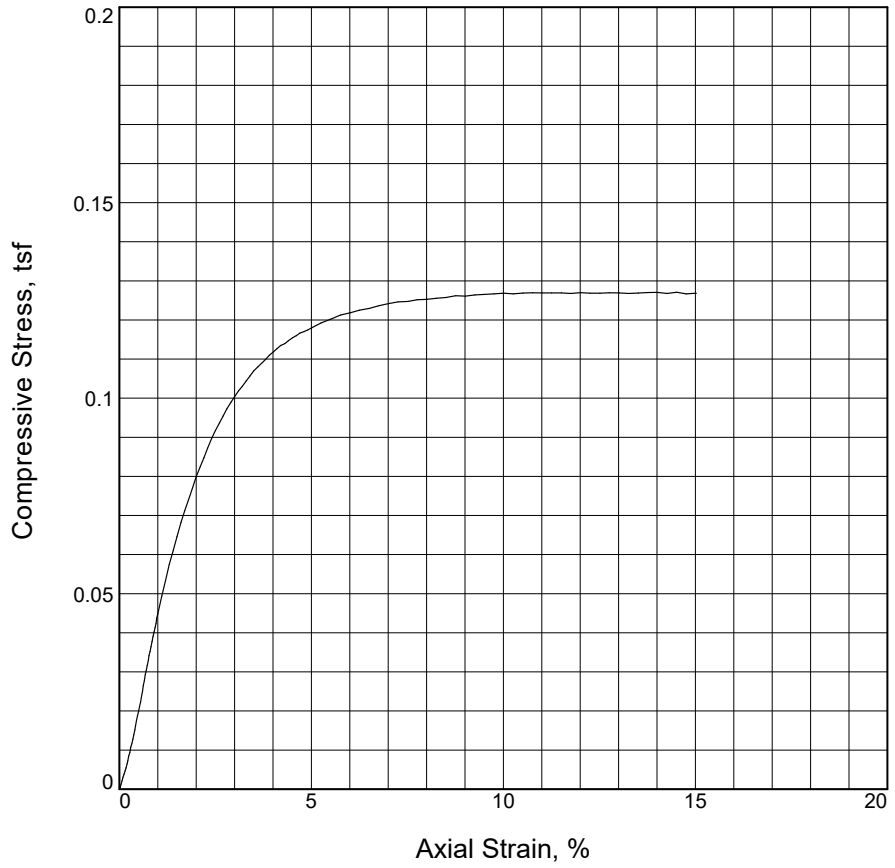
Source of Sample: CB-66 **Depth:** 32.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/21/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.127			
Undrained shear strength, tsf	0.064			
Failure strain, %	14.5			
Strain rate, %/min.	1.00			
Water content, %	68.2			
Wet density, pcf	98.3			
Dry density, pcf	58.5			
Saturation, %	97.8			
Void ratio	1.8824			
Specimen diameter, in.	2.78			
Specimen height, in.	5.93			
Height/diameter ratio	2.13			

Description: Gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/15/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

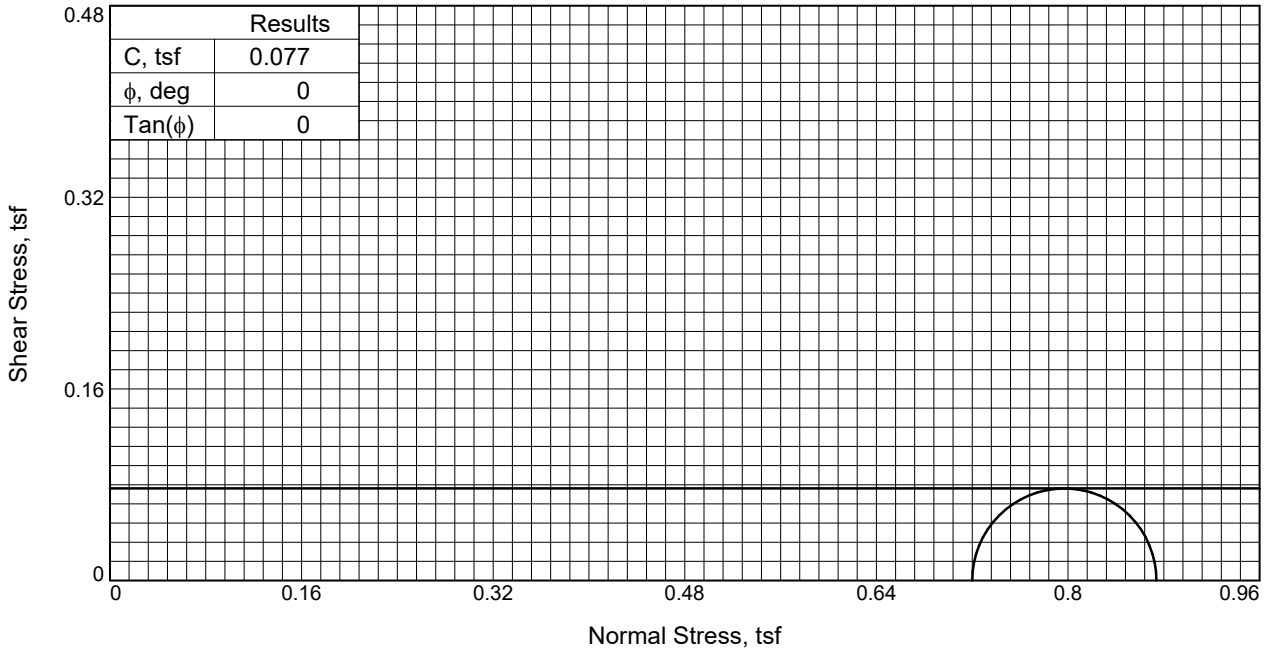
Figure _____

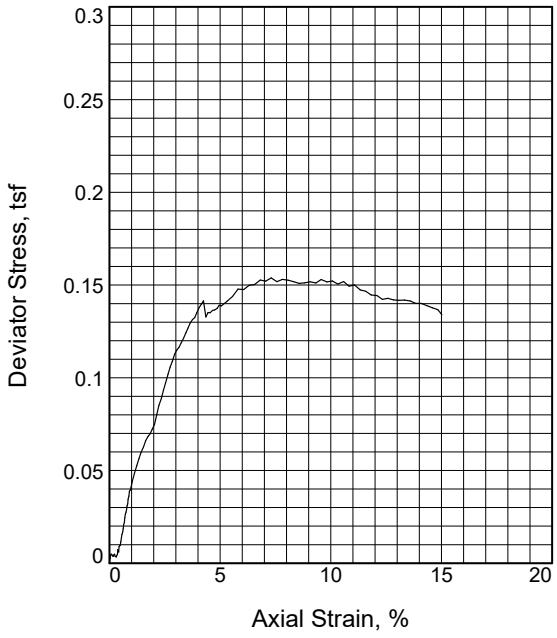
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-67 **Depth:** 20
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	42.7
	Dry Density, pcf	76.7
	Saturation, %	96.4
	Void Ratio	1.1969
	Diameter, in.	2.88
	Height, in.	5.87
At Test	Water Content, %	41.0
	Dry Density, pcf	76.7
	Saturation, %	92.4
	Void Ratio	1.1969
	Diameter, in.	2.88
	Height, in.	5.87
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		10.00
Fail. Stress, tsf		0.15
Strain, %		7.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		0.87
σ_3 Failure, tsf		0.72

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray LEAN CLAY; shell fragments

LL= 42 **PL=** 23 **PI=** 19

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Bulge

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

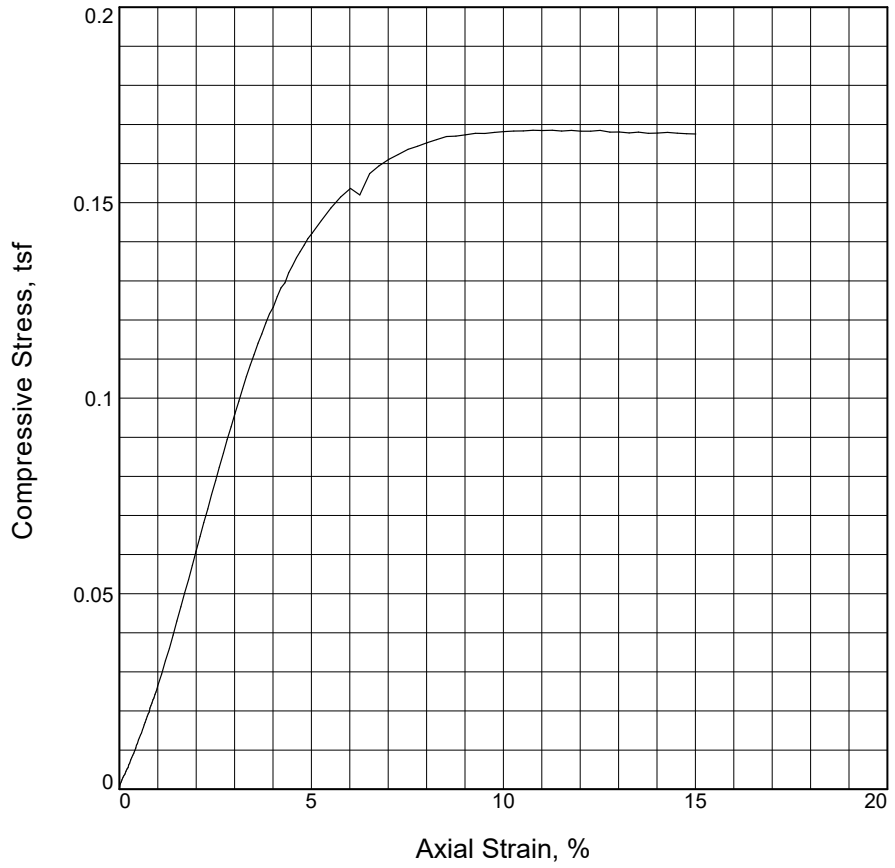
Source of Sample: CB-67 **Depth:** 25

Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/15/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.169			
Undrained shear strength, tsf	0.084			
Failure strain, %	11.3			
Strain rate, %/min.	1.00			
Water content, %	42.9			
Wet density, pcf	110.4			
Dry density, pcf	77.3			
Saturation, %	98.0			
Void ratio	1.1810			
Specimen diameter, in.	2.90			
Specimen height, in.	5.78			
Height/diameter ratio	1.99			

Description: Gray FAT CLAY with SAND; shell fragments

LL = 51	**PL =** 26	**PI =** 25	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/15/21
Remarks:

Test method: ASTM D2166
Failure type: Bulge

Figure _____

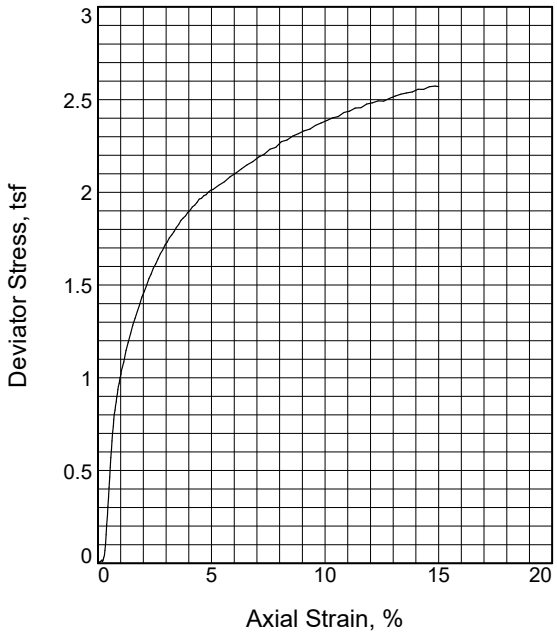
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-68 **Depth:** 26
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	20.8
	Dry Density, pcf	106.6
	Saturation, %	88.7
	Void Ratio	0.6685
	Diameter, in.	2.85
	Height, in.	5.83
At Test	Water Content, %	22.9
	Dry Density, pcf	106.6
	Saturation, %	97.8
	Void Ratio	0.6685
	Diameter, in.	2.85
	Height, in.	5.83
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		2.57
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		3.15
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Light gray SANDY FAT CLAY; sand pockets and calcareous

LL= 56 **PL=** 21 **PI=** 35

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

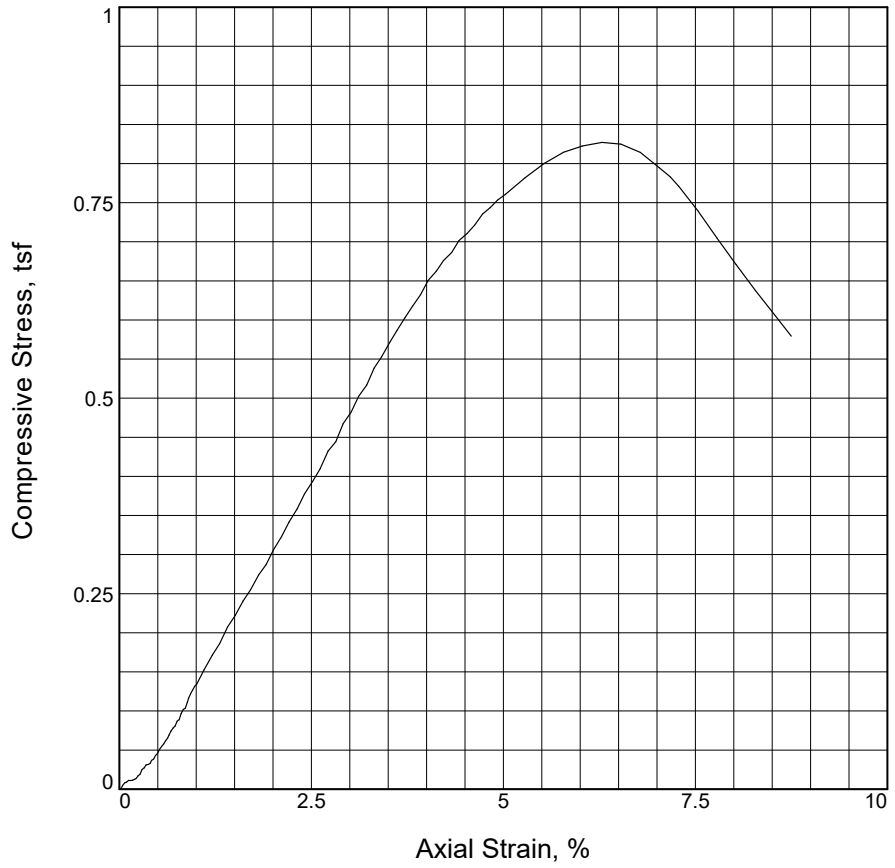
Source of Sample: CB-69 **Depth:** 20

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/10/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.827			
Undrained shear strength, tsf	0.414			
Failure strain, %	6.3			
Strain rate, %/min.	1.00			
Water content, %	13.7			
Wet density, pcf	140.1			
Dry density, pcf	123.2			
Saturation, %	96.0			
Void ratio	0.3933			
Specimen diameter, in.	2.85			
Specimen height, in.	5.83			
Height/diameter ratio	2.05			

Description: Light gray SANDY FAT CLAY; calcareous deposits

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/10/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

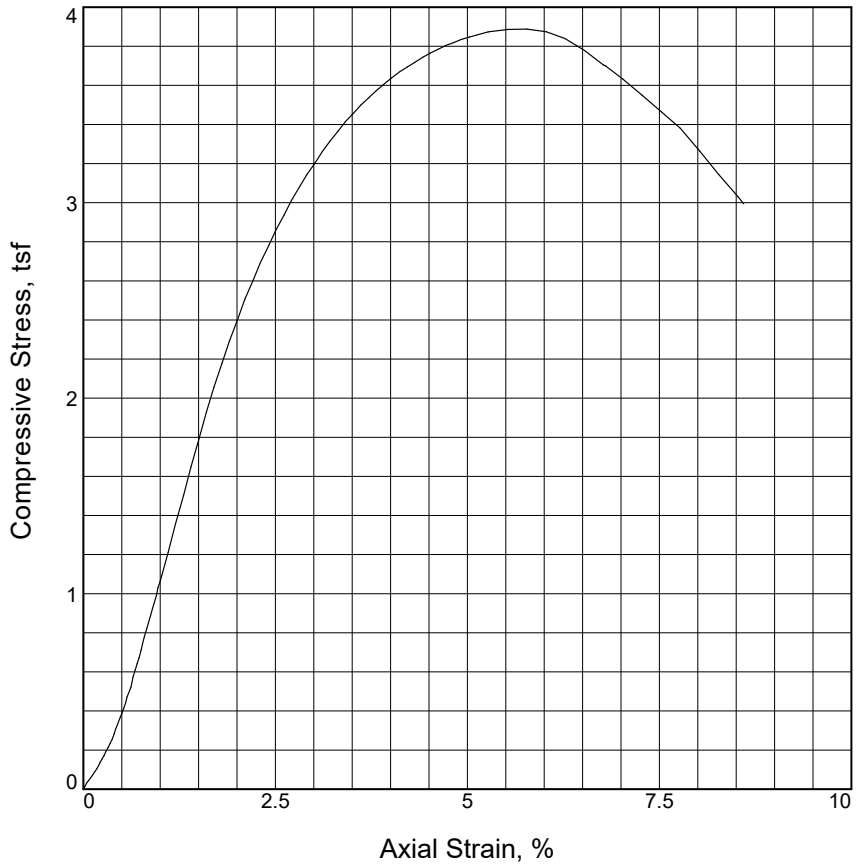
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-69 **Depth:** 25
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.888			
Undrained shear strength, tsf	1.944			
Failure strain, %	5.8			
Strain rate, %/min.	1.00			
Water content, %	17.7			
Wet density, pcf	129.5			
Dry density, pcf	110.0			
Saturation, %	89.7			
Void ratio	0.5318			
Specimen diameter, in.	2.86			
Specimen height, in.	5.84			
Height/diameter ratio	2.04			

Description: Light gray FAT CLAY; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/10/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

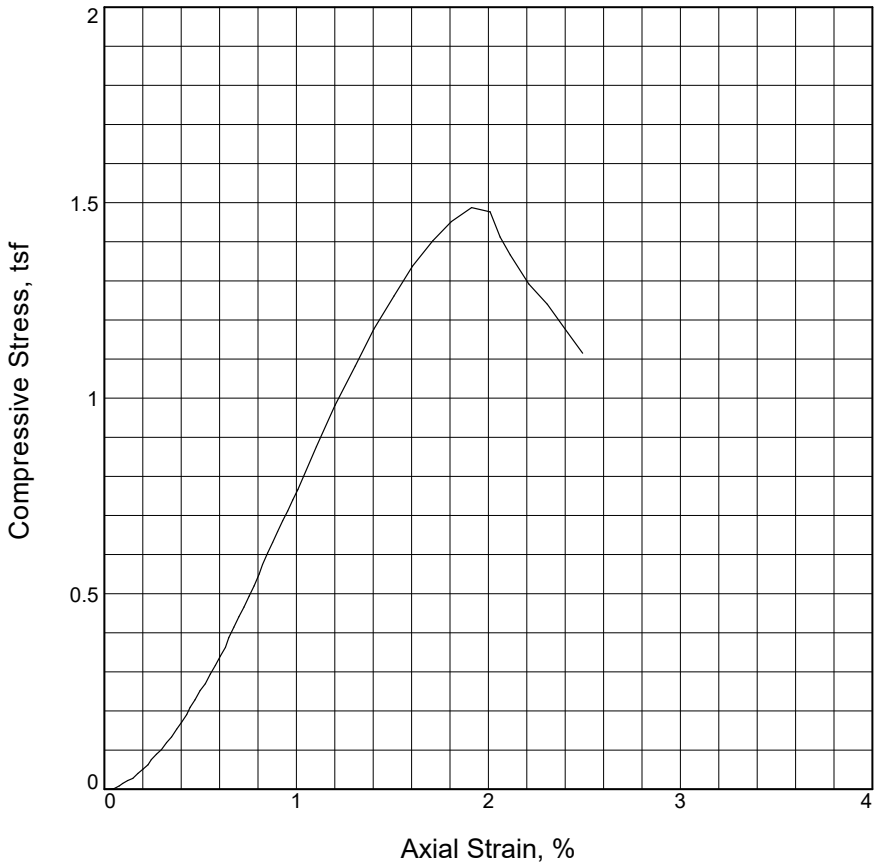
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-69 **Depth:** 40
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.487			
Undrained shear strength, tsf	0.744			
Failure strain, %	1.9			
Strain rate, %/min.	1.00			
Water content, %	30.0			
Wet density, pcf	122.9			
Dry density, pcf	94.6			
Saturation, %	98.9			
Void ratio	0.8483			
Specimen diameter, in.	2.85			
Specimen height, in.	5.80			
Height/diameter ratio	2.04			

Description: Reddish-brown FAT CLAY

LL = 62	**PL =** 24	**PI =** 38	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/10/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

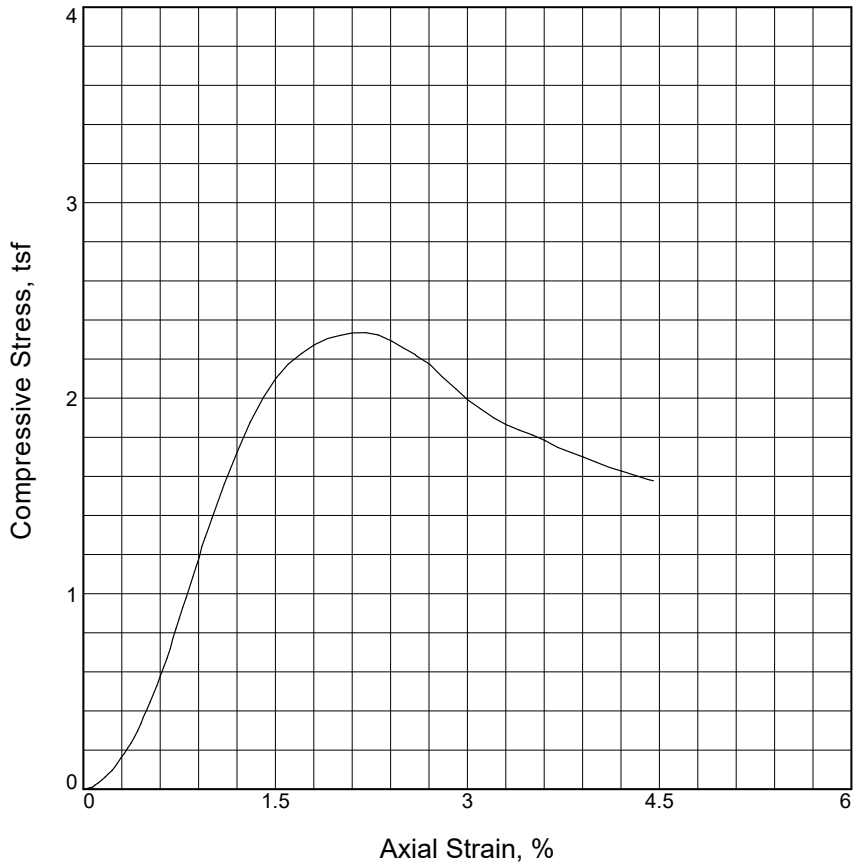
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-69 **Depth:** 55
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.335			
Undrained shear strength, tsf	1.168			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	25.5			
Wet density, pcf	126.6			
Dry density, pcf	100.9			
Saturation, %	97.4			
Void ratio	0.7324			
Specimen diameter, in.	2.85			
Specimen height, in.	5.84			
Height/diameter ratio	2.05			

Description: Tan FAT CLAY; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/10/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

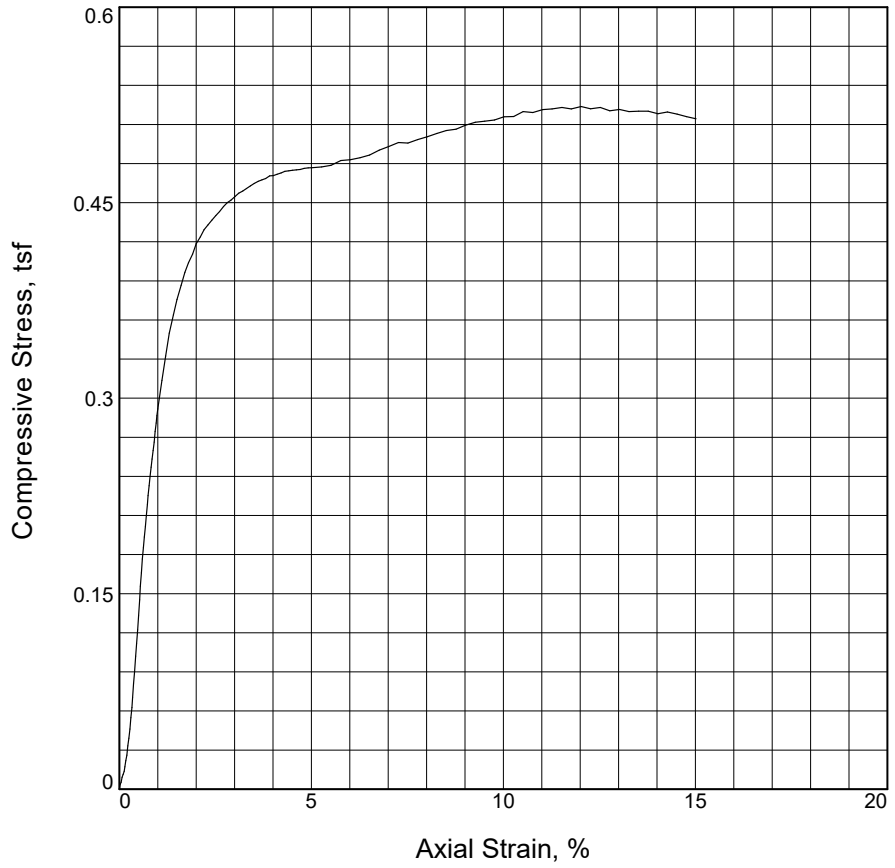
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-69 **Depth:** 62.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.524			
Undrained shear strength, tsf	0.262			
Failure strain, %	12.0			
Strain rate, %/min.	1.00			
Water content, %	27.2			
Wet density, pcf	115.2			
Dry density, pcf	90.6			
Saturation, %	85.3			
Void ratio	0.8609			
Specimen diameter, in.	2.81			
Specimen height, in.	5.83			
Height/diameter ratio	2.08			

Description: Light gray FAT CLAY; sand seams and shell fragments

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

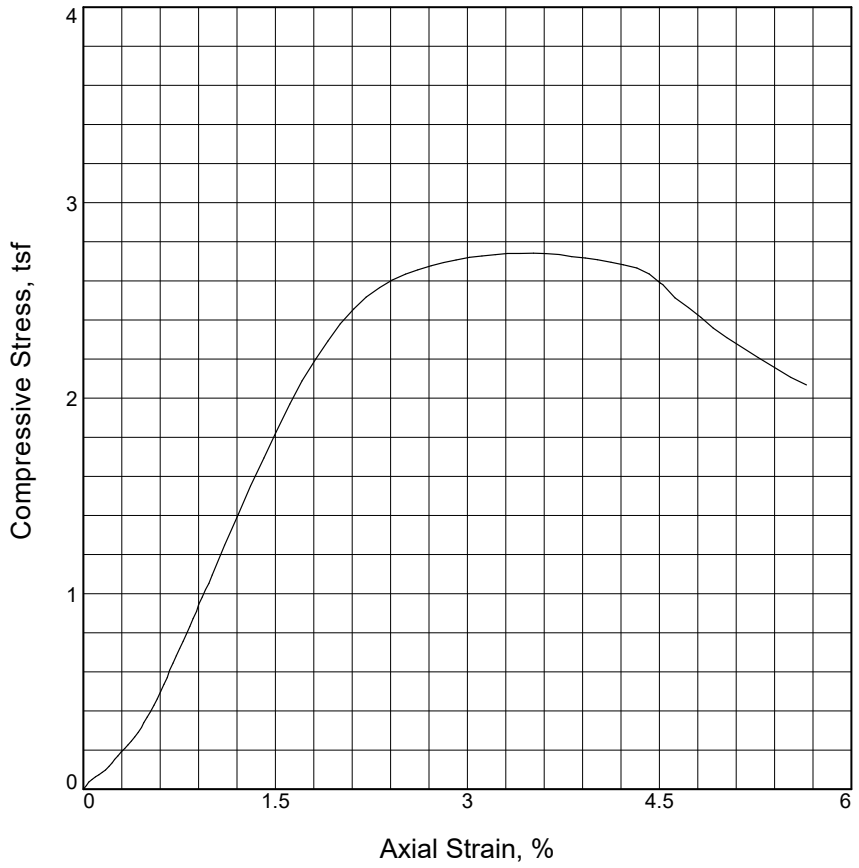
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 10
Sample Number: ST-1

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.741			
Undrained shear strength, tsf	1.371			
Failure strain, %	3.5			
Strain rate, %/min.	1.00			
Water content, %	29.5			
Wet density, pcf	125.1			
Dry density, pcf	96.6			
Saturation, %	100.0			
Void ratio	0.8415			
Specimen diameter, in.	2.84			
Specimen height, in.	5.84			
Height/diameter ratio	2.05			

Description: Reddish-brown and gray FAT CLAY; calcareous deposits

LL = 69	**PL =** 25	**PI =** 44	**Assumed GS=** 2.85	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

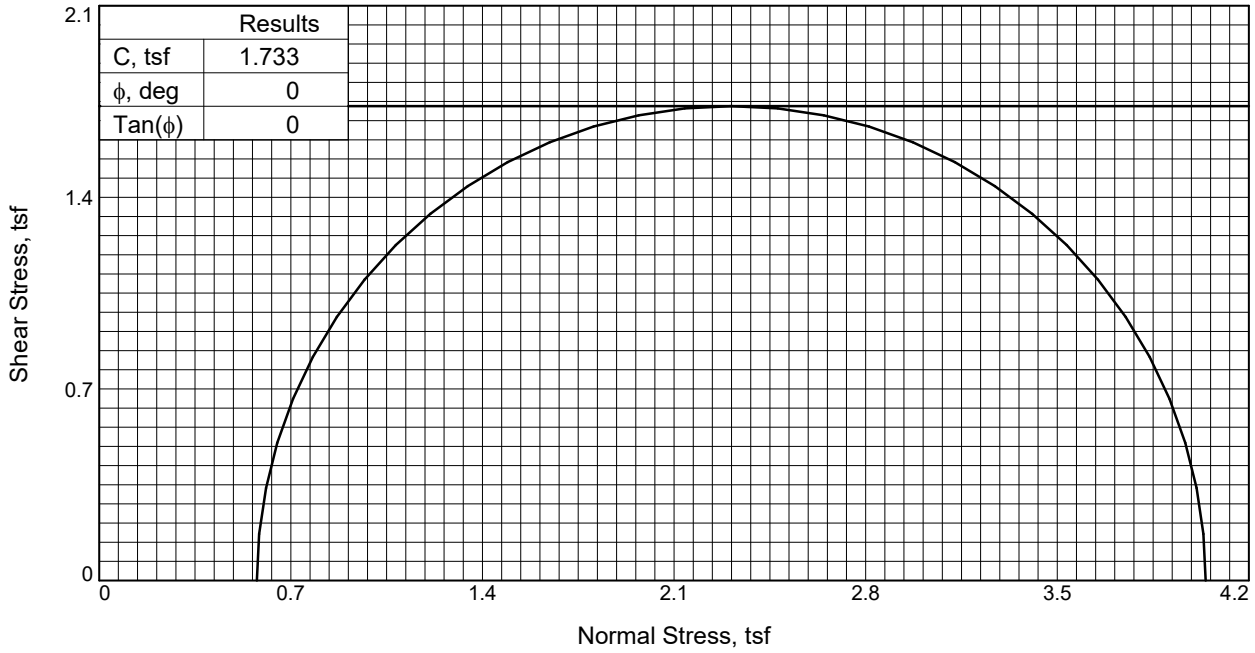
Figure _____

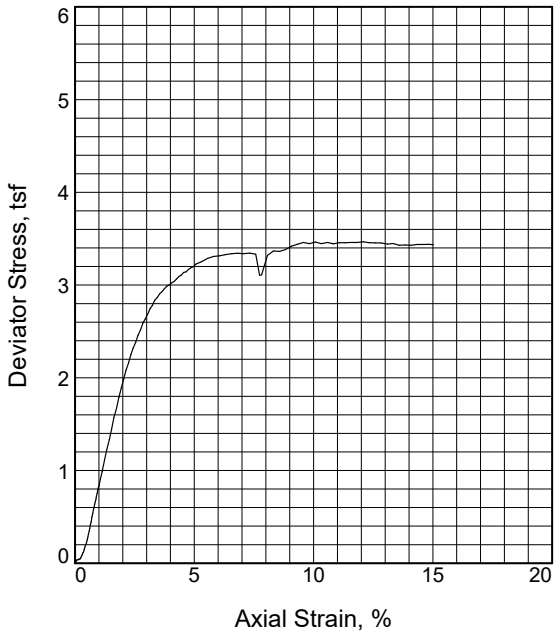
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 15
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	21.6
	Dry Density, pcf	107.1
	Saturation, %	98.7
	Void Ratio	0.6025
	Diameter, in.	2.83
	Height, in.	5.79
At Test	Water Content, %	21.3
	Dry Density, pcf	107.1
	Saturation, %	97.2
	Void Ratio	0.6025
	Diameter, in.	2.83
	Height, in.	5.79
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		8.00
Fail. Stress, tsf		3.47
Strain, %		12.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		4.04
σ_3 Failure, tsf		0.58

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown and gray LEAN CLAY with SAND

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

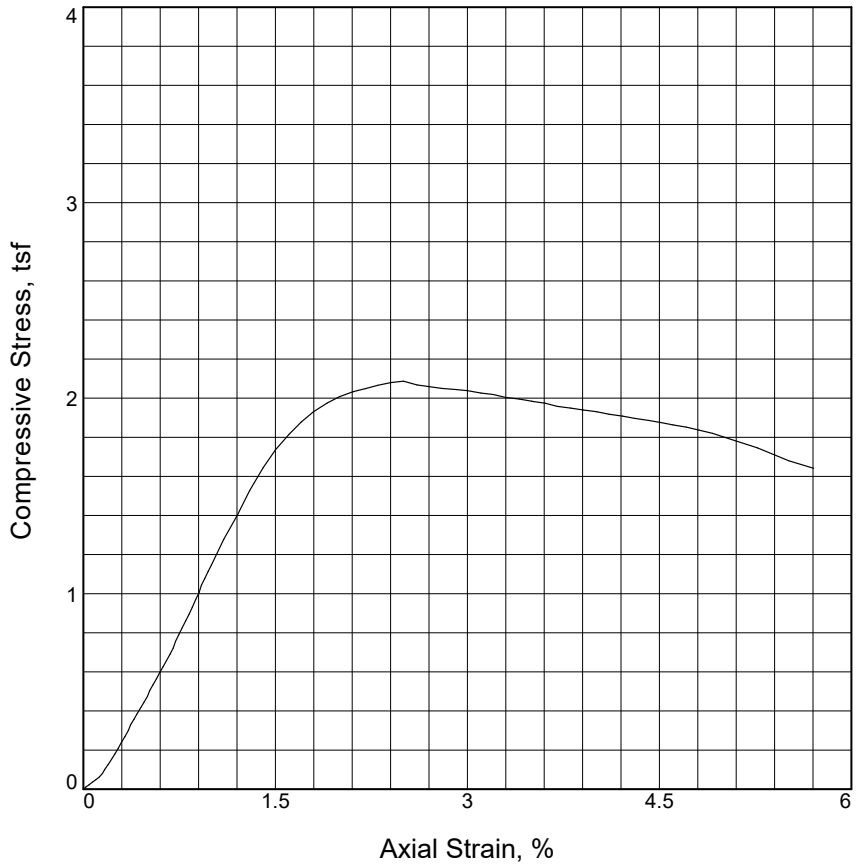
Source of Sample: CB-70 **Depth:** 20

Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/14/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.087			
Undrained shear strength, tsf	1.044			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	28.6			
Wet density, pcf	122.2			
Dry density, pcf	95.0			
Saturation, %	99.7			
Void ratio	0.7735			
Specimen diameter, in.	2.85			
Specimen height, in.	5.84			
Height/diameter ratio	2.05			

Description: Brown and tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

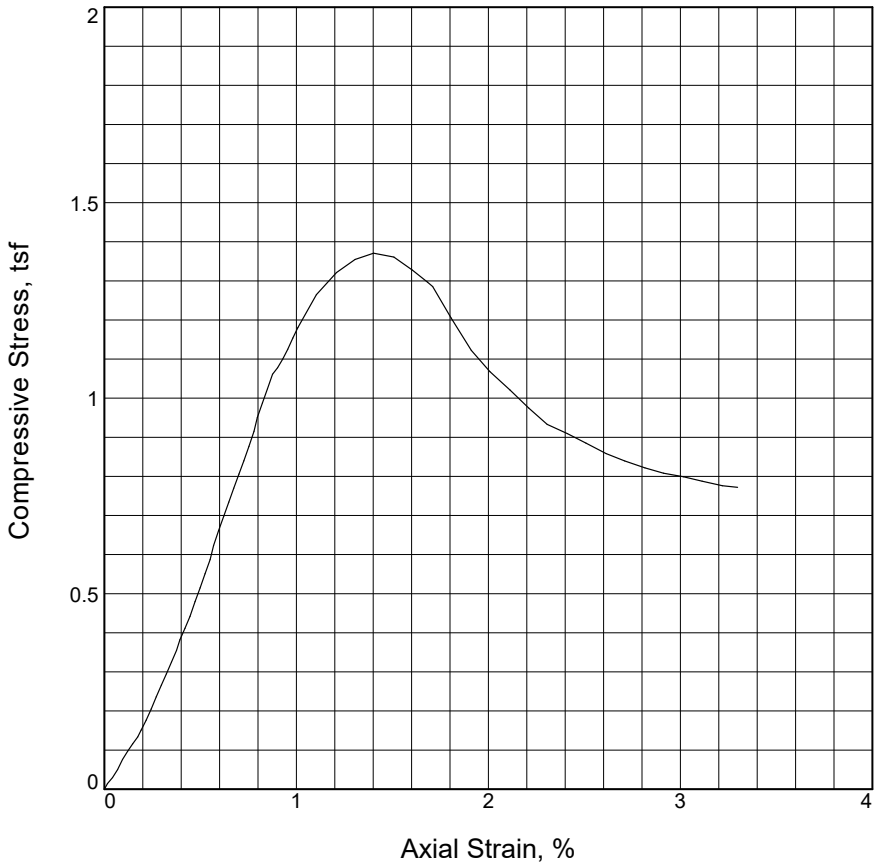
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 25
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.371			
Undrained shear strength, tsf	0.685			
Failure strain, %	1.4			
Strain rate, %/min.	1.00			
Water content, %	31.7			
Wet density, pcf	119.5			
Dry density, pcf	90.7			
Saturation, %	99.8			
Void ratio	0.8575			
Specimen diameter, in.	2.85			
Specimen height, in.	5.83			
Height/diameter ratio	2.05			

Description: Tan FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

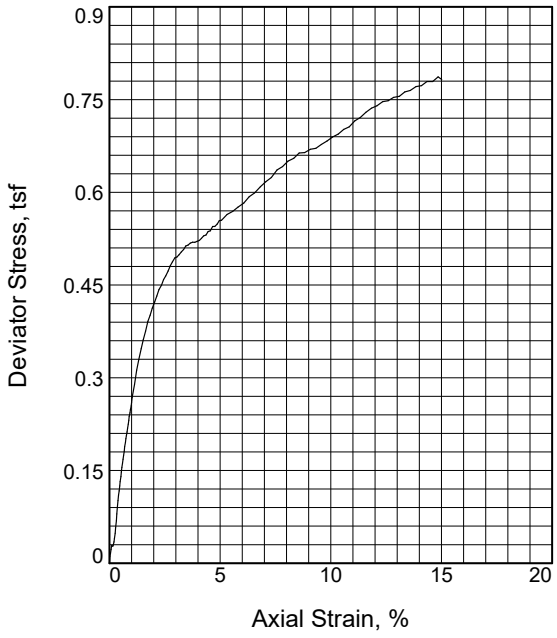
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 40
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	23.0
	Dry Density, pcf	99.0
	Saturation, %	88.5
	Void Ratio	0.7026
	Diameter, in.	2.88
	Height, in.	5.85
At Test	Water Content, %	23.8
	Dry Density, pcf	99.0
	Saturation, %	91.4
	Void Ratio	0.7026
	Diameter, in.	2.88
	Height, in.	5.85
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		5.00
Fail. Stress, tsf		0.79
Strain, %		14.8
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.15
σ_3 Failure, tsf		0.36

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray and tan SANDY LEAN CLAY

LL= 29 **PL=** 16 **PI=** 13

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

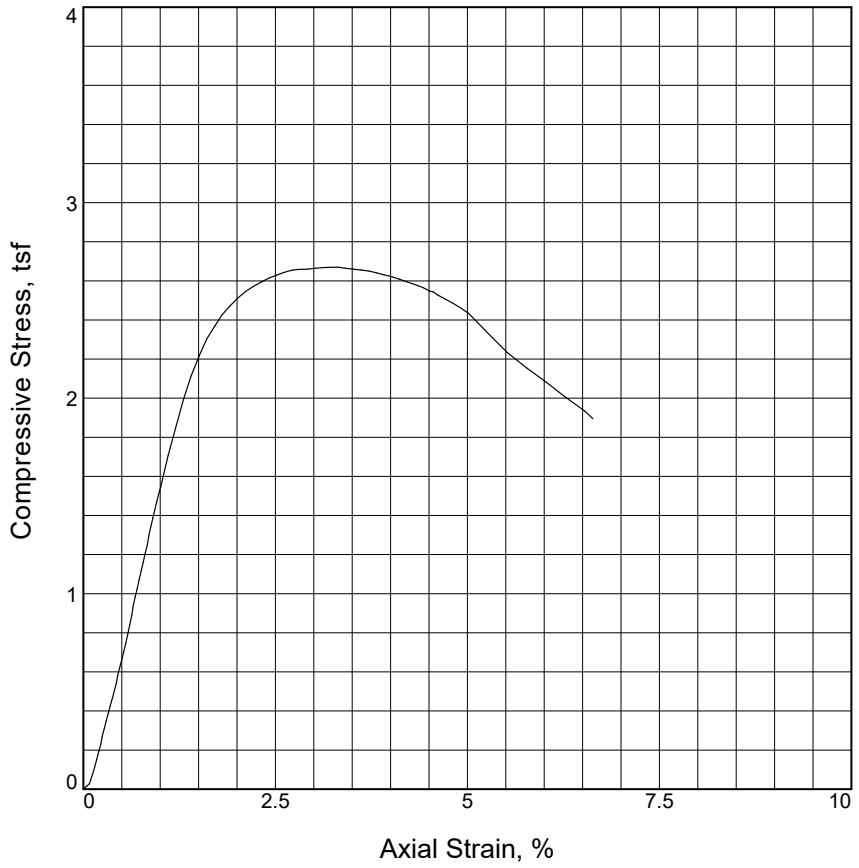
Source of Sample: CB-71 **Depth:** 12

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/12/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.670			
Undrained shear strength, tsf	1.335			
Failure strain, %	3.3			
Strain rate, %/min.	1.00			
Water content, %	24.8			
Wet density, pcf	128.2			
Dry density, pcf	102.7			
Saturation, %	99.0			
Void ratio	0.7013			
Specimen diameter, in.	2.83			
Specimen height, in.	5.83			
Height/diameter ratio	2.06			

Description: Reddish-brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

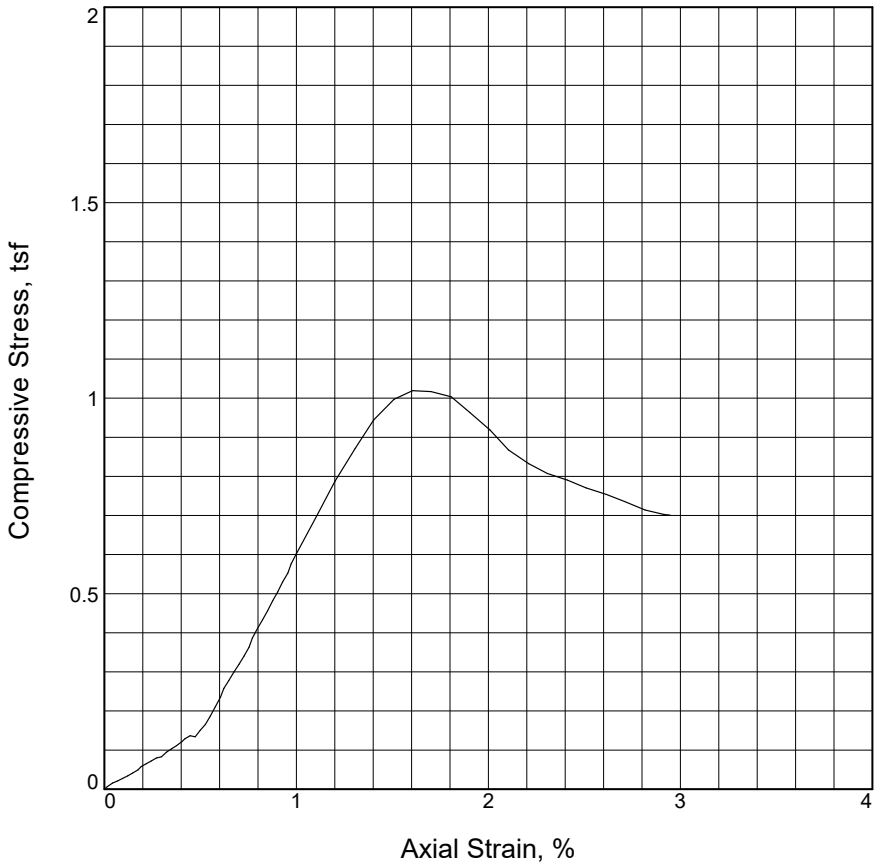
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-71 **Depth:** 17
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.019			
Undrained shear strength, tsf	0.510			
Failure strain, %	1.6			
Strain rate, %/min.	1.00			
Water content, %	35.8			
Wet density, pcf	118.0			
Dry density, pcf	86.9			
Saturation, %	99.0			
Void ratio	1.0121			
Specimen diameter, in.	2.84			
Specimen height, in.	5.82			
Height/diameter ratio	2.05			

Description: Tan FAT CLAY; calcareous and ferrous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

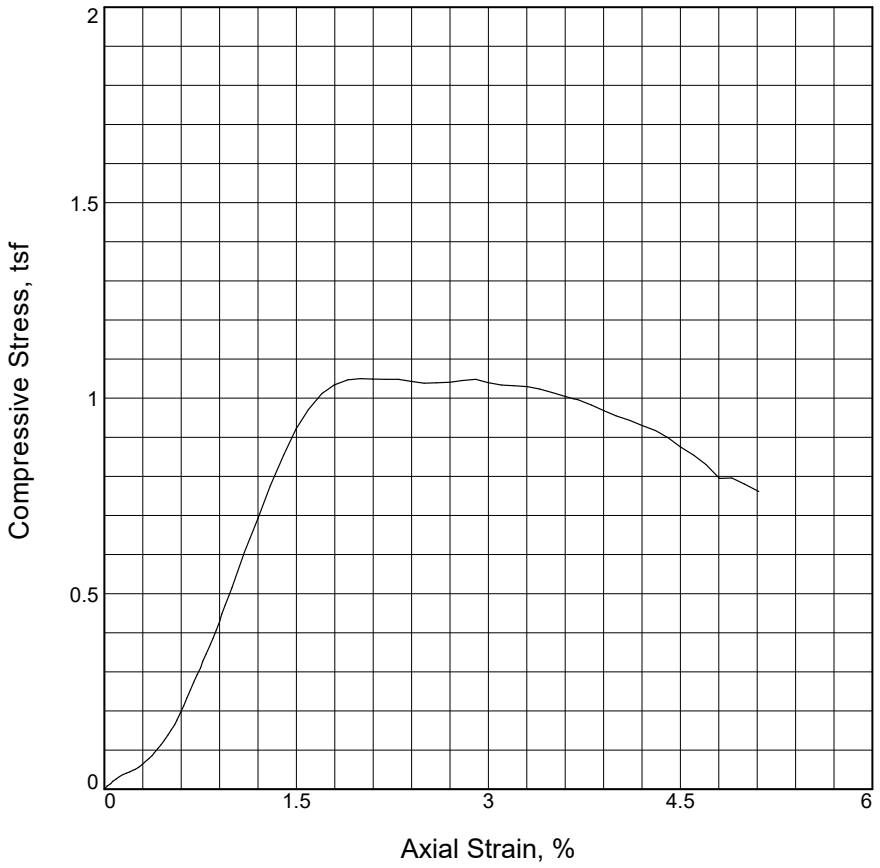
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-71 **Depth:** 22
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.050			
Undrained shear strength, tsf	0.525			
Failure strain, %	2.0			
Strain rate, %/min.	1.00			
Water content, %	36.6			
Wet density, pcf	116.9			
Dry density, pcf	85.6			
Saturation, %	100.0			
Void ratio	1.0067			
Specimen diameter, in.	2.85			
Specimen height, in.	5.81			
Height/diameter ratio	2.04			

Description: Brown and gray FAT CLAY; calcareous

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

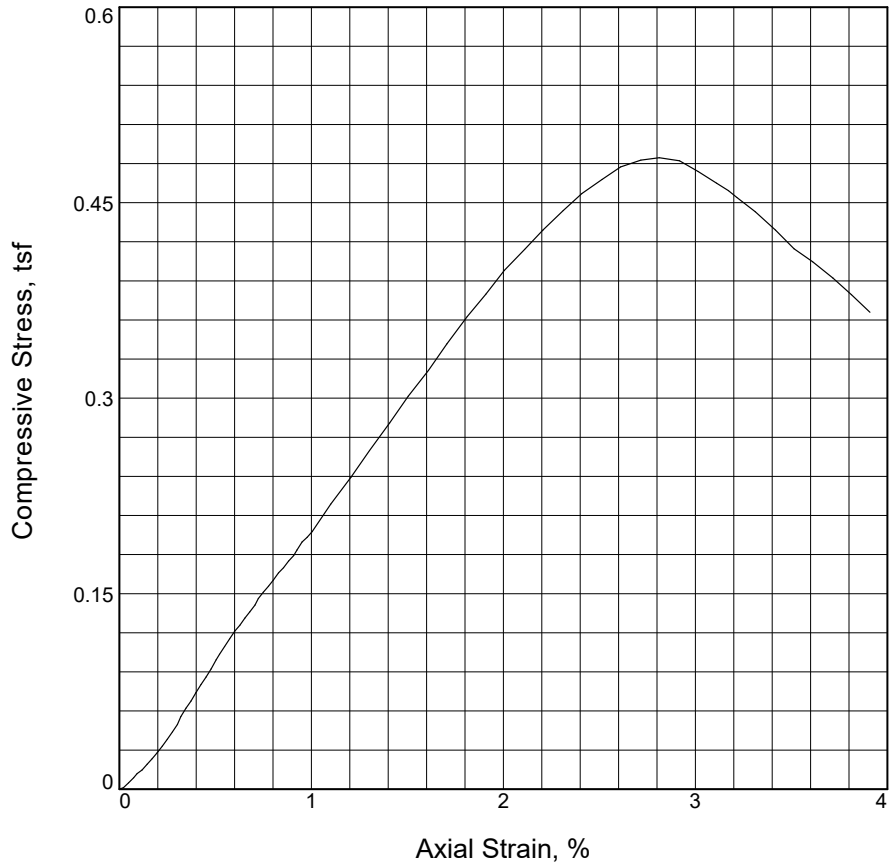
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-71 **Depth:** 32
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.484			
Undrained shear strength, tsf	0.242			
Failure strain, %	2.8			
Strain rate, %/min.	1.00			
Water content, %	20.5			
Wet density, pcf	130.8			
Dry density, pcf	108.6			
Saturation, %	97.0			
Void ratio	0.5811			
Specimen diameter, in.	2.85			
Specimen height, in.	5.73			
Height/diameter ratio	2.01			

Description: Tan SANDY LEAN CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.75	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

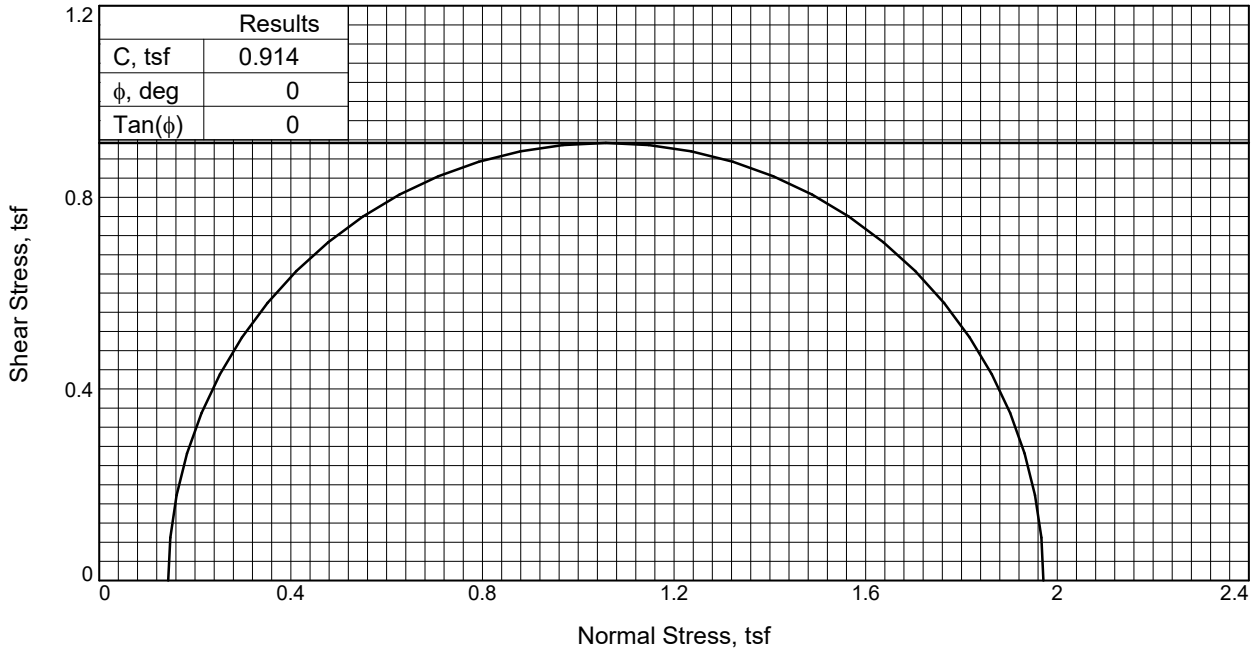
Figure _____

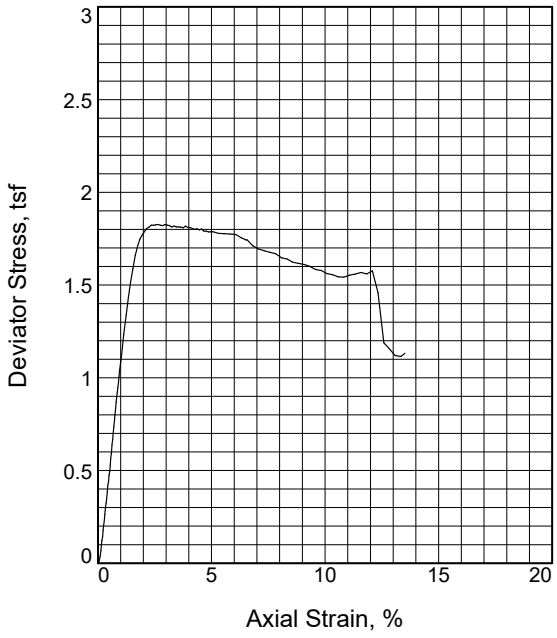
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-71 **Depth:** 39.5
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	30.4
	Dry Density, pcf	94.0
	Saturation, %	99.1
	Void Ratio	0.8587
	Diameter, in.	2.83
	Height, in.	5.82
At Test	Water Content, %	29.9
	Dry Density, pcf	94.0
	Saturation, %	97.6
	Void Ratio	0.8587
	Diameter, in.	2.83
	Height, in.	5.82
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		1.83
Strain, %		2.9
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		1.97
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Reddish-brown FAT CLAY

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

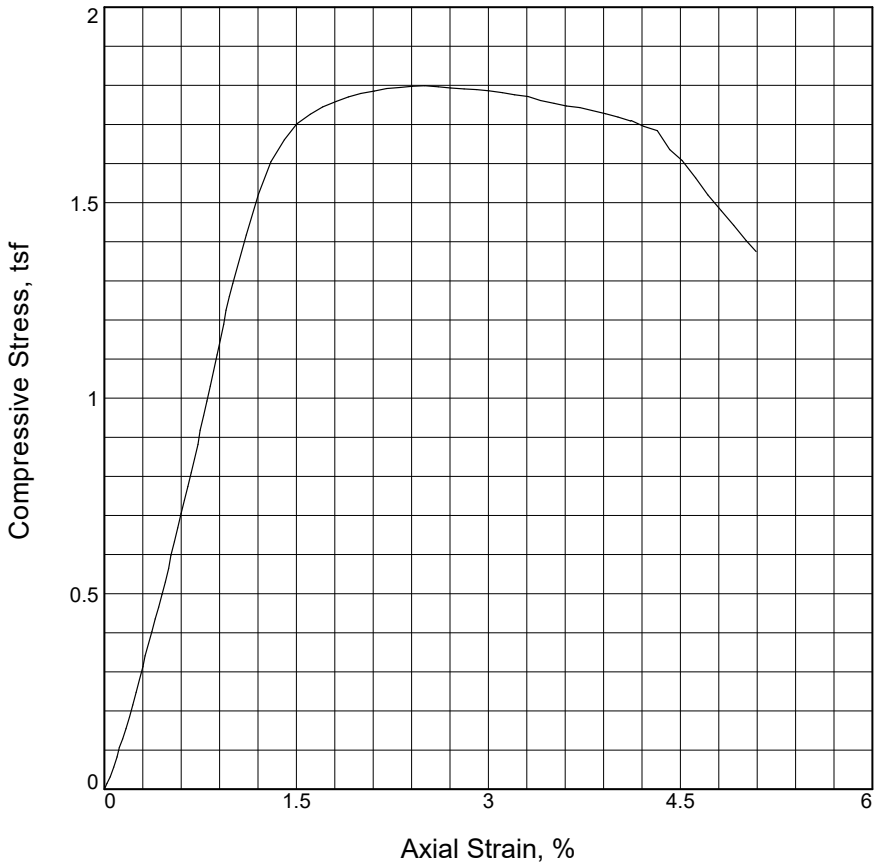
Source of Sample: CB-72 **Depth:** 5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/14/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.799			
Undrained shear strength, tsf	0.899			
Failure strain, %	2.5			
Strain rate, %/min.	1.00			
Water content, %	22.4			
Wet density, pcf	125.9			
Dry density, pcf	102.8			
Saturation, %	94.7			
Void ratio	0.6390			
Specimen diameter, in.	2.85			
Specimen height, in.	5.83			
Height/diameter ratio	2.05			

Description: Reddish-brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

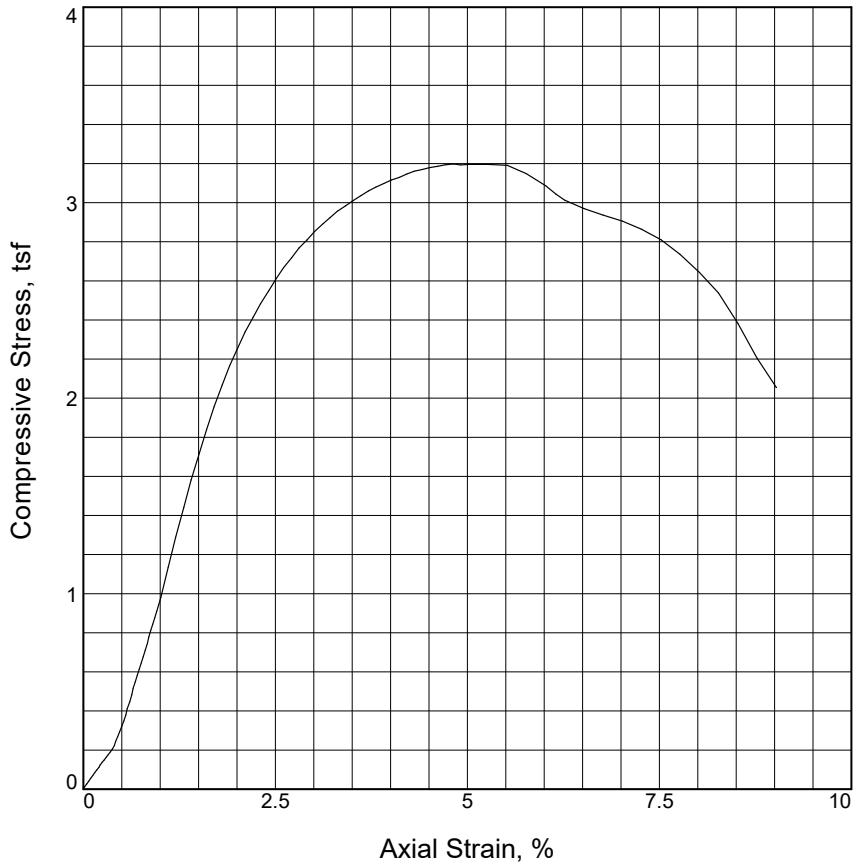
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-72 **Depth:** 10
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.198			
Undrained shear strength, tsf	1.599			
Failure strain, %	4.8			
Strain rate, %/min.	1.00			
Water content, %	18.6			
Wet density, pcf	130.6			
Dry density, pcf	110.1			
Saturation, %	94.8			
Void ratio	0.5313			
Specimen diameter, in.	2.84			
Specimen height, in.	5.85			
Height/diameter ratio	2.06			

Description: Tan and brown FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

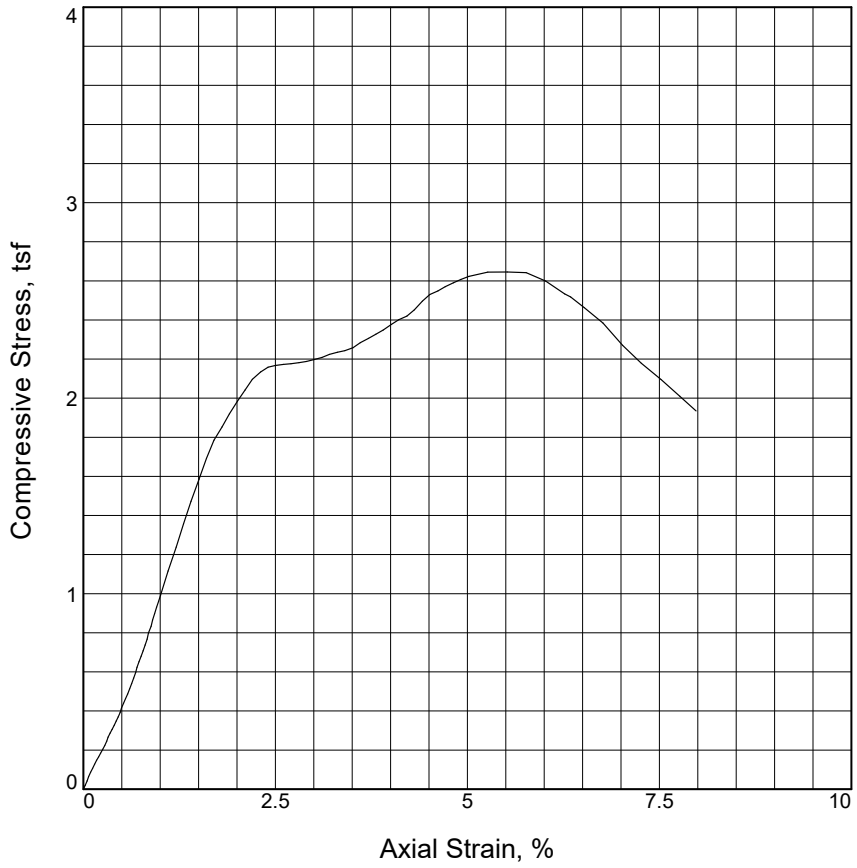
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-72 **Depth:** 20
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.646			
Undrained shear strength, tsf	1.323			
Failure strain, %	5.5			
Strain rate, %/min.	1.00			
Water content, %	24.9			
Wet density, pcf	122.3			
Dry density, pcf	98.0			
Saturation, %	93.2			
Void ratio	0.7202			
Specimen diameter, in.	2.85			
Specimen height, in.	5.80			
Height/diameter ratio	2.04			

Description: Tan FAT CLAY with SAND; calcareous

LL = 65	**PL =** 24	**PI =** 41	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

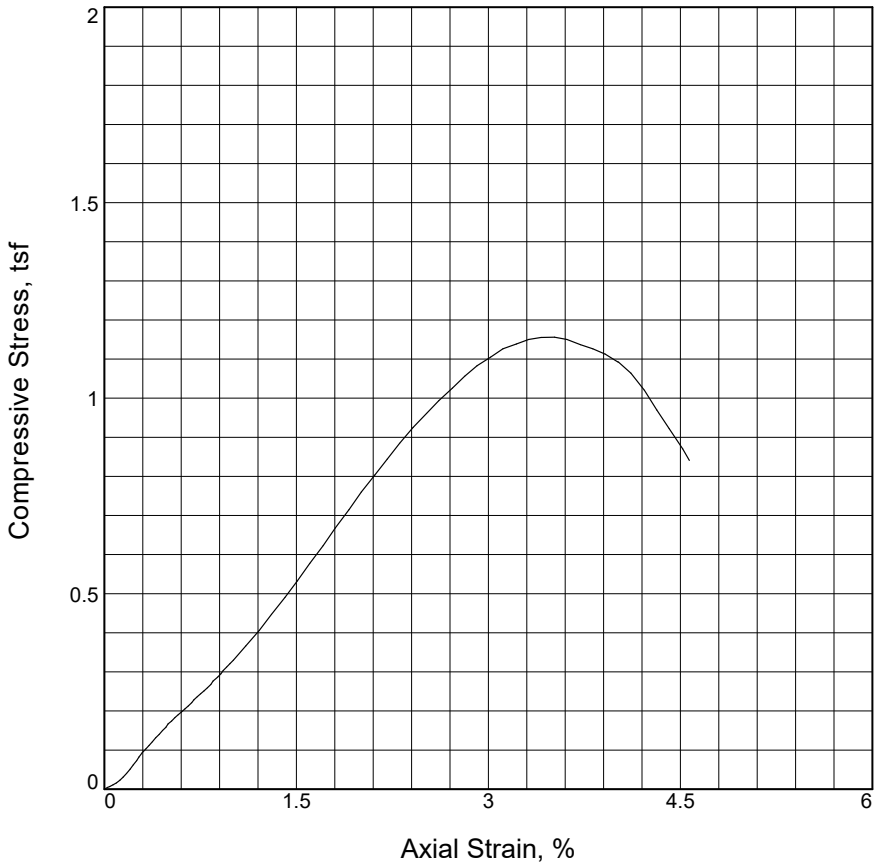
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-72 **Depth:** 30
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.156			
Undrained shear strength, tsf	0.578			
Failure strain, %	3.5			
Strain rate, %/min.	1.00			
Water content, %	17.5			
Wet density, pcf	131.6			
Dry density, pcf	112.1			
Saturation, %	93.5			
Void ratio	0.5041			
Specimen diameter, in.	2.86			
Specimen height, in.	5.79			
Height/diameter ratio	2.02			

Description: Tan CLAYEY SAND

LL = 27	**PL =** 17	**PI =** 10	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/14/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

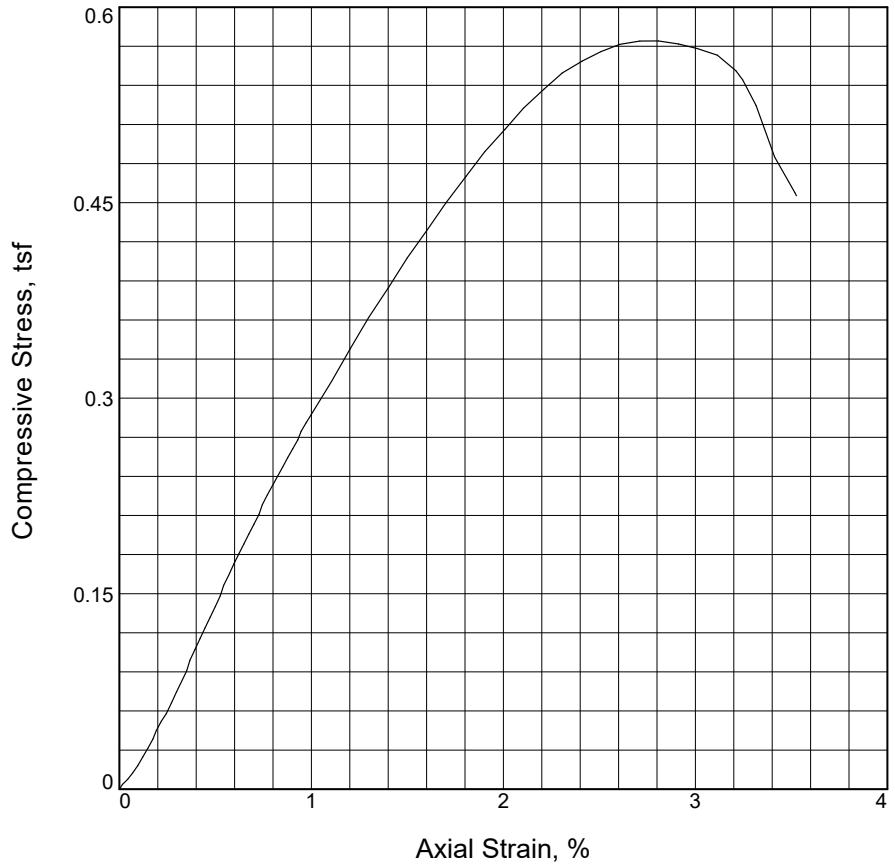
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-72 **Depth:** 37.5
Sample Number: ST-8

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.574			
Undrained shear strength, tsf	0.287			
Failure strain, %	2.8			
Strain rate, %/min.	1.00			
Water content, %	18.3			
Wet density, pcf	129.4			
Dry density, pcf	109.4			
Saturation, %	91.4			
Void ratio	0.5401			
Specimen diameter, in.	2.88			
Specimen height, in.	5.90			
Height/diameter ratio	2.05			

Description: Reddish-brown and gray LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/17/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

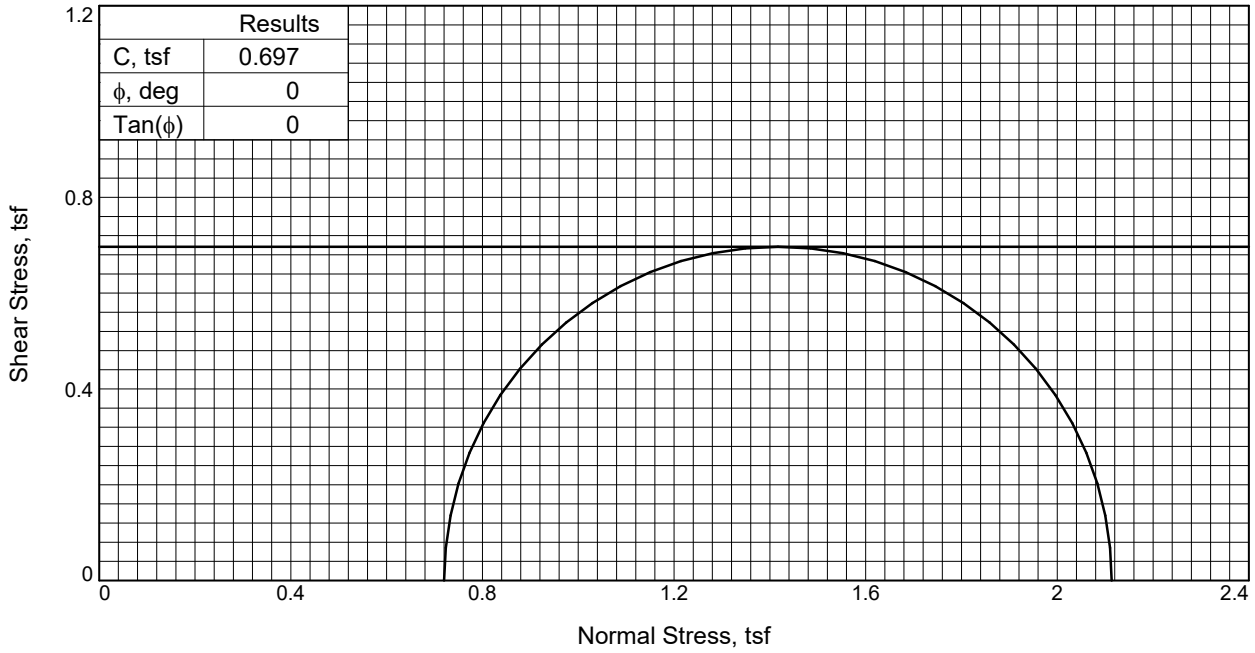
Figure _____

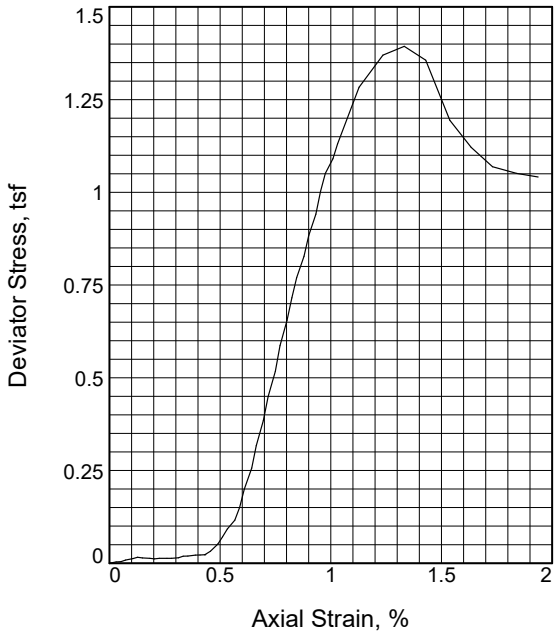
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-73 **Depth:** 19
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	25.1
	Dry Density, pcf	100.0
	Saturation, %	96.3
	Void Ratio	0.7172
	Diameter, in.	2.86
	Height, in.	5.90
At Test	Water Content, %	25.6
	Dry Density, pcf	100.0
	Saturation, %	98.0
	Void Ratio	0.7172
	Diameter, in.	2.86
	Height, in.	5.90
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		10.00
Fail. Stress, tsf		1.39
Strain, %		1.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.11
σ_3 Failure, tsf		0.72

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Gray and tan FAT CLAY with SAND; calcareous

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

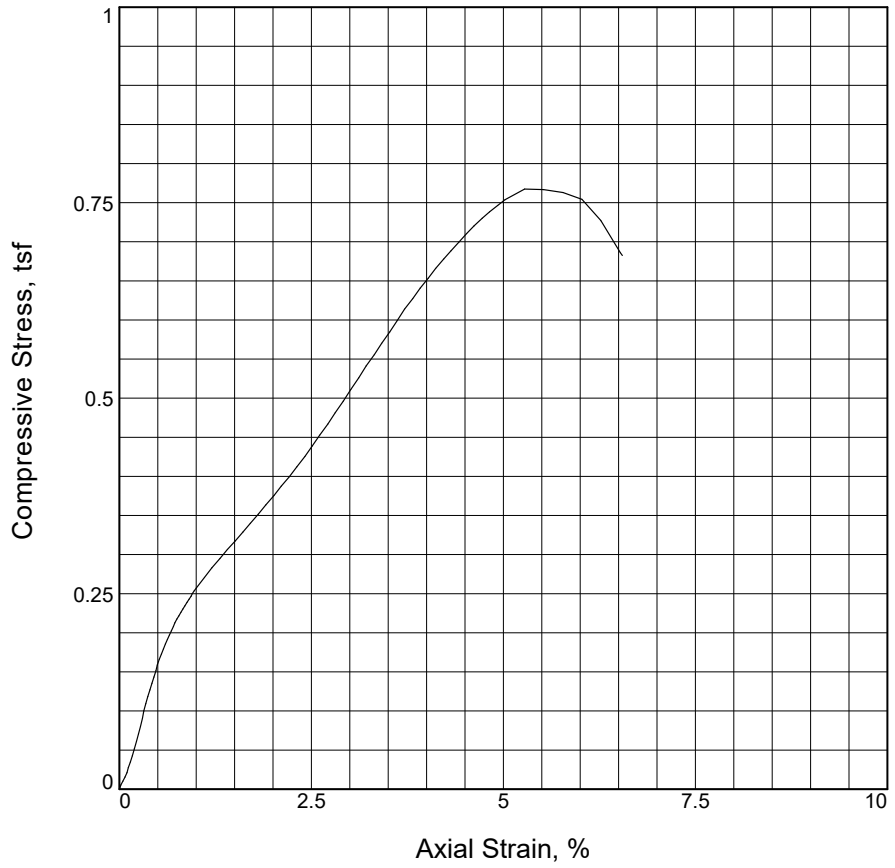
Source of Sample: CB-73 **Depth:** 24

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/12/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.767			
Undrained shear strength, tsf	0.384			
Failure strain, %	5.3			
Strain rate, %/min.	1.00			
Water content, %	18.9			
Wet density, pcf	128.6			
Dry density, pcf	108.1			
Saturation, %	91.2			
Void ratio	0.5586			
Specimen diameter, in.	2.88			
Specimen height, in.	5.94			
Height/diameter ratio	2.07			

Description: Tan and gray SANDY LEAN CLAY

LL = 35	**PL =** 15	**PI =** 20	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/17/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

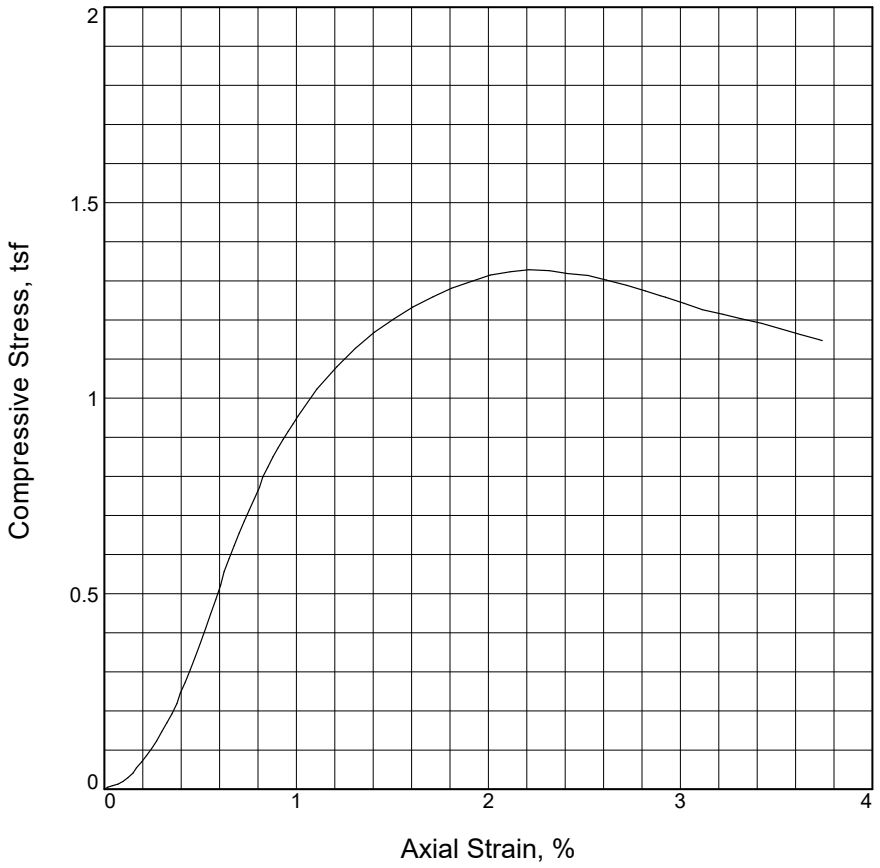
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-73 **Depth:** 34
Sample Number: ST-6

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.329			
Undrained shear strength, tsf	0.664			
Failure strain, %	2.2			
Strain rate, %/min.	1.00			
Water content, %	22.4			
Wet density, pcf	129.8			
Dry density, pcf	106.1			
Saturation, %	96.8			
Void ratio	0.6475			
Specimen diameter, in.	2.85			
Specimen height, in.	5.90			
Height/diameter ratio	2.07			

Description: Tan and gray FAT CLAY; part lean clay with sand

LL =	**PL =**	**PI =**	**Assumed GS=** 2.80	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/17/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

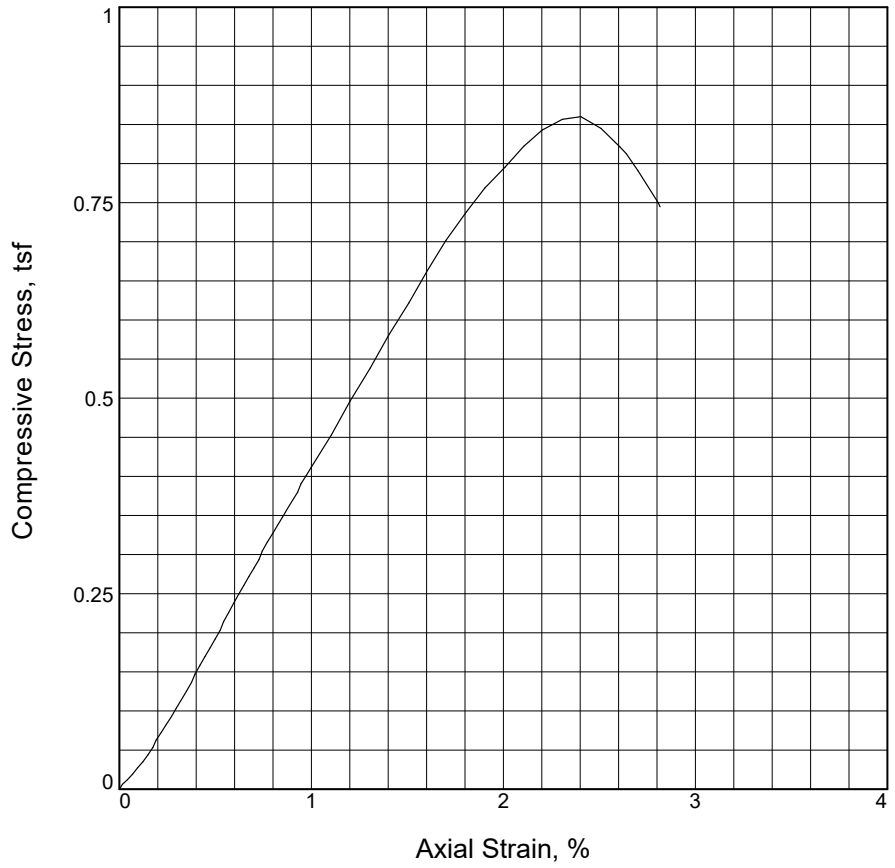
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-73 **Depth:** 39
Sample Number: ST-7

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.860			
Undrained shear strength, tsf	0.430			
Failure strain, %	2.4			
Strain rate, %/min.	1.00			
Water content, %	17.1			
Wet density, pcf	130.1			
Dry density, pcf	111.1			
Saturation, %	89.4			
Void ratio	0.5173			
Specimen diameter, in.	2.89			
Specimen height, in.	5.89			
Height/diameter ratio	2.04			

Description: Tan and gray LEAN CLAY with SAND

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/17/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

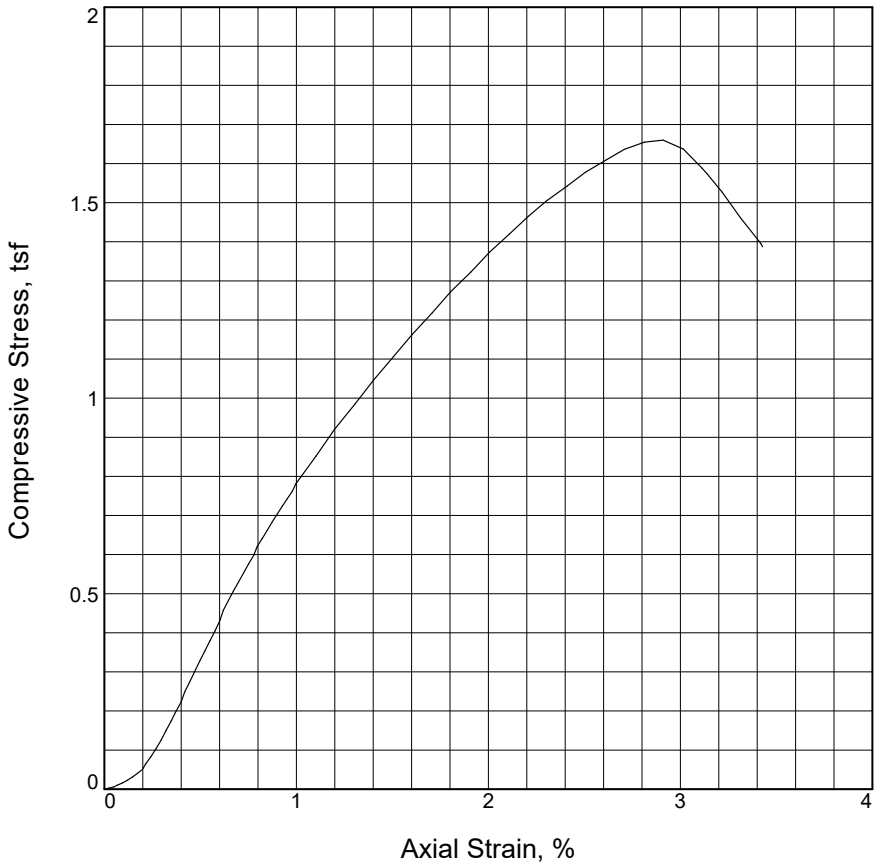
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-73 **Depth:** 46.5
Sample Number: ST-10

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.660			
Undrained shear strength, tsf	0.830			
Failure strain, %	2.9			
Strain rate, %/min.	1.00			
Water content, %	19.9			
Wet density, pcf	127.1			
Dry density, pcf	106.0			
Saturation, %	91.1			
Void ratio	0.5909			
Specimen diameter, in.	2.88			
Specimen height, in.	5.92			
Height/diameter ratio	2.06			

Description: Tan and gray LEAN CLAY with SAND

LL = 38	**PL =** 21	**PI =** 17	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

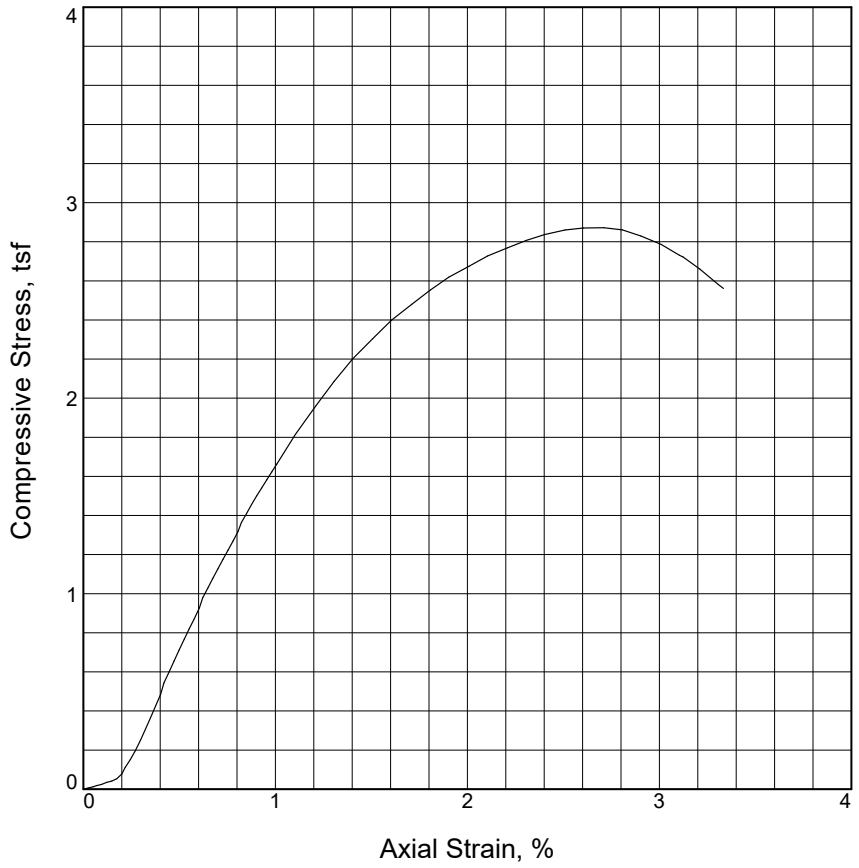
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-74 **Depth:** 7.5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.872			
Undrained shear strength, tsf	1.436			
Failure strain, %	2.7			
Strain rate, %/min.	1.00			
Water content, %	21.2			
Wet density, pcf	125.8			
Dry density, pcf	103.8			
Saturation, %	91.6			
Void ratio	0.6240			
Specimen diameter, in.	2.88			
Specimen height, in.	5.93			
Height/diameter ratio	2.06			

Description: Reddish-brown and gray FAT CLAY

LL =	**PL =**	**PI =**	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

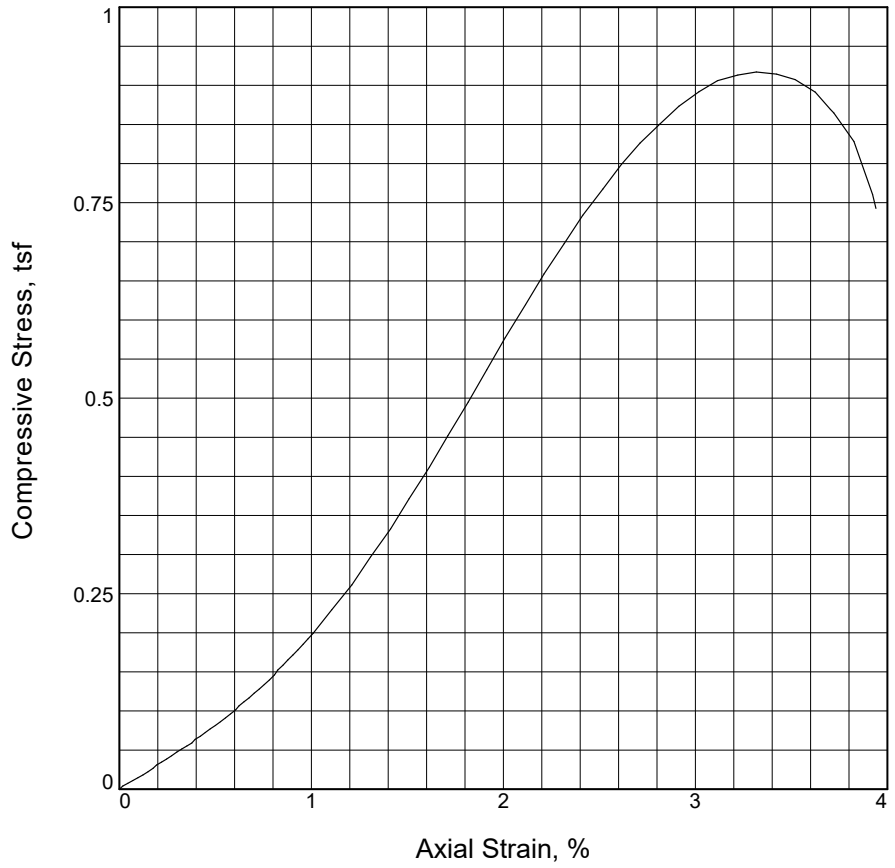
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-74 **Depth:** 10
Sample Number: ST-3

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.917			
Undrained shear strength, tsf	0.459			
Failure strain, %	3.3			
Strain rate, %/min.	1.00			
Water content, %	21.8			
Wet density, pcf	125.9			
Dry density, pcf	103.4			
Saturation, %	93.1			
Void ratio	0.6307			
Specimen diameter, in.	2.86			
Specimen height, in.	5.91			
Height/diameter ratio	2.07			

Description: Tan and gray SANDY LEAN CLAY

LL = 31	**PL =** 18	**PI =** 13	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

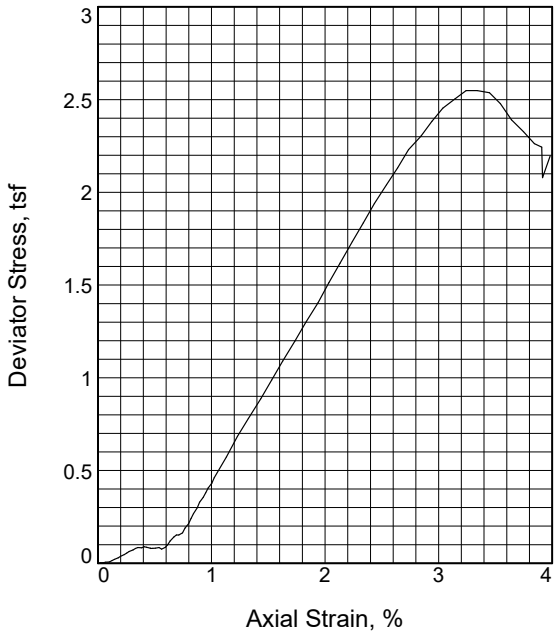
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-74 **Depth:** 15
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	23.8
	Dry Density, pcf	99.9
	Saturation, %	93.4
	Void Ratio	0.6877
	Diameter, in.	2.88
	Height, in.	5.93
At Test	Water Content, %	23.5
	Dry Density, pcf	99.9
	Saturation, %	92.1
	Void Ratio	0.6877
	Diameter, in.	2.88
	Height, in.	5.93
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		10.00
Fail. Stress, tsf		2.55
Strain, %		3.3
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		3.27
σ_3 Failure, tsf		0.72

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan and gray LEAN CLAY

LL= 34 **PL=** 19 **PI=** 15

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2166
Failure type: Vertical shear

Figure _____

Client: CPA/ USACE

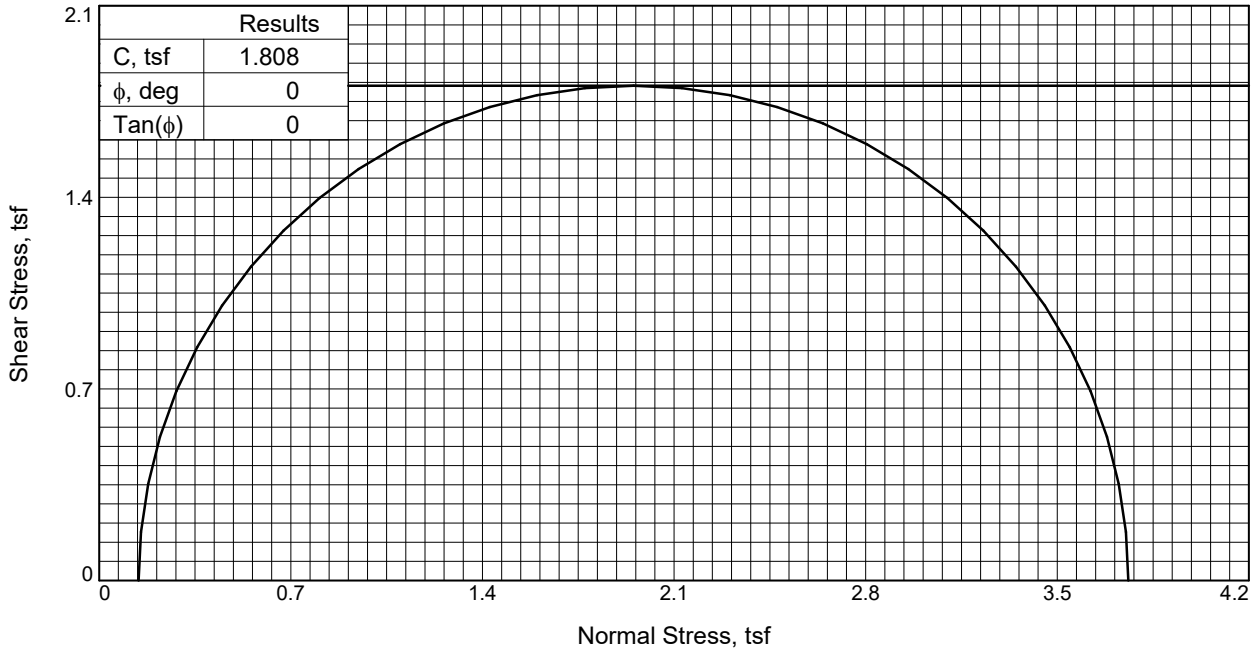
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

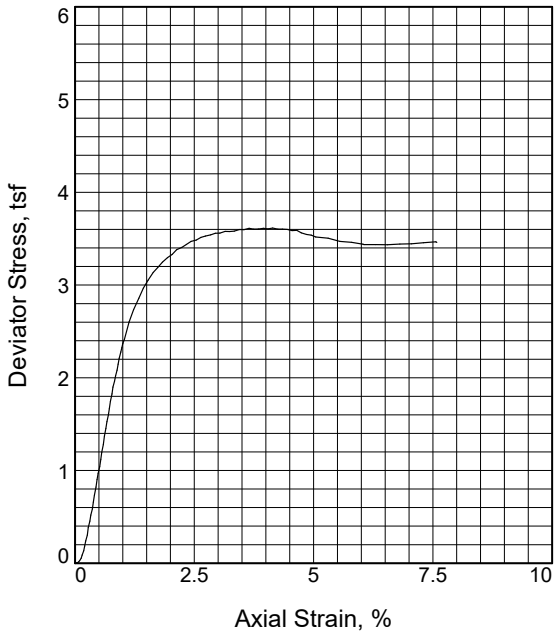
Source of Sample: CB-74 **Depth:** 20

Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 11/18/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	26.7
	Dry Density, pcf	96.5
	Saturation, %	96.8
	Void Ratio	0.7460
	Diameter, in.	2.87
	Height, in.	5.93
At Test	Water Content, %	25.9
	Dry Density, pcf	96.5
	Saturation, %	93.6
	Void Ratio	0.7460
	Diameter, in.	2.87
	Height, in.	5.93
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		3.62
Strain, %		4.1
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		3.76
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan and gray FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Multiple shear

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

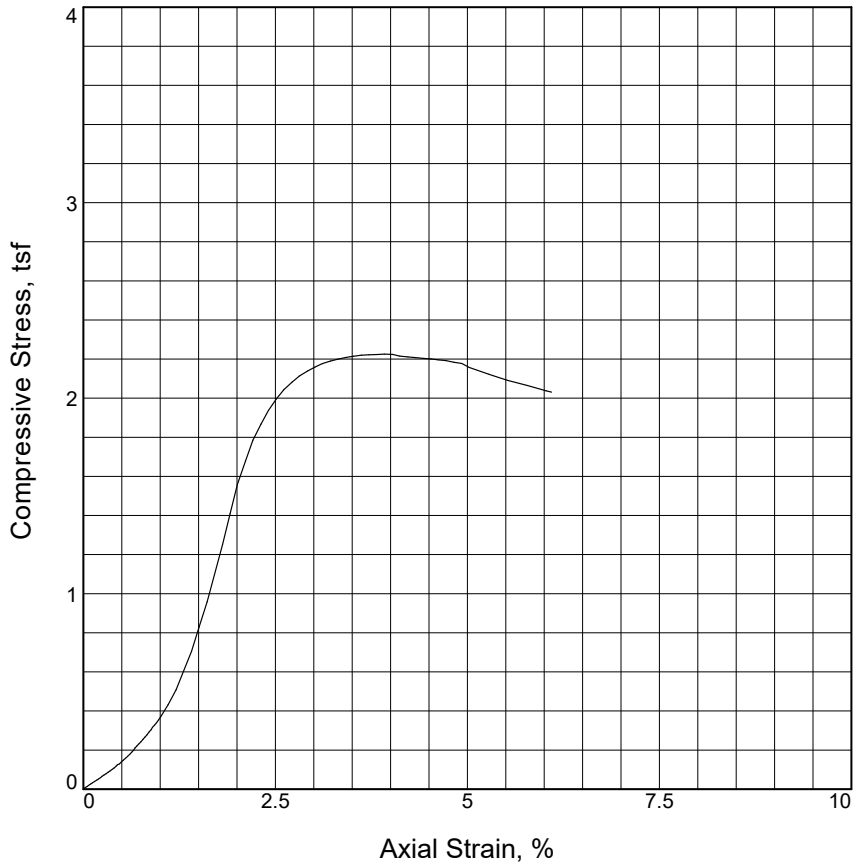
Source of Sample: CB-75 **Depth:** 2.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/18/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.226			
Undrained shear strength, tsf	1.113			
Failure strain, %	3.9			
Strain rate, %/min.	1.00			
Water content, %	26.4			
Wet density, pcf	121.9			
Dry density, pcf	96.5			
Saturation, %	95.2			
Void ratio	0.7474			
Specimen diameter, in.	2.88			
Specimen height, in.	5.07			
Height/diameter ratio	1.76			

Description: Tan and gray FAT CLAY

LL = 68	**PL =** 23	**PI =** 45	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: Slickensided

Figure _____

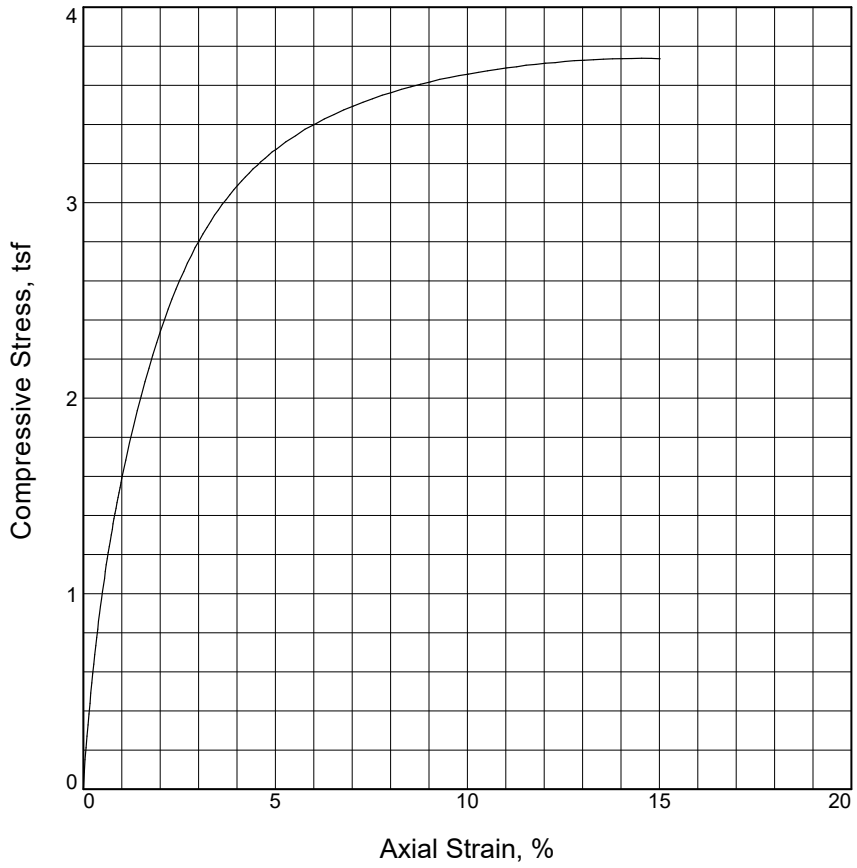
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-75 **Depth:** 5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	3.739			
Undrained shear strength, tsf	1.869			
Failure strain, %	14.5			
Strain rate, %/min.	1.00			
Water content, %	20.6			
Wet density, pcf	128.2			
Dry density, pcf	106.3			
Saturation, %	95.1			
Void ratio	0.5860			
Specimen diameter, in.	2.88			
Specimen height, in.	5.95			
Height/diameter ratio	2.07			

Description: Reddish-brown and tan FAT CLAY with SAND

LL = 51	**PL =** 20	**PI =** 31	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: Multiple shear

Figure _____

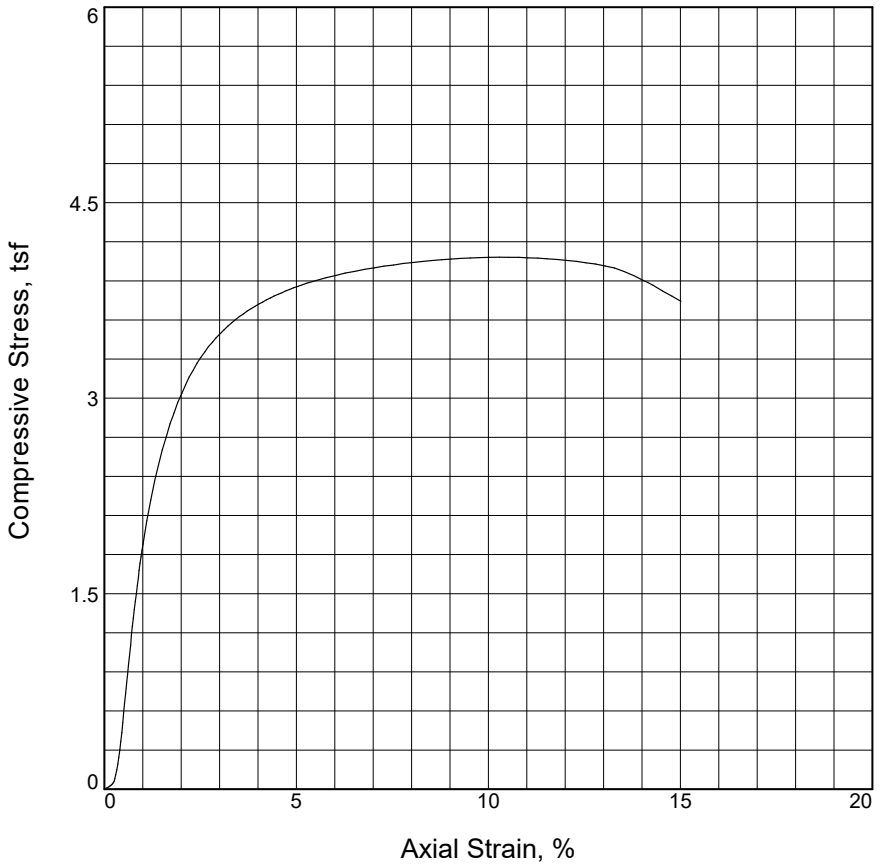
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-75 **Depth:** 10
Sample Number: ST-4

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	4.081			
Undrained shear strength, tsf	2.041			
Failure strain, %	10.3			
Strain rate, %/min.	1.00			
Water content, %	20.6			
Wet density, pcf	127.9			
Dry density, pcf	106.0			
Saturation, %	94.4			
Void ratio	0.5904			
Specimen diameter, in.	2.88			
Specimen height, in.	5.95			
Height/diameter ratio	2.07			

Description: Reddish-brown and gray FAT CLAY

LL = 52	**PL =** 22	**PI =** 30	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

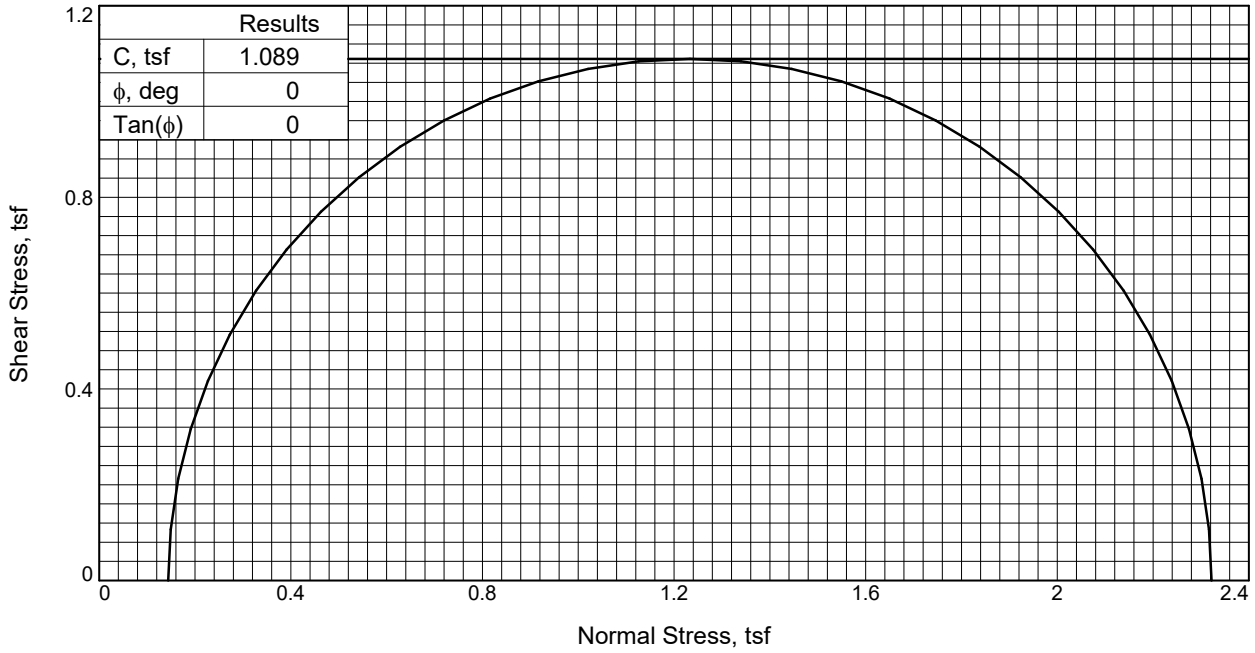
Figure _____

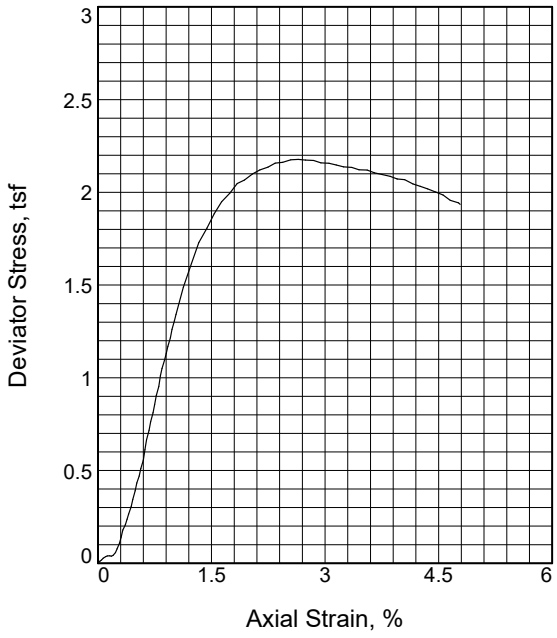
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-75 **Depth:** 12.5
Sample Number: ST-5

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1
Initial	Water Content, %	28.4
	Dry Density, pcf	93.5
	Saturation, %	95.5
	Void Ratio	0.8031
	Diameter, in.	2.88
	Height, in.	5.87
At Test	Water Content, %	27.6
	Dry Density, pcf	93.5
	Saturation, %	92.8
	Void Ratio	0.8031
	Diameter, in.	2.88
	Height, in.	5.87
Strain rate, %/min.		1.00
Back Pressure, psi		0.00
Cell Pressure, psi		2.00
Fail. Stress, tsf		2.18
Strain, %		2.6
Ult. Stress, tsf		
Strain, %		
σ_1 Failure, tsf		2.32
σ_3 Failure, tsf		0.14

Type of Test:
Unconsolidated Undrained

Sample Type: Undisturbed

Description: Tan and gray FAT CLAY

LL= 77 **PL=** 26 **PI=** 51

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D2850
Failure type: Slickensided

Figure _____

Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

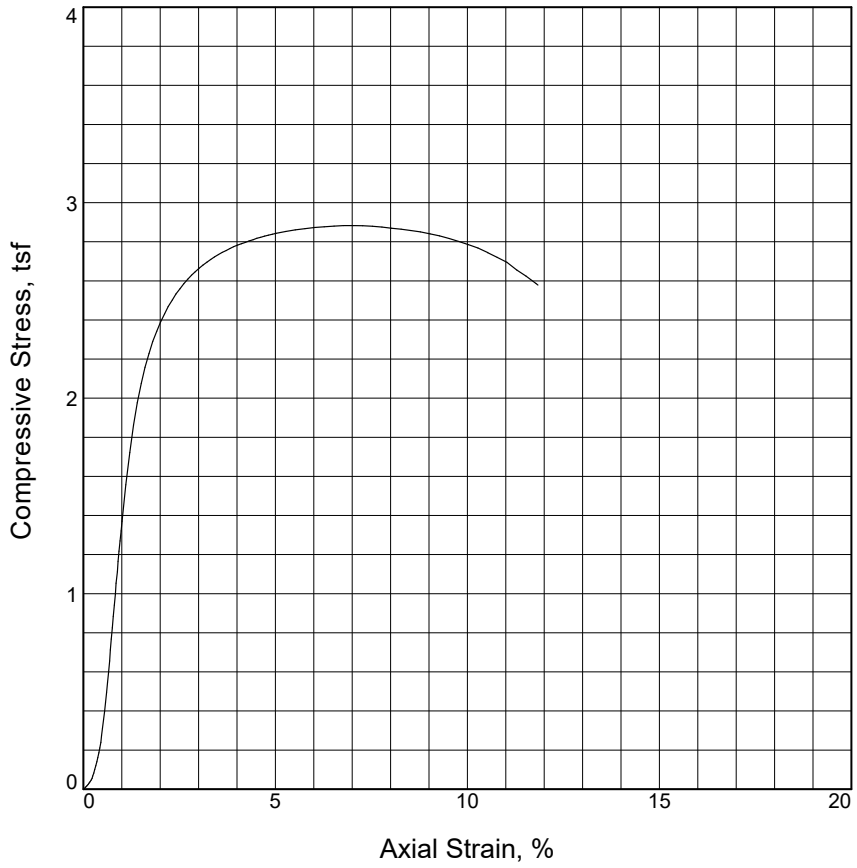
Source of Sample: CB-76 **Depth:** 2.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/18/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.883			
Undrained shear strength, tsf	1.441			
Failure strain, %	6.8			
Strain rate, %/min.	1.00			
Water content, %	27.9			
Wet density, pcf	120.9			
Dry density, pcf	94.5			
Saturation, %	96.1			
Void ratio	0.7835			
Specimen diameter, in.	2.87			
Specimen height, in.	5.88			
Height/diameter ratio	2.05			

Description: Tan and gray FAT CLAY

LL = 66	**PL =** 24	**PI =** 42	**Assumed GS=** 2.70	**Type:** Undisturbed

Project No.: 21.14.223
Date Sampled: 11/18/21
Remarks:

Test method: ASTM D2166
Failure type: 60 degree

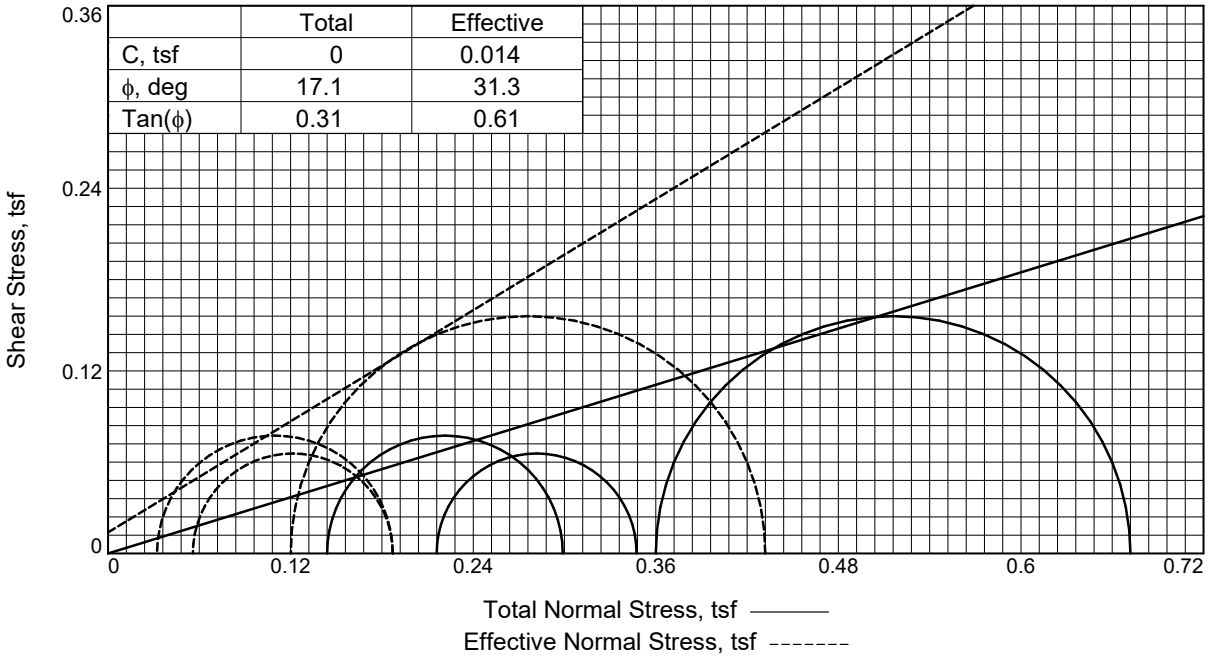
Figure _____

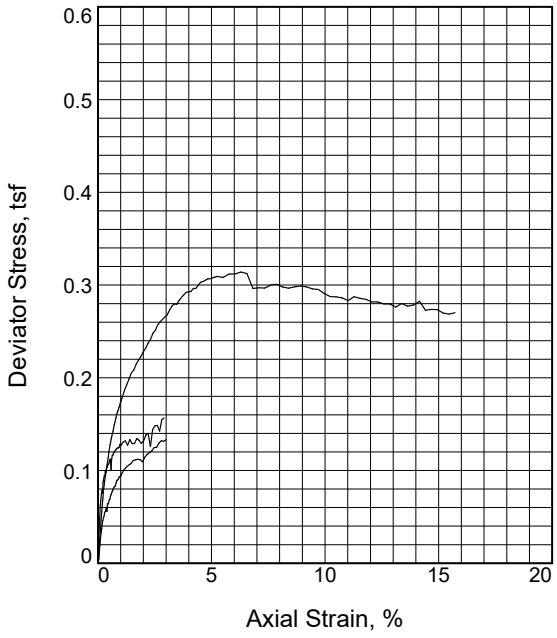
Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-76 **Depth:** 5
Sample Number: ST-2

UNCONFINED COMPRESSION TEST
Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	14.3	14.3	14.3
	Dry Density, pcf	88.0	88.0	88.0
	Saturation, %	42.3	42.3	42.3
	Void Ratio	0.9153	0.9153	0.9153
	Diameter, in.	2.10	2.10	2.10
	Height, in.	4.45	4.45	4.45
At Test	Water Content, %	48.4	48.4	48.4
	Dry Density, pcf	73.0	73.0	73.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.3075	1.3075	1.3075
	Diameter, in.	2.31	2.34	2.36
	Height, in.	4.43	4.32	4.25
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	3.00	5.00
Fail. Stress, tsf		0.15	0.13	0.31
Excess Pore Pr., tsf		0.11	0.16	0.24
Strain, %		2.8	2.9	5.8
Ult. Stress, tsf		0.15	0.13	0.31
Excess Pore Pr., tsf		0.11	0.16	0.24
Strain, %		2.8	2.9	5.8
$\bar{\sigma}_1$ Failure, tsf		0.19	0.19	0.43
$\bar{\sigma}_3$ Failure, tsf		0.03	0.06	0.12

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY

LL= 67 **PL=** 24 **PI=** 43

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

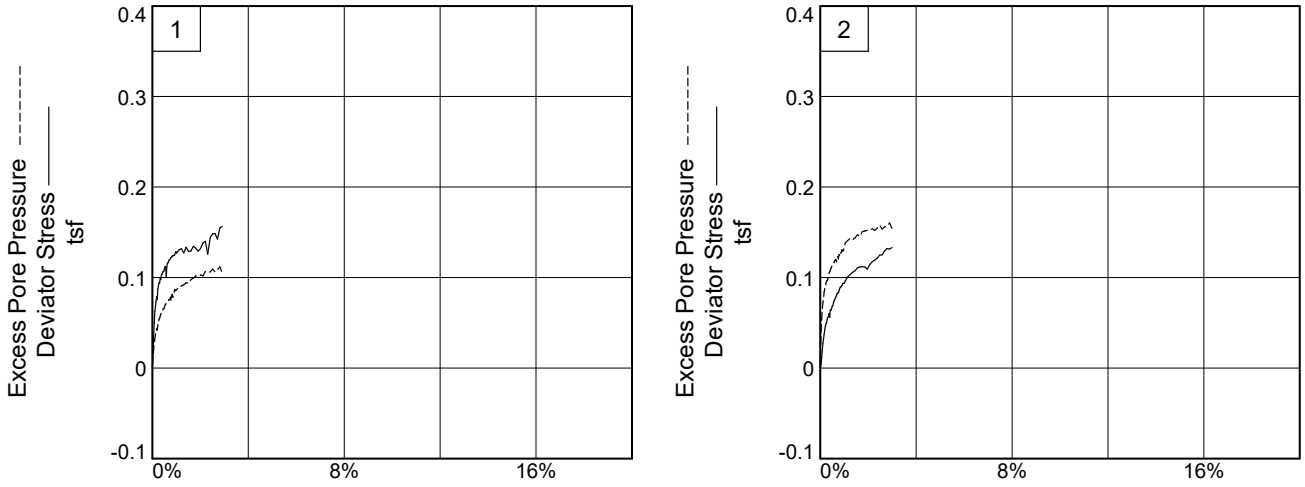
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

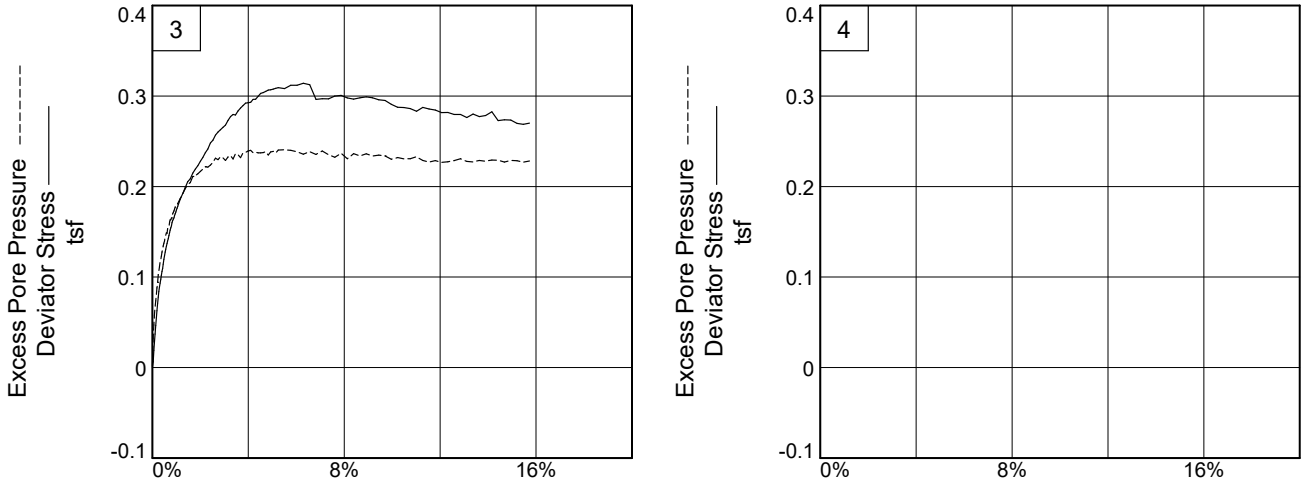
Source of Sample: CB-03 **Depth:** 5

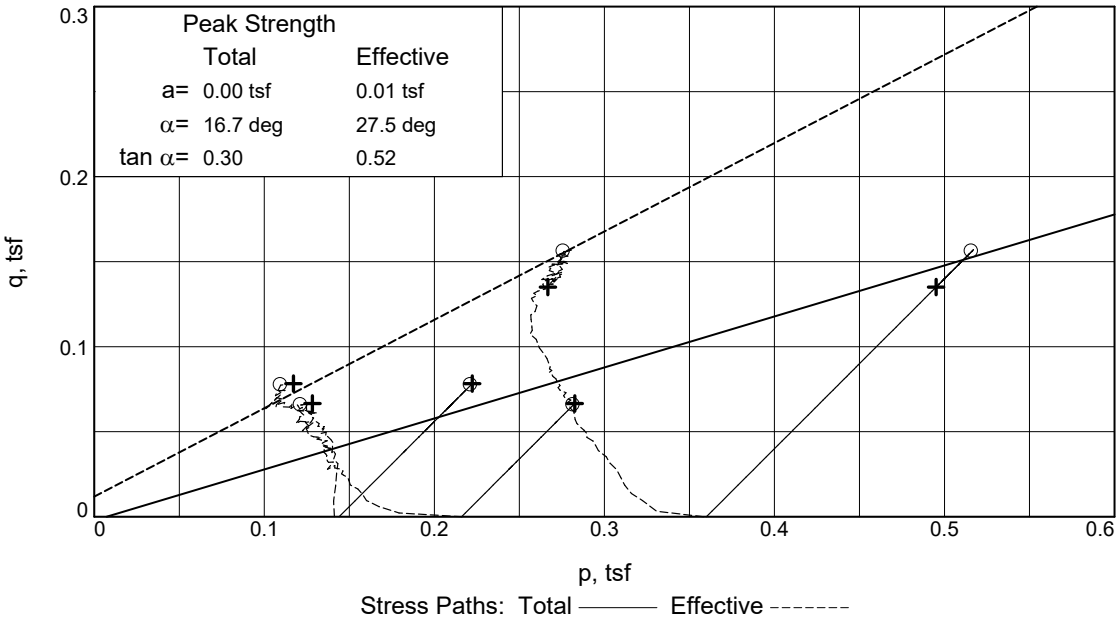
Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/3/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







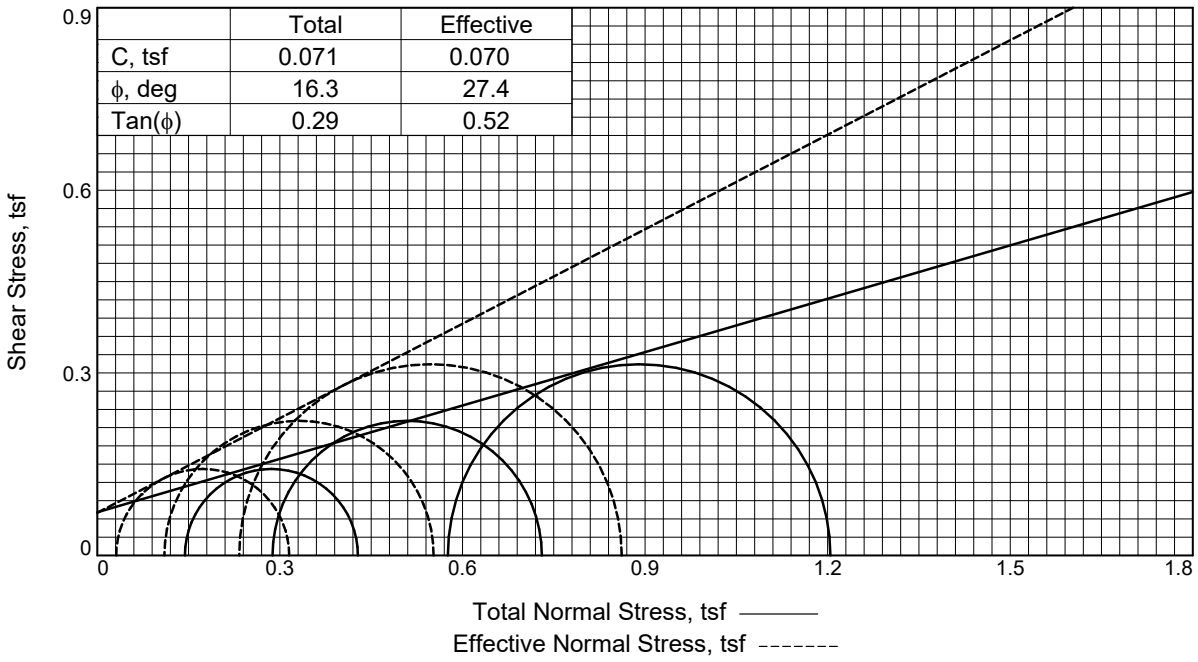
Client: CPA/ USACE

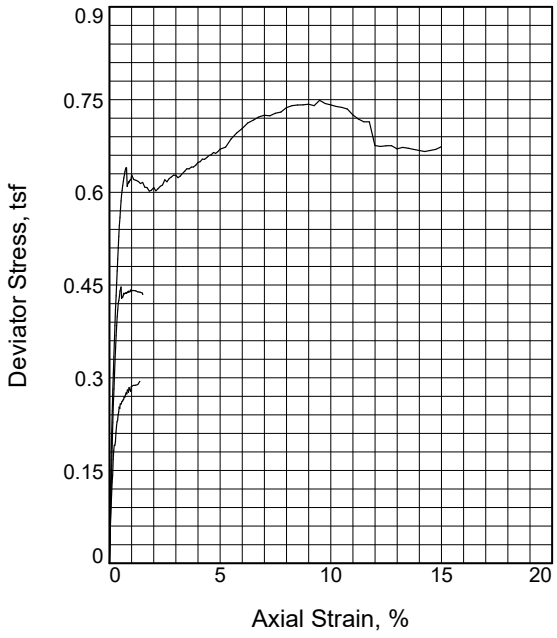
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-03 **Depth:** 5 **Sample Number:** ST-2

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	40.0	40.0	40.0
	Dry Density, pcf	81.8	81.8	81.8
	Saturation, %	98.7	98.7	98.7
	Void Ratio	1.1362	1.1362	1.1362
	Diameter, in.	2.08	2.08	2.08
	Height, in.	4.97	4.97	4.97
At Test	Water Content, %	34.1	34.1	34.1
	Dry Density, pcf	89.4	89.4	89.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9543	0.9543	0.9543
	Diameter, in.	1.97	1.97	1.98
	Height, in.	5.06	5.04	4.97
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.28	0.44	0.63
Excess Pore Pr., tsf		0.11	0.18	0.34
Strain, %		0.9	1.0	1.0
Ult. Stress, tsf		0.28	0.44	0.63
Excess Pore Pr., tsf		0.11	0.18	0.34
Strain, %		0.9	1.0	1.0
$\bar{\sigma}_1$ Failure, tsf		0.32	0.55	0.86
$\bar{\sigma}_3$ Failure, tsf		0.03	0.11	0.23

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray and brown FAT CLAY; sand partings

LL= 75 **PL=** 28 **PI=** 47

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

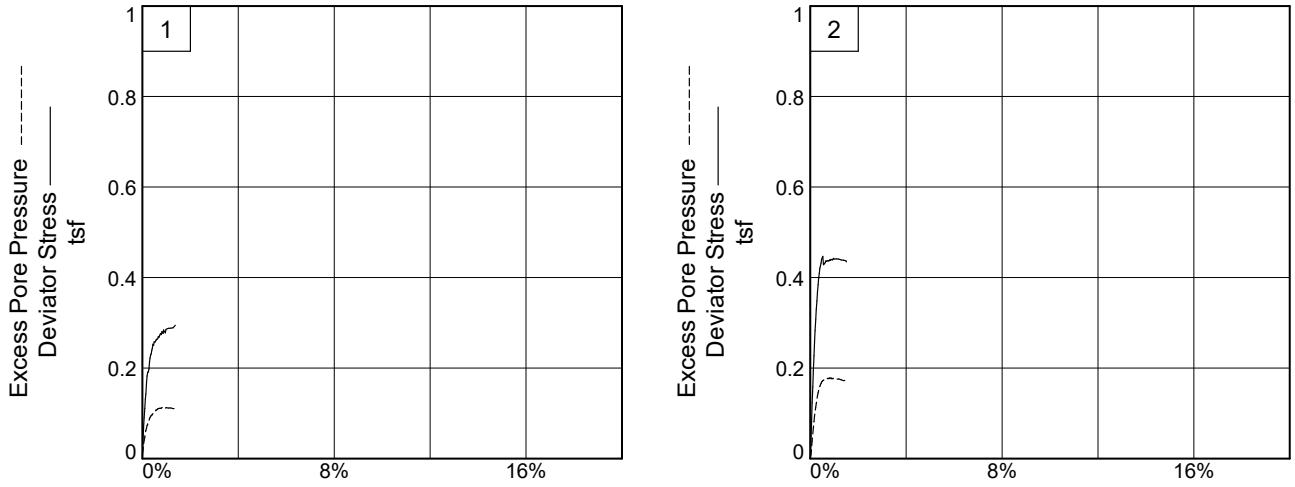
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

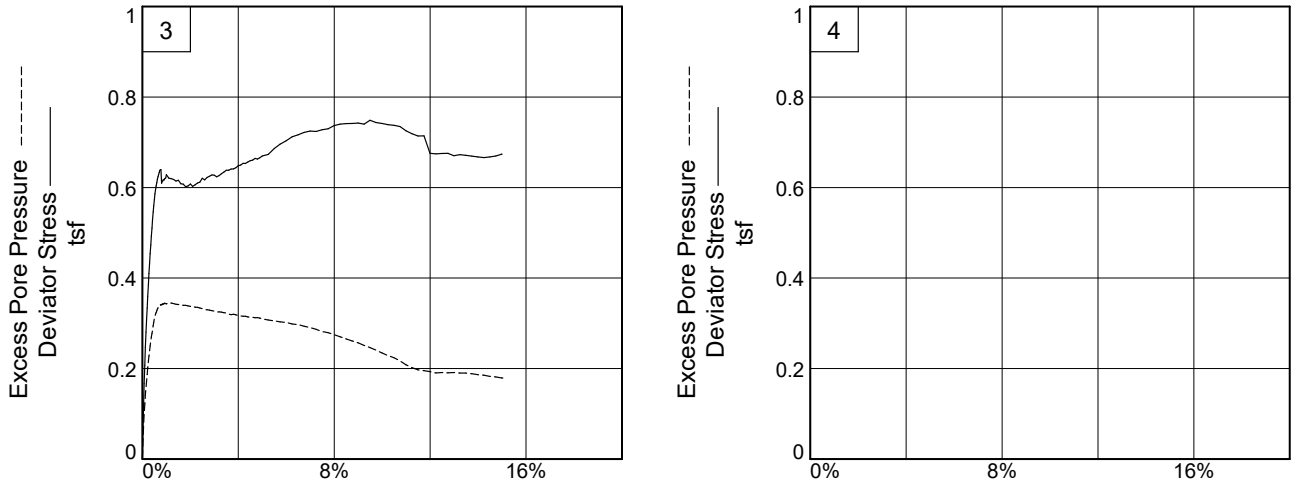
Source of Sample: CB-04 **Depth:** 10

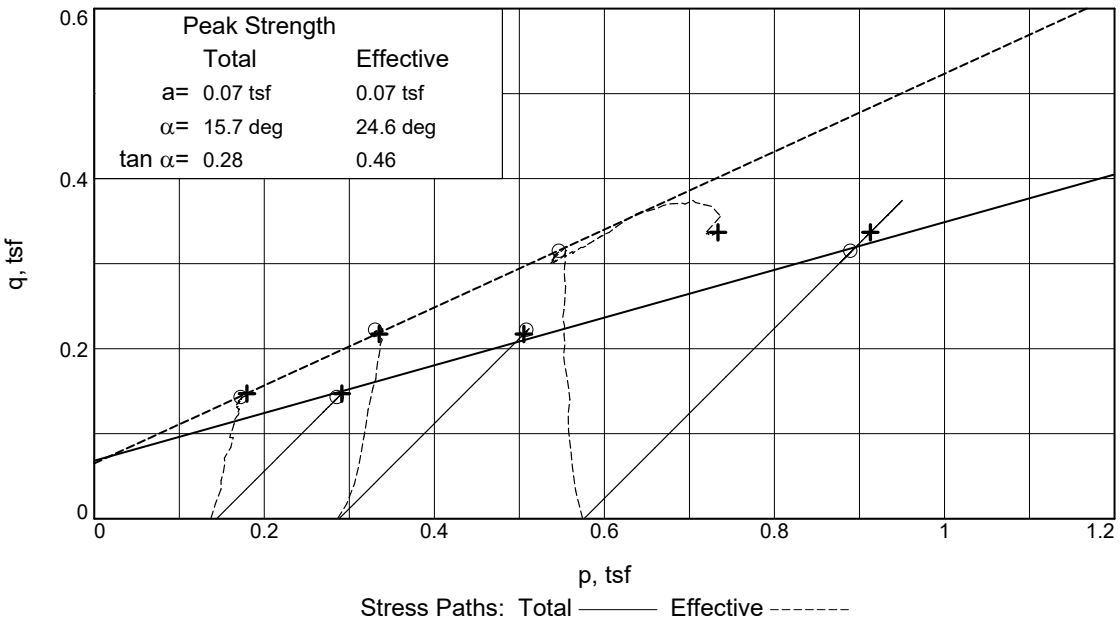
Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







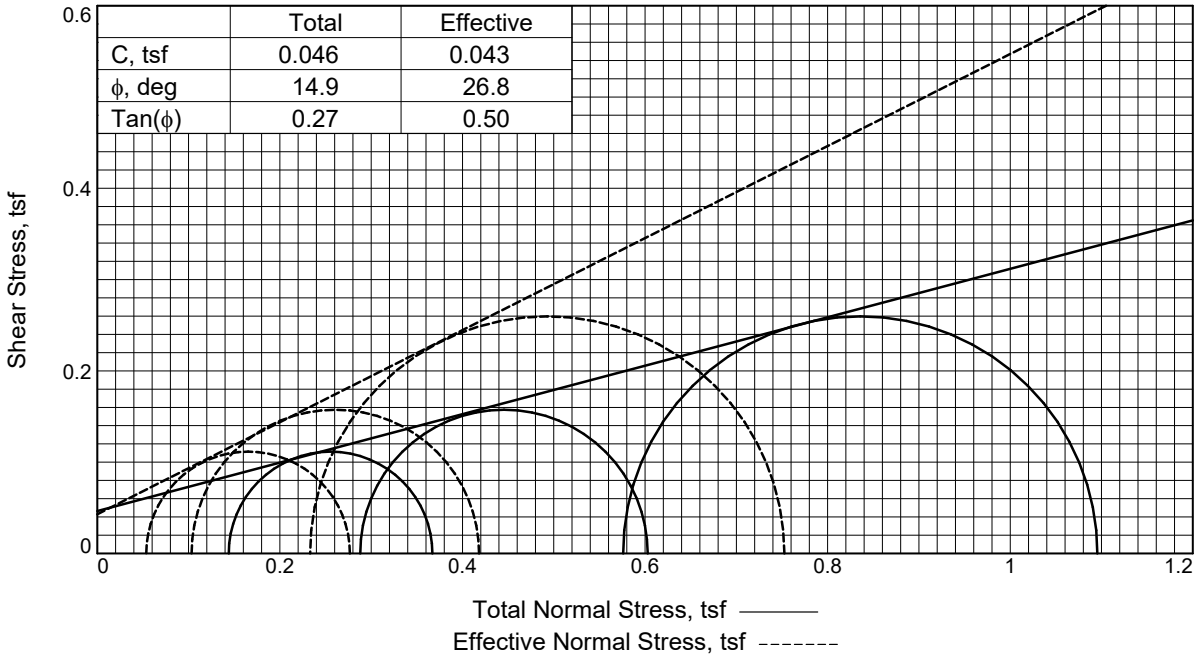
Client: CPA/ USACE

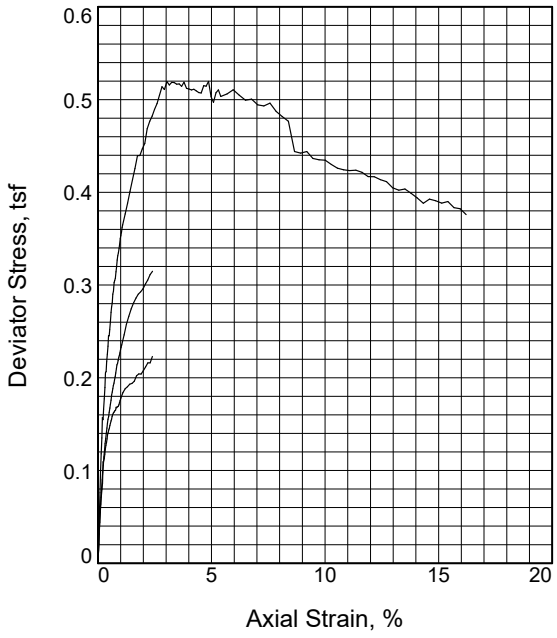
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-04 **Depth:** 10 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	58.8	58.8	58.8
	Dry Density, pcf	62.1	62.1	62.1
	Saturation, %	92.6	92.6	92.6
	Void Ratio	1.7140	1.7139	1.7140
	Diameter, in.	2.06	2.06	2.06
	Height, in.	4.65	4.65	4.65
At Test	Water Content, %	54.5	54.5	54.5
	Dry Density, pcf	68.2	68.2	68.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.4723	1.4723	1.4723
	Diameter, in.	1.96	2.01	2.04
	Height, in.	4.66	4.45	4.30
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.22	0.31	0.52
Excess Pore Pr., tsf		0.09	0.18	0.34
Strain, %		2.4	2.4	3.0
Ult. Stress, tsf		0.22	0.31	0.52
Excess Pore Pr., tsf		0.09	0.18	0.34
Strain, %		2.4	2.4	3.0
$\bar{\sigma}_1$ Failure, tsf		0.28	0.42	0.75
$\bar{\sigma}_3$ Failure, tsf		0.05	0.10	0.23

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

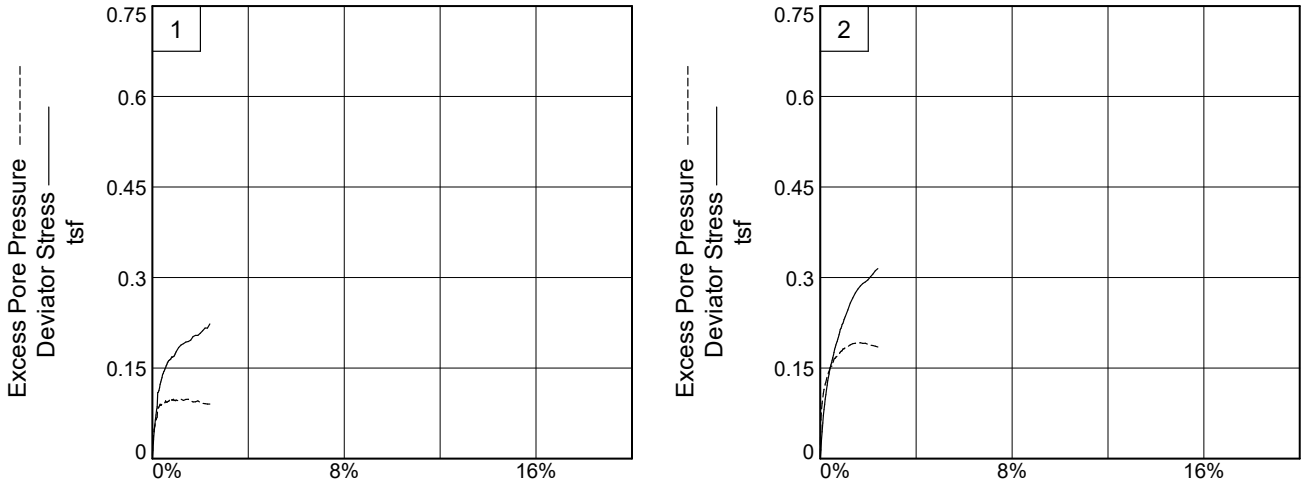
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

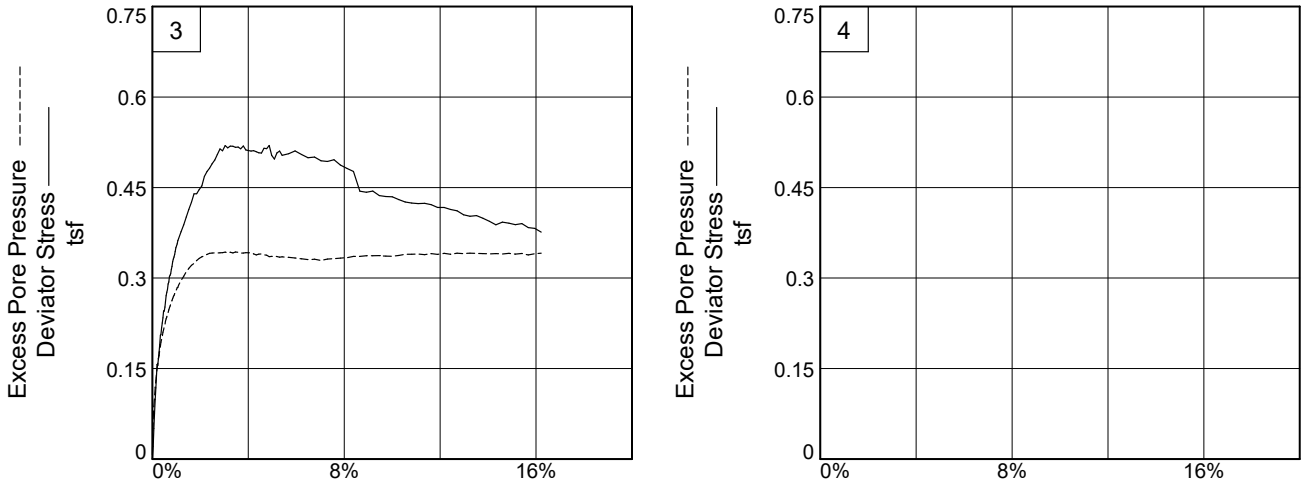
Source of Sample: CB-05 **Depth:** 10

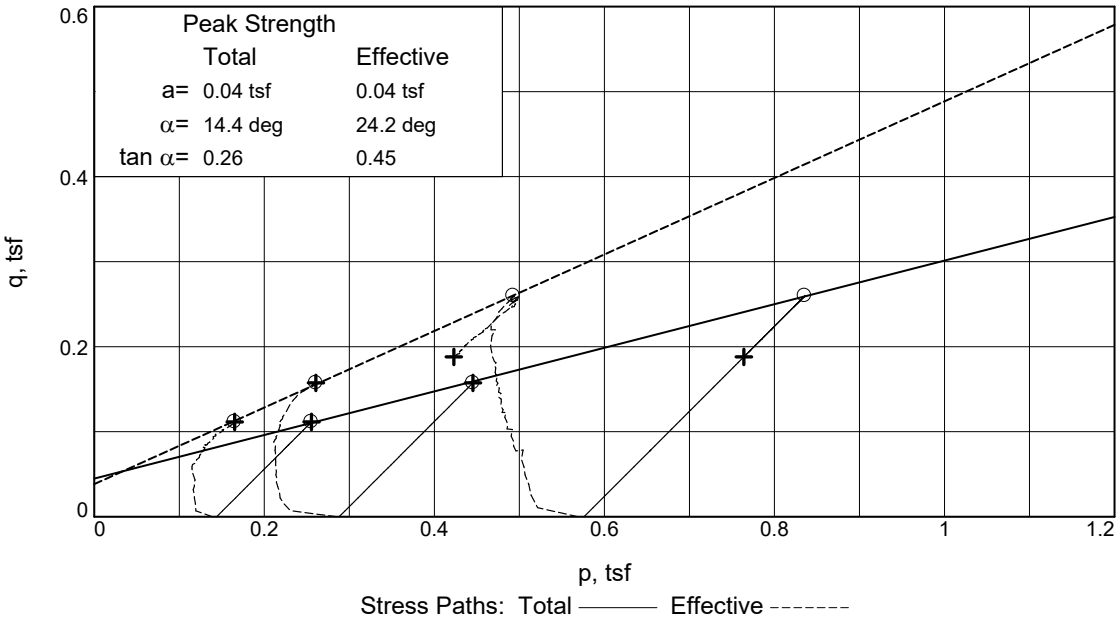
Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/4/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







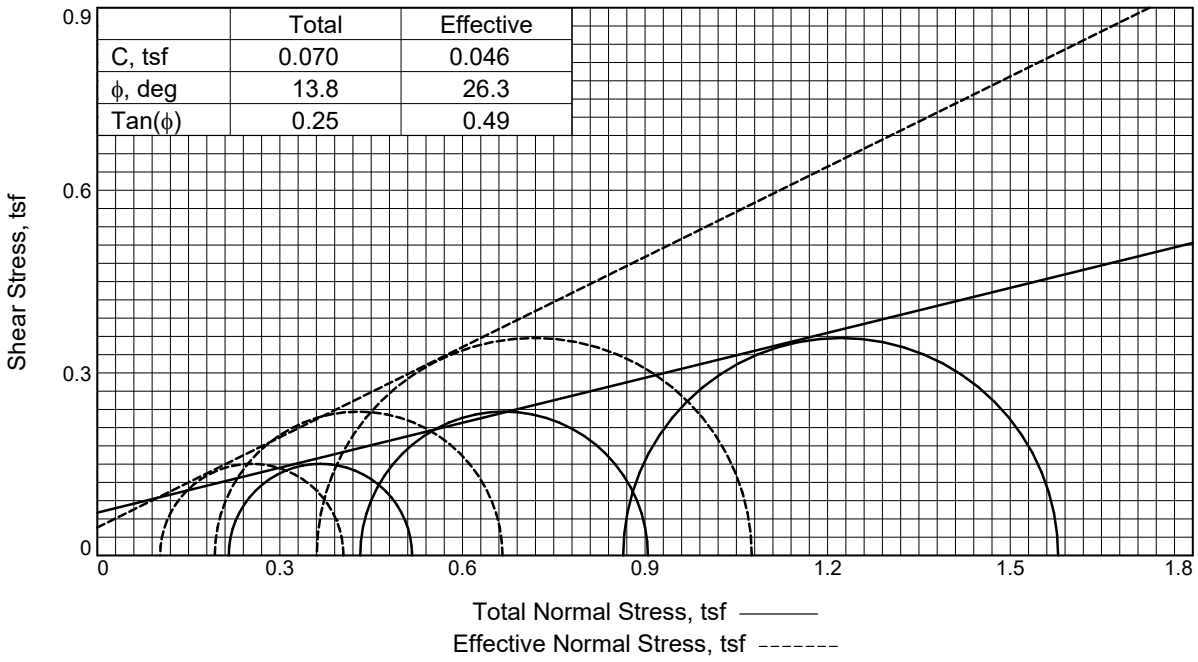
Client: CPA/ USACE

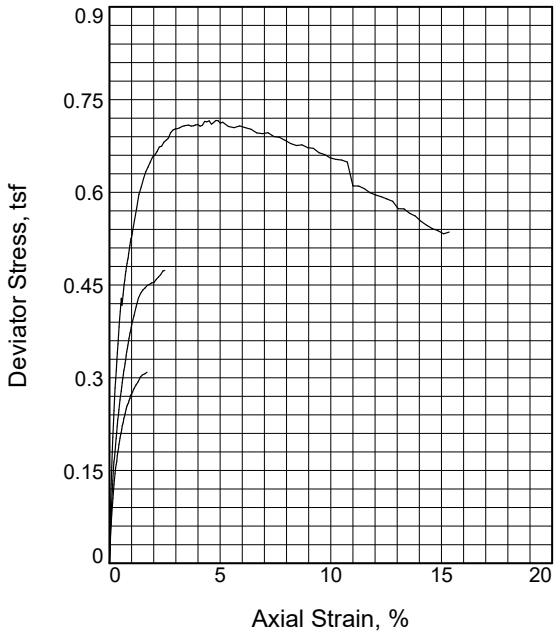
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-05 **Depth:** 10 **Sample Number:** ST-2

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	54.2	54.2	54.2
	Dry Density, pcf	66.7	66.7	66.7
	Saturation, %	95.8	95.8	95.8
	Void Ratio	1.5271	1.5271	1.5271
	Diameter, in.	2.04	2.04	2.04
	Height, in.	4.54	4.54	4.54
At Test	Water Content, %	50.8	50.8	50.8
	Dry Density, pcf	71.1	71.1	71.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.3720	1.3720	1.3720
	Diameter, in.	1.97	1.98	2.00
	Height, in.	4.56	4.51	4.44
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		3.00	6.00	12.00
Fail. Stress, tsf		0.30	0.47	0.71
Excess Pore Pr., tsf		0.11	0.24	0.50
Strain, %		1.4	2.4	4.3
Ult. Stress, tsf		0.30	0.47	0.71
Excess Pore Pr., tsf		0.11	0.24	0.50
Strain, %		1.4	2.4	4.3
$\bar{\sigma}_1$ Failure, tsf		0.40	0.67	1.08
$\bar{\sigma}_3$ Failure, tsf		0.10	0.19	0.36

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY; shell fragments

LL= 70 **PL=** 36 **PI=** 34

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

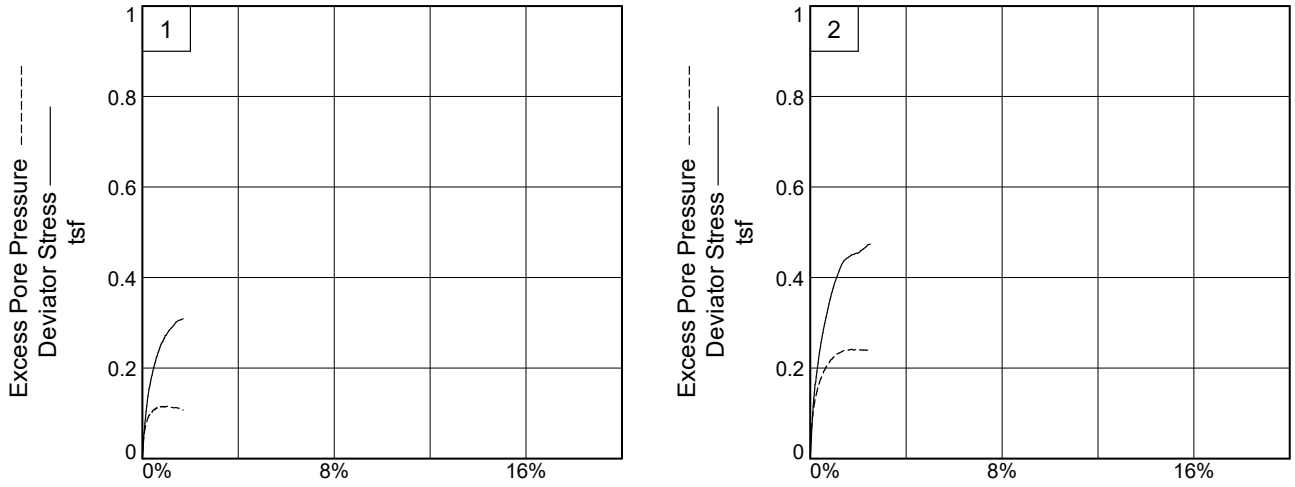
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

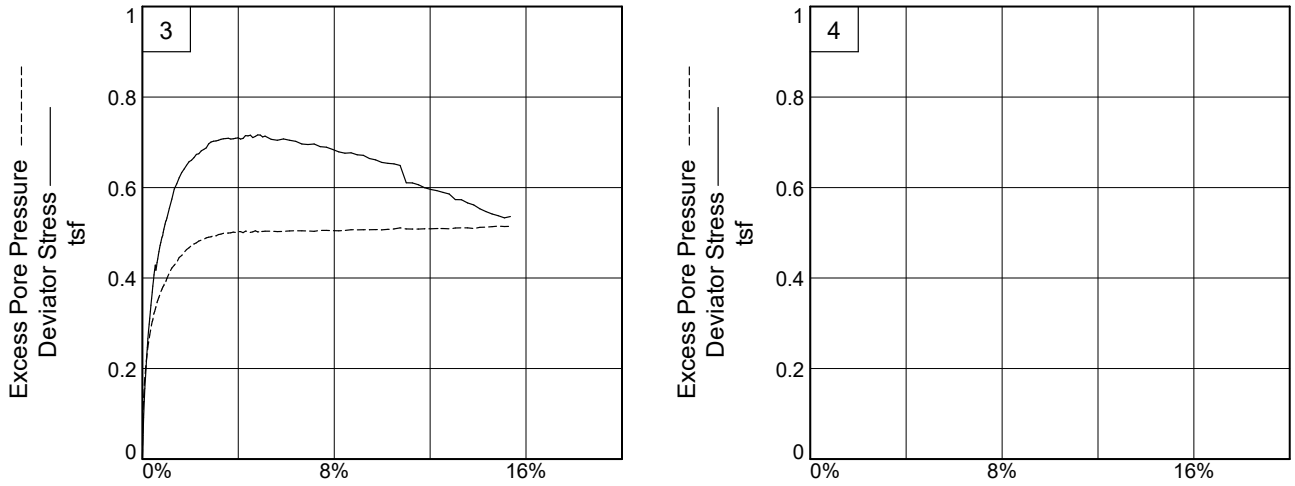
Source of Sample: CB-06 **Depth:** 15

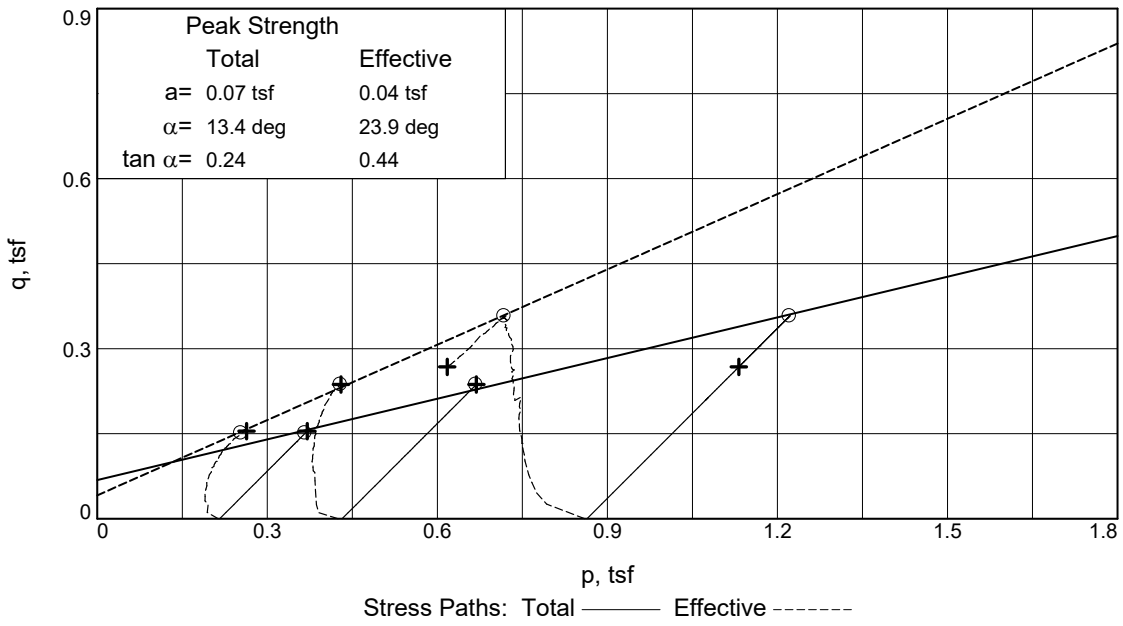
Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 11/5/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







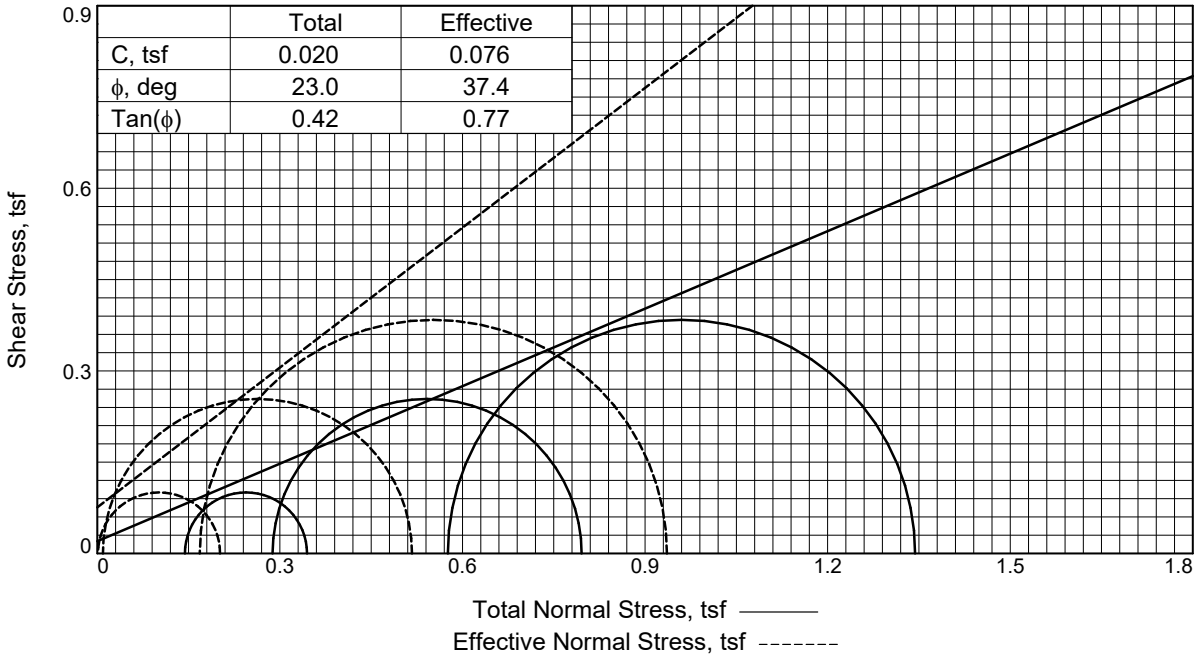
Client: CPA/ USACE

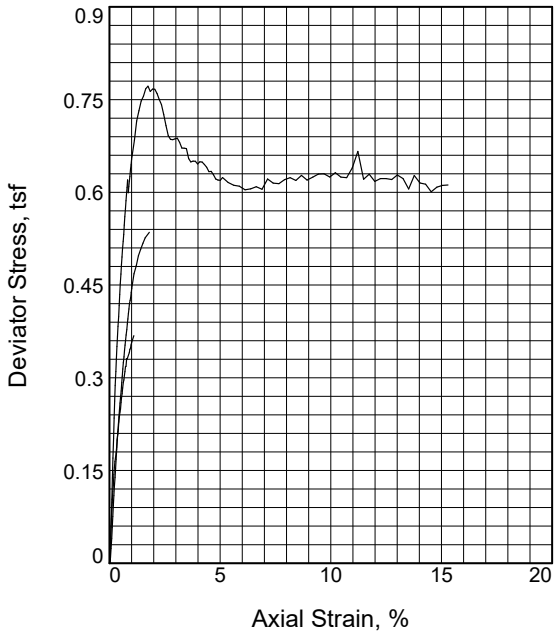
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-06 **Depth:** 15 **Sample Number:** ST-5

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	54.0	54.0	54.0
	Dry Density, pcf	69.2	69.2	69.2
	Saturation, %	99.0	99.0	99.0
	Void Ratio	1.5264	1.5264	1.5264
	Diameter, in.	2.02	2.02	2.02
	Height, in.	4.34	4.34	4.34
At Test	Water Content, %	55.7	55.7	55.7
	Dry Density, pcf	68.3	68.3	68.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.5589	1.5589	1.5589
	Diameter, in.	2.03	2.04	2.05
	Height, in.	4.34	4.31	4.26
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.20	0.51	0.77
Excess Pore Pr., tsf		0.14	0.28	0.41
Strain, %		0.4	1.4	1.6
Ult. Stress, tsf		0.20	0.51	0.77
Excess Pore Pr., tsf		0.14	0.28	0.41
Strain, %		0.4	1.4	1.6
$\bar{\sigma}_1$ Failure, tsf		0.20	0.52	0.94
$\bar{\sigma}_3$ Failure, tsf		0.00	0.01	0.17

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Dark gray FAT CLAY

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

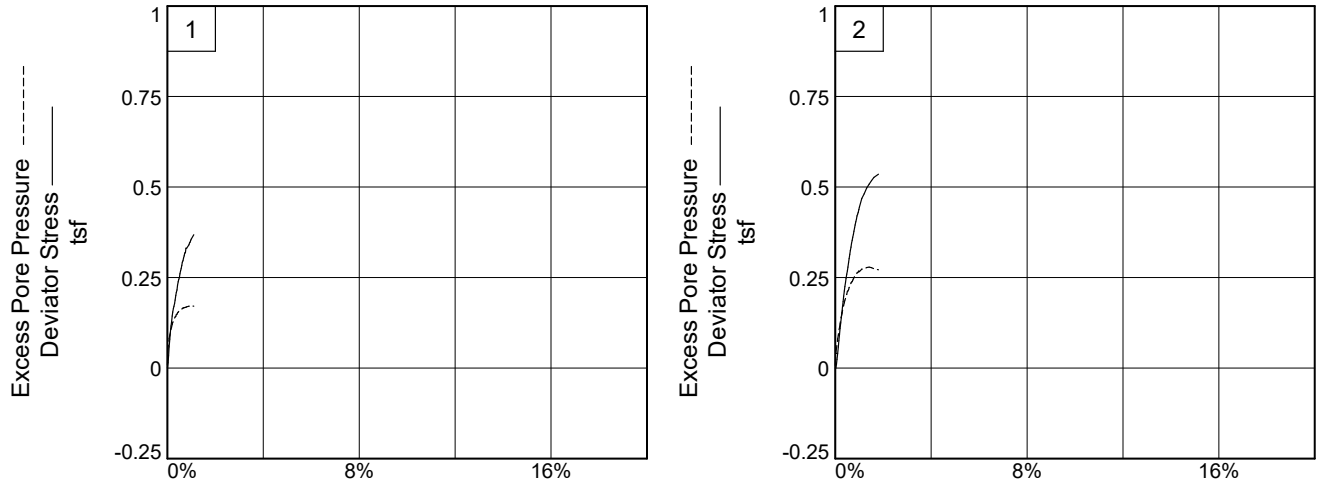
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

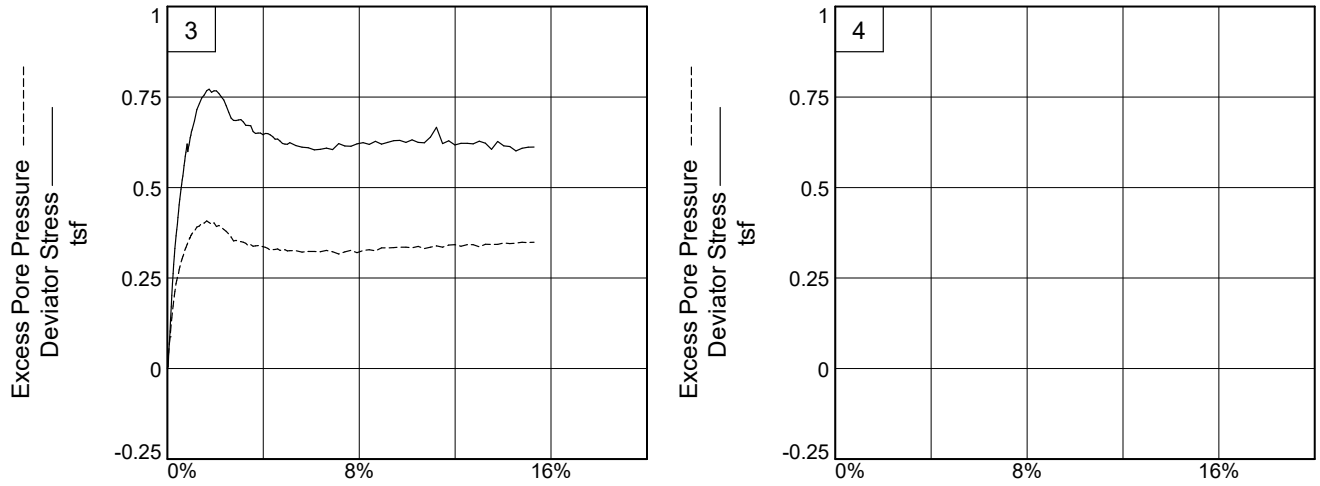
Source of Sample: CB-07 **Depth:** 10

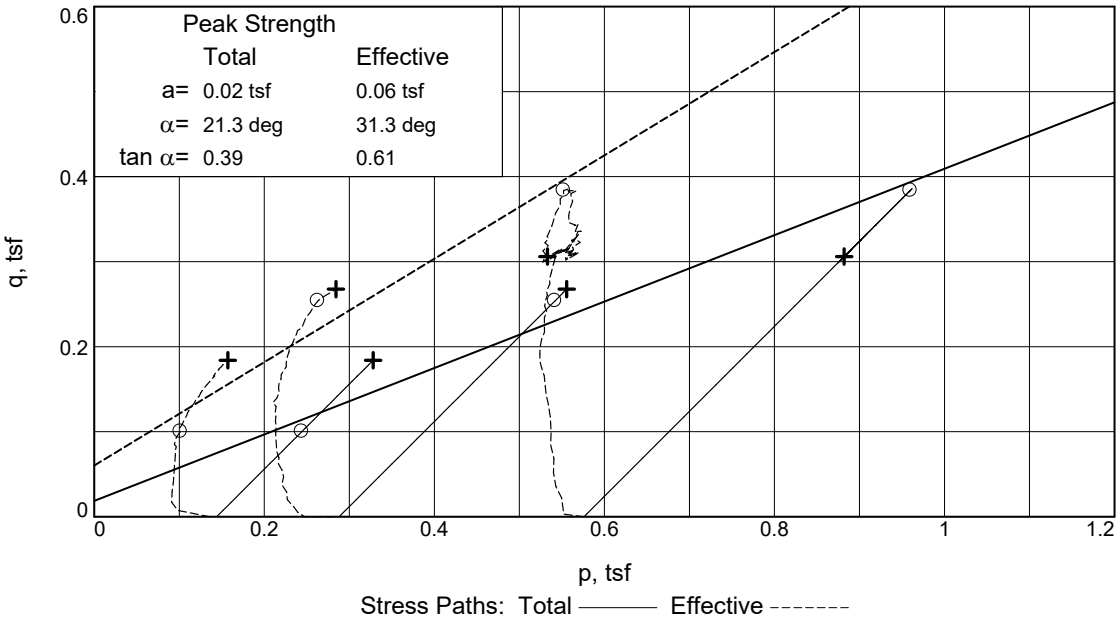
Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/7/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







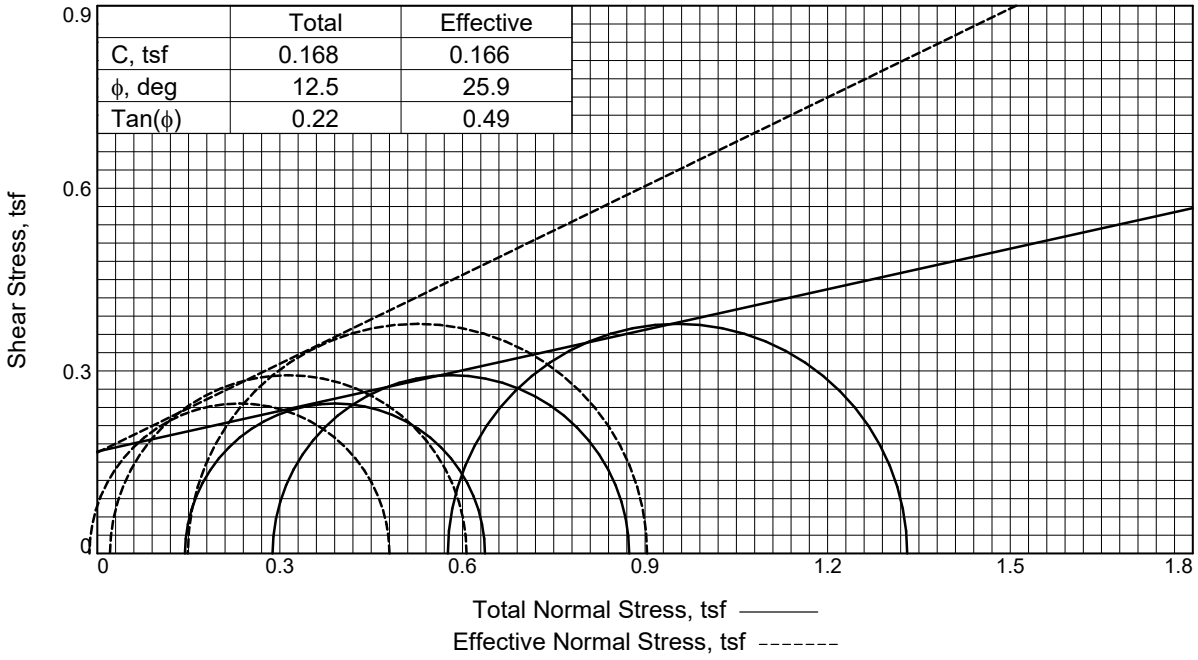
Client: CPA/ USACE

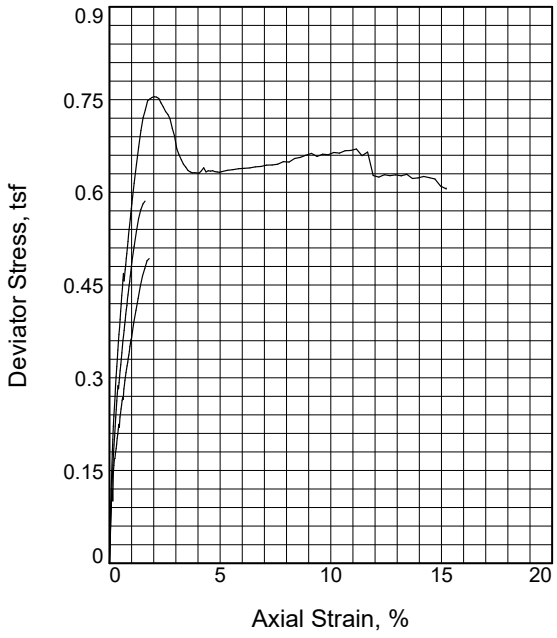
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-07 **Depth:** 10 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	50.9	50.9	50.9
	Dry Density, pcf	70.8	70.8	70.8
	Saturation, %	96.8	96.8	96.8
	Void Ratio	1.4704	1.4704	1.4704
	Diameter, in.	2.08	2.08	2.08
	Height, in.	4.46	4.46	4.46
At Test	Water Content, %	53.5	53.5	53.5
	Dry Density, pcf	70.0	70.0	70.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.4986	1.4986	1.4986
	Diameter, in.	2.09	2.10	2.11
	Height, in.	4.47	4.43	4.40
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.49	0.59	0.75
Excess Pore Pr., tsf		0.16	0.27	0.43
Strain, %		1.8	1.6	2.0
Ult. Stress, tsf		0.49	0.59	0.75
Excess Pore Pr., tsf		0.16	0.27	0.43
Strain, %		1.8	1.6	2.0
$\bar{\sigma}_1$ Failure, tsf		0.48	0.61	0.90
$\bar{\sigma}_3$ Failure, tsf		-0.01	0.02	0.15

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Dark gray FAT CLAY

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

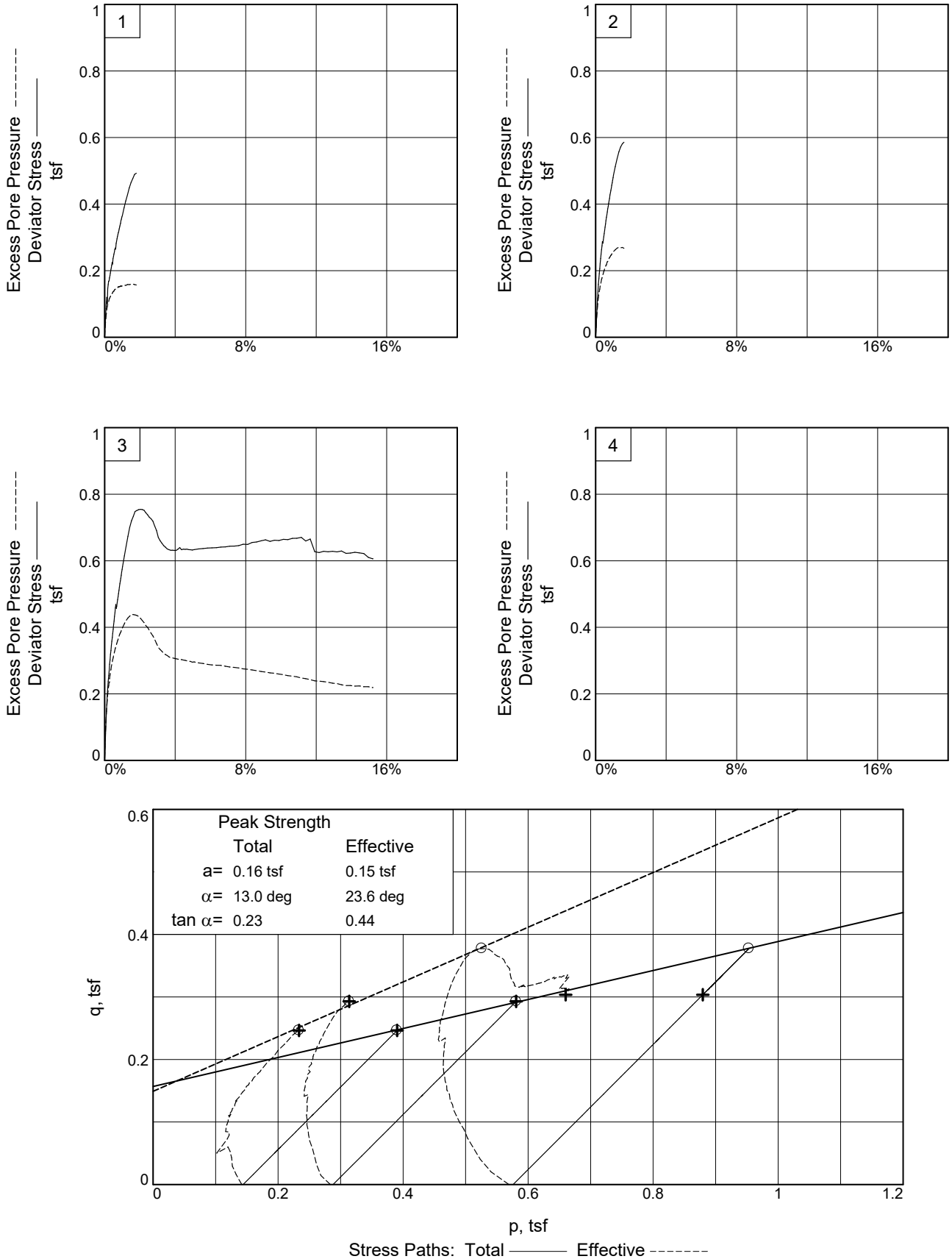
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 10

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/7/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.



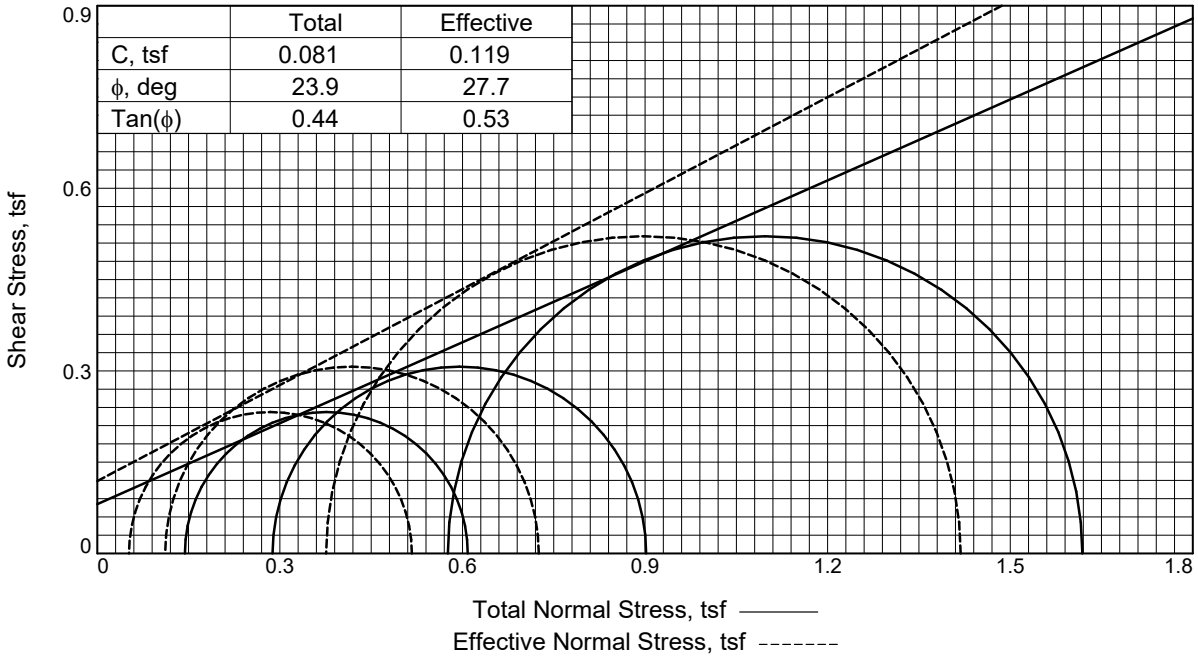
Client: CPA/ USACE

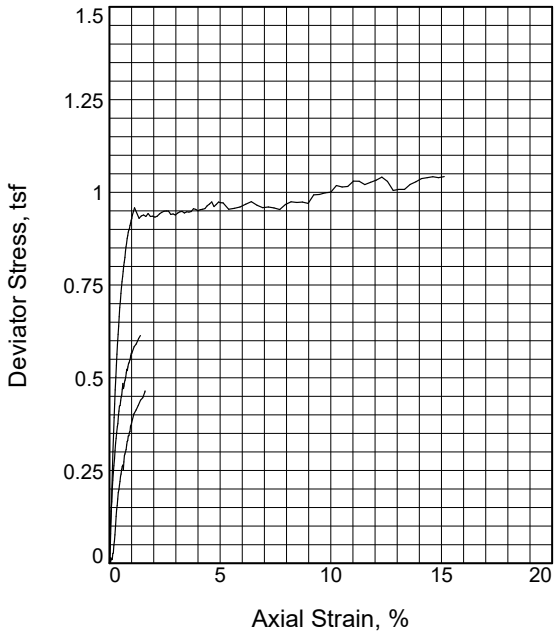
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-08 **Depth:** 10 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	29.1	29.1	29.1
	Dry Density, pcf	91.0	91.0	91.0
	Saturation, %	92.2	92.2	92.2
	Void Ratio	0.8522	0.8522	0.8522
	Diameter, in.	1.98	1.98	1.98
	Height, in.	4.97	4.97	4.97
At Test	Water Content, %	30.2	30.2	30.2
	Dry Density, pcf	92.8	92.8	92.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8162	0.8162	0.8162
	Diameter, in.	1.97	1.97	1.99
	Height, in.	4.96	4.92	4.85
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.46	0.61	1.04
Excess Pore Pr., tsf		0.09	0.18	0.20
Strain, %		1.6	1.4	15.1
Ult. Stress, tsf		0.46	0.61	1.04
Excess Pore Pr., tsf		0.09	0.18	0.20
Strain, %		1.6	1.4	15.1
$\bar{\sigma}_1$ Failure, tsf		0.52	0.73	1.42
$\bar{\sigma}_3$ Failure, tsf		0.05	0.11	0.38

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: FAT CLAY (CH), tan & reddishbrown

LL= 56 **PL=** 22 **PI=** 34

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

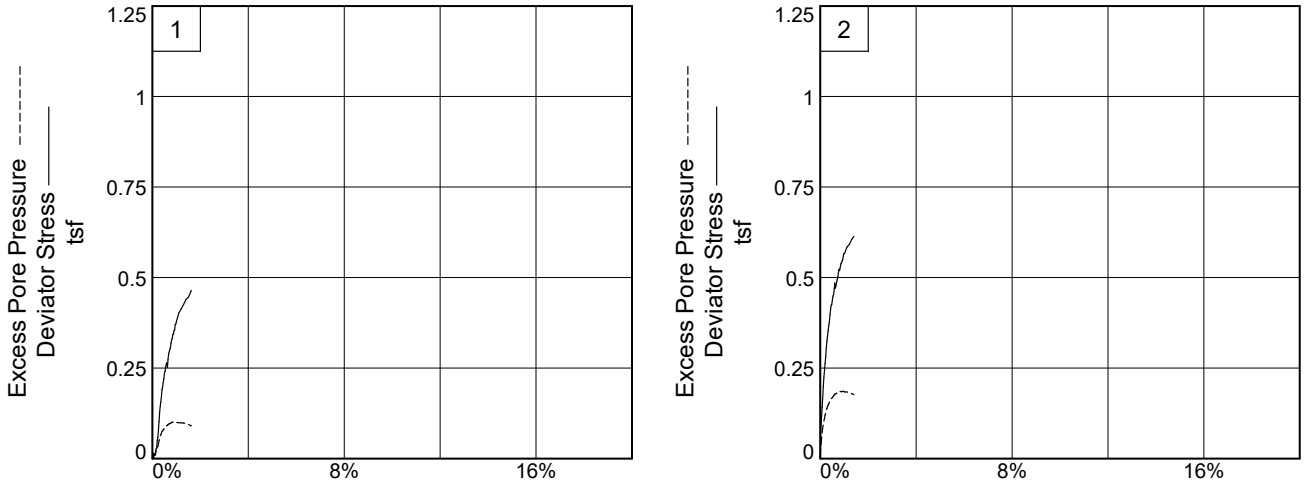
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

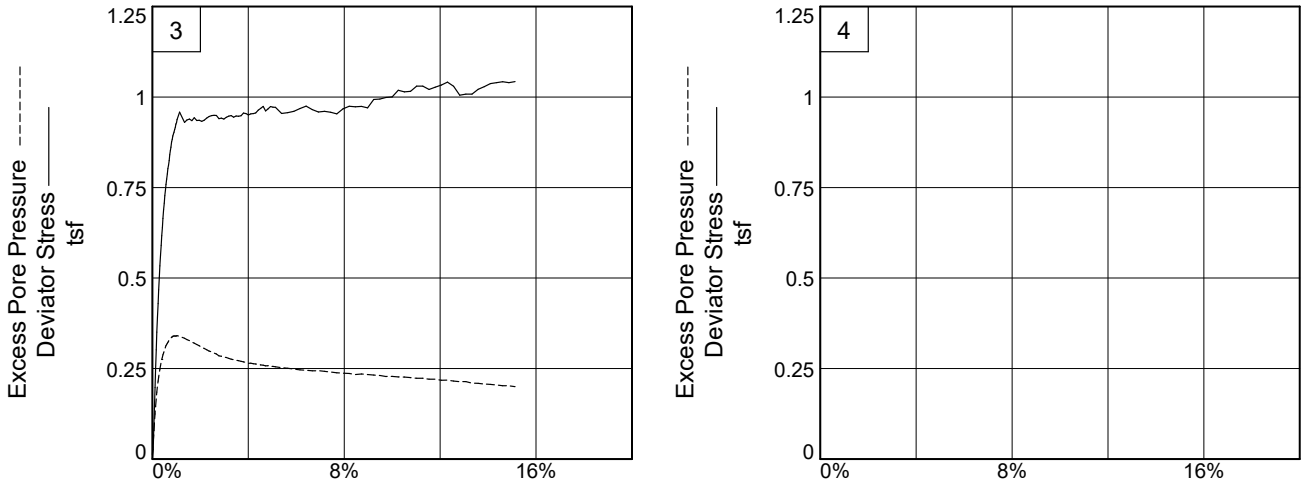
Source of Sample: CB-10 **Depth:** 10

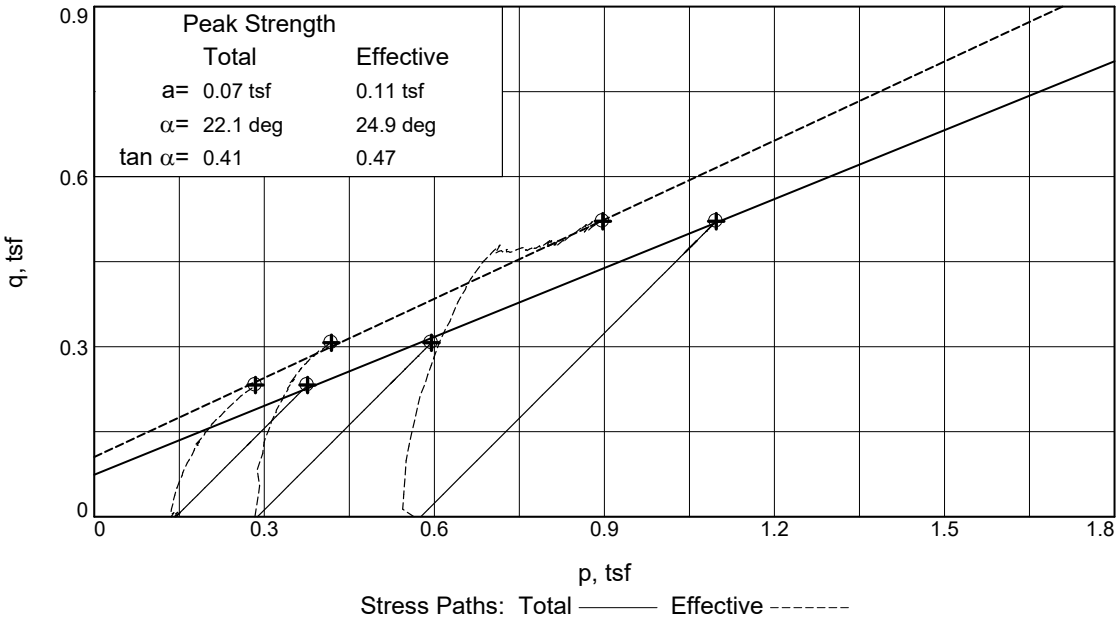
Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/4/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







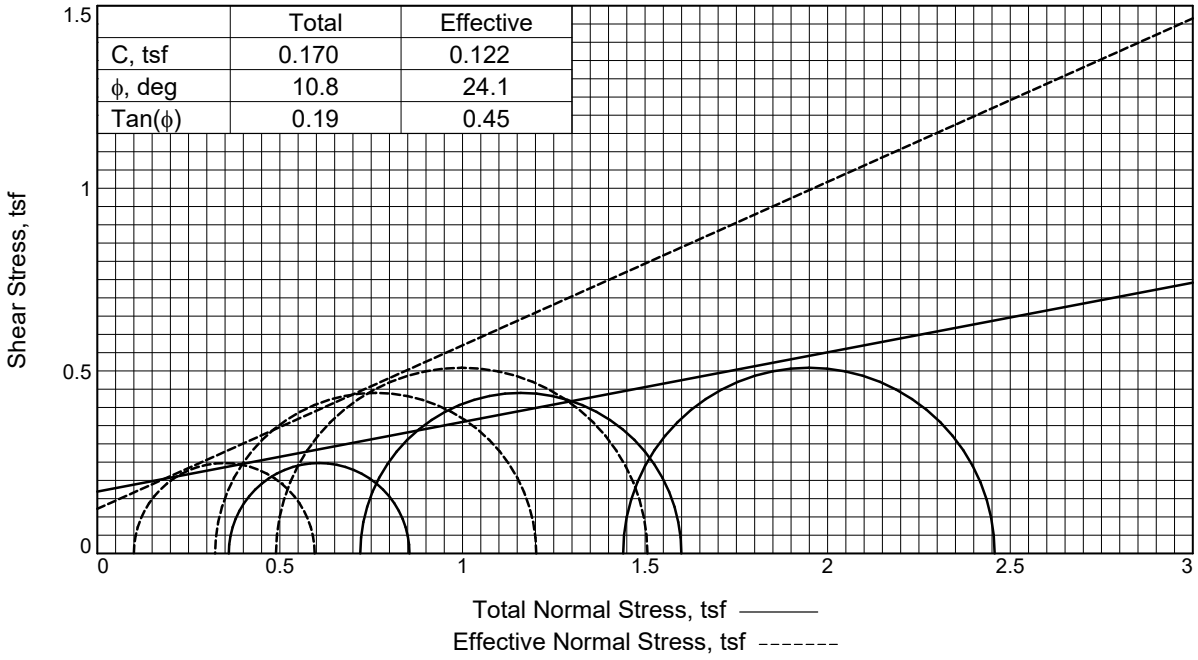
Client: CPA/ USACE

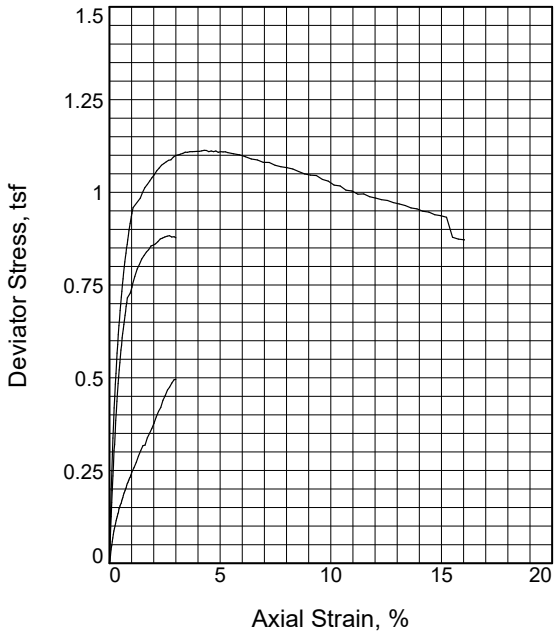
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-10 **Depth:** 10 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	50.7	50.7	50.7
	Dry Density, pcf	72.5	72.5	72.5
	Saturation, %	99.3	99.3	99.3
	Void Ratio	1.4549	1.4549	1.4549
	Diameter, in.	2.08	2.08	2.08
	Height, in.	4.93	4.93	4.93
At Test	Water Content, %	39.5	39.5	39.5
	Dry Density, pcf	83.7	83.7	83.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.1262	1.1262	1.1262
	Diameter, in.	1.94	1.98	2.00
	Height, in.	4.89	4.73	4.61
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, tsf		0.50	0.88	1.02
Excess Pore Pr., tsf		0.26	0.40	0.95
Strain, %		2.9	2.8	10.4
Ult. Stress, tsf		0.50	0.88	1.02
Excess Pore Pr., tsf		0.26	0.40	0.95
Strain, %		2.9	2.8	10.4
$\bar{\sigma}_1$ Failure, tsf		0.60	1.20	1.51
$\bar{\sigma}_3$ Failure, tsf		0.10	0.32	0.49

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Dark gray FAT CLAY; shell fragments

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

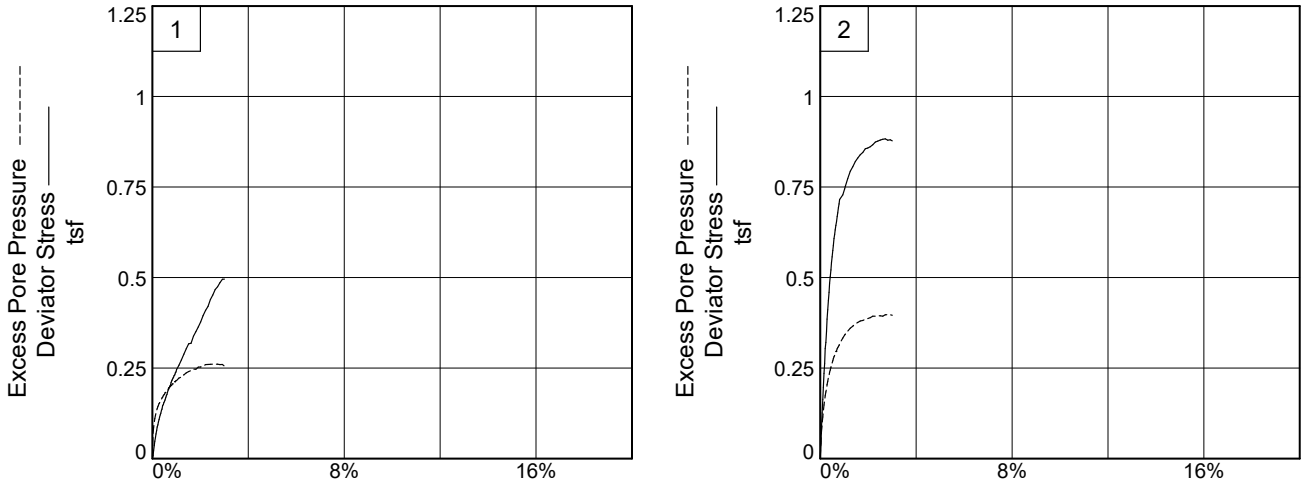
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

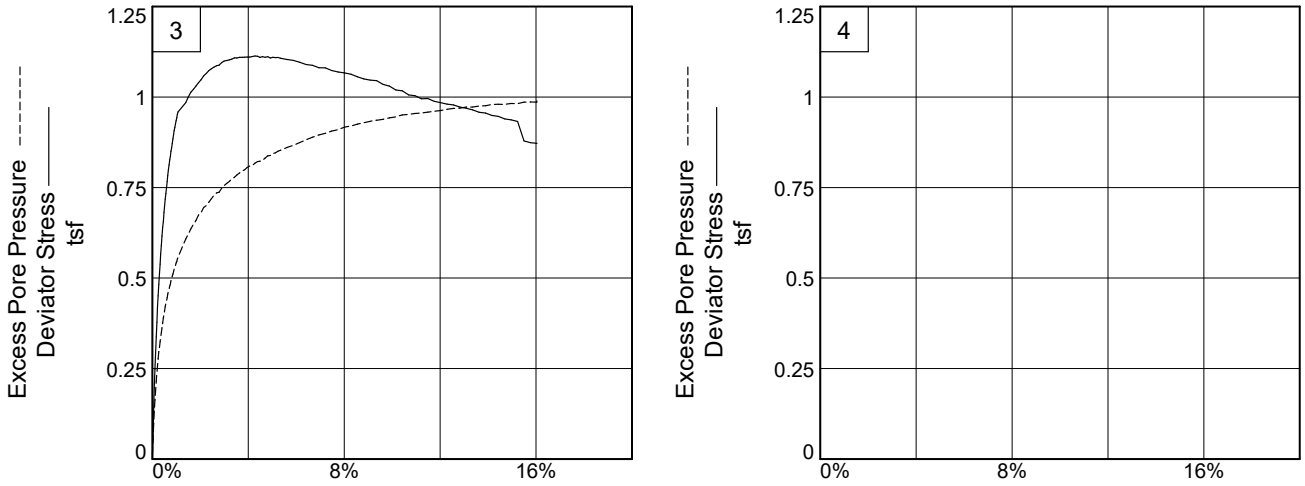
Source of Sample: CB-11 **Depth:** 12.5

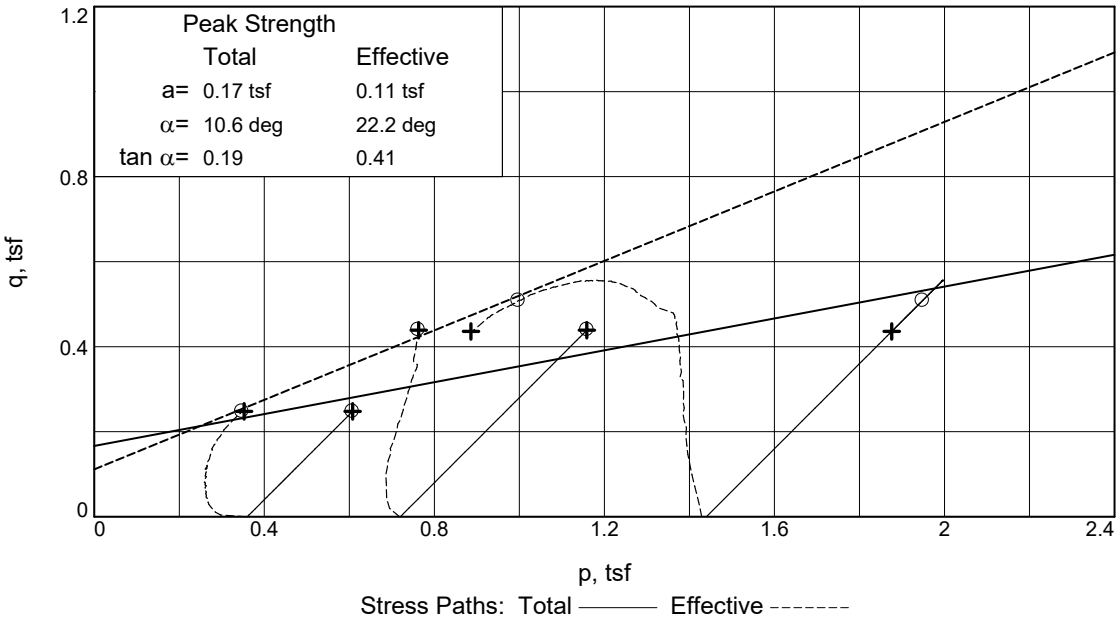
Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/5/21

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Tolunay-Wong Engineers, Inc.







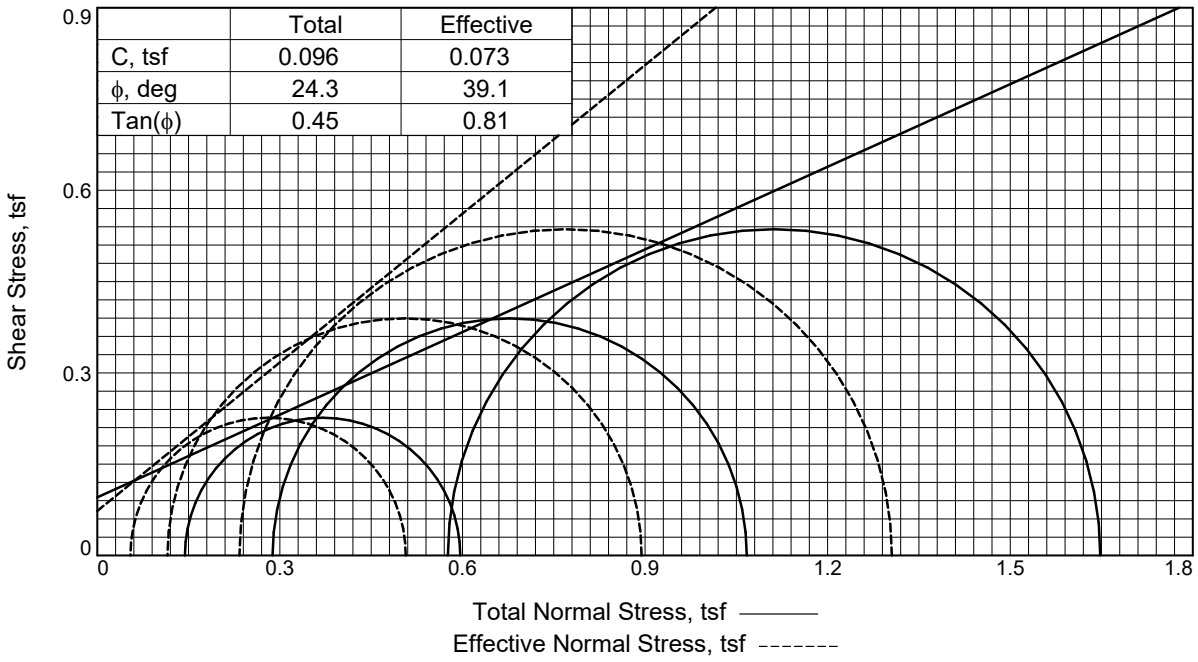
Client: CPA/ USACE

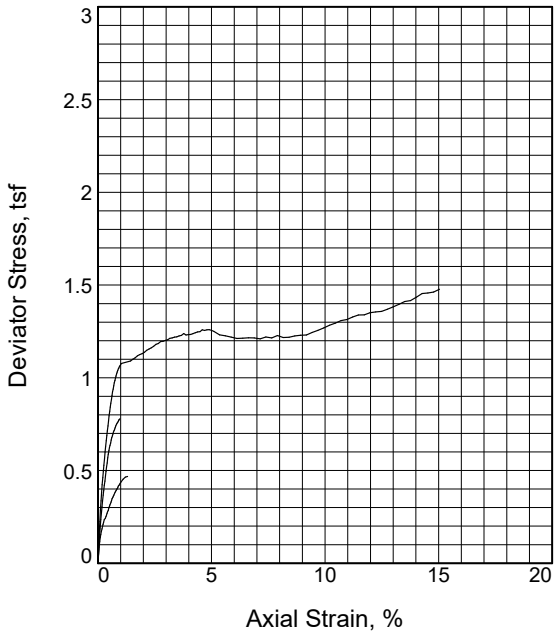
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-11 **Depth:** 12.5 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	23.9	23.9	23.9
	Dry Density, pcf	99.5	99.5	99.5
	Saturation, %	93.2	93.2	93.2
	Void Ratio	0.6933	0.6933	0.6933
	Diameter, in.	2.02	2.02	2.02
	Height, in.	4.97	4.97	4.97
At Test	Water Content, %	22.0	22.0	22.0
	Dry Density, pcf	105.7	105.7	105.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5952	0.5952	0.5952
	Diameter, in.	1.97	1.98	1.98
	Height, in.	4.96	4.91	4.88
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.45	0.78	1.07
Excess Pore Pr., tsf		0.09	0.17	0.34
Strain, %		1.1	1.0	1.0
Ult. Stress, tsf		0.45	0.78	1.07
Excess Pore Pr., tsf		0.09	0.17	0.34
Strain, %		1.1	1.0	1.0
$\bar{\sigma}_1$ Failure, tsf		0.51	0.89	1.31
$\bar{\sigma}_3$ Failure, tsf		0.05	0.12	0.23

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Reddish-brown and gray LEAN CLAY; sand pockets and calcareous

LL= 34 **PL=** 18 **PI=** 16

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

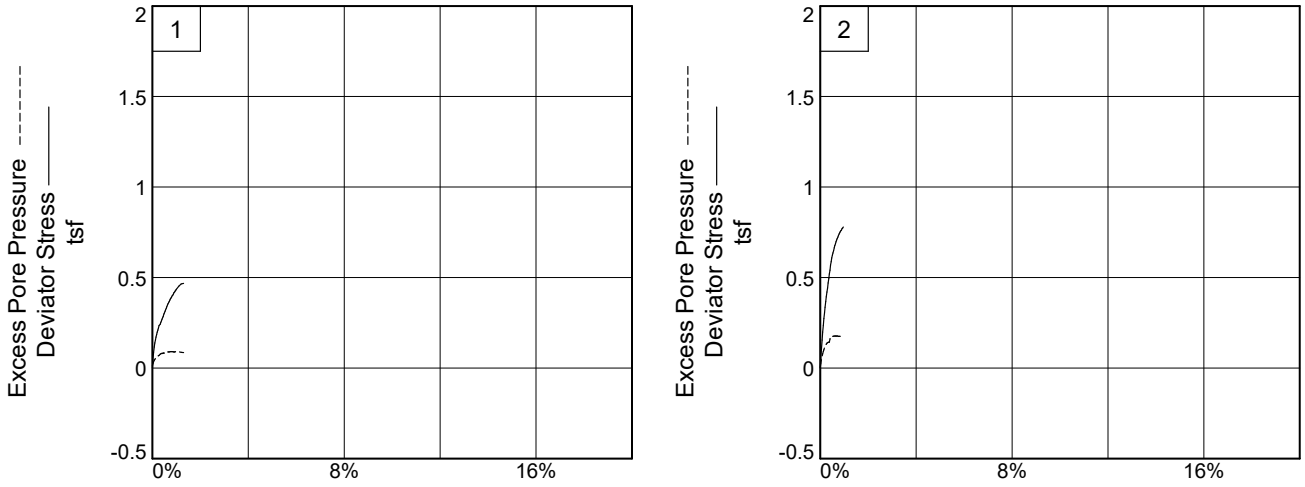
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

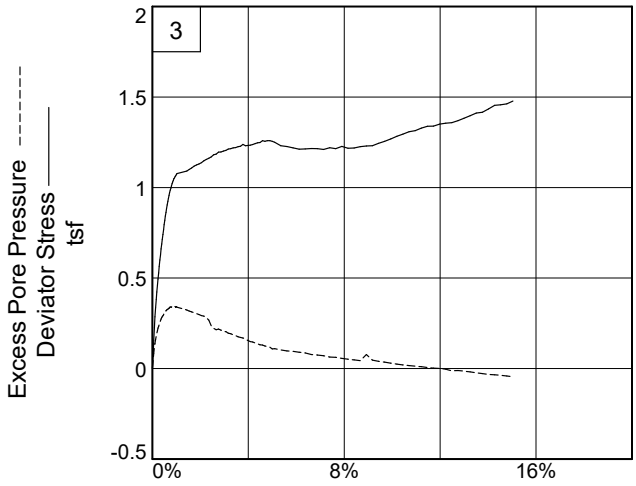
Source of Sample: CB-18 **Depth:** 10

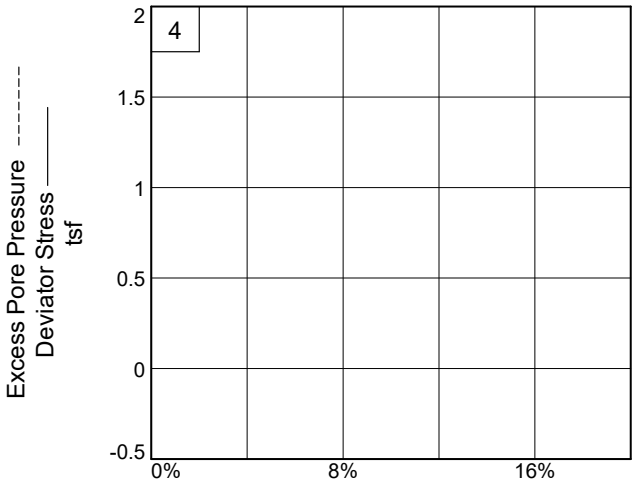
Sample Number: ST-2

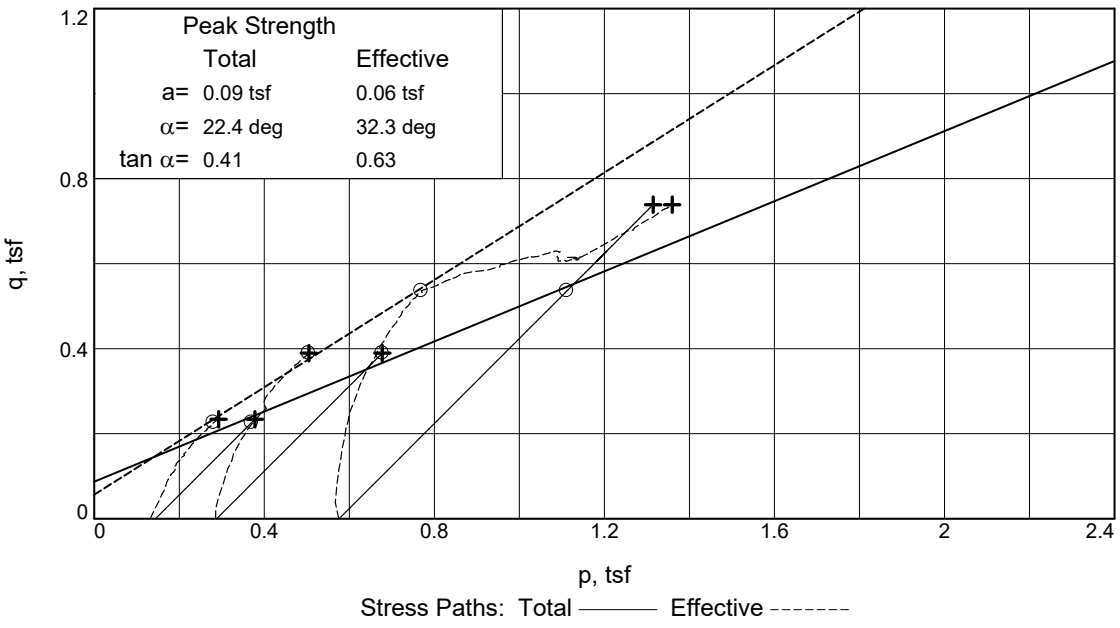
Proj. No.: 21.14.223 **Date Sampled:** 11/7/21

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Tolunay-Wong Engineers, Inc.









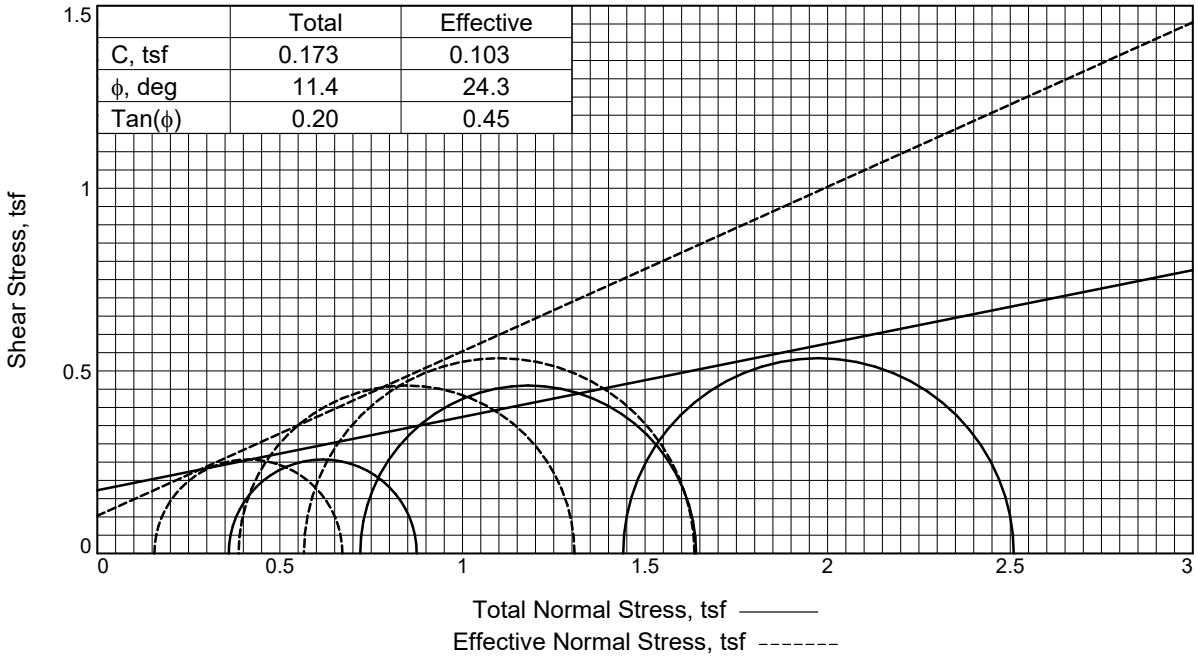
Client: CPA/ USACE

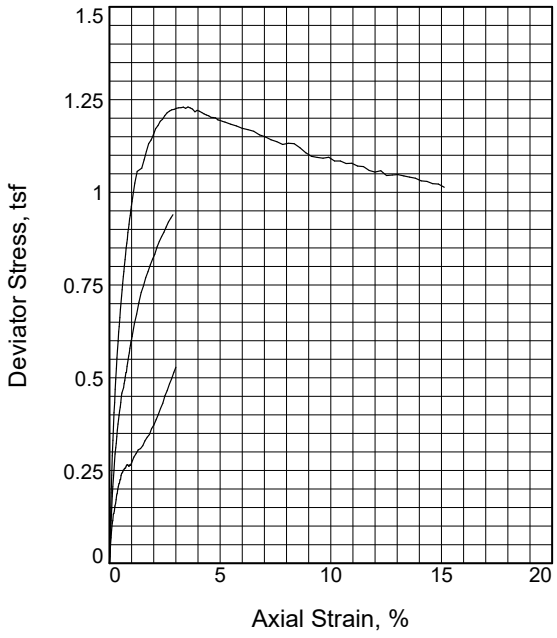
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-18 **Depth:** 10 **Sample Number:** ST-2

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	38.4	38.4	38.4
	Dry Density, pcf	83.2	83.2	83.2
	Saturation, %	97.6	97.6	97.6
	Void Ratio	1.1008	1.1008	1.1008
	Diameter, in.	2.10	2.10	2.10
	Height, in.	4.42	4.42	4.42
At Test	Water Content, %	32.2	32.2	32.2
	Dry Density, pcf	92.0	92.0	92.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.9003	0.9003	0.9003
	Diameter, in.	2.00	2.02	2.04
	Height, in.	4.41	4.32	4.24
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, tsf		0.51	0.92	1.07
Excess Pore Pr., tsf		0.20	0.33	0.87
Strain, %		2.9	2.7	11.5
Ult. Stress, tsf		0.51	0.92	1.07
Excess Pore Pr., tsf		0.20	0.33	0.87
Strain, %		2.9	2.7	11.5
$\bar{\sigma}_1$ Failure, tsf		0.67	1.31	1.64
$\bar{\sigma}_3$ Failure, tsf		0.16	0.39	0.57

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Reddish-brown FAT CLAT; sand pockets and shell fragments

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

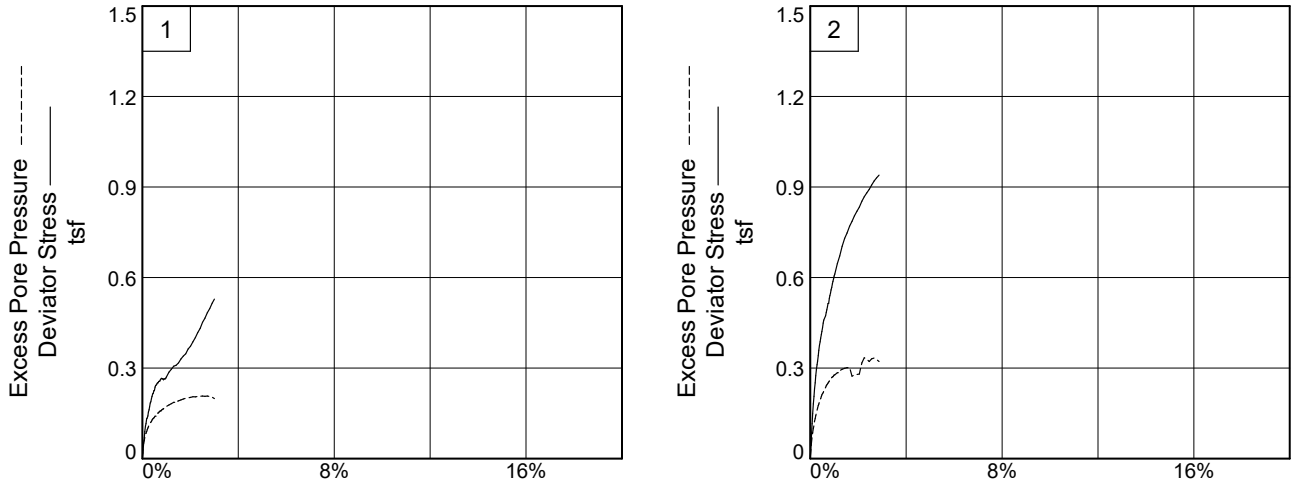
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

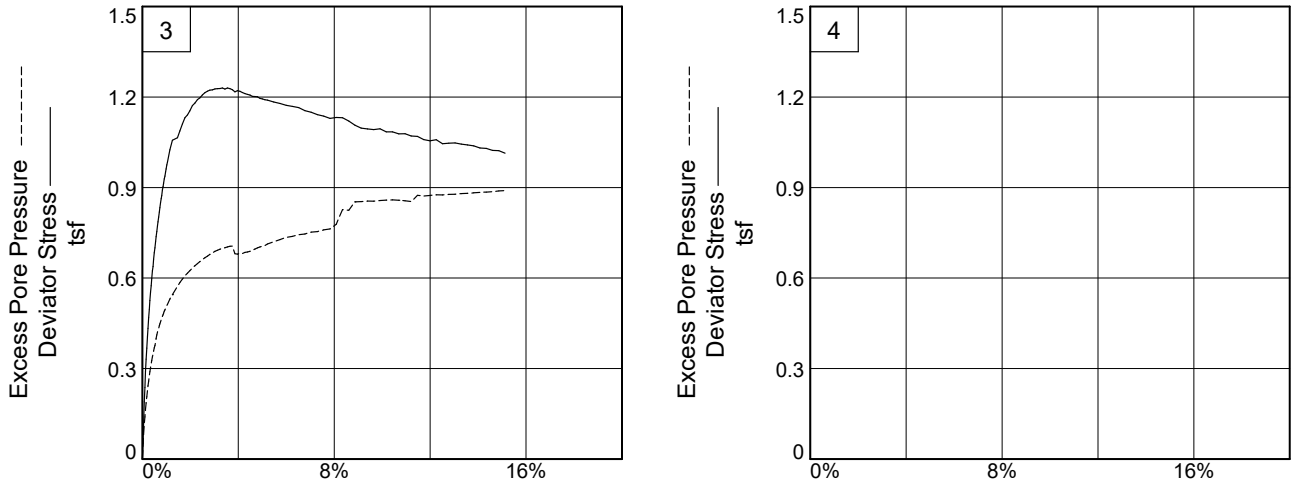
Source of Sample: CB-21 **Depth:** 25

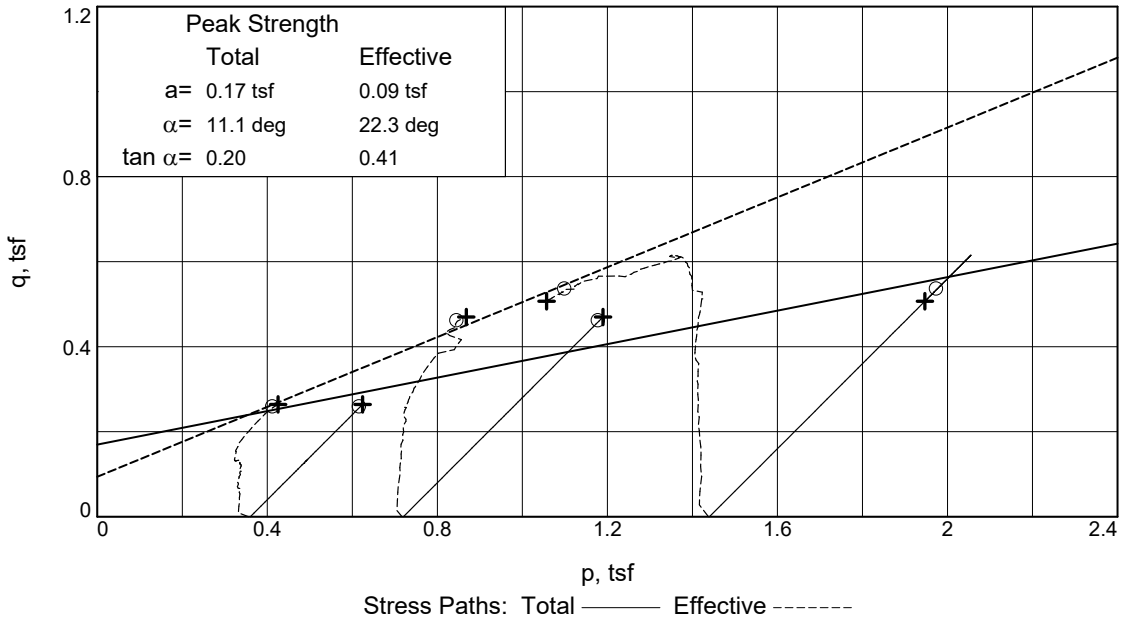
Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/7/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







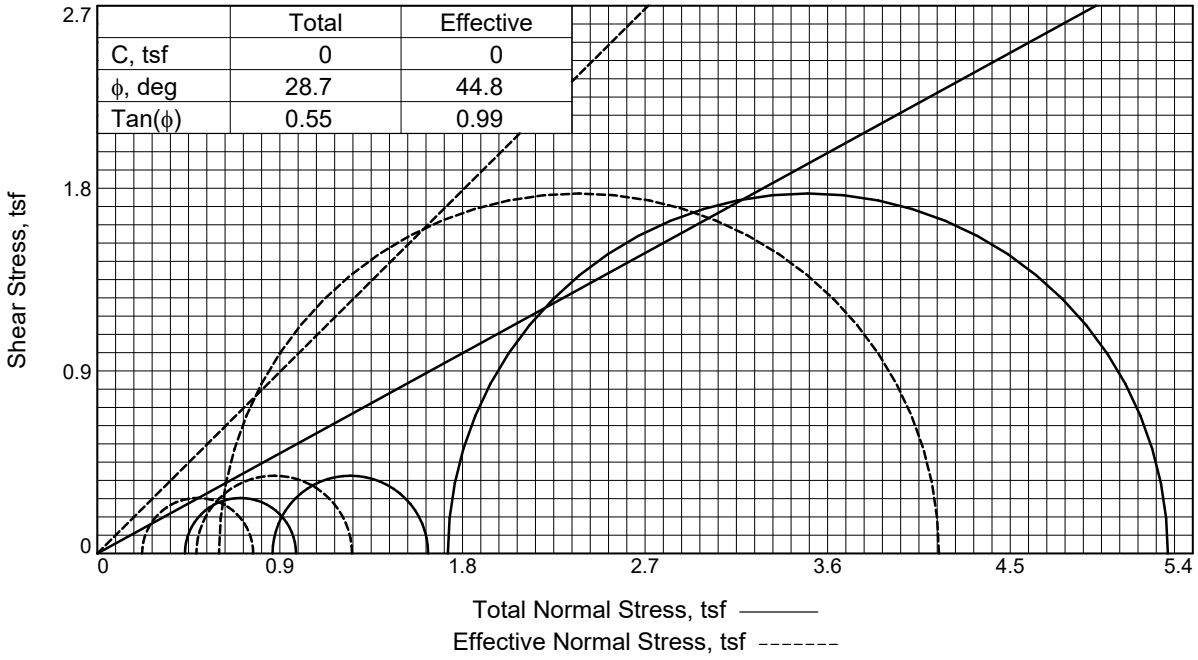
Client: CPA/ USACE

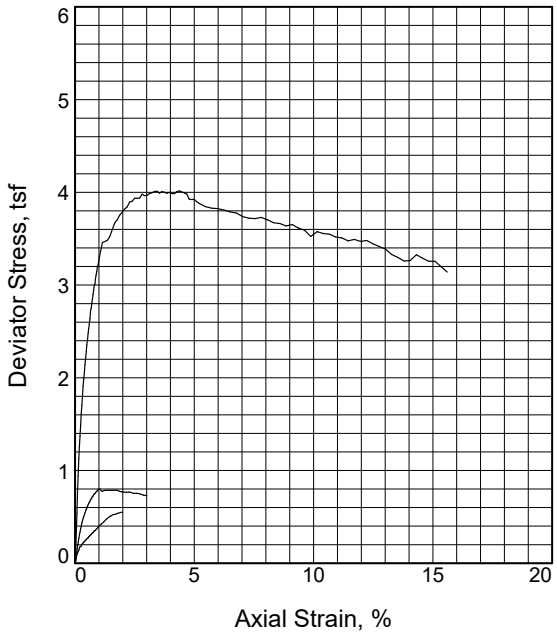
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-21 **Depth:** 25 **Sample Number:** ST-2

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	45.5	45.5	45.5
	Dry Density, pcf	74.8	74.8	19.8
	Saturation, %	96.7	96.7	16.3
	Void Ratio	1.2948	1.2948	7.6823
	Diameter, in.	2.01	2.01	2.01
	Height, in.	4.48	4.48	4.48
At Test	Water Content, %	46.3	46.3	46.3
	Dry Density, pcf	75.5	75.5	75.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.2726	1.2726	1.2726
	Diameter, in.	2.00	2.02	1.05
	Height, in.	4.48	4.39	4.31
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.55	0.77	3.55
Excess Pore Pr., tsf		0.21	0.38	1.13
Strain, %		1.9	2.3	10.7
Ult. Stress, tsf		0.55	0.77	3.55
Excess Pore Pr., tsf		0.21	0.38	1.13
Strain, %		1.9	2.3	10.7
$\bar{\sigma}_1$ Failure, tsf		0.77	1.26	4.15
$\bar{\sigma}_3$ Failure, tsf		0.22	0.49	0.60

Type of Test:
CU with Pore Pressures
Sample Type: Undisturbed
Description: Brown FAT CLAY

LL= 58 **PL=** 26 **PI=** 32
Assumed Specific Gravity= 2.75
Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio
Figure _____

Client: CPA/ USACE

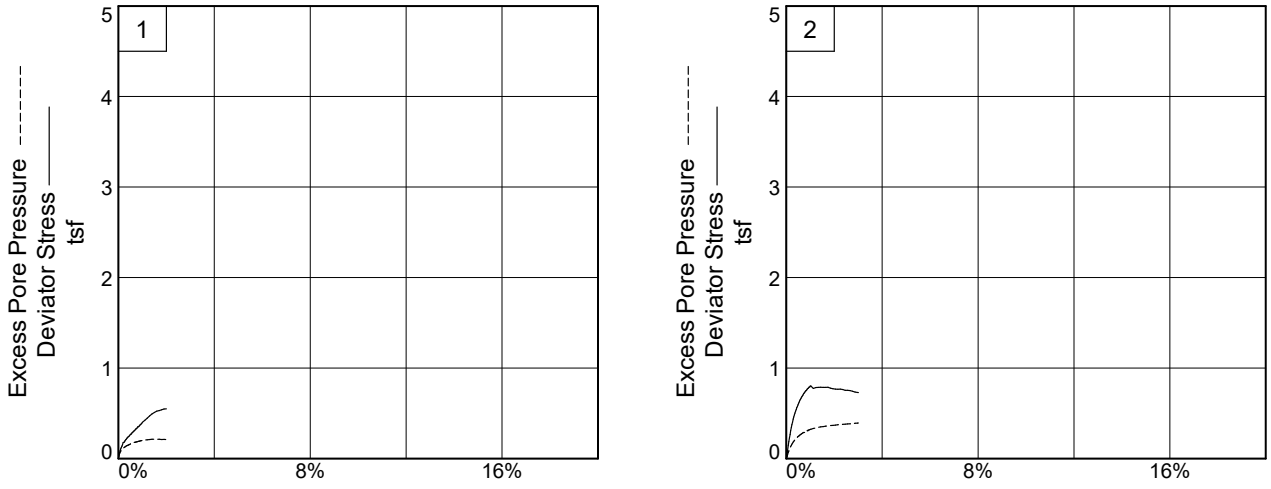
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

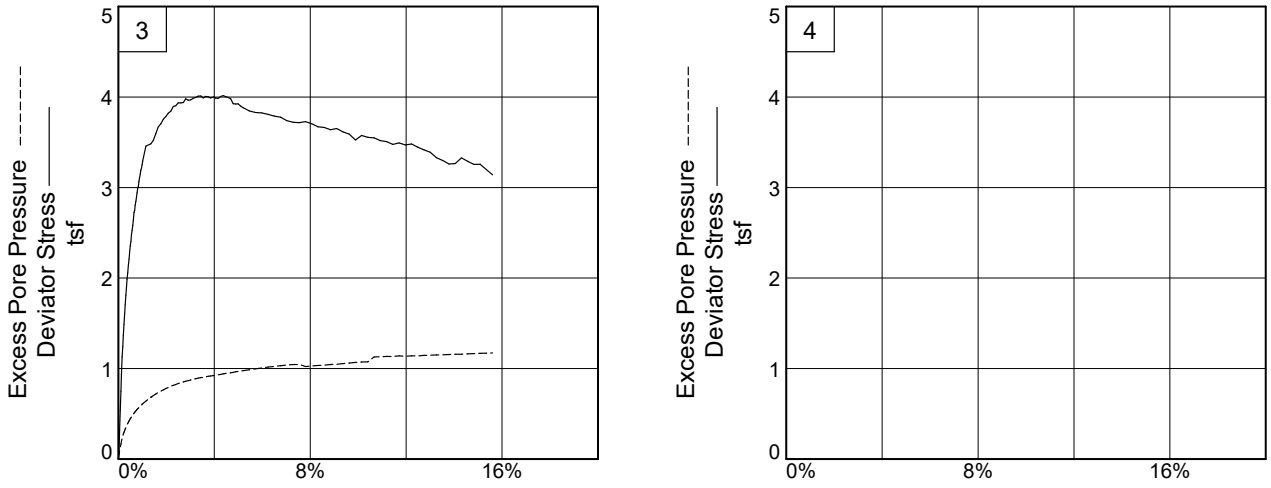
Source of Sample: CB-22 **Depth:** 30

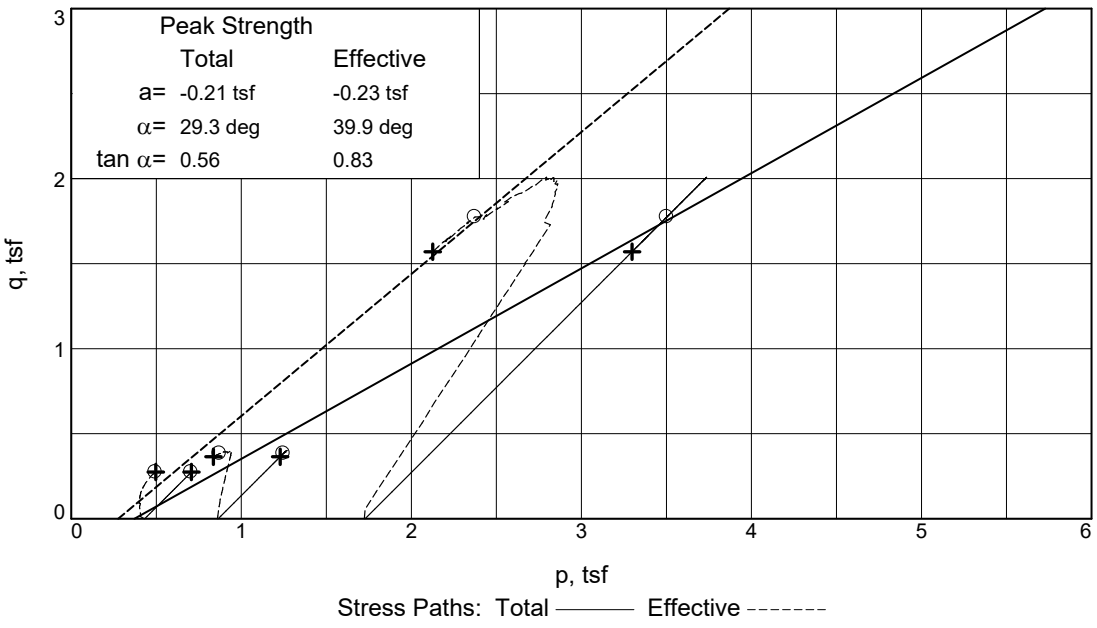
Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/12/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







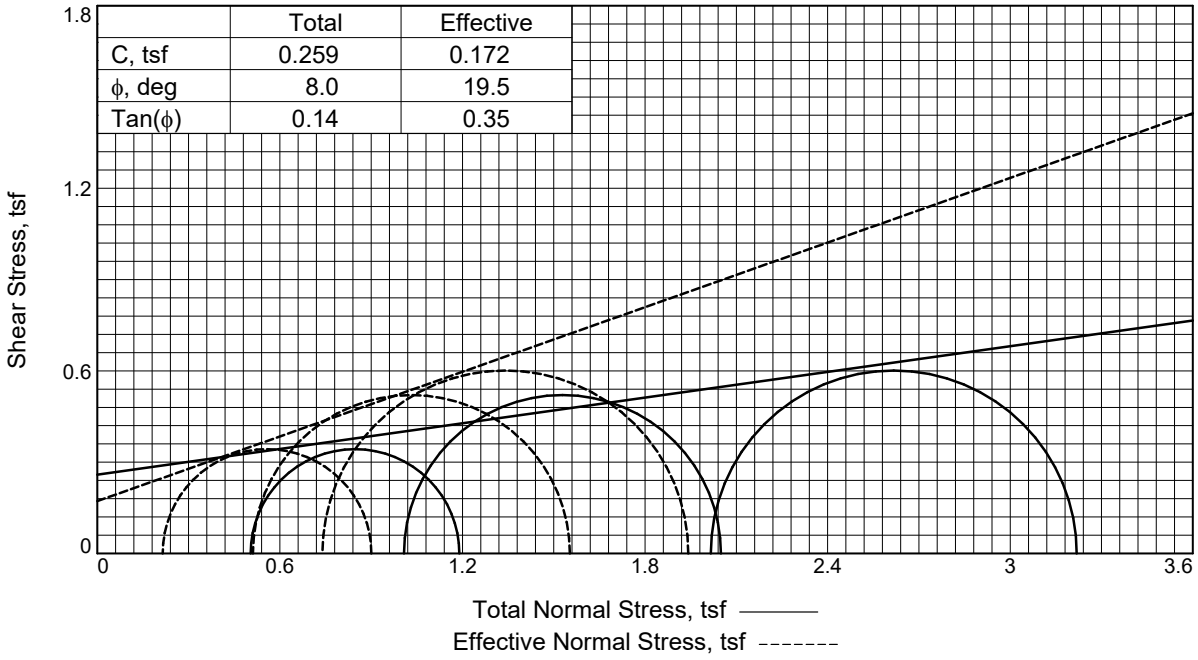
Client: CPA/ USACE

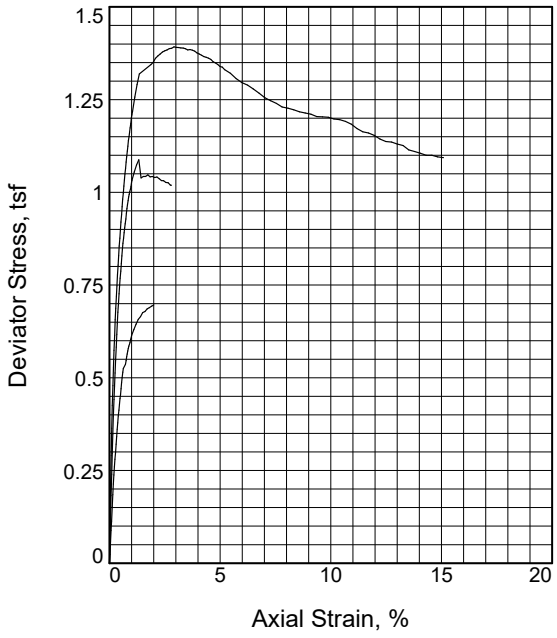
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-22 **Depth:** 30 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	42.4	42.4	42.4
	Dry Density, pcf	78.2	78.2	78.2
	Saturation, %	99.2	99.2	99.2
	Void Ratio	1.1550	1.1550	1.1550
	Diameter, in.	2.04	2.04	2.04
	Height, in.	4.47	4.47	4.47
At Test	Water Content, %	38.2	38.2	38.2
	Dry Density, pcf	82.9	82.9	82.9
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.0325	1.0325	1.0325
	Diameter, in.	1.98	2.00	2.02
	Height, in.	4.46	4.38	4.30
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		7.00	14.00	28.00
Fail. Stress, tsf		0.69	1.04	1.20
Excess Pore Pr., tsf		0.29	0.50	1.28
Strain, %		1.7	2.1	9.9
Ult. Stress, tsf		0.69	1.04	1.20
Excess Pore Pr., tsf		0.29	0.50	1.28
Strain, %		1.7	2.1	9.9
$\bar{\sigma}_1$ Failure, tsf		0.90	1.55	1.94
$\bar{\sigma}_3$ Failure, tsf		0.21	0.51	0.74

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown FAT CLAY; sand pockets

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

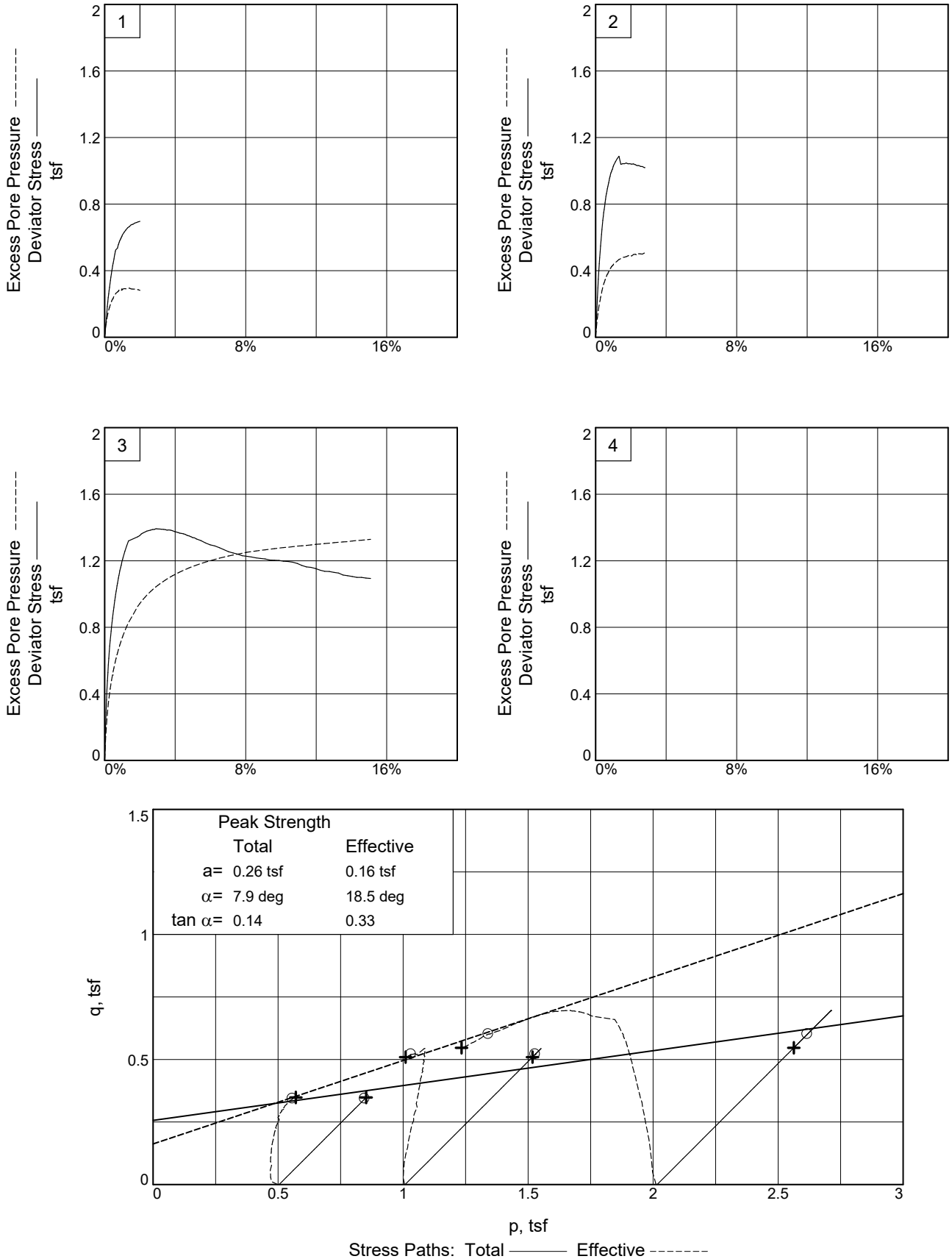
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 35

Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/11/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.



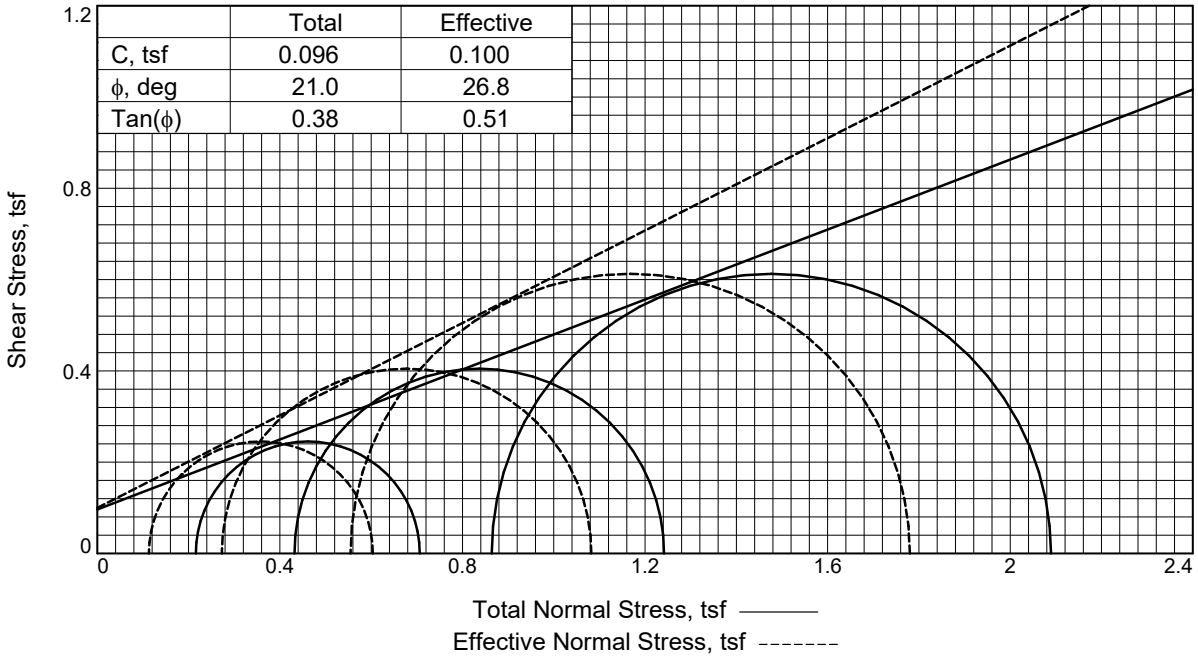
Client: CPA/ USACE

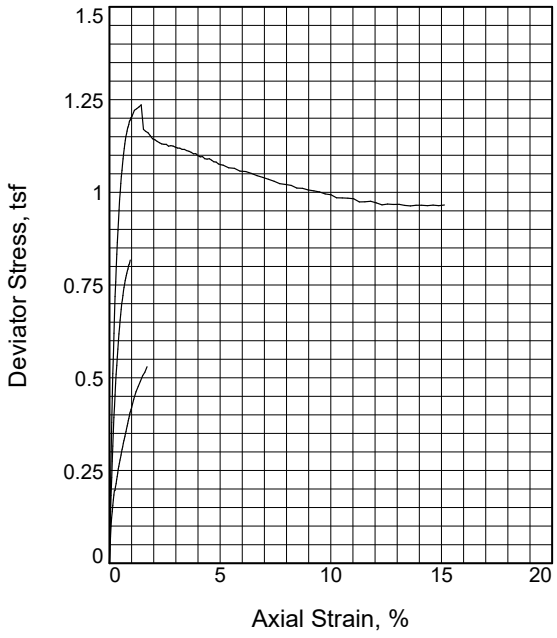
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-23 **Depth:** 35 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	33.8	33.8	33.8
	Dry Density, pcf	87.9	87.9	87.9
	Saturation, %	99.6	99.6	99.6
	Void Ratio	0.9170	0.9170	0.9170
	Diameter, in.	2.04	2.04	2.04
	Height, in.	4.45	4.45	4.45
At Test	Water Content, %	25.4	25.4	25.4
	Dry Density, pcf	100.0	100.0	100.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6863	0.6863	0.6863
	Diameter, in.	1.91	1.93	1.94
	Height, in.	4.45	4.38	4.34
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		3.00	6.00	12.00
Fail. Stress, tsf		0.49	0.81	1.23
Excess Pore Pr., tsf		0.10	0.16	0.31
Strain, %		1.4	0.9	1.2
Ult. Stress, tsf		0.49	0.81	1.23
Excess Pore Pr., tsf		0.10	0.16	0.31
Strain, %		1.4	0.9	1.2
$\bar{\sigma}_1$ Failure, tsf		0.60	1.08	1.78
$\bar{\sigma}_3$ Failure, tsf		0.11	0.27	0.55

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown FAT CLAY

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

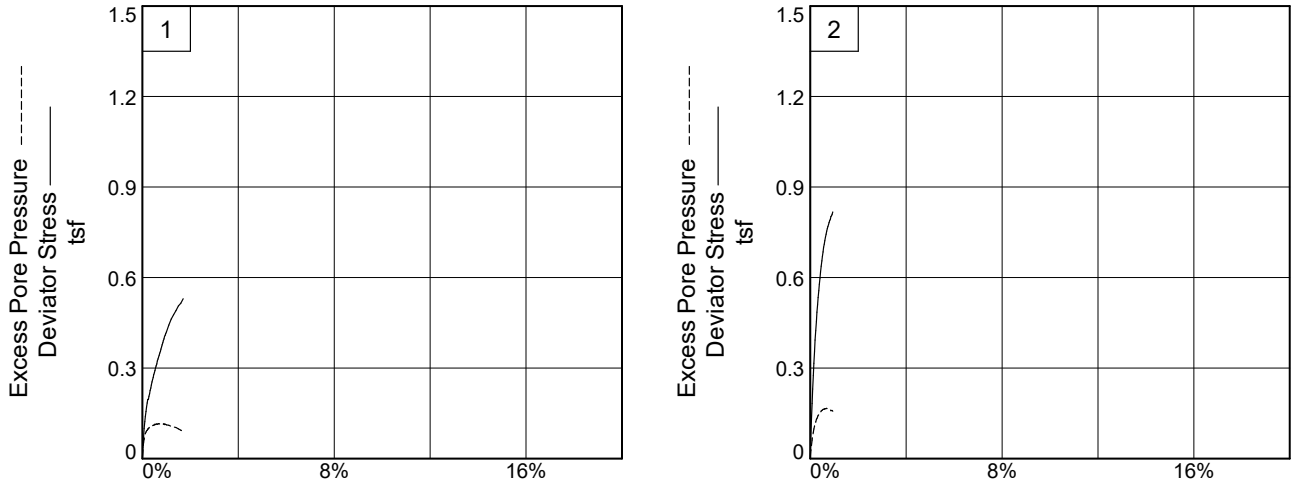
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

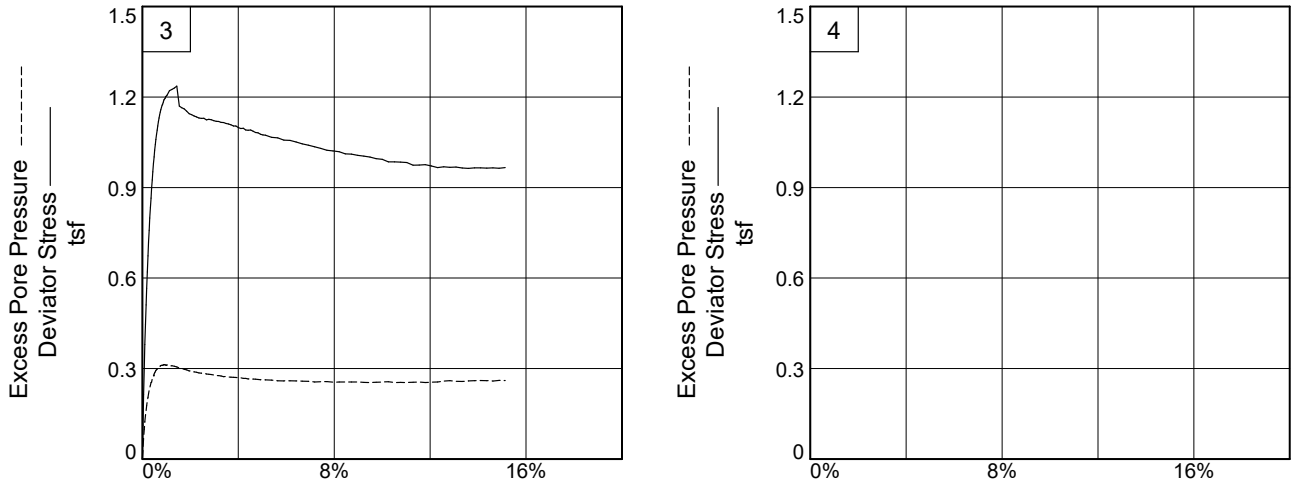
Source of Sample: CB-24 **Depth:** 15

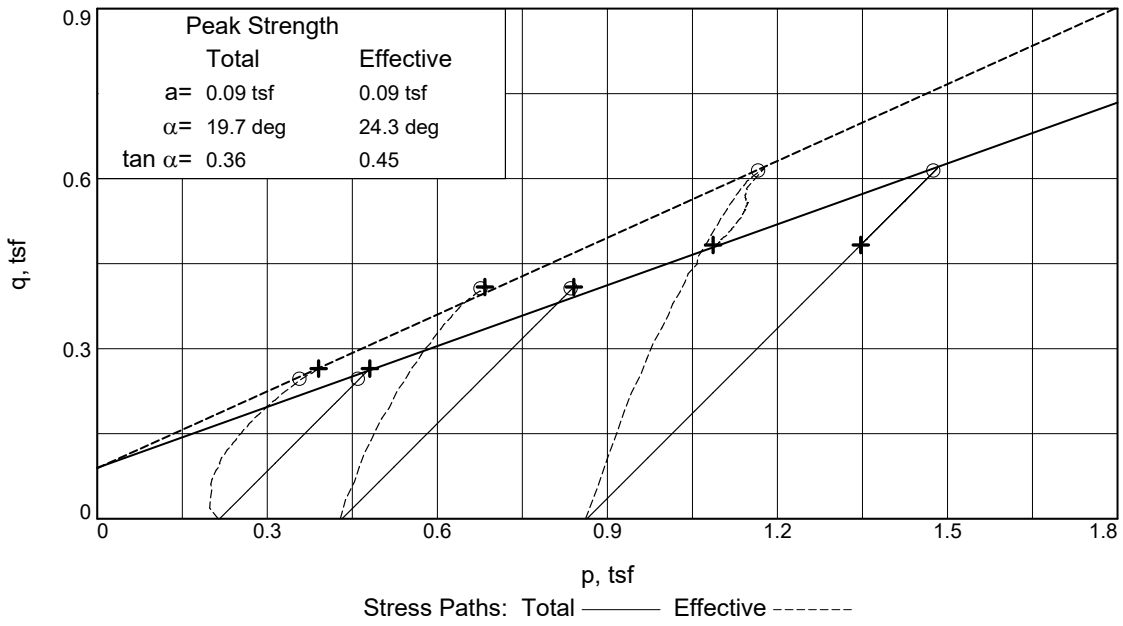
Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 11/10/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







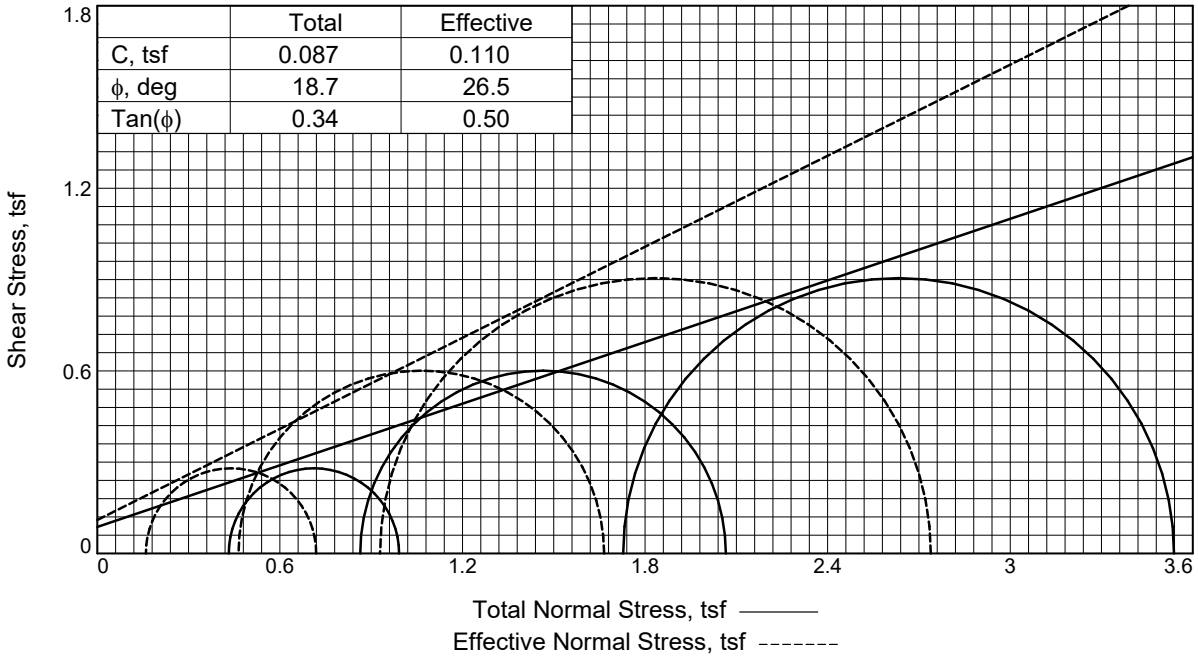
Client: CPA/ USACE

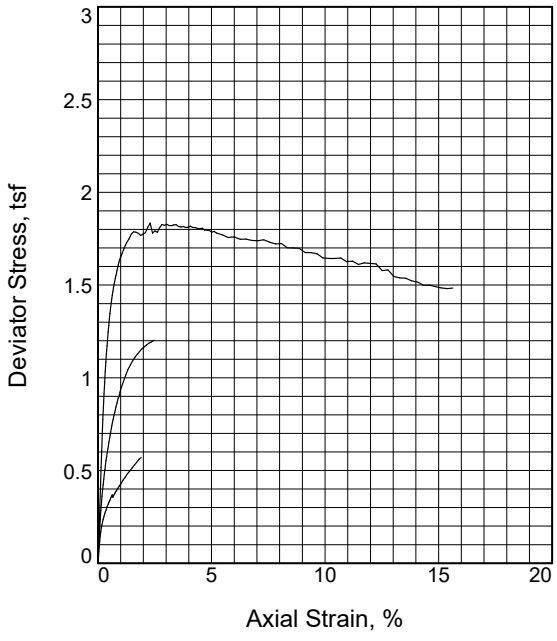
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-24 **Depth:** 15 **Sample Number:** ST-5

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	32.4	32.4	32.4
	Dry Density, pcf	89.9	89.9	89.9
	Saturation, %	98.1	98.1	98.1
	Void Ratio	0.9090	0.9090	0.9090
	Diameter, in.	2.85	2.85	2.85
	Height, in.	5.82	5.82	5.82
At Test	Water Content, %	29.7	29.7	29.7
	Dry Density, pcf	94.5	94.5	94.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8160	0.8160	0.8160
	Diameter, in.	2.78	2.80	2.83
	Height, in.	5.80	5.72	5.59
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.56	1.20	1.81
Excess Pore Pr., tsf		0.27	0.40	0.80
Strain, %		1.8	2.4	4.3
Ult. Stress, tsf		0.56	1.20	1.81
Excess Pore Pr., tsf		0.27	0.40	0.80
Strain, %		1.8	2.4	4.3
$\bar{\sigma}_1$ Failure, tsf		0.72	1.67	2.74
$\bar{\sigma}_3$ Failure, tsf		0.16	0.46	0.93

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Reddish-brown LEAN CLAY; sand pockets

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

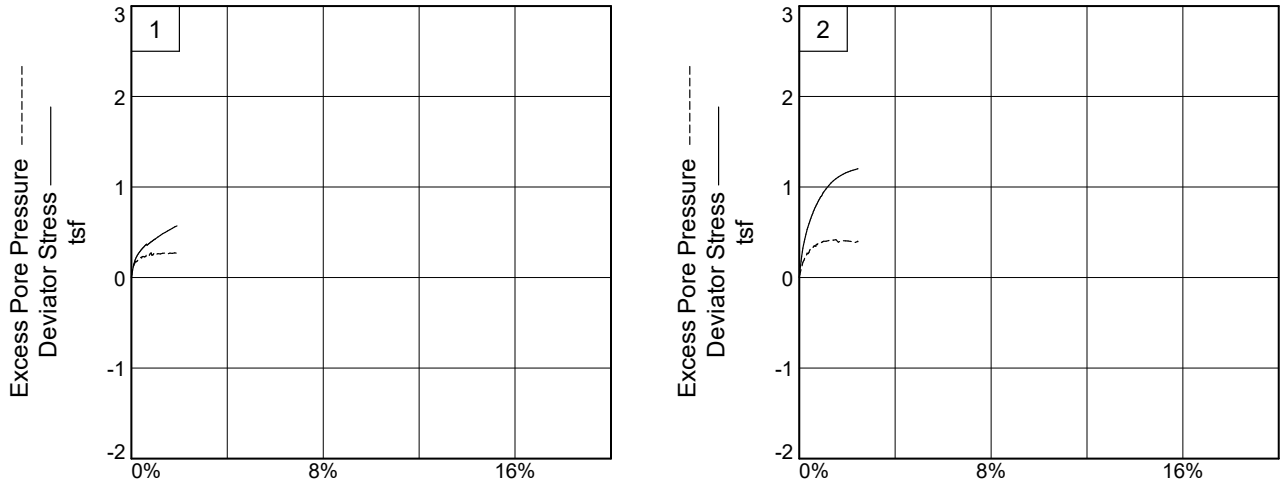
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

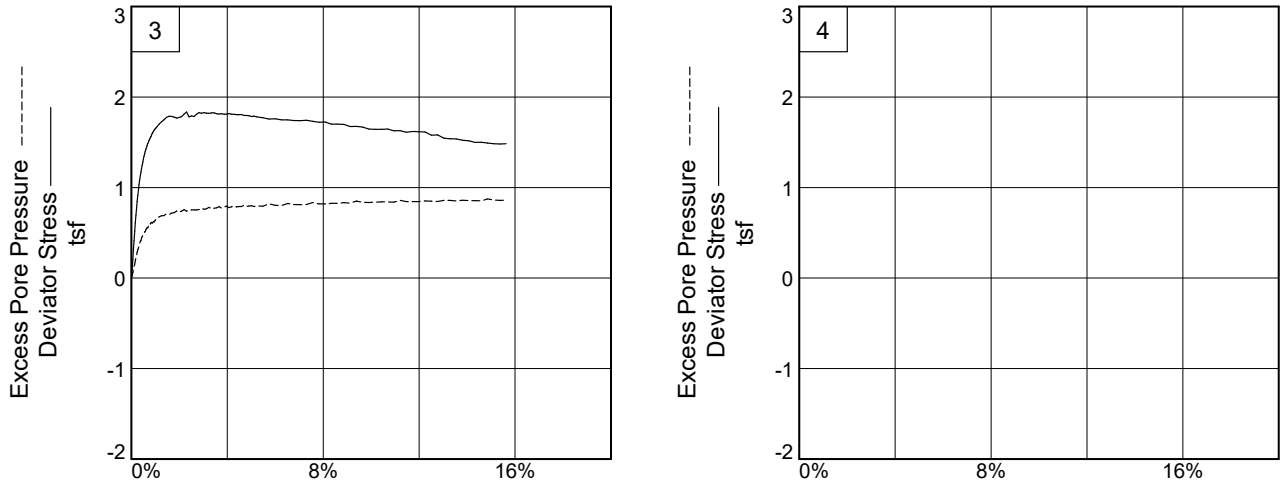
Source of Sample: CB-32 **Depth:** 30

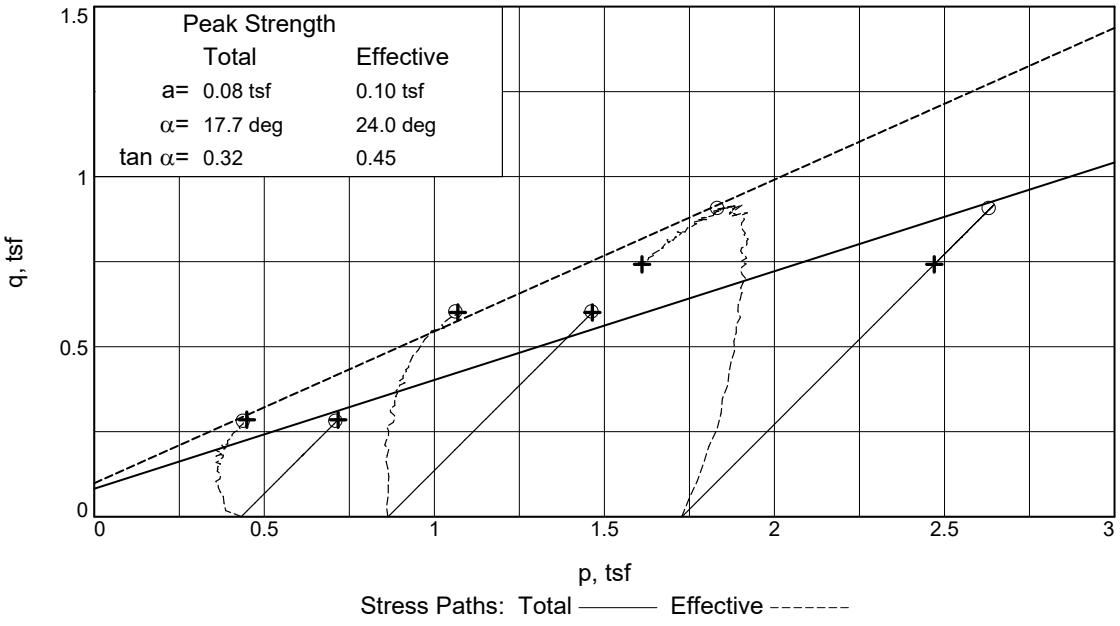
Sample Number: ST-7

Proj. No.: 21.14.223 **Date Sampled:** 8/10/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







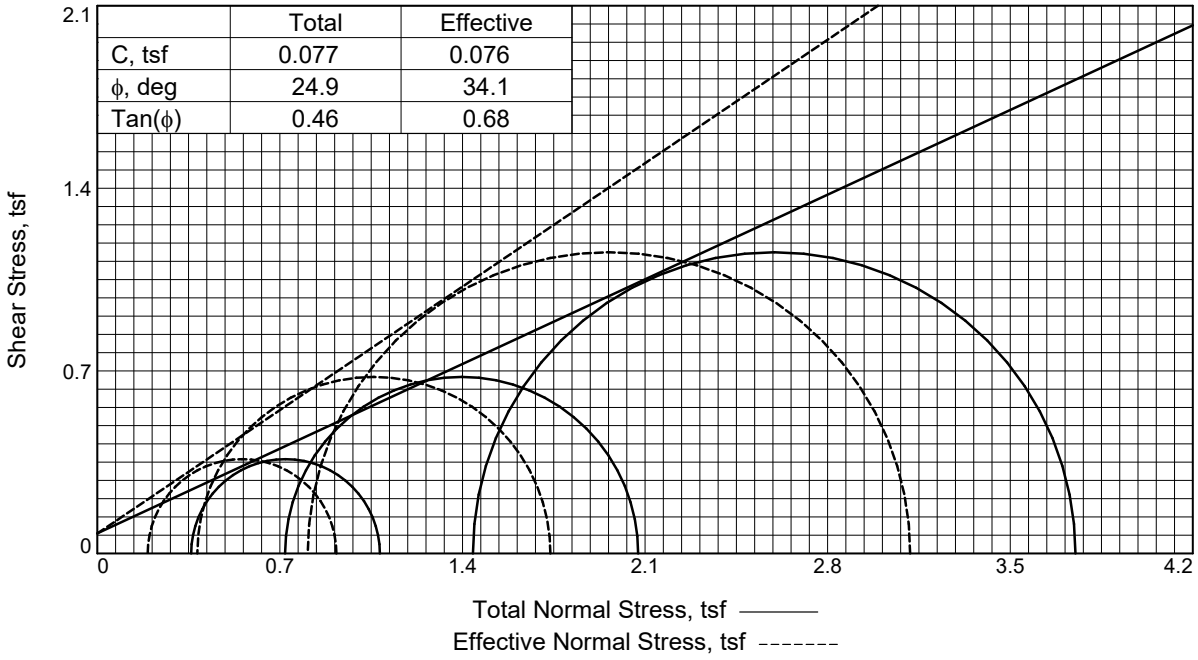
Client: CPA/ USACE

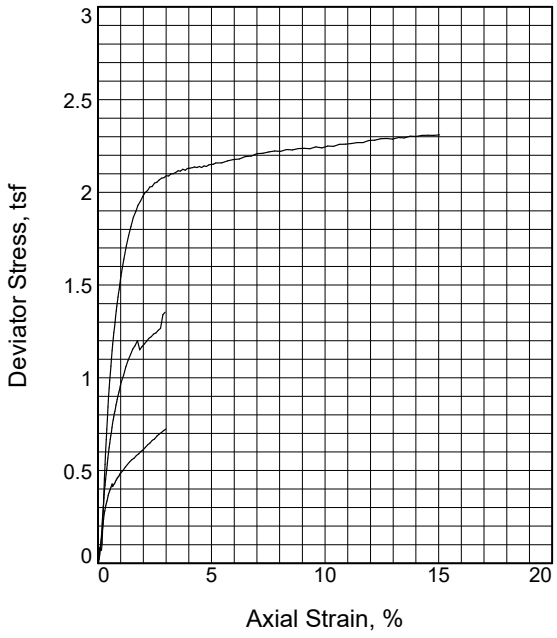
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-32 **Depth:** 30 **Sample Number:** ST-7

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	37.9	37.9	37.9
	Dry Density, pcf	85.2	85.2	85.2
	Saturation, %	99.3	99.3	99.3
	Void Ratio	1.0890	1.0890	1.0890
	Diameter, in.	2.76	2.76	2.76
	Height, in.	5.68	5.68	5.68
At Test	Water Content, %	26.0	26.0	26.0
	Dry Density, pcf	102.2	102.2	102.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7406	0.7406	0.7406
	Diameter, in.	2.51	2.54	2.56
	Height, in.	5.70	5.58	5.47
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, tsf		0.72	1.35	2.31
Excess Pore Pr., tsf		0.17	0.34	0.63
Strain, %		3.0	3.0	15.0
Ult. Stress, tsf		0.72	1.35	2.31
Excess Pore Pr., tsf		0.17	0.34	0.63
Strain, %		3.0	3.0	15.0
$\bar{\sigma}_1$ Failure, tsf		0.92	1.74	3.12
$\bar{\sigma}_3$ Failure, tsf		0.19	0.38	0.81

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Reddish-brown FAT CLAY

LL= 50 **PL=** 20 **PI=** 30

Assumed Specific Gravity= 2.85

Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

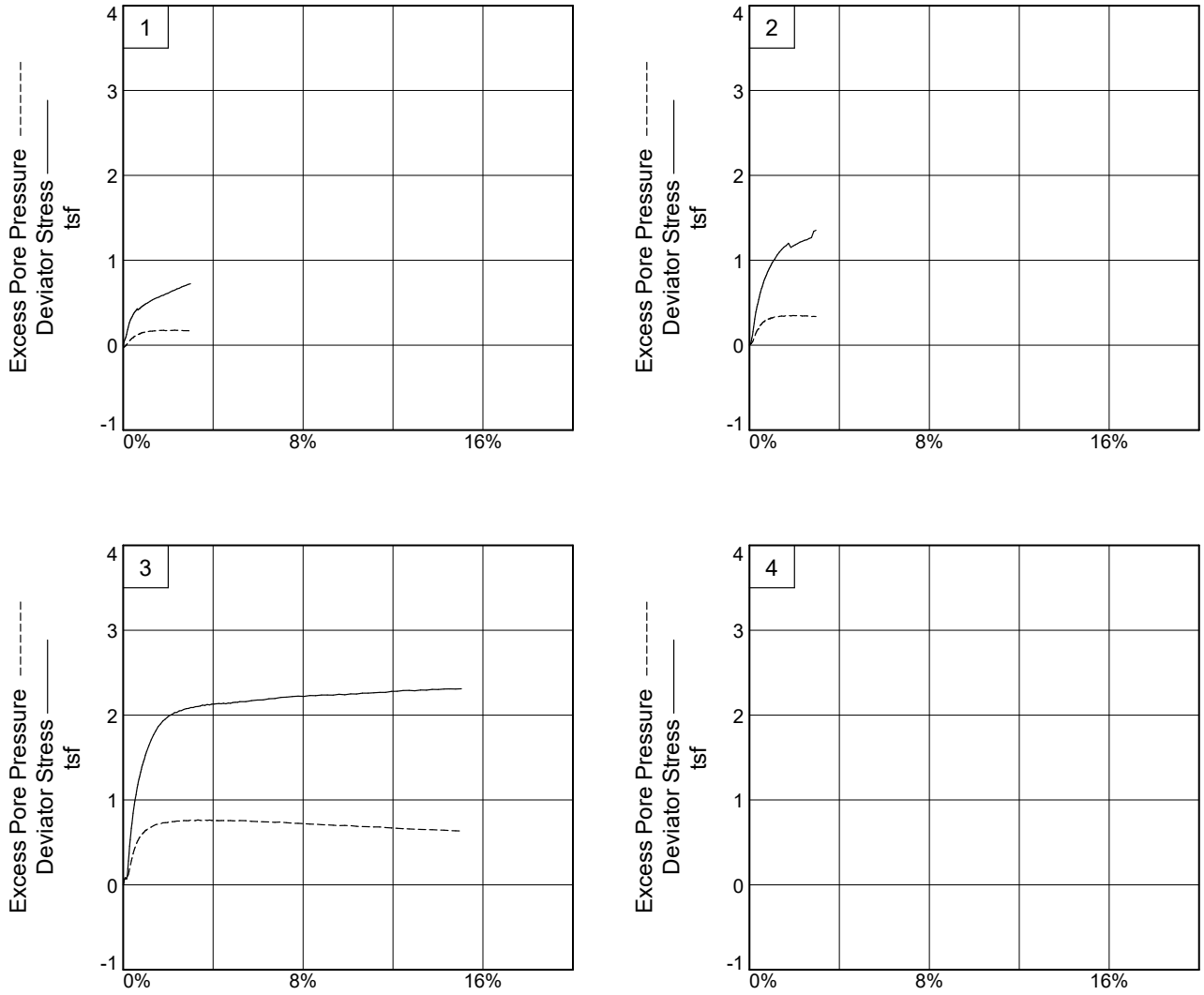
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

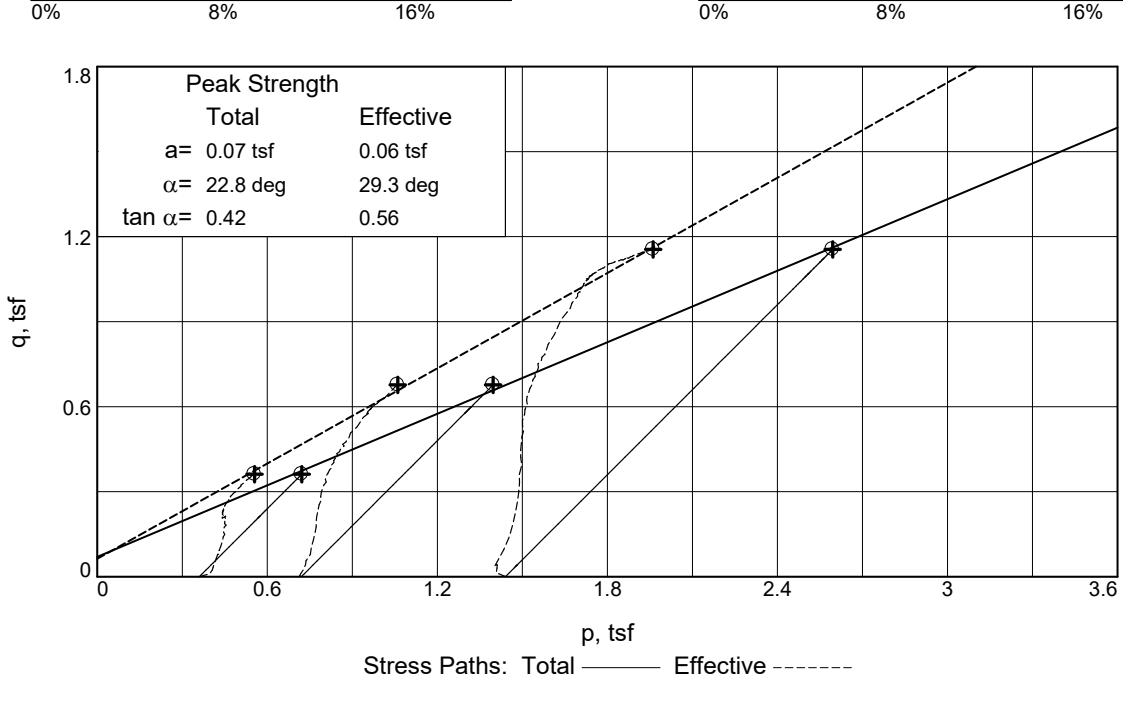
Source of Sample: CB-33 **Depth:** 26

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 9/10/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.





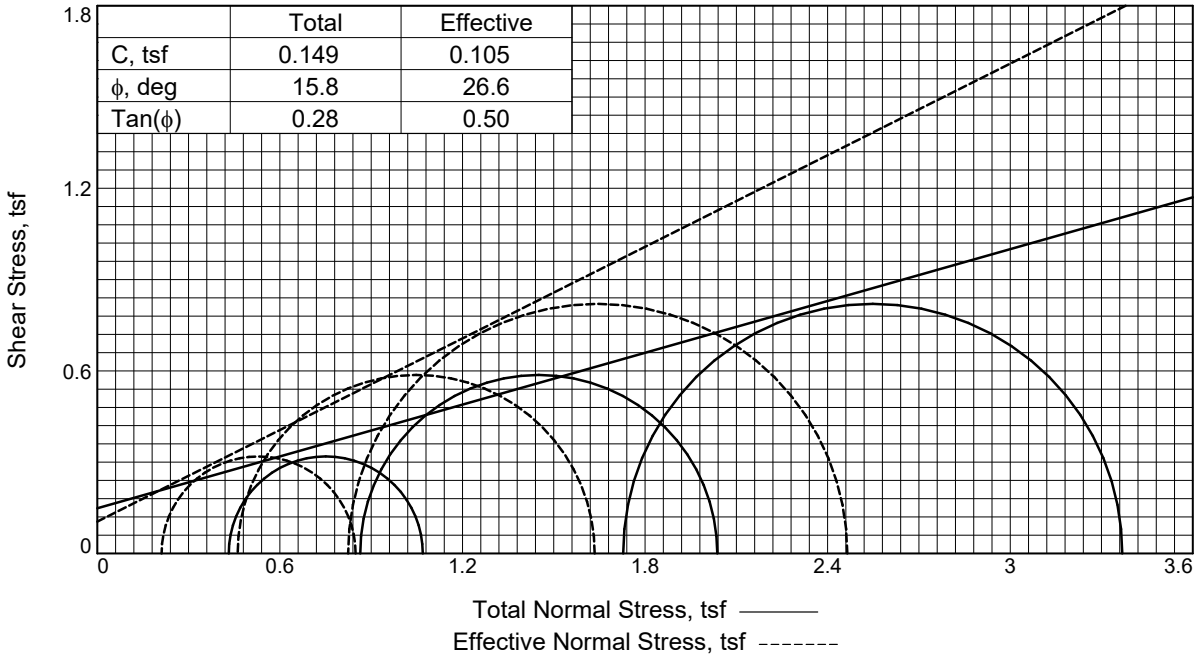
Client: CPA/ USACE

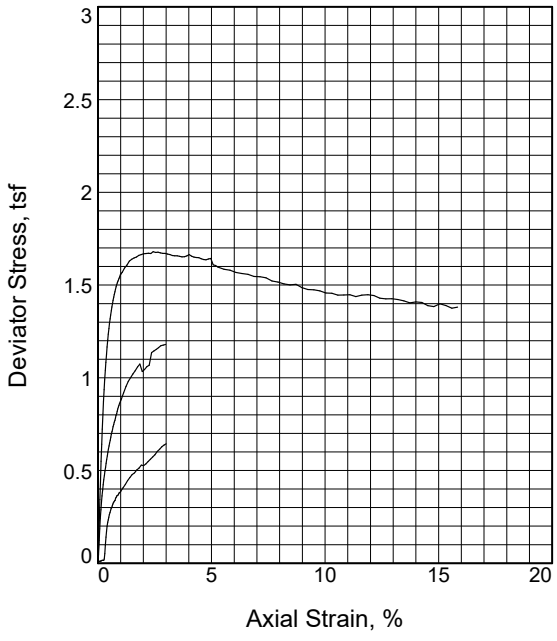
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-33 **Depth:** 26 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	30.2	30.2	30.2
	Dry Density, pcf	92.4	92.4	92.4
	Saturation, %	98.9	98.9	98.9
	Void Ratio	0.8242	0.8245	0.8245
	Diameter, in.	2.83	2.83	2.83
	Height, in.	5.80	5.80	5.80
At Test	Water Content, %	27.2	27.2	27.2
	Dry Density, pcf	97.2	97.2	97.2
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7339	0.7339	0.7339
	Diameter, in.	2.76	2.79	2.83
	Height, in.	5.78	5.65	5.49
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.64	1.17	1.64
Excess Pore Pr., tsf		0.22	0.40	0.90
Strain, %		2.9	2.8	4.9
Ult. Stress, tsf		0.64	1.17	1.64
Excess Pore Pr., tsf		0.22	0.40	0.90
Strain, %		2.9	2.8	4.9
$\bar{\sigma}_1$ Failure, tsf		0.85	1.63	2.46
$\bar{\sigma}_3$ Failure, tsf		0.21	0.46	0.82

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown FAT CLAY with SAND; shell fragments

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

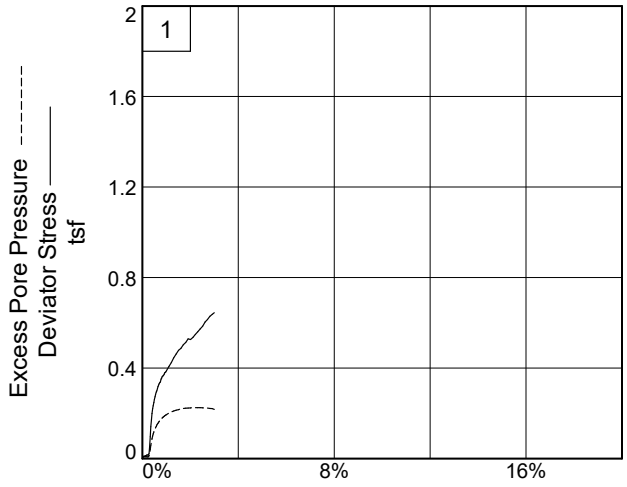
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

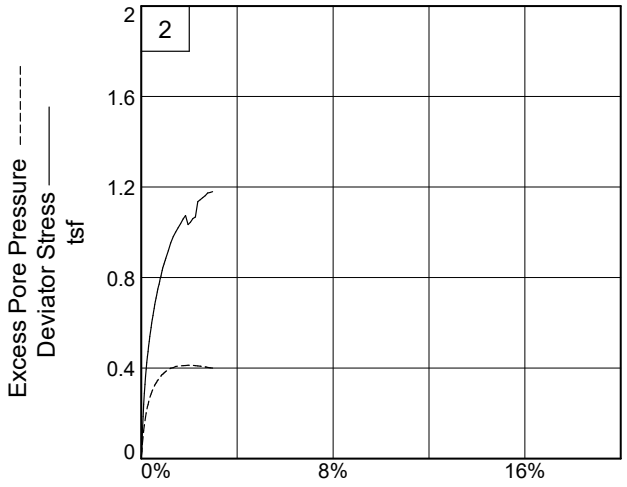
Source of Sample: CB-34 **Depth:** 32.5

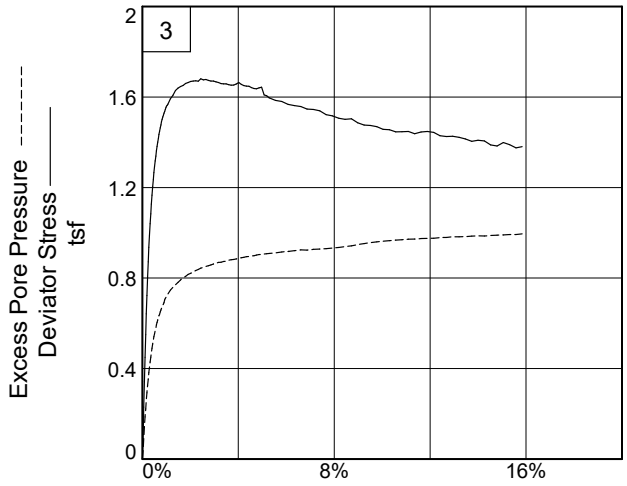
Sample Number: ST-4

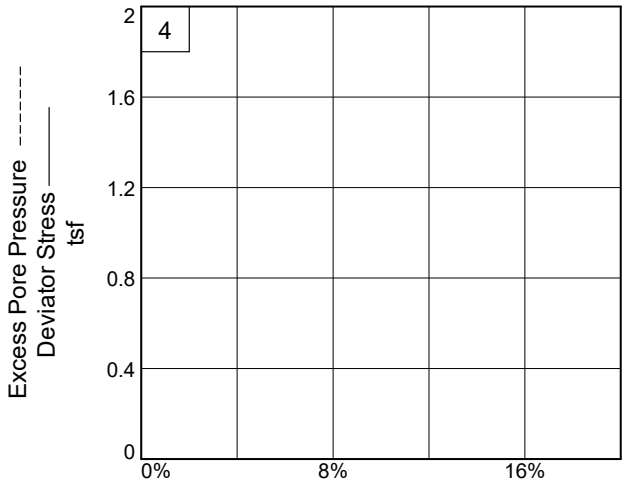
Proj. No.: 21.14.223 **Date Sampled:** 9/16/21

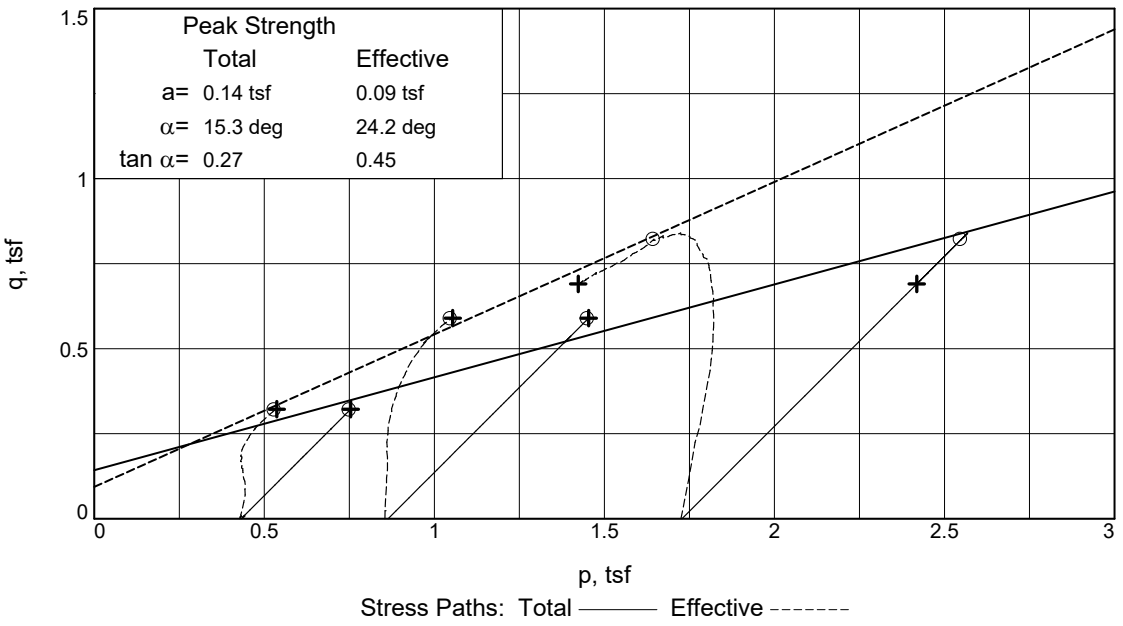
TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.











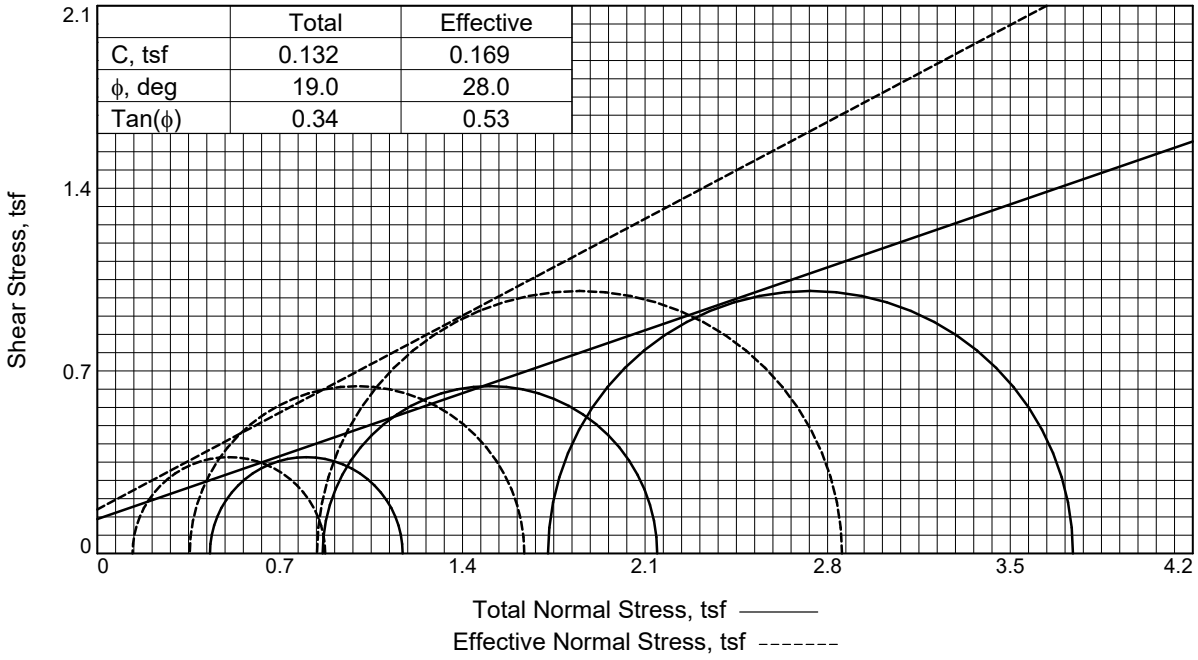
Client: CPA/ USACE

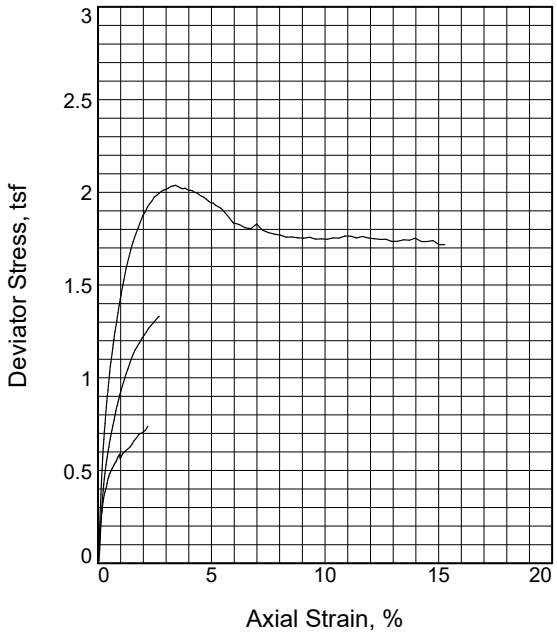
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-34 **Depth:** 32.5 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	38.3	38.3	38.3
	Dry Density, pcf	83.3	83.3	83.3
	Saturation, %	97.8	97.8	97.8
	Void Ratio	1.0974	1.0974	1.0974
	Diameter, in.	2.83	2.83	2.83
	Height, in.	5.75	5.75	5.75
At Test	Water Content, %	32.1	32.1	32.1
	Dry Density, pcf	92.0	92.0	92.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.8998	0.8998	0.8998
	Diameter, in.	2.69	2.72	2.74
	Height, in.	5.76	5.66	5.56
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.74	1.28	2.01
Excess Pore Pr., tsf		0.30	0.51	0.89
Strain, %		2.2	2.3	2.9
Ult. Stress, tsf		0.74	1.28	2.01
Excess Pore Pr., tsf		0.30	0.51	0.89
Strain, %		2.2	2.3	2.9
$\bar{\sigma}_1$ Failure, tsf		0.87	1.64	2.85
$\bar{\sigma}_3$ Failure, tsf		0.14	0.35	0.84

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY with SAND

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

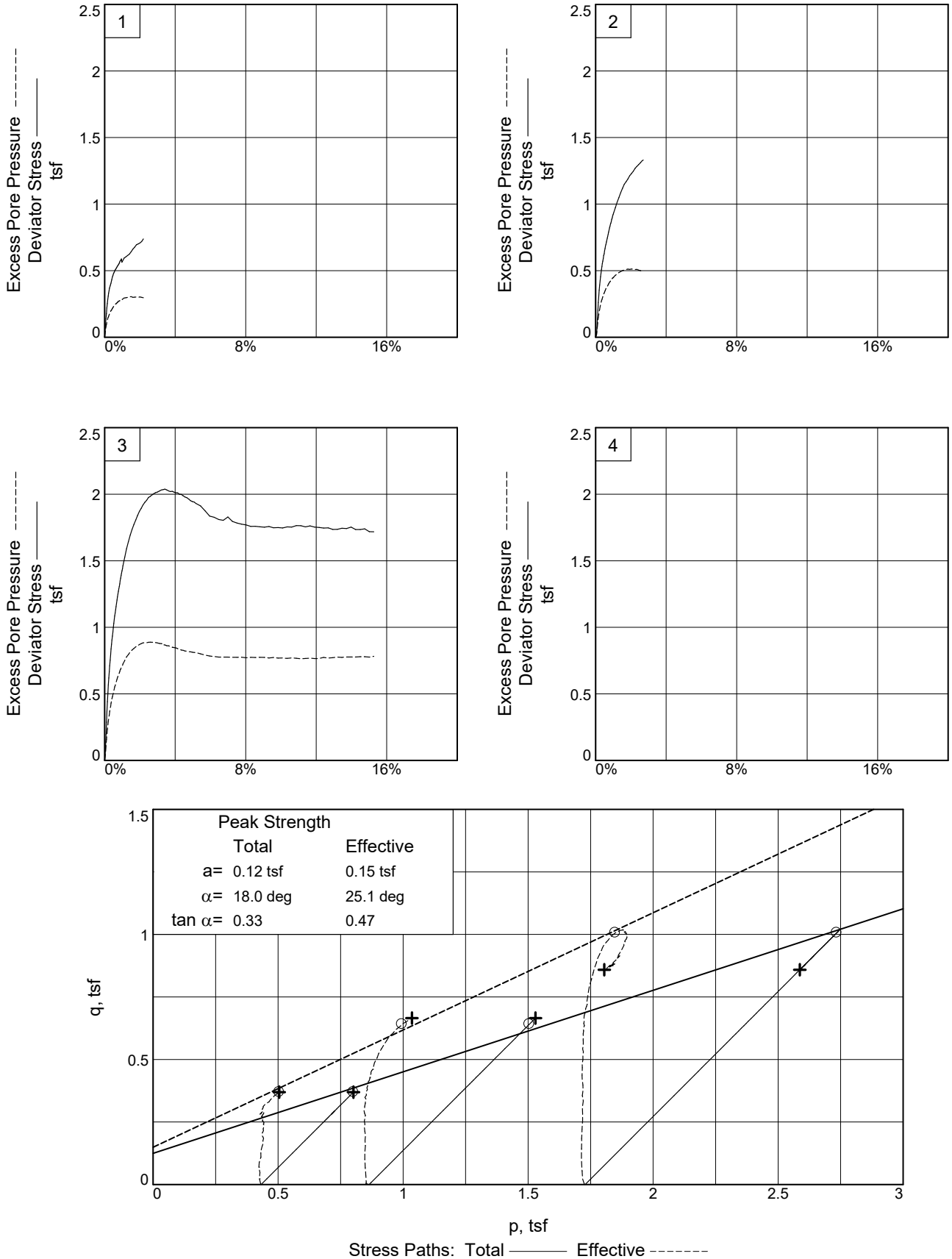
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-38 **Depth:** 32.5

Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 9/30/21

TRIAXIAL SHEAR TEST REPORT
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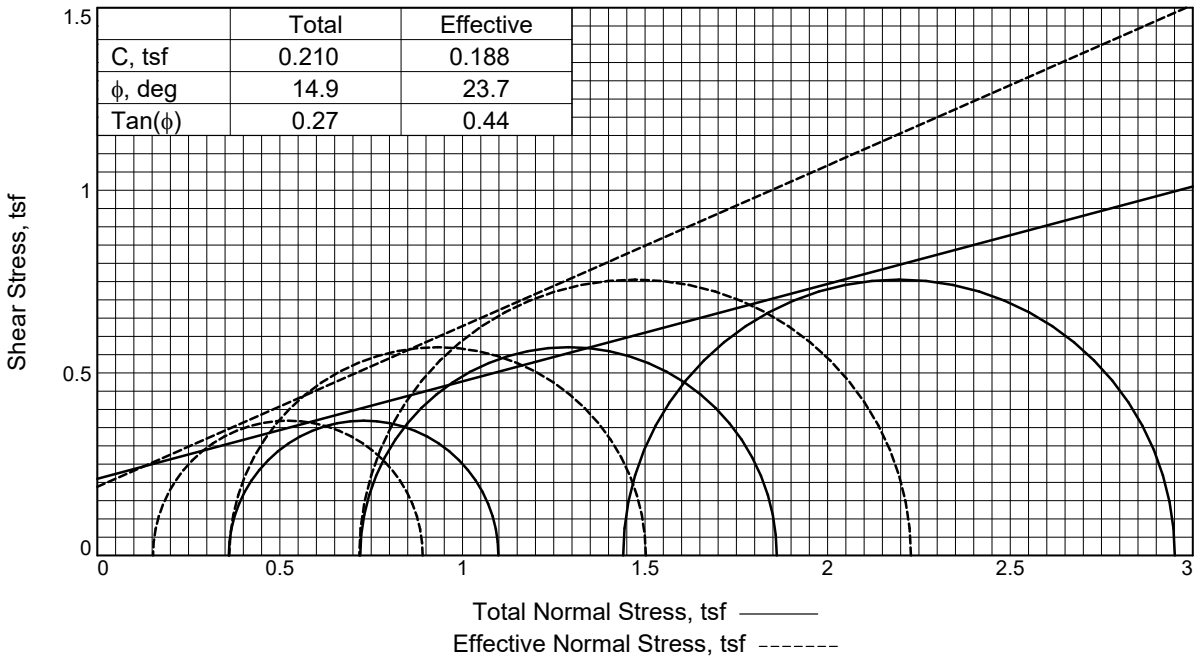
Client: CPA/ USACE

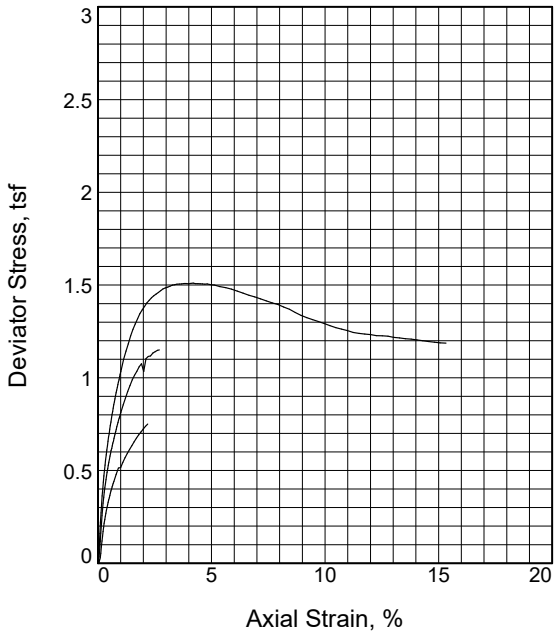
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-38 **Depth:** 32.5 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	37.6	37.6	37.6
	Dry Density, pcf	83.3	83.3	83.3
	Saturation, %	95.9	95.9	95.9
	Void Ratio	1.0987	1.0987	1.0987
	Diameter, in.	2.83	2.83	2.83
	Height, in.	5.78	5.78	5.78
At Test	Water Content, %	38.8	38.8	38.8
	Dry Density, pcf	83.8	83.8	83.8
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.0867	1.0867	1.0867
	Diameter, in.	2.82	2.83	2.85
	Height, in.	5.80	5.74	5.66
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		5.00	10.00	20.00
Fail. Stress, tsf		0.74	1.14	1.51
Excess Pore Pr., tsf		0.21	0.36	0.72
Strain, %		2.1	2.5	4.2
Ult. Stress, tsf		0.74	1.14	1.51
Excess Pore Pr., tsf		0.21	0.36	0.72
Strain, %		2.1	2.5	4.2
$\bar{\sigma}_1$ Failure, tsf		0.89	1.50	2.23
$\bar{\sigma}_3$ Failure, tsf		0.15	0.36	0.72

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY (CH)

LL= 72 **PL=** 28 **PI=** 44

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

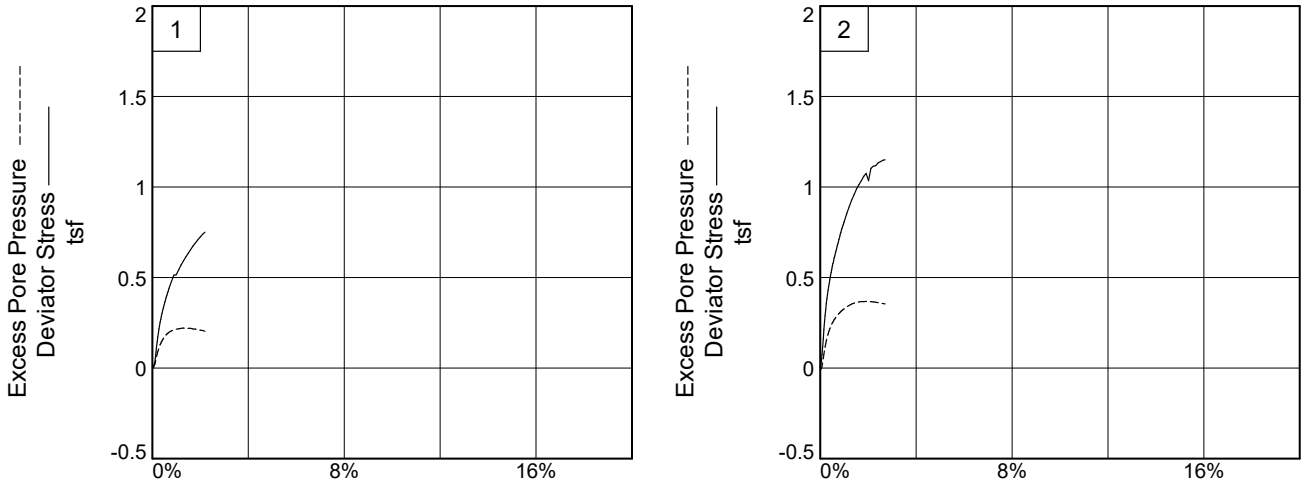
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

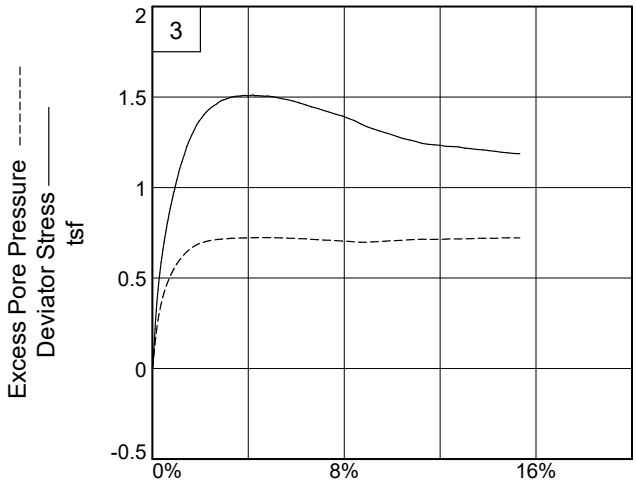
Source of Sample: CB-40 **Depth:** 25

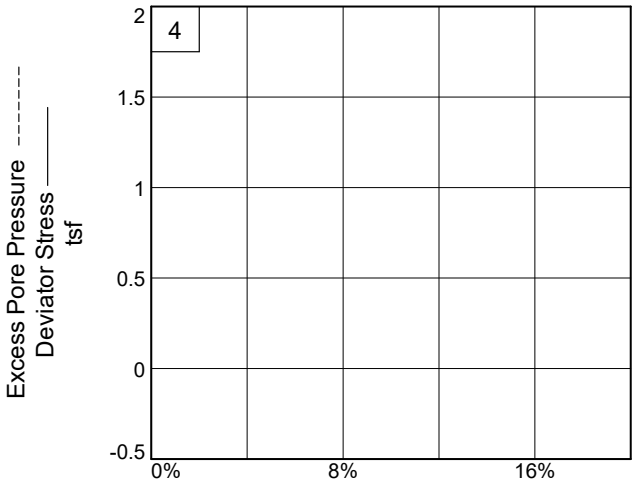
Sample Number: ST-3

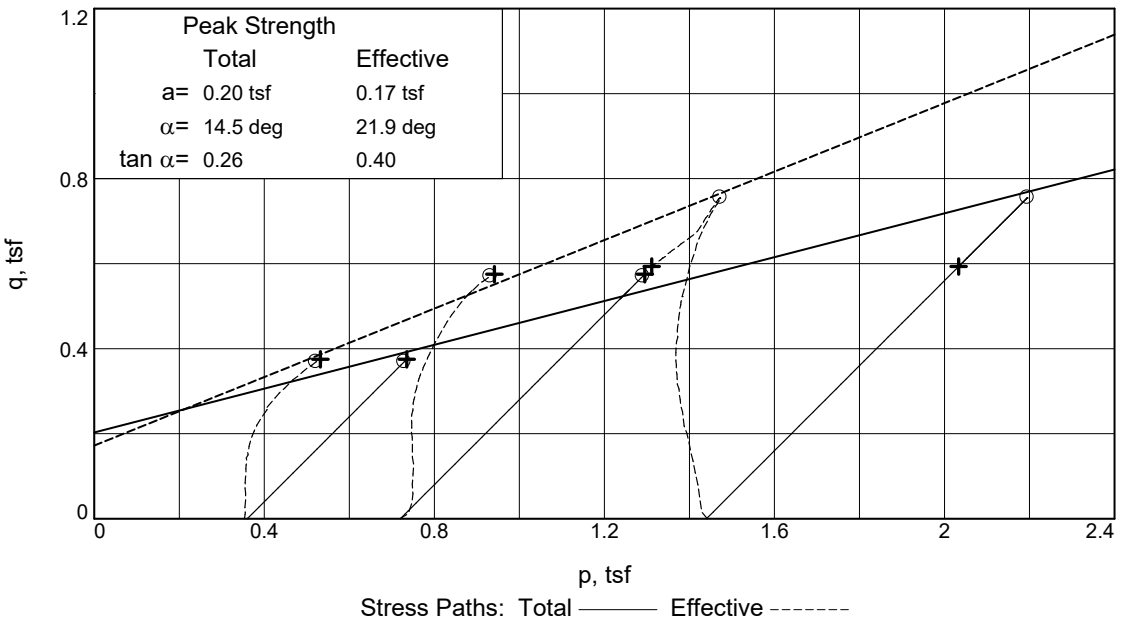
Proj. No.: 21.14.223 **Date Sampled:** 9/10/21

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Tolunay-Wong Engineers, Inc.









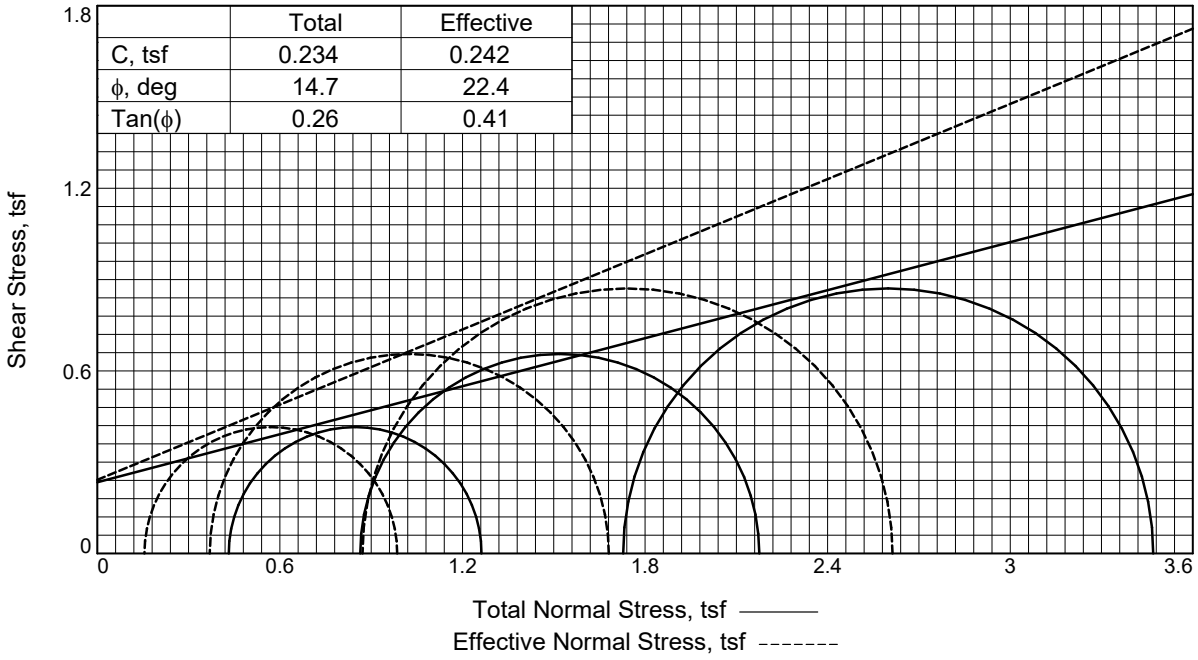
Client: CPA/ USACE

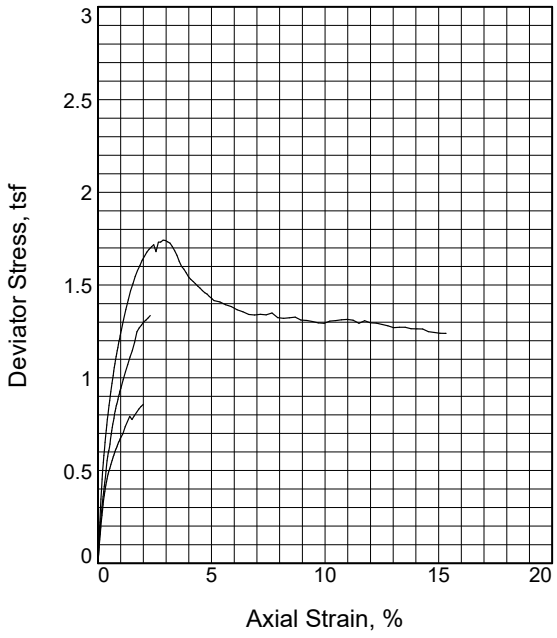
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-40 **Depth:** 25 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	44.3	44.3	44.3
	Dry Density, pcf	76.9	76.9	76.9
	Saturation, %	97.4	97.4	97.4
	Void Ratio	1.2741	1.2741	1.2741
	Diameter, in.	2.85	2.85	2.85
	Height, in.	5.78	5.78	5.78
At Test	Water Content, %	45.9	45.9	45.9
	Dry Density, pcf	76.5	76.5	76.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.2857	1.2857	1.2857
	Diameter, in.	2.85	2.87	2.89
	Height, in.	5.79	5.73	5.66
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.83	1.31	1.74
Excess Pore Pr., tsf		0.28	0.49	0.86
Strain, %		1.8	2.1	2.9
Ult. Stress, tsf		0.83	1.31	1.74
Excess Pore Pr., tsf		0.28	0.49	0.86
Strain, %		1.8	2.1	2.9
$\bar{\sigma}_1$ Failure, tsf		0.99	1.68	2.61
$\bar{\sigma}_3$ Failure, tsf		0.15	0.37	0.87

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Tan and gray FAT CLAY

LL= 73 **PL=** 30 **PI=** 43

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

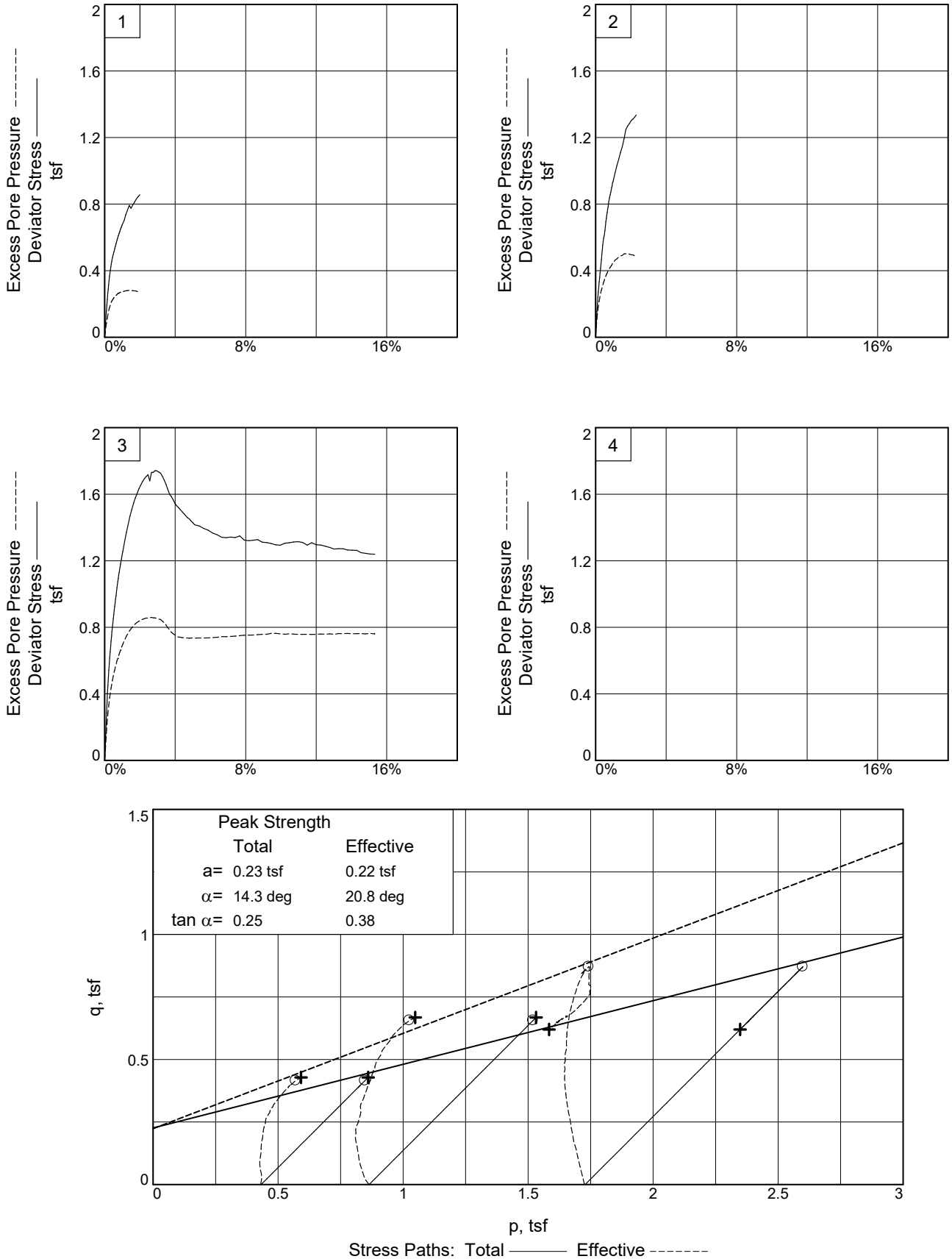
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-42 **Depth:** 27

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 9/16/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.



Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-42 **Depth:** 27 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.

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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (25.0)

TRI Log #: 66894.1
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	5.0	10.0	20.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.05	2.04	1.98	-
Avg. Height (in)	4.25	4.13	4.10	-
Avg. Water Content (%)	30.4	-	-	-
Bulk Density (pcf)	120.8	-	-	-
Dry Density (pcf)	92.6	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	98.1	-	-	-
Void Ratio, n	0.85	0.79	0.67	-
B-Value, End of Saturation	1.00	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.79	0.67	0.65	-

Shear / Post-Shear				
Rate of Strain (%/hr)	0.10	0.10	0.10	-
Avg. Water Content (%)	-	-	29.9	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.3	0.8	1.5	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	3.5	6.5	12.6	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	7.7	11.6	19.9	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	1.5	3.5	7.3	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	11.2	18.1	32.5	-
Secant Friction Angle (degrees)	-	-	-	-	31.5	28.0	26.2	-
Effective Friction Angle (degrees)	-				23.8			
Effective Cohesion (psi)	-				0.9			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
Analysis & Quality Review/Date

The testing herein is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (25.0)

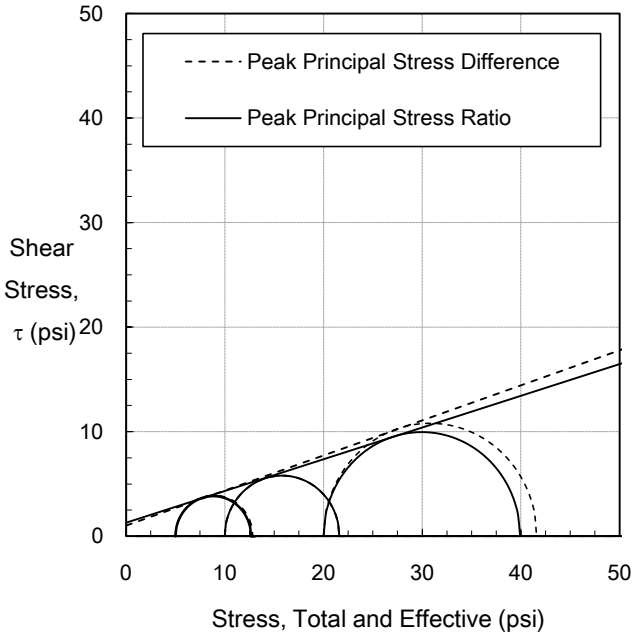
TRI Log #: 66894.1
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	18.5	16.9
Cohesion (psi)	c_R	1.0	1.3

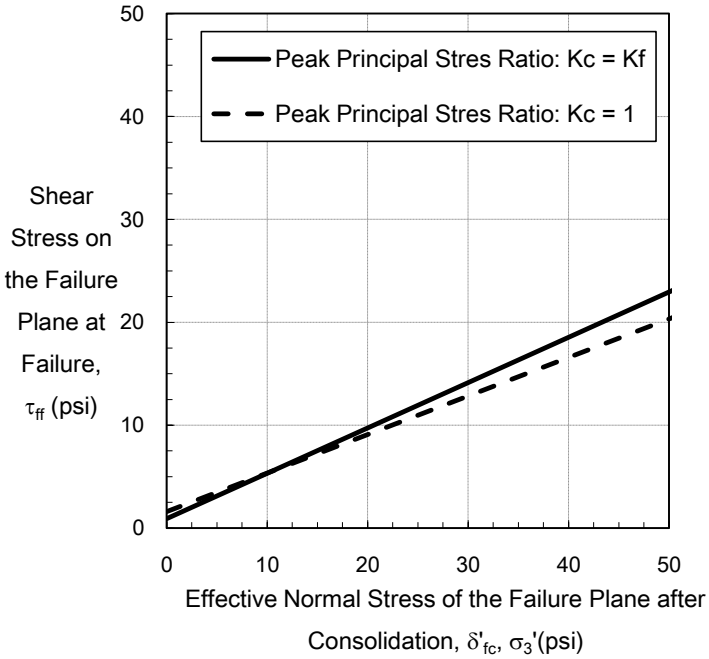
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	23.1	23.8
Effective Cohesion (psi)	c'	1.0	0.9

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	23.2	20.5
Cohesion (psi)	$\psi_{Kc=1}$	1.3	1.6

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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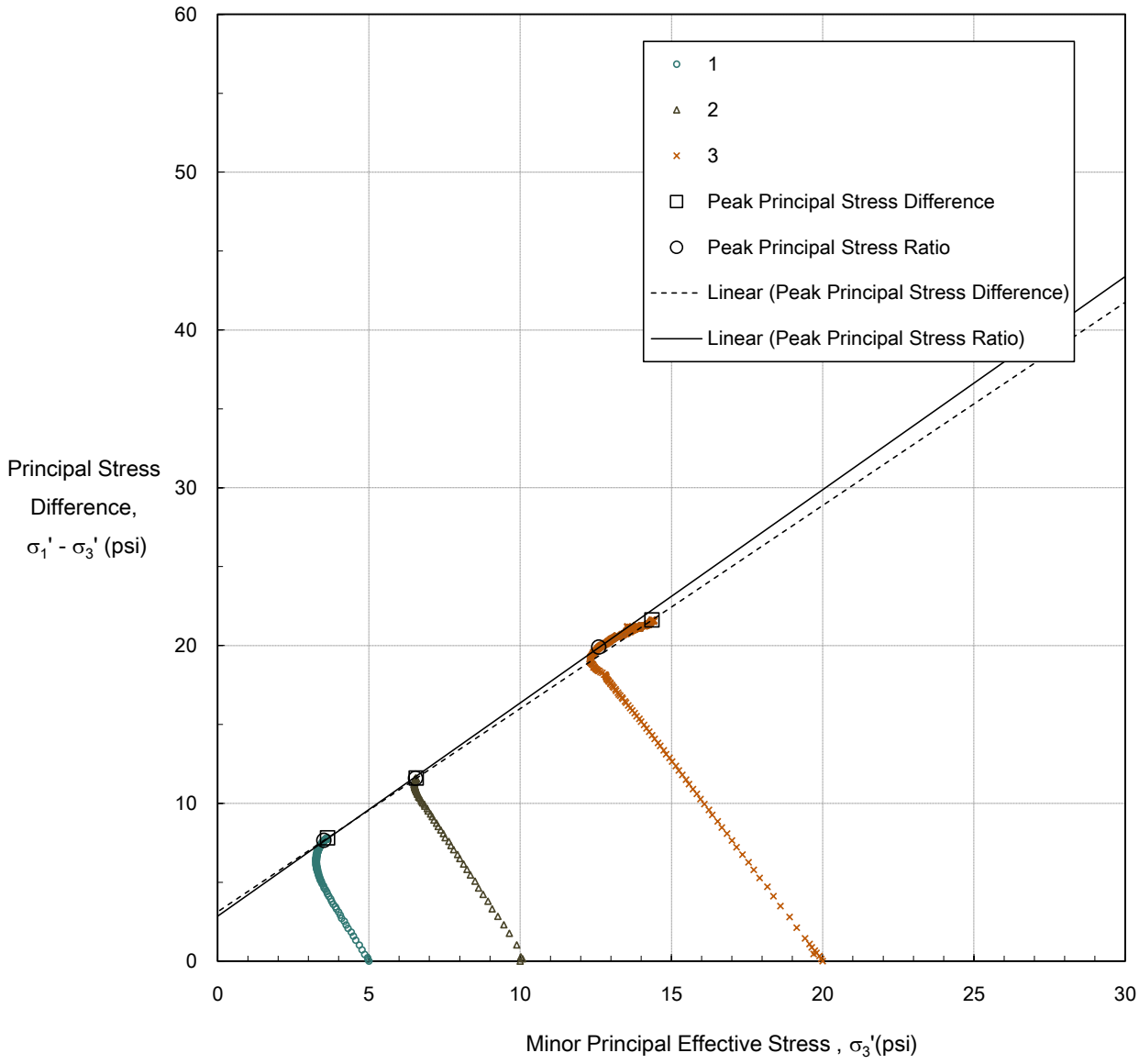
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (25.0)

TRI Log #: 66894.1
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	23.8
Effective Cohesion (psi)	-	0.9

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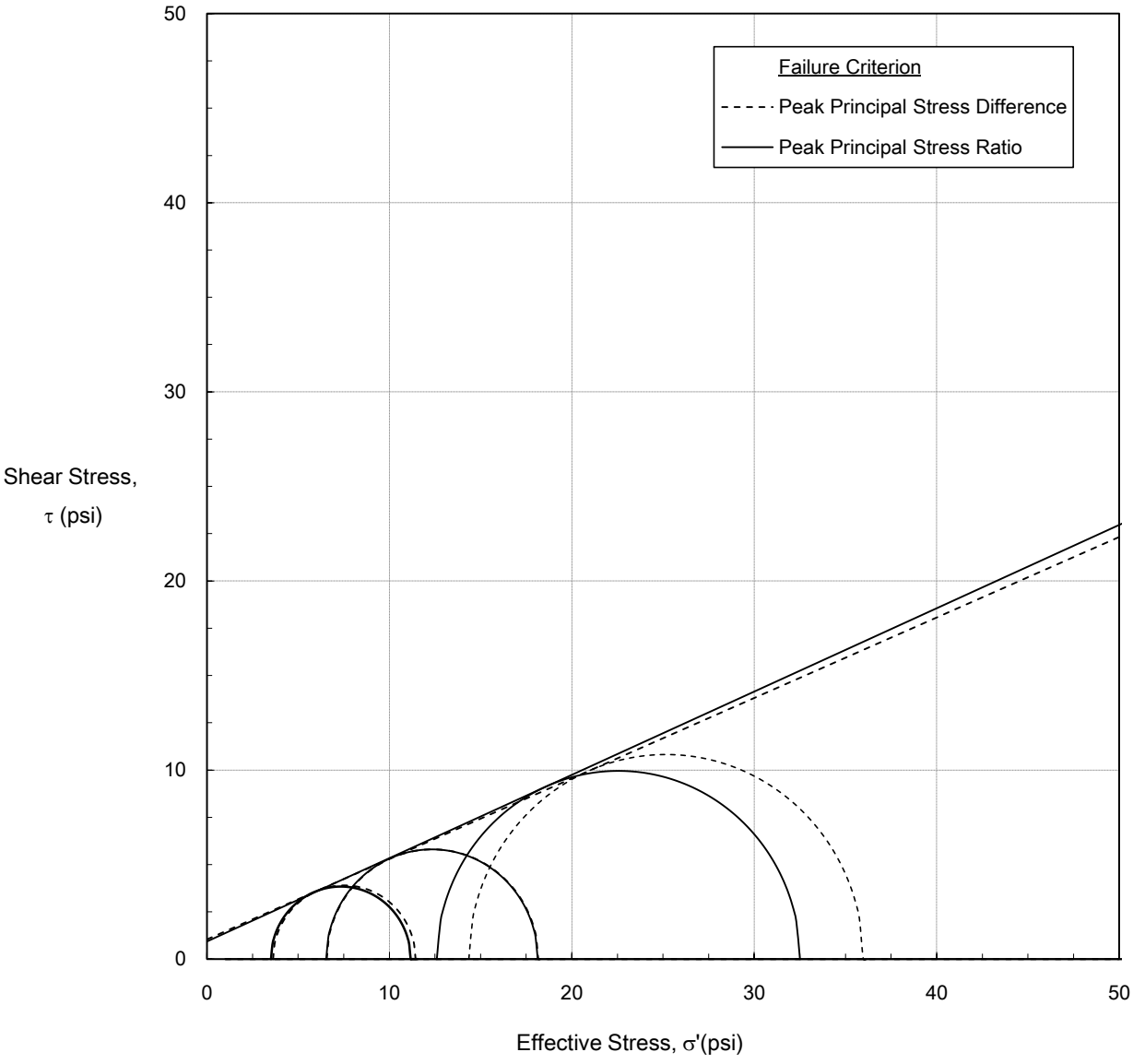
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (25.0)

TRI Log #: 66894.1
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	23.8
Effective Cohesion (psi)	-	0.9

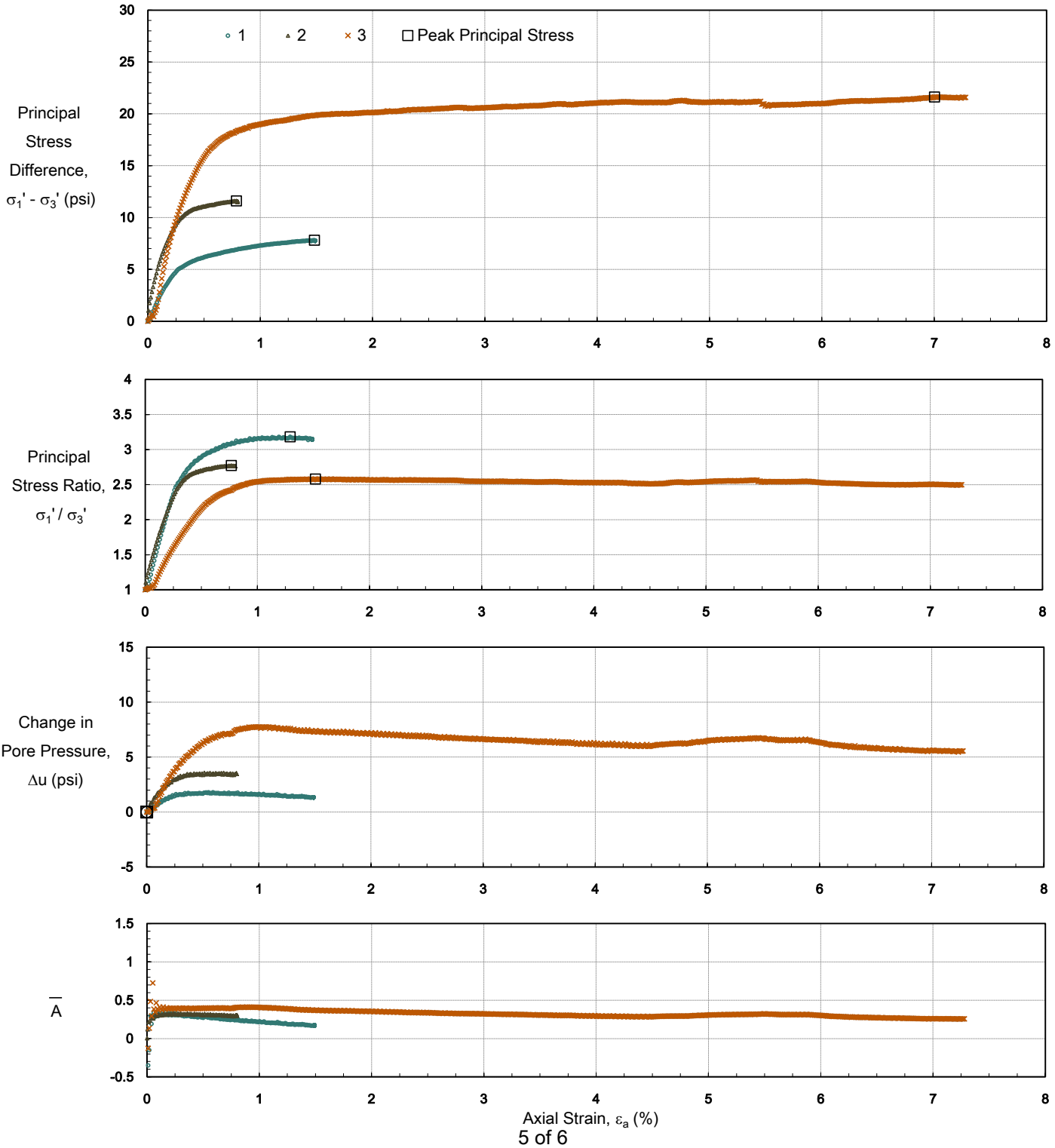
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (25.0)

TRI Log #: 66894.1
Test Method: ASTM D4767 Mod



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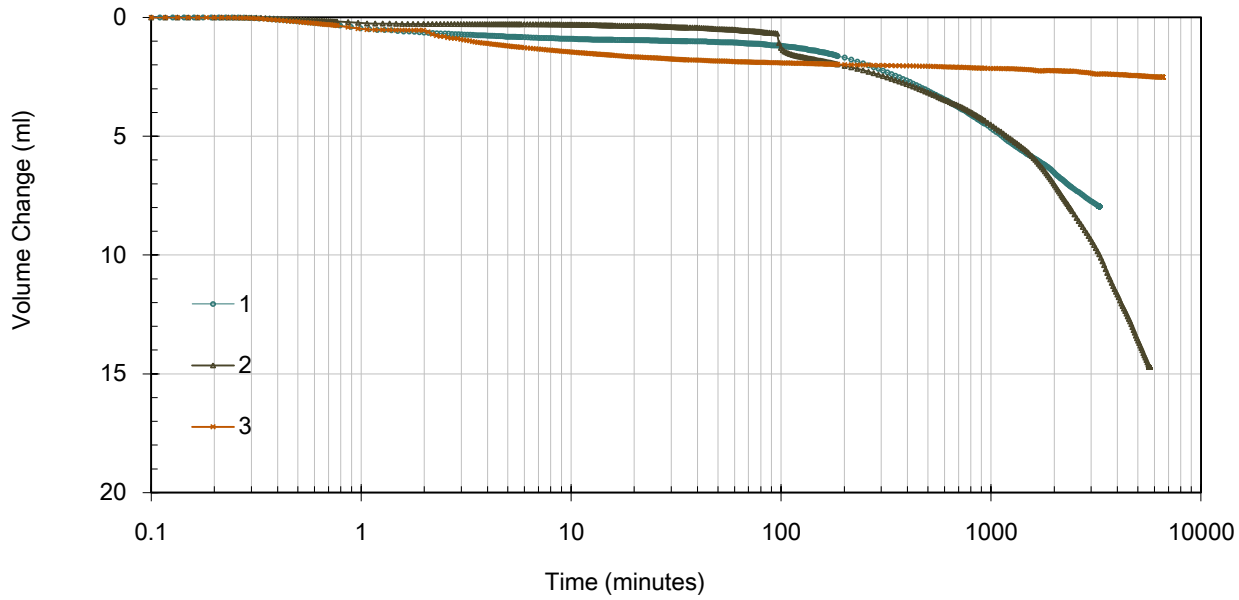
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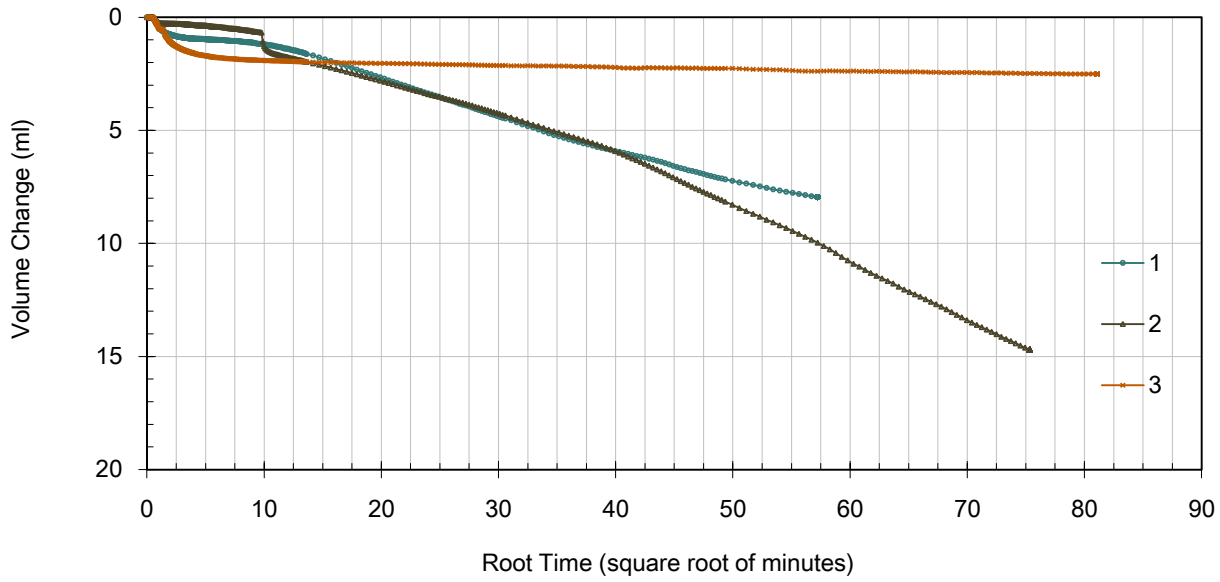
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-44 ST-1 (44.0)

TRI Log #: 66894.1
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (58.0)

TRI Log #: 66894.2
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	4.0	8.0	16.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.05	2.06	2.07	-
Avg. Height (in)	4.32	4.25	4.20	-
Avg. Water Content (%)	30.4	-	-	-
Bulk Density (pcf)	119.4	-	-	-
Dry Density (pcf)	91.6	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	95.7	-	-	-
Void Ratio, n	0.87	0.87	0.85	-
B-Value, End of Saturation	0.97	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.87	0.85	0.83	-

Shear / Post-Shear				
Rate of Strain (%/hr)	1.00	1.00	1.00	-
Avg. Water Content (%)	-	-	-67.7	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	0.4	1.1	4.2	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	2.9	6.2	12.1	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	7.9	11.6	18.6	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	1.2	1.8	3.8	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	10.8	17.7	30.7	-
Secant Friction Angle (degrees)	-	-	-	-	35.5	28.9	25.7	-
Effective Friction Angle (degrees)	-				21.4			
Effective Cohesion (psi)	-				1.6			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
Analysis & Quality Review/Date

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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (20.0)

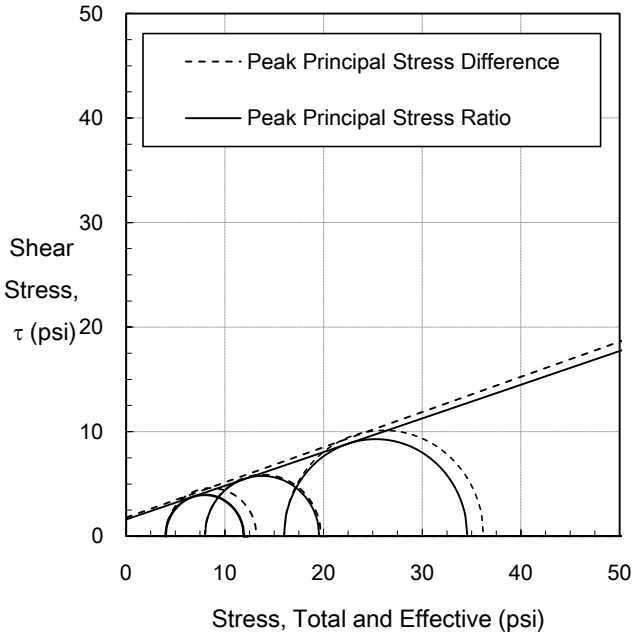
TRI Log #: 66894.2
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	18.6	17.9
Cohesion (psi)	c_R	1.8	1.6

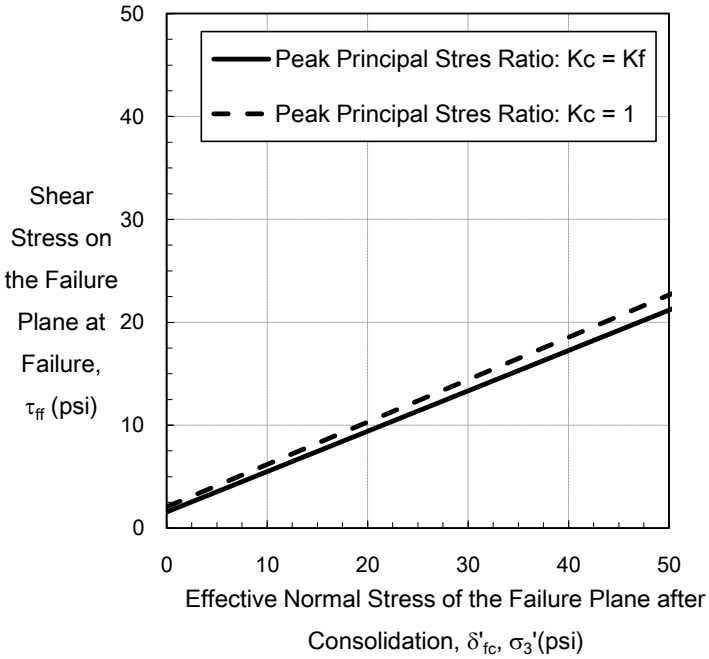
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	20.5	21.4
Effective Cohesion (psi)	c'	1.8	1.6

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	23.7	22.4
Cohesion (psi)	$\psi_{Kc=1}$	2.3	2.1

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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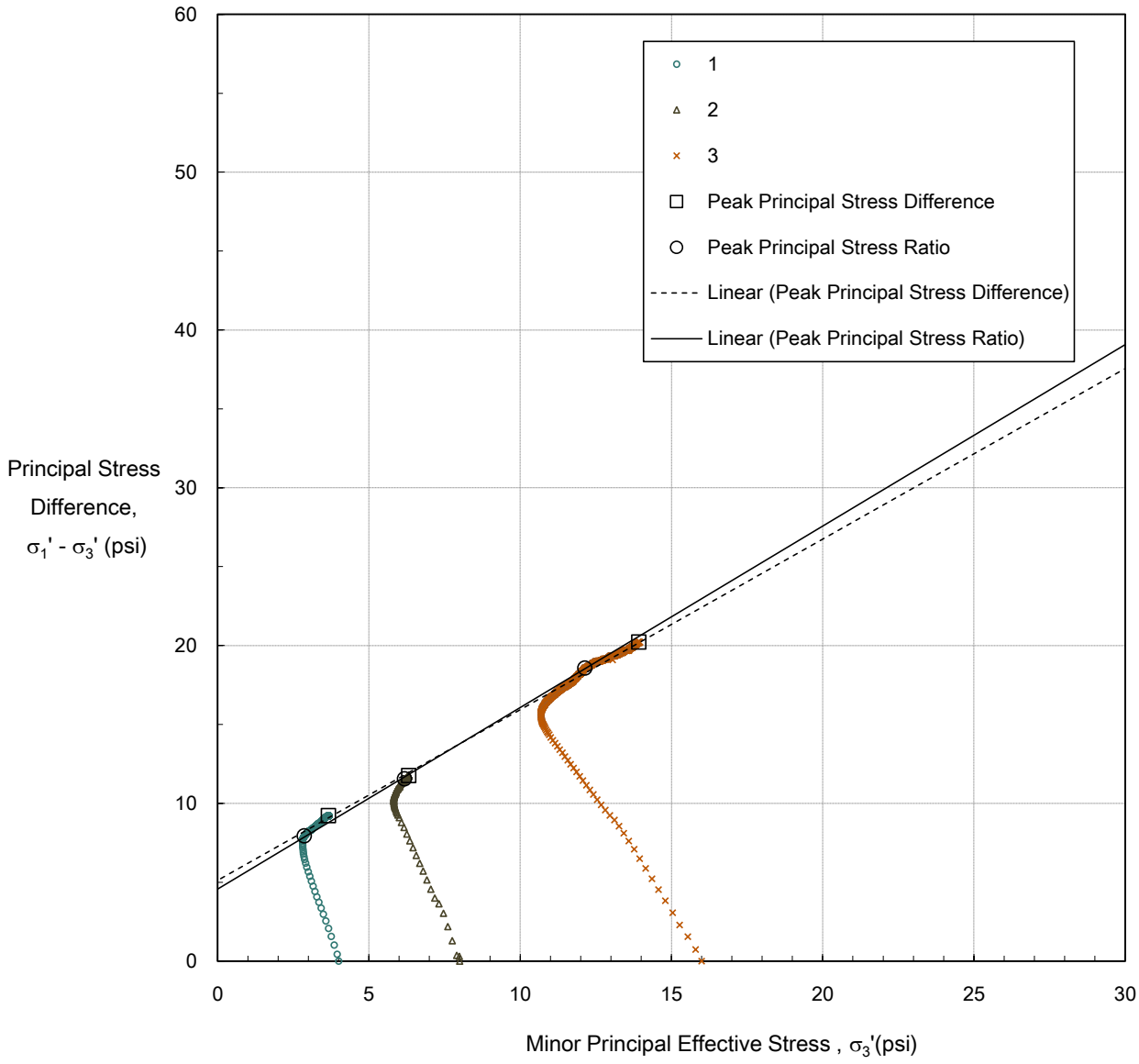
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (20.0)

TRI Log #: 66894.2
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	21.4
Effective Cohesion (psi)	-	1.6

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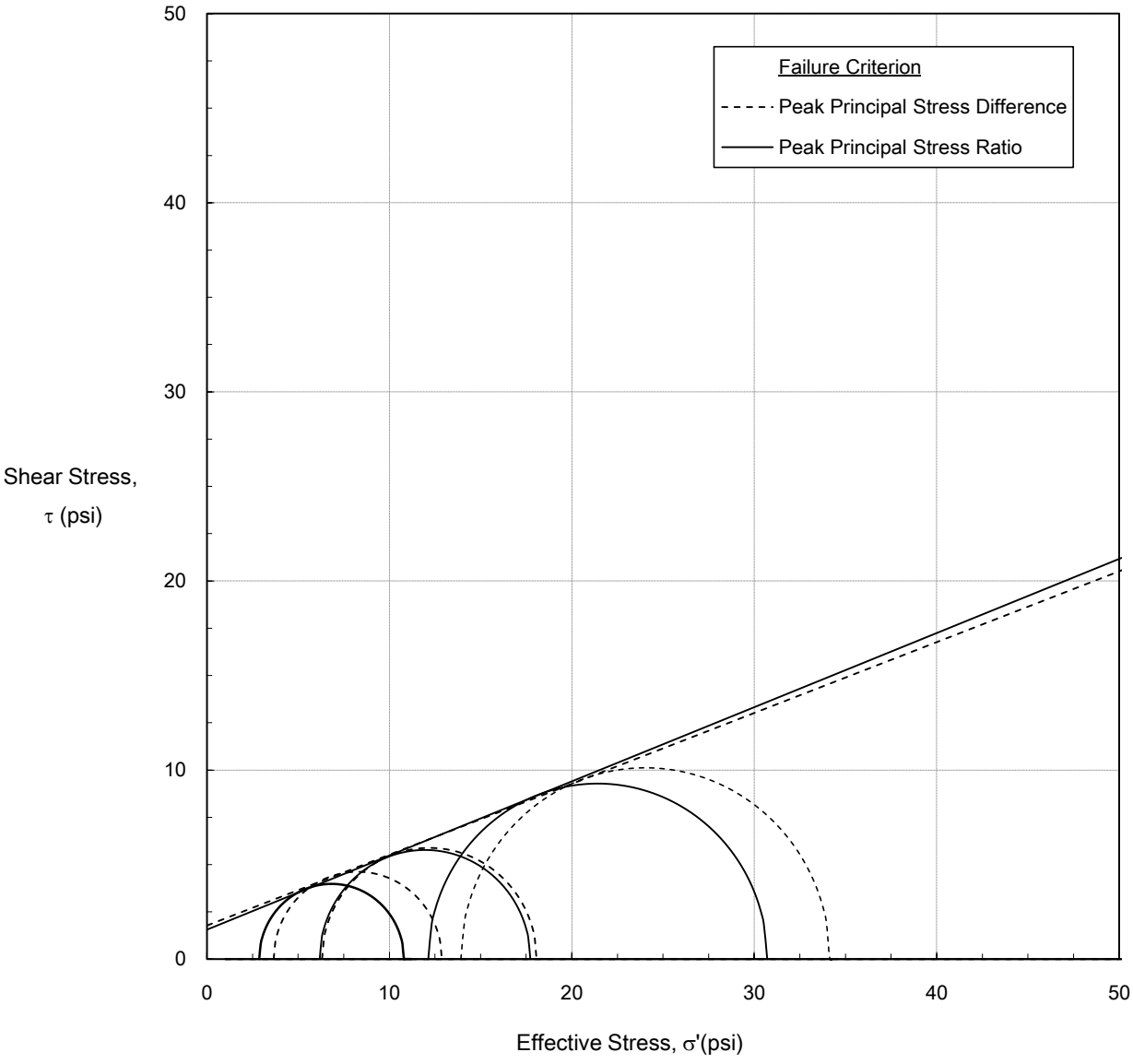
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (20.0)

TRI Log #: 66894.2
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	21.4
Effective Cohesion (psi)	-	1.6

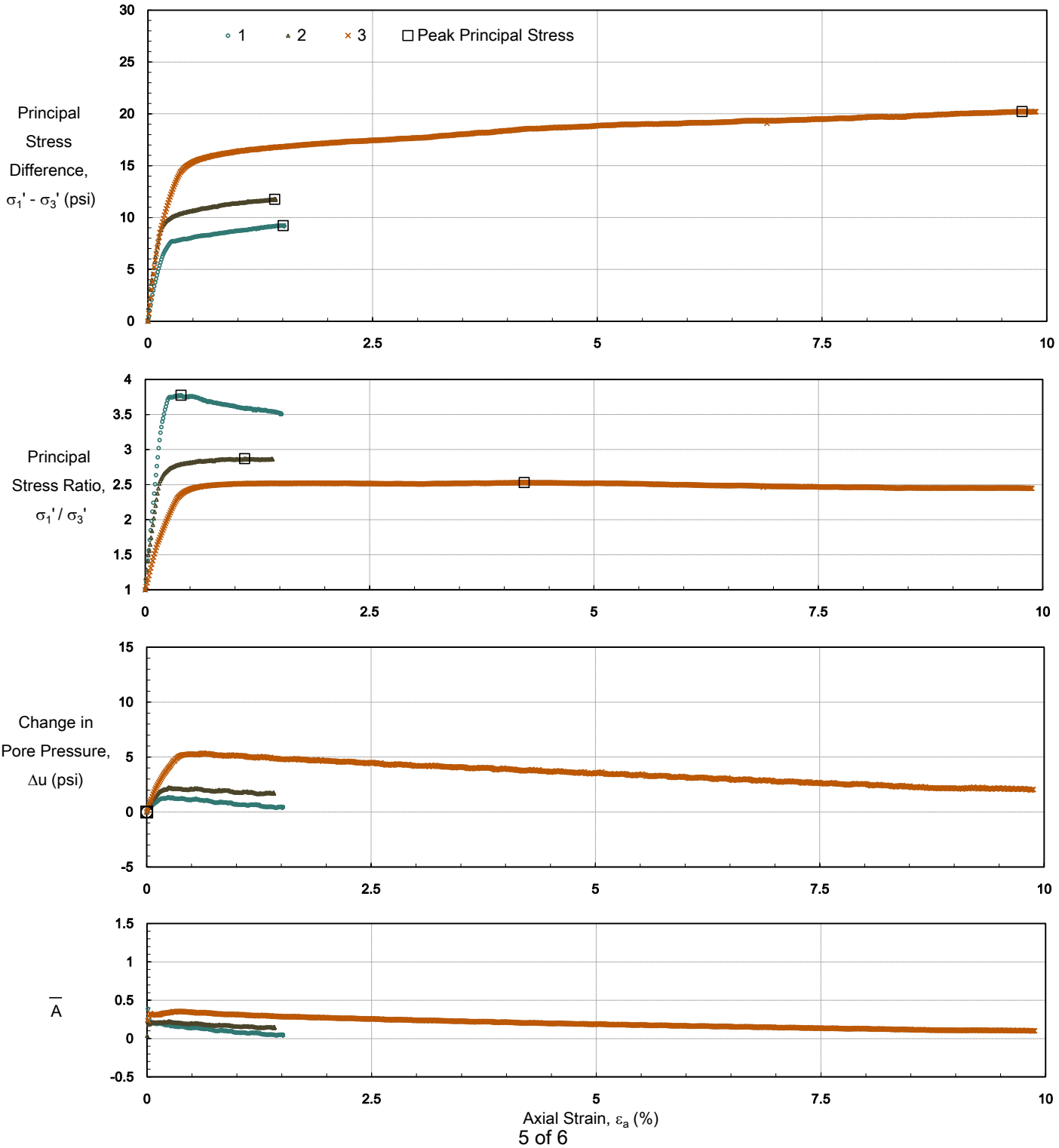
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (20.0)

TRI Log #: 66894.2
Test Method: ASTM D4767 Mod



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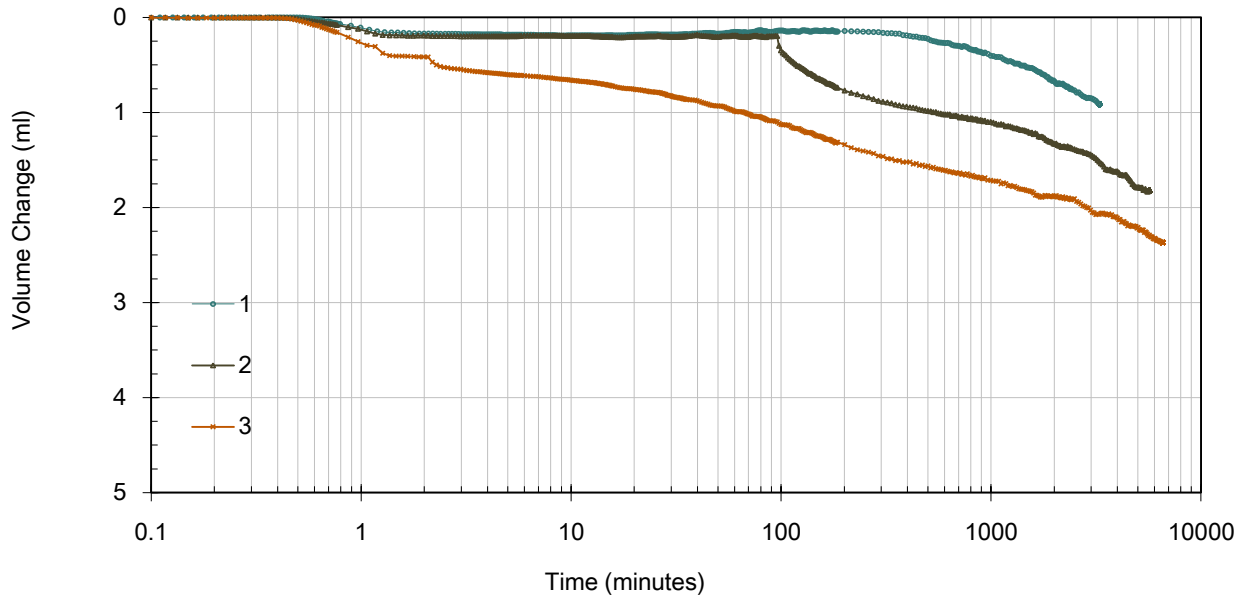
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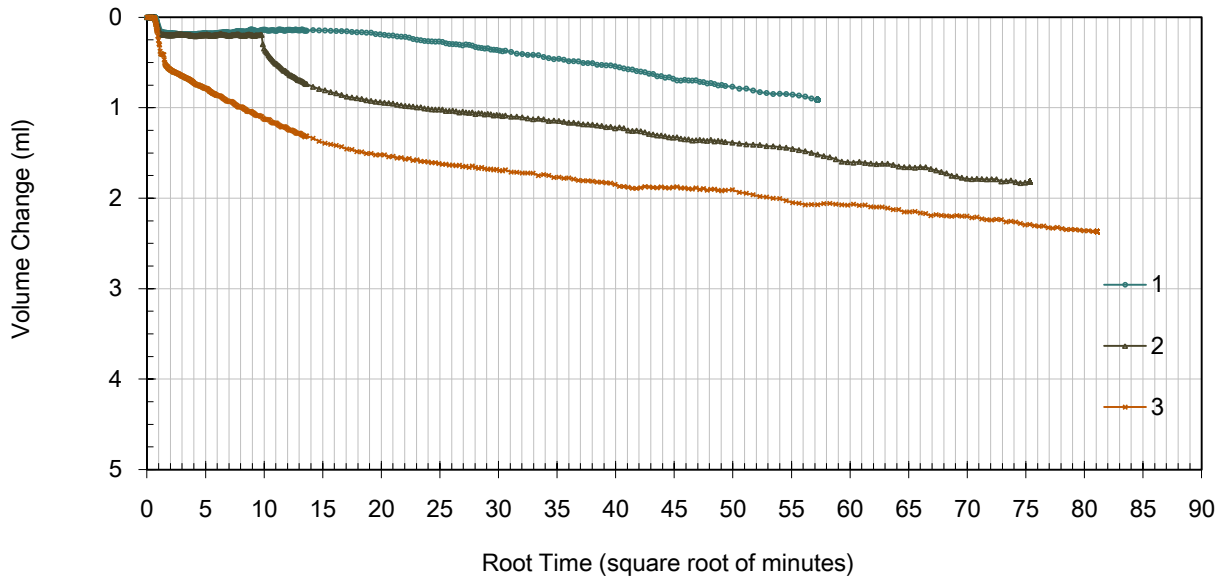
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-52 ST-1 (20.0)

TRI Log #: 66894.2
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

TRI Log #: 66894.3
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	5.0	10.0	20.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.03	2.05	2.03	-
Avg. Height (in)	4.28	4.13	4.08	-
Avg. Water Content (%)	18.0	-	-	-
Bulk Density (pcf)	127.9	-	-	-
Dry Density (pcf)	108.4	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	84.7	-	-	-
Void Ratio, n	0.58	0.55	0.51	-
B-Value, End of Saturation	0.00	-	0.96	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.55	0.51	0.49	-

Shear / Post-Shear				
Rate of Strain (%/hr)	0.06	0.06	0.06	-
Avg. Water Content (%)	-	-	19.8	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.9	1.5	3.0	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	4.5	8.7	19.0	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	16.3	24.2	41.5	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	0.5	1.4	0.9	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	20.8	32.9	60.5	-
Secant Friction Angle (degrees)	-	-	-	-	40.3	35.6	31.4	-
Effective Friction Angle (degrees)	-				27.5			
Effective Cohesion (psi)	-				2.7			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

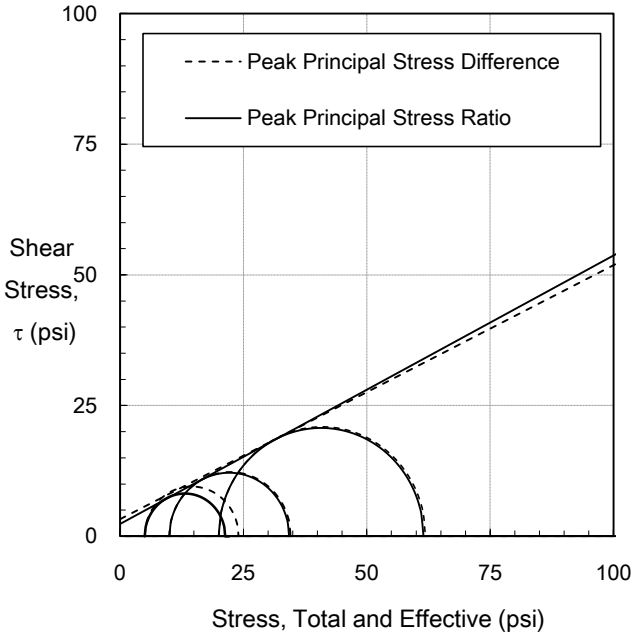
TRI Log #: 66894.3
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	25.9	27.2
Cohesion (psi)	c_R	3.2	2.4

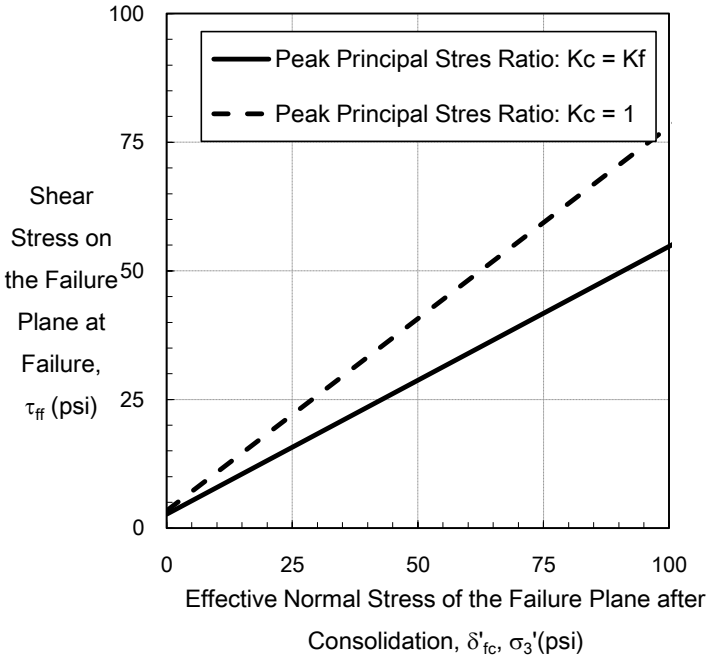
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	26.8	27.5
Effective Cohesion (psi)	c'	3.0	2.7

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	34.7	36.7
Cohesion (psi)	$\psi_{Kc=1}$	4.6	3.4

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



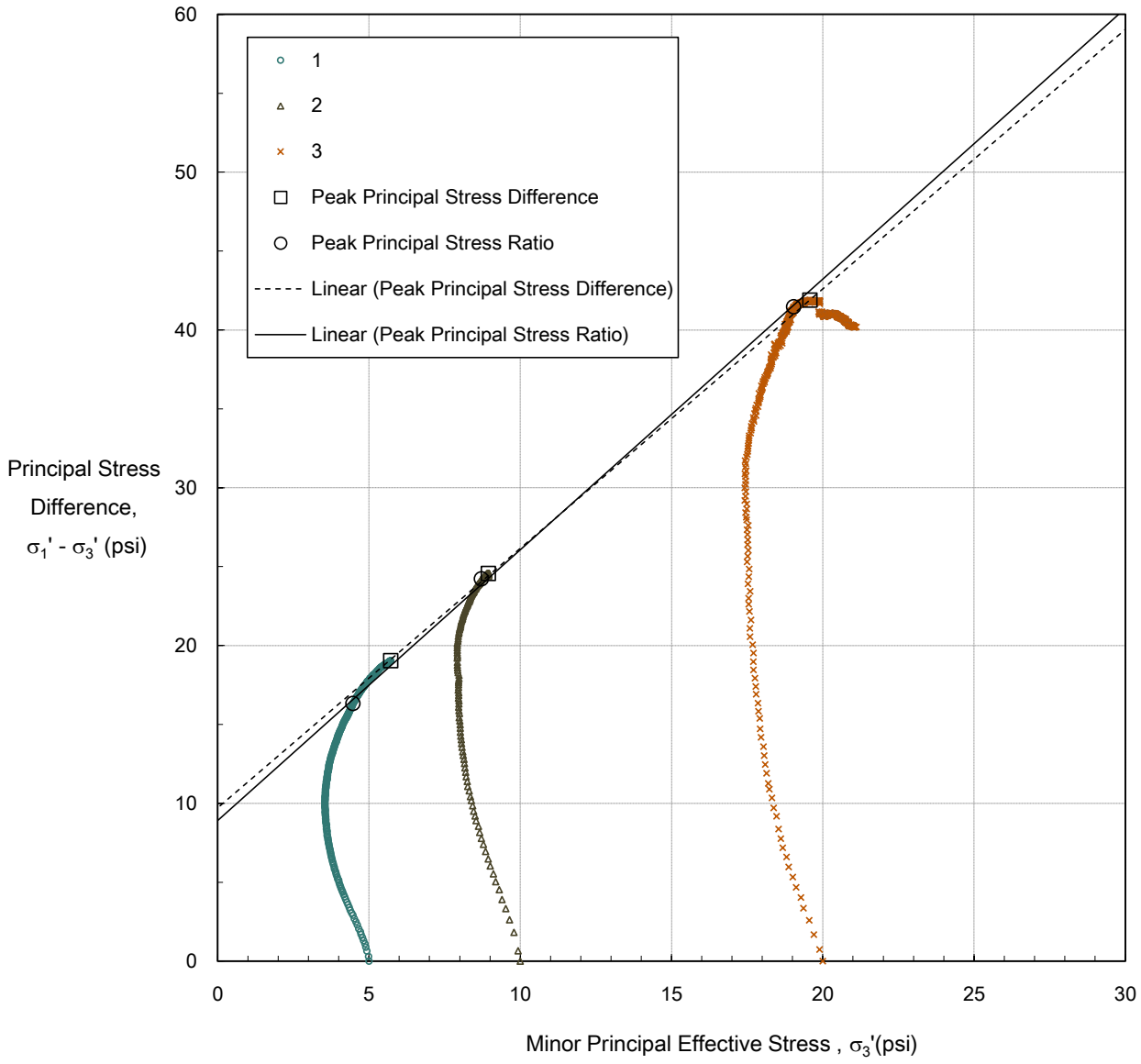
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

TRI Log #: 66894.3
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	27.5
Effective Cohesion (psi)	-	2.7

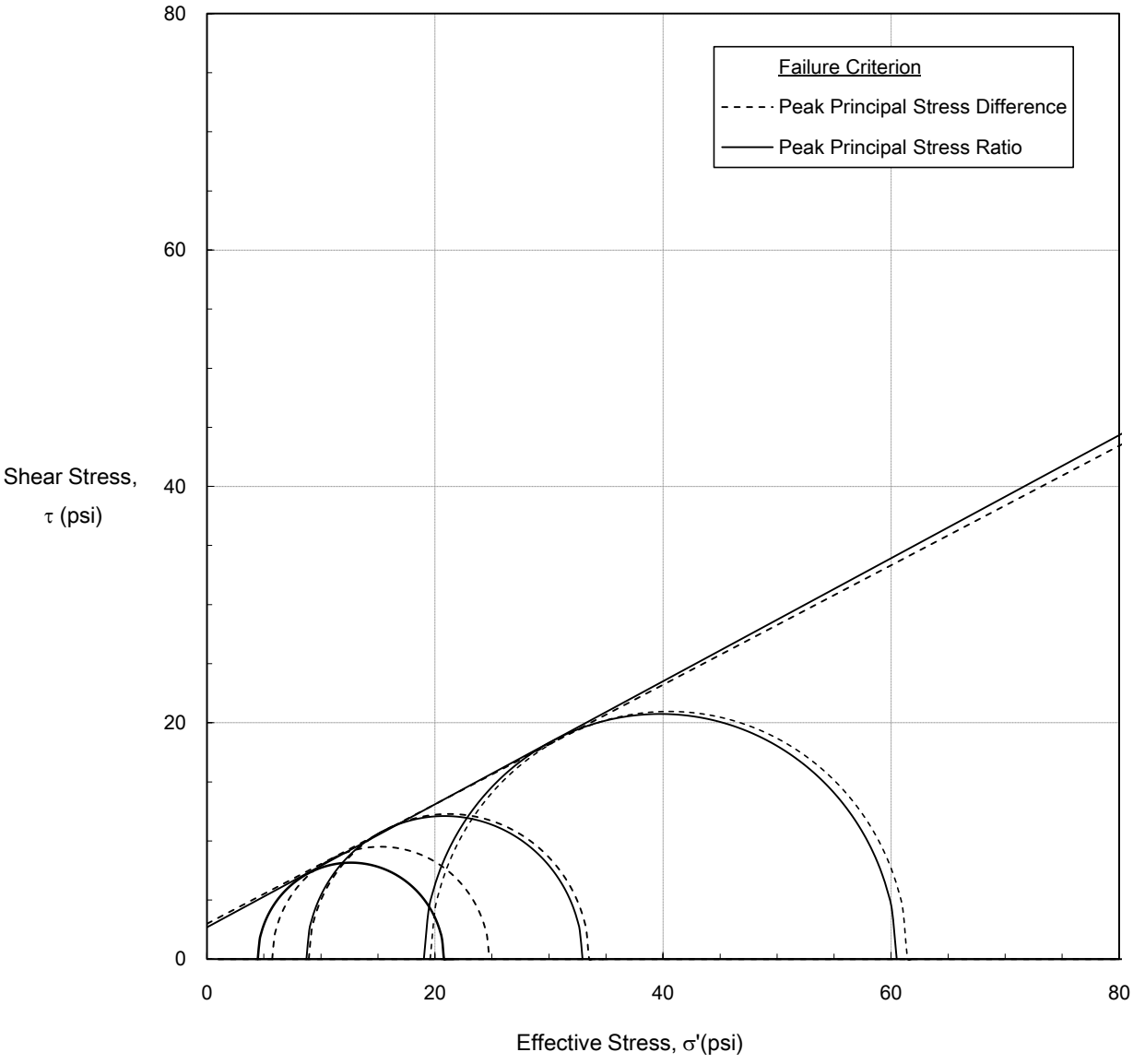
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

TRI Log #: 66894.3
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	27.5
Effective Cohesion (psi)	-	2.7

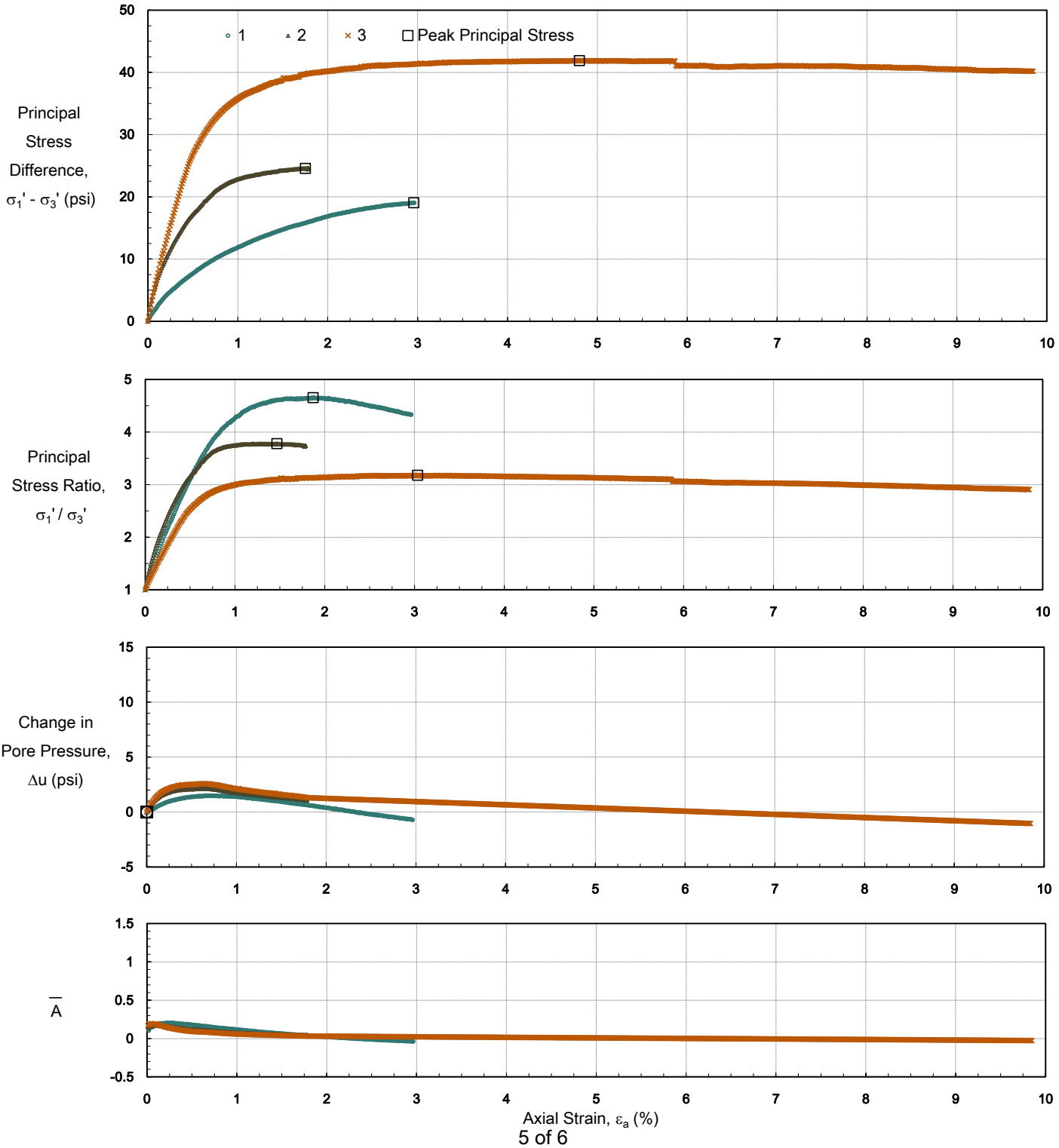
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

TRI Log #: 66894.3
Test Method: ASTM D4767 Mod



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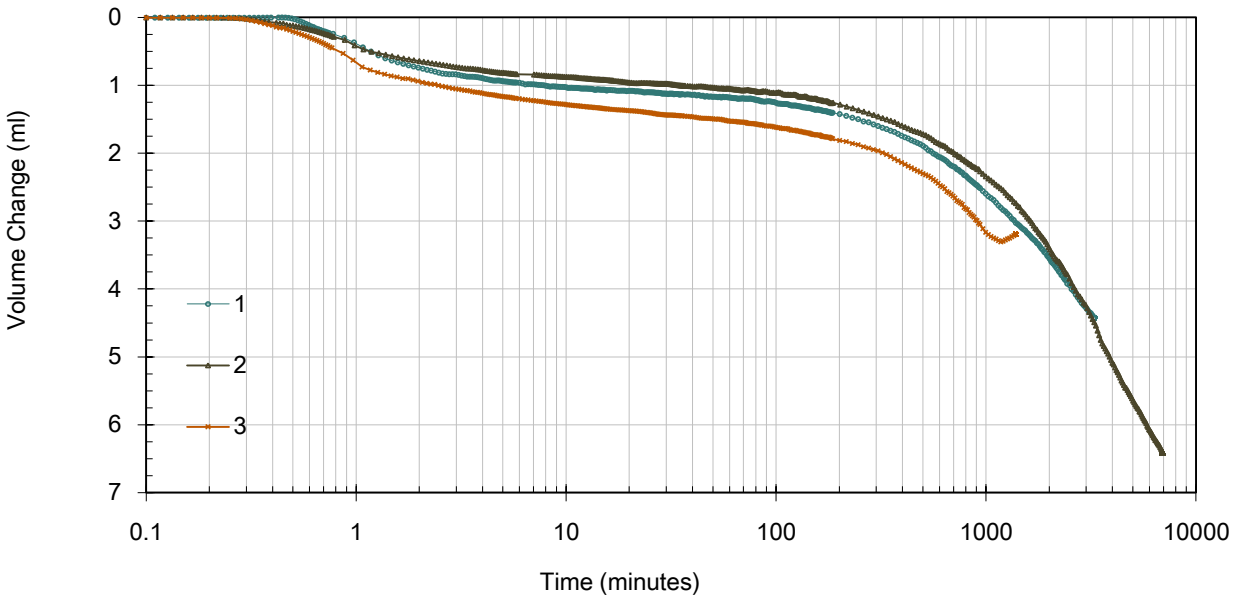
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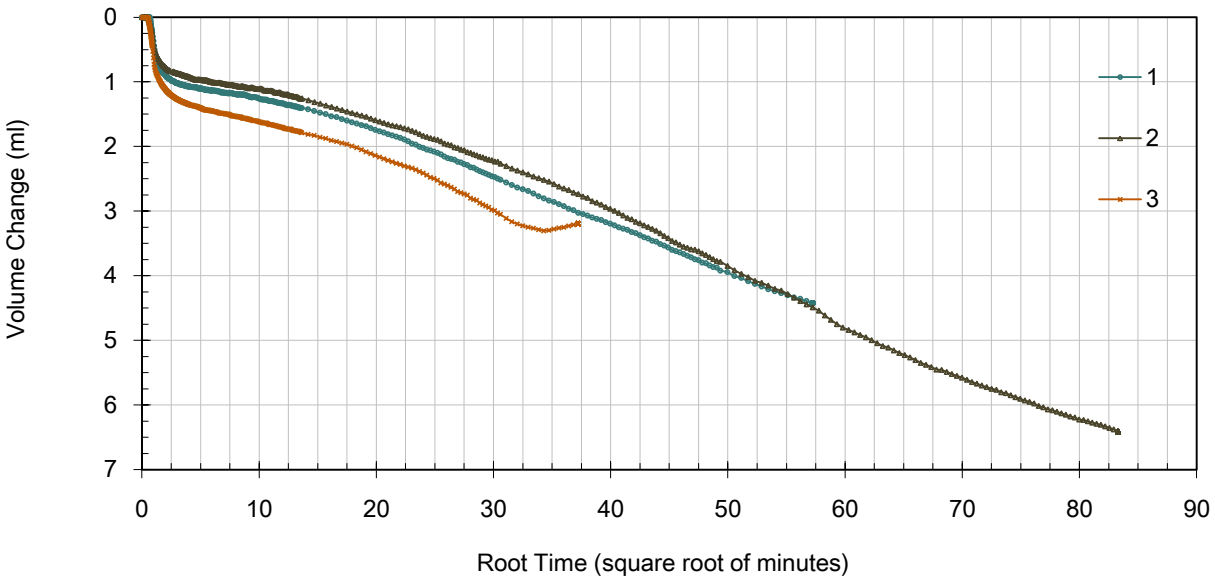
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-59 ST-3 (27.5)

TRI Log #: 66894.3
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

TRI Log #: 66894.4
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	5.0	10.0	20.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.03	2.04	2.05	-
Avg. Height (in)	4.24	4.18	4.15	-
Avg. Water Content (%)	26.5	-	-	-
Bulk Density (pcf)	123.1	-	-	-
Dry Density (pcf)	97.3	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	95.6	-	-	-
Void Ratio, n	0.76	0.76	0.75	-
B-Value, End of Saturation	0.99	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.76	0.75	0.73	-

Shear / Post-Shear				
Rate of Strain (%/hr)	1.00	1.00	1.00	-
Avg. Water Content (%)	-	-	30.1	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.1	1.3	2.1	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	3.8	7.0	12.9	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	7.3	11.5	21.8	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	1.3	3.0	7.1	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	11.1	18.5	34.6	-
Secant Friction Angle (degrees)	-	-	-	-	29.4	26.9	27.3	-
Effective Friction Angle (degrees)	-				26.5			
Effective Cohesion (psi)	-				0.3			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

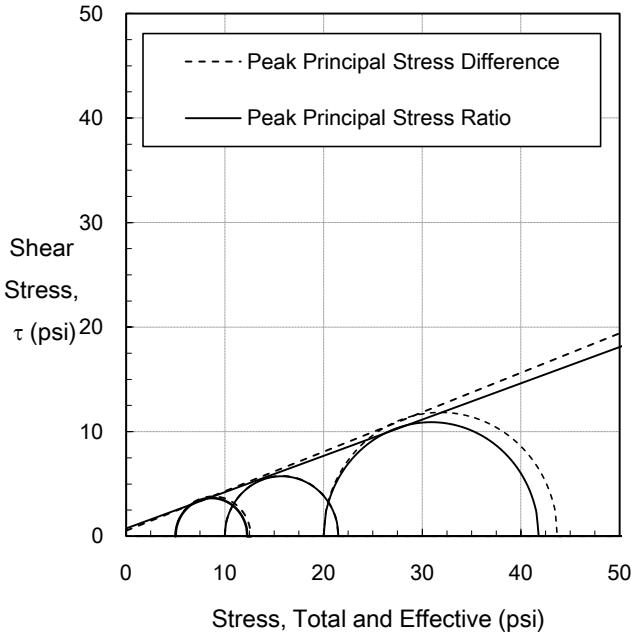
TRI Log #: 66894.4
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	20.7	19.1
Cohesion (psi)	c_R	0.5	0.8

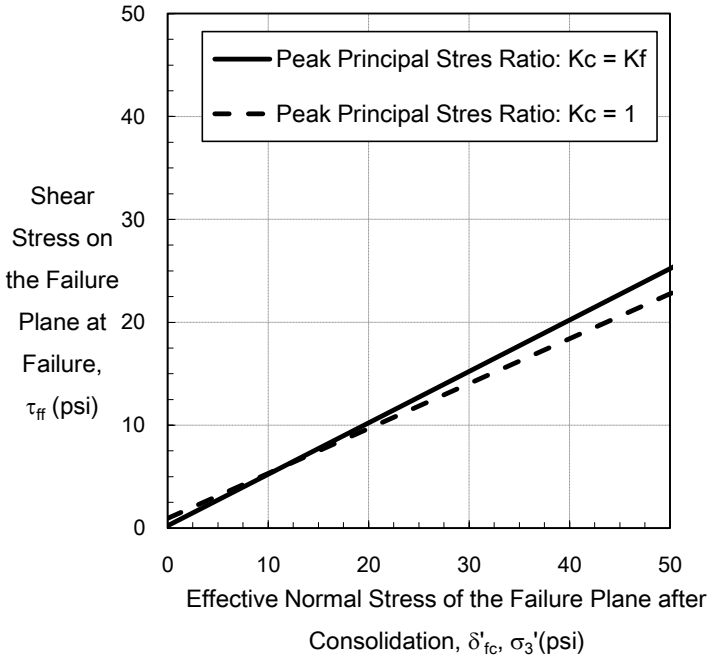
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	23.7	26.5
Effective Cohesion (psi)	c'	0.7	0.3

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	26.6	23.6
Cohesion (psi)	$\psi_{Kc=1}$	0.7	1.0

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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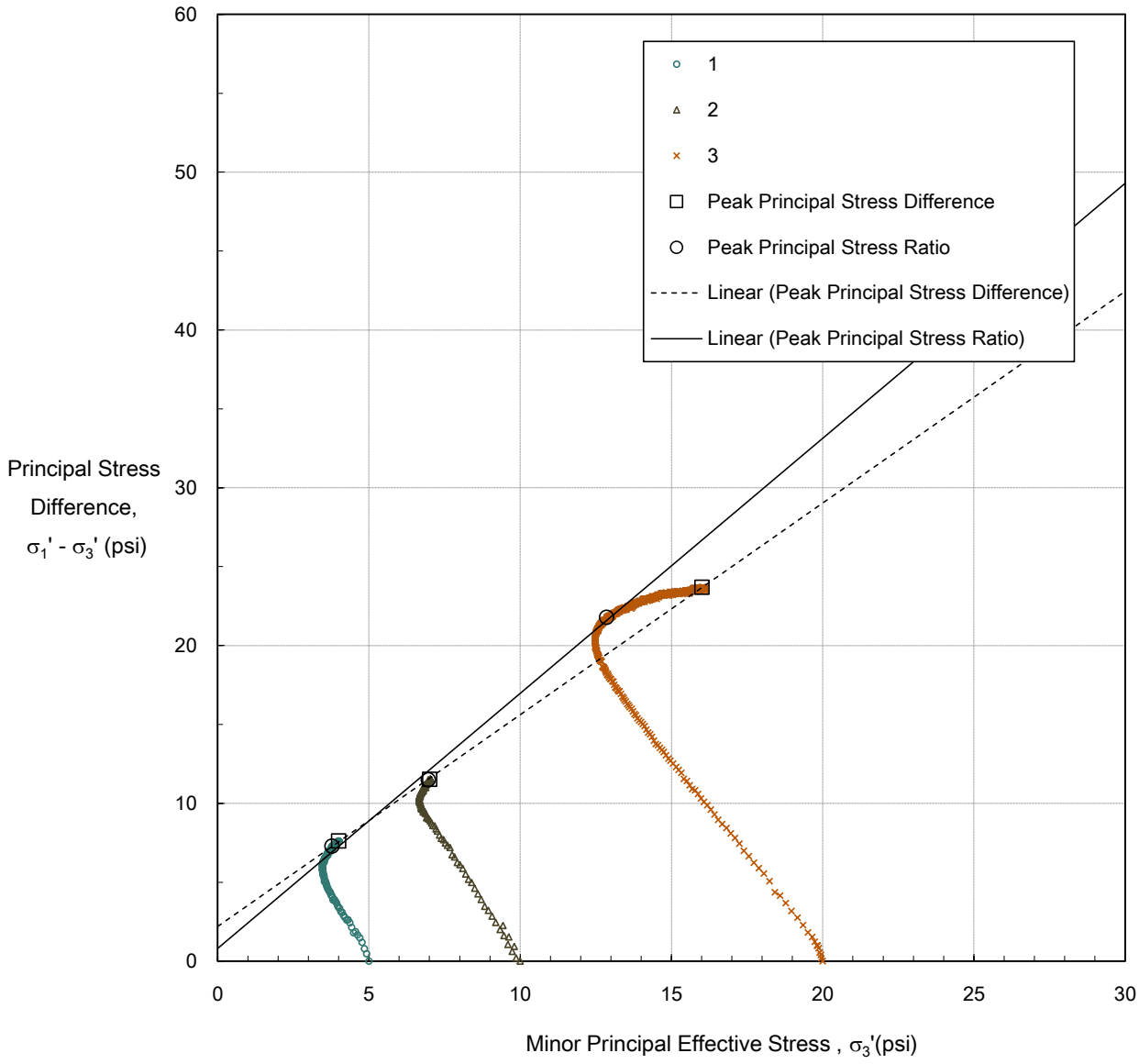
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

TRI Log #: 66894.4
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	26.5
Effective Cohesion (psi)	-	0.3

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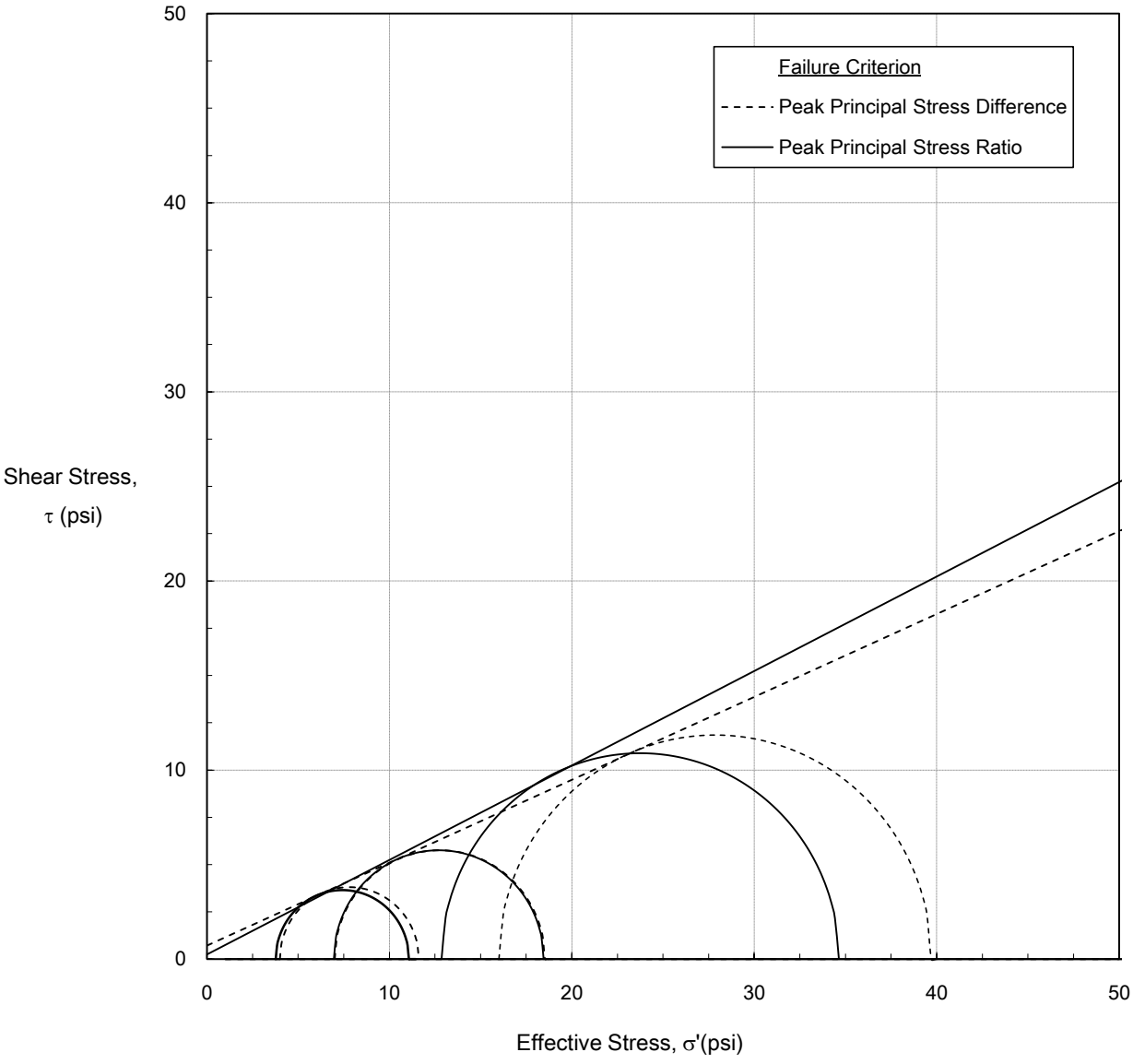
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

TRI Log #: 66894.4
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	26.5
Effective Cohesion (psi)	-	0.3

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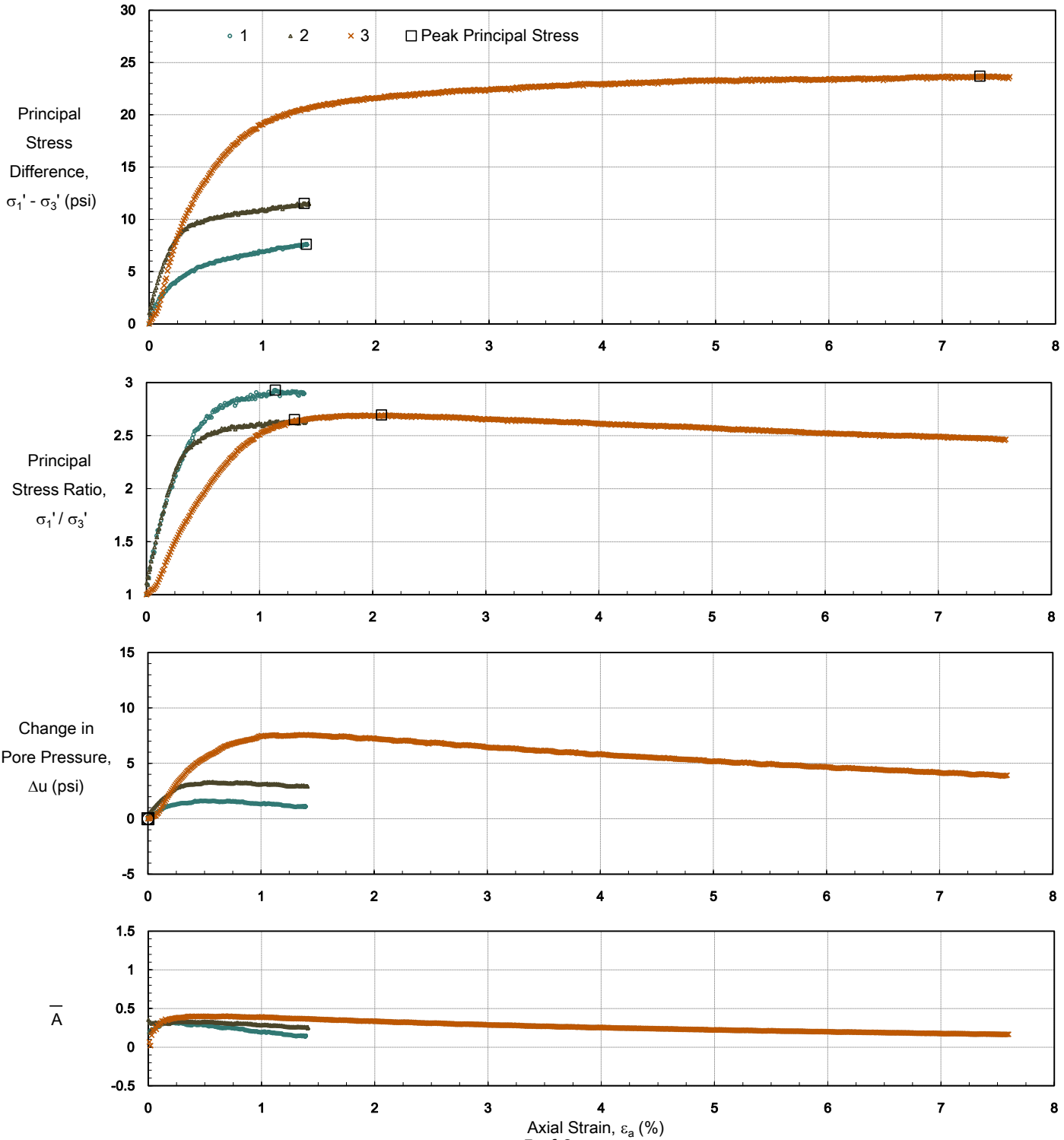
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

TRI Log #: 66894.4
Test Method: ASTM D4767 Mod



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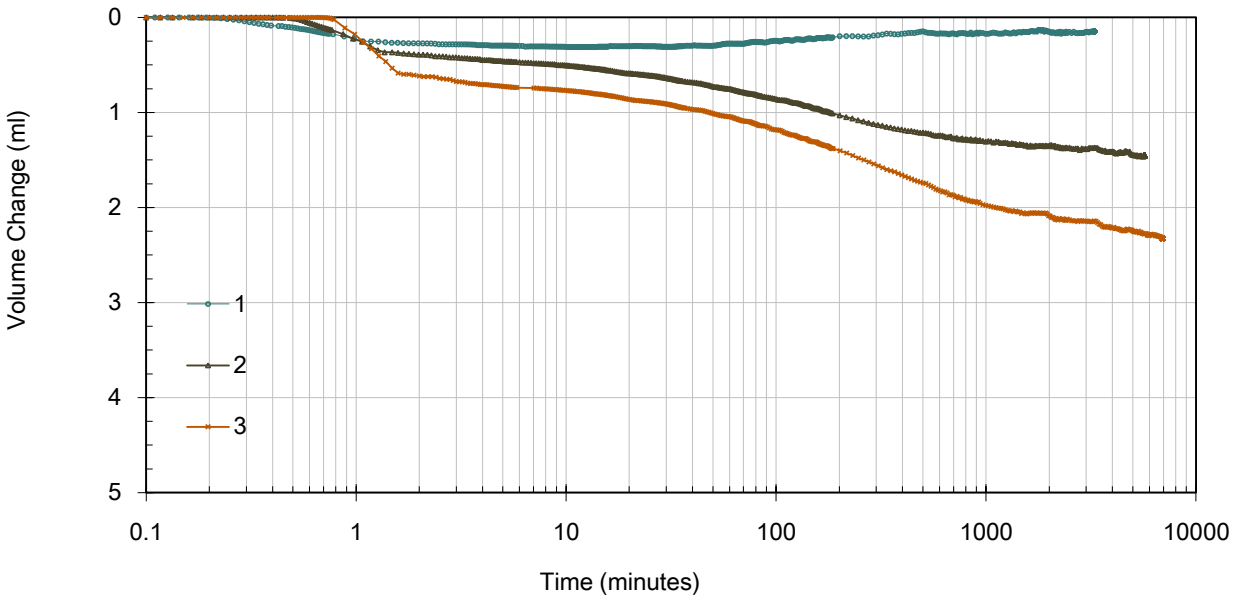
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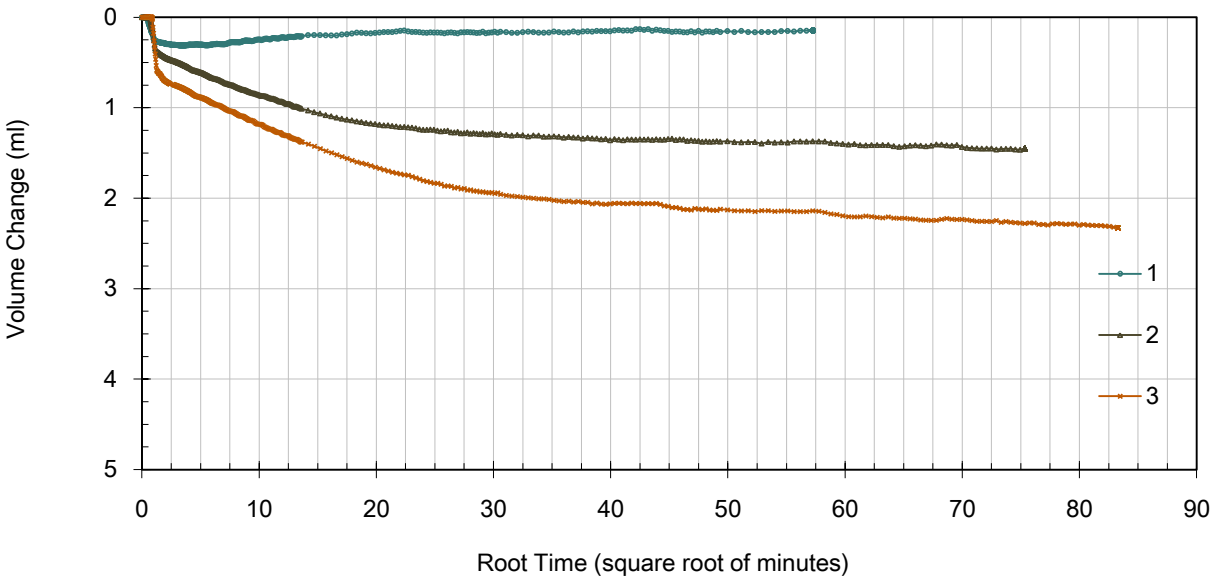
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-60 ST-4 (22.0)

TRI Log #: 66894.4
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

TRI Log #: 66894.5
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	7.0	14.0	28.0	-
Initial Specimen Properties				
Avg. Diameter (in)	1.99	2.00	2.01	-
Avg. Height (in)	4.26	4.19	4.11	-
Avg. Water Content (%)	23.3	-	-	-
Bulk Density (pcf)	123.0	-	-	-
Dry Density (pcf)	99.8	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	89.1	-	-	-
Void Ratio, n	0.72	0.70	0.68	-
B-Value, End of Saturation	0.99	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.70	0.68	0.65	-

Shear / Post-Shear				
Rate of Strain (%/hr)	0.07	0.07	0.07	-
Avg. Water Content (%)	-	-	21.3	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.1	0.9	4.2	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	5.2	9.5	18.2	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	8.5	12.7	19.1	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	1.8	4.4	7.5	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	13.7	22.3	37.3	-
Secant Friction Angle (degrees)	-	-	-	-	26.7	23.7	20.1	-
Effective Friction Angle (degrees)	-				16.6			
Effective Cohesion (psi)	-				1.7			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

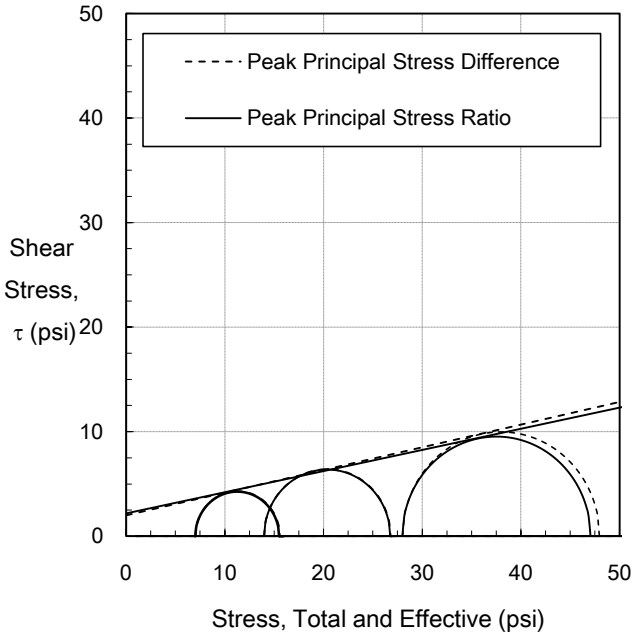
TRI Log #: 66894.5
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	12.2	11.4
Cohesion (psi)	c_R	2.0	2.2

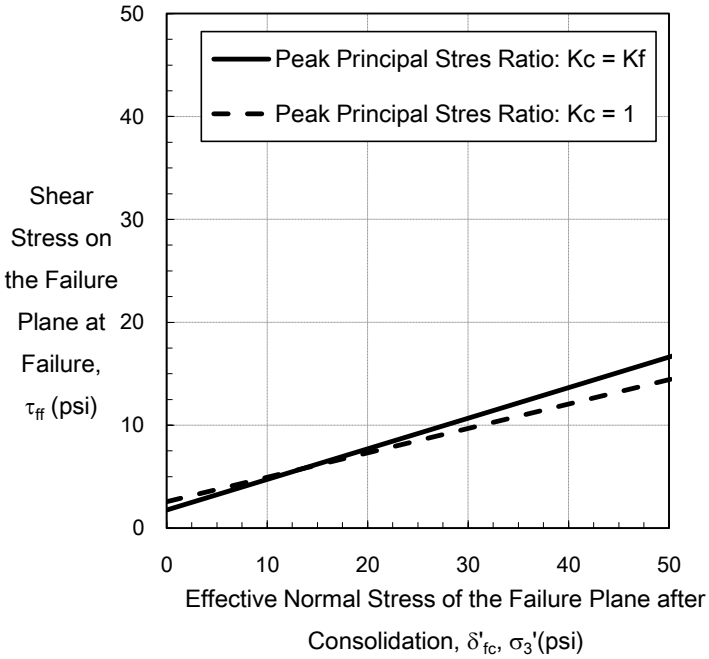
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	16.3	16.6
Effective Cohesion (psi)	c'	1.8	1.7

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	14.5	13.3
Cohesion (psi)	$\psi_{Kc=1}$	2.4	2.6

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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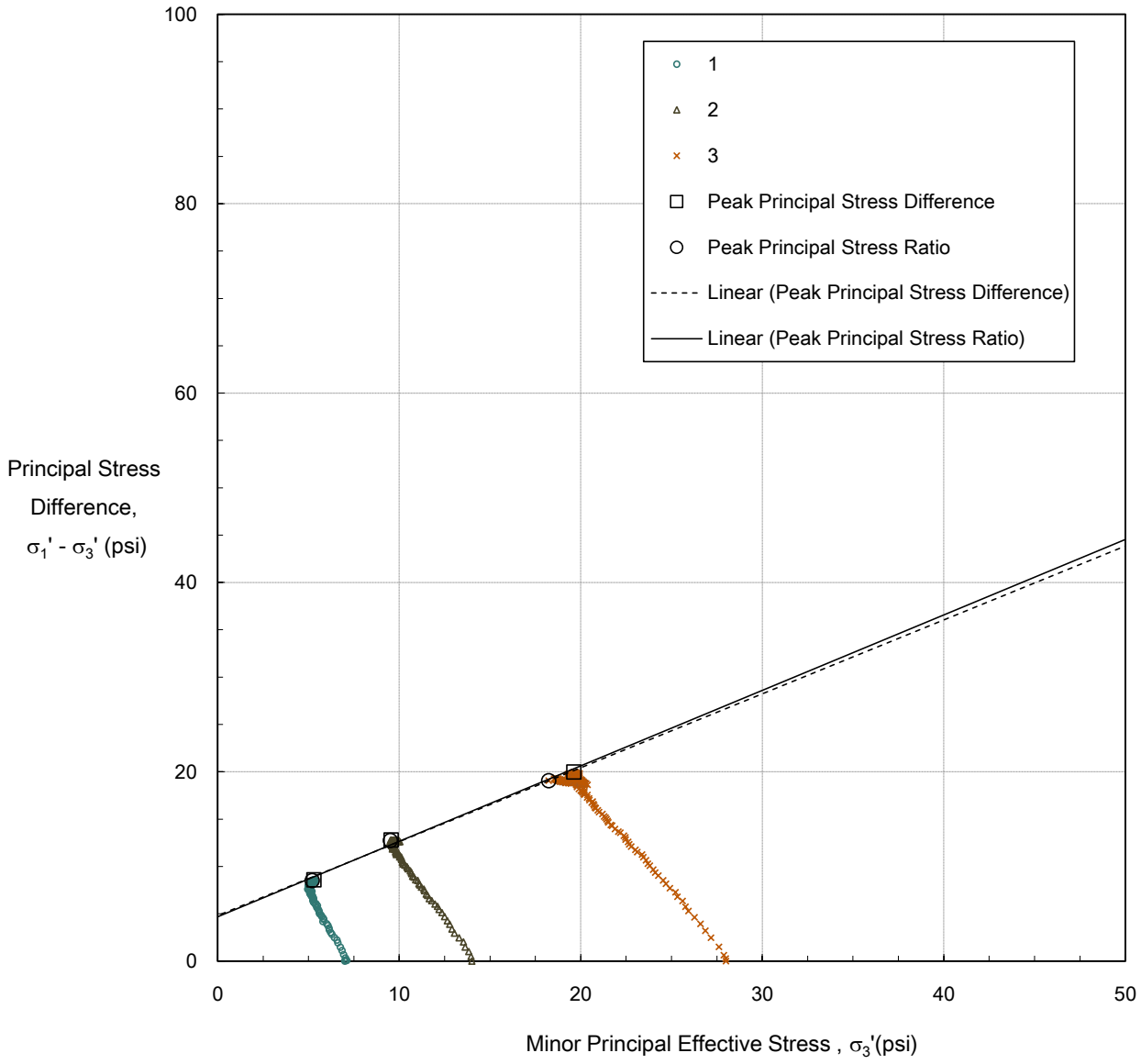
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

TRI Log #: 66894.5
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	16.6
Effective Cohesion (psi)	-	1.7

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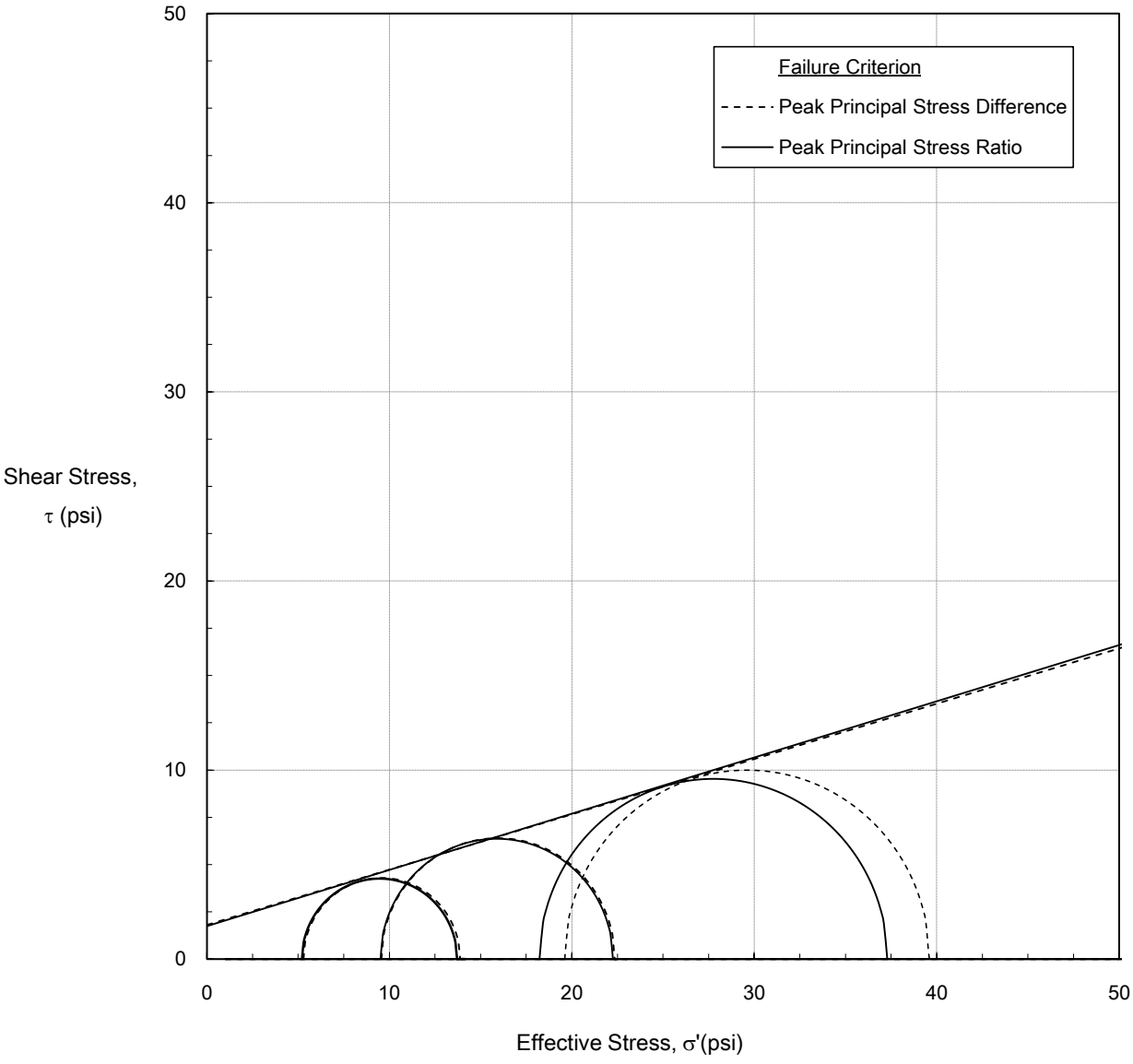
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

TRI Log #: 66894.5
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	16.6
Effective Cohesion (psi)	-	1.7

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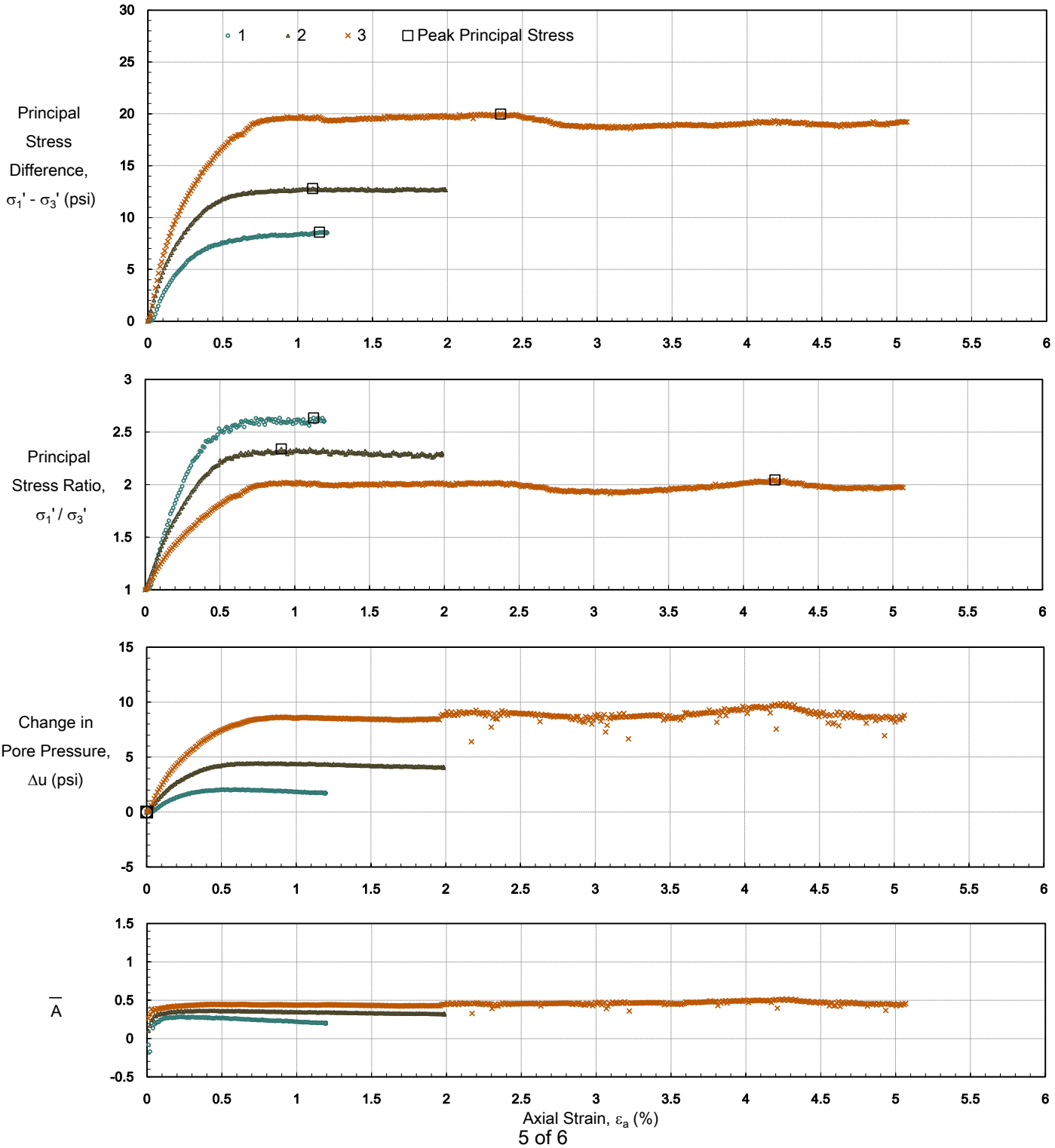
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

TRI Log #: 66894.5
Test Method: ASTM D4767 Mod



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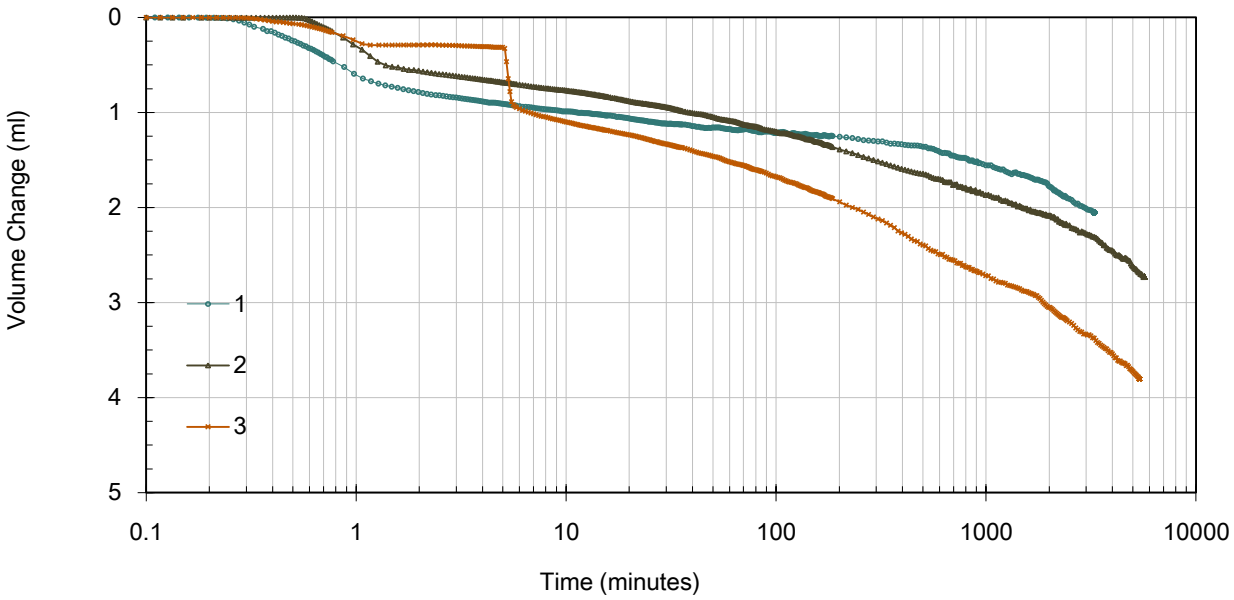
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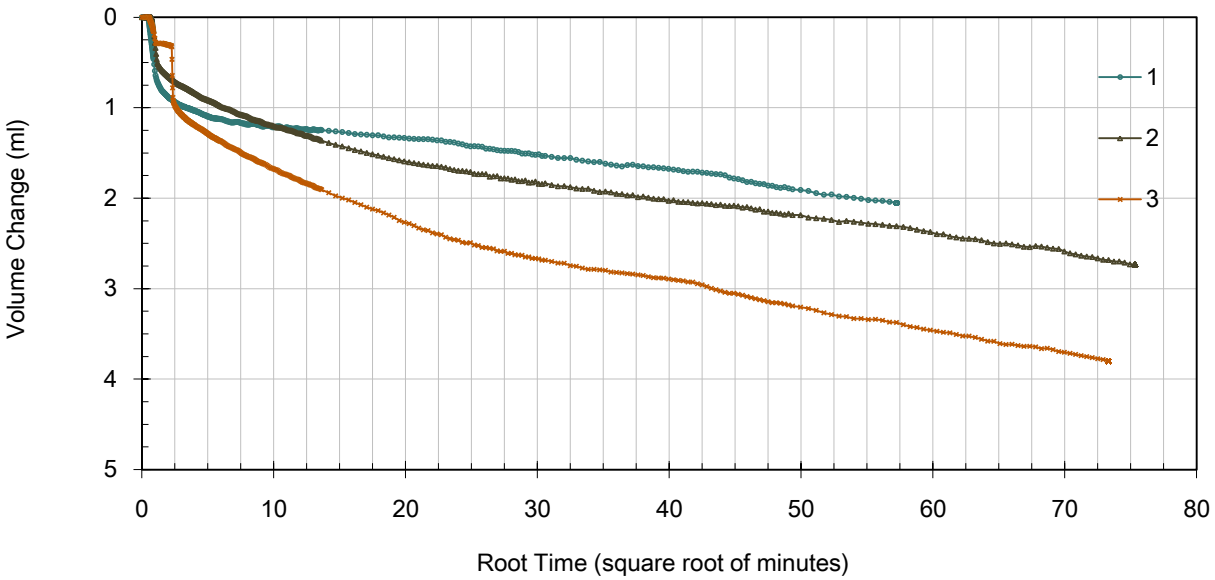
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-61 ST-5 (40.0)

TRI Log #: 66894.5
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-62 ST-2 (54.5)

TRI Log #: 66894.6
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	7.0	14.0	28.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.04	2.04	2.11	-
Avg. Height (in)	4.30	4.21	3.63	-
Avg. Water Content (%)	28.4	-	-	-
Bulk Density (pcf)	123.2	-	-	-
Dry Density (pcf)	95.9	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	99.0	-	-	-
Void Ratio, n	0.79	0.74	0.60	-
B-Value, End of Saturation	0.98	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.74	0.60	0.44	-

Shear / Post-Shear				
Rate of Strain (%/hr)	0.10	0.10	0.10	-
Avg. Water Content (%)	-	-	23.7	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.7	2.1	4.8	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	3.6	8.2	16.3	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	14.3	25.4	37.7	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	3.5	5.8	11.7	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	17.9	33.6	54.0	-
Secant Friction Angle (degrees)	-	-	-	-	41.8	37.4	32.4	-
Effective Friction Angle (degrees)	-				28.2			
Effective Cohesion (psi)	-				2.7			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

Jeffrey A. Kuhn , Ph.D., P.E., 10/27/2021
Analysis & Quality Review/Date

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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-62 ST-2 (37.5)

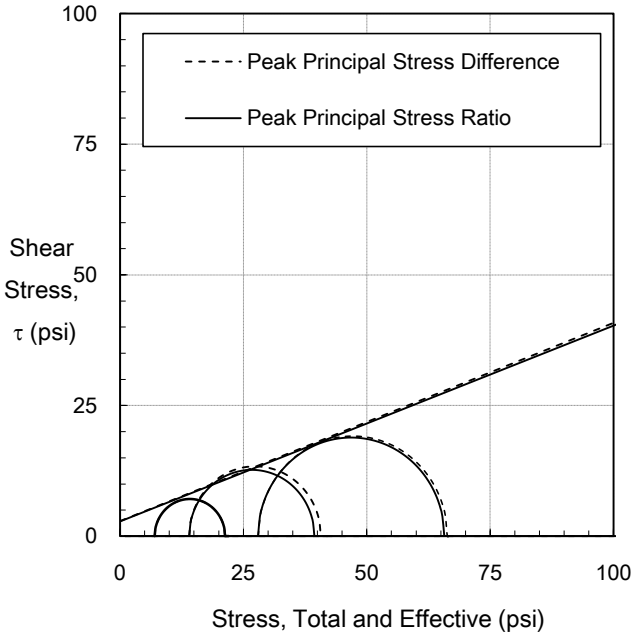
TRI Log #: 66894.6
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	20.8	20.5
Cohesion (psi)	c_R	2.9	2.8

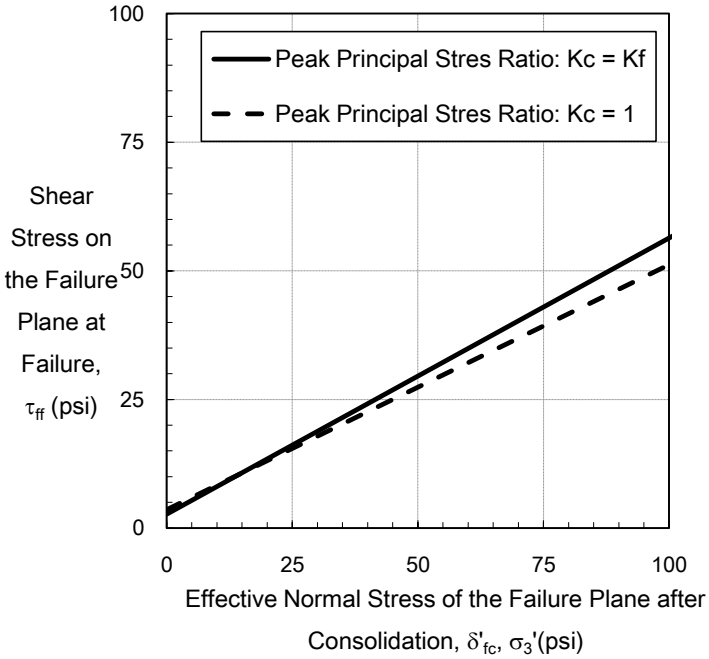
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	28.2	28.2
Effective Cohesion (psi)	c'	2.7	2.7

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	25.8	25.5
Cohesion (psi)	$\psi_{Kc=1}$	3.7	3.6

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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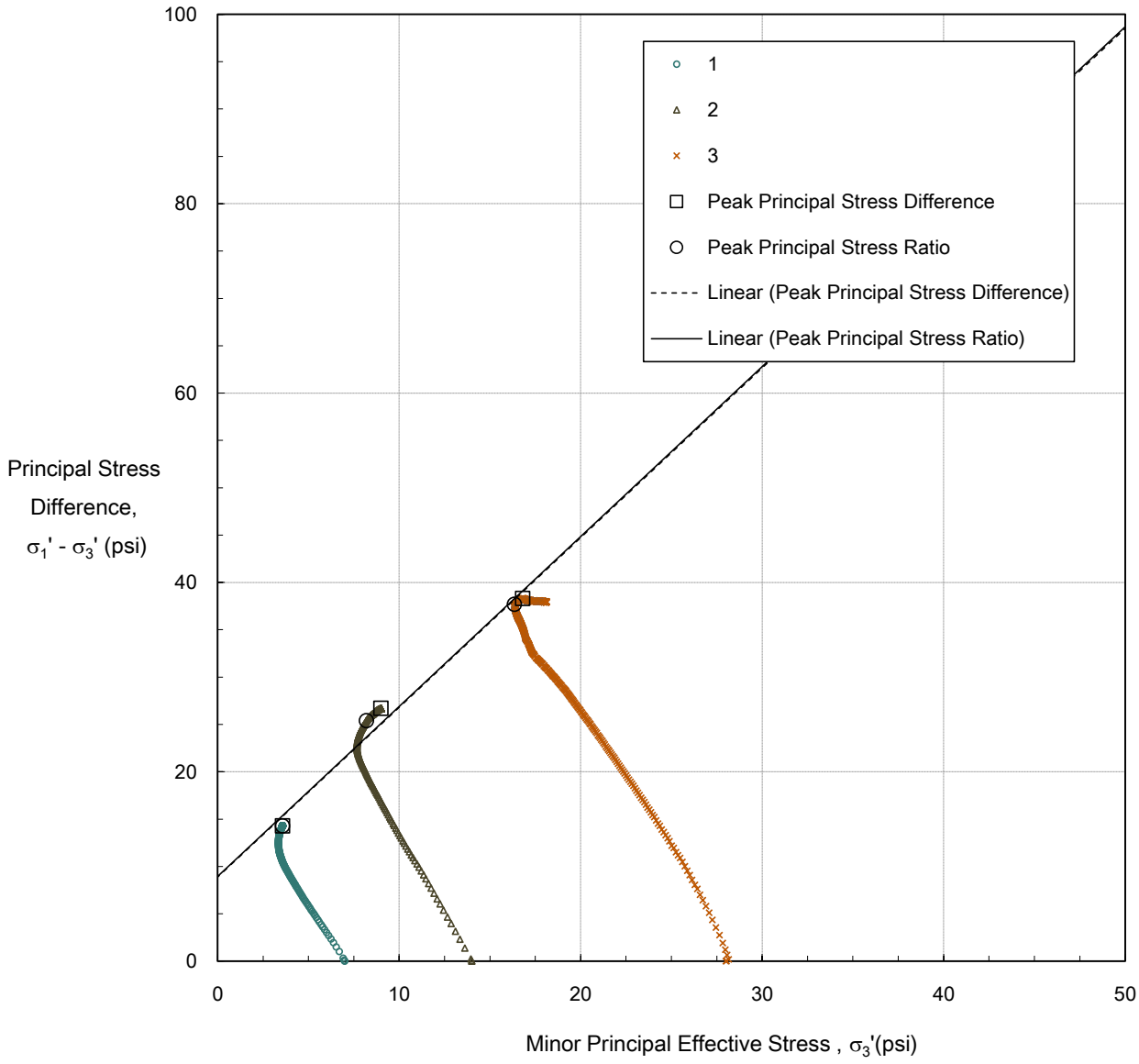
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-62 ST-2 (37.5)

TRI Log #: 66894.6
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	28.2
Effective Cohesion (psi)	-	2.7

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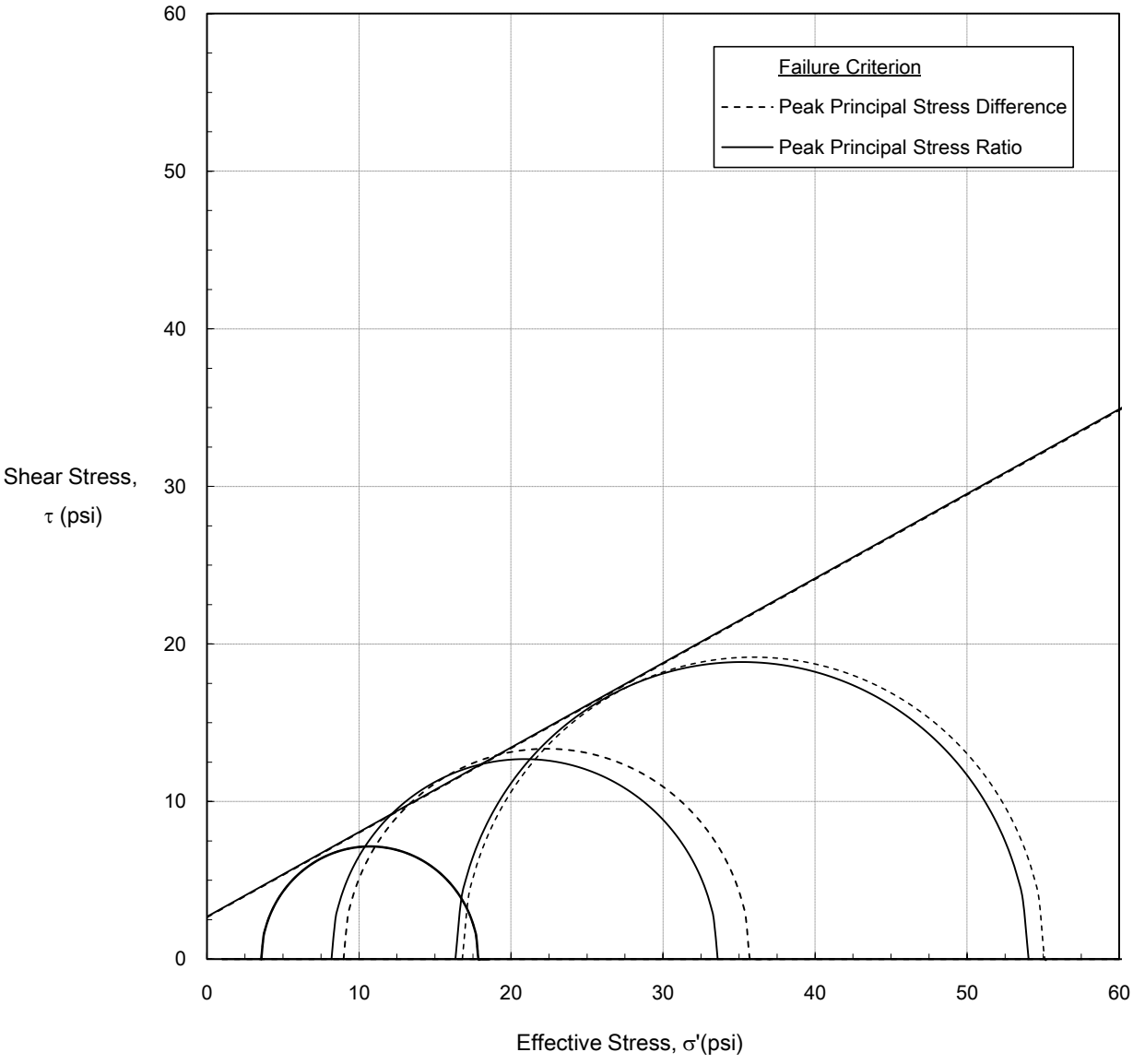
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-62 ST-2 (37.5)

TRI Log #: 66894.6
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	28.2
Effective Cohesion (psi)	-	2.7

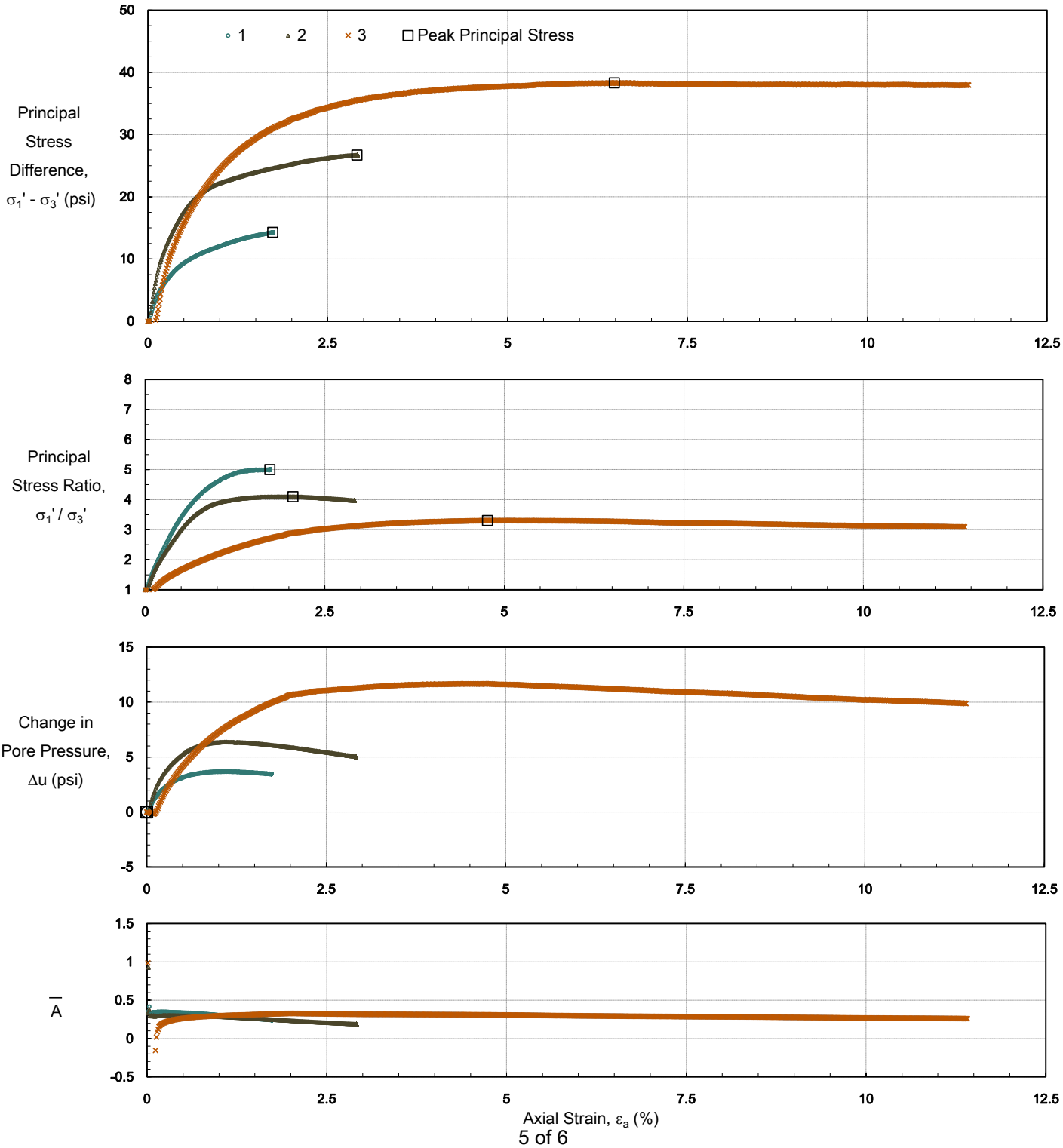
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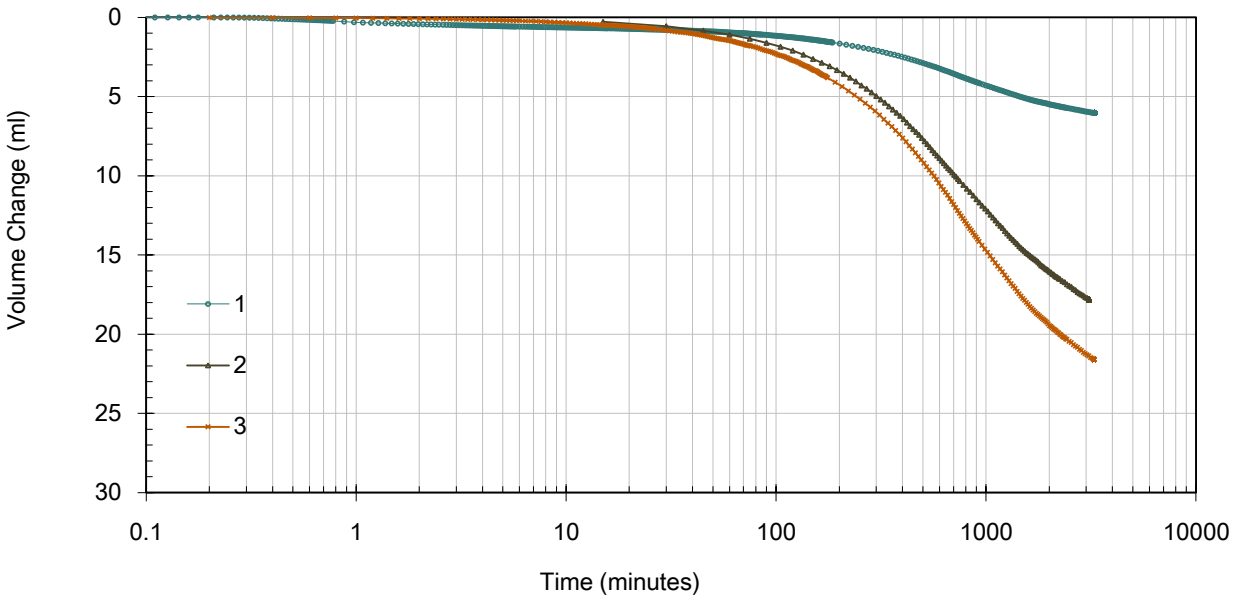
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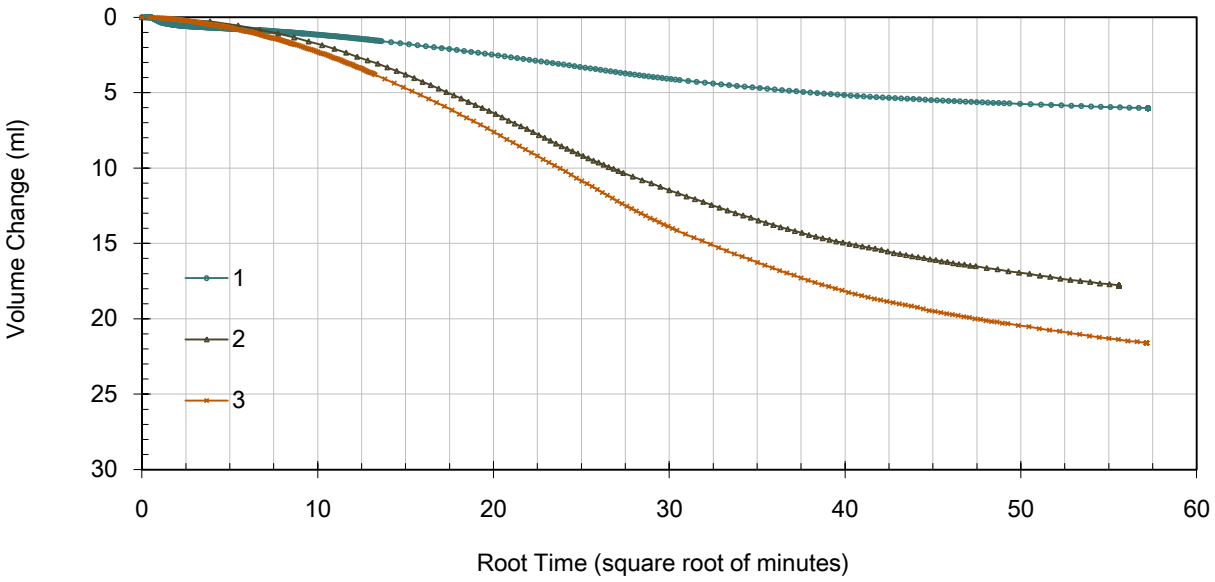
Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-62 ST-2 (37.5)

TRI Log #: 66894.6
Test Method: ASTM D4767 Mod

Consolidation





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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-63 ST-5 (25.0)

TRI Log #: 66894.7
Test Method: ASTM D4767 Mod

Specimens				
Identification	1	2	3	4
Depth/Elev. (ft)	-	-	-	-
Eff. Consol. Stress (psi)	5.0	10.0	20.0	-
Initial Specimen Properties				
Avg. Diameter (in)	2.05	2.05	2.05	-
Avg. Height (in)	4.28	4.24	4.19	-
Avg. Water Content (%)	16.7	-	-	-
Bulk Density (pcf)	128.7	-	-	-
Dry Density (pcf)	110.3	-	-	-
Specific Gravity (Assumed)	2.75			
Saturation (%)	82.5	-	-	-
Void Ratio, n	0.56	0.54	0.52	-
B-Value, End of Saturation	0.97	-	-	-

Test Setup	
Specimen Condition	Undisturbed / Intact
Specimen Preparation	Trimmed
Mounting Method	Wet
Consolidation	Isotropic

Post-Consolidation / Pre-Shear				
Void Ratio	0.54	0.52	0.49	-

Shear / Post-Shear				
Rate of Strain (%/hr)	1.00	1.00	1.00	-
Avg. Water Content (%)	-	-	18.4	-

At Failure								
Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$				Ratio, $(\sigma_1'/\sigma_3')_{max}$			
Axial Strain at Failure (%), $\varepsilon_{a,f}$	-	-	-	-	1.2	1.2	1.3	-
Minor Effective Stress (psi), $\sigma_3'_f$	-	-	-	-	4.0	7.5	13.7	-
Principal Stress Difference (psi), $(\sigma_1-\sigma_3)_f$	-	-	-	-	18.4	27.1	40.6	-
Pore Water Pressure, Δu_f (psi)	-	-	-	-	1.1	2.5	6.4	-
Major Effective Stress (psi), $\sigma_1'_f$	-	-	-	-	22.4	34.6	54.3	-
Secant Friction Angle (degrees)	-	-	-	-	44.4	40.2	36.7	-
Effective Friction Angle (degrees)	-				32.1			
Effective Cohesion (psi)	-				2.7			

Note: Multi-stage testing was performed for this sample. The first two stages were terminated in accordance with stress path tangency and/or peak principal stress ratio. The presented M-C parameters are based on a linear regression in modified stress space, across all assigned effective consolidation stresses. This fit does not purported to capture typical curvature of envelopes that may, in particular, be observed across broader range in effective stresses. Please note that the stresses associated with peak principal stress ratio are presented in tabular form on the first page of the report. There are alternate interpretations to this failure criterion including but not limited to peak principal stress difference and strain compatibility.

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Multi-Stage Consolidated-Undrained Triaxial Compression

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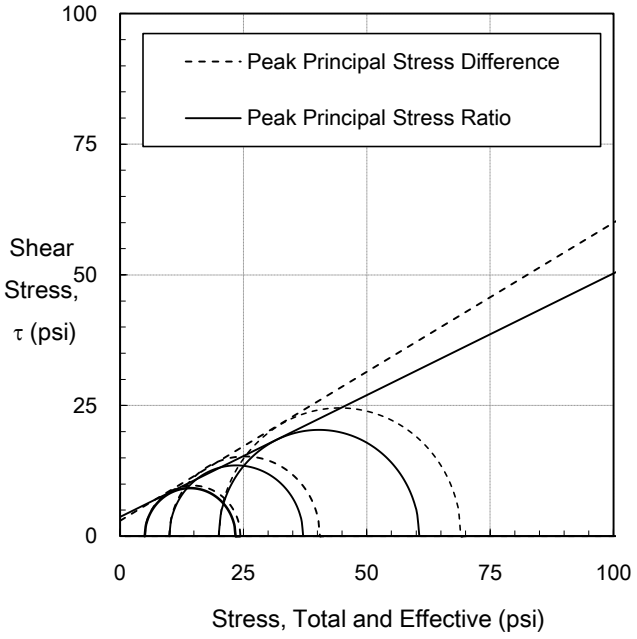
TRI Log #: 66894.7
Test Method: ASTM D4767 Mod

R / "Total Stress" Envelope			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	ϕ_R	29.7	25.0
Cohesion (psi)	c_R	2.9	3.7

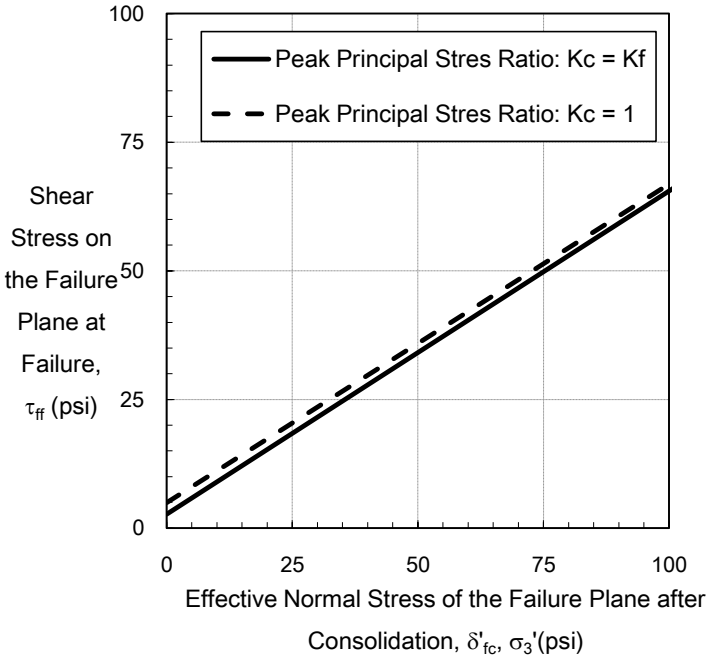
Kc = Kf Envelope, Effective Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	ϕ'	29.6	32.1
Effective Cohesion (psi)	c'	3.5	2.7

Kc = 1 (τ_{ff} vs σ'_{fc}) Envelope, Total Stress Envelope (Duncan et al. 1990)			
Failure Criterion: Peak Principal Stress		Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Friction Angle (deg)	$d_{Kc=1}$	40.5	31.8
Cohesion (psi)	$\psi_{Kc=1}$	4.4	4.9

R / "Total Stress" Envelope



Three-Stage Rapid Drawdown Envelopes



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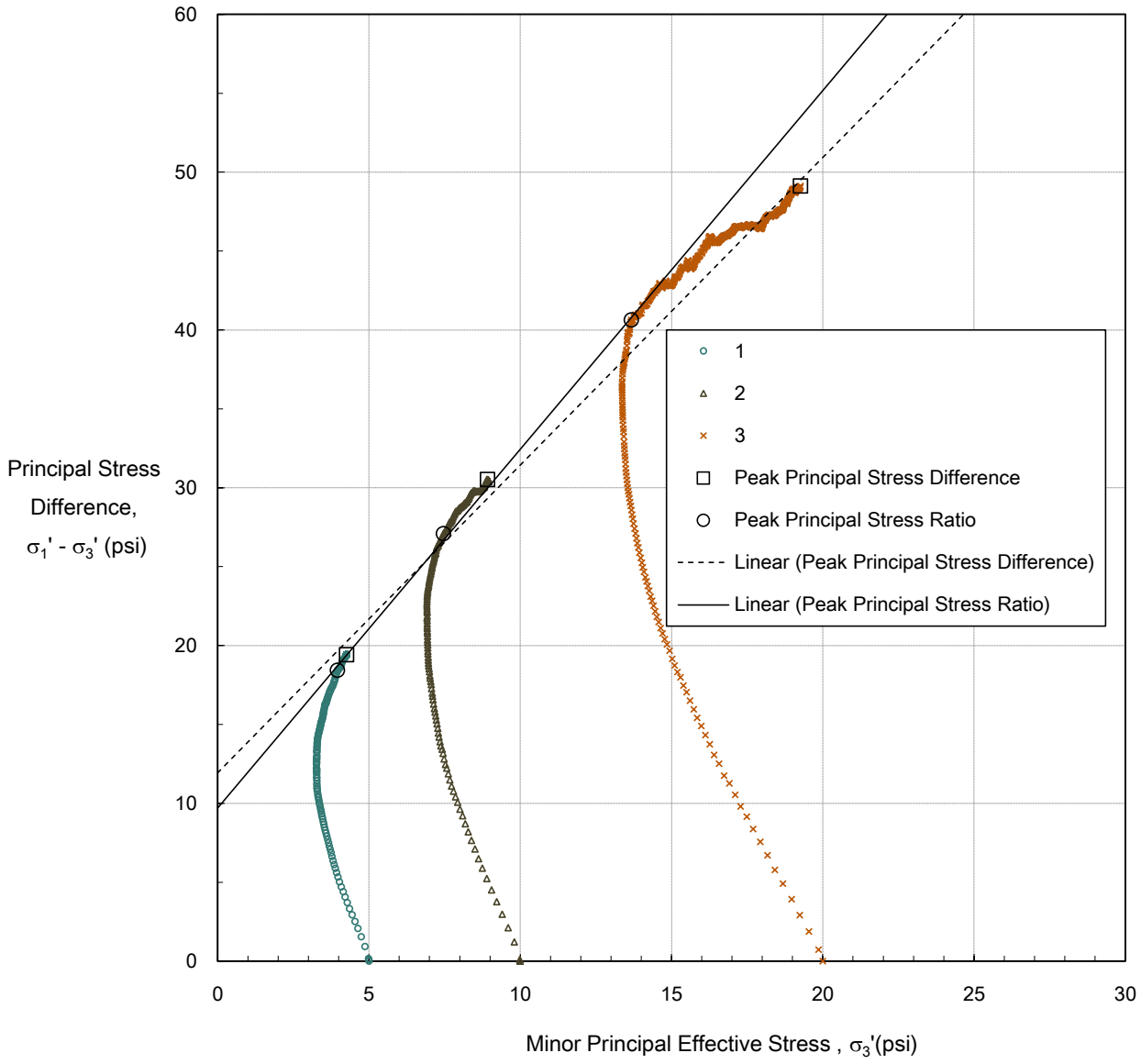
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Multi-Stage Consolidated-Undrained Triaxial Compression

Client: Tolunay Wong Engineers, Inc.
Project: USACOE Matagorda Ship Channel
Sample: CB-63 ST-5 (25.0)

TRI Log #: 66894.7
Test Method: ASTM D4767 Mod

Modified Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	32.1
Effective Cohesion (psi)	-	2.7

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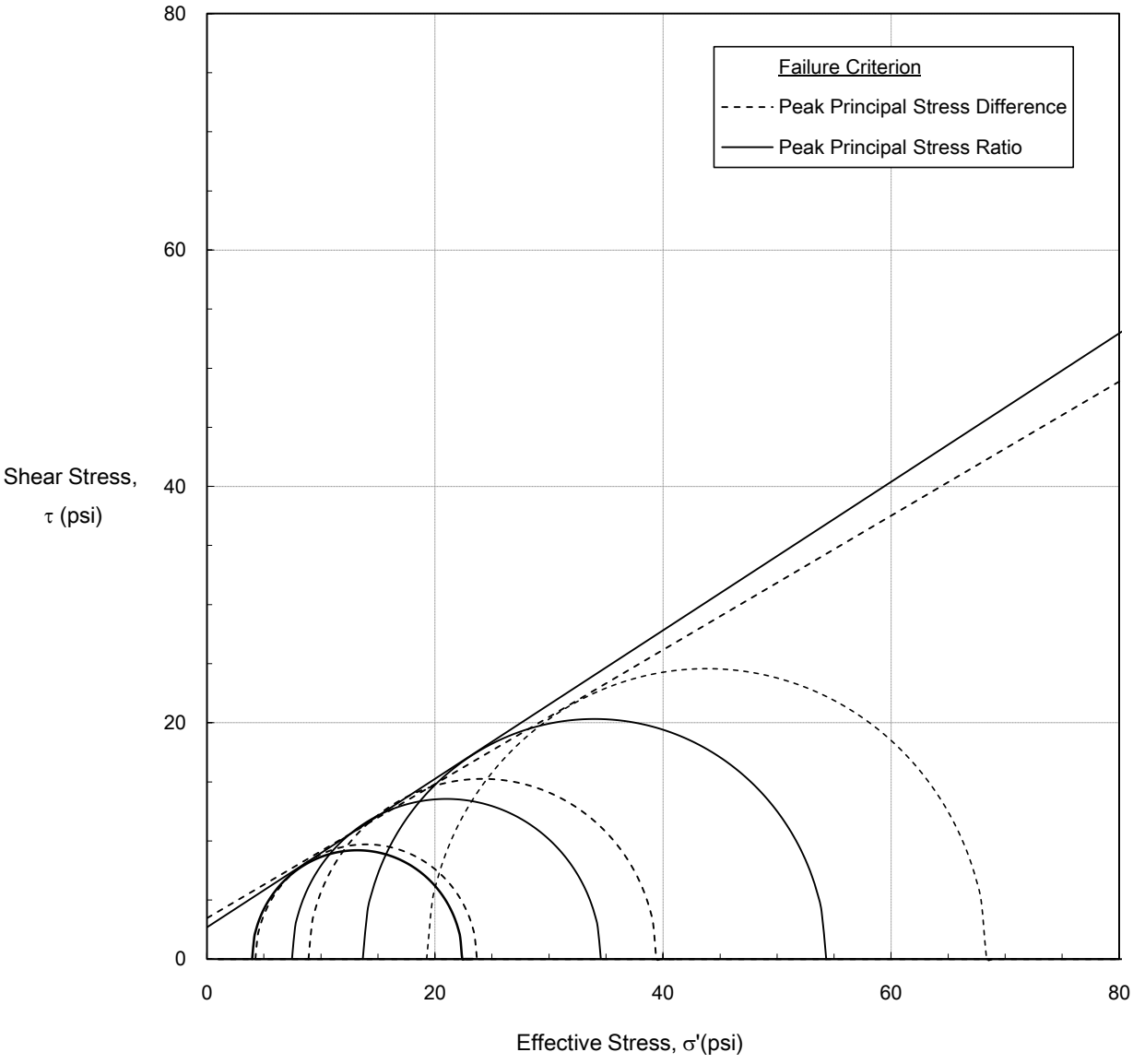
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Multi-Stage Consolidated-Undrained Triaxial Compression

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Project: USACOE Matagorda Ship Channel
Sample: CB-63 ST-5 (25.0)

TRI Log #: 66894.7
Test Method: ASTM D4767 Mod

Mohr-Coulomb



Failure Criterion: Peak Principal Stress	Difference, $(\sigma_1'-\sigma_3')_{max}$	Ratio, $(\sigma_1'/\sigma_3')_{max}$
Effective Friction Angle (deg)	-	32.1
Effective Cohesion (psi)	-	2.7

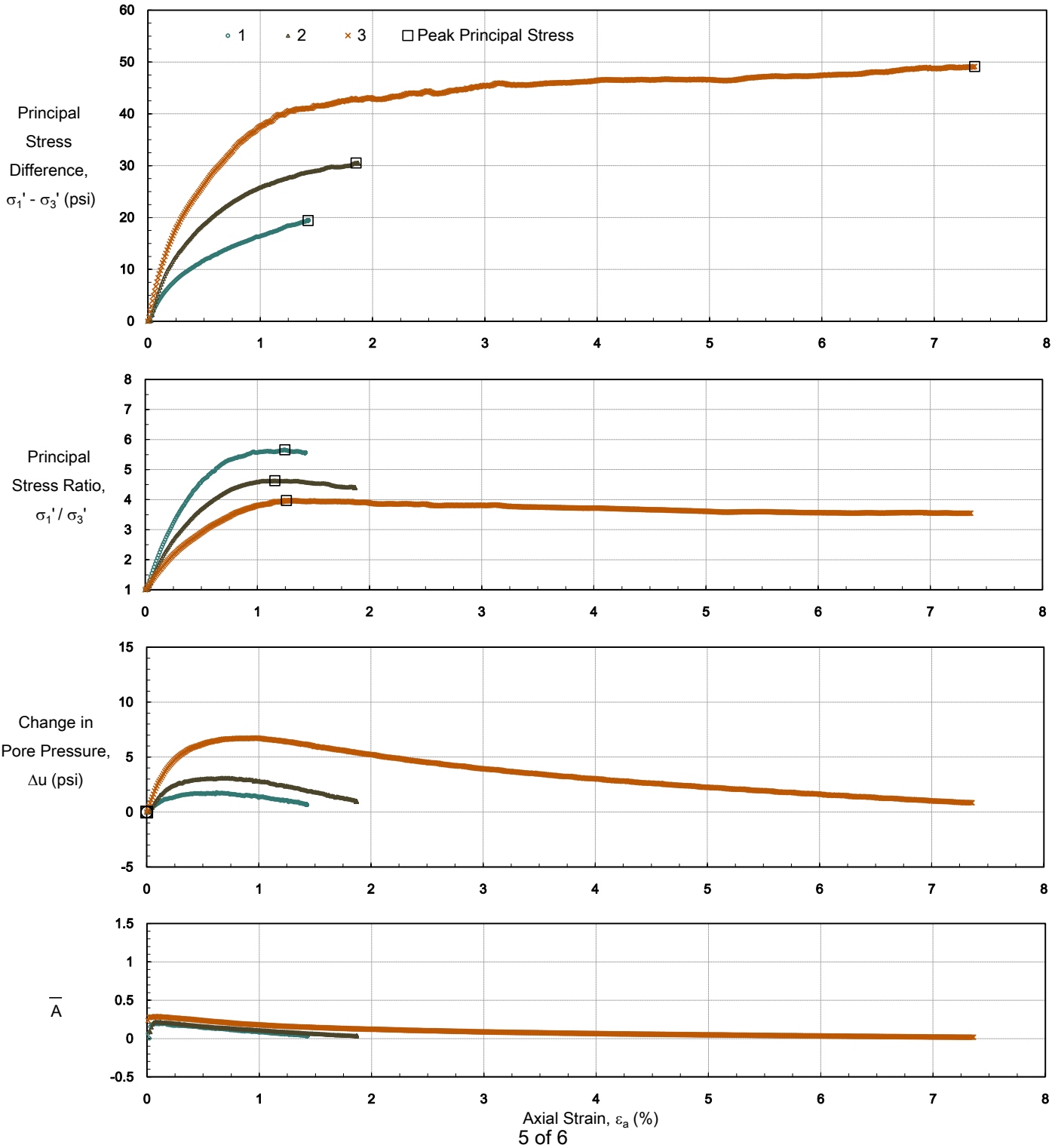
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Multi-Stage Consolidated-Undrained Triaxial Compression

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Sample: CB-63 ST-5 (25.0)

TRI Log #: 66894.7
Test Method: ASTM D4767 Mod



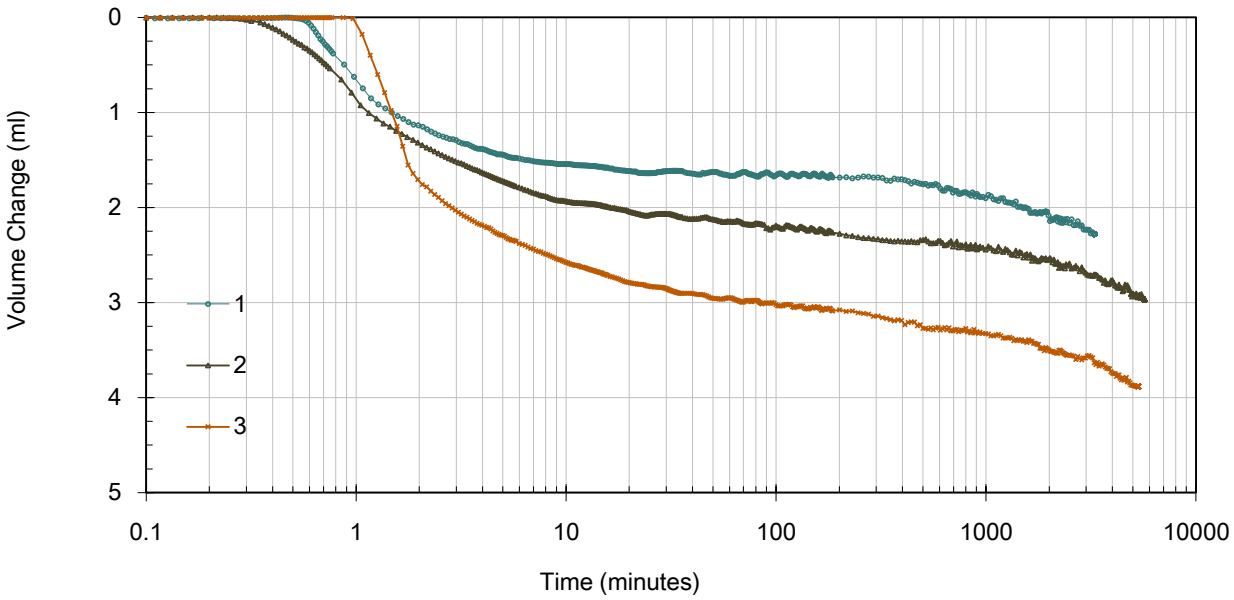
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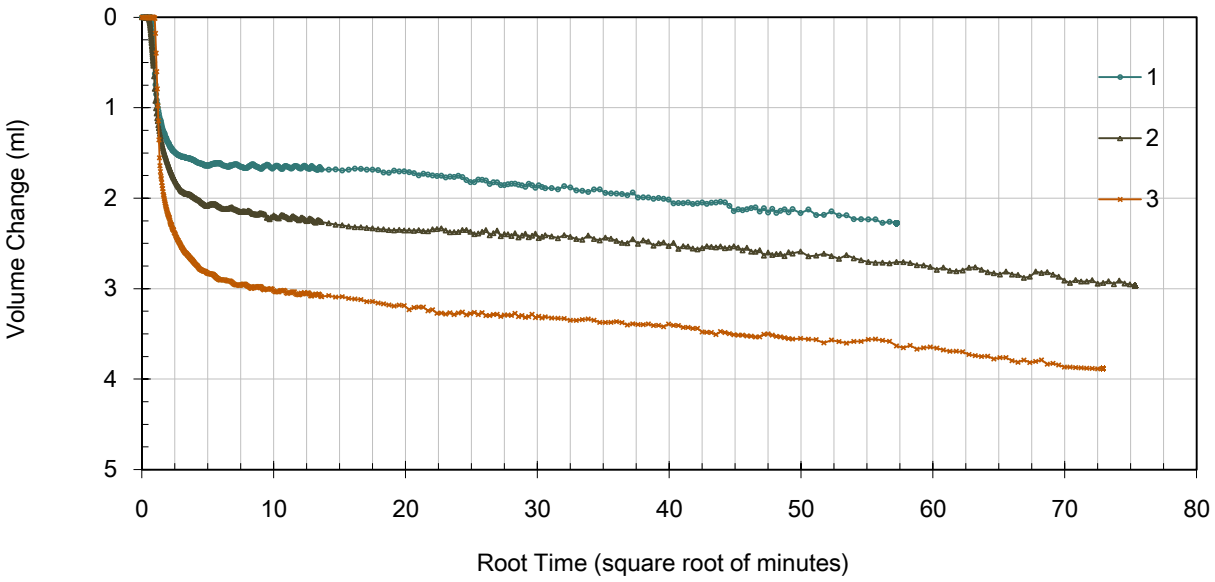
Multi-Stage Consolidated-Undrained Triaxial Compression

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Sample: CB-63 ST-5 (25.0)

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Test Method: ASTM D4767 Mod

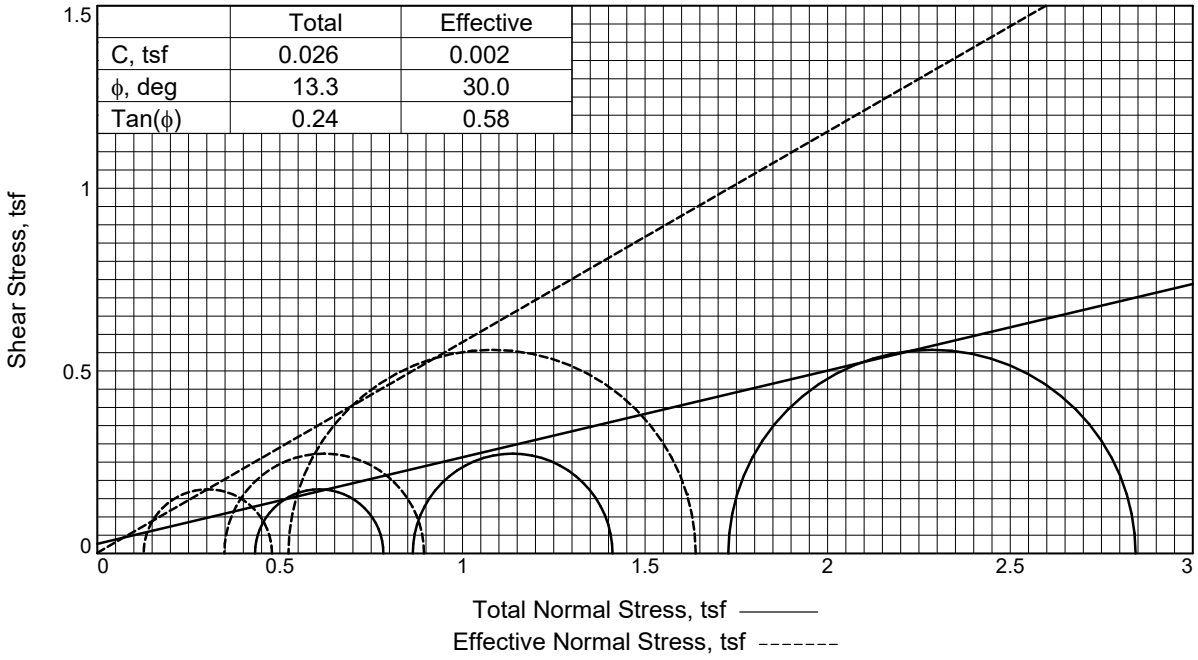
Consolidation

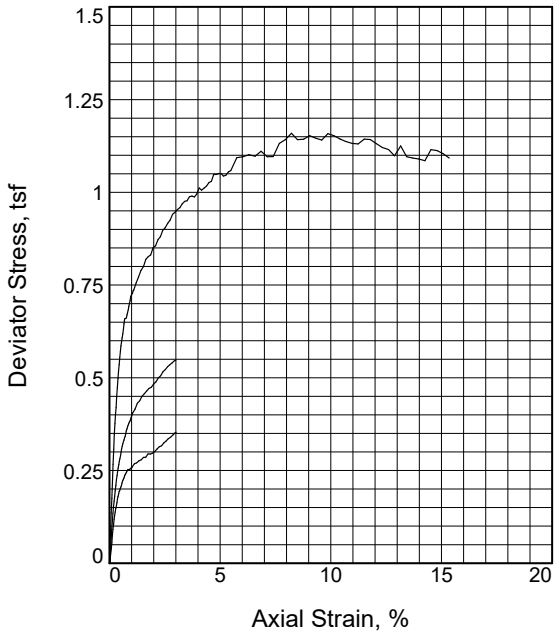




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Sample No.		1	2	3
Initial	Water Content, %	65.2	65.2	65.2
	Dry Density, pcf	61.7	61.7	61.7
	Saturation, %	99.6	99.6	99.6
	Void Ratio	1.8314	1.8314	1.8314
	Diameter, in.	2.00	2.00	2.00
	Height, in.	4.53	4.53	4.53
At Test	Water Content, %	43.2	43.2	43.2
	Dry Density, pcf	79.1	79.1	79.1
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.2109	1.2109	1.2109
	Diameter, in.	1.79	1.81	1.85
	Height, in.	4.44	4.31	4.13
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.35	0.55	1.12
Excess Pore Pr., tsf		0.31	0.52	1.20
Strain, %		3.0	3.0	14.5
Ult. Stress, tsf		0.35	0.55	1.12
Excess Pore Pr., tsf		0.31	0.52	1.20
Strain, %		3.0	3.0	14.5
$\bar{\sigma}_1$ Failure, tsf		0.48	0.89	1.64
$\bar{\sigma}_3$ Failure, tsf		0.13	0.35	0.52

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY; shell fragments

LL= 75 **PL=** 35 **PI=** 40

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

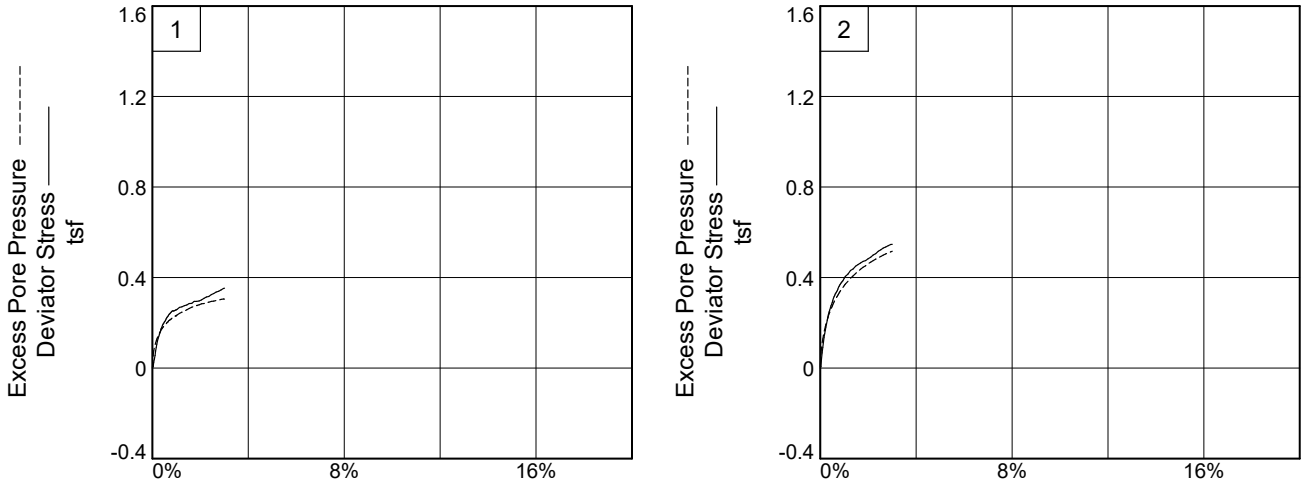
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

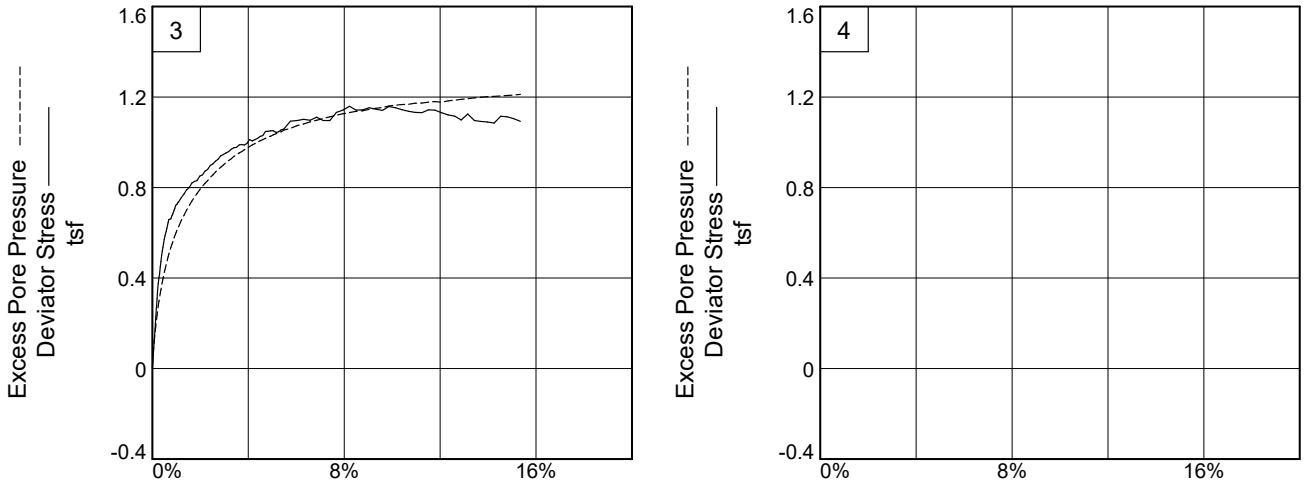
Source of Sample: CB-65 **Depth:** 29

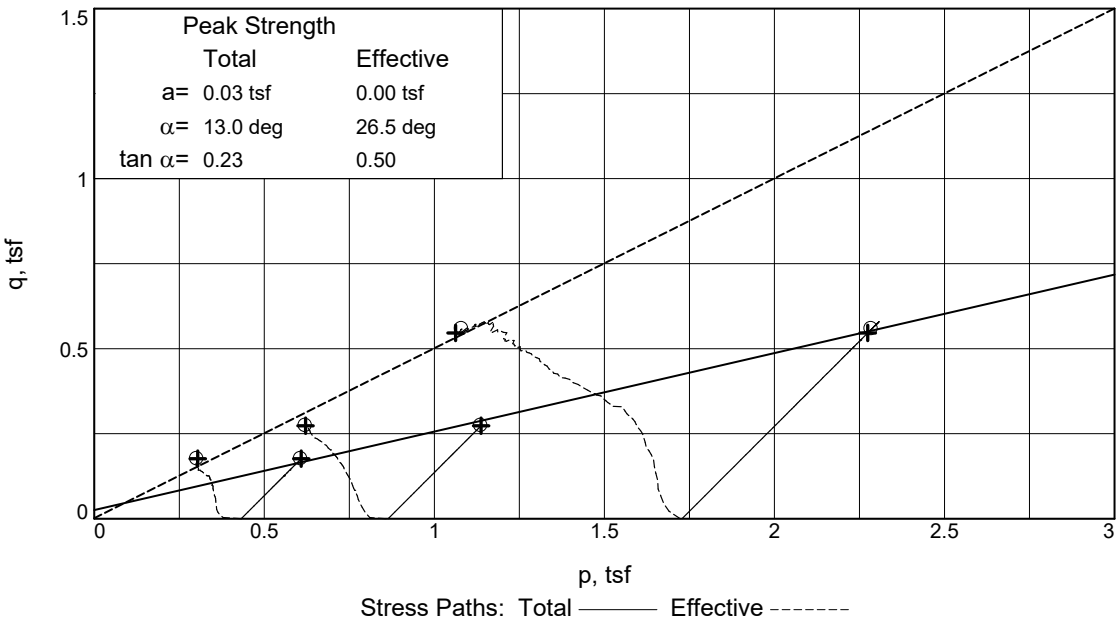
Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/15/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







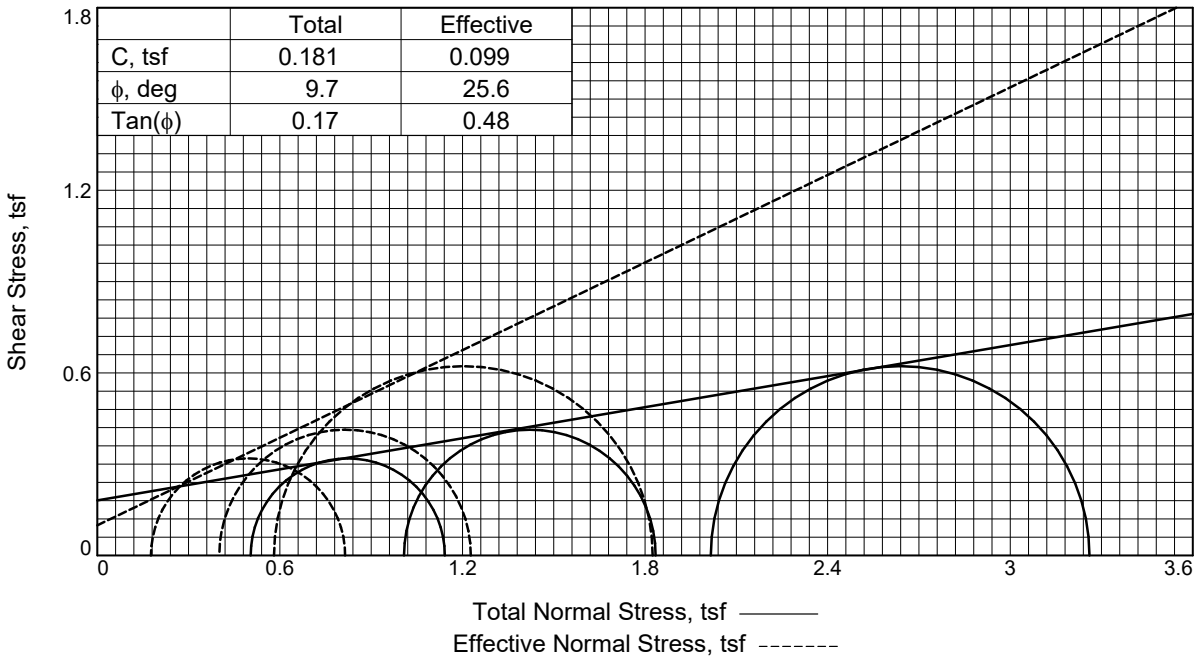
Client: CPA/ USACE

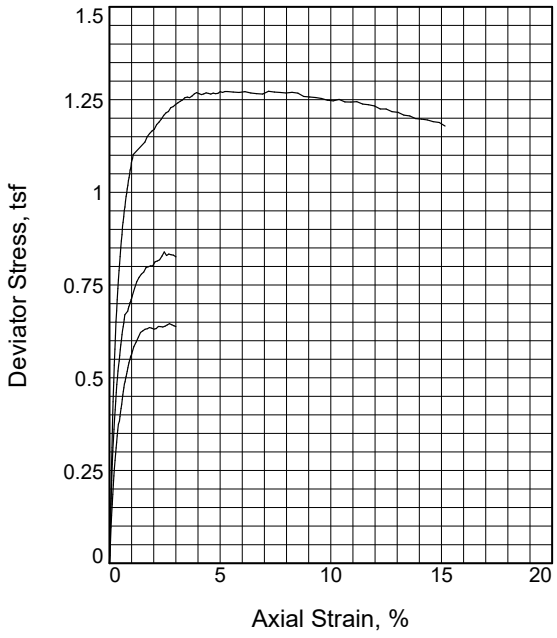
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-65 **Depth:** 29 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	40.9	40.9	40.9
	Dry Density, pcf	78.9	78.9	78.9
	Saturation, %	97.3	97.3	97.3
	Void Ratio	1.1364	1.1364	1.1364
	Diameter, in.	2.06	2.06	2.06
	Height, in.	4.69	4.69	4.69
At Test	Water Content, %	28.9	28.9	28.9
	Dry Density, pcf	94.7	94.7	94.7
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7792	0.7792	0.7792
	Diameter, in.	1.88	1.91	1.94
	Height, in.	4.67	4.55	4.41
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		7.00	14.00	28.00
Fail. Stress, tsf		0.64	0.83	1.24
Excess Pore Pr., tsf		0.33	0.61	1.44
Strain, %		3.0	3.0	11.2
Ult. Stress, tsf		0.64	0.83	1.24
Excess Pore Pr., tsf		0.33	0.61	1.44
Strain, %		3.0	3.0	11.2
$\bar{\sigma}_1$ Failure, tsf		0.81	1.23	1.83
$\bar{\sigma}_3$ Failure, tsf		0.18	0.40	0.58

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray FAT CLAY; shell fragments

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

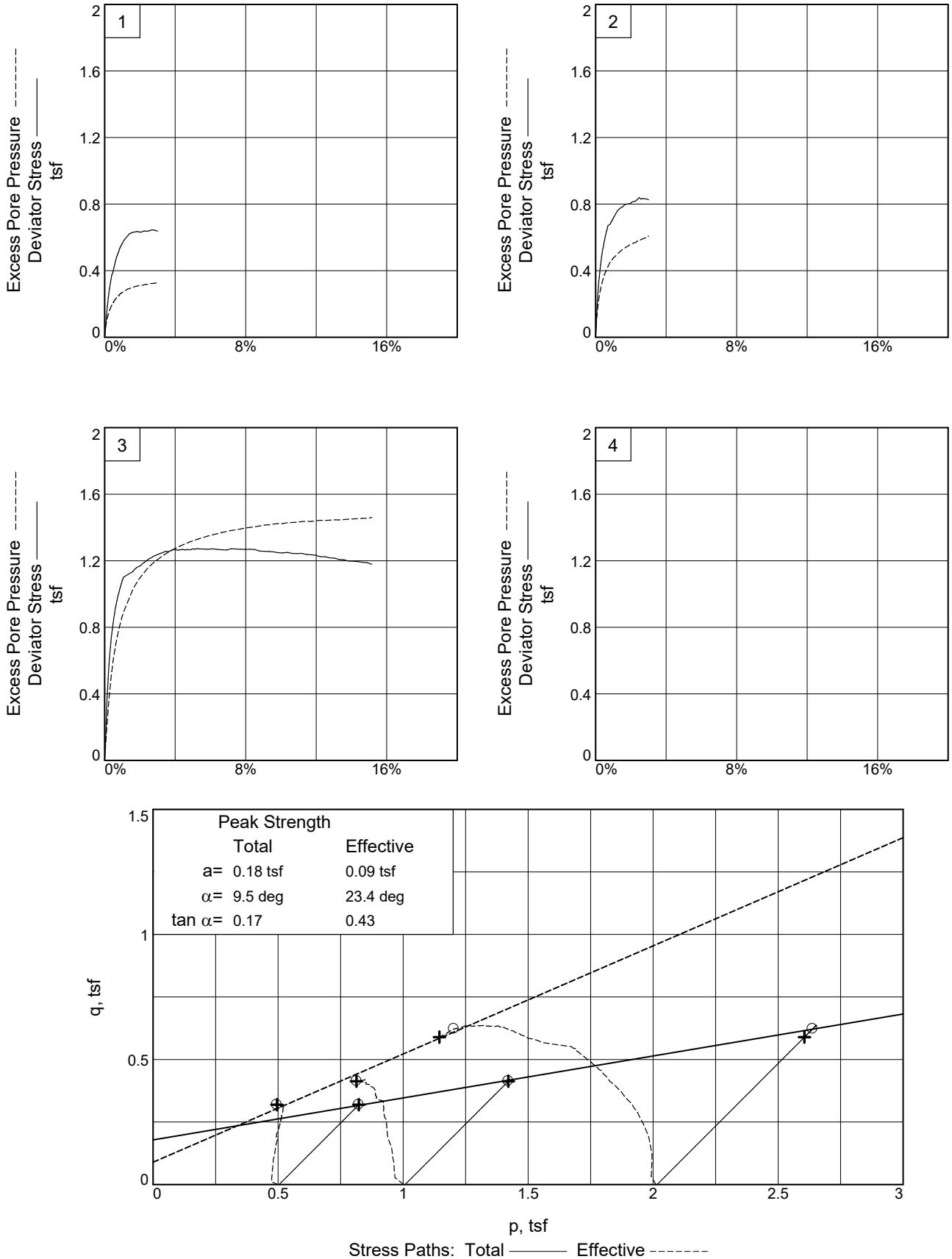
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-67 **Depth:** 35

Sample Number: ST-4

Proj. No.: 21.14.223 **Date Sampled:** 11/13/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.



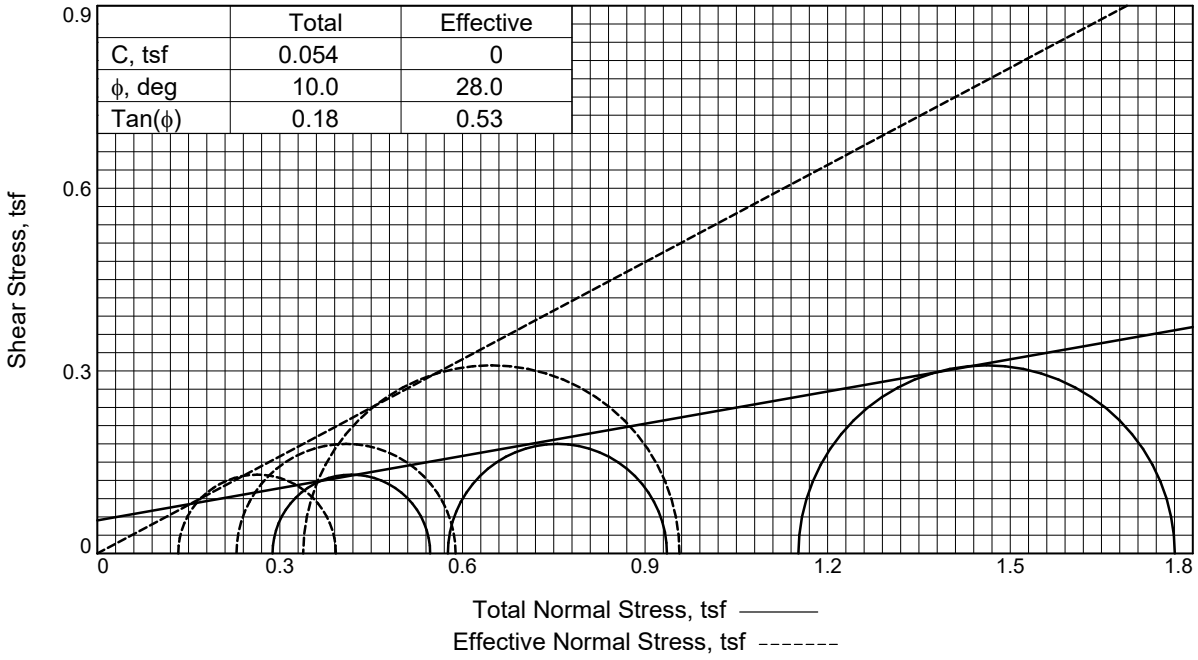
Client: CPA/ USACE

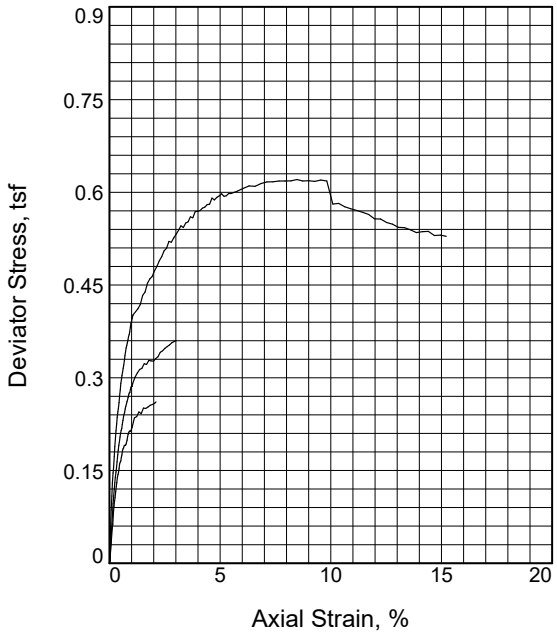
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-67 **Depth:** 35 **Sample Number:** ST-4

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	63.6	63.6	63.6
	Dry Density, pcf	62.3	62.3	62.3
	Saturation, %	99.5	99.5	99.5
	Void Ratio	1.7567	1.7567	1.7567
	Diameter, in.	2.00	2.00	2.00
	Height, in.	4.44	4.44	4.44
At Test	Water Content, %	46.9	46.9	46.9
	Dry Density, pcf	75.0	75.0	75.0
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.2904	1.2904	1.2904
	Diameter, in.	1.85	1.86	1.90
	Height, in.	4.33	4.27	4.11
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		4.00	8.00	16.00
Fail. Stress, tsf		0.26	0.36	0.62
Excess Pore Pr., tsf		0.15	0.35	0.81
Strain, %		2.0	3.0	9.8
Ult. Stress, tsf		0.26	0.36	0.62
Excess Pore Pr., tsf		0.15	0.35	0.81
Strain, %		2.0	3.0	9.8
$\bar{\sigma}_1$ Failure, tsf		0.39	0.59	0.96
$\bar{\sigma}_3$ Failure, tsf		0.13	0.23	0.34

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown and tan FAT CLAY; sand partings

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

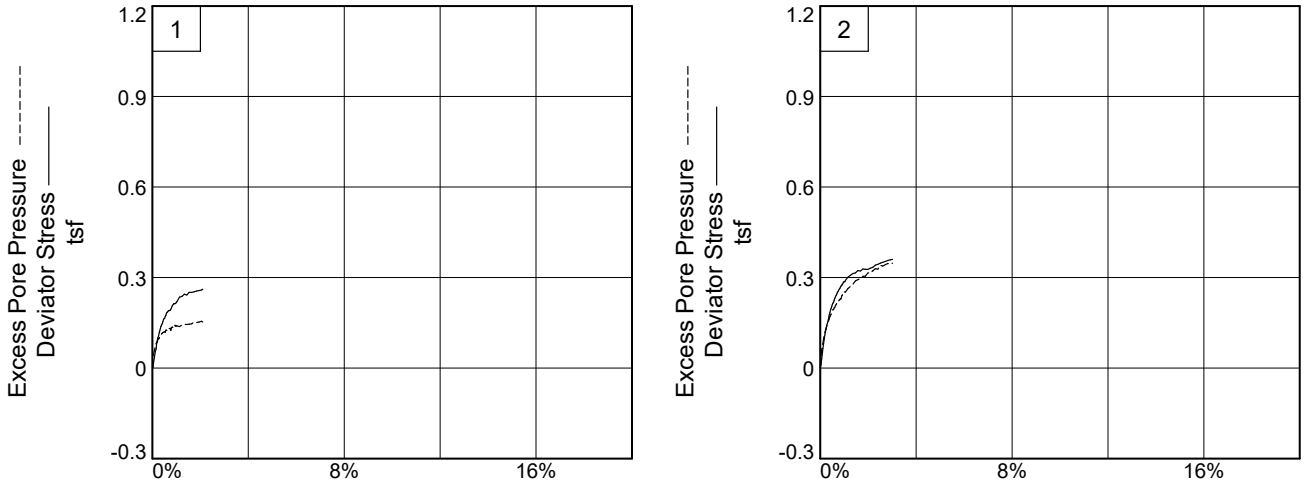
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

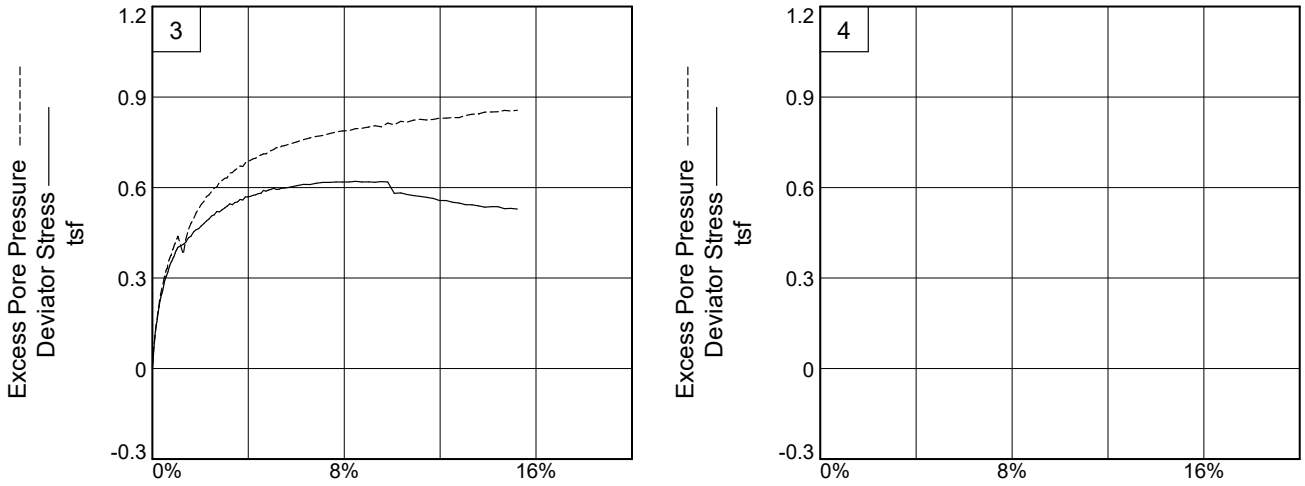
Source of Sample: CB-68 **Depth:** 21

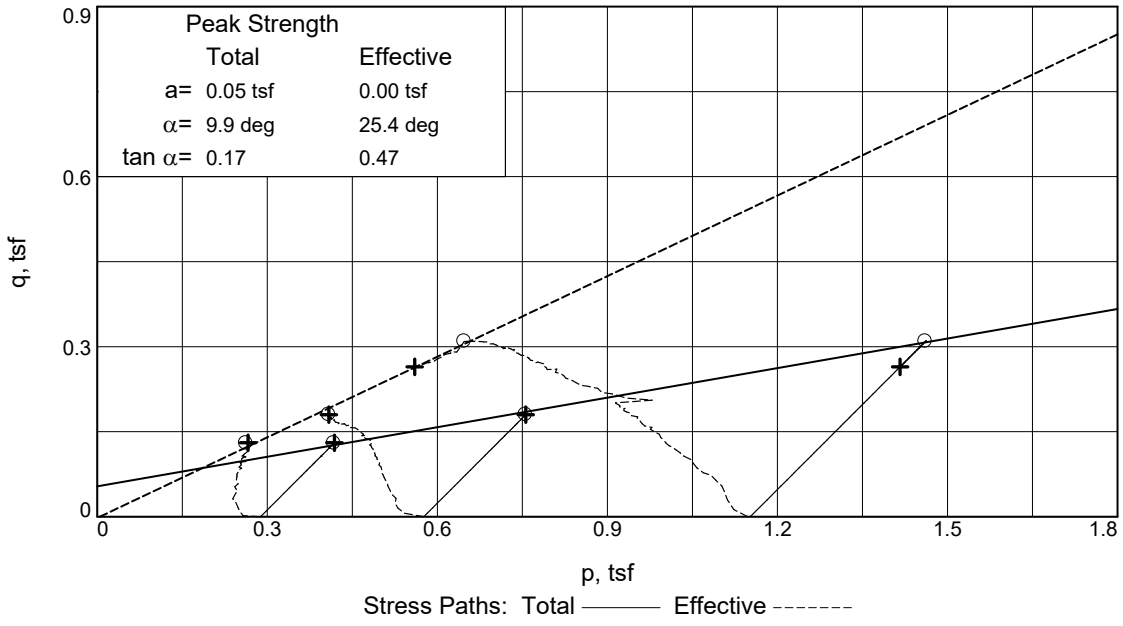
Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/14/21

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Tolunay-Wong Engineers, Inc.







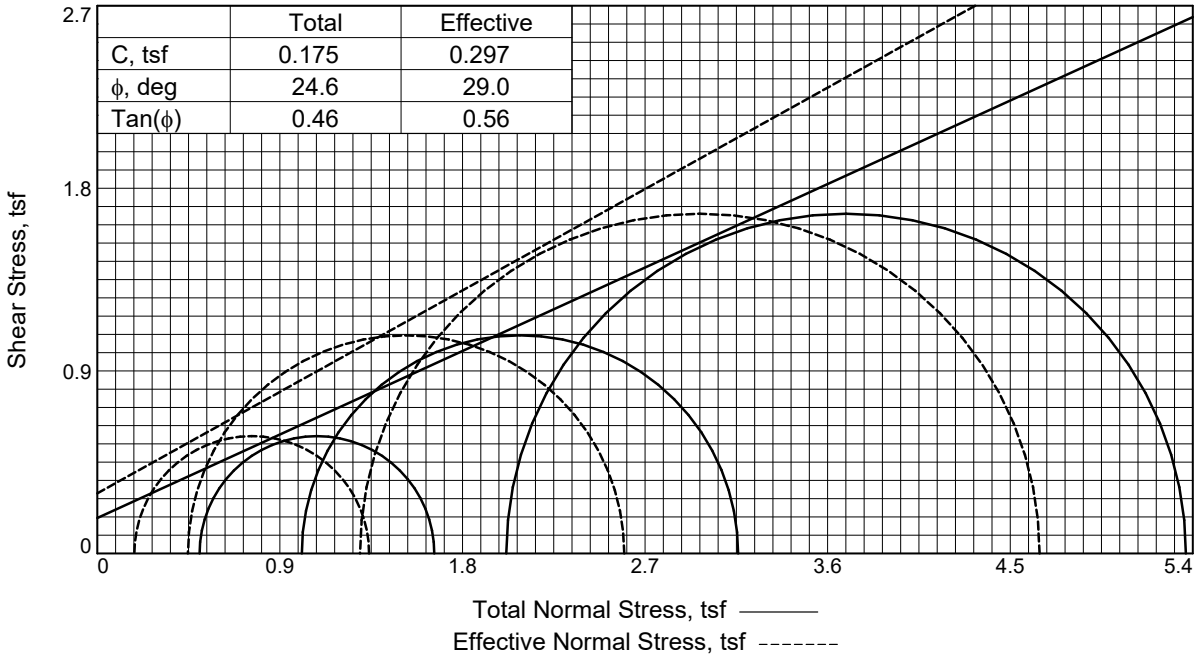
Client: CPA/ USACE

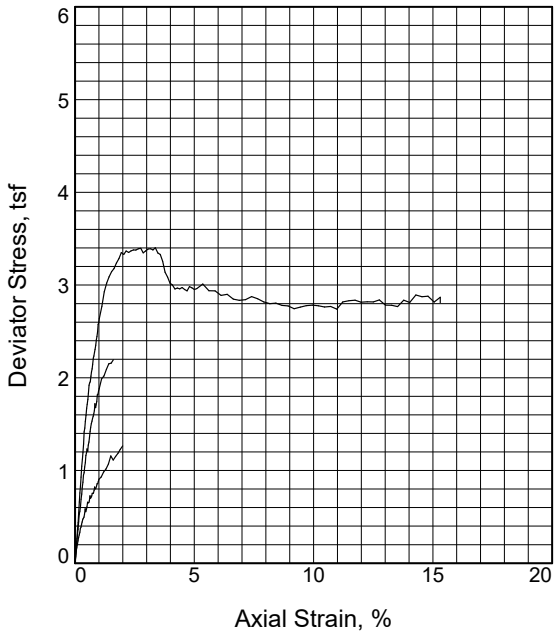
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-68 **Depth:** 21 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	24.0	24.0	24.0
	Dry Density, pcf	101.8	101.8	101.8
	Saturation, %	98.8	98.8	98.8
	Void Ratio	0.6550	0.6550	0.6550
	Diameter, in.	2.09	2.09	2.09
	Height, in.	4.57	4.57	4.57
At Test	Water Content, %	23.3	23.3	23.3
	Dry Density, pcf	103.5	103.5	103.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6289	0.6289	0.6289
	Diameter, in.	2.07	2.08	2.09
	Height, in.	4.57	4.52	4.48
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		7.00	14.00	28.00
Fail. Stress, tsf		1.16	2.15	3.35
Excess Pore Pr., tsf		0.32	0.56	0.72
Strain, %		1.5	1.4	1.9
Ult. Stress, tsf		1.16	2.15	3.35
Excess Pore Pr., tsf		0.32	0.56	0.72
Strain, %		1.5	1.4	1.9
$\bar{\sigma}_1$ Failure, tsf		1.34	2.60	4.64
$\bar{\sigma}_3$ Failure, tsf		0.18	0.45	1.29

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown and gray FAT CLAY with SAND; calcareous

LL= 63 **PL=** 22 **PI=** 41

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

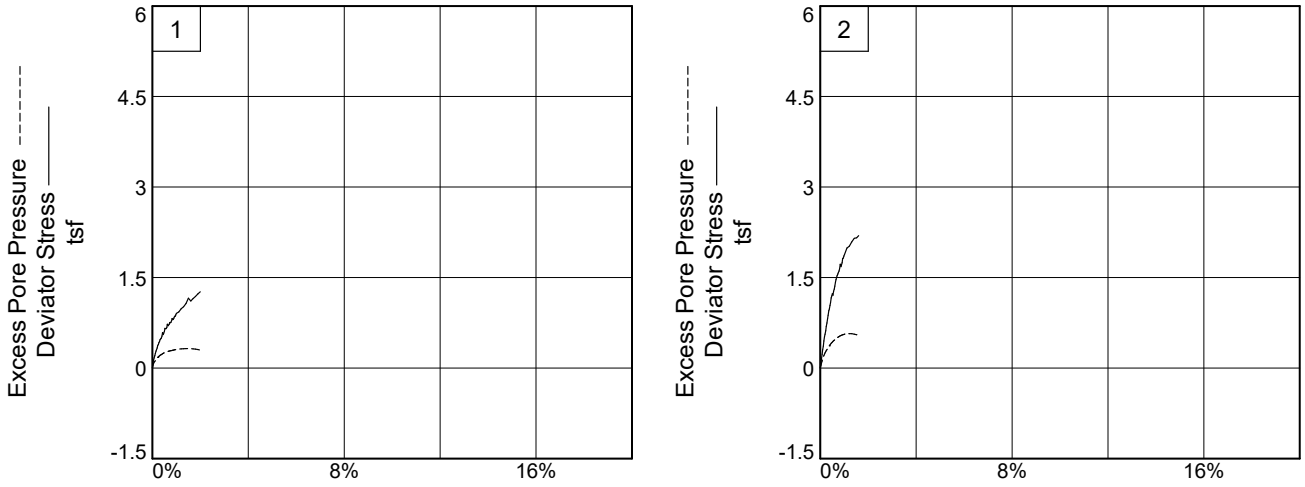
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

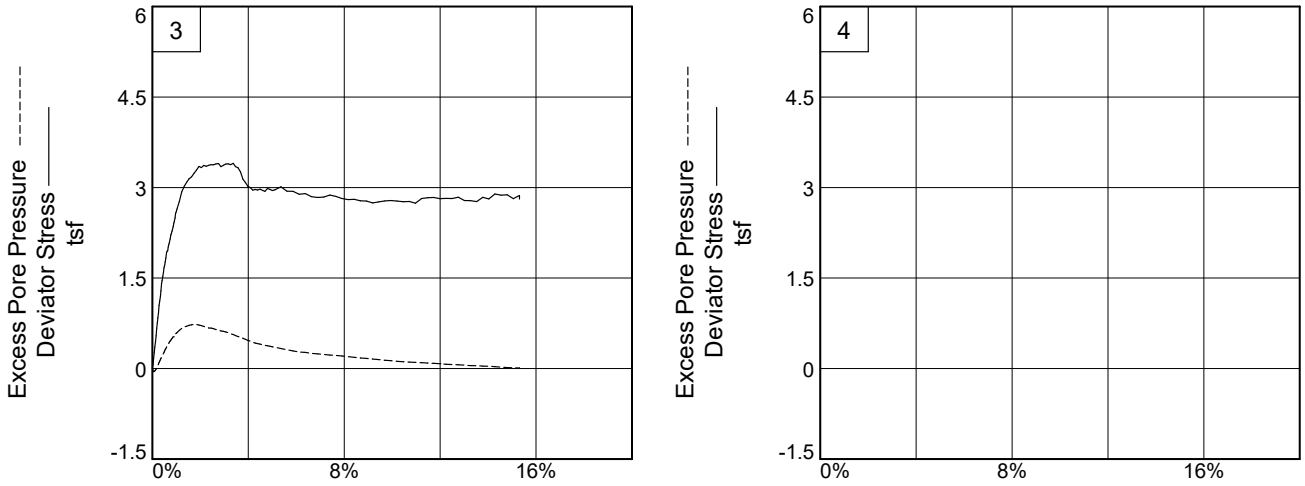
Source of Sample: CB-69 **Depth:** 35

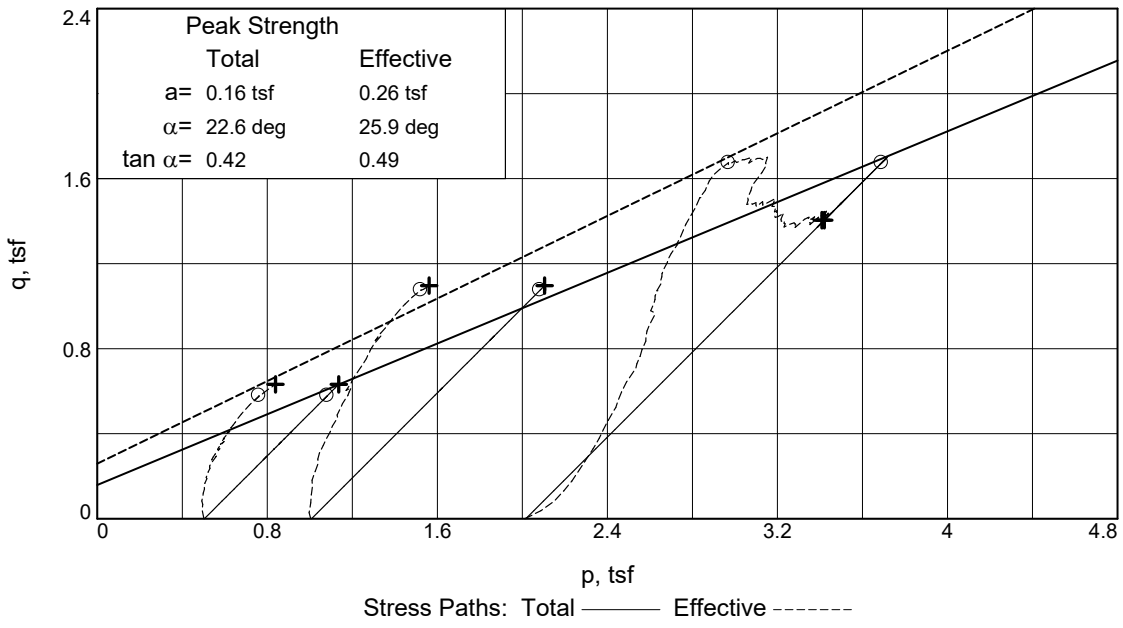
Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/14/21

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Tolunay-Wong Engineers, Inc.







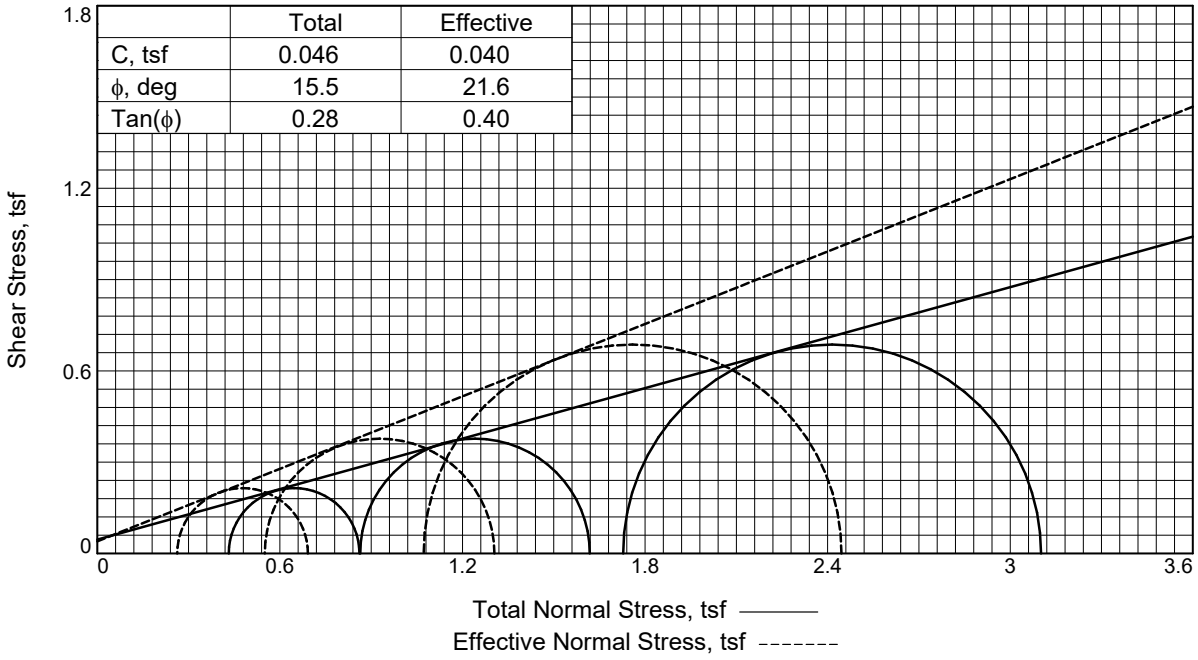
Client: CPA/ USACE

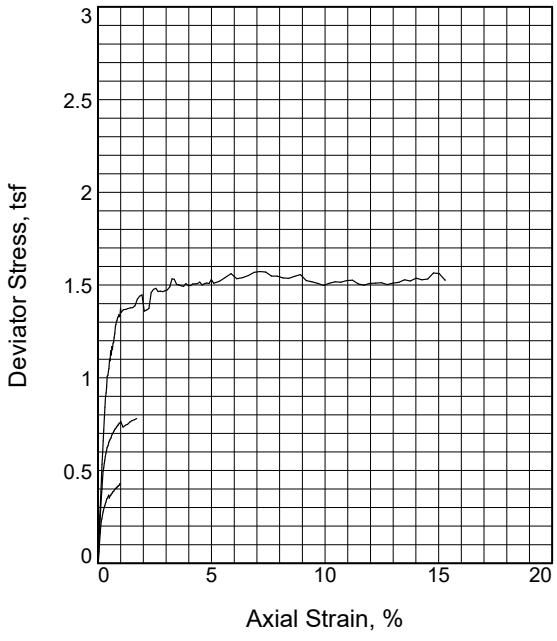
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-69 **Depth:** 35 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	38.8	38.8	38.8
	Dry Density, pcf	83.3	83.3	83.3
	Saturation, %	98.9	98.9	98.9
	Void Ratio	1.0986	1.0986	1.0986
	Diameter, in.	2.13	2.13	2.13
	Height, in.	4.46	4.46	4.46
At Test	Water Content, %	38.1	38.1	38.1
	Dry Density, pcf	84.5	84.5	84.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	1.0677	1.0677	1.0677
	Diameter, in.	2.11	2.12	2.14
	Height, in.	4.49	4.44	4.38
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		6.00	12.00	24.00
Fail. Stress, tsf		0.43	0.75	1.37
Excess Pore Pr., tsf		0.17	0.31	0.66
Strain, %		1.0	0.9	1.0
Ult. Stress, tsf		0.43	0.75	1.37
Excess Pore Pr., tsf		0.17	0.31	0.66
Strain, %		1.0	0.9	1.0
$\bar{\sigma}_1$ Failure, tsf		0.69	1.30	2.45
$\bar{\sigma}_3$ Failure, tsf		0.26	0.55	1.07

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Brown and gray FAT CLAY

LL= 94 **PL=** 36 **PI=** 58

Assumed Specific Gravity= 2.80

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

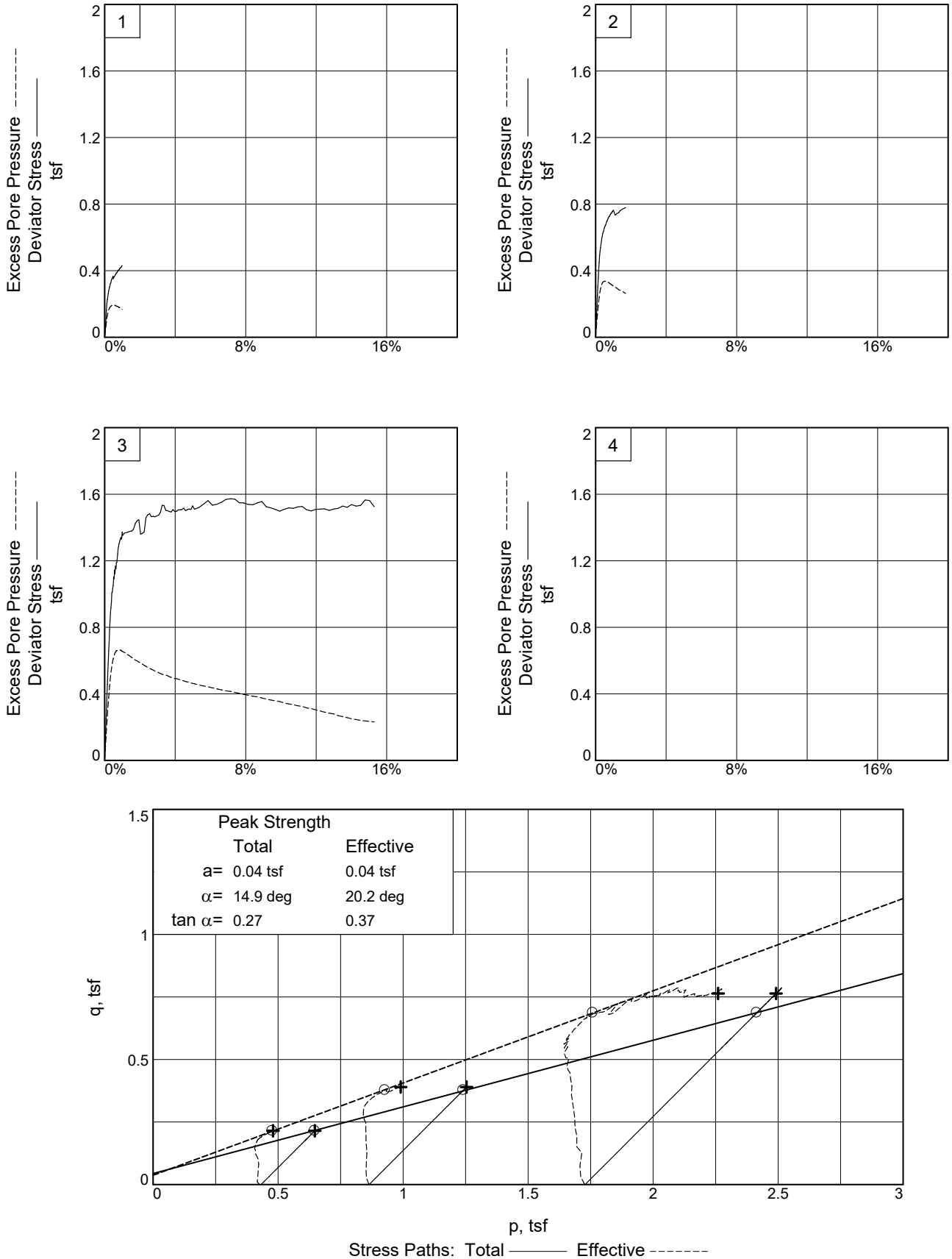
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 30

Sample Number: ST-5

Proj. No.: 21.14.223 **Date Sampled:** 11/16/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.



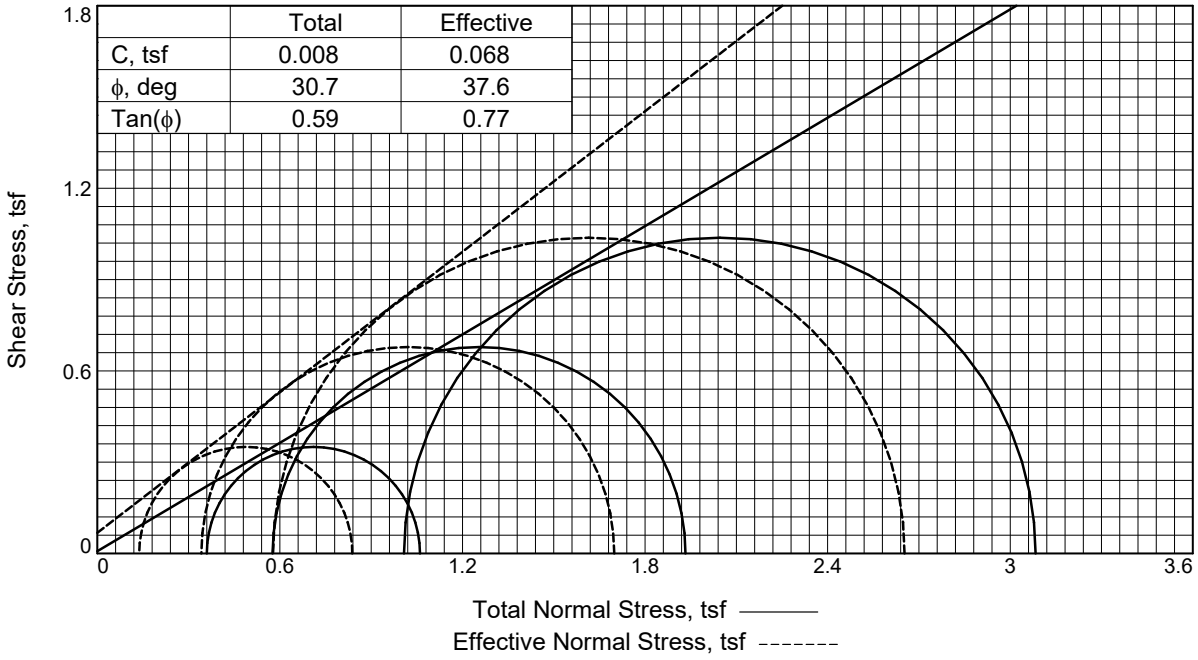
Client: CPA/ USACE

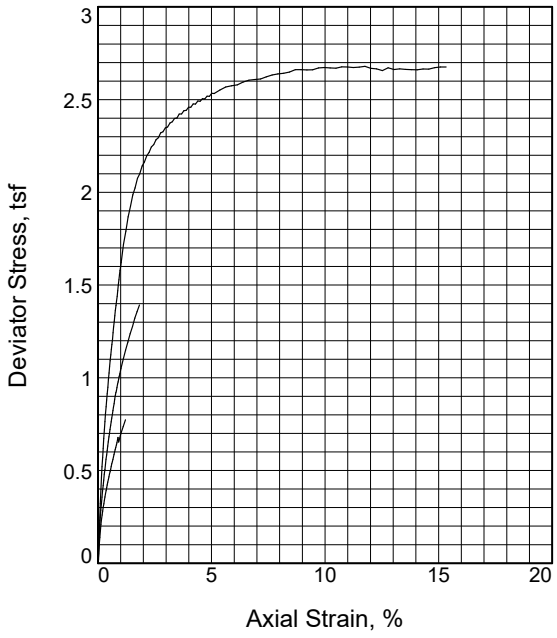
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-70 **Depth:** 30 **Sample Number:** ST-5

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	19.1	19.1	19.1
	Dry Density, pcf	107.9	107.9	107.9
	Saturation, %	91.9	91.9	91.9
	Void Ratio	0.5618	0.5618	0.5618
	Diameter, in.	2.07	2.07	2.07
	Height, in.	4.97	4.97	4.97
At Test	Water Content, %	20.0	20.0	20.0
	Dry Density, pcf	109.4	109.4	109.4
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5411	0.5411	0.5411
	Diameter, in.	2.06	2.07	2.08
	Height, in.	4.96	4.91	4.86
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		5.00	8.00	14.00
Fail. Stress, tsf		0.70	1.36	2.08
Excess Pore Pr., tsf		0.22	0.23	0.43
Strain, %		1.0	1.7	1.7
Ult. Stress, tsf		0.70	1.36	2.08
Excess Pore Pr., tsf		0.22	0.23	0.43
Strain, %		1.0	1.7	1.7
$\bar{\sigma}_1$ Failure, tsf		0.84	1.70	2.65
$\bar{\sigma}_3$ Failure, tsf		0.14	0.34	0.58

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Reddish-brown and gray SANDY LEAN CLAY; calcareous

LL= 38 **PL=** 16 **PI=** 22

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Bulge
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

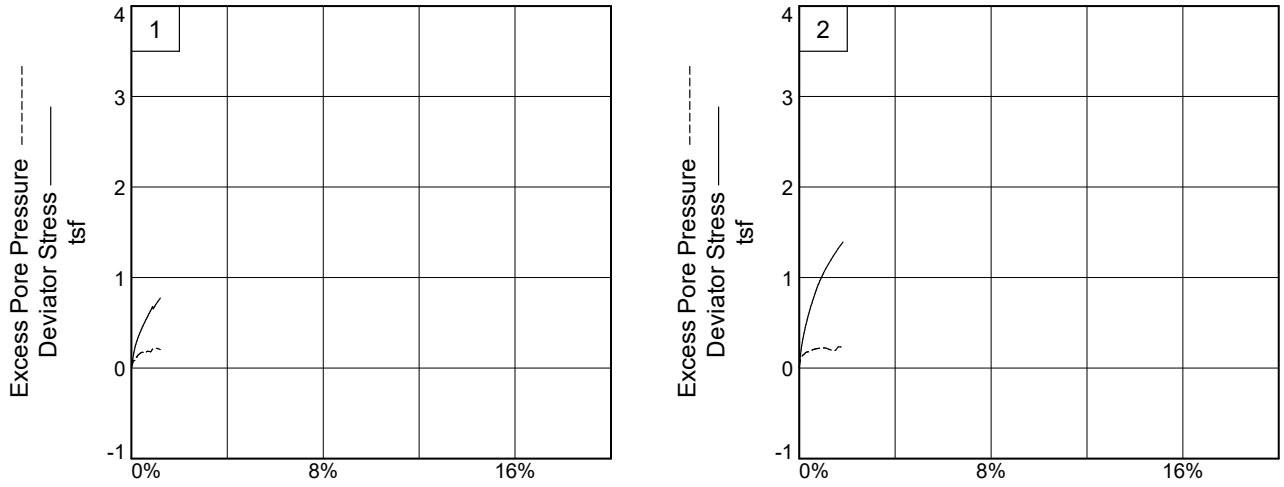
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

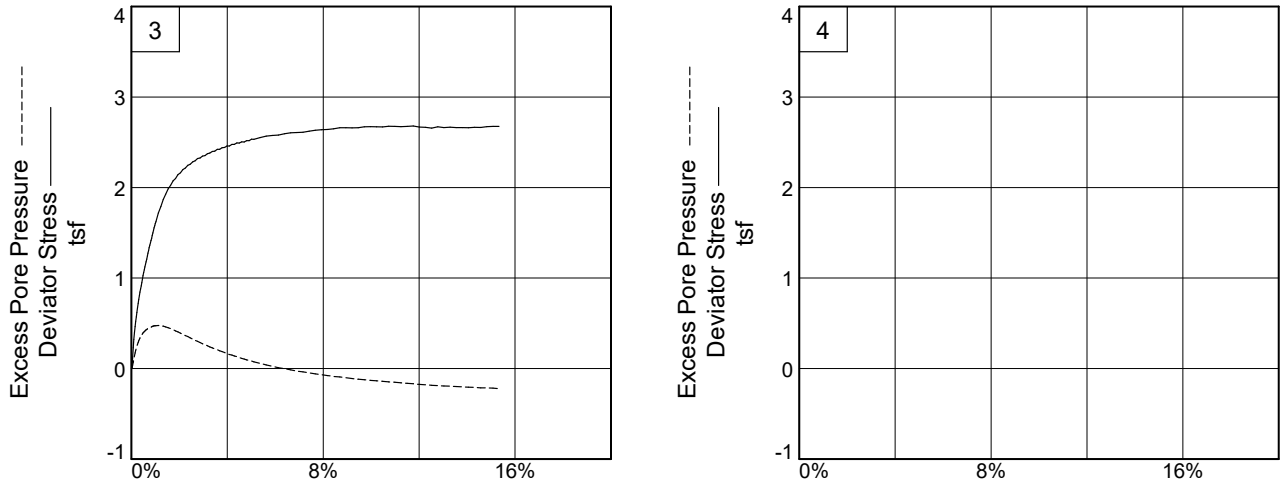
Source of Sample: CB-73 **Depth:** 14

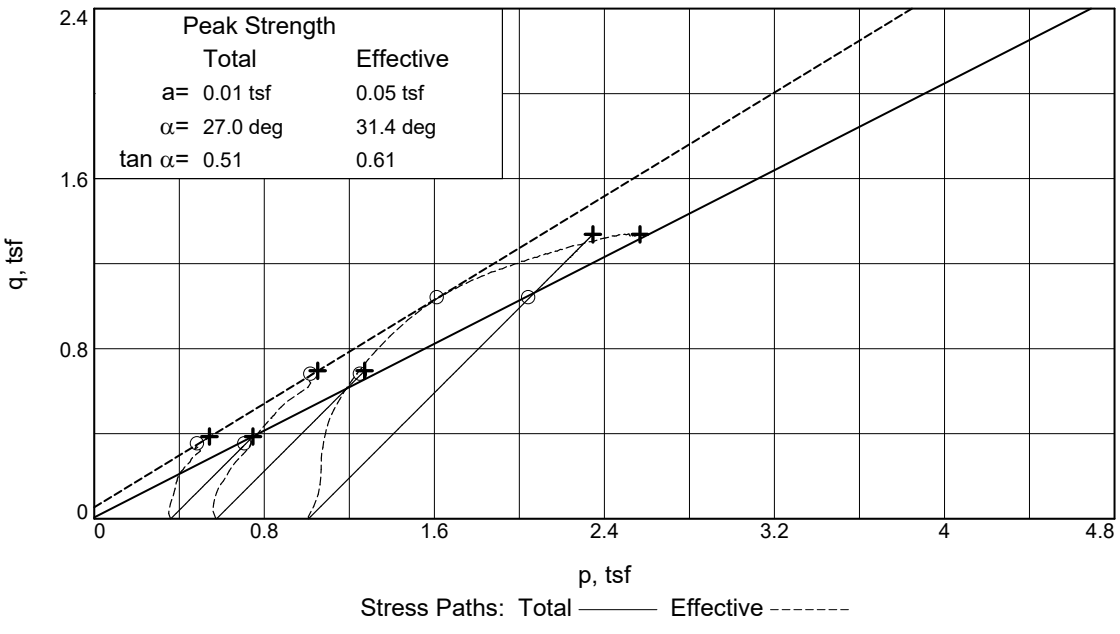
Sample Number: ST-2

Proj. No.: 21.14.223 **Date Sampled:** 11/21/21

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Tolunay-Wong Engineers, Inc.







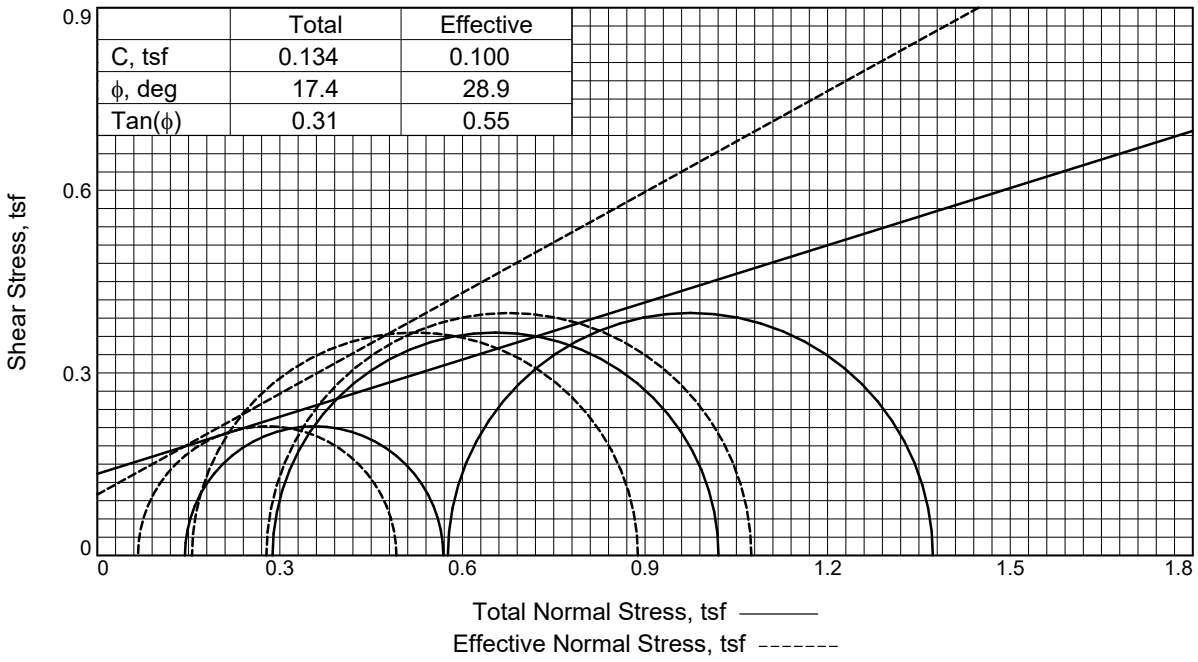
Client: CPA/ USACE

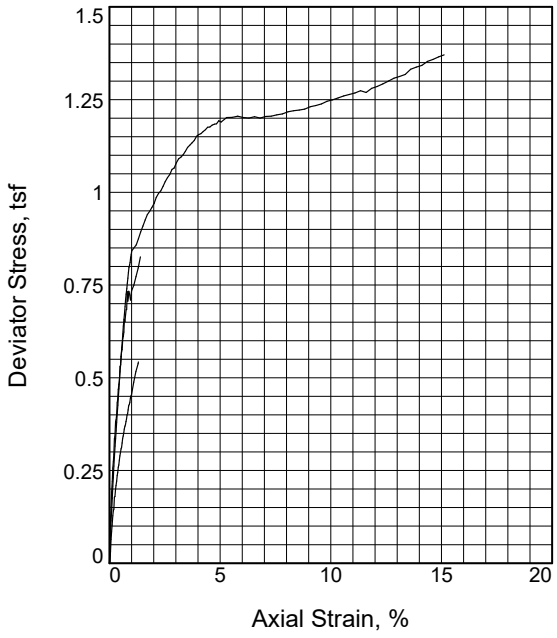
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-73 **Depth:** 14 **Sample Number:** ST-2

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	20.0	20.0	20.0
	Dry Density, pcf	107.4	107.4	107.4
	Saturation, %	94.9	94.9	94.9
	Void Ratio	0.5689	0.5689	0.5689
	Diameter, in.	2.05	2.05	2.05
	Height, in.	4.44	4.44	4.44
At Test	Water Content, %	19.1	19.1	19.1
	Dry Density, pcf	111.3	111.3	111.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.5149	0.5149	0.5149
	Diameter, in.	2.01	2.01	2.02
	Height, in.	4.46	4.43	4.40
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.42	0.73	0.80
Excess Pore Pr., tsf		0.08	0.13	0.30
Strain, %		0.9	0.8	0.9
Ult. Stress, tsf		0.42	0.73	0.80
Excess Pore Pr., tsf		0.08	0.13	0.30
Strain, %		0.9	0.8	0.9
$\bar{\sigma}_1$ Failure, tsf		0.49	0.89	1.07
$\bar{\sigma}_3$ Failure, tsf		0.07	0.16	0.28

Type of Test:
CU with Pore Pressures

Sample Type: Undistuurbed

Description: Gray and brown FAT CLAY; calcareous

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

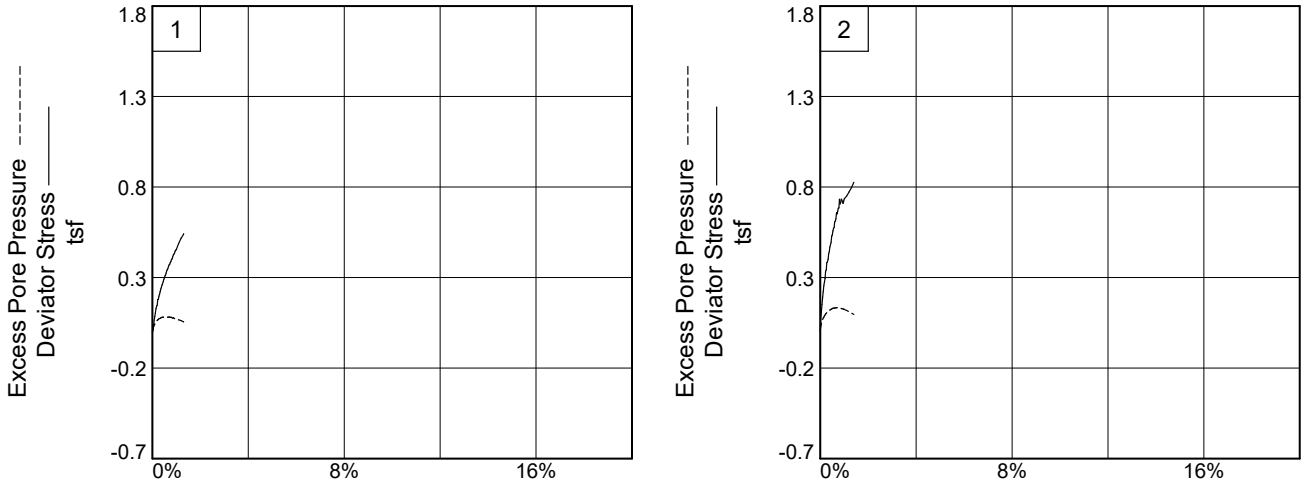
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

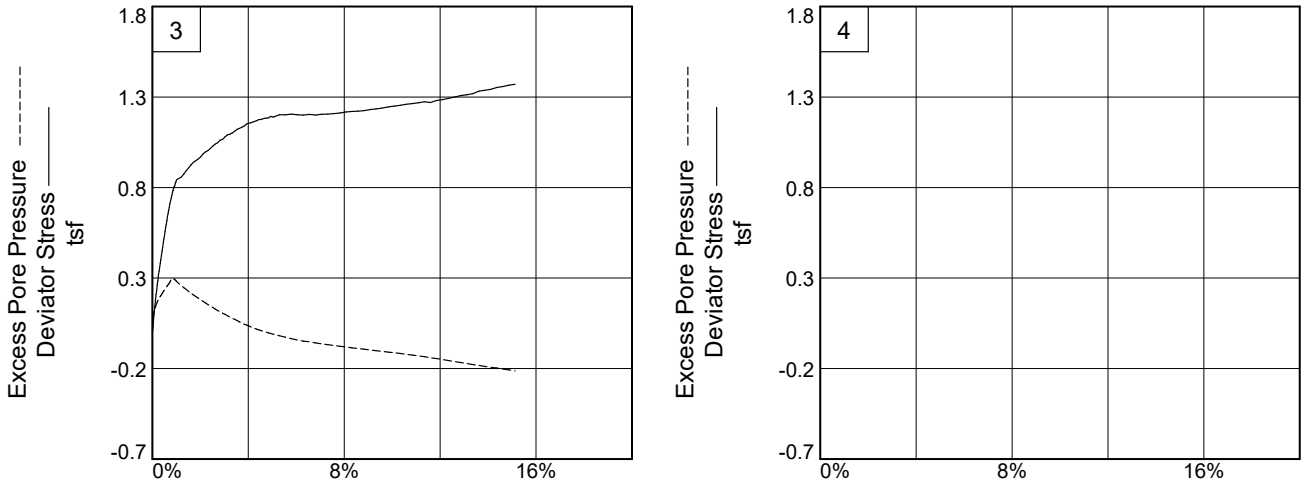
Source of Sample: CB-74 **Depth:** 5

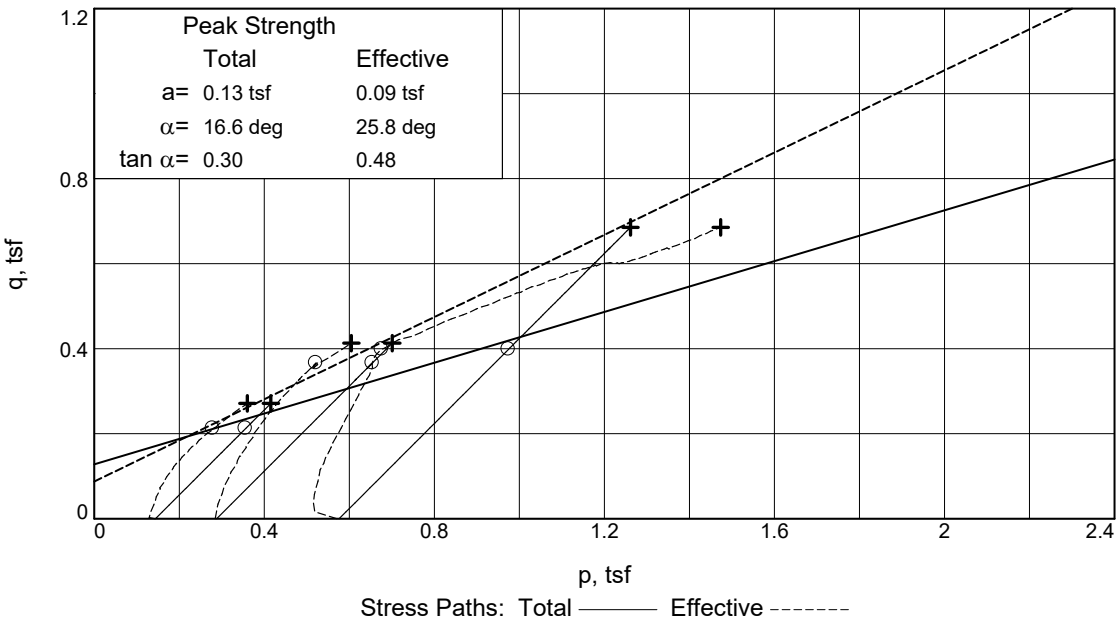
Sample Number: ST-1

Proj. No.: 21.14.223 **Date Sampled:** 11/15/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







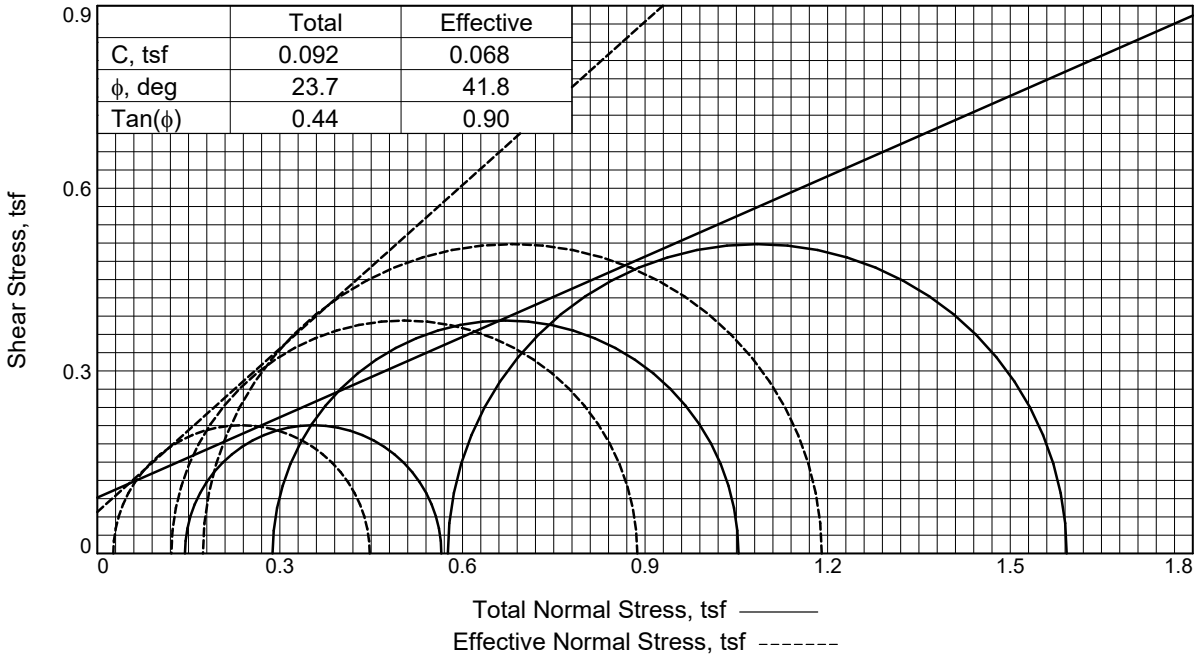
Client: CPA/ USACE

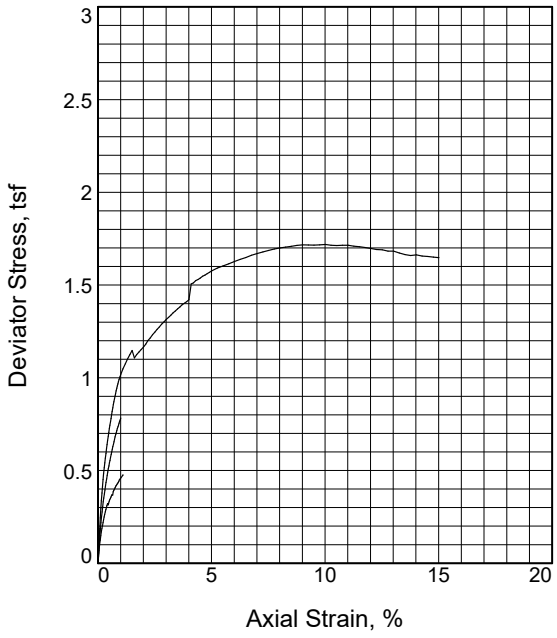
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-74 **Depth:** 5 **Sample Number:** ST-1

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	22.5	22.5	22.5
	Dry Density, pcf	104.8	104.8	104.8
	Saturation, %	99.9	99.9	99.9
	Void Ratio	0.6086	0.6086	0.6086
	Diameter, in.	2.06	2.06	2.06
	Height, in.	4.61	4.61	4.61
At Test	Water Content, %	23.4	23.4	23.4
	Dry Density, pcf	103.3	103.3	103.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.6324	0.6324	0.6324
	Diameter, in.	2.06	2.07	2.07
	Height, in.	4.65	4.63	4.61
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.42	0.77	1.02
Excess Pore Pr., tsf		0.12	0.17	0.40
Strain, %		0.8	1.0	1.0
Ult. Stress, tsf		0.42	0.77	1.02
Excess Pore Pr., tsf		0.12	0.17	0.40
Strain, %		0.8	1.0	1.0
$\bar{\sigma}_1$ Failure, tsf		0.45	0.89	1.19
$\bar{\sigma}_3$ Failure, tsf		0.03	0.12	0.17

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray and brown FAT CLAY; calcareous

Assumed Specific Gravity= 2.70

Remarks:
Test method: ASTM D4767
Failure type: Slickensided
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

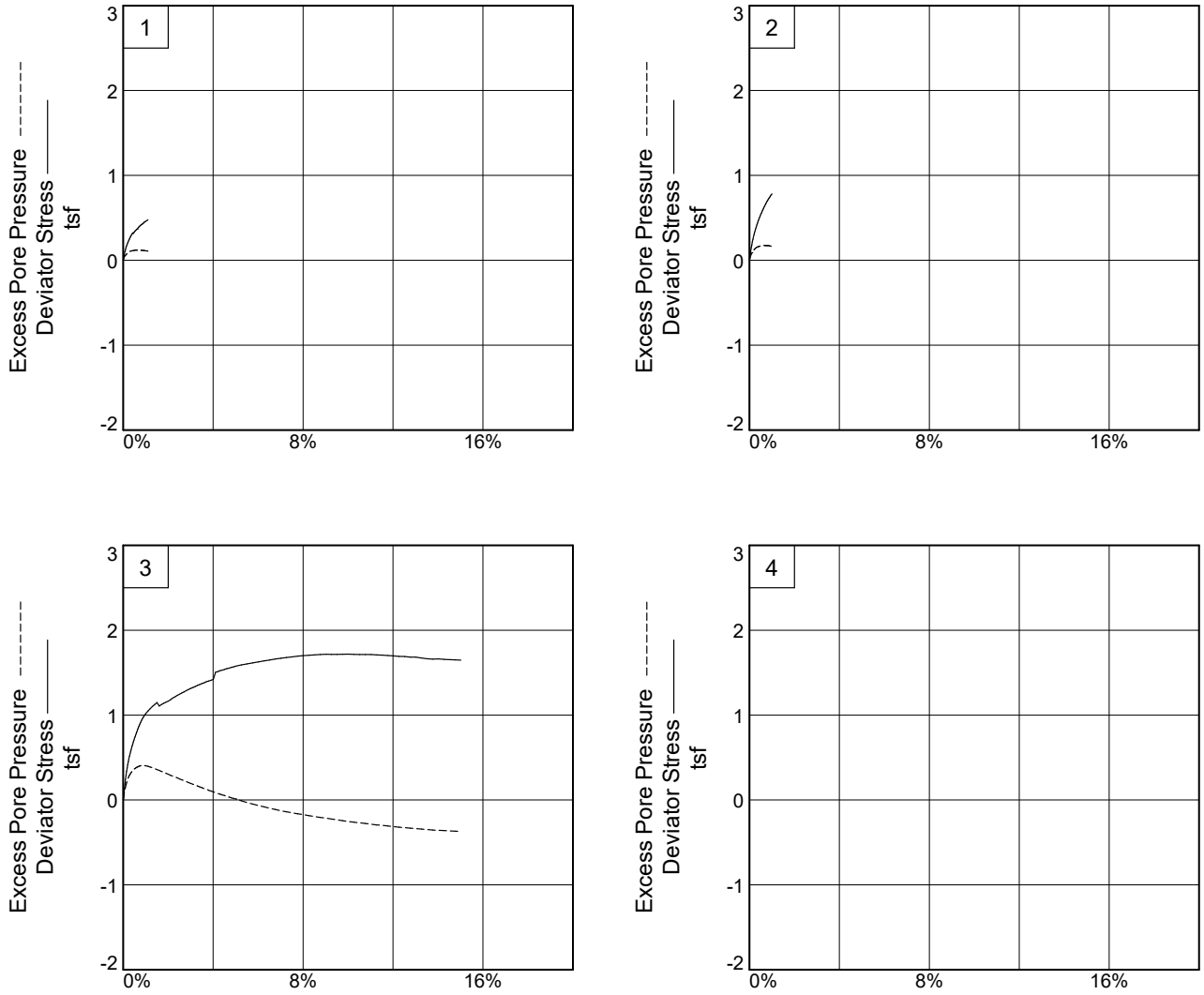
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

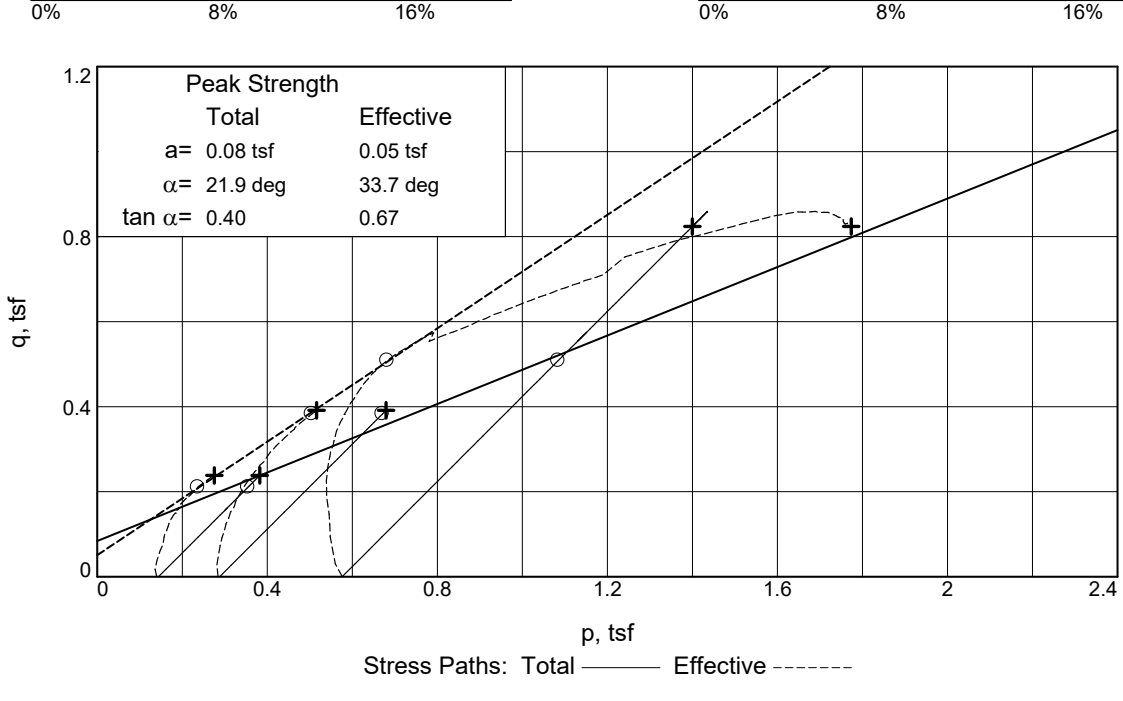
Source of Sample: CB-75 **Depth:** 7.5

Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/16/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.





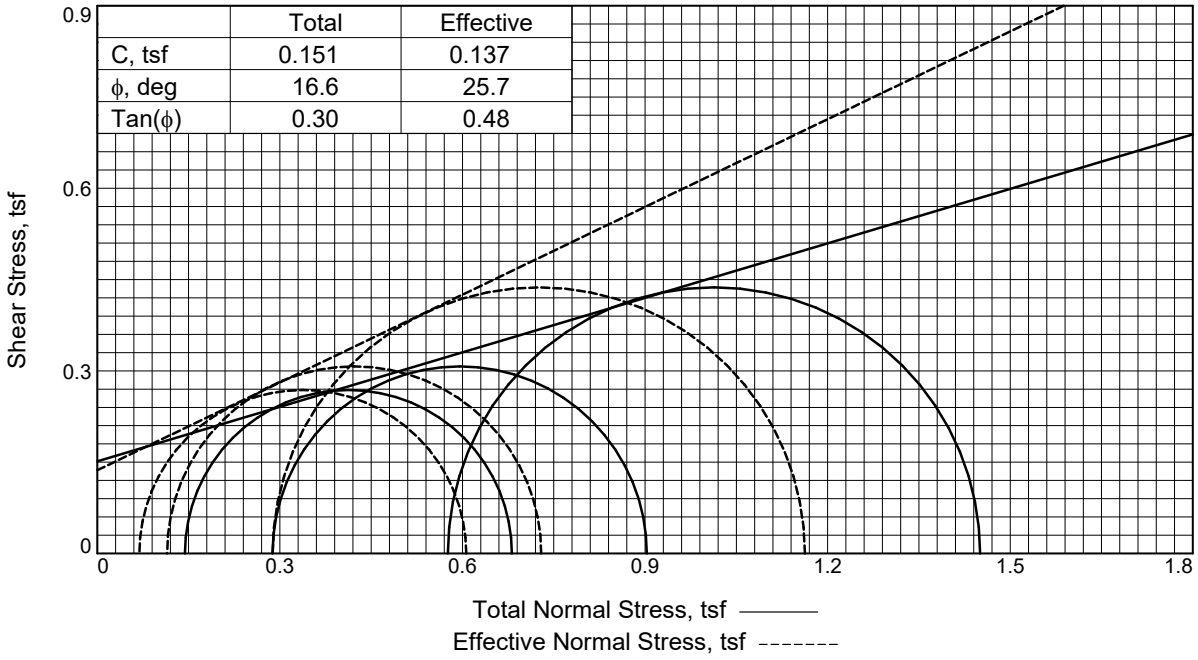
Client: CPA/ USACE

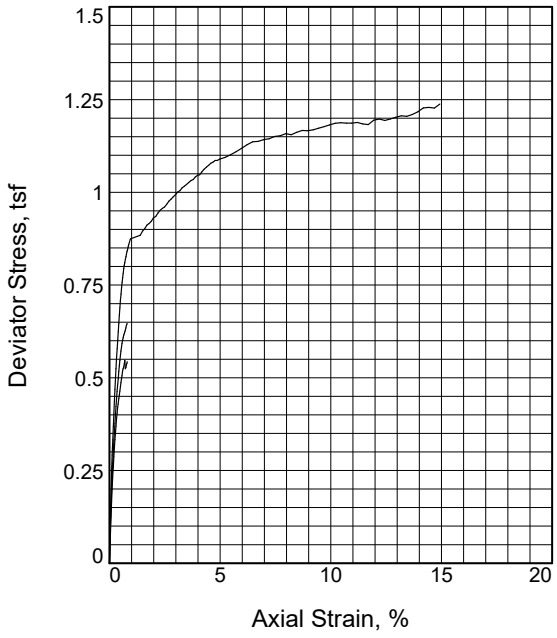
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-75 **Depth:** 7.5 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.





Sample No.		1	2	3
Initial	Water Content, %	27.3	27.3	27.3
	Dry Density, pcf	97.1	97.1	97.1
	Saturation, %	97.9	97.9	97.9
	Void Ratio	0.7673	0.7673	0.7673
	Diameter, in.	2.02	2.02	2.02
	Height, in.	4.62	4.62	4.62
At Test	Water Content, %	28.5	28.5	28.5
	Dry Density, pcf	96.3	96.3	96.3
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.7832	0.7832	0.7832
	Diameter, in.	2.02	2.02	2.03
	Height, in.	4.67	4.66	4.64
Strain rate, %/min.		0.0080	0.0080	0.0080
Eff. Cell Pressure, psi		2.00	4.00	8.00
Fail. Stress, tsf		0.54	0.61	0.87
Excess Pore Pr., tsf		0.07	0.17	0.29
Strain, %		0.7	0.6	0.9
Ult. Stress, tsf		0.54	0.61	0.87
Excess Pore Pr., tsf		0.07	0.17	0.29
Strain, %		0.7	0.6	0.9
$\bar{\sigma}_1$ Failure, tsf		0.61	0.73	1.16
$\bar{\sigma}_3$ Failure, tsf		0.07	0.11	0.29

Type of Test:
CU with Pore Pressures

Sample Type: Undisturbed

Description: Gray and brown FAT CLAY; calcareous

LL= 67 **PL=** 24 **PI=** 43

Assumed Specific Gravity= 2.75

Remarks:
Test method: ASTM D4767
Failure type: Multiple shear
Failure criteria: Effective Stress Ratio

Figure _____

Client: CPA/ USACE

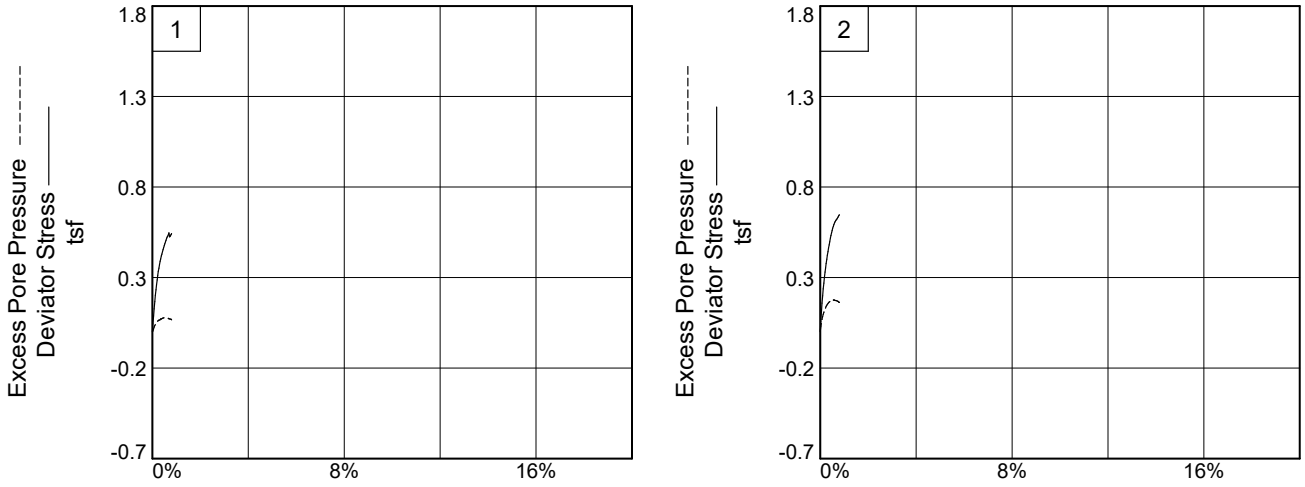
Project: MATAGORDA SHIP CHANNEL/ Placement Areas

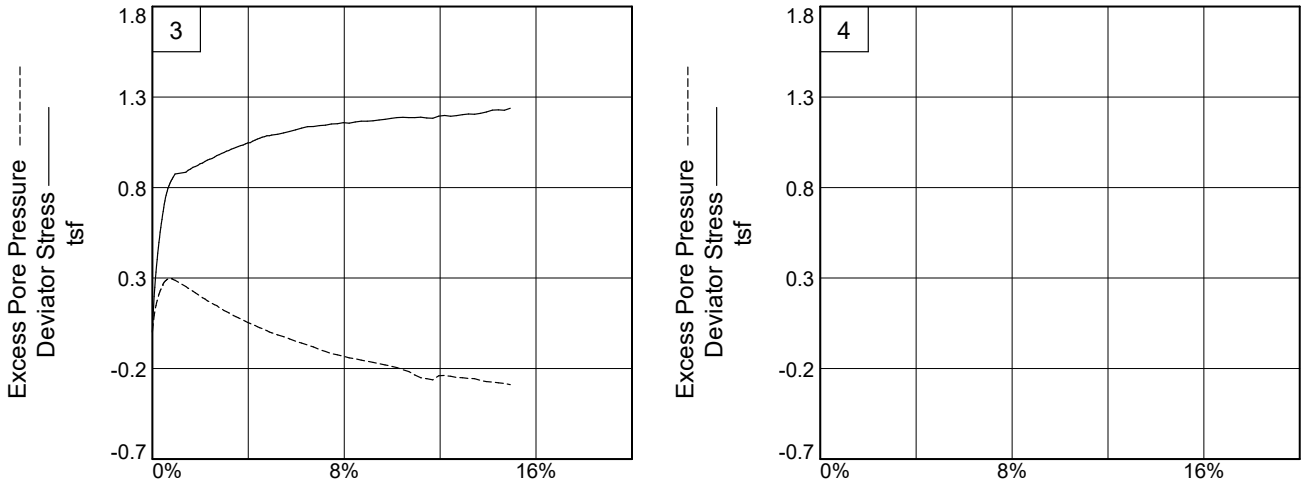
Source of Sample: CB-76 **Depth:** 7.5

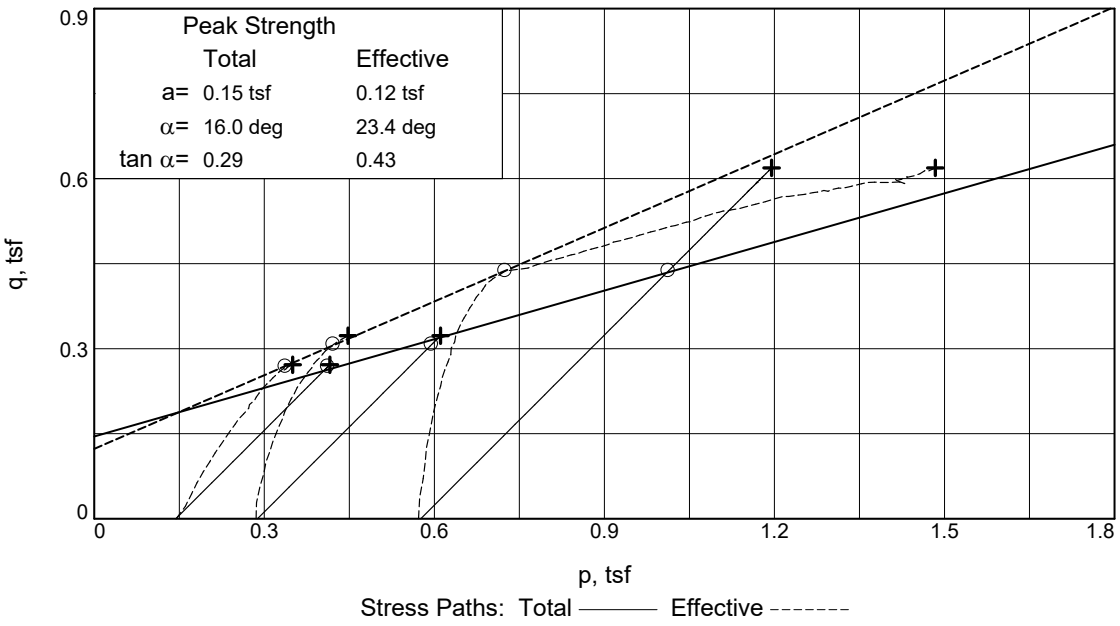
Sample Number: ST-3

Proj. No.: 21.14.223 **Date Sampled:** 11/16/21

TRIAXIAL SHEAR TEST REPORT
Tolunay-Wong Engineers, Inc.







Client: CPA/ USACE

Project: MATAGORDA SHIP CHANNEL/ Placement Areas

Source of Sample: CB-76 **Depth:** 7.5 **Sample Number:** ST-3

Project No.: 21.14.223 **Figure** _____

Tolunay-Wong Engineers, Inc.

APPENDIX F

LABORATORY USACE CALIBRATION CERTIFICATES

MTC
MATERIALS TESTING CENTER

USACE CERTIFICATE OF LABORATORY VALIDATION

Tolunay-Wong Engineers, Inc.
10710 South Sam Houston Parkway West, Suite 100
Houston, TX,
Patricia Hodgkins
(713) 722-7064

has demonstrated, by abbreviated audit of its AASHTO accreditation, or by inspection of required records, equipment, procedures, facilities, and/or final reports, its proficiency to perform testing of construction materials, as established by the quality standards of AASHTO R 18 guidance and the requirements of the applicable ASTM standards.

THIS USACE CERTIFICATE OF LABORATORY VALIDATION IS ACCURATE AS OF ITS DATE AND TIME OF GENERATION:

25 AUG 2020 AT 09:25 HOURS

ALL METHODS LISTED ON THIS CERTIFICATE OF VALIDATION WILL EXPIRE ON 08/16/2022

PLEASE CONFIRM THE CURRENT VALIDATION STATUS OF THIS LABORATORY USING THE SEARCH FEATURE ON OUR PUBLIC WEBSITE: https://mtc.erdc.dren.mil

Chad A. Gartrell, PE, Director
USACE Materials Testing Center
Vicksburg, Mississippi, USA

AGGREGATE

Aggregate - C 29 - Opt - Unit Weight and Voids in Aggregate
Aggregate - C 40 - Opt - Organic Impurities
Aggregate - D 75 - Opt - Sampling
Aggregate - C 117 - Req - Material Finer than 75 µm (No. 200) Sieve
Aggregate - C 123 - Opt - Lightweight Particles
Aggregate - C 127 - Req - Specific Gravity & Absorption in Coarse Aggregate
Aggregate - C 128 - Req - Specific Gravity & Absorption in Fine Aggregate
Aggregate - C 136 - Req - Sieve Analysis of Aggregates
Aggregate - C 142 - Opt - Clay Lumps
Aggregate - D 546 - Opt - Sieve Analysis of Mineral Filler
Aggregate - C 566 - Opt - Total Moisture Content
Aggregate - C 702 - Opt - Reducing Samples to Testing Size
Aggregate - C 1077 - Opt - Concrete and Concrete Aggregate Testing Standards (Quality Standards)

BITUMINOUS

Bituminous - D 140 - Req - Sampling Bituminous Materials
Bituminous - D 979 - Req - Sampling Bituminous Paving Mixtures
Bituminous - D 1560 - Req - Resistance to Deformation & Cohesion by Hveem
Bituminous - D 2041 - Req - Theoretical Maximum Specific Gravity & Density (Rice)
Bituminous - D 2172 - Req - Quantitative Extraction
Bituminous - D 2726 - Req - Bulk Specific Gravity and Density
Bituminous - D 3666 - Opt - Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
Bituminous - D 5444 - Req - Mechanical Size Analysis of Extracted Aggregate

CONCRETE

Concrete - C 31 - Req - Making and Curing Test Specimens in the Field
Concrete - C 39 - Req - Compressive Strength of Cylindrical Specimens

Concrete - C 78 - Opt - Flexural Strength by Third Point Loading
Concrete - C 138 - Req - Unit Weight and Air Content by Gravimetric
Concrete - C 143 - Req - Slump
Concrete - C 172 - Req - Sampling
Concrete - C 173 - Req - Air Content by Volumetric ***required if C231 not performed***
Concrete - C 174 - Opt - Concrete Thickness by Drilled Cores
Concrete - C 231 - Req - Air Content by Pressure ***required if C173 not performed***
Concrete - C 293 - Opt - Flexural Strength by Center Point Loading
Concrete - C 470 - Opt - Molds for Forming Concrete Test Cylinders Vertically
Concrete - C 511 - Opt - Moist Cabinets, Moist Rooms, Water Storage Tanks
Concrete - C 617 - Opt - Capping Cylindrical Specimens
Concrete - C 1064 - Req - Temperature of Concrete
Concrete - C 1077 - Opt - Concrete and Concrete Aggregate Testing Standards (Quality Standards)
Concrete - C 1231 - Opt - Unbonded Caps

SOILS

Soils - G 51 - Opt - Measuring pH of Soil for Use in Corrosion Testing
Soils - G 57 - Opt - Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method
Soils - D 421 - Req - Dry Preparation for Particle Size Distribution & Soil Constants
Soils - D 422 - Req - Particle Size Analysis
Soils - D 558 - Req - Moisture-Density of Soil-Cement
Soils - D 698 - Req - Compaction Characteristics by Standard Effort
Soils - D 854 - Req - Specific Gravity of Soils
Soils - D 1140 - Req - Material Finer than 75 m (No. 200) Sieve
Soils - D 1556 - Req - Density & Unit Weight by Sand Cone
Soils - D 1557 - Req - Compaction Characteristics by Modified Effort
Soils - D 1883 - Req - CA Bearing Ratio (CBR)
Soils - D 2166 - Req - Unconfined Compressive Strength
Soils - D 2168 - Req - Calibration of Laboratory Mechanical-Rammer Soil Compactors
Soils - D 2216 - Req - Water Content
Soils - D 2434 - Opt - Permeability of Granular Soils (Constant Head Method) (Withdrawn 2015)
Soils - D 2435 - Req - One-Dimensional Consolidation Properties
Soils - D 2487 - Req - Classification of Soils
Soils - D 2488 - Req - Description & Identification of Soils (Visual-Manual Procedure)
Soils - D 2850 - Req - Unconsolidated, Undrained Strength in Triaxial Compression
Soils - D 2937 - Req - Density by Drive Cylinder Method
Soils - D 2974 - Req - Moisture, Ash, & Organic Matter of Peat & Other Organic Soils
Soils - D 3080 - Req - Direct Shear Test in Consolidated Drained Conditions
Soils - D 4220 - Req - Preserving & Transporting Samples
Soils - D 4318 - Req - Liquid & Plastic Limits & Plasticity Index
Soils - D 4373 - Opt - Rapid Determination of Carbonate Content of Soils
Soils - D 4546 - Req - One-Dimensional Swell or Settlement Potential
Soils - D 4643 - Req - Determination of Water Content of Soil by Microwave Oven
Soils - D 4647 - Opt - Identification and Classification of Dispersive Clay Soils by the Pinhole Test
Soils - D 4648 - Opt - Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soi
Soils - D 4767 - Req - Consolidated-Undrained Triaxial Compression
Soils - D 5084 - Req - Hydraulic Conductivity using a Flexible Wall Permeameter
Soils - D 6572 - Opt - Determining Dispersive Characteristics of Clayey Soils by the Crumb Test
Soils - D 6913 - Req - Particle-Size Distribution of Soils Using Sieve Analysis
Soils - D 6938 - Req - Density and Water Content by Shallow Depth Nuclear Method
Soils - D 7263 - Opt - Laboratory Determination of Density (Unit Weight) of Soil Specimens

USACE CERTIFICATE OF LABORATORY VALIDATION

TRI / Environmental, Inc.

9063 Bee Caves Road
Austin, TX, United States
Jeffrey Kuhn
(512) 263-2101

has demonstrated, by abbreviated audit of its AASHTO accreditation, or by inspection of required records, equipment, procedures, facilities, and/or final reports, its proficiency to perform testing of construction materials, as established by the quality standards of AASHTO R 18 guidance and the requirements of the applicable ASTM standards.

THIS USACE CERTIFICATE OF LABORATORY VALIDATION IS ACCURATE AS OF ITS DATE AND TIME OF GENERATION:

27 MAY 2020 AT 13:17 HOURS

ALL METHODS LISTED ON THIS CERTIFICATE OF VALIDATION WILL EXPIRE ON 04/04/2022

PLEASE CONFIRM THE CURRENT VALIDATION STATUS OF THIS LABORATORY USING THE SEARCH FEATURE ON OUR PUBLIC WEBSITE: **https://mtc.erdc.dren.mil**

Chad A. Gartrell, PE, Director
USACE Materials Testing Center
Vicksburg, Mississippi, USA

GEOTEXTILES

Geotextiles - E 96 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - FTM 101 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 413 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 527 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 570 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 638 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 696 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 737 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 746 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 751 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 790 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 792 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 882 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - F 904 - Opt - Geosynthetic Standards Institute Test Method
Geotextiles - D 1004 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1203 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1204 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1238 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - F 1249 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1388 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - F 1473 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - CAN/CGSB 1481 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1505 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1593 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1603 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 1822 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 1922 - Opt - ASTM Geosynthetic Materials Testing Standard

Geotextiles - D 1987 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 2122 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 2136 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - F 2136 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 4886 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 5035 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 5596 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 5885 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 5890 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 5891 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 5993 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 5994 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6140 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6213 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6214 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6241 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6243 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6364 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 6454 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6475 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6496 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6524 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 6525 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 6706 - Opt - ASTM Geosynthetic Materials Testing Standard
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Geotextiles - D 7004 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7005 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7056 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7101 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7179 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7207 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7238 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7272 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7275 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7322 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7361 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7406 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7409 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7447 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7448 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7449 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7466 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - D 7737 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 9863 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 9864 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 10319 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 10321 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 10722 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 11058 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - EN 12224 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12225 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12236 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12447 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12956 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12957 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12958 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 12960 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 13426 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 13431 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 13433 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 13438 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - ISO 13934 - Opt - ASTM Geosynthetic Materials Testing Standard
Geotextiles - EN 14030 - Opt - ASTM Geosynthetic Materials Testing Standard

ROCK

Rock - D 3967 - Req - Tensile Strength, Splitting (Brazilian) Method
Rock - D 4543 - Req - Preparing Rock Core Specimens and Determining Tolerances
Rock - D 4644 - Req - Slake Durability of Shales and Weak Rocks
Rock - D 5607 - Req - Laboratory direct Shear Tests on Rock Under Constant Normal
Rock - D 5731 - Req - Point Load Index
Rock - D 7012 - Req - Compressive Strength & Elastic Moduli of Rock Core Specimens

SOILS

Soils - D 421 - Req - Dry Preparation for Particle Size Distribution & Soil Constants
Soils - D 422 - Req - Particle Size Analysis
Soils - D 558 - Req - Moisture-Density of Soil-Cement
Soils - D 698 - Req - Compaction Characteristics by Standard Effort
Soils - D 1140 - Req - Material Finer than 75 µm (No. 200) Sieve
Soils - D 1557 - Req - Compaction Characteristics by Modified Effort
Soils - D 2166 - Req - Unconfined Compressive Strength
Soils - D 2216 - Req - Water Content
Soils - D 2434 - Opt - Permeability of Granular Soils (Constant Head Method) (Withdrawn 2015)
Soils - D 2435 - Req - One-Dimensional Consolidation Properties
Soils - D 2487 - Req - Classification of Soils
Soils - D 2850 - Req - Unconsolidated, Undrained Strength in Triaxial Compression
Soils - D 2974 - Req - Moisture, Ash, & Organic Matter of Peat & Other Organic Soils
Soils - D 3080 - Req - Direct Shear Test in Consolidated Drained Conditions
Soils - D 4253 - Req - Maximum Index Density by Vibratory Table
Soils - D 4254 - Req - Minimum Index Density
Soils - D 4318 - Req - Liquid & Plastic Limits & Plasticity Index
Soils - D 4546 - Req - One-Dimensional Swell or Settlement Potential
Soils - D 4643 - Req - Determination of Water Content of Soil by Microwave Oven
Soils - D 4767 - Req - Consolidated-Undrained Triaxial Compression
Soils - D 4972 - Opt - pH of Soils
Soils - D 5084 - Req - Hydraulic Conductivity using a Flexible Wall Permeameter
Soils - D 6913 - Req - Particle-Size Distribution of Soils Using Sieve Analysis

End of Report

ATTACHMENT G-2

This section presents the stability analyses performed for the 2022 Matagorda Ship Channel (MSC) Improvement project PED phase Contract 1

APPENDIX B – RESULTS OF SLOPE STABILITY MODELS

This section presents the stability analyses performed for the 2022 Matagorda Ship Channel (MSC) Improvement project PED phase Contract 1. The approximate limits of the Contract 1 project (Sta. 0+000 to -26+400) are as shown in the Figure B-1.

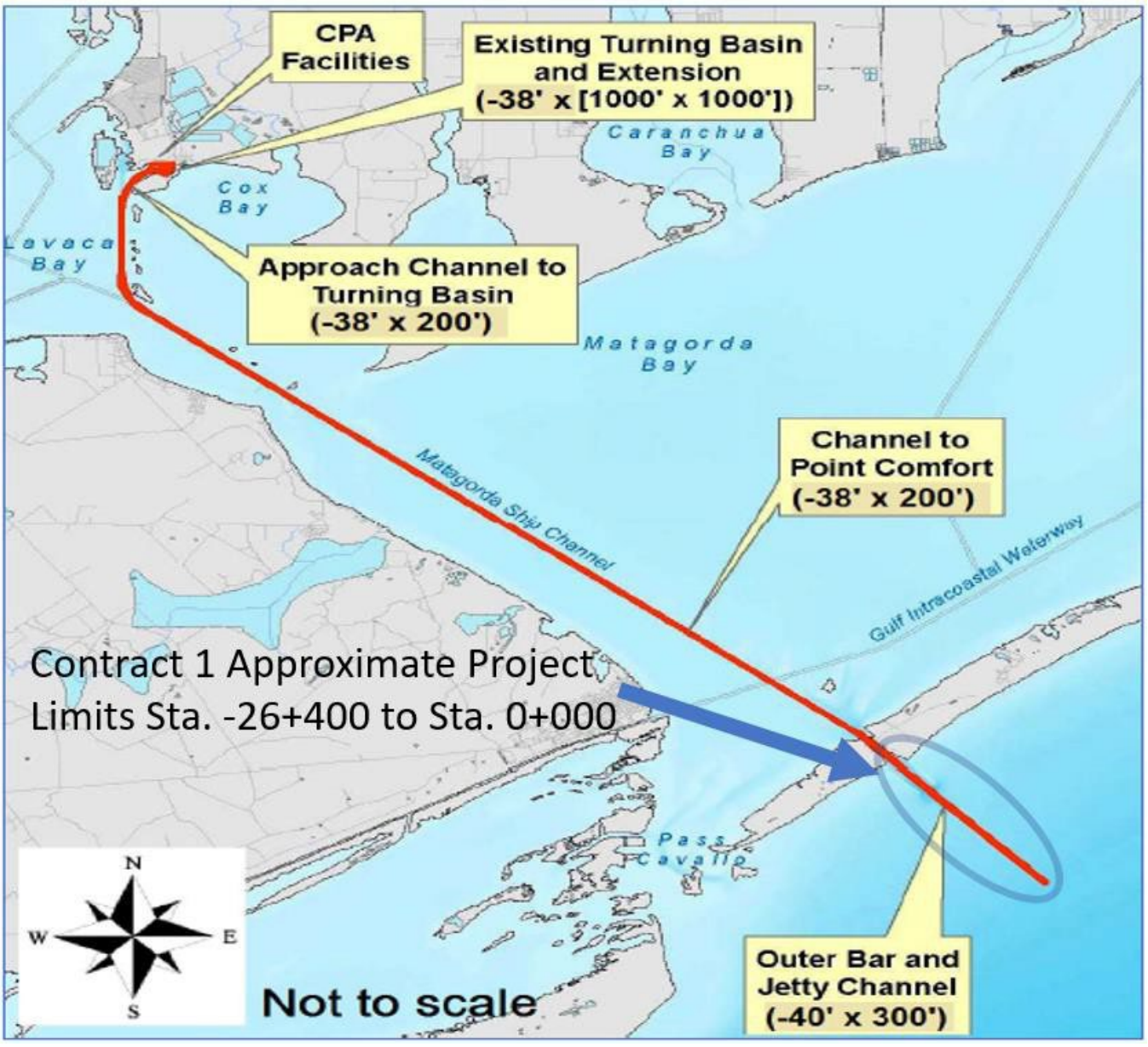


Figure B-1 - Vicinity Map

All the available geotechnical information including the data from Geotechnical Investigation (2021) was collected, reviewed, and utilized as part of the MSC Project PED phase Contract 1 design work in 2022. This section summarizes the channel stability analyses performed as part of the design work.

CHANNEL SLOPE STABILITY

The proposed channel development will consider a design channel slope of 10H:1V (within Sta.-6+000 to -26+400) and a transition design channel slope between 10H:1V and 5H:1V (within Sta. -6+000 to 0+000).

Although the analysis confirms a stable slope under steady-state static conditions, it is acknowledged that the channel slopes will frequently be subject to significant pressure waves when loaded deep-draft vessels pass, and that the pressure wave can cause significant temporary fluctuation in the pore pressure well below the surface of the slope.

This pore pressure fluctuation may result in shallow-slope slides at locations where the slope material is closer to a critical FS. The depths of the slides are limited by the depth of pore pressure fluctuation due to the pressure waves. The potential depths and locations of the slides will be highly variable along the channel, as can be ascertained by a review of previous slope changes, with time, along the channel slopes, which were originally dredged to a uniform slope. Since the sloughing
could occur in various places along the channel and on portions of the slopes it is not practical to find all shallow slides that will occur. Historically, the USACE Galveston District designs the slopes for the steady-state static condition and will remove the sloughed material from the channel bottom during the maintenance-dredging cycles, along with shoaled material.

Two types (circular and block/wedge) of slip surfaces/failure modes were considered using Geoslope software -Morgenstern-Price method for subject channel deepening and widening. Subsurface soil profiles for slope sections were developed based on nearest soil borings from available geotechnical data.

Stability Analyses were performed for two stages.

1) Short-term Stability (Undrained Conditions, immediately after dredging)
2) Long-term Stability (Drained Conditions, after dredging during potential surge level variation)

The channel slopes were analyzed for both undrained and drained conditions.

APPENDIX B – RESULTS OF SLOPE STABILITY MODELS

Safety factors (associated with slope stability analyses) specified in the Engineering Manuals are as summarized below:

- EM 1110-2-5025, Table 4-8 recommends a minimum factor of safety of 1.3 for both the undrained and drained conditions for slopes less than 30 feet in height. This is not applicable because the project Channel slope height is more than 30 feet. For slopes with heights greater than 30 feet, EM 1110-2-1902, Table 3-1 recommends minimum factors of safety of 1.3 and 1.5 for undrained and drained conditions, respectively, for the earth and rock-fill dams. This is not applicable because no drained stage factor of safety for upstream slope (channel face) is not specified in the EM 1110-2- 1902.
- EM 1110-2-1913, Table 6-1b recommends minimum factors of safety of 1.3 and 1.4 for undrained and drained conditions for other embankments and dikes including navigation channels. Table 6-1b also specifies that lower factors of safety may be appropriate when the consequences of failure in terms of safety, environmental damage and economic losses are small.

Considering the relatively low consequences of failure of a channel slope compared to a dam's failure, a minimum factor of safety of 1.3 for end-of-construction (undrained) and for long-term (drained) conditions were selected for this analysis.

A geotechnical engineering evaluation of the slope stability of the channel cut was conducted based on available geotechnical data from 2021 Geotechnical Investigation. Total of four (4) sections were identified as critical and were analyzed for slope stability as part of this 95% design. Results of slope stability models are attached.

The Table B.1 tabulates the various soil strength parameters assumed for subsurface layers and sections for the slope stability models.

APPENDIX B – RESULTS OF SLOPE STABILITY MODELS

Table B.1 Geotechnical Design Parameters

Station Limits	Reference Borings	Elevation	Soil Type	Saturated Unit Weight	Strength Parameters			
					Short-Term/Undrained Shear Strength		Long-Term/Drained Shear Strength	
					Friction Angle (deg)	Undrained Shear Strength /Cohesion (psf)	Friction Angle (deg)	Cohesion (psf)
-11+000	CB-12	-38 to -40	M. Dense SM	125	30	N/A	30	0
		-40 to -55	Dense SP-SM/SM	125	32	N/A	32	0
		-55 to -90	V.Dense SP-SM/SM	125	34	N/A	34	0
-13+000	CB-12	-36 to -48	Loose to V. Dense SP-SM/SM	120	28	N/A	28	0
		-48 to -60	V.Soft CH	120	N/A	250	24	0
		-60 to -90	Soft to Stiff CL	120	N/A	500	26	0
-16+000	CB-10	-35 to -40	M. Dense SM	125	30	N/A	30	0
		-40 to -45	Loose SC	125	28	N/A	28	0
		-45 to -90	Soft to Stiff CL/CH	120	N/A	500	26	0
-20+000	CB-7 & CB-8	Below -42	Soft to Stiff CL/CH	120	N/A	500	26	0

Short-term stability analyses were performed using undrained shear strength parameters for cohesive soils. Long-term Stability analyses were performed using available Consolidated Undrained (CU) testing data and reasonably assumed geotechnical parameters. The Table B.2 tabulates the results of channel slope stability analyses.

Table B.2 Channel Stability Analyses Summary

Station Number	Factor of Safety (FS) - Stability			
	Circle Failure Mode		Block/Wedge Failure Mode	
	Short-term	Long-term	Short-term	Long-term
STA -11+000	3.25	3.21	3.51	2.94
STA -13+000	2.44	2.50	2.57	2.69
STA -16+000	2.68	2.58	2.65	2.65
STA -20+000	6.13	2.62	7.04	2.81

Results show that the lowest factor of safety (FS) was 2.44 for section at STA -13+000 and met the minimum factor of safety of 1.3. Therefore, the proposed channel development is Geotechnically feasible. Graphical illustration with soil information regarding these slope stability analyses are attached in the following section.

REFERENCE

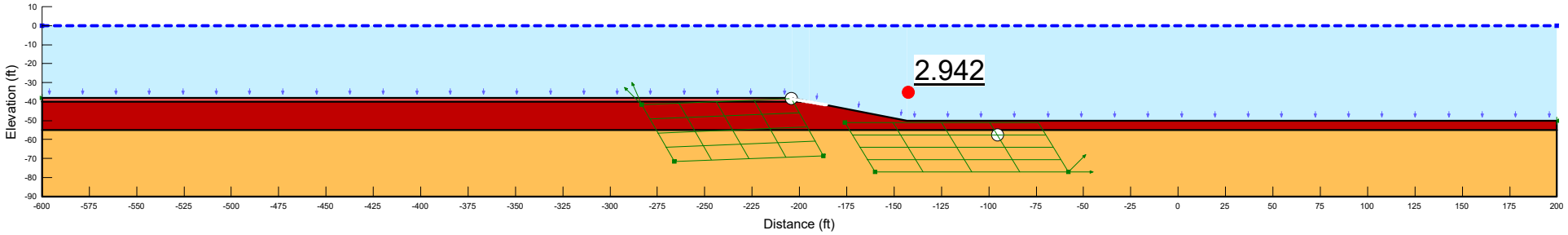
1. Washington, D.C. USACE EM 1110-2-1913 Design and Construction of Levees (30 April 2000)
2. Washington, D.C. USACE EM 1110-2-1902 Slope Stability (31 Oct 2003)
3. Washington, D.C. USACE EM 1110-2-5025 Dredging and Dredged Material Management (31 July 2015)

ATTACHMENT

ATTACHMENT – GRAPHICAL OUTPUT OF THE SHIP CHANNEL STABILITY MODELS

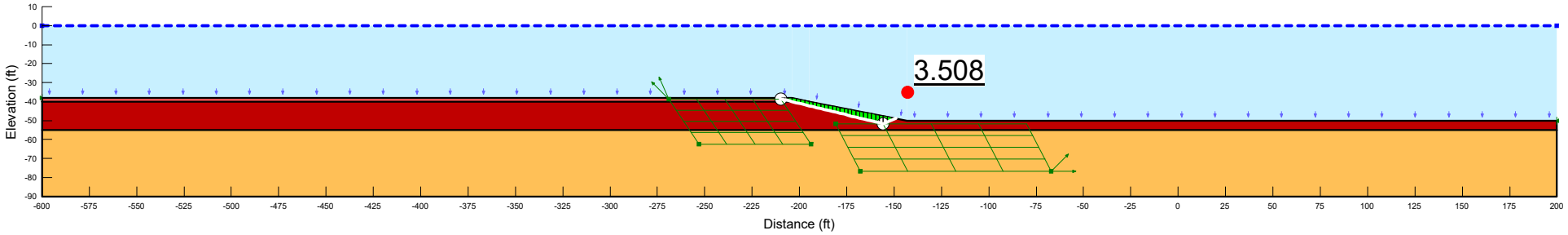
MSC PED_-11+000 Block Exterior LT

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	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



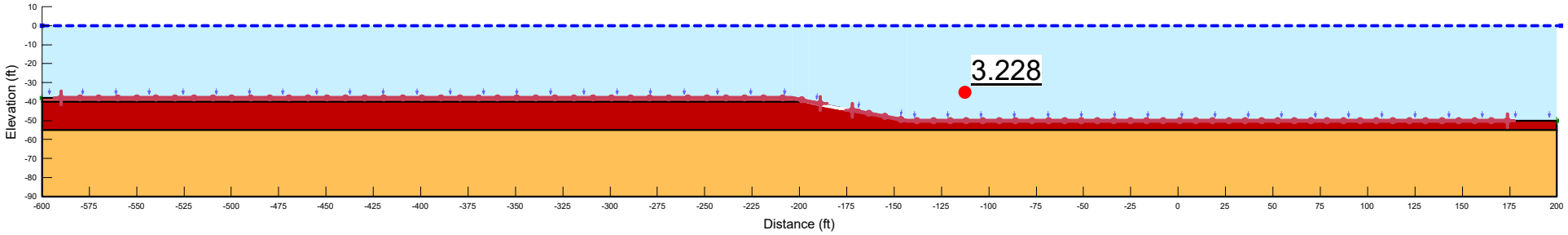
MSC PED_-11+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Phi' (°)
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	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



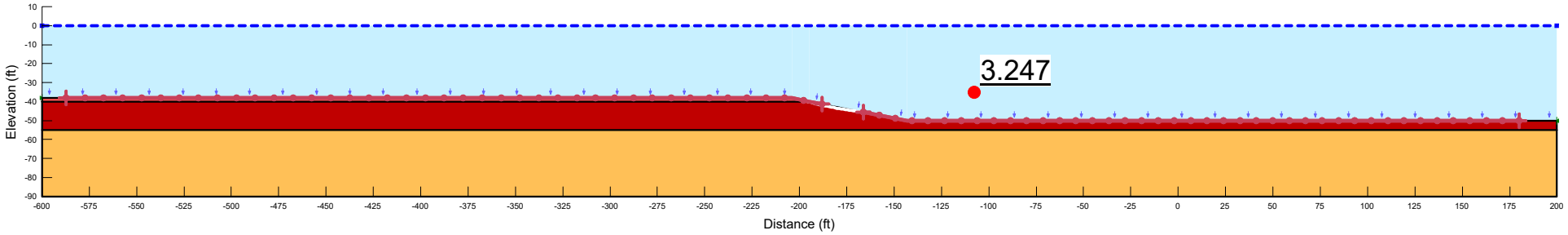
MSC PED_-11+000 Circular Exterior LT

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	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



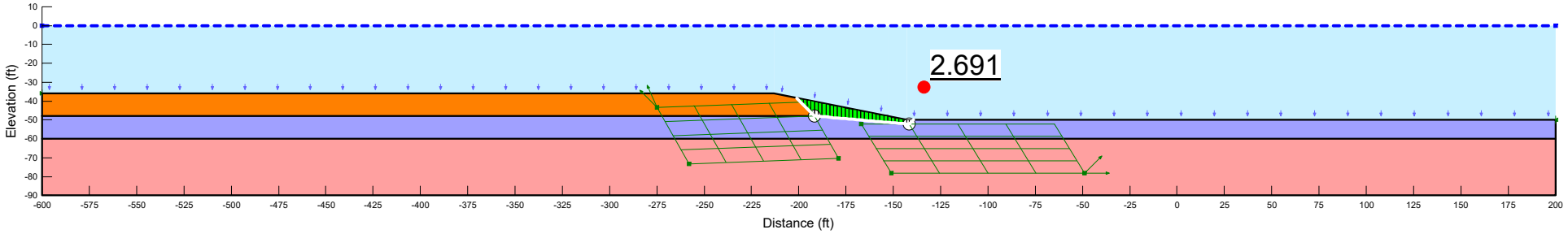
MSC PED_-11+000 Circular Exterior ST

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	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



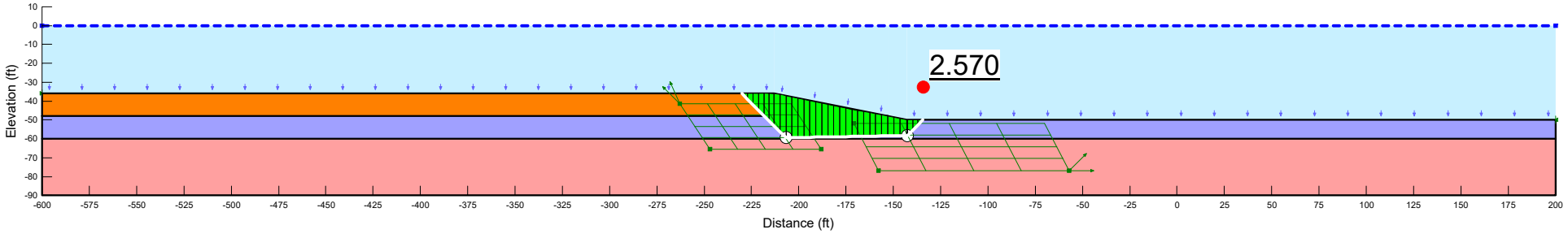
MSC PED_-13+000 Block Exterior LT

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	Soft to Stiff CL for Long Term Parameters	120	26
	V. Soft CH for Long Term Parameters	120	24



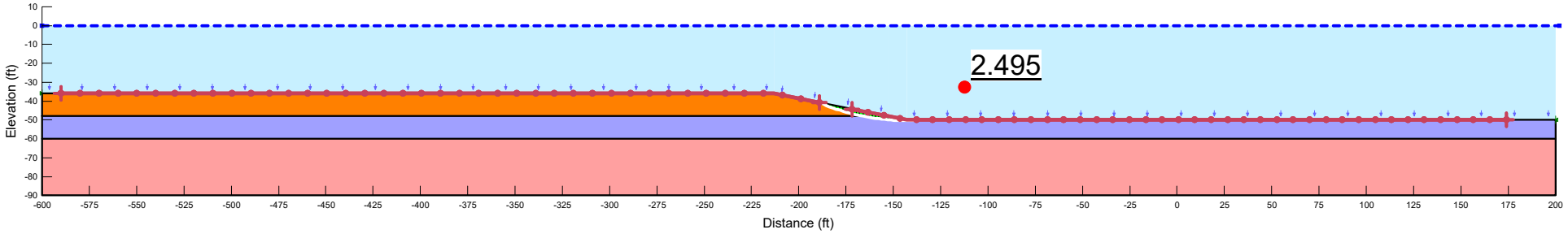
MSC PED_-13+000 Block Exterior ST

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	Soft to Stiff CL	120	500	
	V. Soft CH	120	250	



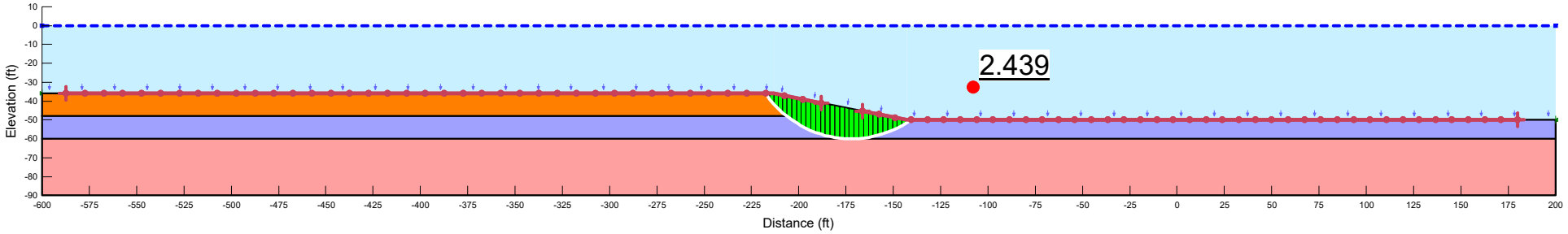
MSC PED_-13+000 Circular Exterior LT

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	V. Soft CH for Long Term Parameters	120	24



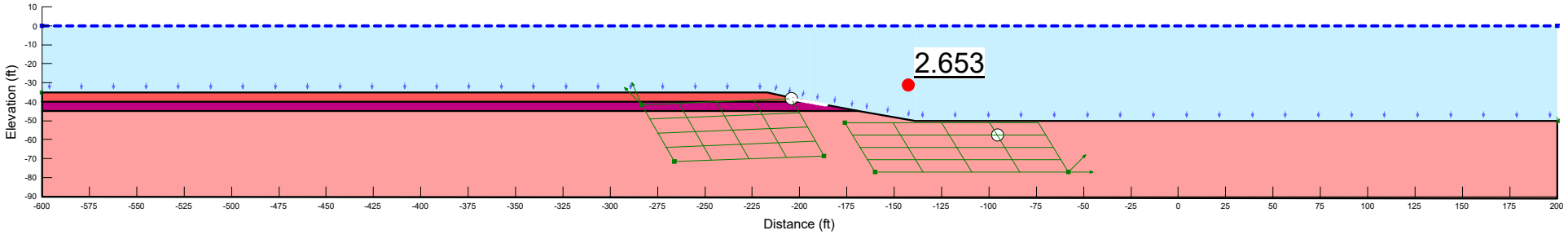
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	V. Soft CH	120	250	



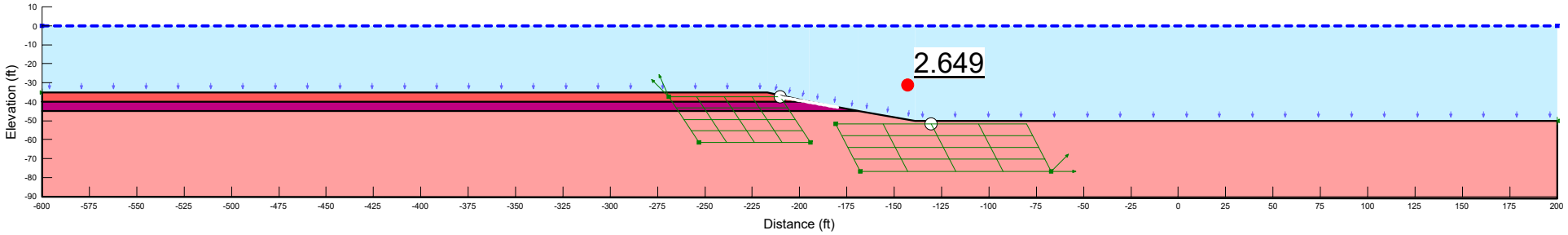
MSC PED_-16+000 Block Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
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	Soft to Stiff CL/CH for Long Term Parameters	120	26



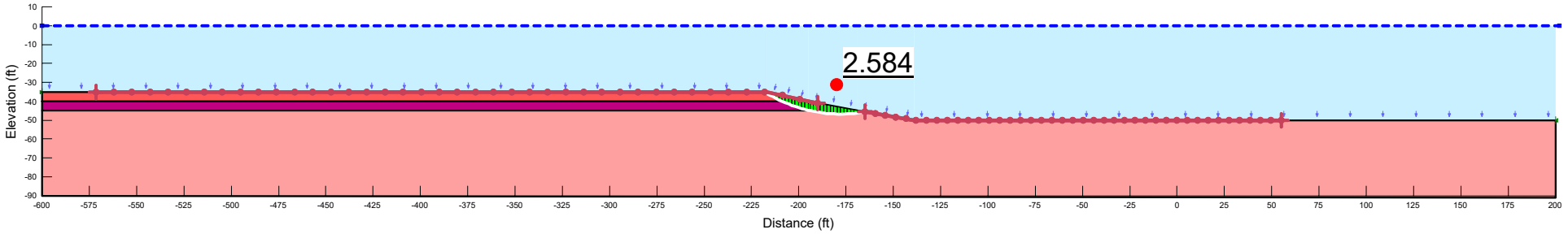
MSC PED_-16+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
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	M. Dense SM	125		30
	Soft to Stiff CL/CH	120	500	



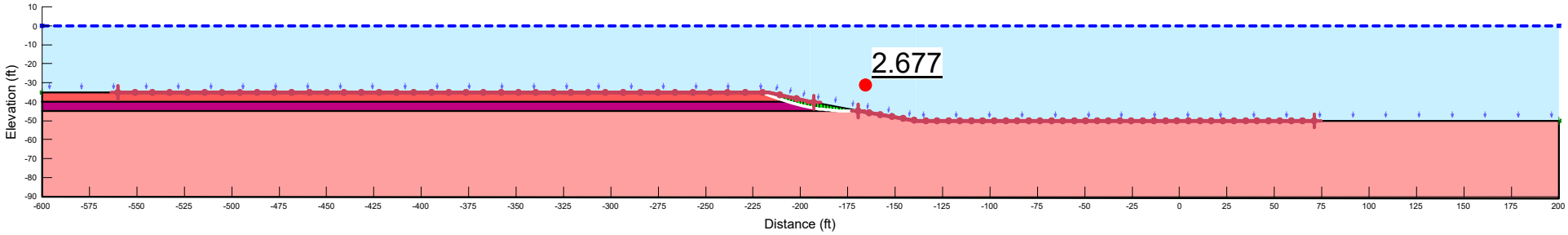
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Color	Name	Unit Weight (pcf)	Phi' (°)
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	M. Dense SM	125	30
	Soft to Stiff CL/CH for Long Term Parameters	120	26



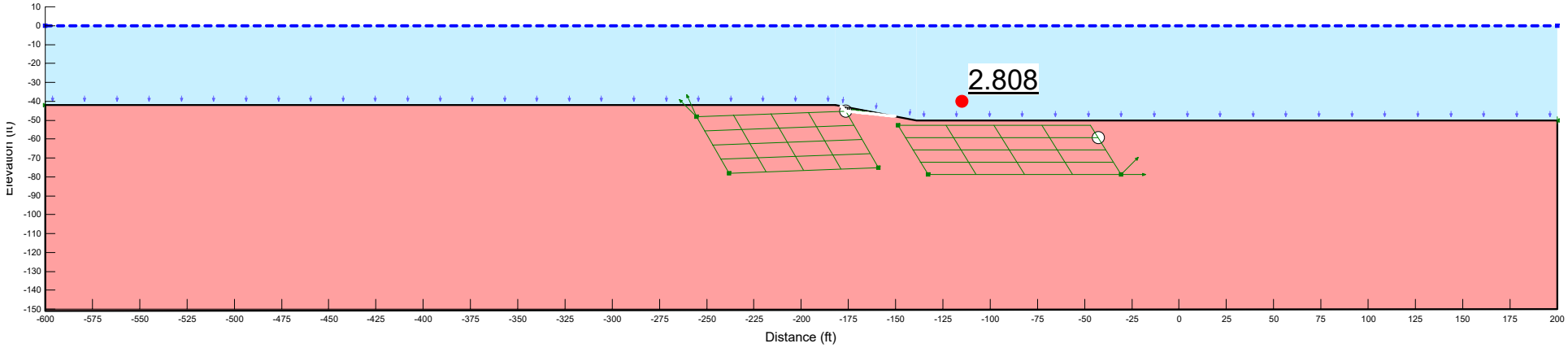
MSC PED_-16+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
	Loose SC	125		28
	M. Dense SM	125		30
	Soft to Stiff CL/CH	120	500	



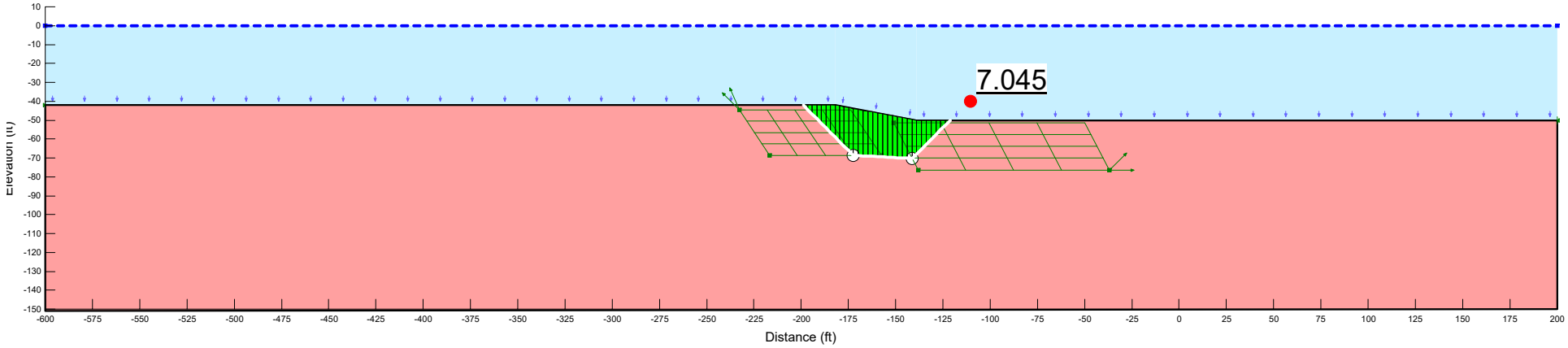
MSC PED_-20+000 Block Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
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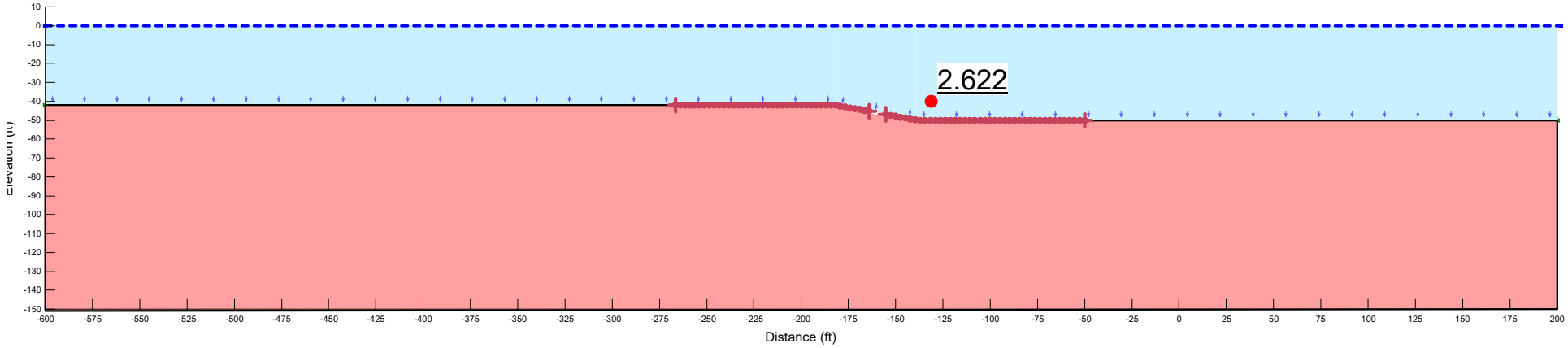
MSC PED_-20+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)
	Soft to Stiff CL/CH	120	500



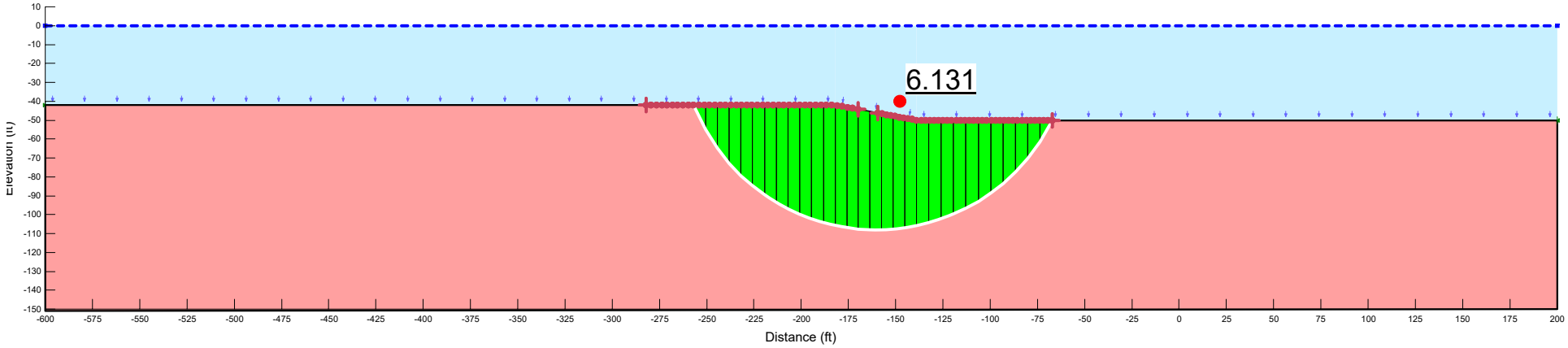
MSC PED_-20+000 Circular Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Soft to Stiff CL/CH for Long Term Parameters	120	26



MSC PED_-20+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)
	Soft to Stiff CL/CH	120	500



GEOTECHNICAL ENGINEERING

This Design Documentation Report (DDR) is submitted with Plans and Specifications for the Matagorda Ship Channel – Channel Improvement Project. This DDR consists of each Disciplines own DDR.

Listed below is the Record of Reviews for this DDR.

Version	**Date**	**Description**
Issue No. 1	30 Nov 2021	Review Draft 65% DQC
Issue No. 2	05 May 2022	Review Draft 95% DQC/ATR
Issue No. 3	06 Jun 2022	Review of Draft 95% Backcheck DQC/ATR

Ratnam I. Tharmendira, PE, GE, PMP, SWG

_____

[Designer, P.E.]

Brandon R. Crawford, PE, SWG

_____

Peer Reviewer

4.0 PROJECT BACKGROUND

This section of the DDR covers the geotechnical aspects of the Matagorda Ship Channel (MSC) Improvement Project Contract 1. The approximate limits of the project (Sta. 0+000 to -26+400) are as shown in the Figure 4-1.

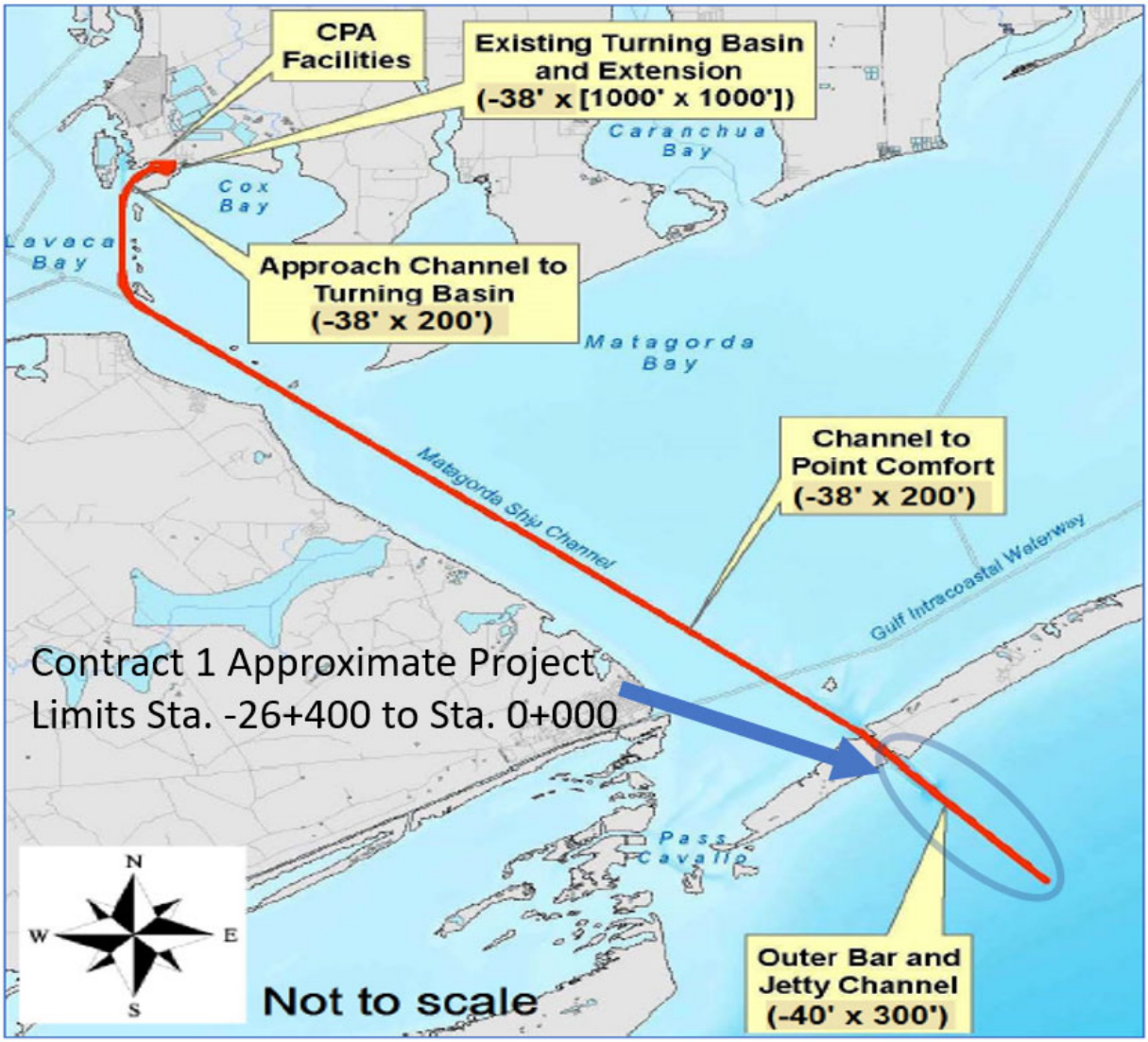


Figure 4-1 - Vicinity Map

All the available geotechnical information including the data from Geotechnical Investigation (2021) was collected, reviewed, and utilized as part of the 95% design of the Project. This DDR section summarizes the available geotechnical data and geotechnical analyses performed for the Project. The appropriate design features and geotechnical considerations related to the proposed dredging activities and dredged material placement features are recommended based on subject 95% design.

4.1 GEOTECHNICAL ENGINEERING TASKS/ANALYSES

The project geotechnical tasks include providing design support for widening and deepening the ship channel within the project limits and implementing Dredged Material Management Plan (DMMP) as shown in the Figure 4-2. Contract 1 DMMP will include expanded ODMDS/PA 1 and Sand Engine (SE) (see Table 4.1 for details).

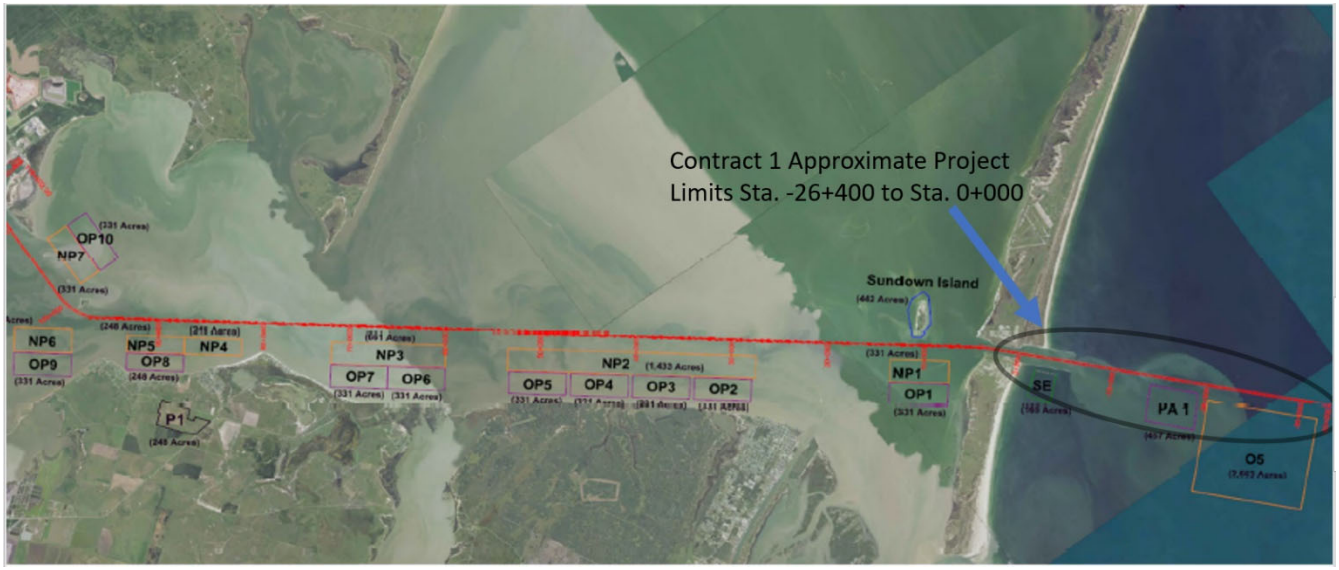


Figure 4-2 – Proposed Dredged Material Management Plan (DMMP)

The 95% geotechnical design of the project involved the following sub-tasks and analyses:

1. Review the available geotechnical data within the channel as part of the MSC Deepening and Widening Project.
2. Develop a Geotechnical Investigation plan and provide support for the completion of the geotechnical investigation (a Work in-kind contract is executed by Calhoun Port Authority in 2021).
3. Support Geotechnical Investigation by reviewing raw logs, laboratory test assignments; review the draft data report.
4. Perform 95% Geotechnical design based on available data (including the data from 2021 geotechnical investigation).

Develop subsurface conditions to support the channel widening & deepening and Environmental Mitigation Site.

- Evaluation of channel slope stability for channel widening & deepening for limited segments (-26+400 through 0+000).
- Evaluation of Potential Dredged New-work material.
- Prepare the Spec sections (Geotechnical).

- Provide inputs for Plan Sheets (Geotechnical), Review the draft Plan Sheets to finalize them.
- Prepare the 95% Design Documentation Report (DDR).

4.2 GEOTECHNICAL INVESTIGATION STUDY

USACE developed and executed a project-specific geotechnical investigation plan as follows for the Ship Channel and for open-water New Work Dredged Material Placement Areas (within NP-1 through NP-7).

- Total of 72 Channel borings along the ship channel (CB-1 through CB-13 and CB-18 through CB-76 with a 2000-foot spacing between borings, west/east side along the new toe as a zig-zag pattern from Sta. -33+000 through Sta. -6+000 and Sta. 0+000 through Sta. 12+000, west side along the new toe as from Sta. -12+000 through Sta. 116+222.29. Borings were drilled up to -70 feet MLLW,
- Total of four shallow (Ponar) sampling (CB-14 through CB-17) to grab (Sampling depth1-foot) sediments within the existing Jetty zone from Sta. -6+000 through Sta. 0+000 due to hazardous currents and other contributing factors the contractor was unable to acquire geotechnical borings.
- Total of 40 Vibracores (VB-1 through VB-40) for underwater New Work Dredged Material Placement Areas (NP-1 through NP-7)

This DDR includes the relevant data (CB-1 through CB-17 from Geotechnical Investigation 2021) associated with Contract 1 as Attachment A.

The approximate locations of the channel borings and sediment sampling (CB-1 through CB-17) within the Contract 1 project limits are presented in the Boring Location Maps (Figures 4-3 through 4-5) as below.

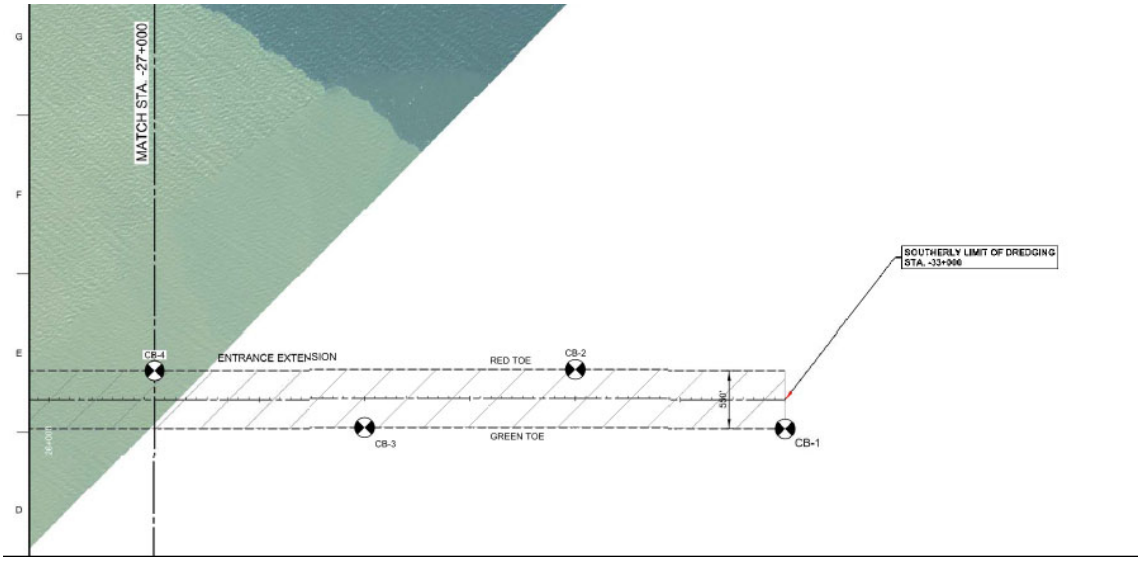


Figure 4-3 – Boring Location Map (CB-1 through CB-4)

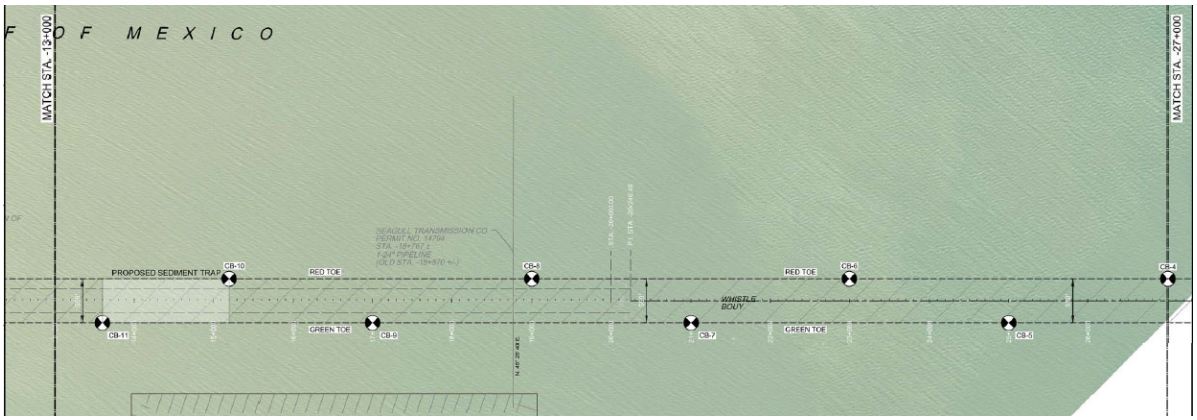


Figure 4-4 – Boring Location Map (CB-5 through CB-11)

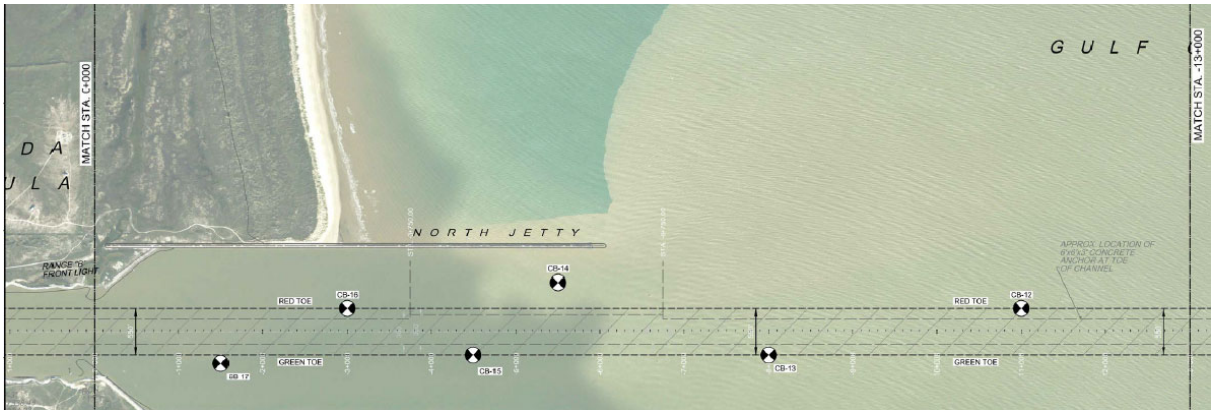


Figure 4-5 – Boring Location Map (CB-12 through CB-17)

4.3 AVAILABLE GEOTECHNICAL DATA

4.3.1 Review of data from 2021 Geotechnical Investigation

The 95% geotechnical design for this DDR was done using the geotechnical data collected from recent geotechnical investigations (2021).

4.3.2 Subsurface Condition along the Matagorda Ship Channel (MSC)

The fence diagram/subsurface profiles (Fence Diagrams Along the Ship Channel) from the 2021 geotechnical data are presented on Attachment A. The distribution of blow counts (SPT N values) and Unconfined Compression Test results (UC) for clayey/silty soils are presented on the fence diagrams to understand potential dredged materials' engineering properties. The potential new work material during the proposed dredging activity was evaluated based on subsurface conditions encountered during the 2021 geotechnical investigation. Table 4.1 presents the Potential Dredged New Work Material Classification based on soils encountered during the recent (2020) geotechnical investigation within the different sections of the project limits. Attachment B presents the Proposed Ship Channel Dredging New Work Material Quantity Summary table.

Table 4.1 Proposed Ship Channel Dredging New Work Material Quantity Summary

From Sta.	To Sta.	Length of Station (Feet)	to PA	Will the new work material be more challenging to dredge compared with the dredging of the O&M material based on Available Geotechnical Data? Yes/No[1]	Predominent New Work Material Type (SANDS/ FINES) Based on Recent Channel Borings	Approximate New Work Material Ratio Between Granular (%): Fines (%) (Fines content includes Soft Clay/Silts & M.Stiff to Hard Clay, Granular contents includes Sands)	Soil Types	Reference Borings	Remarks SPT, Undrained Shear Strength (ksf)
-26+400	-20+600	5+800	ODMDS	No	FINES (CLAYS & SILTS)	Granular (0 %): Fine (100 %)	Soft CH/CL	CB-5, CB-6, CB-7	N=0 to 4
-20+600	-16+000	4+600	ODMDS	Yes	FINES (CLAYS & SILTS)	Granular (0 %): Fine (100 %)	Medium Stiff to Very Firm CL/CH	CB-8, CB-9	N=3 to 18, 0.7 to 1.5 ksf
-16+000	-14+000	2+000	Sand Engine	Yes	FINES (CLAYS & SILTS)	Granular (70%): Fine (30 %)	Loose to M.Dense SC/SM, Soft to M.Stiff CH	CB-10	N=6 to 25, 0.45 to 1.3 tsf
-14+000	-12+000	2+000	Sand Engine	No	SANDS	Granular (75 %): Fine (25 %)	M.Dense to V.Dense SM/SP-SM, Soft CH	CB-11	N=25 to 83, 0.0 to 0.5 ksf
-12+000	-10+000	2+000	Sand Engine	No	SANDS	Granular (100 %): Fine (0 %)	M.Dense to Dense SM/SP-SM	CB-12	N=15 to 47
-10+000	-8+000	2+000	Sand Engine	No	SANDS	Granular (100 %): Fine (0 %)	M.Dense to V. Dense SM/SP-SM	CB-13	N=12 to 92
-8+000	-4+000	4+000	Sand Engine	No	N/A	N/A			
-4+000	0+000	4+000	Sand Engine	No	N/A	N/A			

The SANDS & FINES percentage estimate and interpretation of potential new work material dredgeability condition compared with O&M material were developed to support Rough Order Magnitude (ROM) estimate of the project cost dredging construction planning and others. The assumption made for this interpretation was, the O&M sediment is predominantly loose silts/fine sand. Table 4.1 also presents the relevant soil borings used for this geotechnical evaluation, distribution of blow counts (SPT N values), and Unconfined Compression Test results (UC) data for clayey/silty soils to present the potential new work dredged materials' engineering properties. In general, relatively hard dredging conditions will be anticipated during the dredging of native soils/new work materials compared with the dredging of O&M material. Table 4.1 shows that soft/loose new work materials will be encountered at various station locations.

The approved dredging template's bottom elevation followed the District Policy on Setting Dredging Templates for Studies (CESWG-DE, April 08, 2019). The policy says, "If the new work material to be identified as more challenging to dredge compared with the dredging of the O&M material, then no additional 1-foot extra dredging will not be required". See reference for details.

Table 4.1 presents the potential new work materials characterization and anticipated dredgeability condition. The geotechnical evaluations for Table 4.1 were done based on soil borings drilled, and the findings will be applicable at the drilled locations only. The actual subsurface conditions between the available boring locations may vary. Dredgeability of the new work material is a subjective item to the potential contractors based on their selected equipment and methods. Contractors shall make their own interpretations based on the fence diagram/borings.

4.4 DREDGED MATERIAL

4.4.1 New Work

The total volume of new work material to be dredged from the Matagorda Ship Channel Improvement Project (MSCIP) was estimated using recent geotechnical data. The volume calculations are based on the channel dimensions and include both the overdepth and advance maintenance requirements. Table 4.2 provides an approximate soil classification of the new work dredged material.

Table 4.2 New Work Soil Classification

From Sta.	To Sta.	Length of Station (Feet)	to PA	Approximate New Work Material Ratio Between Sands (%): Soft Clay/Silt (%): M.Stiff to Hard Clay (%) (Based on Recent Channel Borings)	Soil Types	Reference Borings	Remarks SPT, Undrained Shear Strength (ksf)
-26+400	-20+600	5+800	ODMDS	Sands (0%): Soft Clay (100%): M.Stiff to Hard Clay (0%)	Soft CH/CL	CB-5, CB-6, CB-7	N=0 to 4
-20+600	-16+000	4+600	ODMDS	Sands (0%): Soft Clay (0%): M.Stiff to Hard Clay (100%)	Medium Stiff to Very Firm CL/CH	CB-8, CB-9	N=3 to 18, 0.7 to 1.5 ksf
-16+000	-14+000	2+000	Sand Engine	Sands (70%): Soft Clay (10%): M.Stiff to Hard Clay (20%)	Loose to M.Dense SC/SM, Soft to M.Stiff CH	CB-10	N=4 to 83, 0.45 to 1.3 tsf
-14+000	-12+000	2+000	Sand Engine	Sands (75%): Soft Clay (25%): M.Stiff to Hard Clay (0%)	M.Dense to V.Dense SM/SP-SM, Soft CH	CB-11	N=25 to 83, 0.0 to 0.5 ksf
-12+000	-10+000	2+000	Sand Engine	Sands (100%): Soft Clay (0%): M.Stiff to Hard Clay (0%)	M.Dense to Dense SM/SP-SM	CB-12	N=15 to 47
-10+000	-8+000	2+000	Sand Engine	Sands (100%): Soft Clay (0%): M.Stiff to Hard Clay (0%)	M.Dense SM	CB-13	N=12 to 92
-8+000	-4+000	4+000	Sand Engine				
-4+000	0+000	4+000	Sand Engine				

Between boring locations in the existing information, it is assumed that the depths of material layers changed linearly. The assumption is that the last shown material layer continued to the proposed depth. Table 4.2 also provides a summary of the new work placement plan.

4.4.2 Quality of Dredged Material

The subsurface soil conditions of the project site dictate the type of dredge that will be utilized to perform the excavation for DMMP. The physical characteristics of the soil can affect its placement options due to varying strength and compressibility. The subsurface soils in the channel consist of soft clays, very stiff to hard clays, and sand. Section 4.0 (Geotechnical Engineering) describes the detailed geotechnical properties of the material requiring excavation because of continued sedimentation or maintenance material.

4.5 CHANNEL SLOPE STABILITY

The proposed channel development will consider a design channel slope of 10H:1V (within Sta. -6+000 to -26+400), a transition design channel slope between 10H:1V and 4H:1V (within Sta. -6+000 to 2+000).

The current channel slope within the channel segment with approximate station limits between Sta. -1+000 and Sta. 2+000 is steeper than 1V:4H, and the existing channel bottom elevation is -70 ft MLLW. And a 4H:1V design channel slope will not disturb the existing channel slope during the subject channel improvement project. Therefore, a channel design slope of 4H:1V can be considered a safe channel slope within the sta. Limits (-1+000 and Sta. 2+000) due to anticipated minimal dredging work for both new work and future O&M cases.

Although the analysis confirms a stable slope under steady-state static conditions, it is acknowledged that the channel slopes will frequently be subject to significant pressure waves when loaded deep-draft vessels pass, and that the pressure wave can cause significant temporary fluctuation in the pore pressure well below the surface of the slope.

This pore pressure fluctuation may result in shallow-slope slides at locations where the slope material is closer to a critical FS. The depths of the slides are limited by the depth of pore pressure fluctuation due to the pressure waves. The potential depths and locations of the slides will be highly variable along the channel, as can be ascertained by a review of previous slope changes, with time, along the channel slopes, which were originally dredged to a uniform slope. Since the sloughing could occur in various places along the channel and on portions of the slopes it is not practical to find all shallow slides that will occur. Historically, the USACE Galveston District designs the slopes for the steady-state static condition and will remove the sloughed material from the channel bottom during the maintenance-dredging cycles, along with shoaled material.

Two types (circular and block/wedge) of slip surfaces/failure modes were considered using Geoslope software -Morgenstern-Price method for subject channel deepening and widening. Subsurface soil profiles for slope sections were developed based on nearest soil borings from available geotechnical data.

Stability Analyses were performed for two stages.
1) Short-term Stability (Undrained Conditions, immediately after dredging)
2) Long-term Stability (Drained Conditions, after dredging during potential surge level variation)

The channel slopes were analyzed for both undrained and drained conditions.

Safety factors (associated with slope stability analyses) specified in the Engineering Manuals are as summarized below:
EM 1110-2-5025, Table 4-8 recommends a minimum factor of safety of 1.3 for both the undrained and drained conditions for slopes less than 30 feet in height. This is not applicable because the project Channel slope height is more than 30 feet. For slopes with heights greater

than 30 feet, EM 1110-2-1902, Table 3-1 recommends minimum factors of safety of 1.3 and 1.5 for undrained and drained conditions, respectively, for the earth and rock-fill dams. This is not applicable because no drained stage factor of safety for upstream slope (channel face) is not specified in the EM 1110-2-1902.
EM 1110-2-1913, Table 6-1b recommends minimum factors of safety of 1.3 and 1.4 for undrained and drained conditions for other embankments and dikes including navigation channels. Table 6-1b also specifies that lower factors of safety may be appropriate when the consequences of failure in terms of safety, environmental damage and economic losses are small.

Considering the relatively low consequences of failure of a channel slope compared to a dam's failure, a minimum factor of safety of 1.3 for end-of-construction (undrained) and for long-term (drained) conditions were selected for this analysis.

A geotechnical engineering evaluation of the slope stability of the channel cut was conducted based on available geotechnical data from 2021 Geotechnical Investigation. Total of four (4) sections were identified as critical and were analyzed for slope stability as part of this 95% design. Results of slope stability models are documented in Attachment C.

The following table tabulates the various soil strength parameters assumed for subsurface layers and sections for the slope stability models.

Table 4.3 Geotechnical Design Parameters

Station Limits	Reference Borings	Elevation	Soil Type	Saturated Unit Weight	Strength Parameters			
					Short-Term/Undrained Shear Strength		Long-Term/Drained Shear Strength	
					Friction Angle (deg)	Undrained Shear Strength /Cohesion (psf)	Friction Angle (deg)	Cohesion (psf)
-11+000	CB-12	-38 to -40	M. Dense SM	125	30	N/A	30	0
		-40 to -55	Dense SP-SM/SM	125	32	N/A	32	0
		-55 to -90	V.Dense SP-SM/SM	125	34	N/A	34	0
-13+000	CB-12	-36 to -48	Loose to V. Dense SP-SM/SM	120	28	N/A	28	0
		-48 to -60	V.Soft CH	120	N/A	250	24	0
		-60 to -90	Soft to Stiff CL	120	N/A	500	26	0
-16+000	CB-10	-35 to -40	M. Dense SM	125	30	N/A	30	0
		-40 to -45	Loose SC	125	28	N/A	28	0
		-45 to -90	Soft to Stiff CL/CH	120	N/A	500	26	0
-20+000	CB-7 & CB-8	Below -42	Soft to Stiff CL/CH	120	N/A	500	26	0

Short-term stability analyses were performed using undrained shear strength parameters for cohesive soils. Long-term Stability analyses were performed using available Consolidated Undrained (CU) testing data and reasonably assumed geotechnical parameters. The following table tabulates the results of channel slope stability analyses.

Table 4.4 Channel Stability Analyses Summary

Station Number	Factor of Safety (FS) - Stability			
	Circle Failure Mode		Block/Wedge Failure Mode	
	Short-term	Long-term	Short-term	Long-term
STA -11+000	3.25	3.21	3.51	2.94
STA -13+000	2.44	2.50	2.57	2.69
STA -16+000	2.68	2.58	2.65	2.65
STA -20+000	6.13	2.62	7.04	2.81

Results show that the lowest factor of safety (FS) was 2.44 for section at STA -13+000 and met the minimum factor of safety of 1.3. Therefore, the proposed channel development is Geotechnically feasible. Graphical illustration with soil information regarding these slope stability analyses are shown in Attachment C.

ATTACHMENT

ATTACHMENT A – RELEVANT GEOTECHNICAL DATA FROM 2021 GEOTECHNICAL INVESTIGATION

ATTACHMENT B – PROPOSED SHIP CHANNEL DREDGING NEW WORK MATERIAL QUANTITY SUMMARY

ATTACHMENT C - SUMMARY OF THE SHIP CHANNEL STABILITY EVALUATION ANALYSES

REFERENCE

"General Design Memorandum - Boring Layout and Soil Profile, Matagorda Ship Channel, Texas", January 1962 by U.S. Army Corps of Engineers, Galveston District.

Washington, D.C. USACE EM 1110-2-1913 Design and Construction of Levees (30 April 2000)

Washington, D.C. USACE EM 1110-2-1902 Slope Stability (31 Oct 2003)

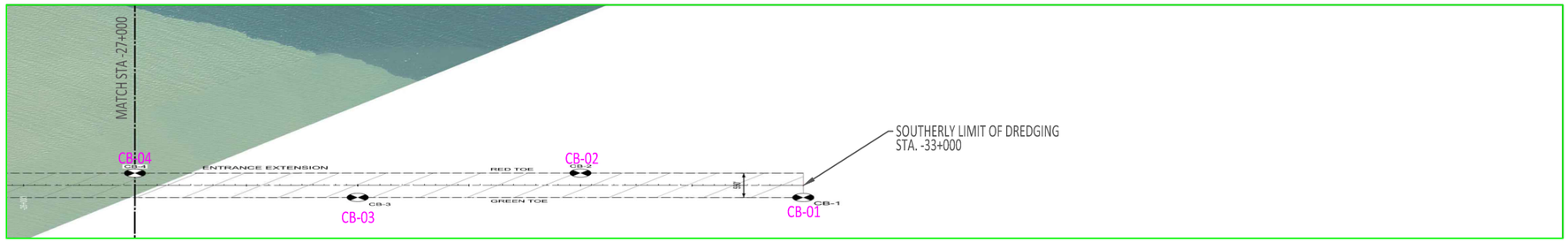
Washington, D.C. USACE EM 1110-2-5025 Dredging and Dredged Material Management (31 July 2015)

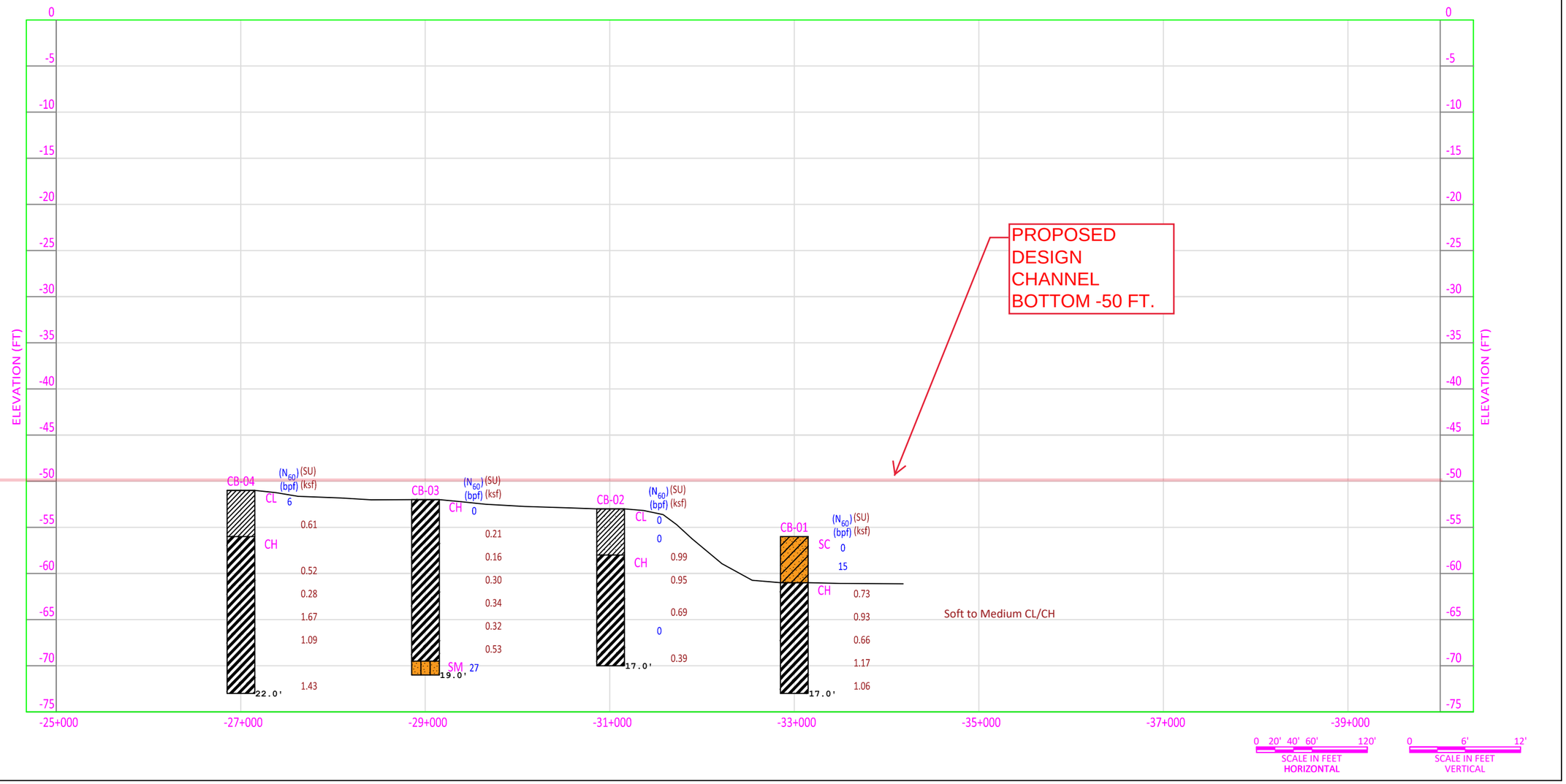
USACE. 2009. Final Environmental Impact Statement for Calhoun Port Authority Proposed Matagorda Ship Channel Improvement Project. USACE Galveston District, Galveston, TX.

District Policy on Setting Dredging Templates for Studies, New Work Construction Projects, and Channel Maintenance, (CESWG-DE, April 08, 2019).

GEOTECH DDR ATTACHMENTS

ATTACHMENT A – RELEVANT GEOTECHNICAL DATA FROM 2021 GEOTECHNICAL INVESTIGATION





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil		
CL	CH	MH	
CL	CH	CL-ML	
CL	CH		

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Shirley Wong Engineers
SIZE: 11" by 17"
ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

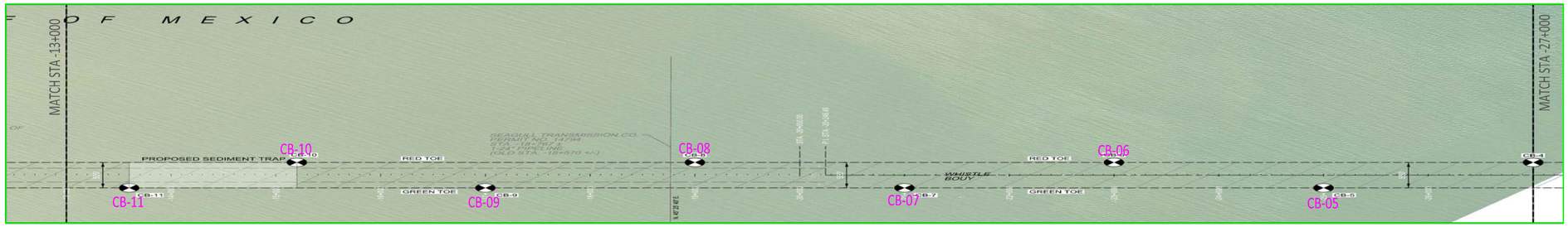
US ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GLAVESTON, TX 77550

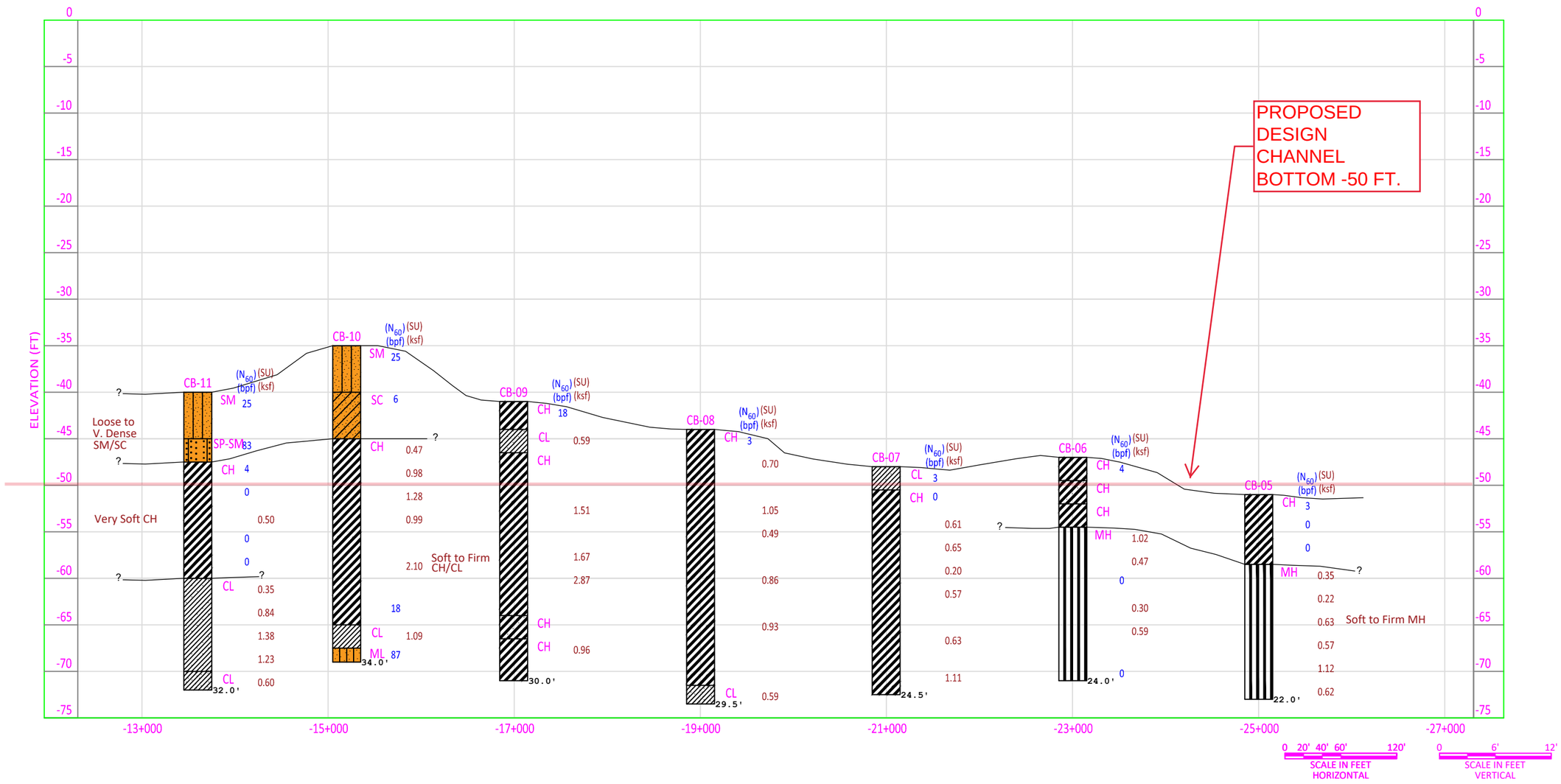
PREPARED UNDER THE DIRECTION OF
TIMOTHY R. VAIL
COLONEL, EN, U.S. ARMY, COMMANDING

CHANNEL IMPROVEMENT PROJECT
MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. -27+000 TO STA. -33+000

SHEET ID
CN 114





Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil
	SP
ML	SM
SC	SP-SM

MARK	DESCRIPTION	DATE
01	Issued for Finnal Factual Report	12/16/21

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Tommy Wong Engineers
SIZE: 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
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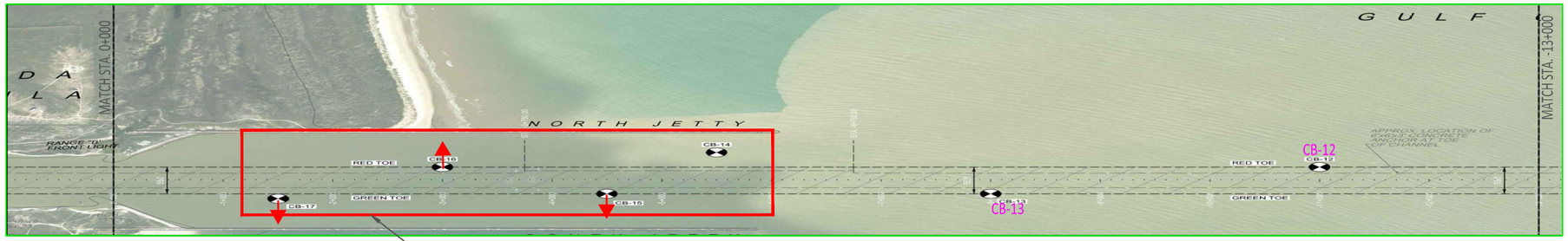
US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT 2000 FORT POINT ROAD GLAVESTON, TX 77550

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CHANNEL IMPROVEMENT PROJECT MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. -13+000 TO STA. -27+000

SHEET ID
CN 115



BORINGS REPLACED WITH GRAB SAMPLE AT MUDLINE

PROPOSED DESIGN CHANNEL BOTTOM -50 FT.

ELEVATION (FT)

0, -5, -10, -15, -20, -25, -30, -35, -40, -45, -50, -55, -60, -65, -70, -75

1+000, 0+000, -1+000, -3+000, -5+000, -7+000, -9+000, -11+000, -13+000

Medium to V. Dense SM/SP-SM/SC

CB-13 (N_{60}) (bpf)

SM	12
	92
SP-SM	47
	63
SM	81
SC	12
	10
CH	16
SP-SM	50

22.0'

CB-12 (N_{60}) (bpf)

SM	15
SP-SM	45
	37
SM	47
	36
	40
SP-SM	51
	62
	66
	87
SM	100
	86
	98

34.0'

0 20' 40' 60' 120' SCALE IN FEET HORIZONTAL

0 6' 12' SCALE IN FEET VERTICAL

Notes:

1. ELEVATION DATUM: MLLW.

Soil Classification Legend	Clay Type Soil	
CL	CH	MH
CL	CH	CL-ML
CL	CH	

Soil Classification Legend	Sand Type Soil	
ML	SP	
ML	SM	
SC	SP-SM	

MARK	DESCRIPTION	
01	Issued for Finnal Factual Report	

DESIGNED BY: AA
DRAWN BY: TT
CHECKED BY: AA
SUBMITTED BY: Tetra Tech/ Wong Engineers
SIZE: E - 11" by 17"

ISSUE DATE: 12/16/21
SOLICITATION NO.: W912HY21B0000
CONTRACT NO.: N/A
SWG FILE NO.: GUAD 0705-0244

US ARMY CORPS OF ENGINEERS GALVESTON DISTRICT 2000 FORT POINT ROAD GLAVESTON, TX 77550

PREPARED UNDER THE DIRECTION OF TIMOTHY R. VAIL COLONEL, EN: U.S. ARMY: COMMANDING

CHANNEL IMPROVEMENT PROJECT MATAGORDA SHIP CHANNEL, TEXAS

PROFILE VIEW
STA. 0+000 TO STA. -13+000

SHEET ID
CN 116

APPENDIX B
CHANNEL BORING LOGS

KEY TO SYMBOLS AND TERMS USED ON BORING LOGS FOR SOIL

Most Common Unified Soil Classifications System Symbols

- Lean Clay (CL)
- Lean Clay w/ Sand (CL)
- Sandy Lean Clay (CL)
- Fat Clay (CH)
- Fat Clay w/ Sand (CH)
- Sandy Fat Clay (CH)
- Silty Clay (CL-ML)
- Silty Clay with Sand (CL-ML)
- Sandy Silty Clay (CL-ML)
- Silty Clayey Sand (SC-SM)
- Clayey Sand (SC)
- Sandy Silt (ML)
- Silty Sand (SM)
- Silt w/ Sand (ML)
- Well Graded Sand (SW)
- Well Graded Sand w/ Gravel (SW-GM)
- Poorly Graded Sand (SP)
- Poorly Graded Sand w/ Silt (SP-SM)
- Silt (ML)
- Elastic Silt (MH)
- Elastic Silt w/ Sand (MH-SP)
- Silty Gravel (GM)
- Clayey Gravel (GC)
- Well Graded Gravel (GW)
- Well Graded Gravel w/ Sand (SP-GM)
- Poorly Graded Gravel (GP)
- Peat

Miscellaneous Materials

- Fill
- Concrete
- Asphalt and/or Base

Sampler Symbols	Meaning
	Pavement core
	Thin - walled tube sample
	Standard Penetration Test (SPT)
	Auger sample
	Sampling attempt with no recovery

Field Test Data

90%/100%	Sample Recovery (Field %)
(P) 2.50	Pocket penetrometer reading in tons per square foot
(T) 1.13	Torvane Measurement in tons per square foot
8/6"	Blow count per 6 - in. interval of the Standard Penetration Test
DP	Drill rig down pressure during tube push in pounds/square inch
PID	Photoionization detector
PPM	Parts per million
	Observed free water during drilling
	Observed static water level

Laboratory Test Data

90%/100%	Sample Recovery (Lab %)
Wc (%)	Moisture content in percent
Dens. (pcf)	Dry unit weight in pounds per cubic foot
LL	Liquid Limit in percent
PI	Plasticity Index
#200 (%)	Percent passing the No. 200 mesh sieve

Strength Legend (ksf)

Qu	Unconfined Compressive Strength
Su	Undrained Shear Strength
UU	Unconsolidated-Undrained Test
UC	Unconfined Compression Test
T	Torvane
P	Pocket Penetrometer ***
M	Miniature Vane Shear

RELATIVE DENSITY OF COHESIONLESS & SEMI-COHESIONLESS SOILS

The following descriptive terms for relative density apply to cohesionless soils such as gravels, silty sands, and sands as well as semi-cohesive and semi-cohesionless soils such as sandy silts, and clayey sands.

Relative Density	Typical N Value Range*
Very Loose	Less than 4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Greater than 50

* N is the number of blows from a 140-lb weight having a free fall of 30-in. required to penetrate the final 12-in. of an 18-in. sample interval.

CONSISTENCY OF COHESIVE SOILS

The following descriptive terms for consistency apply to cohesive soils such as clays, sandy clays, and silty clays.

Undrained Shear Strength, Su (ksf)**	Consistency	Blows per Foot
< 0.25	Very soft	< 2
0.25 - 0.50	Soft	2-4
0.50 - 1.00	Medium	4-8
1.00 - 2.00	Firm	8-15
2.00 - 4.00	Very Firm	15-30
> 4.00	Hard	> 30

** Su = T = M; Su = Qu/2 = P/2

*** Based on our experience, we adjusted the field measurements of the undrained shear strength of natural, overconsolidated Pleistocene Gulf Coast clays by applying a correction factor of 0.67 to the penetrometer readings. The strengths measured by penetrometer are paritally controlled by the presence of macroscopic soil defects and features such as slickensides, which are generally not reflected in penetrometer readings.

LOG OF BORING CB-01

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 21' 38.70" N 96° 15' 30.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -56 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 17 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
0	0	SP-1	CLAYEY SAND (SC), very loose, gray		WOR/6" WOR/6" WOR/6"	0	48.6		43	24	47.4				
		SP-2	-medium dense from 2.5' to 5'		6/6" 7/6" 3/6"	15	27.7				46				
-60	5	ST-1	FAT CLAY (CH), medium, gray slickensided with sand pockets	(P)0.75			58.9	65.6	92	57	99.8	(P)0.50	(UU)0.73	2.8	
		ST-2		(P)1.25			57.7	66.5	80	48	99.6	(P)0.84	(UC)0.93	2	
-65	10	ST-3		(P)1.00			53.7	68			99.9	(P)0.67	(UC)0.66	2.5	
		ST-4	-firm from 12.5' to 17'	(P)1.25			55.9	66.8	86	51	99.6	(P)0.84	(UC)1.17	3	
-70	15	ST-5		(P)1.25			44.5	77.6			99.6	(P)0.84	(UC)1.06	4.7	
			Bottom @ 17 ft.												
-75	20														
-80	25														
-85	30														
-90	35														
-95	40														

COMPLETION DEPTH: 17 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 57 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-02

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 21' 57.00" N 96° 15' 41.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -53 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 17 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-55				SP-1	LEAN CLAY WITH SAND (CL), very soft, dark gray		WOP/6" WOP/6" WOP/6"	0	53.8				71.3				
				SP-2			WOP/6" WOP/6" WOP/6"	0	47.9				78.5				
	5			ST-1	FAT CLAY (CH), medium, brown and gray -with ferrous nodules from 5' to 10'	(P)2.00			38.3	83.1	80	47	99.7	(P)1.34	(UC)0.99	7.3	
-60				ST-2		(P)2.25			40.2	81.1			99.8	(P)1.50	(UU)0.95	7.3	
	10			ST-3	-slickensided from 10' to 12.5'	(P)2.00			49	72.2	82	50	99.9	(P)1.34	(UC)0.69	2.9	
-65				SP-3	-very soft from 12.5' to 15'		WOH/6" WOH/6" WOH/6"	0	54.6		78	46	99.3				
	15			ST-4	-soft from 15' to 17'	(P)1.25			53	69.6	73	46	99.3	(P)0.84	(UC)0.39	11	
-70					Bottom @ 17 ft.												
	20																
-75																	
	25																
-80																	
	30																
-85																	
	35																
-90																	
	40																

COMPLETION DEPTH: 17 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 54 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-03

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 07.30" N 96° 16' 01.70" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -52 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 19 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE / SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0			▼												
			SP-1	FAT CLAY (CH), very soft, gray		WOH/6" WOH/6" WOH/6"	0	57.9		62	38	90				
-55			ST-1	-with sand pockets from 2.5' to 10'	(T)0.17			54.3	69.8			87.3	(T)0.34	(UC)0.21	15	
	5		ST-2	-with shell fragments from 5' to 7.5'	(T)0.12					67	43	90.3	(T)0.24			
-60			ST-3	-soft from 7.5' to 15'	(P)1.00			56.4	67.6			96.5	(P)0.67	(UC)0.30	11.3	
	10		ST-4	-with ferrous nodules from 10' to 12.5'	(P)1.00			53.4	69.4	65	41	87.1	(P)0.67	(UC)0.34	15	
-65			ST-5		(P)1.00			62.7	62.5			93.1	(P)0.67	(UC)0.32	11.5	
	15		ST-6	-medium from 15' to 17'	(P)1.25			63.2	63.1	70	45	95.7	(P)0.83	(UU)0.53	2.8	
-70			SP-2	SILTY SAND (SM), medium dense, gray		14/6" 8/6" 10/6"	27	21.9				15.7				
	20			Bottom @ 19 ft.												
-75																
	25															
-80																
	30															
-85																
	35															
-90																
	40															

COMPLETION DEPTH: 19 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 53 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 11-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-04

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 25.70" N 96° 16' 12.60" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -51 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	LEAN CLAY (CL), medium, gray with sand pockets and ferrous nodules		2/6" 2/6" 2/6"	6	33.8		40	19	99				
-55				ST-1		(P)2.50			32	87.8			99.7	(P)1.68	(UC)0.61	3.5	
	5			ST-2	FAT CLAY (CH), very firm, tan & reddishbrown -slickensided with ferrous nodules from 5' to 22'	(P)4.00			35.3	87.3	65	41	99.3	(P)2.68			
				ST-3	-medium with calcareous nodules from 7.5' to 9.5'	(P)1.75			35.2	81.7			99.6	(P)1.18	(UC)0.52	4.2	
-60	10			ST-4	-very firm from 10' to 12'	(P)3.75			36.1	81.8	75	47	99.9	(P)2.51			CU
				ST-5	-firm from 12.5' to 14.5'	(P)2.00			42.3	80.4			99.8	(P)1.34	(UU)1.67	2.2	
-65	15			ST-6	-firm from 15' to 17'	(P)4.25			41	80			99.6	(P)2.84	(UC)1.09	2.8	
				ST-7	-very firm from 17.5' to 19.5'	(P)3.50			44.3	76.5	82	48	99.8	(P)2.34			
-70	20			ST-8	-firm from 20' to 22'	(P)3.50			46.3	75.7			99.8	(P)2.34	(UC)1.43	3.5	
					Bottom @ 22 ft.												
-75	25																
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-6-21
DATE BORING COMPLETED: 10-6-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-05

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 36.20" N 96° 16' 32.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -51 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), soft, gray -with silt pockets and sand pockets		WOH/6" 1/6" 1/6"	3	51.4		64	36	92.1				
				SP-2	-very soft from 2.5' to 7.5'		WOH/6" WOH/6" WOH/6"	0	57.2				98.2				
-55	5			SP-3			WOH/6" WOH/6" WOH/6"	0	54.6				99.9				
				ST-1	ELASTIC SILT (MH), medium dense, gray	(P)0.75			59.5	65.8	86	44	99.6	(P)0.50	(UU)0.35	12.1	
-60	10			ST-2		(P)1.00			61.8				99.6	(P)0.67			
				ST-3		(P)1.00			56.8	66.5	77	39	99.9	(P)0.67	(UC)0.63	4.7	
-65	15			ST-4		(P)1.25			58.4	66.7			99.9	(P)0.83	(UC)0.57	6	
				ST-5		(P)1.25			59.1	66.1	78	40	99.7	(P)0.83	(UC)1.12	3.3	
-70	20			ST-6		(P)0.75			36.7	83.8			99.3	(P)0.50	(UC)0.62	11.5	
					Bottom @ 22 ft.												
-75	25																
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 10-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-06

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 22' 54.10" N 96° 16' 43.20" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -47 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 24 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), medium, gray -no recovery in shelby tube from 0' to 2.5'		1/6" 2/6" 1/6"	4	61.1		55	28	96.2				
-50				ST-1	FAT CLAY WITH SAND (CH), soft, gray	(P)0.50			48.5	73.4			82.4	(P)0.33			
	5			ST-2	FAT CLAY (CH), soft, gray	(T)0.14			48.2	75.3			96.4	(T)0.28			
-55				ST-3	ELASTIC SILT (ML), medium dense, gray	(P)1.00			54.5	66.5	74	35	99.7	(P)0.67	(UC)1.02	10.8	
	10			ST-4	-medium dense from 10' to 12'	(P)1.25			58.3	65.3			99.8	(P)0.83	(UU)0.47	5.3	
-60				SP-2	-very loose from 12.5' to 14.5' -no recovery in shelby tube from 12.5' to 14.5'		WOH/6" WOH/6" WOH/6"	0	61.9				99				
	15			ST-5	-medium dense from 15' to 22.5'	(P)1.25			57.8		70	34	99.9	(P)0.83			
-65				ST-6	-slickensided from 17.5' to 22.5'	(P)1.25			42.9	72.3			99.8	(P)0.83	(UC)0.60	4.7	
	20			ST-7		(P)1.50			55.1	66.5			99.5	(P)1.00			
-70				SP-3	-very loose from 22.5' to 24' -no recovery in shelby tube from 22.5' to 24.5'		WOH/6" WOH/6" WOH/6"	0	57.3		77	38	99.6				
	25				Bottom @ 24 ft.												
-75																	
	30																
-80																	
	35																
-85																	
	40																

COMPLETION DEPTH: 24 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 48 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-07

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 29°23' 05.30 " N 96° 17' 04.50" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -48 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 24.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			SP-1	LEAN CLAY WITH SAND (CL), soft, gray with silt pockets and sand pockets		3/6" 1/6" 1/6"	3	42.1		45	26	84				
-50				SP-2	FAT CLAY (CH), very soft, gray		WOR/6" WOR/6" WOR/6"	0	55.4				99.7				
	5			ST-1	-medium from 5' to 20' -with ferrous stains from 5' to 7' -slickensided from 5' to 25'	(P)0.75			60.9	64.3			99.7	(P)0.50	(UU)0.61	2	
-55				ST-2		(P)1.00			61	63.9	80	44	99.6	(P)0.67	(UC)0.65	3	
	10			ST-3		(P)0.75							99.9	(P)0.50			
-60				ST-4		(P)1.00			53	75.1			99.2	(P)0.67	(UC)0.57	3.8	
	15			ST-5		(P)1.25			57	66.9	82	44	99.7	(P)0.83			
-65				ST-6		(P)1.25			46.5	75			99.5	(P)0.83	(UC)0.63	9.5	
	20			ST-7	-firm from 20' to 24.5'	(P)1.50			45.7	77.9	55	29		(P)1.00			
-70				ST-8		(P)1.75			45.9	75.2			99.5	(P)1.17	(UC)1.11	3.6	
	25				Bottom @ 24.5 ft.												
-75																	
	30																
-80																	
	35																
-85																	
	40																

COMPLETION DEPTH: 24.5 ft
DATE BORING STARTED: 10-5-21
DATE BORING COMPLETED: 10-5-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 49 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-08

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 22.6" N
96° 17' 13.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -44 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 29.5 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-45				SP-1	FAT CLAY (CH), soft, gray -with ferrous nodules and shell fragments from 0' to 2.5'		WOH/6" WOH/6" 2/6"	3	47.4				98.2				
				ST-1	-medium from 2.5' to 7'	(P)1.25			41	77.2	69	41	99.1	(P)0.83	(UC)0.70	9.8	
	5			ST-2	-very firm from 5' to 7.5' -with ferrous nodules from 5' to 30'	(P)2.25			46.4	72.9			99.7	(P)0.83			
-50				ST-3	-firm from 7.5' to 9.5'	(P)1.25			34.1	86.6	60	37	99.1	(P)0.83	(UC)1.05	7.8	
	10			ST-4	-medium from 10' to 27.5' -slickensided from 10' to 17.5'	(P)1.25			50.7	69.8			99.8	(P)0.83			
-55				ST-5		(P)1.25			54	69.2			99.9	(P)0.86			
	15			ST-6	-with sand seams from 15' to 27.5'	(P)1.25			56.5	67.5	85	51	99.7	(P)0.83	(UC)0.86	2.5	
-60				ST-7		(P)1.00			51.7	70.8				(P)0.67			
	20			ST-8		(P)1.00			38.6	84.6			98.9	(P)0.67	(UC)0.93	4.5	
-65				ST-9		(P)1.25			45.3	77.5	50	27	99.6	(P)0.83			
	25			ST-10		(P)1.00			40.4	82.7			99.7	(P)0.67			
-70				ST-11	SANDY LEAN CLAY (CL), medium, gray with ferrous nodules, sand pockets and shell fragments	(P)1.00			34.3	89.4			64.9	(P)0.67	(UC)0.60	3.2	
	30				Bottom @ 29.5 ft.												
-75																	
	35																
-80																	
	40																

COMPLETION DEPTH: 29.5 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 45 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-09

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 33.60" N
96° 17' 33.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -41 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 30 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
				SP-1	FAT CLAY (CH), very firm, dark brown		5/6" 5/6" 7/6"	18	44.6		65	32	98.5				
-45	5			ST-1	LEAN CLAY WITH SAND (CL), medium, dark brown with ferrous nodules and sand pockets	(P)1.75			27.4	95.9			77.6	(P)1.17	(UC)0.60	6.3	
				ST-2	FAT CLAY (CH), very firm, brown and dark brown	(P)4.00			28.2	93.2				(P)2.68			
-50	10			ST-3		(P)3.50			33.1	90.2	64	34	98.7	(P)2.34			
				ST-4	-firm from 10.5' to 12.5'	(P)3.25			36.1	84.4			99.5	(P)2.17	(UC)1.51	5.8	
-55	15			ST-5	-with calcareous nodules from 13' to 18' -very firm from 13' to 15'	(P)4.00			34.9	85.9			99.3	(P)2.68			
				ST-6	-firm from 15.5' to 17.5'	(P)3.75			31.2	88.5	78	43	69.4	(P)2.51	(UC)1.67	7.6	
-60	20			ST-7	-very firm from 17.5' to 23' -hard from 18' to 20.5'	(P)4.50+			36.8	84.9			99.6	(P)3.01	(UC)2.87	4.1	
				ST-8	-very firm from 20.5' to 30.5'	(P)3.75			36.5	84.4			99.1	(P)2.51			
-65	25			ST-9	FAT CLAY WITH SAND (CH), very firm, dark brown	(P)4.00			32.6	88.3	73	38	83.7	(P)2.68			
				ST-10	FAT CLAY (CH), medium, gray	(P)3.75			28.2	90.5			99.5	(P)2.51	(UC)0.96	1.9	
-70	30			ST-11	-very firm from 28' to 30'	(P)3.75			28.1	91.9			83.1	(P)2.51			
					Bottom @ 30 ft.												
-75	35																
-80	40																

COMPLETION DEPTH: 30 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 42 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 6-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-10

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 51.30" N 96° 17' 42.90" W
STATE PLANE COORD: N -- E --
MUDLINE ELEVATION: -35 ft MLLW
DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-35	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray		3/6" 10/6" 7/6"	25	23.7				17.6				
-40	5			SP-2	CLAYEY SAND (SC), loose, gray & reddishbrown with shell fragments, ferrous nodules and calcareous nodules		3/6" 2/6" 2/6"	6	26.2				40.7				
-45	10			ST-1	FAT CLAY (CH), firm, tan & reddishbrown -with sand seams and calcareous nodules from 10' to 20' -with ferrous nodules from 10' to 27.5'	(P)2.50					56	34	94.2	(P)1.67			
				ST-2	-slickensided from 12.5' to 17.5'	(P)4.25			27.3	95.4			97.1	(P)2.84	(UC)0.98	2.2	
-50	15			ST-3		(P)2.75			36.2	83.7			97.9	(P)1.84	(UU)1.28	3.6	
				ST-4		(P)3.00			32.4	88.1	88	59	98	(P)2.01	(UC)0.99	1.3	
-55	20			ST-5	-slickensided from 20' to 22.5'	(P)4.00			12.1	102.5				(P)2.67			
				ST-6	-very firm from 22.5' to 30' -with shell fragments and sand seams from 22.5' to 25' -with calcareous nodules from 22.5' to 27.5'	(P)3.00			27.5	93			98.2	(P)2.01	(UC)2.10	4.1	
-60	25			ST-7	-slickensided with silt pockets from 25' to 27.5'	(P)4.25			32.6	86.6	75	47	99.4	(P)2.84			
				SP-3			4/6" 6/6" 6/6"	18	33.3				99.5				
-65	30			ST-8	LEAN CLAY (CL), firm, brown	(P)3.50			27.3	98.4	43	21	94	(P)2.34	(UC)1.09	4.7	
				SP-4	SANDY SILT (ML), very dense, brown		19/6" 24/6" 29/6"	87	27.5				57				
					Bottom @ 34 ft.												
-70	35																
-75	40																

COMPLETION DEPTH: 34 ft
DATE BORING STARTED: 10-4-21
DATE BORING COMPLETED: 10-4-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 36 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 7-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-11

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 23' 58.70" N
96° 18' 00.00" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -40 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 32 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
-40	0				▼												
				SP-1	SILTY SAND (SM), medium dense, gray with shell fragments		3/6" 5/6" 12/6"	25	24.5				22.5				
-45	5			SP-2	POORLY GRADED SAND WITH SILT (SP-SM), very dense, gray		25/6" 26/6" 29/6"	83	23.4				7.3				
				SP-3	FAT CLAY (CH), medium, dark gray with sand pockets		2/6" 1/6" 2/6"	4	44.1		64	40	92.6				
-50	10			SP-4	-very soft from 10' to 12.5'		WOH/6" WOH/6" WOH/6"	0	49.5								
				ST-1	-medium from 12.5' to 14.5'	(P)1.00							97.7	(P)0.67			
-55	15			SP-5	-very soft from 15' to 20' -no recovery in shelby tube from 15' to 17'		WOR/6" WOH/6" WOH/6"	0	60.3		90	59	95.3				
				SP-6			WOH/6" WOH'6" WOH/6"	0	44.5				95.7				
-60	20			ST-2	LEAN CLAY WITH SAND (CL), soft, gray	(P)1.00			30	89.2			77.5	(P)0.67	(UU)0.35	14.6	
				ST-3	-medium from 22.5' to 25' -tan and reddishbrown from 22.5' to 30' -with ferrous nodules from 22.5' to 30' -with calcareous nodules from 22.5' to 27.5'	(P)1.50			23.3	103	47	30	78.3	(P)1.50	(UC)0.84	3.7	
-65	25			ST-4	-very firm from 25' to 30' -slickensided from 25' to 27.5'	(P)3.25			23.1	104.2			78.6	(P)2.17	(UC)1.38	9.8	
				ST-5		(P)1.75			17.9	112.9	30	15	73.5	(P)1.17	(UC)1.23	2.5	
-70	30			ST-6	SANDY LEAN CLAY (CL), medium, gray with calcareous nodule	(P)2.50			17.5	108.3			66.5	(P)1.67	(UC)0.60	3	
					Bottom @ 32 ft.												
-75	35																
-80	40																

COMPLETION DEPTH: 32 ft
DATE BORING STARTED: 10-3-21
DATE BORING COMPLETED: 10-3-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 41 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 4-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-12

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 24' 20.80" N
96° 18' 14.80" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -37 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 34 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
					▼												
	0			SP-1	SILTY SAND (SM), medium dense, dark brown with shell fragments		3/6" 4/6" 6/6"	15	20.2				12				
-40																	
	5			SP-2	POORLY GRADED SAND WITH SILT (SP-SM), dense, gray with shell fragments		16/6" 15/6" 15/6"	45	23.6				5.3				
-45				SP-3			6/6" 9/6" 16/6"	37	23								
	10			SP-4	SILTY SAND (SM), dense, light brown and brown with shell fragments		6/6" 12/6" 19/6"	47	19.4				22.6				
-50				SP-5			6/6" 12/6" 12/6"	36	22.4				16				
	15			SP-6			8/6" 12/6" 15/6"	40	21.2				15.1				
-55				SP-7	POORLY GRADED SAND WITH SILT (SP-SM), very dense, brown with shell fragments		8/6" 15/6" 19/6"	51	22.9				8.6				
	20			SP-8			9/6" 16/6" 25/6"	62	23.1				11.7				
-60				SP-9			12/6" 19/6" 25/6"	66	23.6				11.3				
	25			SP-10			15/6" 22/6" 36/6"	87	23.4								
-65				SP-11	SILTY SAND (SM), very dense, brown with shell fragments		18/6" 26/6" 40/6"	100	22.6				12.9				
	30			SP-12			18/6" 26/6" 31/6"	86	25				15.1				
-70				SP-13			14/6" 27/6" 38/6"	98	24.5				16.8				
					Bottom @ 34 ft.												
-75	35																
	40																

COMPLETION DEPTH: 34 ft
DATE BORING STARTED: 10-3-21
DATE BORING COMPLETED: 10-3-21
LOGGER: J.Tamez
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 38 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 8-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

LOG OF BORING CB-13

PROJECT: Matagorda Ship Channel Improvement
Matagorda Bay, Texas

CLIENT: Calhoun Port Authority
Calhoun County, Texas

GPS COORDINATE: 28° 24' 37.10" N
96° 18' 42.50" W

STATE PLANE COORD: N --
E --

MUDLINE ELEVATION: -51 ft MLLW

DRILLING METHOD:
Hollow Aug: Wash Bored:0 ' to 22 '

ELEVATION (FT)	DEPTH (FT)	SAMPLE TYPE	SYMBOL	SAMPLE NUMBER	MATERIAL DESCRIPTION	(P) POCKET PEN (tsf) (T) TORVANE (tsf)	SPT BLOW COUNT	SPT N60	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING #200 SIEVE (%)	SHEAR STRENGTH FIELD TEST, Su (ksf)	SHEAR STRENGTH LAB TEST, Su (ksf)	FAILURE STRAIN (%)	OTHER TESTS PERFORMED
	0				▼												
-55	5			SP-1	SILTY SAND (SM), medium dense, light brown with cemented sand and shell fragments		3/6" 5/6" 3/6"	12	19.6				19				
				SP-2	-very dense from 2.5' to 5'		10/6" 26/6" 35/6"	92	20.2				13.2				
-60	10			SP-3	POORLY GRADED SAND WITH SILT (SP-SM), dense, brown with cemented sand and shell fragments		7/6" 12/6" 19/6"	47	22.5				11.5				
				SP-4	-very dense from 7.5' to 10'		7/6" 20/6" 22/6"	63	19.7				11				
				SP-5	SILTY SAND (SM), very dense, brown		11/6" 23/6" 31/6"	81	22.6				13.6				
-65	15			SP-6	CLAYEY SAND (SC), medium dense, brown		3/6" 6/6" 2/6"	12	23		22	6	24.6				
				SP-7			6/6" 4/6" 3/6"	10	28.9				26.9				
-70	20			SP-8	FAT CLAY (CH), very firm, gray		3/6" 5/6" 6/6"	16	49.7		75	30	95.2				
				SP-9	POORLY GRADED SAND WITH SILT (SP-SM), very dense, light brown with cemented sand and shell fragments		8/6" 15/6" 18/6"	50	25.5				11.3				
-75	25				Bottom @ 22 ft.												
-80	30																
-85	35																
-90	40																

COMPLETION DEPTH: 22 ft
DATE BORING STARTED: 10-2-21
DATE BORING COMPLETED: 10-3-21
LOGGER: C. Hughes
PROJECT NO.: 21.14.223

NOTES: 1) Water depth = 52 FT. Based on weighted measuring tape through casing. 2) Drill Rig Model: DR-15 Simco 2800 Truck Rig. Hammer Energy Transfer Ratio: 91%. 3) Boring drilled using a jack-up vessel, the Dularge. 4) Casing embedded 5-ft below mudline mudline. 5) CU: Consolidated-Undrained. HYD: Hydrometer Analysis. SV: Sieve Analysis.

Tolunay-Wong Engineers, Inc.

LOG OF BORING 21.14.223.GPJ TWEI HOUSTON.GDT 12/26/21

GEOTECH DDR ATTACHMENTS

ATTACHMENT B – PROPOSED SHIP CHANNEL DREDGING NEW WORK MATERIAL QUANTITY SUMMARY

APPENDIX 1 - QUANTITY SUMMARY TABLE

Section No.	From Station	To Station	Length of Station (Feet)	EXISTING CHANNEL	MSC 45-FOOT CHANNEL IMPROVEMENT PROJECT			Placement Area Distribution	Total Estimated CY
					SCHEDULE NO. 1				
				MAINTENANCE QUANTITIES	NEW WORK QUANTITIES				
				Total Depth -45' (CY)	Required Depth -49' (CY)	Allowable Overdepth 1' (CY)	Total Estimated -50' (CY)		
				② ③	①				
1	-26+400.00	-21+000.00	5,400	52,500	294,444	104,700	399,144	ODMDS	451,644
2	-21+000.00	-19+100.00	1,900	29,419	258,834	47,653	306,486	ODMDS	335,906
3	-19+100.00	-18+300.00	800	14,120	0	0	0	ODMDS	14,120
4	-18+300.00	-16+000.00	2,300	46,828	409,709	63,720	473,430	ODMDS	520,257
5	-16+000.00	-14+000.00	2,000	46,587	535,936	64,415	600,351	SAND ENGINE	646,938
6	-14+000.00	-11+000.00	3,000	53,815	576,485	90,841	667,326	SAND ENGINE	721,141
7	-11+000.00	-8+000.00	3,000	38,478	220,963	54,615	275,578	SAND ENGINE	314,056
8	-6+400.00	-2+000.00	4,400	14,463	198,877	54,785	253,662	SAND ENGINE	268,125
SUBTOTAL, SCHEDULE NO. 1			**22,800**	**296,210**	**2,495,248**	**480,729**	**2,975,977**		**3,272,187**
					OPTION NO. 1				
					NEW WORK QUANTITIES				
9	-19+100.00	-18+300.00	800		118,969	22,376	141,344	ODMDS	141,344
SUBTOTAL, OPTION NO. 1			**800**		**118,969**	**22,376**	**141,344**		**141,344**
TOTAL, SCHEDULE NO. 1, OPTION NO. 1			**22,800**	**296,210**	**2,614,217**	**503,105**	**3,117,322**		**3,413,532**

① The term “Required Depth” is synonymous with the term “Prescribed Depth” and “Required Dredging Prism” used elsewhere in the specifications.

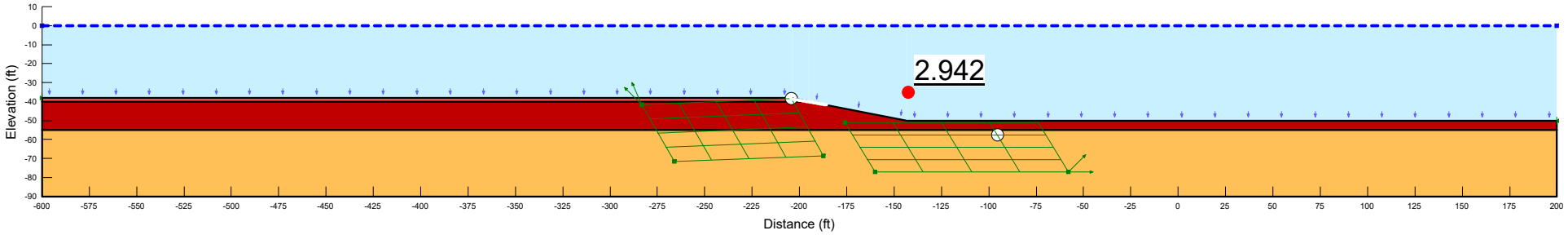
② Includes anticipated shoaling associated with existing channel.

GEOTECH DDR ATTACHMENTS

ATTACHMENT C - SUMMARY OF THE SHIP CHANNEL STABILITY EVALUATION ANALYSES

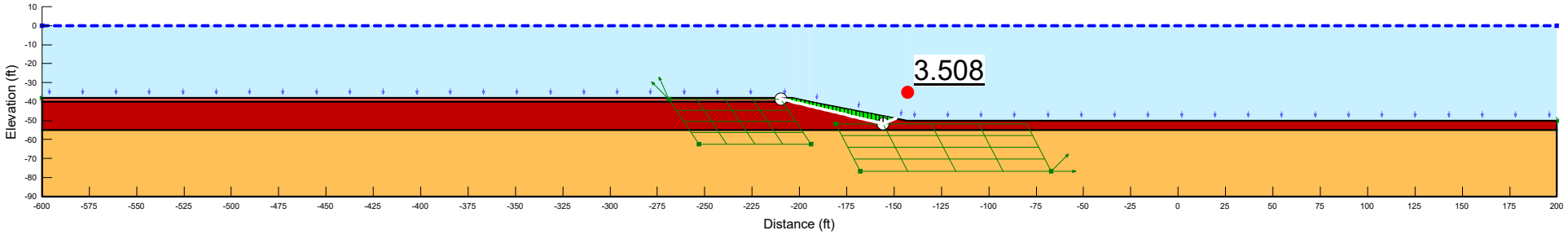
MSC PED_-11+000 Block Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Dense SP-SM/SM	125	32
	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



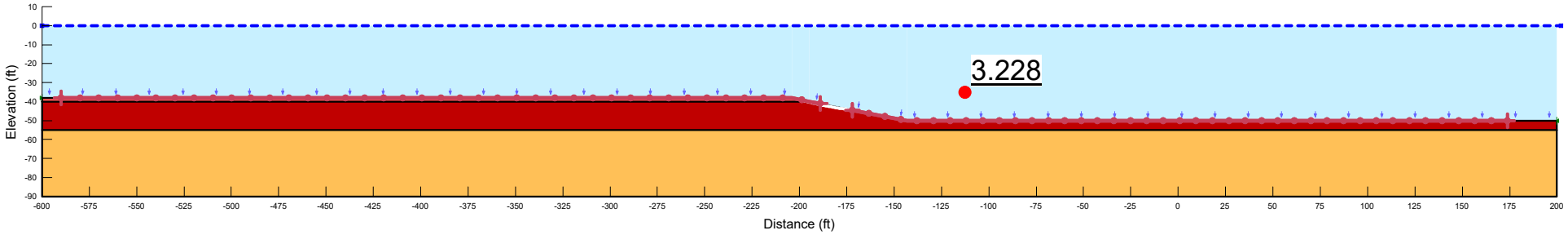
MSC PED_-11+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Phi' (°)
	Dense SP-SM/SM	125	32
	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



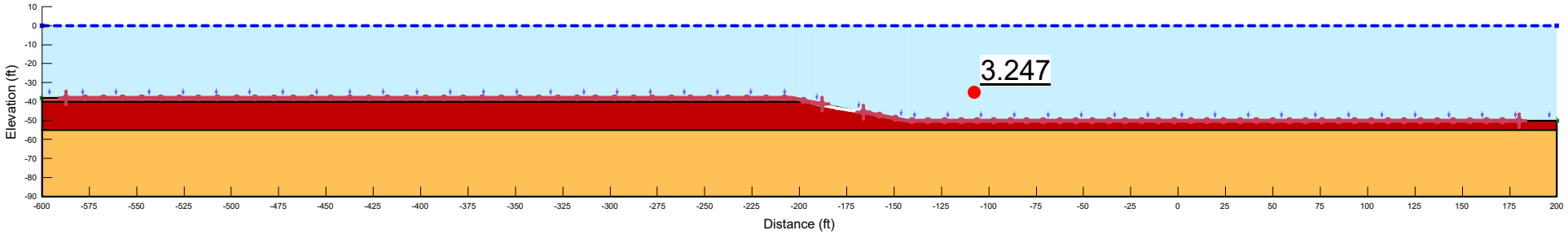
MSC PED_-11+000 Circular Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Dense SP-SM/SM	125	32
	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



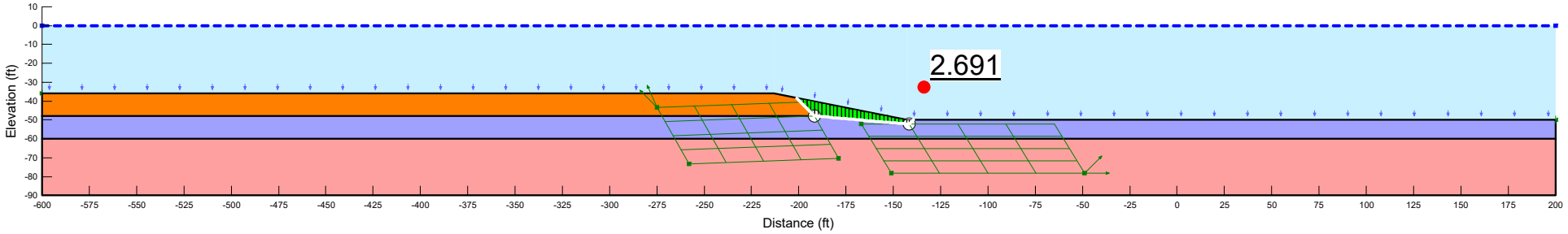
MSC PED_-11+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Phi' (°)
	Dense SP-SM/SM	125	32
	M. Dense SM	125	30
	V. Dense SP-SM/SM	125	34



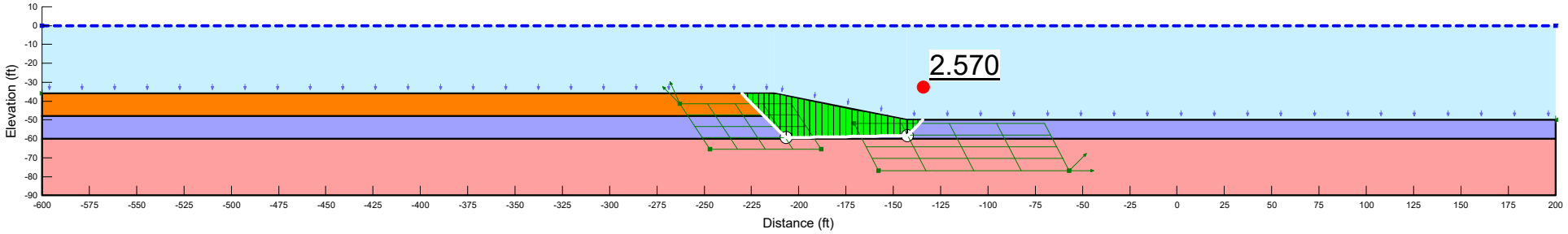
MSC PED_-13+000 Block Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Loose to V.Dense SP-SM/SM	120	28
	Soft to Stiff CL for Long Term Parameters	120	26
	V. Soft CH for Long Term Parameters	120	24



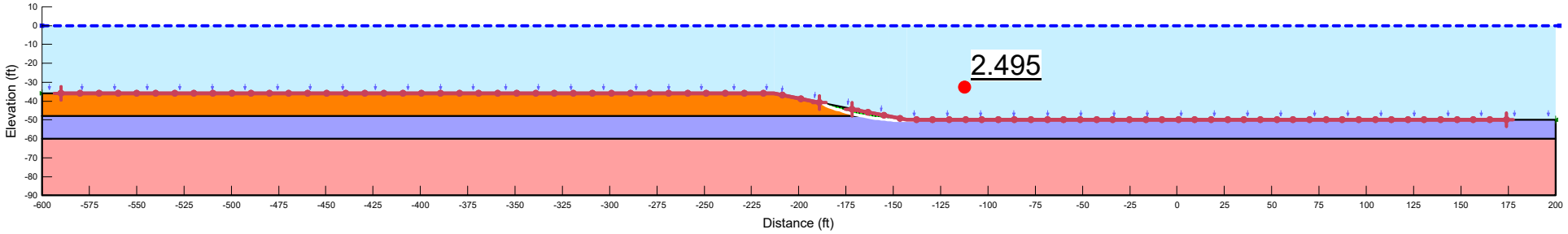
MSC PED_-13+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
	Loose to V.Dense SP-SM/SM	120		28
	Soft to Stiff CL	120	500	
	V. Soft CH	120	250	



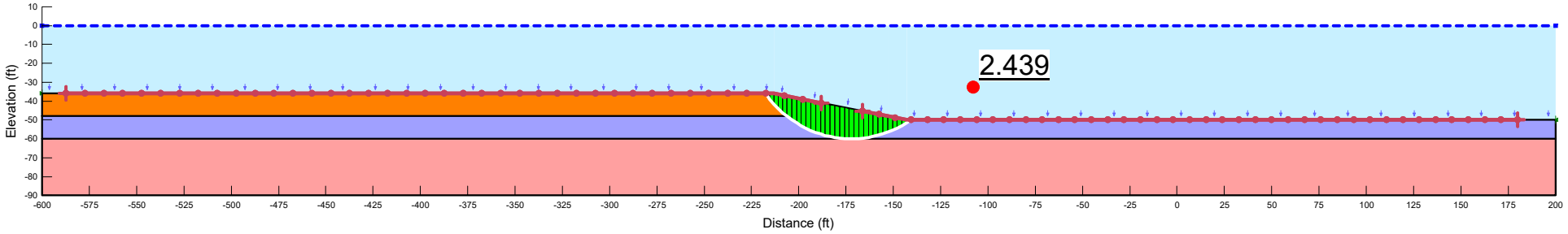
MSC PED_-13+000 Circular Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Loose to V.Dense SP-SM/SM	120	28
	Soft to Stiff CL for Long Term Parameters	120	26
	V. Soft CH for Long Term Parameters	120	24



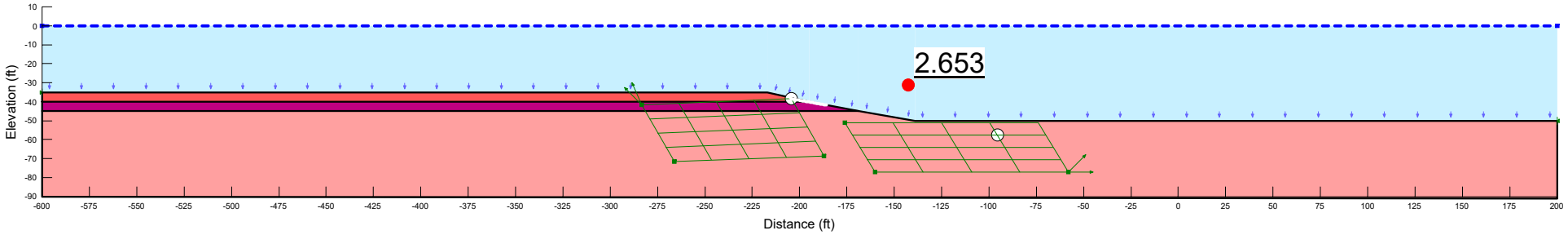
MSC PED_-13+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
	Loose to V.Dense SP-SM/SM	120		28
	Soft to Stiff CL	120	500	
	V. Soft CH	120	250	



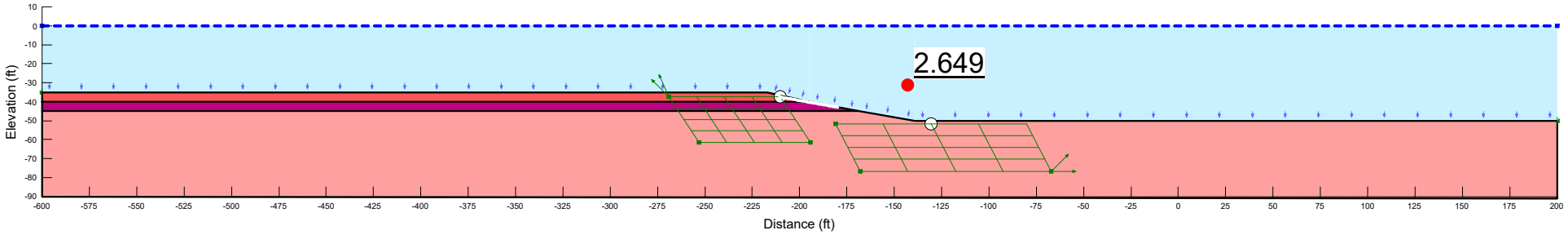
MSC PED_-16+000 Block Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
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	M. Dense SM	125	30
	Soft to Stiff CL/CH for Long Term Parameters	120	26



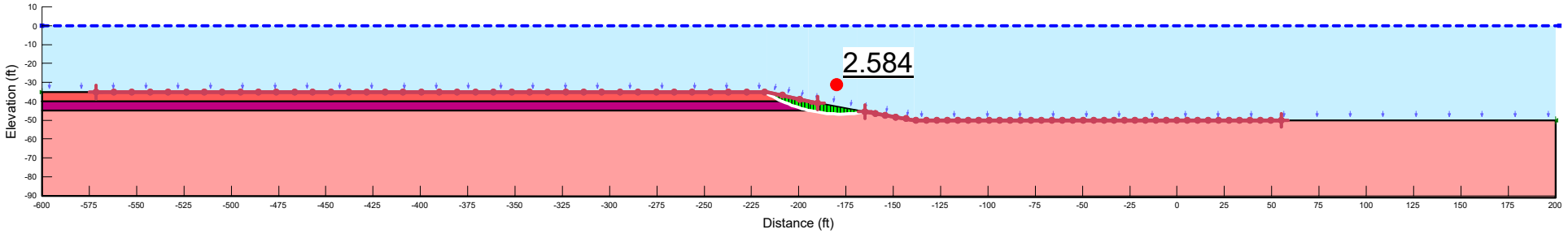
MSC PED_-16+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
	Loose SC	125		28
	M. Dense SM	125		30
	Soft to Stiff CL/CH	120	500	



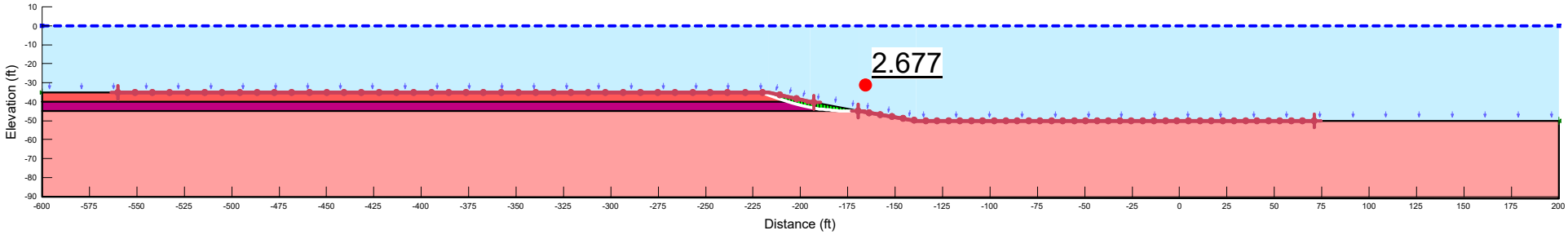
MSC PED_-16+000 Circular Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Loose SC	125	28
	M. Dense SM	125	30
	Soft to Stiff CL/CH for Long Term Parameters	120	26



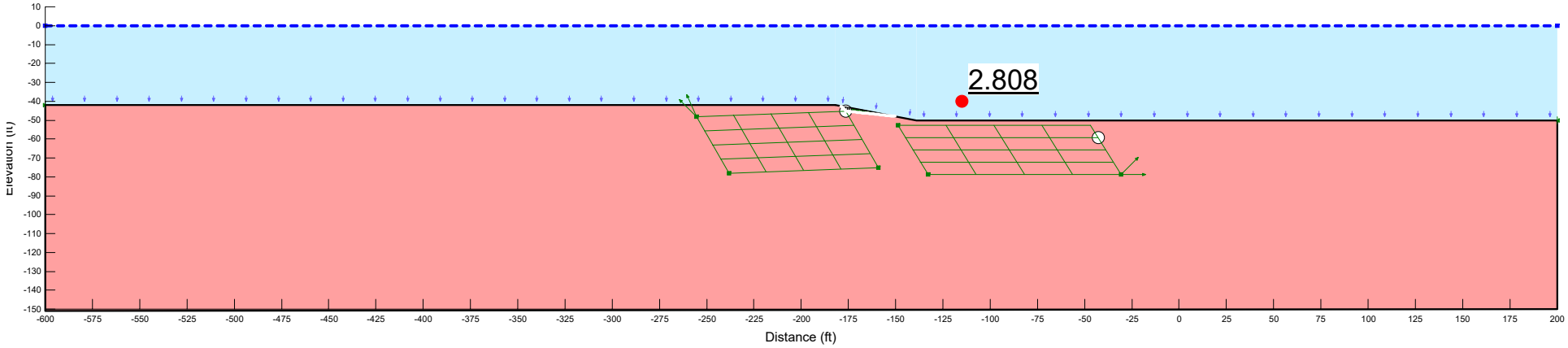
MSC PED_-16+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)	Phi' (°)
	Loose SC	125		28
	M. Dense SM	125		30
	Soft to Stiff CL/CH	120	500	



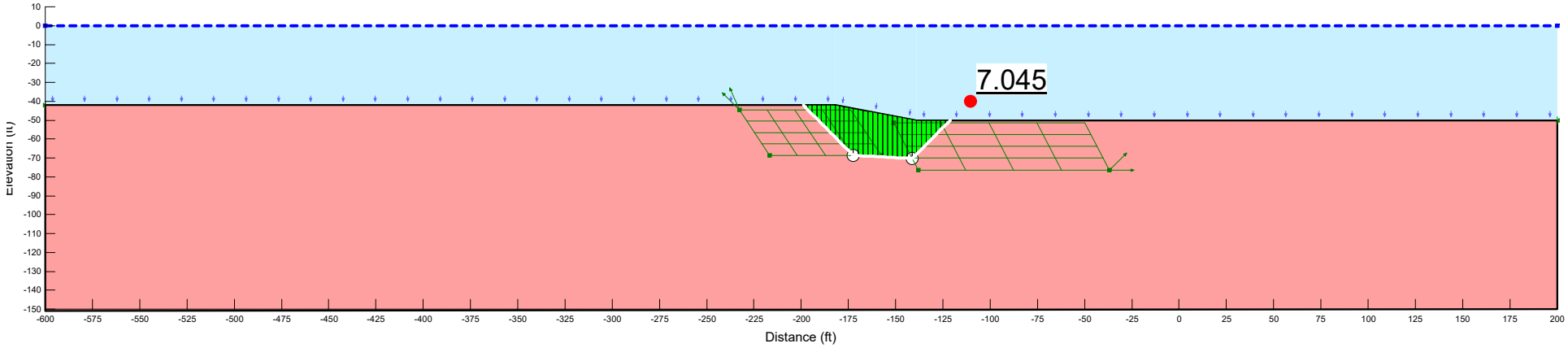
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Color	Name	Unit Weight (pcf)	Phi' (°)
	Soft to Stiff CL/CH for Long Term Parameters	120	26



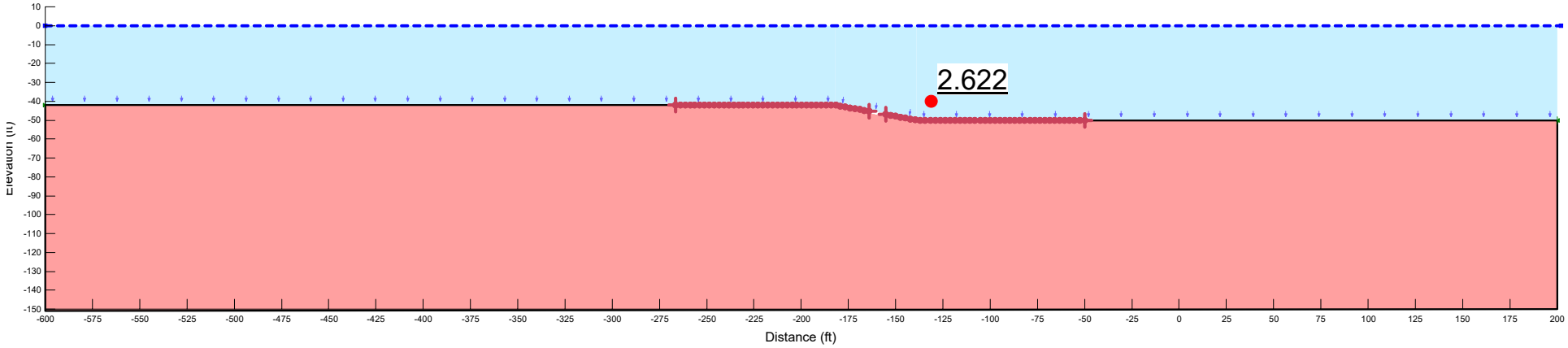
MSC PED_-20+000 Block Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)
	Soft to Stiff CL/CH	120	500



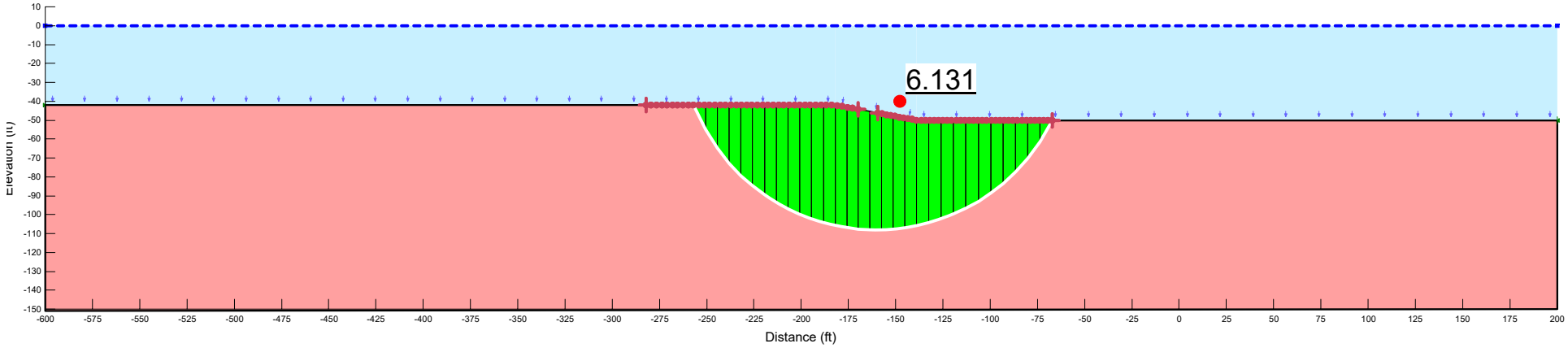
MSC PED_-20+000 Circular Exterior LT

Color	Name	Unit Weight (pcf)	Phi' (°)
	Soft to Stiff CL/CH for Long Term Parameters	120	26



MSC PED_-20+000 Circular Exterior ST

Color	Name	Unit Weight (pcf)	Cohesion (psf)
	Soft to Stiff CL/CH	120	500



Attachment H-1

Field Sampling and Analytical Report

MSCIP Supplemental Sediment Sampling Project

Submitted by:
Alcoa
Point Comfort, Texas

Submitted to:

US Army Corps of Engineers

Prepared by:
Benchmark Ecological Services, Inc.

December
2023

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Attachment 4 – Analytical Results

LIST OF ACRONYMS AND ABBREVIATIONS

Benchmark	Benchmark Ecological Services, Inc.
GPS	Global Positioning System
ID	Identification
MSCIP	Matagorda Ship Channel Improvement Project
NELAP	National Environmental Laboratory Accreditation Program
USACE	United States Army Corps of Engineers

1.0 Introduction

This report summarizes the field sampling event conducted in October and November 2023 based on the Sampling and Analysis Plan (SAP) approved by the U.S. Army Corps of Engineers (USACE) included in Attachment 3. The sample event was developed to support a pre-dredge evaluation of the proposed material associated with the Matagorda Ship Channel Improvement Project (MSCIP) in Lavaca Bay, Texas. Any dredged material containing mercury above 0.5 parts per million (ppm) will be handled by the Aluminum Company of America (Alcoa) under a Record of Decision. The pre-construction engineering and design (PED) process is currently being executed by the U.S. Army Corps of Engineers (USACE) for the MSCIP portion, in the area shown in Figure 1 (Attachment 1). The overall goal of this sample event is to confirm historical data trends for the PED process.

Benchmark Ecological Services, Inc. (Benchmark) was contracted to develop the SAP, conduct the field sampling event, contract the analytical laboratory, and develop the field and analytical (mercury and percent moisture) summary report. Sediment samples were collected and processed from twenty-four (24) stations shown in Figure 2 (Attachment 1) and listed in Table 1 (Attachment 2).

2.0 Methods

Following the procedures specified in the SAP, Benchmark collected 33 sediment samples from 24 sample stations shown in Figure 2 (Attachment 1) and listed in Table 1 (Attachment 2). GPS coordinates were collected at each sample station location at the time of sample collection. All sediment samples were delivered to the analytical laboratories within specified holding times and storage temperature limits. QA/QC procedures specified in the SAP for sediment sampling were followed without exception. A total of 2 duplicates were collected.

Sediment samples were collected using a vibracore and piston core sampling device. New polycarbonate core tubes were used for each sample station and were decontaminated using a scrub brush, Alconox soap and distilled water prior to use. Sediment cores were collected from the sediment surface down to refusal.

Sediment cores were placed horizontally on a sample table in PVC troughs covered with clean aluminum foil. Core tubes were split from top to bottom with pre-cleaned electric shears. Sediment characteristics including color, texture, and general descriptions were recorded on field data sheets. Cores containing 3ft or more of sediment were split in half to form 2 samples. One sample represented the top half of the sediment, and the other sample represented the bottom half of the sediment. Cores containing less than 3ft of sediment were homogenized into a single sample. Sediment from the cuts listed above were placed into separate pre-cleaned stainless steel

bowls and processed using pre-cleaned stainless steel spoons. A total of 33 sediment samples were processed from the 24 sample stations. Individual sediment samples were placed into sample containers provided by the analytical laboratories.

Sediment samples from all twenty-four (24) sample stations were collected between 25 October 2023 and 03 November 2023 and delivered to the analytical laboratory, ALS, on 26 October 2023 and 03 November 2023. ALS is accredited by the National Environmental Laboratory Accreditation Program (NELAP). Analytical methods specified in the SAP were used to evaluate the sediment samples.

3.0 Results

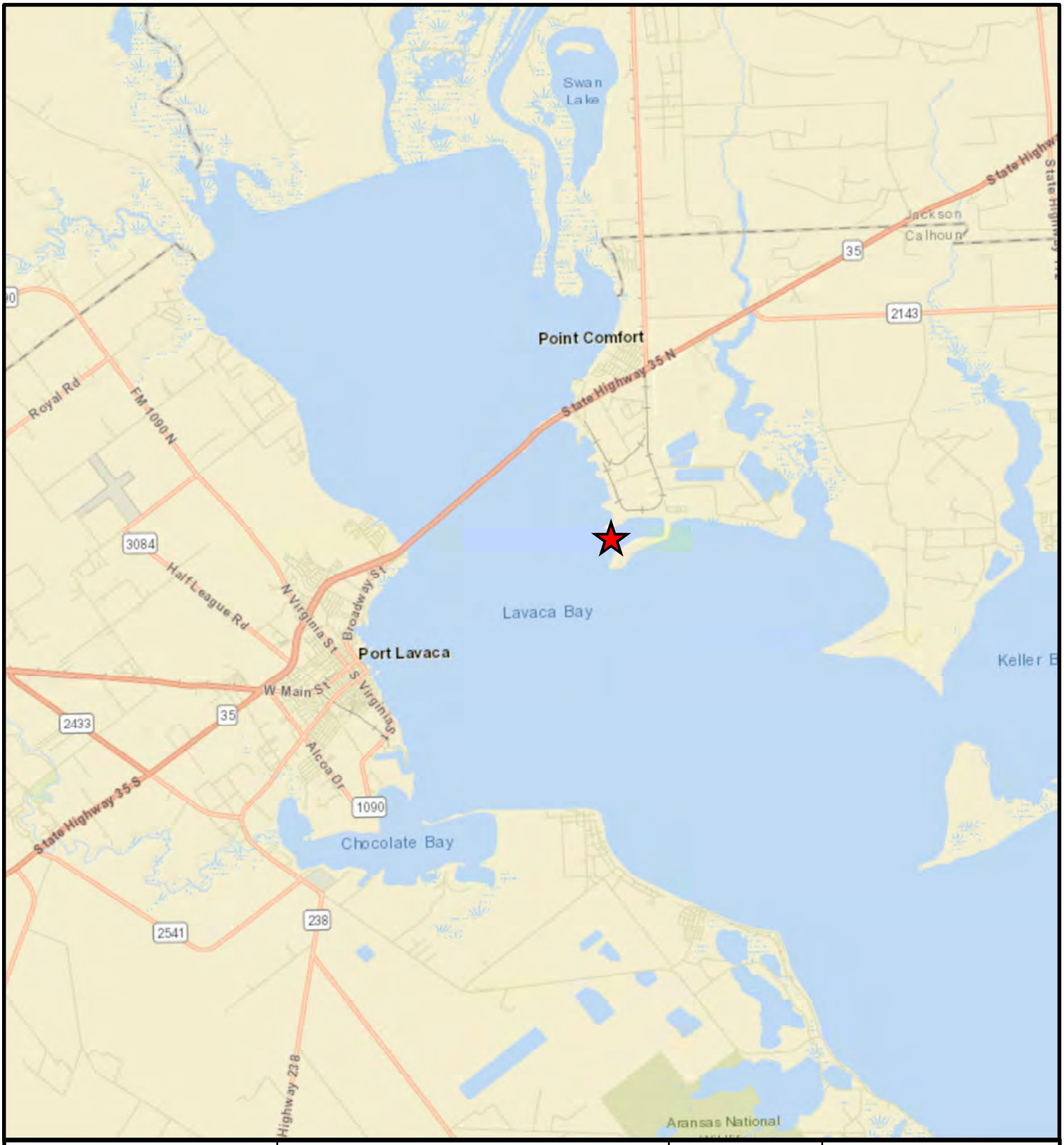
Sample stations, dates, times, sample IDs, sample station coordinates, water depths, and sediment descriptions are provided in Table 1 (Attachment 2). Detailed laboratory reports and notes are provided in Attachment 4 and the analytical electronic data deliverable (EDD) was emailed to the USACE on 15 November 2023. All samples were analyzed within their respective hold times defined in the SAP.

Mercury results are listed in Table 2 (Attachment 2) and shown in Figure 3. Mercury results were detected with values greater than 0.5 parts per million (ppm) at the following sample stations.

- MSCIP-SSS-110223-03A (0.594 mg/Kg)
- MSCIP-SSS-110223-13A (0.651 mg/Kg)
- MSCIP-SSS-110223-13B (0.952 mg/Kg)
- MSCIP-SSS-110223-14B (0.956 mg/Kg)

When conducting the field sampling study, Benchmark scientists did not observe any sediment characteristics that might indicate the presence of potential contaminants within the study area (i.e., chemical sheens).

ATTACHMENT 1 – Figures



N

0 0.75 1.5 3

Miles

Legend	Notes	MSCIP Suplemental Sediment Sampling
★ Site Location	2015 DOQQ (Point Comfort Quad) Calhoun County, TX	Site Location Map
		Prepared for Alcoa Corporation
		Project: 98003-115
		Date: 11/20/2023
		Figure 1

BESI Benchmark Ecological Services, Inc.

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N

0 400 800 1,600 Feet

Legend

Sample Station IDs

Proposed MSCIP Dredge Area

Existing Channel Boundary

Hg results in sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

2023

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas

Sample Stations
Overlaid on Aerial Imagery

MSCIP Supplemental
Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-115

Date: 11/22/2023

Figure 2

Document Path: \\BESINAS1\M-Drive\98003\115\arc\REP\Figure_2_Sample_Stations_Overlaid_on_Aerial_Imagery.mxd



N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

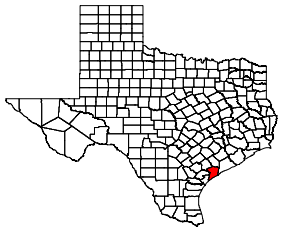
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-115

Date: 1/10/2024

Figure 3

(Page 1 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

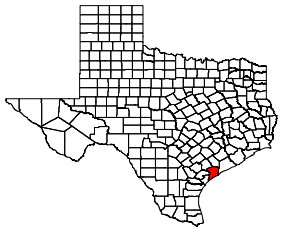
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

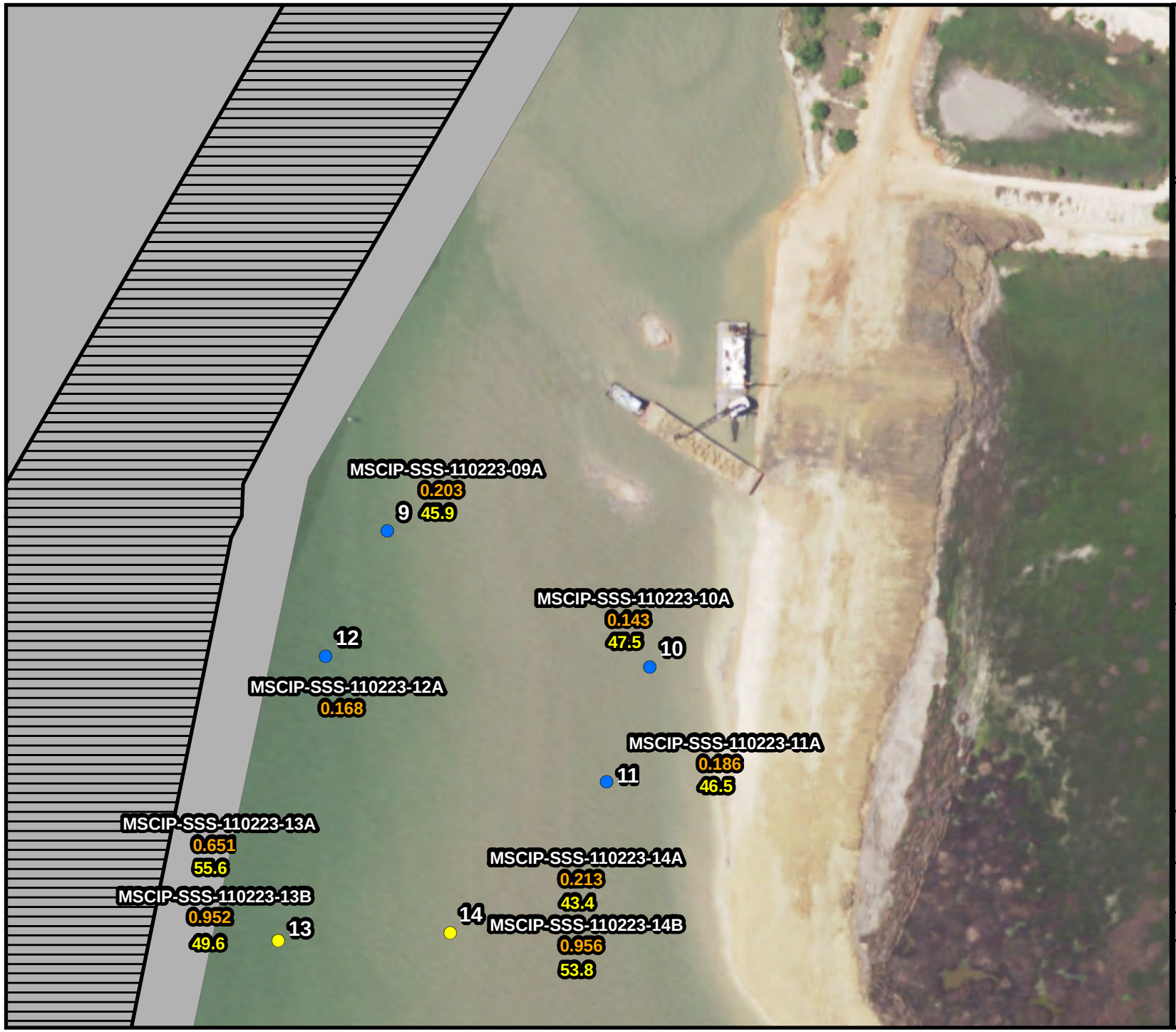
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Date: 1/10/2024

Figure 3

(Page 2 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

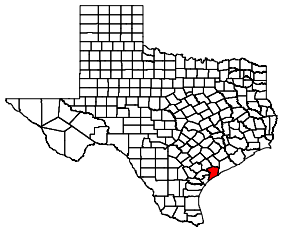
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

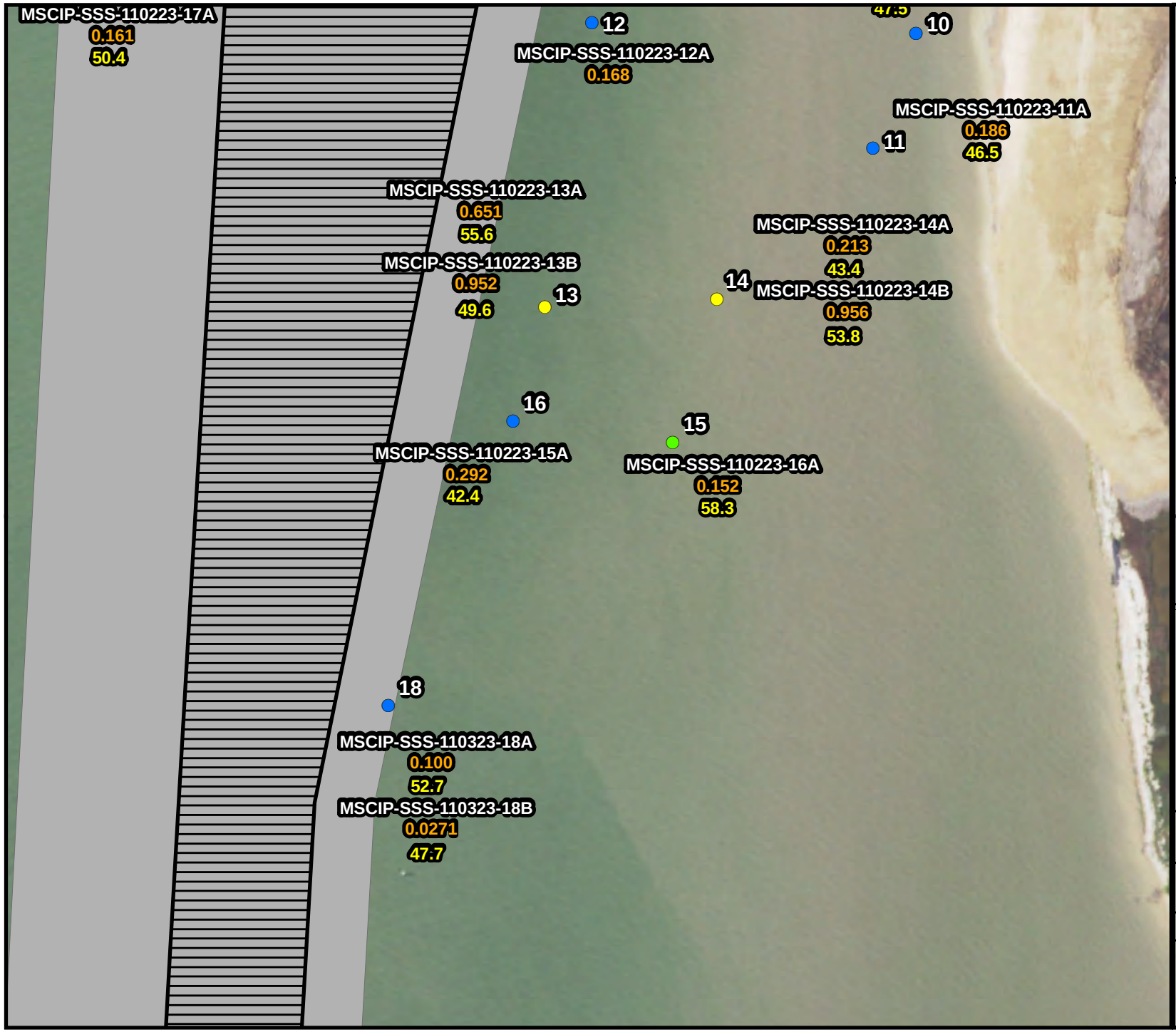
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Date: 1/10/2024

Figure 3

(Page 3 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)
- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

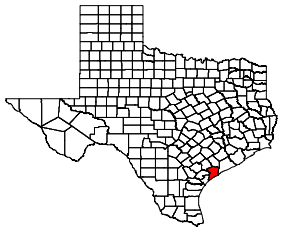
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

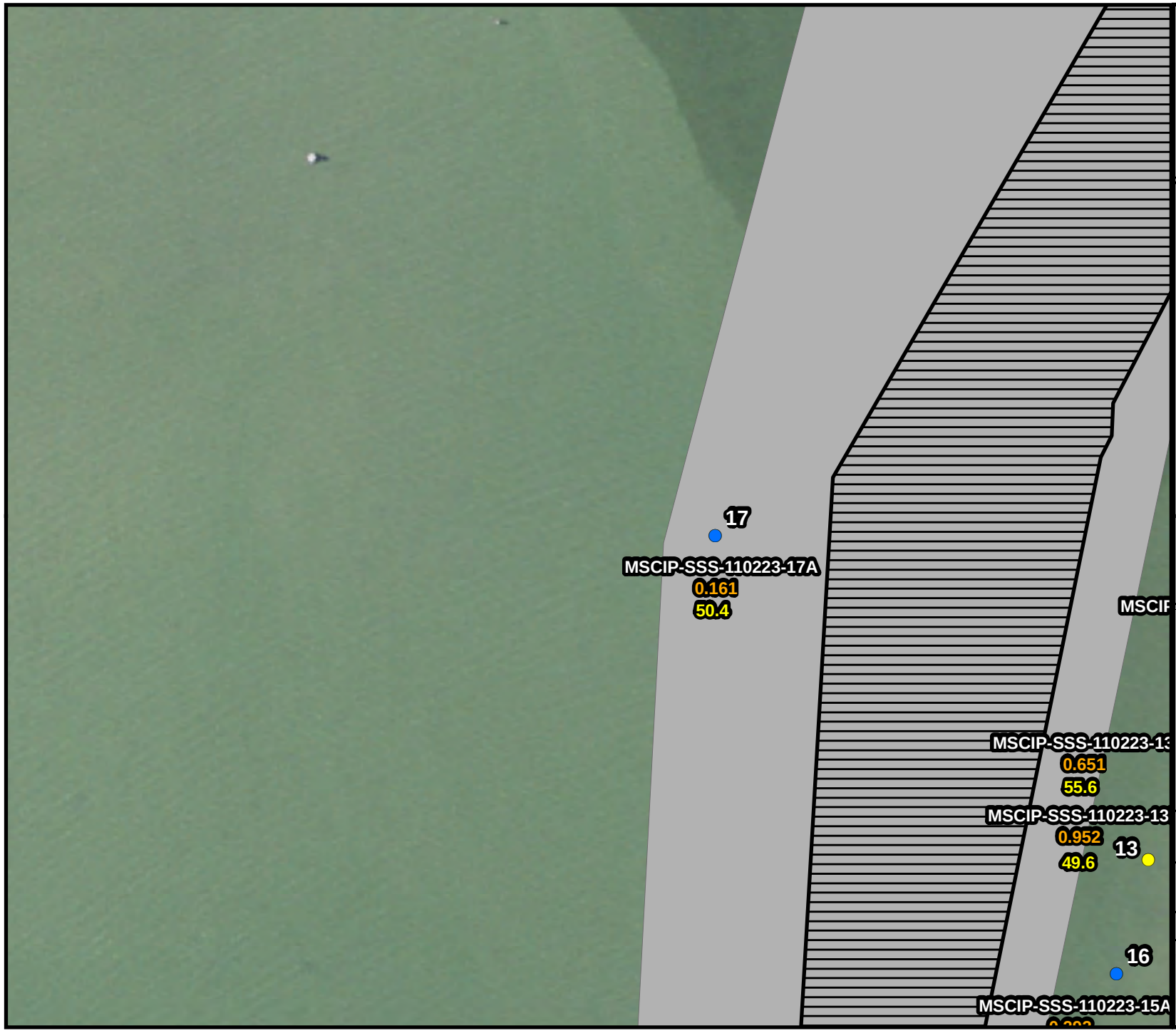
BESI Benchmark Ecological Services, Inc.

Project: 98003-115

Date: 1/10/2024

Figure 3
(Page 4 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas

Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-115

Date: 1/10/2024

Figure 3
(Page 5 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

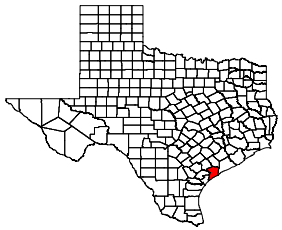
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

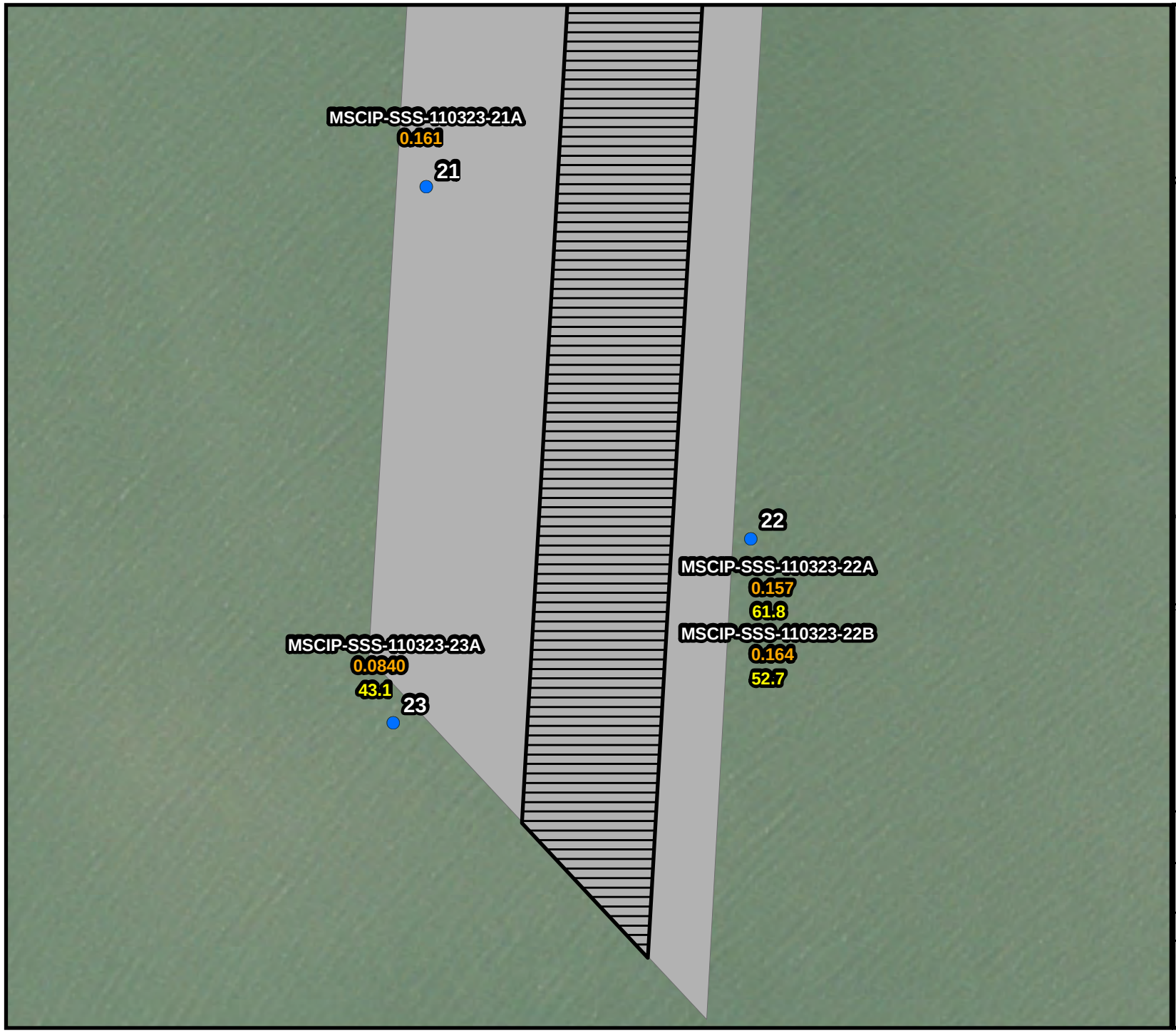
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Project: 98003-115

Date: 1/10/2024

Figure 3
(Page 6 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)

- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

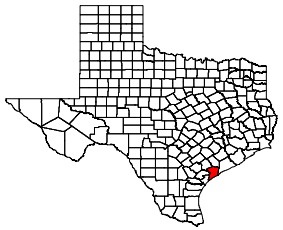
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

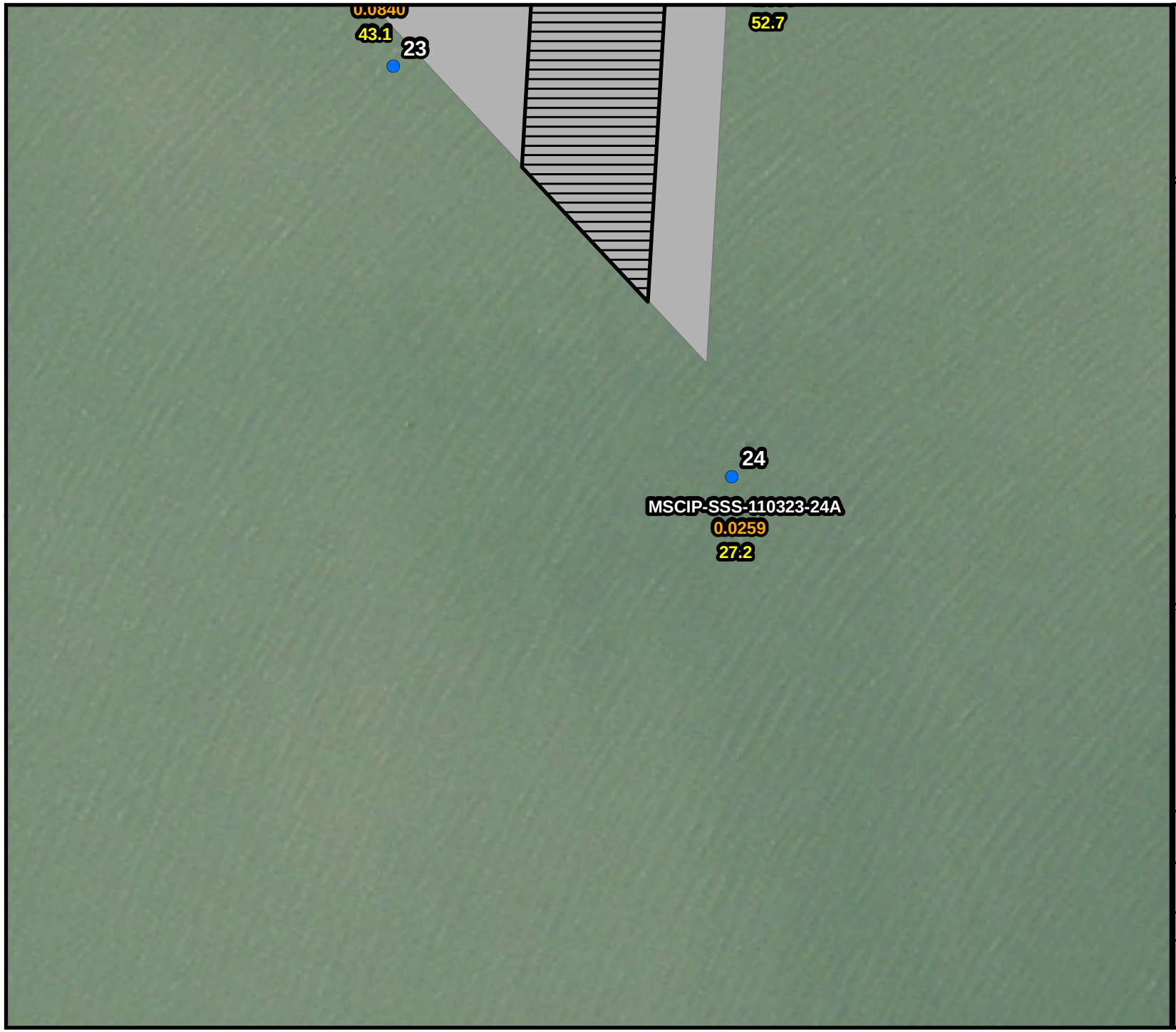
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Date: 1/10/2024

Figure 3

(Page 7 of 8)

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N

0 75 150 300 Feet

Legend

Hg Results in Sediment (mg/kg)
- 0-0.249
- 0.250-0.499
- 0.500-0.999

Proposed MSCIP Dredge Area

Existing Channel Boundary

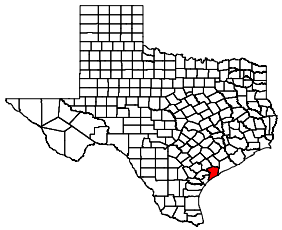
Sample Station IDs

Mercury Results

% Moisture Results

Notes

2022 NAIP Imagery (Calhoun County)
Calhoun County, Texas



Mercury and % Moisture Results and Sample Locations

MSCIP Supplemental Sediment Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 98003-115

Date: 1/10/2024

Figure 3

(Page 8 of 8)

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ATTACHMENT 2 – Tables

Table 1 - Sample Stations, Sample IDs, Coordinates, Dates, Times, and Descriptions

Sample Station	Sample ID	Coordinates (NAD 83 State Plane Texas South Central 4204, Feet)		Sample Matrix[a]	Date	Time	Water Depth (ft)	Tide (MLLW ft)	Sediment Elevation (MLLW ft)	Sediment Elevation (NAVD88 ft)	Sediment Elevation (NGVD29 ft)	Comments
		Easting	Northing									
1	MSCIP-SSS-110223-01A MSCIP-SSS-110223-01B	2749476.38	13425729.93	S	11/2/2023	10:30	26.6	1.31	-25.3	-24.9	-24.3	0 - 12" Dark gray silt. No odor. 12" - 48" Gray clayey silt. No odor. 48" - 96" Gray clayey silt with tan sand partings at 86" to 96". No odor. Samples "A" and "B" collected with Vibracore sampler.
2	MSCIP-SSS-110223-02A MSCIP-SSS-110223-02B	2749668.02	13425711.44	S	11/2/2023	11:00	4.6	1.27	-3.3	-2.9	-2.4	0 - 1" Dark gray silt. No odor. 1" - 22" Light brownish gray clayey sand. No odor. 22" - 44" Light brownish gray clayey sand. No odor. Samples "A" and "B" collected with Piston Core sampler.
3	MSCIP-SSS-110223-03A	2749553.87	13425463.30	S	11/2/2023	11:20	0.6	1.2	0.6	1.0	1.6	0 - 6" Oyster shell pieces and hash with light brown sand partings intermixed. Hit resistance at 6" due to oyster reef. No odor. Sample "A" collected with Vibracore sampler.
4	MSCIP-SSS-110223-04A MSCIP-SSS-110223-04B	2749343.40	13425586.99	S	11/2/2023	11:50	26.4	1.13	-25.3	-24.9	-24.3	0 - 12" Dark gray silt. No odor. 12" - 48" Gray clayey silt. No odor. 48" - 96" Gray clayey silt. No odor. Samples "A" and "B" collected with Vibracore sampler.
5	MSCIP-SSS-102523-05A	2749484.82	13424742.14	S	10/25/2023	08:20	6.9	2.12	-4.8	-4.4	-3.8	0 - 31.5" Light brown sandy silt with shell hash. Sample "A" collected. MSCIP-SSS-102523-69 duplicate of MSCIP-SSS-102523-05A
6	MSCIP-SSS-102523-06A	2749697.27	13424783.78	S	10/25/2023	08:45	6.3	2.13	-4.2	-3.8	-3.2	0 - 34.5" Light brown and gray silt. Sample "A" collected.
7	MSCIP-SSS-110223-07A	2749438.89	13424546.74	S	11/2/2023	12:10	7.5	1.08	-6.4	-6.0	-5.5	0 - 1" Brownish tan and gray silt. No odor. 1" - 20" Brownish tan and gray clayey silt with sand partings. No odor. Sample "A" collected with Vibracore sampler.
8	MSCIP-SSS-102523-08A	2749672.97	13424543.62	S	10/25/2023	10:00	5.8	2.08	-3.7	-3.3	-2.8	0 - 5" Heavy shell with minimal gray sand intermixed. Sample "A" collected.
9	MSCIP-SSS-110223-09A	2749685.18	13422504.98	S	11/2/2023	12:45	4.5	1	-3.5	-3.1	-2.5	0 - 12" Light gray silt. No odor. 12" - 26" Light gray clayey silt with sand partings and orange redox concentrations. No odor. Sample "A" collected with Vibracore sampler. Station approx. 150 yards away from channel dredge operations.
10	MSCIP-SSS-110223-10A	2750090.60	13422320.37	S	11/2/2023	13:00	2.0	0.97	-1.0	-0.6	-0.1	0 - 15" Gray clayey silt with sand partings. No odor. Sample "A" with Piston Core sampler.
11	MSCIP-SSS-110223-11A	2750034.31	13422143.58	S	11/2/2023	13:10	2.5	0.94	-1.6	-1.1	-0.6	0 - 22" Gray clayey silt with sand partings. No odor. Sample "A" collected with Piston Core sampler.
12	MSCIP-SSS-110223-12A	2749601.33	13422311.07	S	11/2/2023	13:15	5.0	0.95	-4.1	-3.6	-3.1	0 - 12" Dark gray silt. No odor. Sample "A" collected with Piston Core sampler.

Table 1 - Sample Stations, Sample IDs, Coordinates, Dates, Times, and Descriptions

Sample Station	Sample ID	Coordinates (NAD 83 State Plane Texas South Central 4204, Feet)		Sample Matrix[a]	Date	Time	Water Depth (ft)	Tide (MLLW ft)	Sediment Elevation (MLLW ft)	Sediment Elevation (NAVD88 ft)	Sediment Elevation (NGVD29 ft)	Comments
		Easting	Northing									
13	MSCIP-SSS-110223-13A MSCIP-SSS-110223-13B	2749551.87	13421879.30	S	11/2/2023	13:30	7.0	0.91	-6.1	-5.7	-5.1	0 - 22" Gray clayey silt. No odor. 22" - 44" Gray clayey silt. No odor. Samples "A" and "B" collected with Piston Core sampler.
14	MSCIP-SSS-110223-14A MSCIP-SSS-110223-14B	2749810.58	13421904.30	S	11/2/2023	13:50	3.5	0.87	-2.6	-2.2	-1.7	0 - 5" Light gray silt. No odor. 5" - 25.5" Light gray clayey silt with sand partings intermixed. No odor. 25.5" - 51.0" Light gray clayey silt with sand partings intermixed. No odor. Samples "A" and "B" collected with Piston Core sampler.
15	MSCIP-SSS-110223-15A	2749755.40	13421685.42	S	11/2/2023	14:00	4.5	0.84	-3.7	-3.2	-2.7	0 - 1" Gray silt. No odor. 1"- 12" Gray clayey silt with shell pieces. No odor. Sample "A" collected with Piston Core sampler.
16	MSCIP-SSS-110223-16A	2748874.55	13422334.42	S	11/2/2023	14:15	5.5	0.81	-4.7	-4.3	-3.7	0 - 22" Dark gray silt with sand partings intermixed. No odor. Sample "A" collected with Piston Core sampler.
17	MSCIP-SSS-110223-17A	2749512.81	13421704.94	S	11/2/2023	14:30	8.3	0.81	-7.5	-7.1	-6.5	0 - 5" Dark gray silt. No odor. 5" - 25" Dark gray clayey silt with shell pieces and sand partings. No odor. Sample "A" collected with Vibracore sampler.
18	MSCIP-SSS-110323-18A MSCIP-SSS-110323-18B	2749347.11	13421266.51	S	11/3/2023	08:40	11.6	1.53	-10.1	-9.7	-9.1	0 - 0.5" Light gray silt. No odor. 0.5" - 22" Light gray clayey silt with sand partings. No odor. 22" - 44" Light gray clayey silt with sand partings. No odor. Samples "A" and "B" collected with Vibracore sampler.
19	MSCIP-SSS-110323-19A MSCIP-SSS-110323-19B	2748811.01	13420742.66	S	11/3/2023	09:00	7.5	1.5	-6.0	-5.6	-5.0	0 - 0.8" Gray silt. No odor. 0.8 - 18.5" Gray clayey silt. No odor. 18.5" - 37.0" Gray clayey silt with sand partings and shell hash. No odor. Samples "A" and "B" collected with Vibracore sampler.
20	MSCIP-SSS-110323-20A MSCIP-SSS-110323-20B	2749328.45	13420286.97	S	11/3/2023	09:10	6.5	1.47	-5.0	-4.6	-4.1	0 - 23" Light gray clayey silt. No odor. 23" - 46" Light gray clayey silt with sand partings and shell hash. No odor. Samples "A" and "B" collected with Vibracore sampler.
21	MSCIP-SSS-110323-21A	2748834.89	13419765.30	S	11/3/2023	09:20	7.0	1.46	-5.5	-5.1	-4.6	0 - 0.8" Gray clayey silt. No odor. 0.8 - 32.0" Gray clayey silt with sand partings and shell hash. No odor. Sample "A" collected with Vibracore sampler. MSCIP-SSS-110323-70 duplicate of MSCIP-SSS-110323-021A
22	MSCIP-SSS-110323-22A MSCIP-SSS-110323-22B	2749350.29	13419260.26	S	11/3/2023	09:30	6.0	1.44	-4.6	-4.1	-3.6	0 - 12" Gray silt. No odor. 12" - 23" Gray clayey silt. No odor. 12" - 46" Gray clayey silt with sand partings. No odor. Samples "A" and "B" collected with Vibracore sampler.
23	MSCIP-SSS-110323-23A	2748825.91	13418955.55	S	11/3/2023	09:40	7.0	1.41	-5.6	-5.2	-4.6	0 - 0.8" Gray silt. No odor. 0.8" -35" Gray clayey silt with sand partings and shell hash. No odor. Sample "A" collected with Vibracore sampler.

Table 1 - Sample Stations, Sample IDs, Coordinates, Dates, Times, and Descriptions

Sample Station	Sample ID	Coordinates (NAD 83 State Plane Texas South Central 4204, Feet)		Sample Matrix[a]	Date	Time	Water Depth (ft)	Tide (MLLW ft)	Sediment Elevation (MLLW ft)	Sediment Elevation (NAVD88 ft)	Sediment Elevation (NGVD29 ft)	Comments
		Easting	Northing									
24	MSCIP-SSS-110323-24A	2749367.46	13418363.55	S	11/3/2023	09:50	8.5	1.39	-7.1	-6.7	-6.2	0 - 0.6" Gray clayey silt with shell hash and sand partings. No odor. Multiple attempts were made to collect a deeper sample, but the bottom surface consists of shell pieces and oyster reef and there are small areas where a thin layer of sediment covers the top of the shell/oyster reef. Sample "A" collected with Vibracore sampler.

a) S = Analysis of a sediment sample; E = Analysis of an elutriate sample; W = Analysis of a water sample

Table 2: Mercury and Percent Moisture Results

Sample Station	Sample ID	Core Length (in)	Sample Cut (in BSS)	Mercury Result (mg/kg)	Percent Moisture Result (wt%)
1	MSCIP-SSS-110223-01A	96	0-48	0.190	67.0
	MSCIP-SSS-110223-01B		48-96	0.179	60.7
2	MSCIP-SSS-110223-02A	44	0-22	0.0214	26.8
	MSCIP-SSS-110223-02B		22-44	0.0107	30.1
3	MSCIP-SSS-110223-03A	6	0-6	0.594	9.31
4	MSCIP-SSS-110223-04A	96	0-48	0.176	67.5
	MSCIP-SSS-110223-04B		48-96	0.194	63.6
5	MSCIP-SSS-102523-05A	31.5	0-31.5	0.177	36.9
6	MSCIP-SSS-102523-06A	34.5	0-34.5	0.368	37.8
7	MSCIP-SSS-110223-07A	20	0-20	0.0312	37.7
8	MSCIP-SSS-102523-08A	5	0-5	0.094	16.0
9	MSCIP-SSS-110223-09A	26	0-26	0.203	45.9
10	MSCIP-SSS-110223-10A	15	0-15	0.143	47.5
11	MSCIP-SSS-110223-11A	22	0-22	0.186	46.5
12	MSCIP-SSS-110223-12A	12	0-12	0.168	58.3
13	MSCIP-SSS-110223-13A	44	0-22	0.651	55.6
	MSCIP-SSS-110223-13B		22-44	0.952	49.6
14	MSCIP-SSS-110223-14A	51	0-25.5	0.213	43.4
	MSCIP-SSS-110223-14B		25.5-51	0.956	53.8
15	MSCIP-SSS-110223-15A	12	0-12	0.292	42.4
16	MSCIP-SSS-110223-16A	22	0-22	0.152	58.3
17	MSCIP-SSS-110223-17A	25	0-25	0.161	50.4
18	MSCIP-SSS-110323-18A	44	0-22	0.1	52.7
	MSCIP-SSS-110323-18B		22-44	0.0271	47.7
19	MSCIP-SSS-110323-19A	37	0-18.5	0.467	51.3
	MSCIP-SSS-110323-19B		18.5-37	0.0206	32.8
20	MSCIP-SSS-110323-20A	46	0-23	0.177	60
	MSCIP-SSS-110323-20B		23-46	0.0414	51
21	MSCIP-SSS-110323-21A	32	0-32	0.161	46.6
22	MSCIP-SSS-110323-22A	46	0-23	0.157	61.8
	MSCIP-SSS-110323-22B		23-46	0.164	52.7
23	MSCIP-SSS-110323-23A	35	0-35	0.084	43.1
24	MSCIP-SSS-110323-24A	0.6	0-0.6	0.0259	27.2

BSS - Below Sediment Surface
in - inches
mg - milligram
kg - kilogram
wt - weight

ATTACHMENT 3 – Sampling and Analysis Plan

Benchmark Ecological Services, Inc.

P.O. Box 158
Katy Texas 77492-0158

Phone 281-934-3403
Fax 281-934-3404
e-mail: nhenthorne@benchmarkeco.com

Technical Memorandum

TO: Ron Morosky – Alcoa

FROM: Neil Henthorne

DATE: September 03, 2023

RE: MSCIP Supplemental Sediment Sampling

This technical memorandum provides a plan to collect, process and analyze samples from 24 stations along the Calhoun County Port Authority / Matagorda Ship Channel for total mercury and percent moisture as a supplement to the US Army Corps of Engineers' (USACE) Matagorda Ship Channel Improvement Project (MSCIP)

Field Sampling

Based on review of historic sediment sample locations, Alcoa has developed a plan to collect sediment samples from sixteen (16) stations around four (4) historic mercury hotspots (>0.5 mg/kg Total Hg) and from eight (8) stations along the Matagorda Ship Channel (shown in Figure 1). A sample collection event will be conducted using a shallow draft survey vessel and GPS to navigate to the stations shown in Figure 1. Field scientists will collect sediment cores at the proposed sample locations shown in Figure 1. Sediment cores will be collected using a piston core or vibecore with three-inch diameter precleaned polycarbonate core tubes. A GPS will be used to collect coordinates at each sample station. Sediment cores from each sample station will be placed horizontally on a sample table in PVC troughs covered with clean aluminum foil. Core tubes will be split from top to bottom with pre-cleaned electric shears. Field scientists will examine each sediment core and document characteristics including length, color, texture, and general descriptions in field notes. Photographs will be taken of each core. Cores containing 3ft of sediment (or greater) will be split in half to create a top (A) sample and a bottom (B) sample. Cores containing less than 3ft of sediment will be processed as a single sample. Sediment for each sample will be removed from the core tube using a pre-cleaned stainless-steel spoon and placed into a pre-cleaned stainless-steel bowl before it is homogenized. The homogenized sediment from each

sample will be placed in clean jars provided by the analytical laboratory and analyzed for % Moisture (EPA 160.3) and Total Hg (EPA 7471).

Samples will be given a unique identification designation to identify the sample location, e.g., MSCIP-SSS-MMDDYY-24:

- MSCIP – Matagorda Ship Channel Improvement Project
- SSS – Supplemental Sediment Sampling
- MMDDYY -Sample Date (Month Date Year)
- 24 – individual sample location ID

Sample Handling

1) The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.

2) All sample containers will be identified by using sample labels that include the date of collection, unique sample number and analyses to be performed.

3) Sample labels will be completed for each sample using waterproof ink.

4) Samples will be accompanied by a properly completed chain-of-custody form.

5) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed chain-of-custody form enclosed in and secured to the inside top of each shipping cooler. Shipping coolers will be secured with custody tape for shipment to the laboratory. The custody tape is then covered with clear plastic tape to prevent accidental damage to the custody tape.

6) If samples are not shipped to the laboratory the same day the samples are collected in the field, additional ice will be placed in the coolers. The coolers will be sealed and kept in a designated secure area until they are shipped to the laboratory as described above.

Quality control samples will be collected according to the following frequency:

Description	Sample Frequency
Matrix Spike	1 per 20 samples
Matrix Spike Duplicate	1 per 20 samples
Field Duplicate	1 per 20 samples
Equipment Rinsate Blank	1 per day/per field team

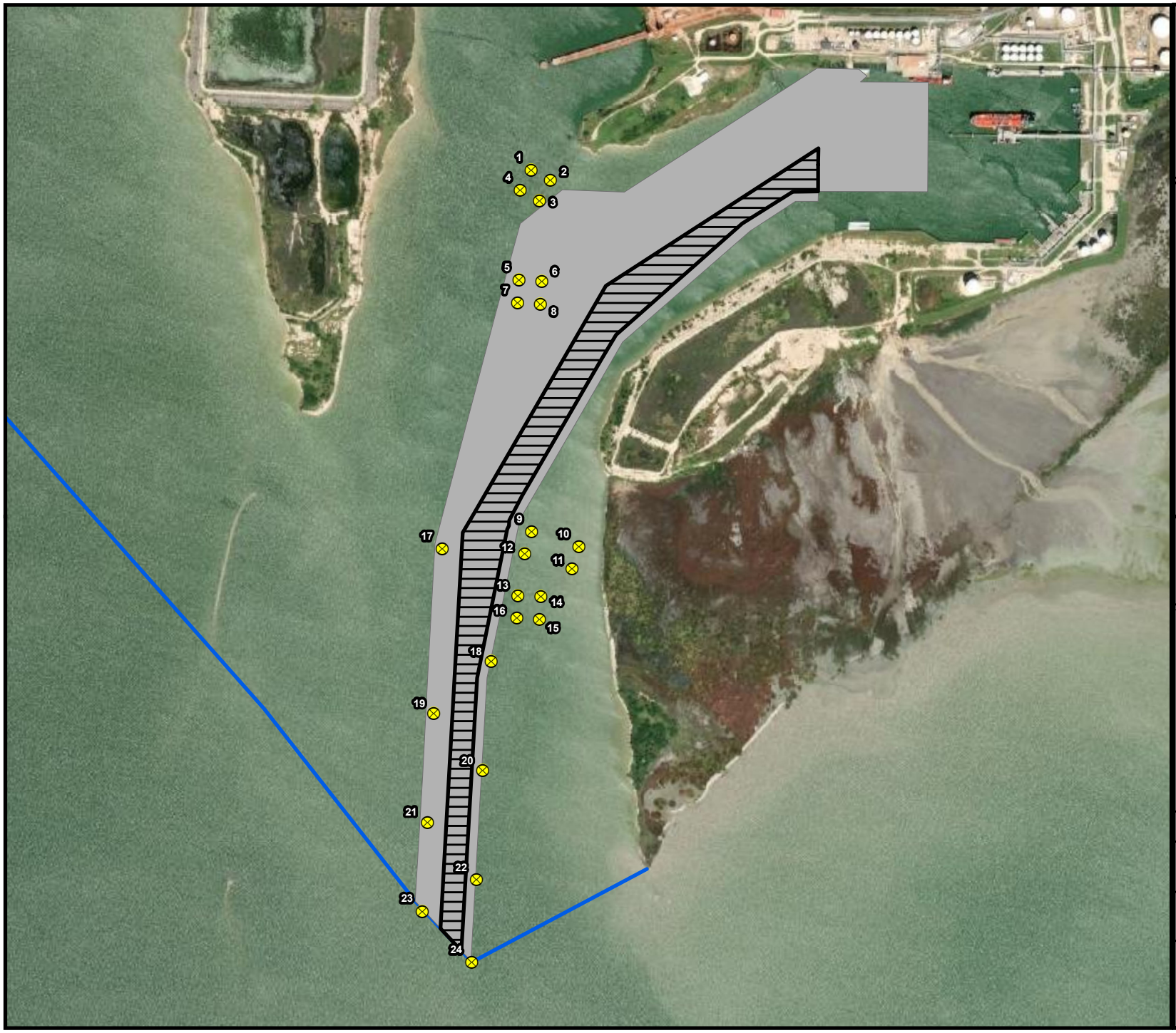
Field Data Management

Field data will be recorded in logbooks or on standard forms. Field data primarily will be direct observations and information related to sample collection. At the beginning of each day, the date, start time, weather, and names of all sampling team members will be entered. Field record entries will be made in ink, signed, and dated with no erasures. Should a correction be necessary, the correct information will be entered into the logbook adjacent to the original entry after it is struck through and initialed by the scribe. Photographs taken of sediment cores will also be noted in the logbook or on data sheets.

Reporting

Once analytical data are received from the laboratory and reviewed, a letter report will be prepared to present the data and describe the sampling effort. Field activities and sample locations will be summarized, complications and resolutions during the sampling activities will be described, adjustments to sample locations will be detailed, and a map showing the actual sample locations will be provided. The analytical data will be presented in a tabular format. Complete analytical laboratory reports will be provided as an attachment to the letter report.

Should you have any questions, please contact me at your convenience.



N

0 450 900 1,800 Feet

Legend

Supplemental Hg Proposed Sediment Sample Stations

Sample Station IDs

Proposed MSCIP Dredge Area

Existing Channel Boundary

Closed Area Boundary

Notes

World Imagery, Calhoun County, Texas



Proposed Sediment Sample Stations

MSCIP Suplemental Sampling

Prepared for Alcoa Corporation

BESI Benchmark Ecological Services, Inc.

Project: 22009-002

Date: 10/28/2022

Figure 1

Document Path: M:\98003\115\arc\10.7\Figure_1.mxd

ATTACHMENT 4 – Analytical Results

HS23101796 98003115 MSCIP Cover Page

ALS WO# HS23101796

ALS Environmental
ALS Group USA, Corp
10450 Stancliff Road, Suite 210
Houston, TX 77099
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F : +1 281 530 5887
www.alsglobal.com

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Form 7 - HG04_450592 LCS
HS23101796 Wetchem Moist

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alsglobal.com

right solutions.
right partner.

WorkOrder: HS23101796

98003-115 MSCIP

Benchmark Ecological Services

Neil Henthorne
4219 S Front St
Brookshire TX 77423

06-Nov-2023

HS23101796 98003115 MSCIP Final

ALS WO# HS23101796

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November 02, 2023

Neil Henthorne
Benchmark Ecological Services
4219 S Front St
Brookshire, TX 77423

Work Order: **HS23101796**

Laboratory Results for: **98003-115 MSCIP**

Dear Neil Henthorne,

ALS Environmental received 4 sample(s) on Oct 26, 2023 for the analysis presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested. Results are expressed as "as received" unless otherwise noted.

QC sample results for this data met EPA or laboratory specifications except as noted in the Case Narrative or as noted with qualifiers in the QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained by ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

If you have any questions regarding this report, please feel free to call me.

Sincerely,

Generated By: JUMOKE.LAWAL
James Guin

Client:	Benchmark Ecological Services
Project:	98003-115 MSCIP
WorkOrder:	**HS23101796**

TRRP Laboratory Data Package Cover Page

This data package consists of all or some of the following as applicable:

This signature page, the laboratory review checklist, and the following reportable data:

R1 Field chain-of-custody documentation;

R2 Sample identification cross-reference;

R3 Test reports (analytical data sheets) for each environmental sample that includes:

a) Items consistent with NELAC Chapter 5,
b) dilution factors,
c) preparation methods,
d) cleanup methods, and
e) if required for the project, tentatively identified compounds (TICs).

R4 Surrogate recovery data including:

a) Calculated recovery (%R), and
b) The laboratory's surrogate QC limits.

R5 Test reports/summary forms for blank samples;

R6 Test reports/summary forms for laboratory control samples (LCSs) including:

a) LCS spiking amounts,
b) Calculated %R for each analyte, and
c)The laboratory's LCS QC limits.

R7 Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:

a) Samples associated with the MS/MSD clearly identified,
b) MS/MSD spiking amounts,
c) Concentration of each MS/MSD analyte measured in the parent and spiked samples,
d) Calculated %Rs and relative percent differences (RPDs), and
e) The laboratory's MS/MSD QC limits.

R8 Laboratory analytical duplicate (if applicable) recovery and precision:

a) the amount of analyte measured in the duplicate,
b) the calculated RPD, and
c) the laboratory's QC limits for analytical duplicates.

R9 List of method quantitation limits (MQLs) and detectability check sample results for each analyte for each method and matrix.

R10 Other problems or anomalies.
The Exception Report for each "No" or "Not Reviewed (NR)" item in Laboratory Review Checklist and for each analyte, matrix, and method for which the laboratory does not hold NELAC accreditation under the Texas Laboratory Accreditation Program.

Client:	Benchmark Ecological Services
Project:	98003-115 MSCIP
WorkOrder:	**HS23101796**

TRRP Laboratory Data Package Cover Page

Release Statement: I am responsible for the release of this laboratory data package. This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes and matrices reported in this data package except as noted in the Exception Reports. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory have been identified by the laboratory in the Laboratory Review Checklist, and no information affecting the quality of the data has been knowingly withheld.

Check, if applicable: [NA] This laboratory meets an exception under 30 TAC §25.6 and was last inspected by [ ] TCEQ or [ ] _____ on (enter date of last inspection). Any findings affecting the data in this laboratory data package are noted in the Exception Reports herein. The official signing the cover page of the report in which these data are used is responsible for releasing this data package and is by signature affirming the above release statement is true.

James Guin

Laboratory Review Checklist: Reportable Data								
Laboratory Name: ALS Laboratory Group			LRC Date: 11/02/2023					
Project Name: 98003-115 MSCIP			Laboratory Job Number: HS23101796					
Reviewer Name: James Guin			Prep Batch Number(s): 202687,R450743					
#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]	
R1	OI	**Chain-of-custody (C-O-C)**						
		Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?	X					
		Were all departures from standard conditions described in an exception report?	X					
R2	OI	**Sample and quality control (QC) identification**						
		Are all field sample ID numbers cross-referenced to the laboratory ID numbers?	X					
		Are all laboratory ID numbers cross-referenced to the corresponding QC data?	X					
R3	OI	**Test reports**						
		Were all samples prepared and analyzed within holding times?	X					
		Other than those results < MQL, were all other raw values bracketed by calibration standards?	X					
		Were calculations checked by a peer or supervisor?	X					
		Were all analyte identifications checked by a peer or supervisor?	X					
		Were sample detection limits reported for all analytes not detected?	X					
		Were all results for soil and sediment samples reported on a dry weight basis?	X					
		Were % moisture (or solids) reported for all soil and sediment samples?	X					
		Were bulk soils/solids samples for volatile analysis extracted with methanol per SW-846 Method 5035?			X			
		If required for the project, TICs reported?			X			
R4	O	**Surrogate recovery data**						
		Were surrogates added prior to extraction?			X			
		Were surrogate percent recoveries in all samples within the laboratory QC limits?			X			
R5	OI	**Test reports/summary forms for blank samples**						
		Were appropriate type(s) of blanks analyzed?	X					
		Were blanks analyzed at the appropriate frequency?	X					
		Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?	X					
		Were blank concentrations < MQL?	X					
R6	OI	**Laboratory control samples (LCS):**						
		Were all COCs included in the LCS?	X					
		Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?	X					
		Were LCSs analyzed at the required frequency?	X					
		Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?	X					
		Does the detectability data document the laboratory's capability to detect the COCs at the MDL used to calculate the SDLs?	X					
		Was the LCSD RPD within QC limits?	X					
R7	OI	**Matrix spike (MS) and matrix spike duplicate (MSD) data**						
		Were the project/method specified analytes included in the MS and MSD?	X					
		Were MS/MSD analyzed at the appropriate frequency?	X					
		Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?	X					
		Were MS/MSD RPDs within laboratory QC limits?	X					
R8	OI	**Analytical duplicate data**						
		Were appropriate analytical duplicates analyzed for each matrix?	X					
		Were analytical duplicates analyzed at the appropriate frequency?	X					
		Were RPDs or relative standard deviations within the laboratory QC limits?	X					
R9	OI	**Method quantitation limits (MQLs):**						
		Are the MQLs for each method analyte included in the laboratory data package?	X					
		Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?	X					
		Are unadjusted MQLs and DCSs included in the laboratory data package?	X					
R10	OI	**Other problems/anomalies**						
		Are all known problems/anomalies/special conditions noted in this LRC and ER?	X					
		Were all necessary corrective actions performed for the reported data?	X					
		Was applicable and available technology used to lower the SDL and minimize the matrix interference affects on the sample results?	X					
		Is the laboratory NELAC-accredited under the Texas Laboratory Program for the analytes, matrices and methods associated with this laboratory data package?	X					

Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
O = Organic Analyses; I = Inorganic Analyses (and general chemistry, when applicable);NA = Not Applicable; NR = Not Reviewed;
R# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Supporting Data							
Laboratory Name: ALS Laboratory Group			LRC Date: 11/02/2023				
Project Name: 98003-115 MSCIP			Laboratory Job Number: HS23101279				
Reviewer Name: James Guim			Prep Batch Number(s): 202687,R450743				
#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]
S1	OI	**Initial calibration (ICAL)**					
		Were response factors and/or relative response factors for each analyte within QC limits?	X				
		Were percent RSDs or correlation coefficient criteria met?	X				
		Was the number of standards recommended in the method used for all analytes?	X				
		Were all points generated between the lowest and highest standard used to calculate the curve?	X				
		Are ICAL data available for all instruments used?	X				
		Has the initial calibration curve been verified using an appropriate second source standard?	X				
S2	OI	**Initial and continuing calibration verification (ICCV and CCV) and continuing calibration blank (CCB)**					
		Was the CCV analyzed at the method-required frequency?	X				
		Were percent differences for each analyte within the method-required QC limits?	X				
		Was the ICAL curve verified for each analyte?	X				
		Was the absolute value of the analyte concentration in the inorganic CCB < MDL?	X				
S3	O	**Mass spectral tuning:**					
		Was the appropriate compound for the method used for tuning?			X		
		Were ion abundance data within the method-required QC limits?			X		
S4	O	**Internal standards (IS):**					
		Were IS area counts and retention times within the method-required QC limits?			X		
S5	OI	**Raw data** (NELAC section 1 appendix A glossary, and section 5.12 or ISO/IEC 17025 section					
		Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?	X				
		Were data associated with manual integrations flagged on the raw data?	X				
S6	O	**Dual column confirmation**					
		Did dual column confirmation results meet the method-required QC?			X		
S7	O	**Tentatively identified compounds (TICs):**					
		If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?			X		
S8	I	**Interference Check Sample (ICS) results:**					
		Were percent recoveries within method QC limits?			X		
S9	I	**Serial dilutions, post digestion spikes, and method of standard additions**					
		Were percent differences, recoveries, and the linearity within the QC limits specified in the method?			X		
S10	OI	**Method detection limit (MDL) studies**					
		Was a MDL study performed for each reported analyte?	X				
		Is the MDL either adjusted or supported by the analysis of DCSs?	X				
S11	OI	**Proficiency test reports:**					
		Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?	X				
S12	OI	**Standards documentation**					
		Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?	X				
S13	OI	**Compound/analyte identification procedures**					
		Are the procedures for compound/analyte identification documented?	X				
S14	OI	**Demonstration of analyst competency (DOC)**					
		Was DOC conducted consistent with NELAC Chapter 5C or ISO/IEC 4?	X				
		Is documentation of the analyst's competency up-to-date and on file?	X				
S15	OI	**Verification/validation documentation for methods** (NELAC Chap 5 or ISO/IEC 17025 Section 5)					
		Are all the methods used to generate the data documented, verified, and validated, where applicable?	X				
S16	OI	**Laboratory standard operating procedures (SOPs):**					
		Are laboratory SOPs current and on file for each method performed?	X				

Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
O = Organic Analyses; I = Inorganic Analyses (and general chemistry, when applicable);
NA = Not Applicable; NR = Not Reviewed;
R# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Exception Reports	
Laboratory Name: ALS Laboratory Group	LRC Date: 11/02/2023
Project Name: 98003-115 MSCIP	Laboratory Job Number: HS23101279
Reviewer Name: James Guin	Prep Batch Number(s): 202687,R450743

ER#[5]	Description
	No Exceptions

Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
O = Organic Analyses; I = Inorganic Analyses (and general chemistry, when applicable);
NA = Not Applicable;
NR = Not Reviewed;
R# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Work Order: HS23101796

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS23101796-01	MSCIP-SSS-102523-05A	Soil		25-Oct-2023 08:20	26-Oct-2023 12:08	☐
HS23101796-02	MSCIP-SSS-102523-69	Soil		25-Oct-2023 08:30	26-Oct-2023 12:08	☐
HS23101796-03	MSCIP-SSS-102523-06A	Soil		25-Oct-2023 08:45	26-Oct-2023 12:08	☐
HS23101796-04	MSCIP-SSS-102523-08A	Soil		25-Oct-2023 10:00	26-Oct-2023 12:08	☐

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-102523-05A
Collection Date: 25-Oct-2023 08:20

ANALYTICAL REPORT
WorkOrder:HS23101796
Lab ID:HS23101796-01
Matrix:Soil

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 31-Oct-2023		Analyst: JS
Mercury	**0.177**		**0.000782**	**0.00553**	**mg/Kg-dry**	1	31-Oct-2023 14:35
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**36.9**		**0.0100**	**0.0100**	**wt%**	1	01-Nov-2023 17:38

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-102523-69
Collection Date: 25-Oct-2023 08:30

ANALYTICAL REPORT
WorkOrder:HS23101796
Lab ID:HS23101796-02
Matrix:Soil

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 31-Oct-2023		Analyst: JS
Mercury	**0.127**		**0.000757**	**0.00535**	**mg/Kg-dry**	1	31-Oct-2023 14:41
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**35.6**		**0.0100**	**0.0100**	**wt%**	1	01-Nov-2023 17:38

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-102523-06A
Collection Date: 25-Oct-2023 08:45

ANALYTICAL REPORT
WorkOrder:HS23101796
Lab ID:HS23101796-03
Matrix:Soil

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 31-Oct-2023		Analyst: JS
Mercury	**0.368**		**0.000779**	**0.00551**	**mg/Kg-dry**	1	31-Oct-2023 14:42
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**37.8**		**0.0100**	**0.0100**	**wt%**	1	01-Nov-2023 17:38

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-102523-08A
Collection Date: 25-Oct-2023 10:00

ANALYTICAL REPORT
WorkOrder:HS23101796
Lab ID:HS23101796-04
Matrix:Soil

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 31-Oct-2023		Analyst: JS
Mercury	**0.0940**		**0.000571**	**0.00404**	**mg/Kg-dry**	1	31-Oct-2023 14:44
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**16.0**		**0.0100**	**0.0100**	**wt%**	1	01-Nov-2023 17:38

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Weight / Prep Log

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

Batch ID: 202687 **Start Date:** 31 Oct 2023 08:30 **End Date:** 31 Oct 2023 08:30
Method: MERCURY PREP - SOLID - 7471B **Prep Code:** HG_S_LOWPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS23101796-01		0.5715 (grams)	40 (mL)	69.99	4-oz glass, Neat
HS23101796-02		0.5787 (grams)	40 (mL)	69.12	4-oz glass, Neat
HS23101796-03		0.5819 (grams)	40 (mL)	68.74	4-oz glass, Neat
HS23101796-04		0.5875 (grams)	40 (mL)	68.09	4-oz glass, Neat

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: 202687 (0)	**Test Name :** MERCURY BY SW7471B				**Matrix:** Soil	
HS23101796-01	MSCIP-SSS-102523-05A	25 Oct 2023 08:20		31 Oct 2023 08:30	31 Oct 2023 14:35	1
HS23101796-02	MSCIP-SSS-102523-69	25 Oct 2023 08:30		31 Oct 2023 08:30	31 Oct 2023 14:41	1
HS23101796-03	MSCIP-SSS-102523-06A	25 Oct 2023 08:45		31 Oct 2023 08:30	31 Oct 2023 14:42	1
HS23101796-04	MSCIP-SSS-102523-08A	25 Oct 2023 10:00		31 Oct 2023 08:30	31 Oct 2023 14:44	1
Batch ID: R450743 (0)	**Test Name :** MOISTURE				**Matrix:** Soil	
HS23101796-01	MSCIP-SSS-102523-05A	25 Oct 2023 08:20			01 Nov 2023 17:38	1
HS23101796-02	MSCIP-SSS-102523-69	25 Oct 2023 08:30			01 Nov 2023 17:38	1
HS23101796-03	MSCIP-SSS-102523-06A	25 Oct 2023 08:45			01 Nov 2023 17:38	1
HS23101796-04	MSCIP-SSS-102523-08A	25 Oct 2023 10:00			01 Nov 2023 17:38	1

WorkOrder: HS23101796
InstrumentID: HG04
Test Code: HG_S_Low
Test Number: SW7471B
Test Name: Mercury by SW7471B

METHOD DETECTION / REPORTING LIMITS

Matrix: Solid **Units:** mg/Kg

Type	Analyte	CAS	DCS Spike	DCS	MDL	PQL
A	Mercury	7439-97-6	0.00167	0.000333	0.000470	0.00332

WorkOrder: HS23101796
InstrumentID: Balance1
Test Code: MOIST_SW3550
Test Number: SW3550
Test Name: Moisture

METHOD DETECTION / REPORTING LIMITS

Matrix: Solid **Units:** wt%

Type	Analyte	CAS	DCS Spike	DCS	MDL	PQL
A	Percent Moisture	MOIST	0	0	0.0100	0.0100

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

QC BATCH REPORT

Batch ID: 202687 (0) **Instrument: HG04** **Method: MERCURY BY SW7471B**

MBLK Sample ID: **MBLK-202687** Units: **ug/Kg** Analysis Date: **31-Oct-2023 13:55**
Client ID: Run ID: **HG04_450592** SeqNo: **7644419** PrepDate: **31-Oct-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	< 0.470	3.32								

LCS Sample ID: **LCS-202687** Units: **ug/Kg** Analysis Date: **31-Oct-2023 13:57**
Client ID: Run ID: **HG04_450592** SeqNo: **7644420** PrepDate: **31-Oct-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	344.7	3.32	333.3	0	103	85 - 115				

MS Sample ID: **HS23101796-01MS** Units: **ug/Kg** Analysis Date: **31-Oct-2023 14:37**
Client ID: **MSCIP-SSS-102523-05A** Run ID: **HG04_450592** SeqNo: **7644473** PrepDate: **31-Oct-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	425.7	3.35	336.2	112	93.3	85 - 115				

MSD Sample ID: **HS23101796-01MSD** Units: **ug/Kg** Analysis Date: **31-Oct-2023 14:39**
Client ID: **MSCIP-SSS-102523-05A** Run ID: **HG04_450592** SeqNo: **7644474** PrepDate: **31-Oct-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	471.2	3.54	355.4	112	101	85 - 115	425.7	10.2	20	

The following samples were analyzed in this batch: HS23101796-01 HS23101796-02 HS23101796-03 HS23101796-04

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

QC BATCH REPORT

Batch ID: **R450743 (0)** **Instrument:** **Balance1** **Method:** **MOISTURE**

DUP Sample ID: **HS23101796-01DUP** Units: **wt%** Analysis Date: **01-Nov-2023 17:38**
Client ID: **MSCIP-SSS-102523-05A** Run ID: **Balance1_450743** SeqNo: **7647820** PrepDate: DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Percent Moisture	40.6	0.0100					36.9	9.55	20	

The following samples were analyzed in this batch: HS23101796-01 HS23101796-02 HS23101796-03 HS23101796-04

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: **HS23101796**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

Unit Reported	Description
mg/Kg-dry	Milligrams per Kilogram- Dry weight corrected

CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	88-00356	27-Mar-2024
California	2919; 2024	30-Apr-2024
Dept of Defense	L23-358	31-May-2025
Florida	E87611-38	30-Jun-2024
Illinois	2000322023-11	30-Jun-2024
Kansas	E-10352 2023-2024	31-Jul-2024
Louisiana	03087 2023-2024	30-Jun-2024
Maryland	343; 2023-2024	30-Jun-2024
North Carolina	624-2023	31-Dec-2023
North Dakota	R-193 2023-2024	30-Apr-2024
Oklahoma	2023-140	31-Aug-2024
Texas	T104704231-23-31	30-Apr-2024
Utah	TX026932023-14	31-Jul-2024

Sample Receipt Checklist

Work Order ID: HS23101796 **Date/Time Received:** **26-Oct-2023 12:08**

Client Name: Benchmark **Received by:** **Corey Grandits**

Completed By:	/S/ Nelson D. Dusara	27-Oct-2023 18:41	**Reviewed by:**	/S/ James Guin	31-Oct-2023 08:29
	eSignature	Date/Time		eSignature	Date/Time

Matrices: **SOIL** Carrier name: **Client**

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
VOA/TX1005/TX1006 Solids in hermetically sealed vials?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	1 Page(s)
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	COC IDs:305127
Samplers name present on COC?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	
Temperature(s)/Thermometer(s):	0.6/0.5 C UC/C	IR 31	
Cooler(s)/Kit(s):			
Date/Time sample(s) sent to storage:	OCT/27/2023 15:15		
Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑
pH adjusted?	Yes ☐	No ☐	N/A ☑
pH adjusted by:			

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

Corrective Action:

Cincinnati, OH +1 513 733 5336
Fort Collins, CO +1 970 490 1511
Houston, TX +1 281 530 5656
Spring City, PA +1 610 948 4903
South Charleston, WV +1 304 356 3168
Everett, WA +1 425 356 2600
Holland, MI +1 616 399 6070
Middletown, PA +1 717 944 5541
Salt Lake City, UT +1 801 266 7700
York, PA +1 717 505 5280

Chain of Custody Form

Page 1 of 1

COC ID: 305127

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	98003-115 MSCIP	Project Name	98003-115 MSCIP	A	HG_S_Low (7471B Total Mercury)
Work Order		Project Number		B	MOIST_SW3550 (Moist %)
Company Name	Benchmark Ecological Services	Bill To Company	Benchmark Ecological Services	C	MS/MSD
Send Report To	Neil Henthorne	Invoice Attn	Katy Garcia - A/P	D	
Address	4219 S Front St	Address	4219 S Front St	E	
				F	
City/State/Zip	Brookshire, TX 77423	City/State/Zip	Brookshire TX 77423	G	
Phone	(281) 934-3403	Phone	(281) 934-3403	H	
Fax	(281) 934-3404	Fax	(281) 934-3404	I	
e-Mail Address	nhenthorne@benchmarkeco.com	e-Mail Address	kgarcia@benchmarkeco.com	J	

HS23101796
Benchmark Ecological Services
98003-115 MSCIP

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	MSCIP-SSS-102523-05A	10/25/23	0820	S	8	3	X	X	X								
2	MSCIP-SSS-102523-69	"	0830	S	8	1	X	X									
3	MSCIP-SSS-102523-06A	"	0845	S	8	1	X	X									
4	MSCIP-SSS-102523-08A	"	10.00	S	8	1	X	X									
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Russell Calvin

Shipment Method:

Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☒ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other

Results Due Date:

Relinquished by:	Date: 10/25/23	Time: 1500	Received by: Winston Carter	Notes: 98003-115 MSCIP	
Relinquished by: Winston Carter	Date: 10/26/23	Time: 12:05	Received by (Laboratory): CG 10-26-23 1205	Cooler ID	Cooler Temp.
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	50977	0.6°
				1R31	

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Data ☒ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

CF=0.1

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

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ALS
10450 Stancliff Rd., Suite 210
Houston, Texas 77099
Tel. +1 281 530 5656
Fax. +1 281 530 5887

50977

CUSTODY SEAL

Date: 10/26/23 Time: 12:08
Name: Winston Carter
Company: Benchmark

Seal Broken By:

Date: 10-26

50977

OCT 2 6 2023

HS23101796 - ME - HG_S_Low

ALS WO# HS23101796

FORM 13 - ANALYSIS RUN LOG

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796
Start Date: 31-Oct-2023 End Date: 31-Oct-2023

Run ID:HG04_450592
Instrument:HG04
Method:SW7470A

Sample No.	D/F	Time	FileID	Analytes
ICCV 1	1	31-Oct-2023 11:53	_7644422	HG
ICV	1	31-Oct-2023 11:55	_7644423	HG
ICB	1	31-Oct-2023 11:57	_7644424	HG
CRA	1	31-Oct-2023 12:02	_7644426	HG
CCV 2	1	31-Oct-2023 12:04	_7644427	HG
CCB 1	1	31-Oct-2023 12:06	_7644428	HG
CCV 3	1	31-Oct-2023 12:30	_7644439	HG
CCB 2	1	31-Oct-2023 12:31	_7644440	HG
CCV 4	1	31-Oct-2023 12:55	_7644451	HG
CCB 3	1	31-Oct-2023 12:57	_7644452	HG
CCV 5	1	31-Oct-2023 13:16	HG04_450592 Raw Data_7644398	HG
CCB 4	1	31-Oct-2023 13:17	_7644399	HG
CCV 6	1	31-Oct-2023 13:37	_7644410	HG
CCB 5	1	31-Oct-2023 13:38	_7644411	HG
MBLK-202687	1	31-Oct-2023 13:55	_7644419	HG
LCS-202687	1	31-Oct-2023 13:57	_7644420	HG
CCV 7	1	31-Oct-2023 14:00	_7644454	HG
CCB 6	1	31-Oct-2023 14:02	_7644455	HG
CCV 8	1	31-Oct-2023 14:21	_7644466	HG
CCB 7	1	31-Oct-2023 14:23	_7644467	HG
MSCIP-SSS-102523-05A	1	31-Oct-2023 14:35	_7644472	HG
MSCIP-SSS-102523-05AMS	1	31-Oct-2023 14:37	_7644473	HG
MSCIP-SSS-102523-05AMSD	1	31-Oct-2023 14:39	_7644474	HG
MSCIP-SSS-102523-69	1	31-Oct-2023 14:41	_7644475	HG
MSCIP-SSS-102523-06A	1	31-Oct-2023 14:42	_7644476	HG
MSCIP-SSS-102523-08A	1	31-Oct-2023 14:44	_7644477	HG
CCV 9	1	31-Oct-2023 14:46	_7644478	HG
CCB 8	1	31-Oct-2023 14:48	_7644479	HG
CCV 10	1	31-Oct-2023 15:11	_7644490	HG
CCB 9	1	31-Oct-2023 15:12	_7644491	HG
CCV 11	1	31-Oct-2023 15:34	_7644502	HG
CCB 10	1	31-Oct-2023 15:36	_7644503	HG

Form 2 - Initial and Continuing Calibration Verification

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

Run ID: HG04_450592
Instrument: HG04
Method: SW7470A

ICCV1	Date: 31-Oct-2023 11:53		Seq: 7644422	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.1	102	90-110	

ICV	Date: 31-Oct-2023 11:55		Seq: 7644423	ICV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.24	105	90-110	

CCV2	Date: 31-Oct-2023 12:04		Seq: 7644427	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.09	102	90-110	

CCV3	Date: 31-Oct-2023 12:30		Seq: 7644439	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.14	103	90-110	

CCV4	Date: 31-Oct-2023 12:55		Seq: 7644451	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.16	103	90-110	

CCV5	Date: 31-Oct-2023 13:16		Seq: 7644398	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.16	103	90-110	

CCV6	Date: 31-Oct-2023 13:37		Seq: 7644410	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.17	103	90-110	

CCV7	Date: 31-Oct-2023 14:00		Seq: 7644454	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.19	104	90-110	

CCV8	Date: 31-Oct-2023 14:21		Seq: 7644466	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.18	104	90-110	

CCV9	Date: 31-Oct-2023 14:46		Seq: 7644478	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.2	104	90-110	

CCV10	Date: 31-Oct-2023 15:11		Seq: 7644490	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.16	103	90-110	

CCV11	Date: 31-Oct-2023 15:34		Seq: 7644502	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.18	104	90-110	

Form 3 - BLANKS

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

Run ID: HG04_450592
Instrument: HG04
Method: SW7470A

ICB	Date: 31-Oct-2023 11:57		Seq: 7644424	ICB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB1	Date: 31-Oct-2023 12:06		Seq: 7644428	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB2	Date: 31-Oct-2023 12:31		Seq: 7644440	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB3	Date: 31-Oct-2023 12:57		Seq: 7644452	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB4	Date: 31-Oct-2023 13:17		Seq: 7644399	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB5	Date: 31-Oct-2023 13:38		Seq: 7644411	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
MBLK-202687	Date: 31-Oct-2023 13:55		Seq: 7644419	MBLK	Units: mg/Kg
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.003325	0.00047	0.003325	U	
CCB6	Date: 31-Oct-2023 14:02		Seq: 7644455	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB7	Date: 31-Oct-2023 14:23		Seq: 7644467	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB8	Date: 31-Oct-2023 14:48		Seq: 7644479	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB9	Date: 31-Oct-2023 15:12		Seq: 7644491	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	
CCB10	Date: 31-Oct-2023 15:36		Seq: 7644503	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	0.2	0.03	0.2	U	

Form 5A - Matrix Spike/Matrix Spike Duplicate Recovery

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

Date Analyzed: 31-Oct-2023 14:39
Date Extracted: 31-Oct-2023 08:30
Units: mg/Kg

Matrix Spike: HS23101796-01MS
Client Sample ID: MSCIP-SSS-102523-05A

Analysis Method: SW7471B

Analyte	Sample Result	MS Result	Spike Amount	% Rec	MSD Result	Spike Amount	% Rec	% Rec Limits	RPD	RPD Limit
Mercury	0.1120	0.4257	0.3362	93.3	0.4712	0.3554	101	85-115	10.2	20

Form 7 - Laboratory Control Sample

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23101796

Date Analyzed: 31-Oct-2023 13:57
Date Extracted: 31-Oct-2023 08:30
Units: mg/Kg

Lab Sample ID: LCS-202687 Analysis Method: SW7471B

Analyte	Spike Amount	LCS Result	% Rec	% Rec Limits
Mercury	0.3333	0.3447	103	85-115

Report Generated By Teledyne Leeman QuickTrace

Analyst: ALSHS.NoUser,

Worksheet file: C:\Users\Public\Documents\Teledyne CETAC\QuickTrace\Worksheets\103123AS.wszf

Creation Date: 10/31/2023 10:52:39 AM

Comment:

Results

Sample Name		Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
Calibration Blank		STD	10/31/23 11:39:21 am	0.000	121	11.93		
Replicates	115.9	121.5	105.3	139.7				
Standard #1 (0.05 ppb)		STD	10/31/23 11:41:03 am	0.050	475	8.19	-11.56%	
Replicates	426.5	520.0	468.0	486.0				
Standard #2 (0.2 ppb)		STD	10/31/23 11:42:46 am	0.200	1620	0.42	-1.87%	
Replicates	1611.4	1627.7	1618.1	1621.1				
Standard #3 (0.5 ppb)		STD	10/31/23 11:44:28 am	0.500	4022	0.70	3.10%	
Replicates	3987.3	4029.9	4055.3	4016.9				
Standard #4 (2.0 ppb)		STD	10/31/23 11:46:11 am	2.000	15191	0.07	-0.04%	
Replicates	15203.8	15187.5	15191.7	15179.3				
Standard #5 (5.0 ppb)		STD	10/31/23 11:47:55 am	5.000	38487	0.28	1.89%	
Replicates	38325.1	38518.6	38558.8	38547.4				
Standard #6 (10.0 ppb		STD	10/31/23 11:49:38 am	10.000	74990	0.17	-0.56%	
Replicates	74799.5	75022.3	75049.9	75089.5				

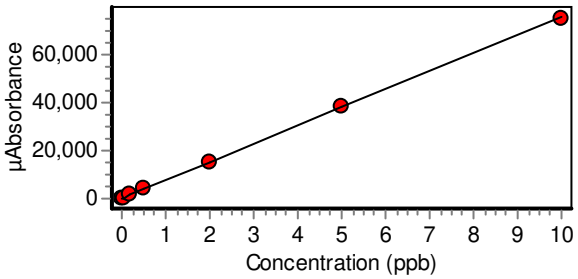
Calibration

Equation: Abs = 7527.022x + 142.319

R2: 0.99985 RSE: 6.13%

SEE: 373.9720

Flags:



ICCV		UNK	10/31/23 11:53:42 am	5.100	38493	0.11		
Replicates	38429.3	38509.3	38511.5	38521.1				
ICV		UNK	10/31/23 11:55:24 am	5.240	39566	0.14		
Replicates	39491.7	39549.7	39606.5	39614.5				
ICB		UNK	10/31/23 11:57:05 am	-0.006	99	79.98		
Replicates	127.1	77.2	61.6	129.8				
CRA		UNK	10/31/23 11:58:47 am	0.193	1592	0.79		
Replicates	1582.5	1603.9	1581.7	1599.7				
CRA		UNK	10/31/23 12:02:40 pm	0.042	459	7.65		
Replicates	492.6	459.1	443.1	439.7				
CCV		UNK	10/31/23 12:04:24 pm	5.090	38465	0.39		
Replicates	38248.0	38496.2	38533.2	38582.0				

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
CCB				UNK	10/31/23 12:06:08 pm	-0.009	76	26.80		
	Replicates	73.3	56.5	99.7	73.7					
MBLK-202685				UNK	10/31/23 12:10:55 pm	-0.004	110	61.47		
	Replicates	121.8	131.0	98.4	88.0					
LCS-202685				UNK	10/31/23 12:12:37 pm	5.140	38827	0.05		
	Replicates	38798.5	38831.7	38833.9	38844.5					
HS23100656-26				UNK	10/31/23 12:14:19 pm	0.529	4125	0.71		
	Replicates	4124.4	4148.9	4142.5	4085.9					
HS23100656-27				UNK	10/31/23 12:16:02 pm	0.250	2025	0.79		
	Replicates	2010.5	2030.4	2043.8	2016.8					
HS23100656-28				UNK	10/31/23 12:17:44 pm	0.318	2533	0.74		
	Replicates	2521.9	2534.7	2517.1	2556.9					
HS23100656-29				UNK	10/31/23 12:19:27 pm	0.242	1967	0.80		
	Replicates	1950.1	1963.7	1968.3	1985.5					
HS23101568-01				UNK	10/31/23 12:21:10 pm	0.056	563	5.03		
	Replicates	545.1	549.6	567.4	591.8					
HS23101568-02				UNK	10/31/23 12:22:53 pm	0.016	265	10.10		
	Replicates	255.9	268.7	281.5	255.3					
HS23101603-11				UNK	10/31/23 12:24:34 pm	0.111	981	1.64		
	Replicates	980.6	994.8	986.0	962.2					
HS23101603-11MS				UNK	10/31/23 12:26:16 pm	5.210	39358	0.40		
	Replicates	39149.1	39348.9	39422.5	39513.3					
CCV				UNK	10/31/23 12:30:01 pm	5.140	38856	0.29		
	Replicates	38689.4	38889.2	38932.6	38911.8					
CCB				UNK	10/31/23 12:31:45 pm	-0.007	93	14.77		
	Replicates	88.6	101.2	85.0	96.2					
HS23101603-12				UNK	10/31/23 12:33:26 pm	5.200	39287	0.38		
	Replicates	39099.6	39252.9	39344.3	39452.5					
HS23101603-13				UNK	10/31/23 12:35:08 pm	0.176	1465	2.23		
	Replicates	1460.0	1433.2	1504.4	1461.2					
HS23101603-14				UNK	10/31/23 12:36:50 pm	0.140	1197	3.39		
	Replicates	1172.6	1242.3	1164.1	1207.3					
HS23101603-15				UNK	10/31/23 12:38:32 pm	0.178	1484	1.73		
	Replicates	1469.9	1458.2	1503.0	1503.6					
HS23101603-16				UNK	10/31/23 12:40:15 pm	0.197	1623	1.36		
	Replicates	1612.9	1600.2	1645.8	1631.4					
HS23101603-17				UNK	10/31/23 12:41:57 pm	0.149	1265	1.76		
	Replicates	1250.5	1246.0	1280.8	1283.8					

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23101603-18					UNK	10/31/23 12:43:40 pm	0.208	1711	0.72		
	Replicates	1711.2	1726.5	1705.7	1700.3						
HS23101745-01					UNK	10/31/23 12:45:22 pm	0.180	1494	1.68		
	Replicates	1517.5	1476.6	1510.2	1473.2						
HS23101745-02					UNK	10/31/23 12:47:05 pm	0.157	1326	1.13		
	Replicates	1322.1	1324.2	1312.0	1344.0						
HS23101745-03					UNK	10/31/23 12:48:48 pm	0.225	1833	1.62		
	Replicates	1820.0	1862.3	1849.1	1801.9						
CCV					UNK	10/31/23 12:55:46 pm	5.160	38971	0.28		
	Replicates	38818.0	38964.9	39040.1	39059.5						
CCB					UNK	10/31/23 12:57:31 pm	-0.007	91	39.65		
	Replicates	61.9	102.7	106.5	93.9						
HS23101745-03					UNK	10/31/23 12:59:12 pm	0.206	1694	1.85		
	Replicates	1653.8	1709.8	1718.8	1695.4						
HS23101745-04					UNK	10/31/23 01:00:54 pm	0.305	2435	0.70		
	Replicates	2417.1	2426.1	2445.7	2450.9						
HS23101745-05					UNK	10/31/23 01:02:35 pm	0.152	1289	3.01		
	Replicates	1257.2	1265.1	1303.5	1331.3						
HS23101745-06					UNK	10/31/23 01:04:17 pm	0.128	1102	0.95		
	Replicates	1091.9	1107.4	1112.0	1097.8						
MBLK-202686					UNK	10/31/23 01:05:59 pm	0.003	166	142.15		
	Replicates	163.5	208.6	126.0	166.2						
LCS-202686					UNK	10/31/23 01:07:41 pm	5.190	39235	0.20		
	Replicates	39131.7	39226.6	39271.2	39309.6						
HS23101568-03					UNK	10/31/23 01:09:23 pm	0.037	418	12.16		
	Replicates	406.1	387.9	466.1	413.7						
HS23101568-03MS					UNK	10/31/23 01:11:06 pm	5.190	39207	0.33		
	Replicates	39022.4	39226.7	39262.3	39315.3						
HS23101568-03MSD					UNK	10/31/23 01:12:48 pm	5.220	39424	0.50		
	Replicates	39175.8	39375.1	39518.9	39627.5						
HS23101572-01					UNK	10/31/23 01:14:31 pm	0.210	1721	1.64		
	Replicates	1724.0	1732.9	1683.7	1742.5						
CCV					UNK	10/31/23 01:16:15 pm	5.160	39005	0.32		
	Replicates	38835.0	39002.8	39065.4	39118.2						
CCB					UNK	10/31/23 01:17:59 pm	-0.008	84	10.46		
	Replicates	84.1	76.0	87.6	89.8						
HS23101573-01					UNK	10/31/23 01:19:42 pm	0.744	5739	1.22		
	Replicates	5639.7	5761.2	5763.4	5793.2						

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23101574-01					UNK	10/31/23 01:21:25 pm	0.134	1152	1.01		
	Replicates	1144.7	1153.8	1165.8	1144.0						
HS23101684-01					UNK	10/31/23 01:23:06 pm	0.104	927	4.21		
	Replicates	933.7	878.4	947.6	948.2						
HS23101684-02					UNK	10/31/23 01:24:48 pm	0.106	942	2.41		
	Replicates	951.1	939.9	915.9	960.5						
HS23101718-01					UNK	10/31/23 01:26:30 pm	0.052	532	13.09		
	Replicates	479.8	531.0	601.2	515.4						
HS23101718-02					UNK	10/31/23 01:28:12 pm	0.077	720	5.89		
	Replicates	714.5	719.3	680.9	763.7						
HS23101718-03					UNK	10/31/23 01:29:54 pm	0.063	618	4.97		
	Replicates	594.6	614.2	613.8	651.2						
HS23101750-01					UNK	10/31/23 01:31:36 pm	0.142	1212	1.49		
	Replicates	1208.7	1210.9	1233.1	1194.5						
HS23101815-01					UNK	10/31/23 01:33:18 pm	0.007	194	31.26		
	Replicates	191.7	203.6	172.0	208.0						
HS23101815-02					UNK	10/31/23 01:35:01 pm	0.010	219	25.58		
	Replicates	214.9	194.5	241.3	225.3						
CCV					UNK	10/31/23 01:37:05 pm	5.170	39027	0.51		
	Replicates	38759.9	39004.4	39128.0	39217.0						
CCB					UNK	10/31/23 01:38:49 pm	-0.001	138	323.67		
	Replicates	123.1	136.8	139.6	154.0						
HS23101815-03					UNK	10/31/23 01:43:29 pm	0.006	186	32.85		
	Replicates	169.2	194.9	200.1	178.9						
HS23101865-01					UNK	10/31/23 01:45:12 pm	0.127	1098	2.97		
	Replicates	1088.6	1106.7	1064.7	1131.7						
HS23101865-04					UNK	10/31/23 01:46:54 pm	0.115	1006	2.24		
	Replicates	979.5	1003.4	1016.8	1023.2						
HS23101865-07					UNK	10/31/23 01:48:38 pm	0.069	664	1.50		
	Replicates	660.2	673.8	655.6	665.6						
HS23101865-10					UNK	10/31/23 01:50:19 pm	0.088	802	2.70		
	Replicates	797.3	824.2	781.2	803.6						
HS23101865-15					UNK	10/31/23 01:52:01 pm	0.083	767	1.33		
	Replicates	765.7	755.7	774.1	772.1						
HS23101865-18					UNK	10/31/23 01:53:43 pm	0.170	1423	0.95		
	Replicates	1432.5	1424.0	1405.4	1429.4						
MBLK-202687					UNK	10/31/23 01:55:26 pm	-0.002	128	110.01		
	Replicates	122.1	120.0	118.0	151.6						

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
LCS-202687				UNK	10/31/23 01:57:08 pm	5.170	39031	0.54		
	Replicates	38779.7	38954.8	39125.8	39261.6					
HS23101415-01				UNK	10/31/23 01:58:50 pm	0.092	835	2.76		
	Replicates	835.5	808.0	851.6	844.6					
CCV				UNK	10/31/23 02:00:34 pm	5.190	39173	0.43		
	Replicates	38939.2	39174.4	39268.2	39311.0					
CCB				UNK	10/31/23 02:02:18 pm	-0.010	70	31.77		
	Replicates	84.5	47.7	54.5	94.9					
HS23101415-02				UNK	10/31/23 02:04:00 pm	0.065	633	3.85		
	Replicates	649.5	642.7	606.5	631.7					
HS23101415-03				UNK	10/31/23 02:05:42 pm	0.134	1154	2.05		
	Replicates	1157.3	1131.0	1146.8	1180.4					
HS23101415-04				UNK	10/31/23 02:07:25 pm	0.524	4086	0.87		
	Replicates	4088.3	4041.4	4088.0	4125.2					
HS23101415-05				UNK	10/31/23 02:09:08 pm	0.854	6568	0.18		
	Replicates	6569.8	6556.4	6563.8	6583.6					
HS23101415-06				UNK	10/31/23 02:10:50 pm	0.366	2894	1.55		
	Replicates	2847.6	2868.7	2937.3	2921.7					
HS23101415-07				UNK	10/31/23 02:12:33 pm	0.131	1131	2.64		
	Replicates	1093.6	1150.2	1133.4	1147.6					
HS23101415-08				UNK	10/31/23 02:14:16 pm	0.342	2716	0.79		
	Replicates	2726.9	2706.4	2692.4	2738.0					
HS23101415-09				UNK	10/31/23 02:15:58 pm	0.650	5034	0.84		
	Replicates	5023.4	4990.5	5033.3	5089.5					
HS23101415-10				UNK	10/31/23 02:17:40 pm	0.428	3360	0.74		
	Replicates	3331.6	3365.2	3389.0	3356.0					
HS23101415-11				UNK	10/31/23 02:19:23 pm	0.511	3986	1.33		
	Replicates	3919.4	3974.0	4014.6	4036.0					
CCV				UNK	10/31/23 02:21:39 pm	5.180	39170	0.38		
	Replicates	38967.2	39160.0	39244.2	39306.6					
CCB				UNK	10/31/23 02:23:23 pm	-0.010	65	19.80		
	Replicates	80.4	55.9	47.7	74.5					
HS23101415-12				UNK	10/31/23 02:29:10 pm	4.190	31702	0.67		
	Replicates	31423.1	31659.3	31833.9	31890.9					
HS23101415-13				UNK	10/31/23 02:30:52 pm	0.485	3794	0.50		
	Replicates	3773.5	3788.8	3794.8	3817.8					
HS23101718-04				UNK	10/31/23 02:32:34 pm	0.052	531	5.12		
	Replicates	519.7	508.9	552.9	540.5					

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23101718-05					UNK	10/31/23 02:34:17 pm	0.043	466	11.89		
	Replicates	448.5	522.9	450.7	440.3						
HS23101796-01					UNK	10/31/23 02:35:59 pm	1.600	12200	0.27		
	Replicates	12217.6	12168.2	12178.4	12236.6						
HS23101796-01MS					UNK	10/31/23 02:37:42 pm	6.330	47812	0.16		
	Replicates	47725.1	47782.7	47845.9	47894.7						
HS23101796-01MSD					UNK	10/31/23 02:39:25 pm	6.630	50024	0.58		
	Replicates	49643.1	49963.4	50203.2	50284.8						
HS23101796-02					UNK	10/31/23 02:41:08 pm	1.180	9000	0.97		
	Replicates	8891.0	8973.4	9058.4	9078.8						
HS23101796-03					UNK	10/31/23 02:42:50 pm	3.330	25204	0.41		
	Replicates	25082.8	25161.5	25261.1	25310.5						
HS23101796-04					UNK	10/31/23 02:44:32 pm	1.160	8850	1.10		
	Replicates	8724.0	8837.7	8888.5	8949.5						
CCV					UNK	10/31/23 02:46:16 pm	5.200	39312	0.49		
	Replicates	39040.2	39316.7	39426.1	39465.1						
CCB					UNK	10/31/23 02:48:00 pm	-0.006	94	39.38		
	Replicates	92.5	68.7	104.1	112.1						
HS23101876-01					UNK	10/31/23 02:52:45 pm	0.004	173	82.98		
	Replicates	202.5	185.9	158.7	145.9						
MBLK-202688					UNK	10/31/23 02:54:28 pm	-0.003	123	148.39		
	Replicates	82.2	126.2	137.4	146.6						
LCS-202688					UNK	10/31/23 02:56:10 pm	5.200	39252	0.37		
	Replicates	39063.0	39224.4	39332.8	39388.2						
HS23101415-14					UNK	10/31/23 02:57:53 pm	0.457	3580	0.62		
	Replicates	3585.7	3549.3	3586.7	3598.3						
HS23101415-15					UNK	10/31/23 02:59:35 pm	0.412	3241	0.73		
	Replicates	3210.6	3249.4	3239.0	3264.4						
HS23101694-01					UNK	10/31/23 03:01:17 pm	0.228	1859	1.13		
	Replicates	1847.1	1885.3	1842.3	1862.7						
HS23101694-01MS					UNK	10/31/23 03:03:00 pm	5.370	40538	0.48		
	Replicates	40294.4	40476.6	40648.0	40732.4						
HS23101694-01MSD					UNK	10/31/23 03:04:43 pm	5.420	40912	0.45		
	Replicates	40657.6	40895.6	41040.8	41053.8						
HS23101694-02					UNK	10/31/23 03:06:25 pm	-0.006	98	48.85		
	Replicates	75.5	89.0	101.8	126.2						
HS23101694-03					UNK	10/31/23 03:08:08 pm	-0.009	78	30.01		
	Replicates	68.6	57.8	81.8	102.8						

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
CCV					UNK	10/31/23 03:11:09 pm	5.160	38994	0.93		
	Replicates	38487.1	38983.2	39211.6	39294.2						
CCB					UNK	10/31/23 03:12:53 pm	-0.003	118	95.08		
	Replicates	137.9	84.3	123.3	125.9						
HS23101694-02					UNK	10/31/23 03:16:02 pm	0.035	407	9.03		
	Replicates	374.7	407.1	416.3	431.3						
HS23101694-03					UNK	10/31/23 03:17:45 pm	0.241	1959	1.40		
	Replicates	1965.9	1963.8	1923.2	1983.4						
HS23101694-04					UNK	10/31/23 03:19:27 pm	0.023	314	8.45		
	Replicates	322.6	328.1	311.9	295.1						
HS23101694-05					UNK	10/31/23 03:21:10 pm	0.187	1553	1.41		
	Replicates	1563.9	1529.8	1574.6	1545.4						
HS23101694-06					UNK	10/31/23 03:22:53 pm	0.038	430	4.72		
	Replicates	414.4	423.3	440.9	442.1						
HS23101694-07					UNK	10/31/23 03:24:35 pm	0.026	337	6.47		
	Replicates	340.2	321.9	351.9	333.1						
HS23101694-08					UNK	10/31/23 03:26:18 pm	0.038	429	4.59		
	Replicates	429.1	430.0	412.8	445.0						
HS23101694-09					UNK	10/31/23 03:28:00 pm	0.036	414	6.73		
	Replicates	389.0	433.1	414.5	417.7						
HS23101694-10					UNK	10/31/23 03:29:43 pm	0.042	461	2.98		
	Replicates	468.4	457.9	468.7	448.9						
HS23101694-11					UNK	10/31/23 03:31:26 pm	0.167	1402	0.90		
	Replicates	1386.3	1405.7	1413.3	1403.3						
CCV					UNK	10/31/23 03:34:23 pm	5.180	39132	0.35		
	Replicates	38958.4	39090.6	39204.0	39274.0						
CCB					UNK	10/31/23 03:36:07 pm	-0.006	94	23.19		
	Replicates	82.6	91.0	109.4	92.4						
HS23101694-12					UNK	10/31/23 03:39:53 pm	0.010	219	22.27		
	Replicates	204.6	221.5	207.7	242.1						
HS23101694-13					UNK	10/31/23 03:41:36 pm	0.032	384	13.92		
	Replicates	394.9	350.6	365.4	426.8						
HS23101694-14					UNK	10/31/23 03:43:19 pm	0.021	299	9.01		
	Replicates	301.2	289.6	317.4	286.2						
HS23101694-15					UNK	10/31/23 03:45:02 pm	0.155	1307	3.25		
	Replicates	1271.2	1277.3	1340.9	1338.3						
HS23101694-16					UNK	10/31/23 03:46:44 pm	0.210	1724	1.90		
	Replicates	1714.3	1693.3	1723.9	1764.9						

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
MBLK-202773				UNK	10/31/23 03:48:27 pm	-0.011	59	49.34		
Replicates	62.9	96.1	76.5	1.1						
LCS-202773				UNK	10/31/23 03:50:10 pm	5.180	39150	0.54		
Replicates	38863.4	39132.9	39269.1	39334.5						
HS23101306-01 X2				UNK	10/31/23 03:55:22 pm	5.950	44960	0.11		
Replicates	45026.7	44959.9	44920.5	44931.3						
HS23101916-01				UNK	10/31/23 03:57:04 pm	0.095	858	3.39		
Replicates	848.8	892.6	856.4	836.0						
HS23101916-03				UNK	10/31/23 03:58:47 pm	0.143	1217	2.88		
Replicates	1210.1	1184.1	1215.9	1258.7						

HS23101796 Wetchem Moist

ALS WO# HS23101796

ALS Environmental

Analyst	Mahali Roman	Temp In Deg C	105
Method	Moisture_HS_01	Temp Out Deg C	104
Data Analyzed	01-Nov-23 05:38 pm	Oven ID	Oven 4
		Balance ID	NA HST BAL016

SampleID	Type	Dish	PanWt (g)	Wet Wt (g)	1st Wt (g)	2nd Wt (g)	3rd Wt (g)	% Moisture	% Solid
HS23101769-21	SAMP	22	0.8265	5.958	5.8264	5.8265	0	16.10	83.90
HS23101769-22	SAMP	23	0.8261	5.9881	5.8441	5.8441	0	16.20	83.80
HS23101769-23	SAMP	24	0.8228	6.6461	6.437	6.4369	0	15.50	84.50
HS23101769-24	SAMP	25	0.8218	5.9528	5.9095	5.9095	0	14.50	85.50
HS23101769-26	SAMP	26	0.8326	5.5785	3.9577	3.9577	0	44.00	56.00
HS23101796-01	SAMP	27	0.8271	6.8121	5.1268	5.1268	0	36.90	63.10
HS23101796-02	SAMP	28	0.8211	5.0661	4.0831	4.083	0	35.60	64.40
HS23101796-03	SAMP	29	0.8332	6.2466	4.7183	4.7183	0	37.80	62.20
HS23101796-04	SAMP	30	0.8157	6.1008	5.9414	5.9414	0	16.00	84.00
HS23101819-01	SAMP	31	0.8161	5.5269	5.0217	5.0218	0	23.90	76.10
HS23101971-01	SAMP	32	0.8209	5.7263	5.843	5.8431	0	12.30	87.70
HS23101971-02	SAMP	33	0.8179	5.4939	5.4647	5.4648	0	15.40	84.60
HS23101971-03	SAMP	34	0.7906	5.3532	5.4796	5.4797	0	12.40	87.60
HS23101971-04	SAMP	35	0.8193	6.909	6.6389	6.6389	0	15.80	84.20
HS23101971-05	SAMP	36	0.8116	7.0934	6.824	6.824	0	15.20	84.80
HS23101796-01DUP	DUP	37	0.8107	6.8011	4.849	4.849	0	40.60	59.40

HS23110291 98003115 MSCIP Cover Page

ALS WO# HS23110291

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right solutions.
right partner.

WorkOrder: HS23110291

98003-115 MSCIP

Benchmark Ecological Services

Neil Henthorne
4219 S Front St
Brookshire TX 77423

15-Nov-2023

HS23110291 98003115 MSCIP Final

ALS WO# HS23110291

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November 10, 2023

Neil Henthorne
Benchmark Ecological Services
4219 S Front St
Brookshire, TX 77423

Work Order: **HS23110291**

Laboratory Results for: **98003-115 MSCIP**

Dear Neil Henthorne,

ALS Environmental received 33 sample(s) on Nov 03, 2023 for the analysis presented in the following report.

The analytical data provided relates directly to the samples received by ALS Environmental and for only the analyses requested. Results are expressed as "as received" unless otherwise noted.

QC sample results for this data met EPA or laboratory specifications except as noted in the Case Narrative or as noted with qualifiers in the QC batch information. Should this laboratory report need to be reproduced, it should be reproduced in full unless written approval has been obtained by ALS Environmental. Samples will be disposed in 30 days unless storage arrangements are made.

If you have any questions regarding this report, please feel free to call me.

Sincerely,

Generated By: DAYNA.FISHER
James Guin

Client:	Benchmark Ecological Services	**TRRP Laboratory Data Package Cover Page**
Project:	98003-115 MSCIP	
WorkOrder:	**HS23110291**	

This data package consists of all or some of the following as applicable:

This signature page, the laboratory review checklist, and the following reportable data:

R1 Field chain-of-custody documentation;

R2 Sample identification cross-reference;

R3 Test reports (analytical data sheets) for each environmental sample that includes:

a) Items consistent with NELAC Chapter 5,
b) dilution factors,
c) preparation methods,
d) cleanup methods, and
e) if required for the project, tentatively identified compounds (TICs).

R4 Surrogate recovery data including:

a) Calculated recovery (%R), and
b) The laboratory's surrogate QC limits.

R5 Test reports/summary forms for blank samples;

R6 Test reports/summary forms for laboratory control samples (LCSs) including:

a) LCS spiking amounts,
b) Calculated %R for each analyte, and
c)The laboratory's LCS QC limits.

R7 Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:

a) Samples associated with the MS/MSD clearly identified,
b) MS/MSD spiking amounts,
c) Concentration of each MS/MSD analyte measured in the parent and spiked samples,
d) Calculated %Rs and relative percent differences (RPDs), and
e) The laboratory's MS/MSD QC limits.

R8 Laboratory analytical duplicate (if applicable) recovery and precision:

a) the amount of analyte measured in the duplicate,
b) the calculated RPD, and
c) the laboratory's QC limits for analytical duplicates.

R9 List of method quantitation limits (MQLs) and detectability check sample results for each analyte for each method and matrix.

R10 Other problems or anomalies.
The Exception Report for each "No" or "Not Reviewed (NR)" item in Laboratory Review Checklist and for each analyte, matrix, and method for which the laboratory does not hold NELAC accreditation under the Texas Laboratory Accreditation Program.

Client:	Benchmark Ecological Services
Project:	98003-115 MSCIP
WorkOrder:	**HS23110291**

TRRP Laboratory Data Package Cover Page

Release Statement: I am responsible for the release of this laboratory data package. This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes and matrices reported in this data package except as noted in the Exception Reports. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exception reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory have been identified by the laboratory in the Laboratory Review Checklist, and no information affecting the quality of the data has been knowingly withheld.

Check, if applicable: [NA] This laboratory meets an exception under 30 TAC §25.6 and was last inspected by [ ] TCEQ or [ ] _____ on (enter date of last inspection). Any findings affecting the data in this laboratory data package are noted in the Exception Reports herein. The official signing the cover page of the report in which these data are used is responsible for releasing this data package and is by signature affirming the above release statement is true.

James Guin

Laboratory Review Checklist: Reportable Data								
Laboratory Name: ALS Laboratory Group			LRC Date: 11/10/2023					
Project Name: 98003-115 MSCIP			Laboratory Job Number: HS23110291					
Reviewer Name: James Guin			Prep Batch Number(s): 203230, 203232, 203269, R451503, R451504					
#[1]	**A[2]**	**Description**	**Yes**	**No**	**NA[3]**	**NR[4]**	**ER#[5]**
R1	OI	**Chain-of-custody (C-O-C)**					
		Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?	X				
		Were all departures from standard conditions described in an exception report?	X				
R2	OI	**Sample and quality control (QC) identification**					
		Are all field sample ID numbers cross-referenced to the laboratory ID numbers?	X				
		Are all laboratory ID numbers cross-referenced to the corresponding QC data?	X				
R3	OI	**Test reports**					
		Were all samples prepared and analyzed within holding times?	X				
		Other than those results < MQL, were all other raw values bracketed by calibration standards?	X				
		Were calculations checked by a peer or supervisor?	X				
		Were all analyte identifications checked by a peer or supervisor?	X				
		Were sample detection limits reported for all analytes not detected?	X				
		Were all results for soil and sediment samples reported on a dry weight basis?	X				
		Were % moisture (or solids) reported for all soil and sediment samples?	X				
		Were bulk soils/solids samples for volatile analysis extracted with methanol per SW-846 Method 5035?			X		
		If required for the project, TICs reported?			X		
R4	O	**Surrogate recovery data**					
		Were surrogates added prior to extraction?			X		
		Were surrogate percent recoveries in all samples within the laboratory QC limits?			X		
R5	OI	**Test reports/summary forms for blank samples**					
		Were appropriate type(s) of blanks analyzed?	X				
		Were blanks analyzed at the appropriate frequency?	X				
		Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?	X				
		Were blank concentrations < MQL?	X				
R6	OI	**Laboratory control samples (LCS):**					
		Were all COCs included in the LCS?	X				
		Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?	X				
		Were LCSs analyzed at the required frequency?	X				
		Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?	X				
		Does the detectability data document the laboratory's capability to detect the COCs at the MDL used to calculate the SDLs?	X				
		Was the LCSD RPD within QC limits?	X				
R7	OI	**Matrix spike (MS) and matrix spike duplicate (MSD) data**					
		Were the project/method specified analytes included in the MS and MSD?	X				
		Were MS/MSD analyzed at the appropriate frequency?	X				
		Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?		X			1
		Were MS/MSD RPDs within laboratory QC limits?	X				
R8	OI	**Analytical duplicate data**					
		Were appropriate analytical duplicates analyzed for each matrix?	X				
		Were analytical duplicates analyzed at the appropriate frequency?	X				
		Were RPDs or relative standard deviations within the laboratory QC limits?	X				
R9	OI	**Method quantitation limits (MQLs):**					
		Are the MQLs for each method analyte included in the laboratory data package?	X				
		Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?	X				
		Are unadjusted MQLs and DCSs included in the laboratory data package?	X				
R10	OI	**Other problems/anomalies**					
		Are all known problems/anomalies/special conditions noted in this LRC and ER?	X				
		Were all necessary corrective actions performed for the reported data?	X				
		Was applicable and available technology used to lower the SDL and minimize the matrix interference affects on the sample results?	X				
		Is the laboratory NELAC-accredited under the Texas Laboratory Program for the analytes, matrices and methods associated with this laboratory data package?	X				

Laboratory Review Checklist: Supporting Data							
Laboratory Name: ALS Laboratory Group			LRC Date: 11/10/2023				
Project Name: 98003-115 MSCIP			Laboratory Job Number: HS23110291				
Reviewer Name: James Guin			Prep Batch Number(s): 203230, 203232, 203269, R451503, R451504				
#[1]	**A[2]**	**Description**	**Yes**	**No**	**NA[3]**	**NR[4]**	**ER#[5]**
S1	OI	**Initial calibration (ICAL)**					
		Were response factors and/or relative response factors for each analyte within QC limits?	X				
		Were percent RSDs or correlation coefficient criteria met?	X				
		Was the number of standards recommended in the method used for all analytes?	X				
		Were all points generated between the lowest and highest standard used to calculate the curve?	X				
		Are ICAL data available for all instruments used?	X				
		Has the initial calibration curve been verified using an appropriate second source standard?	X				
S2	OI	**Initial and continuing calibration verification (ICCV and CCV) and continuing calibration blank (CCB)**					
		Was the CCV analyzed at the method-required frequency?	X				
		Were percent differences for each analyte within the method-required QC limits?	X				
		Was the ICAL curve verified for each analyte?	X				
		Was the absolute value of the analyte concentration in the inorganic CCB < MDL?		X			2
S3	O	**Mass spectral tuning:**					
		Was the appropriate compound for the method used for tuning?	X				
		Were ion abundance data within the method-required QC limits?	X				
S4	O	**Internal standards (IS):**					
		Were IS area counts and retention times within the method-required QC limits?	X				
S5	OI	**Raw data** (NELAC section 1 appendix A glossary, and section 5.12 or ISO/IEC 17025 section					
		Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?	X				
		Were data associated with manual integrations flagged on the raw data?	X				
S6	O	**Dual column confirmation**					
		Did dual column confirmation results meet the method-required QC?			X		
S7	O	**Tentatively identified compounds (TICs):**					
		If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?			X		
S8	I	**Interference Check Sample (ICS) results:**					
		Were percent recoveries within method QC limits?	X				
S9	I	**Serial dilutions, post digestion spikes, and method of standard additions**					
		Were percent differences, recoveries, and the linearity within the QC limits specified in the method?	X				
S10	OI	**Method detection limit (MDL) studies**					
		Was a MDL study performed for each reported analyte?	X				
		Is the MDL either adjusted or supported by the analysis of DCSs?	X				
S11	OI	**Proficiency test reports:**					
		Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?	X				
S12	OI	**Standards documentation**					
		Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?	X				
S13	OI	**Compound/analyte identification procedures**					
		Are the procedures for compound/analyte identification documented?	X				
S14	OI	**Demonstration of analyst competency (DOC)**					
		Was DOC conducted consistent with NELAC Chapter 5C or ISO/IEC 4?	X				
		Is documentation of the analyst's competency up-to-date and on file?	X				
S15	OI	**Verification/validation documentation for methods** (NELAC Chap 5 or ISO/IEC 17025 Section 5)					
		Are all the methods used to generate the data documented, verified, and validated, where applicable?	X				
S16	OI	**Laboratory standard operating procedures (SOPs):**					
		Are laboratory SOPs current and on file for each method performed?	X				

Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
O = Organic Analyses; I = Inorganic Analyses (and general chemistry, when applicable);
NA = Not Applicable;
NR = Not Reviewed;
R# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Exception Reports	
Laboratory Name: ALS Laboratory Group	LRC Date: 11/10/2023
Project Name: 98003-115 MSCIP	Laboratory Job Number: HS23110291
Reviewer Name: James Guin	Prep Batch Number(s): 203230, 203232, 203269, R451503, R451504

ER#[5]	Description
1	Batch 203269, Mercury by method SW7470, Sample HS23110253-05, MS and MSD were performed on an unrelated sample.
2	See Run Log and CCB Exception Reports

Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
O = Organic Analyses; I = Inorganic Analyses (and general chemistry, when applicable);
NA = Not Applicable;
NR = Not Reviewed;
R# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

FORM 13 - ANALYSIS RUN LOG

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291
Start Date: 09-Nov-2023 End Date: 09-Nov-2023

Run ID:HG04_451411
Instrument:HG04
Method:SW7470A

Sample No.	D/F	Time	FileID	Analytes
ICCV 1	1	09-Nov-2023 12:37		HG
ICV	1	09-Nov-2023 12:39		HG
ICB	1	09-Nov-2023 12:40		HG
CRA	1	09-Nov-2023 12:42		HG
CCV 2	1	09-Nov-2023 13:05		HG
CCB 1	1	09-Nov-2023 13:07		HG
CCV 3	1	09-Nov-2023 13:32		HG
CCB 2	1	09-Nov-2023 13:34		HG
CCV 4	1	09-Nov-2023 13:55		HG
CCB 3	1	09-Nov-2023 13:57		HG
CCV 5	1	09-Nov-2023 14:21		HG
CCB 4	1	09-Nov-2023 14:23		HG
CCV 6	1	09-Nov-2023 14:47		HG
CCB 5	1	09-Nov-2023 14:49		HG
CCV 7	1	09-Nov-2023 15:20		HG
CCB 6	1	09-Nov-2023 15:22		HG
CCV 8	1	09-Nov-2023 15:54		HG
CCB 7	1	09-Nov-2023 15:56		HG
CCV 9	1	09-Nov-2023 16:16		HG
CCB 8	1	09-Nov-2023 16:18		HG
CCV 10	1	09-Nov-2023 16:43		HG
CCB 9	1	09-Nov-2023 16:45		HG
CCV 11	1	09-Nov-2023 17:07		HG
CCB 10	1	09-Nov-2023 17:08		HG
MBLK-203269	1	09-Nov-2023 17:16		HG
LCS-203269	1	09-Nov-2023 17:17		HG
ZZZZZZMSD	1	09-Nov-2023 17:26		HG
CCV 12	1	09-Nov-2023 17:31		HG
CCB 11	1	09-Nov-2023 17:32		HG
MSCIP-SSS-110323-EB	1	09-Nov-2023 17:36		HG
MSCIP-SSS-110223-EB	1	09-Nov-2023 17:38		HG
ZZZZZZMS	1	09-Nov-2023 17:41		HG
ZZZZZZMSD	1	09-Nov-2023 17:43		HG
CCV 13	1	09-Nov-2023 17:56		HG
CCB 12	1	09-Nov-2023 17:58		HG
CCV 14	1	09-Nov-2023 18:22		HG
CCB 13	1	09-Nov-2023 18:24		HG
CCV 15	1	09-Nov-2023 18:53		HG
CCB 14	1	09-Nov-2023 18:55		HG
CCV 16	1	09-Nov-2023 19:13		HG
CCB 15	1	09-Nov-2023 19:15		HG
ZZZZZZMS	1	09-Nov-2023 19:27		HG
CCV 17	1	09-Nov-2023 19:30		HG
CCB 16	1	09-Nov-2023 19:32		HG

CCB EXCEPTIONS REPORT

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID:HG04_451411
Instrument:HG04
Method:SW7470A

ICB	Date: 09-Nov-2023 12:40	Seq: 7664314		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.036	0.03	0.2	
CCB 1	Date: 09-Nov-2023 13:07	Seq: 7664287		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.034	0.03	0.2	
CCB 2	Date: 09-Nov-2023 13:34	Seq: 7664299		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.035	0.03	0.2	
CCB 3	Date: 09-Nov-2023 13:57	Seq: 7664311		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.033	0.03	0.2	
CCB 4	Date: 09-Nov-2023 14:23	Seq: 7664327		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.035	0.03	0.2	
CCB 5	Date: 09-Nov-2023 14:49	Seq: 7664339		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.031	0.03	0.2	
CCB 6	Date: 09-Nov-2023 15:22	Seq: 7664345		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.034	0.03	0.2	
CCB 7	Date: 09-Nov-2023 15:56	Seq: 7664654		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.039	0.03	0.2	
CCB 8	Date: 09-Nov-2023 16:18	Seq: 7664664		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.033	0.03	0.2	
CCB 9	Date: 09-Nov-2023 16:45	Seq: 7665134		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.041	0.03	0.2	
CCB 10	Date: 09-Nov-2023 17:08	Seq: 7665146		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.031	0.03	0.2	
CCB 11	Date: 09-Nov-2023 17:32	Seq: 7665158		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.035	0.03	0.2	
CCB 12	Date: 09-Nov-2023 17:58	Seq: 7665170		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	
	Mercury	-0.034	0.03	0.2	
CCB 13	Date: 09-Nov-2023 18:24	Seq: 7665182		D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**	

CCB EXCEPTIONS REPORT

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID:HG04_451411
Instrument:HG04
Method:SW7470A

	Mercury	-0.036	0.03	0.2	

CCB 14	Date: 09-Nov-2023 18:55	Seq: 7665194	D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**
	Mercury	-0.032	0.03	0.2

CCB 15	Date: 09-Nov-2023 19:15	Seq: 7665203	D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**
	Mercury	-0.032	0.03	0.2

CCB 16	Date: 09-Nov-2023 19:32	Seq: 7665207	D/F: 1	Units: ug/L
	Analyte	**Result**	**MDL**	**Report Limit**
	Mercury	-0.034	0.03	0.2

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Work Order: HS23110291

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS23110291-01	MSCIP-SSS-110223-01A	Sediment		02-Nov-2023 10:30	03-Nov-2023 16:15	☐
HS23110291-02	MSCIP-SSS-110223-01B	Sediment		02-Nov-2023 10:30	03-Nov-2023 16:15	☐
HS23110291-03	MSCIP-SSS-110223-02A	Sediment		02-Nov-2023 11:00	03-Nov-2023 16:15	☐
HS23110291-04	MSCIP-SSS-110223-02B	Sediment		02-Nov-2023 11:00	03-Nov-2023 16:15	☐
HS23110291-05	MSCIP-SSS-110223-03A	Sediment		02-Nov-2023 11:20	03-Nov-2023 16:15	☐
HS23110291-06	MSCIP-SSS-110223-04A	Sediment		02-Nov-2023 11:50	03-Nov-2023 16:15	☐
HS23110291-07	MSCIP-SSS-110223-04B	Sediment		02-Nov-2023 11:50	03-Nov-2023 16:15	☐
HS23110291-08	MSCIP-SSS-110223-07A	Sediment		02-Nov-2023 12:10	03-Nov-2023 16:15	☐
HS23110291-09	MSCIP-SSS-110223-09A	Sediment		02-Nov-2023 12:45	03-Nov-2023 16:15	☐
HS23110291-10	MSCIP-SSS-110223-10A	Sediment		02-Nov-2023 13:00	03-Nov-2023 16:15	☐
HS23110291-11	MSCIP-SSS-110223-11A	Sediment		02-Nov-2023 13:10	03-Nov-2023 16:15	☐
HS23110291-12	MSCIP-SSS-110223-12A	Sediment		02-Nov-2023 13:15	03-Nov-2023 16:15	☐
HS23110291-13	MSCIP-SSS-110223-13A	Sediment		02-Nov-2023 13:30	03-Nov-2023 16:15	☐
HS23110291-14	MSCIP-SSS-110223-13B	Sediment		02-Nov-2023 13:30	03-Nov-2023 16:15	☐
HS23110291-15	MSCIP-SSS-110223-14A	Sediment		02-Nov-2023 13:50	03-Nov-2023 16:15	☐
HS23110291-16	MSCIP-SSS-110223-14B	Sediment		02-Nov-2023 13:50	03-Nov-2023 16:15	☐
HS23110291-17	MSCIP-SSS-110223-15A	Sediment		02-Nov-2023 14:00	03-Nov-2023 16:15	☐
HS23110291-18	MSCIP-SSS-110223-16A	Sediment		02-Nov-2023 14:15	03-Nov-2023 16:15	☐
HS23110291-19	MSCIP-SSS-110223-17A	Sediment		02-Nov-2023 14:30	03-Nov-2023 16:15	☐
HS23110291-20	MSCIP-SSS-110323-18A	Sediment		03-Nov-2023 08:40	03-Nov-2023 16:15	☐
HS23110291-21	MSCIP-SSS-110323-18B	Sediment		03-Nov-2023 08:40	03-Nov-2023 16:15	☐
HS23110291-22	MSCIP-SSS-110323-19A	Sediment		03-Nov-2023 09:00	03-Nov-2023 16:15	☐
HS23110291-23	MSCIP-SSS-110323-19B	Sediment		03-Nov-2023 09:00	03-Nov-2023 16:15	☐
HS23110291-24	MSCIP-SSS-110323-20A	Sediment		03-Nov-2023 09:10	03-Nov-2023 16:15	☐
HS23110291-25	MSCIP-SSS-110323-20B	Sediment		03-Nov-2023 09:10	03-Nov-2023 16:15	☐
HS23110291-26	MSCIP-SSS-110323-21A	Sediment		03-Nov-2023 09:20	03-Nov-2023 16:15	☐

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Work Order: HS23110291

SAMPLE SUMMARY

Lab Samp ID	Client Sample ID	Matrix	TagNo	Collection Date	Date Received	Hold
HS23110291-27	MSCIP-SSS-110323-70	Sediment		03-Nov-2023 09:25	03-Nov-2023 16:15	☐
HS23110291-28	MSCIP-SSS-110323-22A	Sediment		03-Nov-2023 09:30	03-Nov-2023 16:15	☐
HS23110291-29	MSCIP-SSS-110323-22B	Sediment		03-Nov-2023 09:30	03-Nov-2023 16:15	☐
HS23110291-30	MSCIP-SSS-110323-23A	Sediment		03-Nov-2023 09:40	03-Nov-2023 16:15	☐
HS23110291-31	MSCIP-SSS-110323-24A	Sediment		03-Nov-2023 09:50	03-Nov-2023 16:15	☐
HS23110291-32	MSCIP-SSS-110323-EB	Water		03-Nov-2023 08:00	03-Nov-2023 16:15	☐
HS23110291-33	MSCIP-SSS-110223-EB	Water		02-Nov-2023 15:00	03-Nov-2023 16:15	☐

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-01A
Collection Date: 02-Nov-2023 10:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-01
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.190**		**0.00148**	**0.0105**	**mg/Kg-dry**	1	10-Nov-2023 12:53
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**67.0**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-01B
Collection Date: 02-Nov-2023 10:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-02
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.179**		**0.00125**	**0.00884**	**mg/Kg-dry**	1	10-Nov-2023 12:54
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**60.7**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-02A
Collection Date: 02-Nov-2023 11:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-03
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0214**		**0.000664**	**0.00470**	**mg/Kg-dry**	1	10-Nov-2023 12:56
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**26.8**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-02B
Collection Date: 02-Nov-2023 11:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-04
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0107**		**0.000676**	**0.00478**	**mg/Kg-dry**	1	10-Nov-2023 13:04
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**30.1**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-03A
Collection Date: 02-Nov-2023 11:20

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-05
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.594**		**0.000534**	**0.00378**	**mg/Kg-dry**	1	10-Nov-2023 13:05
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**9.31**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-04A
Collection Date: 02-Nov-2023 11:50

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-06
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.176**		**0.00154**	**0.0109**	**mg/Kg-dry**	1	10-Nov-2023 13:07
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**67.5**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-04B
Collection Date: 02-Nov-2023 11:50

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-07
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.194**		**0.00131**	**0.00930**	**mg/Kg-dry**	1	10-Nov-2023 13:09
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**63.6**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-07A
Collection Date: 02-Nov-2023 12:10

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-08
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0312**		**0.000788**	**0.00558**	**mg/Kg-dry**	1	10-Nov-2023 13:10
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**37.7**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-09A
Collection Date: 02-Nov-2023 12:45

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-09
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.203**		**0.000873**	**0.00618**	**mg/Kg-dry**	1	10-Nov-2023 13:12
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**45.9**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-10A
Collection Date: 02-Nov-2023 13:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-10
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.143**		**0.000917**	**0.00649**	**mg/Kg-dry**	1	10-Nov-2023 13:14
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**47.5**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-11A
Collection Date: 02-Nov-2023 13:10

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-11
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.186**		**0.000899**	**0.00636**	**mg/Kg-dry**	1	10-Nov-2023 13:15
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**46.5**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-12A
Collection Date: 02-Nov-2023 13:15

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-12
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.168**		**0.00116**	**0.00820**	**mg/Kg-dry**	1	10-Nov-2023 13:17
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**58.3**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-13A
Collection Date: 02-Nov-2023 13:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-13
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.651**		**0.00113**	**0.00802**	**mg/Kg-dry**	1	10-Nov-2023 13:19
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**55.6**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-13B
Collection Date: 02-Nov-2023 13:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-14
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.952**		**0.000954**	**0.00675**	**mg/Kg-dry**	1	10-Nov-2023 13:24
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**49.6**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-14A
Collection Date: 02-Nov-2023 13:50

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-15
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.213**		**0.000841**	**0.00595**	**mg/Kg-dry**	1	10-Nov-2023 13:26
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**43.4**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-14B
Collection Date: 02-Nov-2023 13:50

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-16
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.956**		**0.00105**	**0.00745**	**mg/Kg-dry**	1	10-Nov-2023 13:27
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**53.8**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-15A
Collection Date: 02-Nov-2023 14:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-17
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.292**		**0.000844**	**0.00597**	**mg/Kg-dry**	1	10-Nov-2023 13:29
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**42.4**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-16A
Collection Date: 02-Nov-2023 14:15

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-18
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.152**		**0.00113**	**0.00798**	**mg/Kg-dry**	1	10-Nov-2023 13:34
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**58.3**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-17A
Collection Date: 02-Nov-2023 14:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-19
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.161**		**0.000953**	**0.00675**	**mg/Kg-dry**	1	10-Nov-2023 13:36
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**50.4**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-18A
Collection Date: 03-Nov-2023 08:40

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-20
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.100**		**0.00103**	**0.00729**	**mg/Kg-dry**	1	10-Nov-2023 13:38
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**52.7**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 07:48

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-18B
Collection Date: 03-Nov-2023 08:40

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-21
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0271**		**0.000931**	**0.00659**	**mg/Kg-dry**	1	10-Nov-2023 13:39
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**47.7**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-19A
Collection Date: 03-Nov-2023 09:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-22
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.467**		**0.000989**	**0.00699**	**mg/Kg-dry**	1	10-Nov-2023 13:47
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**51.3**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-19B
Collection Date: 03-Nov-2023 09:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-23
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0206**		**0.000719**	**0.00509**	**mg/Kg-dry**	1	10-Nov-2023 13:49
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**32.8**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-20A
Collection Date: 03-Nov-2023 09:10

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-24
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.177**		**0.00121**	**0.00858**	**mg/Kg-dry**	1	10-Nov-2023 13:50
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**60.0**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-20B
Collection Date: 03-Nov-2023 09:10

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-25
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0414**		**0.00102**	**0.00719**	**mg/Kg-dry**	1	10-Nov-2023 13:52
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**51.0**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-21A
Collection Date: 03-Nov-2023 09:20

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-26
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.161**		**0.000893**	**0.00632**	**mg/Kg-dry**	1	10-Nov-2023 13:54
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**46.6**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-70
Collection Date: 03-Nov-2023 09:25

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-27
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0896**		**0.000907**	**0.00641**	**mg/Kg-dry**	1	10-Nov-2023 14:01
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**46.3**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-22A
Collection Date: 03-Nov-2023 09:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-28
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.157**		**0.00125**	**0.00887**	**mg/Kg-dry**	1	10-Nov-2023 14:02
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**61.8**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-22B
Collection Date: 03-Nov-2023 09:30

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-29
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.164**		**0.00103**	**0.00730**	**mg/Kg-dry**	1	10-Nov-2023 14:04
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**52.7**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-23A
Collection Date: 03-Nov-2023 09:40

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-30
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B	**Method:SW7471B**				Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0840**		**0.000879**	**0.00622**	**mg/Kg-dry**	1	10-Nov-2023 14:09
MOISTURE	**Method:SW3550**						Analyst: MR
Percent Moisture	**43.1**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-24A
Collection Date: 03-Nov-2023 09:50

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-31
Matrix:Sediment

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7471B		**Method:SW7471B**			Prep:SW7471B / 10-Nov-2023		Analyst: JS
Mercury	**0.0259**		**0.000674**	**0.00477**	**mg/Kg-dry**	1	10-Nov-2023 14:11
MOISTURE		**Method:SW3550**					Analyst: MR
Percent Moisture	**27.2**		**0.0100**	**0.0100**	**wt%**	1	10-Nov-2023 10:08

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110323-EB
Collection Date: 03-Nov-2023 08:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-32
Matrix:Water

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7470A	**Method:SW7470A**				Prep:SW7470A / 09-Nov-2023		Analyst: JS
Mercury	< 0.0000300		0.0000300	0.000200	mg/L	1	09-Nov-2023 17:36

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
Sample ID: MSCIP-SSS-110223-EB
Collection Date: 02-Nov-2023 15:00

ANALYTICAL REPORT
WorkOrder:HS23110291
Lab ID:HS23110291-33
Matrix:Water

ANALYSES	RESULT	QUAL	SDL	MQL	UNITS	DILUTION FACTOR	DATE ANALYZED
MERCURY BY SW7470A		**Method:SW7470A**			Prep:SW7470A / 09-Nov-2023		Analyst: JS
Mercury	< 0.0000300		0.0000300	0.000200	mg/L	1	09-Nov-2023 17:38

Note: See Qualifiers Page for a list of qualifiers and their explanation.

Weight / Prep Log

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Batch ID: 203230 **Start Date:** 10 Nov 2023 08:30 **End Date:** 10 Nov 2023 08:30
Method: MERCURY PREP - SOLID - 7471B **Prep Code:** HG_S_LOWPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS23110291-01		0.5756 (grams)	40 (mL)	69.49	4-oz glass, Neat
HS23110291-02		0.5743 (grams)	40 (mL)	69.65	4-oz glass, Neat
HS23110291-03		0.5801 (grams)	40 (mL)	68.95	4-oz glass, Neat
HS23110291-04		0.5965 (grams)	40 (mL)	67.06	4-oz glass, Neat
HS23110291-05		0.5821 (grams)	40 (mL)	68.72	4-oz glass, Neat
HS23110291-06		0.5644 (grams)	40 (mL)	70.87	4-oz glass, Neat
HS23110291-07		0.5896 (grams)	40 (mL)	67.84	4-oz glass, Neat
HS23110291-08		0.5741 (grams)	40 (mL)	69.67	4-oz glass, Neat
HS23110291-09		0.5969 (grams)	40 (mL)	67.01	4-oz glass, Neat
HS23110291-10		0.5856 (grams)	40 (mL)	68.31	4-oz glass, Neat
HS23110291-11		0.5864 (grams)	40 (mL)	68.21	4-oz glass, Neat
HS23110291-12		0.5834 (grams)	40 (mL)	68.56	4-oz glass, Neat
HS23110291-13		0.5602 (grams)	40 (mL)	71.4	4-oz glass, Neat
HS23110291-14		0.5868 (grams)	40 (mL)	68.17	4-oz glass, Neat
HS23110291-15		0.5926 (grams)	40 (mL)	67.5	4-oz glass, Neat
HS23110291-16		0.5797 (grams)	40 (mL)	69	4-oz glass, Neat
HS23110291-17		0.58 (grams)	40 (mL)	68.97	4-oz glass, Neat

Weight / Prep Log

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Batch ID: 203232 **Start Date:** 10 Nov 2023 08:30 **End Date:** 10 Nov 2023 08:30
Method: MERCURY PREP - SOLID - 7471B **Prep Code:** HG_S_LOWPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS23110291-18		0.5993 (grams)	40 (mL)	66.74	4-oz glass, Neat
HS23110291-19		0.5963 (grams)	40 (mL)	67.08	4-oz glass, Neat
HS23110291-20		0.5785 (grams)	40 (mL)	69.14	4-oz glass, Neat
HS23110291-21		0.5791 (grams)	40 (mL)	69.07	4-oz glass, Neat
HS23110291-22		0.5857 (grams)	40 (mL)	68.29	4-oz glass, Neat
HS23110291-23		0.5833 (grams)	40 (mL)	68.58	4-oz glass, Neat
HS23110291-24		0.5811 (grams)	40 (mL)	68.83	4-oz glass, Neat
HS23110291-25		0.5661 (grams)	40 (mL)	70.66	4-oz glass, Neat
HS23110291-26		0.5911 (grams)	40 (mL)	67.67	4-oz glass, Neat
HS23110291-27		0.5793 (grams)	40 (mL)	69.05	4-oz glass, Neat
HS23110291-28		0.5887 (grams)	40 (mL)	67.95	4-oz glass, Neat
HS23110291-29		0.5776 (grams)	40 (mL)	69.25	4-oz glass, Neat
HS23110291-30		0.5639 (grams)	40 (mL)	70.93	4-oz glass, Neat
HS23110291-31		0.5744 (grams)	40 (mL)	69.64	4-oz glass, Neat

Batch ID: 203269 **Start Date:** 09 Nov 2023 09:30 **End Date:** 09 Nov 2023 09:30
Method: MERCURY PREP BY 7470A- WATER **Prep Code:** HG_WPR

Sample ID	Container	Sample Wt/Vol	Final Volume	Prep Factor	
HS23110291-32		10 (mL)	10 (mL)	1	120 plastic HNO3
HS23110291-33		10 (mL)	10 (mL)	1	120 plastic HNO3

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: 203230 (0)	**Test Name :** MERCURY BY SW7471B				**Matrix:** Sediment	
HS23110291-01	MSCIP-SSS-110223-01A	02 Nov 2023 10:30		10 Nov 2023 08:30	10 Nov 2023 12:53	1
HS23110291-02	MSCIP-SSS-110223-01B	02 Nov 2023 10:30		10 Nov 2023 08:30	10 Nov 2023 12:54	1
HS23110291-03	MSCIP-SSS-110223-02A	02 Nov 2023 11:00		10 Nov 2023 08:30	10 Nov 2023 12:56	1
HS23110291-04	MSCIP-SSS-110223-02B	02 Nov 2023 11:00		10 Nov 2023 08:30	10 Nov 2023 13:04	1
HS23110291-05	MSCIP-SSS-110223-03A	02 Nov 2023 11:20		10 Nov 2023 08:30	10 Nov 2023 13:05	1
HS23110291-06	MSCIP-SSS-110223-04A	02 Nov 2023 11:50		10 Nov 2023 08:30	10 Nov 2023 13:07	1
HS23110291-07	MSCIP-SSS-110223-04B	02 Nov 2023 11:50		10 Nov 2023 08:30	10 Nov 2023 13:09	1
HS23110291-08	MSCIP-SSS-110223-07A	02 Nov 2023 12:10		10 Nov 2023 08:30	10 Nov 2023 13:10	1
HS23110291-09	MSCIP-SSS-110223-09A	02 Nov 2023 12:45		10 Nov 2023 08:30	10 Nov 2023 13:12	1
HS23110291-10	MSCIP-SSS-110223-10A	02 Nov 2023 13:00		10 Nov 2023 08:30	10 Nov 2023 13:14	1
HS23110291-11	MSCIP-SSS-110223-11A	02 Nov 2023 13:10		10 Nov 2023 08:30	10 Nov 2023 13:15	1
HS23110291-12	MSCIP-SSS-110223-12A	02 Nov 2023 13:15		10 Nov 2023 08:30	10 Nov 2023 13:17	1
HS23110291-13	MSCIP-SSS-110223-13A	02 Nov 2023 13:30		10 Nov 2023 08:30	10 Nov 2023 13:19	1
HS23110291-14	MSCIP-SSS-110223-13B	02 Nov 2023 13:30		10 Nov 2023 08:30	10 Nov 2023 13:24	1
HS23110291-15	MSCIP-SSS-110223-14A	02 Nov 2023 13:50		10 Nov 2023 08:30	10 Nov 2023 13:26	1
HS23110291-16	MSCIP-SSS-110223-14B	02 Nov 2023 13:50		10 Nov 2023 08:30	10 Nov 2023 13:27	1
HS23110291-17	MSCIP-SSS-110223-15A	02 Nov 2023 14:00		10 Nov 2023 08:30	10 Nov 2023 13:29	1
Batch ID: 203232 (0)	**Test Name :** MERCURY BY SW7471B				**Matrix:** Sediment	
HS23110291-18	MSCIP-SSS-110223-16A	02 Nov 2023 14:15		10 Nov 2023 08:30	10 Nov 2023 13:34	1
HS23110291-19	MSCIP-SSS-110223-17A	02 Nov 2023 14:30		10 Nov 2023 08:30	10 Nov 2023 13:36	1
HS23110291-20	MSCIP-SSS-110323-18A	03 Nov 2023 08:40		10 Nov 2023 08:30	10 Nov 2023 13:38	1
HS23110291-21	MSCIP-SSS-110323-18B	03 Nov 2023 08:40		10 Nov 2023 08:30	10 Nov 2023 13:39	1
HS23110291-22	MSCIP-SSS-110323-19A	03 Nov 2023 09:00		10 Nov 2023 08:30	10 Nov 2023 13:47	1
HS23110291-23	MSCIP-SSS-110323-19B	03 Nov 2023 09:00		10 Nov 2023 08:30	10 Nov 2023 13:49	1
HS23110291-24	MSCIP-SSS-110323-20A	03 Nov 2023 09:10		10 Nov 2023 08:30	10 Nov 2023 13:50	1
HS23110291-25	MSCIP-SSS-110323-20B	03 Nov 2023 09:10		10 Nov 2023 08:30	10 Nov 2023 13:52	1
HS23110291-26	MSCIP-SSS-110323-21A	03 Nov 2023 09:20		10 Nov 2023 08:30	10 Nov 2023 13:54	1
HS23110291-27	MSCIP-SSS-110323-70	03 Nov 2023 09:25		10 Nov 2023 08:30	10 Nov 2023 14:01	1
HS23110291-28	MSCIP-SSS-110323-22A	03 Nov 2023 09:30		10 Nov 2023 08:30	10 Nov 2023 14:02	1
HS23110291-29	MSCIP-SSS-110323-22B	03 Nov 2023 09:30		10 Nov 2023 08:30	10 Nov 2023 14:04	1
HS23110291-30	MSCIP-SSS-110323-23A	03 Nov 2023 09:40		10 Nov 2023 08:30	10 Nov 2023 14:09	1
HS23110291-31	MSCIP-SSS-110323-24A	03 Nov 2023 09:50		10 Nov 2023 08:30	10 Nov 2023 14:11	1
Batch ID: 203269 (0)	**Test Name :** MERCURY BY SW7470A				**Matrix:** Water	
HS23110291-32	MSCIP-SSS-110323-EB	03 Nov 2023 08:00		09 Nov 2023 09:30	09 Nov 2023 17:36	1
HS23110291-33	MSCIP-SSS-110223-EB	02 Nov 2023 15:00		09 Nov 2023 09:30	09 Nov 2023 17:38	1

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

DATES REPORT

Sample ID	Client Samp ID	Collection Date	Leachate Date	Prep Date	Analysis Date	DF
Batch ID: R451503 (0)	**Test Name :** MOISTURE				**Matrix:** Sediment	
HS23110291-01	MSCIP-SSS-110223-01A	02 Nov 2023 10:30			10 Nov 2023 07:48	1
HS23110291-02	MSCIP-SSS-110223-01B	02 Nov 2023 10:30			10 Nov 2023 07:48	1
HS23110291-03	MSCIP-SSS-110223-02A	02 Nov 2023 11:00			10 Nov 2023 07:48	1
HS23110291-04	MSCIP-SSS-110223-02B	02 Nov 2023 11:00			10 Nov 2023 07:48	1
HS23110291-05	MSCIP-SSS-110223-03A	02 Nov 2023 11:20			10 Nov 2023 07:48	1
HS23110291-06	MSCIP-SSS-110223-04A	02 Nov 2023 11:50			10 Nov 2023 07:48	1
HS23110291-07	MSCIP-SSS-110223-04B	02 Nov 2023 11:50			10 Nov 2023 07:48	1
HS23110291-08	MSCIP-SSS-110223-07A	02 Nov 2023 12:10			10 Nov 2023 07:48	1
HS23110291-09	MSCIP-SSS-110223-09A	02 Nov 2023 12:45			10 Nov 2023 07:48	1
HS23110291-10	MSCIP-SSS-110223-10A	02 Nov 2023 13:00			10 Nov 2023 07:48	1
HS23110291-11	MSCIP-SSS-110223-11A	02 Nov 2023 13:10			10 Nov 2023 07:48	1
HS23110291-12	MSCIP-SSS-110223-12A	02 Nov 2023 13:15			10 Nov 2023 07:48	1
HS23110291-13	MSCIP-SSS-110223-13A	02 Nov 2023 13:30			10 Nov 2023 07:48	1
HS23110291-14	MSCIP-SSS-110223-13B	02 Nov 2023 13:30			10 Nov 2023 07:48	1
HS23110291-15	MSCIP-SSS-110223-14A	02 Nov 2023 13:50			10 Nov 2023 07:48	1
HS23110291-16	MSCIP-SSS-110223-14B	02 Nov 2023 13:50			10 Nov 2023 07:48	1
HS23110291-17	MSCIP-SSS-110223-15A	02 Nov 2023 14:00			10 Nov 2023 07:48	1
HS23110291-18	MSCIP-SSS-110223-16A	02 Nov 2023 14:15			10 Nov 2023 07:48	1
HS23110291-19	MSCIP-SSS-110223-17A	02 Nov 2023 14:30			10 Nov 2023 07:48	1
HS23110291-20	MSCIP-SSS-110323-18A	03 Nov 2023 08:40			10 Nov 2023 07:48	1
Batch ID: R451504 (0)	**Test Name :** MOISTURE				**Matrix:** Sediment	
HS23110291-21	MSCIP-SSS-110323-18B	03 Nov 2023 08:40			10 Nov 2023 10:08	1
HS23110291-22	MSCIP-SSS-110323-19A	03 Nov 2023 09:00			10 Nov 2023 10:08	1
HS23110291-23	MSCIP-SSS-110323-19B	03 Nov 2023 09:00			10 Nov 2023 10:08	1
HS23110291-24	MSCIP-SSS-110323-20A	03 Nov 2023 09:10			10 Nov 2023 10:08	1
HS23110291-25	MSCIP-SSS-110323-20B	03 Nov 2023 09:10			10 Nov 2023 10:08	1
HS23110291-26	MSCIP-SSS-110323-21A	03 Nov 2023 09:20			10 Nov 2023 10:08	1
HS23110291-27	MSCIP-SSS-110323-70	03 Nov 2023 09:25			10 Nov 2023 10:08	1
HS23110291-28	MSCIP-SSS-110323-22A	03 Nov 2023 09:30			10 Nov 2023 10:08	1
HS23110291-29	MSCIP-SSS-110323-22B	03 Nov 2023 09:30			10 Nov 2023 10:08	1
HS23110291-30	MSCIP-SSS-110323-23A	03 Nov 2023 09:40			10 Nov 2023 10:08	1
HS23110291-31	MSCIP-SSS-110323-24A	03 Nov 2023 09:50			10 Nov 2023 10:08	1

WorkOrder: HS23110291
InstrumentID: HG04
Test Code: HG_S_Low
Test Number: SW7471B
Test Name: Mercury by SW7471B

METHOD DETECTION / REPORTING LIMITS

Matrix: Solid **Units:** mg/Kg

Type	Analyte	CAS	DCS Spike	DCS	MDL	PQL
A	Mercury	7439-97-6	0.00167	0.000333	0.000470	0.00332

WorkOrder: HS23110291
InstrumentID: HG04
Test Code: HG_W
Test Number: SW7470A
Test Name: Mercury by SW7470A

METHOD DETECTION / REPORTING LIMITS

Matrix: Aqueous **Units:** mg/L

Type	Analyte	CAS	DCS Spike	DCS	MDL	PQL
A	Mercury	7439-97-6	0.000100	0.0000920	0.0000300	0.000200

WorkOrder: HS23110291
InstrumentID: Balance1
Test Code: MOIST_SW3550
Test Number: SW3550
Test Name: Moisture

METHOD DETECTION / REPORTING LIMITS

Matrix: Solid **Units:** wt%

Type	Analyte	CAS	DCS Spike	DCS	MDL	PQL
A	Percent Moisture	MOIST	0	0	0.0100	0.0100

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

QC BATCH REPORT

Batch ID: 203230 (0) **Instrument: HG04** **Method: MERCURY BY SW7471B**

MBLK Sample ID: **MBLK-203230** Units: **ug/Kg** Analysis Date: **10-Nov-2023 12:41**
Client ID: Run ID: **HG04_451510** SeqNo: **7666856** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	< 0.470	3.32								

LCS Sample ID: **LCS-203230** Units: **ug/Kg** Analysis Date: **10-Nov-2023 12:42**
Client ID: Run ID: **HG04_451510** SeqNo: **7666857** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	332.7	3.32	333.3	0	99.8	85 - 115				

MS Sample ID: **HS23101921-02MS** Units: **ug/Kg** Analysis Date: **10-Nov-2023 12:49**
Client ID: Run ID: **HG04_451510** SeqNo: **7666861** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	328.3	3.41	342	3.42	95.0	85 - 115				

MSD Sample ID: **HS23101921-02MSD** Units: **ug/Kg** Analysis Date: **10-Nov-2023 12:51**
Client ID: Run ID: **HG04_451510** SeqNo: **7666862** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	319.3	3.35	335.4	3.42	94.2	85 - 115	328.3	2.78	20	

The following samples were analyzed in this batch:

HS23110291-01	HS23110291-02	HS23110291-03	HS23110291-04
HS23110291-05	HS23110291-06	HS23110291-07	HS23110291-08
HS23110291-09	HS23110291-10	HS23110291-11	HS23110291-12
HS23110291-13	HS23110291-14	HS23110291-15	HS23110291-16
HS23110291-17			

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

QC BATCH REPORT

Batch ID: 203232 (0) **Instrument: HG04** **Method: MERCURY BY SW7471B**

MBLK Sample ID: **MBLK-203232** Units: **ug/Kg** Analysis Date: **10-Nov-2023 13:31**
Client ID: Run ID: **HG04_451510** SeqNo: **7666835** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	< 0.470	3.32								

LCS Sample ID: **LCS-203232** Units: **ug/Kg** Analysis Date: **10-Nov-2023 13:33**
Client ID: Run ID: **HG04_451510** SeqNo: **7666836** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	330	3.32	333.3	0	99.0	85 - 115				

MS Sample ID: **HS23110291-26MS** Units: **ug/Kg** Analysis Date: **10-Nov-2023 13:56**
Client ID: **MSCIP-SSS-110323-21A** Run ID: **HG04_451510** SeqNo: **7666848** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	458.9	3.38	338.9	85.94	110	85 - 115				

MSD Sample ID: **HS23110291-26MSD** Units: **ug/Kg** Analysis Date: **10-Nov-2023 13:59**
Client ID: **MSCIP-SSS-110323-21A** Run ID: **HG04_451510** SeqNo: **7666849** PrepDate: **10-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	459.7	3.38	339	85.94	110	85 - 115	458.9	0.181	20	

The following samples were analyzed in this batch:

HS23110291-18	HS23110291-19	HS23110291-20	HS23110291-21
HS23110291-22	HS23110291-23	HS23110291-24	HS23110291-25
HS23110291-26	HS23110291-27	HS23110291-28	HS23110291-29
HS23110291-30	HS23110291-31		

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

QC BATCH REPORT

Batch ID: 203269 (0) **Instrument: HG04** **Method: MERCURY BY SW7470A**

MBLK Sample ID: **MBLK-203269** Units: **mg/L** Analysis Date: **09-Nov-2023 17:16**
Client ID: Run ID: **HG04_451411** SeqNo: **7665149** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	< 0.0000300	0.000200								

LCS Sample ID: **LCS-203269** Units: **mg/L** Analysis Date: **09-Nov-2023 17:17**
Client ID: Run ID: **HG04_451411** SeqNo: **7665150** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.00557	0.000200	0.005	0	111	80 - 120				

MS Sample ID: **HS23110479-01MS** Units: **mg/L** Analysis Date: **09-Nov-2023 17:41**
Client ID: Run ID: **HG04_451411** SeqNo: **7665162** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.00532	0.000200	0.005	-0.000021	107	75 - 125				

MS Sample ID: **HS23110253-05MS** Units: **mg/L** Analysis Date: **09-Nov-2023 19:27**
Client ID: Run ID: **HG04_451411** SeqNo: **7665205** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.00103	0.000200	0.005	-0.000033	21.3	75 - 125				S

MSD Sample ID: **HS23110479-01MSD** Units: **mg/L** Analysis Date: **09-Nov-2023 17:43**
Client ID: Run ID: **HG04_451411** SeqNo: **7665163** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.00522	0.000200	0.005	-0.000021	105	75 - 125	0.00532	1.9	20	

MSD Sample ID: **HS23110253-05MSD** Units: **mg/L** Analysis Date: **09-Nov-2023 17:26**
Client ID: Run ID: **HG04_451411** SeqNo: **7665155** PrepDate: **09-Nov-2023** DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Mercury	0.00118	0.000200	0.005	-0.000033	24.3	75 - 125	0.00103	13.6	20	S

The following samples were analyzed in this batch: HS23110291-32 HS23110291-33

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

QC BATCH REPORT

Batch ID: R451503 (0) **Instrument:** Balance1 **Method:** MOISTURE

DUP Sample ID: **HS23110291-04DUP** Units: **wt%** Analysis Date: **10-Nov-2023 07:48**
Client ID: **MSCIP-SSS-110223-02B** Run ID: **Balance1_451503** SeqNo: **7666706** PrepDate: DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Percent Moisture	31	0.0100					30.1	2.95	20	

The following samples were analyzed in this batch:

HS23110291-01	HS23110291-02	HS23110291-03	HS23110291-04
HS23110291-05	HS23110291-06	HS23110291-07	HS23110291-08
HS23110291-09	HS23110291-10	HS23110291-11	HS23110291-12
HS23110291-13	HS23110291-14	HS23110291-15	HS23110291-16
HS23110291-17	HS23110291-18	HS23110291-19	HS23110291-20

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

QC BATCH REPORT

Batch ID: **R451504 (0)** **Instrument:** **Balance1** **Method:** **MOISTURE**

DUP Sample ID: **HS23110291-26DUP** Units: **wt%** Analysis Date: **10-Nov-2023 10:08**
Client ID: **MSCIP-SSS-110323-21A** Run ID: **Balance1_451504** SeqNo: **7666730** PrepDate: DF: **1**

Analyte	Result	MQL	SPK Val	SPK Ref Value	%REC	Control Limit	RPD Ref Value	%RPD	RPD Limit	Qual
Percent Moisture	45.4	0.0100					46.6	2.61	20	

The following samples were analyzed in this batch:

HS23110291-21	HS23110291-22	HS23110291-23	HS23110291-24
HS23110291-25	HS23110291-26	HS23110291-27	HS23110291-28
HS23110291-29	HS23110291-30	HS23110291-31	

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: **HS23110291**

QUALIFIERS, ACRONYMS, UNITS

Qualifier	Description
*	Value exceeds Regulatory Limit
a	Not accredited
B	Analyte detected in the associated Method Blank above the Reporting Limit
E	Value above quantitation range
H	Analyzed outside of Holding Time
J	Analyte detected below quantitation limit
M	Manually integrated, see raw data for justification
n	Not offered for accreditation
ND	Not Detected at the Reporting Limit
O	Sample amount is > 4 times amount spiked
P	Dual Column results percent difference > 40%
R	RPD above laboratory control limit
S	Spike Recovery outside laboratory control limits
U	Analyzed but not detected above the MDL/SDL

Acronym	Description
DCS	Detectability Check Study
DUP	Method Duplicate
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MBLK	Method Blank
MDL	Method Detection Limit
MQL	Method Quantitation Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PDS	Post Digestion Spike
PQL	Practical Quantitaion Limit
SD	Serial Dilution
SDL	Sample Detection Limit
TRRP	Texas Risk Reduction Program

Unit Reported	Description
mg/Kg-dry	Milligrams per Kilogram- Dry weight corrected

CERTIFICATIONS,ACCREDITATIONS & LICENSES

Agency	Number	Expire Date
Arkansas	88-00356	27-Mar-2024
California	2919; 2024	30-Apr-2024
Dept of Defense	L23-358	31-May-2025
Florida	E87611-38	30-Jun-2024
Illinois	2000322023-11	30-Jun-2024
Kansas	E-10352 2023-2024	31-Jul-2024
Louisiana	03087 2023-2024	30-Jun-2024
Maryland	343; 2023-2024	30-Jun-2024
North Carolina	624-2023	31-Dec-2023
North Dakota	R-193 2023-2024	30-Apr-2024
Oklahoma	2023-140	31-Aug-2024
Texas	T104704231-23-31	30-Apr-2024
Utah	TX026932023-14	31-Jul-2024

Sample Receipt Checklist

Work Order ID: HS23110291 **Date/Time Received:** **03-Nov-2023 16:15**

Client Name: Benchmark **Received by:** **Paresh M. Giga**

Completed By: /S/ Corey Grandits (eSignature) 03-Nov-2023 17:10 (Date/Time) **Reviewed by:** /S/ James Guin (eSignature) 06-Nov-2023 14:15 (Date/Time)

Matrices: **W/S** Carrier name: **Client**

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	Not Present ☑
VOA/TX1005/TX1006 Solids in hermetically sealed vials?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	4 Page(s)
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	COC IDs:305120, 305121, 305126, 305123
Samplers name present on COC?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Samples in proper container/bottle?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	
All samples received within holding time?	Yes ☑	No ☐	
Container/Temp Blank temperature in compliance?	Yes ☑	No ☐	

Temperature(s)/Thermometer(s):	1.1UC/1.0C	IR31
Cooler(s)/Kit(s):	Blue	
Date/Time sample(s) sent to storage:	11/3/23	

Water - VOA vials have zero headspace?	Yes ☐	No ☐	No VOA vials submitted ☑
Water - pH acceptable upon receipt?	Yes ☑	No ☐	N/A ☐
pH adjusted?	Yes ☐	No ☑	N/A ☐

pH adjusted by:

Login Notes:

Client Contacted: Date Contacted: Person Contacted:

Contacted By: Regarding:

Comments:

Corrective Action:

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Everett, WA +1 425 356 2600
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Holland, MI +1 616 399 6070
Houston, TX +1 281 530 5656
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Spring City, PA +1 610 948 4903
Salt Lake City, UT +1 801 266 7700
South Charleston, WV +1 304 356 3168
York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 305120

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	98003-115 MSCIP	Project Name	98003-115 MSCIP	A	HG_S_Low (7471B Total Mercury)
Work Order		Project Number		B	MOIST_SW3550 (Moist %)
Company Name	Benchmark Ecological Services	Bill To Company	Benchmark Ecological Services	C	MS/MSD
Send Report To	Neil Henthorne	Invoice Attn	Katy Garcia - A/P	D	
Address	4219 S Front St	Address	4219 S Front St	E	
				F	
City/State/Zip	Brookshire, TX 77423	City/State/Zip	Brookshire TX 77423	G	
Phone	(281) 934-3403	Phone	(281) 934-3403	H	
Fax	(281) 934-3404	Fax	(281) 934-3404	I	
e-Mail Address	nhenthorne@benchmarkeco.com	e-Mail Address	kgarcia@benchmarkeco.com	J	

HS23110291
Benchmark Ecological Services
98003-115 MSCIP

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	MSCIP-SSS-110223-01A	11/02/23	10:30	Sed	8	1	X	X									
2	MSCIP-SSS-110223-01B	11/02/23	10:30	Sed	8	1	X	X									
3	MSCIP-SSS-110223-02A	11/02/23	11:00	Sed	8	1	X	X									
4	MSCIP-SSS-110223-02B	11/02/23	11:00	Sed	8	1	X	X									
5	MSCIP-SSS-110223-03A	11/02/23	11:20	Sed	8	1	X	X									
6	MSCIP-SSS-110223-04A	11/02/23	11:50	Sed	8	1	X	X									
7	MSCIP-SSS-110223-04B	11/02/23	11:50	Sed	8	1	X	X									
8	MSCIP-SSS-110223-07A	11/02/23	12:10	Sed	8	1	X	X									
9	MSCIP-SSS-110223-09A	11/02/23	12:45	Sed	8	1	X	X									
10	MSCIP-SSS-110223-10A	11/02/23	13:00	Sed	8	1	X	X									

Sampler(s) Please Print & Sign: Kevin Kuhline
Shipment Method: Delivered
Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☒ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other
Results Due Date:

Relinquished by: Kevin Kuhline	Date: 11/03/23	Time: 16:15	Received by:	
Relinquished by:	Date:	Time:	Received by (Laboratory): 11/3/23 16:15	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	

Notes: 98003-115 MSCIP

Cooler ID	Cooler Temp.
Blue	0.5
	1-1°
	#31
	cf: 0.1°

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Data ☒ TRRP Level IV
☐ Level IV SVM848/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
2. Unless otherwise agreed in a formal contract, services provided by ALS Environmental are expressly limited to the terms and conditions stated on the reverse.
3. The Chain of Custody is a legal document. All information must be completed accurately.

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York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 305121

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	98003-115 MSCIP	Project Name	98003-115 MSCIP	A	HG_S_Low (7471B Total Mercury)
Work Order		Project Number		B	MOIST_SW3550 (Moist %)
Company Name	Benchmark Ecological Services	Bill To Company	Benchmark Ecological Services	C	MS/MSD
Send Report To	Neil Henthorne	Invoice Attn	Katy Garcia - A/P	D	
Address	4219 S Front St	Address	4219 S Front St	E	
				F	
City/State/Zip	Brookshire, TX 77423	City/State/Zip	Brookshire TX 77423	G	
Phone	(281) 934-3403	Phone	(281) 934-3403	H	
Fax	(281) 934-3404	Fax	(281) 934-3404	I	
e-Mail Address	nhenthorne@benchmarkeco.com	e-Mail Address	kgarcia@benchmarkeco.com	J	

HS23110291
Benchmark Ecological Services
98003-115 MSCIP

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	MSCIP-SSS-110223-11A	11/02/23	13:10	Sed	8	1	X	X									
2	MSCIP-SSS-110223-12A	11/02/23	13:15	Sed	8	1	X	X									
3	MSCIP-SSS-110223-13A	11/02/23	13:30	Sed	8	1	X	X									
4	MSCIP-SSS-110223-13B	11/02/23	13:30	Sed	8	1	X	X									
5	MSCIP-SSS-110223-14A	11/02/23	13:50	Sed	8	1	X	X									
6	MSCIP-SSS-110223-14B	11/02/23	13:50	Sed	8	1	X	X									
7	MSCIP-SSS-110223-15A	11/02/23	14:00	Sed	8	1	X	X									
8	MSCIP-SSS-110223-16A	11/02/23	14:15	Sed	8	1	X	X									
9	MSCIP-SSS-110223-17A	11/02/23	14:30	Sed	8	1	X	X									
10	MSCIP-SSS-110323-18A	11/03/23	08:40	Sed	8	1	X	X									

Sampler(s) Please Print & Sign: Kevin Kuehline
Shipment Method: Delivered
Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☒ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other
Results Due Date:

Relinquished by: Kevin Kuehline	Date: 11/03/23	Time: 16:15	Received by:	Notes: 98003-115 MSCIP
Relinquished by:	Date:	Time:	Received by (Laboratory): 11/3/23 16:15	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	

Cooler ID	Cooler Temp.

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Data ☒ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other (8-4°C) 9-5035

Note: 1. Any changes must be made in writing once samples and COC Form have been submitted to ALS Environmental.
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York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 305126

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	98003-115 MSCIP	Project Name	98003-115 MSCIP	A	HG_S_Low (7471B Total Mercury)
Work Order		Project Number		B	MOIST_SW3550 (Moist %)
Company Name	Benchmark Ecological Services	Bill To Company	Benchmark Ecological Services	C	MS/MSD
Send Report To	Neil Henthorne	Invoice Attn	Katy Garcia - A/P	D	
Address	4219 S Front St	Address	4219 S Front St	E	
				F	
City/State/Zip	Brookshire, TX 77423	City/State/Zip	Brookshire TX 77423	G	
Phone	(281) 934-3403	Phone	(281) 934-3403	H	
Fax	(281) 934-3404	Fax	(281) 934-3404	I	
e-Mail Address	nhenthorne@benchmarkeco.com	e-Mail Address	kgarcia@benchmarkeco.com	J	

HS23110291
Benchmark Ecological Services
98003-115 MSCIP

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	~~MSCIP-555-110323-18A KK~~	~~11/03/23 KK~~															
2	MSCIP-555-110323-18B	11/03/23	08:40	Sed	8	1	X	X									
3	MSCIP-555-110323-19A	11/03/23	09:00	Sed	8	1	X	X									
4	MSCIP-555-110323-19B	11/03/23	09:00	Sed	8	1	X	X									
5	MSCIP-555-110323-20A	11/03/23	09:10	Sed	8	1	X	X									
6	MSCIP-555-110323-20B	11/03/23	09:10	Sed	8	1	X	X									
7	MSCIP-555-110323-21A	11/03/23	09:20	Sed	8	3	X	X	X								
8	MSCIP-555-110323-70	11/03/23	09:25	Sed	8	1	X	X									
9	MSCIP-555-110323-22A	11/03/23	09:30	Sed	8	1	X	X									
10	MSCIP-555-110323-22B	11/03/23	09:30	Sed	8	1	X	X									

Sampler(s) Please Print & Sign: Kevin Kuhline
Shipment Method: Delivered
Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☒ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other
Results Due Date:

Relinquished by: Kevin Kuhline	Date: 11/03/23	Time: 16:15	Received by:	
Relinquished by:	Date:	Time:	Received by (Laboratory): 11/3/23 16:15	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	

Notes: 98003-115 MSCIP

Cooler ID	Cooler Temp.

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Data ☒ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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South Charleston, WV +1 304 356 3168
York, PA +1 717 505 5280

Chain of Custody Form

COC ID: 305123

ALS Project Manager: | ALS Work Order #:

Customer Information		Project Information		Parameter/Method Request for Analysis	
Purchase Order	98003-115 MSCIP	Project Name	98003-115 MSCIP	A	HG_S_Low (7471B Total Mercury)
Work Order		Project Number		B	MOIST_SW3550 (Moist %)
Company Name	Benchmark Ecological Services	Bill To Company	Benchmark Ecological Services	C	
Send Report To	Neil Henthorne	Invoice Attn	Katy Garcia - A/P	D	
Address	4219 S Front St	Address	4219 S Front St	E	
				F	
City/State/Zip	Brookshire, TX 77423	City/State/Zip	Brookshire TX 77423	G	
Phone	(281) 934-3403	Phone	(281) 934-3403	H	
Fax	(281) 934-3404	Fax	(281) 934-3404	I	
e-Mail Address	nhenthorne@benchmarkeco.com	e-Mail Address	kgarcia@benchmarkeco.com	J	

HS23110291
Benchmark Ecological Services
98003-115 MSCIP

No.	Sample Description	Date	Time	Matrix	Pres.	# Bottles	A	B	C	D	E	F	G	H	I	J	Hold
1	MSCIP-SSS-110323-23A	11/03/23	09:40	sed	8	1	X	X									
2	MSCIP-SSS-110323-24A	11/03/23	09:50	sed	8	1	X	X									
3	MSCIP-SSS-110323-EB	11/03/23	08:00	Water	8	1	X	X									
4	MSCIP-SSS-110223-EB	11/02/23	15:00	Water	8	1	X	X									
5																	
6																	
7																	
8																	
9																	
10																	

Sampler(s) Please Print & Sign: Kevin Kichline

Shipment Method: Delivered

Required Turnaround Time: (Check Box) ☐ STD 10 Wk Days ☒ 5 Wk Days ☐ 2 Wk Days ☐ 24 Hour ☐ Other

Results Due Date:

Relinquished by: Kevin Kichline	Date: 11/03/23	Time: 16:15	Received by:	
Relinquished by:	Date:	Time:	Received by (Laboratory): 11/3/23 16:15.	
Logged by (Laboratory):	Date:	Time:	Checked by (Laboratory):	

Notes: 98003-115 MSCIP

Cooler ID	Cooler Temp.

QC Package: (Check One Box Below)
☐ Level II Std QC ☐ TRRP Checklist
☐ Level III Std QC/Raw Data ☒ TRRP Level IV
☐ Level IV SW846/CLP
☐ Other

Preservative Key: 1-HCl 2-HNO_3 3-H_2SO_4 4-NaOH 5-$Na_2S_2O_3$ 6-$NaHSO_4$ 7-Other 8-4°C 9-5035

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HS23110291 - ME - HG_S_LowHG_W

ALS WO# HS23110291

FORM 13 - ANALYSIS RUN LOG

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291
Start Date: 09-Nov-2023 End Date: 09-Nov-2023

Run ID:HG04_451411
Instrument:HG04
Method:SW7470A

Sample No.	D/F	Time	FileID	Analytes
ICCV 1	1	09-Nov-2023 12:37	_7664312	HG
ICV	1	09-Nov-2023 12:39	_7664313	HG
ICB	1	09-Nov-2023 12:40	_7664314	HG
CRA	1	09-Nov-2023 12:42	_7664315	HG
CCV 2	1	09-Nov-2023 13:05	HG04_451411 Raw Data_7664286	HG
CCB 1	1	09-Nov-2023 13:07	_7664287	HG
CCV 3	1	09-Nov-2023 13:32	_7664298	HG
CCB 2	1	09-Nov-2023 13:34	_7664299	HG
CCV 4	1	09-Nov-2023 13:55	_7664310	HG
CCB 3	1	09-Nov-2023 13:57	_7664311	HG
CCV 5	1	09-Nov-2023 14:21	_7664326	HG
CCB 4	1	09-Nov-2023 14:23	_7664327	HG
CCV 6	1	09-Nov-2023 14:47	_7664338	HG
CCB 5	1	09-Nov-2023 14:49	_7664339	HG
CCV 7	1	09-Nov-2023 15:20	_7664344	HG
CCB 6	1	09-Nov-2023 15:22	_7664345	HG
CCV 8	1	09-Nov-2023 15:54	_7664653	HG
CCB 7	1	09-Nov-2023 15:56	_7664654	HG
CCV 9	1	09-Nov-2023 16:16	_7664663	HG
CCB 8	1	09-Nov-2023 16:18	_7664664	HG
CCV 10	1	09-Nov-2023 16:43	_7665133	HG
CCB 9	1	09-Nov-2023 16:45	_7665134	HG
CCV 11	1	09-Nov-2023 17:07	_7665145	HG
CCB 10	1	09-Nov-2023 17:08	_7665146	HG
MBLK-203269	1	09-Nov-2023 17:16	_7665149	HG
LCS-203269	1	09-Nov-2023 17:17	_7665150	HG
ZZZZZZMSD	1	09-Nov-2023 17:26	_7665155	HG
CCV 12	1	09-Nov-2023 17:31	_7665157	HG
CCB 11	1	09-Nov-2023 17:32	_7665158	HG
MSCIP-SSS-110323-EB	1	09-Nov-2023 17:36	_7665159	HG
MSCIP-SSS-110223-EB	1	09-Nov-2023 17:38	_7665160	HG
ZZZZZZMS	1	09-Nov-2023 17:41	_7665162	HG
ZZZZZZMSD	1	09-Nov-2023 17:43	_7665163	HG
CCV 13	1	09-Nov-2023 17:56	_7665169	HG
CCB 12	1	09-Nov-2023 17:58	_7665170	HG
CCV 14	1	09-Nov-2023 18:22	_7665181	HG
CCB 13	1	09-Nov-2023 18:24	_7665182	HG
CCV 15	1	09-Nov-2023 18:53	_7665193	HG
CCB 14	1	09-Nov-2023 18:55	_7665194	HG
CCV 16	1	09-Nov-2023 19:13	_7665202	HG
CCB 15	1	09-Nov-2023 19:15	_7665203	HG
ZZZZZZMS	1	09-Nov-2023 19:27	_7665205	HG
CCV 17	1	09-Nov-2023 19:30	_7665206	HG
CCB 16	1	09-Nov-2023 19:32	_7665207	HG

FORM 13 - ANALYSIS RUN LOG

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291
Start Date: 10-Nov-2023 End Date: 10-Nov-2023

Run ID:HG04_451510
Instrument:HG04
Method:SW7470A

Sample No.	D/F	Time	FileID	Analytes
ICCV 1	1	10-Nov-2023 12:23	_7666850	HG
ICV	1	10-Nov-2023 12:24	_7666851	HG
ICB	1	10-Nov-2023 12:26	_7666852	HG
CRA	1	10-Nov-2023 12:28	_7666853	HG
CCV 2	1	10-Nov-2023 12:34	_7666854	HG
CCB 1	1	10-Nov-2023 12:36	_7666855	HG
MBLK-203230	1	10-Nov-2023 12:41	_7666856	HG
LCS-203230	1	10-Nov-2023 12:42	_7666857	HG
ZZZZZZMS	1	10-Nov-2023 12:49	_7666861	HG
ZZZZZZMSD	1	10-Nov-2023 12:51	_7666862	HG
MSCIP-SSS-110223-01A	1	10-Nov-2023 12:53	_7666863	HG
MSCIP-SSS-110223-01B	1	10-Nov-2023 12:54	_7666864	HG
MSCIP-SSS-110223-02A	1	10-Nov-2023 12:56	_7666865	HG
CCV 3	1	10-Nov-2023 12:58	_7666866	HG
CCB 2	1	10-Nov-2023 12:59	_7666867	HG
MSCIP-SSS-110223-02B	1	10-Nov-2023 13:04	HG04_451510 Raw Data_7666819	HG
MSCIP-SSS-110223-03A	1	10-Nov-2023 13:05	_7666820	HG
MSCIP-SSS-110223-04A	1	10-Nov-2023 13:07	_7666821	HG
MSCIP-SSS-110223-04B	1	10-Nov-2023 13:09	_7666822	HG
MSCIP-SSS-110223-07A	1	10-Nov-2023 13:10	_7666823	HG
MSCIP-SSS-110223-09A	1	10-Nov-2023 13:12	_7666824	HG
MSCIP-SSS-110223-10A	1	10-Nov-2023 13:14	_7666825	HG
MSCIP-SSS-110223-11A	1	10-Nov-2023 13:15	_7666826	HG
MSCIP-SSS-110223-12A	1	10-Nov-2023 13:17	_7666827	HG
MSCIP-SSS-110223-13A	1	10-Nov-2023 13:19	_7666828	HG
CCV 4	1	10-Nov-2023 13:21	_7666829	HG
CCB 3	1	10-Nov-2023 13:22	_7666830	HG
MSCIP-SSS-110223-13B	1	10-Nov-2023 13:24	_7666831	HG
MSCIP-SSS-110223-14A	1	10-Nov-2023 13:26	_7666832	HG
MSCIP-SSS-110223-14B	1	10-Nov-2023 13:27	_7666833	HG
MSCIP-SSS-110223-15A	1	10-Nov-2023 13:29	_7666834	HG
MBLK-203232	1	10-Nov-2023 13:31	_7666835	HG
LCS-203232	1	10-Nov-2023 13:33	_7666836	HG
MSCIP-SSS-110223-16A	1	10-Nov-2023 13:34	_7666837	HG
MSCIP-SSS-110223-17A	1	10-Nov-2023 13:36	_7666838	HG
MSCIP-SSS-110323-18A	1	10-Nov-2023 13:38	_7666839	HG
MSCIP-SSS-110323-18B	1	10-Nov-2023 13:39	_7666840	HG
CCV 5	1	10-Nov-2023 13:44	_7666841	HG
CCB 4	1	10-Nov-2023 13:45	_7666842	HG
MSCIP-SSS-110323-19A	1	10-Nov-2023 13:47	_7666843	HG
MSCIP-SSS-110323-19B	1	10-Nov-2023 13:49	_7666844	HG
MSCIP-SSS-110323-20A	1	10-Nov-2023 13:50	_7666845	HG
MSCIP-SSS-110323-20B	1	10-Nov-2023 13:52	_7666846	HG
MSCIP-SSS-110323-21A	1	10-Nov-2023 13:54	_7666847	HG
MSCIP-SSS-110323-21AMS	1	10-Nov-2023 13:56	_7666848	HG
MSCIP-SSS-110323-21AMSD	1	10-Nov-2023 13:59	_7666849	HG
MSCIP-SSS-110323-70	1	10-Nov-2023 14:01	_7666868	HG
MSCIP-SSS-110323-22A	1	10-Nov-2023 14:02	_7666869	HG
MSCIP-SSS-110323-22B	1	10-Nov-2023 14:04	_7666870	HG
CCV 6	1	10-Nov-2023 14:06	_7666871	HG

FORM 13 - ANALYSIS RUN LOG

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291
Start Date: 10-Nov-2023 End Date: 10-Nov-2023

Run ID:HG04_451510
Instrument:HG04
Method:SW7470A

Sample No.	D/F	Time	FileID	Analytes
CCB 5	1	10-Nov-2023 14:08	_7666872	HG
MSCIP-SSS-110323-23A	1	10-Nov-2023 14:09	_7666873	HG
MSCIP-SSS-110323-24A	1	10-Nov-2023 14:11	_7666874	HG
CCV 7	1	10-Nov-2023 14:29	_7666883	HG
CCB 6	1	10-Nov-2023 14:30	_7666884	HG
CCV 8	1	10-Nov-2023 14:49	_7666895	HG
CCB 7	1	10-Nov-2023 14:51	_7666896	HG
CCV 9	1	10-Nov-2023 15:13	_7666907	HG
CCB 8	1	10-Nov-2023 15:14	_7666908	HG
CCV 10	1	10-Nov-2023 15:33	_7666919	HG
CCB 9	1	10-Nov-2023 15:35	_7666920	HG
CCV 11	1	10-Nov-2023 15:39	_7666922	HG
CCB 10	1	10-Nov-2023 15:41	_7666923	HG

Form 2 - Initial and Continuing Calibration Verification

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451411
Instrument: HG04
Method: SW7470A

ICCV1	Date: 09-Nov-2023 12:37		Seq: 7664312	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.06	101	90-110	

ICV	Date: 09-Nov-2023 12:39		Seq: 7664313	ICV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.12	102	90-110	

CCV2	Date: 09-Nov-2023 13:05		Seq: 7664286	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.11	102	90-110	

CCV3	Date: 09-Nov-2023 13:32		Seq: 7664298	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.08	102	90-110	

CCV4	Date: 09-Nov-2023 13:55		Seq: 7664310	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.1	102	90-110	

CCV5	Date: 09-Nov-2023 14:21		Seq: 7664326	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.13	103	90-110	

CCV6	Date: 09-Nov-2023 14:47		Seq: 7664338	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.1	102	90-110	

CCV7	Date: 09-Nov-2023 15:20		Seq: 7664344	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.07	101	90-110	

CCV8	Date: 09-Nov-2023 15:54		Seq: 7664653	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.03	101	90-110	

CCV9	Date: 09-Nov-2023 16:16		Seq: 7664663	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	4.96	99	90-110	

CCV10	Date: 09-Nov-2023 16:43		Seq: 7665133	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	4.96	99	90-110	

CCV11	Date: 09-Nov-2023 17:07		Seq: 7665145	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	4.97	99	90-110	

CCV12	Date: 09-Nov-2023 17:31		Seq: 7665157	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	4.96	99	90-110	

CCV13	Date: 09-Nov-2023 17:56		Seq: 7665169	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	4.95	99	90-110	

Form 2 - Initial and Continuing Calibration Verification

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451411
Instrument: HG04
Method: SW7470A

CCV14 Date: 09-Nov-2023 18:22 Seq: 7665181 CCV Units: ug/L

Analyte	True	Found	%R	Control Limits	Flag
Mercury	5	4.97	99	90-110	

CCV15 Date: 09-Nov-2023 18:53 Seq: 7665193 CCV Units: ug/L

Analyte	True	Found	%R	Control Limits	Flag
Mercury	5	4.94	99	90-110	

CCV16 Date: 09-Nov-2023 19:13 Seq: 7665202 CCV Units: ug/L

Analyte	True	Found	%R	Control Limits	Flag
Mercury	5	4.95	99	90-110	

CCV17 Date: 09-Nov-2023 19:30 Seq: 7665206 CCV Units: ug/L

Analyte	True	Found	%R	Control Limits	Flag
Mercury	5	4.8	96	90-110	

Form 2 - Initial and Continuing Calibration Verification

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451510
Instrument: HG04
Method: SW7470A

ICCV1	Date: 10-Nov-2023 12:23		Seq: 7666850	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.08	102	90-110	

ICV	Date: 10-Nov-2023 12:24		Seq: 7666851	ICV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.11	102	90-110	

CCV2	Date: 10-Nov-2023 12:34		Seq: 7666854	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.04	101	90-110	

CCV3	Date: 10-Nov-2023 12:58		Seq: 7666866	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5	100	90-110	

CCV4	Date: 10-Nov-2023 13:21		Seq: 7666829	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.05	101	90-110	

CCV5	Date: 10-Nov-2023 13:44		Seq: 7666841	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.03	101	90-110	

CCV6	Date: 10-Nov-2023 14:06		Seq: 7666871	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.04	101	90-110	

CCV7	Date: 10-Nov-2023 14:29		Seq: 7666883	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.03	101	90-110	

CCV8	Date: 10-Nov-2023 14:49		Seq: 7666895	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.02	100	90-110	

CCV9	Date: 10-Nov-2023 15:13		Seq: 7666907	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.05	101	90-110	

CCV10	Date: 10-Nov-2023 15:33		Seq: 7666919	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.04	101	90-110	

CCV11	Date: 10-Nov-2023 15:39		Seq: 7666922	CCV	Units: ug/L
Analyte	**True**	**Found**	**%R**	**Control Limits**	**Flag**
Mercury	5	5.04	101	90-110	

Form 3 - BLANKS

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451411
Instrument: HG04
Method: SW7470A

ICB	Date: 09-Nov-2023 12:40	Seq: 7664314	ICB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.036	0.03	0.2	J

CCB1	Date: 09-Nov-2023 13:07	Seq: 7664287	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.034	0.03	0.2	J

CCB2	Date: 09-Nov-2023 13:34	Seq: 7664299	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.035	0.03	0.2	J

CCB3	Date: 09-Nov-2023 13:57	Seq: 7664311	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.033	0.03	0.2	J

CCB4	Date: 09-Nov-2023 14:23	Seq: 7664327	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.035	0.03	0.2	J

CCB5	Date: 09-Nov-2023 14:49	Seq: 7664339	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.031	0.03	0.2	J

CCB6	Date: 09-Nov-2023 15:22	Seq: 7664345	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.034	0.03	0.2	J

CCB7	Date: 09-Nov-2023 15:56	Seq: 7664654	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.039	0.03	0.2	J

CCB8	Date: 09-Nov-2023 16:18	Seq: 7664664	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.033	0.03	0.2	J

CCB9	Date: 09-Nov-2023 16:45	Seq: 7665134	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.041	0.03	0.2	J

CCB10	Date: 09-Nov-2023 17:08	Seq: 7665146	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.031	0.03	0.2	J

MBLK-203269	Date: 09-Nov-2023 17:16	Seq: 7665149	MBLK	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB11	Date: 09-Nov-2023 17:32	Seq: 7665158	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.035	0.03	0.2	J

CCB12	Date: 09-Nov-2023 17:58	Seq: 7665170	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.034	0.03	0.2	J

CCB13	Date: 09-Nov-2023 18:24	Seq: 7665182	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	-0.036	0.03	0.2	J

Form 3 - BLANKS

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451411
Instrument: HG04
Method: SW7470A

CCB14	Date: 09-Nov-2023 18:55		Seq: 7665194	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	-0.032	0.03	0.2	J	

CCB15	Date: 09-Nov-2023 19:15		Seq: 7665203	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	-0.032	0.03	0.2	J	

CCB16	Date: 09-Nov-2023 19:32		Seq: 7665207	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**	
Mercury	-0.034	0.03	0.2	J	

Form 3 - BLANKS

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Run ID: HG04_451510
Instrument: HG04
Method: SW7470A

ICB	Date: 10-Nov-2023 12:26	Seq: 7666852	ICB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB1	Date: 10-Nov-2023 12:36	Seq: 7666855	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

MBLK-203230	Date: 10-Nov-2023 12:41	Seq: 7666856	MBLK	Units: mg/Kg
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.003325	0.00047	0.003325	U

CCB2	Date: 10-Nov-2023 12:59	Seq: 7666867	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB3	Date: 10-Nov-2023 13:22	Seq: 7666830	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

MBLK-203232	Date: 10-Nov-2023 13:31	Seq: 7666835	MBLK	Units: mg/Kg
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.003325	0.00047	0.003325	U

CCB4	Date: 10-Nov-2023 13:45	Seq: 7666842	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB5	Date: 10-Nov-2023 14:08	Seq: 7666872	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB6	Date: 10-Nov-2023 14:30	Seq: 7666884	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB7	Date: 10-Nov-2023 14:51	Seq: 7666896	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB8	Date: 10-Nov-2023 15:14	Seq: 7666908	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB9	Date: 10-Nov-2023 15:35	Seq: 7666920	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

CCB10	Date: 10-Nov-2023 15:41	Seq: 7666923	CCB	Units: ug/L
Analyte	**Result**	**MDL**	**Report Limit**	**Qual**
Mercury	0.2	0.03	0.2	U

Form 5A - Matrix Spike/Matrix Spike Duplicate Recovery

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Date Analyzed: 09-Nov-2023 17:26
Date Extracted: 09-Nov-2023 09:30
Units: ug/L

Matrix Spike: HS23110253-05MS
Client Sample ID:
Analysis Method: SW7470A

Analyte	Sample Result	MS Result	Spike Amount	% Rec	MSD Result	Spike Amount	% Rec	% Rec Limits	RPD	RPD Limit
Mercury	0.2000	1.030	5.000	21.3	1.180	5.000	24.3	75-125	13.6	20

Matrix Spike: HS23110479-01MS
Client Sample ID:
Analysis Method: SW7470A

Analyte	Sample Result	MS Result	Spike Amount	% Rec	MSD Result	Spike Amount	% Rec	% Rec Limits	RPD	RPD Limit
Mercury	0.2000	5.320	5.000	107	5.220	5.000	105	75-125	1.90	20

Form 5A - Matrix Spike/Matrix Spike Duplicate Recovery

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Date Analyzed: 10-Nov-2023 12:51
Date Extracted: 10-Nov-2023 08:30
Units: mg/Kg

Matrix Spike: HS23101921-02MS — Analysis Method: SW7471B
Client Sample ID:

Analyte	Sample Result	MS Result	Spike Amount	% Rec	MSD Result	Spike Amount	% Rec	% Rec Limits	RPD	RPD Limit
Mercury	0.003420	0.3283	0.3420	95.0	0.3193	0.3354	94.2	85-115	2.78	20

Matrix Spike: HS23110291-26MS — Analysis Method: SW7471B
Client Sample ID: MSCIP-SSS-110323-21A

Analyte	Sample Result	MS Result	Spike Amount	% Rec	MSD Result	Spike Amount	% Rec	% Rec Limits	RPD	RPD Limit
Mercury	0.08594	0.4589	0.3389	110	0.4597	0.3390	110	85-115	0.181	20

Form 7 - Laboratory Control Sample

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Date Analyzed: 09-Nov-2023 17:17
Date Extracted: 09-Nov-2023 09:30
Units: ug/L

Lab Sample ID: LCS-203269
Analysis Method: SW7470A

Analyte	Spike Amount	LCS Result	% Rec	% Rec Limits
Mercury	5	5.57	111	80-120

Form 7 - Laboratory Control Sample

Client: Benchmark Ecological Services
Project: 98003-115 MSCIP
WorkOrder: HS23110291

Date Analyzed: 10-Nov-2023 12:42
Date Extracted: 10-Nov-2023 08:30
Units: mg/Kg

Lab Sample ID: LCS-203230 Analysis Method: SW7471B

Analyte	Spike Amount	LCS Result	% Rec	% Rec Limits
Mercury	0.3333	0.3327	100	85-115

Lab Sample ID: LCS-203232 Analysis Method: SW7471B

Analyte	Spike Amount	LCS Result	% Rec	% Rec Limits
Mercury	0.3333	0.33	99	85-115

Report Generated By Teledyne Leeman QuickTrace

Analyst: ALSHS.NoUser,

Worksheet file: C:\Users\Public\Documents\Teledyne CETAC\QuickTrace\Worksheets\110923AW.wszf

Creation Date: 11/9/2023 12:08:08 PM

Comment:

Results

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
Calibration Blank					STD	11/09/23 12:24:02 pm	0.000	20	109.52		
	Replicates	9.3	49.7	24.6	-2.0						
Standard #1 (0.2 ppb)					STD	11/09/23 12:25:44 pm	0.200	1302	1.87	-12.90%	
	Replicates	1288.1	1281.3	1303.3	1335.9						
Standard #2 (0.5 ppb)					STD	11/09/23 12:27:27 pm	0.500	3378	0.73	0.30%	
	Replicates	3350.0	3375.7	3377.7	3409.9						
Standard #3 (2.0 ppb)					STD	11/09/23 12:29:09 pm	2.000	13214	0.31	2.59%	
	Replicates	13170.6	13186.4	13242.6	13254.4						
Standard #4 (5.0 ppb)					STD	11/09/23 12:30:52 pm	5.000	32540	0.12	1.97%	
	Replicates	32498.9	32530.9	32535.1	32595.3						
Standard #5 (10.0 ppb)					STD	11/09/23 12:32:36 pm	10.000	62956	0.12	-1.07%	
	Replicates	62854.2	62953.6	62998.9	63019.3						

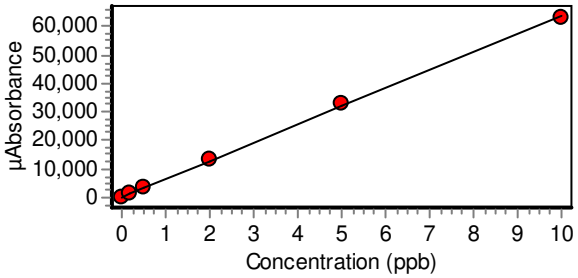
Calibration

Equation: Abs = 6343.805x + 197.064

R2: 0.99967 RSE: 7.71%

SEE: 503.9985

Flags:



ICCV					UNK	11/09/23 12:37:34 pm	5.060	32299	0.71		
	Replicates	31992.7	32269.1	32424.3	32508.8						
ICV					UNK	11/09/23 12:39:16 pm	5.120	32668	0.62		
	Replicates	32431.3	32619.8	32707.9	32914.6						
ICB					UNK	11/09/23 12:40:57 pm	-0.036	-29	10.62		
	Replicates	-35.3	5.5	-49.9	-37.1						
CRA					UNK	11/09/23 12:42:39 pm	0.167	1254	0.95		
	Replicates	1262.4	1261.8	1249.8	1241.6						
CCV					UNK	11/09/23 01:05:36 pm	5.110	32625	0.15		
	Replicates	32573.1	32600.3	32641.3	32686.8						
CCB					UNK	11/09/23 01:07:20 pm	-0.034	-19	6.43		
	Replicates	-27.8	1.8	-22.6	-26.6						
MBLK-203261					UNK	11/09/23 01:14:12 pm	-0.021	65	21.38		
	Replicates	90.0	29.9	85.3	53.1						

Sample Name			Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
LCS-203261			UNK	11/09/23 01:15:54 pm	5.370	34247	0.33		
Replicates	34373.1	34223.9	34107.3	34282.5					
MBLKT1-202975			UNK	11/09/23 01:17:36 pm	-0.026	32	12.69		
Replicates	41.2	55.6	24.4	7.2					
MBLKT2-202898			UNK	11/09/23 01:19:19 pm	-0.018	80	13.13		
Replicates	62.3	99.5	81.3	75.9					
MBLKT3-203181			UNK	11/09/23 01:21:01 pm	-0.024	45	16.04		
Replicates	15.3	49.5	40.0	74.3					
MBLKT4-203182			UNK	11/09/23 01:22:44 pm	-0.021	63	7.79		
Replicates	52.3	71.2	55.8	72.8					
HS23101690-01			UNK	11/09/23 01:24:27 pm	-0.018	81	25.79		
Replicates	73.6	117.8	45.6	86.6					
HS23101690-02			UNK	11/09/23 01:26:10 pm	-0.018	84	16.14		
Replicates	100.9	71.8	97.8	64.6					
HS23101690-03			UNK	11/09/23 01:27:51 pm	-0.021	61	20.74		
Replicates	29.7	49.7	96.4	66.8					
HS23101693-01			UNK	11/09/23 01:29:33 pm	-0.013	117	29.20		
Replicates	126.4	137.1	83.1	120.3					
CCV			UNK	11/09/23 01:32:42 pm	5.080	32398	0.28		
Replicates	32286.1	32393.8	32409.2	32503.4					
CCB			UNK	11/09/23 01:34:25 pm	-0.035	-25	12.93		
Replicates	-2.4	2.2	-53.8	-44.6					
HS23110159-01			UNK	11/09/23 01:38:35 pm	-0.021	65	5.25		
Replicates	55.4	63.6	71.4	68.2					
HS23110173-01			UNK	11/09/23 01:40:17 pm	-0.021	65	14.79		
Replicates	59.9	54.6	93.6	51.0					
HS23110173-02			UNK	11/09/23 01:41:59 pm	-0.025	38	14.70		
Replicates	46.0	32.5	8.2	63.8					
HS23110173-03			UNK	11/09/23 01:43:41 pm	-0.027	28	16.75		
Replicates	14.3	64.8	32.7	-1.1					
HS23110173-04			UNK	11/09/23 01:45:23 pm	-0.031	-1	16.29		
Replicates	10.0	19.3	-48.9	16.1					
HS23110182-01			UNK	11/09/23 01:47:06 pm	-0.023	49	13.53		
Replicates	76.1	40.2	49.0	29.0					
HS23110182-02			UNK	11/09/23 01:48:48 pm	-0.023	50	22.00		
Replicates	18.9	49.7	36.5	94.7					
HS23110182-03			UNK	11/09/23 01:50:31 pm	-0.015	102	21.76		
Replicates	94.1	114.3	123.4	77.4					

Sample Name		Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110182-04		UNK	11/09/23 01:52:14 pm	-0.023	52	12.58		
Replicates	54.8	46.3	76.1	32.7				
HS23110182-04MS		UNK	11/09/23 01:53:57 pm	5.490	35015	0.31		
Replicates	34855.4	35035.4	35077.9	35089.4				
CCV		UNK	11/09/23 01:55:59 pm	5.100	32532	0.10		
Replicates	32514.2	32506.2	32529.4	32580.0				
CCB		UNK	11/09/23 01:57:43 pm	-0.033	-12	7.33		
Replicates	-7.1	2.7	-33.5	-10.3				
HS23110182-04MSD		UNK	11/09/23 02:01:21 pm	5.700	36375	0.18		
Replicates	36386.6	36426.6	36407.6	36279.3				
HS23110182-05		UNK	11/09/23 02:03:03 pm	-0.030	9	23.64		
Replicates	-0.1	42.9	42.9	-50.7				
HS23110182-06		UNK	11/09/23 02:04:44 pm	-0.020	71	17.10		
Replicates	44.8	93.0	83.2	62.2				
HS23110182-07		UNK	11/09/23 02:06:26 pm	-0.019	74	21.94		
Replicates	98.8	93.2	41.2	62.8				
HS23110182-08		UNK	11/09/23 02:08:08 pm	-0.024	44	7.71		
Replicates	54.2	42.2	27.8	51.0				
HS23110182-09		UNK	11/09/23 02:09:50 pm	-0.023	52	11.44		
Replicates	53.2	54.0	31.0	71.4				
HS23110182-10		UNK	11/09/23 02:11:33 pm	-0.025	37	15.39		
Replicates	38.1	69.2	30.0	9.8				
HS23110182-11		UNK	11/09/23 02:13:15 pm	-0.023	53	10.44		
Replicates	31.1	62.4	63.8	53.5				
MBLK-203262		UNK	11/09/23 02:14:58 pm	-0.025	37	10.31		
Replicates	38.5	22.0	28.2	59.6				
LCS-203262		UNK	11/09/23 02:16:40 pm	5.490	35055	0.27		
Replicates	34941.7	35018.9	35100.3	35157.3				
CCV		UNK	11/09/23 02:21:30 pm	5.130	32754	0.32		
Replicates	32655.3	32686.8	32788.1	32885.6				
CCB		UNK	11/09/23 02:23:14 pm	-0.035	-25	7.83		
Replicates	-8.4	-31.4	-46.0	-12.8				
MBLKT1-203182		UNK	11/09/23 02:24:57 pm	-0.025	42	25.44		
Replicates	47.0	94.4	3.2	21.4				
MBLKT2-203181		UNK	11/09/23 02:26:40 pm	-0.023	51	9.00		
Replicates	47.5	45.9	70.7	41.5				
MBLKT3-203035		UNK	11/09/23 02:28:21 pm	-0.025	39	24.41		
Replicates	93.7	28.1	31.8	3.0				

Sample Name		Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
MBLKT4-202898		UNK	11/09/23 02:30:03 pm	-0.025	36	9.61		
Replicates	46.3	36.4	47.0	13.8				
HS23101824-01		UNK	11/09/23 02:31:45 pm	-0.023	53	6.00		
Replicates	47.2	49.9	48.5	65.7				
HS23101863-01		UNK	11/09/23 02:33:27 pm	-0.018	80	13.00		
Replicates	81.7	57.8	89.4	90.6				
HS23101863-02		UNK	11/09/23 02:35:09 pm	-0.026	29	13.57		
Replicates	29.1	4.6	59.6	24.0				
HS23110182-12		UNK	11/09/23 02:36:51 pm	-0.012	123	45.18		
Replicates	131.3	73.7	148.3	138.3				
HS23110182-13		UNK	11/09/23 02:38:33 pm	-0.021	63	22.74		
Replicates	37.2	78.8	98.5	38.5				
HS23110182-14		UNK	11/09/23 02:40:16 pm	-0.017	90	22.49		
Replicates	101.8	98.8	54.1	105.3				
CCV		UNK	11/09/23 02:47:50 pm	5.100	32569	0.17		
Replicates	32491.8	32602.6	32571.3	32610.8				
CCB		UNK	11/09/23 02:49:34 pm	-0.031	1	11.71		
Replicates	29.6	-26.0	-3.7	4.2				
HS23110182-15		UNK	11/09/23 02:56:37 pm	-0.021	65	14.15		
Replicates	61.5	82.6	75.2	40.0				
HS23110182-15MS		UNK	11/09/23 03:00:27 pm	5.330	34036	0.27		
Replicates	33941.3	34079.6	33984.2	34140.6				
HS23110182-15MSD		UNK	11/09/23 03:04:29 pm	5.380	34357	0.48		
Replicates	34256.8	34190.1	34424.1	34555.3				
HS23110259-01		UNK	11/09/23 03:06:12 pm	-0.024	46	17.97		
Replicates	39.9	51.1	13.5	79.1				
MBLK-203265		UNK	11/09/23 03:07:54 pm	-0.011	127	31.52		
Replicates	145.6	133.0	94.4	133.2				
LCS-203265		UNK	11/09/23 03:09:36 pm	5.430	34670	1.02		
Replicates	34334.4	34421.8	34841.6	35080.6				
HS23101662-03		UNK	11/09/23 03:11:18 pm	0.020	321	29.28		
Replicates	346.5	357.0	302.2	280.0				
HS23101662-04		UNK	11/09/23 03:13:00 pm	0.072	656	2.62		
Replicates	661.1	665.5	657.7	638.3				
HS23101763-01		UNK	11/09/23 03:14:42 pm	-0.021	61	18.60		
Replicates	73.8	75.8	23.5	72.3				
HS23101765-01		UNK	11/09/23 03:16:25 pm	-0.012	120	31.64		
Replicates	120.7	85.7	135.3	139.1				

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
CCV					UNK	11/09/23 03:20:16 pm	5.070	32349	0.18		
	Replicates	32265.0	32376.6	32366.0	32387.8						
CCB					UNK	11/09/23 03:22:00 pm	-0.034	-18	13.78		
	Replicates	5.4	-2.6	-61.0	-14.8						
HS23101766-01					UNK	11/09/23 03:23:42 pm	-0.030	4	17.45		
	Replicates	45.9	-2.5	7.1	-36.1						
HS23101798-02					UNK	11/09/23 03:25:25 pm	-0.026	30	18.53		
	Replicates	24.2	59.1	48.5	-10.5						
HS23101798-03					UNK	11/09/23 03:27:07 pm	-0.024	42	10.07		
	Replicates	52.7	38.6	56.2	22.0						
HS23101798-03MS					UNK	11/09/23 03:28:50 pm	5.190	33132	0.25		
	Replicates	33037.4	33141.1	33112.3	33235.3						
HS23101798-03MSD					UNK	11/09/23 03:30:33 pm	5.610	35799	0.41		
	Replicates	35747.7	36014.8	35726.6	35708.6						
HS23110033-02 X2					UNK	11/09/23 03:35:53 pm	6.350	40475	0.47		
	Replicates	40252.4	40402.4	40552.4	40691.1						
HS23110033-03 X100					UNK	11/09/23 03:45:45 pm	3.030	19443	0.11		
	Replicates	19470.4	19445.3	19435.2	19419.8						
HS23110089-01					UNK	11/09/23 03:47:27 pm	0.001	203	430.28		
	Replicates	208.2	235.6	186.4	181.1						
HS23110089-02					UNK	11/09/23 03:49:09 pm	0.010	260	44.71		
	Replicates	259.0	280.7	220.5	279.5						
HS23110089-03					UNK	11/09/23 03:50:51 pm	-0.024	43	10.17		
	Replicates	57.7	22.5	52.3	39.1						
CCV					UNK	11/09/23 03:54:55 pm	5.030	32120	0.24		
	Replicates	32034.6	32078.4	32180.8	32185.4						
CCB					UNK	11/09/23 03:56:39 pm	-0.039	-48	6.53		
	Replicates	-41.6	-61.9	-60.5	-28.5						
HS23110089-04					UNK	11/09/23 03:58:21 pm	-0.027	27	11.24		
	Replicates	41.7	28.7	-1.1	36.7						
HS23110089-05					UNK	11/09/23 04:00:03 pm	0.054	540	6.46		
	Replicates	535.2	512.0	546.0	565.0						
HS23110089-06					UNK	11/09/23 04:01:45 pm	-0.030	8	6.68		
	Replicates	22.8	-4.3	13.4	-0.9						
HS23110089-07					UNK	11/09/23 04:03:28 pm	-0.018	84	15.78		
	Replicates	100.0	58.9	87.3	91.3						
HS23110122-01					UNK	11/09/23 04:05:10 pm	0.029	379	3.14		
	Replicates	379.3	380.8	370.4	383.6						

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110124-01				UNK	11/09/23 04:06:53 pm	-0.027	26	6.06		
	Replicates	15.5	27.0	39.4	20.2					
HS23110559-01				UNK	11/09/23 04:08:36 pm	1.610	10419	0.63		
	Replicates	10427.5	10463.3	10460.8	10325.8					
HS23110559-02				UNK	11/09/23 04:10:19 pm	2.830	18152	0.54		
	Replicates	18025.9	18134.8	18192.8	18253.3					
MBLK-203268				UNK	11/09/23 04:12:01 pm	-0.029	10	7.56		
	Replicates	30.4	-2.5	6.1	6.7					
LCS-203268				UNK	11/09/23 04:13:44 pm	5.470	34870	0.55		
	Replicates	35114.8	34927.7	34751.1	34687.3					
CCV				UNK	11/09/23 04:16:17 pm	4.960	31667	0.44		
	Replicates	31497.2	31634.4	31712.6	31825.0					
CCB				UNK	11/09/23 04:18:01 pm	-0.033	-11	9.06		
	Replicates	5.6	5.4	-25.3	-28.8					
HS23101798-04				UNK	11/09/23 04:21:12 pm	-0.023	49	15.99		
	Replicates	54.3	66.7	61.0	14.4					
HS23101798-05				UNK	11/09/23 04:22:54 pm	-0.027	26	16.91		
	Replicates	26.6	47.6	-15.0	45.0					
HS23101798-05MS				UNK	11/09/23 04:27:36 pm	4.890	31226	0.21		
	Replicates	31320.9	31223.8	31187.6	31172.6					
HS23101798-05MSD				UNK	11/09/23 04:31:26 pm	5.020	32050	0.82		
	Replicates	32436.2	31984.0	31873.0	31905.8					
HS23101798-06				UNK	11/09/23 04:33:08 pm	-0.066	-219	5.79		
	Replicates	-195.6	-251.7	-219.7	-208.1					
HS23101798-07				UNK	11/09/23 04:34:50 pm	-0.032	-7	20.30		
	Replicates	29.1	27.3	-32.5	-51.9					
HS23101798-08				UNK	11/09/23 04:36:33 pm	-0.022	58	13.92		
	Replicates	67.3	36.1	80.1	50.1					
HS23101798-09				UNK	11/09/23 04:38:16 pm	-0.028	19	11.17		
	Replicates	-8.8	33.1	17.1	33.7					
HS23101798-10				UNK	11/09/23 04:39:59 pm	-0.027	26	8.22		
	Replicates	33.9	27.0	36.4	5.4					
HS23101798-12				UNK	11/09/23 04:41:42 pm	-0.033	-9	6.20		
	Replicates	-7.9	7.6	-22.4	-15.0					
CCV				UNK	11/09/23 04:43:44 pm	4.960	31631	0.25		
	Replicates	31551.6	31575.2	31687.8	31708.2					
CCB				UNK	11/09/23 04:45:28 pm	-0.041	-65	4.81		
	Replicates	-70.6	-50.1	-60.5	-79.3					

Sample Name			Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23101798-13			UNK	11/09/23 04:48:52 pm	-0.026	35	22.95		
Replicates	50.5	-14.3	29.1	73.3					
HS23101798-14			UNK	11/09/23 04:50:35 pm	-0.016	98	3.98		
Replicates	94.9	93.9	100.3	101.9					
HS23101798-15			UNK	11/09/23 04:52:18 pm	-0.024	48	14.43		
Replicates	23.0	38.3	59.5	71.2					
HS23101934-01			UNK	11/09/23 04:54:00 pm	-0.038	-46	16.33		
Replicates	-83.1	0.6	-26.8	-74.4					
HS23101934-02			UNK	11/09/23 04:55:43 pm	-0.050	-120	5.04		
Replicates	-105.0	-111.7	-141.5	-123.7					
HS23101934-03			UNK	11/09/23 04:57:25 pm	-0.038	-43	6.86		
Replicates	-35.1	-67.9	-33.3	-36.7					
HS23101934-04			UNK	11/09/23 04:59:08 pm	-0.037	-40	8.97		
Replicates	-38.1	-15.7	-37.9	-67.5					
HS23101934-05			UNK	11/09/23 05:00:51 pm	-0.030	9	11.40		
Replicates	-1.8	14.2	-13.6	36.0					
HS23101934-06			UNK	11/09/23 05:02:33 pm	-0.036	-32	4.36		
Replicates	-30.0	-41.6	-19.2	-38.4					
HS23110224-01			UNK	11/09/23 05:04:16 pm	-0.024	46	14.11		
Replicates	51.3	73.6	30.8	27.4					
CCV			UNK	11/09/23 05:07:05 pm	4.970	31738	0.28		
Replicates	31636.3	31706.3	31768.3	31840.1					
CCB			UNK	11/09/23 05:08:48 pm	-0.031	2	7.89		
Replicates	18.5	-18.5	4.1	5.5					
HS23110253-01			UNK	11/09/23 05:12:36 pm	0.018	314	18.35		
Replicates	326.5	287.0	335.6	308.0					
HS23110253-02			UNK	11/09/23 05:14:19 pm	-0.018	80	22.76		
Replicates	48.3	73.0	84.0	112.8					
MBLK-203269			UNK	11/09/23 05:16:02 pm	-0.023	53	12.14		
Replicates	75.5	55.3	48.8	33.3					
LCS-203269			UNK	11/09/23 05:17:44 pm	5.570	35528	1.34		
Replicates	34986.3	35323.8	35719.6	36080.8					
HS23110253-03			UNK	11/09/23 05:19:27 pm	-0.022	59	10.98		
Replicates	66.4	36.5	66.3	67.4					
HS23110253-04			UNK	11/09/23 05:21:09 pm	-0.026	33	31.26		
Replicates	43.9	92.4	-32.0	26.8					
HS23110253-05			UNK	11/09/23 05:22:52 pm	-0.033	-13	6.86		
Replicates	-20.2	-22.9	8.3	-17.3					

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110253-05MS					UNK	11/09/23 05:24:35 pm	0.797	5255	0.59		
	Replicates	5244.4	5223.0	5294.5	5258.4						
HS23110253-05MSD					UNK	11/09/23 05:26:17 pm	1.180	7659	1.23		
	Replicates	7768.8	7699.4	7598.8	7569.8						
HS23110253-06					UNK	11/09/23 05:28:00 pm	-0.066	-224	7.64		
	Replicates	-203.3	-259.9	-191.1	-241.5						
CCV					UNK	11/09/23 05:31:06 pm	4.960	31653	0.32		
	Replicates	31577.0	31585.7	31653.5	31795.7						
CCB					UNK	11/09/23 05:32:50 pm	-0.035	-25	5.28		
	Replicates	-34.4	-34.1	-10.1	-20.7						
HS23110291-32					UNK	11/09/23 05:36:26 pm	-0.029	11	3.05		
	Replicates	14.2	9.7	16.1	3.3						
HS23110291-33					UNK	11/09/23 05:38:09 pm	-0.025	36	9.20		
	Replicates	39.6	35.8	17.0	52.8						
HS23110479-01					UNK	11/09/23 05:39:52 pm	-0.021	67	5.24		
	Replicates	73.4	72.3	62.3	60.0						
HS23110479-01MS					UNK	11/09/23 05:41:35 pm	5.320	33923	0.59		
	Replicates	33686.4	33843.6	34019.0	34143.4						
HS23110479-01MSD					UNK	11/09/23 05:43:18 pm	5.220	33325	0.56		
	Replicates	33135.8	33255.6	33334.4	33574.4						
HS23110479-02					UNK	11/09/23 05:45:00 pm	-0.019	79	23.84		
	Replicates	51.5	100.3	58.4	106.3						
MBLK-203270					UNK	11/09/23 05:46:43 pm	-0.027	28	20.61		
	Replicates	15.8	77.2	-4.4	25.0						
LCS-203270					UNK	11/09/23 05:48:26 pm	5.010	32009	0.26		
	Replicates	31894.6	32023.1	32028.7	32091.4						
HS23110297-01					UNK	11/09/23 05:50:09 pm	-0.032	-4	7.72		
	Replicates	-6.2	17.9	-18.3	-9.9						
HS23110297-01MS					UNK	11/09/23 05:54:21 pm	5.280	33687	0.25		
	Replicates	33724.8	33771.8	33577.8	33673.9						
CCV					UNK	11/09/23 05:56:52 pm	4.950	31580	0.32		
	Replicates	31436.8	31584.7	31635.3	31661.9						
CCB					UNK	11/09/23 05:58:36 pm	-0.034	-21	12.51		
	Replicates	-12.1	3.2	-59.8	-13.6						
HS23110297-01MSD					UNK	11/09/23 06:04:37 pm	5.420	34568	1.22		
	Replicates	35056.9	34744.0	34376.8	34093.8						
HS23110298-01					UNK	11/09/23 06:06:20 pm	-0.030	8	9.43		
	Replicates	17.1	-3.6	-9.4	28.8						

Sample Name		Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110299-01		UNK	11/09/23 06:08:03 pm	-0.024	45	17.11		
Replicates	76.6	55.3	20.5	26.8				
HS23110299-02		UNK	11/09/23 06:09:46 pm	-0.021	61	18.23		
Replicates	44.8	37.6	92.0	69.6				
HS23110299-03		UNK	11/09/23 06:11:29 pm	-0.027	24	15.71		
Replicates	-16.0	40.3	39.5	34.0				
HS23110299-04		UNK	11/09/23 06:13:12 pm	-0.028	18	12.36		
Replicates	-12.7	28.4	38.3	19.0				
HS23110301-01		UNK	11/09/23 06:14:55 pm	-0.019	77	15.69		
Replicates	71.8	53.2	95.3	88.3				
HS23110302-01		UNK	11/09/23 06:16:38 pm	-0.022	58	14.50		
Replicates	78.2	30.3	60.7	63.7				
HS23110303-01		UNK	11/09/23 06:18:21 pm	-0.016	95	33.29		
Replicates	97.8	132.5	49.9	99.5				
HS23110304-01		UNK	11/09/23 06:20:04 pm	-0.020	69	17.79		
Replicates	83.2	34.7	79.3	77.9				
CCV		UNK	11/09/23 06:22:27 pm	4.970	31710	0.29		
Replicates	31609.2	31686.1	31717.5	31828.1				
CCB		UNK	11/09/23 06:24:11 pm	-0.036	-29	19.33		
Replicates	-13.7	15.5	-88.2	-28.1				
HS23110308-01		UNK	11/09/23 06:28:12 pm	0.056	551	4.75		
Replicates	534.8	555.3	542.5	573.3				
HS23110309-01		UNK	11/09/23 06:29:55 pm	-0.029	13	11.38		
Replicates	-10.8	2.8	27.8	33.6				
HS23110310-01		UNK	11/09/23 06:31:38 pm	-0.026	30	18.57		
Replicates	45.2	-15.4	38.6	52.6				
MBLK-203289		UNK	11/09/23 06:33:21 pm	-0.024	46	7.39		
Replicates	54.6	47.3	53.1	30.3				
LCS-203289		UNK	11/09/23 06:37:02 pm	5.500	35104	0.32		
Replicates	35227.8	35161.8	35044.2	34981.0				
MBLKT-203111		UNK	11/09/23 06:38:45 pm	-0.028	17	3.58		
Replicates	14.6	12.5	26.5	14.1				
HS23101863-01		UNK	11/09/23 06:40:28 pm	-0.021	64	5.61		
Replicates	74.9	58.3	60.1	64.1				
HS23101863-01MS		UNK	11/09/23 06:44:25 pm	5.490	35007	0.15		
Replicates	34945.3	34985.5	35040.5	35057.1				
HS23101863-01MSD		UNK	11/09/23 06:48:22 pm	5.240	33415	0.43		
Replicates	33561.8	33494.3	33366.3	33238.3				

Sample Name	Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23101863-02	UNK	11/09/23 06:50:05 pm	-0.024	46	10.07		
Replicates	60.2	38.3	56.8	28.3			
CCV	UNK	11/09/23 06:53:17 pm	4.940	31526	0.38		
Replicates	31380.9	31481.6	31586.4	31654.6			
CCB	UNK	11/09/23 06:55:01 pm	-0.032	-2	8.91		
Replicates	-13.6	23.4	-14.6	-5.2			
MBLK-203290	UNK	11/09/23 06:56:44 pm	-0.023	54	12.53		
Replicates	43.6	37.4	55.0	78.2			
LCS-203290	UNK	11/09/23 07:00:35 pm	5.410	34491	0.11		
Replicates	34445.2	34484.4	34495.8	34539.8			
MBLKT1-203107	UNK	11/09/23 07:02:18 pm	-0.030	5	6.52		
Replicates	1.6	13.1	-11.9	15.5			
HS23101863-01	UNK	11/09/23 07:04:01 pm	-0.026	31	16.53		
Replicates	10.4	12.6	69.8	30.0			
HS23101863-01MS	UNK	11/09/23 07:07:52 pm	5.580	35614	0.19		
Replicates	35518.6	35673.4	35630.9	35634.9			
HS23101863-01MSD	UNK	11/09/23 07:09:35 pm	4.950	31595	0.59		
Replicates	31353.3	31562.4	31673.2	31790.0			
HS23101863-02	UNK	11/09/23 07:11:19 pm	-0.027	27	9.72		
Replicates	40.4	4.3	23.5	37.9			
CCV	UNK	11/09/23 07:13:24 pm	4.950	31612	0.43		
Replicates	31452.1	31566.3	31660.5	31769.3			
CCB	UNK	11/09/23 07:15:08 pm	-0.032	-7	7.33		
Replicates	-9.1	2.6	6.2	-27.0			
HS23110253-05MSD	UNK	11/09/23 07:27:32 pm	1.030	6759	0.72		
Replicates	6798.6	6782.6	6763.0	6692.2			
CCV	UNK	11/09/23 07:30:28 pm	4.800	30646	0.10		
Replicates	30614.0	30629.0	30683.6	30656.6			
CCB	UNK	11/09/23 07:32:12 pm	-0.034	-20	3.66		
Replicates	-16.0	-30.2	-21.2	-11.8			

Report Generated By Teledyne Leeman QuickTrace

Analyst: ALSHS.NoUser,

Worksheet file: C:\Users\Public\Documents\Teledyne CETAC\QuickTrace\Worksheets\111023AS.wszf

Creation Date: 11/10/2023 11:37:56 AM

Comment:

Results

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
Calibration Blank				STD	11/10/23 12:07:28 pm	0.000	116	27.54		
Replicates	107.8	112.7	160.4	84.1						
Standard #1 (0.05 ppb)				STD	11/10/23 12:09:10 pm	0.050	511	3.93	-5.15%	
Replicates	506.0	529.3	484.5	523.0						
Standard #2 (0.2 ppb)				STD	11/10/23 12:10:53 pm	0.200	1721	1.58	0.30%	
Replicates	1730.9	1680.9	1739.7	1733.5						
Standard #3 (0.5 ppb)				STD	11/10/23 12:12:35 pm	0.500	4092	0.39	0.11%	
Replicates	4101.3	4109.0	4079.4	4076.3						
Standard #4 (2.0 ppb)				STD	11/10/23 12:14:18 pm	2.000	15939	0.45	-0.02%	
Replicates	15858.2	15904.6	15972.2	16019.4						
Standard #5 (5.0 ppb)				STD	11/10/23 12:16:01 pm	5.000	39927	0.28	0.70%	
Replicates	39785.4	39888.6	40018.6	40014.4						
Standard #6 (10.0 ppb)				STD	11/10/23 12:17:45 pm	10.000	78829	0.34	-0.42%	
Replicates	78488.3	78759.1	78947.0	79120.5						

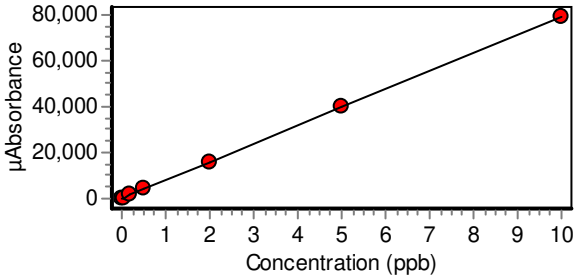
Calibration

Equation: Abs = 7902.845x + 135.894

R2: 0.99996 RSE: 2.61%

SEE: 194.9311

Flags:



ICCV				UNK	11/10/23 12:23:04 pm	5.080	40277	0.37		
Replicates	40124.4	40206.8	40301.4	40474.6						
ICV				UNK	11/10/23 12:24:45 pm	5.110	40483	0.34		
Replicates	40310.8	40459.6	40527.8	40635.6						
ICB				UNK	11/10/23 12:26:27 pm	-0.004	103	39.61		
Replicates	101.6	117.8	87.0	107.4						
CRA				UNK	11/10/23 12:28:09 pm	0.049	526	6.22		
Replicates	531.5	493.0	551.5	526.0						
CCV				UNK	11/10/23 12:34:26 pm	5.040	39927	0.43		
Replicates	39732.5	39855.4	39991.1	40129.1						
CCB				UNK	11/10/23 12:36:10 pm	-0.005	97	65.85		
Replicates	122.8	66.1	88.7	112.3						

Sample Name			Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
MBLK-203230			UNK	11/10/23 12:41:05 pm	-0.001	131	152.27		
Replicates	128.4	140.0	121.4	133.2					
LCS-203230			UNK	11/10/23 12:42:47 pm	4.990	39599	0.41		
Replicates	39390.5	39557.2	39706.6	39740.0					
HS23101863-01			UNK	11/10/23 12:44:29 pm	8.950	70836	0.38		
Replicates	70485.3	70782.1	70987.7	71087.3					
HS23101863-02			UNK	11/10/23 12:46:12 pm	7.710	61103	0.28		
Replicates	61238.9	61230.3	61059.3	60883.3					
HS23101921-02			UNK	11/10/23 12:47:54 pm	0.050	530	6.70		
Replicates	506.0	509.6	548.3	557.8					
HS23101921-02MS			UNK	11/10/23 12:49:37 pm	4.800	38045	0.42		
Replicates	37877.9	37962.4	38096.4	38244.8					
HS23101921-02MSD			UNK	11/10/23 12:51:20 pm	4.760	37735	0.59		
Replicates	37497.2	37620.4	37815.2	38005.8					
HS23110291-01			UNK	11/10/23 12:53:03 pm	0.903	7276	0.40		
Replicates	7246.3	7257.1	7297.3	7302.7					
HS23110291-02			UNK	11/10/23 12:54:44 pm	1.010	8117	0.81		
Replicates	8049.5	8075.0	8162.5	8181.6					
HS23110291-03			UNK	11/10/23 12:56:25 pm	0.227	1930	1.64		
Replicates	1915.1	1960.7	1896.3	1947.1					
CCV			UNK	11/10/23 12:58:09 pm	5.000	39615	0.37		
Replicates	39414.1	39609.1	39695.7	39742.9					
CCB			UNK	11/10/23 12:59:53 pm	-0.009	62	33.49		
Replicates	94.1	56.3	62.5	33.9					
HS23110291-04			UNK	11/10/23 01:04:01 pm	0.112	1018	2.11		
Replicates	994.3	1019.8	1019.3	1039.8					
HS23110291-05			UNK	11/10/23 01:05:43 pm	7.840	62094	0.43		
Replicates	61769.4	62009.1	62207.3	62390.7					
HS23110291-06			UNK	11/10/23 01:07:25 pm	0.806	6506	0.74		
Replicates	6451.5	6488.1	6522.5	6561.4					
HS23110291-07			UNK	11/10/23 01:09:07 pm	1.040	8331	0.60		
Replicates	8269.3	8313.7	8365.0	8375.0					
HS23110291-08			UNK	11/10/23 01:10:49 pm	0.279	2340	1.01		
Replicates	2328.2	2358.9	2313.9	2357.8					
HS23110291-09			UNK	11/10/23 01:12:32 pm	1.640	13060	0.60		
Replicates	12973.3	13028.0	13087.0	13152.2					
HS23110291-10			UNK	11/10/23 01:14:14 pm	1.100	8856	0.47		
Replicates	8820.8	8822.0	8885.8	8897.3					

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110291-11					UNK	11/10/23 01:15:57 pm	1.460	11708	0.51		
	Replicates	11629.7	11702.4	11731.0	11767.8						
HS23110291-12					UNK	11/10/23 01:17:40 pm	1.020	8228	0.53		
	Replicates	8210.7	8196.4	8212.8	8290.6						
HS23110291-13					UNK	11/10/23 01:19:23 pm	4.050	32152	0.52		
	Replicates	31975.1	32061.2	32223.9	32349.6						
CCV					UNK	11/10/23 01:21:07 pm	5.050	40023	0.52		
	Replicates	39786.1	39944.1	40087.3	40272.9						
CCB					UNK	11/10/23 01:22:51 pm	-0.010	56	10.78		
	Replicates	61.8	63.7	44.7	55.5						
HS23110291-14					UNK	11/10/23 01:24:32 pm	7.040	55788	0.53		
	Replicates	55476.6	55631.1	55894.8	56149.9						
HS23110291-15					UNK	11/10/23 01:26:14 pm	1.790	14313	0.62		
	Replicates	14218.7	14260.1	14396.1	14378.9						
HS23110291-16					UNK	11/10/23 01:27:55 pm	6.400	50703	0.20		
	Replicates	50608.9	50644.9	50716.9	50839.9						
HS23110291-17					UNK	11/10/23 01:29:37 pm	2.440	19391	0.51		
	Replicates	19282.6	19331.6	19476.6	19471.6						
MBLK-203232					UNK	11/10/23 01:31:19 pm	-0.006	91	19.62		
	Replicates	90.5	81.7	102.9	90.7						
LCS-203232					UNK	11/10/23 01:33:01 pm	4.950	39241	0.42		
	Replicates	39030.4	39198.6	39335.1	39401.8						
HS23110291-18					UNK	11/10/23 01:34:43 pm	0.951	7653	0.57		
	Replicates	7596.1	7680.5	7643.0	7691.3						
HS23110291-19					UNK	11/10/23 01:36:26 pm	1.190	9559	0.55		
	Replicates	9509.8	9549.7	9542.1	9632.5						
HS23110291-20					UNK	11/10/23 01:38:08 pm	0.685	5546	0.33		
	Replicates	5524.1	5553.0	5565.2	5540.4						
HS23110291-21					UNK	11/10/23 01:39:51 pm	0.205	1758	0.85		
	Replicates	1740.7	1754.7	1765.3	1772.7						
CCV					UNK	11/10/23 01:44:03 pm	5.030	39853	0.34		
	Replicates	39694.2	39810.0	39891.4	40014.6						
CCB					UNK	11/10/23 01:45:47 pm	-0.004	102	57.87		
	Replicates	101.4	110.4	74.2	120.4						
HS23110291-22					UNK	11/10/23 01:47:30 pm	3.330	26466	0.39		
	Replicates	26341.5	26434.1	26508.7	26581.7						
HS23110291-23					UNK	11/10/23 01:49:13 pm	0.202	1728	1.28		
	Replicates	1717.4	1711.4	1727.4	1757.2						

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110291-24				UNK	11/10/23 01:50:54 pm	1.030	8270	0.38		
Replicates	8236.1	8251.4	8295.2	8296.4						
HS23110291-25				UNK	11/10/23 01:52:36 pm	0.287	2405	1.12		
Replicates	2370.3	2402.8	2428.9	2417.6						
HS23110291-26				UNK	11/10/23 01:54:18 pm	1.270	10188	0.42		
Replicates	10126.8	10193.7	10214.9	10216.7						
HS23110291-26MS				UNK	11/10/23 01:56:00 pm	6.770	53599	0.63		
Replicates	53195.8	53483.1	53741.9	53973.8						
HS23110291-26MSD				UNK	11/10/23 01:59:32 pm	6.780	53684	0.49		
Replicates	53372.8	53593.9	53787.1	53980.7						
HS23110291-27				UNK	11/10/23 02:01:14 pm	0.697	5642	0.29		
Replicates	5619.6	5639.7	5653.5	5653.3						
HS23110291-28				UNK	11/10/23 02:02:56 pm	0.885	7127	0.79		
Replicates	7047.5	7140.6	7141.2	7177.4						
HS23110291-29				UNK	11/10/23 02:04:39 pm	1.120	9021	0.25		
Replicates	8996.0	9010.7	9030.8	9046.8						
CCV				UNK	11/10/23 02:06:23 pm	5.040	39973	0.48		
Replicates	39764.6	39881.3	40045.1	40200.5						
CCB				UNK	11/10/23 02:08:07 pm	-0.006	92	63.71		
Replicates	114.8	50.5	99.4	101.7						
HS23110291-30				UNK	11/10/23 02:09:49 pm	0.674	5462	0.87		
Replicates	5415.8	5431.8	5481.1	5517.5						
HS23110291-31				UNK	11/10/23 02:11:32 pm	0.271	2275	1.31		
Replicates	2271.4	2275.0	2243.0	2311.4						
HS23110307-01				UNK	11/10/23 02:13:15 pm	0.235	1989	0.80		
Replicates	1999.0	1980.3	1973.1	2004.1						
HS23110307-02				UNK	11/10/23 02:14:58 pm	0.316	2635	0.98		
Replicates	2606.6	2665.4	2628.6	2638.2						
HS23110307-03				UNK	11/10/23 02:16:40 pm	0.162	1413	0.77		
Replicates	1425.0	1417.1	1402.9	1408.1						
HS23110307-04				UNK	11/10/23 02:18:22 pm	0.220	1872	1.39		
Replicates	1844.8	1858.9	1885.7	1897.3						
HS23110307-05				UNK	11/10/23 02:20:04 pm	0.211	1806	0.77		
Replicates	1810.6	1815.1	1787.3	1812.3						
HS23110307-06				UNK	11/10/23 02:21:46 pm	0.842	6786	0.70		
Replicates	6726.7	6777.6	6805.0	6836.6						
MBLK-203233				UNK	11/10/23 02:23:28 pm	-0.006	85	39.12		
Replicates	109.1	82.4	88.4	60.8						

Sample Name					Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
LCS-203233					UNK	11/10/23 02:25:10 pm	5.000	39681	0.33		
	Replicates	39531.4	39648.9	39701.1	39842.4						
CCV					UNK	11/10/23 02:29:13 pm	5.030	39883	0.41		
	Replicates	39681.8	39824.3	39975.6	40049.9						
CCB					UNK	11/10/23 02:30:57 pm	-0.004	102	76.11		
	Replicates	98.8	99.3	136.4	74.3						
HS23110307-07					UNK	11/10/23 02:32:40 pm	0.089	839	1.23		
	Replicates	833.2	838.7	833.5	851.7						
HS23110307-07MS					UNK	11/10/23 02:34:22 pm	4.990	39598	0.49		
	Replicates	39352.5	39547.4	39699.1	39792.4						
HS23110307-07MSD					UNK	11/10/23 02:36:05 pm	5.060	40120	0.45		
	Replicates	39938.8	40019.9	40176.6	40343.1						
HS23110307-08					UNK	11/10/23 02:37:47 pm	0.134	1192	0.89		
	Replicates	1181.0	1187.7	1197.5	1201.9						
HS23110307-09					UNK	11/10/23 02:39:30 pm	0.088	832	1.43		
	Replicates	820.1	830.9	844.3	834.3						
HS23110307-10					UNK	11/10/23 02:41:13 pm	0.219	1867	1.28		
	Replicates	1842.1	1869.9	1895.2	1860.6						
HS23110307-11					UNK	11/10/23 02:42:55 pm	0.284	2383	0.86		
	Replicates	2363.1	2379.1	2379.4	2409.6						
HS23110307-12					UNK	11/10/23 02:44:38 pm	0.192	1654	1.55		
	Replicates	1669.1	1662.2	1665.2	1618.8						
HS23110307-13					UNK	11/10/23 02:46:20 pm	0.328	2726	0.74		
	Replicates	2703.1	2721.8	2728.6	2749.6						
HS23110307-14					UNK	11/10/23 02:48:02 pm	0.197	1695	2.50		
	Replicates	1655.2	1668.3	1726.4	1730.4						
CCV					UNK	11/10/23 02:49:46 pm	5.020	39779	0.61		
	Replicates	39507.4	39676.1	39869.1	40062.6						
CCB					UNK	11/10/23 02:51:30 pm	-0.005	95	43.15		
	Replicates	82.0	78.3	101.9	116.3						
HS23110307-15					UNK	11/10/23 02:53:12 pm	0.274	2302	1.74		
	Replicates	2293.8	2252.5	2337.5	2323.5						
HS23110307-16					UNK	11/10/23 02:54:55 pm	0.072	708	2.70		
	Replicates	690.3	713.6	701.6	726.2						
HS23110307-17					UNK	11/10/23 02:56:37 pm	0.188	1618	2.37		
	Replicates	1640.2	1578.3	1599.7	1654.1						
HS23110307-18					UNK	11/10/23 02:58:20 pm	0.146	1286	2.42		
	Replicates	1251.5	1302.6	1277.2	1313.9						

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
HS23110307-19				UNK	11/10/23 03:00:02 pm	0.160	1400	1.95		
	Replicates	1394.0	1400.3	1373.1	1432.7					
HS23110307-20				UNK	11/10/23 03:01:45 pm	4.330	34393	0.61		
	Replicates	34133.1	34321.9	34517.9	34600.4					
HS23110307-21				UNK	11/10/23 03:03:28 pm	0.119	1073	2.37		
	Replicates	1052.2	1072.6	1103.8	1062.9					
HS23110307-22				UNK	11/10/23 03:05:11 pm	0.202	1734	0.56		
	Replicates	1722.2	1739.7	1742.4	1733.3					
HS23110307-23				UNK	11/10/23 03:06:53 pm	0.101	935	5.60		
	Replicates	901.6	996.6	902.2	938.0					
HS23110307-24				UNK	11/10/23 03:08:35 pm	0.210	1798	1.07		
	Replicates	1775.7	1815.2	1809.0	1792.4					
CCV				UNK	11/10/23 03:13:01 pm	5.050	40013	0.38		
	Replicates	39840.1	39972.5	40037.9	40202.3					
CCB				UNK	11/10/23 03:14:46 pm	-0.002	116	114.23		
	Replicates	142.9	116.8	88.2	117.5					
HS23110307-25				UNK	11/10/23 03:16:28 pm	0.523	4271	0.49		
	Replicates	4285.2	4289.6	4265.4	4245.6					
HS23110432-01				UNK	11/10/23 03:18:10 pm	0.119	1073	1.44		
	Replicates	1060.0	1082.9	1063.5	1086.7					
MBLK-203234				UNK	11/10/23 03:19:52 pm	-0.002	120	99.78		
	Replicates	126.2	139.3	110.1	104.1					
LCS-203234				UNK	11/10/23 03:21:35 pm	5.010	39747	0.41		
	Replicates	39558.1	39705.5	39775.5	39949.3					
HS23110432-04				UNK	11/10/23 03:23:17 pm	0.118	1068	1.82		
	Replicates	1057.3	1054.3	1068.7	1091.7					
HS23110432-04MS				UNK	11/10/23 03:25:00 pm	5.020	39818	0.57		
	Replicates	39581.9	39703.7	39888.3	40098.9					
HS23110432-04MSD				UNK	11/10/23 03:26:42 pm	5.150	40811	0.47		
	Replicates	40603.7	40703.8	40916.2	41021.6					
HS23110432-07				UNK	11/10/23 03:28:25 pm	0.689	5579	0.52		
	Replicates	5552.9	5563.9	5582.5	5618.1					
HS23110432-10				UNK	11/10/23 03:30:08 pm	0.067	663	4.18		
	Replicates	630.5	672.3	668.5	679.8					
HS23110432-13				UNK	11/10/23 03:31:51 pm	0.255	2149	2.09		
	Replicates	2124.8	2176.2	2103.2	2192.6					
CCV				UNK	11/10/23 03:33:34 pm	5.040	39991	0.34		
	Replicates	39832.1	39951.9	40021.3	40159.3					

Sample Name				Type	Date/Time	Conc (ppb)	µAbs	%RSD	Residual	Flags
CCB				UNK	11/10/23 03:35:18 pm	-0.005	93	37.48		
	Replicates	92.2	85.0	115.6	78.6					
HS23110432-16				UNK	11/10/23 03:37:01 pm	0.193	1665	1.47		
	Replicates	1640.9	1656.4	1668.4	1694.2					
CCV				UNK	11/10/23 03:39:35 pm	5.040	39953	0.59		
	Replicates	39691.5	39842.4	40051.6	40228.1					
CCB				UNK	11/10/23 03:41:20 pm	-0.004	107	149.97		
	Replicates	143.7	140.7	89.9	52.5					

HS23110291 Wetchem Moist-1

ALS WO# HS23110291

ALS Environmental

Analyst	Mahali Roman	Temp In Deg C	105
Method	Moisture_HS_01	Temp Out Deg C	105
Data Analyzed	10-Nov-23 07:48 am	Oven ID	Oven 4
		Balance ID	NA HST BAL016

SampleID	Type	Dish	PanWt (g)	Wet Wt (g)	1st Wt (g)	2nd Wt (g)	3rd Wt (g)	% Moisture	% Solid
HS23110291-01	SAMP	43	0.8165	7.2417	3.2052	3.2054	0	67.00	33.00
HS23110291-02	SAMP	44	0.8122	7.5281	3.7716	3.7715	0	60.70	39.30
HS23110291-03	SAMP	45	0.8252	8.686	7.1857	7.1856	0	26.80	73.20
HS23110291-04	SAMP	46	0.8224	7.4599	6.0369	6.0369	0	30.10	69.90
HS23110291-05	SAMP	47	0.8238	5.9633	6.2321	6.2322	0	9.31	90.69
HS23110291-06	SAMP	48	0.8287	7.1573	3.1564	3.1563	0	67.50	32.50
HS23110291-07	SAMP	49	0.849	6.8483	3.3404	3.3405	0	63.60	36.40
HS23110291-08	SAMP	50	0.856	5.8826	4.5231	4.5231	0	37.70	62.30
HS23110291-09	SAMP	51	0.825	5.9307	4.0343	4.0341	0	45.90	54.10
HS23110291-10	SAMP	52	0.8301	8.7213	5.4097	5.4098	0	47.50	52.50
HS23110291-11	SAMP	53	0.8285	7.0977	4.6258	4.6258	0	46.50	53.50
HS23110291-12	SAMP	54	0.8335	8.527	4.3895	4.3897	0	58.30	41.70
HS23110291-13	SAMP	55	0.8317	6.1023	3.5419	3.5418	0	55.60	44.40
HS23110291-14	SAMP	56	0.8336	8.3122	5.0235	5.0235	0	49.60	50.40
HS23110291-15	SAMP	57	0.842	5.7637	4.1029	4.103	0	43.40	56.60
HS23110291-16	SAMP	58	0.8291	5.6635	3.443	3.443	0	53.80	46.20
HS23110291-17	SAMP	59	0.8126	6.236	4.4015	4.4015	0	42.40	57.60
HS23110291-18	SAMP	60	0.8252	5.4792	3.1122	3.1125	0	58.30	41.70
HS23110291-19	SAMP	61	0.8265	5.2562	3.4324	3.4322	0	50.40	49.60
HS23110291-20	SAMP	62	0.8278	6.6445	3.9726	3.9725	0	52.70	47.30
HS23110291-04DUP	DUP	63	0.8253	7.4529	5.9658	5.9659	0	31.00	69.00

HS23110291 Wetchem Moist-2

ALS WO# HS23110291

ALS Environmental

Analyst	Mahali Roman	Temp In Deg C	105
Method	Moisture_HS_01	Temp Out Deg C	105
Data Analyzed	10-Nov-23 10:08 am	Oven ID	Oven 4
		Balance ID	NA HST BAL016

SampleID	Type	Dish	PanWt (g)	Wet Wt (g)	1st Wt (g)	2nd Wt (g)	3rd Wt (g)	% Moisture	% Solid
HS23110291-21	SAMP	64	0.8162	5.9526	3.9281	3.928	0	47.70	52.30
HS23110291-22	SAMP	65	0.8161	6.775	4.1181	4.1177	0	51.30	48.70
HS23110291-23	SAMP	66	0.8322	6.2613	5.0414	5.0417	0	32.80	67.20
HS23110291-24	SAMP	67	0.8193	5.8538	3.1634	3.1634	0	60.00	40.00
HS23110291-25	SAMP	68	0.8323	5.632	3.5896	3.5896	0	51.00	49.00
HS23110291-26	SAMP	69	0.8095	6.7884	4.433	4.4329	0	46.60	53.40
HS23110291-27	SAMP	70	0.8095	7.2761	4.7182	4.7182	0	46.30	53.70
HS23110291-28	SAMP	71	0.8073	5.673	2.9771	2.9771	0	61.80	38.20
HS23110291-29	SAMP	72	0.8168	7.1619	4.2014	4.2014	0	52.70	47.30
HS23110291-30	SAMP	73	0.8161	7.5956	5.1398	5.1399	0	43.10	56.90
HS23110291-31	SAMP	74	0.8199	7.7891	6.4925	6.4925	0	27.20	72.80
HS23110596-01	SAMP	75	0.8157	6.1396	6.3401	6.3403	0	10.00	90.00
HS23110291-26DUP	DUP	76	0.8146	6.7818	4.5191	4.5193	0	45.40	54.60

Attachment S-1

List of Contract 1 Specifications

01 10 00.00 45	Non-Regulated Special Contract Requirements
01 11 00	Summary of Work
01 20 00	Price and Payment Procedures
01 30 00	Administrative Requirements
01 32 01.00 45	Project Schedule
01 33 00	Submittal Procedures
01 35 26	Governmental Safety Requirements
01 35 53.00 45	Security Procedures
01 42 00	Sources for Reference Publications
01 45 00	Quality Control
01 45 00.15 10	Resident Management System Contractor Mode (RMS CM)
01 50 00	Temporary Construction Facilities and Controls
01 57 20.00 45	Environmental Protection
01 58 13.01 45	Project Identification
01 58 13.04 45	Bulletin Board
01 74 19	Construction Waste Management and Disposal
01 78 00.00 45	Closeout Submittals
02 41 00	Demolition (Abandoned Pipelines)
31 32 19.00 10	Geotextiles for Riprap
35 20 23.12 45	Hopper Dredging
35 20 23.13	National Dredging Quality Management Program – Scow [Monitoring] [and] [Ullage] Profile
35 20 23.14 45	Protection of Sea Turtles
35 20 23.16 45	Pipeline Dredging
35 20 23.18 45	Dredging
35 20 23.23	National Dredging Quality Management Program – Hopper Dredge
35 20 23.33	National Dredging Quality Management Program – Pipeline Hydraulic Dredge
35 31 10.10 45	Dredged Material Placement
35 31 19.40	Stone Revetment