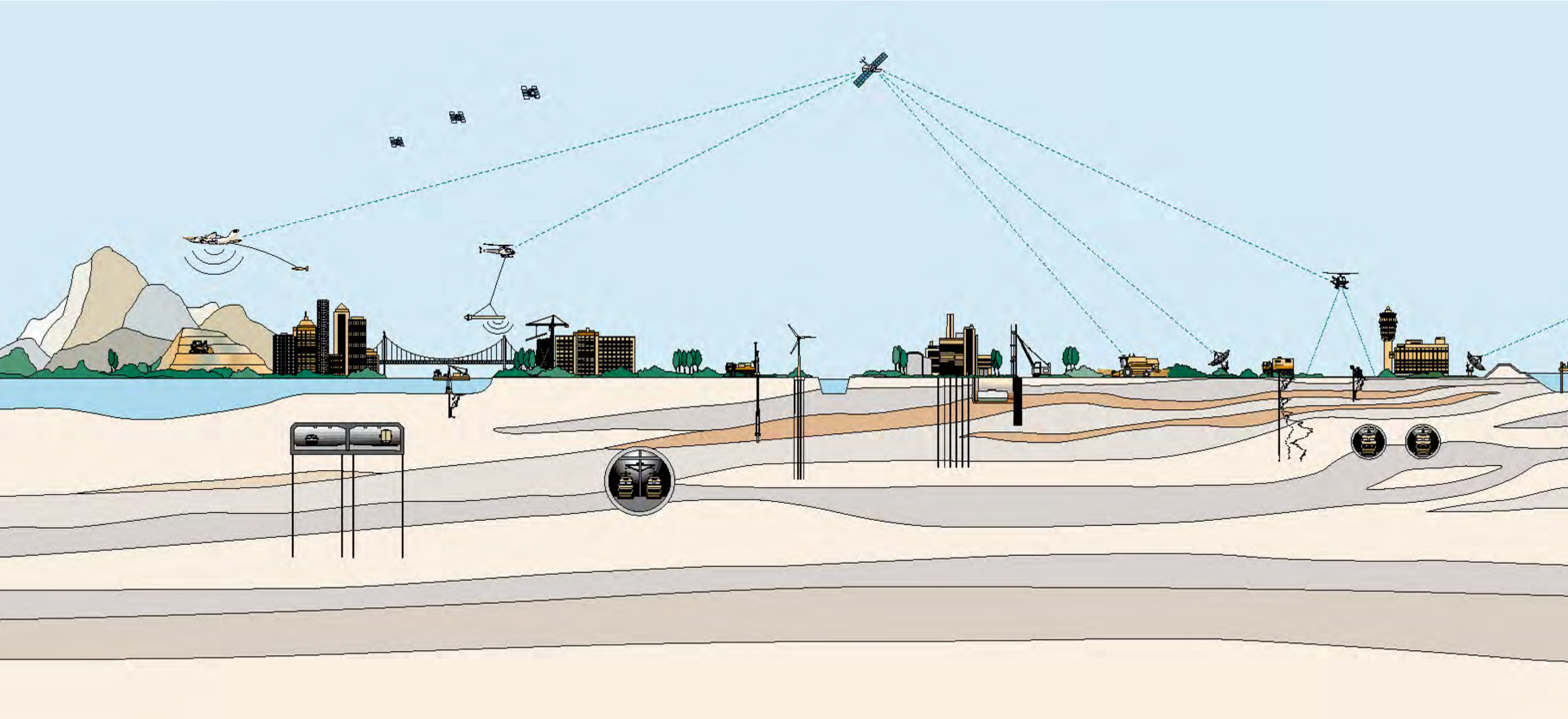
FUGRO USA LAND, INC.

GEOTECHNICAL DATA REPORT CORPUS CHRISTI SHIP CHANNEL, CHANNEL DEEPENING PROJECT PORT OF CORPUS CHRISTI AUTHORITY CORPUS CHRISTI, TEXAS

REPORT NO. 04.10180080



FUGRO USA LAND, INC.

FEBRUARY 19, 2019

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Houston, Texas 77274
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AECOM
5444 Westheimer Rd., Suite 400
Houston, Texas 77056

Attention: Ms. Ashley Judith, P.E.

Geotechnical Data Report
Ship Channel Deepening Project
Port of Corpus Christi Authority
Corpus Christi, Texas

Fugro USA Land Inc. (Fugro) is pleased to present this geotechnical data report performed as part of Port of Corpus Christi Authority (PCCA) Channel Deepening Project extending from the Gulf of Mexico into Harbor Island. Ms. Ashley Judith, P.E. with AECOM requested this study via an e-mail sent to Mr. Tom Posey, P.E. with Fugro on May 2, 2018. AECOM authorized our services under Task Order No. 103224 issued under the existing Master Consulting Services Subcontract dated January 01, 2018 between AECOM Technical Services, Inc. and Fugro USA Land, Inc.

This report presents only the factual information related to the soil borings and associated laboratory testing performed to support the proposed deepening of the ship channel. Our report consists of only data and information as it relates to the geotechnical evaluation of the project area. No recommendation or evaluation was completed as a part of this study. We appreciate the opportunity to work with you on this project and look forward to continuing as your geotechnical consultants. If you need further assistance or have any questions, please contact Fugro at (713) 369 5400.

Sincerely,
FUGRO USA LAND, INC.
TBPE Firm Registration No. 299

for
Andrew E. Bull, E.I.T.
Project Professional

Abhishek S. Shethji, P.E. (Texas)
Engineering Manager

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1.0 INTRODUCTION

1.1. Project Description

Port of Corpus Christi Authority (PCCA) is envisioning developing a Crude Export Terminal at Harbor Island for servicing anticipated VLCC vessels in order to meet the State of Texas' growth and rapid production of crude oil from the nearby Permian Basin. AECOM has been selected by the PCCA to submit permit application for approval to deepen the Corpus Christi Ship Channel from its authorized depth of -54 feet Mean Lower Low Water (MLLW) to -75 feet MLLW from the Gulf of Mexico to Harbor Island to accommodate Very Large Crude Carrier (VLCC) vessels.

Fugro was requested to perform geotechnical investigations from Harbor Island (USACE Station 30+00) to the -75-foot MLLW contour in the Gulf of Mexico (USACE Station at -600+00) only. A site vicinity map is presented on Plate 1 of this report.

1.2. Purpose and Scope

The main purpose of this study was:

- to explore and evaluate subsurface conditions along the proposed channel to be dredged, and
- to provide geotechnical input to support the proposed dredging of the channel

Following is a brief summary of the field investigation program completed for this study.

- Supervision and management of the nearshore field operations;
- Performing a total of thirty-five (35) borings to depths varying between 8 ft and 72 ft below mudline (a minimum El. -85 ft MLLW)
- Performing field and laboratory tests on the selected samples to evaluate geotechnical engineering properties of subsurface soils;
- Generalizing subsurface soil stratigraphy based on the collected subsurface data; and
- Preparing this geotechnical report summarizing our factual findings.

1.3. Applicability of Report

We have prepared this factual report for AECOM for use as geotechnical input for the proposed dredging of the Corpus Christi Ship Channel. The scope of the explorations and tests performed in this report are from Harbor Island (USACE Station 30+00) to the -75 foot MLLW contour in the Gulf of Mexico (USACE Station at -600+00) only. The tests were selected or developed based on our understanding of the project as described in this report and our discussions with Client representatives.

1.4. Limitations

Fugro makes no claim or representation concerning any activity or condition falling outside the specified purposes to which this report is directed. We have conducted our work using the standard level of care and diligence normally practiced by recognized engineering firms now performing similar services under similar circumstances. We intend for this report, including all illustrations, to be used in its entirety. The information presented in this report may not apply to locations not explored by borings or areas outside the project boundaries. This information should be made available to prospective users for information only, and not as a warranty of subsurface conditions.

1.5. Datums

All coordinates are reported in Datum WGS 84, and State Place Coordinate System 1983 (SPCS83) Texas South Zone.

2.0 FIELD EXPLORATION

2.1 General

Overall the field services for the nearshore geotechnical program consisted of drilling and sampling geotechnical borings to support the proposed project. The geotechnical field services were completed between July 29, 2018 and August 17, 2018.

The geotechnical investigation consisted of drilling and sampling 38 borings to various depths depending on mudline elevations at each location. The boring termination depth determined based on minimum requirement to end the boring at El. -85 ft Mean Lower Low Water (MLLW). In order to determine that we were meeting the minimum depth requirements, two measurements were taken 1) deck to mudline (DTM) and 2) deck to water (DTW). From these measurements water depth could be determined and corrected with tide charts to ensure that the specified elevation (El. -85 ft MLLW) was being met. It should be noted that due to time, weather, and logistical constraints three (3) of the original planned borings (BH-23, BH-24, and BH-25) were cancelled, reducing the number of borings to 35.

The drilling and sampling was conducted using a CME 75 drill rig, which was welded to the deck of the Lift Boat (L/B) Petite. Operations were conducted on a 24-hr schedule with two crews and included the Marine Vessel (M/V) Miss Vivian for night-watch and support.

A detailed Project Execution Plan (PEP) providing our field procedures, safety, security, health, environment, and quality plans for the proposed project was submitted to AECOM on July 25, 2018. Hazard Identification (HAZID) workshops were conducted based on our execution plan along with representatives from various technical disciplines, field SSHE representatives, site managers, and project manager.

Locations of soil borings are presented on Plate 2 of this report. A detailed description of our equipment/vessel details and methodologies about the exploration activities are described in our PEP. A brief description of various field activities is provided in the following sections of this report.

2.2 Staging Area

Prior to mobilizing to Corpus Christi, the L/B Petite was stationed at Martin Dock in Galveston, TX where the drill rig was driven onto, and secured to the deck. A pre-fabricated cantilevered working platform was also secured to the deck so that the drilling could take place over the side of the L/B Petite. The base of operations for the project in Corpus Christi was the Martin Dock; where supplies and additional personnel were loaded and unloaded during the ongoing field services.

2.3 Vessels and Equipment

Geotechnical drilling operations were conducted from a subcontracted class 150 liftboat L/B Petite owned and operated by Laredo group. The Lift Boat is self-propelled equipped with twin GM 6V-

71N, maximum speed is 8-10 knots, average sailing speed is 4-5 knots. The Lift Boat is fitted with two cranes, a 70-ton and a 10-ton auxiliary crane.

Drilling operations were completed using CME-75 Truck-Mounted Drill Rig owned and operated by Fugro. The rig was positioned on the L/B Petite such that drilling operations could be conducted over the front deck through a “stinger” or “moon pull” on the work platform. The drilling equipment consisted of 4.0-inch diameter HW casing w/ 4.0-inch carbine bit, NWJ rods, Shelby tubes, and split spoon samplers.

Facilities aboard the L/B Petite consisted of an elevated work platform that is 79 ft in overall length x 59 ft beam, with a draft of 5.5 ft, 2800 square feet of open deck space and accommodations for twenty-eight including crew along with four heads or bathrooms. The maximum working depth was 85 ft with a 25 ft air gap.

The M/V Miss Vivian was used as a support/crew vessel which included a 41 ft x 16 ft rear deck and was used as a Guard / Watch Vessel as well as crew transfer / support vessel in the areas that were prone to rougher sea conditions due to its size and weight. The Guard Vessel attended the Lift Boat during the hours of darkness and during completion of the sensitive boring locations within the Harbor Island channel area.

Specifications for the vessels and equipment used for the nearshore geotechnical investigation are presented in Appendix A.

2.4 Permits & Coordination

All permits for offshore drilling and sampling were provided by AECOM prior to commencement of the project. However, Fugro was responsible and involved in meetings and calls with the United States Coast Guard (USCG), Port of Corpus Christi Authority (PCCA), and the Aransas-Corpus Christi Pilots.

2.5 Surveying and Positioning

The L/B Petite utilized Fugro’s Office Assisted Remote Services (OARS) system which enabled the L/B Petite to position within an acceptable range of the location. Surveyed as-built coordinates and elevations for the marine explorations including the “Starfix Final Positioning Reports” are presented in Appendix B.

Borings BH-28 and 29 were relocated due to ship wrecks nearby the original boring locations. A tolerance of 8-ft was considered allowable unless the seas were unfavorable. After being settled on location the L/B Petite was jacked up out of the influence of the wave, usually about 1-ft to 2-ft out of the water. The boat was then allowed to settle depending on if the bottom was hard or soft. Once the vessel was jacked-up on location, a GPS system (Fugro Starfix Positioning System) was used to record the location of the exploration at the start of each borehole drilling. Coordinates of the actual locations were reported in SPCS83 (State Plane Coordinate System 1983) Texas South Zone (US Survey feet) and WGS84 (World Geodetic System 1984) coordinate systems.

2.6 Water Depth and Seabed Elevation

Once the platform was positioned at a location, water depth measurements were taken prior to the commencement of drilling operations with a weighted tape. The weight was dropped down the casing to minimize the current's effect on the measurement. Seafloor elevations measured are presented on Plate B-1 and B-2 in Appendix B.

2.7 Equipment Inspections

All vessels were inspected by the US Coast Guard within the last 12 months. Prior to mobilization from Galveston to Corpus Christi, a sailing checklist was completed as well as an inspection by Fugro's On Site Project Manager to ensure all equipment is in working order and secured for mobilization.

2.8 Geotechnical Borings

A total of thirty-five (35) marine geotechnical borings were drilled below the mudline line to varying depths. Summary of the completed borings is provided in Appendix B and the plan of borings can be found on Plate 2. The drilling of the geotechnical borings was conducted from July 30th through August 17th of 2018.

Upon mobilization to Corpus Christi, the L/B Petite was positioned outside of the ship channel near boring BH-07 where M/V Miss Vivian transported crew to the L/B Petite. The drilling and execution of the borings began with BH-07 out into the Gulf of Mexico to boring BH-01 (See Plate 2) to enable clearance of a pipeline which was in close relation to BH-01. Following the completion of BH-01, the Petite positioned on BH-08 and then completed borings in numerical order while working in towards the coast until finished with BH-20. Following the completion of BH-20 the borings were completed in a non-numerical order due to weather, tidal current, ship traffic, and other logistical issues.

Detailed descriptions of the soils encountered in the borings drilled for this study are presented on the boring logs in Appendix C on Plates C-1 through C-38. A key identifying the terms and symbols used on the boring logs is presented on Plates C-39a and C-39b. Field activities related to geotechnical borings, drilling and sampling methods, and borehole completion are discussed herein.

<u>Drilling Methods.</u> Drilling was performed over the bow of the L/B Petite using a CME-75 drill rig. A drilling casing (4.0-in OD) was run from deck level to the seafloor through which the rods were run through. The pipe was positioned down a few feet below the seabed especially in granular materials. Drilling fluid consisting of sea water and MI-Swaco Duo-Vis polymer drilling mud were used in the rotary drilling process to remove the cuttings from the drill hole, and to stabilize the boring walls during the drill process. The water was pumped from the sea into the holding tank aboard the deck of the jack-up. The drilling fluids were circulated in a mud tank adjacent to the drill rig.

Drilling additives (MI-Swaco's Duo-Vis Biopolymer) were added to the water to stabilize the borehole and provide for circulation during the drilling process. The additives were mixed onsite in the mud tank on an as-needed basis.

Mud rotary drilling was accomplished by lowering the sampler through the casing to the seafloor and obtaining the first sample. Once the soil sample was retrieved, the casing was rotated with a drill bit into the soil formation before the next sample interval. As the sampling progressed into the subsurface, drilling fluid was pumped from the mud tank, through the top drive mechanism, down the casing, through the drill bit, and up the casing where it returned back into the mud tank. As the fluid passes through the bit, the drill cuttings were incorporated into the fluid and returned to the mud tank. As the fluid circulated through the mud tank, the drill cuttings settled from suspension.

Casing was required to stabilize the upper/near surface of the boreholes. At the completion of the borehole all casing was recovered. Sampling was performed within soil materials using pushed or driven sampling techniques as appropriate.

Procedure for Advancing the Borehole. Sediment samples were taken with either, Shelby tube or split spoon sampler. Sands were encountered at the seabed and below that caused borehole instability; the casing was required to advance to a depth suitable to isolate this formation. Sampling and testing were performed in front of advancing casing.

Sampling Methods. Sampling was performed in 2-ft intervals; continuously from 0 to 16-ft below the mudline and every 5-ft thereafter to the termination depth of the boring. All sampling was completed in accordance with ASTM standards. Both the driller and the geotechnical engineer on shift kept accurate logs of all activities performed and all recovered materials. The sampling program for cohesive materials involved pushing Shelby tubes to collect undisturbed samples as described below. Sampling in granular materials consisted of percussion sampling as described below.

- Push Sampling. High-quality cohesive samples were collected by pushing a 3-in Shelby tube into the soil formation with the weight of the drill pipe. After the boring is drilled to the desired sampling depth, the drill rod and bit were raised to the deck, removed and the sampler was attached at the base of the drill rod. The drill rod was then lowered to the base of the hole and the sampler pushed about 24-in into the soil by pushing the drill rod with the drill rig top drive. The sampler was retrieved by pulling it out of the soil formation with the drill rig up to the deck. After retrieving the sampler, the soil sampler was removed, the drill bit installed, lowered, and the boring is advanced with wet rotary techniques, then the sampling process is repeated.

  The field procedure for cohesive soil sampling was conducted in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587). Pocket penetrometer and/or hand Torvane readings were generally conducted in the recovered soil materials exposed in the bottom ends of the tube samples where appropriate and when possible. The readings are reported on the respective boring logs presented in Appendix C and on the summary of test results in Appendix D.

- Pocket Penetrometer Tests. This test is performed by slowly pressing a small flat-ended cylindrical metal rod (6.3 mm diameter) into the flat surface of the soil sample through a spring until it is embedded a predetermined depth within the sample. The resistance to penetration is recorded by the spring that is calibrated to read the unconfined compressive strength of the soil based on spring compression.
- Torvane Tests. In the Torvane test, a small hand-operated device, consisting of a metal disc with thin, radial vanes projecting from one face, is pressed against the flat surface of the soil until the vanes are fully embedded. The device is then rotated through a torsion spring until the soil is sheared. The device is calibrated to indicate the undrained shear strength of the soil directly from the rotation of the torsion spring. In this case, all Torvane readings were taken using the large fin, or vane adapter.

- Standard Penetration Testing. Granular materials were recovered by conventional percussion sampling using the Standard Penetration Testing (SPT) technique in general accordance with ASTM Standard (ASTM D1586). The sampler was attached to the base of the drill pipe after the boring had been advanced to the desired sampling depth similar to the push sampling effort. The sampler consists of a 2-in OD split-barrel with core catcher attached to a 140-lb sliding weight that is dropped about 30-in a sufficient number of times to obtain 18-in sampler penetration, a maximum of 50 blows in one interval, or 100 blows total. The SPT N-values, defined as the number of blows required for a 140 lbs hammer falling 30-in to drive the split-barrel sampler the final 12-in of the 18-in sampling interval, are recorded during sampling and are presented on the boring logs presented in Appendix C.

2.9 Borehole Completion

Borings were not backfilled with grout, and the borings were allowed to cave-in once the drilling and sampling was completed.

2.10 Sample Storage and Shipping

Fugro's field geotechnical engineer visually classified and logged the recovered soil samples collected at each boring location. The recovered samples were labeled and transported to the Fugro laboratory in Houston, TX. The following outlines our general procedure for sample storage and shipping:

- Soil samples were immediately logged, sealed, and labeled with project number, date, depth, boring number, etc. upon collection.
- All disturbed samples were packaged in plastic bags and labeled for further storage and shipping. The soil samples recovered with Shelby tubes were extruded, logged, and

packaged in appropriate containers (plastic quart and bag samples) for storage and shipment.

Soil sample transportation to the laboratory in Houston, TX was provided by a Fugro employee from the Martin Energy dock while refueling and dumping trash during the middle of the project, and at the end of the project by the project engineer/geologist.

3.0 LABORATORY TESTING

3.1 General

The laboratory-testing program was designed to evaluate pertinent engineering properties of the existing soils. All the laboratory testing assignments were assigned by the Fugro geotechnical engineer and sent to AECOM for review and approval. The laboratory testing was performed at Fugro's Houston Laboratory located in Houston, Texas. Summary of test results is presented on a table in Appendix D, on Plates D1-1 through D1-9. The following sections present brief description of the soil tests performed on the selected samples. Laboratory tests were performed in general accordance with ASTM standards and are summarized in Table 3.1.

3.2 Classification Tests

The classification tests included visual soil classification, tests for natural water content, liquid and plastic limits (collectively termed Atterberg limits), sieve analysis, material finer than the No. 200 and sieve (percent fines). These tests aid in classifying the soils and are used to correlate the results of other tests performed on samples taken from different borings and/or different depths. The results of these tests are presented on the boring logs in Appendix C. Summary of test results is presented on a table in Appendix D, on Plates D1-1 through D1-9. Grain size curves and plasticity charts are also presented in Appendix D, on Plates D2-1 through D2-16 and D3-1 through D3-10, respectively.

3.3 Unconsolidated-Undrained Triaxial Compression Tests (UU)

The undrained shear strength was evaluated for selected undisturbed samples of cohesive soils by performing unconsolidated-undrained (UU) triaxial compression tests (ASTM D2850) for intact samples. The natural water content and dry unit weights were determined as routine parts of the laboratory strength tests. The results of the laboratory undrained shear strength tests, along with the field estimates of undrained shear strength, are presented on the boring logs in Appendix C and in summary tables in Appendix D, on Plates D1-1 through D1-9.

3.4 Summary of Laboratory Tests

The laboratory tests were performed in general accordance with ASTM standards and are presented in Table 3.1 along with the quantity of each test type performed.

Table 3.1: Summary of Laboratory Tests

Laboratory Test	Testing Standard	Quantity
Water Content	ASTM D2216	79
Unit Weights	ASTM D2166	8
Atterberg Limits	ASTM D4318	47
Sieve Analysis	ASTM D422	79
Percent Finer than No. 200 Sieve	ASTM D1140	92
Unconsolidated-Undrained Triaxial Compression	ASTM D2850	16

4.0 GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site Conditions

Overall the proposed channel deepening is planned within the existing Corpus Christi Ship Channel from the Gulf of Mexico to La Quinta Junction. However, Fugro's study was limited from offshore Gulf of Mexico, approximately 12-miles out of Aransas Pass and then into Corpus Christi Ship Channel inland near Harbor Island. The boring furthest up the channel was in Aransas Pass, just East of the Hwy 361 Ferry Crossing. The borings are each spaced approximately 0.5-mile apart from each other and with closer spacing once inside of the rock jetties. The proposed boring locations are shown on Plate 2 of this report. The following sections present information on regional geology and geomorphology, and site specific subsurface and groundwater conditions.

4.2 Regional Geology and Geomorphology

The project site lies in the south-central part of the Texas Gulf Coast, East of the Nueces River. The region is underlain by large masses of sediments which are slightly inclined toward the Gulf of Mexico. Sediments encountered are primarily of the Beaumont formation of late Pleistocene geologic age, and consist of clays, clayey sands, and silts. Minor amounts of Holocene deposits are found along the shoreline of Corpus Christi Bay and significant amounts of Holocene deposits found in the barrier islands of St. Joseph, Mustang, and Padre Isands

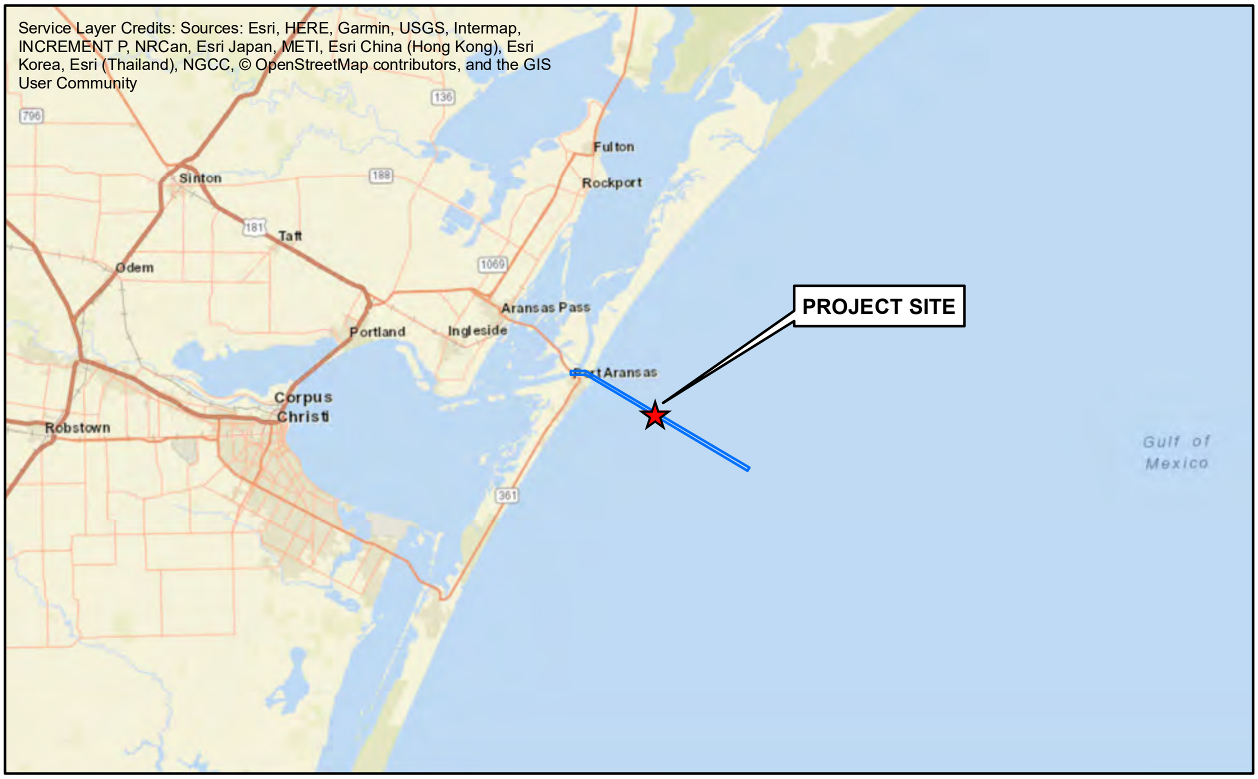
4.3 Subsurface Conditions

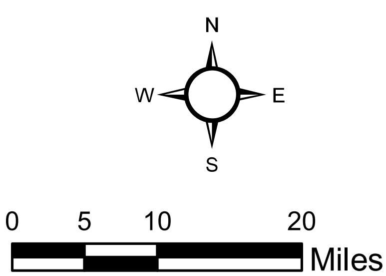
The subsurface conditions discovered during the investigation are based on thirty-five (35) borings that were completed as part of the channel deepening project. Generally, the borings further out into the Gulf of Mexico, BH-01 through BH-12, consisted of very soft clay with some intermixed layers of silt, sand, and shell fragments. As the sampling progressed further inland the samples transitioned from soft clays into loose, clayey and silty sands. Detailed stratigraphy, material descriptions, index properties and strengths of the soil materials encountered along the channel explored are presented on each of the boring logs presented in Appendix C on Plates C-1 through C-38. Additionally, generalized subsurface cross sections were generated along the borings drilled along with the bathymetry data provided by AECOM and presented on Plate 3 through Plate 5.

4.4 Variations

Our interpretations of soil conditions, as described in this report, are based on the boring logs from our field exploration, the results of the completed laboratory tests, and our experience with similar projects. Although we allowed for minor variations in the subsurface conditions, our interpretations may not be appropriate for subsurface conditions other than those reported herein. It is possible that undisclosed variations in soil conditions may occur outside the boring locations. We recommend performing careful review of subsurface conditions during engineering analysis and design to verify our generalized subsurface interpretations. Should variations from our interpretations be found, we recommend that we be notified and authorized to evaluate what, if any, revisions should be made to our interpretations.

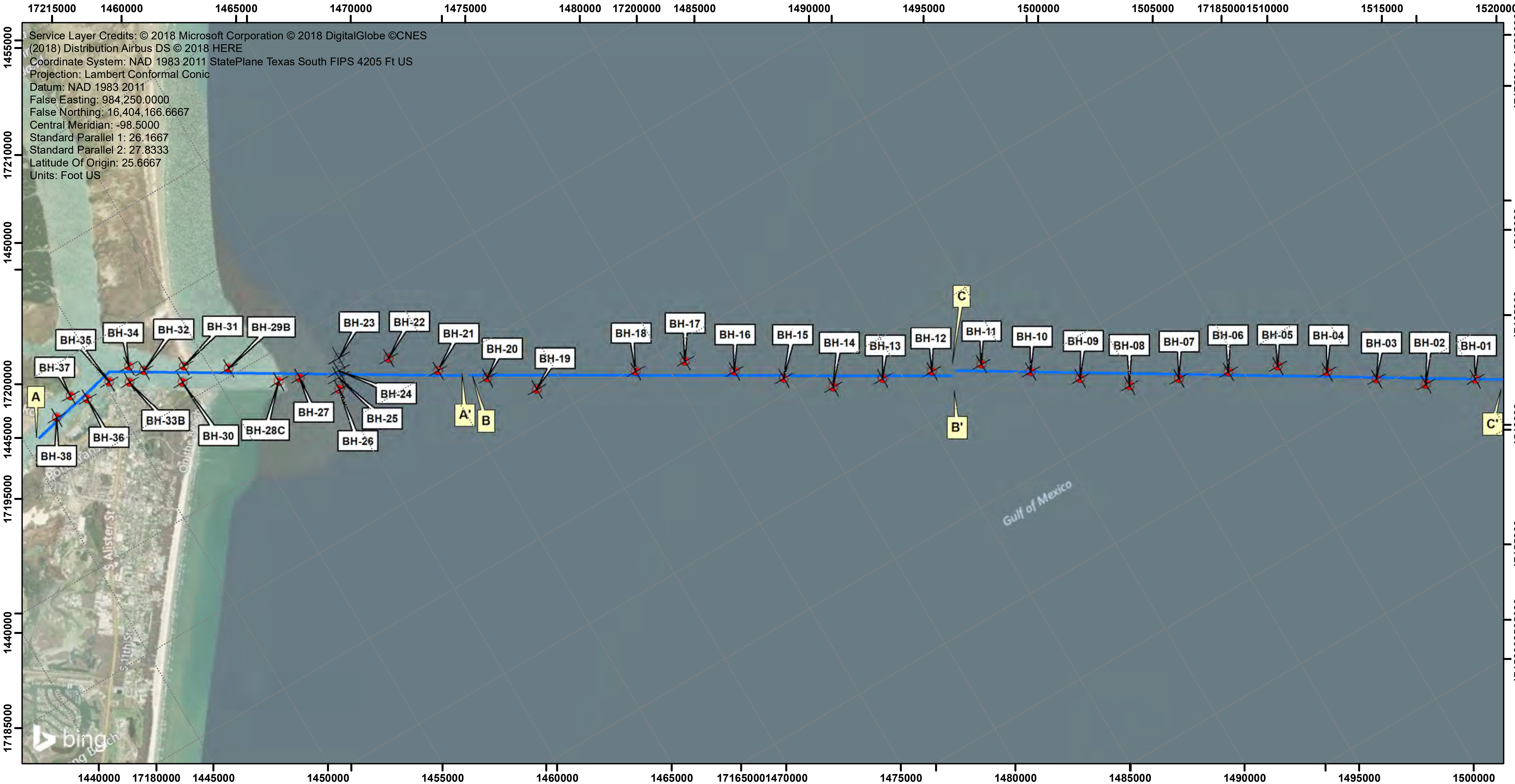
ILLUSTRATIONS





VICINITY MAP

PCCA CORPUS CHRISTI CHANNEL DEEPENING PROJECT
AECOM
CORPUS CHRISTI, TEXAS



LEGEND

GEOTECHNICAL BORING

COMPLETED

CANCELLED

CROSS-SECTION LINES

NOTES:

1. Boring locations are approximate.
2. As-built coordinates of exploration locations surveyed by Fugro Starfix Positioning System.

N E S W

0 2,500 5,000 10,000 Feet

PLAN OF BORINGS

PCCA CORPUS CHRISTI CHANNEL DEEPENING PROJECT
AECOM
CORPUS CHRISTI, TEXAS

PLATE 2

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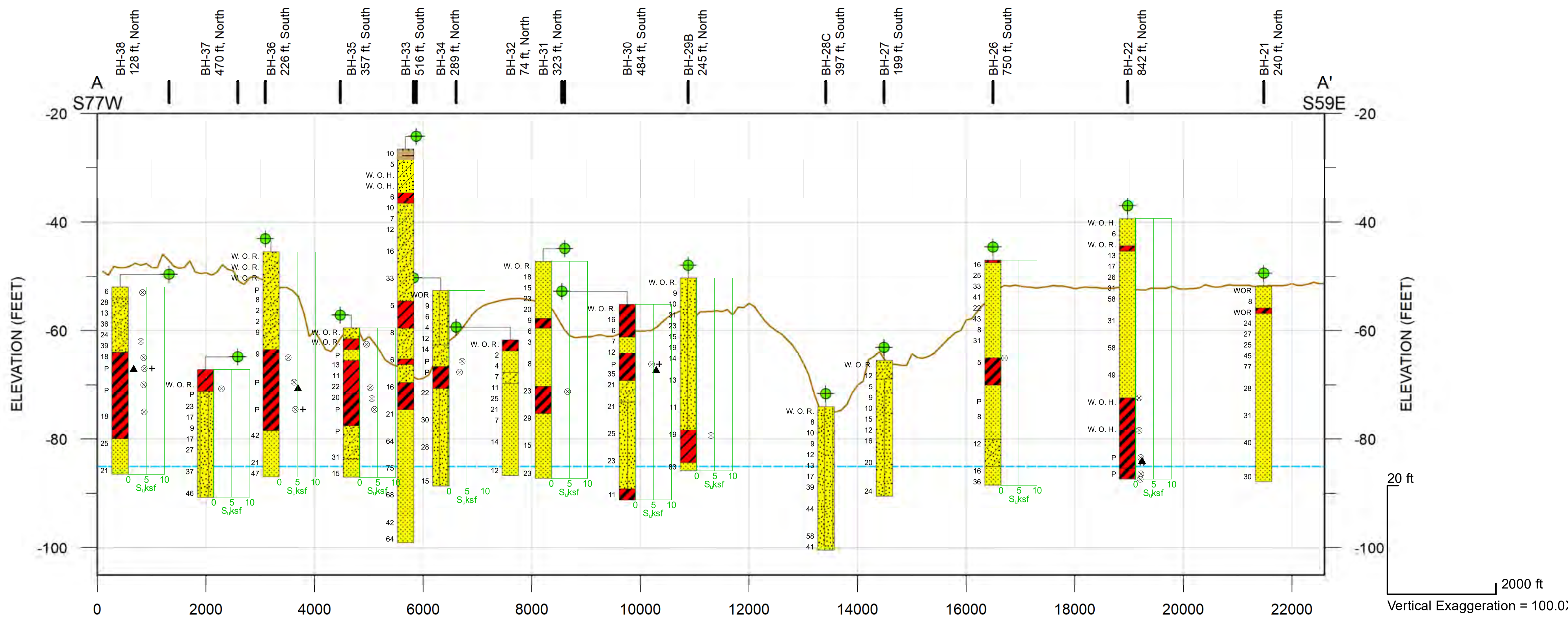
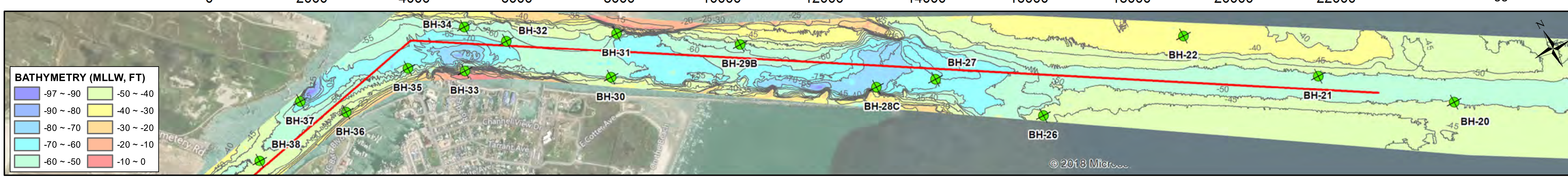




LEGEND

- Fill
- Lean CLAY (CL)
- Fat CLAY (CH)
- Poorly-Graded SAND (SP)
- Clayey SAND (SC)
- Silty SAND (SM)
- Bathymetry (MLLW, ft)
- Minimum Boring Termination Depth (85 ft, MLLW)

UNDRAINED SHEAR STRENGTH (S_u)

- ▲ Unconsolidated Undrained Triaxial
- Torvane
- ⊗ Pocket Penetrometer
- + Soil Strength Exceeds Instrument's Maximum Measurable Strength.

TUBE AND SPT SAMPLES

P	Push thin-walled 3" tube.
20	Number of blows to produce 12" of penetration after the initial 6" of seating.
86/11"	Number of blows required to produce the indicated penetration after an initial 6" seating.
Ref/3"	50 blows produced the indicated penetration during the initial 6" interval.
W.O.H.	Weight of Hammer

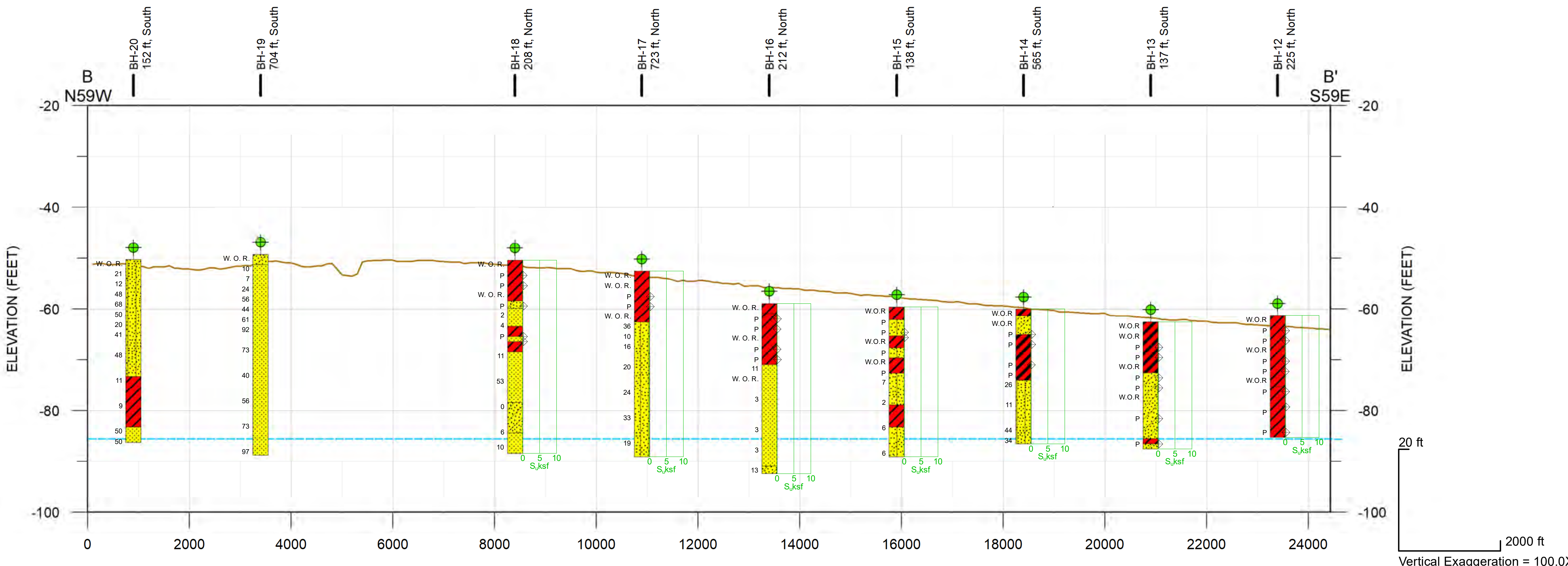
NOTES:

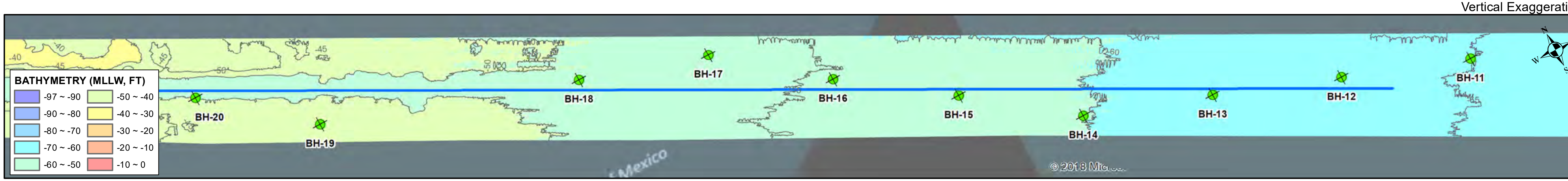
1. As-built coordinates of exploration locations provided by Fugro Starfix Positioning System.
2. Stratigraphic contacts are approximate, and interpreted from borings. Conditions vary both along and perpendicular to the section line. The lateral extent of the top soil is not known based on the limited borings.
3. Boring data are projected onto the cross section line, therefore, stratigraphic contacts may not correspond to the descriptions (lithology, shear strength, etc.) on the logs.
4. Material descriptions are generalized. Materials may vary within the stratigraphic unit and include layers of material that differ from the general description. Refer to boring logs for detailed descriptions of the materials encountered at the exploration location.
5. See Plate 2 for location of explorations and cross section lines.

SUBSURFACE PROFILE (A-A')

PCCA CORPUS CHRISTI CHANNEL DEEPENING PROJECT
AECOM
CORPUS CHRISTI, TEXAS

PLATE 3





LEGEND

- Lean CLAY (CL)
- Fat CLAY (CH)
- Poorly-Graded SAND (SP)
- Clayey SAND (SC)
- Silty SAND (SM)
- Bathymetry (MLLW, ft)
- Minimum Boring Termination Depth (85 ft, MLLW)

UNDRAINED SHEAR STRENGTH (S_u)

- ▲ Unconsolidated Undrained Triaxial
- Torvane
- Pocket Penetrometer
- + Soil Strength Exceeds Instrument's Maximum Measurable Strength.

TUBE AND SPT SAMPLES

P	Push thin-walled 3" tube.
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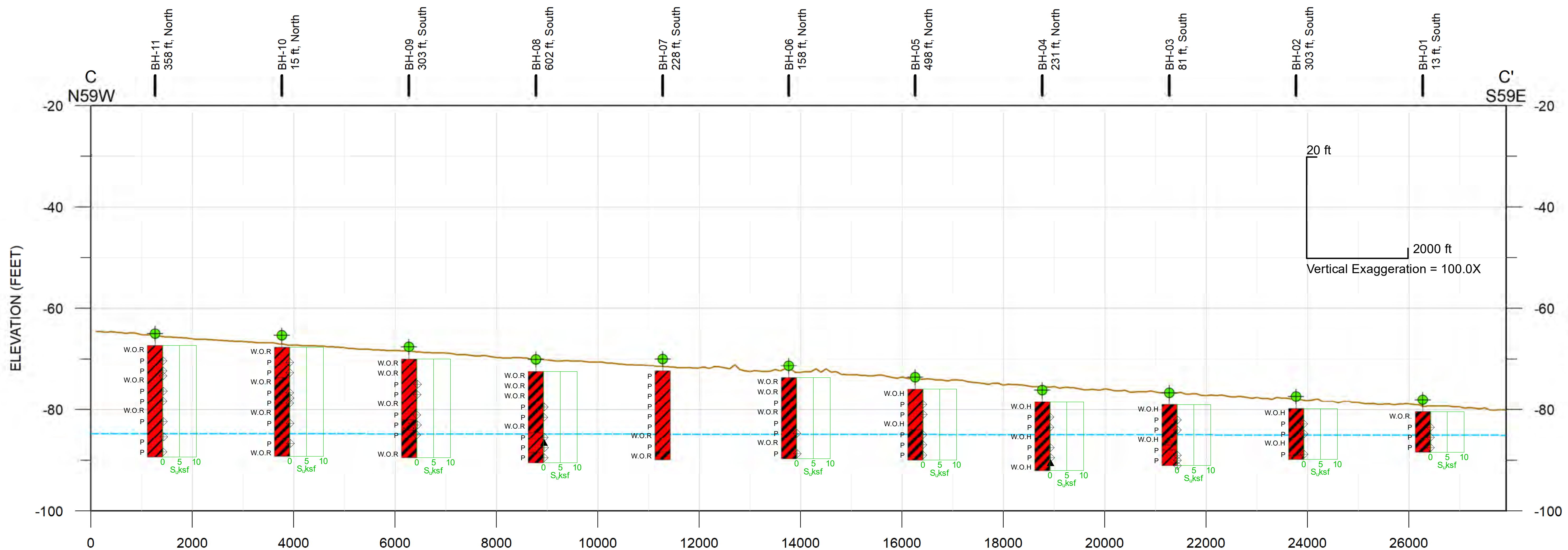
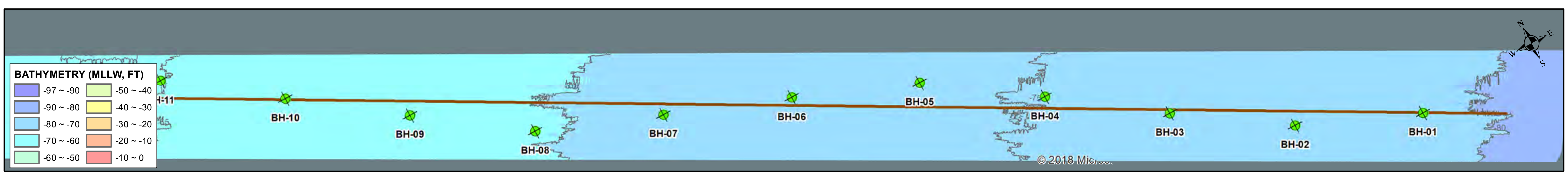
5. See Plate 2 for location of explorations and cross section lines.

SUBSURFACE PROFILE (B-B')

PCCA CORPUS CHRISTI CHANNEL DEEPENING PROJECT
AECOM
CORPUS CHRISTI, TEXAS





LEGEND

- Lean CLAY (CL)
- Fat CLAY (CH)
- Sandy Fat CLAY (CH)
- Bathymetry (MLLW, ft)
- Minimum Boring Termination Depth (85 ft, MLLW)

UNDRAINED SHEAR STRENGTH (S_u)

- ▲ Unconsolidated Undrained Triaxial
- Torvane
- ⊗ Pocket Penetrometer
- + Soil Strength Exceeds Instrument's Maximum Measurable Strength.

TUBE AND SPT SAMPLES

P	Push thin-walled 3" tube.
20	Number of blows to produce 12" of penetration after the initial 6" of seating.
86/11"	Number of blows required to produce the indicated penetration after an initial 6" seating.
Ref/3"	50 blows produced the indicated penetration during the initial 6" interval.
W.O.H.	Weight of Hammer

NOTES:

1. As-built coordinates of exploration locations provided by Fugro Starfix Positioning System.
2. Stratigraphic contacts are approximate, and interpreted from borings. Conditions vary both along and perpendicular to the section line. The lateral extent of the top soil is not known based on the limited borings.
3. Boring data are projected onto the cross section line, therefore, stratigraphic contacts may not correspond to the descriptions (lithology, shear strength, etc.) on the logs.
4. Material descriptions are generalized. Materials may vary within the stratigraphic unit and include layers of material that differ from the general description. Refer to boring logs for detailed descriptions of the materials encountered at the exploration location.
5. See Plate 2 for location of explorations and cross section lines.

SUBSURFACE PROFILE (C-C')

PCCA CORPUS CHRISTI CHANNEL DEEPENING PROJECT
AECOM
CORPUS CHRISTI, TEXAS

R:\04100\2018 Projects\0001-0099\04.10180080 - Corpus Christi Channel Deepening\00_GIS\MXD\Xsect\Plate_05-Subsurface_Profile_C.mxd, 10/17/2018, k.kim

APPENDIX A

LAREDO

M/V Petite - Class 150 Liftboat Vessel Specifications

Main Characteristics

Overall Length	79 ft
Overall Beam	59 ft
Hull	75 ft
Design Draft	5.5 ft (based upon deck load)
Depth	8 ft
Total Deck Space	2,800 sq ft
Useable Deck area	1,600 sq ft
Fuel Capacity	7,500 gl
Potable Water	9,000 gl
Gross Tonnage	Under 200 GRT
Max Deck Cargo	105,000 lbs
Variable Deck load:	150,000lbs disposable

Registration

Flag	United States

Jacking

Max Working Depth	80 ft (with 25 ft air gap)
Max Height of Deck	140 ft (above mud line less penetration)
Max Sea Conditions	4 ft (hard bottom) / 5 ft (soft bottom)

Legs

Number	4
Length	150 ft
Diameter	42 in
Wall Thickness	5/8" braced

Pads

Length	22 ft
Width	12 ft
Depth	24 in
Footing	51x50

Cranes (API 2C Certified)

Main: Stbd	Capacity - 70 tons Boom Length - 87 ft
Auxiliary: Port	Capacity - 5 tons - Boom Length 50 ft
Crane Engine:	6V-71N GM

Propulsion

Main Engines	(2) 12 V-71N GM
Shaft Horsepower	Approx 680 SHP
Estimated Speed	4 knots
Reduction gear (Twin Disc ratio)	3:1:1

Accessories

(2) Deep Well Pumps
(2) Welding Machines

Generators

Engines	(2) 6V-71N GM
Generators	(2) 100 KW

Navigation/Communication Equipment

Communications	Satellite (phone, fax,internet, email)
Radios	Multichannel VHF Marine Radio; SSB
Compass	GPS
Depth	Furuno

Accommodations

Berths	Total 29 (5 crew / 24 PAC's)
Climate	Central Air and Heating
Lounge	Satellite TV and Sofas
Lavatory Facilities	(4)
Galley	(16) Seats; Freezer & Icemaker
Laundry	(2) Washer and Dryer

Special Features

VIP Stateroom	(1) Company Rep Room
Lounge Room	Seating & T.V.

CME-75 Truck Mounted Auger Drill Specifications

Features | Specifications | Optional Equipment

Engine

- Cummins QSB 6.7L [409 cubic inch] 133 horsepower [99 kilowatt] 6 cylinder turbocharged and charge air cooled diesel engine. U.S. EPA Tier 3 emissions certified diesel engine.

Rotary drive

- Clutch, heavy duty
  - 13 inch [33 cm]
- Transmission
  - 5 speed forward, 1 speed reverse
- Standard Rotary Box
  - 10,230 foot pounds [13,870 Nm] max
  - 740 rpm max
- High Torque Rotary Box (optional)
  - 12,950 foot pounds [17,557 Nm] max
  - 580 rpm max
- High Speed Rotary Box (optional)
  - 8,180 foot pounds [11,090 Nm] max
  - 930 rpm max

Hydraulic feed system

PLATE NO. A-2

- Retract force
  - 30,000 pounds [13,608 kg]
- Pulldown force
  - 20,000 pounds [9,072 kg]
- Retract rate (max)
  - 30 feet [9 m] per minute
- Rapid Retract rate (max)
  - 78 feet [24 m] per minute
- Feed Rate (max)
  - 48 feet [14 m] per minute
- Stroke
  - 72 inch [183 cm]

Leveling system

Hydraulic jacks, inverted design with chrome-plated piston rods enclosed at all times.

- Stroke
  - 36 inch [91.4 cm]

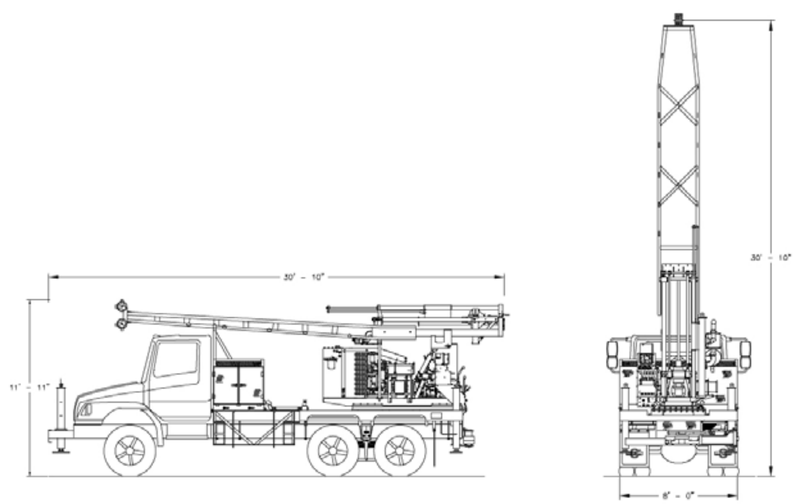


PLATE NO. A-3

JANNA E. INC

Phone: 361-758-7487
Fax: 361-758-7796
Email: sealevelmarine@cableone.net
Website: www.sealevelmarine.net

M/V MAVERICK

USCG Certified

SPECIFICATIONS:	LENGTH: 65’	DEPTH: 7.8’	BREADTH: 16.6’

Available Deck Space: 20’ x 13’
Maximum Speed: 18 Knots
Total Fuel Capacity: 560 Gallons
Potable Water Capacity: 60 Gallons

MACHINERY AND EQUIPMENT:

Generators: (2) 20 KW Northern Lights
Engines: (2) 6 Cylinder IVECO
HP: 1100

ELECTRONCIS AND COMMUNICATION:

Communication: 2 Radars, 2 VHF radios, 1 Single Side Band radio, 1 depth indicators, 2 GPS

LIFESAVING EQUIPMENT:

Life Preservers: 24
Life Rafts: 1 Containerized inflatable raft; 25 man


EAGLE
MAVERICK

Sea Level Marine Inc.

PH: (361) 758-7487 Fax: (361) 758-7796
sealevelmarine@cableone.net www.sealevelmarine.net

M/V MISS VIVIAN

USCG Certified

SPECIFICATIONS: **LENGTH: 91.3’** **DEPTH: 2.3’** **BREADTH: 19.6’**

Available Deck Space: 41’ x 16’
Maximum Speed: 20 Knots
Total Fuel Capacity: 3,000 Gallons
Potable Water Capacity: 750 Gallons

MACHINERY AND EQUIPMENT:

Generators: (2) 30KW Detroit Diesel
Engines: (3) V12 71TI Detroit Diesel with Twin Disc 2 to 1 gears
HP: 1500
1 Fire Pump - Delivers 60 PSI to 2: 1.5” Fire Hoses

ELECTRONICS AND COMMUNICATION:

Communication: Satellite Phone, 2 VHF, 2 GPS, 1 Radar, AIS, 1 Depth Sounder, PA System, 1 EPIRB, 1 Single Side Band Radio

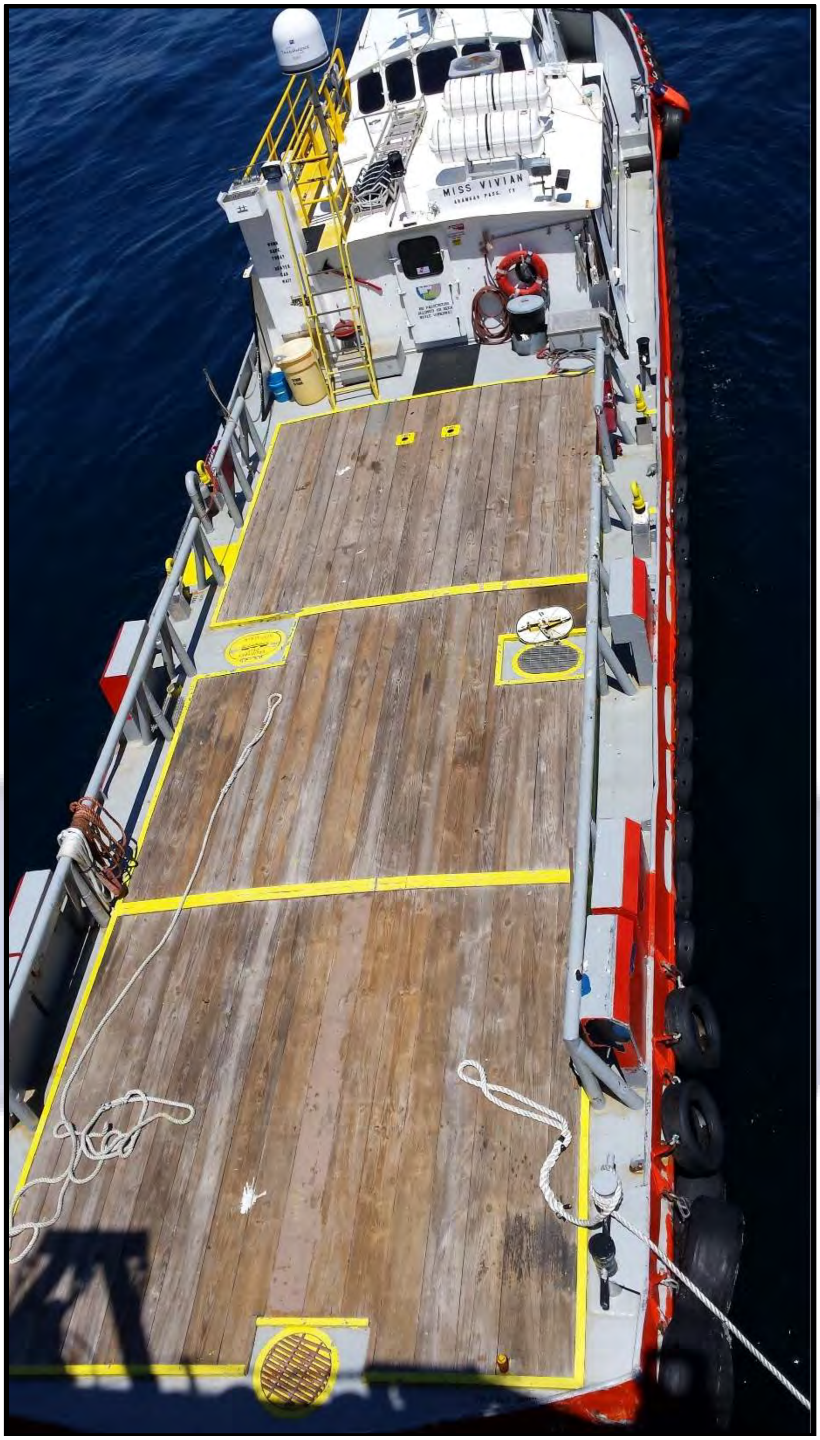
LIFESAVING EQUIPMENT:

Life Preservers: 50
Life Rafts: 2 Containerized Inflatable Rafts; 25 Man ea. Raft for a Total of 50
Ring Buoys: 3 Throwable

ACCOMMODATIONS:

46 Passengers and 4 Crew- 50
Quarters: Bunks for 5 Passengers, 2 Bathrooms, 1 with Shower
Full Size Washer and Dryer, Lounge
Full Size Galley with 2 Full Size Freezers

PH: (361) 758-7487 Fax: (361) 758-7796
sealevelmarine@cableone.net www.sealevelmarine.net



APPENDIX B

Summary of Geotechnical Explorations

Boring ID	Date Performed	AS BUILT LOCATIONS SPCS83 South Texas Zone (FT)		Time of Observed Water Tide (FT) Above MLLW	Observed Water Tide (FT) Above MLLW	Proposed Target Depth (FT)	Final Boring Depth (FT)	Water Depth (FT)	Mudline Elevation Below MLLW (FT)	Termination Elevation (FT) Below MLLW
		Northing	Easting							
BH-01	1-Aug-18	17,162,944.34	1,509,920.94	5:30	1.1	8.0	8.0	81.5	-80.4	**-88.4**
BH-02	1-Aug-18	17,163,996.65	1,507,636.00	1:00	0.1	10.0	10.0	79.9	-79.8	**-89.8**
BH-03	31-Jul-18	17,165,487.76	1,505,616.61	20:30	0.8	11.0	12.0	79.8	-79.0	**-91.0**
BH-04	31-Jul-18	17,167,059.27	1,503,637.56	12:45	0.7	13.0	13.5	79.2	-78.5	**-92.0**
BH-05	31-Jul-18	17,168,589.98	1,501,637.07	9:15	0.7	14.0	14.0	76.6	-75.9	**-89.9**
BH-06	30-Jul-18	17,169,597.94	1,499,330.58	19:31	0.4	15.0	16.0	74.0	-73.7	**-89.7**
BH-07	30-Jul-18	17,170,565.45	1,497,001.40	10:30	0.9	17.0	17.5	73.2	-72.3	**-89.8**
BH-08	1-Aug-18	17,171,545.89	1,494,672.55	11:00	1.1	18.0	18.0	73.5	-72.4	**-90.4**
BH-09	1-Aug-18	17,173,104.22	1,492,690.09	16:00	1.4	19.0	19.5	71.3	-70.0	**-89.5**
BH-10	1-Aug-18	17,174,679.28	1,490,716.77	20:30	1.2	21.0	21.5	68.9	-67.7	**-89.2**
BH-11	2-Aug-18	17,176,274.51	1,488,756.93	1:35	0.9	22.0	22.0	68.2	-67.3	**-89.3**
BH-12	2-Aug-18	17,177,218.24	1,486,408.27	7:45	1.5	24.0	24.0	62.8	-61.3	**-85.3**
BH-13	2-Aug-18	17,178,177.54	1,484,072.29	13:00	1.2	25.0	25.0	63.7	-62.5	**-87.5**
BH-14	2-Aug-18	17,179,080.40	1,481,702.39	18:30	1.4	27.0	26.5	61.4	-60.0	**-86.5**
BH-15	3-Aug-18	17,180,716.26	1,479,773.98	23:15	1.3	30.0	29.5	60.9	-59.6	**-89.1**
BH-16	3-Aug-18	17,182,291.66	1,477,795.46	6:45	1.7	33.0	33.5	60.6	-58.9	**-92.4**
BH-17	3-Aug-18	17,184,005.55	1,475,898.81	11:45	1.4	36.0	36.5	54.0	-52.6	**-89.1**
BH-18	3-Aug-18	17,184,830.95	1,473,488.59	16:50	1.1	38.0	37.5	51.5	-50.4	**-87.9**
BH-19	4-Aug-18	17,186,590.29	1,468,718.22	21:55	1.3	40.0	39.5	50.6	-49.3	**-88.8**
BH-20	4-Aug-18	17,188,336.63	1,466,847.30	13:00	1.0	36.0	36.5	51.3	-50.3	**-86.8**
BH-21	17-Aug-18	17,189,920.41	1,464,875.82	7:15	1.3	36.0	36.0	53.1	-51.8	**-87.8**
BH-22	6-Aug-18	17,191,731.57	1,463,038.76	21:20	1.5	48.0	48.0	40.8	-39.3	**-87.3**
BH-23	CANCELLED BORING									
BH-24	CANCELLED BORING									
BH-25	CANCELLED BORING									
BH-26	15-Aug-18	17,191,649.40	1,460,094.94	20:45	1.3	42.0	41.5	48.3	-47.0	**-88.5**
BH-27	15-Aug-18	17,193,156.82	1,458,662.33	17:10	1.4	21.0	25.0	66.8	-65.5	**-90.5**
BH-28C	12-Aug-18	17,193,541.21	1,457,641.94	2:00	1.1	27.0	26.5	75.1	-74.0	**-100.5**

Summary of Geotechnical Explorations

Boring ID	Date Performed	AS BUILT LOCATIONS SPCS83 South Texas Zone (FT)		Time of Observed Water Tide (FT) Above MLLW	Observed Water Tide (FT) Above MLLW	Proposed Target Depth (FT)	Final Boring Depth (FT)	Water Depth (FT)	Mudline Elevation Below MLLW (FT)	Termination Elevation (FT) Below MLLW
		Northing	Easting							
BH-29B	10-Aug-18	17,195,399.99	1,455,805.48	15:00	1.5	29.0	35.5	51.8	-50.3	**-85.8**
BH-30	10-Aug-18	17,195,978.11	1,453,436.63	14:30	1.4	36.0	36.0	56.5	-55.1	**-91.1**
BH-31	12-Aug-18	17,196,640.88	1,453,898.49	10:30	1.7	37.0	40.0	48.9	-47.2	**-87.2**
BH-32	13-Aug-18	17,197,463.29	1,452,054.37	15:25	1.4	25.0	25.0	63.1	-61.7	**-86.7**
BH-33B	9-Aug-18	17,197,335.55	1,451,125.34	2:15	2.0	73.0	72.5	28.5	-26.5	**-99.0**
BH-34	12-Aug-18	17,198,051.12	1,451,495.84	15:10	1.6	32.0	36.0	54.2	-52.6	**-88.6**
BH-35	12-Aug-18	17,197,870.11	1,450,226.35	19:00	0.8	28.0	27.5	60.3	-59.5	**-87.0**
BH-36	8-Aug-18	17,197,693.19	1,448,851.66	13:20	1.6	41.0	41.5	47.0	-45.5	**-87.0**
BH-37	8-Aug-18	17,198,260.81	1,448,203.76	10:30	1.9	23.0	23.5	69.0	-67.2	**-90.7**
BH-38	13-Aug-18	17,197,646.23	1,447,038.94	20:15	0.9	36.0	34.5	52.8	-52.0	**-86.5**

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**1**		
Comment:			

Session Name: 20180801-101513-v1
Start Time: 01 Aug 2018, 05:15:58-05:00
End Time: 01 Aug 2018, 05:30:57-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 1

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°44’41.20874”N	27°44’41.20874”N
Longitude	096°52’29.28396”W	096°52’29.28396”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,162,944.34ftUS N	
Easting	1,509,920.94ftUS E	
Height	-45.82ft Ell.	
Final Rig Heading	139.16°True (138.43°Grid)	

Final Position for CL_Drill is 4.01ftUS @ 199.2°True (198.5°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.73779°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°44’41.24625”N	Longitude: 096°52’29.26926”W	Northing: 17,162,948.14ftUS N	Easting: 1,509,922.21ftUS E
Intended Rig Heading	140.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,162,944.34ftUS N, 1,509,920.94ftUS E, -45.82ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,162,944.95ftUS N, 1,509,920.23ftUS E, -46.75ft Ell.	0.62ftUS	-0.70ftUS	-0.93ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-3

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		873 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°44’41.58546”N	±0.61ftUS	27°44’41.71959”N	±0.09ftUS
Longitude	096°52’29.78121”W	±0.22ftUS	096°52’29.65075”W	±0.06ftUS
Height	-45.82ft Ell.	±0.41ftUS	-46.75ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°44’41.58546”N	±0.61ftUS	27°44’41.71959”N	±0.09ftUS
Longitude	096°52’29.78121”W	±0.22ftUS	096°52’29.65075”W	±0.06ftUS
Height	-45.82ft Ell.	±0.41ftUS	-46.75ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,162,981.80ftUS N	±0.61ftUS	17,162,995.50ftUS N	±0.09ftUS
Easting	1,509,875.77ftUS E	±0.21ftUS	1,509,887.32ftUS E	±0.06ftUS
Height	-45.82ft Ell.	±0.41ftUS	-46.75ft Ell.	±0.11ftUS

HDOP	1.23		0.67	
No. Satellites	8		16	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	139.16°True	±0.0°	139.16°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°44’41.20874”N	±0.61ftUS	27°44’41.21493”N	±0.10ftUS
Longitude	096°52’29.28396”W	±0.22ftUS	096°52’29.29180”W	±0.09ftUS
Height	-45.82ft Ell.	±0.41ftUS	-46.75ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,162,944.34ftUS N	±0.61ftUS	17,162,944.95ftUS N	±0.10ftUS
Easting	1,509,920.94ftUS E	±0.22ftUS	1,509,920.23ftUS E	±0.09ftUS
Height	-45.82ft Ell.	±0.41ftUS	-46.75ft Ell.	±0.11ftUS

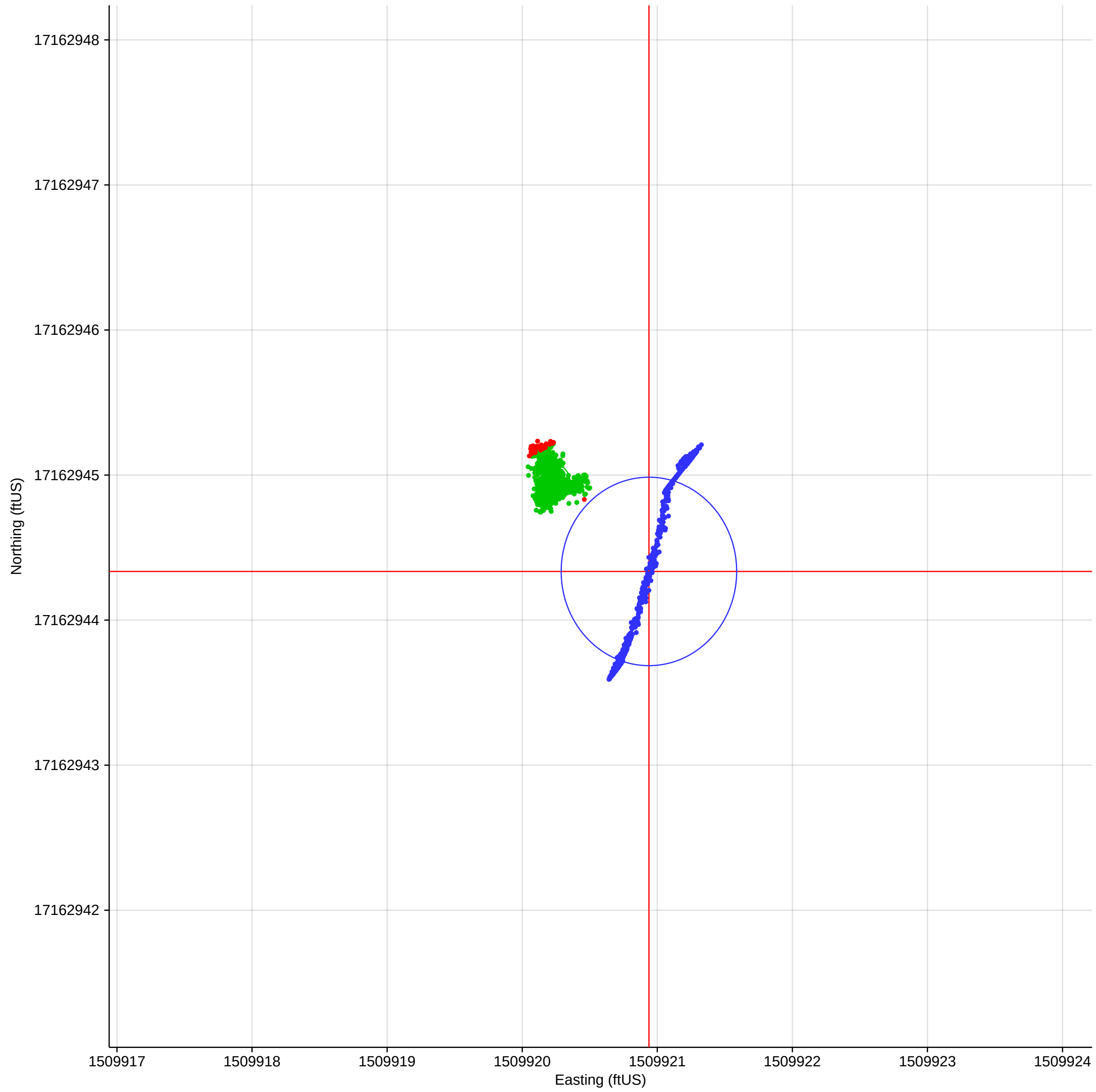
Delta Northing	0.00ftUS		0.62ftUS	
Delta Easting	0.00ftUS		-0.70ftUS	
Delta Height	0.00ftUS		-0.93ftUS	

Position of CL_Drill from proposed location				
Range	4.01ftUS		3.76ftUS	

PLATE NO. B-5

Bearing	199.22°True		212.63°True	

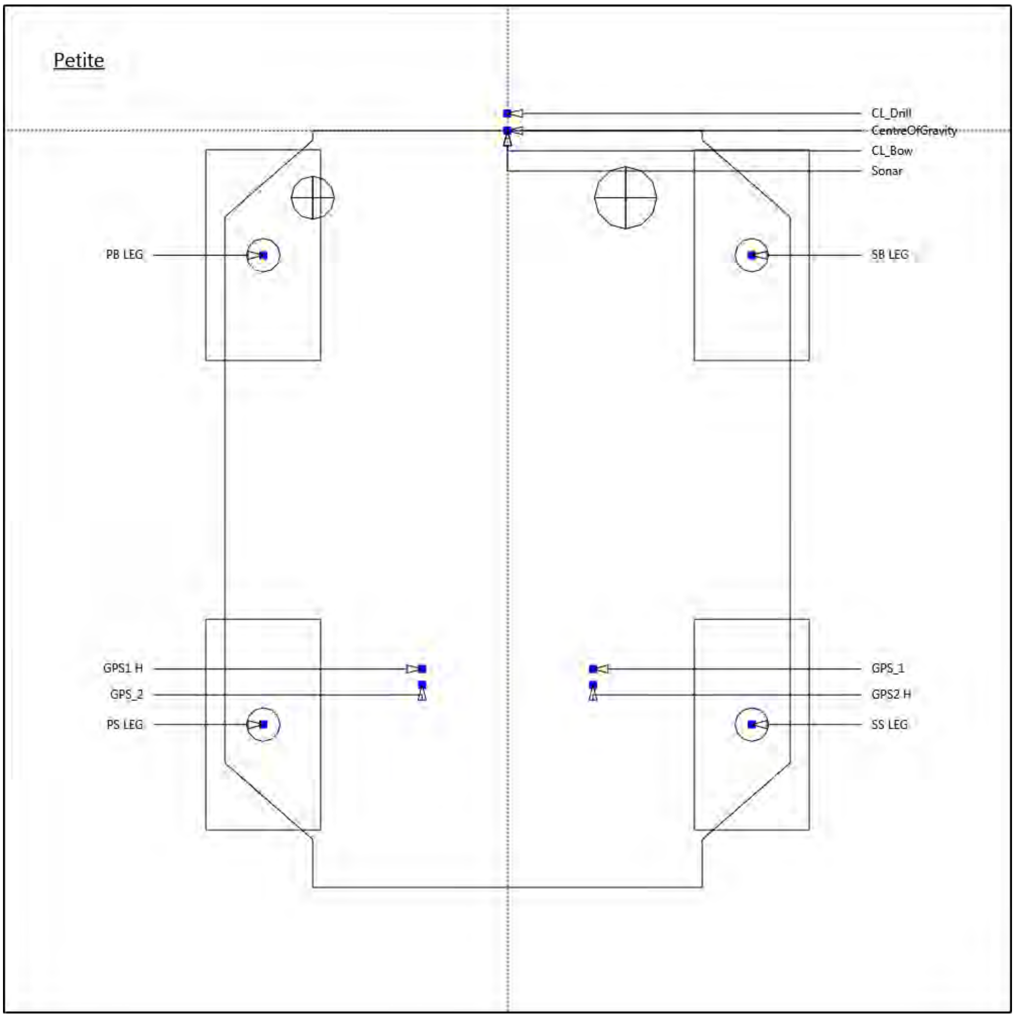
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,162,944.34ftUS N, 1,509,920.94ftUS E, -45.82ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,162,944.95ftUS N, 1,509,920.23ftUS E, -46.75ft Ell.	0.62ftUS	-0.70ftUS	-0.93ftUS

PLATE NO. B-7

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	81.50ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**2**		
Comment:			

Session Name: 20180801-040829-v1
Start Time: 01 Aug 2018, 01:24:28-05:00
End Time: 01 Aug 2018, 01:39:27-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 2

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°44’51.91874”N	27°44’51.91873”N
Longitude	096°52’54.56239”W	096°52’54.56239”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,163,996.65ftUS N	
Easting	1,507,636.00ftUS E	
Height	-48.29ft Ell.	
Final Rig Heading	180.72°True (179.99°Grid)	

Final Position for CL_Drill is 5.65ftUS @ 298.7°True (297.9°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.73465°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°44’51.89187”N	Longitude: 096°52’54.50719”W	Northing: 17,163,994.00ftUS N	Easting: 1,507,640.99ftUS E
Intended Rig Heading	180.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,163,996.65ftUS N, 1,507,636.00ftUS E, -48.29ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,163,997.26ftUS N, 1,507,635.44ftUS E, -46.86ft Ell.	0.62ftUS	-0.54ftUS	1.43ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-10

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		878 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°44’52.49411”N	±0.10ftUS	27°44’52.51433”N	±0.04ftUS
Longitude	096°52’54.65359”W	±0.15ftUS	096°52’54.46075”W	±0.05ftUS
Height	-48.29ft Ell.	±0.09ftUS	-46.86ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°44’52.49411”N	±0.10ftUS	27°44’52.51434”N	±0.04ftUS
Longitude	096°52’54.65359”W	±0.15ftUS	096°52’54.46075”W	±0.05ftUS
Height	-48.29ft Ell.	±0.09ftUS	-46.86ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,164,054.65ftUS N	±0.10ftUS	17,164,056.91ftUS N	±0.04ftUS
Easting	1,507,627.06ftUS E	±0.15ftUS	1,507,644.36ftUS E	±0.05ftUS
Height	-48.29ft Ell.	±0.09ftUS	-46.86ft Ell.	±0.11ftUS

HDOP	0.89		0.76	
No. Satellites	10		13	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	180.72°True	±0.1°	180.72°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°44’51.91874”N	±0.11ftUS	27°44’51.92485”N	±0.04ftUS
Longitude	096°52’54.56239”W	±0.24ftUS	096°52’54.56845”W	±0.08ftUS
Height	-48.29ft Ell.	±0.09ftUS	-46.86ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,163,996.65ftUS N	±0.11ftUS	17,163,997.26ftUS N	±0.04ftUS
Easting	1,507,636.00ftUS E	±0.23ftUS	1,507,635.44ftUS E	±0.08ftUS
Height	-48.29ft Ell.	±0.09ftUS	-46.86ft Ell.	±0.11ftUS

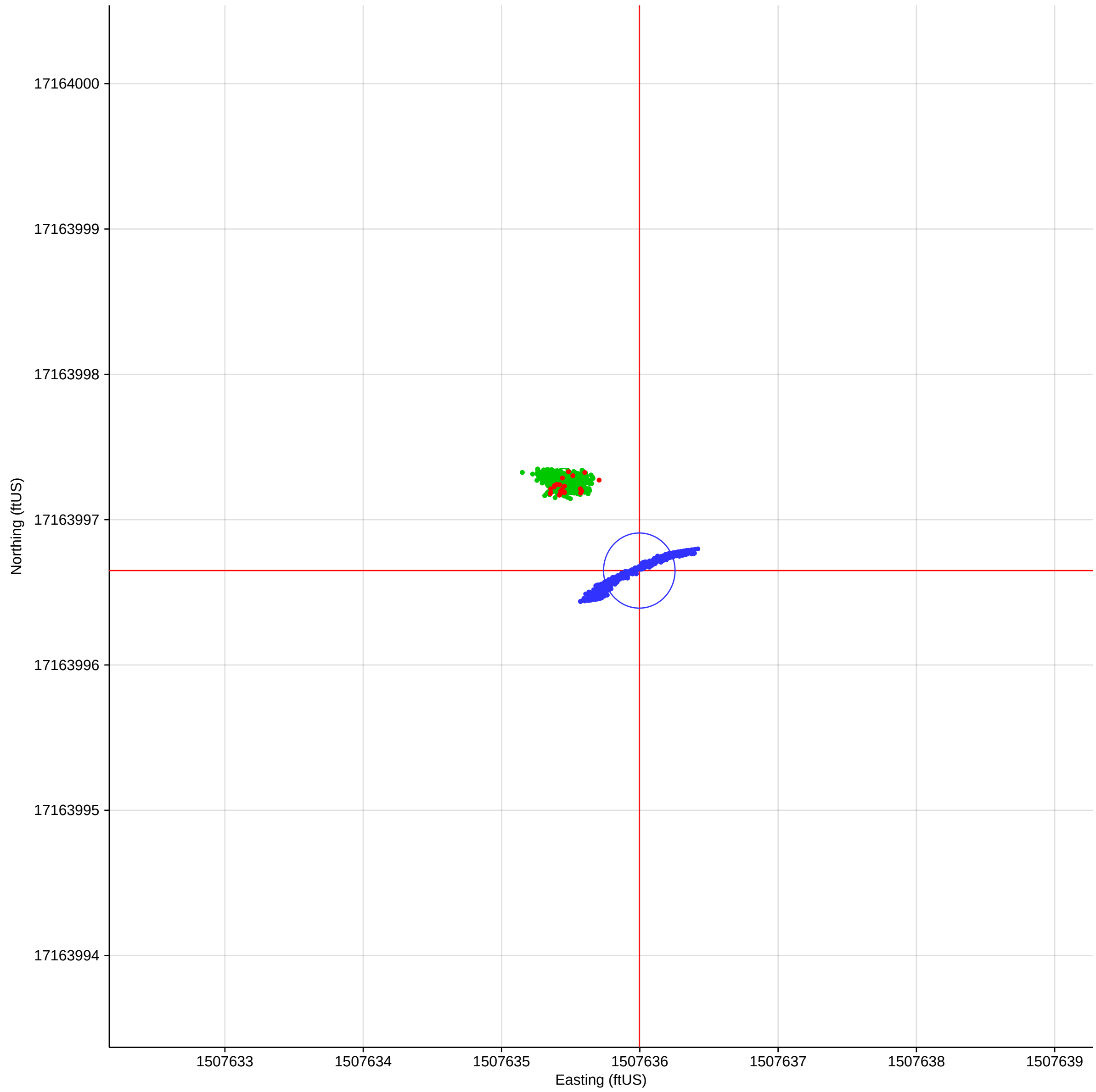
Delta Northing	0.00ftUS		0.62ftUS	
Delta Easting	0.00ftUS		-0.54ftUS	
Delta Height	0.00ftUS		1.43ftUS	

Position of CL_Drill from proposed location				
Range	5.65ftUS		6.43ftUS	

PLATE NO. B-12

Bearing	298.68°True		301.18°True	

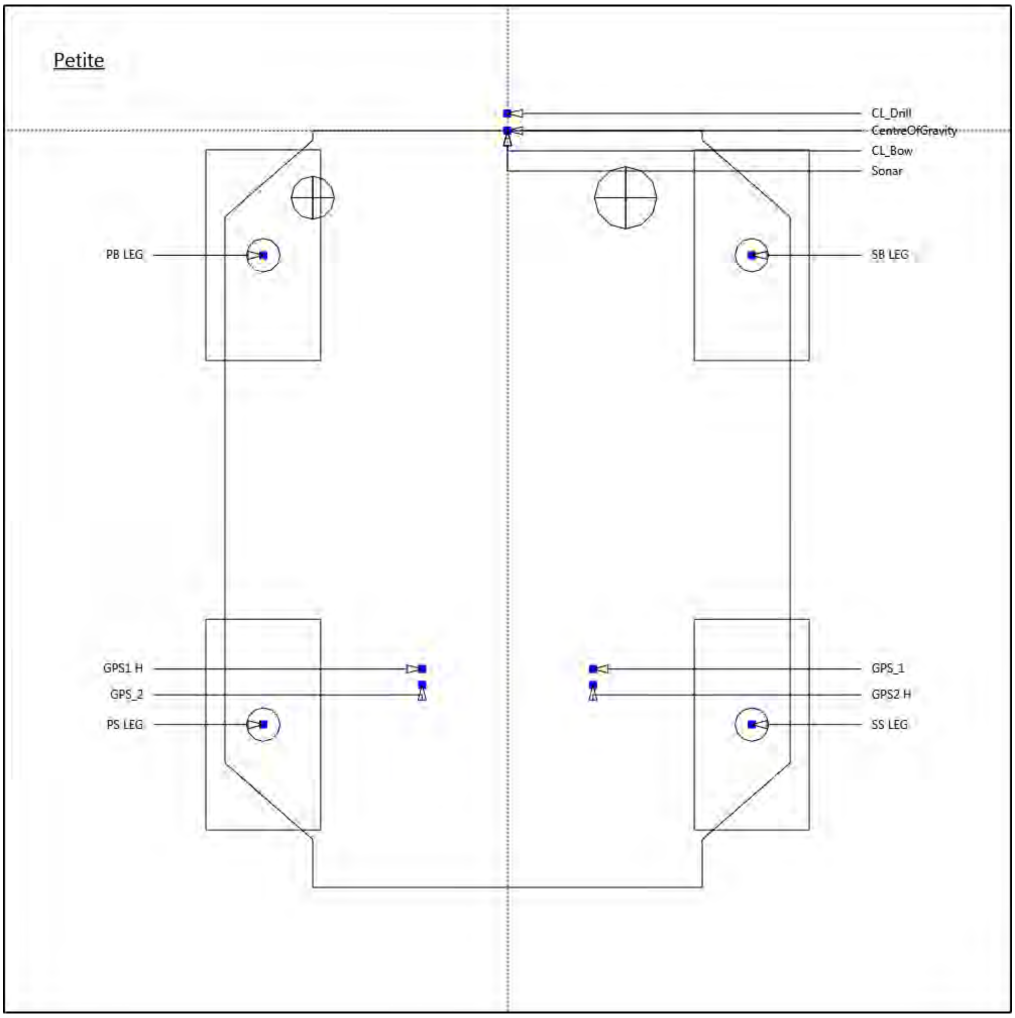
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,163,996.65ftUS N, 1,507,636.00ftUS E, -48.29ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,163,997.26ftUS N, 1,507,635.44ftUS E, -46.86ft Ell.	0.62ftUS	-0.54ftUS	1.43ftUS

PLATE NO. B-14

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-15

Seabed Information

Seabed Depth	79.90ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**3**		
Comment:			

Session Name: 20180731-211909-v1
Start Time: 31 Jul 2018, 17:48:31-05:00
End Time: 31 Jul 2018, 18:03:30-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 3

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°45’06.93852”N	27°45’06.93852”N
Longitude	096°53’16.82436”W	096°53’16.82436”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,165,487.76ftUS N	
Easting	1,505,616.61ftUS E	
Height	-50.12ft Ell.	
Final Rig Heading	170.62°True (169.89°Grid)	

Final Position for CL_Drill is 1.96ftUS @ 69.5°True (68.8°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.73183°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°45’06.93174”N	Longitude: 096°53’16.84478”W	Northing: 17,165,487.05ftUS N	Easting: 1,505,614.78ftUS E
Intended Rig Heading	170.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,165,487.76ftUS N, 1,505,616.61ftUS E, -50.12ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,165,488.11ftUS N, 1,505,615.63ftUS E, -49.05ft Ell.	0.37ftUS	-0.97ftUS	1.07ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		888 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°45'07.49074"N	±0.19ftUS	27°45'07.53931"N	±0.06ftUS
Longitude	096°53'17.02761"W	±0.22ftUS	096°53'16.84538"W	±0.09ftUS
Height	-50.12ft Ell.	±0.36ftUS	-49.05ft Ell.	±0.22ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°45'07.49074"N	±0.19ftUS	27°45'07.53931"N	±0.06ftUS
Longitude	096°53'17.02761"W	±0.22ftUS	096°53'16.84538"W	±0.09ftUS
Height	-50.12ft Ell.	±0.36ftUS	-49.05ft Ell.	±0.22ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,165,543.29ftUS N	±0.19ftUS	17,165,548.40ftUS N	±0.06ftUS
Easting	1,505,597.63ftUS E	±0.22ftUS	1,505,613.94ftUS E	±0.09ftUS
Height	-50.12ft Ell.	±0.36ftUS	-49.05ft Ell.	±0.22ftUS

HDOP	1.00		0.83	
No. Satellites	8		11	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	170.62°True	±0.0°	170.62°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°45'06.93852"N	±0.20ftUS	27°45'06.94216"N	±0.06ftUS
Longitude	096°53'16.82436"W	±0.21ftUS	096°53'16.83516"W	±0.08ftUS
Height	-50.12ft Ell.	±0.36ftUS	-49.05ft Ell.	±0.22ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,165,487.76ftUS N	±0.20ftUS	17,165,488.11ftUS N	±0.06ftUS
Easting	1,505,616.61ftUS E	±0.21ftUS	1,505,615.63ftUS E	±0.08ftUS
Height	-50.12ft Ell.	±0.36ftUS	-49.05ft Ell.	±0.22ftUS

Delta Northing	0.00ftUS		0.37ftUS	
Delta Easting	0.00ftUS		-0.97ftUS	
Delta Height	0.00ftUS		1.07ftUS	

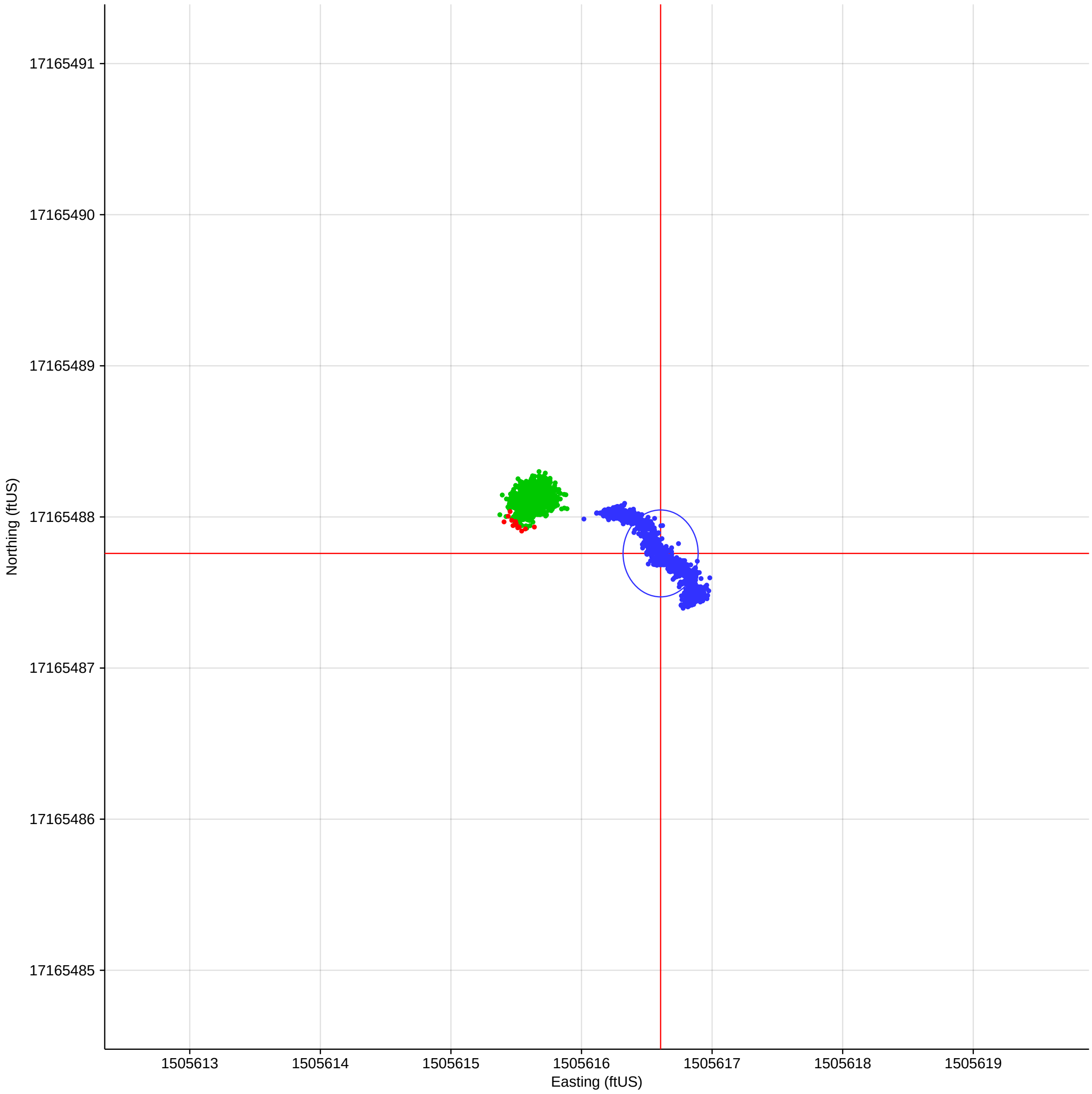
Position of CL_Drill from proposed location				
Range	1.96ftUS		1.36ftUS	

PLATE NO. B-19

Bearing	69.52°True		39.42°True	

PLATE NO. B-20

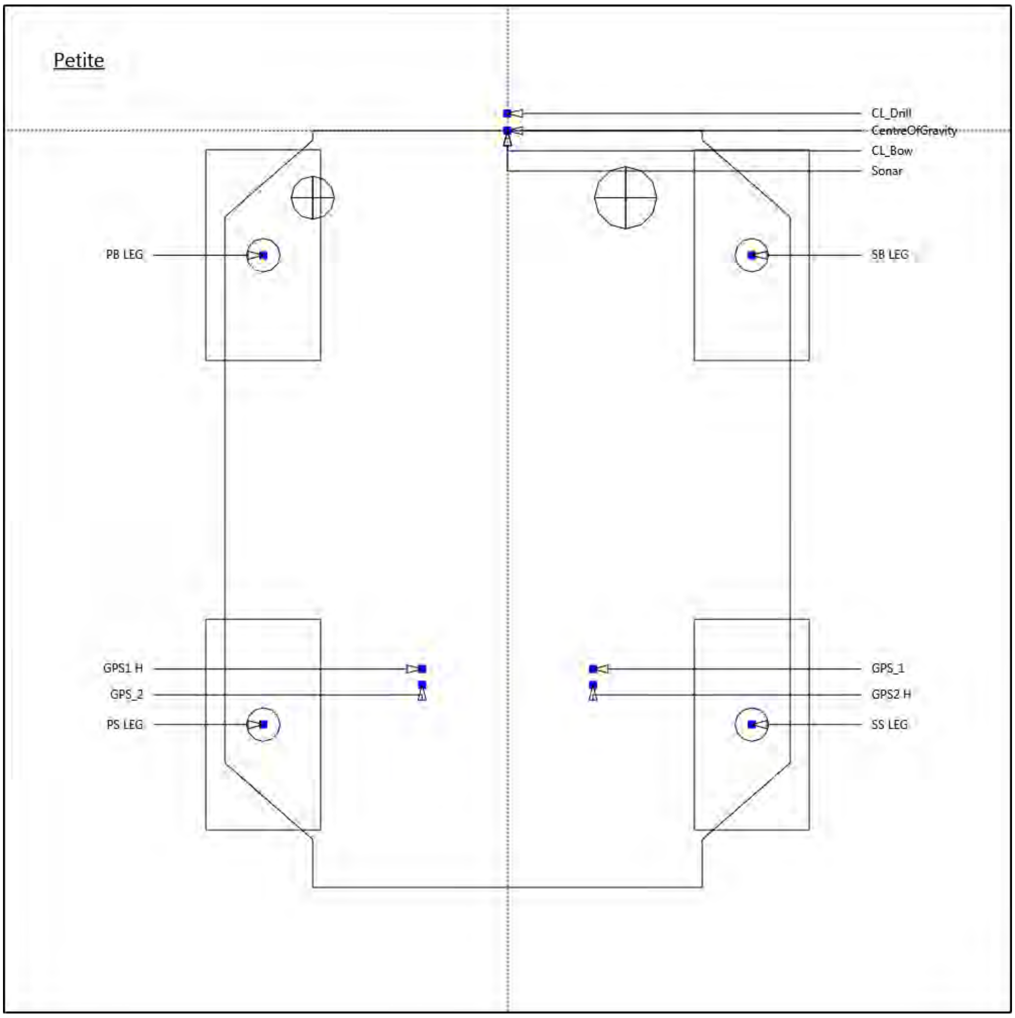
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,165,487.76ftUS N, 1,505,616.61ftUS E, -50.12ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,165,488.11ftUS N, 1,505,615.63ftUS E, -49.05ft Ell.	0.37ftUS	-0.97ftUS	1.07ftUS

PLATE NO. B-21

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	79.88ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**4**		
Comment:			

Session Name: 20180731-172831-v1
Start Time: 31 Jul 2018, 13:13:11-05:00
End Time: 31 Jul 2018, 13:28:10-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 4

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°45’22.74833”N	27°45’22.74833”N
Longitude	096°53’38.62761”W	096°53’38.62761”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,167,059.27ftUS N	
Easting	1,503,637.56ftUS E	
Height	-49.60ft Ell.	
Final Rig Heading	207.87°True (207.14°Grid)	

Final Position for CL_Drill is 1.76ftUS @ 316.1°True (315.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.72913°		

Proposed Location

North American Datum 1983		SPCS83 Texas South zone (US Survey feet) CM -99° W	
Latitude: 27°45’22.73578”N	Longitude: 096°53’38.61405”W	Northing: 17,167,058.02ftUS N	Easting: 1,503,638.79ftUS E
Intended Rig Heading	205.0°True		

Positioning System Comparison

Sensor	Mean Position SPCS83 Texas South zone (US Survey feet) CM -99° W	Delta Northing	Delta Easting	Delta Height
Primary	17,167,059.27ftUS N, 1,503,637.56ftUS E, -49.60ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,167,058.82ftUS N, 1,503,636.29ftUS E, -47.29ft Ell.	-0.44ftUS	-1.27ftUS	2.31ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	831 of 900 used		890 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°45'23.29733"N	±0.14ftUS	27°45'23.22482"N	±0.09ftUS
Longitude	096°53'38.41362"W	±0.09ftUS	096°53'38.24360"W	±0.07ftUS
Height	-49.60ft Ell.	±0.11ftUS	-47.29ft Ell.	±0.23ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°45'23.29733"N	±0.14ftUS	27°45'23.22482"N	±0.09ftUS
Longitude	096°53'38.41362"W	±0.09ftUS	096°53'38.24360"W	±0.07ftUS
Height	-49.60ft Ell.	±0.11ftUS	-47.29ft Ell.	±0.23ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,167,114.95ftUS N	±0.14ftUS	17,167,107.83ftUS N	±0.09ftUS
Easting	1,503,656.07ftUS E	±0.09ftUS	1,503,671.44ftUS E	±0.07ftUS
Height	-49.60ft Ell.	±0.11ftUS	-47.29ft Ell.	±0.23ftUS

HDOP	1.30		0.73	
No. Satellites	7		14	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	207.87°True	±0.0°	207.87°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°45'22.74833"N	±0.13ftUS	27°45'22.74399"N	±0.09ftUS
Longitude	096°53'38.62761"W	±0.09ftUS	096°53'38.64177"W	±0.07ftUS
Height	-49.60ft Ell.	±0.11ftUS	-47.29ft Ell.	±0.23ftUS

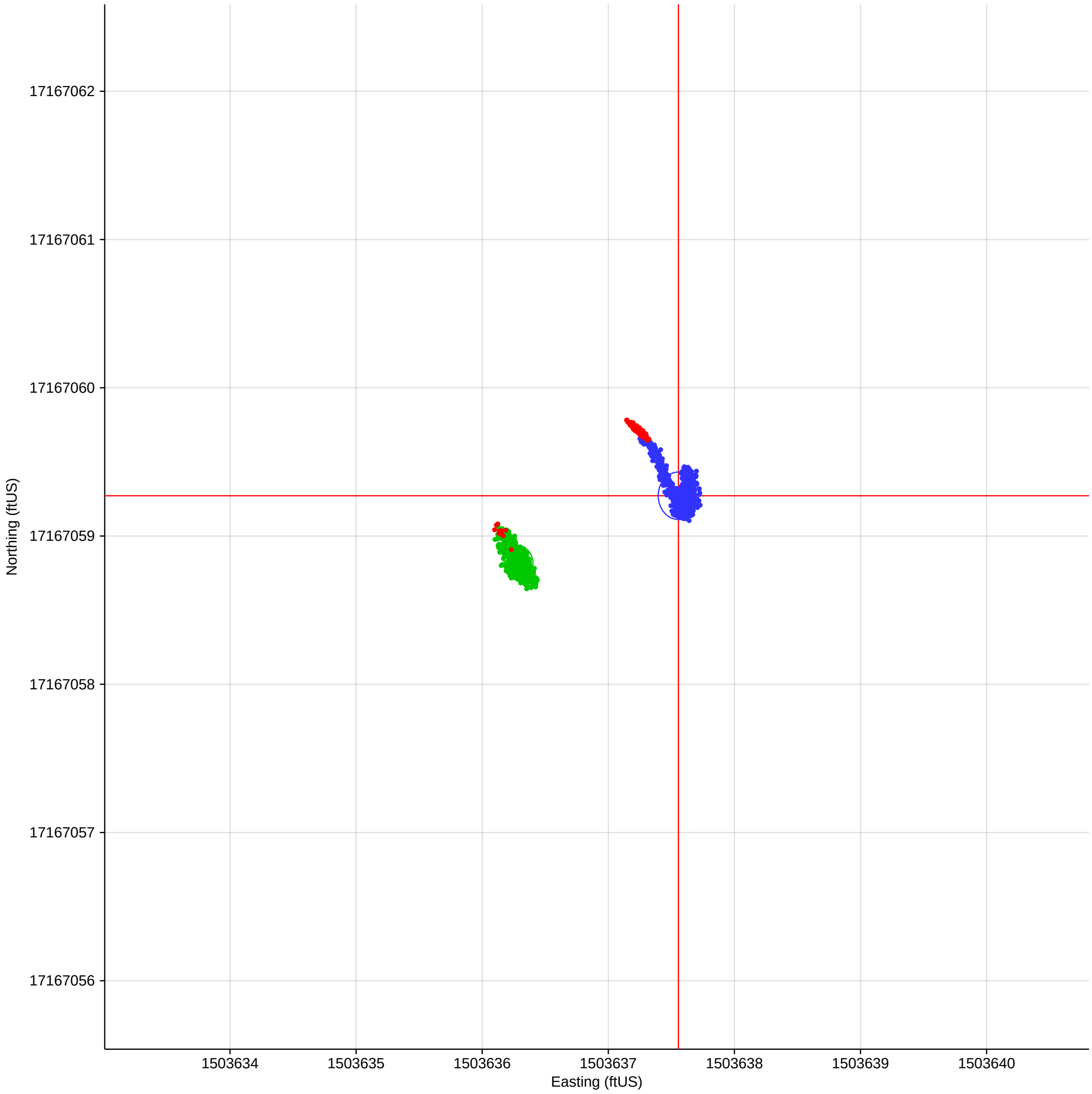
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,167,059.27ftUS N	±0.13ftUS	17,167,058.82ftUS N	±0.09ftUS
Easting	1,503,637.56ftUS E	±0.09ftUS	1,503,636.29ftUS E	±0.07ftUS
Height	-49.60ft Ell.	±0.11ftUS	-47.29ft Ell.	±0.23ftUS

Delta Northing	0.00ftUS		-0.44ftUS	
Delta Easting	0.00ftUS		-1.27ftUS	
Delta Height	0.00ftUS		2.31ftUS	

Position of CL_Drill from proposed location				
Range	1.76ftUS		2.62ftUS	

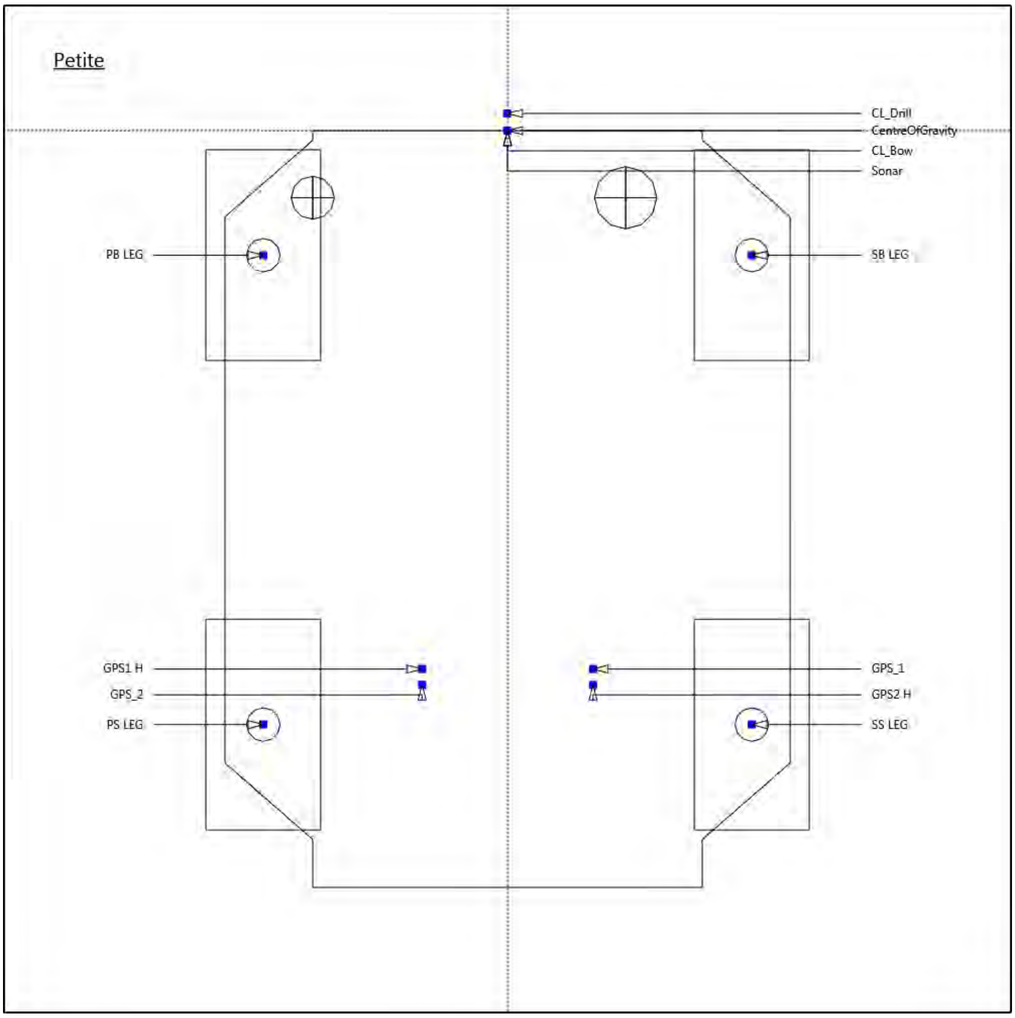
Bearing	316.13°True		288.40°True	

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,167,059.27ftUS N, 1,503,637.56ftUS E, -49.60ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,167,058.82ftUS N, 1,503,636.29ftUS E, -47.29ft Ell.	-0.44ftUS	-1.27ftUS	2.31ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-29

Seabed Information

Seabed Depth	79.20ft
Comment	

Remarks

PLATE NO. B-30

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**5**		
Comment:			

Session Name: 20180731-062420-v2
Start Time: 31 Jul 2018, 04:50:50-05:00
End Time: 31 Jul 2018, 05:05:49-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 5

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°45'38.15583"N	27°45'38.15583"N
Longitude	096°54'00.67693"W	096°54'00.67693"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,168,589.98ftUS N	
Easting	1,501,637.07ftUS E	
Height	-45.74ft Ell.	
Final Rig Heading	204.65°True (203.93°Grid)	

Final Position for CL_Drill is 2.73ftUS @ 331.3°True (330.6°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.72635°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°45'38.13212"N	Longitude: 096°54'00.66234"W	Northing: 17,168,587.60ftUS N	Easting: 1,501,638.41ftUS E
Intended Rig Heading	205.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,168,589.98ftUS N, 1,501,637.07ftUS E, -45.74ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,168,589.96ftUS N, 1,501,635.61ftUS E, -46.65ft Ell.	0.01ftUS	-1.46ftUS	-0.91ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		888 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°45'38.71465"N	±0.11ftUS	27°45'38.65584"N	±0.04ftUS
Longitude	096°54'00.49793"W	±0.14ftUS	096°54'00.32595"W	±0.05ftUS
Height	-45.74ft Ell.	±0.19ftUS	-46.66ft Ell.	±0.10ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°45'38.71466"N	±0.11ftUS	27°45'38.65584"N	±0.04ftUS
Longitude	096°54'00.49793"W	±0.14ftUS	096°54'00.32595"W	±0.05ftUS
Height	-45.74ft Ell.	±0.19ftUS	-46.66ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,168,646.61ftUS N	±0.10ftUS	17,168,640.87ftUS N	±0.04ftUS
Easting	1,501,652.43ftUS E	±0.14ftUS	1,501,667.96ftUS E	±0.05ftUS
Height	-45.74ft Ell.	±0.19ftUS	-46.66ft Ell.	±0.10ftUS

HDOP	1.09		0.74	
No. Satellites	8		13	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	204.65°True	±0.1°	204.65°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°45'38.15583"N	±0.10ftUS	27°45'38.15589"N	±0.05ftUS
Longitude	096°54'00.67693"W	±0.13ftUS	096°54'00.69319"W	±0.08ftUS
Height	-45.74ft Ell.	±0.19ftUS	-46.65ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,168,589.98ftUS N	±0.10ftUS	17,168,589.96ftUS N	±0.05ftUS
Easting	1,501,637.07ftUS E	±0.13ftUS	1,501,635.61ftUS E	±0.08ftUS
Height	-45.74ft Ell.	±0.19ftUS	-46.65ft Ell.	±0.10ftUS

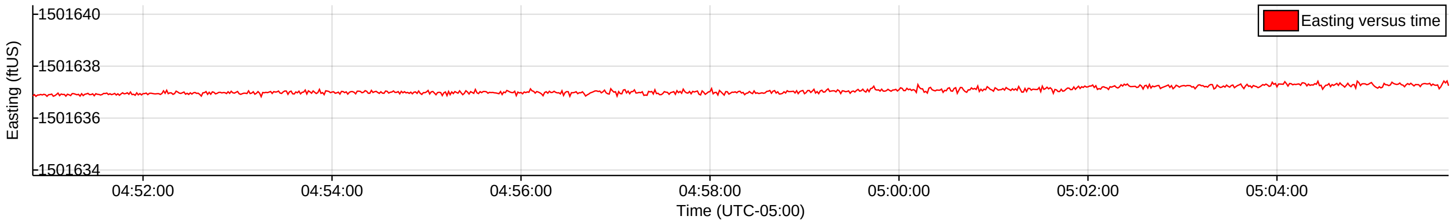
Delta Northing	0.00ftUS		0.01ftUS	
Delta Easting	0.00ftUS		-1.46ftUS	
Delta Height	0.00ftUS		-0.91ftUS	

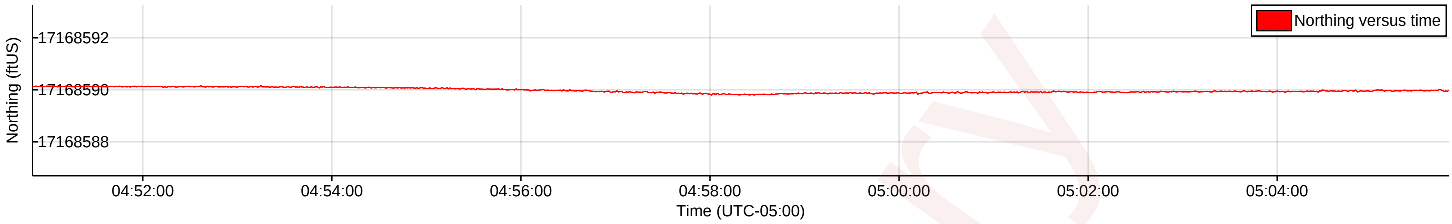
Position of CL_Drill from proposed location				
Range	2.73ftUS		3.67ftUS	

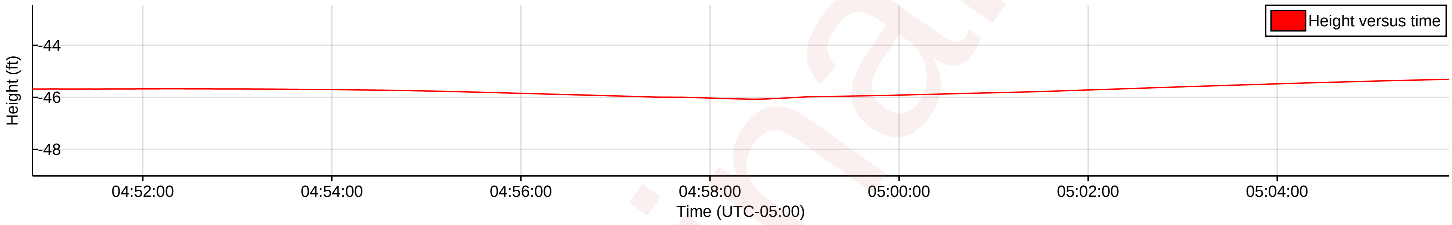
PLATE NO. B-33

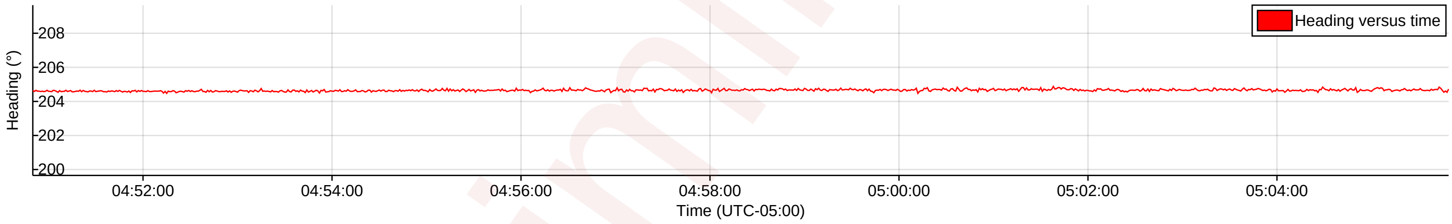
Bearing	331.29°True		310.89°True	

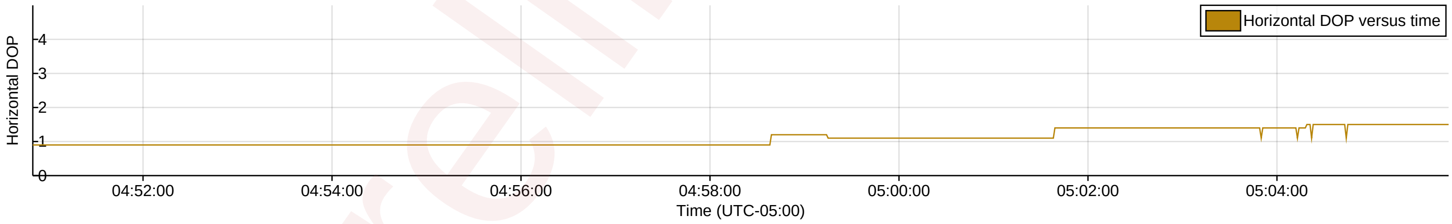
Time Series Plots for Primary

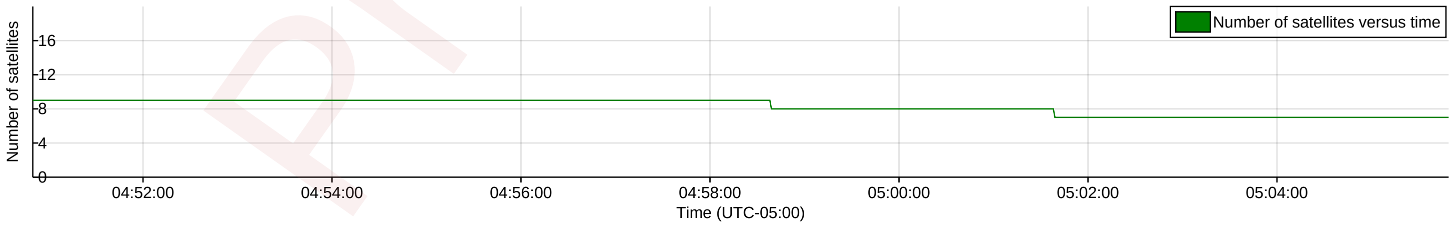












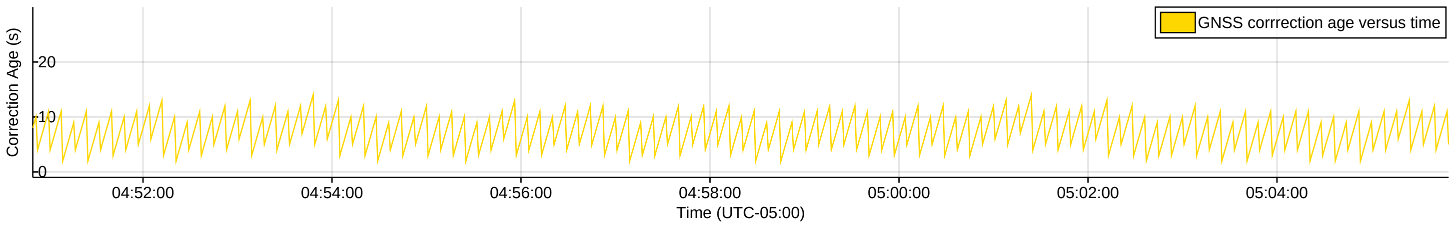
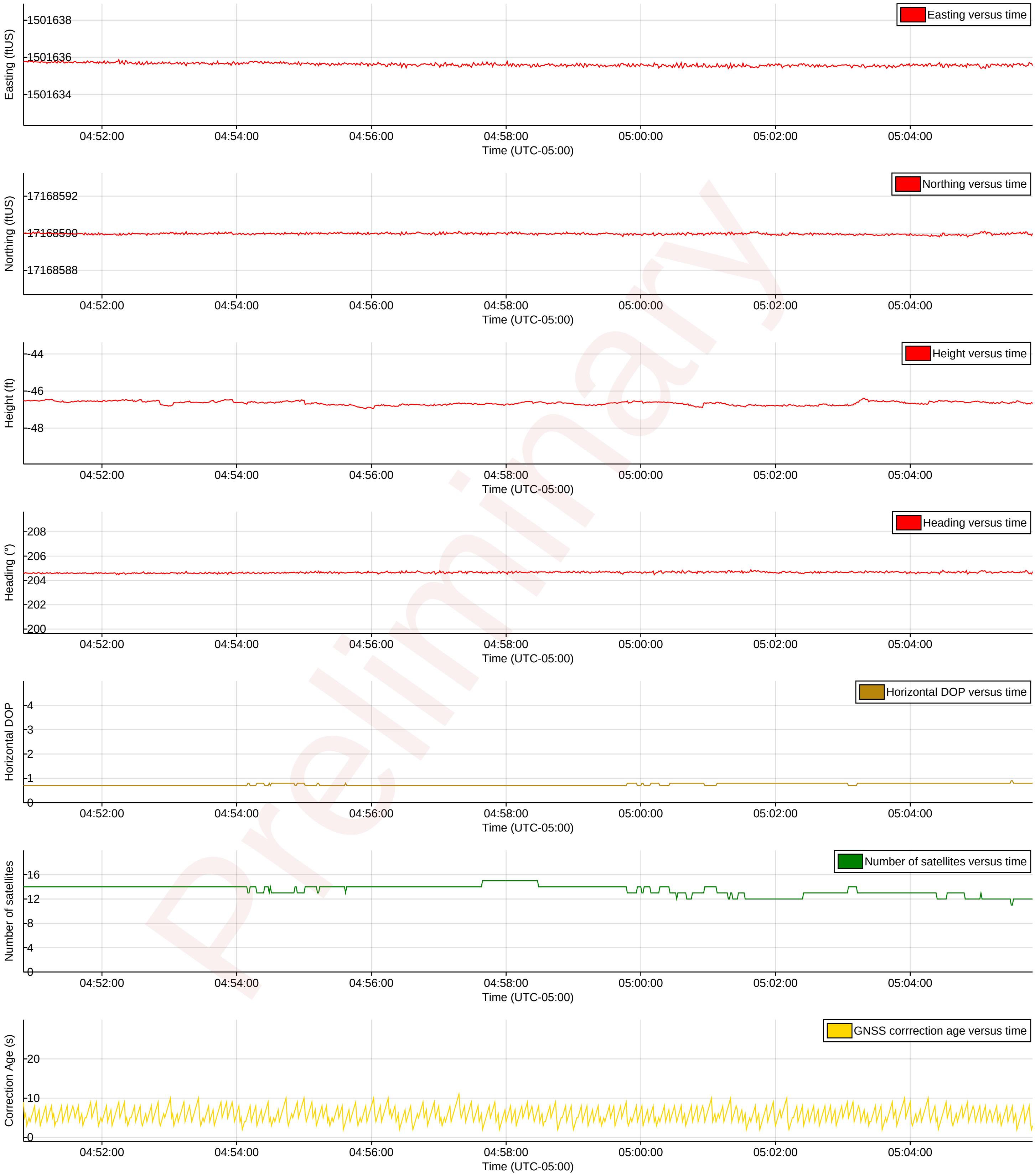
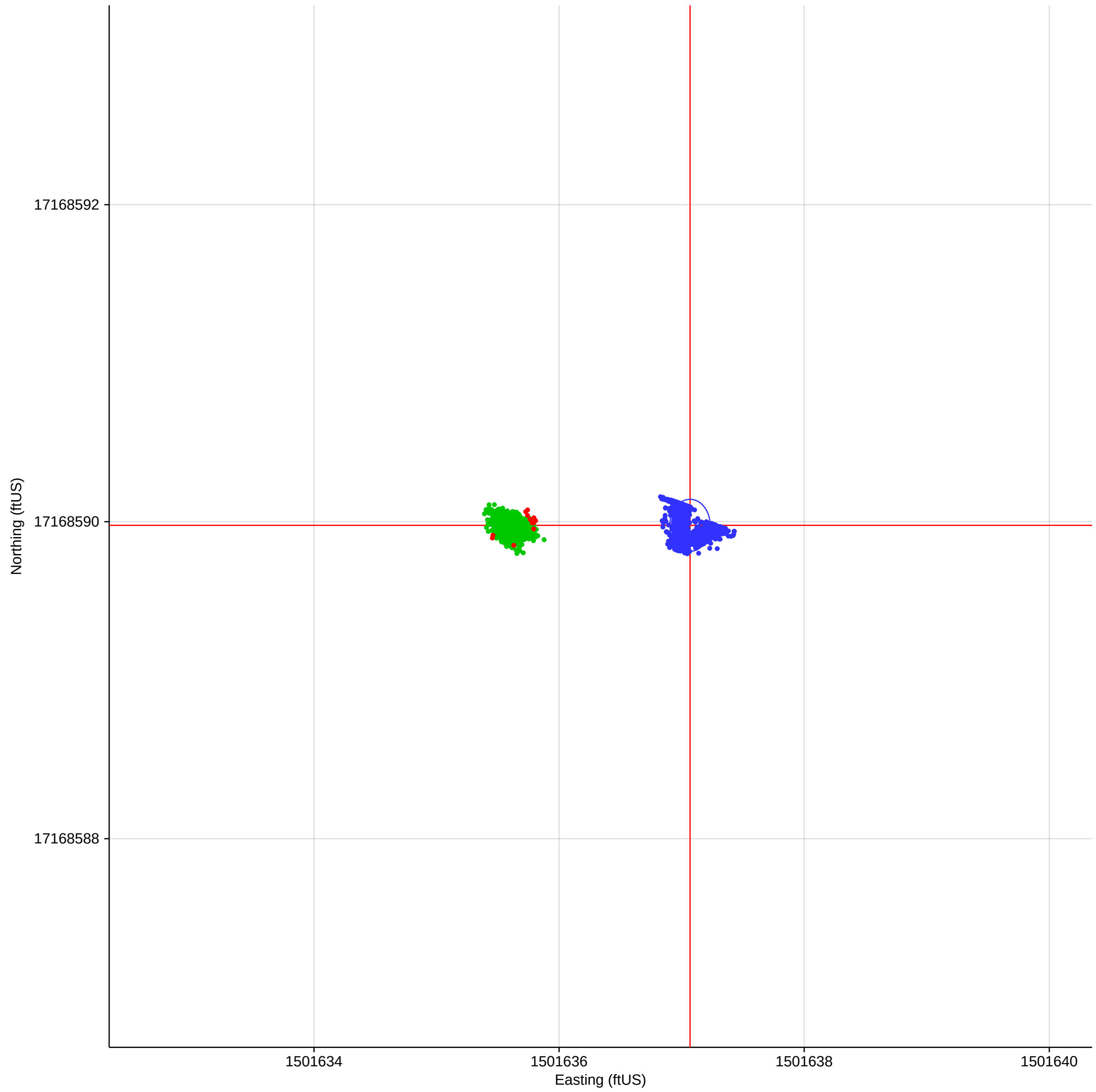


PLATE NO. B-35

Time Series Plots for Secondary

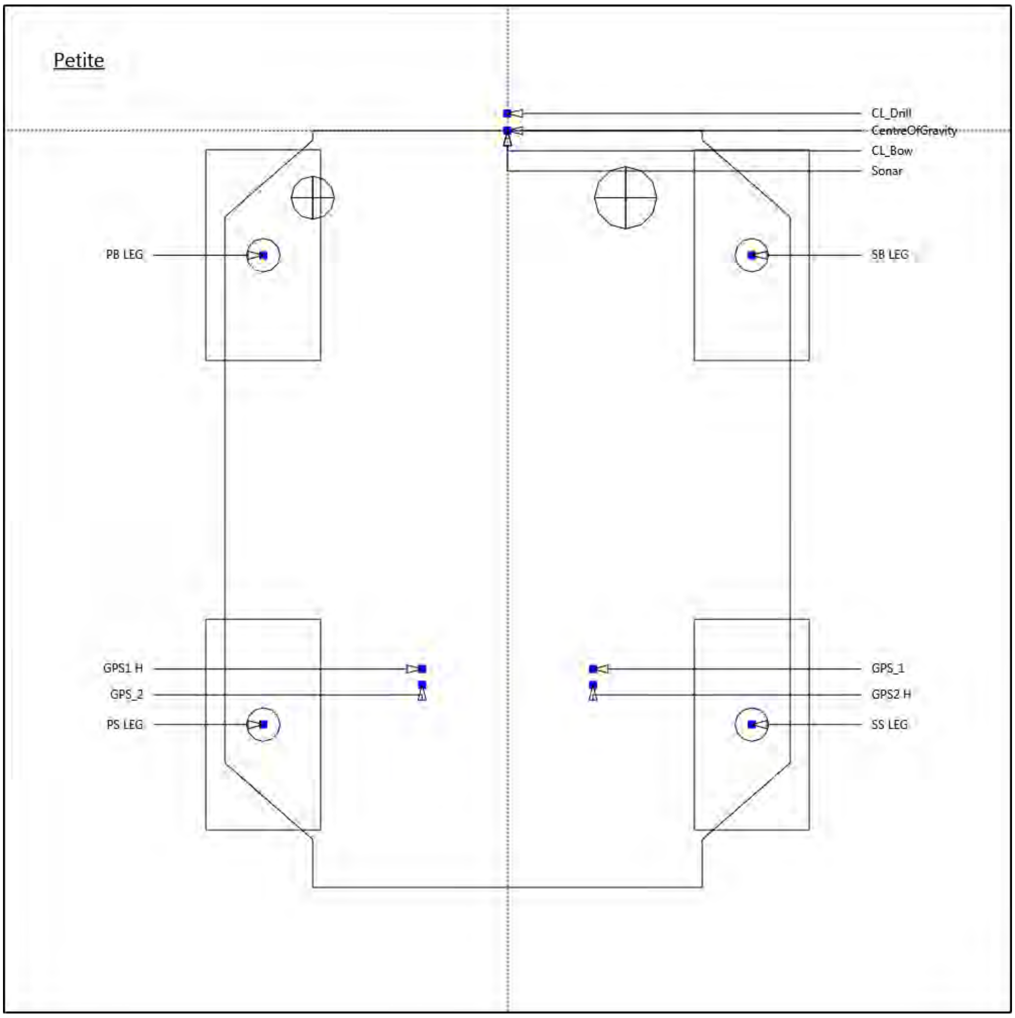


Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,168,589.98ftUS N, 1,501,637.07ftUS E, -45.74ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,168,589.96ftUS N, 1,501,635.61ftUS E, -46.65ft Ell.	0.01ftUS	-1.46ftUS	-0.91ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	75.80ft
Comment	

STARFIX
FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**na**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**6**		
Comment:			

Session Name: 20180731-005209-v1
Start Time: 30 Jul 2018, 19:53:42-05:00
End Time: 30 Jul 2018, 20:08:41-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Position Fix Summary for Petite at 6

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°45’48.42483”N	27°45’48.42483”N
Longitude	096°54’26.20742”W	096°54’26.20742”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,169,597.94ftUS N	
Easting	1,499,330.58ftUS E	
Height	-48.44ft Ell.	
Rig Heading	187.27°True (186.55°Grid)	

Position for CL_Drill is 1.28ftUS @ 323.1°True (322.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.72310°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°45’48.41470”N	Longitude: 096°54’26.19887”W	Northing: 17,169,596.93ftUS N	Easting: 1,499,331.36ftUS E
Intended Rig Heading	185.7°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,169,597.94ftUS N, 1,499,330.58ftUS E, -48.44ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,169,598.16ftUS N, 1,499,330.20ftUS E, -47.14ft Ell.	0.22ftUS	-0.38ftUS	1.30ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

na
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		900 of 900 used	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°45'48.42483"N	±0.15ftUS	27°45'48.42705"N	±0.04ftUS
Longitude	096°54'26.20742"W	±0.14ftUS	096°54'26.21166"W	±0.09ftUS
Height	-48.44ft Ell.	±0.18ftUS	-47.14ft Ell.	±0.15ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,169,597.94ftUS N	±0.14ftUS	17,169,598.16ftUS N	±0.04ftUS
Easting	1,499,330.58ftUS E	±0.15ftUS	1,499,330.20ftUS E	±0.09ftUS
Height	-48.44ft Ell.	±0.18ftUS	-47.14ft Ell.	±0.15ftUS

Delta Northing	0.00ftUS		0.22ftUS	
Delta Easting	0.00ftUS		-0.38ftUS	
Delta Height	0.00ftUS		1.30ftUS	

Position of CL_Drill from proposed location				
Range	1.28ftUS		1.70ftUS	
Bearing	323.09°True		317.34°True	

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**na**
Fugro Personnel:	**Aubrey Lamb**		
Primary Vessel:	**Petite**		
Location:	**7**		
Comment:			

Session Name:	20180730-150134-v2		
	Start Time:	30 Jul 2018, 10:05:09-05:00	
	End Time:	30 Jul 2018, 10:20:08-05:00	(Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 7

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°45’58.29477”N	27°45’58.29477”N
Longitude	096°54’51.99746”W	096°54’51.99746”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,170,565.45ftUS N	
Easting	1,497,001.40ftUS E	
Height	-47.10ft Ell.	
Final Rig Heading	166.43°True (165.71°Grid)	

Final Position for CL_Drill is 1.58ftUS @ 68.8°True (68.1°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.71982°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°45’58.28911”N	Longitude: 096°54’52.01386”W	Northing: 17,170,564.86ftUS N	Easting: 1,496,999.93ftUS E
Intended Rig Heading	165.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,170,565.45ftUS N, 1,497,001.40ftUS E, -47.10ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,170,565.90ftUS N, 1,497,001.56ftUS E, -45.78ft Ell.	0.45ftUS	0.17ftUS	1.32ftUS

Aubrey Lamb	na
Surveyor	Client Representative
FUSAMI (Fugro USA Marine, Inc.)	Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	876 of 900 used		879 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°45'58.83230"N	±0.03ftUS	27°45'58.89410"N	±0.04ftUS
Longitude	096°54'52.24554"W	±0.16ftUS	096°54'52.05481"W	±0.07ftUS
Height	-47.10ft Ell.	±0.58ftUS	-45.78ft Ell.	±0.18ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°45'58.83231"N	±0.03ftUS	27°45'58.89410"N	±0.04ftUS
Longitude	096°54'52.24554"W	±0.16ftUS	096°54'52.05481"W	±0.07ftUS
Height	-47.10ft Ell.	±0.58ftUS	-45.78ft Ell.	±0.18ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,170,619.45ftUS N	±0.03ftUS	17,170,625.91ftUS N	±0.04ftUS
Easting	1,496,978.43ftUS E	±0.16ftUS	1,496,995.48ftUS E	±0.07ftUS
Height	-47.10ft Ell.	±0.58ftUS	-45.78ft Ell.	±0.18ftUS

HDOP	0.90		0.81	
No. Satellites	9		13	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	166.43°True	±0.1°	166.43°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°45'58.29477"N	±0.05ftUS	27°45'58.29921"N	±0.04ftUS
Longitude	096°54'51.99746"W	±0.18ftUS	096°54'51.99555"W	±0.11ftUS
Height	-47.10ft Ell.	±0.58ftUS	-45.78ft Ell.	±0.18ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,170,565.45ftUS N	±0.05ftUS	17,170,565.90ftUS N	±0.04ftUS
Easting	1,497,001.40ftUS E	±0.18ftUS	1,497,001.56ftUS E	±0.11ftUS
Height	-47.10ft Ell.	±0.58ftUS	-45.78ft Ell.	±0.18ftUS

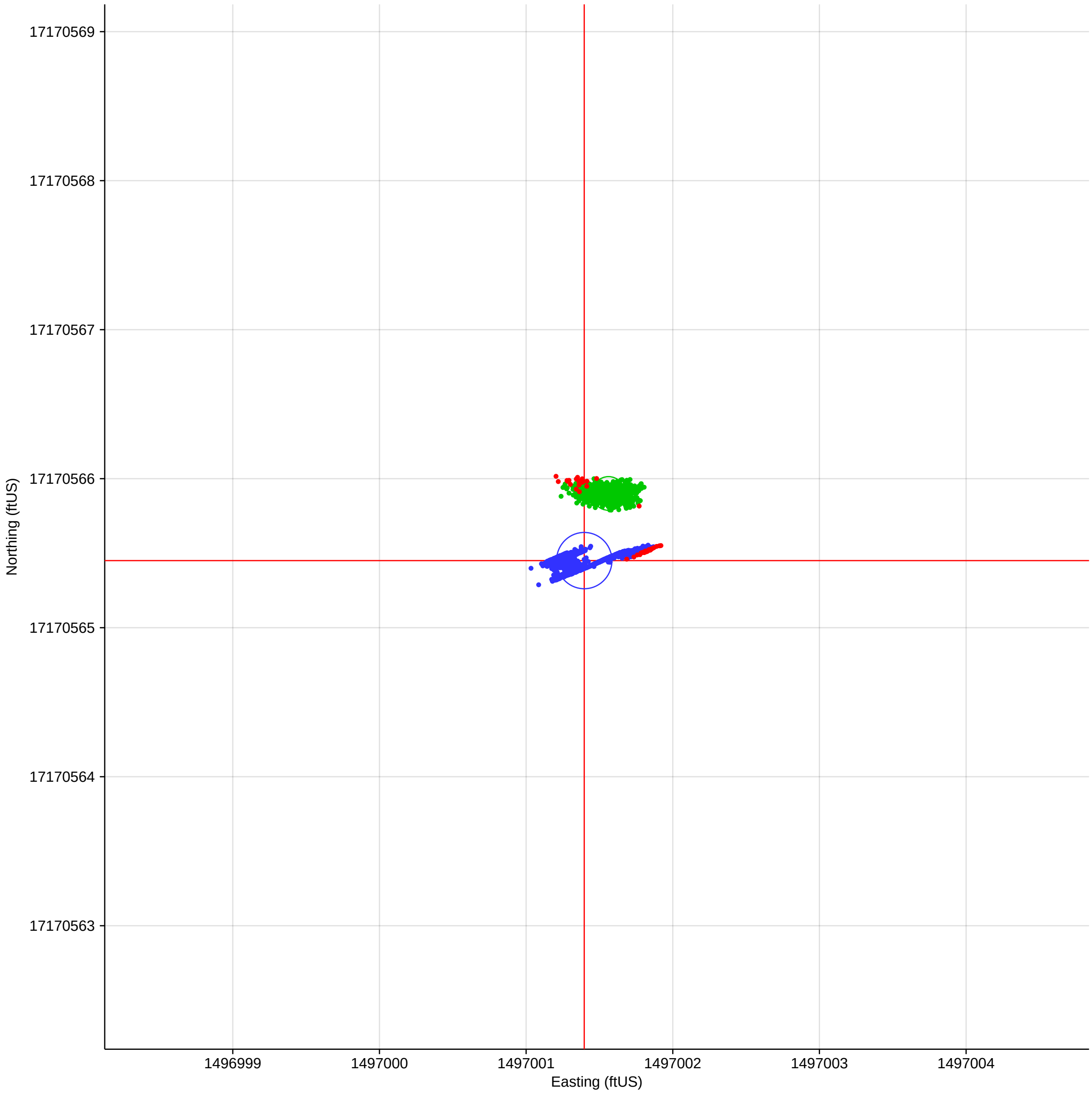
Delta Northing	0.00ftUS		0.45ftUS	
Delta Easting	0.00ftUS		0.17ftUS	
Delta Height	0.00ftUS		1.32ftUS	

Position of CL_Drill from proposed location				
Range	1.58ftUS		1.94ftUS	

Bearing	68.79°True		58.19°True	

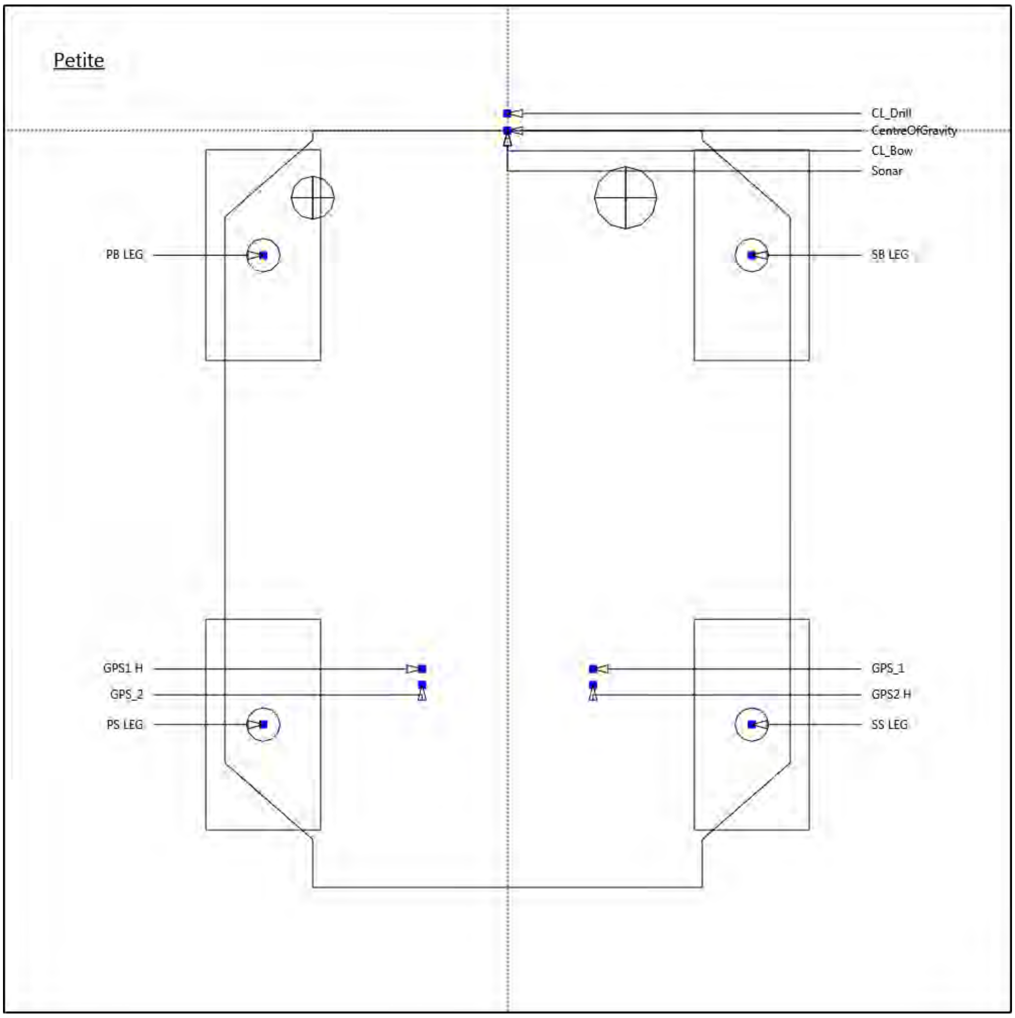
PLATE NO. B-46

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,170,565.45ftUS N, 1,497,001.40ftUS E, -47.10ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,170,565.90ftUS N, 1,497,001.56ftUS E, -45.78ft Ell.	0.45ftUS	0.17ftUS	1.32ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	70.00ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**8**		
Comment:			

Session Name: 20180801-161453-v1
Start Time: 01 Aug 2018, 11:15:43-05:00
End Time: 01 Aug 2018, 11:30:42-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 8

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°46'08.29145"N	27°46'08.29145"N
Longitude	096°55'17.78318"W	096°55'17.78318"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,171,545.89ftUS N	
Easting	1,494,672.55ftUS E	
Height	-45.53ft Ell.	
Final Rig Heading	0.93°True (0.22°Grid)	

Final Position for CL_Drill is 3.99ftUS @ 339.2°True (338.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.71661°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°46'08.25449"N	Longitude: 096°55'17.76736"W	Northing: 17,171,542.18ftUS N	Easting: 1,494,674.02ftUS E
Intended Rig Heading	300.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,171,545.89ftUS N, 1,494,672.55ftUS E, -45.53ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,171,545.92ftUS N, 1,494,671.37ftUS E, -45.73ft Ell.	0.04ftUS	-1.18ftUS	-0.20ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	887 of 900 used		878 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°46'07.71578"N	±0.06ftUS	27°46'07.70275"N	±0.04ftUS
Longitude	096°55'17.69435"W	±0.10ftUS	096°55'17.90652"W	±0.04ftUS
Height	-45.53ft Ell.	±0.28ftUS	-45.73ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°46'07.71578"N	±0.06ftUS	27°46'07.70276"N	±0.04ftUS
Longitude	096°55'17.69435"W	±0.10ftUS	096°55'17.90652"W	±0.04ftUS
Height	-45.53ft Ell.	±0.28ftUS	-45.73ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,171,487.86ftUS N	±0.06ftUS	17,171,486.31ftUS N	±0.04ftUS
Easting	1,494,681.26ftUS E	±0.10ftUS	1,494,662.22ftUS E	±0.04ftUS
Height	-45.53ft Ell.	±0.28ftUS	-45.73ft Ell.	±0.11ftUS

HDOP	1.01		0.88	
No. Satellites	8		12	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	0.93°True	±0.1°	0.93°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°46'08.29145"N	±0.06ftUS	27°46'08.29189"N	±0.04ftUS
Longitude	096°55'17.78318"W	±0.13ftUS	096°55'17.79637"W	±0.07ftUS
Height	-45.53ft Ell.	±0.28ftUS	-45.73ft Ell.	±0.11ftUS

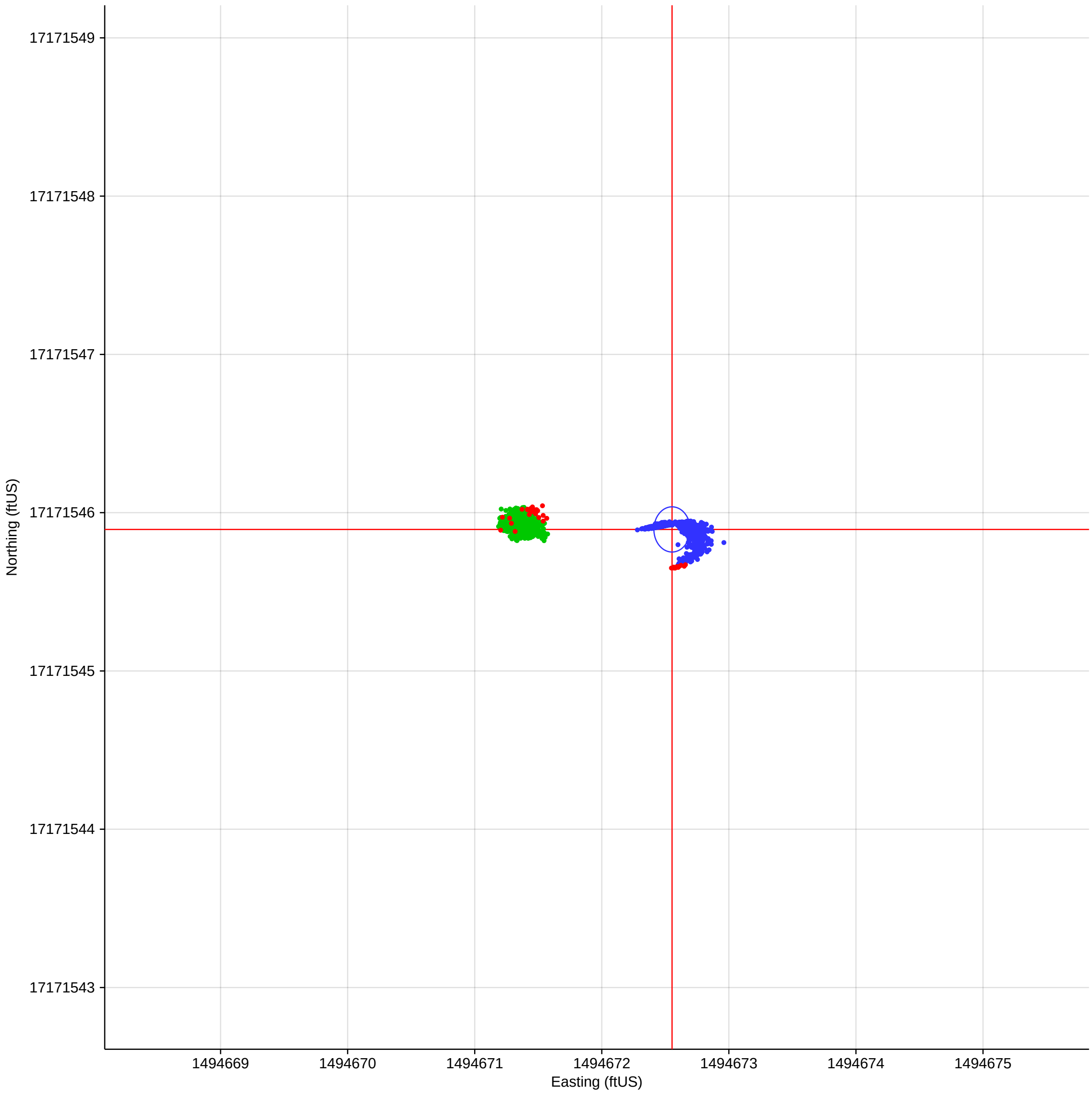
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,171,545.89ftUS N	±0.06ftUS	17,171,545.92ftUS N	±0.04ftUS
Easting	1,494,672.55ftUS E	±0.13ftUS	1,494,671.37ftUS E	±0.07ftUS
Height	-45.53ft Ell.	±0.28ftUS	-45.73ft Ell.	±0.11ftUS

Delta Northing	0.00ftUS		0.04ftUS	
Delta Easting	0.00ftUS		-1.18ftUS	
Delta Height	0.00ftUS		-0.20ftUS	

Position of CL_Drill from proposed location				
Range	3.99ftUS		4.59ftUS	

Bearing	339.16°True		325.40°True	

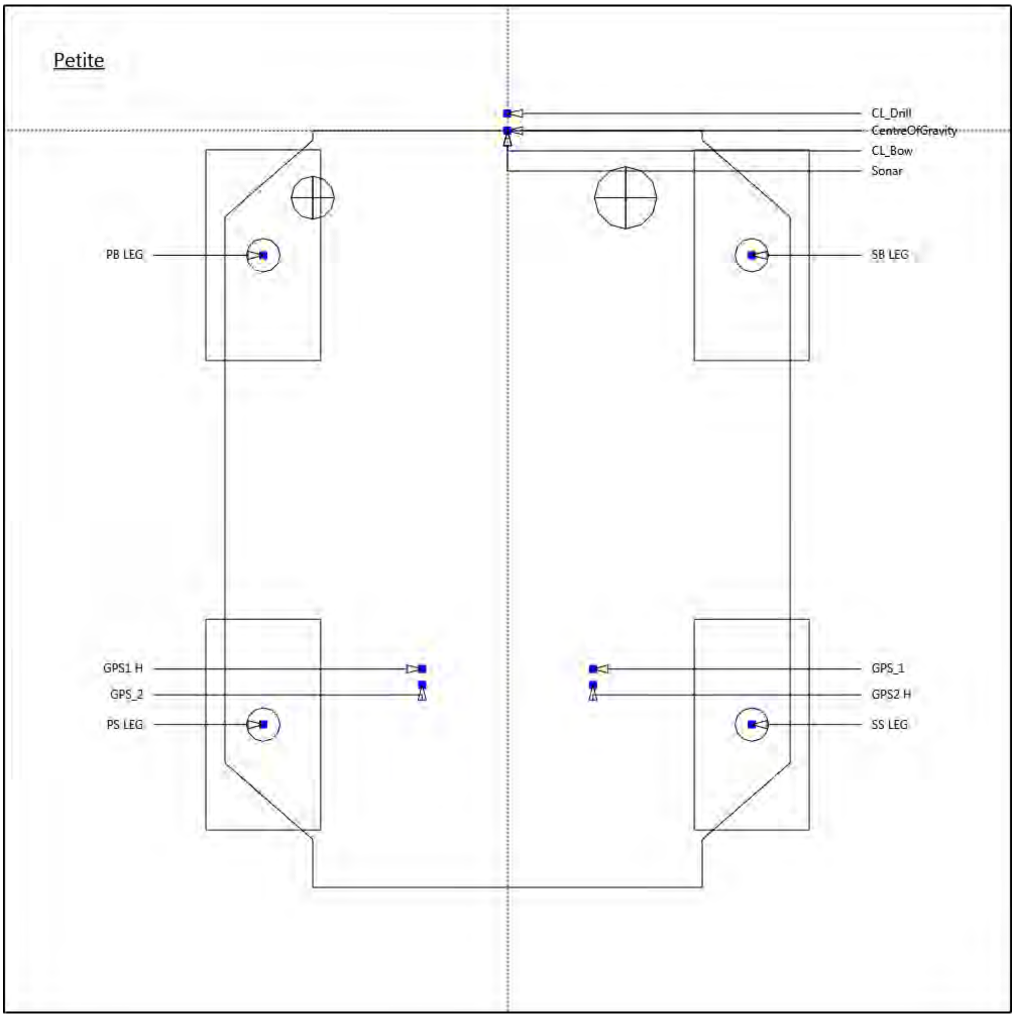
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,171,545.89ftUS N, 1,494,672.55ftUS E, -45.53ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,171,545.92ftUS N, 1,494,671.37ftUS E, -45.73ft Ell.	0.04ftUS	-1.18ftUS	-0.20ftUS

PLATE NO. B-54

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	73.50ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**9**		
Comment:			

Session Name: 20180801-211215-v2
Start Time: 01 Aug 2018, 16:19:52-05:00
End Time: 01 Aug 2018, 16:34:51-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 9

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°46’23.96584”N	27°46’23.96584”N
Longitude	096°55’39.63433”W	096°55’39.63433”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,173,104.22ftUS N	
Easting	1,492,690.09ftUS E	
Height	-41.59ft Ell.	
Final Rig Heading	356.27°True (355.56°Grid)	

Final Position for CL_Drill is 2.45ftUS @ 281.3°True (280.5°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.71386°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°46’23.96109”N	Longitude: 096°55’39.60753”W	Northing: 17,173,103.77ftUS N	Easting: 1,492,692.50ftUS E
Intended Rig Heading	1.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,173,104.22ftUS N, 1,492,690.09ftUS E, -41.59ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,173,104.37ftUS N, 1,492,688.51ftUS E, -46.72ft Ell.	0.17ftUS	-1.57ftUS	-5.13ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	897 of 900 used		841 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°46'23.39849"N	±0.33ftUS	27°46'23.37242"N	±0.53ftUS
Longitude	096°55'39.49320"W	±0.77ftUS	096°55'39.70781"W	±0.48ftUS
Height	-41.59ft Ell.	±8.44ftUS	-46.72ft Ell.	±1.36ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°46'23.39849"N	±0.33ftUS	27°46'23.37242"N	±0.53ftUS
Longitude	096°55'39.49320"W	±0.77ftUS	096°55'39.70781"W	±0.48ftUS
Height	-41.59ft Ell.	±8.44ftUS	-46.72ft Ell.	±1.36ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,173,047.09ftUS N	±0.33ftUS	17,173,044.21ftUS N	±0.52ftUS
Easting	1,492,703.48ftUS E	±0.77ftUS	1,492,684.23ftUS E	±0.49ftUS
Height	-41.59ft Ell.	±8.44ftUS	-46.72ft Ell.	±1.36ftUS

HDOP	0.95		0.86	
No. Satellites	9		11	
Age of Corrections	5.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	356.27°True	±0.1°	356.27°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°46'23.96584"N	±0.33ftUS	27°46'23.96757"N	±0.53ftUS
Longitude	096°55'39.63433"W	±0.74ftUS	096°55'39.65186"W	±0.51ftUS
Height	-41.59ft Ell.	±8.44ftUS	-46.72ft Ell.	±1.36ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,173,104.22ftUS N	±0.33ftUS	17,173,104.37ftUS N	±0.53ftUS
Easting	1,492,690.09ftUS E	±0.74ftUS	1,492,688.51ftUS E	±0.51ftUS
Height	-41.59ft Ell.	±8.44ftUS	-46.72ft Ell.	±1.36ftUS

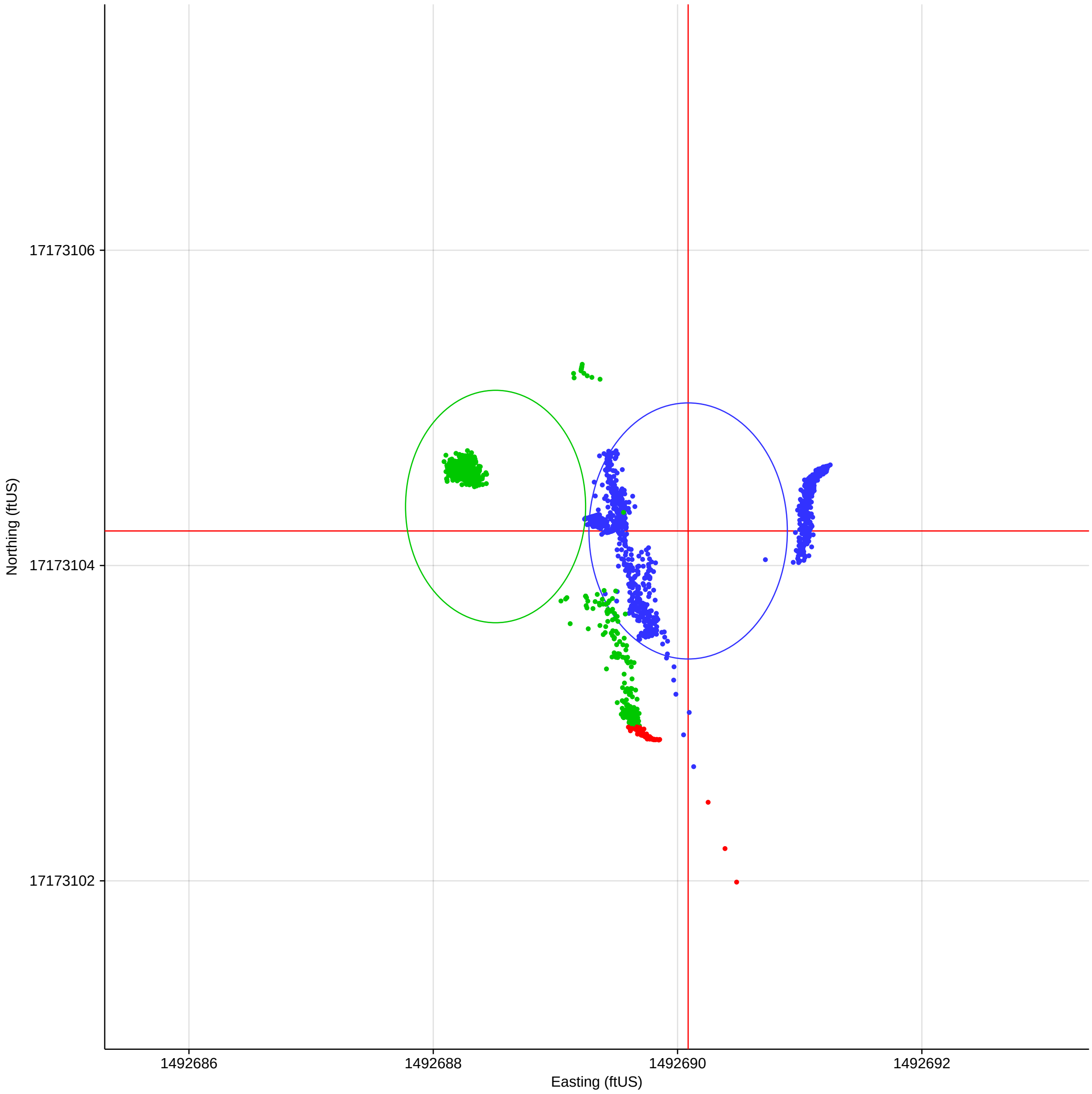
Delta Northing	0.00ftUS		0.17ftUS	
Delta Easting	0.00ftUS		-1.57ftUS	
Delta Height	0.00ftUS		-5.13ftUS	

Position of CL_Drill from proposed location				
Range	2.45ftUS		4.04ftUS	

PLATE NO. B-59

Bearing	281.26°True		279.33°True	

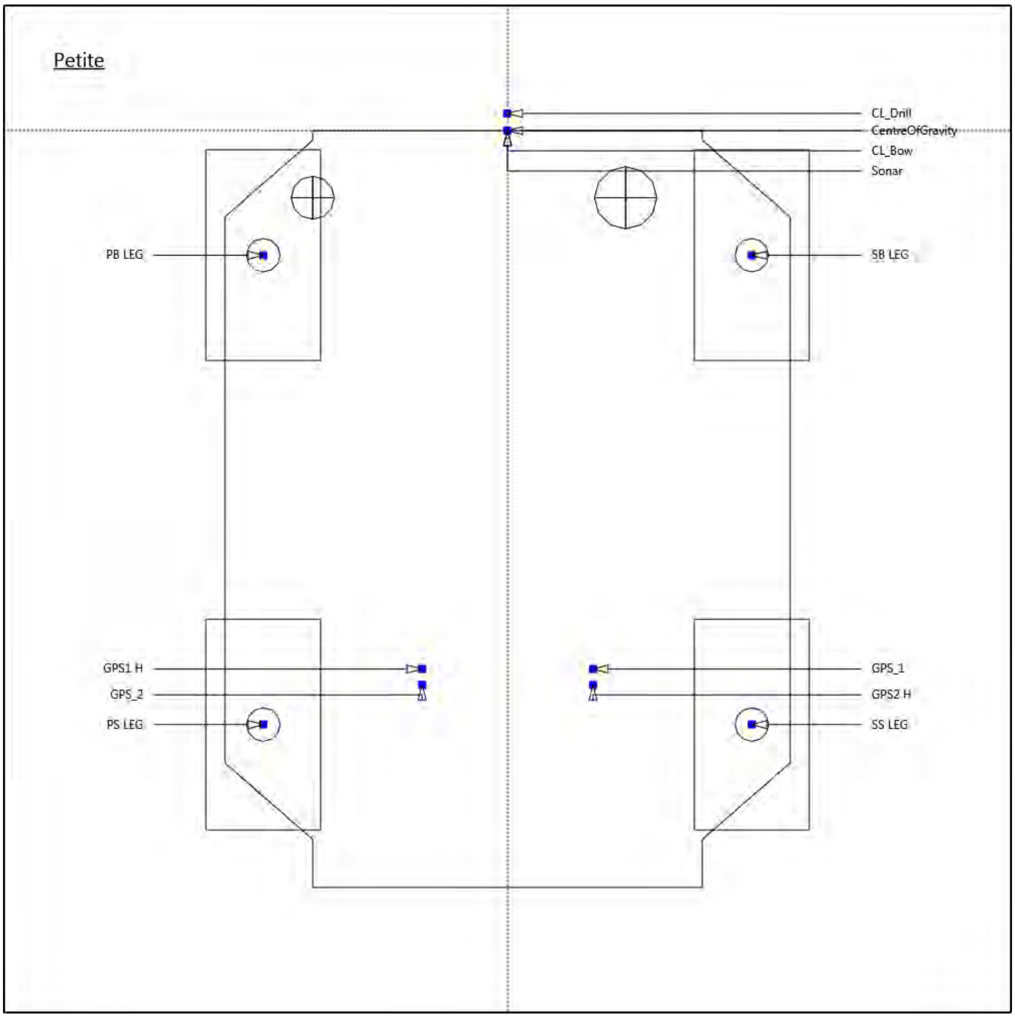
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,173,104.22ftUS N, 1,492,690.09ftUS E, -41.59ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,173,104.37ftUS N, 1,492,688.51ftUS E, -46.72ft Ell.	0.17ftUS	-1.57ftUS	-5.13ftUS

PLATE NO. B-61

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-62

Seabed Information

Seabed Depth	71.30ft
Comment	

Remarks

PLATE NO. B-63

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**10**		
Comment:			

Session Name: 20180802-021302-v2
Start Time: 01 Aug 2018, 21:14:05-05:00
End Time: 01 Aug 2018, 21:29:04-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 10

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°46'39.80384"N	27°46'39.80383"N
Longitude	096°56'01.38300"W	096°56'01.38300"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,174,679.28ftUS N	
Easting	1,490,716.77ftUS E	
Height	-46.85ft Ell.	
Final Rig Heading	43.68°True (42.97°Grid)	

Final Position for CL_Drill is 4.54ftUS @ 4.0°True (3.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.71106°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°46'39.75902"N	Longitude: 096°56'01.38653"W	Northing: 17,174,674.75ftUS N	Easting: 1,490,716.51ftUS E
Intended Rig Heading	45.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,174,679.28ftUS N, 1,490,716.77ftUS E, -46.85ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,174,679.75ftUS N, 1,490,716.09ftUS E, -47.04ft Ell.	0.48ftUS	-0.67ftUS	-0.19ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	896 of 900 used		875 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°46’39.32746”N	±0.25ftUS	27°46’39.44242”N	±0.05ftUS
Longitude	096°56’01.75710”W	±0.19ftUS	096°56’01.92097”W	±0.05ftUS
Height	-46.85ft Ell.	±0.27ftUS	-47.04ft Ell.	±0.14ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°46’39.32747”N	±0.25ftUS	27°46’39.44242”N	±0.05ftUS
Longitude	096°56’01.75710”W	±0.19ftUS	096°56’01.92097”W	±0.05ftUS
Height	-46.85ft Ell.	±0.27ftUS	-47.04ft Ell.	±0.14ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,174,630.76ftUS N	±0.24ftUS	17,174,642.18ftUS N	±0.05ftUS
Easting	1,490,683.77ftUS E	±0.19ftUS	1,490,668.90ftUS E	±0.05ftUS
Height	-46.85ft Ell.	±0.27ftUS	-47.04ft Ell.	±0.14ftUS

HDOP	1.29		0.70	
No. Satellites	7		14	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	43.68°True	±0.0°	43.68°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°46’39.80384”N	±0.24ftUS	27°46’39.80854”N	±0.06ftUS
Longitude	096°56’01.38300”W	±0.18ftUS	096°56’01.39048”W	±0.06ftUS
Height	-46.85ft Ell.	±0.27ftUS	-47.04ft Ell.	±0.14ftUS

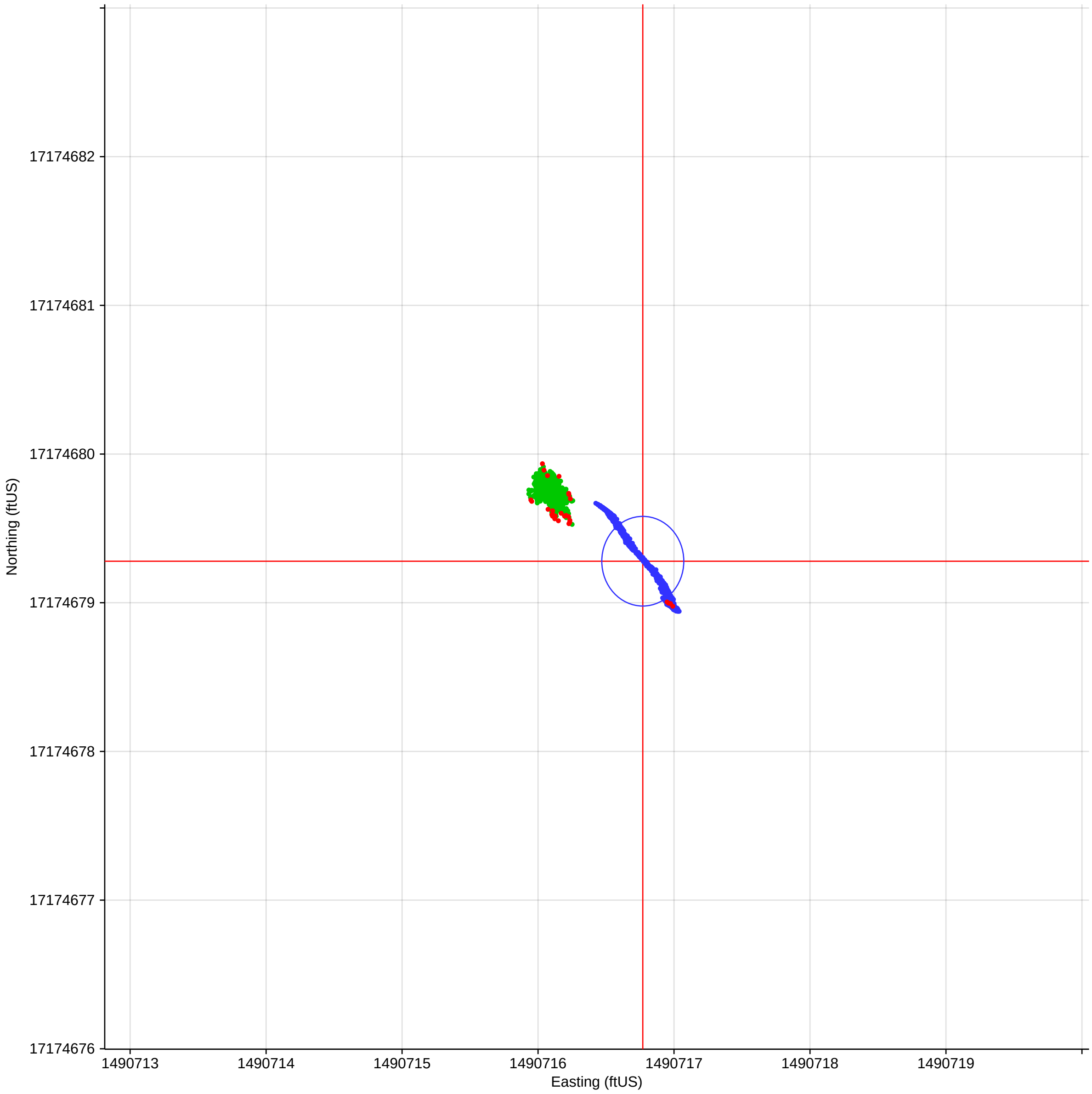
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,174,679.28ftUS N	±0.24ftUS	17,174,679.75ftUS N	±0.06ftUS
Easting	1,490,716.77ftUS E	±0.18ftUS	1,490,716.09ftUS E	±0.06ftUS
Height	-46.85ft Ell.	±0.27ftUS	-47.04ft Ell.	±0.14ftUS

Delta Northing	0.00ftUS		0.48ftUS	
Delta Easting	0.00ftUS		-0.67ftUS	
Delta Height	0.00ftUS		-0.19ftUS	

Position of CL_Drill from proposed location				
Range	4.54ftUS		5.01ftUS	

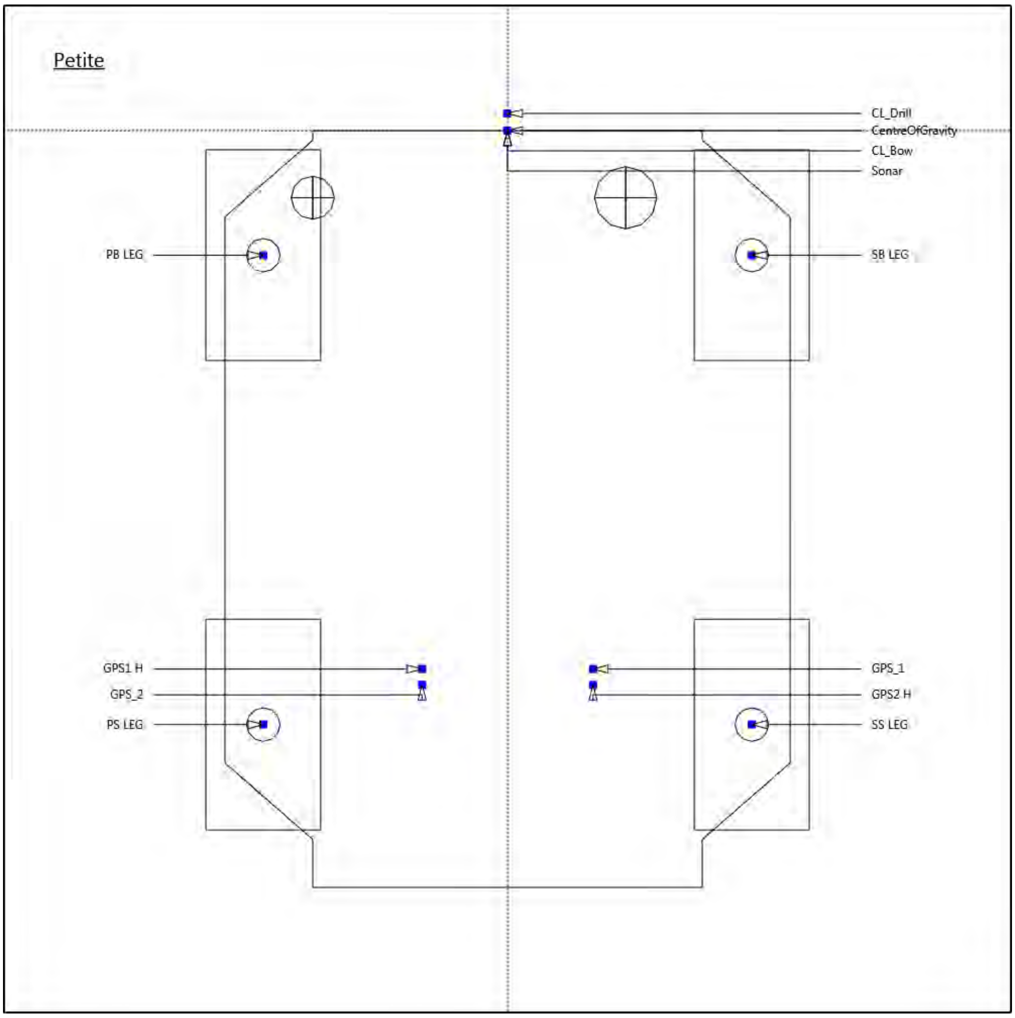
Bearing	4.00°True		355.94°True	

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,174,679.28ftUS N, 1,490,716.77ftUS E, -46.85ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,174,679.75ftUS N, 1,490,716.09ftUS E, -47.04ft Ell.	0.48ftUS	-0.67ftUS	-0.19ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-69

Seabed Information

Seabed Depth	68.90ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**11**		
Comment:			

Session Name: 20180802-053919-v1
Start Time: 02 Aug 2018, 01:59:13-05:00
End Time: 02 Aug 2018, 02:14:12-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 11

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°46’55.83890”N	27°46’55.83890”N
Longitude	096°56’22.98063”W	096°56’22.98063”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,176,274.51ftUS N	
Easting	1,488,756.93ftUS E	
Height	-47.13ft Ell.	
Final Rig Heading	84.51°True (83.80°Grid)	

Final Position for CL_Drill is 0.94ftUS @ 241.8°True (241.1°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.70830°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°46’55.84330”N	Longitude: 096°56’22.97140”W	Northing: 17,176,274.96ftUS N	Easting: 1,488,757.75ftUS E
Intended Rig Heading	85.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,176,274.51ftUS N, 1,488,756.93ftUS E, -47.13ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,176,275.44ftUS N, 1,488,755.98ftUS E, -46.10ft Ell.	0.95ftUS	-0.93ftUS	1.03ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	883 of 900 used		884 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°46'55.69596"N	±0.09ftUS	27°46'55.87970"N	±0.08ftUS
Longitude	096°56'23.61388"W	±0.04ftUS	096°56'23.66156"W	±0.06ftUS
Height	-47.13ft Ell.	±0.09ftUS	-46.10ft Ell.	±0.12ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°46'55.69596"N	±0.09ftUS	27°46'55.87970"N	±0.08ftUS
Longitude	096°56'23.61388"W	±0.04ftUS	096°56'23.66156"W	±0.06ftUS
Height	-47.13ft Ell.	±0.09ftUS	-46.10ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,176,259.37ftUS N	±0.09ftUS	17,176,277.87ftUS N	±0.08ftUS
Easting	1,488,700.23ftUS E	±0.04ftUS	1,488,695.72ftUS E	±0.06ftUS
Height	-47.13ft Ell.	±0.09ftUS	-46.10ft Ell.	±0.12ftUS

HDOP	0.92		0.86	
No. Satellites	9		12	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	84.51°True	±0.1°	84.51°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°46'55.83890"N	±0.06ftUS	27°46'55.84828"N	±0.09ftUS
Longitude	096°56'22.98063"W	±0.05ftUS	096°56'22.99099"W	±0.06ftUS
Height	-47.13ft Ell.	±0.09ftUS	-46.10ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,176,274.51ftUS N	±0.06ftUS	17,176,275.44ftUS N	±0.09ftUS
Easting	1,488,756.93ftUS E	±0.05ftUS	1,488,755.98ftUS E	±0.06ftUS
Height	-47.13ft Ell.	±0.09ftUS	-46.10ft Ell.	±0.12ftUS

Delta Northing	0.00ftUS		0.95ftUS	
Delta Easting	0.00ftUS		-0.93ftUS	
Delta Height	0.00ftUS		1.03ftUS	

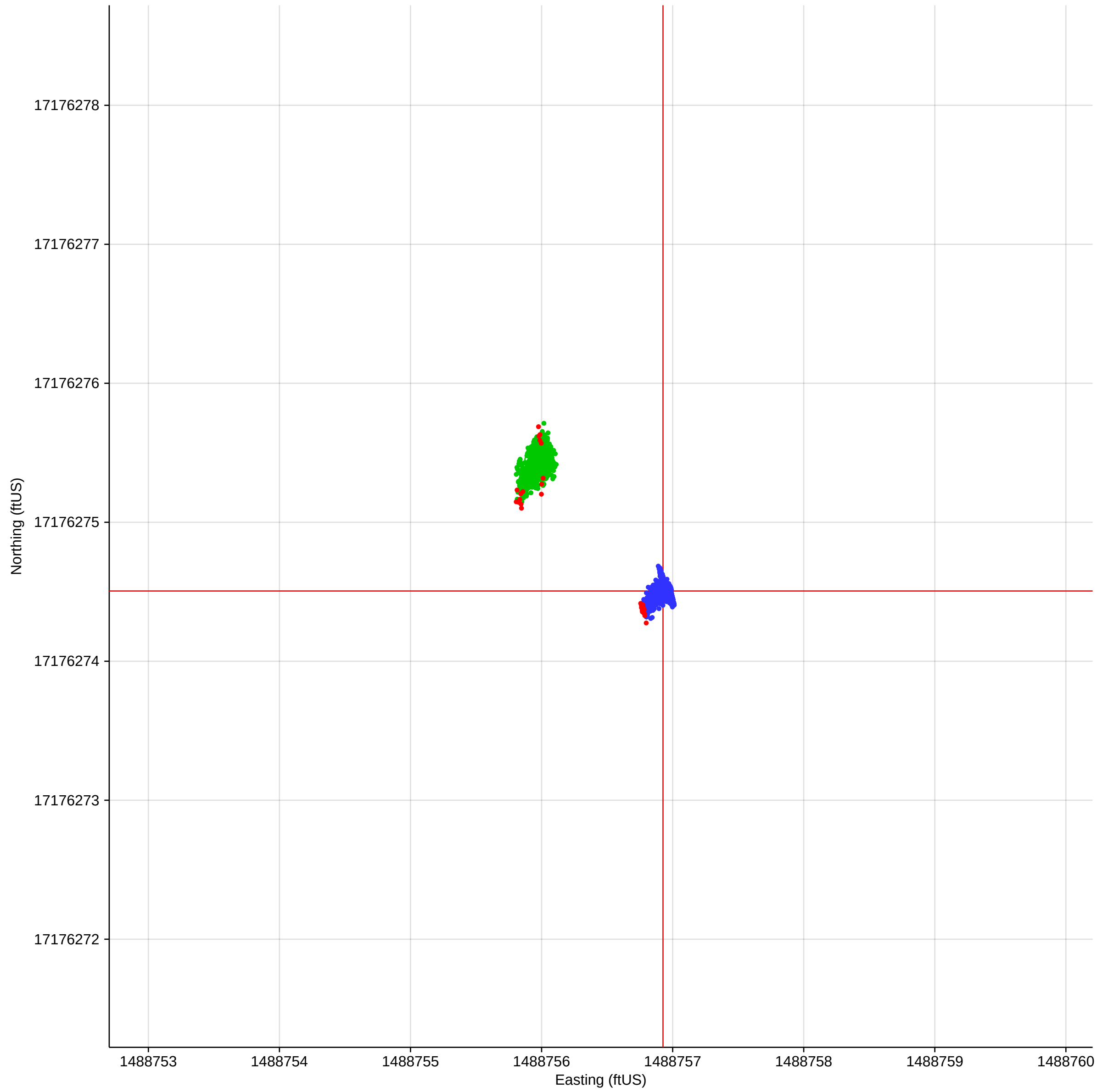
Position of CL_Drill from proposed location				
Range	0.94ftUS		1.83ftUS	

PLATE NO. B-73

Bearing	241.82°True		285.95°True	

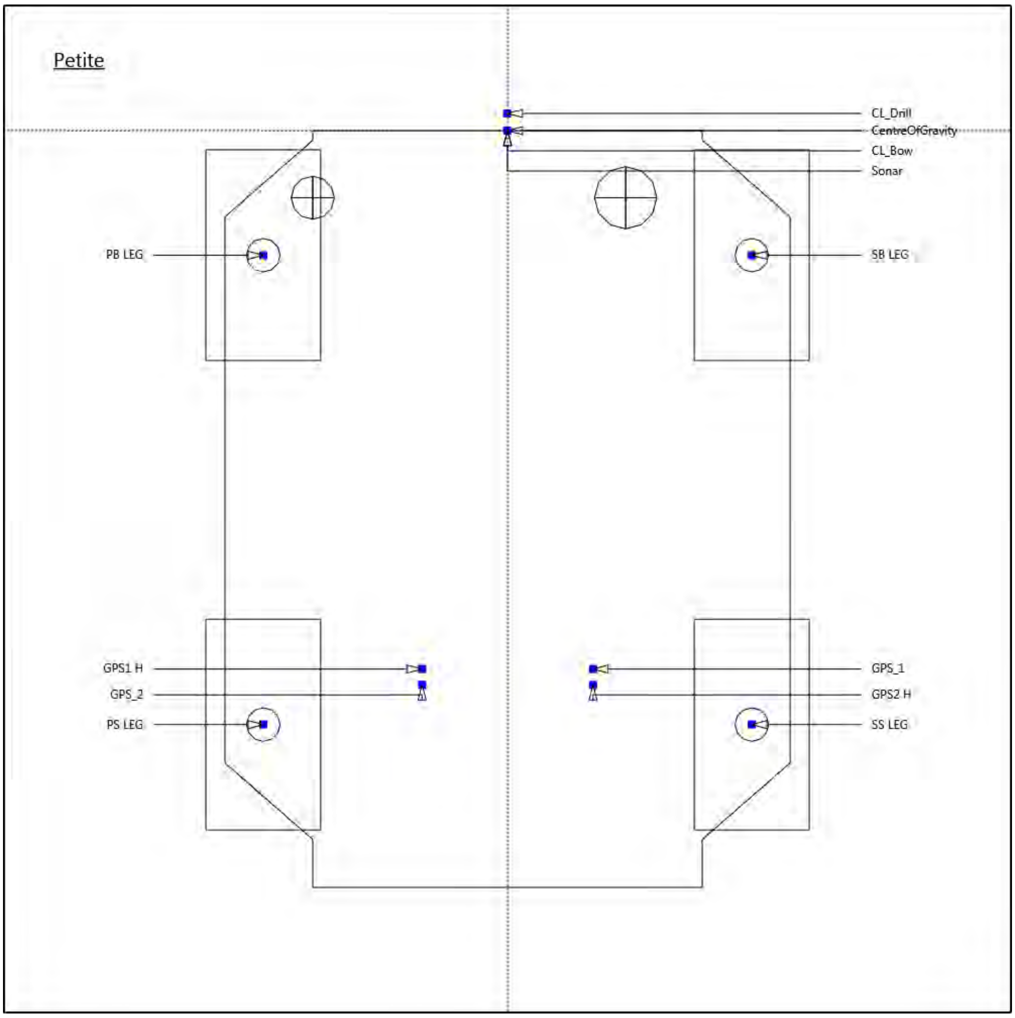
PLATE NO. B-74

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,176,274.51ftUS N, 1,488,756.93ftUS E, -47.13ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,176,275.44ftUS N, 1,488,755.98ftUS E, -46.10ft Ell.	0.95ftUS	-0.93ftUS	1.03ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-76

Seabed Information

Seabed Depth	68.20ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**12**		
Comment:			

Session Name: 20180802-091619-v1
Start Time: 02 Aug 2018, 07:02:49-05:00
End Time: 02 Aug 2018, 07:17:48-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 12

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°47’05.46988”N	27°47’05.46987”N
Longitude	096°56’48.99792”W	096°56’48.99792”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,177,218.24ftUS N	
Easting	1,486,408.27ftUS E	
Height	-50.43ft Ell.	
Final Rig Heading	86.80°True (86.09°Grid)	

Final Position for CL_Drill is 4.65ftUS @ 350.7°True (350.0°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.70502°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°47’05.42443”N	Longitude: 096°56’48.98960”W	Northing: 17,177,213.66ftUS N	Easting: 1,486,409.07ftUS E
Intended Rig Heading	84.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,177,218.24ftUS N, 1,486,408.27ftUS E, -50.43ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,177,218.84ftUS N, 1,486,406.77ftUS E, -49.15ft Ell.	0.62ftUS	-1.49ftUS	1.28ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	893 of 900 used		888 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°47’05.34954”N	±0.05ftUS	27°47’05.53119”N	±0.04ftUS
Longitude	096°56’49.63711”W	±0.10ftUS	096°56’49.68310”W	±0.05ftUS
Height	-50.43ft Ell.	±0.34ftUS	-49.15ft Ell.	±0.17ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°47’05.34954”N	±0.05ftUS	27°47’05.53119”N	±0.04ftUS
Longitude	096°56’49.63711”W	±0.10ftUS	096°56’49.68310”W	±0.05ftUS
Height	-50.43ft Ell.	±0.34ftUS	-49.15ft Ell.	±0.17ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,177,205.38ftUS N	±0.04ftUS	17,177,223.67ftUS N	±0.04ftUS
Easting	1,486,351.01ftUS E	±0.10ftUS	1,486,346.65ftUS E	±0.05ftUS
Height	-50.43ft Ell.	±0.34ftUS	-49.15ft Ell.	±0.17ftUS

HDOP	0.87		0.70	
No. Satellites	10		14	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	86.80°True	±0.1°	86.80°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°47’05.46988”N	±0.09ftUS	27°47’05.47597”N	±0.06ftUS
Longitude	096°56’48.99792”W	±0.10ftUS	096°56’49.01446”W	±0.05ftUS
Height	-50.43ft Ell.	±0.34ftUS	-49.15ft Ell.	±0.17ftUS

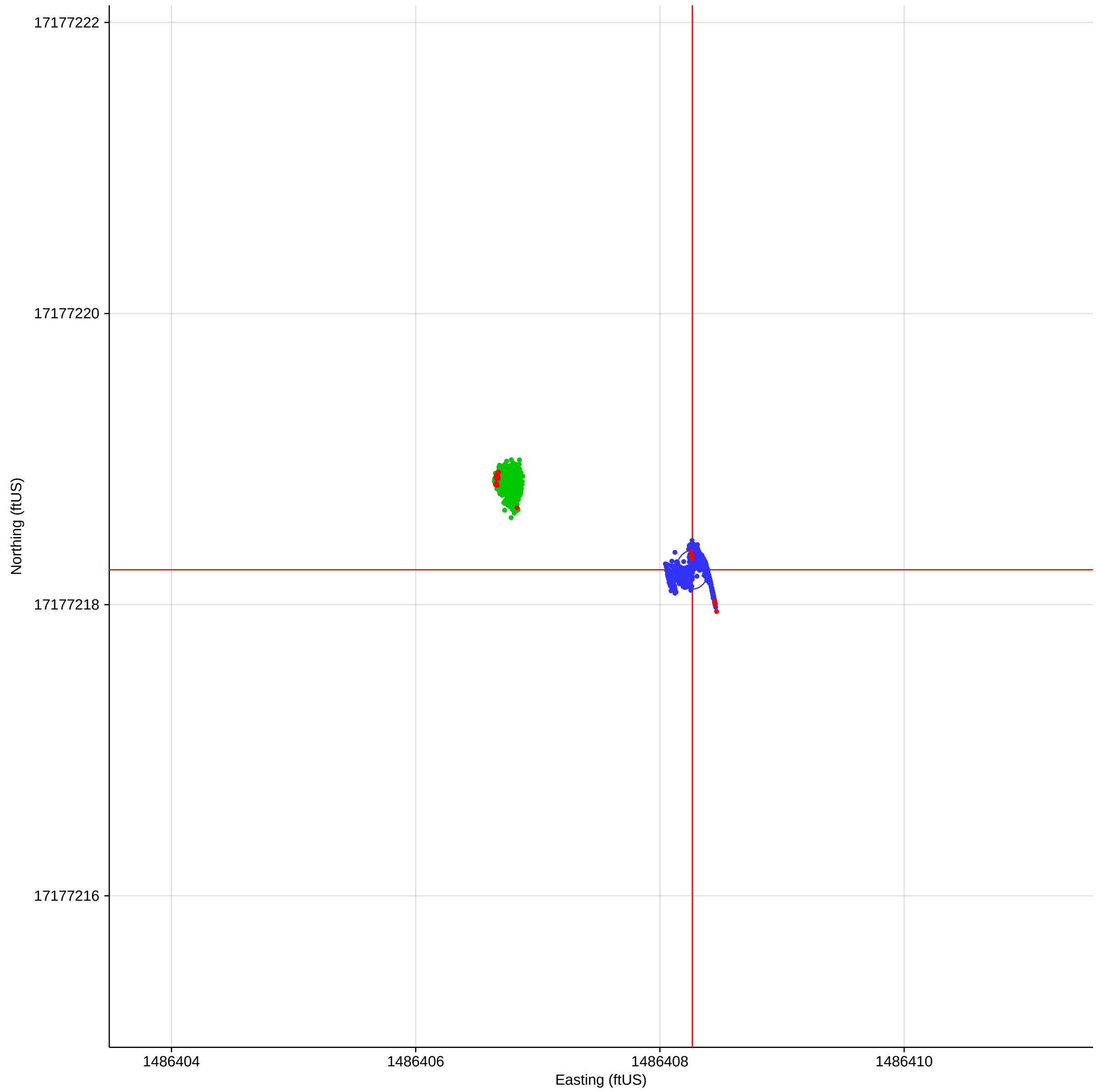
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,177,218.24ftUS N	±0.08ftUS	17,177,218.84ftUS N	±0.06ftUS
Easting	1,486,408.27ftUS E	±0.10ftUS	1,486,406.77ftUS E	±0.05ftUS
Height	-50.43ft Ell.	±0.34ftUS	-49.15ft Ell.	±0.17ftUS

Delta Northing	0.00ftUS		0.62ftUS	
Delta Easting	0.00ftUS		-1.49ftUS	
Delta Height	0.00ftUS		1.28ftUS	

Position of CL_Drill from proposed location				
Range	4.65ftUS		5.66ftUS	

Bearing	350.74°True		336.77°True	

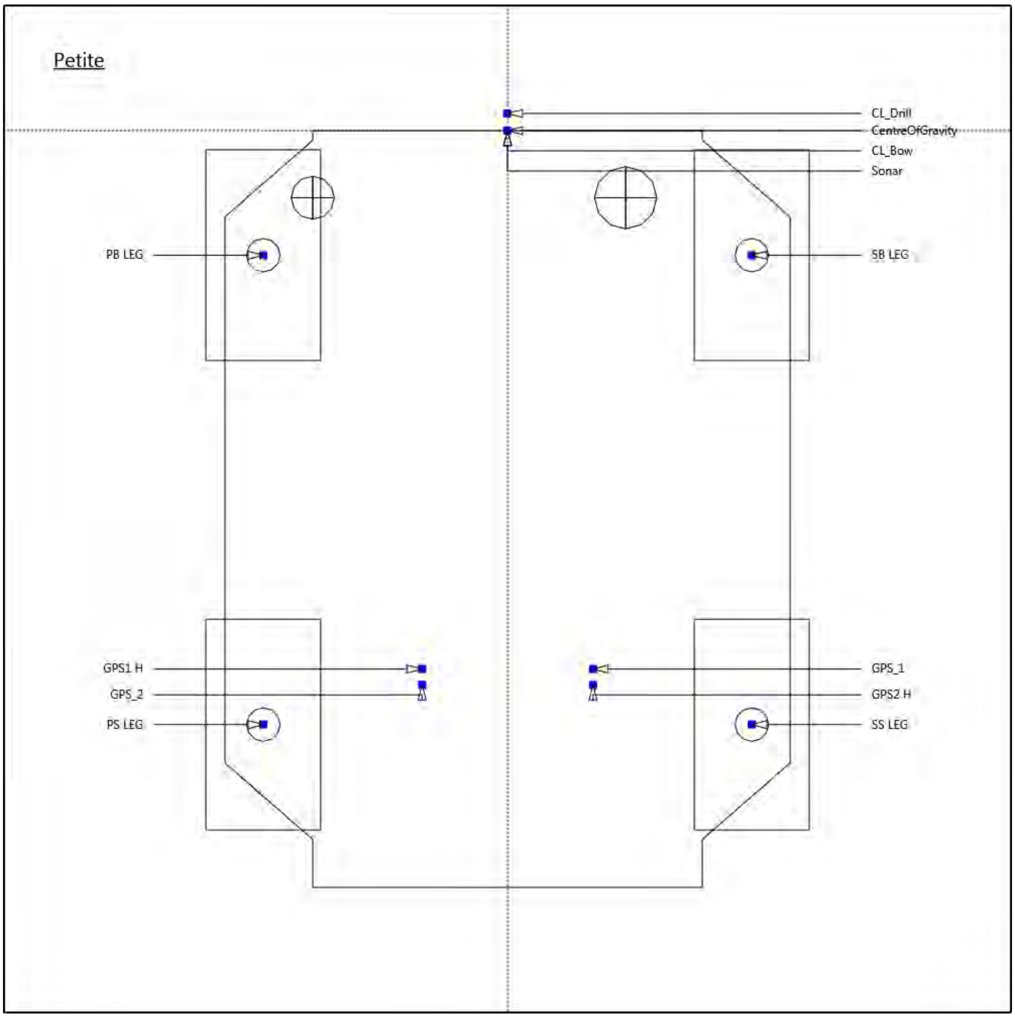
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,177,218.24ftUS N, 1,486,408.27ftUS E, -50.43ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,177,218.84ftUS N, 1,486,406.77ftUS E, -49.15ft Ell.	0.62ftUS	-1.49ftUS	1.28ftUS

PLATE NO. B-82

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information Remarks

PLATE NO. B-84

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**13**		
Comment:			

Session Name: 20180802-151943-v1
Start Time: 02 Aug 2018, 11:21:04-05:00
End Time: 02 Aug 2018, 11:36:03-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 13

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°47’15.25204”N	27°47’15.25204”N
Longitude	096°57’14.87307”W	096°57’14.87307”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,178,177.54ftUS N	
Easting	1,484,072.29ftUS E	
Height	-51.03ft Ell.	
Final Rig Heading	8.31°True (7.61°Grid)	

Final Position for CL_Drill is 6.71ftUS @ 233.5°True (232.8°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.70184°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°47’15.29154”N	Longitude: 096°57’14.81300”W	Northing: 17,178,181.59ftUS N	Easting: 1,484,077.64ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,178,177.54ftUS N, 1,484,072.29ftUS E, -51.03ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,178,177.64ftUS N, 1,484,070.89ftUS E, -51.37ft Ell.	0.12ftUS	-1.40ftUS	-0.33ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	881 of 900 used		830 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°47'14.67099"N	±0.13ftUS	27°47'14.68160"N	±0.16ftUS
Longitude	096°57'14.86807"W	±0.19ftUS	096°57'15.08304"W	±0.18ftUS
Height	-51.03ft Ell.	±0.14ftUS	-51.37ft Ell.	±0.84ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°47'14.67099"N	±0.13ftUS	27°47'14.68161"N	±0.16ftUS
Longitude	096°57'14.86807"W	±0.19ftUS	096°57'15.08304"W	±0.18ftUS
Height	-51.03ft Ell.	±0.14ftUS	-51.37ft Ell.	±0.84ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,178,118.86ftUS N	±0.13ftUS	17,178,119.70ftUS N	±0.16ftUS
Easting	1,484,073.46ftUS E	±0.18ftUS	1,484,054.14ftUS E	±0.18ftUS
Height	-51.03ft Ell.	±0.14ftUS	-51.37ft Ell.	±0.84ftUS

HDOP	0.94		0.80	
No. Satellites	8		13	
Age of Corrections	8.0 secs		4.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	8.31°True	±0.1°	8.31°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°47'15.25204"N	±0.13ftUS	27°47'15.25327"N	±0.17ftUS
Longitude	096°57'14.87307"W	±0.19ftUS	096°57'14.88872"W	±0.15ftUS
Height	-51.03ft Ell.	±0.14ftUS	-51.37ft Ell.	±0.84ftUS

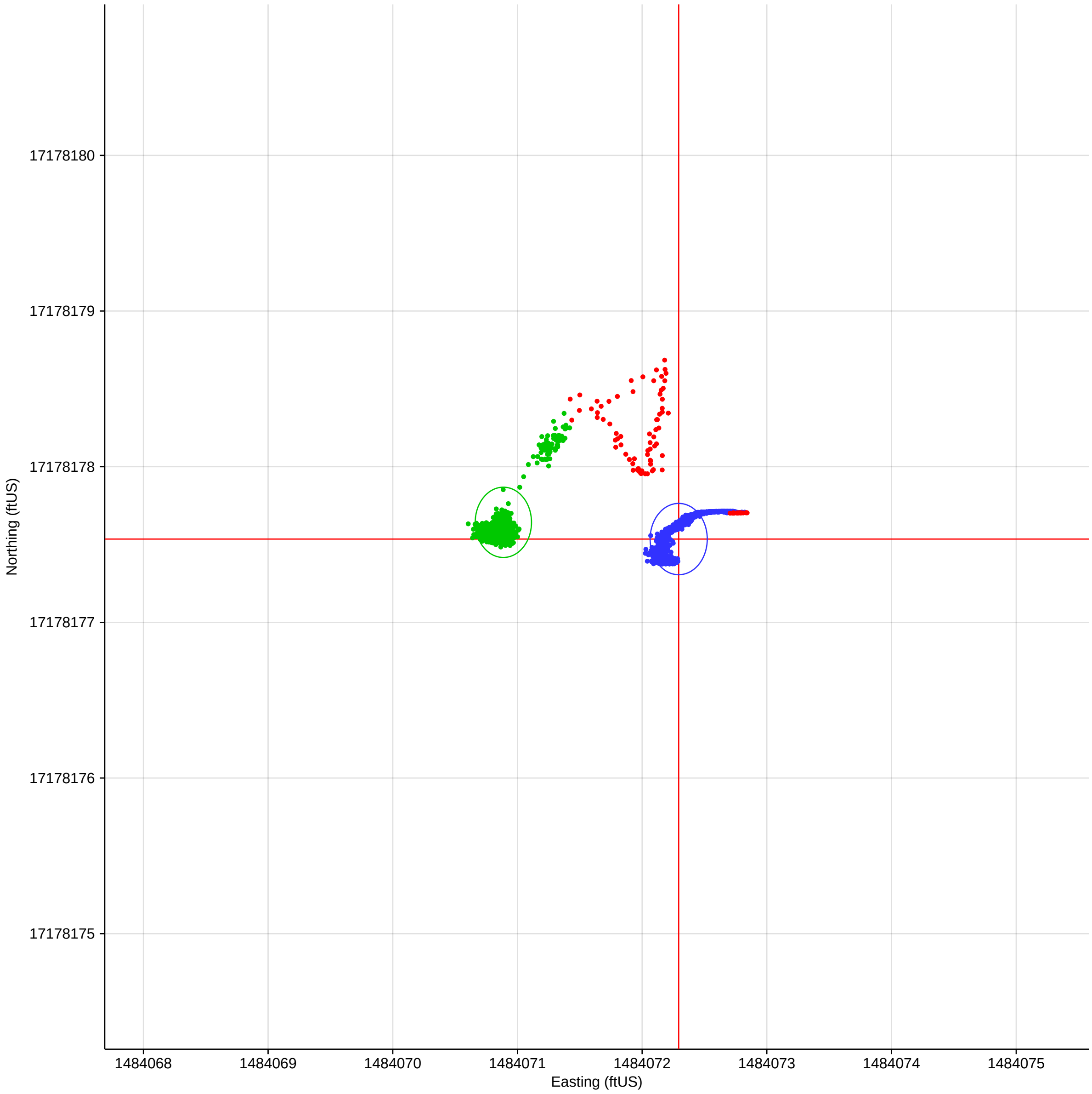
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,178,177.54ftUS N	±0.13ftUS	17,178,177.64ftUS N	±0.17ftUS
Easting	1,484,072.29ftUS E	±0.19ftUS	1,484,070.89ftUS E	±0.14ftUS
Height	-51.03ft Ell.	±0.14ftUS	-51.37ft Ell.	±0.84ftUS

Delta Northing	0.00ftUS		0.12ftUS	
Delta Easting	0.00ftUS		-1.40ftUS	
Delta Height	0.00ftUS		-0.33ftUS	

Position of CL_Drill from proposed location				
Range	6.71ftUS		7.82ftUS	

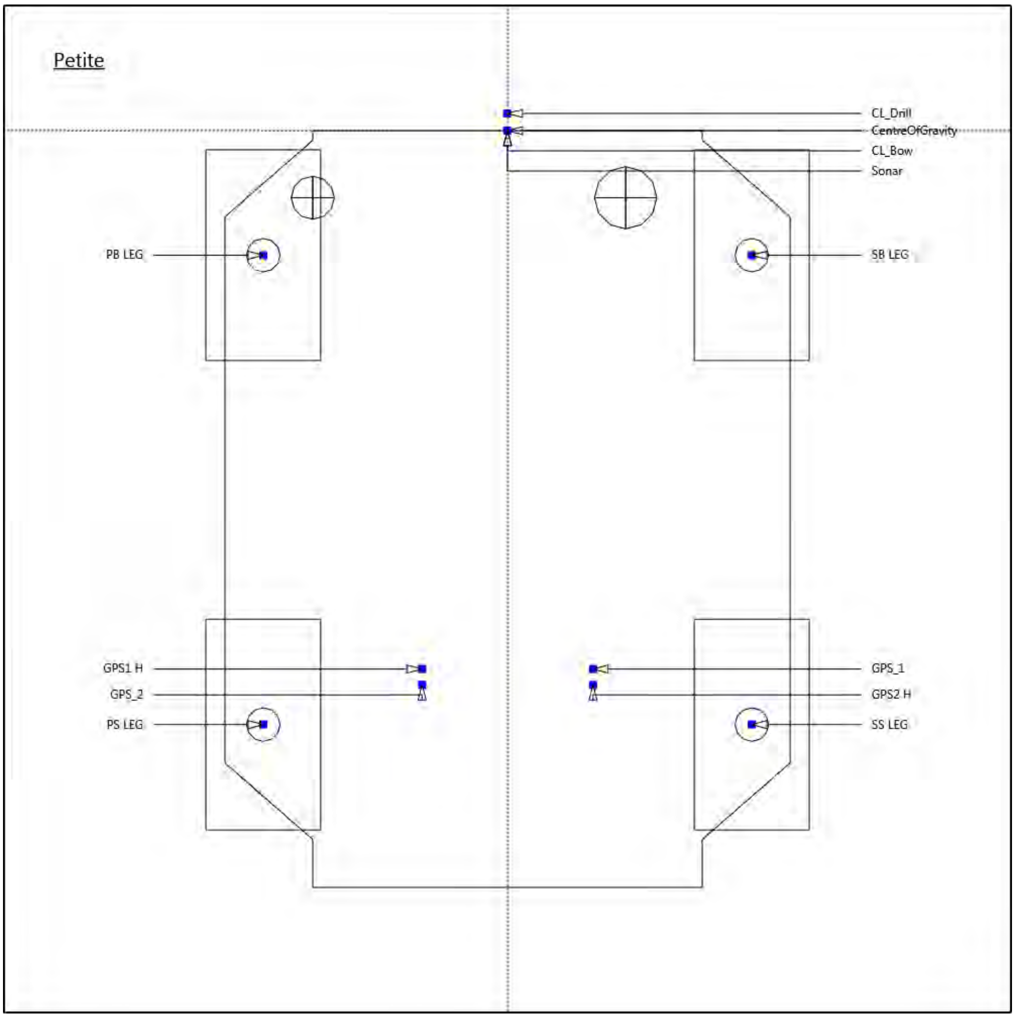
Bearing	233.52°True		240.39°True	

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,178,177.54ftUS N, 1,484,072.29ftUS E, -51.03ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,178,177.64ftUS N, 1,484,070.89ftUS E, -51.37ft Ell.	0.12ftUS	-1.40ftUS	-0.33ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-90

Seabed Information

Seabed Depth	63.70ft
Comment	

Remarks

PLATE NO. B-91

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**14**		
Comment:			

Session Name: 20180802-194455-v1
Start Time: 02 Aug 2018, 17:05:58-05:00
End Time: 02 Aug 2018, 17:20:57-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 14

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°47’24.47822”N	27°47’24.47821”N
Longitude	096°57’41.13489”W	096°57’41.13489”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,179,080.40ftUS N	
Easting	1,481,702.39ftUS E	
Height	-47.24ft Ell.	
Final Rig Heading	12.18°True (11.49°Grid)	

Final Position for CL_Drill is 3.05ftUS @ 331.0°True (330.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.69852°		

Proposed Location

North American Datum 1983		SPCS83 Texas South zone (US Survey feet) CM -99° W	
Latitude: 27°47’24.45183”N	Longitude: 096°57’41.11845”W	Northing: 17,179,077.75ftUS N	Easting: 1,481,703.90ftUS E
Intended Rig Heading	8.0°True		

Positioning System Comparison

Sensor	Mean Position SPCS83 Texas South zone (US Survey feet) CM -99° W	Delta Northing	Delta Easting	Delta Height
Primary	17,179,080.40ftUS N, 1,481,702.39ftUS E, -47.24ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,179,081.23ftUS N, 1,481,701.49ftUS E, -47.41ft Ell.	0.85ftUS	-0.89ftUS	-0.18ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	864 of 900 used		867 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°47’23.89819”N	±0.14ftUS	27°47’23.92789”N	±0.05ftUS
Longitude	096°57’41.17406”W	±0.12ftUS	096°57’41.38214”W	±0.03ftUS
Height	-47.24ft Ell.	±0.50ftUS	-47.41ft Ell.	±0.12ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°47’23.89819”N	±0.14ftUS	27°47’23.92790”N	±0.05ftUS
Longitude	096°57’41.17406”W	±0.12ftUS	096°57’41.38214”W	±0.03ftUS
Height	-47.24ft Ell.	±0.50ftUS	-47.41ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,179,021.78ftUS N	±0.14ftUS	17,179,024.55ftUS N	±0.05ftUS
Easting	1,481,699.59ftUS E	±0.12ftUS	1,481,680.86ftUS E	±0.03ftUS
Height	-47.24ft Ell.	±0.50ftUS	-47.41ft Ell.	±0.12ftUS

HDOP	1.00		0.80	
No. Satellites	8		13	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	12.18°True	±0.0°	12.18°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°47’24.47822”N	±0.14ftUS	27°47’24.48658”N	±0.06ftUS
Longitude	096°57’41.13489”W	±0.12ftUS	096°57’41.14483”W	±0.05ftUS
Height	-47.24ft Ell.	±0.50ftUS	-47.41ft Ell.	±0.12ftUS

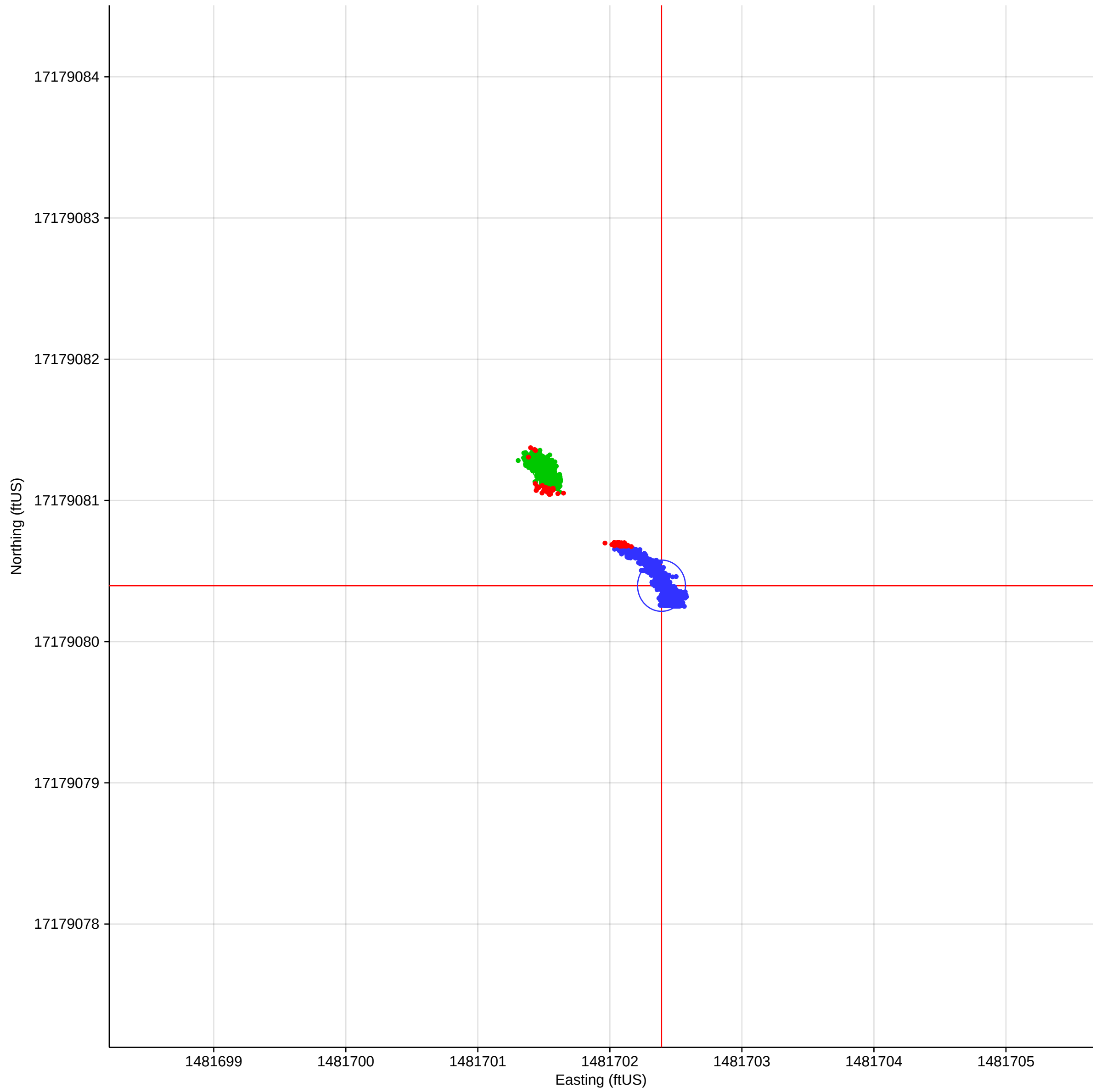
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,179,080.40ftUS N	±0.14ftUS	17,179,081.23ftUS N	±0.06ftUS
Easting	1,481,702.39ftUS E	±0.12ftUS	1,481,701.49ftUS E	±0.05ftUS
Height	-47.24ft Ell.	±0.50ftUS	-47.41ft Ell.	±0.12ftUS

Delta Northing	0.00ftUS		0.85ftUS	
Delta Easting	0.00ftUS		-0.89ftUS	
Delta Height	0.00ftUS		-0.18ftUS	

Position of CL_Drill from proposed location				
Range	3.05ftUS		4.23ftUS	

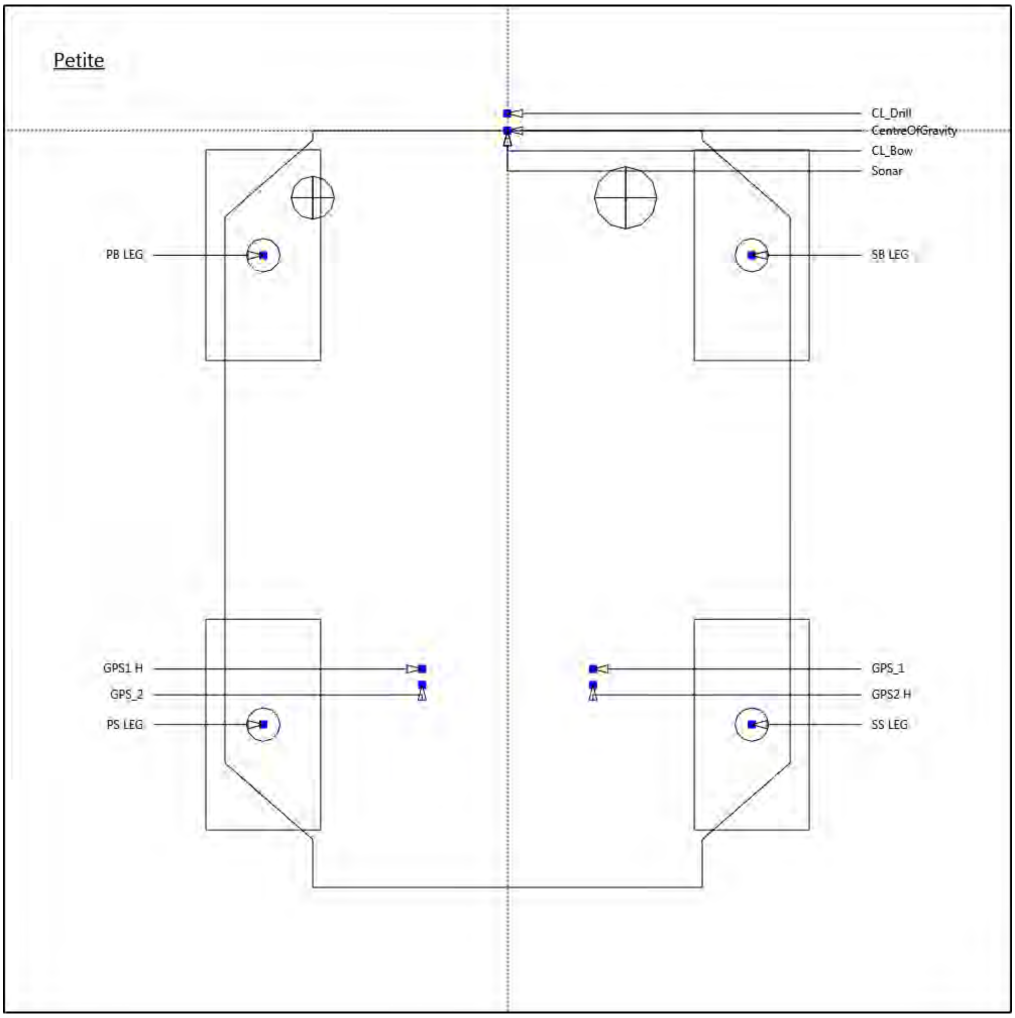
Bearing	331.01°True			325.98°True	

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,179,080.40ftUS N, 1,481,702.39ftUS E, -47.24ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,179,081.23ftUS N, 1,481,701.49ftUS E, -47.41ft Ell.	0.85ftUS	-0.89ftUS	-0.18ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-97

Seabed Information

Seabed Depth	61.40ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**15**		
Comment:			

Session Name: 20180803-032400-v1
Start Time: 02 Aug 2018, 23:16:09-05:00
End Time: 02 Aug 2018, 23:31:08-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 15

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°47'40.90753"N	27°47'40.90752"N
Longitude	096°58'02.38345"W	096°58'02.38345"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,180,716.26ftUS N	
Easting	1,479,773.98ftUS E	
Height	-50.32ft Ell.	
Final Rig Heading	54.07°True (53.38°Grid)	

Final Position for CL_Drill is 5.67ftUS @ 139.1°True (138.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.69578°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°47'40.95000"N	Longitude: 096°58'02.42480"W	Northing: 17,180,720.50ftUS N	Easting: 1,479,770.21ftUS E
Intended Rig Heading	12.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,180,716.26ftUS N, 1,479,773.98ftUS E, -50.32ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,180,716.76ftUS N, 1,479,772.77ftUS E, -46.79ft Ell.	0.52ftUS	-1.20ftUS	3.53ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-99

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		887 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°47’40.49899”N	±0.10ftUS	27°47’40.63769”N	±0.05ftUS
Longitude	096°58’02.84809”W	±0.12ftUS	096°58’02.99294”W	±0.04ftUS
Height	-50.32ft Ell.	±0.56ftUS	-46.79ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°47’40.49899”N	±0.10ftUS	27°47’40.63769”N	±0.05ftUS
Longitude	096°58’02.84809”W	±0.12ftUS	096°58’02.99294”W	±0.04ftUS
Height	-50.32ft Ell.	±0.56ftUS	-46.79ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,180,674.49ftUS N	±0.09ftUS	17,180,688.34ftUS N	±0.05ftUS
Easting	1,479,732.75ftUS E	±0.12ftUS	1,479,719.57ftUS E	±0.04ftUS
Height	-50.32ft Ell.	±0.56ftUS	-46.79ft Ell.	±0.11ftUS

HDOP	1.24		0.83	
No. Satellites	9		13	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	54.07°True	±0.1°	54.07°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°47’40.90753”N	±0.11ftUS	27°47’40.91269”N	±0.07ftUS
Longitude	096°58’02.38345”W	±0.13ftUS	096°58’02.39681”W	±0.04ftUS
Height	-50.32ft Ell.	±0.56ftUS	-46.79ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,180,716.26ftUS N	±0.11ftUS	17,180,716.76ftUS N	±0.07ftUS
Easting	1,479,773.98ftUS E	±0.13ftUS	1,479,772.77ftUS E	±0.04ftUS
Height	-50.32ft Ell.	±0.56ftUS	-46.79ft Ell.	±0.11ftUS

Delta Northing	0.00ftUS		0.52ftUS	
Delta Easting	0.00ftUS		-1.20ftUS	
Delta Height	0.00ftUS		3.53ftUS	

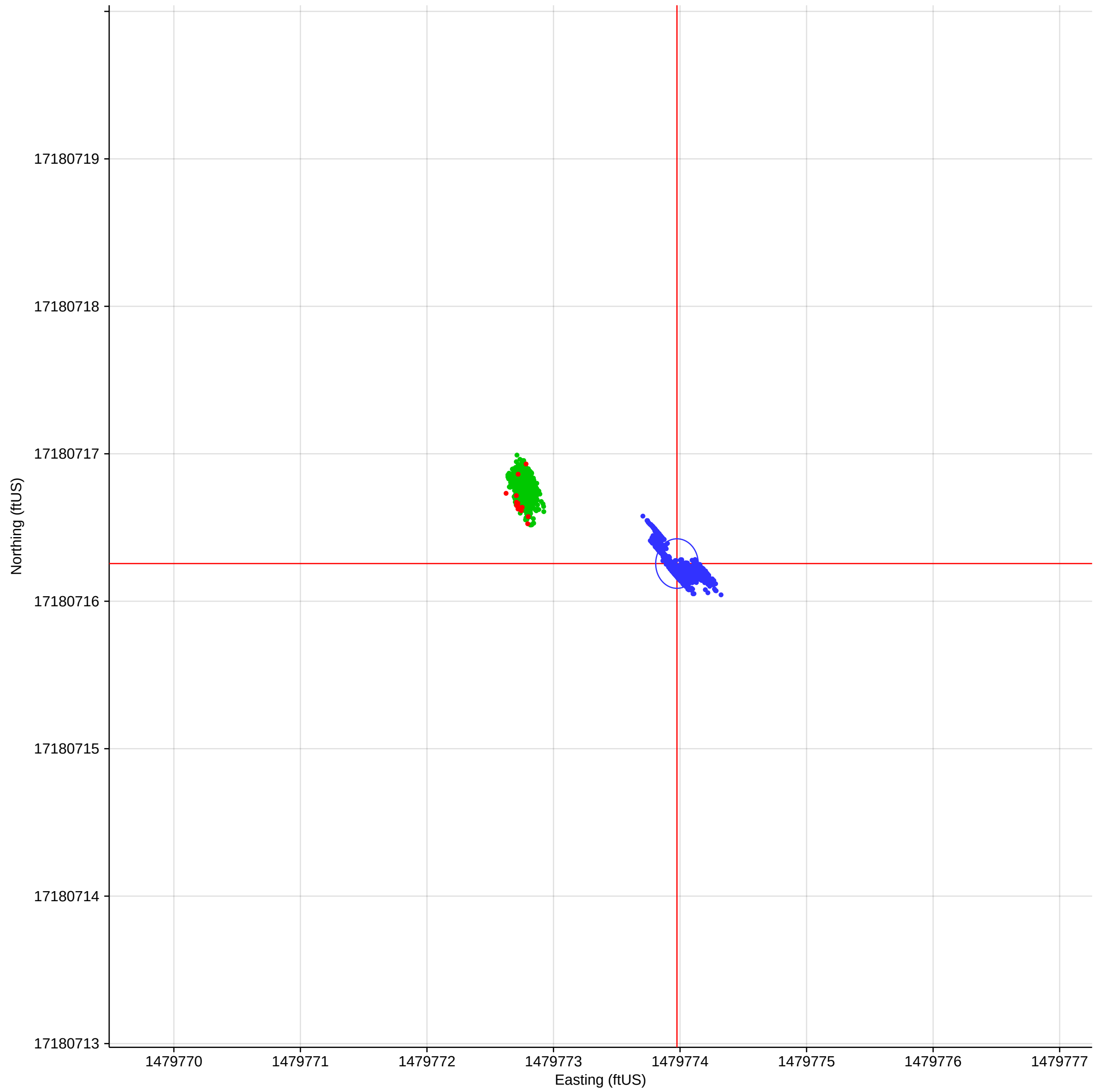
Position of CL_Drill from proposed location				
Range	5.67ftUS		4.53ftUS	

PLATE NO. B-101

Bearing	139.12°True		146.29°True	

PLATE NO. B-102

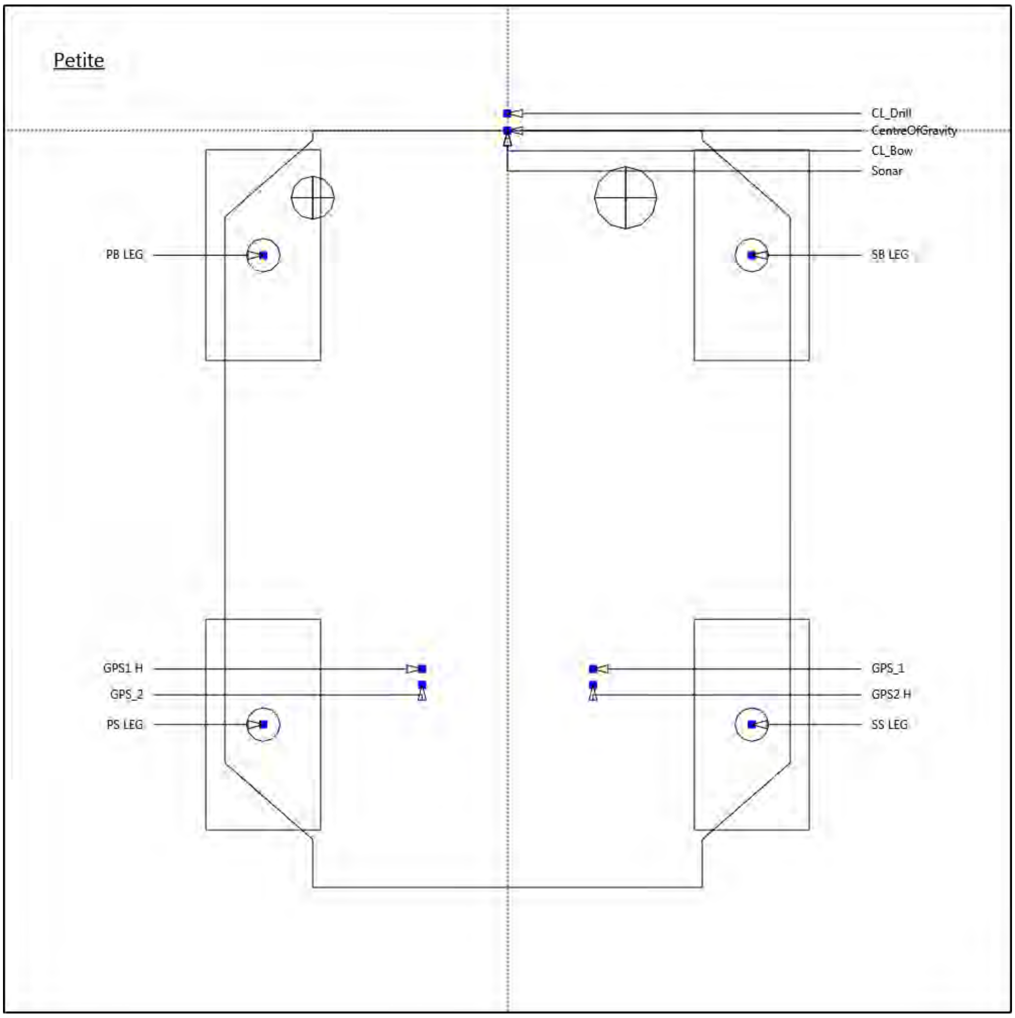
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,180,716.26ftUS N, 1,479,773.98ftUS E, -50.32ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,180,716.76ftUS N, 1,479,772.77ftUS E, -46.79ft Ell.	0.52ftUS	-1.20ftUS	3.53ftUS

PLATE NO. B-103

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	60.90ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**16**		
Comment:			

Session Name: 20180803-100705-v1
Start Time: 03 Aug 2018, 05:07:54-05:00
End Time: 03 Aug 2018, 05:22:53-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 16

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°47'56.74334"N	27°47'56.74334"N
Longitude	096°58'24.19973"W	096°58'24.19973"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,182,291.66ftUS N	
Easting	1,477,795.46ftUS E	
Height	-45.32ft Ell.	
Final Rig Heading	18.74°True (18.05°Grid)	

Final Position for CL_Drill is 1.25ftUS @ 82.0°True (81.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.69308°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°47'56.74162"N	Longitude: 096°58'24.21354"W	Northing: 17,182,291.47ftUS N	Easting: 1,477,794.22ftUS E
Intended Rig Heading	18.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,182,291.66ftUS N, 1,477,795.46ftUS E, -45.32ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,182,292.04ftUS N, 1,477,795.56ftUS E, -46.99ft Ell.	0.37ftUS	0.11ftUS	-1.66ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		884 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°47'56.17109"N	±0.24ftUS	27°47'56.21612"N	±0.08ftUS
Longitude	096°58'24.31314"W	±0.09ftUS	096°58'24.50608"W	±0.07ftUS
Height	-45.32ft Ell.	±0.30ftUS	-46.99ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°47'56.17110"N	±0.24ftUS	27°47'56.21613"N	±0.08ftUS
Longitude	096°58'24.31314"W	±0.09ftUS	096°58'24.50608"W	±0.07ftUS
Height	-45.32ft Ell.	±0.30ftUS	-46.99ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,182,233.75ftUS N	±0.24ftUS	17,182,238.09ftUS N	±0.09ftUS
Easting	1,477,785.97ftUS E	±0.09ftUS	1,477,768.59ftUS E	±0.07ftUS
Height	-45.32ft Ell.	±0.30ftUS	-46.99ft Ell.	±0.11ftUS

HDOP	1.07		0.68	
No. Satellites	8		14	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	18.74°True	±0.1°	18.74°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°47'56.74334"N	±0.24ftUS	27°47'56.74706"N	±0.09ftUS
Longitude	096°58'24.19973"W	±0.12ftUS	096°58'24.19855"W	±0.10ftUS
Height	-45.32ft Ell.	±0.30ftUS	-46.99ft Ell.	±0.11ftUS

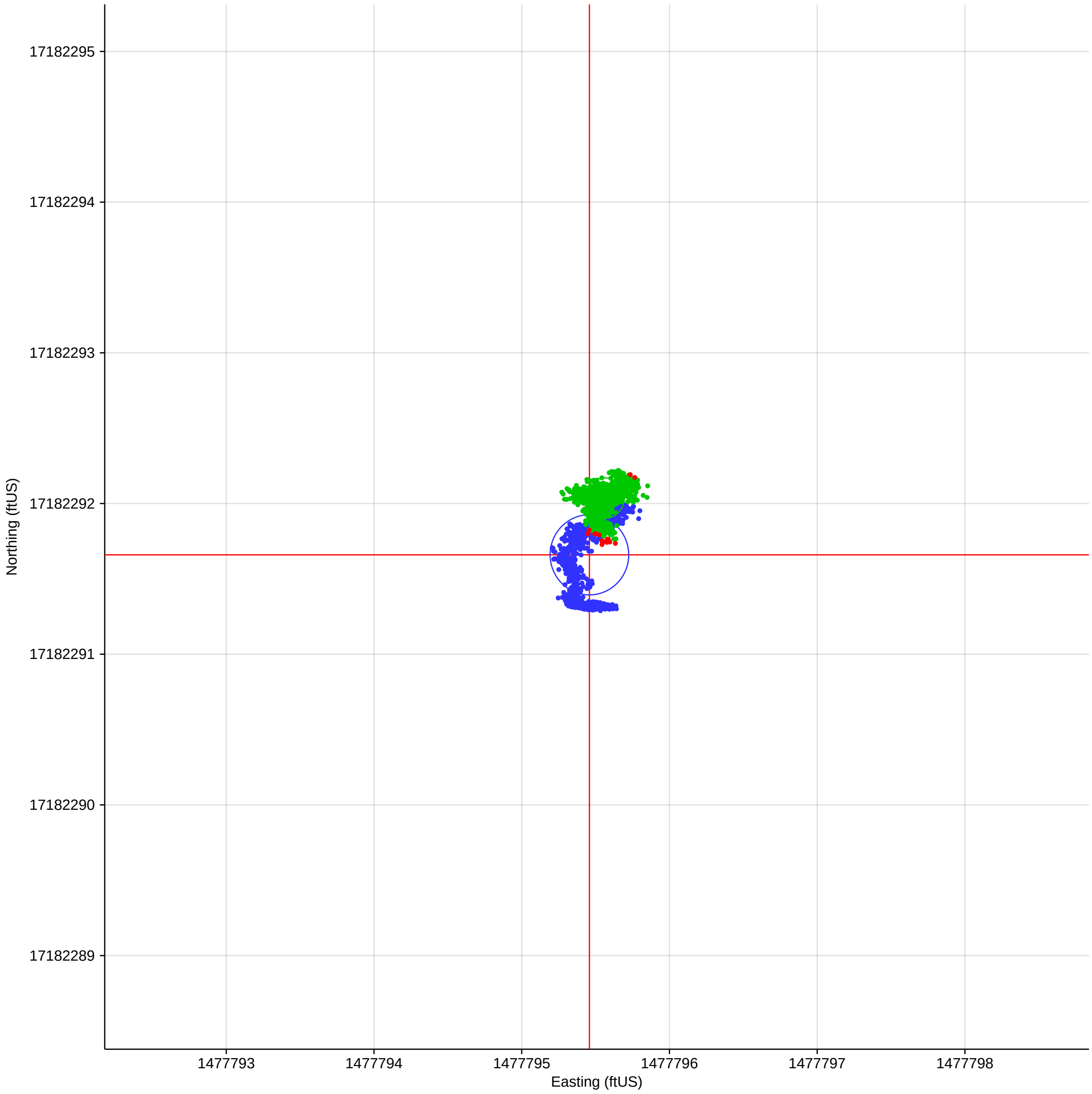
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,182,291.66ftUS N	±0.24ftUS	17,182,292.04ftUS N	±0.09ftUS
Easting	1,477,795.46ftUS E	±0.11ftUS	1,477,795.56ftUS E	±0.10ftUS
Height	-45.32ft Ell.	±0.30ftUS	-46.99ft Ell.	±0.11ftUS

Delta Northing	0.00ftUS		0.37ftUS	
Delta Easting	0.00ftUS		0.11ftUS	
Delta Height	0.00ftUS		-1.66ftUS	

Position of CL_Drill from proposed location				
Range	1.25ftUS		1.45ftUS	

Bearing	81.99°True		67.80°True	

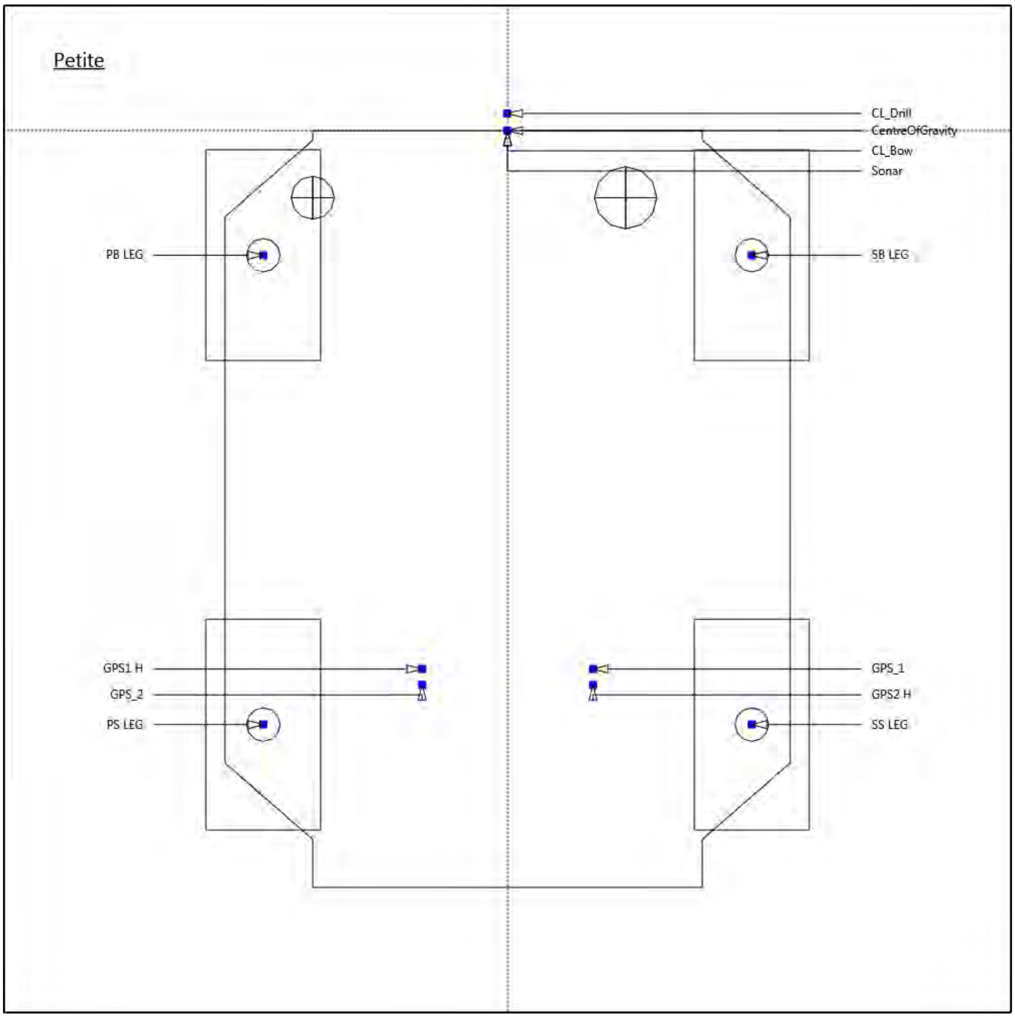
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,182,291.66ftUS N, 1,477,795.46ftUS E, -45.32ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,182,292.04ftUS N, 1,477,795.56ftUS E, -46.99ft Ell.	0.37ftUS	0.11ftUS	-1.66ftUS

PLATE NO. B-110

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	60.60ft
Comment	

Remarks

PLATE NO. B-112

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**17**		
Comment:			

Session Name: 20180803-152142-v1
Start Time: 03 Aug 2018, 12:04:27-05:00
End Time: 03 Aug 2018, 12:19:26-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 17

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°48’13.93964”N	27°48’13.93963”N
Longitude	096°58’45.08757”W	096°58’45.08757”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,184,005.55ftUS N	
Easting	1,475,898.81ftUS E	
Height	-45.45ft Ell.	
Final Rig Heading	28.43°True (27.74°Grid)	

Final Position for CL_Drill is 3.38ftUS @ 284.8°True (284.1°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.69043°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°48’13.93110”N	Longitude: 096°58’45.05113”W	Northing: 17,184,004.73ftUS N	Easting: 1,475,902.09ftUS E
Intended Rig Heading	18.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,184,005.55ftUS N, 1,475,898.81ftUS E, -45.45ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,184,005.54ftUS N, 1,475,898.01ftUS E, -47.35ft Ell.	0.00ftUS	-0.80ftUS	-1.91ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	854 of 900 used		872 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°48'13.39252"N	±0.06ftUS	27°48'13.46227"N	±0.05ftUS
Longitude	096°58'45.30766"W	±0.11ftUS	096°58'45.50006"W	±0.06ftUS
Height	-45.45ft Ell.	±0.09ftUS	-47.35ft Ell.	±0.10ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°48'13.39252"N	±0.06ftUS	27°48'13.46227"N	±0.05ftUS
Longitude	096°58'45.30766"W	±0.11ftUS	096°58'45.50006"W	±0.06ftUS
Height	-45.45ft Ell.	±0.09ftUS	-47.35ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,183,950.06ftUS N	±0.05ftUS	17,183,956.90ftUS N	±0.05ftUS
Easting	1,475,879.71ftUS E	±0.11ftUS	1,475,862.35ftUS E	±0.06ftUS
Height	-45.45ft Ell.	±0.09ftUS	-47.35ft Ell.	±0.10ftUS

HDOP	1.11		0.78	
No. Satellites	6		12	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	28.43°True	±0.1°	28.43°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°48'13.93964"N	±0.07ftUS	27°48'13.93962"N	±0.05ftUS
Longitude	096°58'45.08757"W	±0.13ftUS	096°58'45.09643"W	±0.08ftUS
Height	-45.45ft Ell.	±0.09ftUS	-47.35ft Ell.	±0.10ftUS

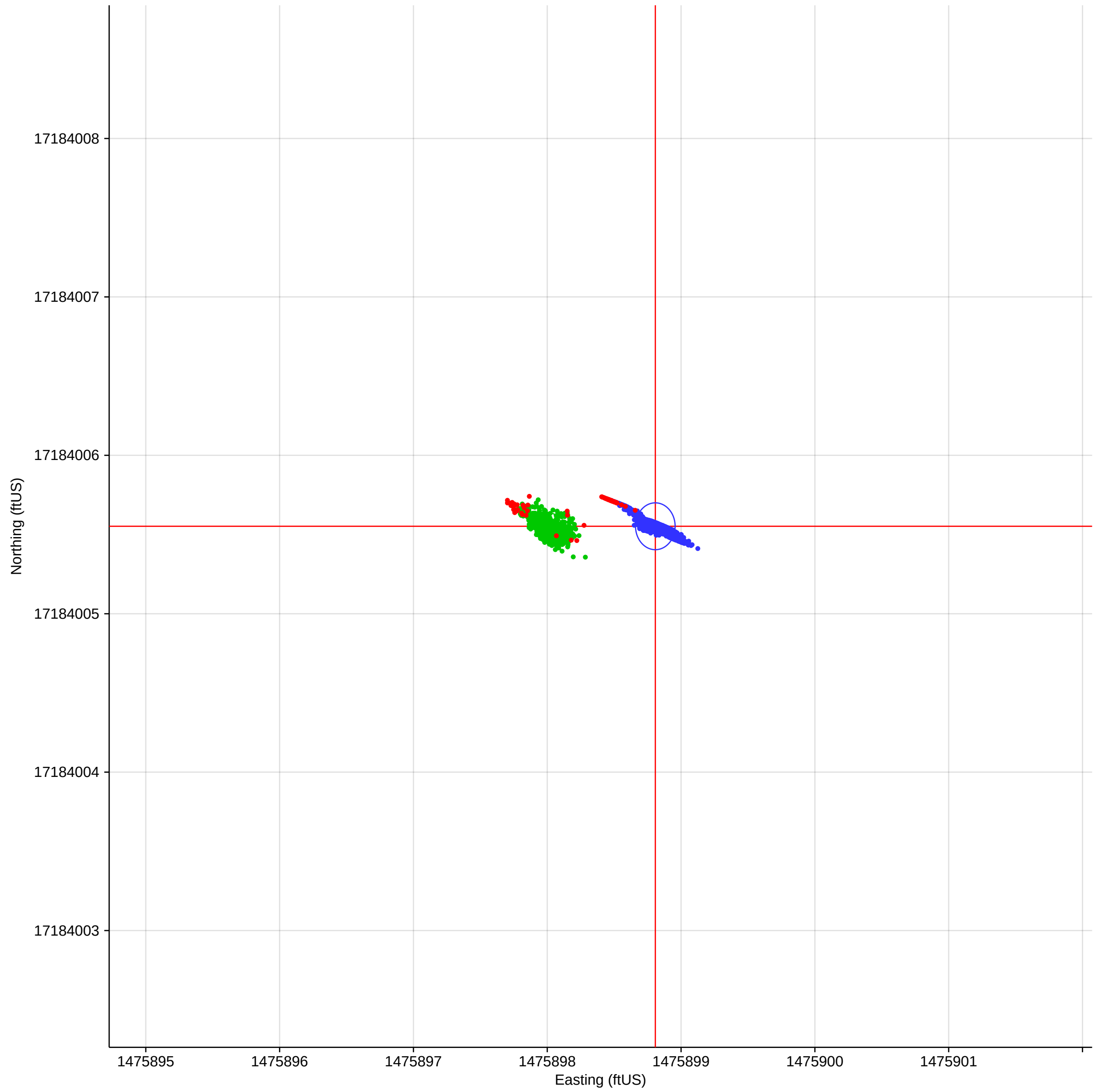
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,184,005.55ftUS N	±0.06ftUS	17,184,005.54ftUS N	±0.05ftUS
Easting	1,475,898.81ftUS E	±0.13ftUS	1,475,898.01ftUS E	±0.08ftUS
Height	-45.45ft Ell.	±0.09ftUS	-47.35ft Ell.	±0.10ftUS

Delta Northing	0.00ftUS		0.00ftUS	
Delta Easting	0.00ftUS		-0.80ftUS	
Delta Height	0.00ftUS		-1.91ftUS	

Position of CL_Drill from proposed location				
Range	3.38ftUS		4.16ftUS	

Bearing	284.75°True		281.93°True	

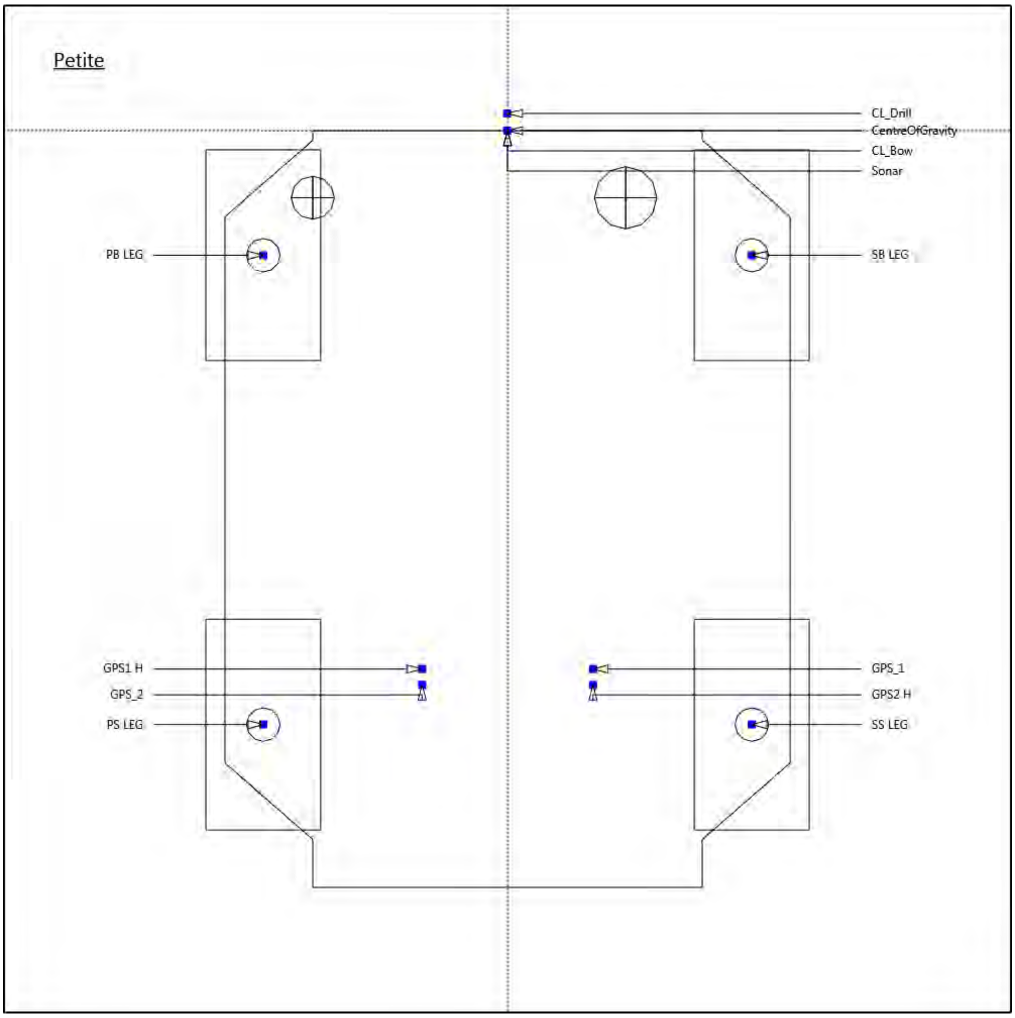
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,184,005.55ftUS N, 1,475,898.81ftUS E, -45.45ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,184,005.54ftUS N, 1,475,898.01ftUS E, -47.35ft Ell.	0.00ftUS	-0.80ftUS	-1.91ftUS

PLATE NO. B-117

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	54.00ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**18**		
Comment:			

Session Name: 20180803-215203-v1
Start Time: 03 Aug 2018, 19:05:31-05:00
End Time: 03 Aug 2018, 19:20:30-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 18

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°48’22.39895”N	27°48’22.39895”N
Longitude	096°59’11.81447”W	096°59’11.81447”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,184,830.95ftUS N	
Easting	1,473,488.59ftUS E	
Height	-44.56ft Ell.	
Final Rig Heading	21.53°True (20.84°Grid)	

Final Position for CL_Drill is 1.89ftUS @ 73.1°True (72.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.68707°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°48’22.39350”N	Longitude: 096°59’11.83464”W	Northing: 17,184,830.38ftUS N	Easting: 1,473,486.79ftUS E
Intended Rig Heading	18.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,184,830.95ftUS N, 1,473,488.59ftUS E, -44.56ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,184,830.49ftUS N, 1,473,487.46ftUS E, -48.17ft Ell.	-0.45ftUS	-1.14ftUS	-3.61ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	846 of 900 used		890 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°48'21.83229"N	±0.05ftUS	27°48'21.87753"N	±0.04ftUS
Longitude	096°59'11.95905"W	±0.06ftUS	096°59'12.16347"W	±0.06ftUS
Height	-44.56ft Ell.	±0.96ftUS	-48.17ft Ell.	±0.34ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°48'21.83229"N	±0.05ftUS	27°48'21.87753"N	±0.04ftUS
Longitude	096°59'11.95905"W	±0.06ftUS	096°59'12.16347"W	±0.06ftUS
Height	-44.56ft Ell.	±0.96ftUS	-48.17ft Ell.	±0.34ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,184,773.57ftUS N	±0.05ftUS	17,184,777.92ftUS N	±0.04ftUS
Easting	1,473,476.30ftUS E	±0.06ftUS	1,473,457.89ftUS E	±0.06ftUS
Height	-44.56ft Ell.	±0.96ftUS	-48.17ft Ell.	±0.34ftUS

HDOP	0.91		0.87	
No. Satellites	7		10	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	21.53°True	±0.1°	21.54°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°48'22.39895"N	±0.05ftUS	27°48'22.39451"N	±0.05ftUS
Longitude	096°59'11.81447"W	±0.10ftUS	096°59'11.82719"W	±0.08ftUS
Height	-44.56ft Ell.	±0.96ftUS	-48.17ft Ell.	±0.34ftUS

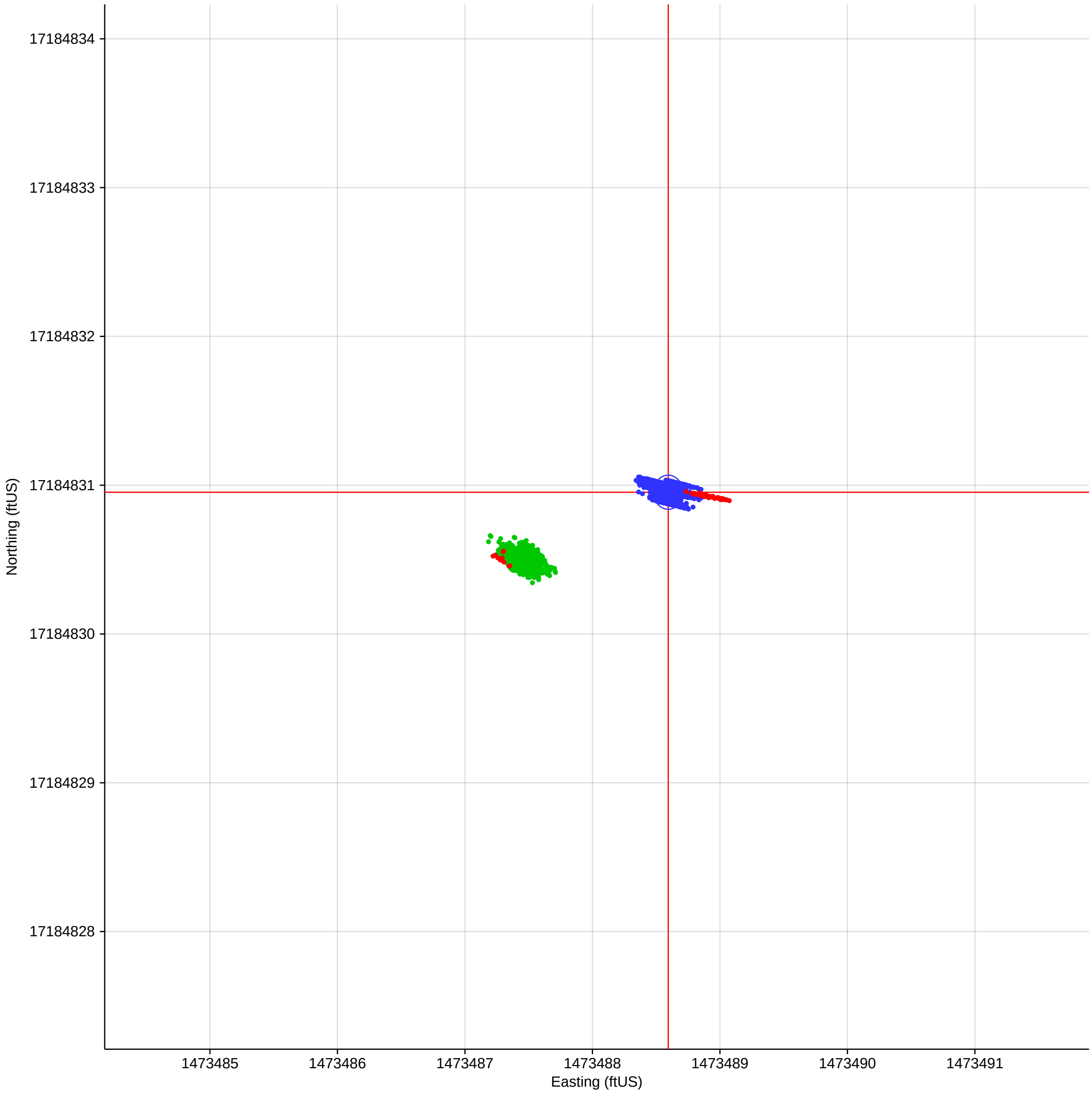
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,184,830.95ftUS N	±0.05ftUS	17,184,830.49ftUS N	±0.05ftUS
Easting	1,473,488.59ftUS E	±0.10ftUS	1,473,487.46ftUS E	±0.08ftUS
Height	-44.56ft Ell.	±0.96ftUS	-48.17ft Ell.	±0.34ftUS

Delta Northing	0.00ftUS		-0.45ftUS	
Delta Easting	0.00ftUS		-1.14ftUS	
Delta Height	0.00ftUS		-3.61ftUS	

Position of CL_Drill from proposed location				
Range	1.89ftUS		0.68ftUS	

Bearing	73.08°True		81.34°True	

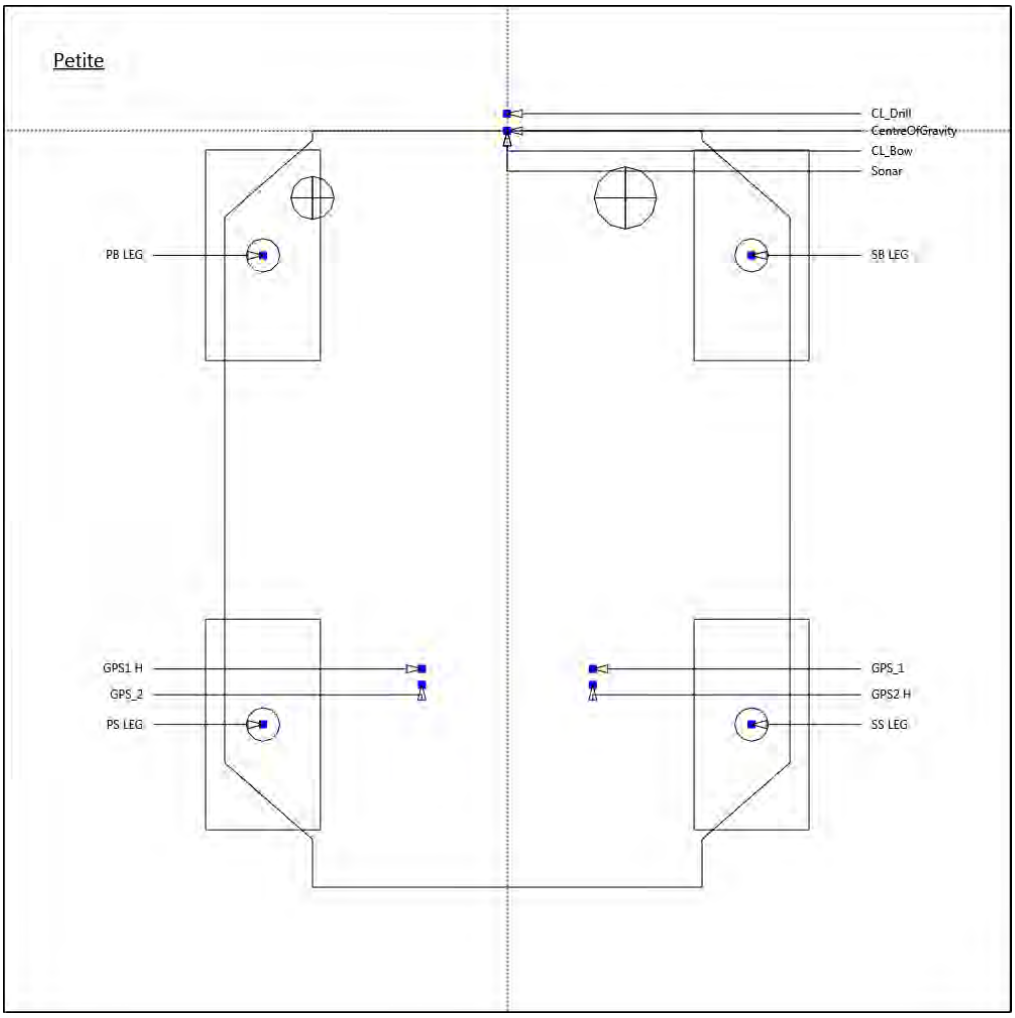
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,184,830.95ftUS N, 1,473,488.59ftUS E, -44.56ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,184,830.49ftUS N, 1,473,487.46ftUS E, -48.17ft Ell.	-0.45ftUS	-1.14ftUS	-3.61ftUS

PLATE NO. B-124

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	51.50ft
Comment	

Remarks

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**19**		
Comment:			

Session Name: 20180804-025635-v1
Start Time: 03 Aug 2018, 21:57:14-05:00
End Time: 03 Aug 2018, 22:12:13-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 19

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°48'40.38210"N	27°48'40.38210"N
Longitude	097°00'04.69994"W	097°00'04.69994"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,186,590.29ftUS N	
Easting	1,468,718.22ftUS E	
Height	-46.15ft Ell.	
Final Rig Heading	242.25°True (241.57°Grid)	

Final Position for CL_Drill is 2.18ftUS @ 339.7°True (339.0°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.68048°		

Proposed Location

North American Datum 1983		SPCS83 Texas South zone (US Survey feet) CM -99° W	
Latitude: 27°48'40.36183"N	Longitude: 097°00'04.69151"W	Northing: 17,186,588.25ftUS N	Easting: 1,468,719.00ftUS E
Intended Rig Heading	90.0°True		

Positioning System Comparison

Sensor	Mean Position SPCS83 Texas South zone (US Survey feet) CM -99° W	Delta Northing	Delta Easting	Delta Height
Primary	17,186,590.29ftUS N, 1,468,718.22ftUS E, -46.15ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,186,591.29ftUS N, 1,468,716.33ftUS E, -46.08ft Ell.	1.02ftUS	-1.87ftUS	0.07ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		892 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°48’40.72775”N	±0.07ftUS	27°48’40.58908”N	±0.04ftUS
Longitude	097°00’04.17463”W	±0.31ftUS	097°00’04.08665”W	±0.08ftUS
Height	-46.15ft Ell.	±0.26ftUS	-46.08ft Ell.	±0.10ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°48’40.72775”N	±0.07ftUS	27°48’40.58908”N	±0.04ftUS
Longitude	097°00’04.17463”W	±0.31ftUS	097°00’04.08665”W	±0.08ftUS
Height	-46.15ft Ell.	±0.26ftUS	-46.08ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,186,625.75ftUS N	±0.06ftUS	17,186,611.84ftUS N	±0.04ftUS
Easting	1,468,764.97ftUS E	±0.31ftUS	1,468,773.04ftUS E	±0.08ftUS
Height	-46.15ft Ell.	±0.26ftUS	-46.08ft Ell.	±0.10ftUS

HDOP	0.85		0.70	
No. Satellites	10		13	
Age of Corrections	8.0 secs		4.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	242.25°True	±0.1°	242.25°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°48’40.38210”N	±0.09ftUS	27°48’40.39224”N	±0.06ftUS
Longitude	097°00’04.69994”W	±0.32ftUS	097°00’04.72079”W	±0.09ftUS
Height	-46.15ft Ell.	±0.26ftUS	-46.08ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,186,590.29ftUS N	±0.08ftUS	17,186,591.29ftUS N	±0.06ftUS
Easting	1,468,718.22ftUS E	±0.32ftUS	1,468,716.33ftUS E	±0.09ftUS
Height	-46.15ft Ell.	±0.26ftUS	-46.08ft Ell.	±0.10ftUS

Delta Northing	0.00ftUS		1.02ftUS	
Delta Easting	0.00ftUS		-1.87ftUS	
Delta Height	0.00ftUS		0.07ftUS	

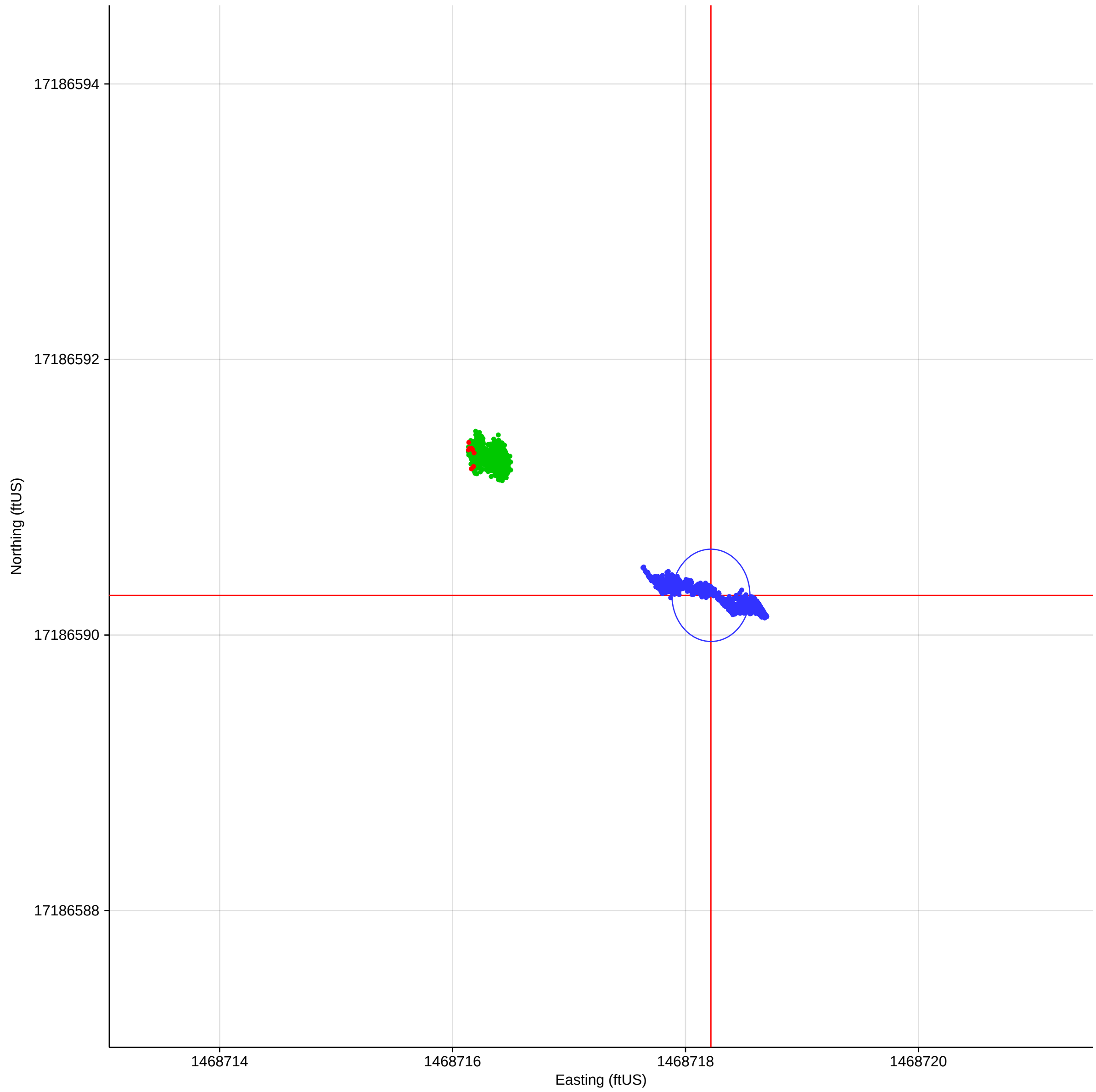
Position of CL_Drill from proposed location				
Range	2.18ftUS		4.04ftUS	

PLATE NO. B-129

Bearing	339.70°True		319.44°True	

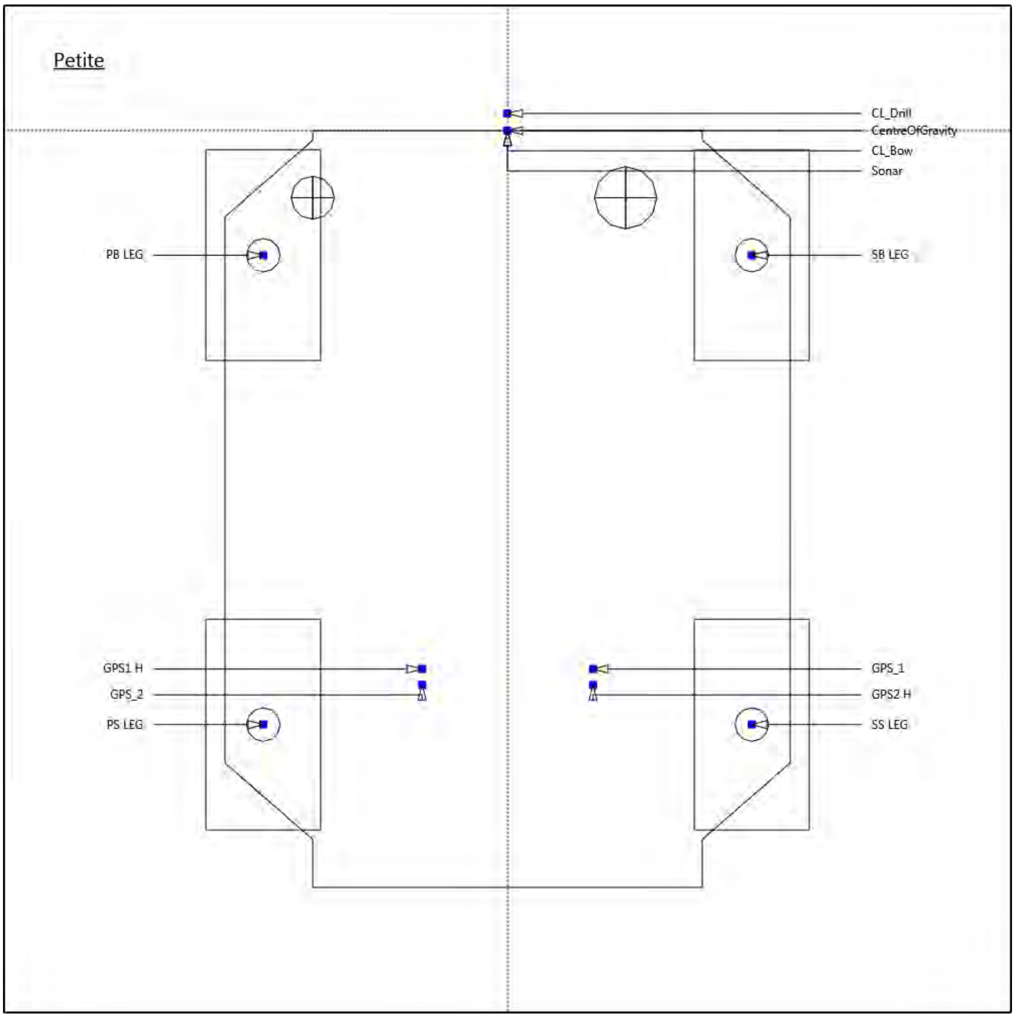
PLATE NO. B-130

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,186,590.29ftUS N, 1,468,718.22ftUS E, -46.15ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,186,591.29ftUS N, 1,468,716.33ftUS E, -46.08ft Ell.	1.02ftUS	-1.87ftUS	0.07ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	50.60ft
Comment	

Remarks

PLATE NO. B-133

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**20**		
Comment:			

Session Name: 20180804-170754-v1
Start Time: 04 Aug 2018, 12:09:22-05:00
End Time: 04 Aug 2018, 12:24:21-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 20

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°48’57.89251”N	27°48’57.89251”N
Longitude	097°00’25.30345”W	097°00’25.30345”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,188,336.63ftUS N	
Easting	1,466,847.30ftUS E	
Height	-47.40ft Ell.	
Final Rig Heading	127.50°True (126.82°Grid)	

Final Position for CL_Drill is 0.85ftUS @ 227.1°True (226.5°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.67775°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°48’57.89824”N	Longitude: 097°00’25.29651”W	Northing: 17,188,337.22ftUS N	Easting: 1,466,847.92ftUS E
Intended Rig Heading	242.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,188,336.63ftUS N, 1,466,847.30ftUS E, -47.40ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,188,336.83ftUS N, 1,466,845.91ftUS E, -46.21ft Ell.	0.22ftUS	-1.39ftUS	1.20ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-134

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		891 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°48'58.17198"N	±0.15ftUS	27°48'58.32430"N	±0.05ftUS
Longitude	097°00'25.87643"W	±0.06ftUS	097°00'25.78549"W	±0.05ftUS
Height	-47.40ft Ell.	±0.25ftUS	-46.21ft Ell.	±0.20ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°48'58.17199"N	±0.15ftUS	27°48'58.32430"N	±0.05ftUS
Longitude	097°00'25.87643"W	±0.06ftUS	097°00'25.78549"W	±0.05ftUS
Height	-47.40ft Ell.	±0.25ftUS	-46.21ft Ell.	±0.20ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,188,364.25ftUS N	±0.15ftUS	17,188,379.73ftUS N	±0.05ftUS
Easting	1,466,795.52ftUS E	±0.06ftUS	1,466,803.51ftUS E	±0.05ftUS
Height	-47.40ft Ell.	±0.25ftUS	-46.21ft Ell.	±0.20ftUS

HDOP	1.09		0.86	
No. Satellites	7		12	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	127.50°True	±0.1°	127.50°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°48'57.89251"N	±0.18ftUS	27°48'57.89466"N	±0.05ftUS
Longitude	097°00'25.30345"W	±0.05ftUS	097°00'25.31894"W	±0.06ftUS
Height	-47.40ft Ell.	±0.25ftUS	-46.21ft Ell.	±0.20ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,188,336.63ftUS N	±0.18ftUS	17,188,336.83ftUS N	±0.05ftUS
Easting	1,466,847.30ftUS E	±0.05ftUS	1,466,845.91ftUS E	±0.06ftUS
Height	-47.40ft Ell.	±0.25ftUS	-46.21ft Ell.	±0.20ftUS

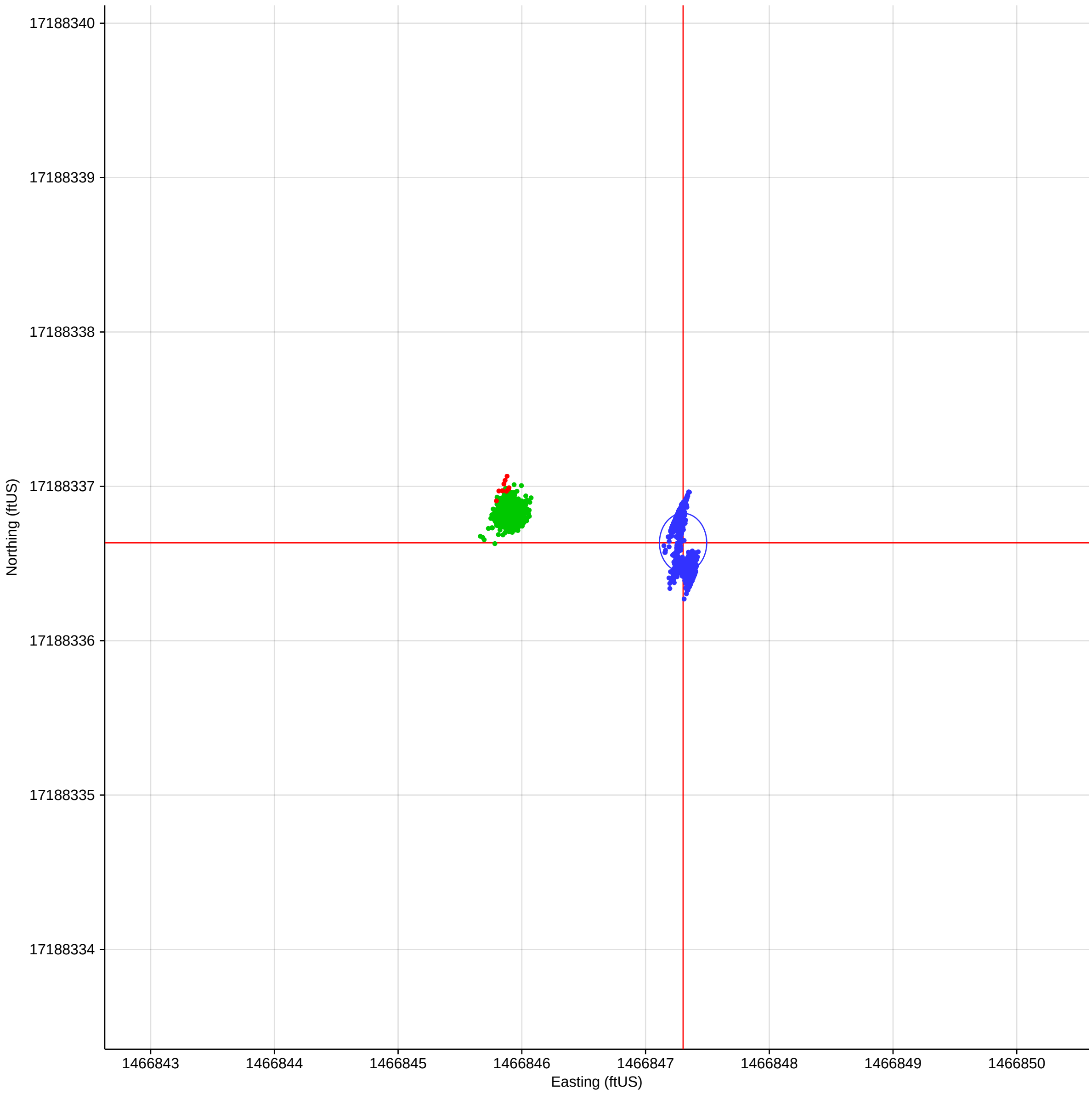
Delta Northing	0.00ftUS		0.22ftUS	
Delta Easting	0.00ftUS		-1.39ftUS	
Delta Height	0.00ftUS		1.20ftUS	

Position of CL_Drill from proposed location				
Range	0.85ftUS		2.05ftUS	

PLATE NO. B-136

Bearing	227.14°True		259.81°True	

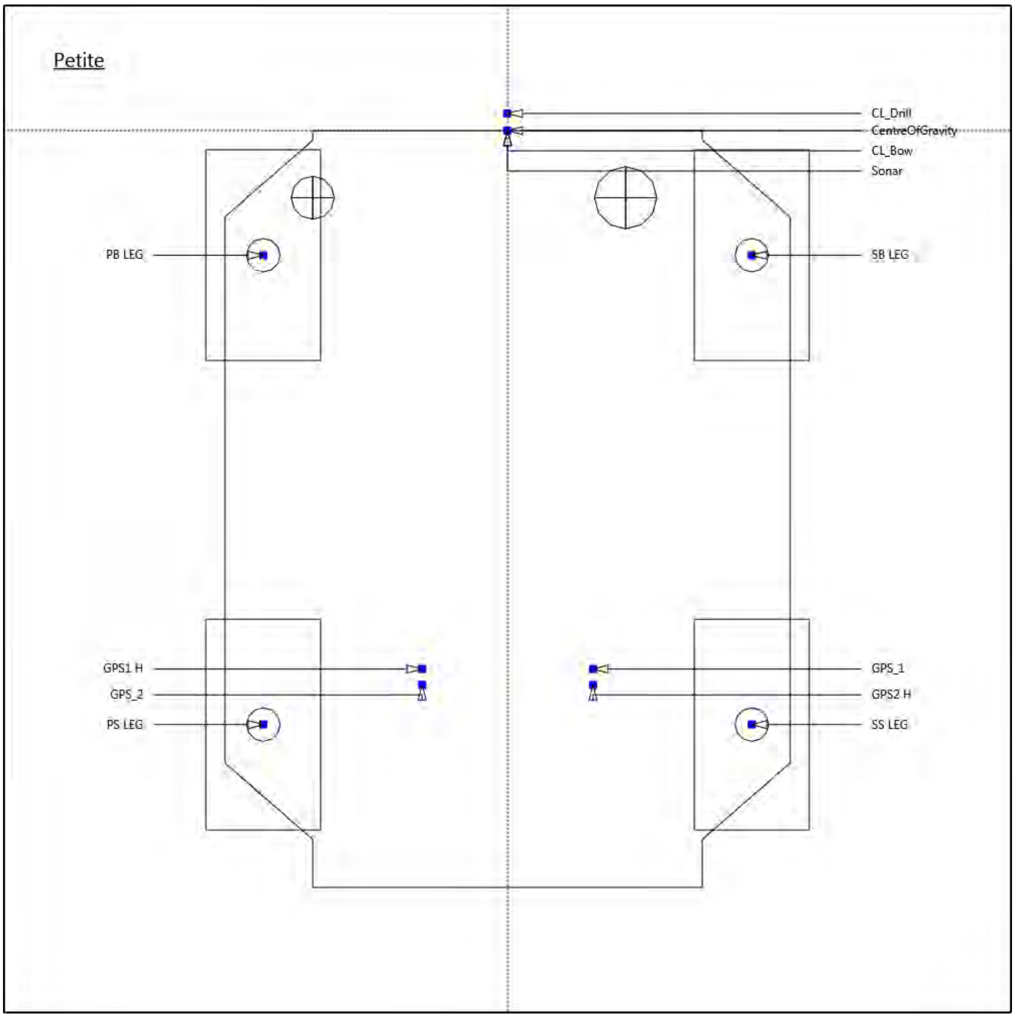
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,188,336.63ftUS N, 1,466,847.30ftUS E, -47.40ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,188,336.83ftUS N, 1,466,845.91ftUS E, -46.21ft Ell.	0.22ftUS	-1.39ftUS	1.20ftUS

PLATE NO. B-138

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-139

Seabed Information

Seabed Depth	51.60ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**21**		
Comment:			

Session Name: 20180817-123549-v1
Start Time: 17 Aug 2018, 07:36:29-05:00
End Time: 17 Aug 2018, 07:51:28-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 21

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°49’13.80421”N	27°49’13.80420”N
Longitude	097°00’47.05008”W	097°00’47.05008”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,189,920.41ftUS N	
Easting	1,464,875.82ftUS E	
Height	-46.27ft Ell.	
Final Rig Heading	151.23°True (150.56°Grid)	

Final Position for CL_Drill is 12.83ftUS @ 18.3°True (17.6°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.67503°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°49’13.68363”N	Longitude: 097°00’47.09498”W	Northing: 17,189,908.19ftUS N	Easting: 1,464,871.93ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,189,920.41ftUS N, 1,464,875.82ftUS E, -46.27ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,189,921.08ftUS N, 1,464,875.34ftUS E, -44.66ft Ell.	0.67ftUS	-0.47ftUS	1.61ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-141

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		879 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°49'14.26510"N	±0.08ftUS	27°49'14.37115"N	±0.04ftUS
Longitude	097°00'47.44809"W	±0.19ftUS	097°00'47.28791"W	±0.04ftUS
Height	-46.27ft Ell.	±0.06ftUS	-44.66ft Ell.	±0.10ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°49'14.26510"N	±0.08ftUS	27°49'14.37116"N	±0.04ftUS
Longitude	097°00'47.44809"W	±0.19ftUS	097°00'47.28791"W	±0.04ftUS
Height	-46.27ft Ell.	±0.06ftUS	-44.66ft Ell.	±0.10ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,189,966.54ftUS N	±0.09ftUS	17,189,977.42ftUS N	±0.04ftUS
Easting	1,464,839.53ftUS E	±0.19ftUS	1,464,853.79ftUS E	±0.04ftUS
Height	-46.27ft Ell.	±0.06ftUS	-44.66ft Ell.	±0.10ftUS

HDOP	1.09		0.83	
No. Satellites	9		13	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	151.23°True	±0.1°	151.23°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

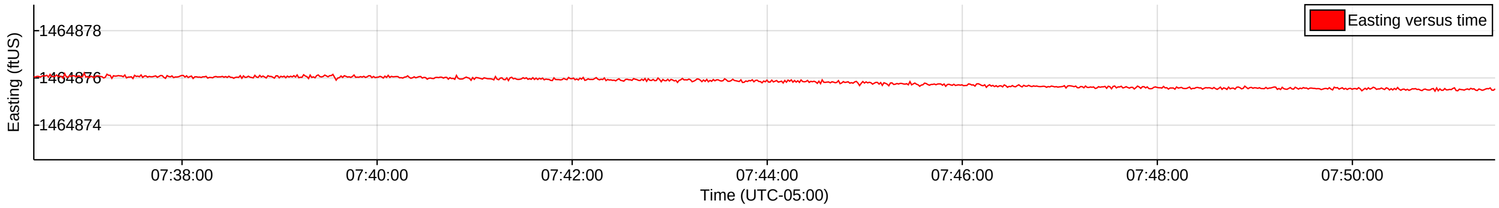
CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°49'13.80421"N	±0.10ftUS	27°49'13.81089"N	±0.05ftUS
Longitude	097°00'47.05008"W	±0.21ftUS	097°00'47.05532"W	±0.06ftUS
Height	-46.27ft Ell.	±0.06ftUS	-44.66ft Ell.	±0.10ftUS

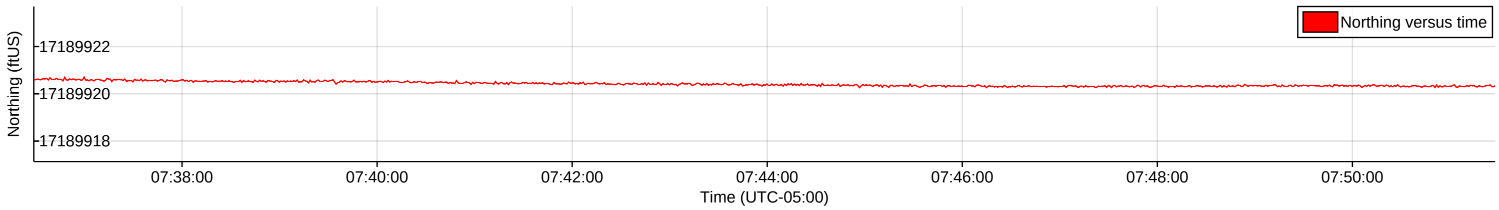
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,189,920.41ftUS N	±0.10ftUS	17,189,921.08ftUS N	±0.05ftUS
Easting	1,464,875.82ftUS E	±0.21ftUS	1,464,875.34ftUS E	±0.06ftUS
Height	-46.27ft Ell.	±0.06ftUS	-44.66ft Ell.	±0.10ftUS

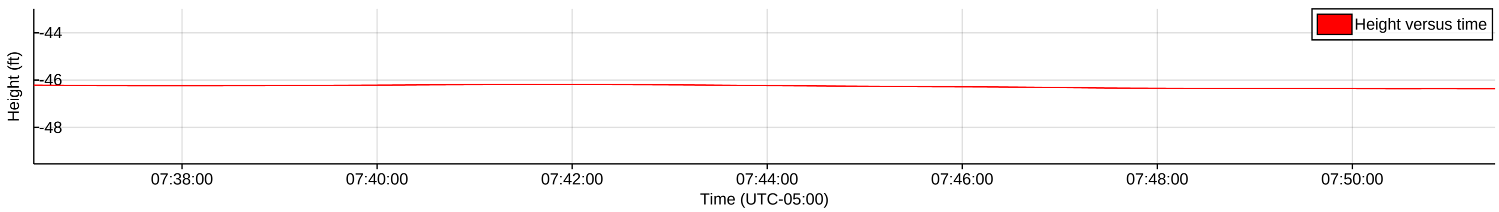
Delta Northing	0.00ftUS		0.67ftUS	
Delta Easting	0.00ftUS		-0.47ftUS	
Delta Height	0.00ftUS		1.61ftUS	

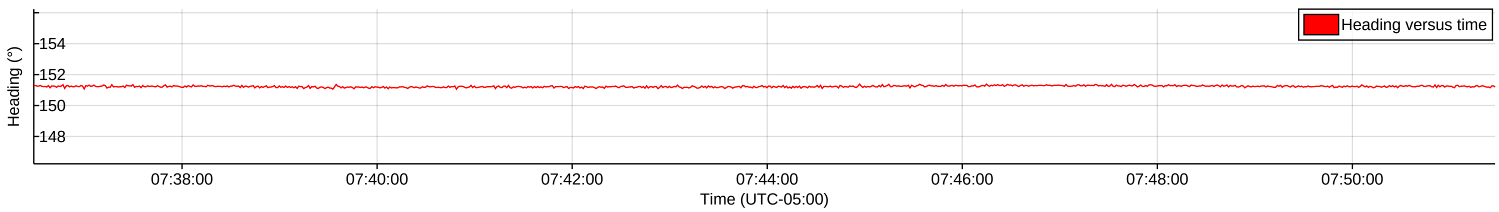
Position of CL_Drill from proposed location				
Range	12.83ftUS		13.34ftUS	
Bearing	18.32°True		15.49°True	

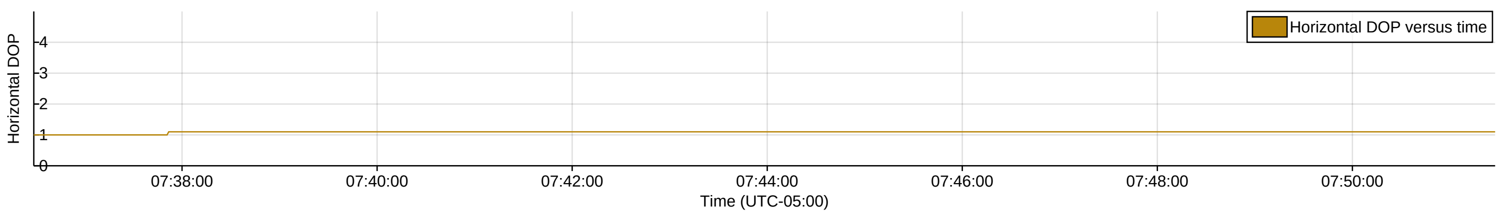
Time Series Plots for Primary

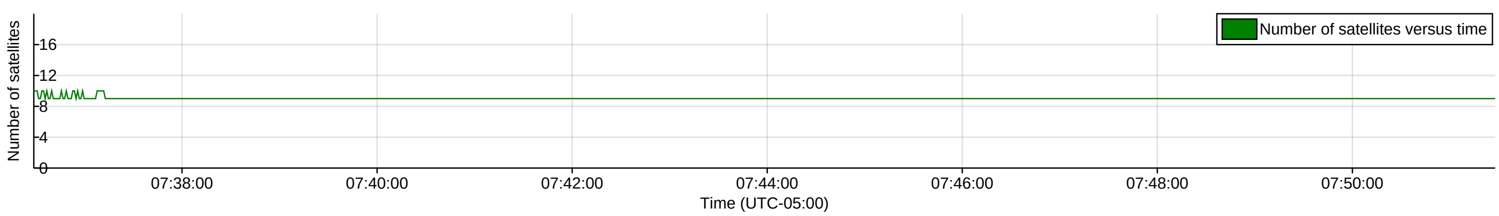












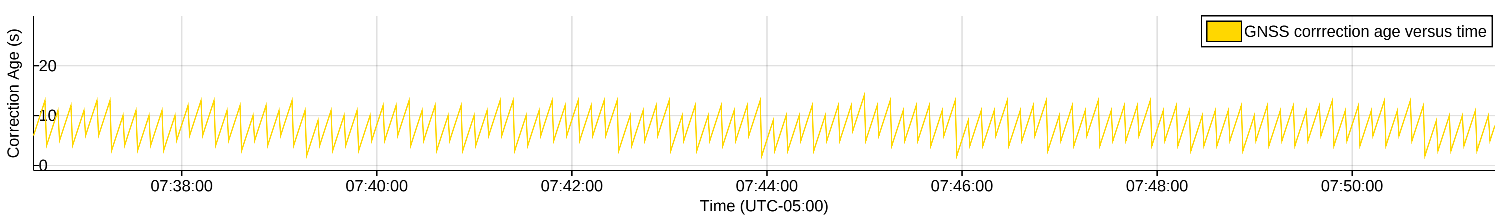
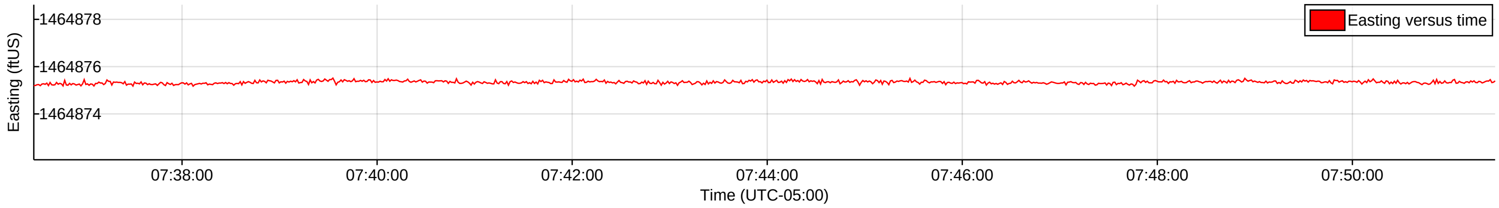
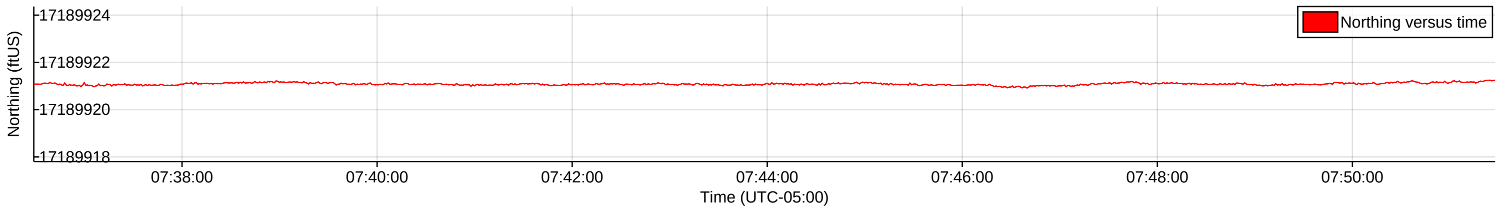
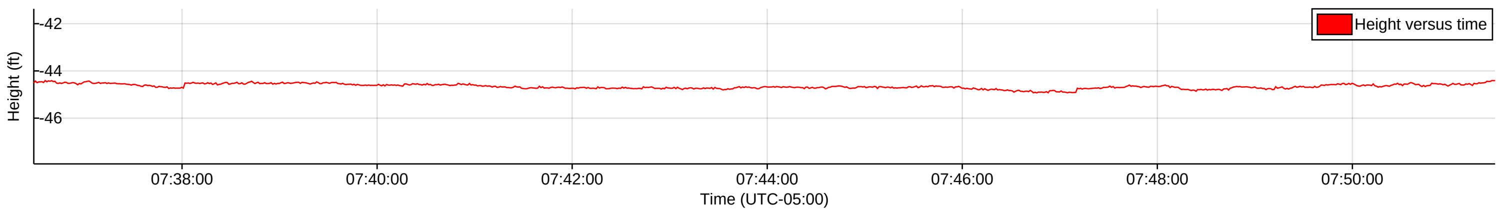


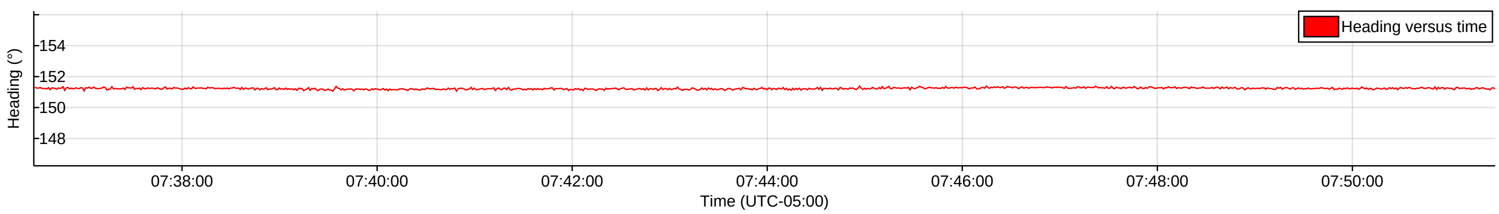
PLATE NO. B-146

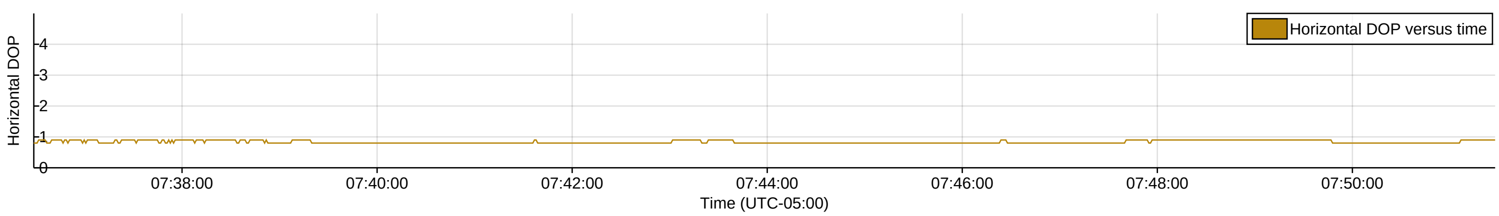
Time Series Plots for Secondary

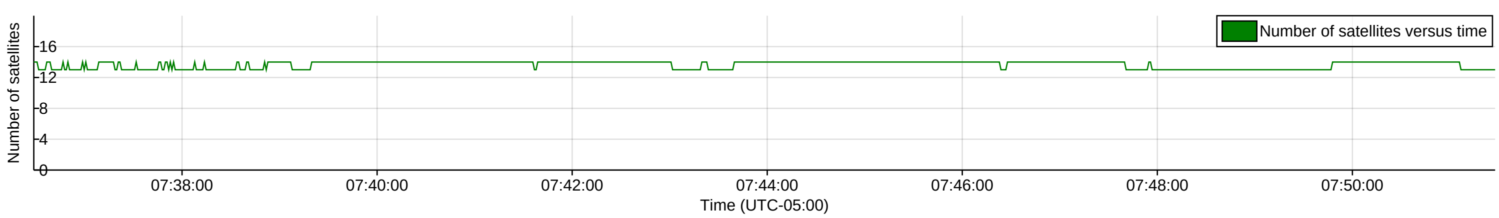












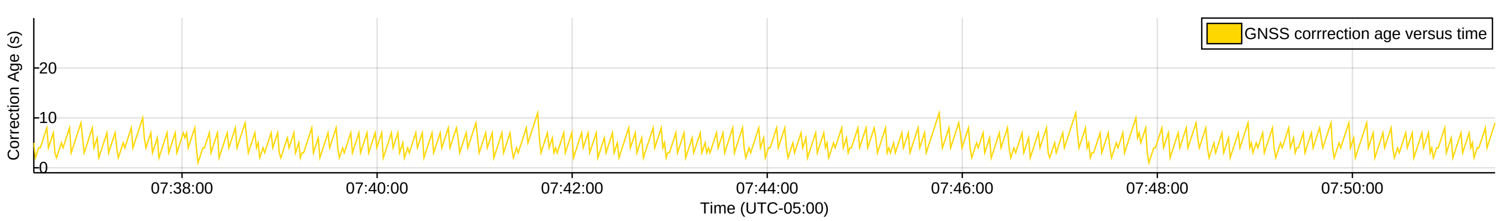
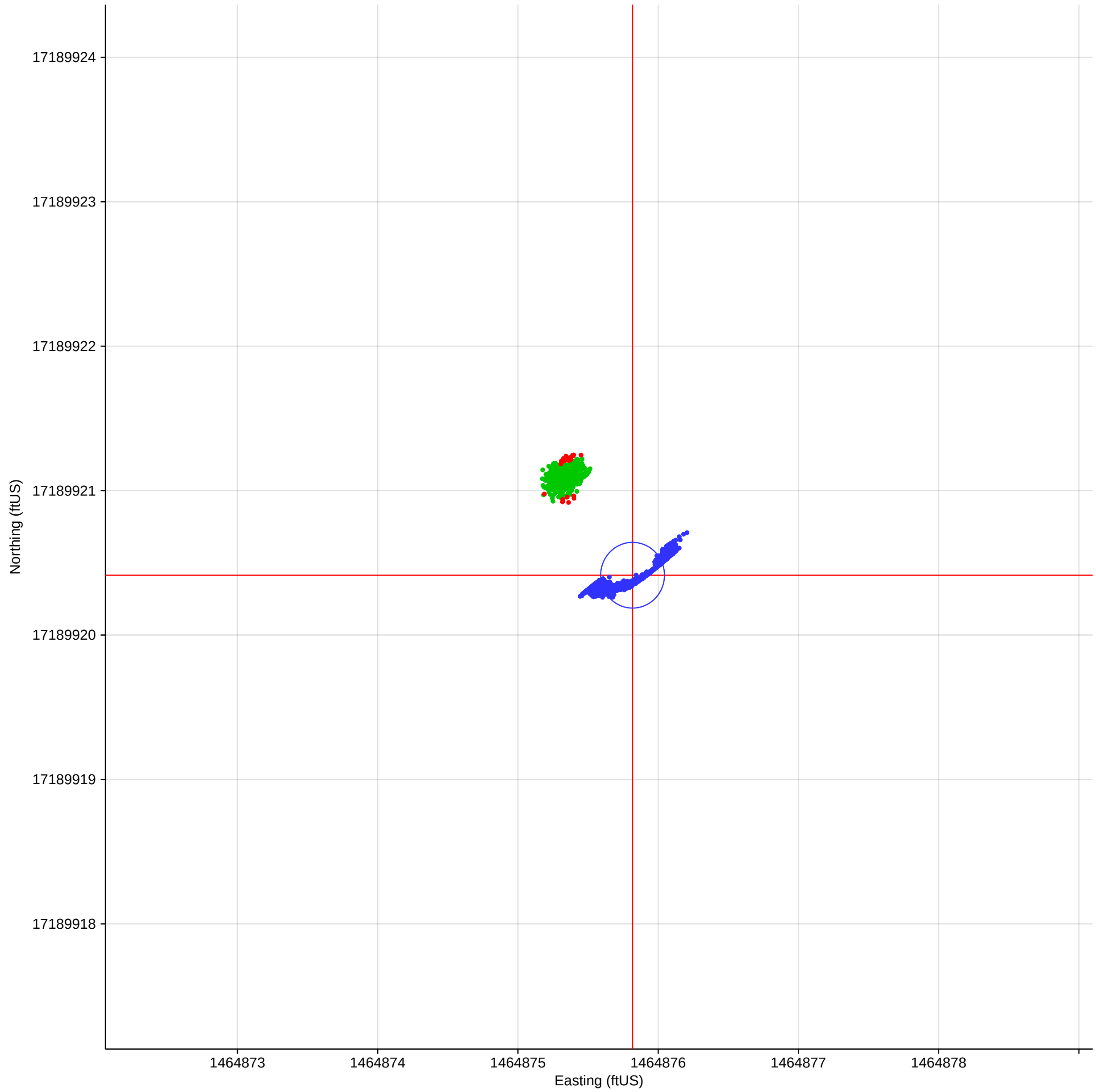


PLATE NO. B-147

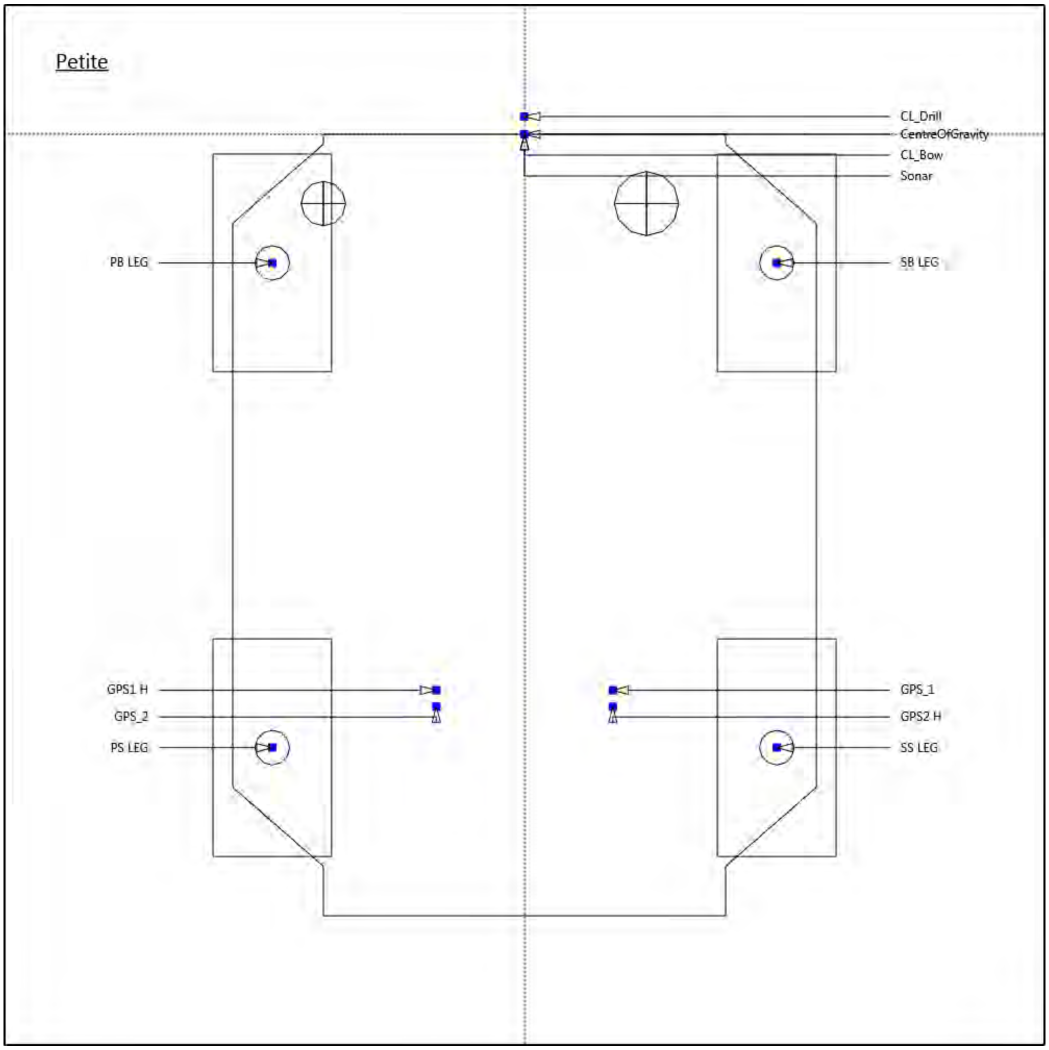
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,189,920.41ftUS N, 1,464,875.82ftUS E, -46.27ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,189,921.08ftUS N, 1,464,875.34ftUS E, -44.66ft Ell.	0.67ftUS	-0.47ftUS	1.61ftUS

PLATE NO. B-148

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Gulf of Mexico MMS Lease Information

The final position has the following distances to the MU859S boundary

From North boundary :	2,018.23ftUS Grid	From East boundary :	4,453.26ftUS Grid
From South boundary :	3,261.72ftUS Grid	From West boundary :	826.70ftUS Grid

Seabed Information

Seabed Depth	52.90ft
Comment	

Area Map

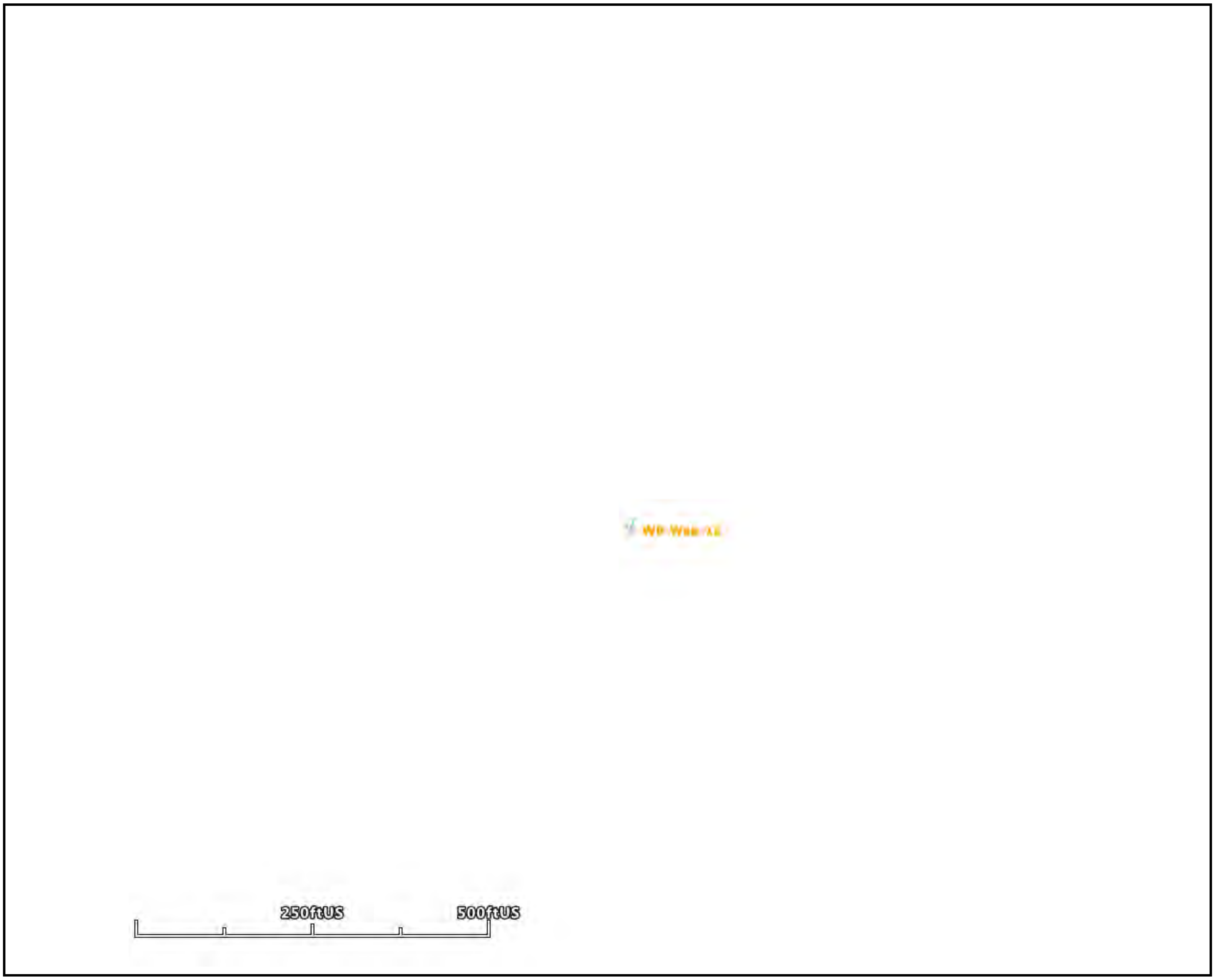


PLATE NO. B-152

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Ryan Powell**		
Primary Vessel:	**Petite**		
Location:	**22**		
Comment:			

Session Name: 20180805-180855-v1
Start Time: 05 Aug 2018, 22:08:21-05:00
End Time: 05 Aug 2018, 22:23:20-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 22

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°49’31.95064”N	27°49’31.95064”N
Longitude	097°01’07.27164”W	097°01’07.27164”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,191,731.57ftUS N	
Easting	1,463,038.76ftUS E	
Height	-45.58ft Ell.	
Final Rig Heading	68.24°True (67.57°Grid)	

Final Position for CL_Drill is 5.69ftUS @ 275.8°True (275.1°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.67246°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°49’31.94500”N	Longitude: 097°01’07.20862”W	Northing: 17,191,731.07ftUS N	Easting: 1,463,044.42ftUS E
Intended Rig Heading	180.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,191,731.57ftUS N, 1,463,038.76ftUS E, -45.58ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,191,731.61ftUS N, 1,463,038.09ftUS E, -45.52ft Ell.	0.04ftUS	-0.67ftUS	0.06ftUS

Ryan Powell
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	898 of 900 used		900 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°49'31.65567"N	±0.13ftUS	27°49'31.81419"N	±0.10ftUS
Longitude	097°01'07.83476"W	±0.13ftUS	097°01'07.93295"W	±0.05ftUS
Height	-45.58ft Ell.	±0.40ftUS	-45.52ft Ell.	±0.25ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°49'31.65567"N	±0.13ftUS	27°49'31.81419"N	±0.10ftUS
Longitude	097°01'07.83476"W	±0.13ftUS	097°01'07.93295"W	±0.05ftUS
Height	-45.58ft Ell.	±0.40ftUS	-45.52ft Ell.	±0.25ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,191,701.19ftUS N	±0.13ftUS	17,191,717.10ftUS N	±0.10ftUS
Easting	1,462,988.55ftUS E	±0.13ftUS	1,462,979.55ftUS E	±0.05ftUS
Height	-45.58ft Ell.	±0.40ftUS	-45.52ft Ell.	±0.25ftUS

HDOP	1.02		0.80	
No. Satellites	8		12	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	68.24°True	±0.1°	68.24°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°49'31.95064"N	±0.13ftUS	27°49'31.95106"N	±0.13ftUS
Longitude	097°01'07.27164"W	±0.14ftUS	097°01'07.27907"W	±0.06ftUS
Height	-45.58ft Ell.	±0.40ftUS	-45.52ft Ell.	±0.25ftUS

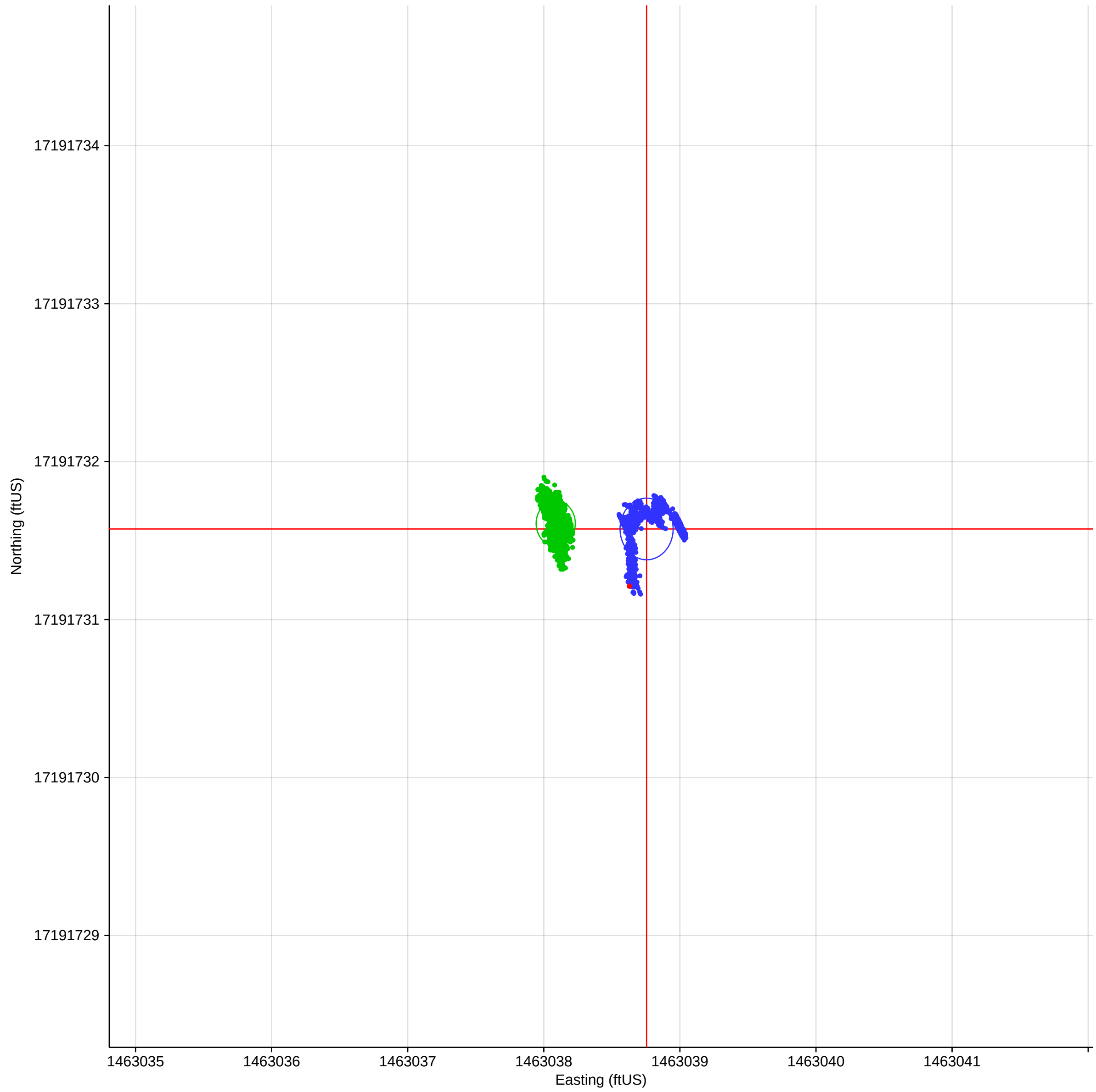
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,191,731.57ftUS N	±0.13ftUS	17,191,731.61ftUS N	±0.13ftUS
Easting	1,463,038.76ftUS E	±0.14ftUS	1,463,038.09ftUS E	±0.06ftUS
Height	-45.58ft Ell.	±0.40ftUS	-45.52ft Ell.	±0.25ftUS

Delta Northing	0.00ftUS		0.04ftUS	
Delta Easting	0.00ftUS		-0.67ftUS	
Delta Height	0.00ftUS		0.06ftUS	

Position of CL_Drill from proposed location				
Range	5.69ftUS		6.36ftUS	

Bearing	275.75°True		275.53°True	

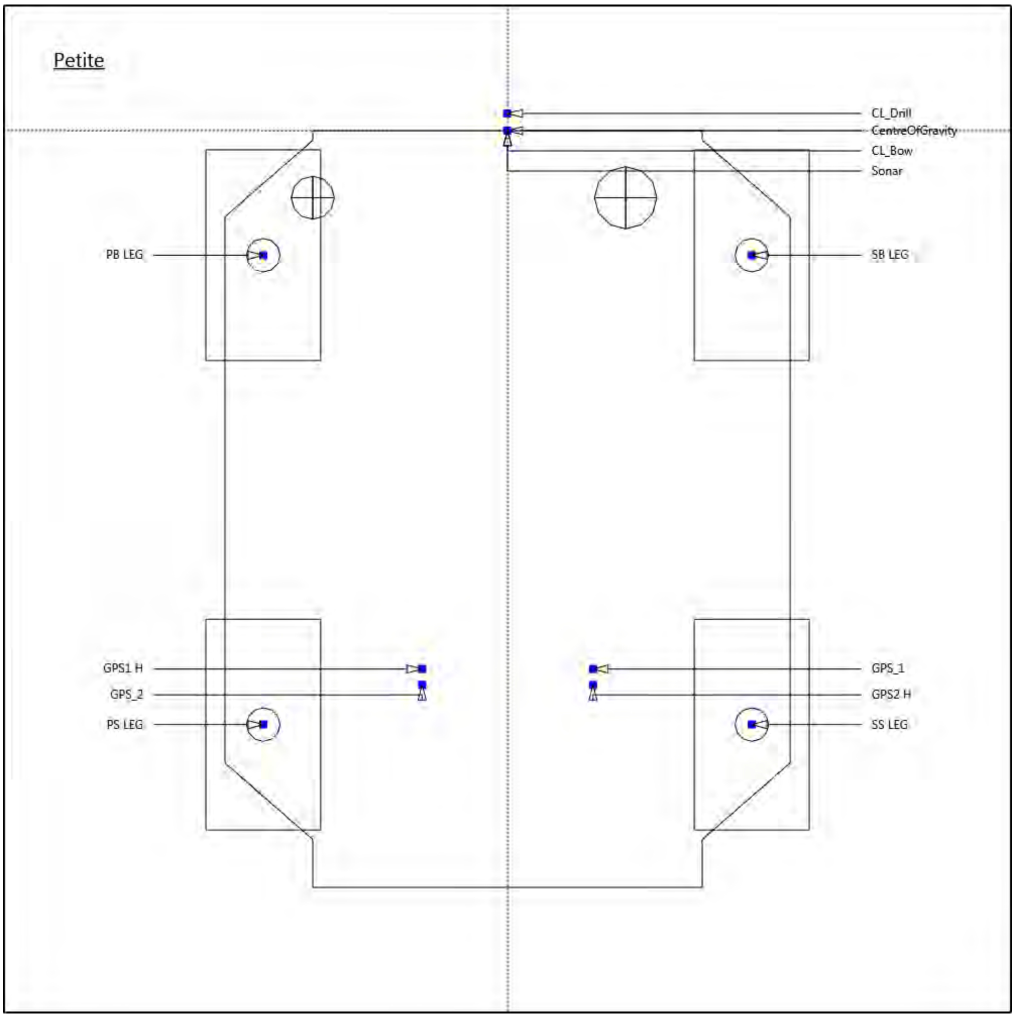
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,191,731.57ftUS N, 1,463,038.76ftUS E, -45.58ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,191,731.61ftUS N, 1,463,038.09ftUS E, -45.52ft Ell.	0.04ftUS	-0.67ftUS	0.06ftUS

PLATE NO. B-157

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	40.50ft
Comment	

Remarks

PLATE NO. B-159

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**26**		
Comment:			

Session Name: 20180816-024431-v1
Start Time: 15 Aug 2018, 21:45:11-05:00
End Time: 15 Aug 2018, 22:00:10-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 26

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°49’31.47812”N	27°49’31.47811”N
Longitude	097°01’40.06737”W	097°01’40.06737”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,191,649.40ftUS N	
Easting	1,460,094.94ftUS E	
Height	-47.01ft Ell.	
Final Rig Heading	106.37°True (105.70°Grid)	

Final Position for CL_Drill is 0.95ftUS @ 176.2°True (175.5°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.66831°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°49’31.48753”N	Longitude: 097°01’40.06808”W	Northing: 17,191,650.35ftUS N	Easting: 1,460,094.87ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,191,649.40ftUS N, 1,460,094.94ftUS E, -47.01ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,191,651.25ftUS N, 1,460,095.16ftUS E, -46.21ft Ell.	1.85ftUS	0.24ftUS	0.80ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	845 of 900 used		880 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°49’31.55517”N	±0.10ftUS	27°49’31.74759”N	±0.04ftUS
Longitude	097°01’40.71519”W	±0.10ftUS	097°01’40.67415”W	±0.04ftUS
Height	-47.01ft Ell.	±0.19ftUS	-46.21ft Ell.	±0.19ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°49’31.55517”N	±0.10ftUS	27°49’31.74759”N	±0.04ftUS
Longitude	097°01’40.71519”W	±0.10ftUS	097°01’40.67415”W	±0.04ftUS
Height	-47.01ft Ell.	±0.19ftUS	-46.21ft Ell.	±0.19ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,191,656.50ftUS N	±0.10ftUS	17,191,675.98ftUS N	±0.04ftUS
Easting	1,460,036.69ftUS E	±0.10ftUS	1,460,040.15ftUS E	±0.04ftUS
Height	-47.01ft Ell.	±0.19ftUS	-46.21ft Ell.	±0.19ftUS

HDOP	1.14		0.63	
No. Satellites	8		16	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	106.37°True	±0.0°	106.36°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

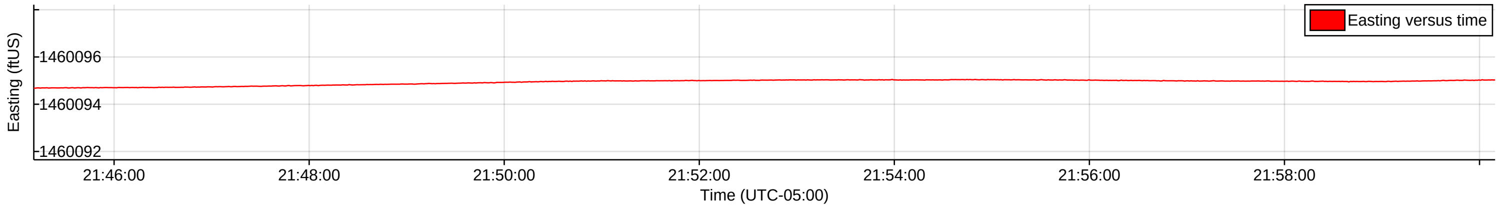
CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°49’31.47812”N	±0.13ftUS	27°49’31.49641”N	±0.07ftUS
Longitude	097°01’40.06737”W	±0.10ftUS	097°01’40.06469”W	±0.04ftUS
Height	-47.01ft Ell.	±0.19ftUS	-46.21ft Ell.	±0.19ftUS

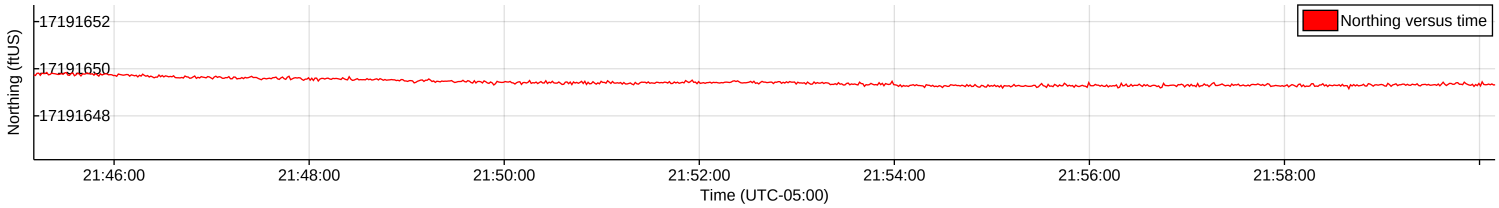
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,191,649.40ftUS N	±0.13ftUS	17,191,651.25ftUS N	±0.07ftUS
Easting	1,460,094.94ftUS E	±0.10ftUS	1,460,095.16ftUS E	±0.04ftUS
Height	-47.01ft Ell.	±0.19ftUS	-46.21ft Ell.	±0.19ftUS

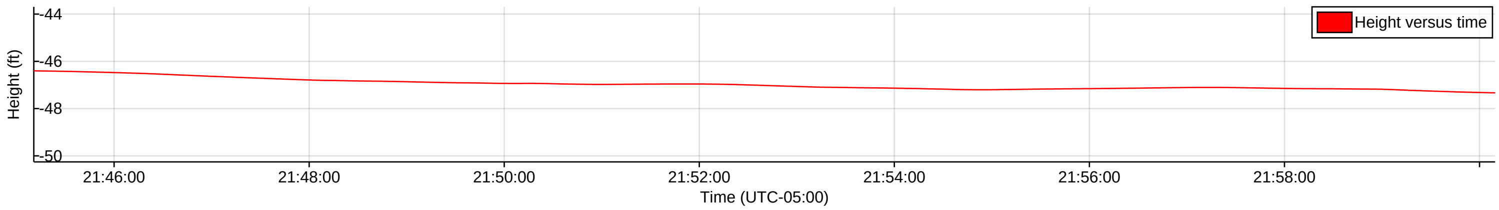
Delta Northing	0.00ftUS		1.85ftUS	
Delta Easting	0.00ftUS		0.24ftUS	
Delta Height	0.00ftUS		0.80ftUS	

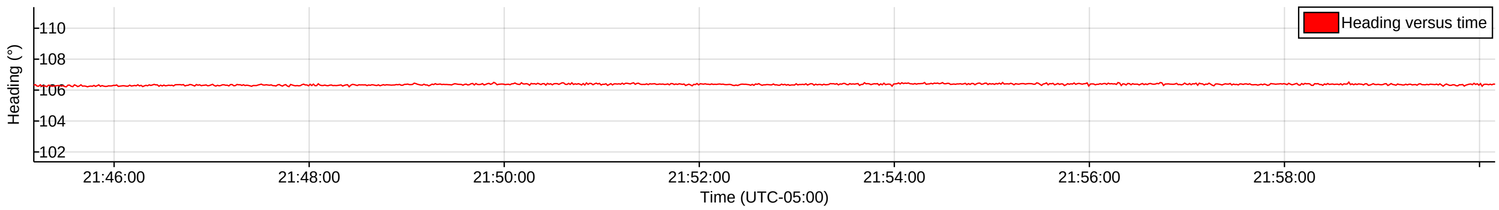
Position of CL_Drill from proposed location				
Range	0.95ftUS		0.95ftUS	
Bearing	176.18°True		18.72°True	

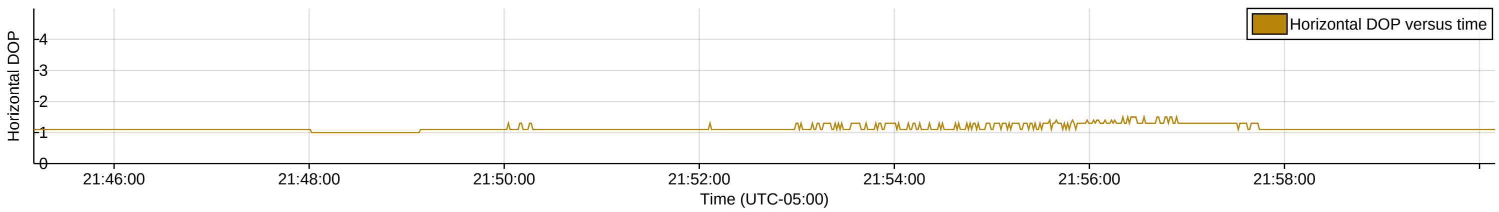
Time Series Plots for Primary

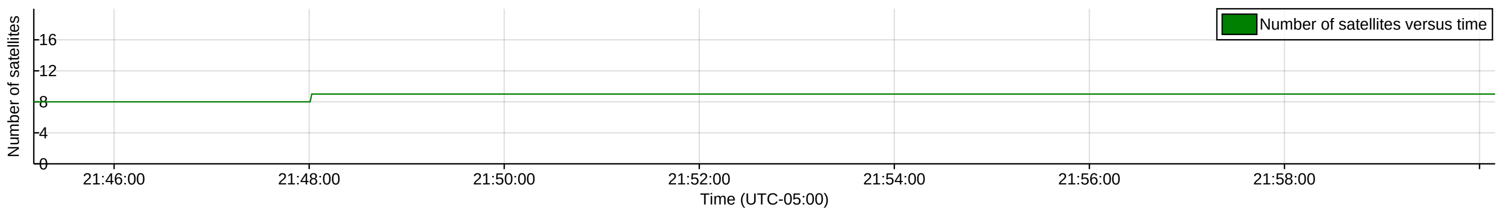












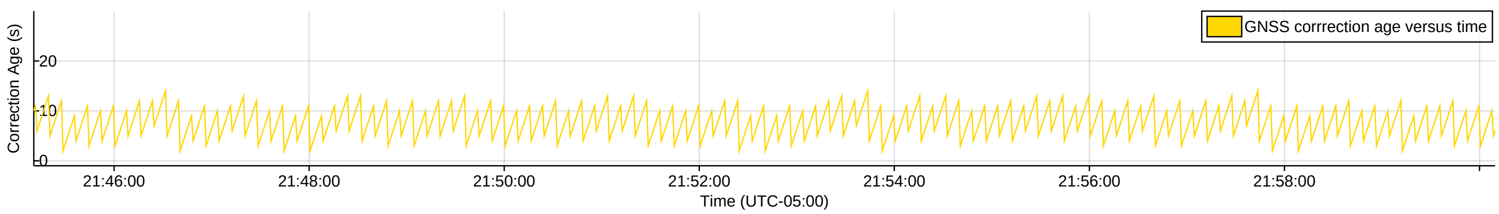
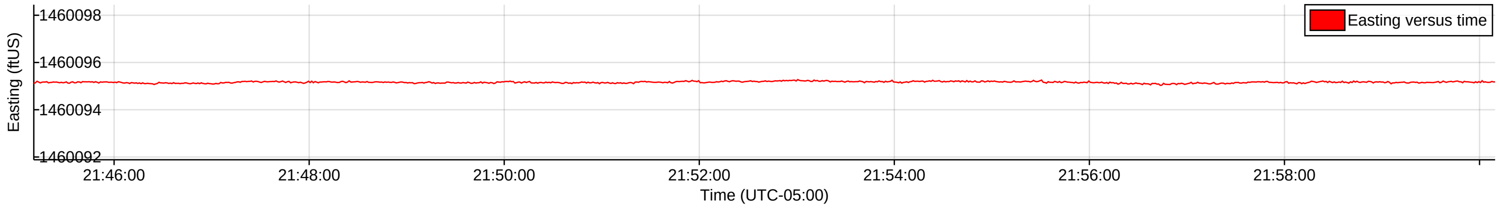
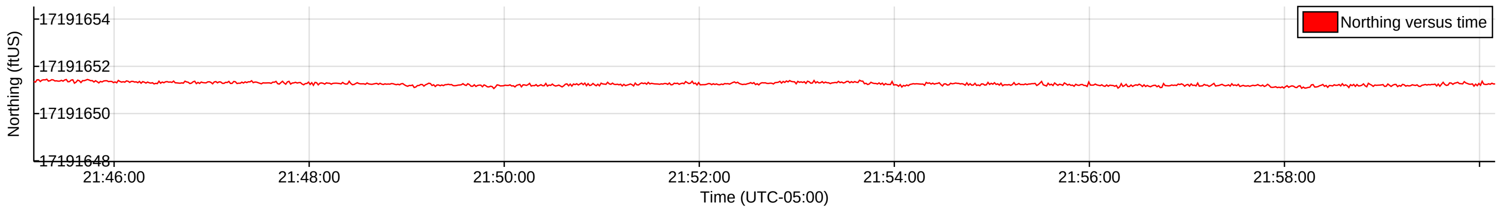
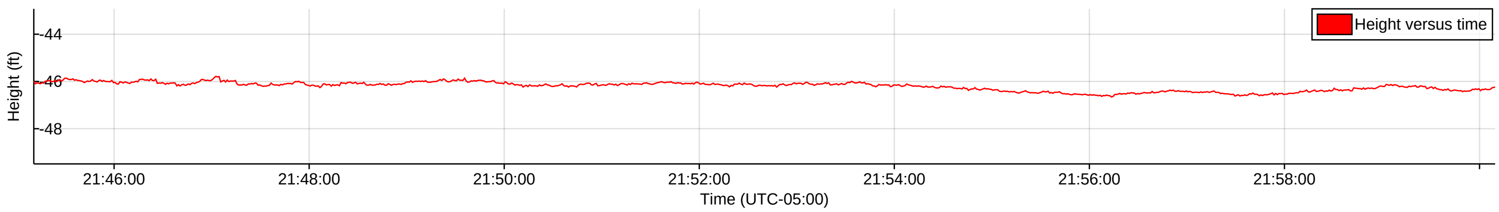


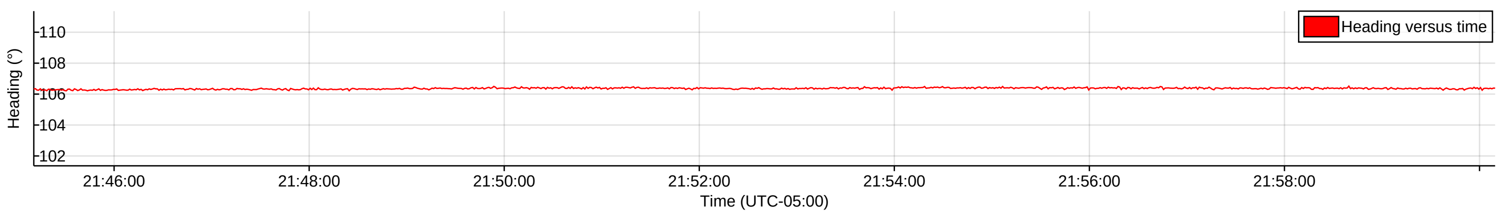
PLATE NO. B-165

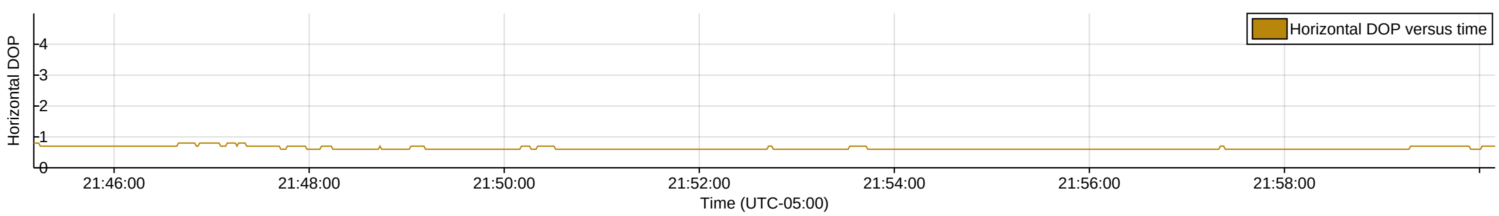
Time Series Plots for Secondary

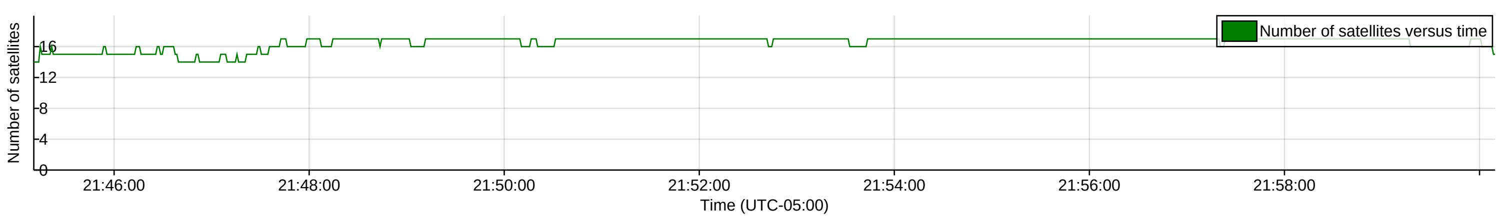


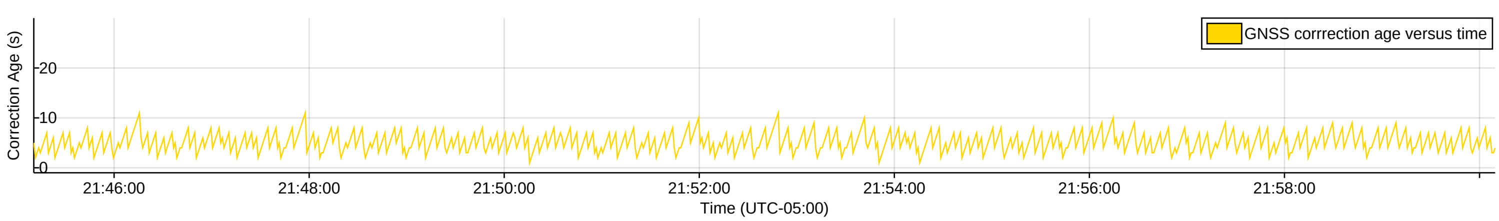




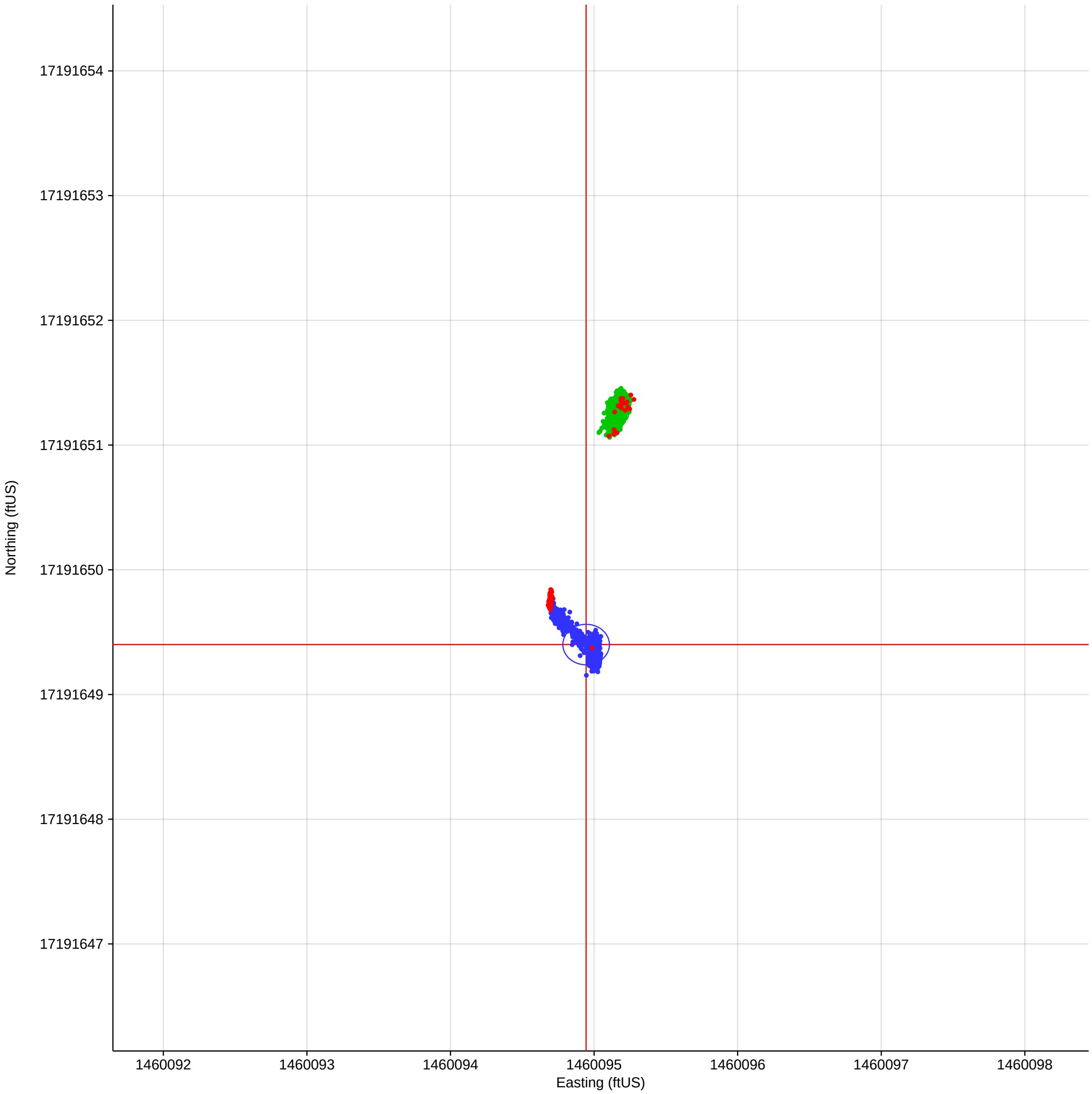








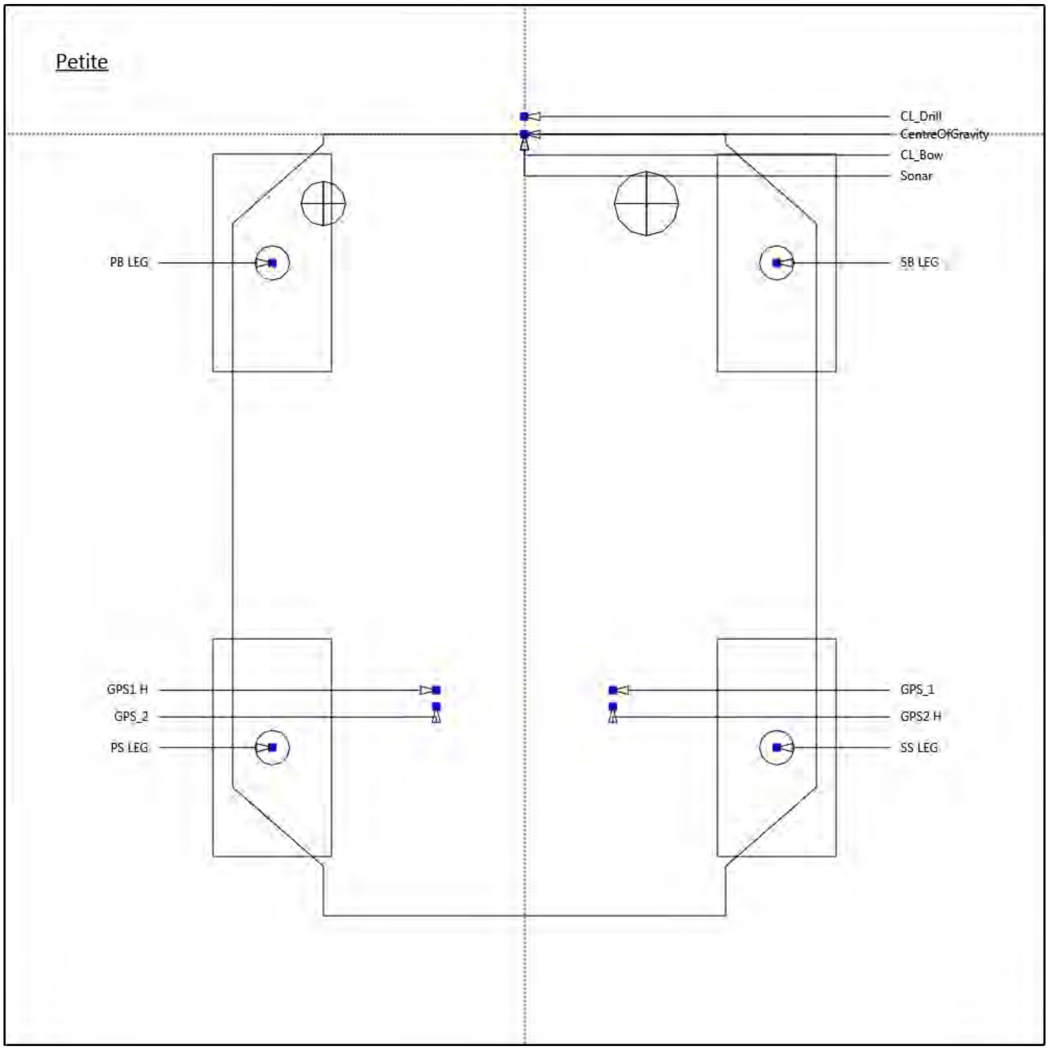
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,191,649.40ftUS N, 1,460,094.94ftUS E, -47.01ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,191,651.25ftUS N, 1,460,095.16ftUS E, -46.21ft Ell.	1.85ftUS	0.24ftUS	0.80ftUS

PLATE NO. B-167

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-168

Gulf of Mexico MMS Lease Information

The final position has the following distances to the MU858S boundary

From North boundary :	289.26ftUS Grid	From East boundary :	3,954.17ftUS Grid
From South boundary :	4,990.69ftUS Grid	From West boundary :	1,325.78ftUS Grid

PLATE NO. B-169

Seabed Information

Seabed Depth	48.30ft
Comment	

Area Map

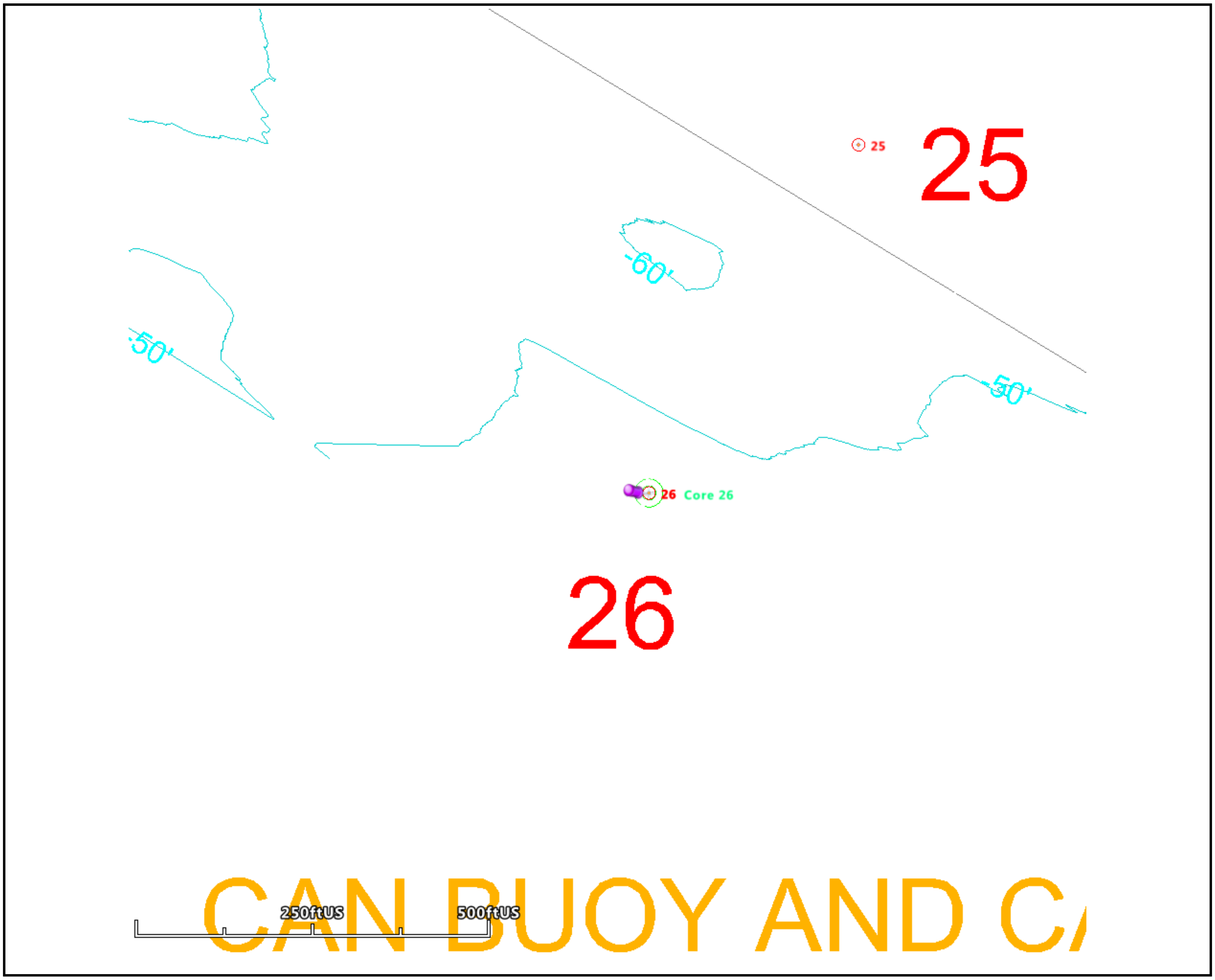


PLATE NO. B-171

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**27**		
Comment:			

Session Name:	20180815-222825-v1		
	Start Time:	15 Aug 2018, 17:29:03-05:00	
	End Time:	15 Aug 2018, 17:44:33-05:00	(Session Length 0.258 hrs - No. Obs. 844)

Final Position Fix Summary for Petite at 27

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°49'46.56847"N	27°49'46.56846"N
Longitude	097°01'55.82701"W	097°01'55.82701"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,193,156.82ftUS N	
Easting	1,458,662.33ftUS E	
Height	-45.00ft Ell.	
Final Rig Heading	348.13°True (347.47°Grid)	

Final Position for CL_Drill is 4.57ftUS @ 199.4°True (198.7°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.66643°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°49'46.61110"N	Longitude: 097°01'55.81010"W	Northing: 17,193,161.14ftUS N	Easting: 1,458,663.80ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,193,156.82ftUS N, 1,458,662.33ftUS E, -45.00ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,193,156.59ftUS N, 1,458,662.47ftUS E, -45.93ft Ell.	-0.23ftUS	0.13ftUS	-0.93ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	843 of 844 used		829 of 844 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°49'46.02460"N	±0.04ftUS	27°49'45.96997"N	±0.06ftUS
Longitude	097°01'55.59688"W	±0.02ftUS	097°01'55.78620"W	±0.07ftUS
Height	-45.00ft Ell.	±0.36ftUS	-45.93ft Ell.	±0.14ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°49'46.02461"N	±0.04ftUS	27°49'45.96998"N	±0.06ftUS
Longitude	097°01'55.59688"W	±0.02ftUS	097°01'55.78620"W	±0.07ftUS
Height	-45.00ft Ell.	±0.36ftUS	-45.93ft Ell.	±0.14ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,193,102.14ftUS N	±0.04ftUS	17,193,096.42ftUS N	±0.06ftUS
Easting	1,458,683.63ftUS E	±0.02ftUS	1,458,666.70ftUS E	±0.07ftUS
Height	-45.00ft Ell.	±0.36ftUS	-45.93ft Ell.	±0.14ftUS

HDOP	1.08		0.80	
No. Satellites	7		12	
Age of Corrections	8.0 secs		4.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	348.13°True	±0.0°	348.13°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°49'46.56847"N	±0.04ftUS	27°49'46.56617"N	±0.06ftUS
Longitude	097°01'55.82701"W	±0.04ftUS	097°01'55.82554"W	±0.09ftUS
Height	-45.00ft Ell.	±0.36ftUS	-45.93ft Ell.	±0.14ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,193,156.82ftUS N	±0.04ftUS	17,193,156.59ftUS N	±0.06ftUS
Easting	1,458,662.33ftUS E	±0.04ftUS	1,458,662.47ftUS E	±0.09ftUS
Height	-45.00ft Ell.	±0.36ftUS	-45.93ft Ell.	±0.14ftUS

Delta Northing	0.00ftUS		-0.23ftUS	
Delta Easting	0.00ftUS		0.13ftUS	
Delta Height	0.00ftUS		-0.93ftUS	

Position of CL_Drill from proposed location				
Range	4.57ftUS		4.74ftUS	
Bearing	199.42°True		196.99°True	

Time Series Plots for Primary

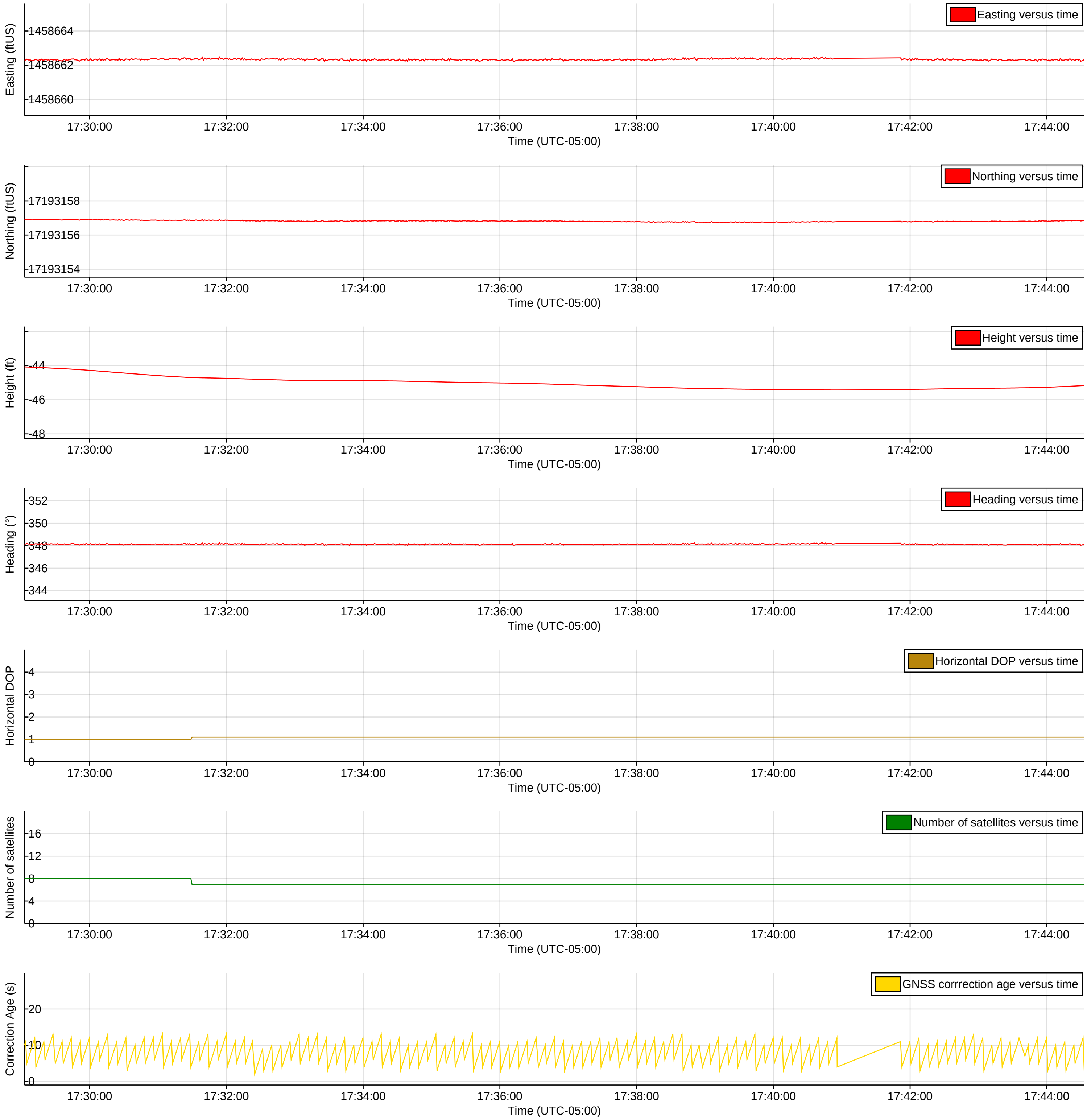
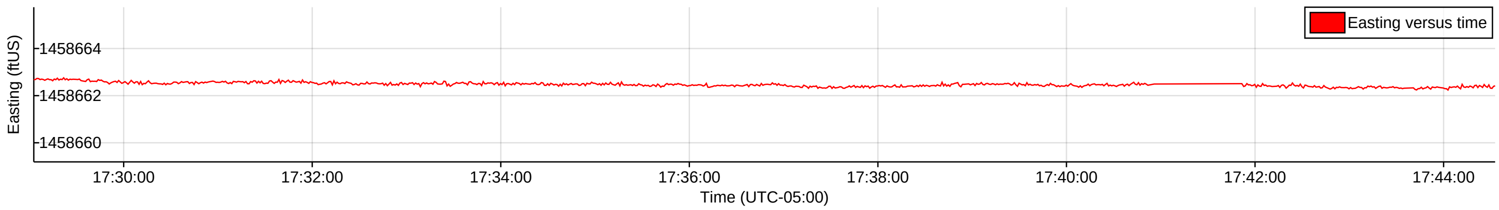
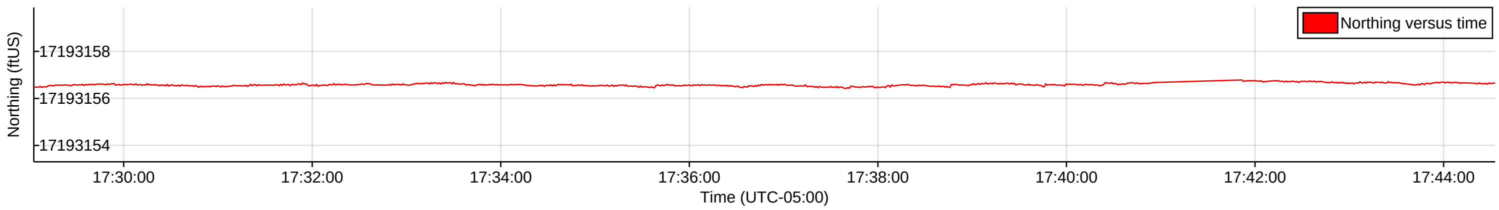
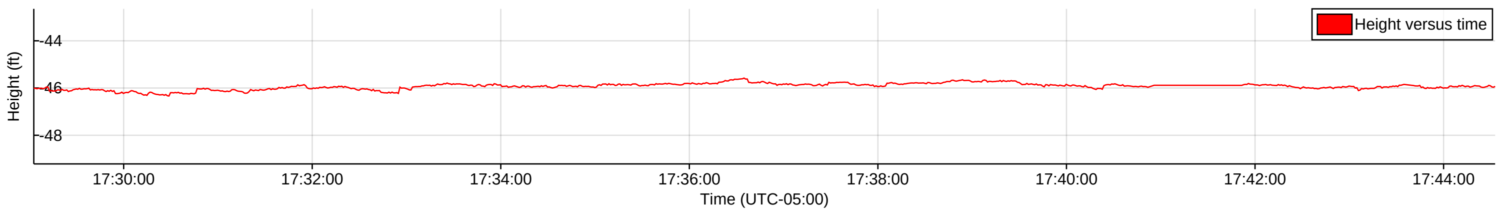


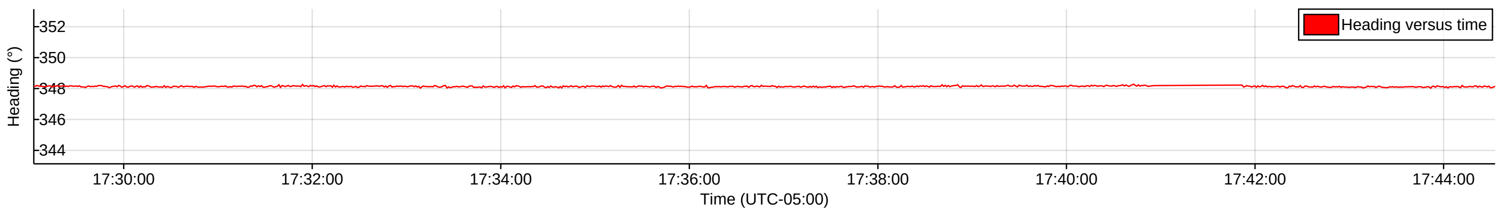
PLATE NO. B-177

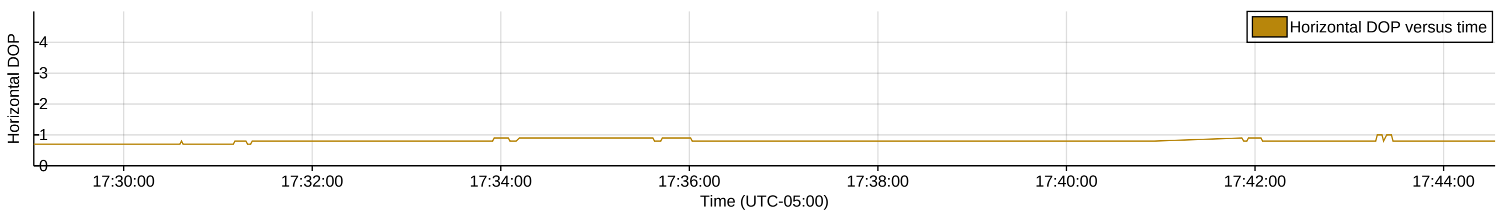
Time Series Plots for Secondary

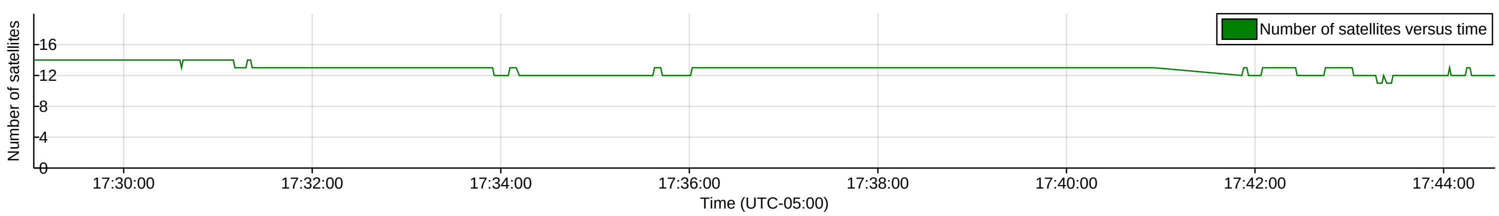












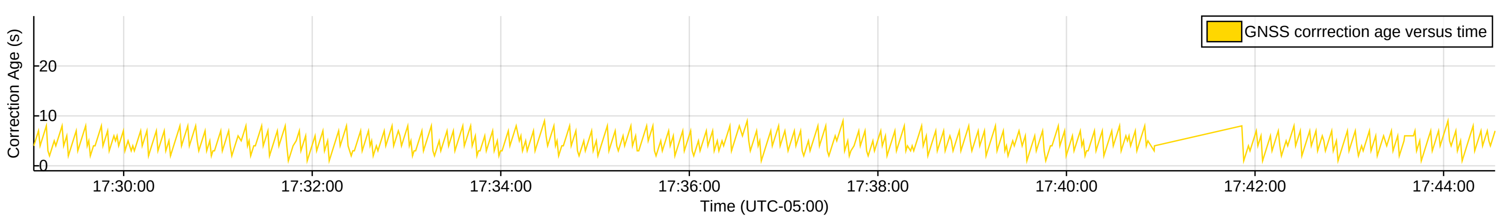
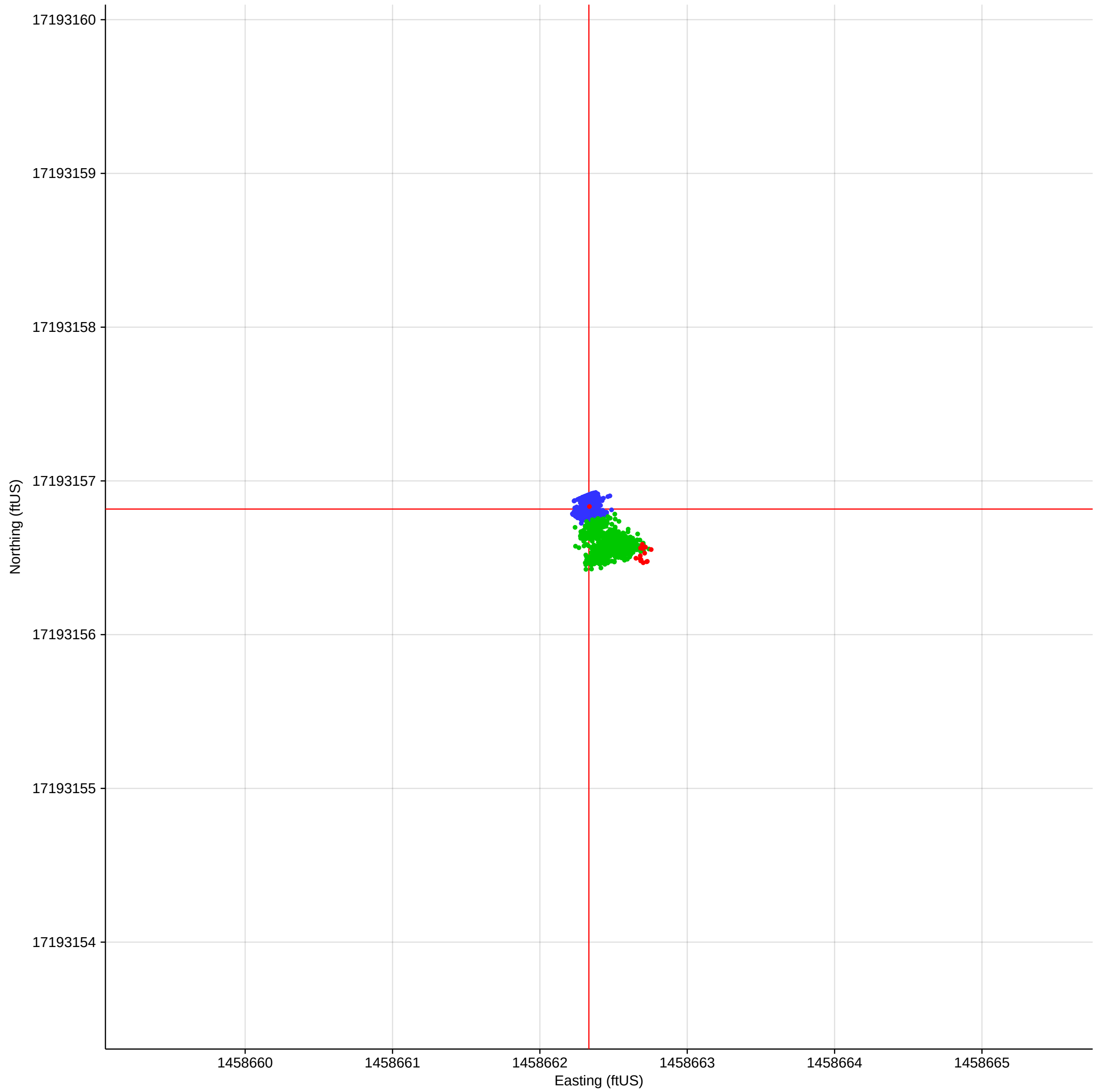


PLATE NO. B-178

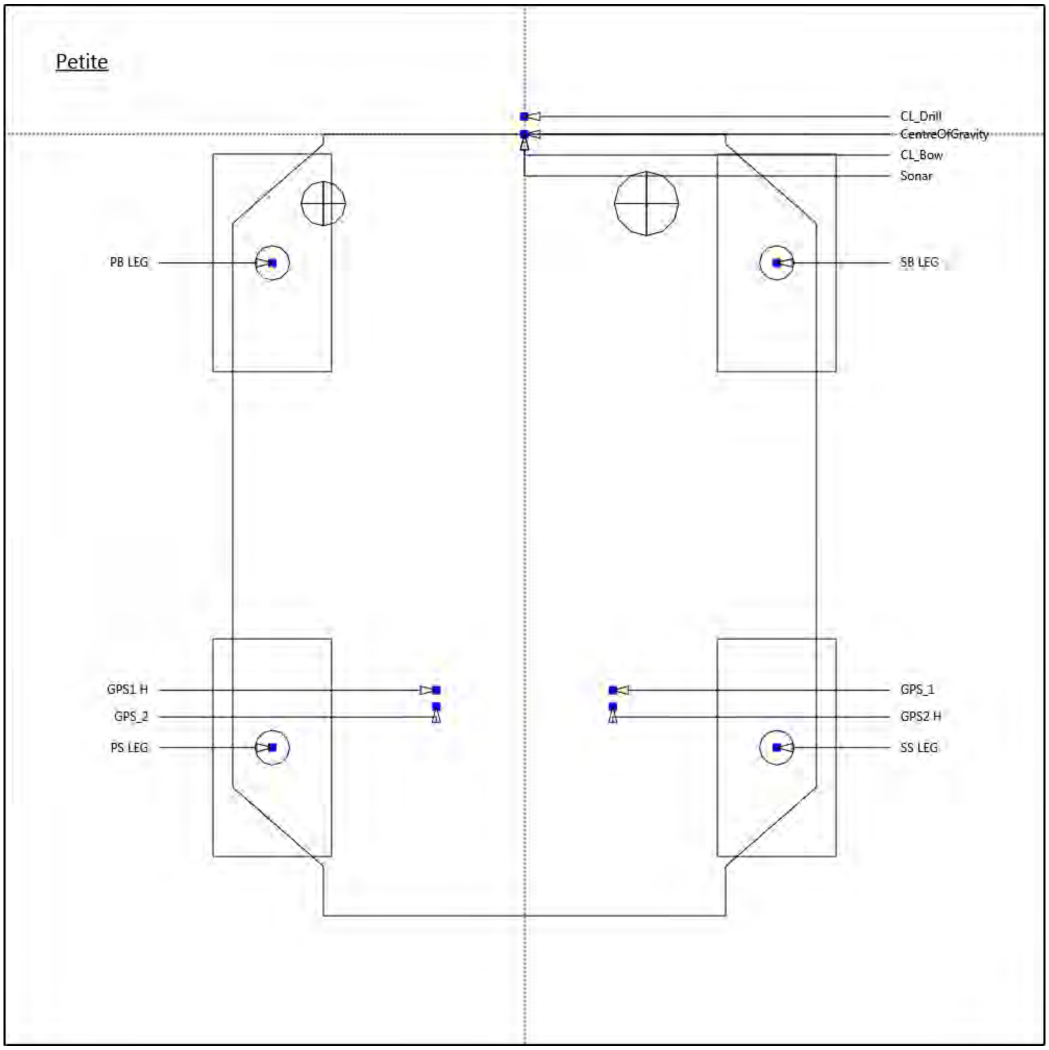
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,193,156.82ftUS N, 1,458,662.33ftUS E, -45.00ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,193,156.59ftUS N, 1,458,662.47ftUS E, -45.93ft Ell.	-0.23ftUS	0.13ftUS	-0.93ftUS

PLATE NO. B-179

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-180

Gulf of Mexico MMS Lease Information

The final position has the following distances to the MU855S boundary

From North boundary :	4,033.21ftUS Grid	From East boundary :	106.82ftUS Grid
From South boundary :	1,218.15ftUS Grid	From West boundary :	5,912.83ftUS Grid

Seabed Information

Seabed Depth	66.80ft
Comment	

PLATE NO. B-182

Area Map

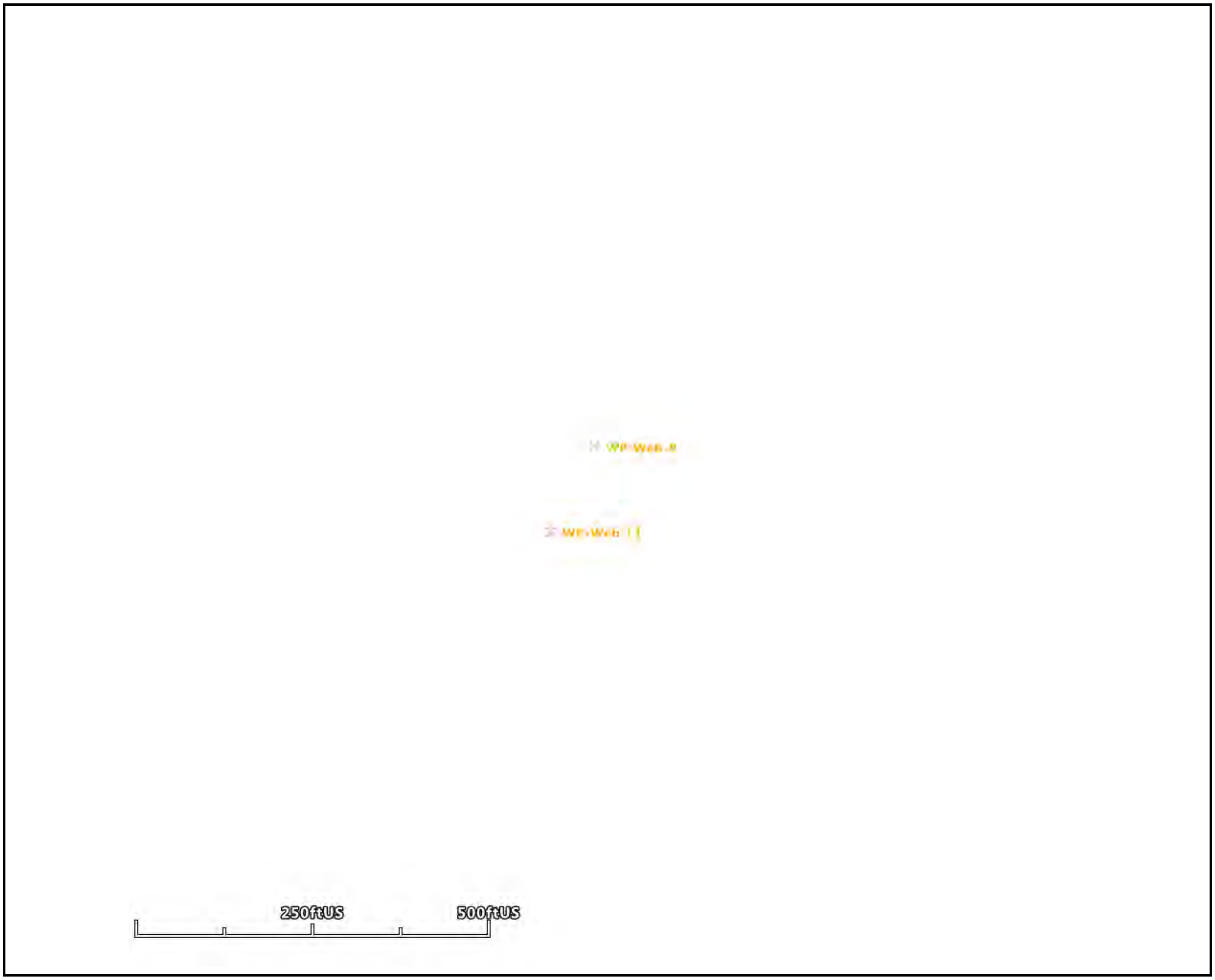


PLATE NO. B-183

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**28**		
Comment:	**28C**		

Session Name: 20180812-113310-v1
Start Time: 12 Aug 2018, 06:34:19-05:00
End Time: 12 Aug 2018, 06:49:25-05:00 (Session Length 0.252 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 28

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°49’50.49177”N	27°49’50.49177”N
Longitude	097°02’07.14182”W	097°02’07.14182”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,193,541.21ftUS N	
Easting	1,457,641.94ftUS E	
Height	-43.19ft Ell.	
Final Rig Heading	288.48°True (287.81°Grid)	

Final Position for CL_Drill is 906.86ftUS @ 158.0°True (157.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.66506°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°49’58.81563”N	Longitude: 097°02’10.93072”W	Northing: 17,194,377.85ftUS N	Easting: 1,457,292.04ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,193,541.21ftUS N, 1,457,641.94ftUS E, -43.19ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,193,542.12ftUS N, 1,457,641.63ftUS E, -45.53ft Ell.	0.92ftUS	-0.30ftUS	-2.35ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-184

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	842 of 900 used		869 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°49’50.39357”N	±0.08ftUS	27°49’50.22980”N	±0.04ftUS
Longitude	097°02’06.49760”W	±0.07ftUS	097°02’06.54650”W	±0.07ftUS
Height	-43.19ft Ell.	±0.09ftUS	-45.53ft Ell.	±0.12ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°49’50.39358”N	±0.08ftUS	27°49’50.22980”N	±0.04ftUS
Longitude	097°02’06.49760”W	±0.07ftUS	097°02’06.54650”W	±0.07ftUS
Height	-43.19ft Ell.	±0.09ftUS	-45.53ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,193,531.97ftUS N	±0.08ftUS	17,193,515.38ftUS N	±0.04ftUS
Easting	1,457,699.89ftUS E	±0.07ftUS	1,457,695.69ftUS E	±0.07ftUS
Height	-43.19ft Ell.	±0.09ftUS	-45.53ft Ell.	±0.12ftUS

HDOP	1.04		0.70	
No. Satellites	9		15	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	288.48°True	±0.0°	288.48°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°49’50.49177”N	±0.10ftUS	27°49’50.50085”N	±0.05ftUS
Longitude	097°02’07.14182”W	±0.07ftUS	097°02’07.14512”W	±0.07ftUS
Height	-43.19ft Ell.	±0.09ftUS	-45.53ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,193,541.21ftUS N	±0.11ftUS	17,193,542.12ftUS N	±0.05ftUS
Easting	1,457,641.94ftUS E	±0.07ftUS	1,457,641.63ftUS E	±0.07ftUS
Height	-43.19ft Ell.	±0.09ftUS	-45.53ft Ell.	±0.12ftUS

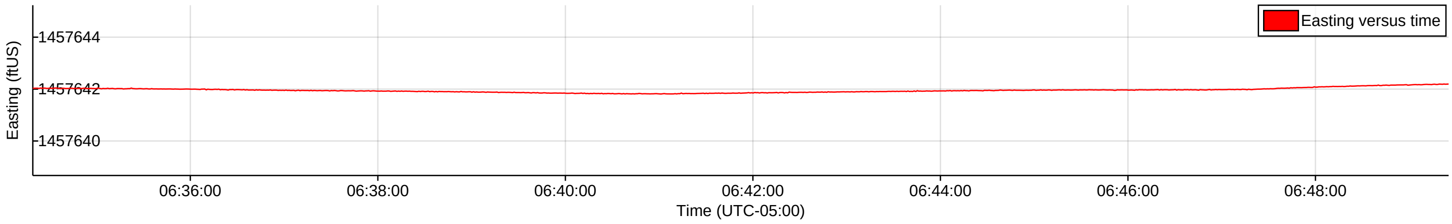
Delta Northing	0.00ftUS		0.92ftUS	
Delta Easting	0.00ftUS		-0.30ftUS	
Delta Height	0.00ftUS		-2.35ftUS	

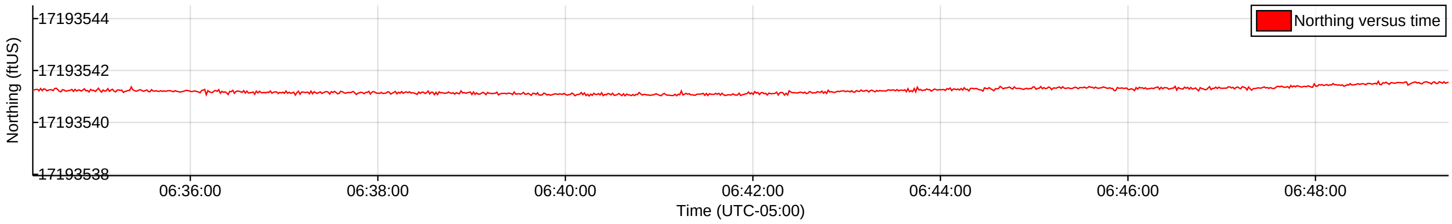
Position of CL_Drill from proposed location				
Range	906.86ftUS		905.90ftUS	

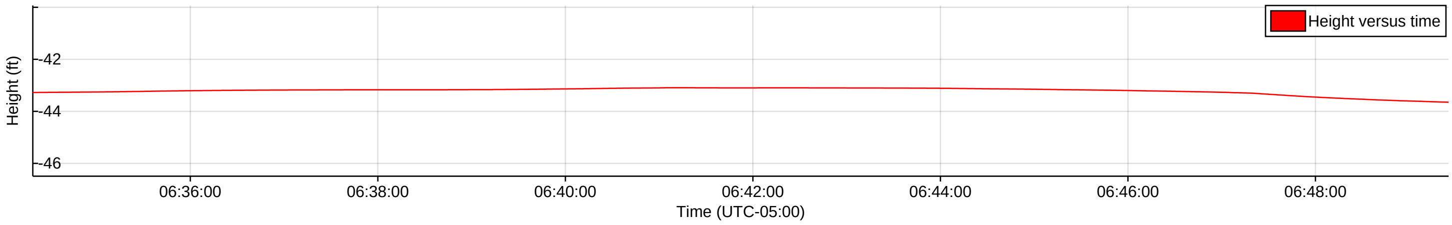
PLATE NO. B-186

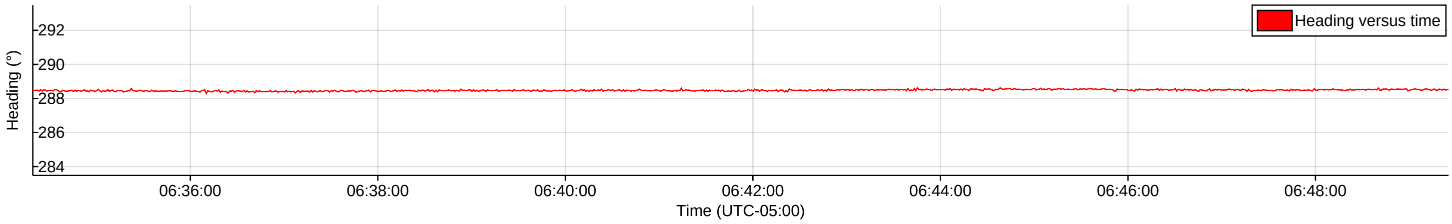
Bearing	157.97°True		157.96°True	

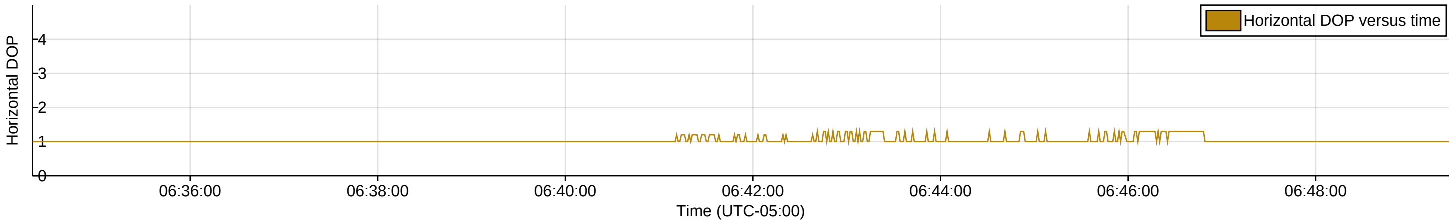
Time Series Plots for Primary

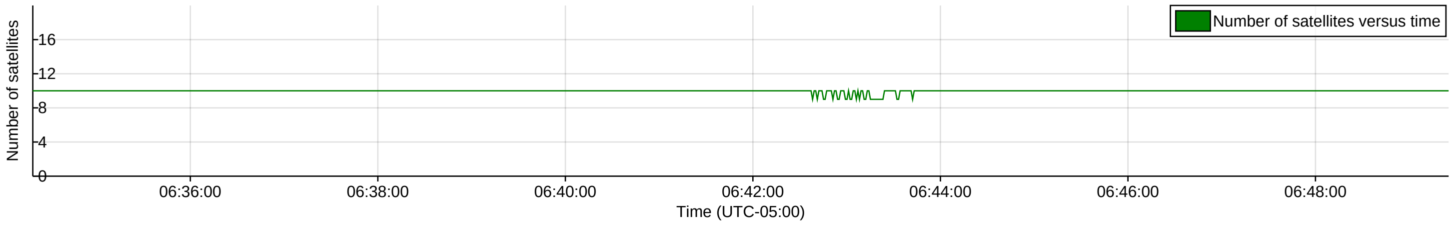












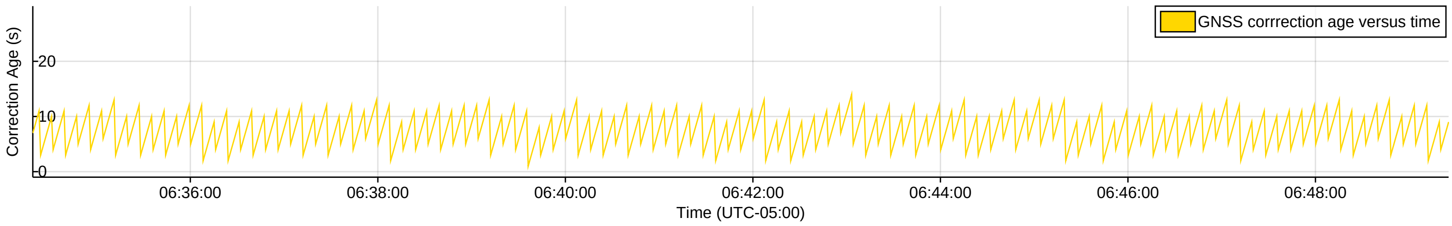
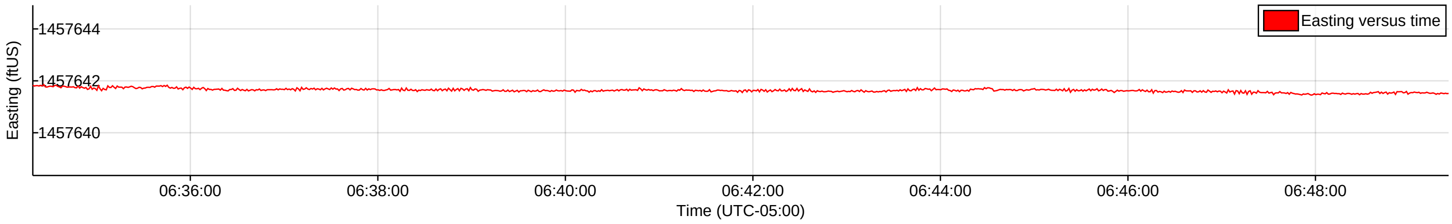
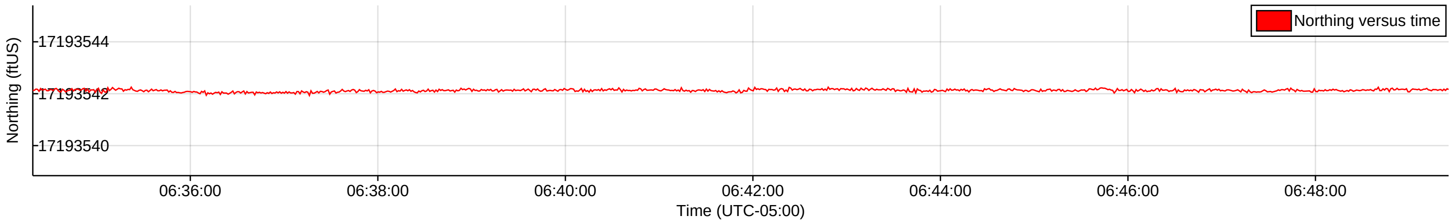
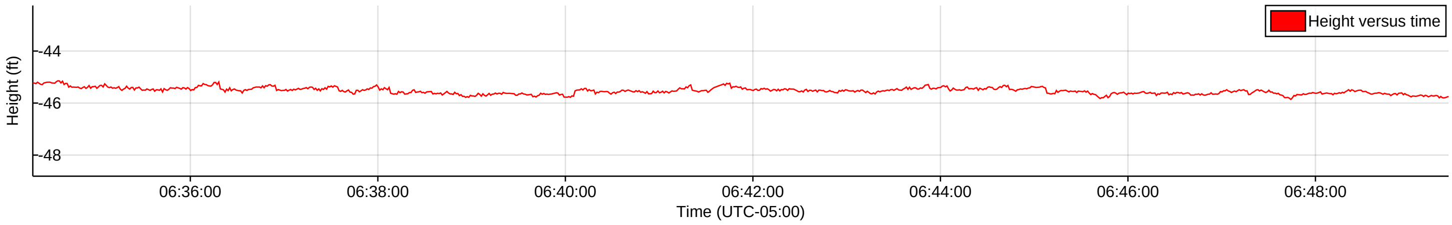


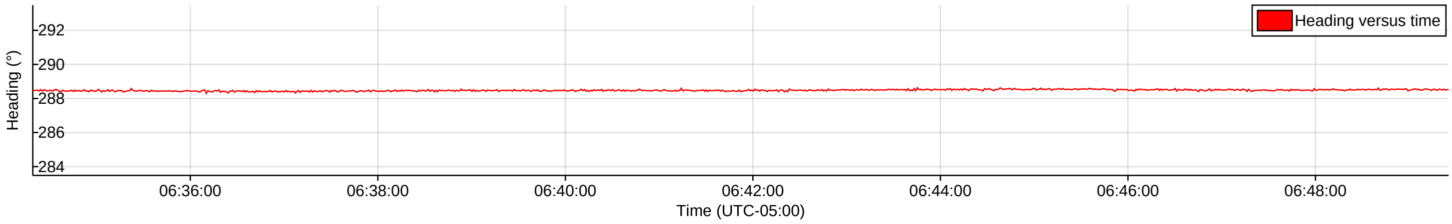
PLATE NO. B-188

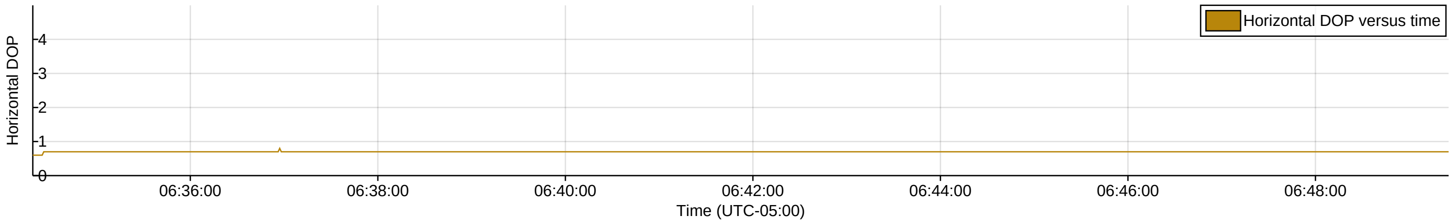
Time Series Plots for Secondary

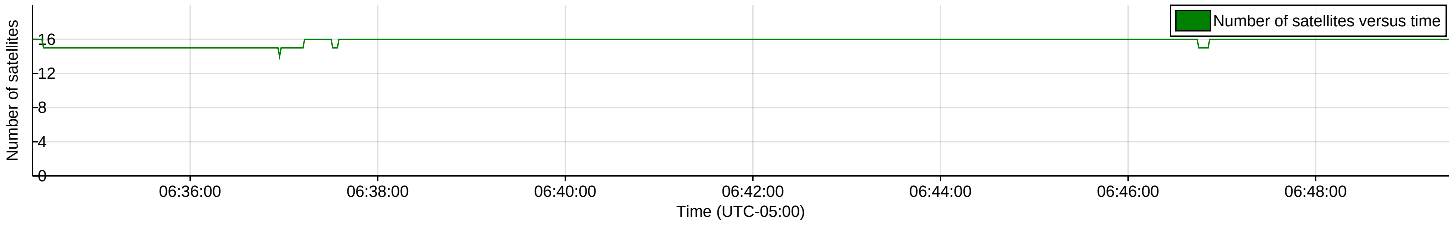












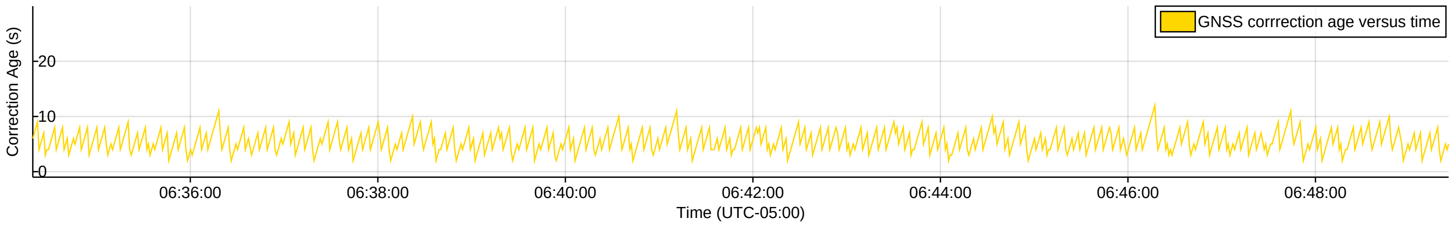
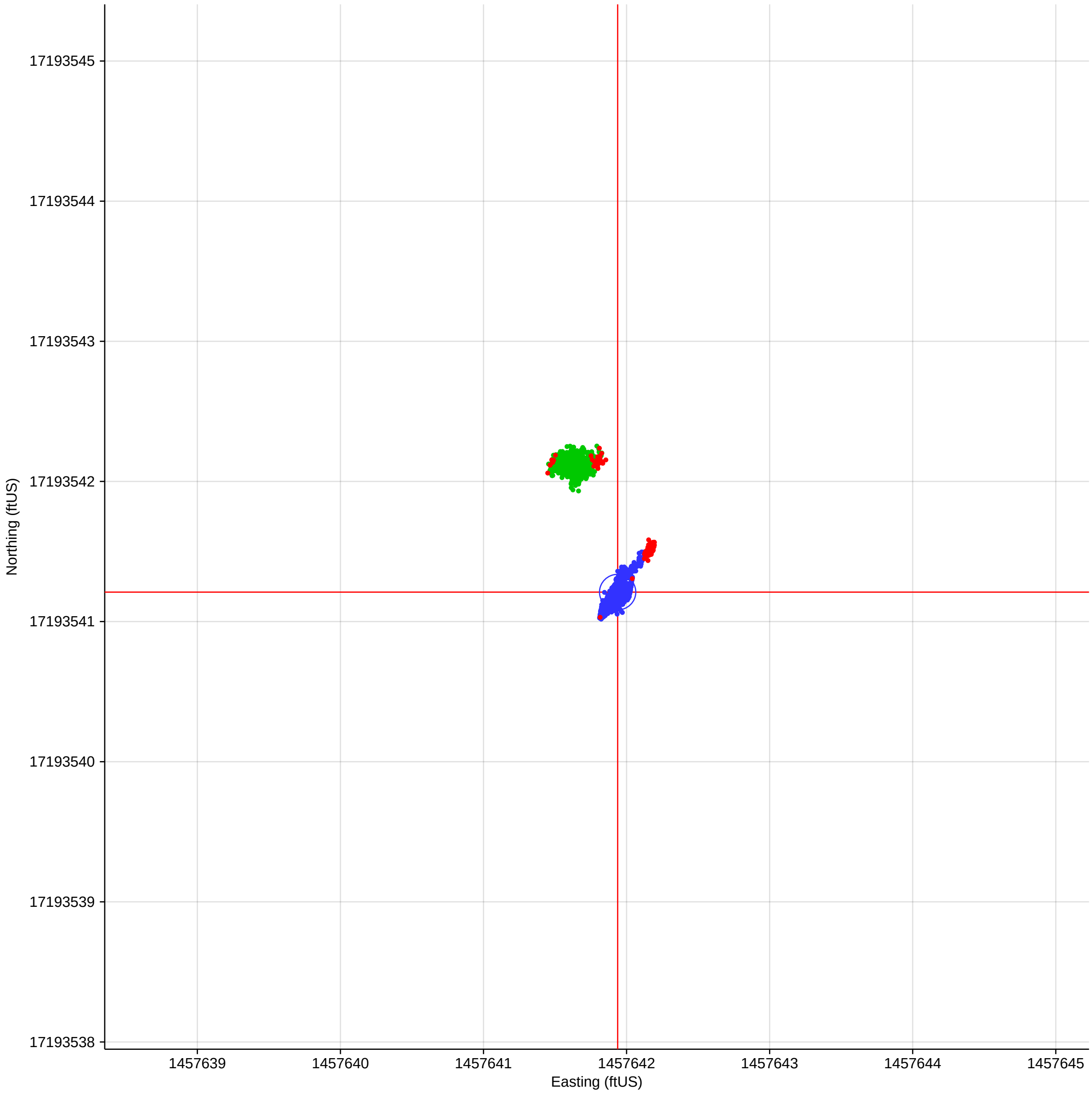


PLATE NO. B-189

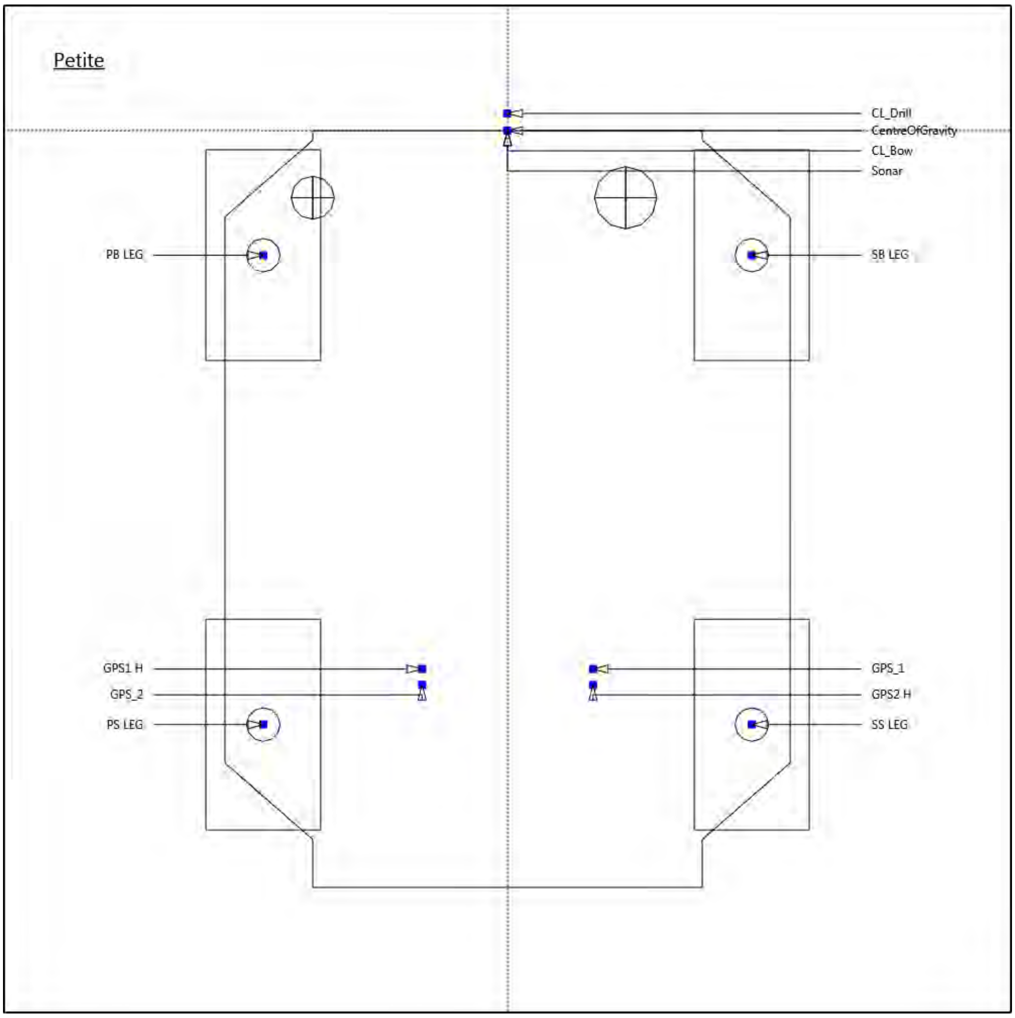
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,193,541.21ftUS N, 1,457,641.94ftUS E, -43.19ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,193,542.12ftUS N, 1,457,641.63ftUS E, -45.53ft Ell.	0.92ftUS	-0.30ftUS	-2.35ftUS

PLATE NO. B-190

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-191

Seabed Information

Seabed Depth	75.10ft
Comment	

STARFIX
FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**29B**		
Comment:			

Session Name: 20180810-221805-v1
Start Time: 10 Aug 2018, 17:20:10-05:00
End Time: 10 Aug 2018, 17:35:11-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Position Fix Summary for Petite at 29B

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’09.10639”N	27°50’09.10638”N
Longitude	097°02’27.35592”W	097°02’27.35592”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,195,399.99ftUS N	
Easting	1,455,805.48ftUS E	
Height	-46.43ft Ell.	
Rig Heading	114.40°True (113.74°Grid)	

Position for CL_Drill is 6.20ftUS @ 31.8°True (31.1°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.66235°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’09.05418”N	Longitude: 097°02’27.39227”W	Northing: 17,195,394.68ftUS N	Easting: 1,455,802.28ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,195,399.99ftUS N, 1,455,805.48ftUS E, -46.43ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,195,400.45ftUS N, 1,455,805.09ftUS E, -46.94ft Ell.	0.46ftUS	-0.39ftUS	-0.51ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

PLATE NO. B-195

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		882 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'09.26313"N	±0.05ftUS	27°50'09.43539"N	±0.06ftUS
Longitude	097°02'27.98534"W	±0.10ftUS	097°02'27.92431"W	±0.04ftUS
Height	-46.43ft Ell.	±0.28ftUS	-46.94ft Ell.	±0.12ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'09.26313"N	±0.05ftUS	27°50'09.43539"N	±0.06ftUS
Longitude	097°02'27.98534"W	±0.10ftUS	097°02'27.92431"W	±0.04ftUS
Height	-46.43ft Ell.	±0.28ftUS	-46.94ft Ell.	±0.12ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,195,415.17ftUS N	±0.05ftUS	17,195,432.63ftUS N	±0.06ftUS
Easting	1,455,748.80ftUS E	±0.10ftUS	1,455,754.07ftUS E	±0.04ftUS
Height	-46.43ft Ell.	±0.28ftUS	-46.94ft Ell.	±0.12ftUS

HDOP	1.08		0.93	
No. Satellites	7		11	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	114.40°True	±0.0°	114.40°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

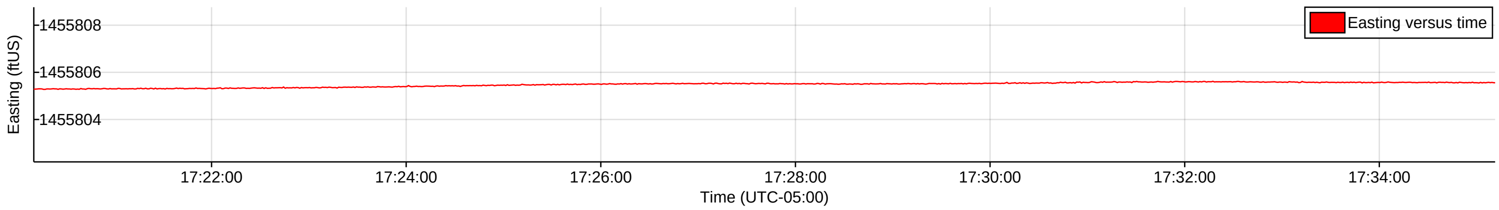
CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'09.10639"N	±0.06ftUS	27°50'09.11094"N	±0.07ftUS
Longitude	097°02'27.35592"W	±0.10ftUS	097°02'27.36027"W	±0.05ftUS
Height	-46.43ft Ell.	±0.28ftUS	-46.94ft Ell.	±0.12ftUS

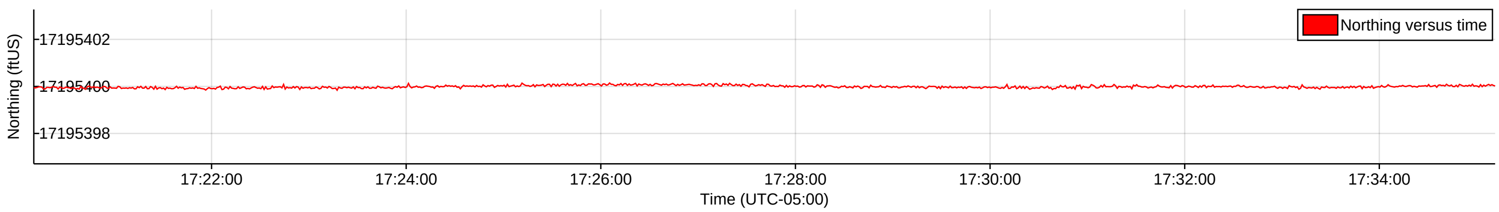
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,195,399.99ftUS N	±0.06ftUS	17,195,400.45ftUS N	±0.07ftUS
Easting	1,455,805.48ftUS E	±0.10ftUS	1,455,805.09ftUS E	±0.05ftUS
Height	-46.43ft Ell.	±0.28ftUS	-46.94ft Ell.	±0.12ftUS

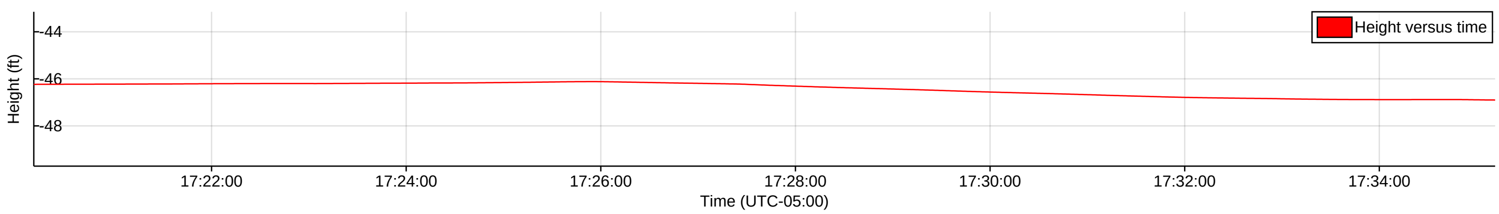
Delta Northing	0.00ftUS		0.46ftUS	
Delta Easting	0.00ftUS		-0.39ftUS	
Delta Height	0.00ftUS		-0.51ftUS	

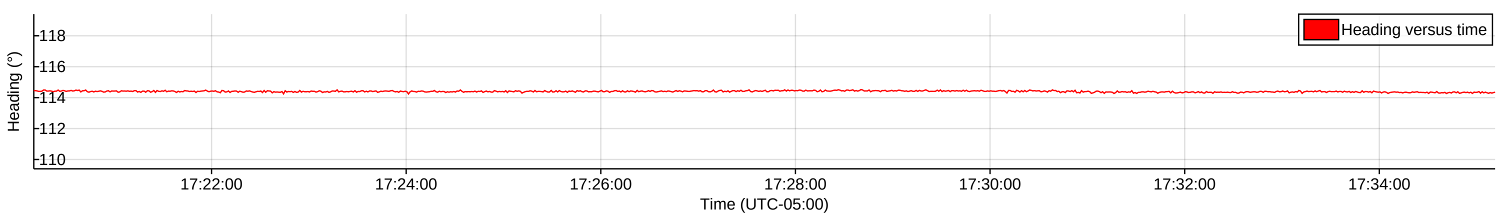
Position of CL_Drill from proposed location				
Range	6.20ftUS		6.41ftUS	
Bearing	31.76°True		26.62°True	

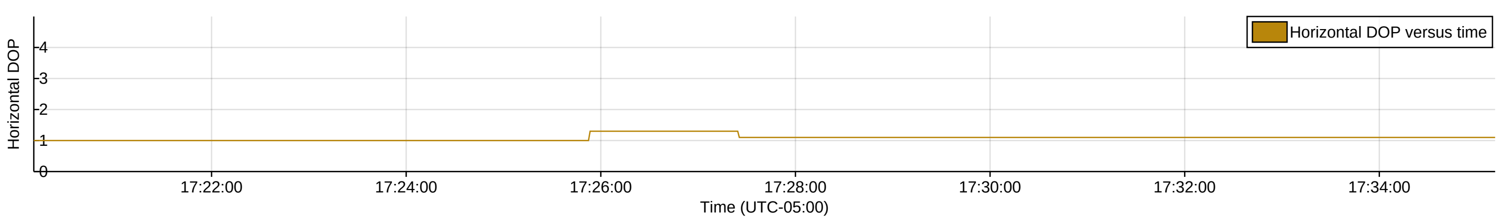
Time Series Plots for Primary

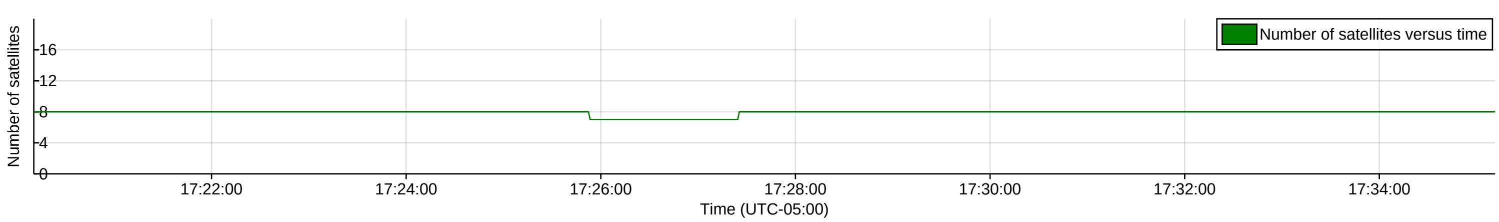












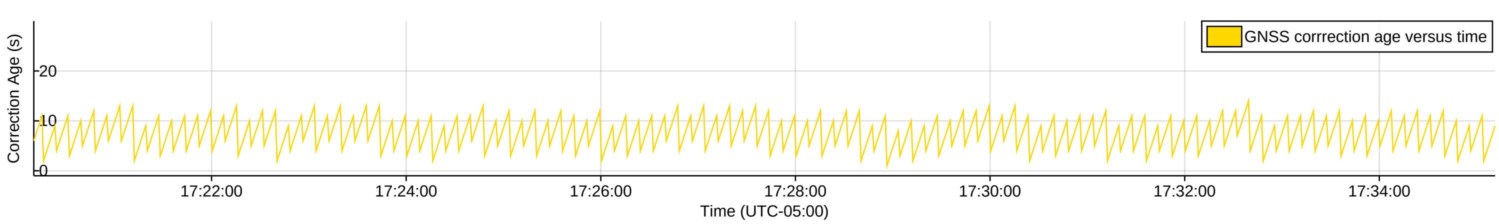
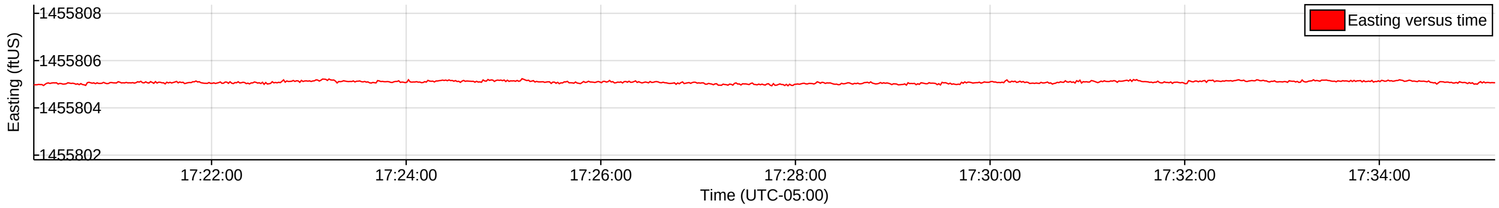
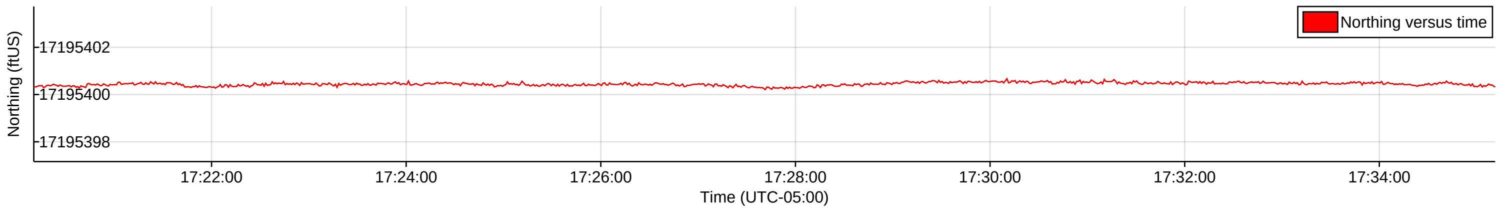
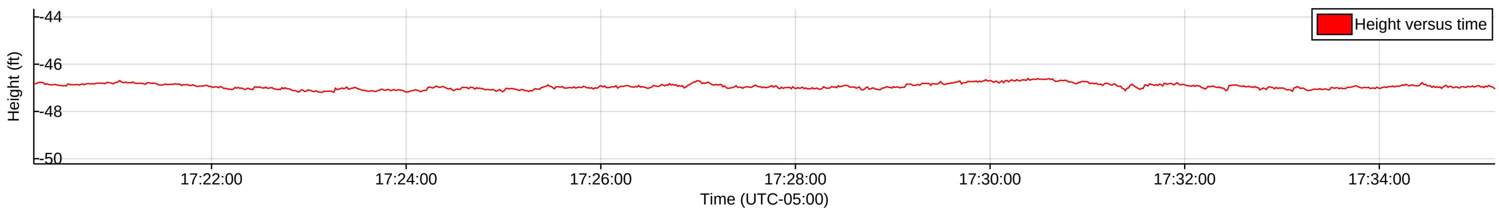


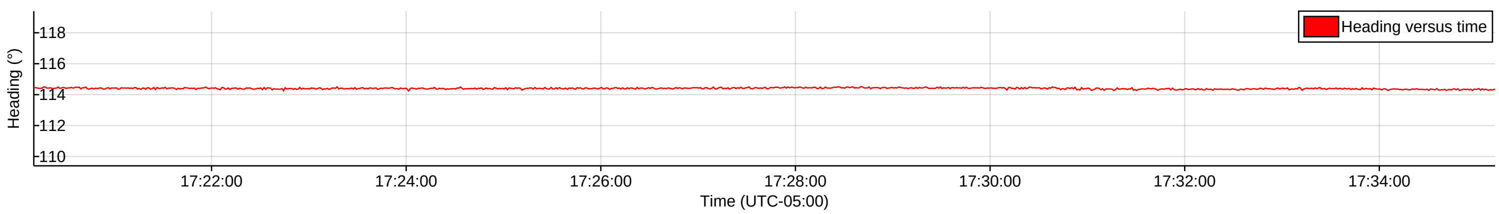
PLATE NO. B-198

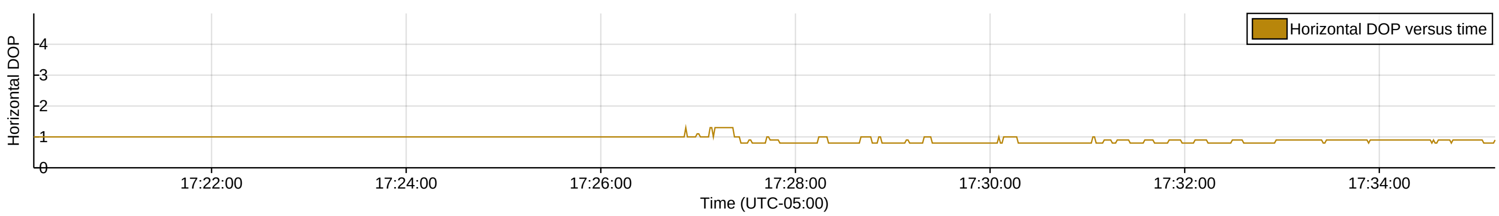
Time Series Plots for Secondary

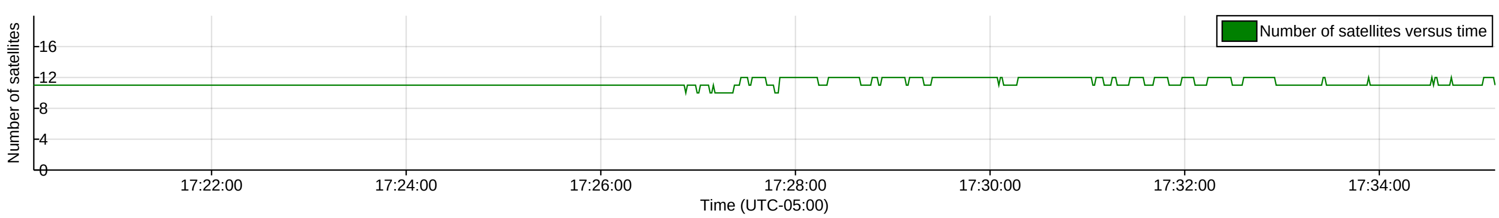


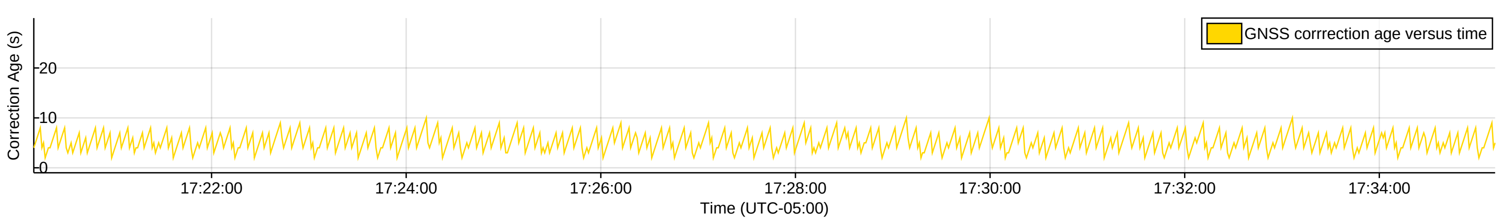




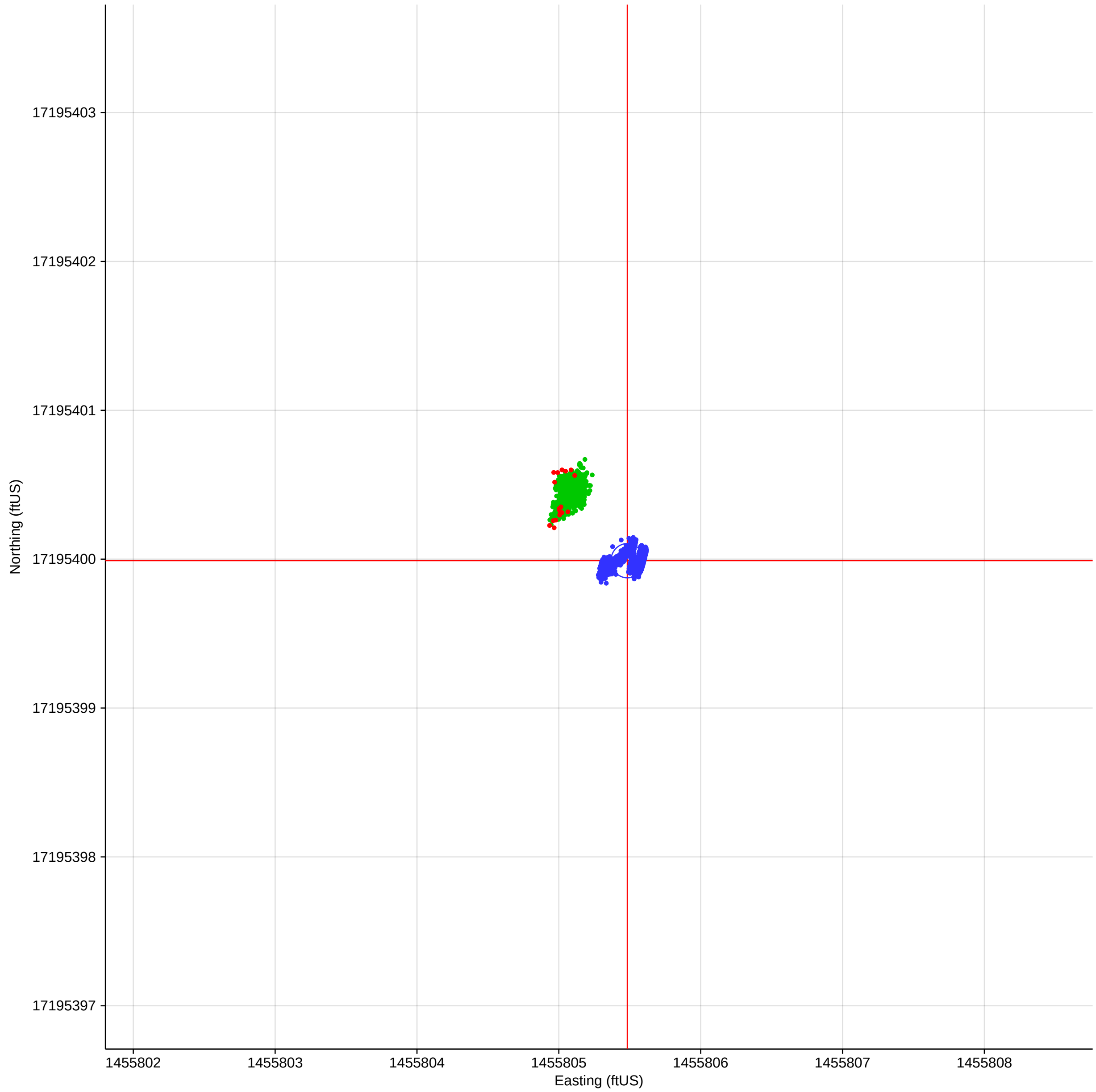








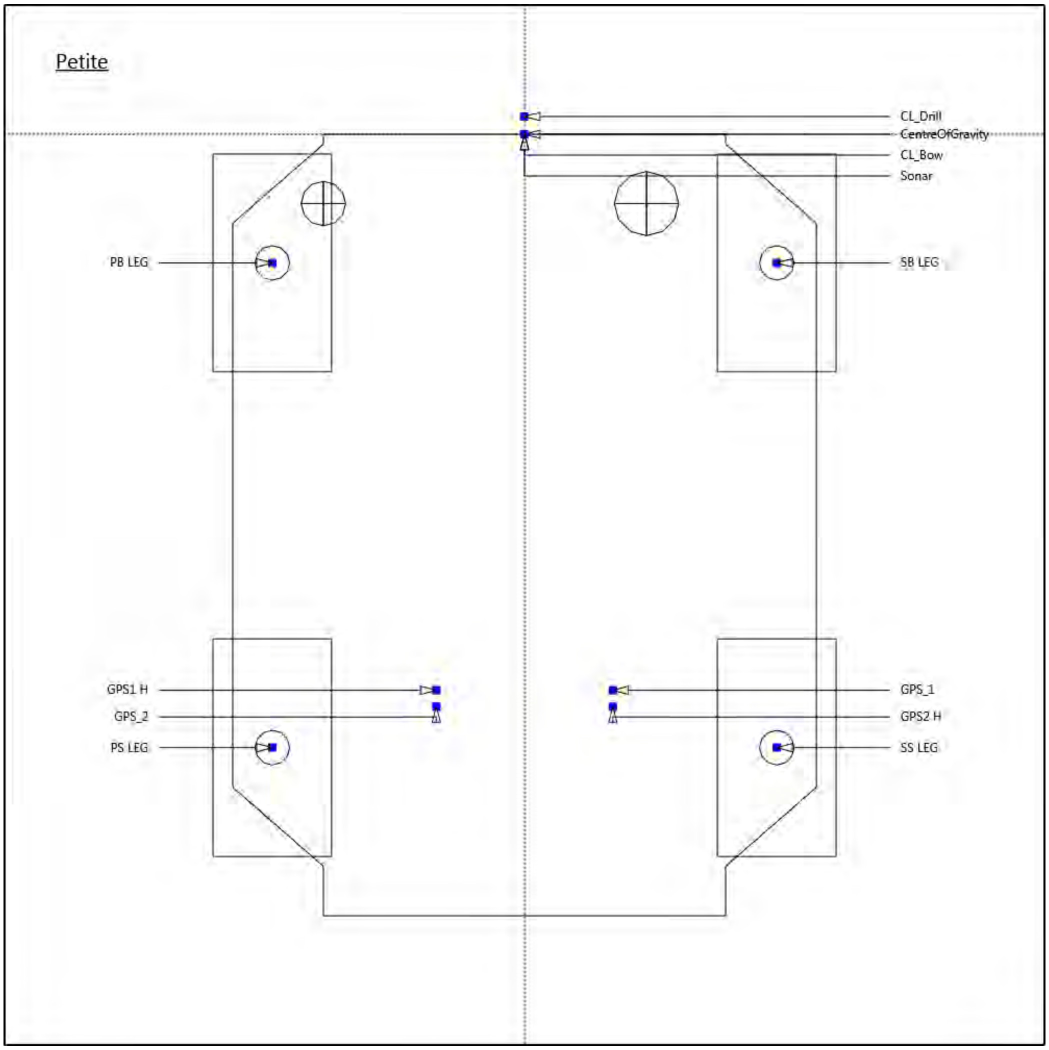
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,195,399.99ftUS N, 1,455,805.48ftUS E, -46.43ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,195,400.45ftUS N, 1,455,805.09ftUS E, -46.94ft Ell.	0.46ftUS	-0.39ftUS	-0.51ftUS

PLATE NO. B-200

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-201

Gulf of Mexico MMS Lease Information

The final position has the following distances to the MU855S boundary

From North boundary :	1,804.90ftUS Grid	From East boundary :	2,963.66ftUS Grid
From South boundary :	3,461.32ftUS Grid	From West boundary :	1,625.42ftUS Grid

Seabed Information

Seabed Depth	51.80ft
Comment	

Area Map

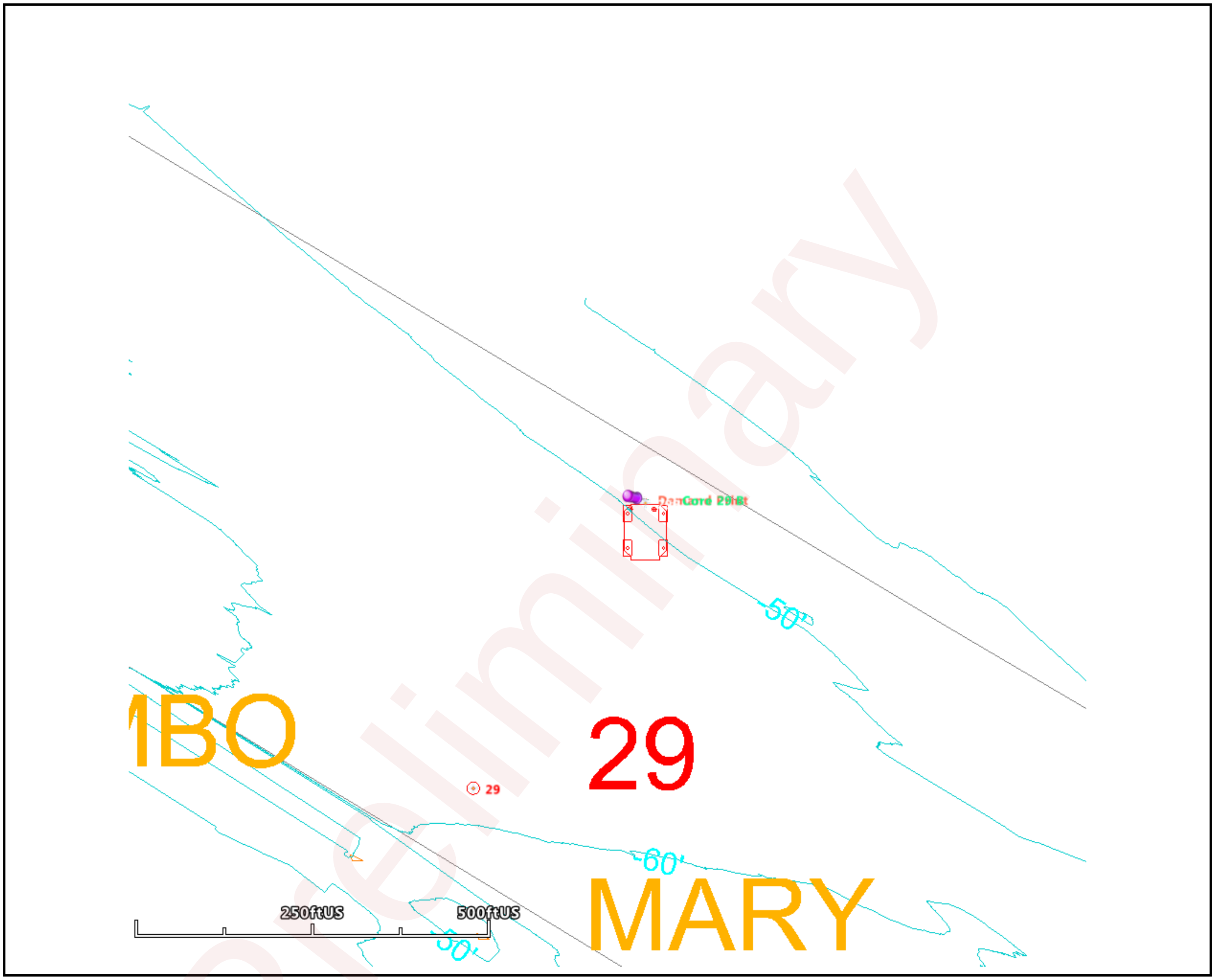


PLATE NO. B-204

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**30**		
Comment:			

Session Name: 20180809-214149-v1
Start Time: 09 Aug 2018, 16:42:36-05:00
End Time: 09 Aug 2018, 16:57:35-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 30

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’15.10095”N	27°50’15.10094”N
Longitude	097°02’53.66605”W	097°02’53.66605”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,195,978.11ftUS N	
Easting	1,453,436.63ftUS E	
Height	-48.74ft Ell.	
Final Rig Heading	177.10°True (176.44°Grid)	

Final Position for CL_Drill is 4.62ftUS @ 10.9°True (10.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65909°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’15.05605”N	Longitude: 097°02’53.67581”W	Northing: 17,195,973.57ftUS N	Easting: 1,453,435.81ftUS E
Intended Rig Heading	180.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,195,978.11ftUS N, 1,453,436.63ftUS E, -48.74ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,195,978.32ftUS N, 1,453,436.25ftUS E, -47.15ft Ell.	0.21ftUS	-0.38ftUS	1.58ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	898 of 900 used		880 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'15.67003"N	±0.11ftUS	27°50'15.69735"N	±0.05ftUS
Longitude	097°02'53.79808"W	±0.08ftUS	097°02'53.60464"W	±0.04ftUS
Height	-48.74ft Ell.	±0.20ftUS	-47.15ft Ell.	±0.08ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'15.67003"N	±0.11ftUS	27°50'15.69735"N	±0.05ftUS
Longitude	097°02'53.79808"W	±0.08ftUS	097°02'53.60464"W	±0.04ftUS
Height	-48.74ft Ell.	±0.20ftUS	-47.15ft Ell.	±0.08ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,196,035.45ftUS N	±0.11ftUS	17,196,038.41ftUS N	±0.05ftUS
Easting	1,453,424.12ftUS E	±0.08ftUS	1,453,441.45ftUS E	±0.04ftUS
Height	-48.74ft Ell.	±0.20ftUS	-47.15ft Ell.	±0.08ftUS

HDOP	1.00		0.80	
No. Satellites	8		13	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	177.10°True	±0.0°	177.09°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'15.10095"N	±0.11ftUS	27°50'15.10299"N	±0.05ftUS
Longitude	097°02'53.66605"W	±0.09ftUS	097°02'53.67025"W	±0.07ftUS
Height	-48.74ft Ell.	±0.20ftUS	-47.15ft Ell.	±0.08ftUS

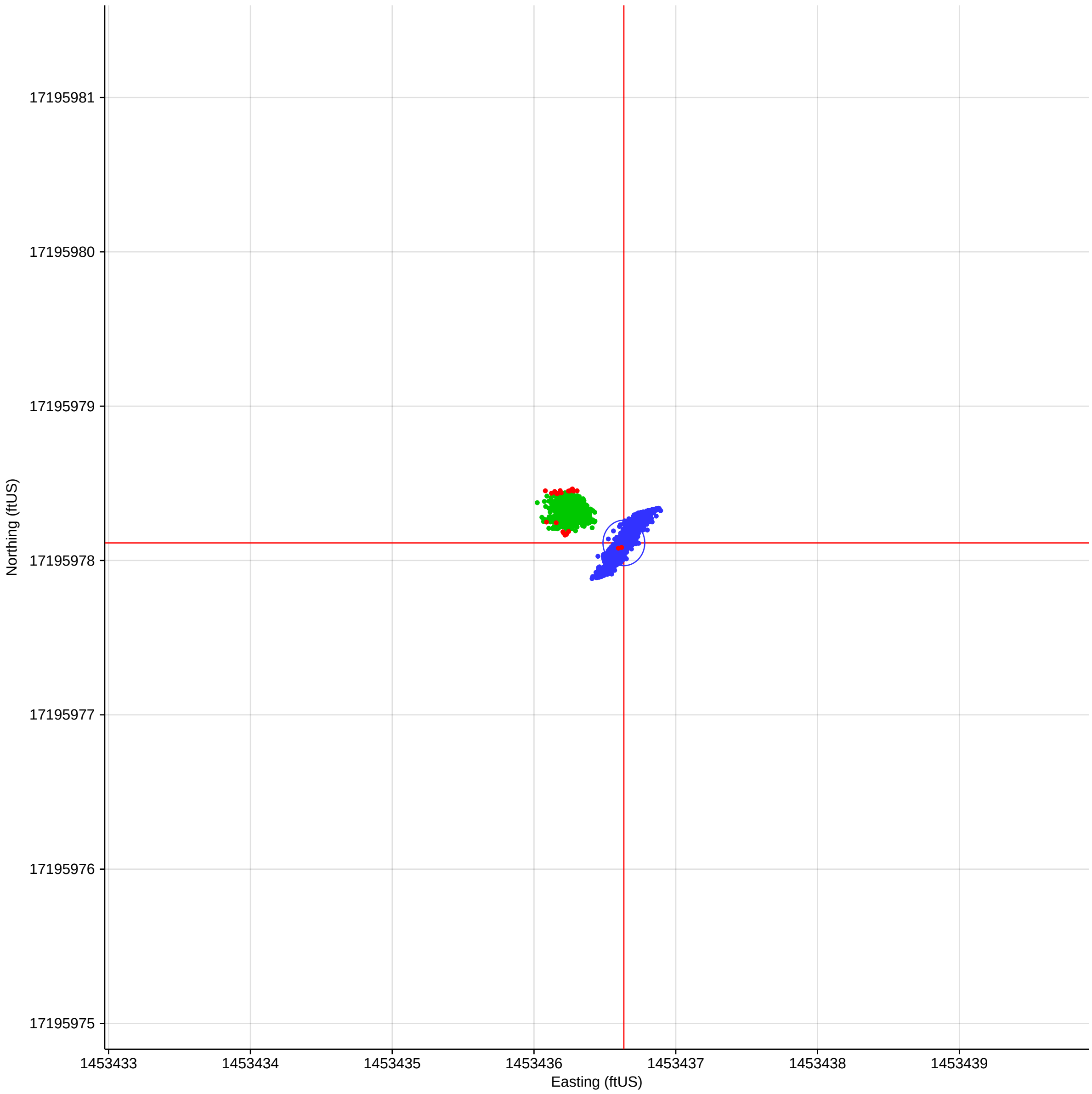
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,195,978.11ftUS N	±0.11ftUS	17,195,978.32ftUS N	±0.05ftUS
Easting	1,453,436.63ftUS E	±0.09ftUS	1,453,436.25ftUS E	±0.07ftUS
Height	-48.74ft Ell.	±0.20ftUS	-47.15ft Ell.	±0.08ftUS

Delta Northing	0.00ftUS		0.21ftUS	
Delta Easting	0.00ftUS		-0.38ftUS	
Delta Height	0.00ftUS		1.58ftUS	

Position of CL_Drill from proposed location				
Range	4.62ftUS		4.77ftUS	

Bearing	10.94°True		6.01°True	

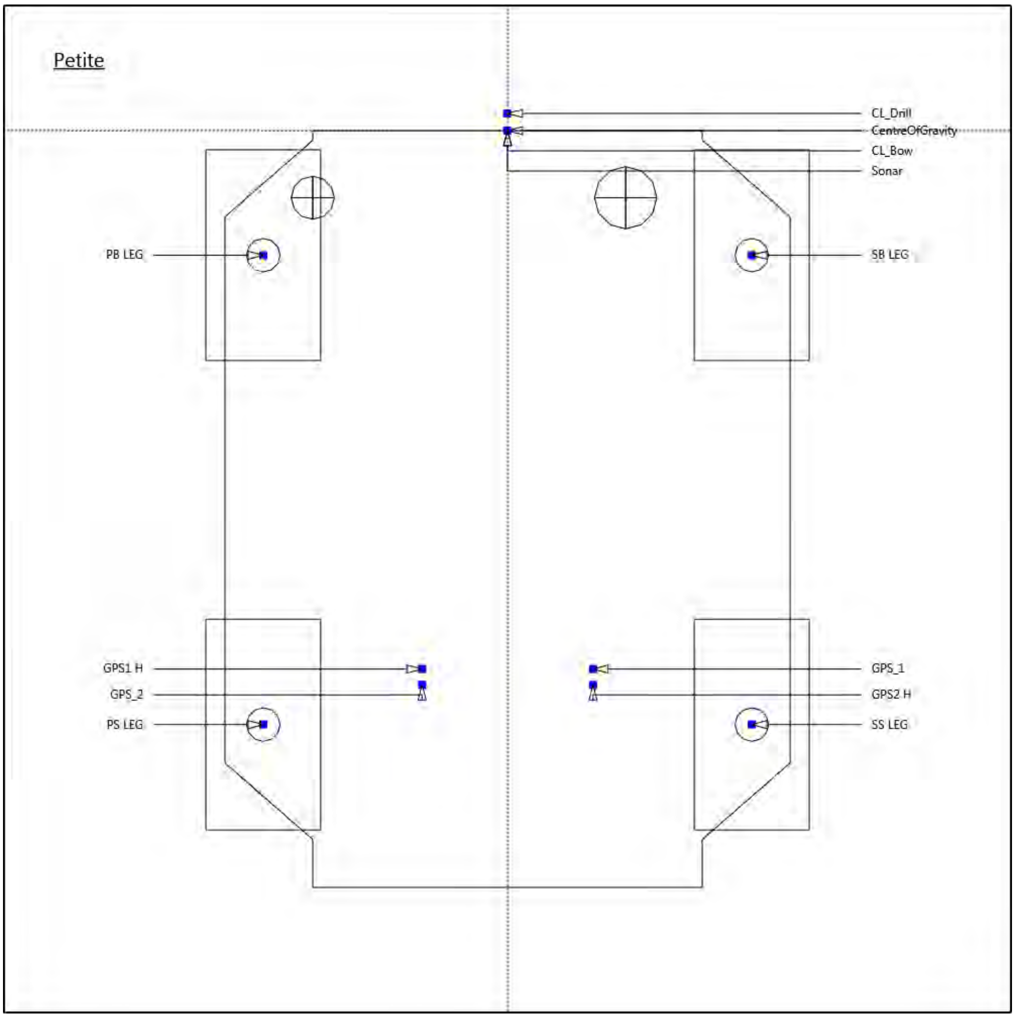
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,195,978.11ftUS N, 1,453,436.63ftUS E, -48.74ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,195,978.32ftUS N, 1,453,436.25ftUS E, -47.15ft Ell.	0.21ftUS	-0.38ftUS	1.58ftUS

PLATE NO. B-209

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	56.50ft
Comment	

Remarks

STARFIX
FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**31**		
Comment:	**31**		

Session Name: 20180812-173146-v1
Start Time: 12 Aug 2018, 12:33:04-05:00
End Time: 12 Aug 2018, 12:48:15-05:00
(Session Length 0.253 hrs - No. Obs. 900)

Position Fix Summary for Petite at 31

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’21.61043”N	27°50’21.61042”N
Longitude	097°02’48.43687”W	097°02’48.43687”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,196,640.88ftUS N	
Easting	1,453,898.49ftUS E	
Height	-49.38ft Ell.	
Rig Heading	111.10°True (110.44°Grid)	

Position for CL_Drill is 25.01ftUS @ 161.7°True (161.0°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65969°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’21.84551”N	Longitude: 097°02’48.52434”W	Northing: 17,196,664.53ftUS N	Easting: 1,453,890.36ftUS E
Intended Rig Heading	0.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,196,640.88ftUS N, 1,453,898.49ftUS E, -49.38ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,196,640.70ftUS N, 1,453,899.25ftUS E, -45.66ft Ell.	-0.19ftUS	0.76ftUS	3.72ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-212

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

PLATE NO. B-214

STARFIX
FIX REPORT

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		892 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'21.73472"N	±0.04ftUS	27°50'21.90362"N	±0.06ftUS
Longitude	097°02'49.07541"W	±0.14ftUS	097°02'49.01250"W	±0.06ftUS
Height	-49.38ft Ell.	±1.23ftUS	-45.66ft Ell.	±0.15ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'21.73472"N	±0.04ftUS	27°50'21.90363"N	±0.06ftUS
Longitude	097°02'49.07541"W	±0.14ftUS	097°02'49.01250"W	±0.06ftUS
Height	-49.38ft Ell.	±1.23ftUS	-45.66ft Ell.	±0.15ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,196,652.77ftUS N	±0.04ftUS	17,196,669.89ftUS N	±0.06ftUS
Easting	1,453,841.02ftUS E	±0.14ftUS	1,453,846.47ftUS E	±0.06ftUS
Height	-49.38ft Ell.	±1.23ftUS	-45.66ft Ell.	±0.15ftUS

HDOP	1.35		0.72	
No. Satellites	7		14	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	111.10°True	±0.0°	111.10°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'21.61043"N	±0.04ftUS	27°50'21.60856"N	±0.06ftUS
Longitude	097°02'48.43687"W	±0.13ftUS	097°02'48.42839"W	±0.07ftUS
Height	-49.38ft Ell.	±1.23ftUS	-45.66ft Ell.	±0.15ftUS

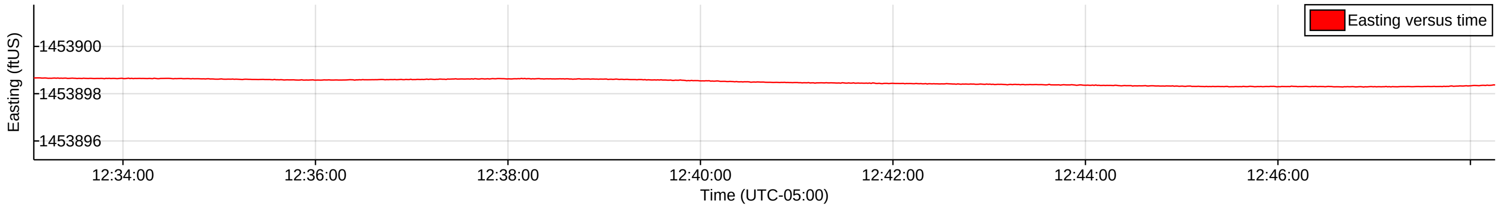
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,196,640.88ftUS N	±0.04ftUS	17,196,640.70ftUS N	±0.06ftUS
Easting	1,453,898.49ftUS E	±0.13ftUS	1,453,899.25ftUS E	±0.07ftUS
Height	-49.38ft Ell.	±1.23ftUS	-45.66ft Ell.	±0.15ftUS

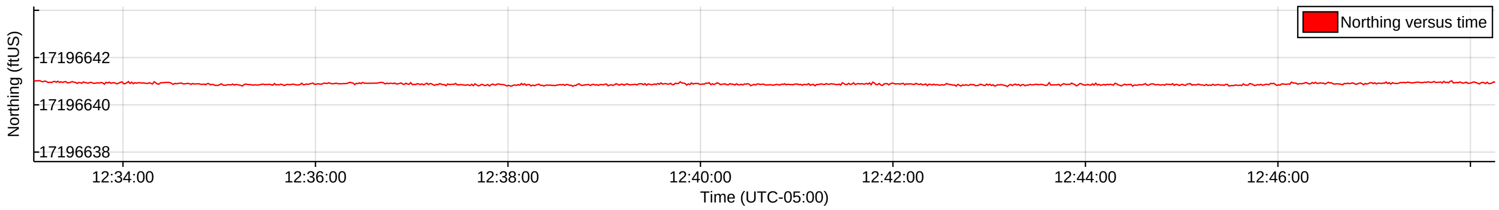
Delta Northing	0.00ftUS		-0.19ftUS	
Delta Easting	0.00ftUS		0.76ftUS	
Delta Height	0.00ftUS		3.72ftUS	

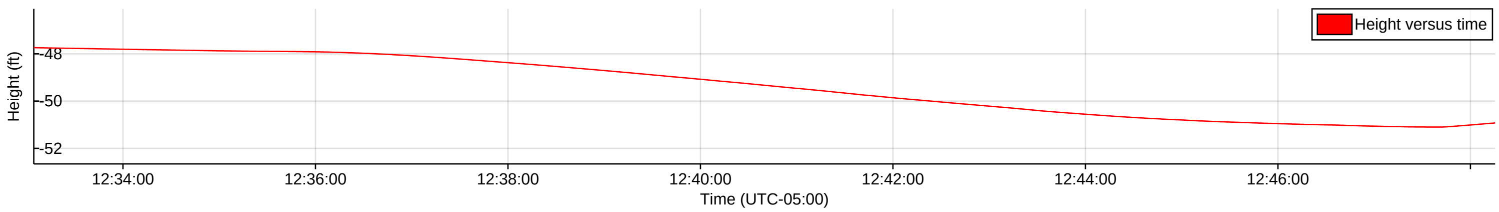
PLATE NO. B-215

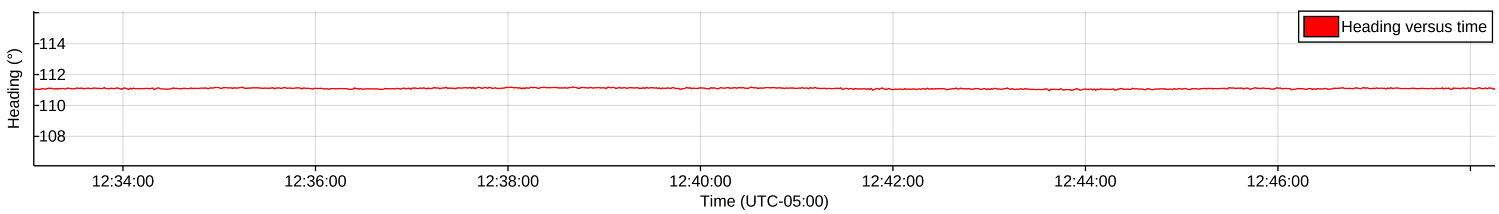
Position of CL_Drill from proposed location				
Range	25.01ftUS		25.43ftUS	
Bearing	161.70°True		160.20°True	

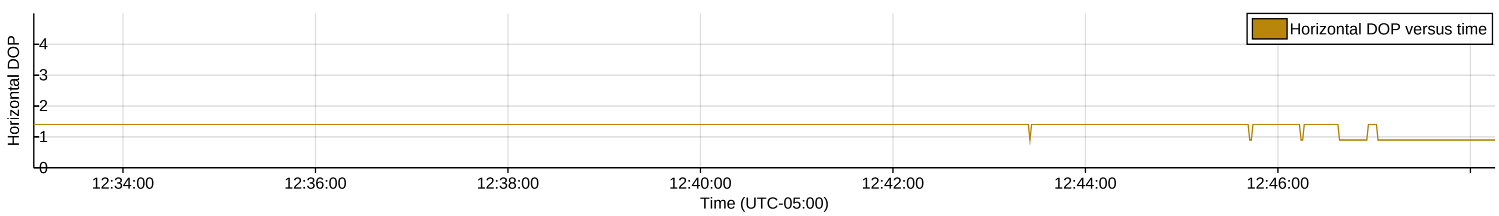
Time Series Plots for Primary

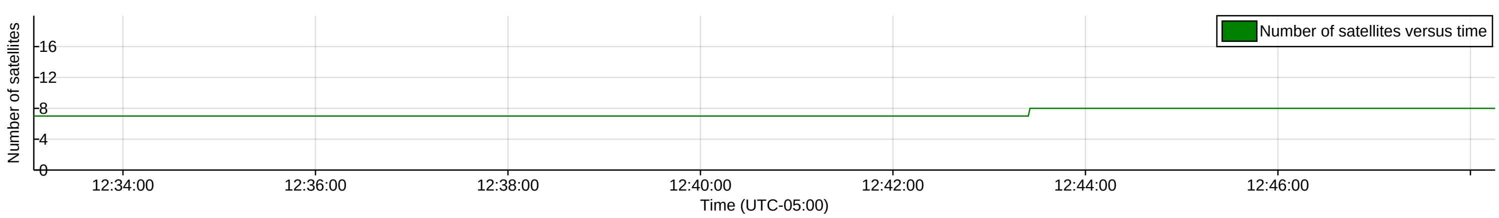












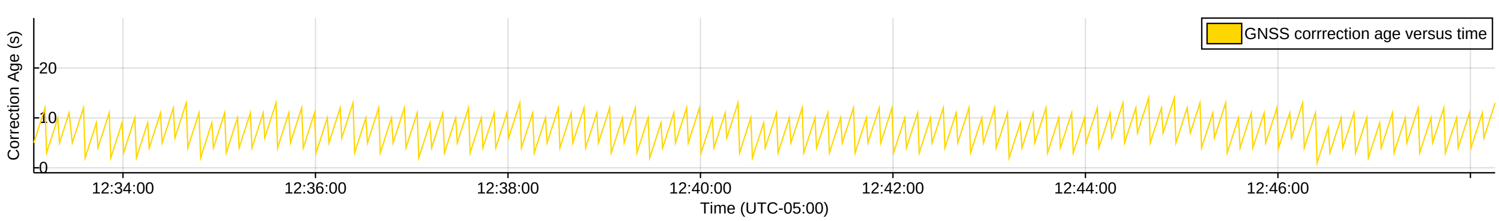
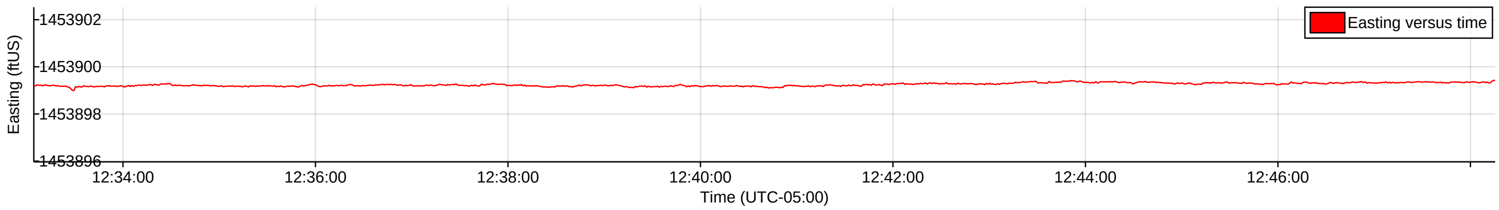
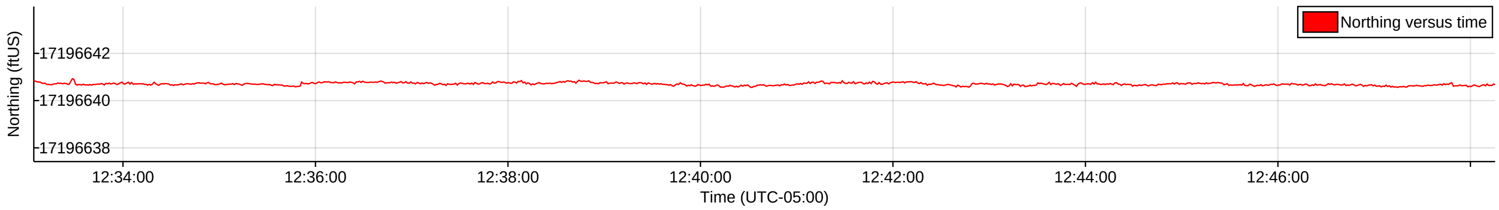
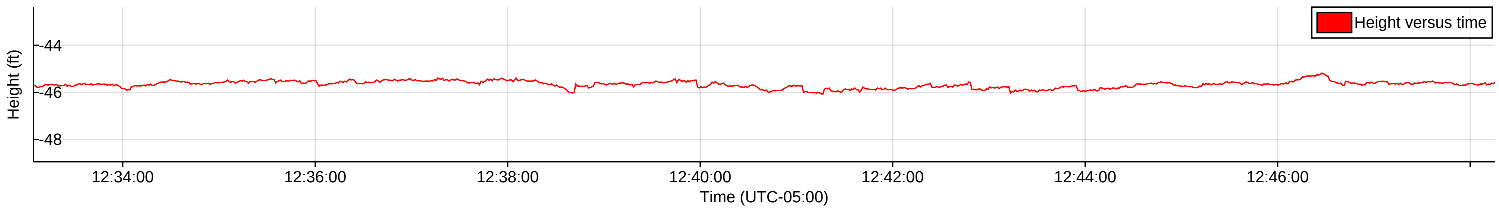


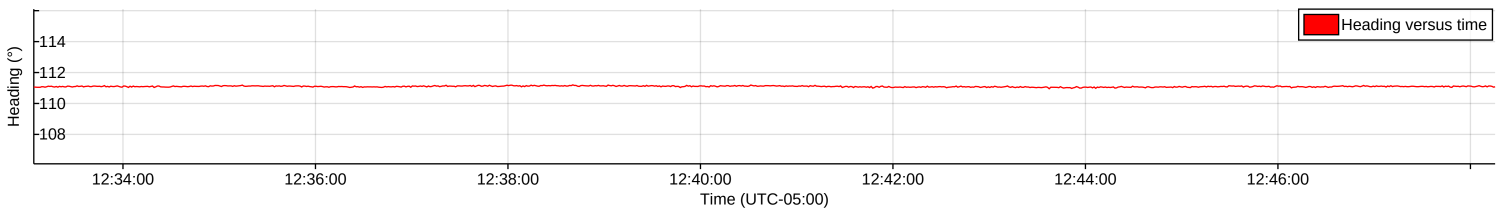
PLATE NO. B-217

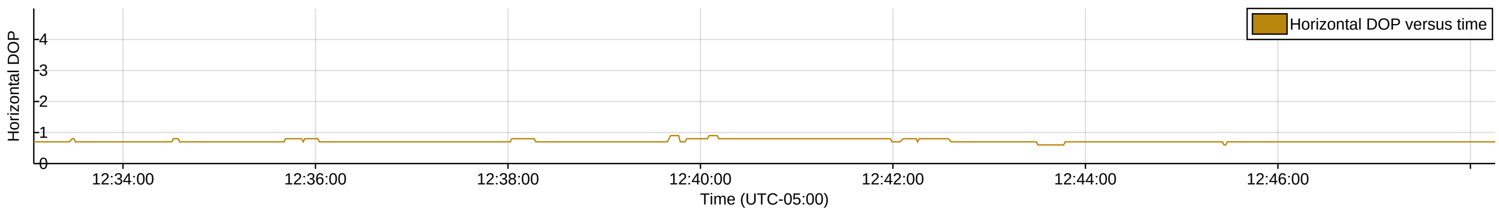
Time Series Plots for Secondary

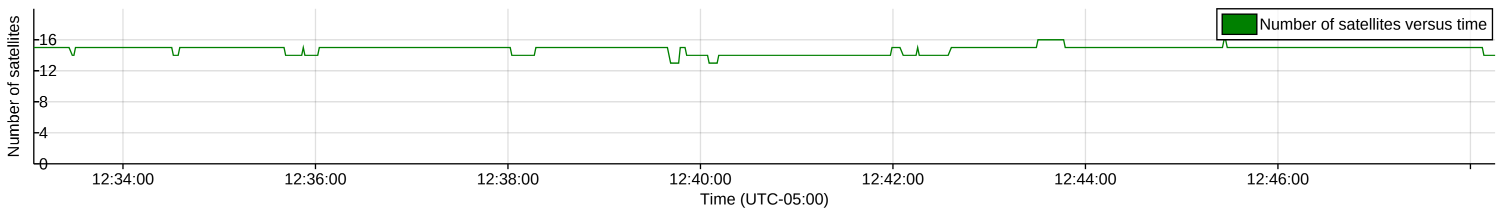












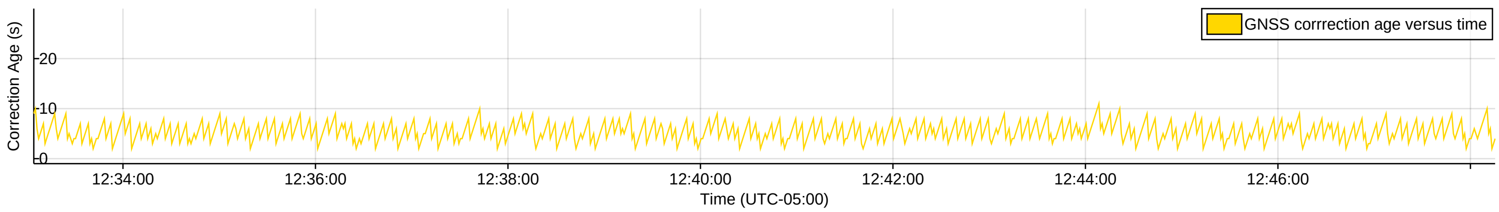
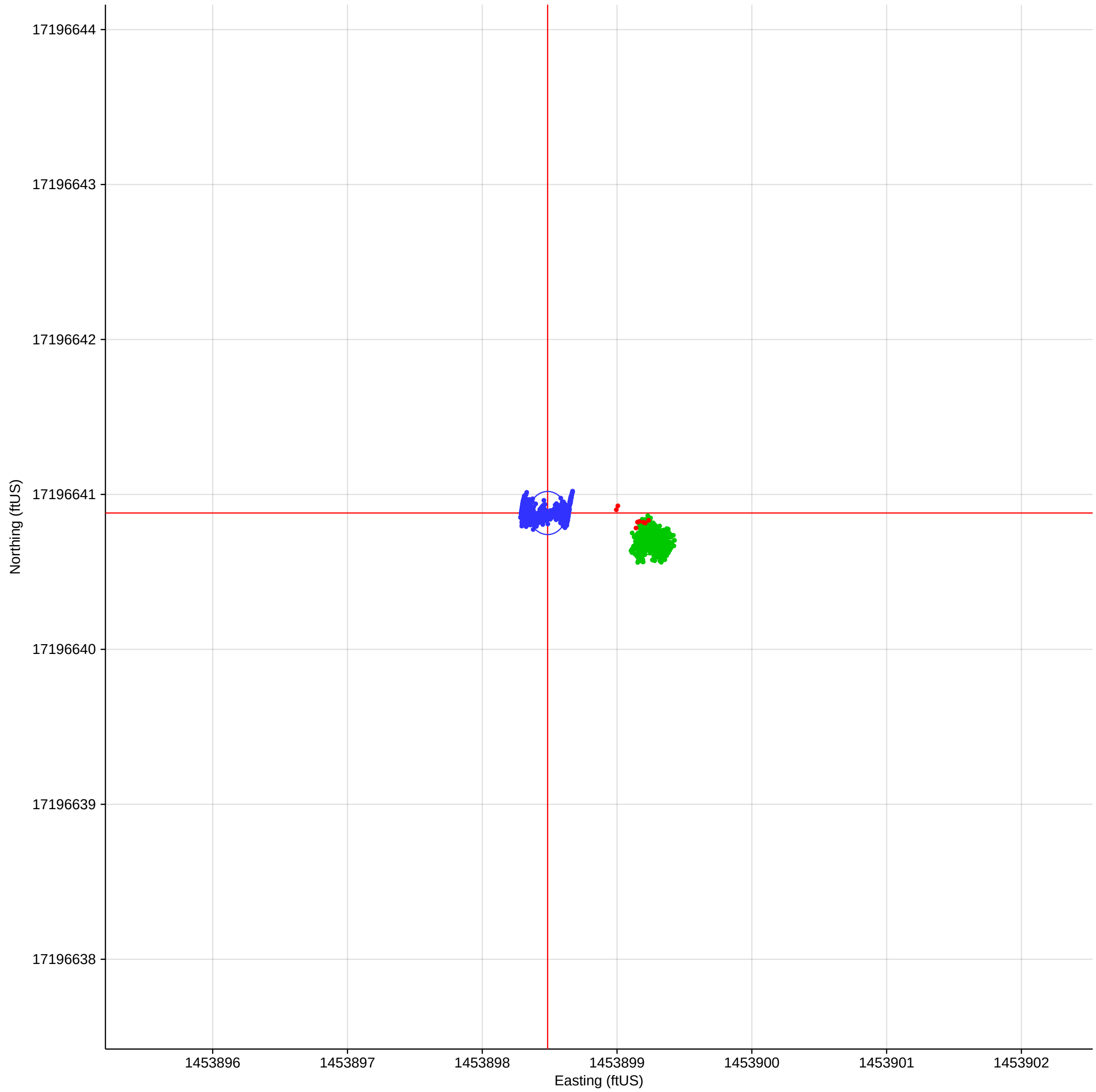


PLATE NO. B-218

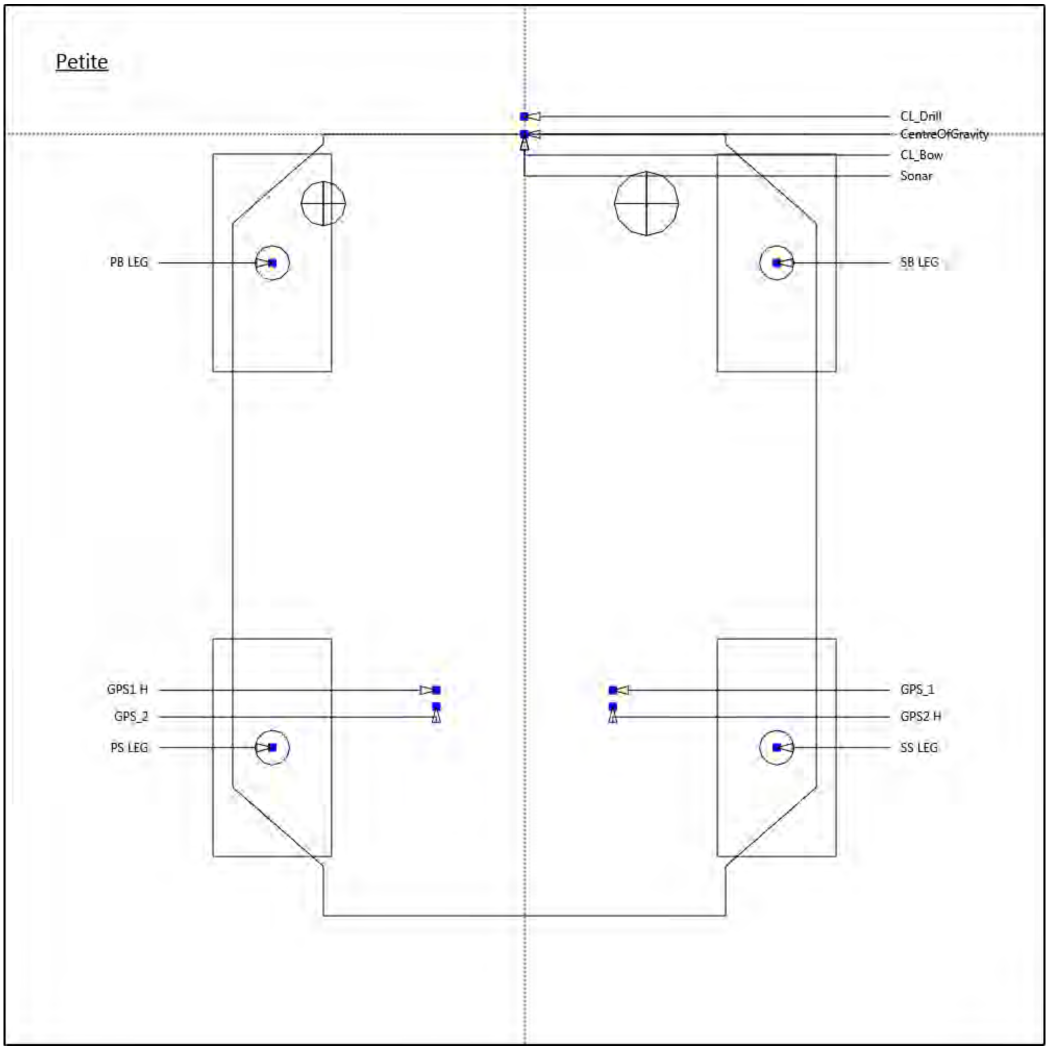
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,196,640.88ftUS N, 1,453,898.49ftUS E, -49.38ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,196,640.70ftUS N, 1,453,899.25ftUS E, -45.66ft Ell.	-0.19ftUS	0.76ftUS	3.72ftUS

PLATE NO. B-219

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	48.90ft
Comment	

Area Map

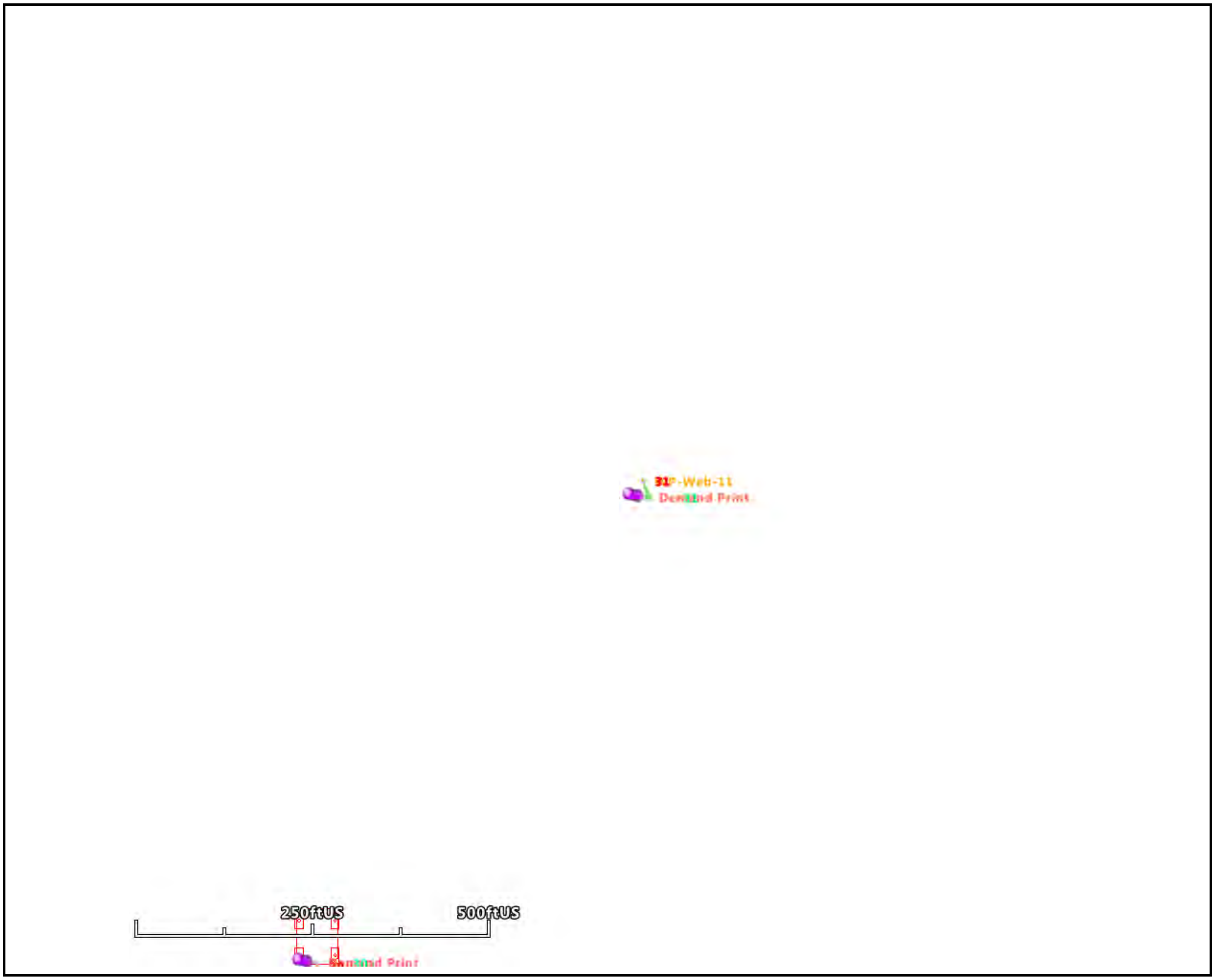


PLATE NO. B-222

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**32**		
Comment:			

Session Name: 20180813-222504-v1
Start Time: 13 Aug 2018, 17:26:57-05:00
End Time: 13 Aug 2018, 17:42:04-05:00 (Session Length 0.252 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 32

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50'29.96303"N	27°50'29.96303"N
Longitude	097°03'08.87220"W	097°03'08.87220"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,197,463.29ftUS N	
Easting	1,452,054.37ftUS E	
Height	-48.39ft Ell.	
Final Rig Heading	128.32°True (127.66°Grid)	

Final Position for CL_Drill is 6.05ftUS @ 294.1°True (293.5°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65712°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50'29.93854"N	Longitude: 097°03'08.81066"W	Northing: 17,197,460.88ftUS N	Easting: 1,452,059.92ftUS E
Intended Rig Heading	220.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,463.29ftUS N, 1,452,054.37ftUS E, -48.39ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,463.66ftUS N, 1,452,054.50ftUS E, -48.47ft Ell.	0.37ftUS	0.14ftUS	-0.09ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-223

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		898 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'30.24976"N	±0.19ftUS	27°50'30.40224"N	±0.06ftUS
Longitude	097°03'09.44075"W	±0.10ftUS	097°03'09.33037"W	±0.07ftUS
Height	-48.39ft Ell.	±0.22ftUS	-48.47ft Ell.	±0.11ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'30.24976"N	±0.19ftUS	27°50'30.40224"N	±0.06ftUS
Longitude	097°03'09.44075"W	±0.10ftUS	097°03'09.33037"W	±0.07ftUS
Height	-48.39ft Ell.	±0.22ftUS	-48.47ft Ell.	±0.11ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,197,491.66ftUS N	±0.19ftUS	17,197,507.17ftUS N	±0.06ftUS
Easting	1,452,003.00ftUS E	±0.10ftUS	1,452,012.73ftUS E	±0.07ftUS
Height	-48.39ft Ell.	±0.22ftUS	-48.47ft Ell.	±0.11ftUS

HDOP	1.05		0.79	
No. Satellites	7		13	
Age of Corrections	8.0 secs		4.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	128.32°True	±0.1°	128.32°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'29.96303"N	±0.18ftUS	27°50'29.96670"N	±0.08ftUS
Longitude	097°03'08.87220"W	±0.10ftUS	097°03'08.87067"W	±0.07ftUS
Height	-48.39ft Ell.	±0.22ftUS	-48.47ft Ell.	±0.11ftUS

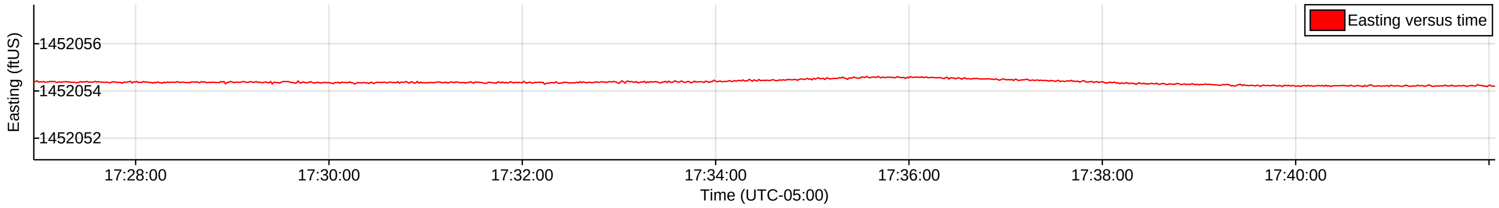
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,197,463.29ftUS N	±0.18ftUS	17,197,463.66ftUS N	±0.08ftUS
Easting	1,452,054.37ftUS E	±0.10ftUS	1,452,054.50ftUS E	±0.07ftUS
Height	-48.39ft Ell.	±0.22ftUS	-48.47ft Ell.	±0.11ftUS

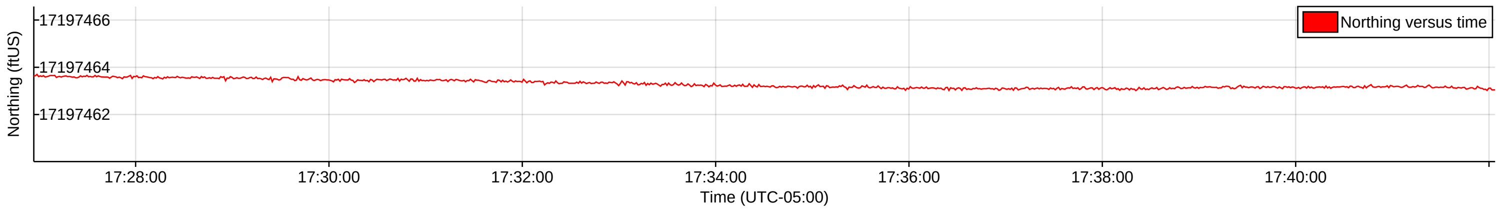
Delta Northing	0.00ftUS		0.37ftUS	
Delta Easting	0.00ftUS		0.14ftUS	
Delta Height	0.00ftUS		-0.09ftUS	

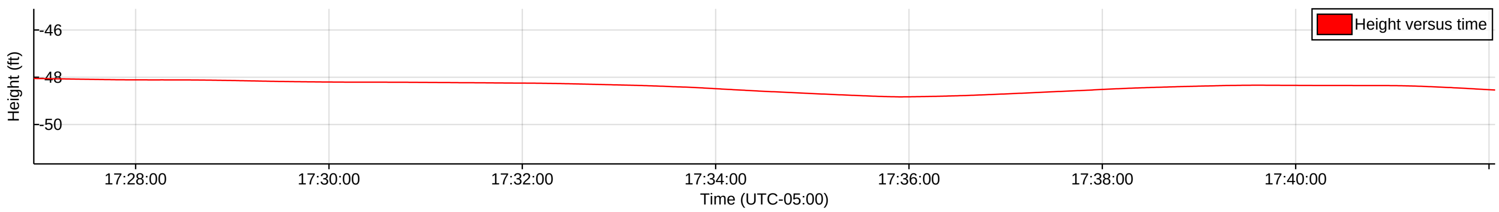
Position of CL_Drill from proposed location				
Range	6.05ftUS		6.09ftUS	
Bearing	294.12°True		297.84°True	

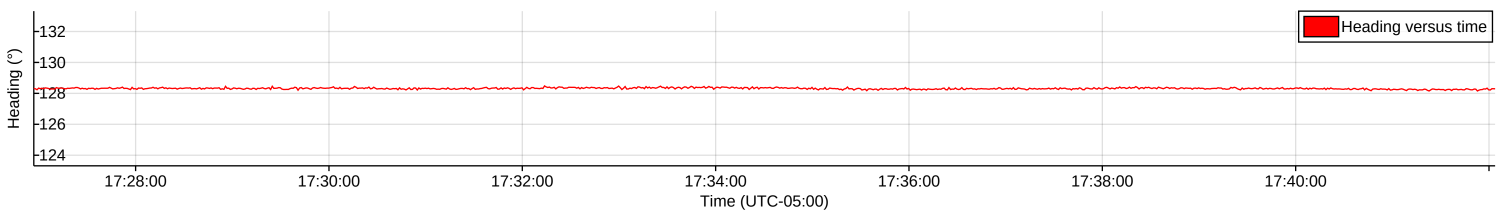
PLATE NO. B-227

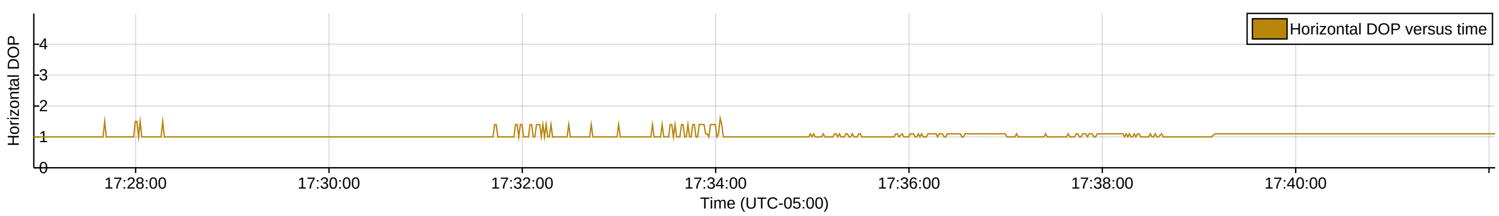
Time Series Plots for Primary

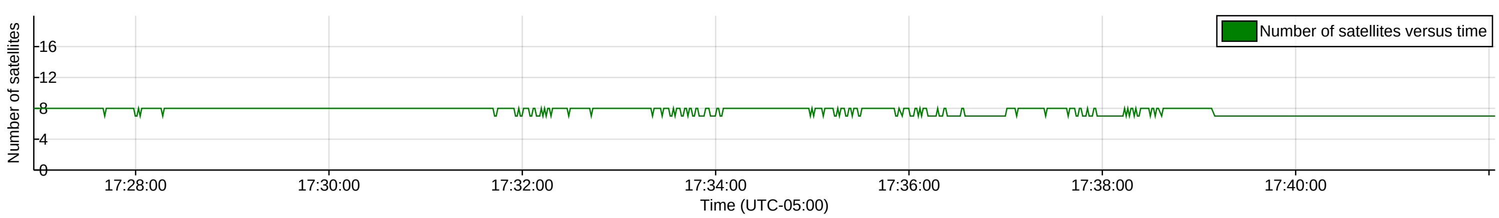












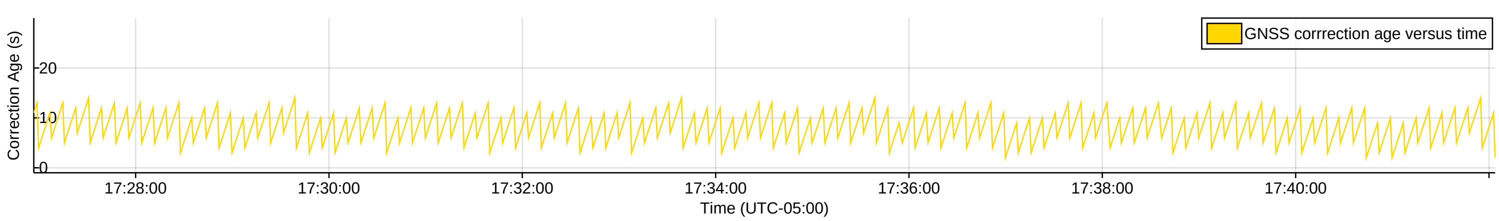
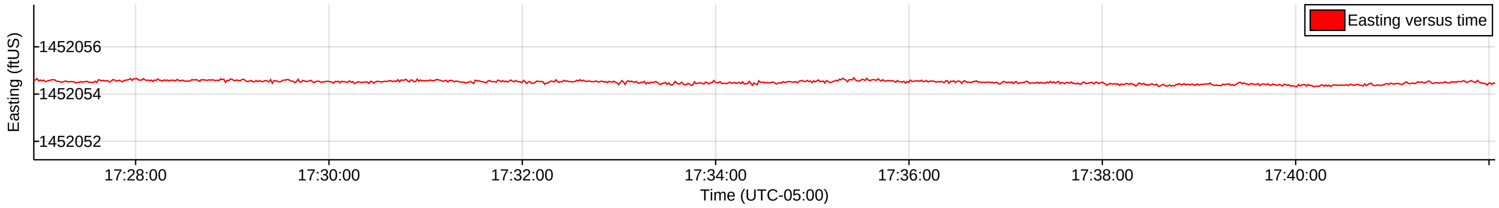
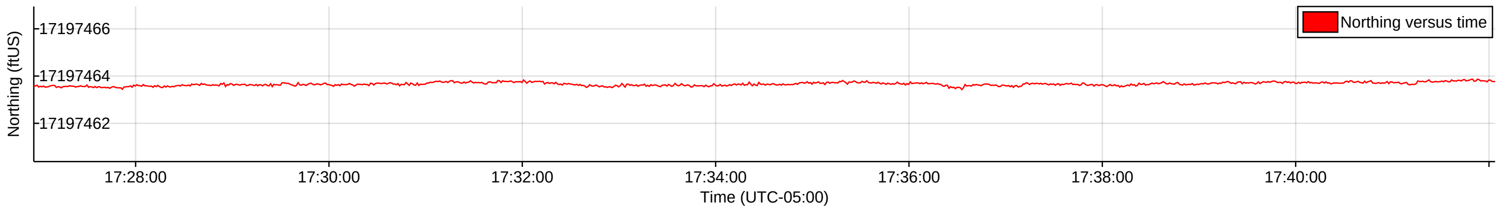
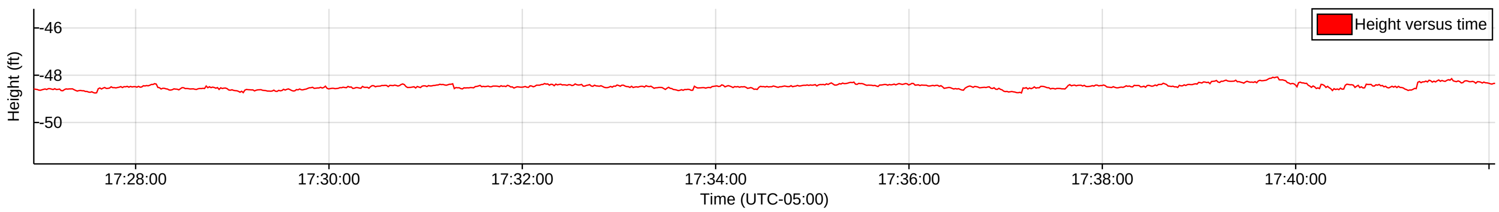


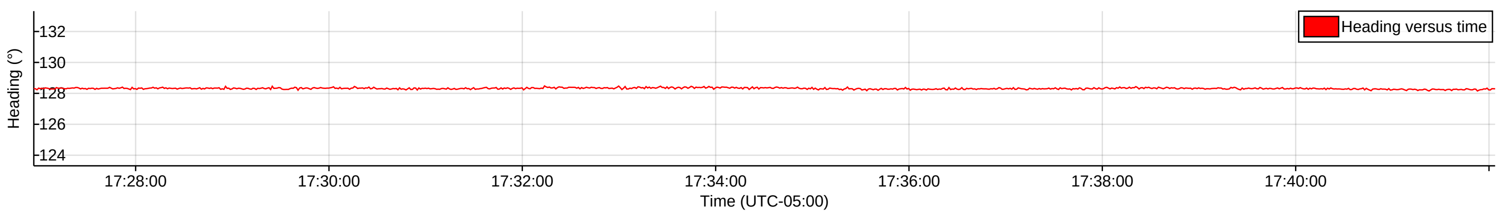
PLATE NO. B-228

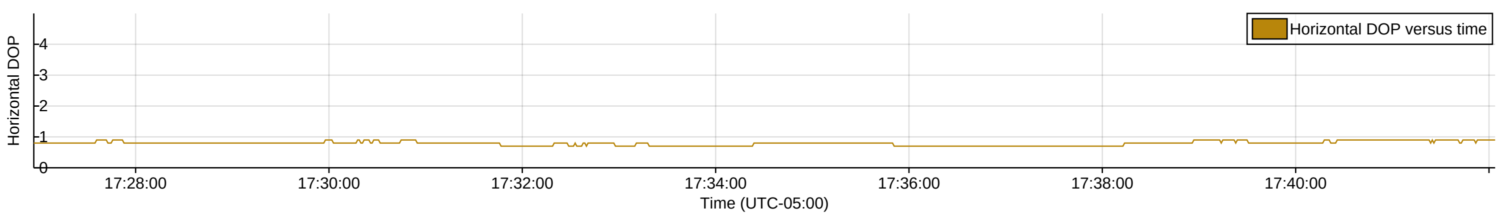
Time Series Plots for Secondary

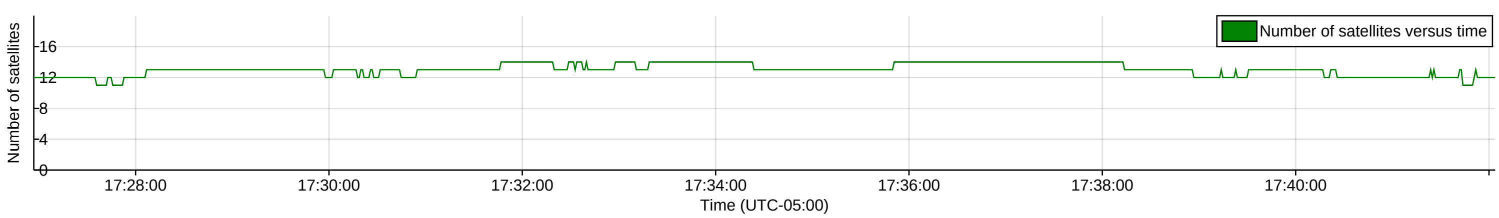












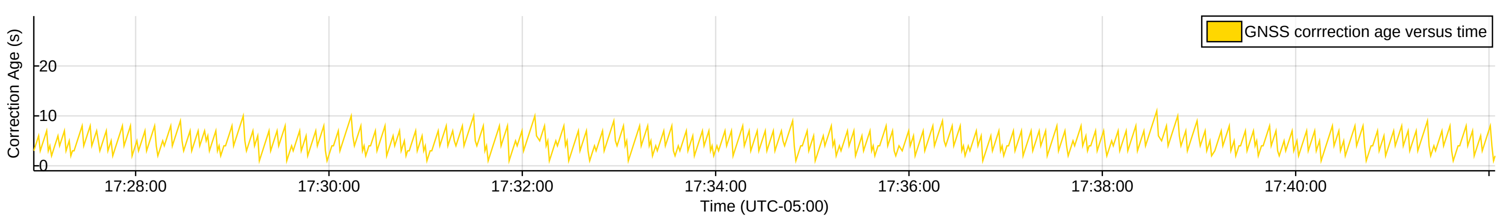
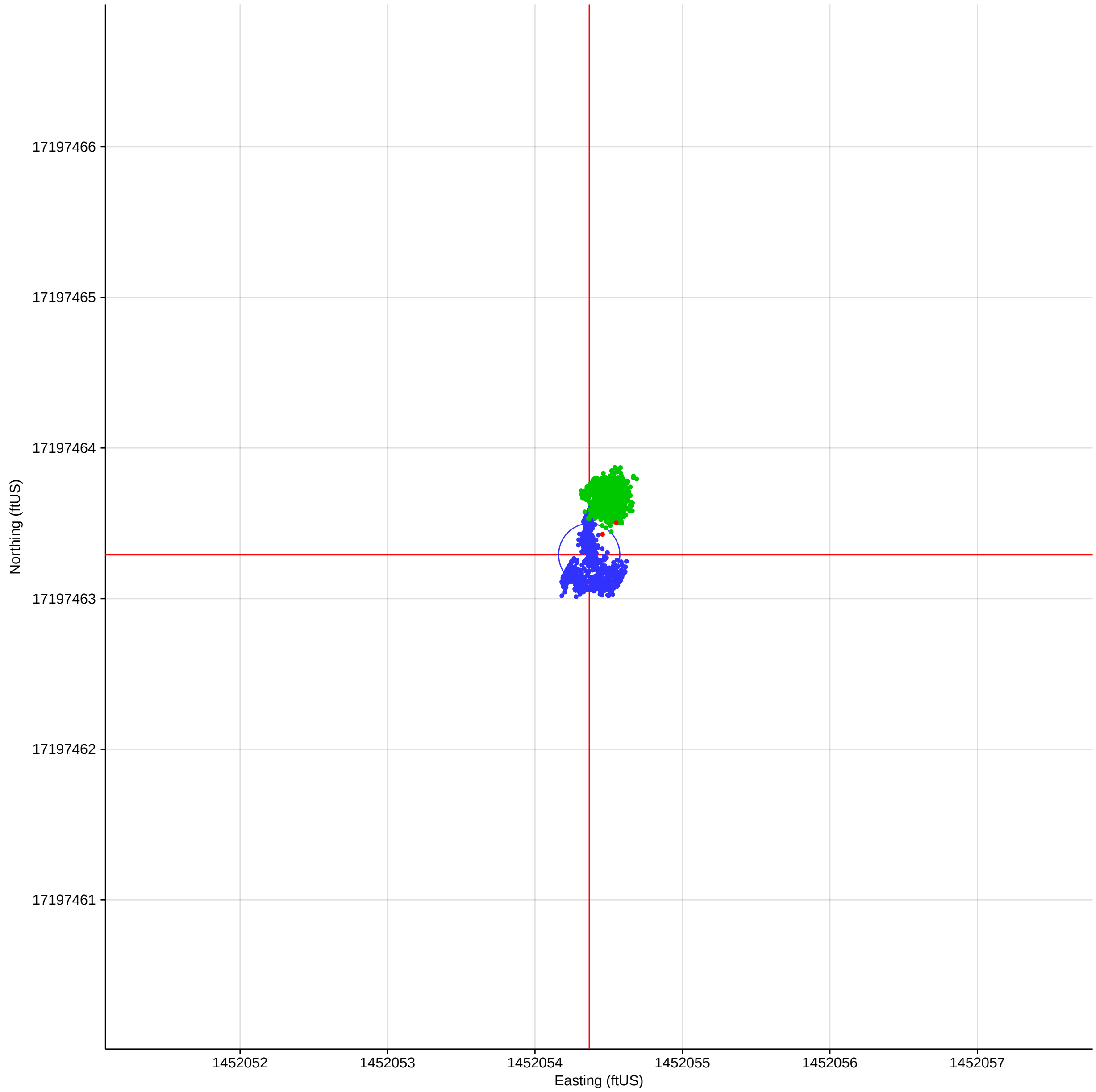


PLATE NO. B-229

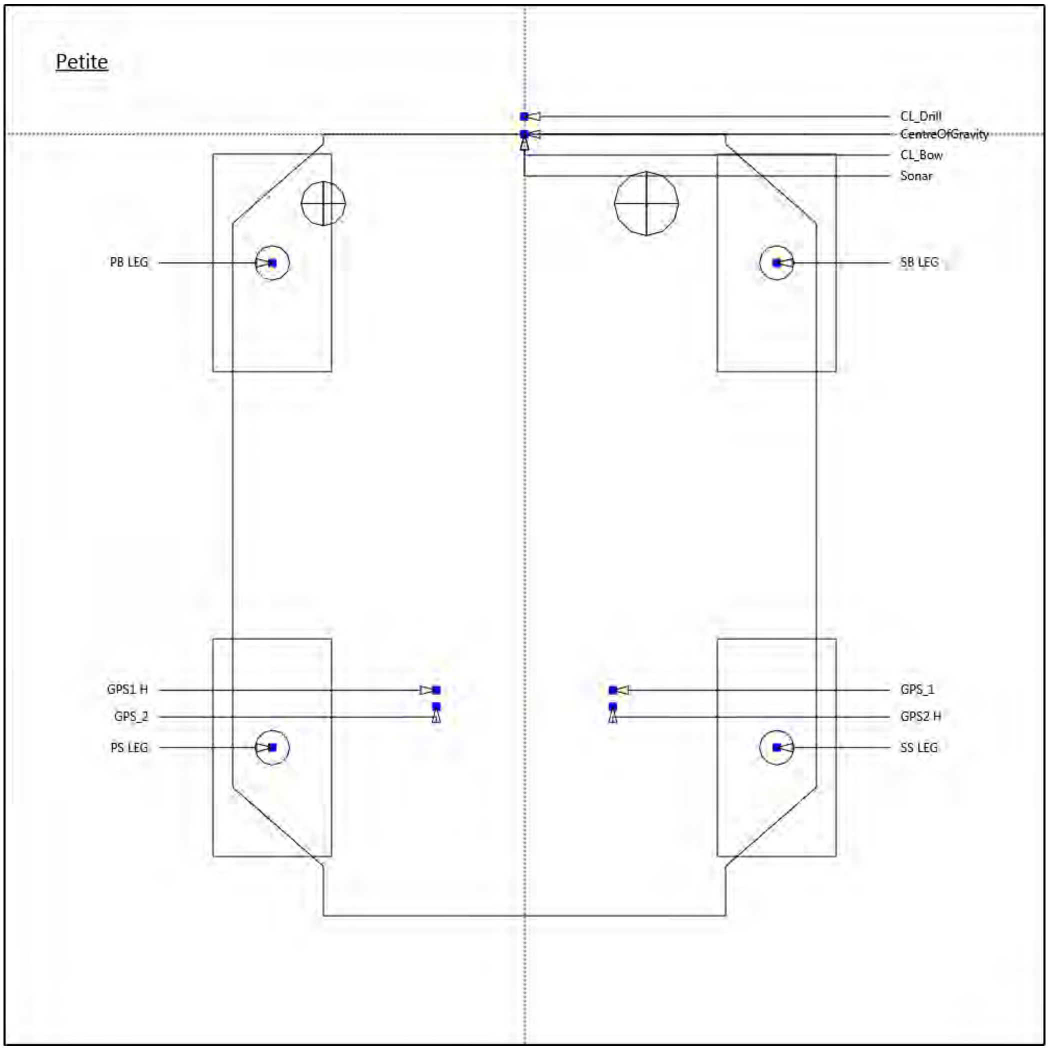
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,463.29ftUS N, 1,452,054.37ftUS E, -48.39ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,463.66ftUS N, 1,452,054.50ftUS E, -48.47ft Ell.	0.37ftUS	0.14ftUS	-0.09ftUS

PLATE NO. B-230

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-231

Seabed Information

Seabed Depth	63.10ft
Comment	

Area Map

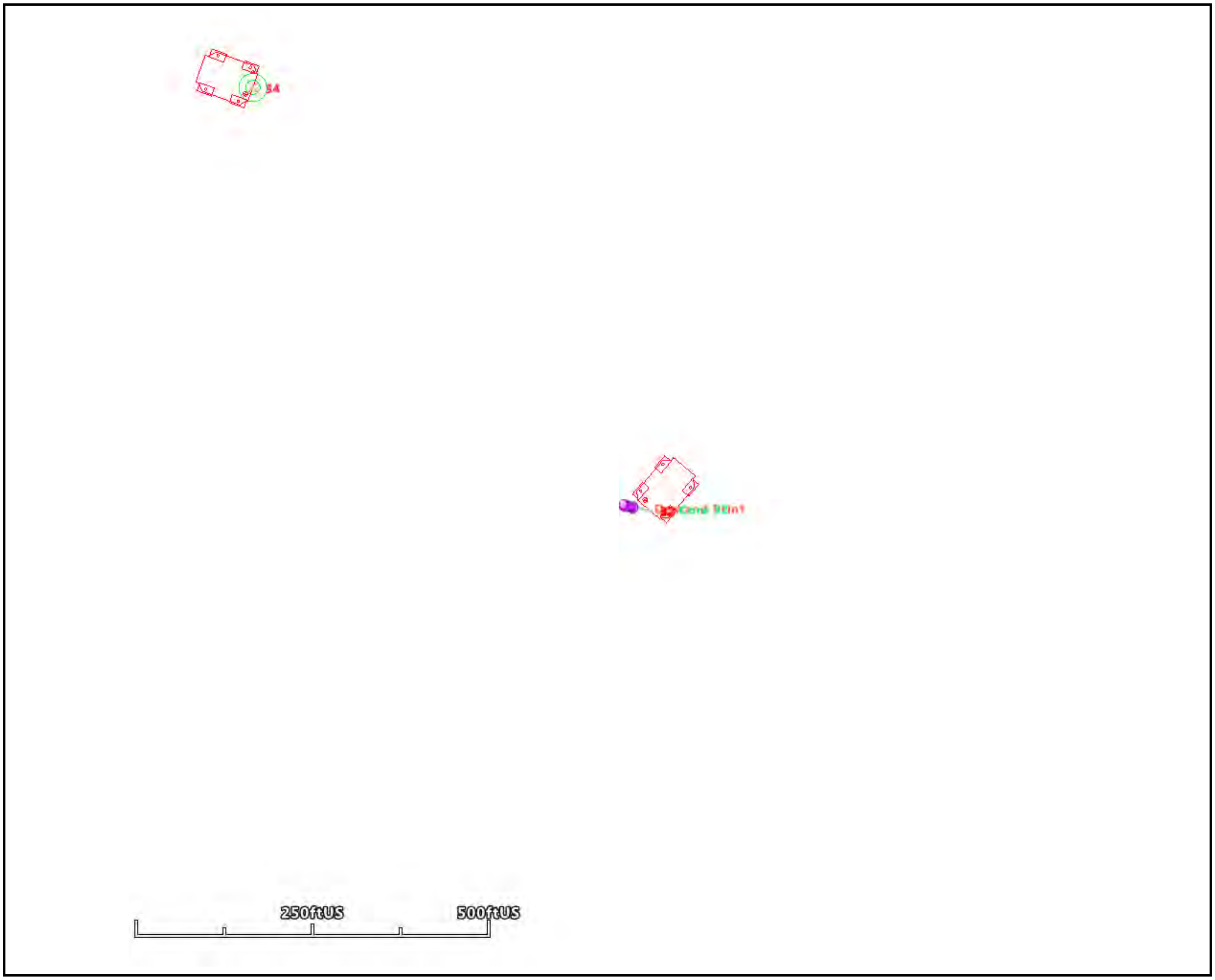


PLATE NO. B-233

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**33B**		
Comment:			

Session Name: 20180809-075354-v1
Start Time: 09 Aug 2018, 02:54:27-05:00
End Time: 09 Aug 2018, 03:09:26-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 33B

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’28.80368”N	27°50’28.80367”N
Longitude	097°03’19.23652”W	097°03’19.23652”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,197,335.55ftUS N	
Easting	1,451,125.34ftUS E	
Height	-49.56ft Ell.	
Final Rig Heading	116.90°True (116.25°Grid)	

Final Position for CL_Drill is 0.15ftUS @ 230.0°True (229.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65581°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’28.80464”N	Longitude: 097°03’19.23523”W	Northing: 17,197,335.65ftUS N	Easting: 1,451,125.46ftUS E
Intended Rig Heading	117.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,197,335.55ftUS N, 1,451,125.34ftUS E, -49.56ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,335.20ftUS N, 1,451,124.65ftUS E, -49.29ft Ell.	-0.34ftUS	-0.69ftUS	0.26ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		884 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50’28.98474”N	±0.22ftUS	27°50’29.14636”N	±0.05ftUS
Longitude	097°03’19.85765”W	±0.19ftUS	097°03’19.79176”W	±0.10ftUS
Height	-49.56ft Ell.	±0.14ftUS	-49.29ft Ell.	±0.17ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50’28.98474”N	±0.22ftUS	27°50’29.14637”N	±0.05ftUS
Longitude	097°03’19.85765”W	±0.19ftUS	097°03’19.79176”W	±0.10ftUS
Height	-49.56ft Ell.	±0.14ftUS	-49.29ft Ell.	±0.17ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,353.20ftUS N	±0.21ftUS	17,197,369.59ftUS N	±0.05ftUS
Easting	1,451,069.37ftUS E	±0.19ftUS	1,451,075.10ftUS E	±0.10ftUS
Height	-49.56ft Ell.	±0.14ftUS	-49.29ft Ell.	±0.17ftUS

HDOP	0.89		0.79	
No. Satellites	9		14	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	116.90°True	±0.0°	116.90°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50’28.80368”N	±0.22ftUS	27°50’28.80029”N	±0.08ftUS
Longitude	097°03’19.23652”W	±0.18ftUS	097°03’19.24420”W	±0.10ftUS
Height	-49.56ft Ell.	±0.14ftUS	-49.29ft Ell.	±0.17ftUS

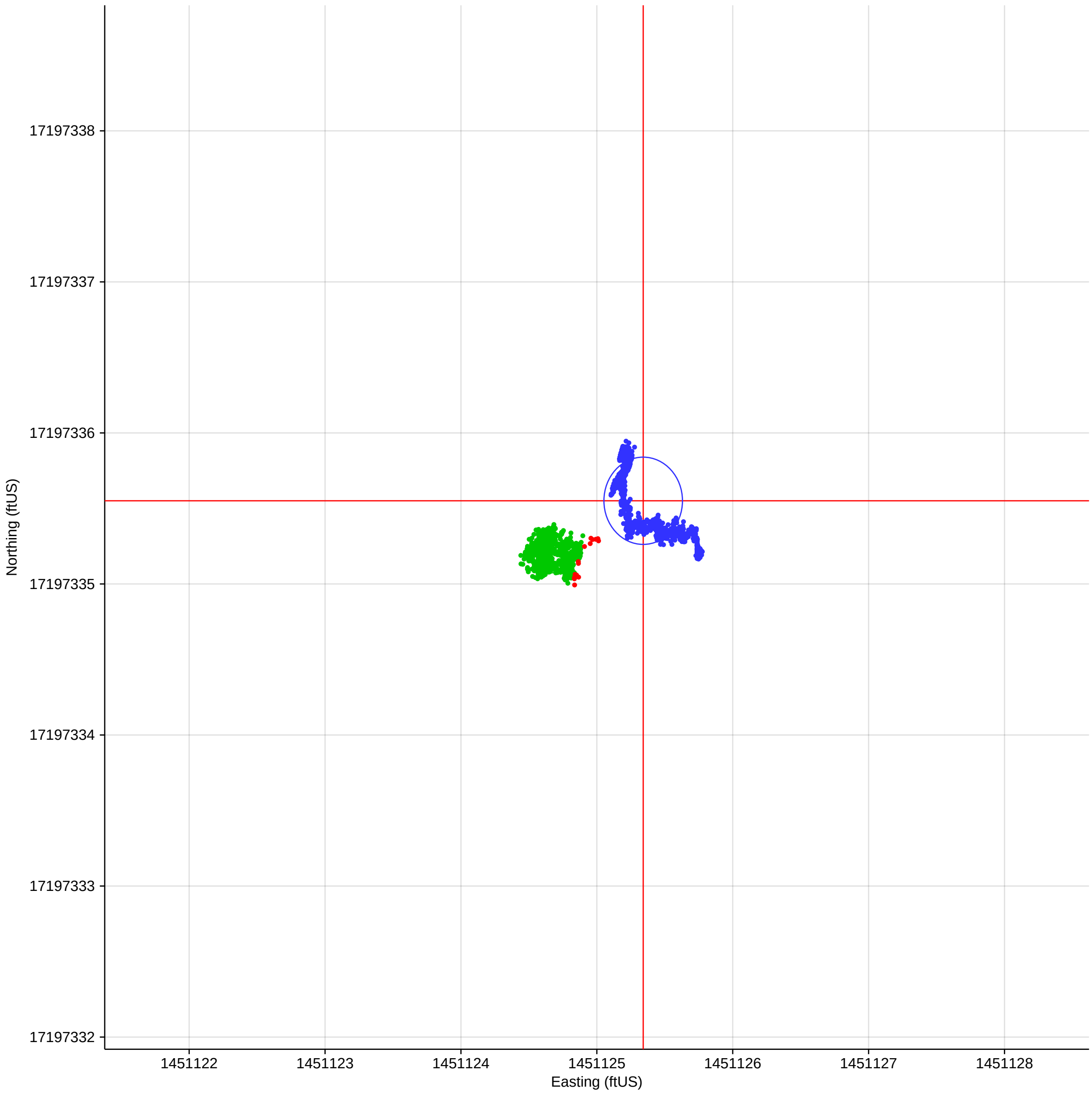
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,335.55ftUS N	±0.22ftUS	17,197,335.20ftUS N	±0.08ftUS
Easting	1,451,125.34ftUS E	±0.18ftUS	1,451,124.65ftUS E	±0.10ftUS
Height	-49.56ft Ell.	±0.14ftUS	-49.29ft Ell.	±0.17ftUS

Delta Northing	0.00ftUS		-0.34ftUS	
Delta Easting	0.00ftUS		-0.69ftUS	
Delta Height	0.00ftUS		0.26ftUS	

Position of CL_Drill from proposed location				
Range	0.15ftUS		0.92ftUS	

Bearing	230.02°True		241.42°True	

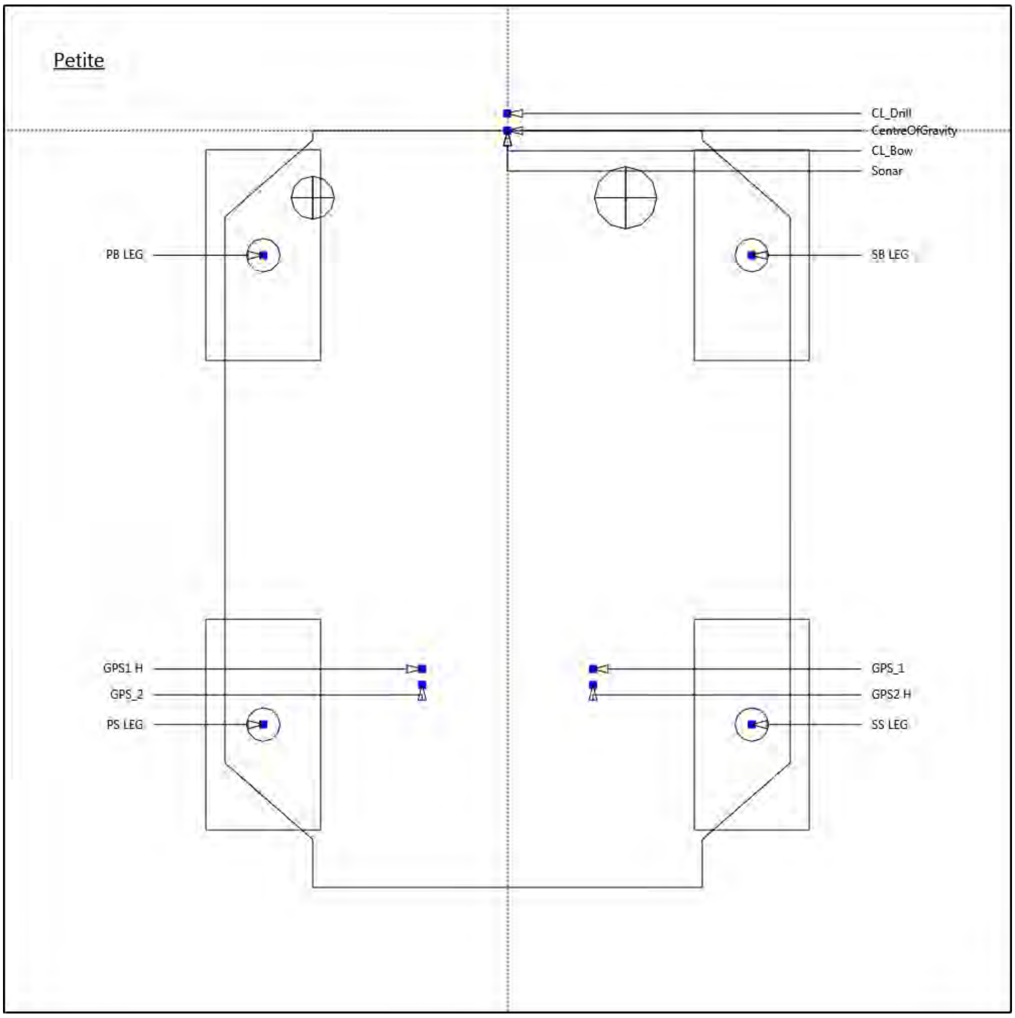
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,335.55ftUS N, 1,451,125.34ftUS E, -49.56ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,335.20ftUS N, 1,451,124.65ftUS E, -49.29ft Ell.	-0.34ftUS	-0.69ftUS	0.26ftUS

PLATE NO. B-238

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-239

Seabed Information

Seabed Depth	28.00ft
Comment	

Remarks

PLATE NO. B-240

STARFIX
FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**34**		
Comment:	**34**		

Session Name: 20180812-204724-v1
Start Time: 12 Aug 2018, 15:48:05-05:00
End Time: 12 Aug 2018, 16:03:12-05:00 (Session Length 0.252 hrs - No. Obs. 900)

Position Fix Summary for Petite at 34

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’35.84653”N	27°50’35.84653”N
Longitude	097°03’15.01837”W	097°03’15.01837”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,198,051.12ftUS N	
Easting	1,451,495.84ftUS E	
Height	-48.03ft Ell.	
Rig Heading	129.48°True (128.83°Grid)	

Position for CL_Drill is 3.55ftUS @ 102.1°True (101.4°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65635°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’35.85390”N	Longitude: 097°03’15.05706”W	Northing: 17,198,051.82ftUS N	Easting: 1,451,492.36ftUS E
Intended Rig Heading	110.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,198,051.12ftUS N, 1,451,495.84ftUS E, -48.03ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,198,051.74ftUS N, 1,451,495.93ftUS E, -46.61ft Ell.	0.63ftUS	0.10ftUS	1.42ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

PLATE NO. B-242

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	882 of 900 used		894 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'36.14351"N	±0.32ftUS	27°50'36.29653"N	±0.07ftUS
Longitude	097°03'15.58024"W	±0.05ftUS	097°03'15.46691"W	±0.06ftUS
Height	-48.03ft Ell.	±0.26ftUS	-46.61ft Ell.	±0.35ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'36.14351"N	±0.32ftUS	27°50'36.29653"N	±0.07ftUS
Longitude	097°03'15.58024"W	±0.05ftUS	097°03'15.46691"W	±0.06ftUS
Height	-48.03ft Ell.	±0.26ftUS	-46.61ft Ell.	±0.35ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,198,080.53ftUS N	±0.32ftUS	17,198,096.10ftUS N	±0.07ftUS
Easting	1,451,445.06ftUS E	±0.05ftUS	1,451,455.06ftUS E	±0.06ftUS
Height	-48.03ft Ell.	±0.26ftUS	-46.61ft Ell.	±0.35ftUS

HDOP	1.00		0.90	
No. Satellites	7		10	
Age of Corrections	8.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	129.48°True	±0.1°	129.48°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'35.84653"N	±0.37ftUS	27°50'35.85275"N	±0.08ftUS
Longitude	097°03'15.01837"W	±0.07ftUS	097°03'15.01729"W	±0.10ftUS
Height	-48.03ft Ell.	±0.26ftUS	-46.61ft Ell.	±0.35ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,198,051.12ftUS N	±0.37ftUS	17,198,051.74ftUS N	±0.08ftUS
Easting	1,451,495.84ftUS E	±0.07ftUS	1,451,495.93ftUS E	±0.10ftUS
Height	-48.03ft Ell.	±0.26ftUS	-46.61ft Ell.	±0.35ftUS

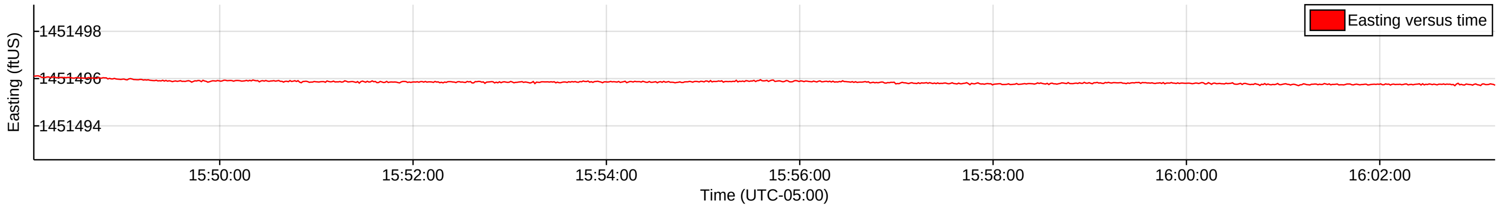
Delta Northing	0.00ftUS		0.63ftUS	
Delta Easting	0.00ftUS		0.10ftUS	
Delta Height	0.00ftUS		1.42ftUS	

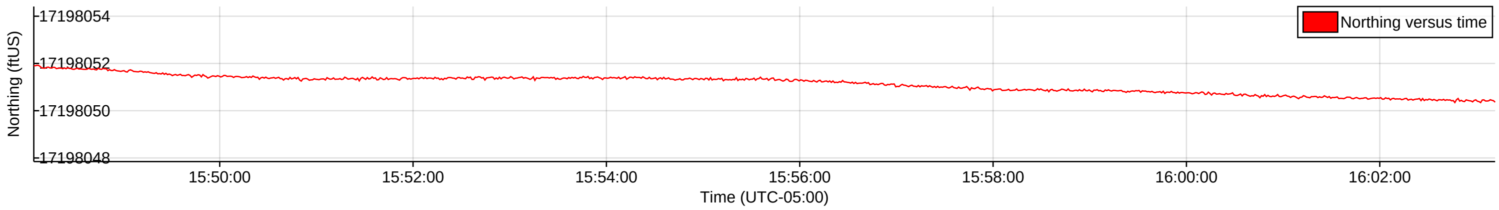
PLATE NO. B-244

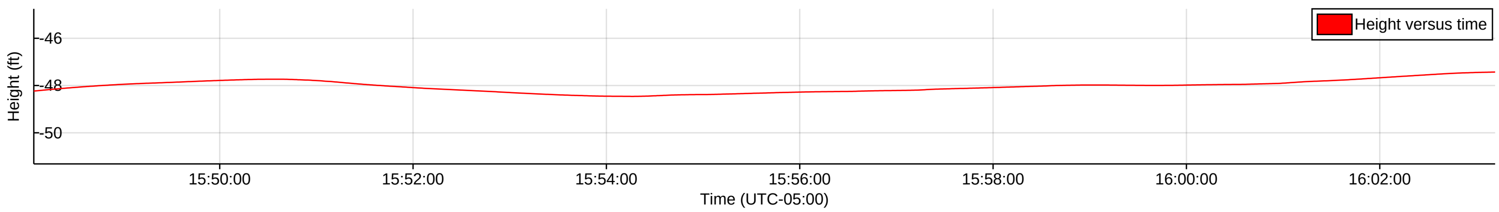
Position of CL_Drill from proposed location				
Range	3.55ftUS		3.57ftUS	
Bearing	102.10°True		91.86°True	

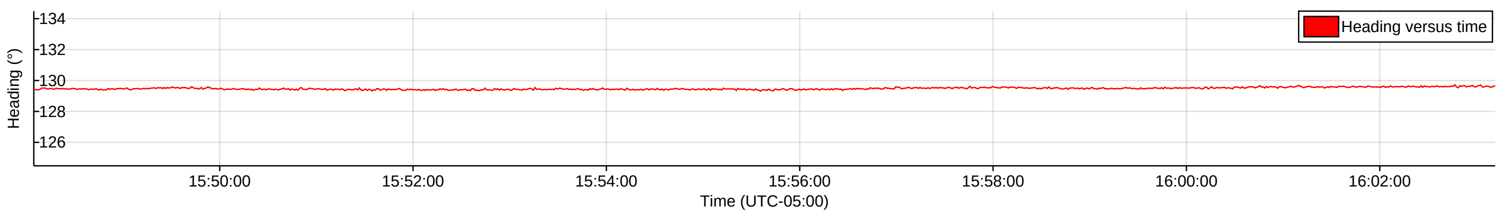
PLATE NO. B-245

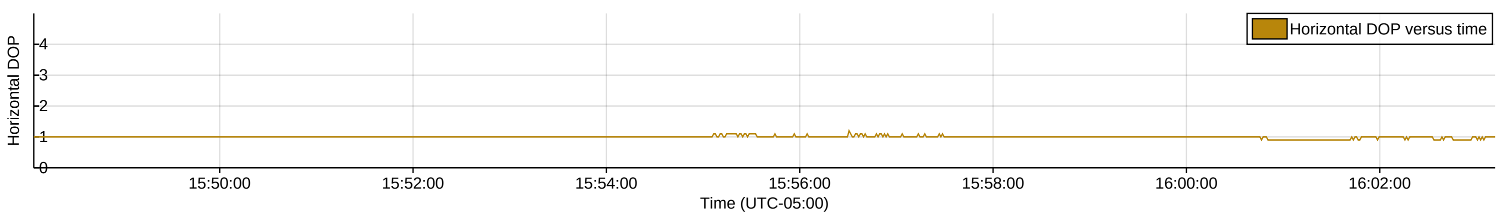
Time Series Plots for Primary

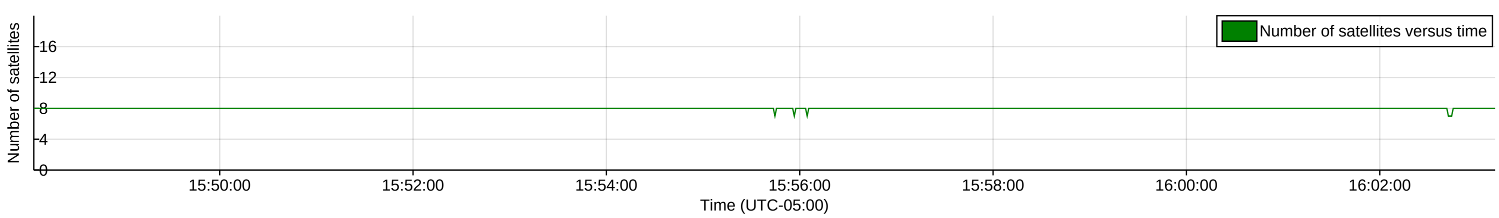












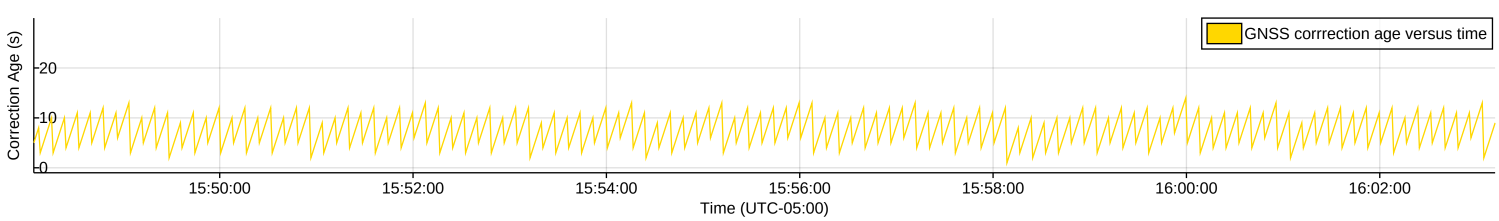
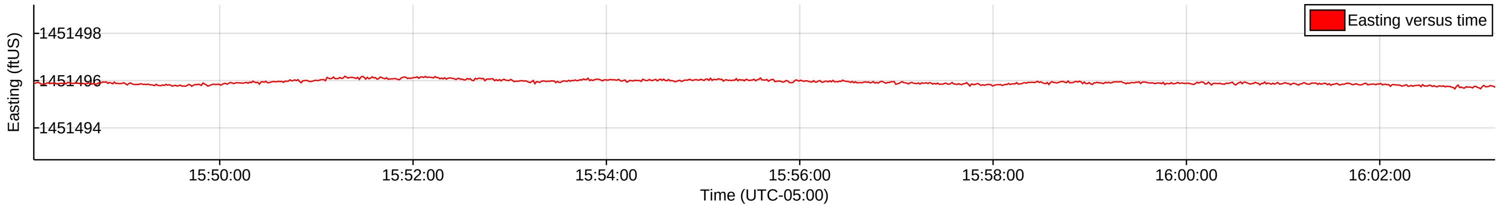
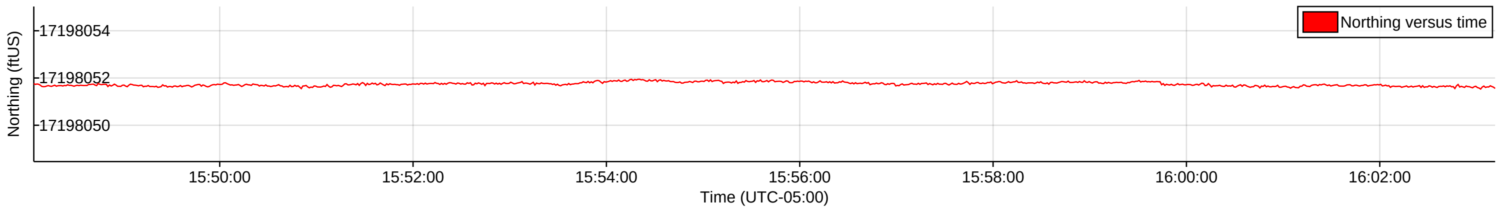
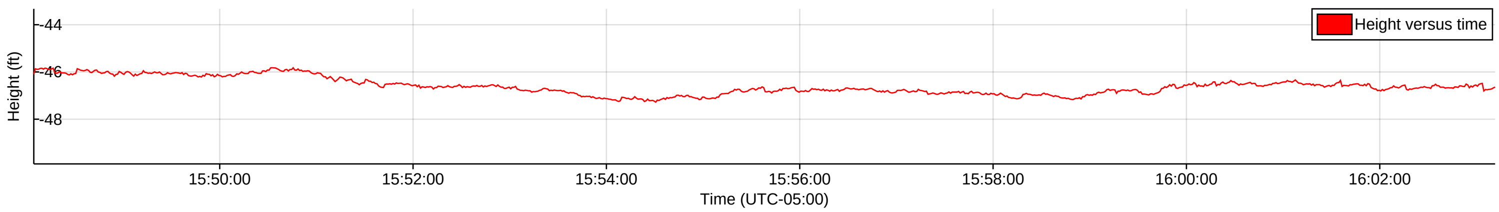


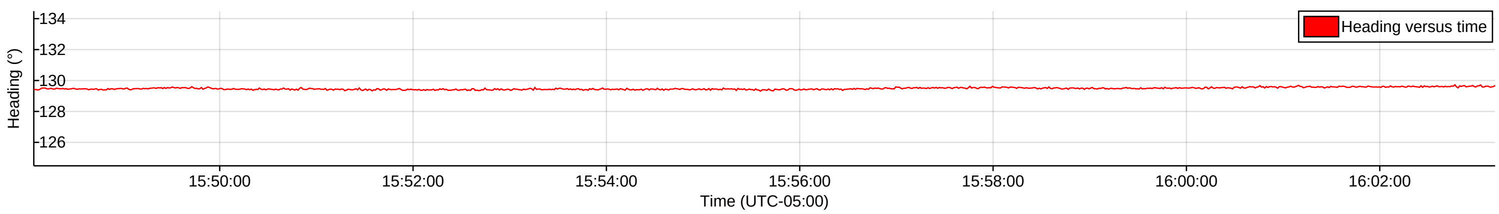
PLATE NO. B-246

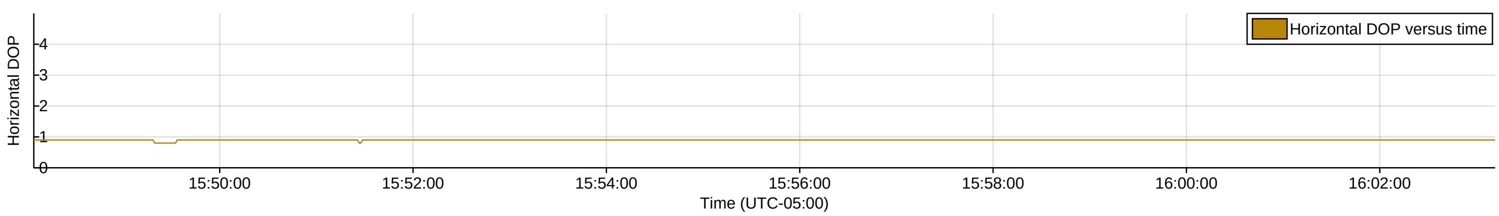
Time Series Plots for Secondary

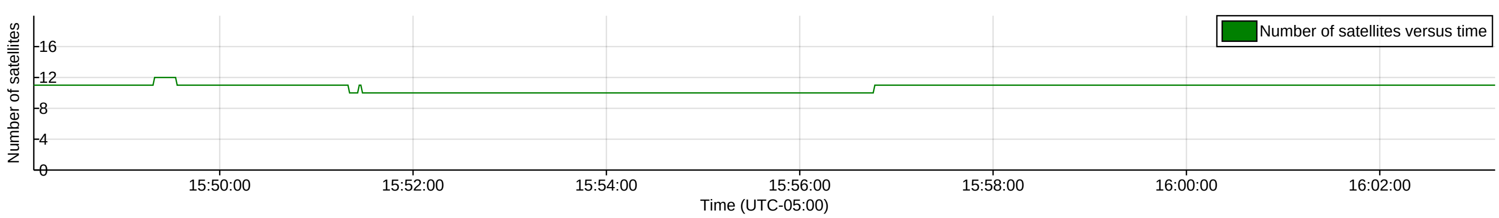












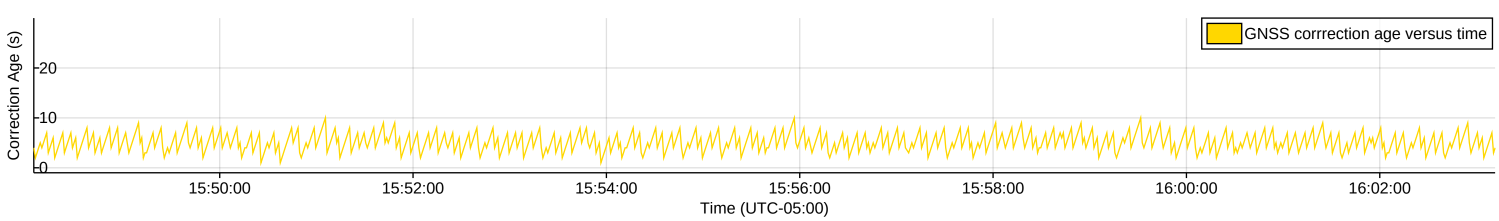
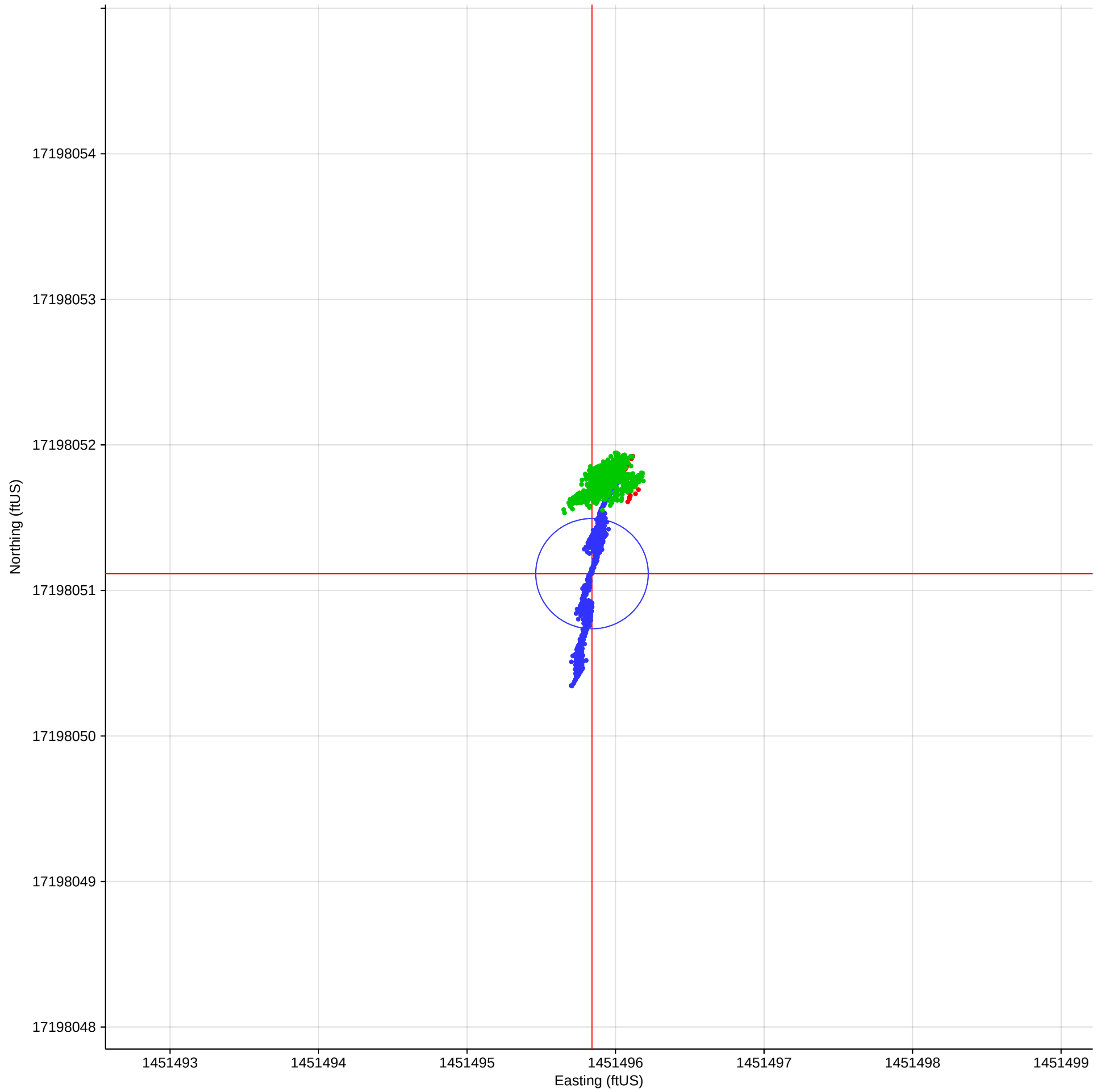


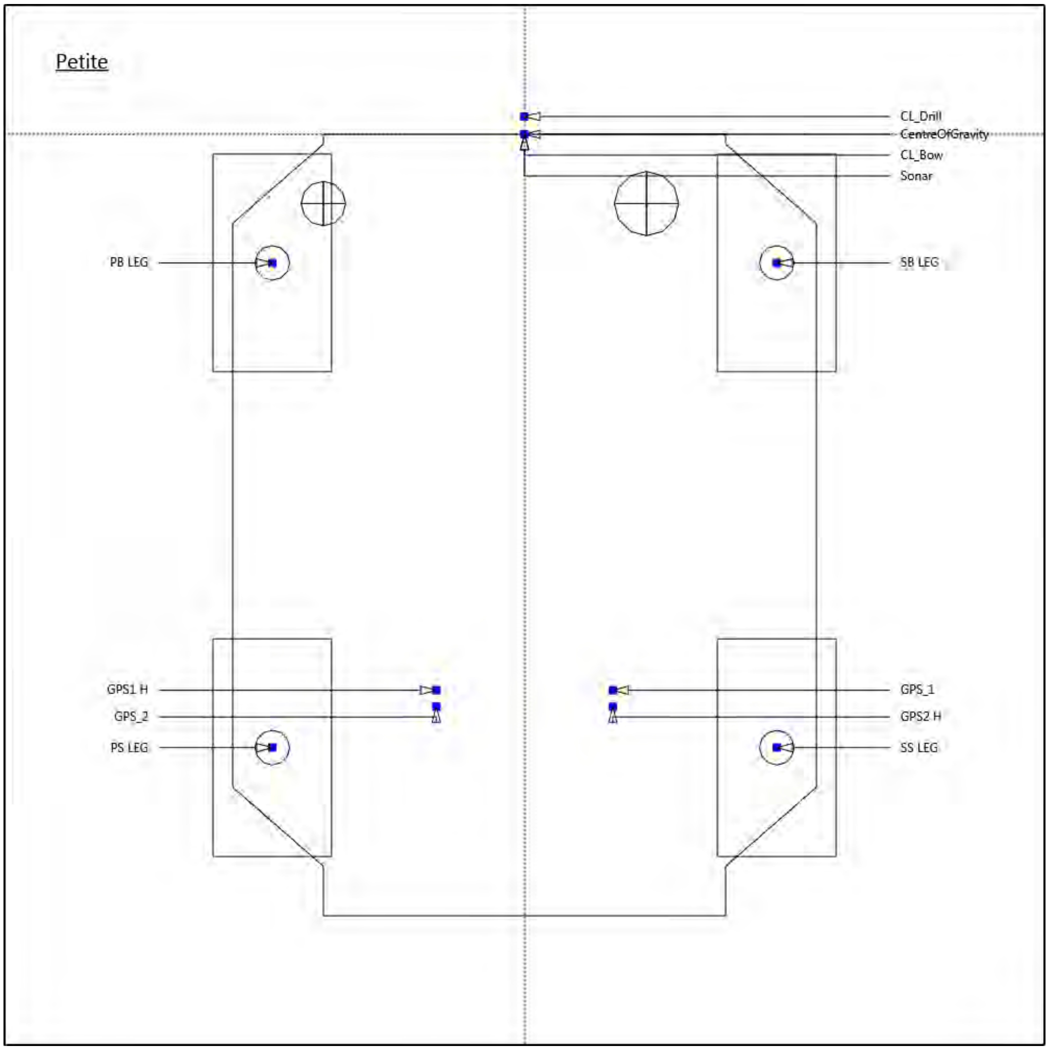
PLATE NO. B-247

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,198,051.12ftUS N, 1,451,495.84ftUS E, -48.03ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,198,051.74ftUS N, 1,451,495.93ftUS E, -46.61ft Ell.	0.63ftUS	0.10ftUS	1.42ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-249

Seabed Information

Seabed Depth	65.70ft
Comment	

Area Map

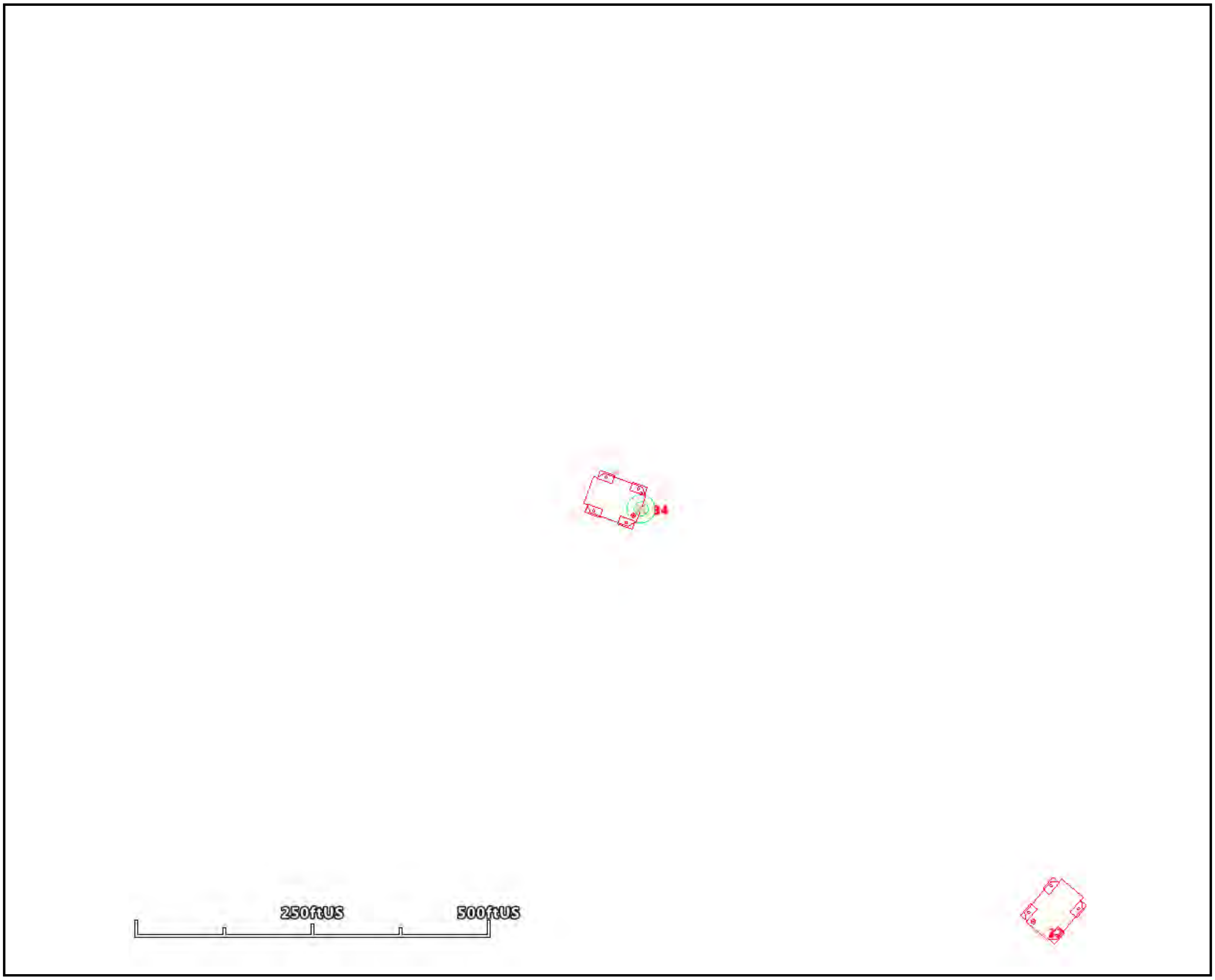


PLATE NO. B-251

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**35**		
Comment:			

Session Name: 20180813-135437-v2
Start Time: 13 Aug 2018, 08:55:36-05:00
End Time: 13 Aug 2018, 09:10:48-05:00 (Session Length 0.253 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 35

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50’34.19815”N	27°50’34.19815”N
Longitude	097°03’29.18193”W	097°03’29.18193”W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,197,870.11ftUS N	
Easting	1,450,226.35ftUS E	
Height	-50.73ft Ell.	
Final Rig Heading	102.28°True (101.62°Grid)	

Final Position for CL_Drill is 14.45ftUS @ 353.6°True (352.9°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65455°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50’34.05601”N	Longitude: 097°03’29.16393”W	Northing: 17,197,855.77ftUS N	Easting: 1,450,228.13ftUS E
Intended Rig Heading	110.0°True		

Positioning System Comparison

Sensor	**Mean Position**	**Delta Northing**	**Delta Easting**	**Delta Height**
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,870.11ftUS N, 1,450,226.35ftUS E, -50.73ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,871.02ftUS N, 1,450,225.61ftUS E, -51.42ft Ell.	0.92ftUS	-0.73ftUS	-0.69ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-252

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		900 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'34.23392"N	±0.10ftUS	27°50'34.41924"N	±0.21ftUS
Longitude	097°03'29.83438"W	±0.21ftUS	097°03'29.81823"W	±0.09ftUS
Height	-50.73ft Ell.	±0.14ftUS	-51.42ft Ell.	±0.27ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'34.23392"N	±0.10ftUS	27°50'34.41924"N	±0.21ftUS
Longitude	097°03'29.83438"W	±0.21ftUS	097°03'29.81823"W	±0.09ftUS
Height	-50.73ft Ell.	±0.14ftUS	-51.42ft Ell.	±0.27ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,873.05ftUS N	±0.10ftUS	17,197,891.78ftUS N	±0.21ftUS
Easting	1,450,167.74ftUS E	±0.21ftUS	1,450,168.98ftUS E	±0.09ftUS
Height	-50.73ft Ell.	±0.14ftUS	-51.42ft Ell.	±0.27ftUS

HDOP	0.90		0.90	
No. Satellites	9		9	
Age of Corrections	8.0 secs		8.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	102.28°True	±0.0°	102.28°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'34.19815"N	±0.13ftUS	27°50'34.20729"N	±0.22ftUS
Longitude	097°03'29.18193"W	±0.21ftUS	097°03'29.19010"W	±0.09ftUS
Height	-50.73ft Ell.	±0.14ftUS	-51.42ft Ell.	±0.27ftUS

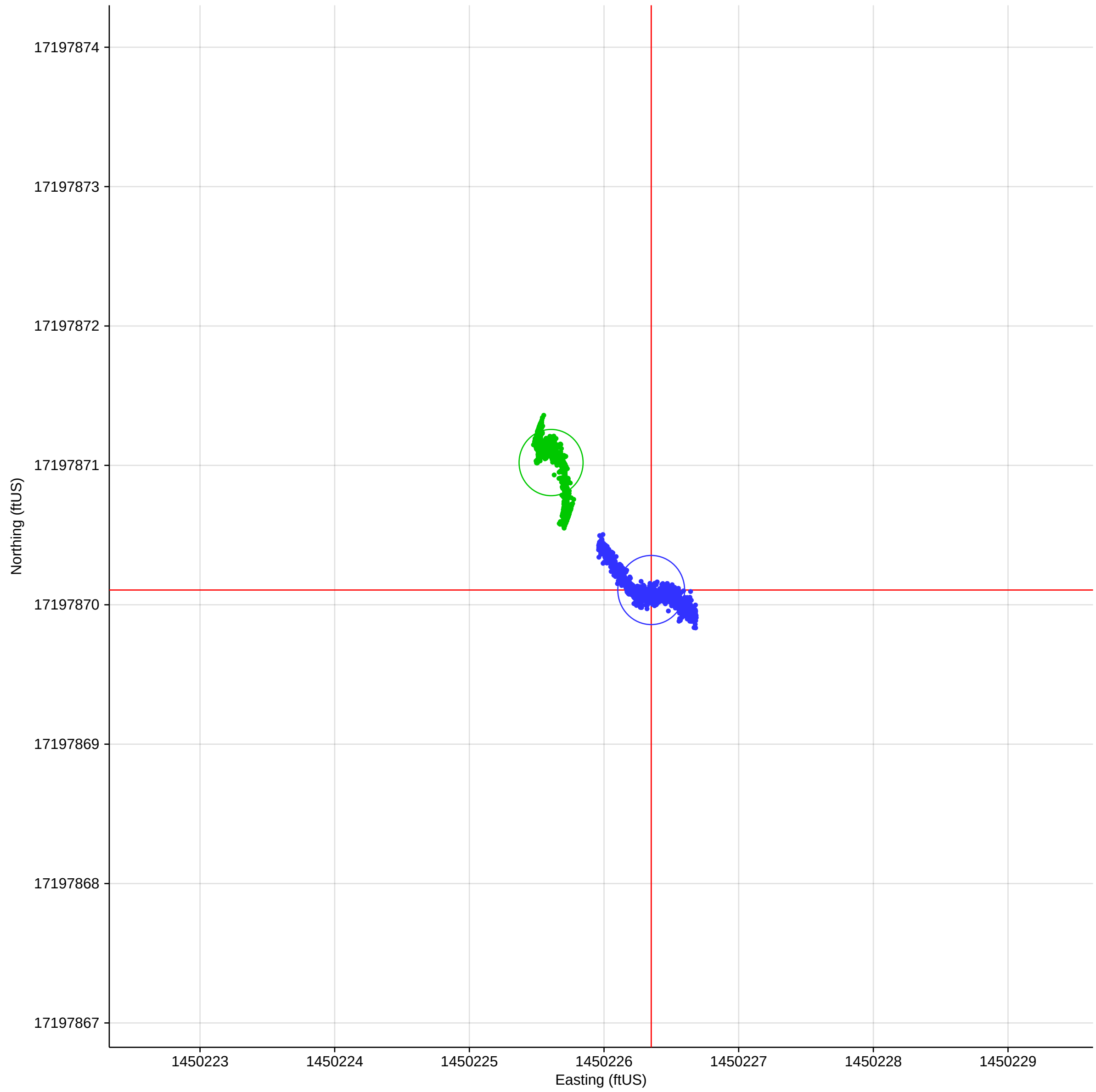
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,870.11ftUS N	±0.13ftUS	17,197,871.02ftUS N	±0.22ftUS
Easting	1,450,226.35ftUS E	±0.21ftUS	1,450,225.61ftUS E	±0.09ftUS
Height	-50.73ft Ell.	±0.14ftUS	-51.42ft Ell.	±0.27ftUS

Delta Northing	0.00ftUS		0.92ftUS	
Delta Easting	0.00ftUS		-0.73ftUS	
Delta Height	0.00ftUS		-0.69ftUS	

Position of CL_Drill from proposed location				
Range	14.45ftUS		15.46ftUS	

Bearing	353.58°True		351.26°True	

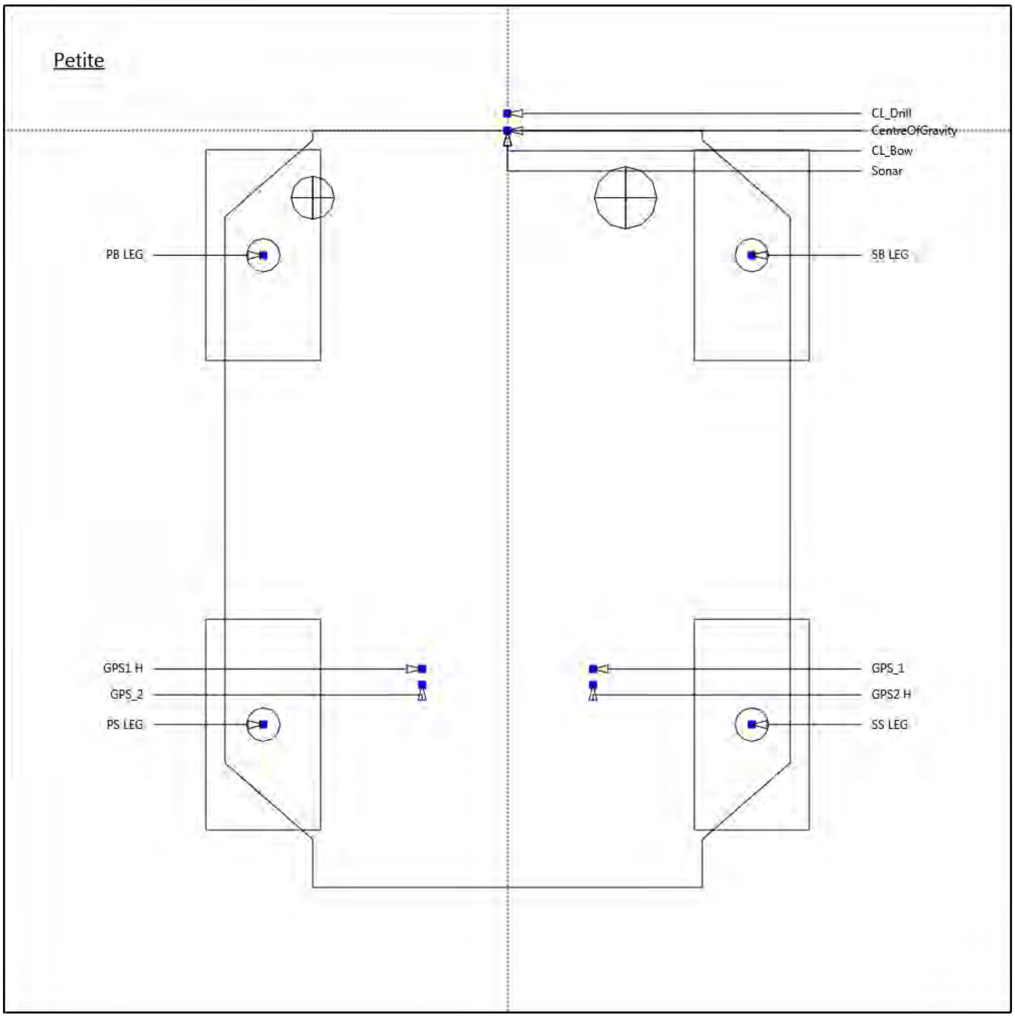
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,870.11ftUS N, 1,450,226.35ftUS E, -50.73ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,871.02ftUS N, 1,450,225.61ftUS E, -51.42ft Ell.	0.92ftUS	-0.73ftUS	-0.69ftUS

PLATE NO. B-256

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	60.30ft
Comment	

Remarks

PLATE NO. B-258

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**36**		
Comment:			

Session Name: 20180808-192327-v1
Start Time: 08 Aug 2018, 14:24:21-05:00
End Time: 08 Aug 2018, 14:39:20-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 36

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50'32.60174"N	27°50'32.60174"N
Longitude	097°03'44.51660"W	097°03'44.51660"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,197,693.19ftUS N	
Easting	1,448,851.66ftUS E	
Height	-48.24ft Ell.	
Final Rig Heading	260.09°True (259.43°Grid)	

Final Position for CL_Drill is 4.66ftUS @ 348.9°True (348.3°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65277°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50'32.55643"N	Longitude: 097°03'44.50663"W	Northing: 17,197,688.62ftUS N	Easting: 1,448,852.61ftUS E
Intended Rig Heading	90.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,197,693.19ftUS N, 1,448,851.66ftUS E, -48.24ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,693.10ftUS N, 1,448,851.71ftUS E, -47.22ft Ell.	-0.08ftUS	0.05ftUS	1.02ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-259

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	899 of 900 used		900 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50'32.78767"N	±0.16ftUS	27°50'32.61556"N	±0.12ftUS
Longitude	097°03'43.89728"W	±0.09ftUS	097°03'43.84438"W	±0.09ftUS
Height	-48.24ft Ell.	±0.06ftUS	-47.22ft Ell.	±0.20ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50'32.78768"N	±0.16ftUS	27°50'32.61556"N	±0.12ftUS
Longitude	097°03'43.89728"W	±0.09ftUS	097°03'43.84438"W	±0.09ftUS
Height	-48.24ft Ell.	±0.06ftUS	-47.22ft Ell.	±0.20ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,712.60ftUS N	±0.16ftUS	17,197,695.27ftUS N	±0.12ftUS
Easting	1,448,907.04ftUS E	±0.09ftUS	1,448,911.99ftUS E	±0.09ftUS
Height	-48.24ft Ell.	±0.06ftUS	-47.22ft Ell.	±0.20ftUS

HDOP	1.38		0.69	
No. Satellites	7		14	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	260.09°True	±0.1°	260.09°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50'32.60174"N	±0.22ftUS	27°50'32.60092"N	±0.08ftUS
Longitude	097°03'44.51660"W	±0.08ftUS	097°03'44.51604"W	±0.09ftUS
Height	-48.24ft Ell.	±0.06ftUS	-47.22ft Ell.	±0.20ftUS

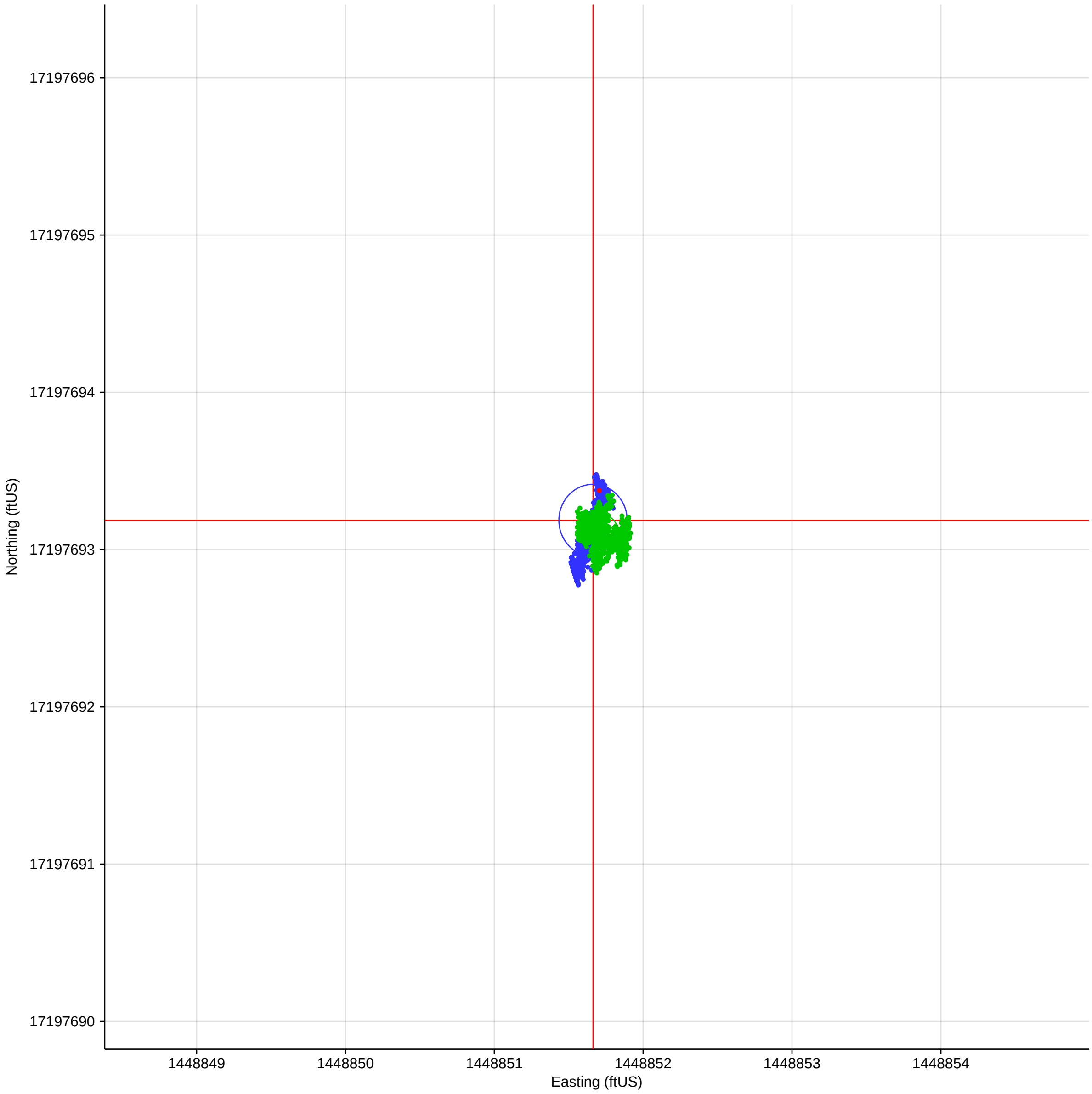
Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,197,693.19ftUS N	±0.22ftUS	17,197,693.10ftUS N	±0.08ftUS
Easting	1,448,851.66ftUS E	±0.07ftUS	1,448,851.71ftUS E	±0.09ftUS
Height	-48.24ft Ell.	±0.06ftUS	-47.22ft Ell.	±0.20ftUS

Delta Northing	0.00ftUS		-0.08ftUS	
Delta Easting	0.00ftUS		0.05ftUS	
Delta Height	0.00ftUS		1.02ftUS	

Position of CL_Drill from proposed location				
Range	4.66ftUS		4.57ftUS	

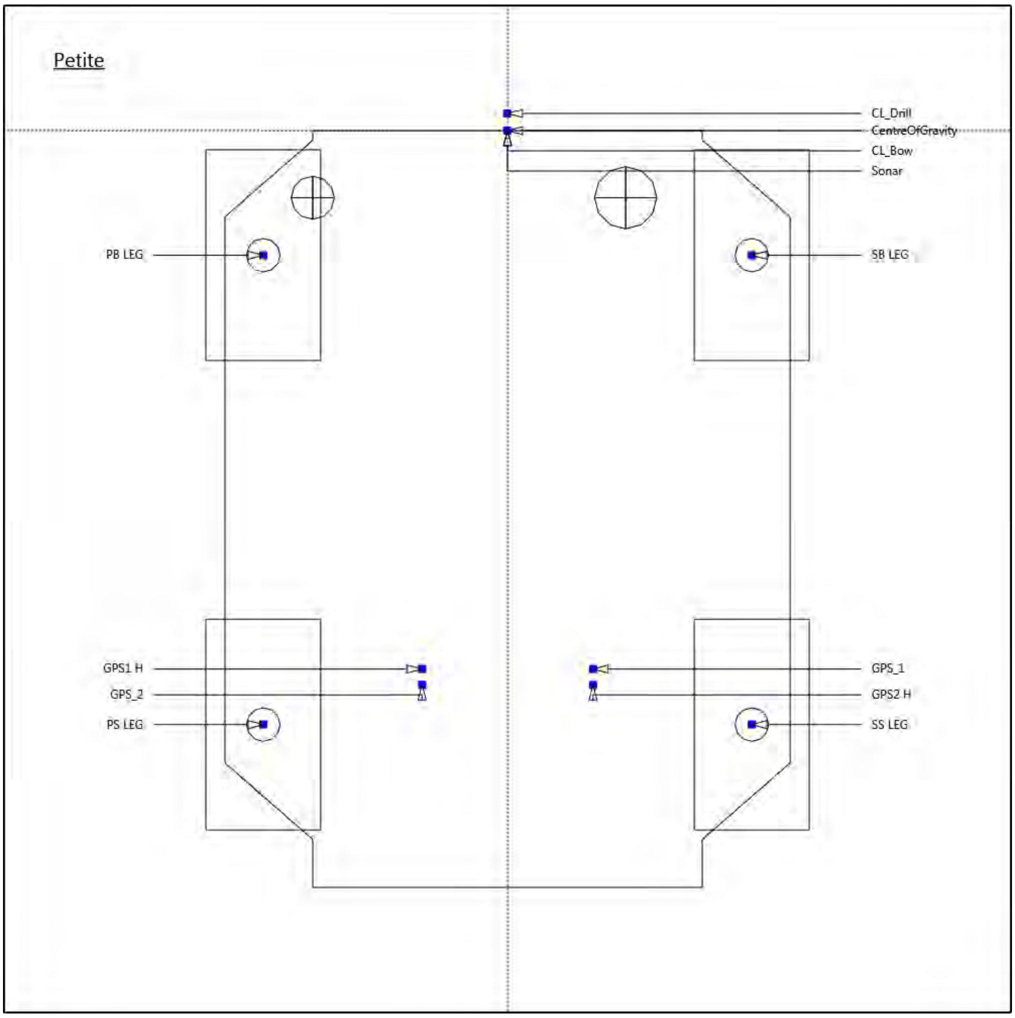
Bearing	348.94°True		349.36°True	

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,693.19ftUS N, 1,448,851.66ftUS E, -48.24ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,693.10ftUS N, 1,448,851.71ftUS E, -47.22ft Ell.	-0.08ftUS	0.05ftUS	1.02ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	47.00ft
Comment	

Remarks

PLATE NO. B-265

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**37**		
Comment:			

Session Name: 20180808-014140-v1
Start Time: 07 Aug 2018, 20:42:49-05:00
End Time: 07 Aug 2018, 20:57:48-05:00 (Session Length 0.25 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 37

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50'38.29488"N	27°50'38.29487"N
Longitude	097°03'51.66140"W	097°03'51.66140"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,198,260.81ftUS N	
Easting	1,448,203.76ftUS E	
Height	-49.30ft Ell.	
Final Rig Heading	281.67°True (281.02°Grid)	

Final Position for CL_Drill is 24.00ftUS @ 81.7°True (81.0°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65188°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50'38.26051"N	Longitude: 097°03'51.92591"W	Northing: 17,198,257.07ftUS N	Easting: 1,448,180.06ftUS E
Intended Rig Heading	90.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,198,260.81ftUS N, 1,448,203.76ftUS E, -49.30ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,198,262.84ftUS N, 1,448,202.38ftUS E, -50.43ft Ell.	2.05ftUS	-1.36ftUS	-1.13ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

PLATE NO. B-267

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		900 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50’38.26527”N	±0.03ftUS	27°50’38.10915”N	±0.06ftUS
Longitude	097°03’51.00855”W	±0.37ftUS	097°03’51.04592”W	±0.40ftUS
Height	-49.30ft Ell.	±0.08ftUS	-50.43ft Ell.	±0.13ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50’38.26527”N	±0.03ftUS	27°50’38.10915”N	±0.06ftUS
Longitude	097°03’51.00855”W	±0.37ftUS	097°03’51.04592”W	±0.40ftUS
Height	-49.30ft Ell.	±0.08ftUS	-50.43ft Ell.	±0.13ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,198,258.49ftUS N	±0.02ftUS	17,198,242.68ftUS N	±0.06ftUS
Easting	1,448,262.40ftUS E	±0.37ftUS	1,448,259.23ftUS E	±0.40ftUS
Height	-49.30ft Ell.	±0.08ftUS	-50.43ft Ell.	±0.13ftUS

HDOP	1.31		1.30	
No. Satellites	7		7	
Age of Corrections	8.0 secs		6.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	281.67°True	±0.0°	281.67°True	±0.0°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50’38.29488”N	±0.06ftUS	27°50’38.31516”N	±0.09ftUS
Longitude	097°03’51.66140”W	±0.36ftUS	097°03’51.67656”W	±0.39ftUS
Height	-49.30ft Ell.	±0.08ftUS	-50.43ft Ell.	±0.13ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM - 99° W			
Northing	17,198,260.81ftUS N	±0.06ftUS	17,198,262.84ftUS N	±0.09ftUS
Easting	1,448,203.76ftUS E	±0.37ftUS	1,448,202.38ftUS E	±0.39ftUS
Height	-49.30ft Ell.	±0.08ftUS	-50.43ft Ell.	±0.13ftUS

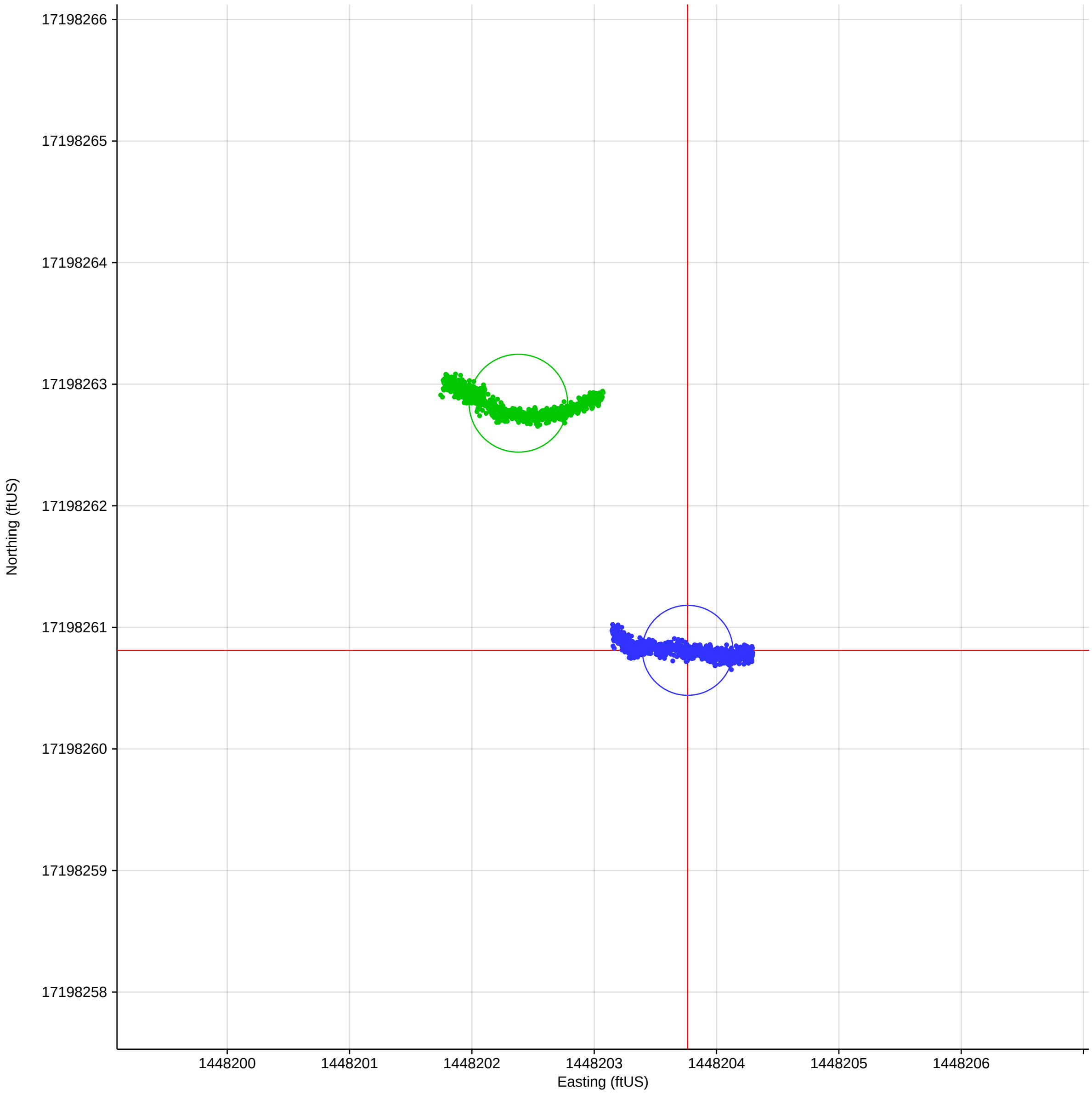
Delta Northing	0.00ftUS		2.05ftUS	
Delta Easting	0.00ftUS		-1.36ftUS	
Delta Height	0.00ftUS		-1.13ftUS	

Position of CL_Drill from proposed location				
Range	24.00ftUS		23.05ftUS	

PLATE NO. B-268

Bearing	81.68°True		76.15°True	

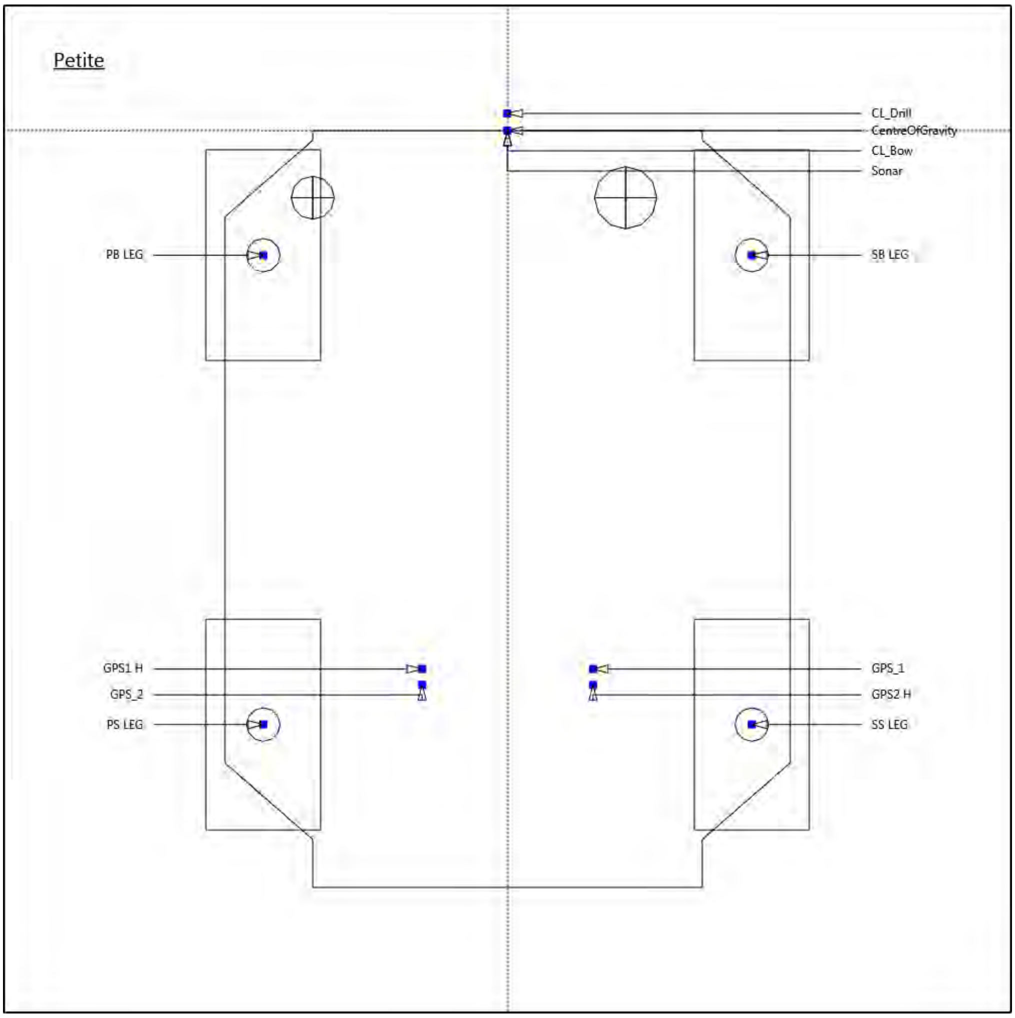
Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,198,260.81ftUS N, 1,448,203.76ftUS E, -49.30ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,198,262.84ftUS N, 1,448,202.38ftUS E, -50.43ft Ell.	2.05ftUS	-1.36ftUS	-1.13ftUS

PLATE NO. B-270

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

PLATE NO. B-271

Seabed Information

Seabed Depth	52.00ft
Comment	

Remarks

STARFIX
FINAL FIX REPORT

Project ID:	**18010738_MustangIsland-SoilBoring_LBPetite**		
Project Name:	**18010738_Petite_MU745-855_21A**	**Client:**	**Fugro**
Fugro OPCO:	**FUSAMI (Fugro USA Marine, Inc.)**	**Client Rep:**	**Luis Ferriera**
Fugro Personnel:	**Aubrey Lamb, Christopher Henson, Oars Surveyor**		
Primary Vessel:	**Petite**		
Location:	**38**		
Comment:			

Session Name: 20180814-013744-v1
Start Time: 13 Aug 2018, 20:38:42-05:00
End Time: 13 Aug 2018, 20:53:54-05:00 (Session Length 0.253 hrs - No. Obs. 900)

Final Position Fix Summary for Petite at 38

CL_Drill position computed from GPS 1 (Primary)

Geodetic Datum	**North American Datum 1983**	**World Geodetic System 1984**
Latitude	27°50'32.34090"N	27°50'32.34089"N
Longitude	097°04'04.71383"W	097°04'04.71383"W
Grid System	**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Northing	17,197,646.23ftUS N	
Easting	1,447,038.94ftUS E	
Height	-49.22ft Ell.	
Final Rig Heading	74.76°True (74.11°Grid)	

Final Position for CL_Drill is 0.96ftUS @ 120.7°True (120.0°Grid) FROM the proposed location.

CL_Drill from CRP:	Starboard = 0.00ftUS	Forward = 1.80ftUS	Up = 0.00ftUS
GPS 1 Antenna Offset from CRP:	Starboard = 8.93ftUS	Forward = -56.20ftUS	Up = 0.00ftUS
Heading correction applied (C-O):	-90.00°		
Convergence:	0.65007°		

Proposed Location

North American Datum 1983		**SPCS83 Texas South zone (US Survey feet) CM -99° W**	
Latitude: 27°50'32.34574"N	Longitude: 097°04'04.72302"W	Northing: 17,197,646.71ftUS N	Easting: 1,447,038.11ftUS E
Intended Rig Heading	79.0°True		

Positioning System Comparison

Sensor	**Mean Position** SPCS83 Texas South zone (US Survey feet) CM -99° W	**Delta Northing**	**Delta Easting**	**Delta Height**
Primary	17,197,646.23ftUS N, 1,447,038.94ftUS E, -49.22ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,646.68ftUS N, 1,447,038.51ftUS E, -48.18ft Ell.	0.46ftUS	-0.43ftUS	1.04ftUS

Oars Surveyor
Party Chief
FUSAMI (Fugro USA Marine, Inc.)

Luis Ferriera
Client Representative
Fugro

PLATE NO. B-273

Geodetic Parameters

Name : NAD83 / Texas South (ftUS) [DMA-N Am]		
EPSG Code	EPSG::2279	
Global Navigation Satellite System (GNSS) Geodetic Parameters		
Datum	World Geodetic System 1984	EPSG::6326
Ellipsoid	WGS 84	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257223563	
Local Geodetic Datum Parameters		
Datum	North American Datum 1983	EPSG::6269
Ellipsoid	GRS 1980	
Semi major axis	a = 6,378,137.000 m	
Inverse flattening	1/f = 298.257222101	
Datum Transformation Parameters from WGS 84 to NAD83		
X-axis translation 0 m	X-axis rotation 0 ”	Scale difference 0 ppm
Y-axis translation 0 m	Y-axis rotation 0 ”	Coordinate Frame rotation
Z-axis translation 0 m	Z-axis rotation 0 ”	EPSG::1188
Local Projection Parameters		
Map Projection	Lambert Conic Conformal (2SP)	
Grid System	SPCS83 Texas South zone (US Survey feet)	EPSG::15361
Latitude Origin	25°40’00.000”N	
Central Meridian	098°30’00.000”W	
Latitude of 1st standard parallel	27°50’00.000”N	
Latitude of 2nd standard parallel	26°10’00.000”N	
False Easting	984,250 ftUS	
False Northing	16,404,166.667 ftUS	

Summary of Positions

	Primary	SD	Secondary	SD
System	GPS 1		GPS 2	
Observations	900 of 900 used		886 of 900 used	

ANTENNA POSITIONS				
Geodetic Datum	World Geodetic System 1984			
Latitude	27°50’32.10467”N	±0.06ftUS	27°50’32.27543”N	±0.04ftUS
Longitude	097°04’05.31107”W	±0.10ftUS	097°04’05.38581”W	±0.06ftUS
Height	-49.22ft Ell.	±0.37ftUS	-48.18ft Ell.	±0.17ftUS

Geodetic Datum	North American Datum 1983			
Latitude	27°50’32.10467”N	±0.06ftUS	27°50’32.27543”N	±0.04ftUS
Longitude	097°04’05.31107”W	±0.10ftUS	097°04’05.38581”W	±0.06ftUS
Height	-49.22ft Ell.	±0.37ftUS	-48.18ft Ell.	±0.17ftUS

Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,197,621.77ftUS N	±0.06ftUS	17,197,638.93ftUS N	±0.04ftUS
Easting	1,446,985.60ftUS E	±0.10ftUS	1,446,978.70ftUS E	±0.06ftUS
Height	-49.22ft Ell.	±0.37ftUS	-48.18ft Ell.	±0.17ftUS

HDOP	0.98		0.69	
No. Satellites	8		15	
Age of Corrections	7.0 secs		5.0 secs	
Heading System	GPS 1		GPS 1	
Heading (Corrected)	74.76°True	±0.1°	74.76°True	±0.1°
Heading Correction (C-O)	-90.00°		-90.00°	

Offsets from CRP				
Starboard	8.93ftUS		-8.93ftUS	
Forward	-56.20ftUS		-57.85ftUS	
Up	0.00ftUS		0.00ftUS	

CL_DRILL POSITION				
Geodetic Datum	North American Datum 1983			
Latitude	27°50’32.34090”N	±0.08ftUS	27°50’32.34542”N	±0.06ftUS
Longitude	097°04’04.71383”W	±0.08ftUS	097°04’04.71857”W	±0.05ftUS
Height	-49.22ft Ell.	±0.37ftUS	-48.18ft Ell.	±0.17ftUS

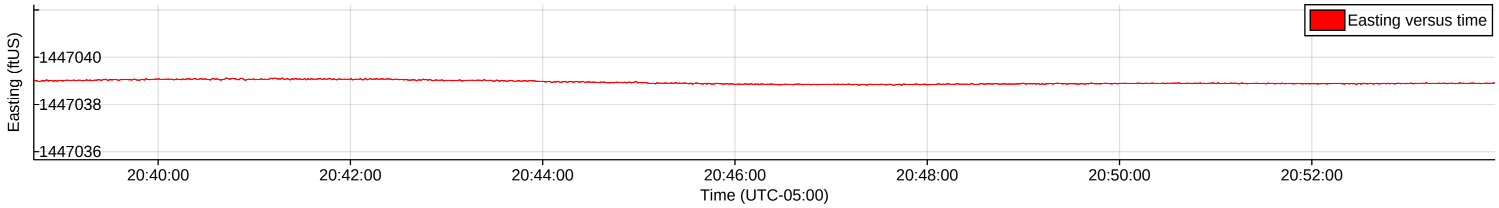
Grid System	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Northing	17,197,646.23ftUS N	±0.08ftUS	17,197,646.68ftUS N	±0.06ftUS
Easting	1,447,038.94ftUS E	±0.08ftUS	1,447,038.51ftUS E	±0.05ftUS
Height	-49.22ft Ell.	±0.37ftUS	-48.18ft Ell.	±0.17ftUS

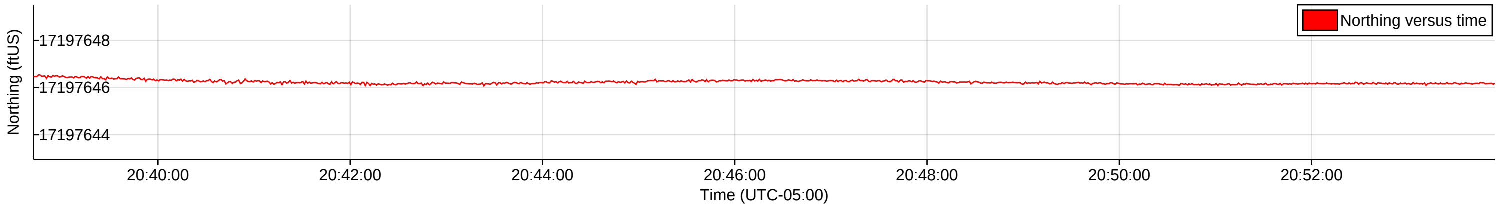
Delta Northing	0.00ftUS		0.46ftUS	
Delta Easting	0.00ftUS		-0.43ftUS	
Delta Height	0.00ftUS		1.04ftUS	

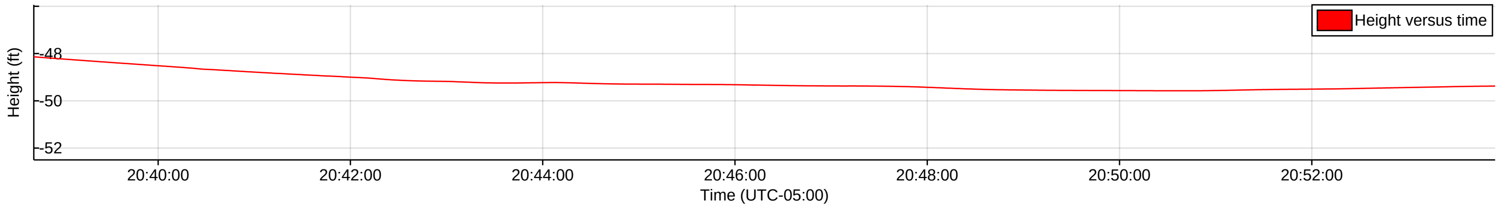
Position of CL_Drill from proposed location				
Range	0.96ftUS		0.40ftUS	
Bearing	120.68°True		94.69°True	

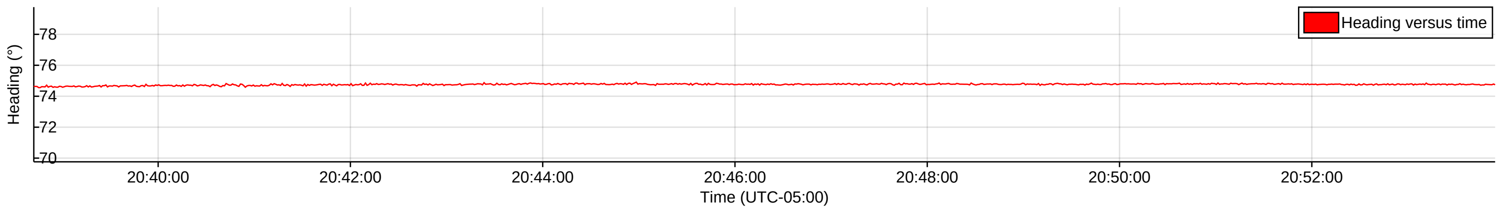
PLATE NO. B-277

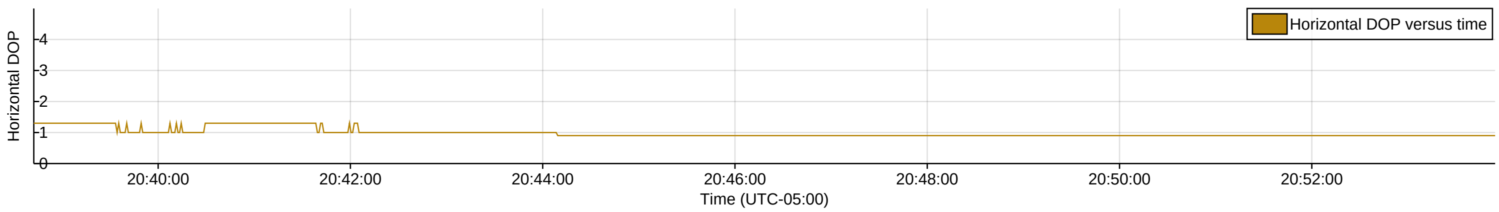
Time Series Plots for Primary

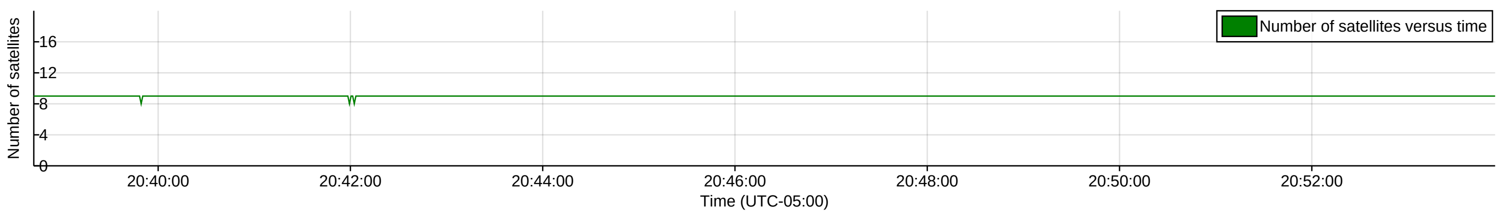












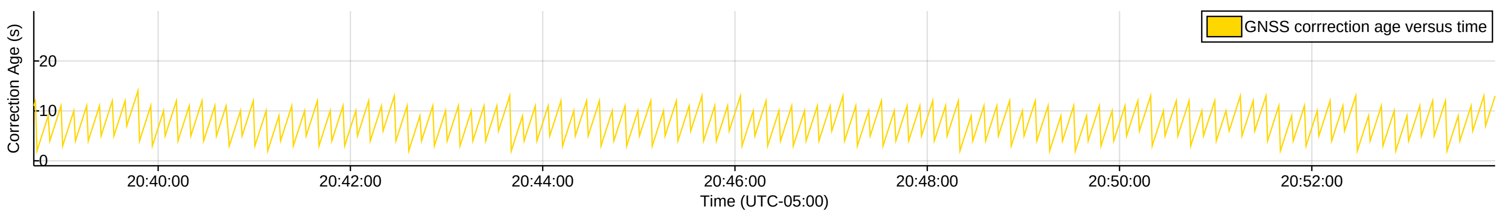
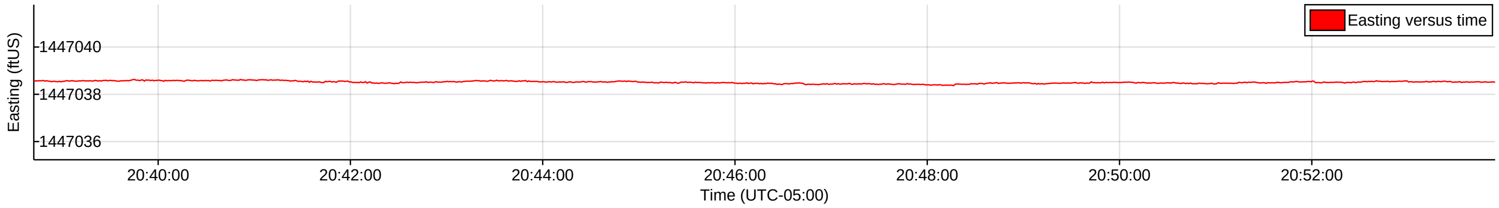
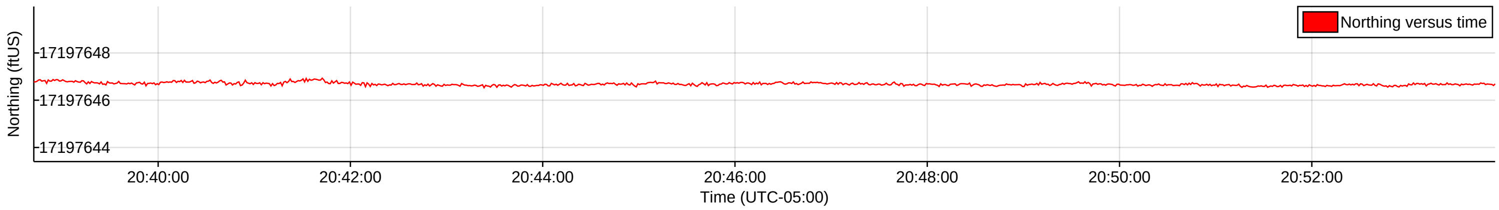
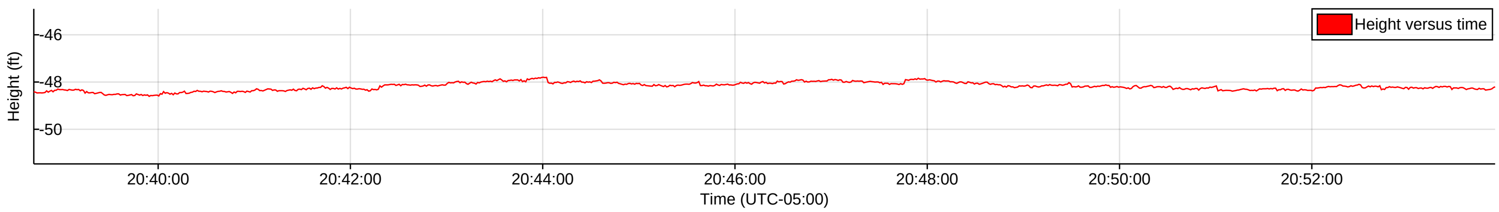


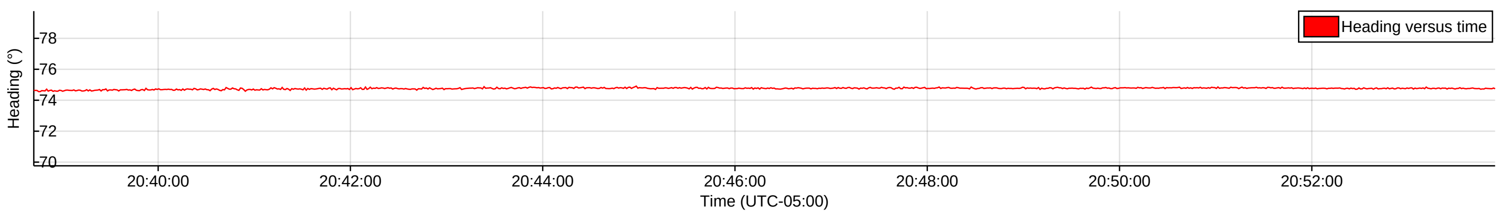
PLATE NO. B-278

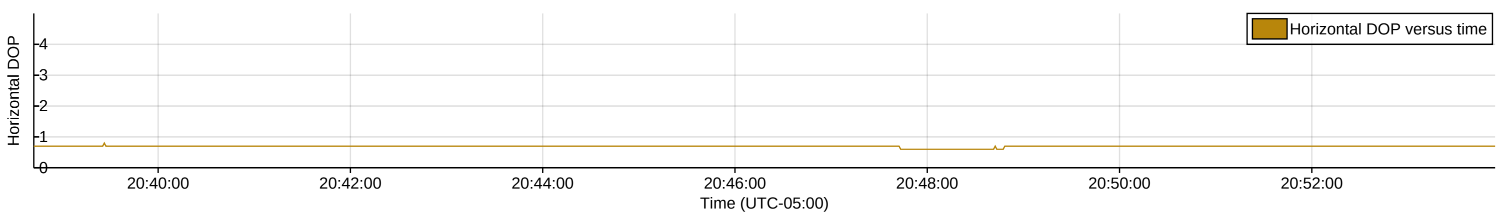
Time Series Plots for Secondary

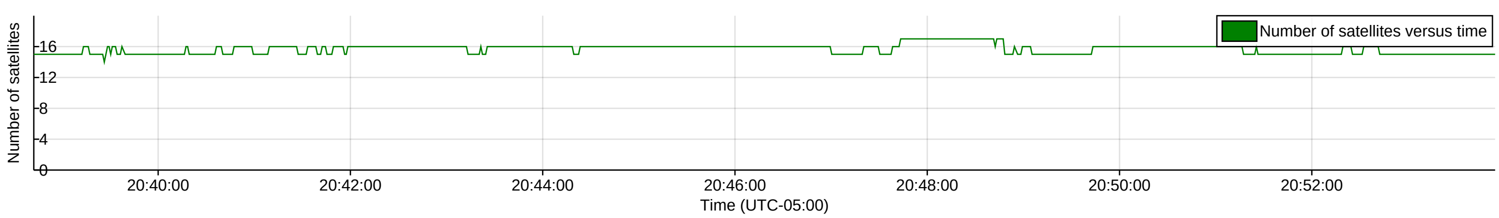












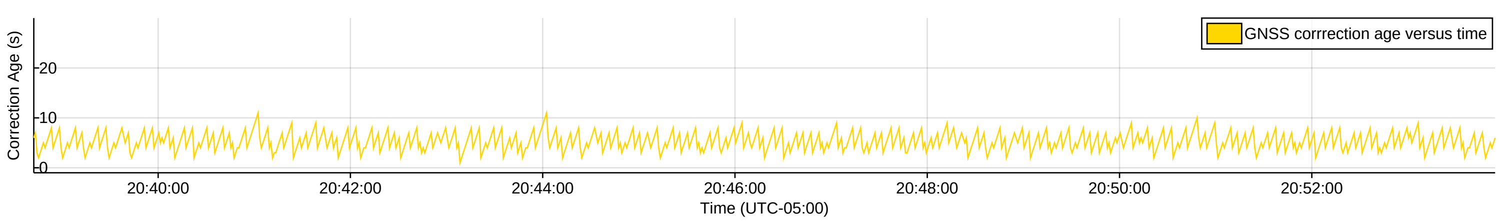
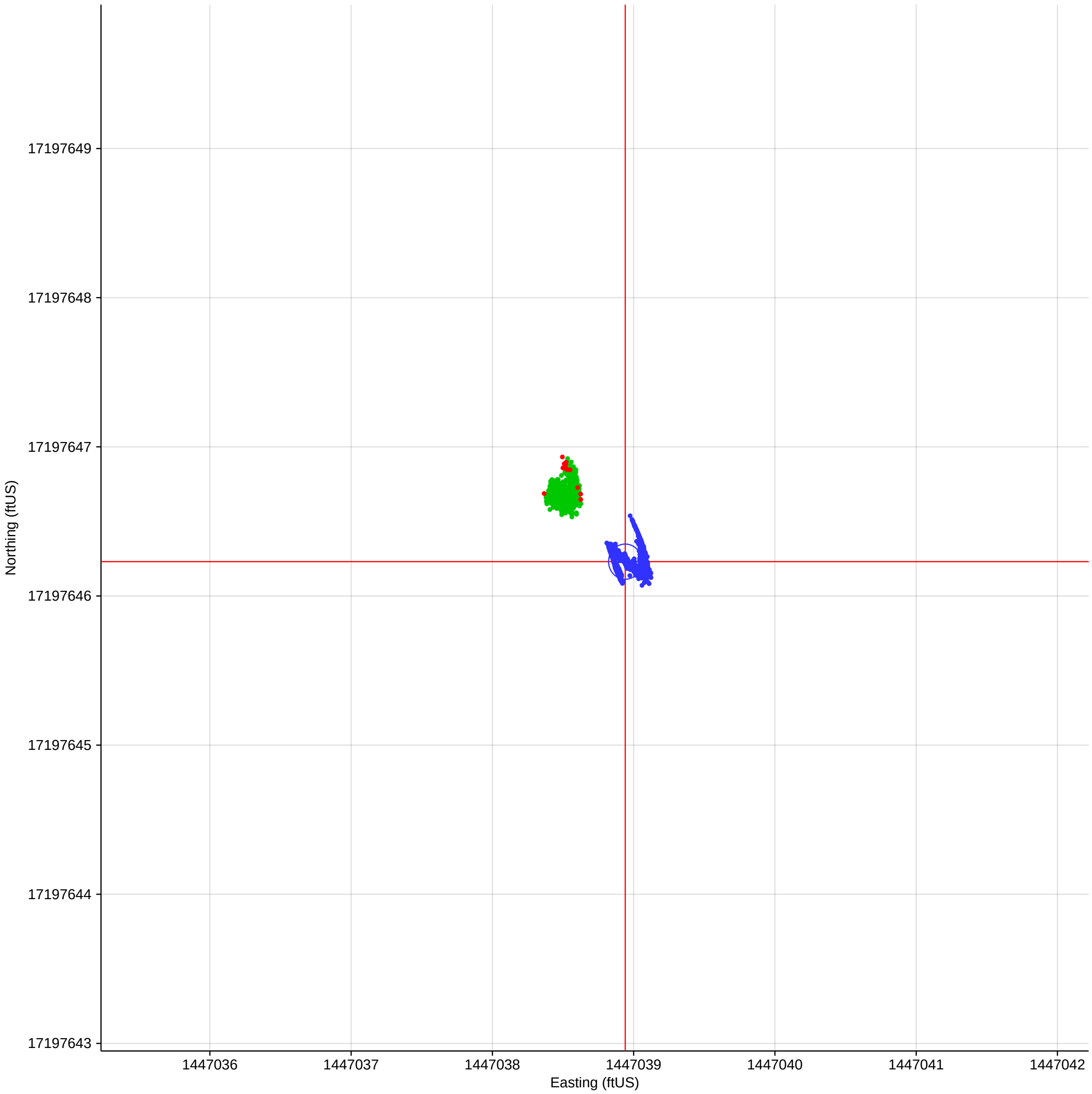


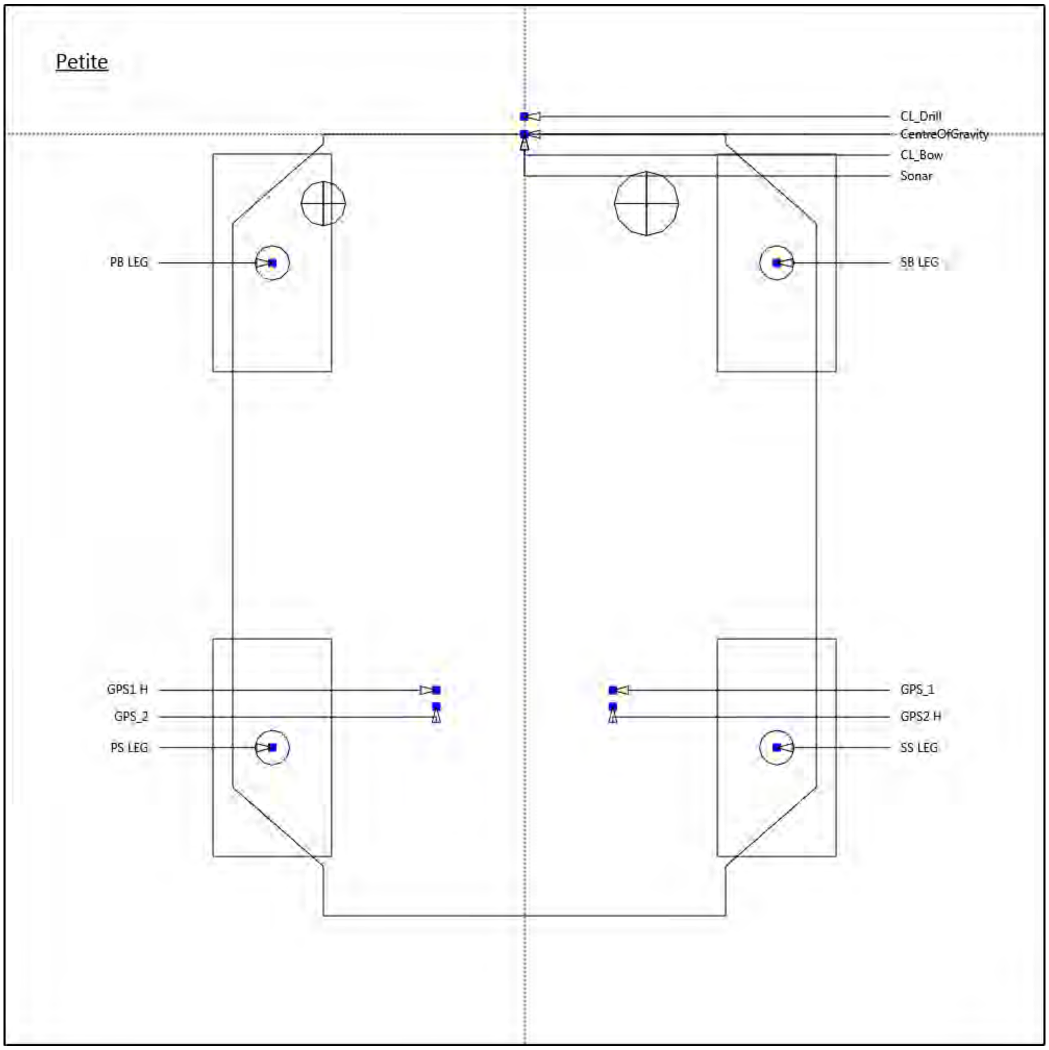
PLATE NO. B-279

Scatter Plot



Sensor Group	Petite Mean Position at CL_Drill	Delta Northing	Delta Easting	Delta Height
	SPCS83 Texas South zone (US Survey feet) CM -99° W			
Primary	17,197,646.23ftUS N, 1,447,038.94ftUS E, -49.22ft Ell.	0.00ftUS	0.00ftUS	0.00ftUS
Secondary	17,197,646.68ftUS N, 1,447,038.51ftUS E, -48.18ft Ell.	0.46ftUS	-0.43ftUS	1.04ftUS

Vessel Outline and Offsets



Petite - Defined Offsets

Name	Purpose	X Offset	Y Offset	Z Offset
CL_Bow		0.00ftUS	0.00ftUS	0.00ftUS
CL_Drill		0.00ftUS	1.80ftUS	0.00ftUS
CentreOfGravity	CentreOfGravity	0.00ftUS	0.00ftUS	0.00ftUS
CommonReferencePoint	CommonReferencePoint	0.00ftUS	0.00ftUS	0.00ftUS
GPS_1	DGPSantenna1	8.93ftUS	-56.20ftUS	0.00ftUS
GPS1 H	GPSantenna1	-8.93ftUS	-56.20ftUS	0.00ftUS
GPS_2	DGPSantenna2	-8.93ftUS	-57.85ftUS	0.00ftUS
GPS2 H	GPSantenna2	8.93ftUS	-57.85ftUS	0.00ftUS
PB LEG		-25.50ftUS	-13.00ftUS	0.00ftUS
PS LEG		-25.50ftUS	-62.00ftUS	0.00ftUS
SB LEG		25.50ftUS	-13.00ftUS	0.00ftUS
SS LEG		25.50ftUS	-62.00ftUS	0.00ftUS
Sonar		0.00ftUS	0.00ftUS	0.00ftUS

Seabed Information

Seabed Depth	52.80ft
Comment	

Area Map

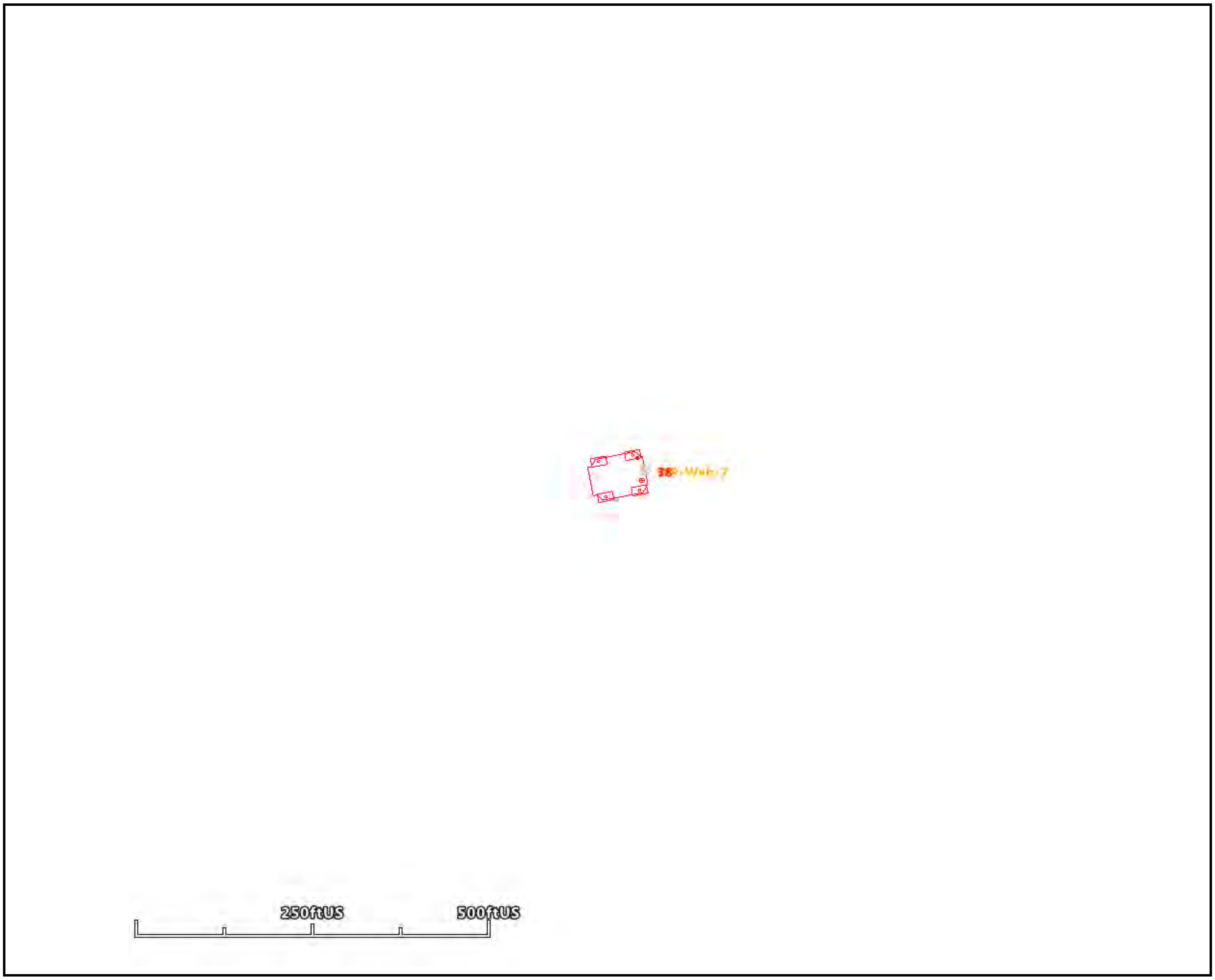


PLATE NO. B-283

APPENDIX C

LOCATION: See Plate 2

COORDINATES: 1509922.214 N
17162948.141 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -80.4' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R.	FAT CLAY (CH): very soft, gray to dark gray, wet, with traces of sand							
3	T		- gray, with sand, below 3'			90	51	51	16	35
5	T									
7	T			-88.4	81		42			

SHEAR STRENGTH (KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5)

☐ Penetrometer ◇ Torvane △ Field Vane
Unconfined ▼ Triaxial ● Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 92.0
Depth to Water (ft) = 10.5
Water Depth (ft) = 81.5
Record Date&Time: 8/1/2018 5:30

DATE: August 1, 2018
TOTAL DEPTH: 8'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 8'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto/A. Bull

LOG OF BORING NO. BH-01
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1507640.985 N
17163994.001 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -79.8' (MLLW)

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
0				SPT	W.O.H		FAT CLAY (CH): very soft, gray to dark gray, wet, with sand								
				T			- with traces of sand, 1.5' to 4'			95	43	52	16	36	◇
5				T											◇
				SPT	W.O.H										
				T											◇
							- with seam of silty sand, 9.3' to 9.6'	-89.1							
10								-89.8		78	44	28	18	10	

Depth scale: 5, 10, 15, 20, 25, 30, 35

Shear strength legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 90.1
Depth to Water (ft) = 10.2
Water Depth (ft) = 79.9
Record Date&Time: 8/1/2018 1:00

DATE: August 1, 2018
TOTAL DEPTH: 10'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 10'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-02
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: See Plate 2 COORDINATES: 1505614.784 N 17165487.048 E (SPCS83 South Texas Zone) MUDLINE EL.: -79.0' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
				SPT	W.O.H		FAT CLAY (CH): very soft, olive gray, with fine sand							
				T			- gray, with sand, with traces of shell frags, 2' to 6'				60	60	16	44
5				T										
				SPT	W.O.H		- gray, witg traces of sand, with traces of shell gragments below 6'							
							SANDY LEAN CLAY (CL): very soft, gray to dark gray, wet, with fine sand, with traces of shell fragments	-87.0						
				T				-88.0		63	24	29	21	8
10														
				T			LEAN CLAY (CL): very soft, gray to dark gray, wet, with traces of sand	-91.0						
15														
20														
25														
30														
35														

SHEAR STRENGTH

☐ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

KIPS PER SQ FT: 0.5 1.0 1.5 2.0 2.5

NOTES:

Depth to Mudline (ft) = 97.0
Depth to Water (ft) = 17.2
Water Depth (ft) = 79.8
Record Date&Time: 7/31/2018 20:30

DATE: July 31, 2018
TOTAL DEPTH: 12'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 12'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull/J. Soto

LOG OF BORING NO. BH-03
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1503638.793 N
17167058.022 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -78.5' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	W.O.H	FAT CLAY (CH): very soft, olive gray, wet, with fine sand							
	T					93	44	53	16	37
5	T		- with traces of shell fragments, 4' to 6'							
	SPT	W.O.H								
	T		- with shell fragments, 8' to 10'							
10						91	44	67	18	49
	T		- with little sand below 10'							
					72		52			
	SPT	W.O.H	- with shell fragments below 12'	-92.0						

SHEAR STRENGTH: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲ — KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

NOTES:
Depth to Mudline (ft) = 89.5
Depth to Water (ft) = 10.3
Water Depth (ft) = 79.2
Record Date&Time: 7/31/2018 12:45

DATE: July 31, 2018
TOTAL DEPTH: 13.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 13.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-04
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1501638.405 N
17168587.604 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -75.9' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0–8	SPT	W.O.H	LEAN CLAY (CL): very soft, gray to olive gray, wet, with sand, with traces of shell fragments						
	T		- with gray to dark gray, 2' to 4'		89	44	49	16	33
5	T		- gray below 4' - with sand, 4' to 8'						
	SPT	W.O.H							
8–14	T		FAT CLAY (CH): very soft, gray, wet, with silt	-83.9					
10	T		- with sand, 8' to 10'						
	T				94	57	52	15	37
14				-89.9					

SHEAR STRENGTH (KIPS PER SQ FT): □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 88.0
Depth to Water (ft) = 11.4
Water Depth (ft) = 76.6
Record Date&Time: 7/31/2018 9:15

DATE: July 31, 2018
TOTAL DEPTH: 14'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 14'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto/A. Bull

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LOG OF BORING NO. BH-05
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1499331.364 N
17169596.93 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -73.7' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	W.O.R	FAT CLAY (CH): very soft, gray, wet, with sand				77	53	16	37
	SPT	W.O.R				85				
5	T									
	SPT	W.O.R	- with seam of sandy clay, gray, wet, with fine sand, 7.2' to 8.4'							
	T		- with traces of sand, 8' to 12'							
10	T					99	57	66	18	48
	SPT	W.O.R								
15	T			-89.7						

SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5): □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 84.0
Depth to Water (ft) = 10.0
Water Depth (ft) = 74.0
Record Date&Time: 7/30/2018 19:31

DATE: July 30, 2018
TOTAL DEPTH: 16'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 16'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-06
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1496999.926 N
17170564.864 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -72.3' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0			LEAN CLAY (CL): very soft, gray							
	T									
	T									
5	T					90	51	48	16	32
	T		- with fine sand, with traces of shell fragments, 6' to 8'							
	T									
10	T		- with clay, below 10'							
	SPT	W.O.R								
15	T									
16	SPT	W.O.R	FAT CLAY (CH): very soft, gray, with silt	-88.3		85	54	62	18	44
17.5				-89.8						

SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5): □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 84.4
Depth to Water (ft) = 11.2
Water Depth (ft) = 73.2
Record Date&Time: 7/30/2018 10:30

DATE: July 30, 2018
TOTAL DEPTH: 17.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 18'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-07
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1494674.019 N
17171542.182 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -72.4' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R	FAT CLAY (CH): very soft, olive gray, wet, with sand							
2	SPT	W.O.R								
4	SPT	W.O.R								
6	T		- with little sand, 6' to 14'			97	55	59	19	40
8	T									
10	SPT	W.O.R								
12	T		LEAN CLAY (CL): very soft, olive gray, wet, with little sand	-84.4		90				
13					75		51	43	15	28
14	T		- with sand below 14'							
16	T		FAT CLAY (CH): very soft, olive gray, wet, with sand and trace shell fragments	-88.4		90	48	60	17	43
18				-90.4						

SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

Legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 85.6
Depth to Water (ft) = 12.1
Water Depth (ft) = 73.5
Record Date&Time: 8/1/2018 11:00

DATE: August 1, 2018
TOTAL DEPTH: 18'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 18'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-08
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	W.O.R	LEAN CLAY (CL): very soft, olive gray, wet, with clean sand at the tip of SPT							
	SPT	W.O.R	- with clean sand layer, 2.8' to 3.3'			88	43	43	15	28
5	T		- with sand , 3.3' to 12'							
	T									
	SPT	W.O.R								
10	T				71		51	70	19	51
	T		SANDY FAT CLAY (CH): very soft, gray, wet, with sand pocket	-82.0						
15	T		FAT CLAY (CH): very soft, olive gray, wet, with sand	-84.0						
	SPT	W.O.R	- with little sand below 18'			92	45	54	16	38
20				-89.5						

LOCATION: See Plate 2

COORDINATES: 1492692.496 N
17173103.771 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -70.0' (MLLW)

SHEAR STRENGTH
□ Penetrometer ◇ Torvane △ Field Vane
Unconfined ▼ Triaxial ● Miniature Vane ▲
KIPS PER SQ FT
0.5 1.0 1.5 2.0 2.5

NOTES:
Depth to Mudline (ft) = 82.8
Depth to Water (ft) = 11.5
Water Depth (ft) = 71.3
Record Date&Time: 8/1/2018 14:45

DATE: August 1, 2018
TOTAL DEPTH: 19.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 19.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-09
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

FUGRO

LOCATION: See Plate 2

COORDINATES: 1490716.505 N
17174674.745 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -67.7' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	W.O.R	LEAN CLAY (CL): very soft, olive gray, wet, with traces of sand,							
			- sandy clay partings, with traces of shell fragments							
	T						27	39	14	25
			- with many shell fragments, 3.8' to 3.9'							
5	T		- with sand pockets below 4'			83				
	SPT	W.O.R	FAT CLAY (CH): very soft, olive gray, wet, with traces of sand, with shell fragments, with silt partings	-73.7						
			- with silty sand seams, 6.2' to 6.7'							
	T		- moist to wet, 8' to 12'							
10			- with traces of shell fragments, 8' to 10'							
	T					94	55	66	19	47
	SPT	W.O.R	- wet, 12' to 16'							
15	T									
	T		- gray to greenish gray, with traces of sand, with traces of shell fragments							
20						96	51	65	18	47
	SPT	W.O.R								
				-89.2						
25										
30										
35										

SHEAR STRENGTH

☐ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

KIPS PER SQ FT: 0.5 1.0 1.5 2.0 2.5

NOTES:

Depth to Mudline (ft) = 79.7
Depth to Water (ft) = 10.8
Water Depth (ft) = 68.9
Record Date&Time: 8/1/2018 20:55

DATE: August 1, 2018
TOTAL DEPTH: 21.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 21.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

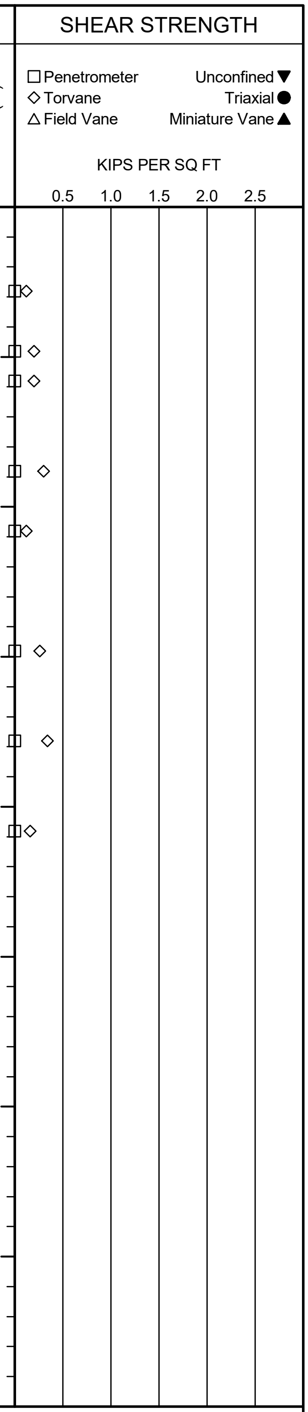
LOG OF BORING NO. BH-10
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0				SPT	W.O.R		LEAN CLAY (CL): very soft, olive gray, wet							
				T										
4							- with seam of silty sand and fine sand, 3.5' to 3.7'			79	40	44	15	29
5				T			- with sand, with silty sand seams and pockets, 4' to 6'							
				SPT	W.O.R									
				T			- with traces of sand, 8' to 10'							
10				T										
				SPT	W.O.R									
							- with seam of silty sand, 13.2' to 13.4'							
15				T			- greenish gray, 14' to 18' -moist to wet, with sand, 14' to 20'			84	39			
							- gray to greenish gray below 18'							
				T			- with traces of shell fragments, 18' to 20'							
20				T			- with traces of sand below 20'							
22								-89.3						

LOCATION: See Plate 2

COORDINATES: 1488757.749 N, 17176274.959 E (SPCS83 South Texas Zone)

MUDLINE EL.: -67.3' (MLLW)



NOTES:
Depth to Mudline (ft) = 79.8
Depth to Water (ft) = 11.6
Water Depth (ft) = 68.2
Record Date&Time: 8/2/2018 1:35

DATE: August 2, 2018
TOTAL DEPTH: 22'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 22'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

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LOG OF BORING NO. BH-11
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

FUGRO

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R	SANDY LEAN CLAY (CL): very soft, olive gray, wet, with sand							
3	T									
5	T					66	35	46	15	31
6	SPT	W.O.R	- with traces of shell fragments at 6'							
7.3			- with 2" of clean sand seam at 7.3'							
9	T									
11	T									
12	SPT	W.O.R								
13.5			- with 2" of clean sand seam at 13.5'	-75.3						
14			LEAN CLAY (CL): very soft, gray, wet, with sand pockets							
15	T		- with shell fragments at 19'				44			
19	T					77	36	31	16	15
23	T		- with shell fragments, 22' to 23'							
24				-85.3						

LOCATION: See Plate 2

COORDINATES: 1486409.073 N 17177213.655 E (SPCS83 South Texas Zone)

MUDLINE EL.: -61.3' (MLLW)

SHEAR STRENGTH — KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

☐ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

NOTES:

Depth to Mudline (ft) = 70.25
Depth to Water (ft) = 7.5
Water Depth (ft) = 62.75
Record Date&Time: 8/2/2018 7:45

DATE: August 2, 2018
TOTAL DEPTH: 24'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 24'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-12

SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1484077.637 N 17178181.587 E (SPCS83 South Texas Zone)

MUDLINE EL.: -62.5' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R	FAT CLAY (CH): very soft, olive gray, wet, with sand pockets							
2	SPT	W.O.R	- with trace shell fragments, 2' to 3.5'				75			
4	T									
6	T					97	46	59	16	43
8	SPT	W.O.R								
10	T		CLAYEY SAND (SC): very loose, olive gray, wet, with clay pockets and traces of shell fragments	-72.5						
12	T									
14	SPT	W.O.R				70	40			
18	T		- gray below 18'							
23	T		SANDY CLAY (CL): very soft, gray, wet, with shell fragments	-85.5						
24			CLAYEY SAND (SC): very loose, gray, wet, with shell fragments	-86.5						
25				-87.5						

SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

Legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 74.2
Depth to Water (ft) = 10.5
Water Depth (ft) = 63.7
Record Date&Time: 8/2/2018 13:00

DATE: August 2, 2018
TOTAL DEPTH: 25'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 25'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-13
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1481703.897 N
17179077.753 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -60.0' (MLLW)

Depth, ft	Sample Type	Blows per Foot	Stratum Description	Stratum Elevation, ft	Unit Dry Wt, pcf	Passing No. 200 Sieve, %	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index (PI)	Shear Strength (kips per sq ft)
0	SPT	W.O.R	FAT CLAY (CH): very soft, olive gray, wet								
			CLAYEY SAND (SC): very loose, olive gray, wet	-61.3							
	SPT	W.O.R									
5	T		FAT CLAY (CH): very soft, olive gray, wet, with sand	-65.0		97	62				◇ Torvane
	T										◇ Torvane
			- with sand seam, 9' to 9.5'								
10	T		- moist to wet, with traces of shell fragments, below 10'			79	48	51	14	37	□ Penetrometer, ◇ Torvane
	T		- with sandy silt seam, 12' to 14			86	29				
15	SPT	26	SILTY SAND (SM): medium dense to dense, gray to olive gray, moist to wet, with fine grained sand	-74.0							
	SPT	11				15					
20			- gray to greenish gray, with shell fragments, 19.2' to 19.5'								
	SPT	44	- dense, gray to dark gray, below 23'								
25	SPT	34									
				-86.5							

Shear strength legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲. KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 71.2
Depth to Water (ft) = 9.8
Water Depth (ft) = 61.4
Record Date&Time: 8/2/2018 18:30

DATE: August 2, 2018
TOTAL DEPTH: 26.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 26.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull/J. Soto

LOG OF BORING NO. BH-14
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1479770.208 N
17180720.495 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -59.6' (MLLW)

STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
LEAN CLAY (CL): very soft, olive gray, wet, with traces of sand, with sandy clay pockets - moist to wet, with sand pockets, below 1'	-62.1						
SILTY SAND (SM): gray to olive gray, wet, with fine sand	-65.3		69	31			
LEAN CLAY (CL): very soft, olive gray, wet - gray to olive gray,with sand pockets, below 7'	-67.6						
SILTY SAND (SM): gray to olive gray, wet, with fine sand, with traces of clay	-69.6						
LEAN CLAY (CL): very soft, gray to greenish gray, moist to wet, with sandy clay pockets, with traces of shell fragments	-72.6		49	32	34	15	19
SILTY SAND (SM): gray to greenish gray, moist to wet, - with fine grained seam of clay, greenish gray, wet, 15' to 15.7' - very loose, gray, wet, fine grained sand, below 18'	-78.9		94				
LEAN CLAY (CL): very soft, gray, wet - soft, moist to wet below 23'	-83.3						
SILTY SAND (SM): loose, gray, wet, fine grained sand - with shell fragments, 24' to 24.3 - dark gray, with traces of shell fragments, below 28'	-89.1		31	29			

DEPTH, FT (approx.)	SAMPLE TYPE	BLOWS PER FOOT
0	SPT	W.O.R
3	T	
5	T	
6	SPT	W.O.R
8	T	
10	SPT	W.O.R
13	T	
15	SPT	7
19	SPT	2
24	SPT	6
29	SPT	6

SHEAR STRENGTH, KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5)

☐ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 71.1
Depth to Water (ft) = 10.2
Water Depth (ft) = 60.9
Record Date&Time: 8/2/2018 23:15

DATE: August 3, 2018
TOTAL DEPTH: 29.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 29.5
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-15
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

Report No. 04.10180080

LOCATION: See Plate 2

COORDINATES: 1477794.217 N
17182291.468 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -58.9' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W. O. R.	SANDY LEAN CLAY (CL): very soft, olive gray, wet, with shell fragments						
2	T		LEAN CLAY (CL): very soft, gray, wet, with sand and shell fragments	-60.9					
4	T		- olive gray below 4'		81	56	43	15	28
6	SPT	W. O. R.							
8	T								
10	T				72				
12	SPT	11	SAND (SP): very loose, olive gray, wet, with shell fragments and little clay	-70.9					
14	SPT	W. O. R.							
18	SPT	3	- with abundant shell fragments			25			
22			- 6" clay layer, 22' to 22.5' - with abundant shell fragments and clay						
24	SPT	3							
28	SPT	3	- with shell fragments and very little to no clay						
32	SPT	13	CLAYEY SAND (SC): medium dense, greenish gray, with shell fragments and calcareous/calcium deposit pockets - olive gray sand (SP) with clay noted at bottom of SPS	-90.9 -92.4	28	20			

SHEAR STRENGTH

☐ Penetrometer — Unconfined ▼
◇ Torvane — Triaxial ●
△ Field Vane — Miniature Vane ▲

KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 71.1
Depth to Water (ft) = 10.5
Water Depth (ft) = 60.6
Record Date&Time: 8/3/2018 6:45

DATE: August 3, 2018
TOTAL DEPTH: 33.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 33'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-16
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	W.O.R.	SANDY LEAN CLAY (CL): very soft, olive gray, wet, high plasticity to 6'							
	SPT	W.O.R.					44	43	15	28
5	T		- gray, 4' to 8'							
	T		- with shell fragments							
	SPT	W.O.R.	- olive gray							
10	SPT	36	SILTY SAND (SM): dense, gray, with shell fragments	-62.6						
	SPT	10	- loose - with abundant shell fragments, 12' to 16'			22	28			
15	SPT	16	- medium dense, 14' to 28'							
	SPT	20	- with shell fragments to 28'							
20–25	SPT	24	- olive gray to 33'			9				
30	SPT	33	- dense, with trace of clay							
35	SPT	19	- medium dense, greenish gray and reddish brown below 33'			26	21			
	SPT			-89.1						

LOCATION: See Plate 2
COORDINATES: 1475902.092 N 17184004.727 E (SPCS83 South Texas Zone)
MUDLINE EL.: -52.6' (MLLW)

SHEAR STRENGTH — KIPS PER SQ FT (0.5, 1.0, 1.5, 2.0, 2.5): □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 64.8
Depth to Water (ft) = 10.8
Water Depth (ft) = 54
Record Date&Time: 8/3/2018 11:45

DATE: August 3, 2018
TOTAL DEPTH: 36.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 36'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-17
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1473486.788 N
17184830.376 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -50.4' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R.	SANDY LEAN CLAY (CL): very soft, olive gray, wet, with shell fragments and sand							
3	T					86	41	40	16	24
5	T		- gray							
7	SPT	W.O.R.	- olive gray with sand seams below 6'							
8			CLAYEY SAND (SC): very soft, olive gray, wet, with shell fragments	-58.4						
9	T		- with clean sand starting at 9.5'							
9.5			SAND (SP): very loose, olive gray, wet, with shell fragments	-59.9						
11	SPT	2				27				
13	SPT	4	- loose, gray, fine grained, with many shell fragments and sandy clay pockets							
13			LEAN CLAY (CL): very soft, gray to greenish gray, moist to wet, with trace sand	-63.4						
15	T			-65.4			28	25	15	10
15			SAND (SP): gray to greenish gray, moist to wet, fine grained, with sandy clay pockets and many shell fragments							
16			LEAN CLAY (CL): very soft, gray to greenish gray, moist	-66.4						
18			SAND (SP): medium dense, gray, wet, fine grained, with shell fragments and trace silt	-68.4						
19	SPT	11				8				
24	SPT	53	- very dense							
28			CLAYEY SAND (SC): very loose, greenish gray, wet, fine grained	-78.4						
29	SPT	0				15				
34	SPT	6								
34			SAND (SP): loose, greenish gray, wet, fine grained, with silt, clay, and shell fragments	-84.4						
37	SPT	10	- with trace silt, trace clay, and trace shell fragments below 37'							
38				-88.4						

SHEAR STRENGTH (KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5)

□ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 62.6
Depth to Water (ft) = 11.1
Water Depth (ft) = 51.5
Record Date&Time: 8/3/2018 16:50

DATE: August 3, 2018
TOTAL DEPTH: 38'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 38'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull/J. Soto

LOG OF BORING NO. BH-18
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %
0–2	SPT	W.O.R.	CLAYEY SAND (SC): very loose, gray to olive gray, wet	-51.3	36	36
2	SPT	10	SAND (SP): loose, gray to olive gray, moist to wet, fine grained - with silt to 6' - olive gray to 12' - with shell fragments to 8'			
4	SPT	7				
6	SPT	24	- medium dense, with clay pockets		36	21
8	SPT	56	- very dense - moist with silt to 12'			
10	SPT	44	- dense			
12	SPT	61	- fine to medium grained, gray, wet - very dense to 24' - with shell fragments to 13' - fine grained to 18' - moist below 14'			
14	SPT	92				
18	SPT	73	- fine to medium grained, gray to light gray, with many shells and shell fragments		7	
23	SPT	40	- fine grained below 24' - dense, gray, with trace silt and trace shell fragments			
28	SPT	56	- gray to greenish gray, with many shell fragments and sandy clay pockets - very dense below 28'			
33	SPT	73	- light gray below 34' - with silt		7	
38	SPT	97		-88.8		

LOCATION: See Plate 2

COORDINATES: 1468718.997 N
17186588.25 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -49.3' (MLLW)

Other columns (not filled): WATER LEVEL, SYMBOL, SAMPLES, % RECOVERY / RQD, UNIT DRY WT, PCF, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX (PI), CLASSIFICATION, SHEAR STRENGTH (□ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲; KIPS PER SQ FT 0.5 1.0 1.5 2.0 2.5)

NOTES:
Depth to Mudline (ft) = 61.5
Depth to Water (ft) = 10.9
Water Depth (ft) = 50.6
Record Date&Time: 8/3/2018 21:55

DATE: August 3, 2018
TOTAL DEPTH: 39.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 40'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-19
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1466847.92 N
17188337.218 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -50.3' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W. O. R.		SILTY SAND (SM): very loose, olive gray, fine grained			25	31			
	SPT	21		- medium dense to 6' fine grained to 10' - with little shells							
5	SPT	12		- with abundant shell fragments to 10'							
	SPT	48		- gray to 12' - dense							
	SPT	68		- very dense to 12'							
10	SPT	50		- with some shell fragments to 18'							
	SPT	20		- medium dense, olive gray			12				
15	SPT	41		- dense, gray to olive gray							
	SPT	48		- very dense, gray, with little shells							
23	SPT	11		SANDY LEAN CLAY (CL): stiff, greenish gray to brown, with sand seams and high plasticity	-73.3		72	28	36	13	23
	SPT	9		- hard with gray sand seams, possibly clay with sand, high plasticity							
33	SPT	50		SAND (SP): very dense, gray, with trace shells	-83.3		13				
35	SPT	50									
36					-86.3						

SHEAR STRENGTH (KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5) — □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 62.5
Depth to Water (ft) = 11.2
Water Depth (ft) = 51.3
Record Date&Time: 8/4/2018 13:00

DATE: August 4, 2018
TOTAL DEPTH: 36.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 36.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-20
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

FUGRO

LOCATION: See Plate 2

COORDINATES: 1464871.929 N
17189908.192 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -51.8' (MLLW)

Depth, ft	Sample Type	Blows per Foot	% Recovery / RQD	Stratum Description	Stratum Elevation, ft	Unit Dry Wt, pcf	Passing No. 200 Sieve, %	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index (PI)	Shear Strength (kips per sq ft)
0	SPT	WOR		SAND (SP): very loose, olive gray, wet			12	27				
	SPT	8		- loose, with trace shell fragments and trace clay	-55.8							
5	SPT	WOR		FAT CLAY (CH): very soft, olive gray, with sand pockets and shells	-56.8							
	SPT	24		SAND (SP): very loose, olive gray, with shell fragments - medium dense, 6' to 12' gray, 6' to 28'								
	SPT	27		- with trace shell fragments								
10	SPT	25										
	SPT	45		- dense, with abundant shells								
15	SPT	77		- very dense, with trace shell fragments			7					
	SPT	28		- medium dense, with abundant shell fragments								
20												
	SPT	31		- with shells and few clay pockets - dense, 23' to 34'								
25												
	SPT	40		- greenish gray to brownish green, with clay			26					
30												
35	SPT	30		- medium dense, greenish gray	-87.8							

Shear strength legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲. KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 66.3
Depth to Water (ft) = 13.2
Water Depth (ft) = 53.1
Record Date&Time: 8/17/2018 07:20

DATE: August 17, 2018
TOTAL DEPTH: 36'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 36'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-21
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %
	SPT	W.O.H.	SAND (SP): very soft, olive gray to dark gray, wet, fine grained, with trace medium grained			
	SPT	6	- loose		7	23
5	SPT	W.O.R.	- very loose, with silt	-44.3		
			LEAN CLAY (CL): very soft, gray to olive gray, moist to wet	-45.3		
	SPT	13	SAND (SP): medium dense, olive gray, wet, fine grained			
	SPT	17	- olive gray to gray - moist to wet to 12'			
10	SPT	26	- gray to 14' - with trace shell fragments			
	SPT	31	- dense, moist, fine to medium grained sand, with many shells and shell fragments			
15	SPT	58	- very dense, moist - with many shells and shell fragments - gray to light gray, fine grained sand to 24'			
	SPT	31	- dense, gray to light gray, moist to wet, with shells and shell fragments		8	25
20						
	SPT	58				
25			- very dense, moist, fine to medium grained sand - gray below 24'			
	SPT	49	- dense, fine grained sand, wet, with partings of organic material at 28.8'			
30						
	SPT	W.O.H.	FAT CLAY (CH): soft, gray to greenish gray, moist, very sticky	-72.3		
35						
	SPT	W.O.H.	- greenish gray to 43'			

LOCATION: See Plate 2

COORDINATES: 1463044.417 N
17191731.071 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -39.3' (MLLW)

Other columns: WATER LEVEL, SYMBOL, SAMPLES, % RECOVERY / RQD, UNIT DRY WT, PCF, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX (PI)

SHEAR STRENGTH: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲ — KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 54.1
Depth to Water (ft) = 13.3
Water Depth (ft) = 40.5
Record Date&Time: 8/6/2018 21:30

DATE: August 6, 2018
TOTAL DEPTH: 48'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 48'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-22
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1463044.417 N
17191731.071 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -39.3' (MLLW)

DEPTH, FT	SAMPLE TYPE	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
44–45	T	- stiff, gray to greenish gray - with seam of shell fragments, 44.4' to 44.6'		74	93	47	97	25	72
46–48	T	SANDY FAT CLAY (CH): stiff, gray to greenish gray, moist, with shells, 46' to 46.5' - with clayey sand pockets below 47'	-85.3 -87.3		53	26			

SHEAR STRENGTH (KIPS PER SQ FT): □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

Depth scale: 45, 50, 55, 60, 65, 70, 75

NOTES:
Depth to Mudline (ft) = 54.1
Depth to Water (ft) = 13.3
Water Depth (ft) = 40.5
Record Date&Time: 8/6/2018 21:30

DATE: August 6, 2018
TOTAL DEPTH: 48'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 48'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-22
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: See Plate 2

COORDINATES: 1460094.874 N
17191650.348 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -47.0' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
0	SPT	16	SANDY LEAN CLAY (CL): soft, black to light gray, wet	-47.5							
	SPT	25	SAND (SP): medium dense, light gray, wet, fine grained			5	24				
			- greenish gray, 2.6' to 3.5'								
			- gray and greenish gray at 4'								
5	SPT	33	- dense, 4' to 7.5'								
	SPT	41	- gray, 6' to 9.5'								
	SPT	22	- medium dense at 8'								
10	SPT	43	- dense, gray and dark gray, with trace shell fragments at 10'								
	SPT	8	- loose at 12'								
			- gray below 12'								
15	SPT	31	- dense at 14'								
18	SPT	5	FAT CLAY (CH): medium stiff, gray to olive gray, moist, with trace sand pockets and seams	-65.0			46	72	21	51	Penetrometer 1.0
23			SAND (SP): gray, wet, fine grained, with trace shell fragments	-70.0							
25	T										
28	SPT	8	- loose, gray to dark gray, with organic matter intermixed at 28'								
33	SPT	12	CLAYEY SAND (SC): medium dense, greenish gray to olive, wet, fine grained, with shell fragments	-80.0		14					
38	SPT	16		-85.0							

SHEAR STRENGTH legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 61.1
Depth to Water (ft) = 12.8
Water Depth (ft) = 48.3
Record Date&Time: 8/15/2018 20:45

DATE: August 16, 2018
TOTAL DEPTH: 41.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-26
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: See Plate 2 COORDINATES: 1460094.874 N 17191650.348 E (SPCS83 South Texas Zone) MUDLINE EL.: -47.0' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH, KIPS PER SQ FT
				SPT	36		SAND (SP): medium dense, greenish gray, wet, fine grained, with shells, shell fragments, and trace clay - dense, gray to greenish gray, moist to wet at 40' - with shell fragments 40' to 40.6'	-88.5							

CLASSIFICATION

SHEAR STRENGTH: □ Penetrometer ◇ Torvane △ Field Vane; Unconfined ▼ Triaxial ● Miniature Vane ▲; KIPS PER SQ FT 0.5 1.0 1.5 2.0 2.5

Depth scale: 45, 50, 55, 60, 65, 70, 75

NOTES:
Depth to Mudline (ft) = 61.1
Depth to Water (ft) = 12.8
Water Depth (ft) = 48.3
Record Date&Time: 8/15/2018 20:45

DATE: August 16, 2018
TOTAL DEPTH: 41.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 41.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

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LOG OF BORING NO. BH-26
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: See Plate 2 COORDINATES: 1458663.804 N 17193161.142 E (SPCS83 South Texas Zone) MUDLINE EL.: -65.5' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
				SPT	W.O.R.		CLAYEY SAND (SC): very loose, olive gray, with shells								
				SPT	12		- medium dense, greenish gray to light gray at 2'								
							- with clean sand starting at 3.4'	-68.9		54	22				
5				SPT	5		SILTY SAND (SM): loose, gray, wet, with trace shell fragments								
				SPT	9		- gray to brownish gray, with shells at 6'								
				SPT	10		- gray to light gray, with few shells at 8'								
10				SPT	15		- gray at 10' - medium dense below 10'								
				SPT	12		- gray and brown, 12' to 15.5' - wet at 12'								
15				SPT	16		- with gravel, 15.3' to 18.2'			16					
				SPT	20		- brownish gray to gray at 18'								
20															
				SPT	24		-								
25								-90.5							
30															
35															

Shear strength legend: □ Penetrometer, ◇ Torvane, △ Field Vane; Unconfined ▼, Triaxial ●, Miniature Vane ▲. Scale: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 79.9
Depth to Water (ft) = 13.1
Water Depth (ft) = 66.8
Record Date&Time: 8/15/2018 17:10

DATE: August 15, 2018
TOTAL DEPTH: 25'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 25'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-27
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: Aransas Pass COORDINATES: 1457292.035 N 17194377.851 E (SPCS83 South Texas Zone) MUDLINE EL.: -74.0' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
				SPT	W. O. R.		SILTY SAND (SM): very loose, black to olive gray and light gray, wet, fine grained, with calcareous particles, 1.3' to 1.5' - loose, 2' to 8' - gray to greenish gray, 2' to 8' - sulfur odor coming from drill area at 4'							
				SPT	8					16	25			
5				SPT	10									
				SPT	9									
				SPT	12		- medium dense, 8' to 14' - gray to olive, 8' to 12'							
10				SPT	13									
				SPT	17		- green to greenish gray, 12' to 23' - with plot of shell fragments at 13' - with rock fragments, 12.4' to 12.7' - moist to wet at 14' - dense, 14' to 19.5'							
15				SPT	39					17				
				SPT	44		- gray to greenish gray, moist at 18' - with calcareous particles, 18.8' to 19'							
20														
				SPT	58		- very dense, olive to olive green at 23' - wet below 23'							
25				SPT	41		- dense, gray to greenish gray at 25'	-100.5						
30														
35														

SHEAR STRENGTH

☐ Penetrometer ◇ Torvane △ Field Vane — Unconfined ▼ Triaxial ● Miniature Vane ▲

KIPS PER SQ FT: 0.5 1.0 1.5 2.0 2.5

NOTES:
Depth to Mudline (ft) = 88.3
Depth to Water (ft) = 13.2
Water Depth (ft) = 75.1
Record Date&Time: 8/12/2018 02:00

DATE: August 12, 2018
TOTAL DEPTH: 26.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 26.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-28C
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: Aransas Pass

COORDINATES: 1455562.455 N
17194989.156 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -50.3' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
0	SPT	W.O.R.	SILTY SAND (SM): very loose, olive gray, with shell fragments								
2	SPT	9	- loose, 2' to 6' - dark gray, 2.5' to 7.3'			6	28				
4	SPT	10	- organic order, 4' to 8'								
6	SPT	31	- dense at 6' - brown, 7.3' to 11'								
8	SPT	23	- medium dense below 8' - with shells, 8' to 14'								
10	SPT	15	- dark gray at 11' - olive gray at 12'								
12	SPT	19				20					
14	SPT	14	- greenish gray, with some shells, 14' to 19.5'								
18	SPT	13									
23	SPT	11	- light gray, with cemented sand nodules and trace of clay at 23'								
28	SPT	19	LEAN CLAY (CL): very stiff to hard, brown to light gray, with sand partings	-78.3		74	21	46	15	31	Penetrometer >2.5
34	SPT	83	SAND (SP): very dense, gray, moist, fine grained	-84.3							
35.5				-85.8							

Legend: □ Penetrometer ◇ Torvane △ Field Vane ▼ Unconfined ● Triaxial ▲ Miniature Vane

NOTES:
Depth to Mudline (ft) = 63.5
Depth to Water (ft) = 11.7
Water Depth (ft) = 51.8
Record Date&Time: 8/10/2018 15:00

DATE: August 10, 2018
TOTAL DEPTH: 35.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 35.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-29B
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: Aransas Pass

COORDINATES: 1453435.814 N
17195973.571 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -55.1' (MLLW)

DEPTH, FT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT
0–6	SANDY FAT CLAY (CH): medium dense, greenish gray to brown and gray, with few shells - with shell fragments below 2' - loose, greenish gray and brown at 4'	-61.1
6–9	SAND (SP): loose, greenish gray to brown, with trace clay - medium dense, brown with some greenish gray, with some clay at 8 '	-64.1
9–14	FAT CLAY (CH): very stiff, brown to greenish gray, with sand pockets - hard, with sand seams, 11' to 14'	-69.1
14–18	CLAYEY SAND (SC): medium dense, greenish gray to brown, moist, fine grained	-73.1
18–34	SILTY SAND (SM): medium dense, light gray, moist to wet, fine grained, with trace clay and trace silt - with calcareous particles, 18.5' to 18.7' - olive. 18.7' to 24.1' - moist, with shell fragments at 23' - greenish gray, 24.1' to 24.5' - olive to brown, with silt at 28' - with clay, 29.3' to 29.5'	-89.1
34–36	SANDY FAT CLAY (CH): very stiff, brown to gray, with shells	-91.1

DEPTH, FT (approx.)	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH, KIPS PER SQ FT
0	SPT	W. O. R.								
2	SPT	16			53	21				
4	SPT	6								
6	SPT	7								
8	SPT	12								
10	T			108	89	21	59	17	42	Penetrometer □; Triaxial ● 5.8
12	SPT	35								
14	SPT	21								
18	SPT	21			14	22				
23	SPT	25								
28	SPT	23								
34	SPT	11								

SHEAR STRENGTH legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲ — KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 67.5
Depth to Water (ft) = 11.0
Water Depth (ft) = 56.5
Record Date&Time: 8/9/2018 14:15

DATE: August 9, 2018
TOTAL DEPTH: 36'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 36'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull/J. Soto

LOG OF BORING NO. BH-30
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: Aransas Pass COORDINATES: 1453890.358 N 17196664.533 E (SPCS83 South Texas Zone) MUDLINE EL.: -47.2' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
0				SPT	W.O.R.		SAND (SP): very loose, olive gray to brown and greenish gray, with shell fragments - with gravels at top 3"								
2				SPT	18		- medium dense below 2' - brown, olive gray, and green, statified, with trace shells and gravel at 2'			5	23				
4				SPT	15		- cemented seam (2") at 5'								
6				SPT	23		- grayish brown and brown, with 3" sandy clay seam at 6'								
8				SPT	20		- brown, with fine shell fragments at 8'								
10				SPT	9		- olive gray, with abundant shell fragments at 10'	-57.7		63	22				
12				SPT	6		SANDY FAT CLAY (CH): soft, greenish gray to gray, with shell fragments	-59.5							
14				SPT	3		SAND (SP): loose, greenish gray, with shell fragments and trace clay - very loose, brown, 14' to 15.5'								
18				SPT	8		- with trace clay at 18'								
23				SPT	23		FAT CLAY (CH): hard, greenish gray to brown, with sand partings	-70.2			21	66	19	47	Penetrometer >2.5
28				SPT	29		SAND (SP): medium dense, gray to brown, wet, stratified	-75.2							
33				SPT	15		- greenish brown below 33'								
38				SPT	23										
40								-87.2							

Shear strength legend: □ Penetrometer; ◇ Torvane; △ Field Vane; Unconfined ▼; Triaxial ●; Miniature Vane ▲. Scale: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 60.5
Depth to Water (ft) = 11.6
Water Depth (ft) = 48.9
Record Date&Time: 8/12/2018 11:30

DATE: August 12, 2018
TOTAL DEPTH: 40'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 40'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

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LOG OF BORING NO. BH-31
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: Aranssas Pass

COORDINATES: 1452059.924 N
17197460.882 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -61.7' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %
	SPT	W. O. R.	SANDY FAT CLAY (CH): firm, greenish gray, with shells and gravel	-63.7		22
	SPT	2	SAND (SP): very loose, greenish gray, with some clay		31	
5	SPT	4		-67.7		
	SPT	7	CLAYEY SAND (SC): loose, greenish gray to gray	-69.7		
	SPT	11	SAND (SP): medium dense, greenish gray, with trace clay			
10	SPT	25	- with clay pockets, calcareous nodules, ferrous stains, and gravel at 10'		59	
	SPT	21	- with cemented sand nodules, 12' to 19.5'			
15	SPT	7				
	SPT	14				
20						
	SPT	12	- brown, with clay pockets at 23' - with sandy clay starting at 25'	-86.7		
25						

Other columns: WATER LEVEL, SYMBOL, SAMPLES, % RECOVERY / RQD, UNIT DRY WT, PCF, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX (PI) — CLASSIFICATION; SHEAR STRENGTH (☐ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲; KIPS PER SQ FT 0.5 1.0 1.5 2.0 2.5)

NOTES:
Depth to Mudline (ft) = 73.4
Depth to Water (ft) = 10.3
Water Depth (ft) = 63.1
Record Date&Time: 8/13/2018 15:25

DATE: August 13, 2018
TOTAL DEPTH: 25'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 25'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-32
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	LOCATION: Aransas Pass COORDINATES: 1451149.414 N 17197277.613 E (SPCS83 South Texas Zone) MUDLINE EL.: -26.5' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	10	FILL: loose, gray to black, FILL: Concrete							
	SPT	5	CLAYEY SAND (SC): loose, gray, fine to medium grained, with shells	-28.5		15				
5	SPT	W.O.H.	- very loose below 4'							
	SPT	W.O.H.	- with shell fragments and sulfur odor at 6'			17				
	SPT	6	LEAN CLAY (CL): medium stiff, greenish gray, moist, with sand and trace shell fragments	-34.5			21			
10	SPT	10	CLAYEY SAND (SC): loose, greenish gray to white, moist to wet, with calcium nodules	-36.5						
	SPT	7	- calcareous nodules							
15	SPT	12	- light gray to gray, with white pockets and trace clay at 14' - medium dense, 14' to 19.5'			13				
	SPT	16	- gray and tan, wet at 18' - with seam of clay, 19' to 19.1'							
20										
	SPT	33	- dense, brown, moist at 23'							
25										
	SPT	5	SANDY LEAN CLAY (CL): medium stiff, greenish gray to brown, moist to wet, with shell fragments	-54.5			23	27	15	12
30										
	SPT	8	CLAYEY SAND (SC): loose, gray to tan, wet, fine grained, with trace shell fragments - borderline sand with clay	-59.5						
35										
	SPT	6		-65.2						
				-66.2						

SHEAR STRENGTH: □ Penetrometer ◇ Torvane △ Field Vane; Unconfined ▼ Triaxial ● Miniature Vane ▲ — KIPS PER SQ FT: 0.5 1.0 1.5 2.0 2.5

NOTES:
Depth to Mudline (ft) = 36.7
Depth to Water (ft) = 8.2
Water Depth (ft) = 28.5
Record Date&Time: 8/9/2018 02:20

DATE: August 9, 2018
TOTAL DEPTH: 72.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 72.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto/A. Bull

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LOG OF BORING NO. BH-33
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

Report No. 04.10180080

LOCATION: Aransas Pass

COORDINATES: 1451149.414 N
17197277.613 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -26.5' (MLLW)

SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
			LEAN CLAY (CL): medium stiff, greenish gray to brown, moist								
			CLAYEY SAND (SC): loose, gray to greenish gray, wet, fine grained, with trace shell fragments	-69.5							
SPT	16		FAT CLAY (CH): very stiff, olive to greenish gray, moist, with trace sand and red streaks				23				
SPT	21		SAND (SP): medium stiff, gray, wet, with fine to medium grain sand	-74.5		13					
SPT	64		- very dense, 53' to 64.2'								
SPT	75		- fine grain, light gray below 58'								
SPT	68										
SPT	42		- dense, with trace clay and trace shell fragments at 68'								
SPT	64		- very dense, with shell fragments at 72'	-99.0							

DEPTH, FT: 45, 50, 55, 60, 65, 70, 75

SHEAR STRENGTH legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲; KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 36.7
Depth to Water (ft) = 8.2
Water Depth (ft) = 28.5
Record Date&Time: 8/9/2018 02:20

DATE: August 9, 2018
TOTAL DEPTH: 72.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 72.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto/A. Bull

LOG OF BORING NO. BH-33
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

FUGRO

LOCATION: Aransas Pass

COORDINATES: 1451492.362 N
17198051.824 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -52.6' (MLLW)

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH, KIPS PER SQ FT
0				SPT	WOR		SILTY SAND (SM): very loose, grayish brown, with shell fragments								
				SPT	9		- loose, 2' to 6'			20					
5				SPT	6		- greenish gray, 4' to 10' - with shells below 4'								
				SPT	4		- very loose								
				SPT	12		- medium dense, with clay at 8'								
10				SPT	14		CLAYEY SAND (SC): medium dense, greenish gray to brown	-62.6		50					
				T			- very stiff, brown sand and greenish gray clay pockets, with ferrous staining at 12'								2.2 (Penetrometer)
15				T			SANDY FAT CLAY (CH): very stiff, greenish gray to brown, with shells, 15' to 16'	-66.6			21	64	19	45	1.8 (Penetrometer)
				SPT	22		SILTY SAND (SM): medium dense, greenish gray, fine grained	-70.6		21					
25				SPT	30		- dense at 23' - light gray below 23'								
				SPT	28		- medium dense below 28'								
35				SPT	15			-88.6							

Shear strength legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲. Scale: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 65.7
Depth to Water (ft) = 11.5
Water Depth (ft) = 54.2
Record Date&Time: 8/12/2018 15:15

DATE: August 12, 2018
TOTAL DEPTH: 36'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 36'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-34
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

FUGRO

LOCATION: Aransas Pass

COORDINATES: 1450228.13 N, 17197855.77 E (SPCS83 South Texas Zone)

MUDLINE EL.: -59.5' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
0	SPT	W.O.R.		CLAYEY SAND (SC): very loose, gray to greenish gray, wet, fine grained, with shell fragments			26	24			
	SPT	W.O.R.		SANDY LEAN CLAY (CL): very soft, greenish gray, moist, with tan pockets, shell fragments, and sand pockets	-61.5			20	29	12	17
5	T			SAND (SP): greenish gray, moist to wet, with clay	-63.5						
	SPT	13		SANDY LEAN CLAY (CL): stiff, greenish gray, moist, with clayey sand seams and pockets	-65.5						
	SPT	11						24	34	14	20
10	SPT	22									
	SPT	20		FAT CLAY (CH): very stiff, brown to light gray, moist	-71.5						
15	T			- hard, with sand partings and trace calcareous particles at 14'				24	73	22	51
	T			CLAYEY SAND (SC): light gray, wet, fine grained	-77.5						
20							15				
	SPT	31		SAND (SP): dense, brown to gray, wet, fine grained	-83.6						
25											
	SPT	15		- medium dense, olive gray and greenish gray at 27' - with sandy clay seam, 27.1' to 27.2'	-87.0						
30											
35											

SHEAR STRENGTH (KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5)

□ Penetrometer ◇ Torvane △ Field Vane; Unconfined ▼ Triaxial ● Miniature Vane ▲

NOTES:

Depth to Mudline (ft) = 70.4
Depth to Water (ft) = 10.1
Water Depth (ft) = 60.3
Record Date&Time: 8/13/2018 19:00

DATE: August 12, 2018
TOTAL DEPTH: 27.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 27.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

LOG OF BORING NO. BH-35

SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH, KIPS PER SQ FT
	SPT	W.O.R.		CLAYEY SAND (SC): very loose, gray to dark gray			21	35				
	SPT	W.O.R.		- with shell fragments								
5	SPT	W.O.R.		- dark gray and gray (stratified), with trace of clay								
	T			- with clay pockets, 6.5' to 7'								
	SPT	8		- loose, greenish gray, with shell fragments, 8' to 18'								
10	SPT	2		- with trace of clay, 8' to 12' - very loose			26	20				
	SPT	2		- greenish gray below 12'								
15	SPT	9		- loose, with 4" shell layer starting at 14.8'								
	SPT	9		SANDY FAT CLAY (CH): very stiff, brown, with sand pockets	-63.5							Penetrometer ≈1.5
20												
	T			- brown, light gray, and greenish gray - hard below 23'								Penetrometer ≈2.5
25						101	99	25 23	73	23	50	Triaxial 5.2
	T			- greenish gray and brown, with white calcareous nodules and clear cementitious nodules								Penetrometer
30												
	SPT	42		SAND (SP): dense, brown, with clay	-78.5							
35												
	SPT	21		- medium dense, light gray and brown - with shell fragments below 38'								

LOCATION: Aransas Pass
COORDINATES: 1448852.609 N
17197688.622 E
(SPCS83 South Texas Zone)
MUDLINE EL.: -45.5' (MLLW)

SHEAR STRENGTH legend: □ Penetrometer, ◇ Torvane, △ Field Vane; Unconfined ▼, Triaxial ●, Miniature Vane ▲
KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

NOTES:
Depth to Mudline (ft) = 58.0
Depth to Water (ft) = 11.0
Water Depth (ft) = 47.0
Record Date&Time: 8/6/2018 13:20

DATE: August 8, 2018
TOTAL DEPTH: 41.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0 to 41.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-36
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

DEPTH, FT	WATER LEVEL	SYMBOL	SAMPLES	SAMPLE TYPE	BLOWS PER FOOT	% RECOVERY / RQD	LOCATION: Aransas Pass COORDINATES: 1448852.609 N 17197688.622 E (SPCS83 South Texas Zone) MUDLINE EL.: -45.5' (MLLW) STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
				SPT	47		- olive gray and brown	-87.0		24	23				

Shear strength legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲. KIPS PER SQ FT: 0.5, 1.0, 1.5, 2.0, 2.5

Depth scale: 45, 50, 55, 60, 65, 70, 75

NOTES:
Depth to Mudline (ft) = 58.0
Depth to Water (ft) = 11.0
Water Depth (ft) = 47.0
Record Date&Time: 8/6/2018 13:20

DATE: August 8, 2018
TOTAL DEPTH: 41.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0 to 41.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-36
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: Aransas Pass

COORDINATES: 1448180.061 N
17198257.072 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -67.2' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)	SHEAR STRENGTH (KIPS PER SQ FT)
0–4	SPT	W.O.R. W.O.R.	SANDY LEAN CLAY (CL): very stiff, tan to light gray			28	38	12	26	Penetrometer ~1.7
4			SILTY SAND (SM): loose, greenish gray to brown, fine grained	-71.2						
5	T									
6	SPT	23	- greenish gray, brown and light gray - medium dense to 10'		12	24				
8	SPT	17	- greenish brown							
10	SPT	9	- loose, greenish brown and light gray							
12	SPT	17	- medium dense, 12' to 16', brownish gray - with shell fragments below 12'							
14	SPT	27	- grayish brown							
18	SPT	37	- dense, brown to 19', gray below 19'		16	22				
22	SPT	46								
23.5				-90.7						

Shear strength legend: □ Penetrometer, ◇ Torvane, △ Field Vane, Unconfined ▼, Triaxial ●, Miniature Vane ▲

NOTES:
Depth to Mudline (ft) = 78.8
Depth to Water (ft) = 9.8
Water Depth (ft) = 69.0
Record Date&Time: 8/8/2018 10:10

DATE: August 8, 2018
TOTAL DEPTH: 23.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0 to 23.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: A. Bull

LOG OF BORING NO. BH-37
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION: Aransas Pass

COORDINATES: 1447038.105 N
17197646.706 E
(SPCS83 South Texas Zone)

MUDLINE EL.: -52.0' (MLLW)

DEPTH, FT	SAMPLE TYPE	BLOWS PER FOOT	STRATUM DESCRIPTION	STRATUM ELEVATION, FT	UNIT DRY WT, PCF	PASSING NO. 200 SIEVE, %	WATER CONTENT, %	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX (PI)
	SPT	6	SAND (SP): loose, gray to dark gray, wet, with shells and shell fragments - with clay seam, 1.2' to 1.3'	-54.0		9	31			
	SPT	28	CLAYEY SAND (SC): medium dense, gray, wet, fine grained							
5	SPT	13	medium dense, gray to white, with course sand to fine gravel sized shell fragments and medium grain sand	-57.2		25	18	21	12	9
	SPT	36	- hard, light gray to greenish gray at 7'							
	SPT	24								
10	SPT	39	- borderline sandy clay	-64.0		24	18			
	SPT	18	FAT CLAY (CH): very stiff, light gray to brown, moist							
15	T		- hard below 14' - with silty sand partings at 14' - with pockets of shell fragments, 14' to 15'		98		25	43	14	29
	T		- slickensided, 18 to 18.5' - with sand partings and pockets, 18.5' to 20'	-75.0						
20										
25	SPT	18	SANDY FAT CLAY (CH): very stiff, light gray to greenish gray, moist, with brown pockets	-80.0			17			
30	SPT	25	SAND (SP): medium dense, gray to greenish gray, moist, fine grained							
35	SPT	21		-86.5						

SHEAR STRENGTH

□ Penetrometer ◇ Torvane △ Field Vane
Unconfined ▼ Triaxial ● Miniature Vane ▲

KIPS PER SQ FT
0.5 1.0 1.5 2.0 2.5

NOTES:
Depth to Mudline (ft) = 62.2
Depth to Water (ft) = 9.4
Water Depth (ft) = 51.8
Record Date&Time: 8/13/2018 20:20

DATE: August 13, 2018
TOTAL DEPTH: 34.5'
CAVED DEPTH: Not Applicable
DRY AUGER: Not Applicable
WET ROTARY: 0' to 34.5'
BACKFILL: NONE
HAMMER TYPE: Automatic Trip
LOGGER: J. Soto

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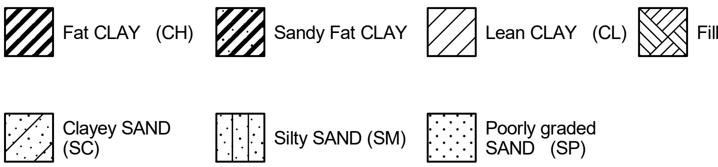
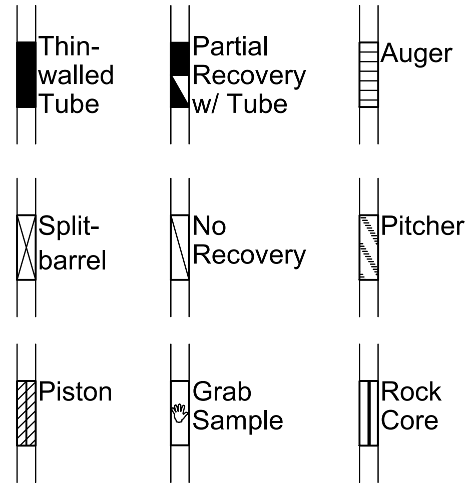
LOG OF BORING NO. BH-38
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

SOIL TYPES



SAMPLER TYPES

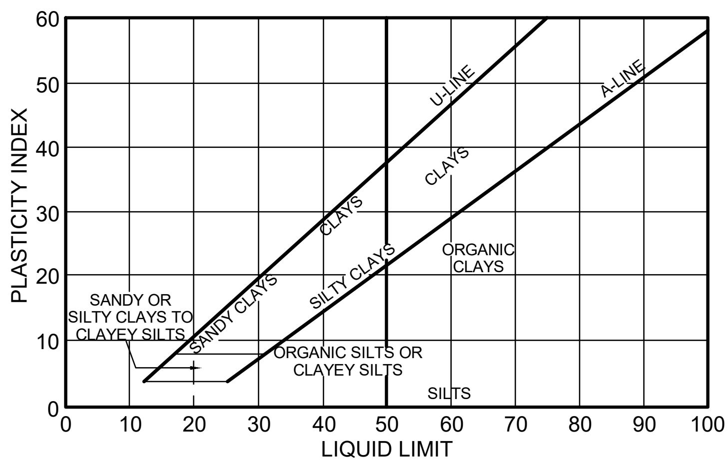


SOIL GRAIN SIZE

U.S. Standard Sieve

	6"		3"		3/4"		4		10		40		200		
Boulders		Cobbles		Gravel				Sand						Silt	Clay
				Coarse		Fine		Coarse		Medium		Fine			
	152		76.2		19.1		4.76		2.00		0.420		0.074	0.002	(mm)

PLASTICITY CHART



SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

TERMS AND SYMBOLS USED ON BORING LOGS

SOIL CLASSIFICATION (1 of 2)

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

DENSITY OF GRANULAR SOILS

Descriptive Term	*Relative Density, %	**Blows Per Foot (SPT)
Very Loose	< 15	0 to 4
Loose	15 to 35	5 to 10
Medium Dense	35 to 65	11 to 30
Dense	65 to 85	31 to 50
Very Dense	> 85	> 50

*Estimated from sampler driving record.
**Requires correction for depth, groundwater level, and grain size.

STRENGTH OF COHESIVE SOILS

Term	Undrained Shear Strength, ksf	Blows Per Foot (SPT) (approximate)
Very Soft	< 0.25	0 to 2
Soft	0.25 to 0.50	2 to 4
Firm	0.50 to 1.00	4 to 8
Stiff	1.00 to 2.00	8 to 16
Very Stiff	2.00 to 4.00	16 to 32
Hard	> 4.00	> 32

SHEAR STRENGTH TEST METHOD

U - Unconfined Q = Unconsolidated - Undrained Triaxial

P = Pocket Penetrometer T = Torvane V = Miniature Vane F = Field Vane

HAND PENETROMETER CORRECTION

Our experience has shown that the hand penetrometer generally overestimates the in-situ undrained shear strength of over consolidated Pleistocene Gulf Coast clays. These strengths are partially controlled by the presence of macroscopic soil defects such as slickensides, which generally do not influence smaller scale tests like the hand penetrometer. Based on our experience, we have adjusted these field estimates of the undrained shear strength of natural, overconsolidated Pleistocene Gulf Coast soils by multiplying the measured penetrometer reading by a factor of 0.6. These adjusted strength estimates are recorded in the "Shear Strength" column on the boring logs. Except as described in the text, we have not adjusted estimates of the undrained shear strength for projects located outside of the Pleistocene Gulf Coast formations.

Information on each boring log is a compilation of subsurface conditions and soil or rock classifications obtained from the field as well as from laboratory testing of samples. Strata have been interpreted by commonly accepted procedures. The stratum lines on the logs may be transitional and approximate in nature. Water level measurements refer only to those observed at the time and places indicated, and can vary with time, geologic condition, or construction activity.

TERMS AND SYMBOLS USED ON BORING LOGS

SOIL CLASSIFICATION (2 of 2)

APPENDIX D

Laboratory Test Results

APPENDIX D1

Summary of Test Results

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	ESTIMATED STRENGTH PP S_u, ksf	ESTIMATED STRENGTH TV S_u, ksf	UU TRIAXIAL S_u, ksf	UU TRIAXIAL Remold S_u, ksf	CU TRIAXIAL C', ksf	CU TRIAXIAL PHI' deg	DRAINED STRENGTH (DS or DSS Test) C' ksf	DRAINED STRENGTH (DS or DSS Test) PHI' deg	MINIMUM DRY DENSITY pcf	MAXIMUM DRY DENSITY pcf	CORROSIVITY TESTS R ohm-cm	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl^- ppm	CORROSIVITY TESTS SO_4^{2-} ppm	CORROSIVITY TESTS S^{2-} ppm	CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
BH-01	3.0									0.1																	t
BH-01	4.0	51				90	51	35	0.0																		M, A, S, FC, p
BH-01	5.0									0.1																	t
BH-01	6.0								0.0																		p
BH-01	7.0									0.1																	t
BH-01	8.0	42	115.0	81.1					0.0																		M, T, Qu, p
BH-02	3.0									0.1																	t
BH-02	3.5	43				95	52	36																			M, A, S, FC
BH-02	5.0									0.2																	t
BH-02	9.0									0.2																	t
BH-02	10.0	44				78	28	10																			M, A, S, FC
BH-03	3.0	60					60	44	0.0	0.2																	M, A, p, t
BH-03	5.0								0.0	0.2																	p, t
BH-03	9.0	24				63	29	8																			M, A, S, FC
BH-03	10.0								0.0	0.2																	p, t
BH-03	11.0								0.0	0.2																	p, t
BH-03	12.0								0.0	0.2																	p, t
BH-04	3.0	44				93	53	37	0.0	0.2																	M, A, S, FC, p, t
BH-04	4.0								0.0																		p
BH-04	5.0									0.2																	t
BH-04	9.0									0.2																	t
BH-04	10.0	44				91	67	49	0.0																		M, A, S, FC, p
BH-04	11.0								0.0	0.3																	p, t
BH-04	12.0	52	110.0	72.4					0.0		0.2																M, T, p, U
BH-05	3.0	44				89	49	33		0.1																	M, A, S, FC, t
BH-05	4.0								0.0																		p
BH-05	5.0									0.2																	t
BH-05	6.0								0.0																		p
BH-05	9.0									0.1																	t
BH-05	10.0								0.0																		p

Classification Tests
LL = Liquid Limit
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NP = Non-Plastic
*Oven-Dried Specimen

Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
M = Moisture Content
T = Total & Dry Unit Weight
S = Sieve Analysis
FC = % Passing #200 Sieve
H = Hydrometer Analysis
A = Atterberg Limits
DS = Direct Shear
DSS = Direct Simple Shear
C = Consolidation
Cb = Percent Carbonate
CDSS = Cyclic DSS
Co = Corrosivity
CU = CU Triaxial
OC = Organic Content
MM = Min/Max
Pm = Permeability
RC = Resonant Column
SG = Specific Gravity
TC = Thermal Conductivity
U = UU Triaxial (intact)
Ur = UU Triaxial (remolded)
XR = X-Ray Radiography
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SUMMARY OF TEST RESULTS
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CORPUS CHRISTI, TEXAS

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	ESTIMATED STRENGTH PP S_u, ksf	ESTIMATED STRENGTH TV S_u, ksf	UU TRIAXIAL S_u, ksf	UU TRIAXIAL Remold S_u, ksf	CU TRIAXIAL C', ksf	CU TRIAXIAL PHI' deg	DRAINED STRENGTH (DS or DSS Test) C' ksf	DRAINED STRENGTH (DS or DSS Test) PHI' deg	MINIMUM DRY DENSITY pcf	MAXIMUM DRY DENSITY pcf	CORROSIVITY TESTS R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm	CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
BH-05	11.0									0.1																	t
BH-05	12.0								0.0																		p
BH-05	13.0	57				94	52	37		0.1																	M, A, S, FC, t
BH-05	14.0								0.0																		p
BH-06	1.5	77					53	37																			M, A
BH-06	3.5					85																					S, FC
BH-06	5.0									0.0																	t
BH-06	9.0									0.0																	t
BH-06	10.0									0.0																	t
BH-06	11.0									0.3																	t
BH-06	11.5	57				99	66	48																			M, A, S, FC
BH-06	15.0									0.3																	t
BH-07	2.0									0.0																	t
BH-07	4.0									0.0																	t
BH-07	5.0	51				90	48	32																			M, A, S, FC
BH-07	6.0									0.0																	t
BH-07	8.0									0.0																	t
BH-07	10.0									0.0																	t
BH-07	12.0									0.0																	t
BH-07	16.0									0.0																	t
BH-07	17.5	54				85	62	44																			M, A, S, FC
BH-08	7.0	55				97	59	40		0.2																	M, A, S, FC, t
BH-08	8.0								0.0																		p
BH-08	9.0									0.2																	t
BH-08	10.0								0.0																		p
BH-08	13.0					90				0.3																	S, t
BH-08	14.0	51	113.3	75.2			43	28	0.0		0.2																M, T, A, p, U
BH-08	15.0									0.4																	t
BH-08	16.0								0.0																		p
BH-08	17.0	48				90	60	43		0.3																	M, A, S, FC, t

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Pm = Permeability
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CORPUS CHRISTI, TEXAS

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BH-08	18.0								0.0																		p
BH-09	3.5	43				88	43	28																			M, A, S, FC
BH-09	5.0									0.4																	t
BH-09	6.0								0.0																		p
BH-09	7.0									0.3																	t
BH-09	8.0								0.0																		p
BH-09	11.0									0.2																	t
BH-09	12.0	51	106.5	70.5			70	51	0.0																		M, T, A, Qu, p
BH-09	13.0									0.3																	t
BH-09	14.0								0.0																		p
BH-09	15.0									0.2																	t
BH-09	16.0								0.0																		p
BH-09	19.5	45				92	54	38																			M, A, S, FC
BH-10	3.0									0.2																	t
BH-10	4.0	27					39	25																			M, A
BH-10	5.0									0.1																	t
BH-10	5.5					83																					S, FC
BH-10	9.0									0.2																	t
BH-10	10.0									0.2																	t
BH-10	11.0	55				94	66	47		0.2																	M, A, S, FC, t
BH-10	15.0									0.3																	t
BH-10	19.0									0.3																	t
BH-10	20.0	51				96	65	47																			M, A, S, FC
BH-11	3.0								0.0	0.1																	p, t
BH-11	4.5	40				79	44	29																			M, A, S, FC
BH-11	5.0								0.0	0.2																	p, t
BH-11	6.0								0.0	0.2																	p, t
BH-11	9.0								0.0	0.3																	p, t
BH-11	11.0								0.0	0.1																	p, t
BH-11	15.0	39				84			0.0	0.3																	M, FC, p, t

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									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
BH-11	18.0								0.0	0.3																	p, t
BH-11	21.0								0.0	0.2																	p, t
BH-12	3.0									0.2																	t
BH-12	4.0								0.0																		p
BH-12	5.0	35				66	46	31		0.2																	M, A, S, FC, t
BH-12	6.0								0.0																		p
BH-12	9.0									0.2																	t
BH-12	10.0								0.0																		p
BH-12	11.0									0.1																	t
BH-12	12.0								0.0																		p
BH-12	15.0	44								0.2																	M, t
BH-12	16.0								0.0																		p
BH-12	18.0									0.3																	t
BH-12	19.0	36				77	31	15																			M, A, S, FC
BH-12	20.0								0.0																		p
BH-12	23.0									0.3																	t
BH-12	24.0								0.0																		p
BH-13	3.5					75																					S, FC
BH-13	5.0									0.3																	t
BH-13	6.0								0.0																		p
BH-13	7.0	46				97	59	43		0.3																	M, A, FC, t
BH-13	8.0								0.0																		p
BH-13	11.0									0.3																	t
BH-13	12.0								0.0																		p
BH-13	13.0									0.3																	t
BH-13	14.0								0.0																		p
BH-13	15.5	40				70																					M, FC
BH-13	19.0									0.3																	t
BH-13	20.0								0.0																		p
BH-13	24.0									0.3																	t

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BH-13	25.0								0.0																		p
BH-14	5.0	62				97				0.3																	M, FC, t
BH-14	7.0									0.3																	t
BH-14	11.0	48				79	51	37	0.0	0.2																	M, A, S, FC, p, t
BH-14	14.0	29				86																					M, S, FC
BH-14	19.5					15																					S, FC
BH-15	5.0	31				69			0.0	0.1																	M, FC, p, t
BH-15	6.0								0.0	0.1																	p, t
BH-15	13.0	32				49	34	19																			M, A, S, FC
BH-15	15.3					94																					FC
BH-15	29.4	29				31																					M, S, FC
BH-16	3.0									0.2																	t
BH-16	4.0								0.0																		p
BH-16	5.0	56				81	43	28		0.2																	M, A, FC, t
BH-16	6.0								0.0																		p
BH-16	9.0									0.2																	t
BH-16	10.0								0.0																		p
BH-16	11.0					72				0.2																	S, FC, t
BH-16	12.0								0.0																		p
BH-16	19.5	25																									M
BH-16	33.5	20				28																					M, S, FC
BH-17	3.5	44					43	28																			M, A
BH-17	5.0									0.3																	t
BH-17	6.0								0.0																		p
BH-17	7.0									0.3																	t
BH-17	8.0								0.0																		p
BH-17	13.5	28				22																					M, S, FC
BH-17	24.5					9																					S, FC
BH-17	34.5	21				26																					M, S, FC
BH-18	3.0	41				86	40	24		0.3																	M, A, S, FC, t

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BH-18	5.0									0.3																	t
BH-18	9.0									0.3																	t
BH-18	11.5					27																					S, FC
BH-18	15.0	28					25	10	0.0	0.4																	M, A, p, t
BH-18	16.0								0.0	0.4																	p, t
BH-18	19.5					8																					S, FC
BH-18	29.5					15																					S, FC
BH-19	1.5	36				36																					M, S, FC
BH-19	7.5	21				36																					M, S, FC
BH-19	19.5					7																					S, FC
BH-19	34.5					7																					S, FC
BH-20	1.5	31				25																					M, S, FC
BH-20	13.5					12																					S, FC
BH-20	24.5	28				72	36	23																			M, A, FC
BH-20	34.5					13																					FC
BH-21	1.5	27				12																					M, S, FC
BH-21	15.5					7																					S, FC
BH-21	29.5					26																					FC
BH-22	3.5	23				7																					M, S, FC
BH-22	19.5	25				8																					M, S, FC
BH-22	33.0								1.0																		p
BH-22	39.0								1.0																		p
BH-22	44.0								1.5																		p
BH-22	44.5	47	108.3	73.9		93	97	72			1.8																M, T, A, S, FC, U
BH-22	45.0								1.8																		p
BH-22	47.0								1.5																		p
BH-22	48.0	26				53			1.3																		M, S, FC, p
BH-26	3.5	24				5																					M, FC
BH-26	18.0								1.0																		p
BH-26	19.5	46					72	51																			M, A

Classification Tests
LL = Liquid Limit
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Drained Strength
C' = Cohesion
PHI' = Friction Angle

Strength Estimate
PP = Pocket Penetrometer
TV = Torvane

Strength Tests
S_u = Undrained Shear Strength
UU = Unconsolidated Undrained Triaxial
CU = Consolidated Undrained Triaxial
DS = Direct Shear
DSS = Direct Simple Shear

Corrosivity Tests
R = Resistivity
Cl^- = Chloride
SO_4^{2-} = Sulfate
S^{2-} = Sulfide

Test Listing Abbreviations
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SUMMARY OF TEST RESULTS
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS LL	ATTERBERG LIMITS PI	ESTIMATED STRENGTH PP S_u, ksf	ESTIMATED STRENGTH TV S_u, ksf	UU TRIAXIAL S_u, ksf	UU TRIAXIAL Remold S_u, ksf	CU TRIAXIAL C', ksf	CU TRIAXIAL PHI' deg	DRAINED STRENGTH (DS or DSS Test) C' ksf	DRAINED STRENGTH (DS or DSS Test) PHI' deg	MINIMUM DRY DENSITY pcf	MAXIMUM DRY DENSITY pcf	CORROSIVITY TESTS R ohm-cm	CORROSIVITY TESTS pH	CORROSIVITY TESTS Cl^- ppm	CORROSIVITY TESTS SO_4^{2-} ppm	CORROSIVITY TESTS S^{2-} ppm	CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
BH-26	34.5					14																					S, FC
BH-27	3.5	22				54																					M, S, FC
BH-27	15.5					16																					S, FC
BH-28C	3.5	25				16																					M, S
BH-28C	15.5					17																					S, FC
BH-29B	3.5	28				6																					M, S, FC
BH-29B	13.5					20																					S, FC
BH-29B	29.0								4.0																		p
BH-29B	29.5	21				74	46	31																			M, A, S, FC
BH-30	3.5	21				53																					M, S, FC
BH-30	11.0					89	59	42	4.5																		A, S, FC, p
BH-30	12.0	21	130.2	107.8							5.8																M, T, U
BH-30	19.5	22				14																					M, S, FC
BH-31	3.5	23				5																					M, S, FC
BH-31	11.5	22				63																					M, S, FC
BH-31	24.0								4.5																		p
BH-31	24.5	21					66	47																			M, A
BH-32	1.5	22																									M
BH-32	3.5					31																					FC
BH-32	11.5					59																					S, FC
BH-33	3.5					15																					S, FC
BH-33	7.5					17																					S, FC
BH-33	9.5	21																									M
BH-33	15.5					13																					S, FC
BH-33	29.5	23					27	12																			M, A
BH-33	44.5	23																									M
BH-33	49.5					13																					S, FC
BH-34	3.5					20																					S, FC
BH-34	11.5					50																					FC
BH-34	13.0								3.8																		p

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CORPUS CHRISTI, TEXAS

LOCATION	DEPTH, ft	MOISTURE CONTENT (%)	UNIT WEIGHT WET pcf	UNIT WEIGHT DRY pcf	SPECIFIC GRAVITY	%PASSING #200 SIEVE	ATTERBERG LIMITS		ESTIMATED STRENGTH		UU TRIAXIAL		CU TRIAXIAL		DRAINED STRENGTH (DS or DSS Test)		MINIMUM DRY DENSITY	MAXIMUM DRY DENSITY	CORROSIVITY TESTS					CARBONATE (%)	ORGANIC CONTENT (%)	PERMEABILITY (cm/sec)	TEST LISTING
									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
BH-34	15.0	21					64	45	3.0																		M, A, p
BH-34	19.5					21																					S, FC
BH-35	1.5	24				26																					M, S, FC
BH-35	3.0								2.0																		p
BH-35	3.5	20					29	17																			M, A
BH-35	9.5	24					34	20																			M, A
BH-35	11.0								3.0																		p
BH-35	13.0								3.5																		p
BH-35	15.0	24							4.3																		M, p
BH-35	15.5						73	51																			A
BH-35	20.0					15																					S, FC
BH-36	1.5	35				21																					M, S, FC
BH-36	11.5	20				26																					M, S, FC
BH-36	19.5								2.5																		p
BH-36	24.0								4.3																		p
BH-36	25.0	25	126.5	101.4		99	73	50			5.2																M, T, A, FC, U
BH-36	25.1	23																									M
BH-36	29.0								4.5																		p
BH-36	41.5	23				24																					M, S, FC
BH-37	3.5	28					38	26	2.3																		M, A, p
BH-37	7.5	24				12																					M, S, FC
BH-37	19.5	22				16																					M, S, FC
BH-38	1.0								4.0																		p
BH-38	1.5	31				9																					M, S, FC
BH-38	5.5	18				25	21	9																			M, A, S, FC
BH-38	10.0								3.5																		p
BH-38	11.5	18				24																					M, S, FC
BH-38	13.0								4.3																		p
BH-38	15.0	25	122.1	97.9			43	29	4.5		1.5																M, T, A, p, U
BH-38	18.0								4.3																		p

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									PP	TV																	
							LL	PI	S_u, ksf	S_u, ksf	S_u, ksf	Remold S_u, ksf	C', ksf	PHI' deg	C' ksf	PHI' deg	pcf	pcf	R ohm-cm	pH	Cl^- ppm	SO_4^{2-} ppm	S^{2-} ppm				
BH-38	23.0								4.5																		p
BH-38	24.5	17																									M

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SHIP CHANNEL DEEPENING PROJECT
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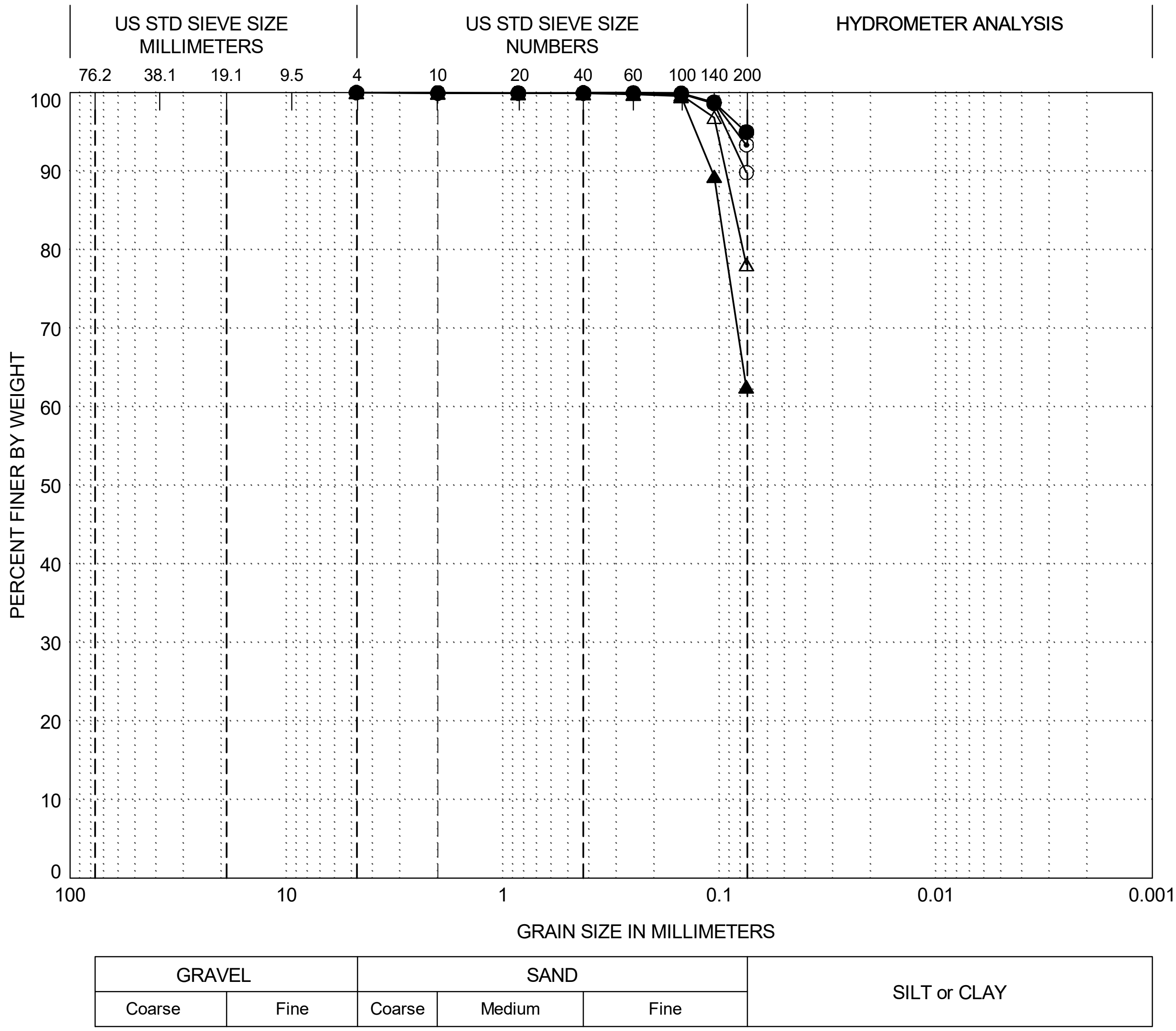
CORPUS CHRISTI, TEXAS

APPENDIX D2

Grain Size Distribution Curves



LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-01	4.0	Clay, olive gray, with sand pockets			0	10	90
●	BH-02	3.5	Clay, olive gray			0	5	95
△	BH-02	10.0	Sandy Clay, olive gray			0	22	78
▲	BH-03	9.0	Sandy Clay, olive gray			0	37	63
⊙	BH-04	3.0	Clay, olive gray			0	7	93

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
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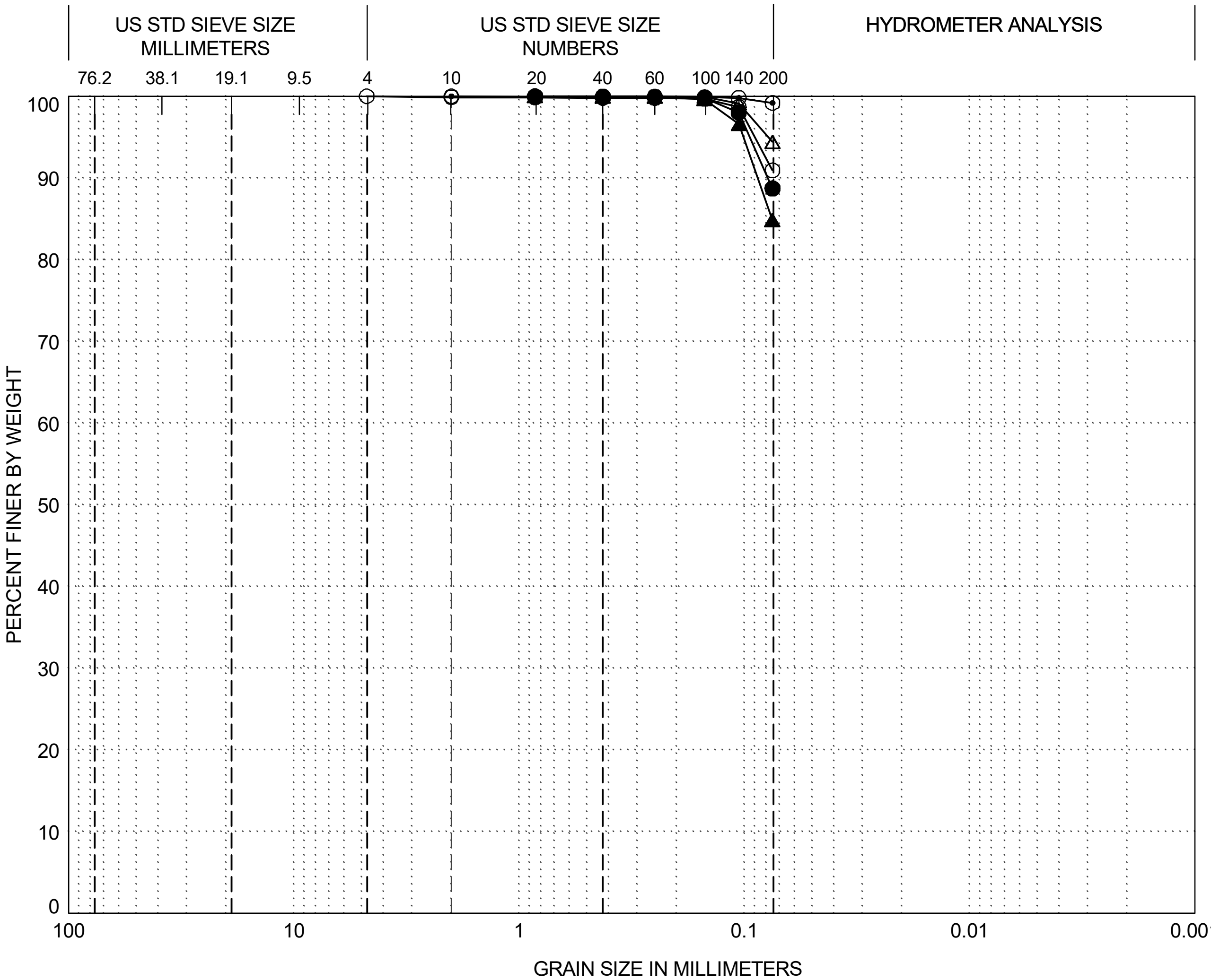

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-04	10.0	Clay, olive gray, with slt pockets and shell fragments			0	9	91
●	BH-05	3.0	Clay, olive gray, with sand pockets and shell fragments			0	11	89
△	BH-05	13.0	Clay, olive gray and brown			0	6	94
▲	BH-06	3.5	Clay, gray			0	15	85
⊙	BH-06	11.5	Clay, olive gray and brown			0	1	99

GRAIN SIZE CURVES
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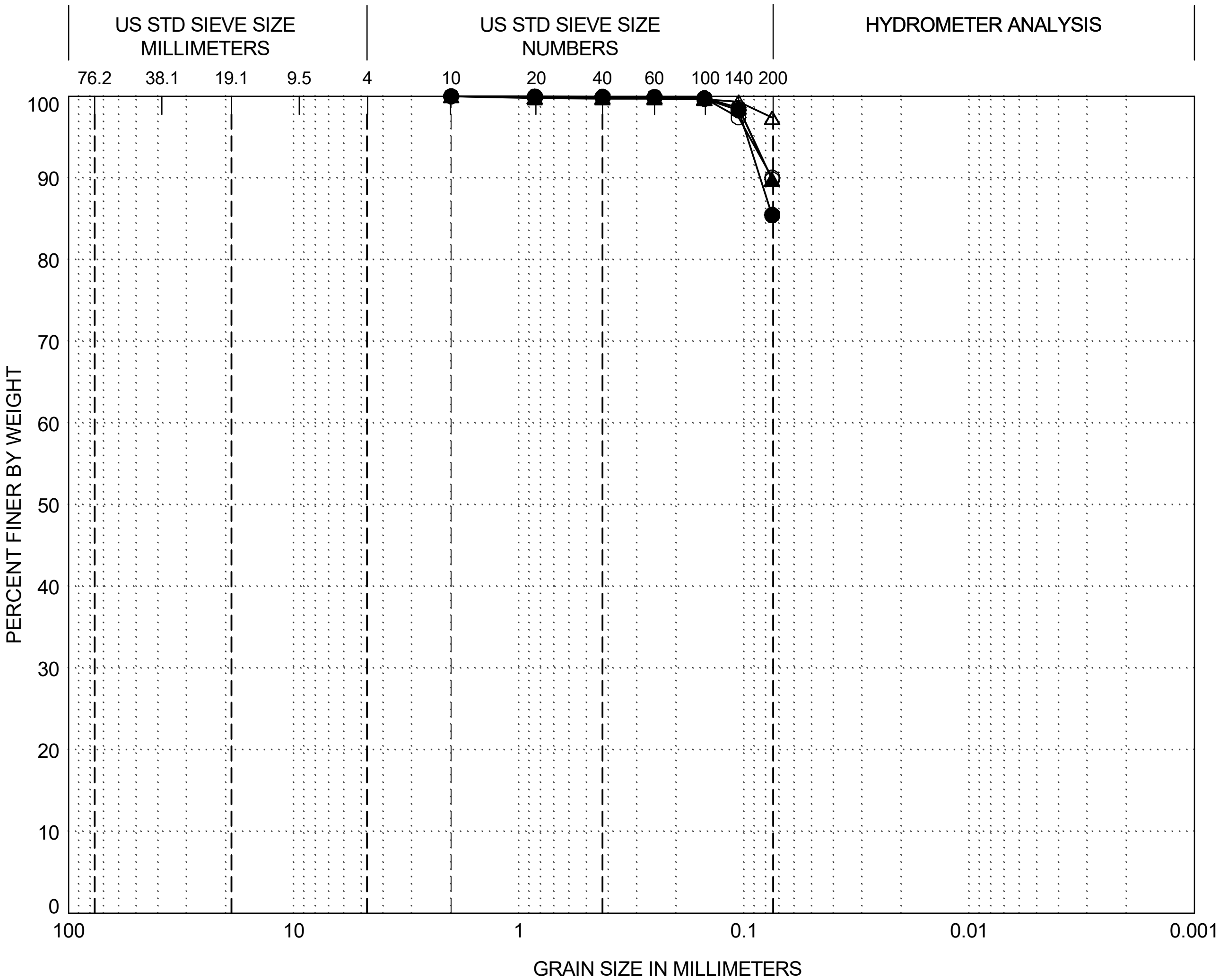
PLATE D2-2

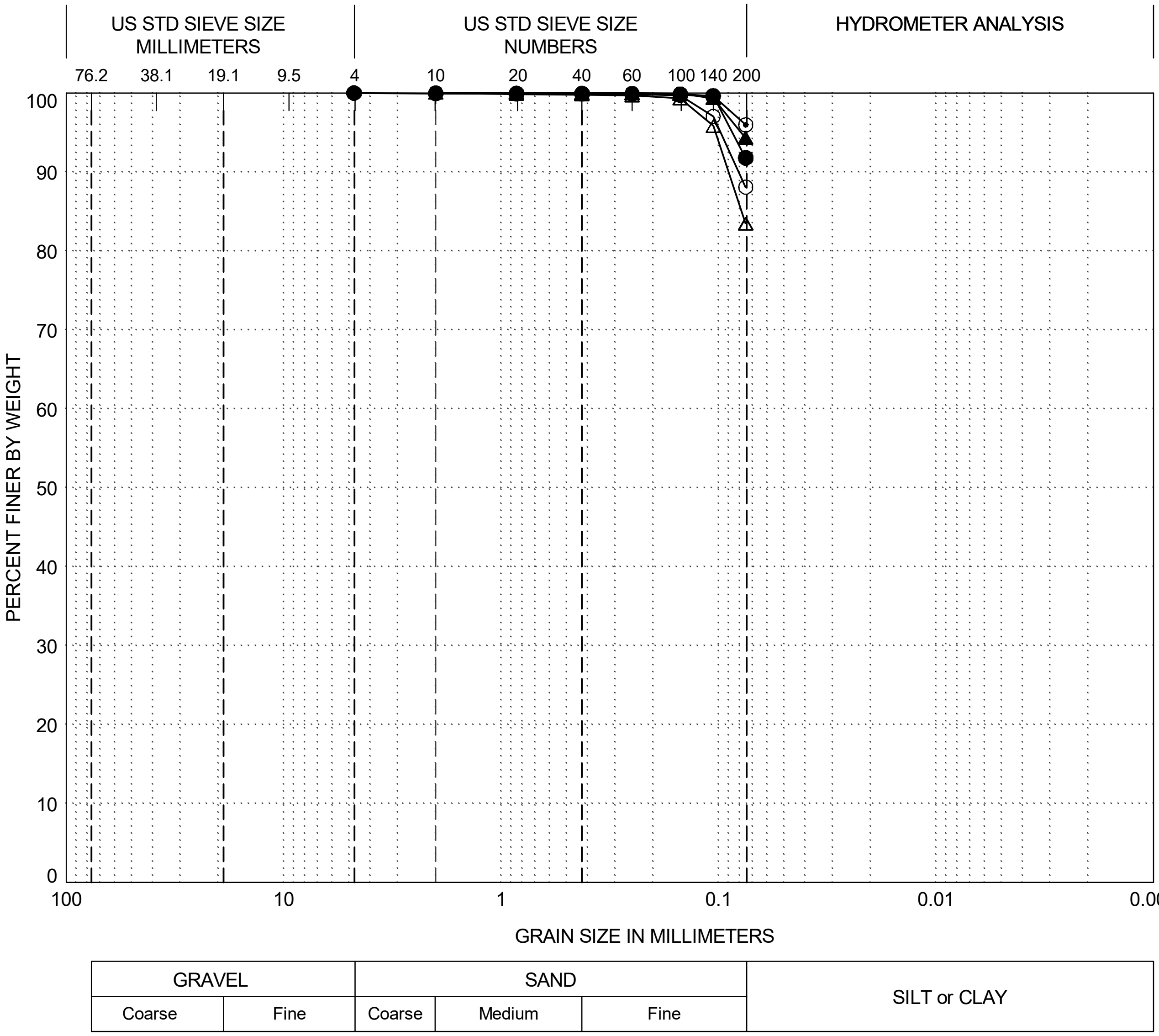


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-07	5.0	Clay, olive gray, with sand seams			0	10	90
●	BH-07	17.5	Clay, olive gray			0	15	85
△	BH-08	7.0	Clay, dark brown and dark gray, with silt pockets and shell fragments			0	3	97
▲	BH-08	13.0				0	10	90
⊙	BH-08	17.0	Clay, olive gray, with silt pockets			0	10	90

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D2-3



LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-09	3.5	Clay, olive gray, with sand seams			0	12	88
●	BH-09	19.5	Clay, olive gray			0	8	92
△	BH-10	5.5	Silty Clay, olive gray, with shell fragments			0	17	83
▲	BH-10	11.0	Clay, olive gray			0	6	94
⊙	BH-10	20.0	Clay, olive gray			0	4	96

GRAIN SIZE CURVES
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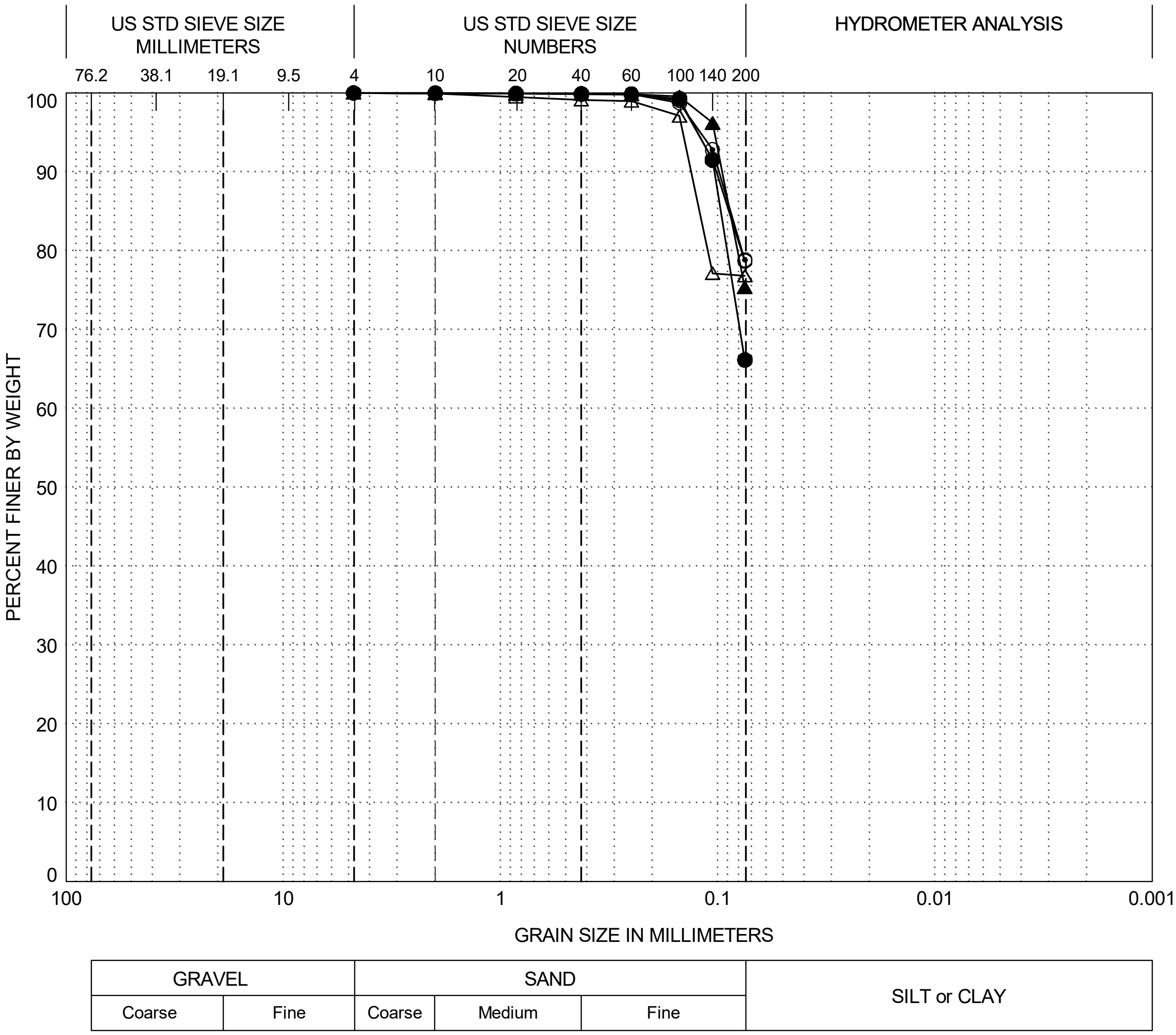

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-11	4.5	Clay, olive gray, with silty sand pockets			0	21	79
●	BH-12	5.0	Clay, olive gray, with sehll fragments and sand pockets			0	34	66
△	BH-12	19.0	Clay, olive gray, with silt pockets			0	23	77
▲	BH-13	3.5	Clay, olive gray, with silt pockets			0	25	75
⊙	BH-14	11.0	Clay, olive gray, with silt pockets and shell fragments			0	21	79

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
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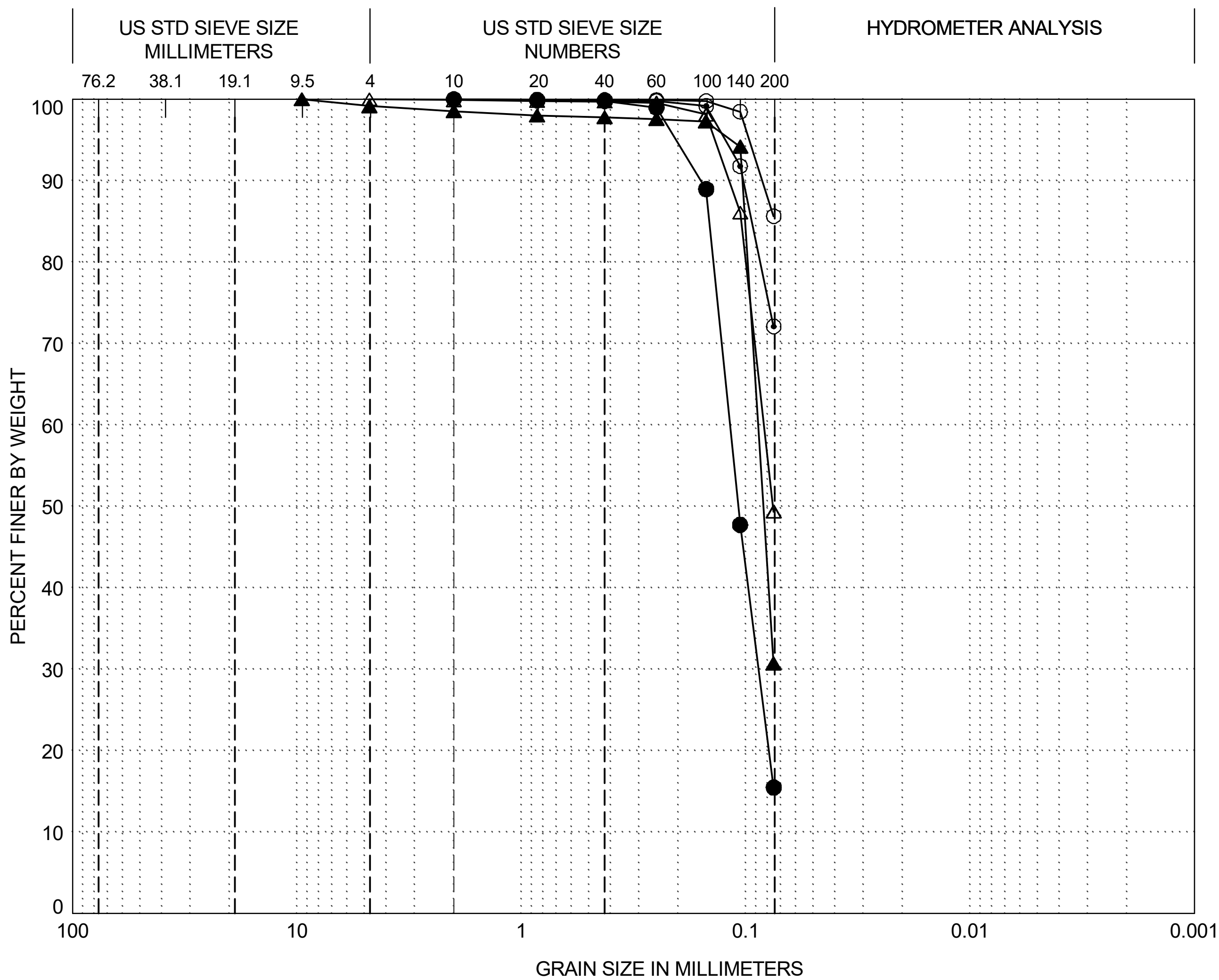

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-14	14.0	Clay, olive gray, with silty sand seams and shell fragments			0	14	86
●	BH-14	19.5	Silty Sand, olive gray, with shell fragments			0	85	15
△	BH-15	13.0	Sandy Clay, olive gray			0	51	49
▲	BH-15	29.4	Sandy Silt, olive gray, with clay seams and shell fragments			1	68	31
⊙	BH-16	11.0	Clay, olive gray, with silt pockets			0	28	72

GRAIN SIZE CURVES
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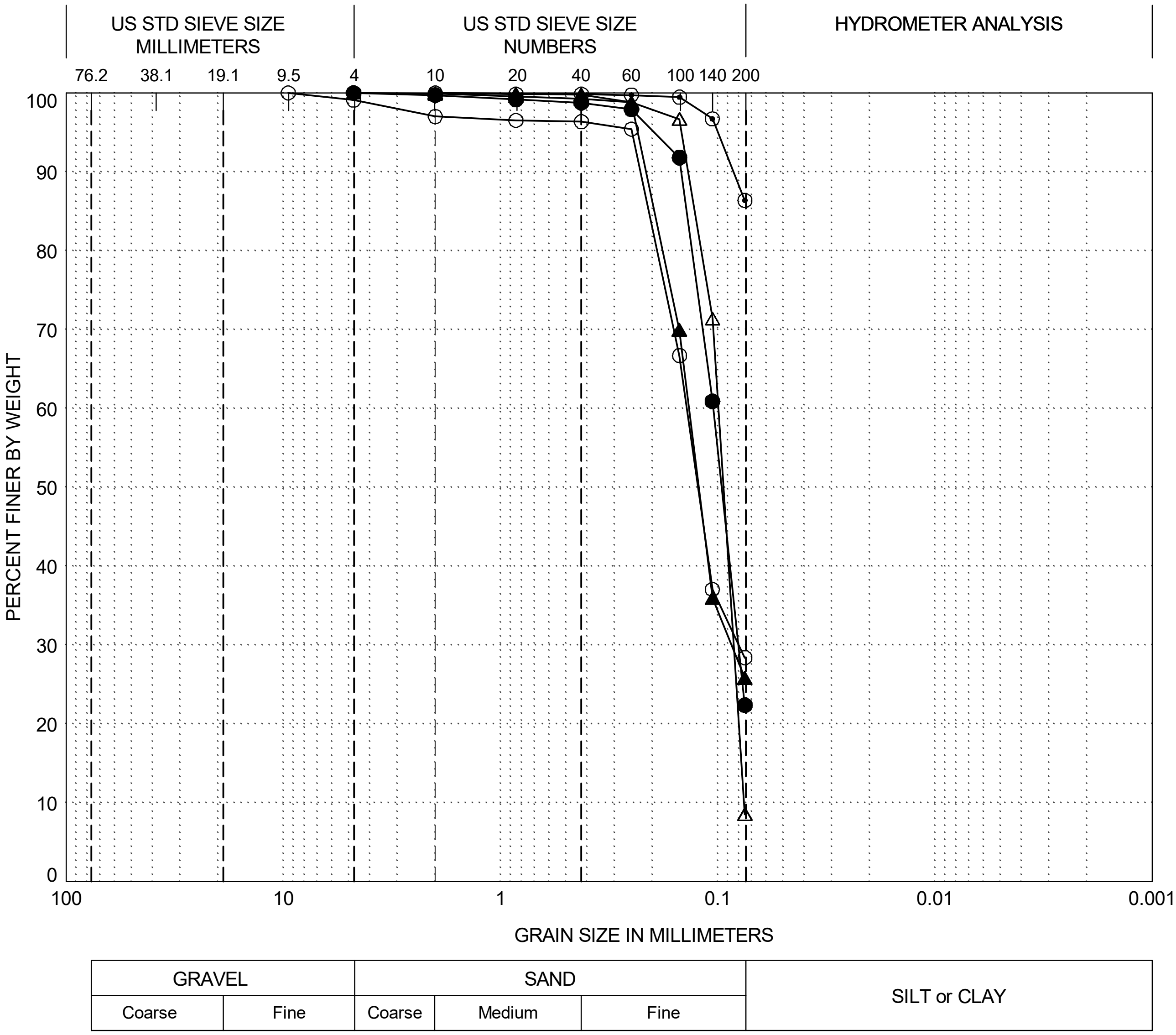

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-16	33.5	Sandy Clay, greenish gray, with shell fragments			1	71	28
●	BH-17	13.5	Sandy Silt, olive gray, with shell fragments			0	78	22
△	BH-17	24.5	Silty Sand, olive gray	0.9	1.3	0	91	9
▲	BH-17	34.5	Sandy Clay, tan and gray, with ferrous stains			0	74	26
⊙	BH-18	3.0	Clay, olive gray, with sandy silt seams and shell fragments			0	14	86

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
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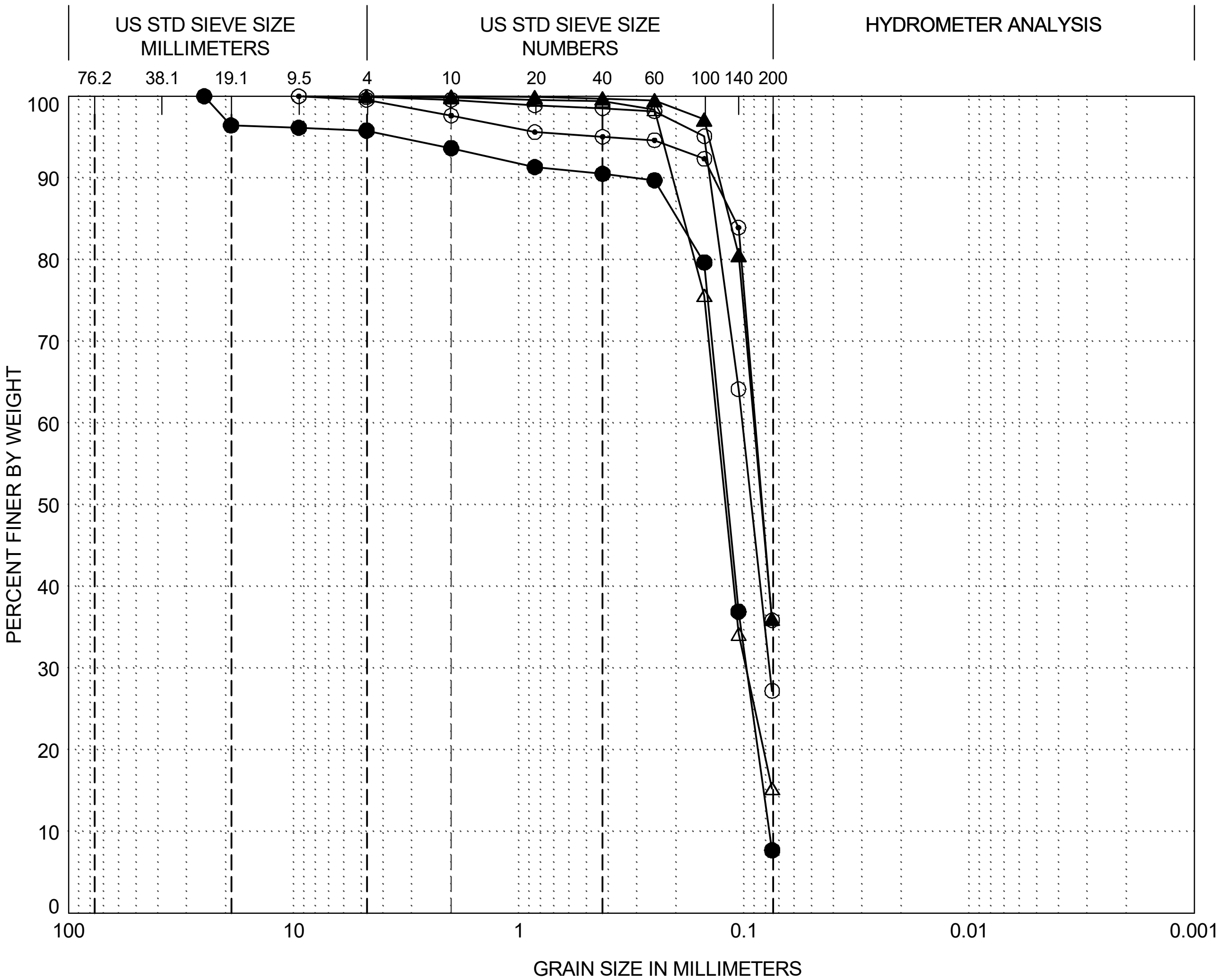
PLATE D2-7



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-18	11.5	Silty Sand, gray, with shell fragments and clay seams			0	73	27
●	BH-18	19.5	Silty Sand, gray, with shell fragments	1.0	1.7	4	88	8
△	BH-18	29.5	Silty Sand, greenish gray, with clay seams			0	85	15
▲	BH-19	1.5	Sandy Clay, olive gray, with shell fragments			0	64	36
⊙	BH-19	7.5	Silty Sand, olive gray, with shell fragments			0	64	36

GRAIN SIZE CURVES
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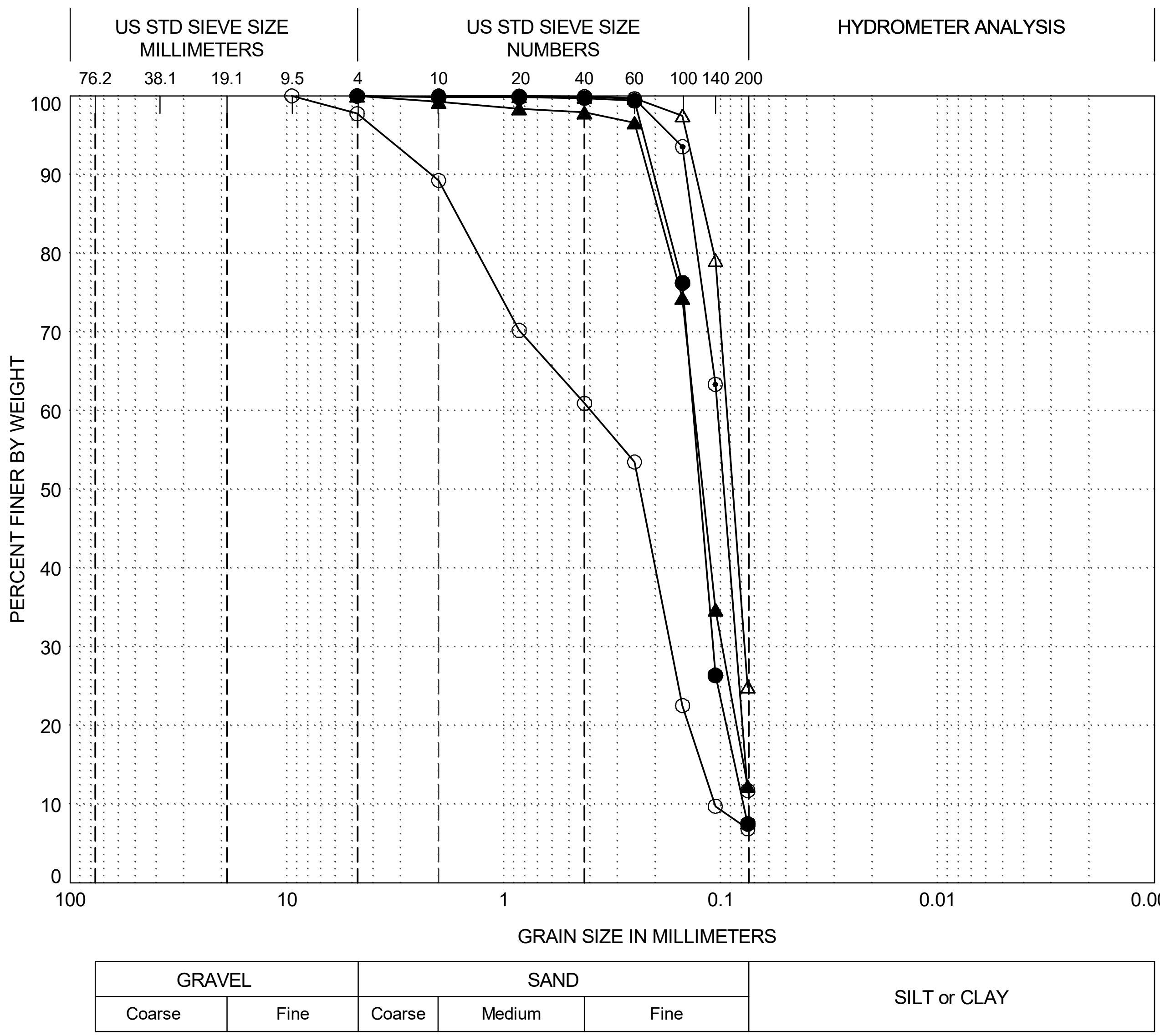

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-19	19.5	Silty Sand, gray, with shell fragments	0.7	3.7	2	91	7
●	BH-19	34.5	Silty Sand, gray	1.1	1.7	0	93	7
△	BH-20	1.5	Sandy Clay, olive gray, with shell fragments			0	75	25
▲	BH-20	13.5	Silty Sand, gray, with shell fragments	1.0	1.8	0	88	12
⊙	BH-21	1.5	Silty Sand, olive gray	0.9	1.4	0	88	12

GRAIN SIZE CURVES
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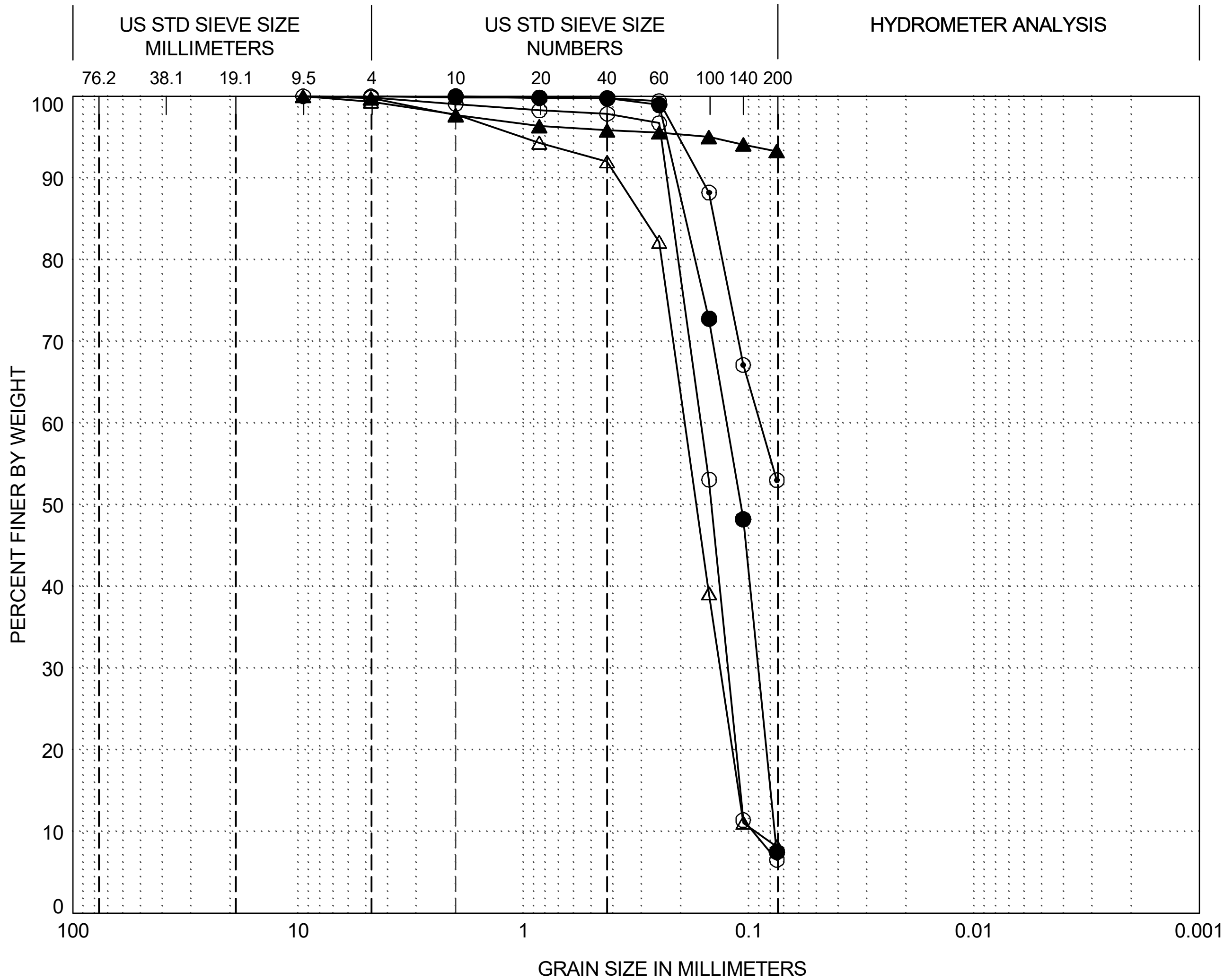

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-21	15.5	Silty Sand, olvie gray, with shell fragments	1.0	1.7	0	93	7
●	BH-22	3.5	Silty Sand, olive gray	0.9	1.6	0	93	7
△	BH-22	19.5	Silty Sand, gray, with shell fragments	1.0	2.1	1	91	8
▲	BH-22	44.5	Clay, gray, with shell fragments			0	6	93
⊙	BH-22	48.0	Sandy Clay, olive gray			0	47	53

GRAIN SIZE CURVES
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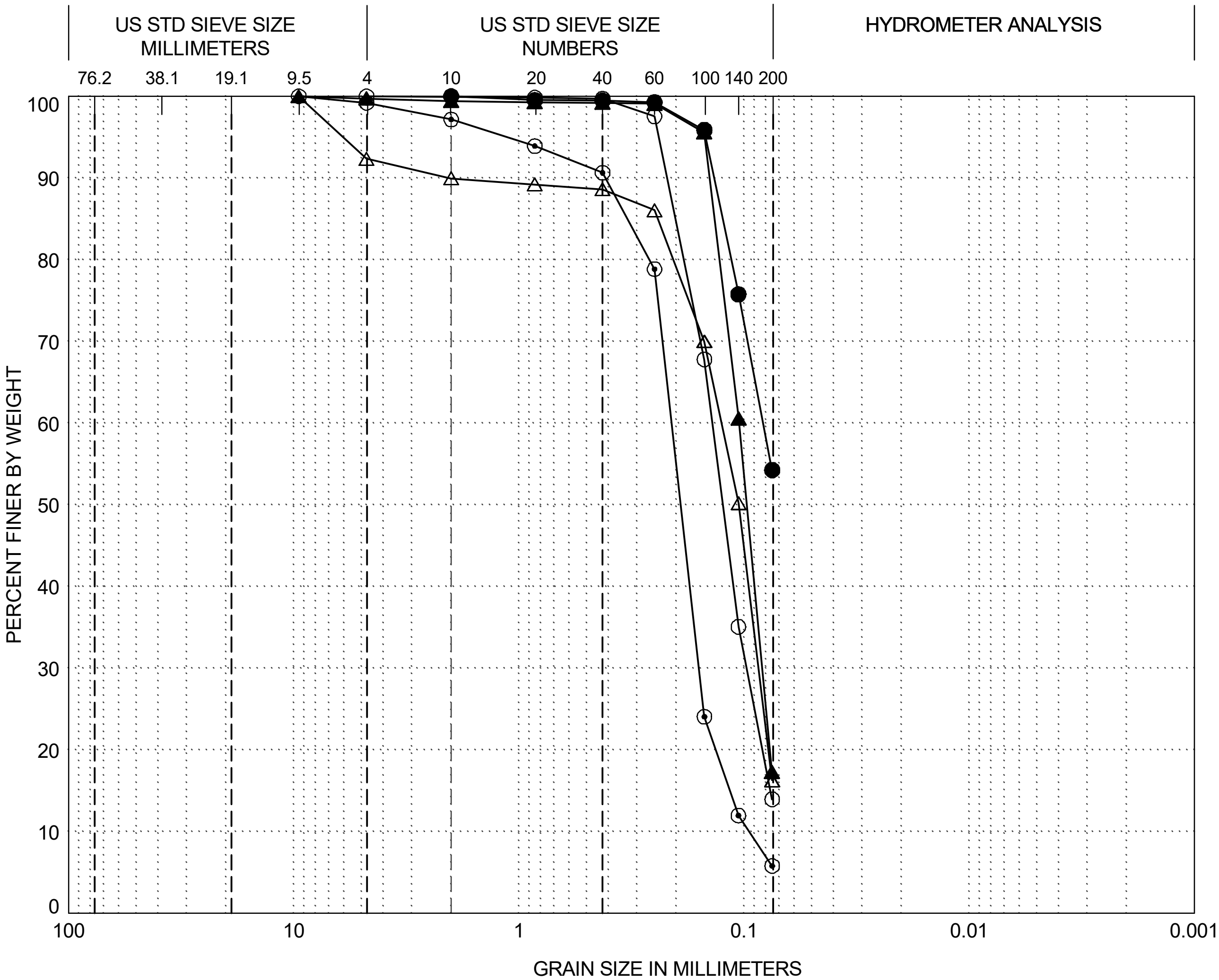

GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-26	34.5	Silty Sand, olive gray, with clay seams and shell fragments			0	86	14
●	BH-27	3.5	Sandy Clay, greenish gray			0	46	54
△	BH-27	15.5	Silty Sand, tan and greenish gray, with clay seams and calcareous nodules			8	76	16
▲	BH-28C	15.5	Silty Sand, brown and greenish gray			0	82	17
⊙	BH-29B	3.5	Silty Sand, olive gray, with shell fragments	1.3	2.2	1	93	6

GRAIN SIZE CURVES
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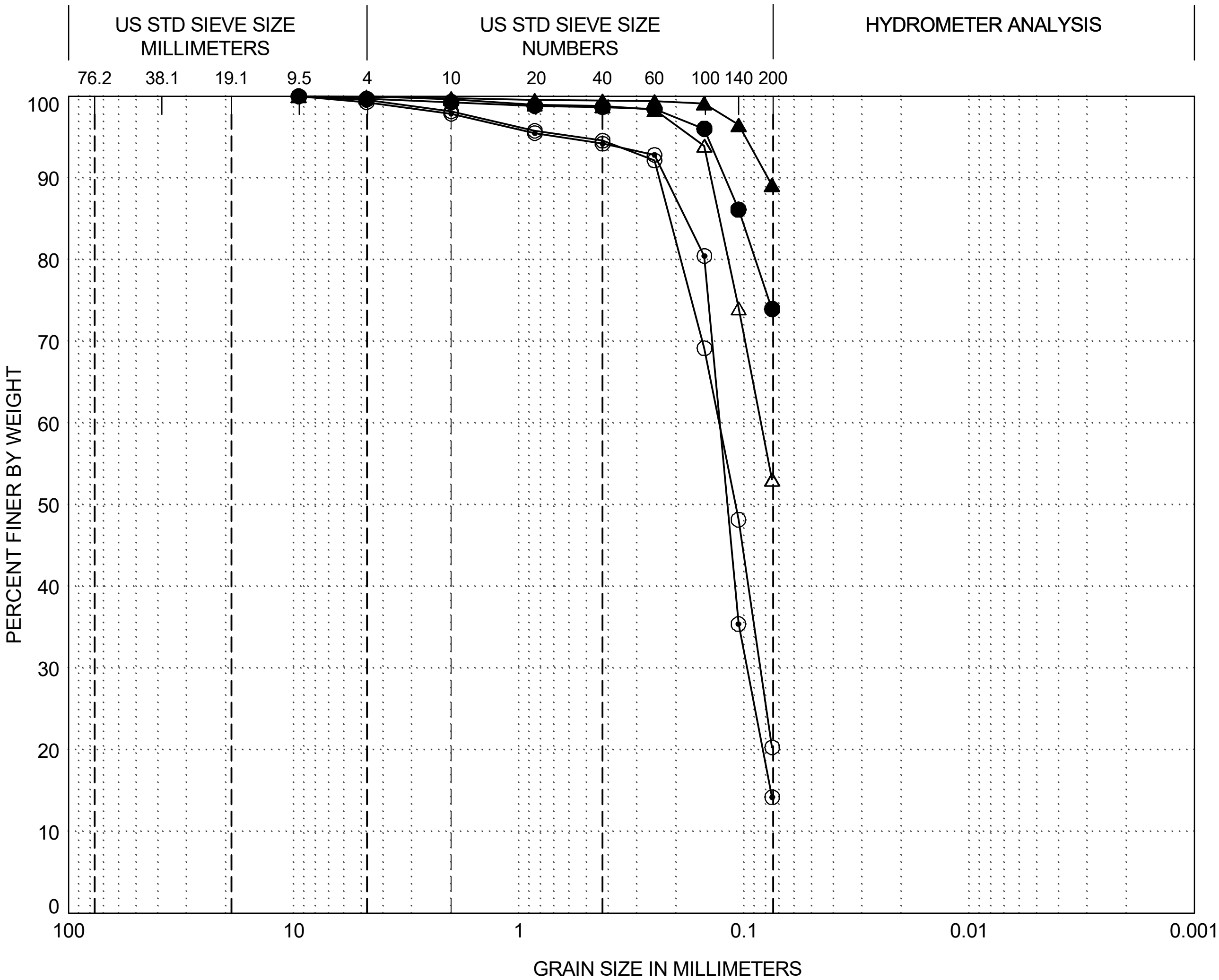
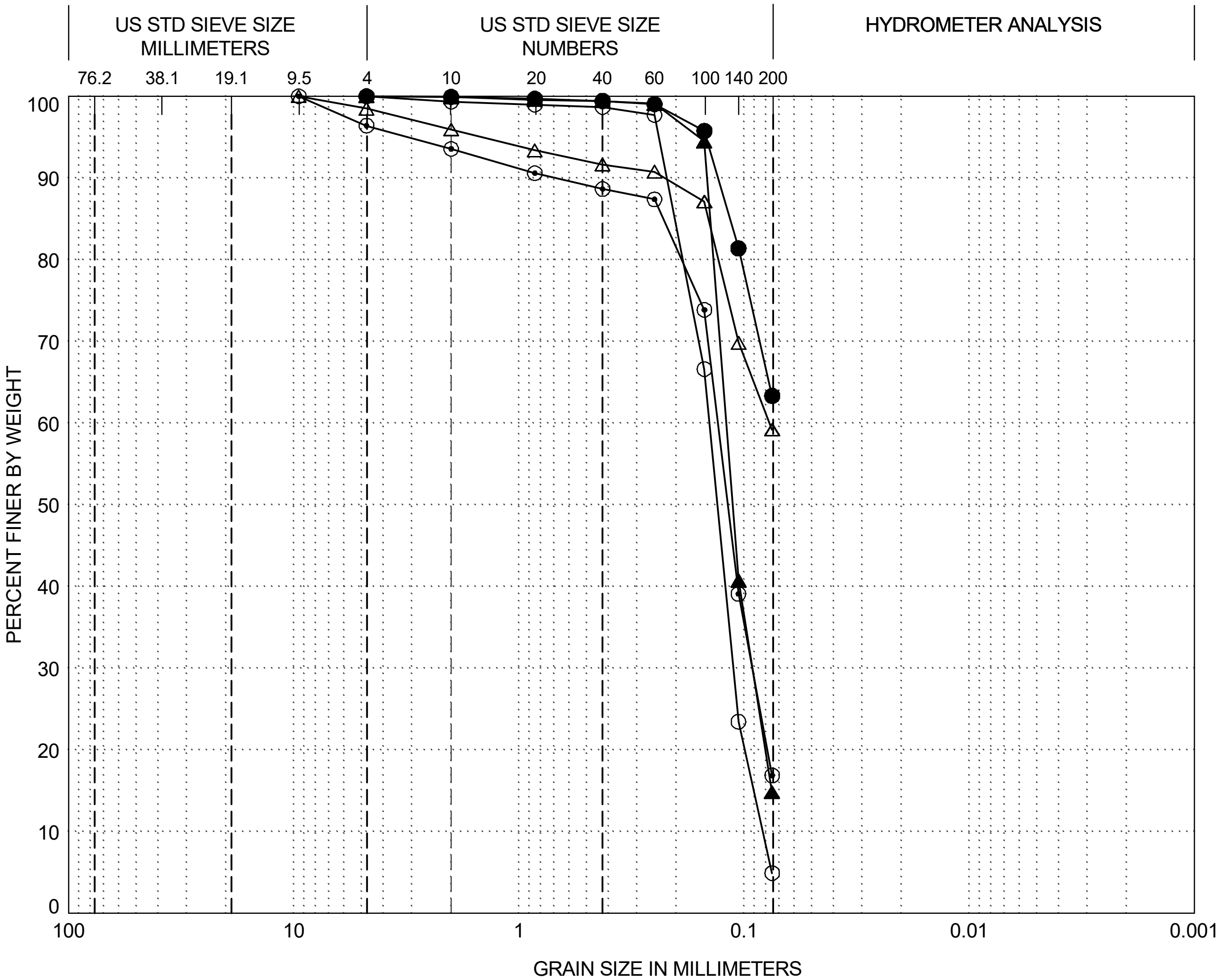


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-29B	13.5	Silty Sand, olive gray, with shell fragments			0	79	20
●	BH-29B	29.5	Clay, brown and greenish gray, with sandy clay seams			0	26	74
△	BH-30	3.5	Sandy Clay, brown and greenish gray			0	47	53
▲	BH-30	11.0	Clay, brown and greenish gray, with gypsum and silt pockets			0	11	89
⊙	BH-30	19.5	Silty Sand, brown and gray			1	85	14

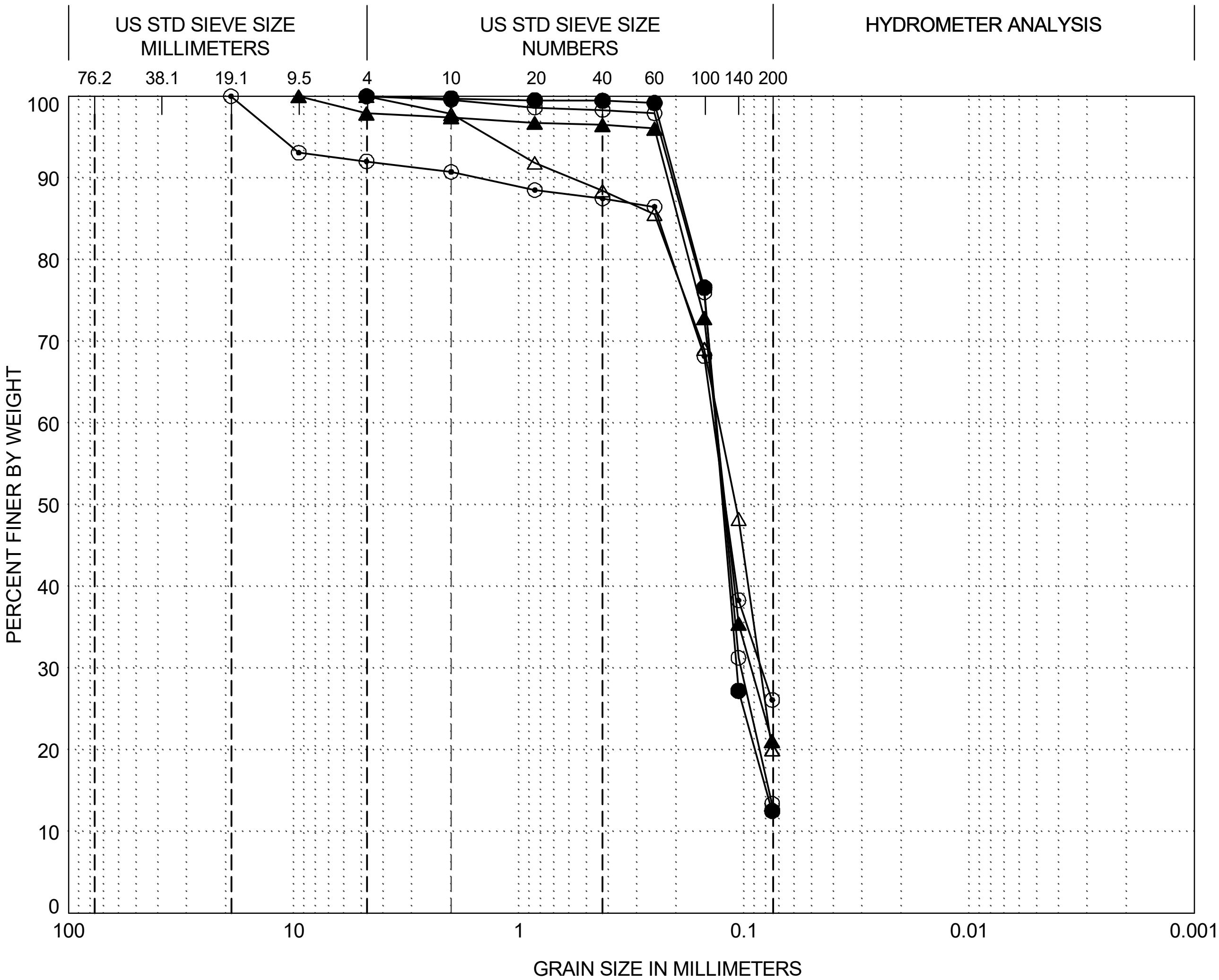
GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-31	3.5	Silty Sand, brown, with shell fragments	1.1	1.7	0	95	5
●	BH-31	11.5	Sandy Clay, greenish gray			0	37	63
△	BH-32	11.5	Clay, greenish gray and brown, with calcareous nodules			1	39	59
▲	BH-33	3.5	Silty Sand, olive gray, with clay pockets and shell fragments			0	85	15
⊙	BH-33	7.5	Clayey Sand, olive gray, with shell fragments			4	80	17

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

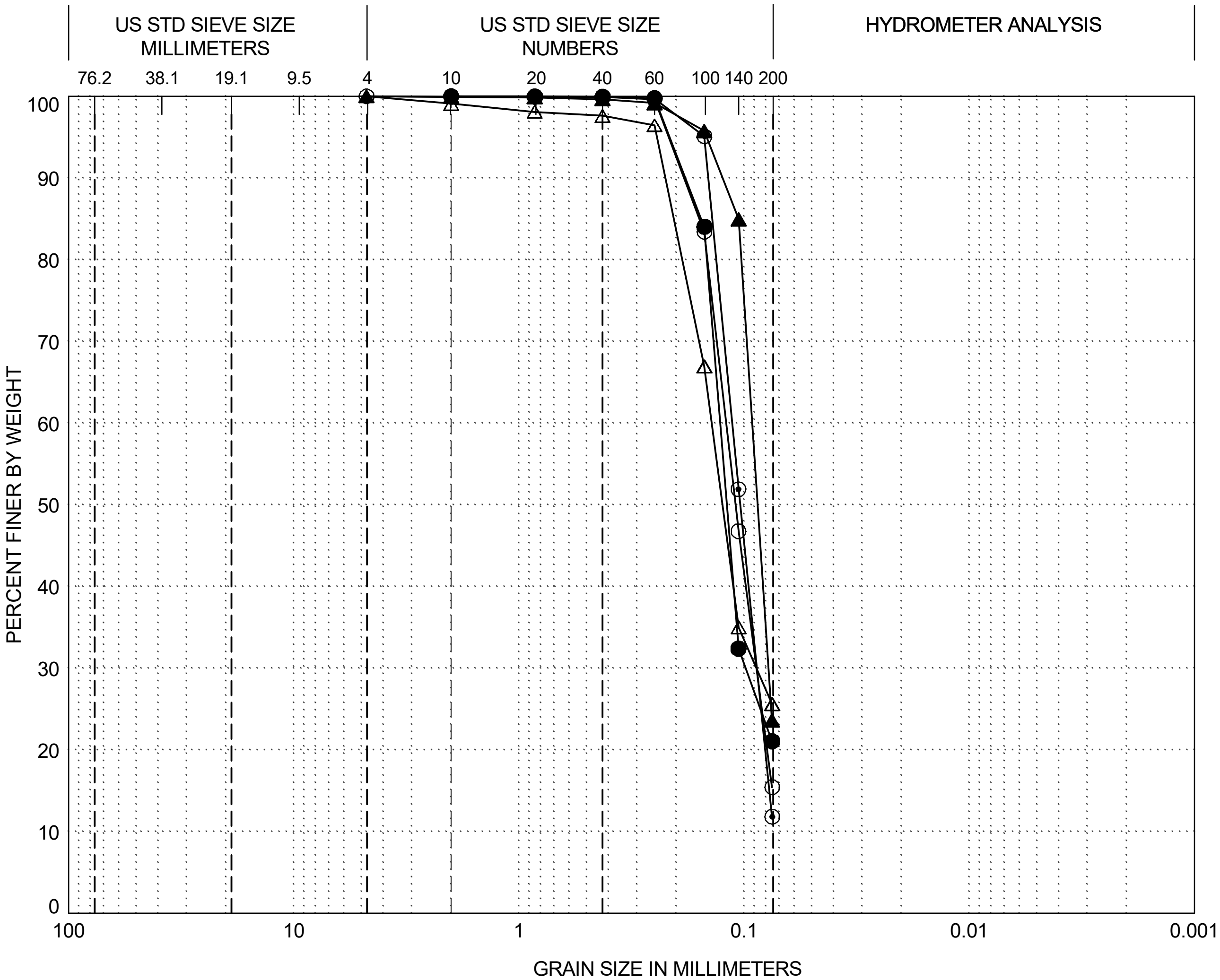


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-33	15.5	Silty Sand, gray, with shell fragments			0	87	13
●	BH-33	49.5	Silty Sand, gray			0	87	13
△	BH-34	3.5	Silty Sand, brown, with shell fragments			0	80	20
▲	BH-34	19.5	Silty Sand, tan and gray, with clay pockets and shell fragments			2	77	21
⊙	BH-35	1.5	Sandy Clay, olive gray and greenish gray, with shell fragments			8	66	26

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

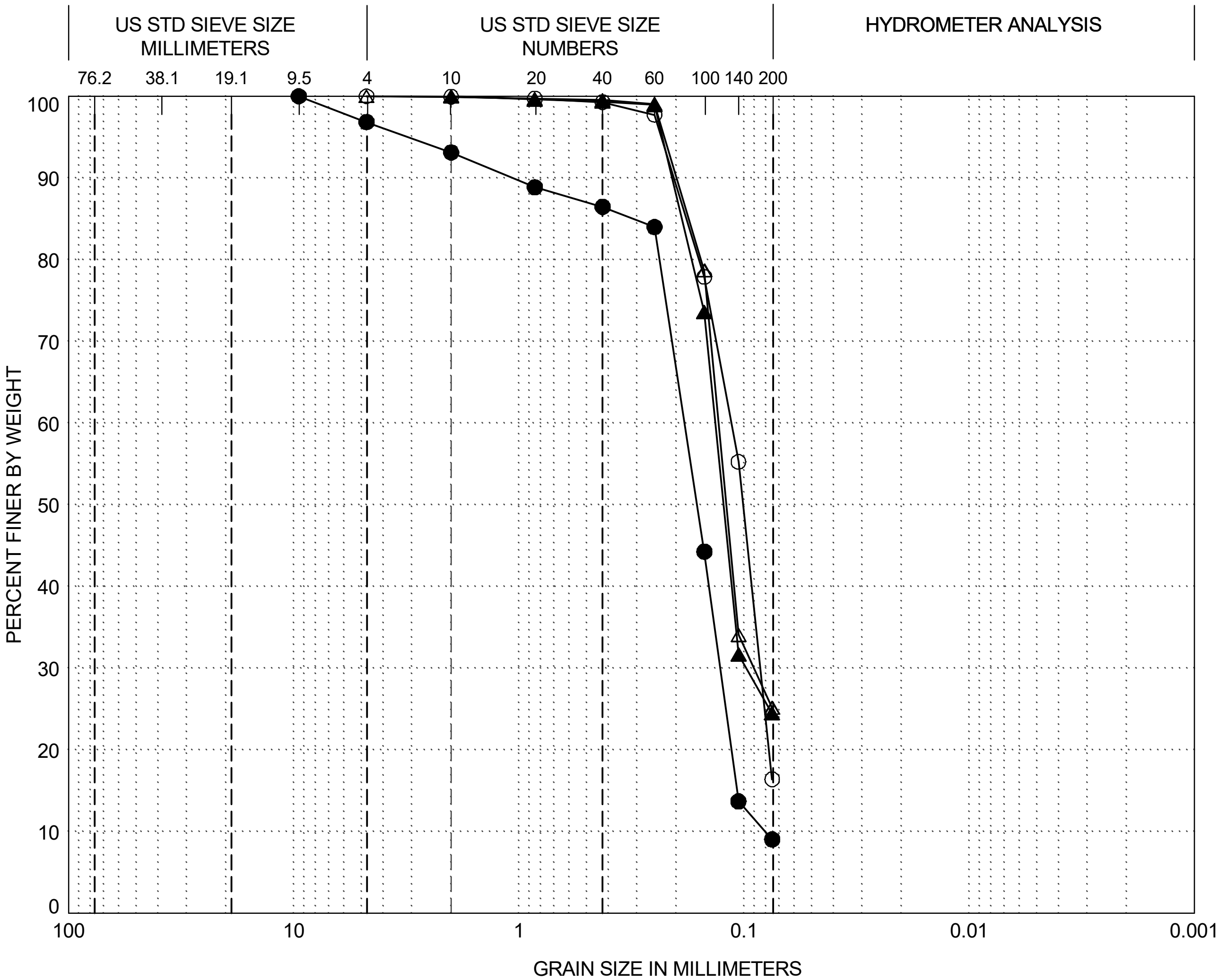
PLATE D2-14



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-35	20.0	Silty Sand, brown and greenish gray			0	85	15
●	BH-36	1.5	Clayey Sand, olvie gray, with clay pockets			0	79	21
△	BH-36	11.5	Sandy Clay, brown and greenish gray			0	74	26
▲	BH-36	41.5	Silty Sand, brown and gray			0	76	24
⊙	BH-37	7.5	Silty Sand, brown	0.9	1.5	0	88	12

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS



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<tr><td>Coarse</td><td>Fine</td><td>Coarse</td><td>Medium</td><td>Fine</td></tr>
</table>

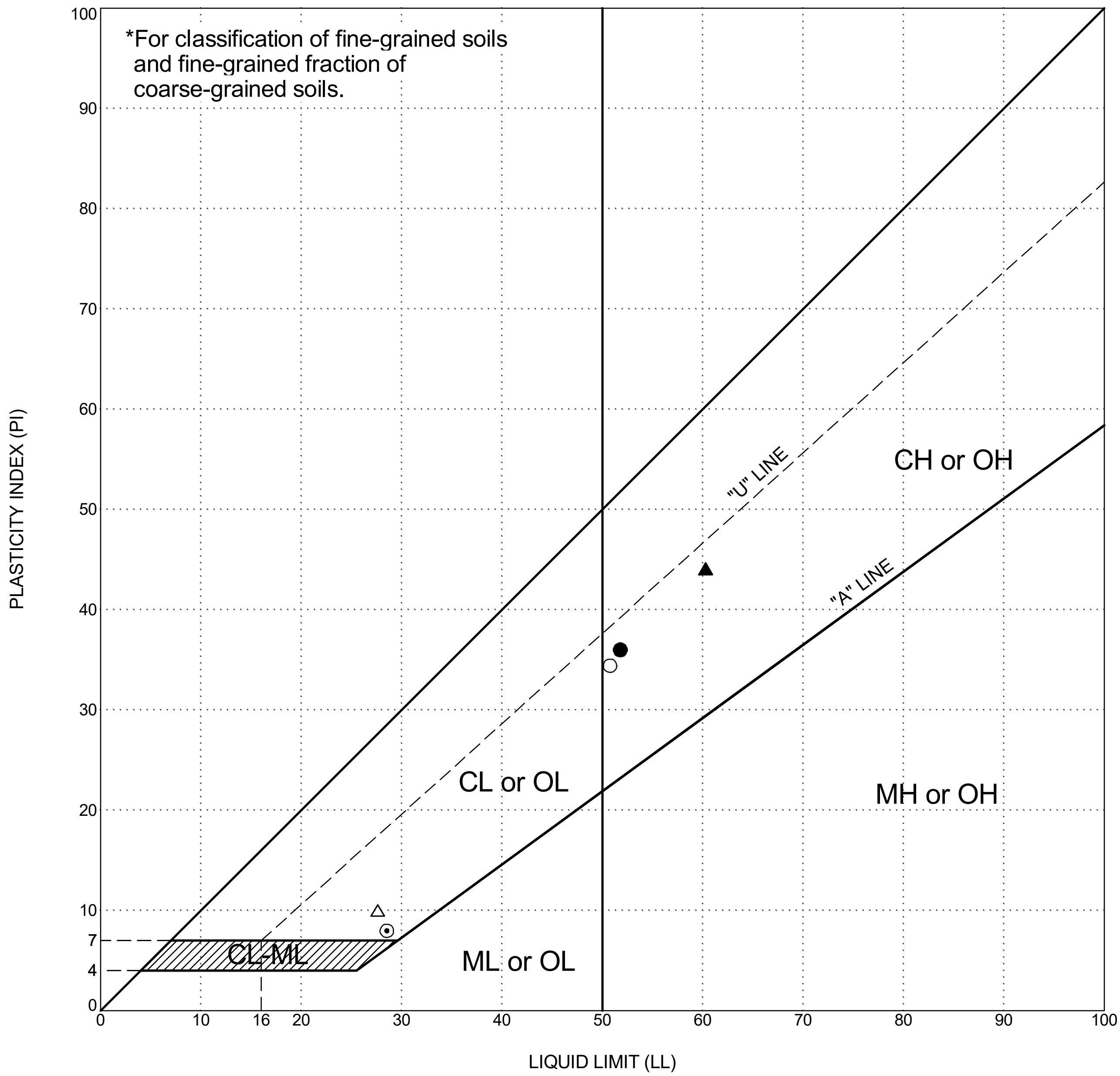
LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION	Cc	Cu	%Gravel	%Sand	%Fines
○	BH-37	19.5	Silty Sand, brown			0	84	16
●	BH-38	1.5	Silty Sand, gray, with shell fragments	1.1	2.3	3	88	9
△	BH-38	5.5	Sandy Clay, gray			0	75	25
▲	BH-38	11.5	Sandy Clay, gray			0	76	24

GRAIN SIZE CURVES
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D2-16

APPENDIX D3

Plasticity Charts

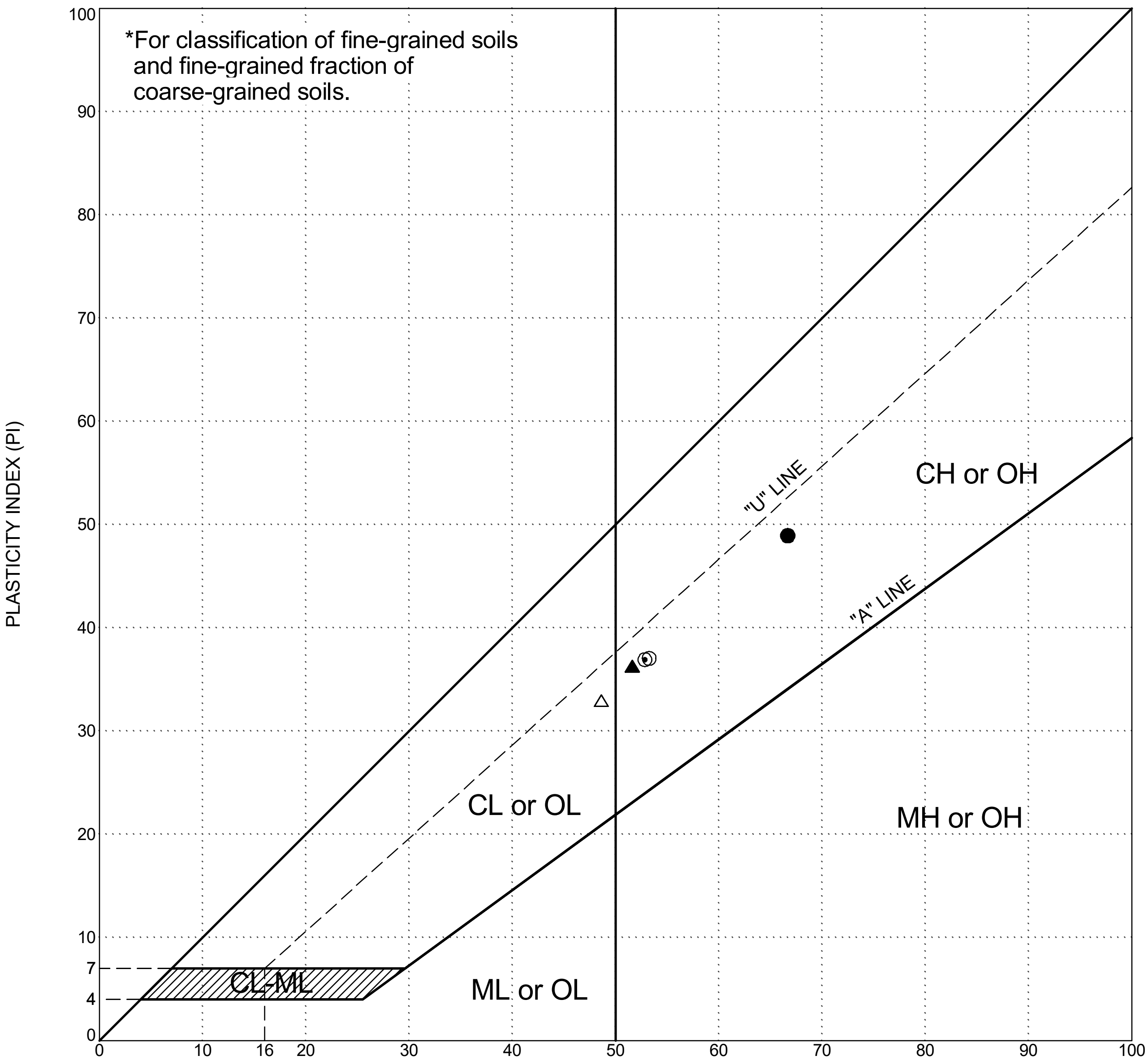


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-01	4.0	Clay, olive gray, with sand pockets	51	16	35	90
●	BH-02	3.5	Clay, olive gray	52	16	36	95
△	BH-02	10.0	Sandy Clay, olive gray	28	18	10	78
▲	BH-03	3.0		60	16	44	
⊙	BH-03	9.0	Sandy Clay, olive gray	29	21	8	63

ATTERBERG LIMITS TEST RESULTS

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-1

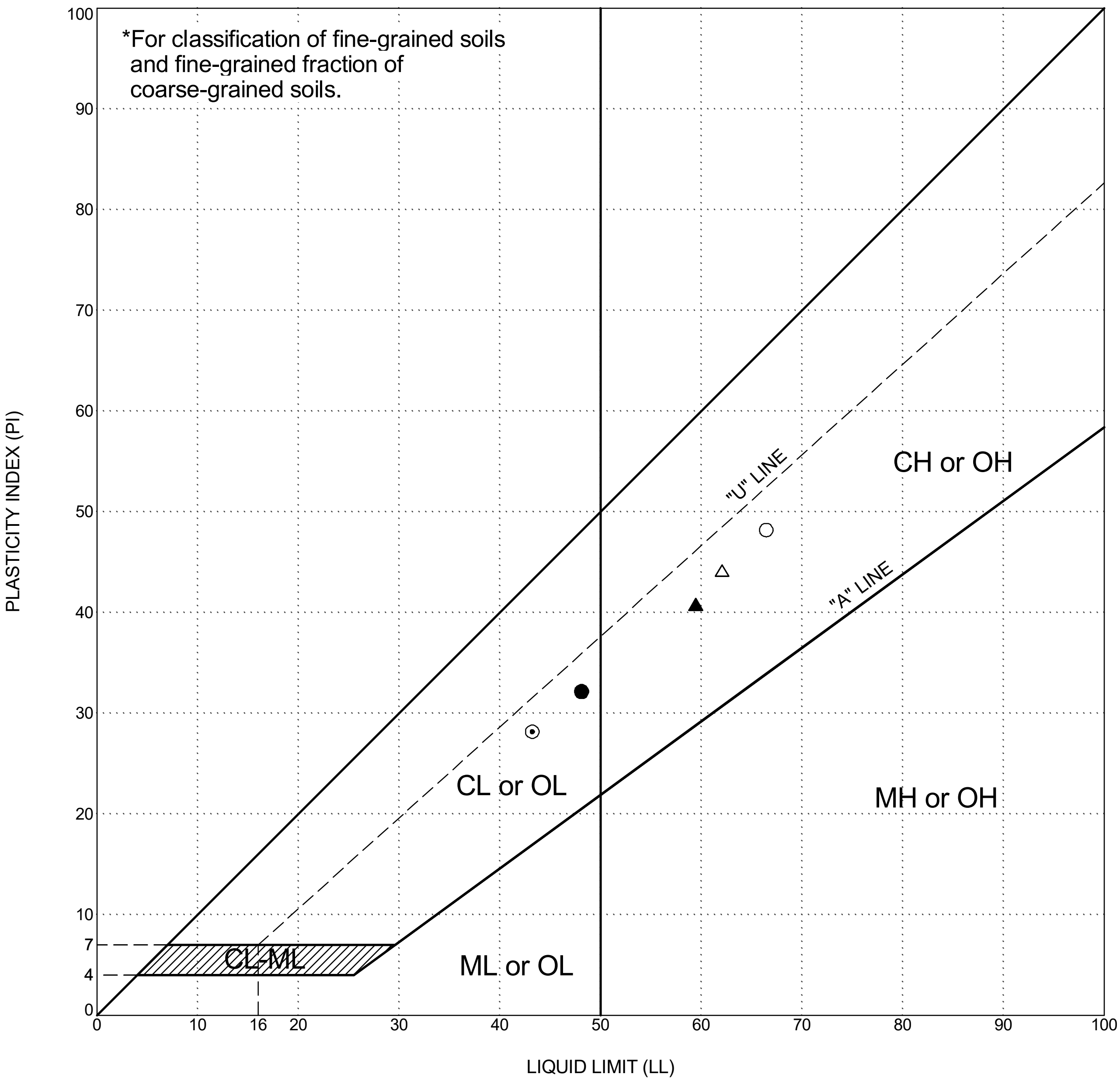


ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-04	3.0	Clay, olive gray	53	16	37	93
●	BH-04	10.0	Clay, olive gray, with slt pockets and shell fragments	67	18	49	91
△	BH-05	3.0	Clay, olive gray, with sand pockets and shell fragments	49	16	33	89
▲	BH-05	13.0	Clay, olive gray and brown	52	15	37	94
⊙	BH-06	1.5		53	16	37	

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-2

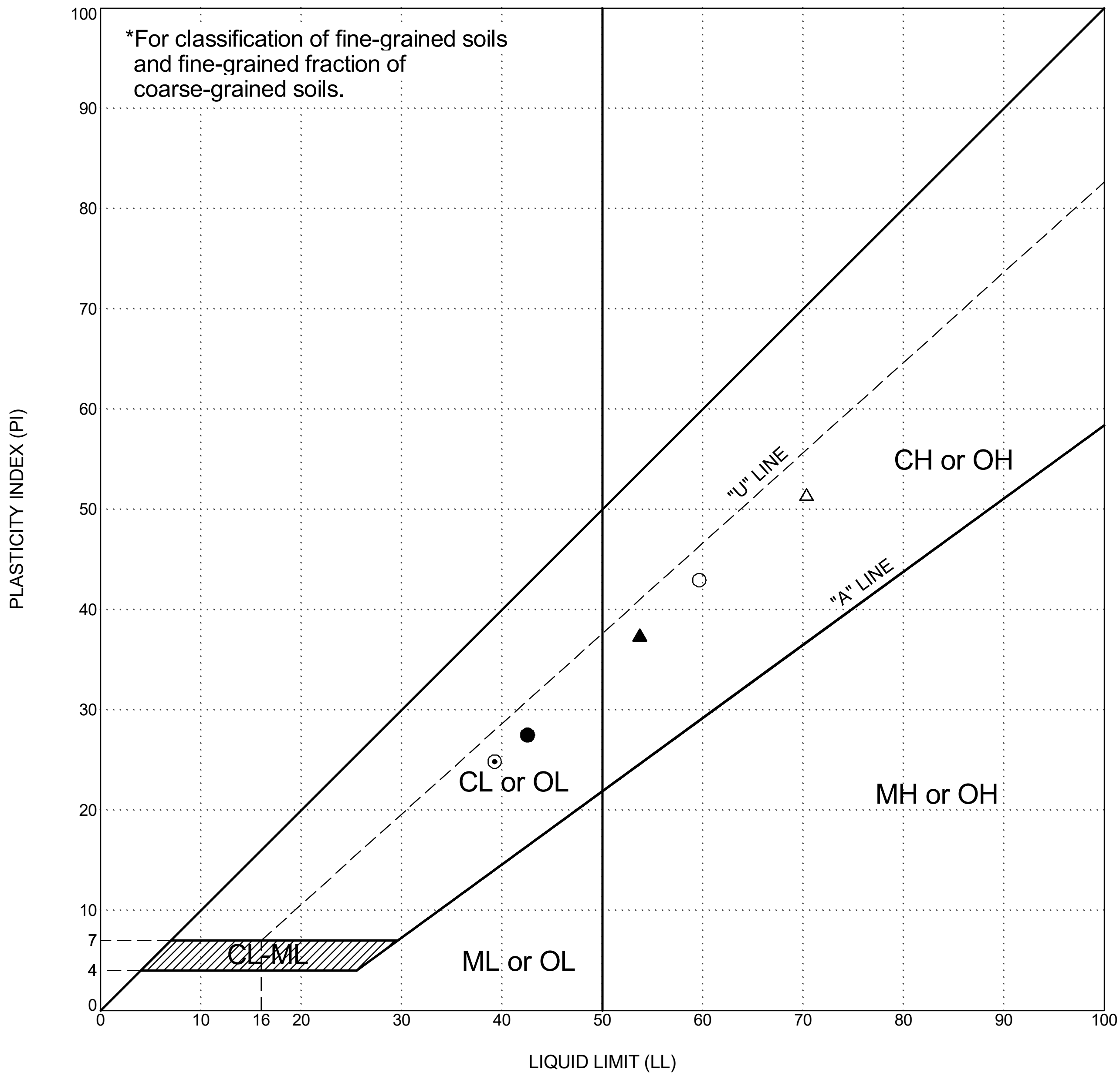


ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-06	11.5	Clay, olive gray and brown	66	18	48	99
●	BH-07	5.0	Clay, olive gray, with sand seams	48	16	32	90
△	BH-07	17.5	Clay, olive gray	62	18	44	85
▲	BH-08	7.0	Clay, dark brown and dark gray, with silt pockets and shell fragments	59	19	40	97
⊙	BH-08	14.0		43	15	28	

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-3

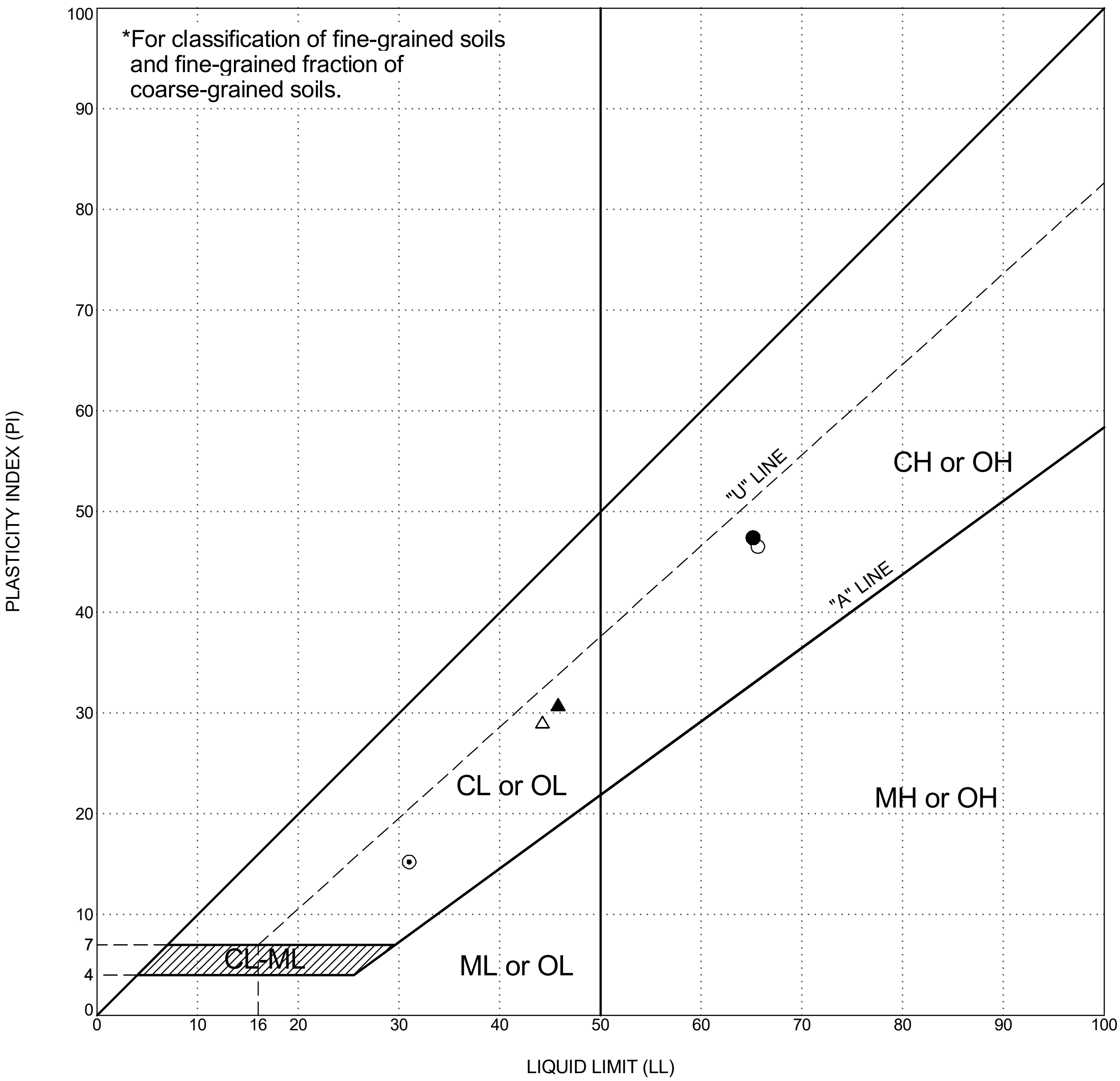


ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-08	17.0	Clay, olive gray, with silt pockets	60	17	43	90
●	BH-09	3.5	Clay, olive gray, with sand seams	43	15	28	88
△	BH-09	12.0		70	19	51	
▲	BH-09	19.5	Clay, olive gray	54	16	38	92
⊙	BH-10	4.0		39	14	25	

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-4

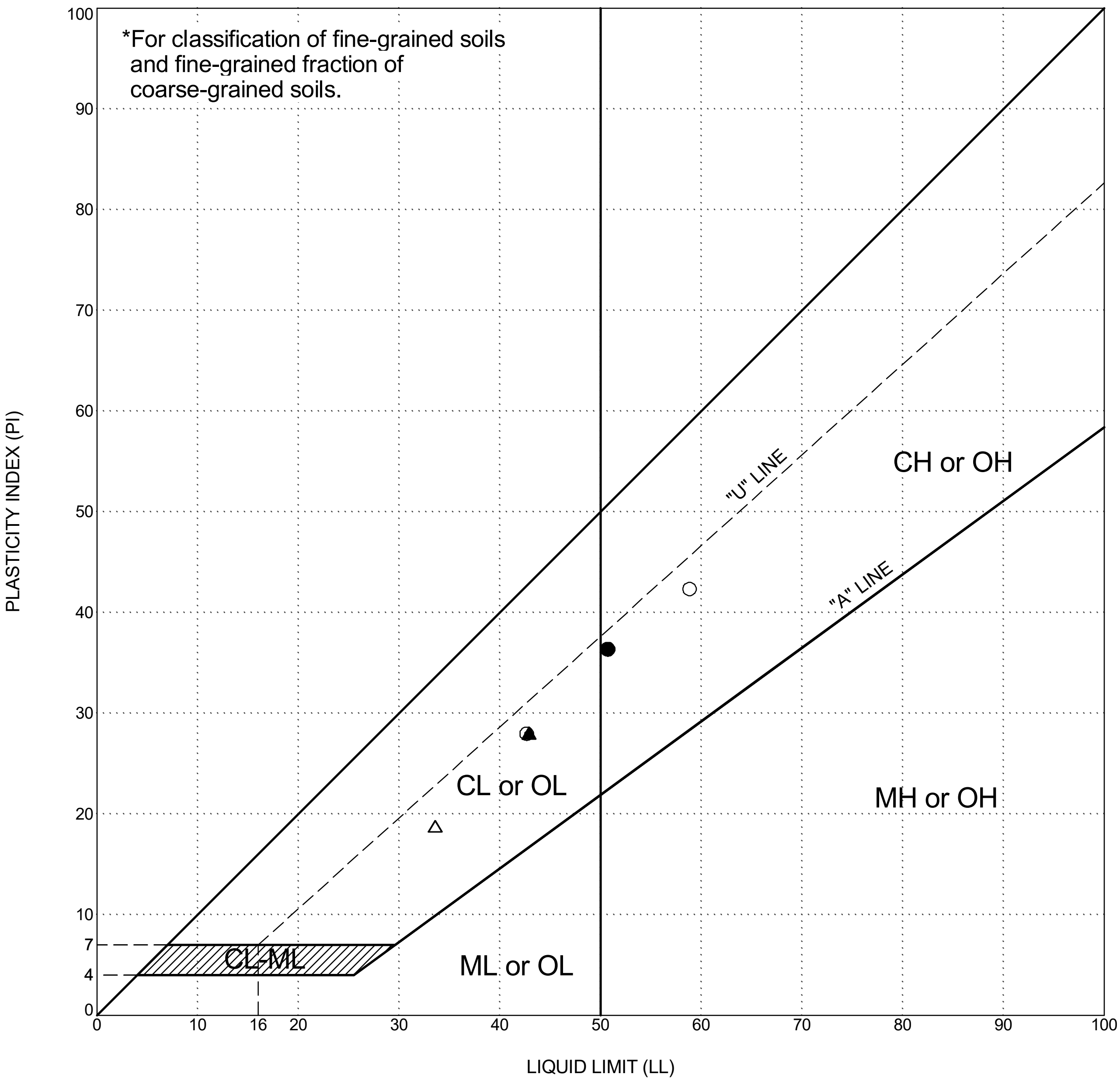


ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-10	11.0	Clay, olive gray	66	19	47	94
●	BH-10	20.0	Clay, olive gray	65	18	47	96
△	BH-11	4.5	Clay, olive gray, with silty sand pockets	44	15	29	79
▲	BH-12	5.0	Clay, olive gray, with sehll fragments and sand pockets	46	15	31	66
⊙	BH-12	19.0	Clay, olive gray, with silt pockets	31	16	15	77

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-5

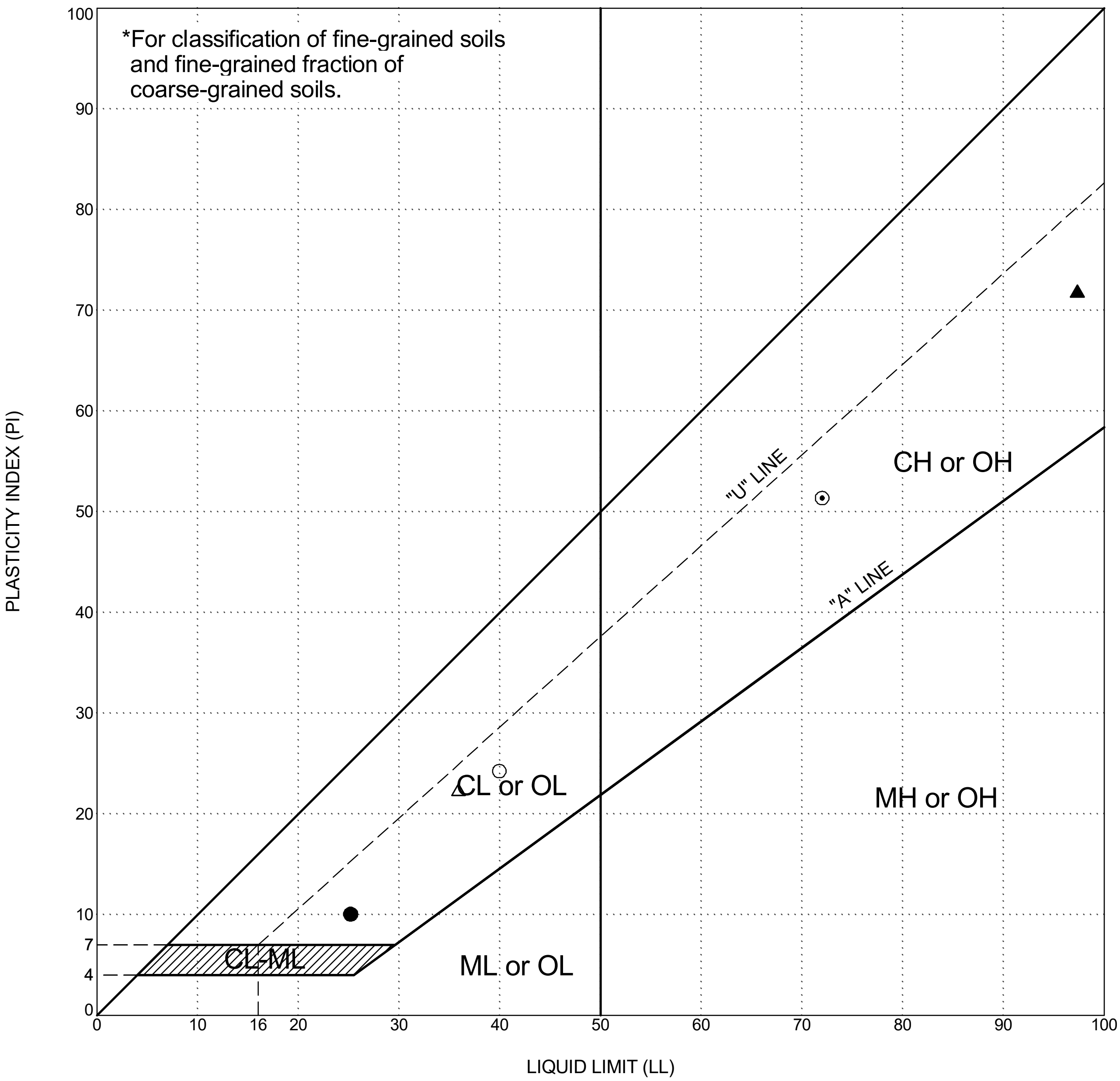


LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-13	7.0	Clay, olive gray	59	16	43	97
●	BH-14	11.0	Clay, olive gray, with silt pockets and shell fragments	51	14	37	79
△	BH-15	13.0	Sandy Clay, olive gray	34	15	19	49
▲	BH-16	5.0	Clay, olive gray, with silt pockets	43	15	28	81
⊙	BH-17	3.5		43	15	28	

ATTERBERG LIMITS TEST RESULTS

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

PLATE D3-6

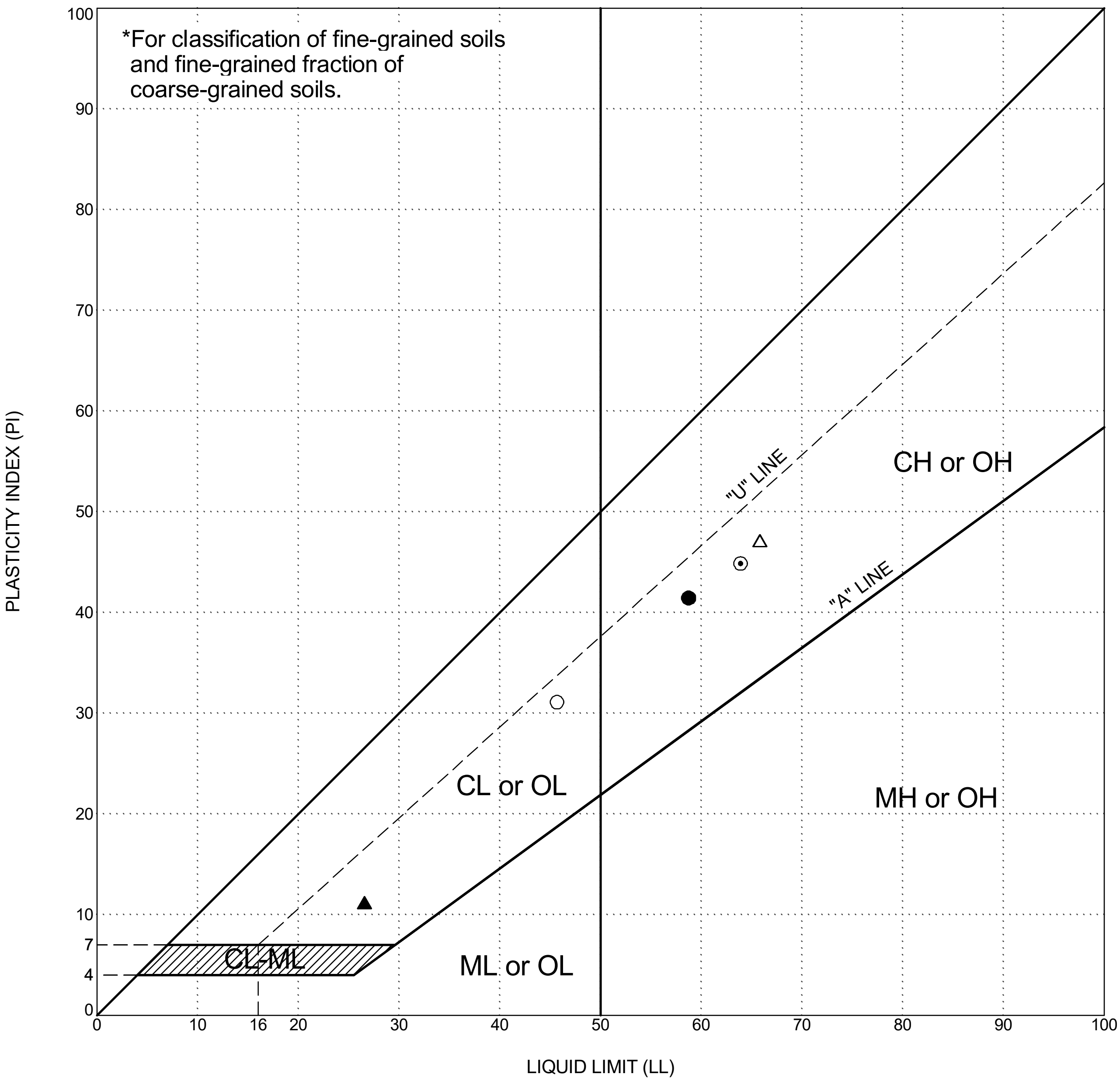


ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-18	3.0	Clay, olive gray, with sandy silt seams and shell fragments	40	16	24	86
●	BH-18	15.0		25	15	10	
△	BH-20	24.5	Silty Clay, greenish gray	36	13	23	72
▲	BH-22	44.5	Clay, gray, with shell fragments	97	25	72	93
⊙	BH-26	19.5		72	21	51	

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

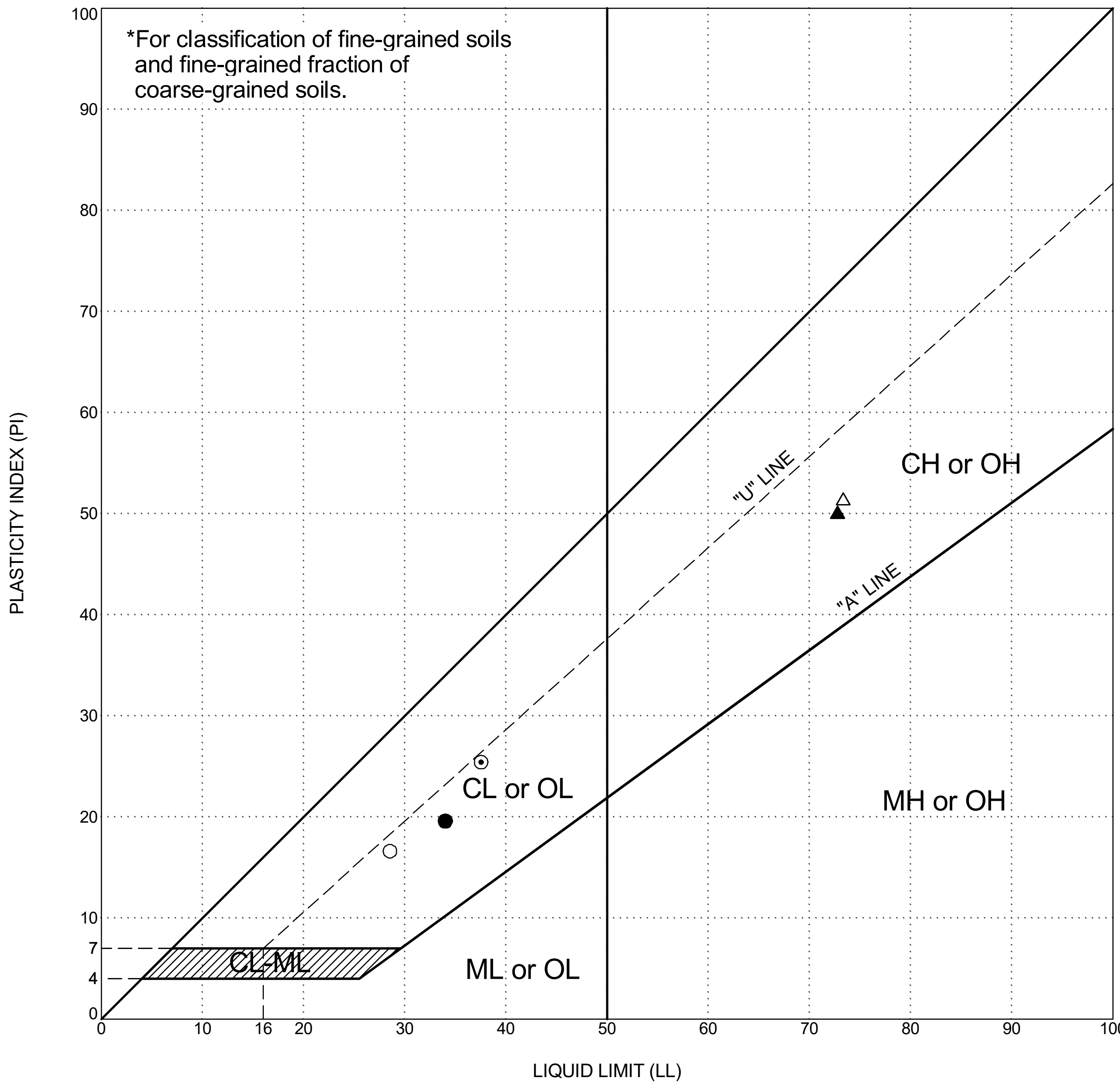
PLATE D3-7



ATTERBERG LIMITS TEST RESULTS

LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-29B	29.5	Clay, brown and greenish gray, with sandy clay seams	46	15	31	74
●	BH-30	11.0	Clay, brown and greenish gray, with gypsum and silt pockets	59	17	42	89
△	BH-31	24.5		66	19	47	
▲	BH-33	29.5		27	15	12	
⊙	BH-34	15.0		64	19	45	

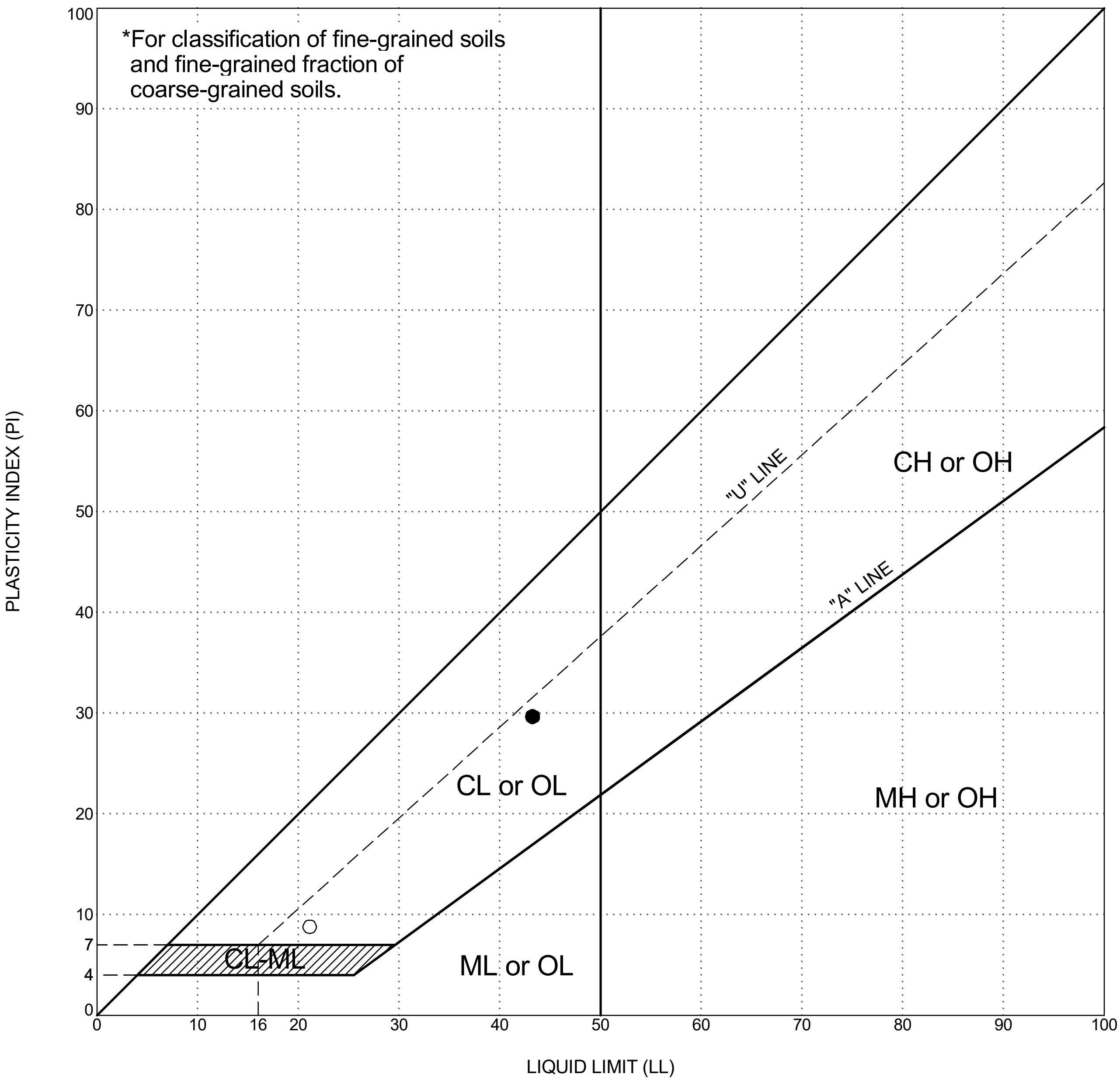
PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS



LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-35	3.5		29	12	17	
●	BH-35	9.5		34	14	20	
△	BH-35	15.5		73	22	51	
▲	BH-36	25.0	Clay, greenish gray and tan, with silt pockets	73	23	50	99
⊙	BH-37	3.5		38	12	26	

ATTERBERG LIMITS TEST RESULTS

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS



LEGEND (symbol)	(location)	(depth, ft)	CLASSIFICATION*	LIQUID LIMIT(LL)	PLASTIC LIMIT(PL)	PLASTICITY INDEX (PI)	%-200
○	BH-38	5.5	Sandy Clay, gray	21	12	9	25
●	BH-38	15.0		43	14	29	

ATTERBERG LIMITS TEST RESULTS

PLASTICITY CHART
SHIP CHANNEL DEEPENING PROJECT
PORT OF CORPUS CHRISTI AUTHORITY
CORPUS CHRISTI, TEXAS

Innovative approaches
Practical results
Outstanding service

CORPUS CHRISTI
New Work
Ocean Dredged Material Disposal Site
Proposed Expansion

Unconfined Open Water Disposal
New Work Dredged Material
Sediment Fate Numerical Modeling

March 2021
(Version 2)

Version	Date	Version Description	Prepared by	Reviewed by	Approved by
1	12/31/20	MDFATE/LTFATE	Risko/Kirk	Sepulveda/Vitale	Mack
2	3/15/21	MPFATE/DELFT3D	Risko/Kirk	Sepulveda/Vitale	Mack

Acknowledgements

Freese and Nichols, Inc. (FNI) would like to acknowledge the Port of Corpus Christi Authority (PCCA), the U.S. Army Corps of Engineers (USACE), Galveston District, USACE Portland District (Hans R. Moritz), and the USACE Engineer Research and Development Center (ERDC) (Jarrell Smith) who contributed to the sediment fate numerical modeling efforts for the proposed expansion to the Corpus Christi New Work Ocean Dredged Material Disposal Site (ODMDS). This report was developed under the contractual requirement entered between the Port of Corpus Christi Authority and FNI on October 20, 2020.

SEDIMENT FATE MODELING TEAM

CONSULTANT

Freese and Nichols, Inc.

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Appendices

Glossary of Terms

CCCDP	Corpus Christi Channel Deepening Project
CCSCIP	Corpus Christi Ship Channel Improvement Project
CY	cubic yard
DEM	Digital Elevation Model
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
FNI	Freese and Nichols, Inc.
FR	Federal Register
ft	feet
GUI	Graphical User Interface
LTFATE	Long-Term Fate Dredged Material Model
MCY	million cubic yards
MDFATE	Multiple-Dump Fate Dredged Material Model
MLLW	Mean Lower Low Water
mm	millimeters
MPFATE	Multiple-Placement Fate Dredged Material Model
MPRSA	Marine Protection, Research, and Sanctuaries Act
NAD	North American Datum
NCEI	National Centers for Environmental Information
NOAA	National Oceanic and Atmospheric Administration
NW	New Work
O&M	Operations and Maintenance
ODMDS	Ocean Dredged Material Disposal Site
PCCA	Port of Corpus Christi Authority
ppt	parts per thousand
SG	specific gravity
SMMP	Site Management and Monitoring Plan
STFATE	Short Term Fate Dredged Material Model
TxSED	Texas Coastal Sediment Geodatabase
USACE	U.S. Army Corps of Engineers

1.0 - INTRODUCTION AND BACKGROUND

Under Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972, the U.S. Environmental Protection Agency (EPA) Region 6 has undertaken an evaluation to expand the geometric footprint of the existing authorized Corpus Christi New Work (NW) Ocean Dredged Material Disposal Site (ODMDS), previously referred to as the Homeport Project ODMDS (See Figure 1).

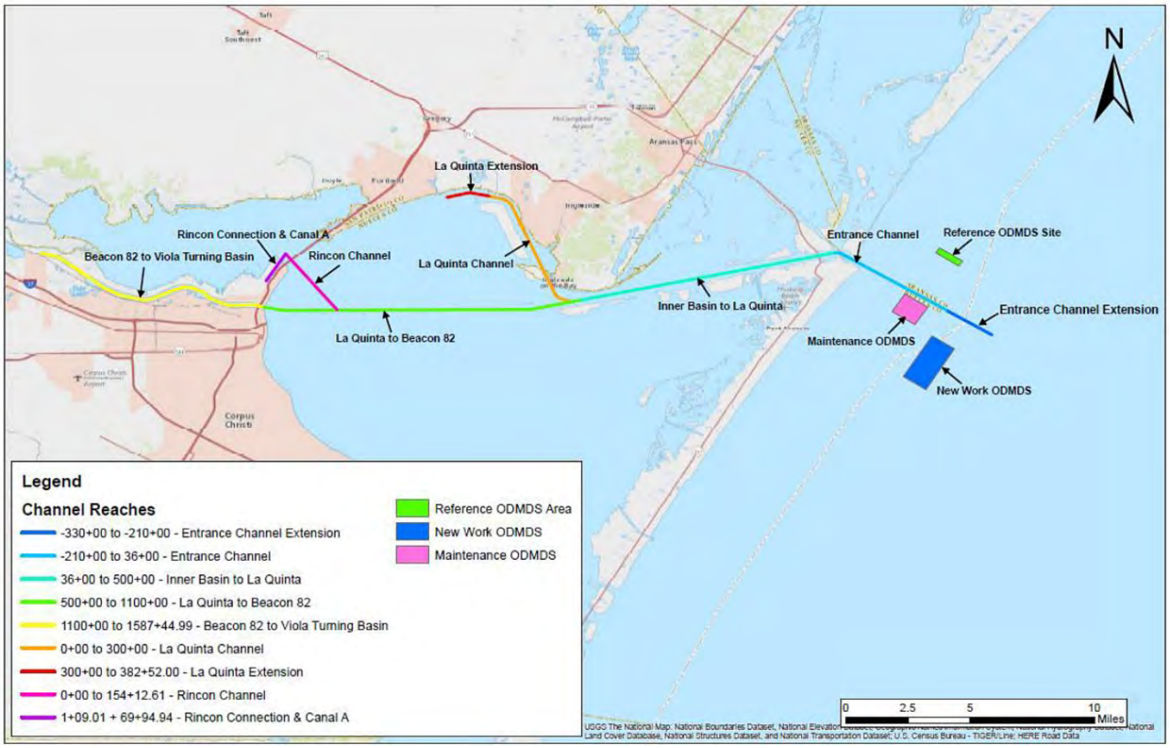


Figure 1. Geometric footprint of the existing New Work ODMDS
(Source: EPA/USACE, 2018)

Through the Federal Register (FR) August 31, 1988 (53 FR 169) Final Rule publication, the Homeport Project ODMDS was originally designated to provide a disposal area for placement of suitable construction dredged material from the U.S. Navy's Homeport Project at Corpus Christi/Ingleside, Texas and future maintenance dredged material. Since the Homeport project never materialized, the Homeport Project ODMDS was not used for disposal of construction dredged material for this project.

A subsequent Final Rule publication in the FR August 6, 2014 (79 FR 151), changed the use restriction period for the Corpus Christi Ship Channel Improvement Project (CCSCIP) and renamed the Homeport ODMDS to the New Work ODMDS.

1.1 Purpose and Need

Expanding the size of the New Work ODMDS footprint is needed to accommodate additional volume of construction dredged material for the potential future deepening of the Corpus Christi Ship Channel and other potential new work dredging activities. EPA Region 6 requires the proposed expanded New Work ODMDS be numerically modeled to ascertain the fate of dredged materials (e.g., fine to coarse grain sediments) and suitability of the proposed ODMDS expansion footprint to accommodate additional quantities of construction dredged material that may be generated from a future Corpus Christi Channel Deepening Project (CCCDP) or other potential new work dredging projects. EPA Region 6 has requested assistance from the U.S. Army Corps of Engineers (USACE), Galveston District to accomplish the required New Work ODMDS numerical modeling activities.

1.2 Location Description

The existing New Work ODMDS (Figure 1) is located approximately 3.4 miles offshore and about 6,200 feet (ft) southwest of the centerline of the Outer Bar Channel, occupying an area of approximately 1.36 square nautical miles. Bathymetric elevations range from –46 ft to –53 ft referenced to Mean Lower Low Water (MLLW). Corner coordinates of the site referenced to the North American Datum of 1983 (NAD 83) are shown in Table 1. The existing New Work ODMDS geometric footprint was based on numerical model simulations to sufficiently place approximately 2.4 million cubic yards (mcy) of construction material from the Navy's Homeport Project.

Table 1
Existing New Work ODMDS Boundary Coordinates (NAD 83)

Latitude	Longitude
27° 47' 43.1052” N	97° 00' 12.9522” W
27° 47' 16.1052” N	96° 59' 25.9512” W
27° 46' 18.1086” N	97° 01' 12.9534” W
27° 45' 50.1084” N	97° 00' 25.9488” W

EPA Region 6 proposes to expand the New Work ODMDS to accommodate the placement of additional volumes of construction dredged material. The Expanded New Work ODMDS’s geometric footprint is proposed to be enlarged within the limits of a recently completed EPA Region 6 ecological survey area (Figure 2). Corner coordinates of the ecological survey area are shown in Table 2:

Table 2
Corpus Christi ODMDS Ecological Survey Boundary Coordinates (NAD 83)

Latitude	Longitude
27° 49' 25.2” N	97° 01' 30.0” W
27° 47' 46.2” N	96° 58’ 28.2” W
27° 46' 28.2” N	97° 03' 40.2” W
27° 44' 49.2” N	97° 00' 38.4” W

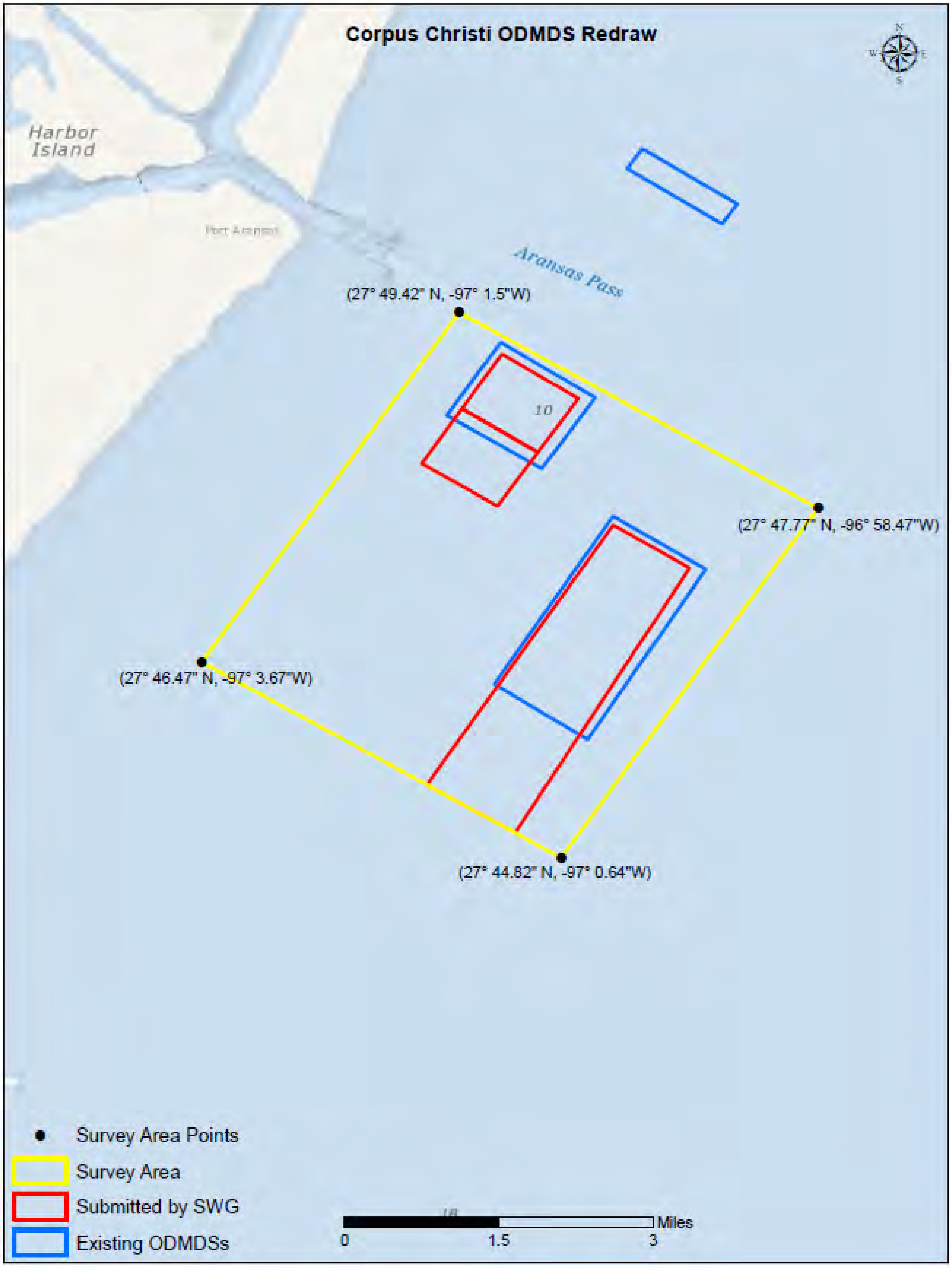


Figure 2. New Work ODMDS Proposed Expansion Area
(Source: USACE, 2020a)

2.0 - DREDGED MATERIAL FATE MODELING OVERVIEW

The Port of Corpus Christi Authority (PCCA), in collaboration with the USACE Galveston District, commissioned the numerical simulations of the dredged material open water placement (i.e., ocean dumping by bottom dump scows or hopper dredges) and disposal mound morphology changes at the proposed Expanded New Work ODMDS through a contract with Freese and Nichols, Inc. (FNI).

The modeling work entails determining the sufficient geometric boundaries for the proposed Expanded New Work ODMDS to accommodate the desired potential volumes within the ecological survey footprint through numerically simulating the open water placement of over 40 mcy dredged material.

2.1 Simulated Dredged Material Placement Processes

Sediment fate and morphological processes modeled during the open water placement of dredge material included:

- Short-term fate of dredged material following the open-water release from the disposal platform, consisting of descent, dynamic collapse, bottom transport, and stripping;
- Cumulative build-up (or mounding) of the dredged material disposal mound by simulating multiple disposal events and the near-term fate of the placed sediments concurrently with changes in the mound morphology induced by deposition, consolidation, erosion, and avalanching; and
- Post-placement morphological changes in the migration and dispersion of sediments of the disposal mound from sediment erosion, plus bottom transport and re-deposition of longer-term sediment fate induced by waves and currents.

2.2 Dredged Material Disposal Simulation Objectives

The objectives of the open water dredged material disposal simulations are to inform:

- The selection of the New Work ODMDS expanded boundaries; and
- The determination of the active disposal area within the Expanded New Work ODMDS boundaries.

2.3 Dredged Material Disposal Simulation Constraints

The dredged material disposal simulation scenarios are generally guided by the following constraints:

- The cumulative disposal mound thickness within the Expanded New Work ODMDS is not to exceed 11 ft, as governed by the Site Management and Monitoring Plan (SMMP) (EPA/USACE, 2018); and
- The accumulation of sediments at the Expanded New Work ODMDS is not to exceed a thickness of 1 foot above the ambient bottom bathymetry, as governed by the SMMP.

3.0 - DREDGED MATERIAL FATE MODELING SUITE

The dredged material and sediment fate models selected to simulate dredged material open water multiple placement, cumulative mound build-up, and long-term mound morphology changes included a combination of MDFATE, MPFATE, and Delft3D.

3.1 MDFATE Model

The Multiple Disposal Fate (MDFATE) (Moritz, 1994) of dredged material model simulates the post-disposal bathymetry and fate of multiple dredged material disposal events within an open water environment. MDFATE incorporates the existing Short-Term Fate (STFATE) (Johnson, 1992) and Long-Term Fate (LTFATE) (Scheffner et al., 1995) dredged material numerical models as subset codes to simulate both the short-term and long-term behavior of dredged material placed within open water.

Short-term physical processes of convective decent, dynamic collapse, and passive transport dispersion during dredged material placement are simulated by MDFATE through the STFATE subset code.

Long-term processes simulated by MDFATE through the LTFATE subset code include self-weight consolidation of cohesive sediments, sediment transport by waves and currents, and mound avalanching of non-cohesive sediments.

MDFATE provides the numerical modeling platform to efficiently evaluate alternative ODMDS geometries and dredged material disposal scenarios based on site physical, environmental, and operational constraints. The architecture of the MDFATE model is DOS-based and is menu driven, and therefore was limited to executing in 16-bit/32-bit operating systems or DOS emulators.

3.2 MPFATE Model

Similar to MDFATE, the Multiple Placement Fate (MPFATE) (Smith, 2006) of dredged material model simulates the accumulation of multiple dredged material placement events in an open water environment by incorporating STFATE as a subset code. The more recent architecture of the MPFATE model employs MATLAB-based Graphical User Interface (GUI), which assists with input/output and model execution, plus advances larger model grids, time-variant current and waves, and passive diffusion.

The primary limitations of MPFATE are the model does not simulate avalanching, the process of consolidation, or dispersion after disposal, as noted in the MPFATE User Guide. Simulation of long-term wave and current induced dispersion or post-placement migration of the dredged material mound requires the application of subsequent but separate sediment dispersion modeling, such as LTFATE or Delft3D.

3.3 Delft3D Model

The Deltares Delft3D modeling suite including the hydrodynamic module (D-Flow Flexible Mesh), wave module (D-Waves) and sediment transport module (D-Morphology) provides an integrated numerical tool to simulate sediment transport dynamics in the ocean environment by incorporating interactions of waves and currents that induce sediment transport. When coupled with MPFATE, Delft3D can predict the long-term dispersion and morphological changes to post-placement dredged material disposal mounds and surrounding bathymetry.

4.0 - FATE MODEL PARAMETERS

To perform the short-term and long-term dredged material placement fate simulations requires model input parameters that define the ODMDS site bathymetry, geotechnical properties of the dredged material, wave and current conditions, and operational parameters of the dredged material disposal platform. In 2018, the PCCA commissioned AECOM to perform an ODMDS analysis to assess the feasibility of placing 20,400,000 cubic yards (cy) of new work dredged material from the combined CCSCIP and proposed CCCDP. The results of AECOM's analysis were detailed in a report, herein referenced as PCCA 2018. FNI's review concludes the PCCA 2018 report evaluation results of the new work dredged material geotechnical characteristics, overflow losses, disposal sediment properties, and wave and current time series can be re-applied to the proposed Corpus Christi New Work ODMDS Expansion analysis.

4.1 Dredged Material Geotechnical Characteristics

PCCA 2018 characterized the new work dredge material within the entire footprint of the proposed CCCDP navigation channel based on geotechnical borings collected in 2018 (Fugro, 2018). Results of the characterization concluded the average sand content as 54% and silt and clay making up 44% of the remaining sediment fraction, with an average water content of 35%. With respect to potential new work projects, the modeling of placement of over 40 mcy with this volume, distribution and its relatively high percentage of sand, is a likely conservative scenario for assessing the capacity of the New Work ODMDS, given the likely smaller volumes of other projects and/or higher clay and silt percentages in borings viewed in the Texas General Land Office's (GLO) Texas Coastal Sediment Geodatabase (TxSED) along the navigation channels bay-ward.

4.2 Dump Scow Solids Concentration

Several of the assumptions on dredged material behavior from PCCA 2018 were made based on consultation with ERDC MPFATE program technical support staff. Therefore, these same assumptions were used in this analysis, given the same CCDP dredge prism and geotechnical properties being analyzed. Clay from the fines fraction would be expected to exhibit cohesion and result in clump formation. PCCA initiated construction of the CCSCIP, which will deepen the current channel to –54 ft or –56 ft MLLW, with the first contract for the Entrance Channel extension, completed in 2020. Observations of hopper loads by the USACE Galveston District Field Office did not indicate clumping occurred during hopper dredging and placement into the New Work ODMDS (USACE, 2020b). The CCSCIP Entrance Channel dredge prism reflects the higher sand content characteristic of the landward half of the CCCDP project segment, while higher clay content is observed in the seaward half. Clumping results in large, dredged material aggregates with relatively high settling velocities, and greater deposition than the fines that form it, and therefore assuming it occurs would be conservative with respect assessing ODMDS capacity, since it is less dispersive. Despite no clumping observed in the CCSCIP initial New Work ODMDS dredging, considering the higher clay content in the seaward portion, 10% clumping as material enters the hopper or scow was assumed to occur. Based on the geotechnical characteristics of the new work dredged material, PCCA 2018 estimated hydraulic dredging would introduce significant quantities of water into the sediment mixture, and with overflow occurring during loading of dump scows that 40% of the non-clump fines would be lost due to overflow. The resulting solids concentration in the dump scow would be 60% with the remaining concentration consisting of water and voids, and with the sediment class fractions distributed as 11.7% clumps, 63.1% fine sand, 14.0% silt, and 11.2% clay.

4.3 Disposal Sediment Properties

The sediment properties specified as parameters for the fate models were determined in PCCA 2018 by multiplying the solids content in the scow (60%) by the sediment class distribution listed in the preceding section (Section 4.2). These were reviewed and deemed reasonable. The specific gravity (SG) or density of solids was assumed to be 2.65 (unitless SG or gm/cm^3), which is consistent with standard assumptions in dredge production, and middle range values given in Figure 2-21 and the default assumption in Equation 2-6 of Engineer Manual (EM) 1110-2-5025, *Dredging and Dredged Material Management*. The median grain size consistent with fine sand of 0.13 millimeters (mm) was assumed for sand fraction grain size. Particle settling velocity curves provided by ERDC's Jarrell Smith were reviewed to select the settling velocity curve most applicable to the environmental conditions at Aransas Pass. The 33 parts per thousand (ppt) salinity at 20 degrees Centigrade water temperature settling velocity curve was deemed the curve most representative to Aransas Pass's average annual salinity and temperature conditions. The settling speeds specified for the fate model sediment parameters are consistent with the speeds in the selected settling velocity curve. The specified void ratios are typical for sand, silt and clay. The resulting sediment parameters used for the fate modeling are listed in Table 3.

Table 3
Fate Model Sediment Parameters

Particle Class	Density (g/cm^3)	Solids Content (ft^3/ft^3)	Settling Speed (ft/s)	Void Ratio	Critical Stress for Erosion (lbf/ft^2)	Simulation Stripping
CLUMPS	2.65	0.070	2	0.5	99	NO
SAND	2.65	0.380	0.06	0.5	0.15	YES
SILT	2.65	0.083	0.003	4.5	0.05	YES
CLAY	2.65	0.067	0.001	4.5	0.002	YES

4.4 Wave Data

PCCA 2018 extracted ten years (2005 to 2014) of offshore wave data from a nearby Wave Information Study (WIS) station (Figure 3). Evaluation of the wave data set concluded the wave data for 2009 represented the median value with one of the lower maximum wave heights. The 2009 wave time series was selected as the input wave parameters for the fate models, and were temporally shifted to start the time series on 01/01/2021. The 2009 wave characteristics consist of a representative wave height of 3.82 ft and a maximum wave height of 10.92 ft. A portion of the wave data is required to be repeated to cover the duration of fate simulations in excess of one-year.

As a check on bottom shear stresses that might induce sediment transport, using the linear wave theory equation for intermediate depth, wave induced near bottom velocity computations, and the Komar and Miller (1973) threshold of motion curves for oscillatory water waves (Appendix A), analyses were performed to determine the likelihood of incipient sediment motion at the proposed Expanded New Work ODMDS depths. The aforementioned 2009 wave time series and the dredged sediment's sand fraction grain diameter of 0.13 mm were utilized as input parameters for the forcing computations. Based on these forcing computations and analyses, sediment motion would be expected at bottom depths for wave induced near bottom velocities and wave period combination parameters generally exceeding the wave condition percentiles as listed in Table 4.

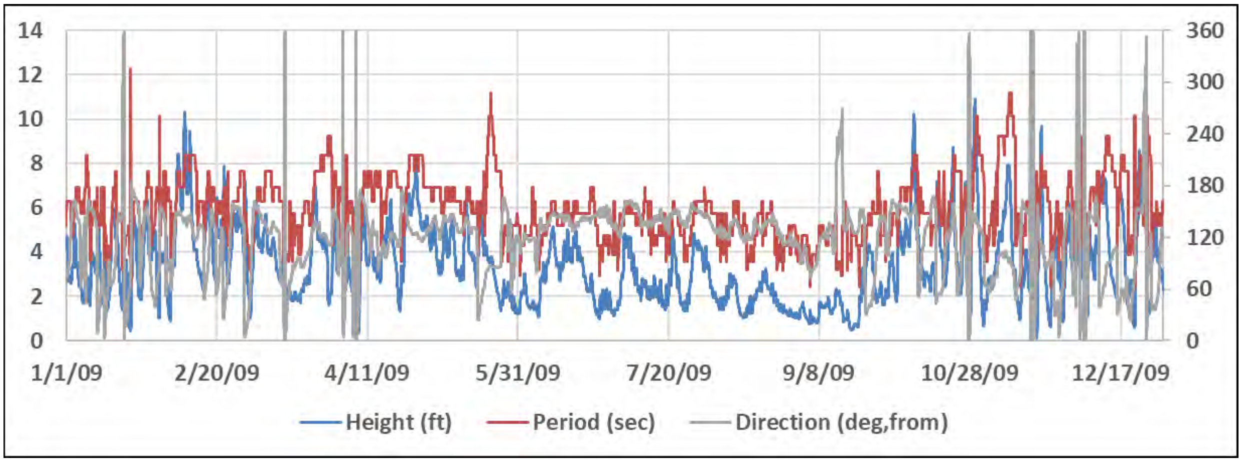


Figure 3. WIS 2009 Wave Time Series
(*Source: PCCA, 2018*)

Table 4
Wave Parameters Percentiles for Incipient Sediment Motion

Bottom Depth (ft, MLLW)	Wave Condition Percentile	Combination Wave Parameters	
		Near Bottom Velocity (ft/s)	Wave Period (s)
30	26th	0.53	4.74
40	41st	0.56	5.73
50	54th	0.56	5.73
60	68th	0.59	6.30

4.5 Current Data

PCCA 2018 obtained offshore current data from National Oceanic and Atmospheric Administration's (NOAA) Corpus Christi PORTS AP cc0101 Buoy and used data available from 03/15/2018 to 10/13/2018 (Figure 4). For the fate modeling, these time periods were shifted temporally to start on 01/01/2021. Peak speeds exceeded 4 ft/s with an average speed of 0.75 ft/s. A portion of the current data were required to be repeated to cover the duration of fate simulations.

4.6 Bathymetry

A site bathymetry grid was created for the numerical models' site using NOAA National Centers for Environmental Information (NCEI) Bathymetric Digital Elevation Models (DEM) at https://maps.ngdc.noaa.gov/viewers/bathymetry/. Supplemental hydrographic survey data of the existing New Work ODMDS was also obtained from USACE Galveston District which consisted of 2020 post-placement survey data at the existing O&M and New Work ODMDSs following completion of open water disposal of new work dredged material from the CCSCIP project.

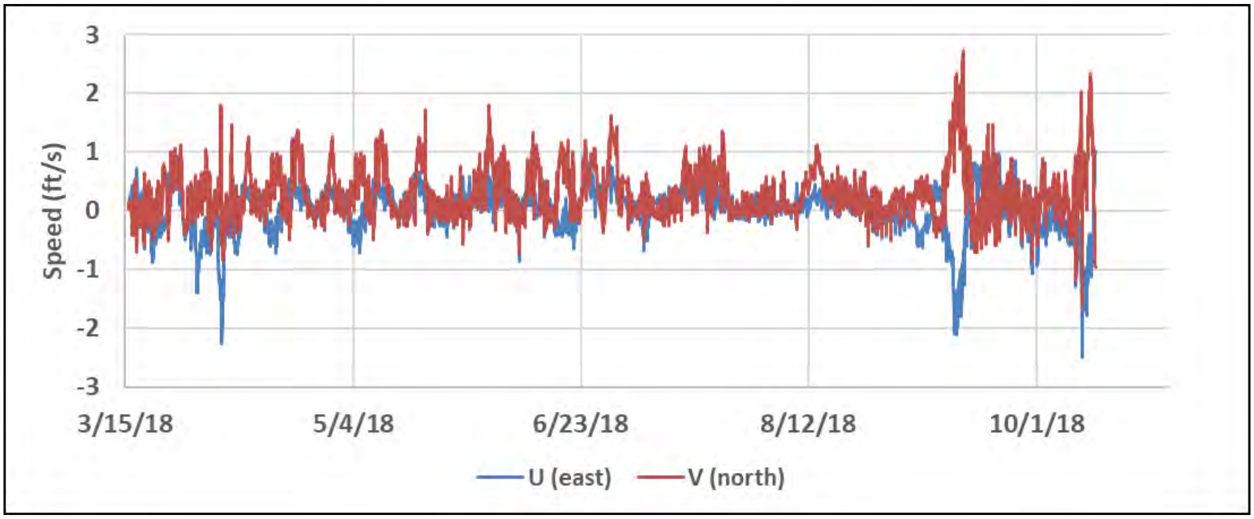


Figure 4. PORTS AP cc0101 Buoy 2018 Current Time Series
(*Source: PCCA, 2018*)

4.7 Dredged Material Disposal Vessel

New work dredged material generated during the construction of the CCSCIP Entrance Channel was placed within the existing New Work ODMDS. Dredging and dredged material disposal within the existing New Work ODMDS were performed by Great Lakes Dredge and Dock, Co. (GLDD) using the dredge platforms Ellis Island and Terrapin Island from April 2019 to February 2020. Approximately 2.7 mcy of new dredged material was disposed within the existing New Work ODMDS (USACE, 2020b).

The Ellis Island is an Articulated Tug Barge (ATB) trailing head hopper dredge with a hopper capacity of approximately 15,000 cy. The Terrapin Island is trailing head split hull hopper dredge with a hopper capacity of approximately 6,400 cy.

Both the Ellis Island and Terrapin Island's performance and dimension parameters were used as disposal operation data for simulating placement of dredged material within the fate models. Performance and disposal parameters for both dredge disposal vessels are provided in Table 5.

Table 5
Dredge Disposal Vessel Parameters

Disposal Vessel Class	Hopper Capacity (cy)	Vessel Length (ft)	Vessel Beam (ft)	Vessel Draft Loaded (ft)
Terrapin Island	6,400	315	70	22
Ellis Island	15,000	480	92	30

5.0 - EXPANDED NEW WORK ODMDS MODEL PARAMETERS

The attributes formulated to model scenarios for the proposed Expanded New Work ODMDS consisted of: 1) expanded ODMDS geometric footprint, 2) expanded active disposal area within the expanded ODMDS geometric footprint, 3) dredged material volume, 4) disposal vessel capacity, 5) number of dump points, 6) number of dump sorties per day, and 7) dump durations. These modeling attributes were used for all simulations conducted in MDFATE, and MPFATE/Delft3D.

5.1 Expanded New Work ODMDS Geometry

The proposed expansion to the New Work ODMDS geometry footprint was initially calculated based on the area required to actively dispose 44 mcy of placed dredged material without theoretically exceeding a cumulative mound height of 11 ft. Buffer distances similar to the existing New Work ODMDS were then applied around the theoretical active disposal area to define the geometry of the Expanded New Work ODMDS footprint. The geometry footprint resulted in dimensions of 11,200 ft x 18,300 ft and an area of 4,700 acres, in water depths ranging from –37 to –59 ft referenced to MLLW. The expanded ODMDS geometric shape was set inside the ecological survey area to establish the corner coordinates of the proposed Expanded New Work ODMDS as reported in Table 6 and shown in Figure 5. Bathymetric contours for the same are displayed in Appendix B.

Table 6
Expanded New Work ODMDS Boundary Coordinates (NAD 83)

Label	Latitude	Longitude
ExNW1	27° 48' 31.6” N	97° 00' 24.3” W
ExNW2	27° 47' 32.6” N	96° 58’ 40.4” W
ExNW3	27° 46' 00.4” N	97° 02' 19.4” W
ExNW4	27° 45' 01.2” N	97° 00' 32.2” W

5.2 Expanded New Work ODMDS Active Disposal Area

As described in Section 5.1, the proposed expanded active disposal area within the proposed Expanded New Work ODMDS was determined based on the area required to actively dispose 44 mcy of placed dredged material without theoretically exceeding a cumulative mound height of 11 ft. The geometry footprint resulted in dimensions of 9,000 ft x 12,000 ft and an area of 2,480 acres. This geometric footprint is the first (Option 1) of two (Option 2) active disposal area options evaluated for dredged material placement and fate simulations. Option 2 is a modification of Option 1 by extending the active disposal area geometry by 2,000 ft toward the southwestwardly direction.

Corner coordinates for the Option 1 active disposal area are reported in Table 7 and shown in Figure 6. Corner coordinates for the Option active disposal area are reported in Table 8 and shown in Figure 7.

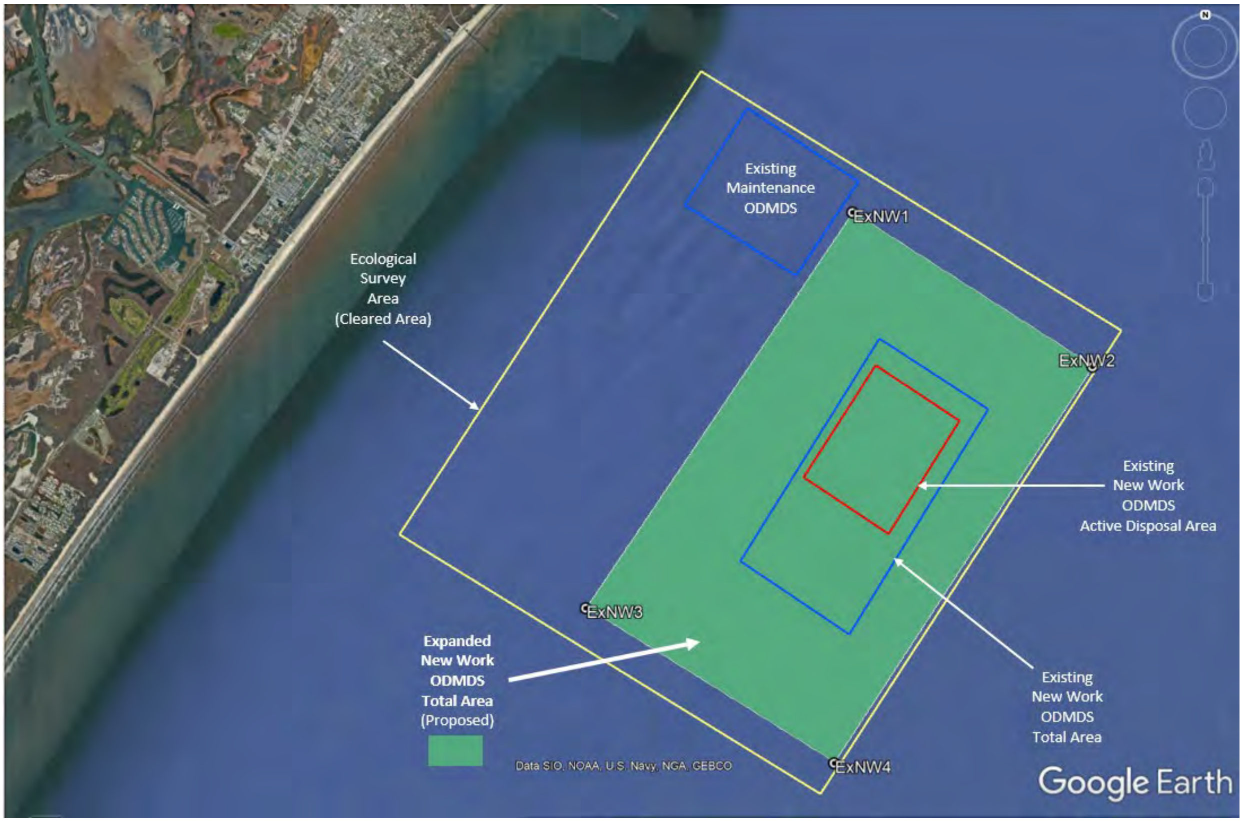


Figure 5. Proposed Expanded New Work ODMDS Geometric Footprint

Table 7
Expanded New Work ODMDS Boundary Coordinates (NAD 83)
(Active Disposal Area – Option 1)

Label	Latitude	Longitude
ExNW1-A	27° 48' 16.4” N	97° 00' 18.8” W
ExNW2-A	27° 47' 28.7” N	96° 58' 54.9” W
ExNW3-A	27° 46' 33.8” N	97° 01' 39.7” W
ExNW4-A	27° 45' 42.0” N	97° 00' 13.3” W

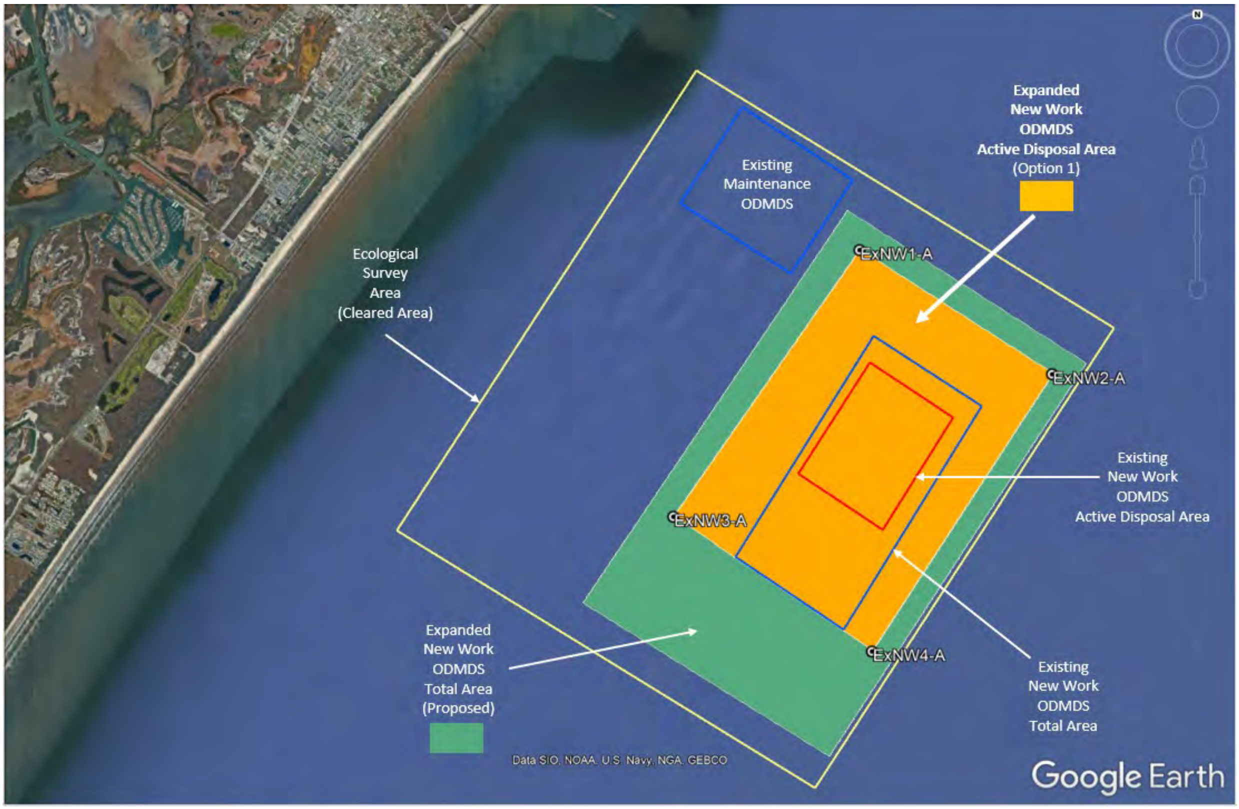


Figure 6. Proposed Expanded New Work ODMDS Active Disposal Area (Option 1)

Table 8
Expanded New Work ODMDS Boundary Coordinates (NAD 83)
(Active Disposal Area 2 – 2,000 ft Extension)

Label	Latitude	Longitude
ExNW1-AE	27° 48' 16.4” N	97° 00' 18.8” W
ExNW2-AE	27° 47' 28.7” N	96° 58’ 54.9” W
ExNW3-AE	27° 46' 18.8” N	97° 01' 52.2” W
ExNW4-AE	27° 45' 22.6” N	97° 00' 24.2” W

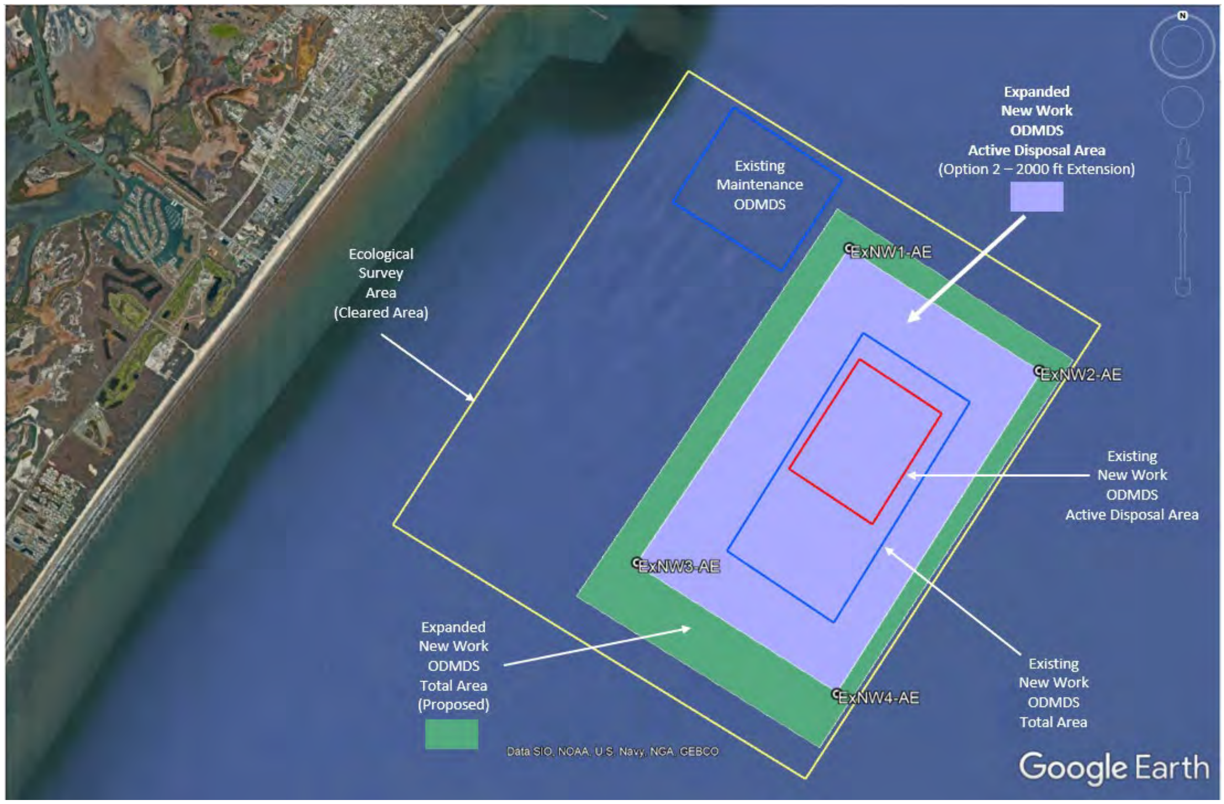


Figure 7. Proposed Expanded New Work ODMDS Active Disposal Area
(Option 2 – 2,000 ft Extension)

5.3 Dredged Material Volume

Dredged material dump volumes used for the placement and fate model simulations ranged between 40.5 mcy and 45.2 mcy. These volumes were based on a combination of solids (60%) and water/voids (40%) at the time of the dump phase. The sediment classes of the solids include clumps, fine sand, silt, and clay in fractions as reported in Section 4.3 (Disposal Sediment Properties). The equivalent dredged material in-situ volume ranged between 43.7 mcy to 48.7 mcy, with solid losses from overflow processes as described in Section 4.2 (Dump Scow Solids Characterization).

5.4 Disposal Vessel Capacity

Two sizes of disposal vessel hopper capacities (6,400 cy and 15,000 cy) were used to simulate dredged material placement within the proposed Expanded New Work ODMDS active disposal areas, with the vessel dimensions described in Section 4.7 (Dredge Material Disposal Vessel).

5.5 Number of Dump Points

Depending on the volume of dredged material to dump, the size of the active disposal area, the size of disposal vessel, and the selected spacing between the dump points, the number of dump points established for the fate model simulations ranged between 2,700 points to 7,056 points.

5.6 Number of Dump Sorties Per Day

The number of sorties per day selected per disposal vessel was based on the potential production rate for each vessel class (USACE, 2017). For the 6,400 cy hopper capacity vessel, the number of sorties per day was estimated at 12, assuming two vessels operating concurrently. This equates to a daily production rate of approximately23,000 cy/day per vessel. For the 15,000 cy hopper capacity vessel, the number of sorties per day was estimated at 7, assuming two vessels operating concurrently. This equates to a daily production rate of approximately32,000 cy/day per vessel.

5.7 Dump Duration

Dump durations (amount of time to release all dredged material from the disposal vessel) of 240 and 480 seconds were selected for the early simulations, with the intent of simulating and evaluating a wider spread of the dredged material to reduce the peak heights of the disposal mound.

5.8 Common Parameters

Other common parameters applied during the simulations included the disposal vessel approaching from the southwest, against the southwestwardly prevailing current direction (EPA, 1988), and a disposal vessel dump speed of 3.3 ft/s. Tidal velocities were neglected given the small tidal velocities within the open Northern Gulf of Mexico

5.9 Short-Term and Long-Term Fate Durations

Simulation days were selected to account for short-term and long-term fate effects of the placed dredged material. Simulation days ranged from the number of days to complete a disposal sequence increment to the long-term fate effects simulation of 1- and 2-years, or 365-days and 730-days, respectively.

6.0 - MDFATE SIMULATION SCENARIOS

A number of dredged material placement scenarios were simulated within the latest version of the MDFATE model. This version of the MDFATE model was obtained from Mr. Hans R. Moritz (USACE Portland District) and was last updated in 2007. The updated MDFATE model provides enhancements to the user to include the ability to import a wave data file consisting of date, time, significant wave height, wave period, and wave direction in 3 hour increments; applying variabilities to disposal vessel speed (+/-30%), vessel heading (+/-45 degrees), and disposal duration (+/-20%); and, applying variabilities to residual current speed (+/-30%) and current direction (+/-25 degrees).

The MDFATE model will accept either one constant residual current velocity or two constant residual current velocities that are permitted to change at a specified day into the simulation run. The one constant residual current velocity option incorporating the variability algorithm was selected for all simulation scenarios. A constant average residual current speed of 1.0 ft/s was applied as calculated and reported in PCCA 2018.

As noted in Section 4.4 (Wave Data), the 2009 WIS wave data was used as MDFATE's input parameters for the wave time series. A portion of the 2009 wave time series was repeated when the cumulative short-term and long-term effects simulation days exceeded 365 days.

6.1 MDFATE Scenarios Simulation Matrix

Appendix C provides a list of dredged material placement and fate alternatives simulated by the MDFATE model. Each scenario consisted of the model parameters described in Section 5.0 (Expanded New Work ODMDS Model Parameters). All alternatives involved incrementally simulating the placement activities over six dredged material placement increments. Each new increment would cumulatively stack on the previous increments until all increments were simulated for both short-term and long-term effects.

The final two alternatives modeled by MDFATE are shown in Table 9 and are labeled Scenario 1 and Scenario 2. Scenario 1 consists of an active disposal area with the dimensions of 9,000 ft x 12,000 ft. Scenario 2 extends the active disposal area by 2,000 ft, with the dimensions of 9,000 ft x 14,000 ft. Both scenarios consisted of a dredged material volume of approximately 44 mcy, and long-term fate effects simulation of 365-days and 730-days.

Table 9
Expanded New Work ODMDS Final Scenarios (MDFATE)

Model Parameters	Scenario 1	Scenario 2
Expanded New Work ODMDS Geometry	11,200 ft x 18,300 ft	11,200 ft x 18,300 ft
Expanded Active Disposal Area	9,000-ft x 12,000-ft (Expanded)	9,000-ft x 14,000-ft (Expanded – Extended)
Dredged Material Volume	44,236,800 cy	44,236,800 cy
Total In-Situ Volume	47,700,000 cy	47,700,000 cy
Disposal Vessel Capacity	6,400 cy	6,400 cy
Number of Dump Points	6,912	6,912
Number of Dump Sorties Per Day	12	12
Dump Duration	240 sec	240 sec
Number of Incremental Simulations	6	6
Total Dredged Material Volume per Simulation Increment	7,372,800 cy	7,372,800 cy
No. of STFATE Days per Dump Simulation Increment	96 days	96 days
No. of LTFATE Days per Dump Simulation Increment	96 days	96 days
No. of LTFATE Days Post-Final Dump Event	365 days (1-Yr) 730 days (2-Yr)	365 days (1-Yr) 730 days (2-Yr)

7.0 - MDFATE SIMULATION RESULTS

MDFATE simulation results for Scenario 1 and Scenario 2 are summarized in the following sub-sections. Immediately following the last Increment 6 dump event, both scenarios displayed mound heights that peaked above 11 ft, at 15.54 ft (Scenario 1) and 13.25 ft (Scenario 2). However, the number of peaks above a height of 11-ft are minimal for both scenarios. When simulating the long-term fate effects, the resulting mound height peaks for both scenarios fall well below 11 ft after 365 days and 730 days of wave and current exposure occurs upon the mound. In addition, for both scenarios, the accumulated thickness at the edges of the proposed Expanded New Work ODMDS does not exceed 1-ft at the end of the Increment 6 dump event and at the end of the 365-day and 730-day long-term fate simulations.

7.1 MDFATE Scenario 1 Results

To simulate in MDFATE the placement of 44.2 mcy of dredged material required a total of 576 simulation days, segmented into 6 cumulative simulation increments of 96 days each (i.e., Increment 1 [days 1-96], Increment 2 [days 97-192] and so forth to Increment 6 [days 481-576]). An additional 365 and 730 simulation days were added to assess the long-term fate effects on the dredged material placement mound.

Figures 8 and 9 show the plan view and cross-section results of Scenario 1's relief mound geometries at the end of the Increment 6. At the end of the Increment 6 placement, 7.7% of the discernable (i.e, thicknesses greater than one foot) dredged material mound exceeded a relief height of 11 ft, with a median mound height of 7.8 ft.

Figures 10 and 11 show Scenario 1's relief mound geometries at the 365-day, and 730-day long-term simulations, respectively. For both long-term simulations, the maximum relief heights for the disposal mound were markedly less than 11 ft.

Appendix D provides 3D graphical displays of Scenario 1's bathymetry and mound thickness for Increment 6 and for post-Increment 6 long-term simulation days of 365 and 730 plus corresponding statistical histogram and frequency plots of Increment 6's mound thicknesses, respectively.

MDFATE calculates the net volume of sediments within the open water placement site following disposal and short-term and long-term fate effects, to include accounting for the solid concentration, bulking (voids), and consolidation of cohesive sediments. Table 10 lists the remaining net volume of sediments for Scenario 1 following the end of Increment 6 disposal, and at days 365 and 730 (post-Increment 6).

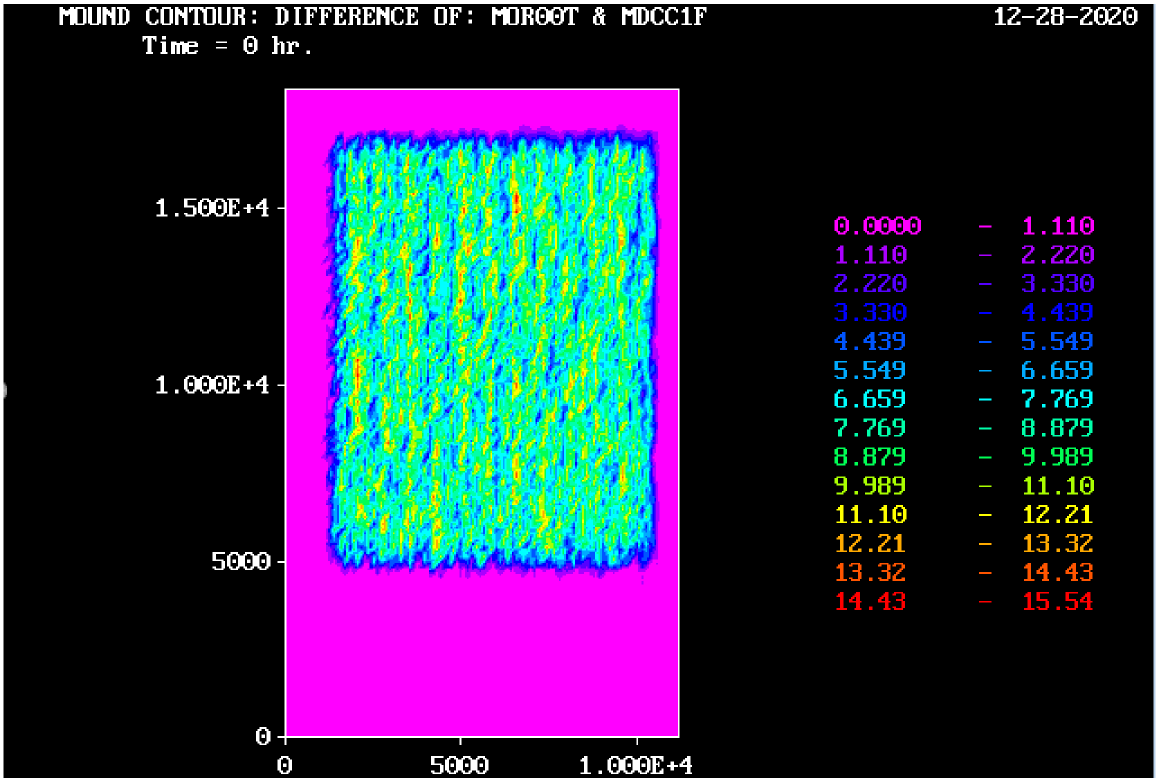


Figure 8. MDFATE Scenario 1 at the End of Increment 6 (in ft)

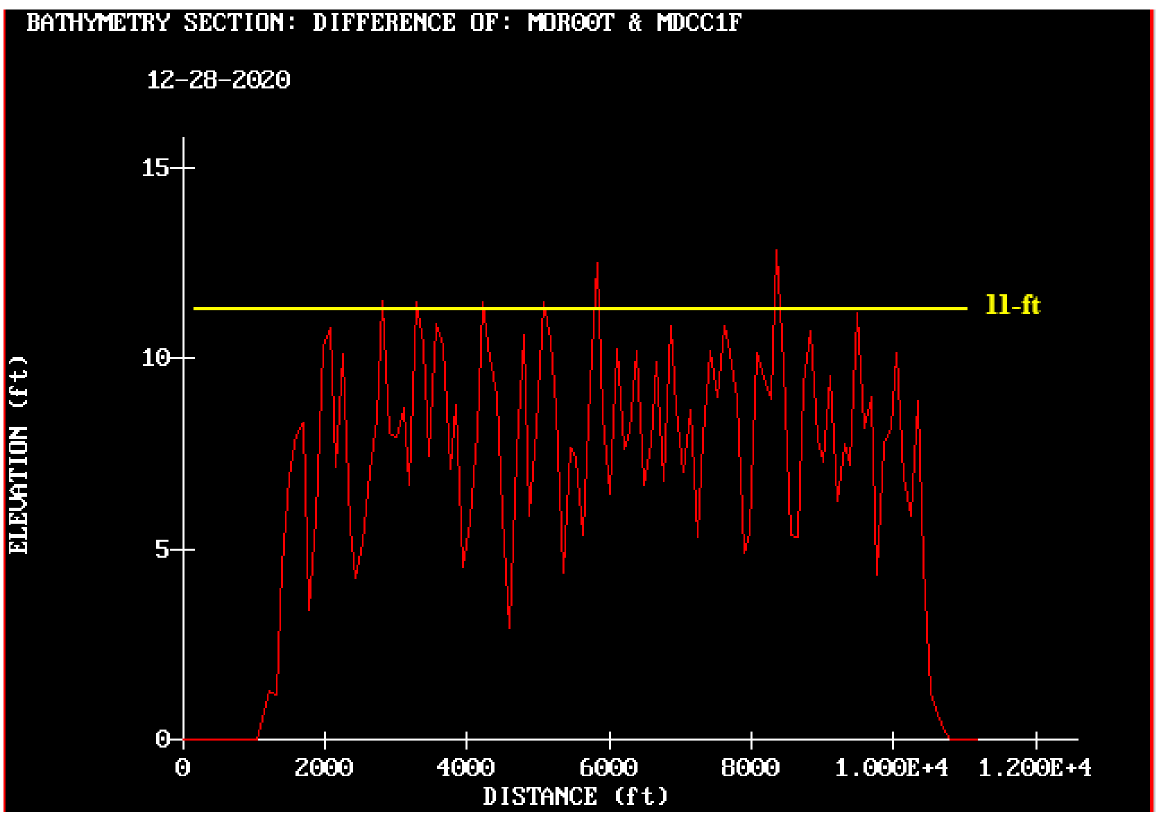


Figure 9. MDFATE Scenario 1 at the End of Increment 6 (Center Cross-Section)

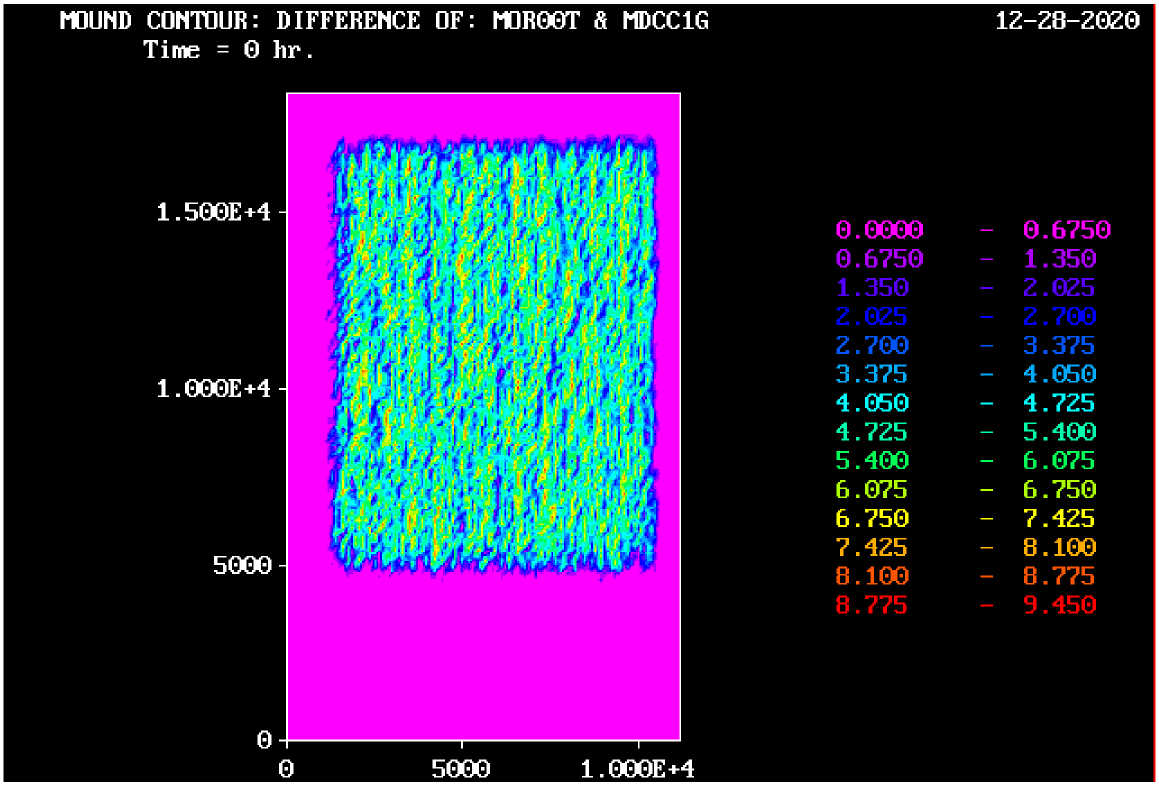


Figure 10. MDFATE Scenario 1 at Day 365 (Post-Increment 6) (in ft)

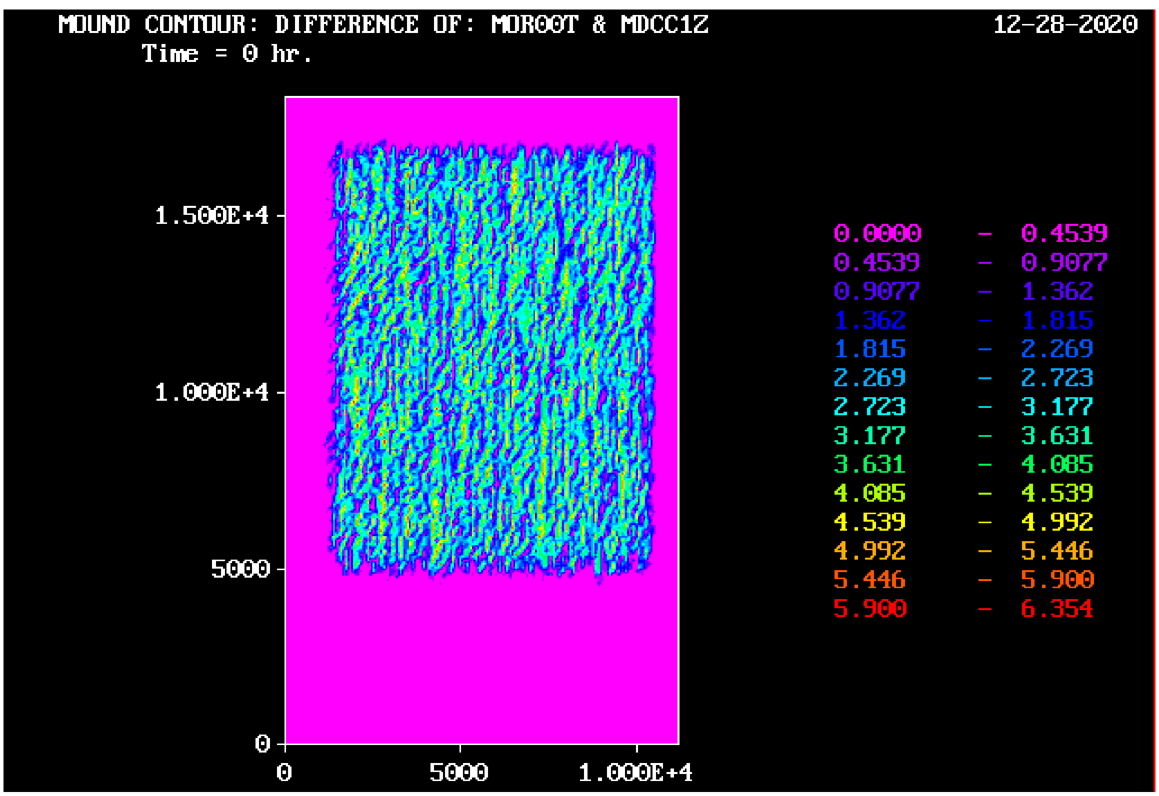


Figure 11. MDFATE Scenario 1 at Day 730 (Post-Increment 6) (in ft)

Table 10
MDFATE Scenario 1 Temporal Sediment Volume Change

Simulation End Day	Remaining Dredged Material Volume (Solids/Water/Voids)
Total Dredged Material Placed	44.2 mcy
At End of Increment 6	33.2 mcy
At Day 365 (Post-Increment 6)	18.8 mcy
At Day 730 (Post-Increment 6)	10.4 mcy

7.2 MDFATE Scenario 2 Results

To simulate in MDFATE the placement of 44.2 mcy of dredged material required a total of 576 simulation days, segmented into 6 cumulative simulation increments of 96 days each. An additional 365 and 730 simulation days were simulated to assess the long-term fate effects on the dredged material placement mound. Figures 12 and 13 show the plan view and cross-section results of Scenario 2's relief mound geometries at the end of the Increment 6. At the end of the Increment 6 placement, only 1.1% of the discernable (i.e., thicknesses greater than one foot) dredged material mound exceeded a relief height of 11 ft, with a median mound height of 6.8 ft.

Figures 14 and 15 show Scenario 2's relief mound geometries at the 365-day, and 730-day long-term simulations, respectively. For both long-term simulations, the maximum relief heights for the disposal mound were markedly less than 11 ft.

Appendix E provides 3D graphical displays of Scenario 2's bathymetry and mound thickness for Increment 6 and for post-Increment 6 long-term simulation days of 365 and 730 plus statistical histogram and frequency plots of Increment 6's mound thicknesses, respectively.

MDFATE calculates the net volume of sediments within the open water placement site following disposal and short-term and long-term fate effects, to include accounting for the solid concentration, bulking (voids), and consolidation of cohesive sediments. Table 11 lists the remaining net volume of sediments for Scenario 2 following the end of Increment 6 disposal, and at days 365 and 730 (post-Increment 6).

Table 11
MDFATE Scenario 2 Temporal Sediment Volume Change

Simulation End Day	Remaining Dredged Material Volume (Solids/Water/Voids)
Total Dredged Material Placed	44.2 mcy
At End of Increment 6	34.2 mcy
At Day 365 (Post-Increment 6)	21.1 mcy
At Day 730 (Post-Increment 6)	12.5 mcy

When comparing the remaining net volumes between the two scenarios, Scenario 1's remaining net volume is less than Scenario 2. This is most likely due to Scenario 1 having a smaller footprint but a higher mound elevation than Scenario 2, and therefore experiencing greater sediment transport induced by stronger wave and current energies at top of mound depth (i.e., taller sediment peaks subject to exposure of larger orbital wave velocities and accelerations closer to the water surface).

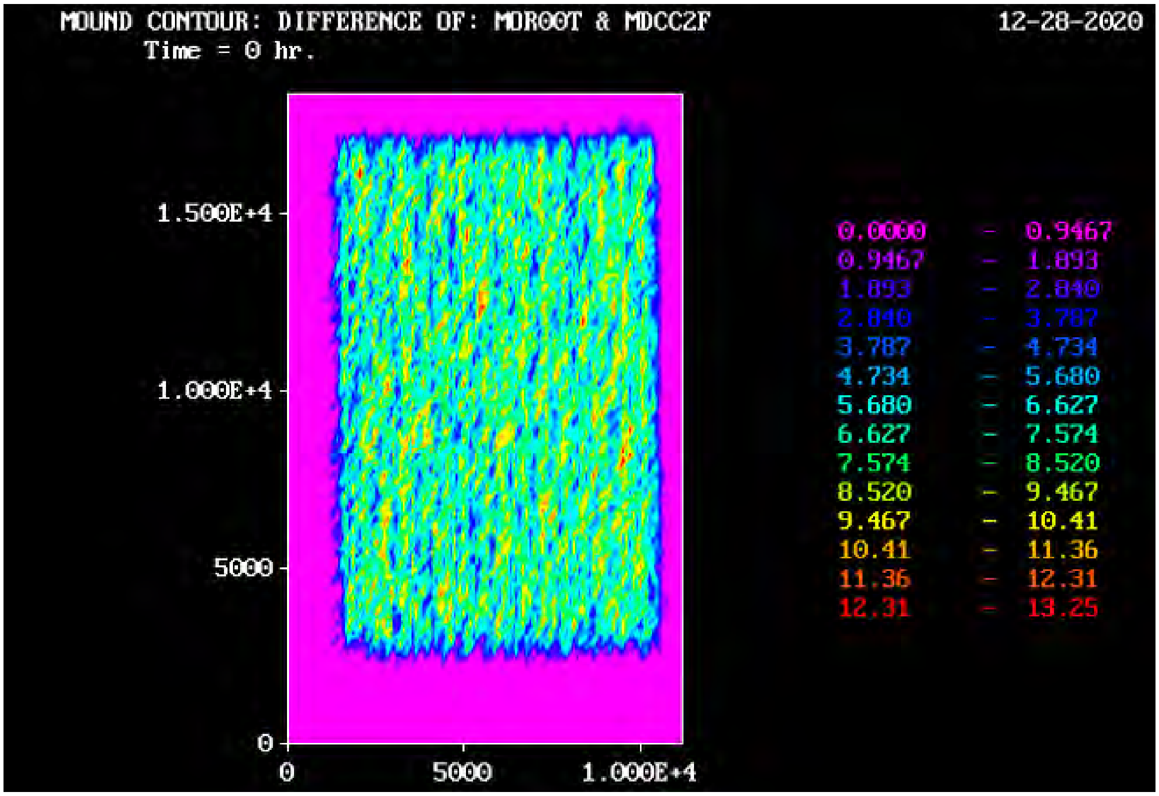


Figure 12. MDFATE Scenario 2 at the End of Increment 6 (in ft)

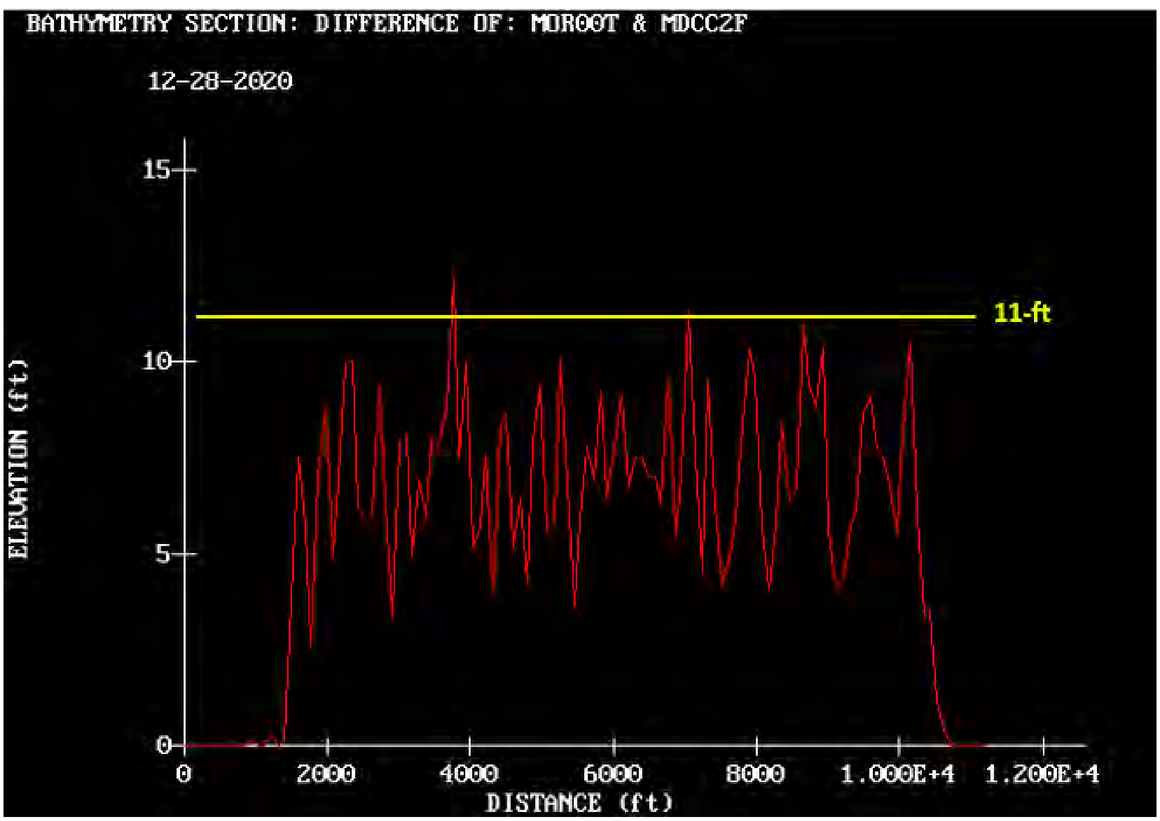


Figure 13. MDFATE Scenario 2 at the End of Increment 6 (Center Cross-Section)

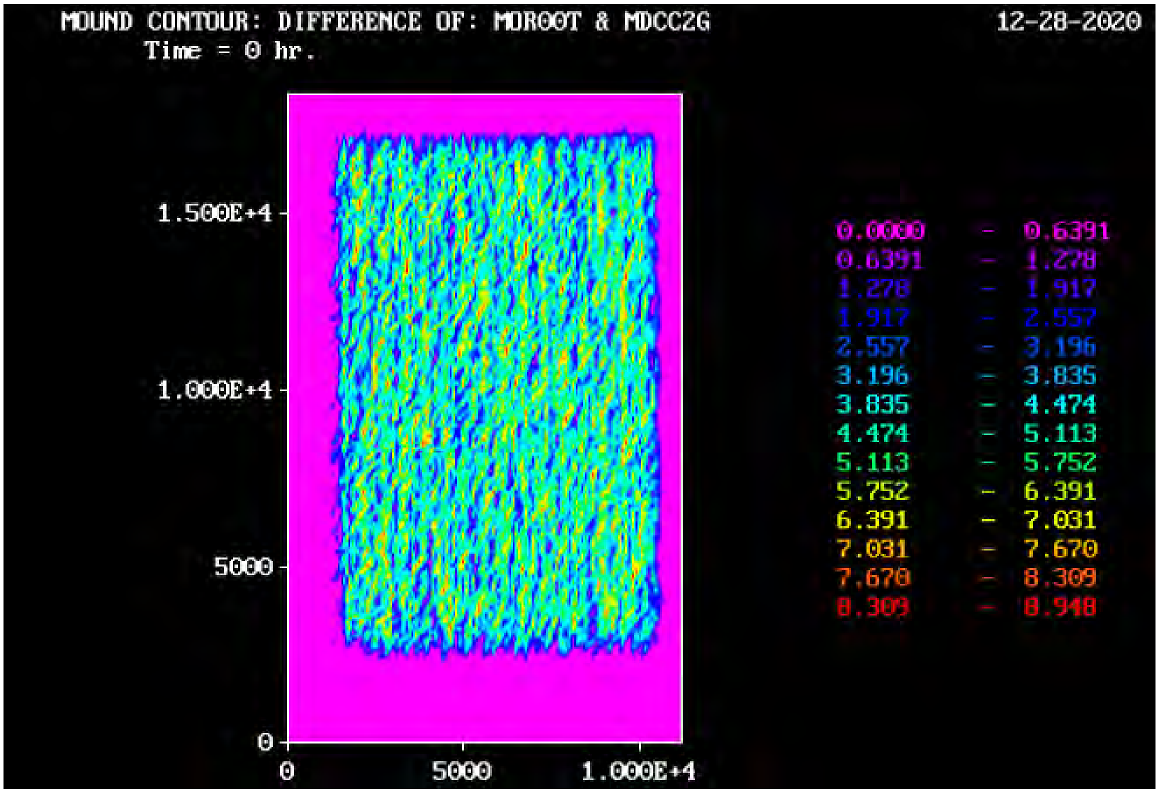


Figure 14. MDFATE Scenario 2 at Day 365 (Post-Increment 6) (in ft)

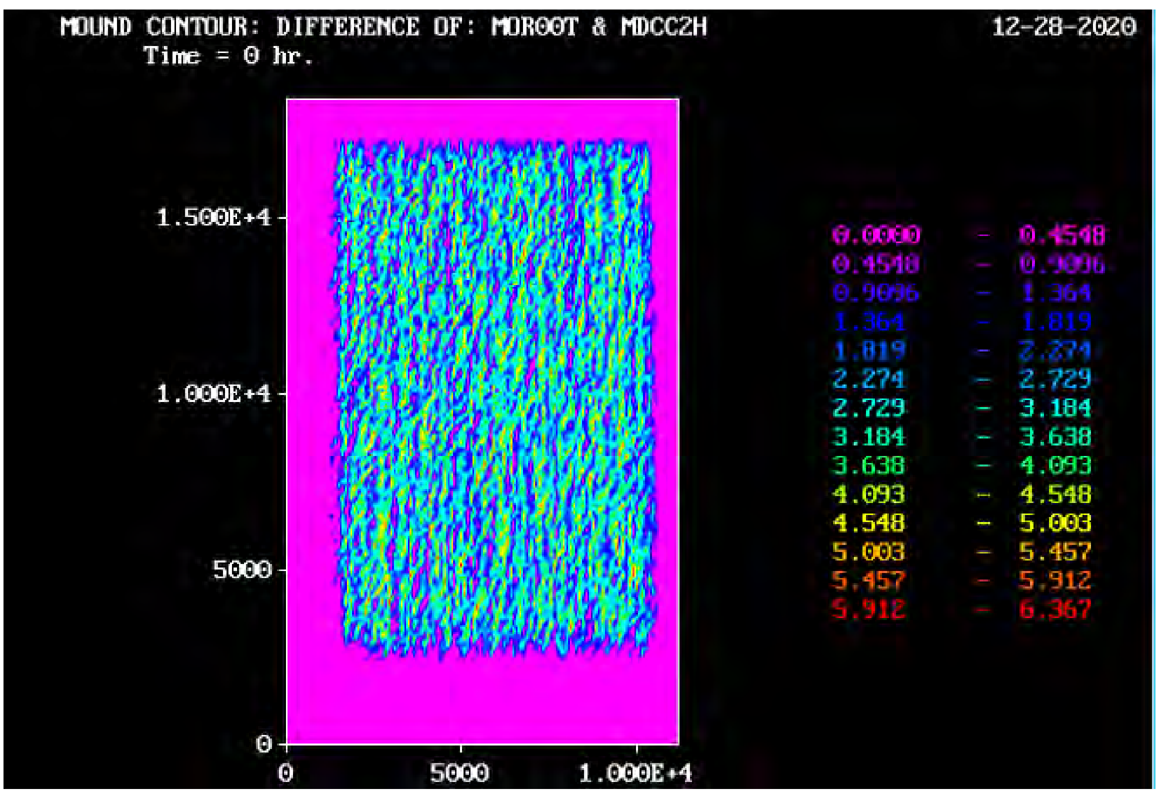


Figure 15. MDFATE Scenario 2 at Day 730 (Post-Increment 6) (in ft)

Table 12 provides a side-by-side comparison of results between MDFATE Scenario 1 and Scenario 2.

Table 12
MDFATE Scenario 1 and 2 Comparisons

Simulation End Day	MDFATE Scenario 1	MDFATE Scenario 2
Total Dredged Material Volume - Placed -	44.2 mcy	44.2 mcy
Remaining Dredged Material Volume - At End of Increment 6 -	33.2 mcy	34.2 mcy
Remaining Dredged Material Volume - At Day 365 (Post-Increment 6) -	18.8 mcy	21.1 mcy
Remaining Dredged Material Volume - At Day 730 (Post-Increment 6) -	10.4 mcy	12.5 mcy
Median Mound Height - At End of Increment 6 -	7.8 ft	6.8 ft
Percent Mound Height > 11 ft - At End of Increment 6 -	7.7%	1.1%

8.0 - MPFATE SIMULATIONS

As discussed in Section 3.2 (MPFATE Model), MPFATE is an alternative fate model that simulates open water multiple dredged material placement and subsequent sediment accumulation configuration at the bottom. Simulations of Scenario 2 were executed with MPFATE using an updated v2.0a MATLAB-based GUI provided by Jarrell Smith (USACE ERDC). As discussed in Section 5.0, the same values for input and parameters common to all models, including MPFATE, were used in each model, such as grid and placement coordinates, bathymetry, dredge characteristics, placement volumes, dredge event and material assumptions. The following discusses model set-up specific to MPFATE. The computation grid was set to 100-foot spacing and rotated -33 degree from north to provide comparability with previous MPFATE calculations for this ODMDS in PCCA 2018. This grid angle is aligned with the ODMDS long-side axis and equivalent to the MDFATE and Delft3D grid alignments. Due to program code coordinate digit limitations, grid coordinates were converted from NAD83 State Plane Texas South Central FIPS 4204 coordinates to six-digit coordinates by subtracting a common integer value to convert x and y values to acceptable length coordinates. Appendix F summarizes the set up and key parameters used for MPFATE.

8.1 MPFATE Initial Simulations

For the purpose of initially comparing the MPFATE generated placement mound with the MDFATE generated placement mound, an MPFATE simulation was performed with the placement of the entire 44.2 mcy of dredged material under a single model run, using the same model parameters as applied for MDFATE, with the exception of also including the current time series as described in Section 4.5 (Current Data).

At the final dredged material disposal sortie, a peak mound height of 23 ft was generated by this MPFATE simulation (Figures 16 and 17), as opposed to a peak mound height of 13.25 ft generated by the MDFATE simulations.

The excessive mound heights resulting from the MPFATE simulation was as expected given that MPFATE is not accounting for dispersion of “mounded” sediments during the simulation. To align with the MDFATE simulations require simulating dispersion of the MPFATE generated mound with a sediment dynamics model. The integrated Delft3D suite of modules (D-Flow Flexible Mesh, D-Wave, and D-Morphology) was applied (i.e., “coupled) with the MPFATE generated mounds to simulate mound dispersion of post-placement dredged sediments.

8.2 MPFATE Incremental Simulations

To more closely align with the Increment 6 simulations performed with MDFATE, MPFATE simulations were performed in the same incremental manner as MDFATE. However, after each MPFATE increment (i.e., recall an increment is a 96-day simulation), the grid bathymetry generated by the MPFATE increment was exercised by Delft3D to simulate sediment dispersion using the same wave and current time series for that increment. The resulting dispersed mound bathymetry grid generated by Delft3D was subsequently passed back to MPFATE as the new base bathymetry for each successive MPFATE simulation increment. Figure 18 demonstrates the model coupling flow process between MPFATE and Delft3D.

Results of the MPFATE and Delft3D coupled model incremental placement simulations and long-term dispersion simulation are described in Section 10.0 of this report.

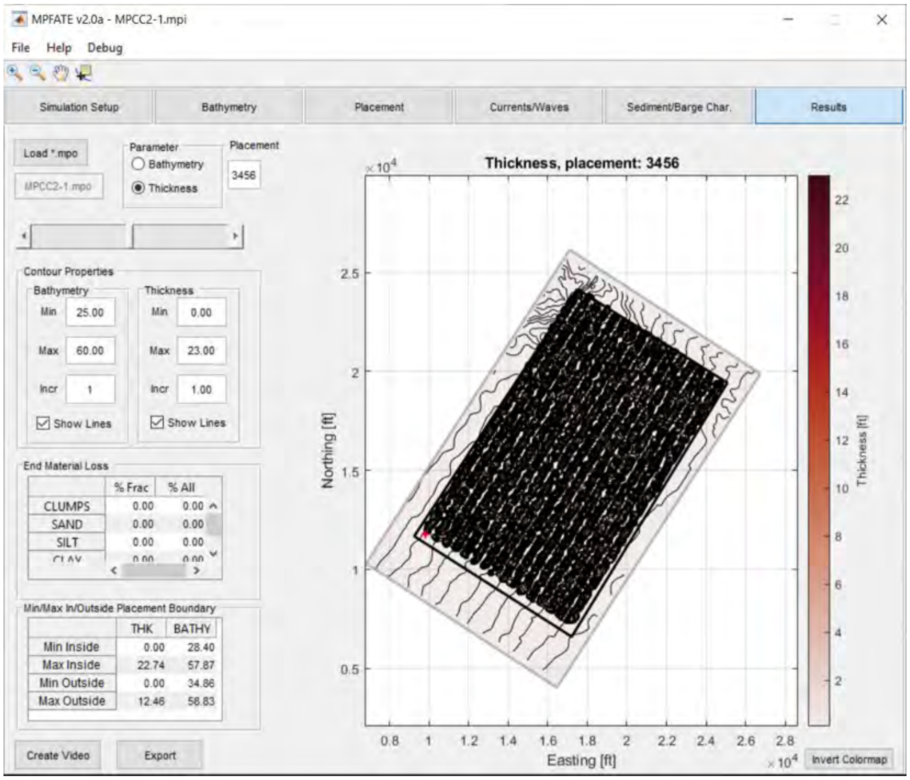


Figure 16. MPFATE Scenario 2 Mound Thickness Display at Final Disposal Event

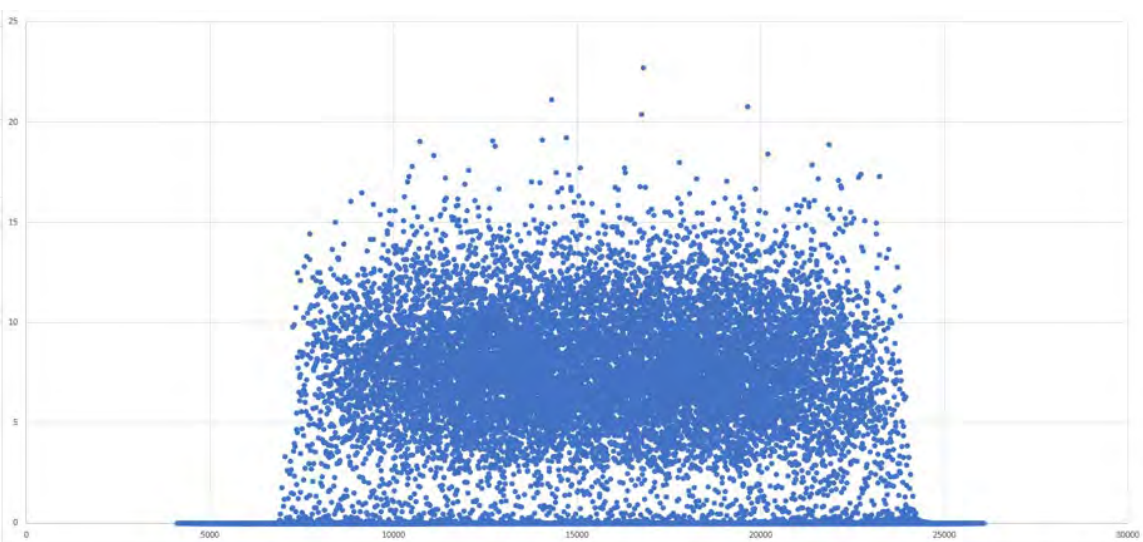


Figure 17. MPFATE Scenario 2 Mound Thickness Scatter vs Y Plot at Final Disposal Event

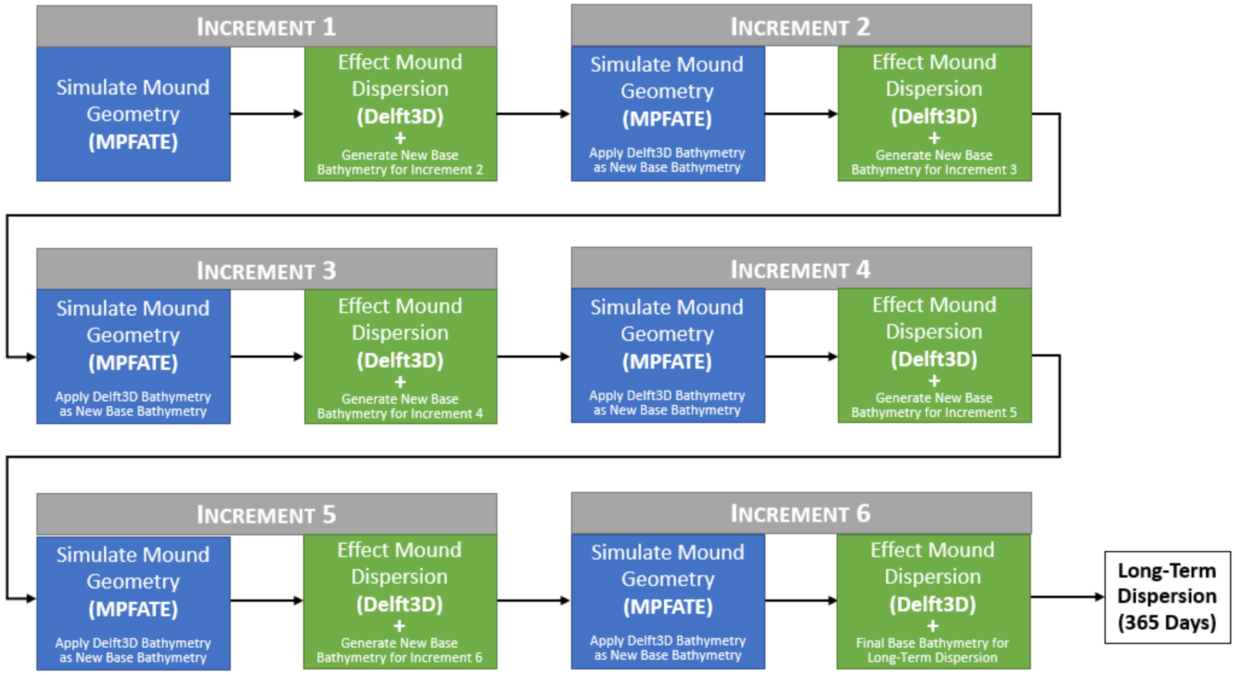


Figure 18. MPFATE / Delft3D Model Coupling Process

9.0 - DELFT3D SIMULATIONS

Delft3D was applied as a post-processor for the dispersion of sediments generated MPFATE model results. The Delft3D simulations were used to determine the bed level change and bed-load transport of dredge material placement piles through the means of current and wave force interaction per placement increment. Three modules within the Delft3D modeling suite were used to drive sediment dynamics: hydrodynamics (D-Flow Flexible Mesh), waves (D-Waves or SWAN), and sediment transport (D-Morphology).

A grid was developed within the Flexible Mesh using local coordinates rotated 57.4 degrees from the global X-axis. The grid is approximately 18,000 ft in the “U-direction” and 11,000 ft in the “V-direction”, corresponding to a generated grid density of 211 and 140 cells, respectively (see Figure 19).

For the starting conditions of modeling simulations, bathymetries were imported from the NOAA NCEI Bathymetric DEMs, then interpolated onto the previously generated grid. This process set the model mesh grid cells with relevant bathymetric elevations pertaining to Scenario 2.

Four (4) boundary conditions were imposed on the outer-most edges of the grid. All boundary conditions contained a static water surface elevation of 0-ft and a normal current velocity. Boundary conditions 1 and 2 acted in the V-Direction (Cross-Shore), and boundary conditions 3 and 4 acted in the U-Direction (Along-Shore). The currents are equal and opposite to allow the correct amount of fluid to remain in the domain. The flow convention is shown in Figure 19.

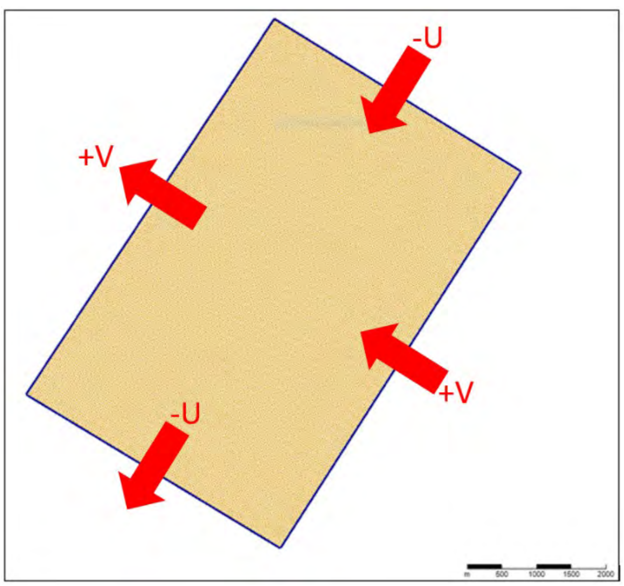


Figure 19. Delft3D Computational Grid

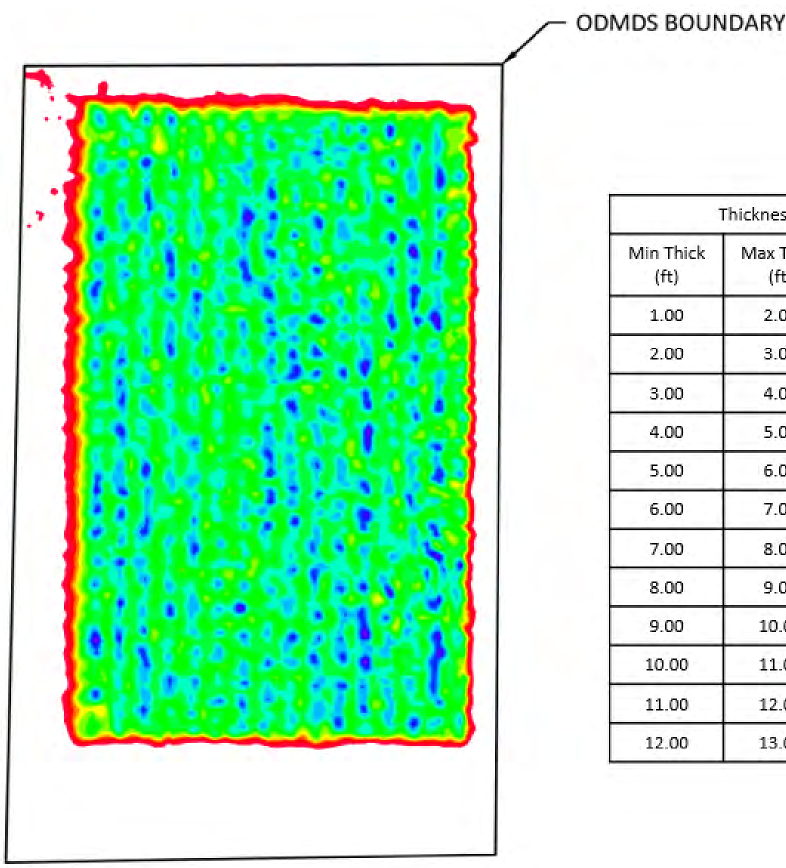
The sediment characteristic selected for the bed-load transport and morphologic change simulations represented the predominant type of sediment (sand) expected to reside at the bottom of the disposal area as noted in Section 4.1 (Dredged Material Disposal Geotechnical Characteristics). Simulations were performed using 0.13 mm sand particles, with the top mound relief of material set as erodible, and the boundary prohibited from absorbing any material to force the retention of all sediment in the domain.

10.0 - MPFATE / DELFT3D COUPLED SIMULATIONS

Similar to the MDFATE simulations for Scenario 2, the coupled MPFATE/Delft3D (hydrodynamic, wave, and sediment transport) models simulated the placement of 44.2 mcy of dredged material which required a total of 576 simulation days, segmented into 6 cumulative simulation increments of 96 days each. An additional 365 simulation days using the Delft3D model only were added to assess the long-term fate effects on the dredged material placement mound. Figures 20 and 21 show the plan view and cross-section results of MPFATE/Delft3D Scenario 2's relief mound geometries at the end of the Increment 6. At the end of the Increment 6 placement, only 0.7% of the discernable (i.e., greater than one foot thickness) dredged material mound exceeded a relief height of 11 ft, with a median mound height of 7.6 ft.

Figures 22 and 23 show plan view and cross-section results of MPFATE/Delft3D Scenario 2's relief mound geometries at the post-365 day simulations. For this long-term simulation, the maximum relief heights for the disposal mound were markedly less than 11 ft. The profile of the mound at day 365 (Figure 23) depicts the erosion/deposition caused by Delft3D when compared to the mound profile at the end of Increment 6 (Figure 21).

Appendix G provides 3D graphical displays of MPFATE/Delft3D Scenario 2's bathymetry and mound thickness for Increment 6 and for post-Increment 6 long-term simulation days of 365 plus statistical histogram and frequency plots of Increment 6's mound thicknesses.



Thickness Table		
Min Thick (ft)	Max Thick (ft)	Color
1.00	2.00	
2.00	3.00	
3.00	4.00	
4.00	5.00	
5.00	6.00	
6.00	7.00	
7.00	8.00	
8.00	9.00	
9.00	10.00	
10.00	11.00	
11.00	12.00	
12.00	13.00	

Figure 20. MPFATE/Delft3D Scenario 2 Mound Height at the End of Increment 6 (in ft)

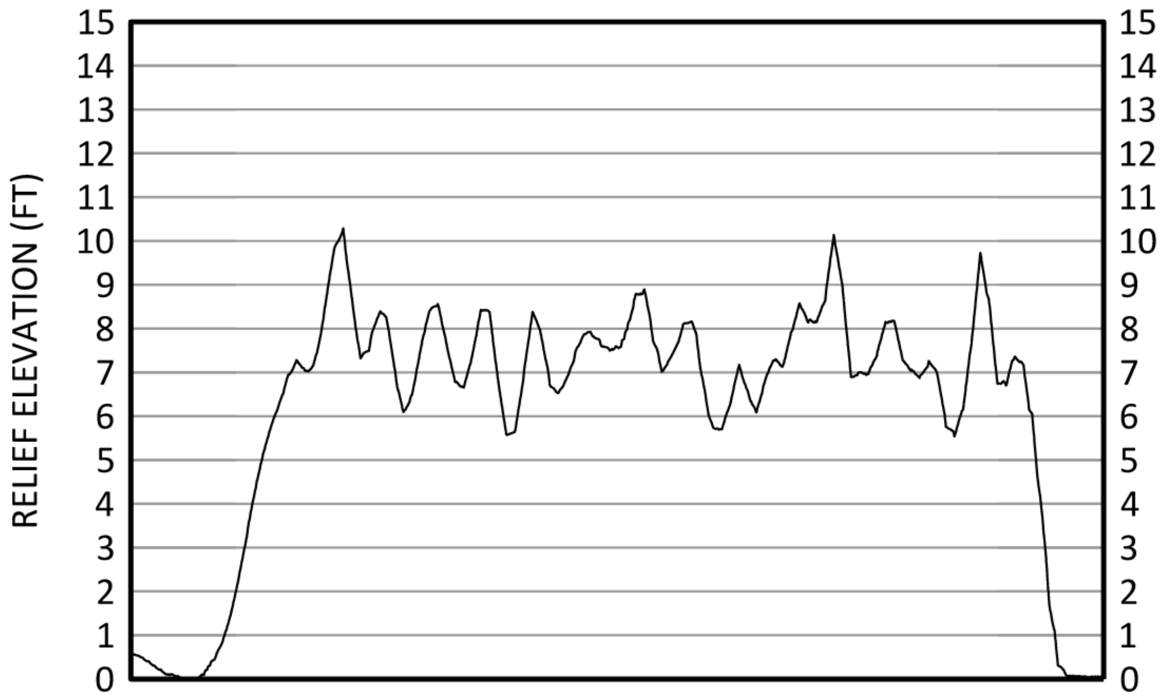
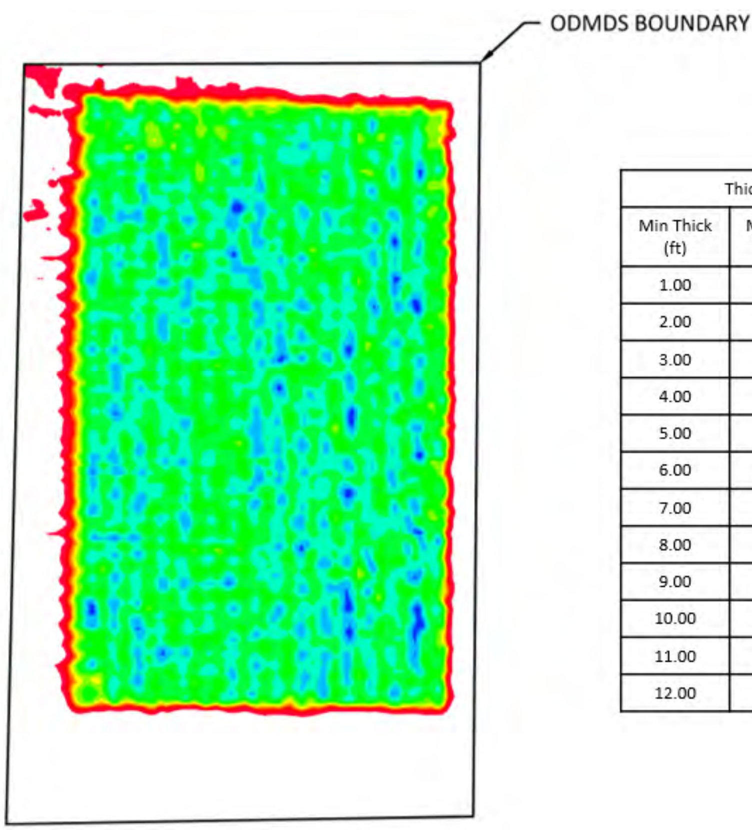


Figure 21. MPFATE/Delft3D Scenario 2 at the End of Increment 6
(Center Cross-Section)



Thickness Table		
Min Thick (ft)	Max Thick (ft)	Color
1.00	2.00	
2.00	3.00	
3.00	4.00	
4.00	5.00	
5.00	6.00	
6.00	7.00	
7.00	8.00	
8.00	9.00	
9.00	10.00	
10.00	11.00	
11.00	12.00	
12.00	13.00	

Figure 22. MPFATE/Delft3D Scenario 2 Mound Height at Day 365
(Post-Increment 6) (in ft)

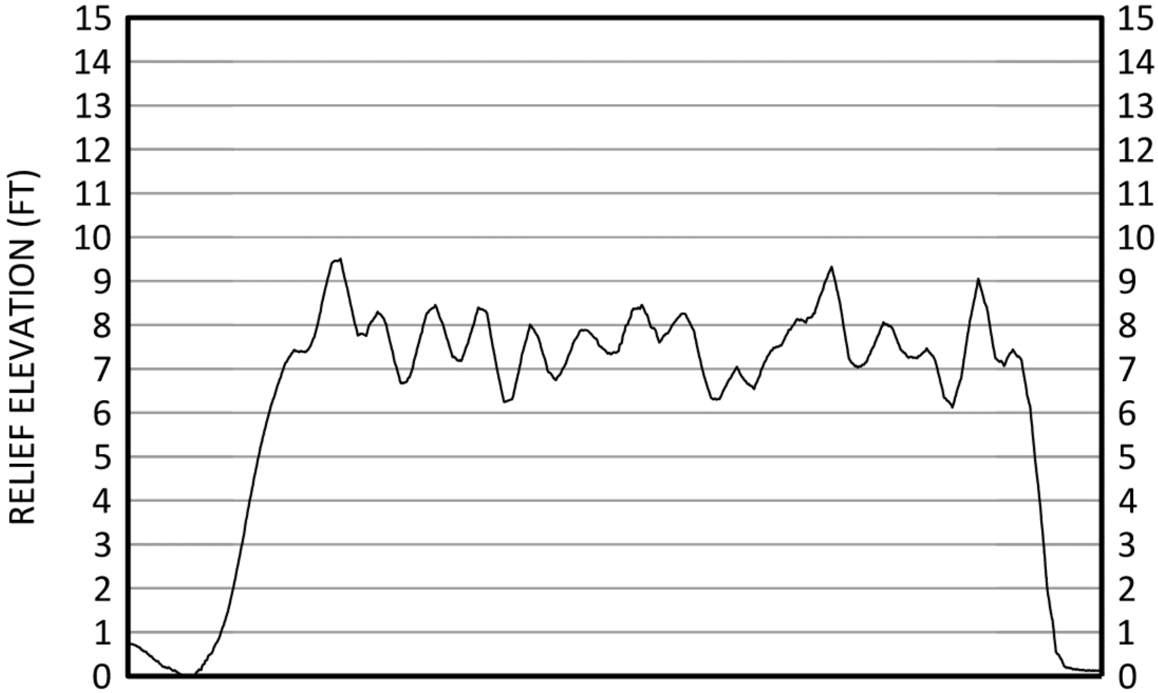


Figure 23. MPFATE/Delft3D Scenario 2 at Day 365 (Center Cross-Section)

Net volume of sediments within the open water placement site following disposal and short-term and long-term fate effects were calculated using Autodesk Civil3D. Table 13 lists the remaining net volume of sediments for Scenario 2 following the end of Increment 6 disposal, and at day 365 (post-Increment 6).

Table 13
MPFATE/Delft3D Scenario 2 Temporal Sediment Volume Change

Simulation End Day	Remaining Dredged Material Volume (Solids/Water/Voids)
Total Dredged Material Placed	44.2 mcy
At End of Increment 6	38.6 mcy
At Day 365 (Post-Increment 6)	38.4 mcy*

*See Section 11.0 for Volume Explanation at Simulation Day 365

11.0 - MDFATE AND MPFATE / DELFT3D COMPARISONS

When comparing the overview of the two simulation approaches (i.e., MDFATE with LTFATE sub-code and MPFATE with Delft3D, the mean, max and percent exceedance of 11-foot mounding was similar. The differences arise when evaluating the remaining sediment volume between the two. MDFATE calculates the remaining volume while accounting for sediment classes, solid concentration, bulking, consolidation of cohesive sediments and more dispersive sediment during and immediately after dumping. MPFATE does take into account different sediment classes during the dumping phase, though it does not account for the other previously stated items. This is exacerbated when MPFATE results are passed to Delft3D which was setup to consider all sediment that has settled to be consolidated sand.

Anecdotally, under these conditions one can assume that MPFATE would induce less sediment motion and would produce a more conservative model due to readily erodible sediments being converted to sand. The lack of sediment motion is precisely what was seen in the MPFATE/Delft3D coupled simulation. The lack of erosion, paired with the similar mound statistics, gives confidence in the MPFATE/Delft3D model while allowing for improvements to include sediment classes, different dispersion rates during the dumping phase, and solids/bulking.

The long-term dispersion simulation results “At Day 365” are most likely attributed to sediment layer classifications and erodibility. The conservatism added to MPFATE/Delft3D by assuming all settled sediment is sand causes the model to resist erosion more than MDFATE. This is seen in the difference in volumes when comparing the two modeling approaches. However, more emphasis on the peak mound criteria (i.e., 11 ft) governs acceptability of the mound geometries.

While the remaining volume of MPFATE/Delft3D dispersed sediments is conservative when compared to MDFATE, the peak elevations of the ODMDS were still below the governing threshold (mound height < 11 ft) and were comparable with the MDFATE results, which provides corroboration of the applicability of coupling the MPFATE and Delft3D models.

Table 14 displays the results comparison between MDFATE Scenario 1 and Scenario 2.

Table 14
MDFATE and MPFATE/Delft3D Scenario 2 Comparisons

Simulation End Day	MDFATE Scenario 2	MPFATE/Delft3D Scenario 2
Total Dredged Material Volume - Placed -	44.2 mcy	44.2 mcy
Remaining Dredged Material Volume - At End of Increment 6 -	34.2 mcy	38.6 mcy
Remaining Dredged Material Volume - At Day 365 (Post-Increment 6) -	21.1 mcy	38.4 mcy
Maximum Mound Height - At End of Increment 6 -	13.3 ft	12.7 ft
Median Mound Height - At End of Increment 6 -	6.8 ft	7.6 ft
Percent Mound Height > 11 ft - At End of Increment 6 -	1.1%	0.7%

12.0 - CONCLUSIONS

Dredged material placement and fate simulations were performed with the MDFATE model to assess the viability of expanding the Corpus Christi New Work ODMDS to accommodate an excess of 40 mcy of future new work dredged material. Two final scenarios were simulated to ascertain the geometric footprints of both the proposed Expanded New Work ODMDS and the extent of the active disposal area within the expanded ODMDS footprint.

Based on the results of the MDFATE modeling, both Scenario 1 and Scenario 2 boundaries are viable geometries for the proposed Expanded New Work ODMDS footprint and for the proposed active disposal area footprints to receive up to 47.7 mcy of in-situ dredged material or 44.3 mcy of placed dredged material. Simulated maximum mound heights for both scenarios peaked above the Corpus Christi ODMDS SMMP (EPA/USACE, 2018) mound height threshold of 11 ft; however, the median mound heights are within the 11-foot tolerance at the end of the last simulated disposal event and are well below the 11-foot tolerance after 1 and 2 years of long-term dispersion simulations. Additionally, accumulation at the edges of the proposed Expanded New Work ODMDS for both scenarios do not exceed a thickness threshold of 1-foot.

Additional simulations with the MPFATE and Delft3D (D-Flow D-Waves, and D-Morphology) models were performed for the proposed extended Expanded New Work ODMDS (Scenario 2) footprint to compare with the conclusions derived from the MDFATE modeling results. This effort was accomplished through the coupling of the two models to simulate sediment accumulation and long-term dispersion. The coupled model runs were performed through a series of six (6) disposal and dispersion simulation increments, consistent with the MDFATE simulation increments; and, with a concluding Delft3D long-term dispersion model run over a 365-day simulation period.

As with the MDFATE results, the coupled MPFATE/Delft3D Scenario simulations resulted in a peak mound height exceeding the mound height threshold of 11 ft; however, the median mound height is within the 11-foot tolerance at the end of the last simulated disposal event, and is well below the 11-foot tolerance after 1 year of long-term dispersion simulation.

The most notable difference between the results of the MDFATE and coupled MPFATE/Delft3D simulations is at the end of the 356-day long-term dispersion simulation, the total volume of the remaining placed dredged sediments within the proposed extended Expanded New ODMDS did not markedly change under the MPFATE/Delft3D model runs. This lack of total volumetric change is most likely attributable to the sediment characteristic for the Delft3D dispersion model runs that was set at a fine sand (0.13 mm) only, rather than mixed sediment characteristics (sand, silt, clay, and clumps) used for the MDFATE and MPFATE models. Therefore, the Delft3D long-term dispersion simulation redistributed the fine sand within the ODMDS footprint, rather than transporting the sediment beyond the boundaries of the ODMDS footprint.

In conclusion, the accumulation and short- and long-term dispersion of placing over 44 mcy dredged material within the proposed Expanded New Work ODMDS (Scenario 1) and extended Expanded New Work ODMDS (Scenario 2) will be within the tolerance thicknesses as established by the Corpus Christi ODMDS SMMP (USACE/USACE, 2018), as based on the MDFATE modeling results. Furthermore, subsequent simulations of Scenario 2 using the coupled MPFATE/Delft3D models corroborate the results and conclusions derived from the MDFATE modeling.

13.0 - REFERENCES

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______. 2020a. E-mail Transmittal from USACE Galveston District (Regulatory – J. Hudson) to Freese and Nichols, Inc. (FNI) (L. Vitale), Subject: PCCA CDP ODMDS Draft Modeling Scope. October 8, 2020.

______. 2020b. Personal Communication between USACE Galveston District (Corpus Christi Resident Office – A. Abo-Obeid) and Freese and Nichols, Inc. (FNI) (A. Risko). December 2, 2020.

Appendix A

Threshold of Sediment Motion Curves

THRESHOLD OF SEDIMENT MOTION CURVES

Table A.1. Wave Parameters Percentiles for Incipient Sediment Motion (Expanded New Work ODMDS Bottom Depths)

Bottom Depth (ft, MLLW)	Wave Condition Percentile[1]	Combination Wave Parameters		
		Near Bottom Velocity (ft/s)	Wave Period (s)	Dimensionless Stress (Threshold / Computed)
30	26th	0.53	4.74	~12.90 / 13.02
40	41st	0.56	5.73	~14.30 / 14.39
50	54th	0.56	5.73	~14.30 / 14.35
60	68th	0.59	6.30	~15.50 / 15.66

[1]Computed Using 2009 Wave Time Series WIS Data Source (PCCA, 2018)

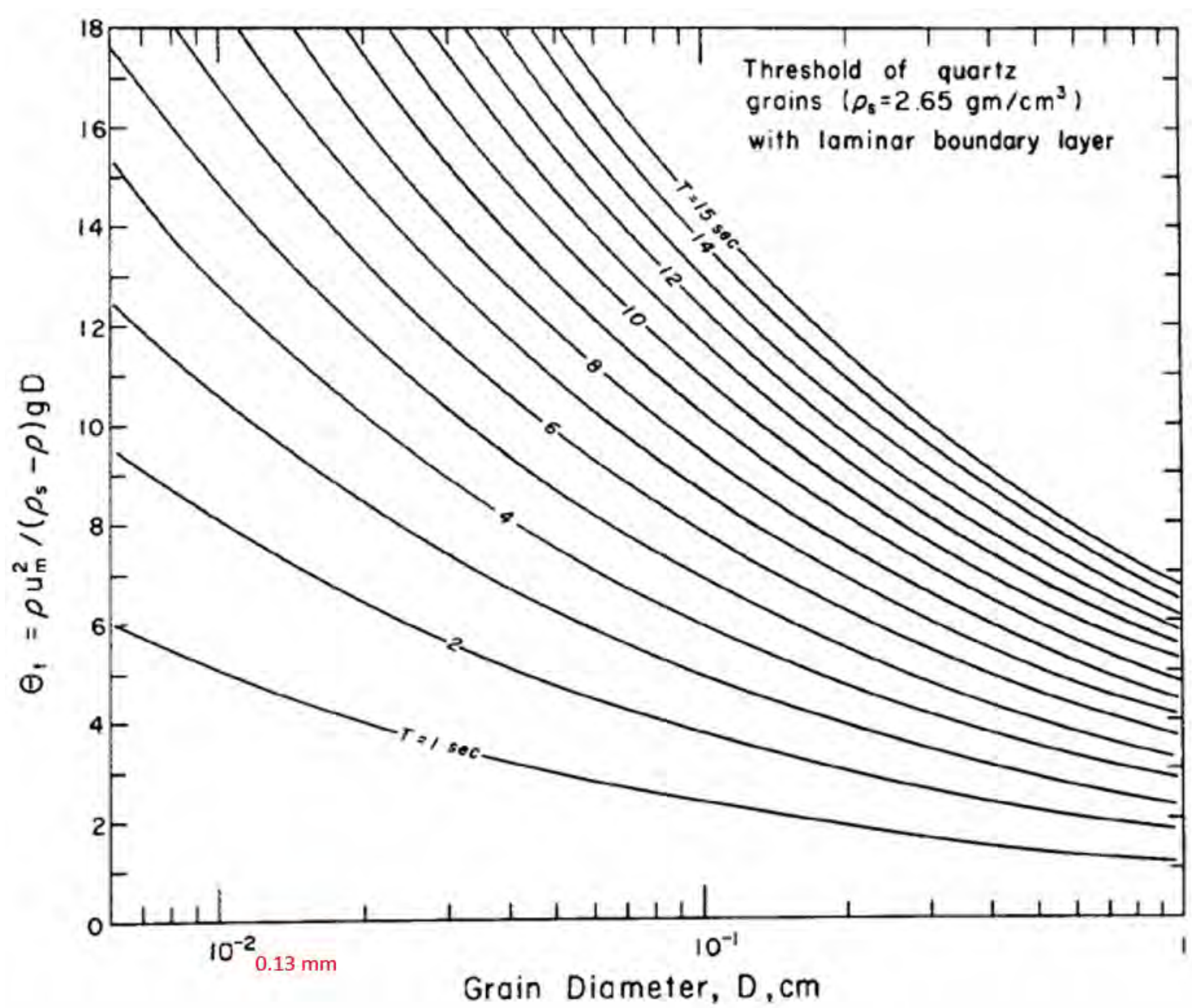

Figure A.1. Threshold of Sediment Motion Curves (Komar and Miller, 1973)

Table A.2. Incipient Sediment Motion Forcing Functions

WAVE LENGTH[1] (L)	NEAR BOTTOM VELOCITY (u_m)	DIMENSIONLESS RELATIVE STRESS[2] (Θ_1)
$L = (g/2\pi)T^2 \tanh(2\pi D/L)$	$u_m = \pi H / T \sinh(2\pi h/L)$	$\Theta_1 = \rho u^2_m / (\rho_s - \rho) g D$
• g = gravity • T = wave period • D = water depth	• h = water depth • H = wave height • T = wave period • L = wave length	• ρ = water density • ρ_s = solid density • u_m = near bottom velocity • g = gravity • D = grain diameter

[1]Linear Wave Theory
Intermediate Depth Equation
Iterative Convergence

[2]Komar and Miller (1973)

Appendix B

Site Bathymetry

SITE BATHYMETRY

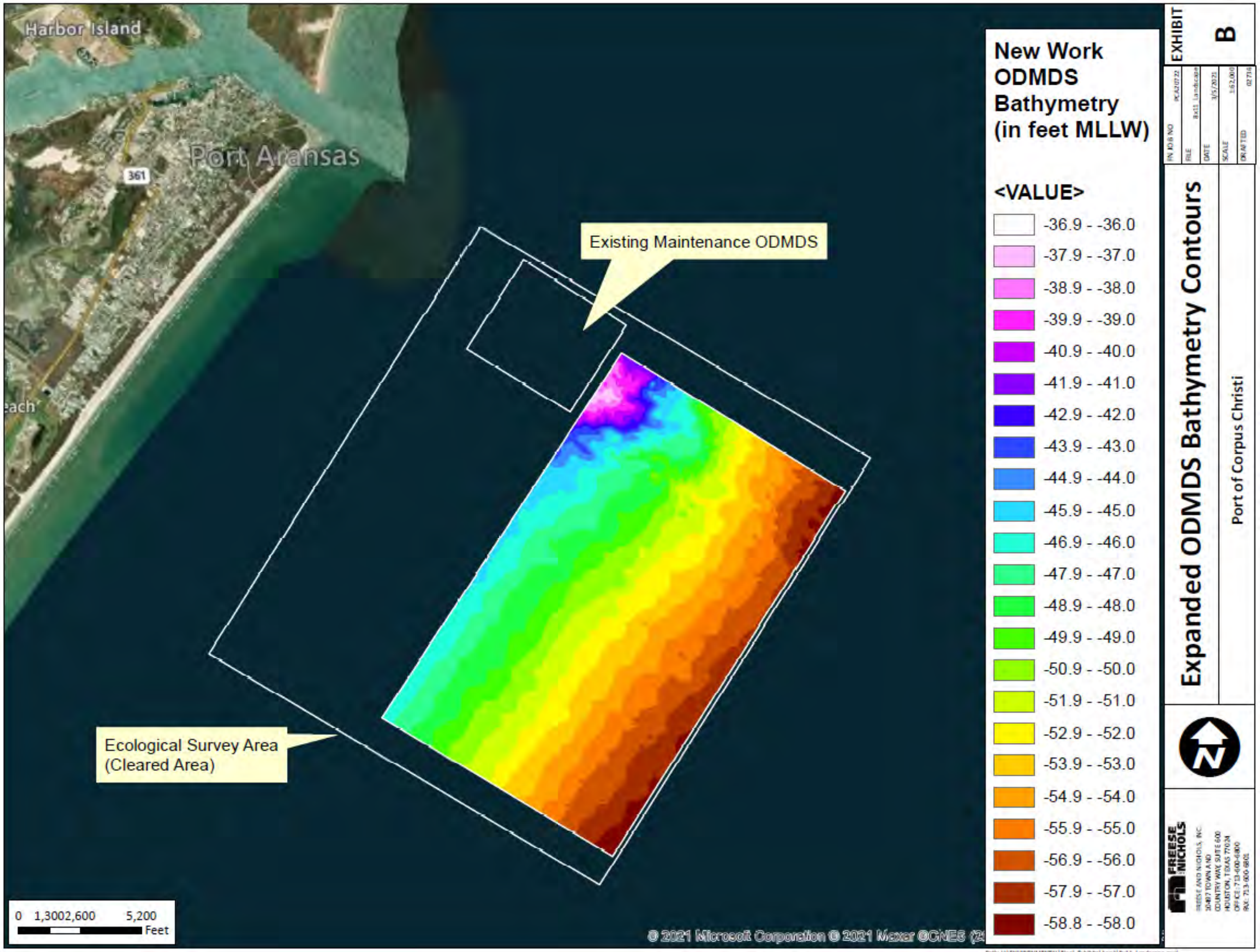

Figure B.1. Site Bathymetry at Proposed Expanded New Work ODMDS

Appendix C

MDFATE Alternatives Simulation Matrix

MDFATE ALTERNATIVES SIMULATION MATRIX

Table C.1. Matrix of MDFATE Placement Simulation Alternatives

SCENARIO	5A-S (300)	5A-L (300)	6A-S (300)	6S-L (300)	7A-S (240)	8A-S (240)	9A-S (240)	9W-S (480)	10A-S (240)	10W-S (240)	10W-S (480)	SCENARIO 1	SCENARIO 2
FOLDER	MD32T	MD32T	MDFCOR	MDFCOR	MDFCOR	MDFCOR	MDF125	MDF125W	MDF1020E_NoWaves	MDF1020E_Waves	MDF1020E	MDFCC1	MDFCC2
ACTIVE DISPOSAL AREA	Expanded	Expanded	Expanded	Expanded	Expanded	Expanded	Expanded	Expanded	2000-ft Extension	2000-ft Extension	2000-ft Extension	Expanded	2000-ft Extension
DUMP POINT SPACING	500-ft	500-ft	500-ft	500-ft	250-ft	250-ft	125-ft	125-ft	100-ft x 200-ft	100-ft x 200-ft	100-ft x 200-ft	125-ft	94-ft x 200-ft
DUMP SCOW	15,000 cy Multi-Bin Hopper	15,000 cy Multi-Bin Hopper	15,000 cy Multi-Bin Hopper	15,000 cy Multi-Bin Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper	6400 cy Split Hull Hopper
NO. DUMPS PER DAY	7	7	7	7	12	12	12	12	12	12	12	12	12
NO. INCREMENTAL SIMULATIONS	3	3	3	3	6	6	6	6	6	6	6	6	6
NO. INCREMENTAL DUMPS	900	900	1176 (1-2) 450 (3)	1176 (1-2) 450 (3)	1176	1176 (1-5) 682 (6)	1152	1152	1095	1095	1095	1152	1152
TOTAL NO. DUMPS	2700	2700	2802	2802	7056	6562	6912	6912	6570	6570	6570	6912	6912
DUMP VOLUME PER INCREMENT	13,500,000 cy	13,500,000 cy	17,640,000 cy (1-2) 6,750,000 cy (3)	17,640,000 cy (1-2) 6,750,000 cy (3)	7,526,400 cy	7,526,400 cy (1-5) 4,364,800 cy (6)	7,372,800 cy	7,372,800 cy	7,008,000 cy	7,008,000 cy	7,008,000 cy	7,372,800 cy	7,372,800 cy
TOTAL DUMP VOLUME	40,500,000 cy	40,500,000 cy	42,030,000 cy	42,030,000 cy	45,158,400 cy	41,996,800 cy	44,236,800 cy	44,236,800 cy	42,048,000 cy	42,048,000 cy	42,048,000 cy	44,236,800 cy	44,236,800 cy
TOTAL IN-SITU VOLUME	43,700,000 cy	43,700,000 cy	45,800,000 cy	45,800,000 cy	48,700,000 cy	45,200,000 cy	47,700,000 cy	47,700,000 cy	45,800,000 cy	45,800,000 cy	45,800,000 cy	47,700,000 cy	47,700,000 cy
NO. STFATE DAYS PER DUMP INCREMENT	128	128	168 (1-2) 64 (3)	168 (1-2) 64 (3)	98	98 (1-5) 57 (6)	96	96	91	91	91	96	96
NO. LTFATE DAYS PER DUMP INCREMENT	160	160	198 (1-2) 94 (3)	198 (1-2) 94 (3)	128	128 (1-5) 87 (6)	126	96	91	91	91	96	96
NO. LTFATE DAYS POST-FINAL DUMP	0	360	0	365	0	0	0	0	0	0	0	0	0
DUMP DURATION	300 sec	300 sec	300 sec	300 sec	240 sec	240 sec	240 sec	480 sec	240 sec	240 sec	480 sec	240 sec	240 sec
VESSEL SPEED	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps	3.3 fps
VESSEL APPROACH	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW	From SW
DREDGED MATERIAL													
Clumps	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070	0.070
FineSand	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380	0.380
Silt	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
Clay	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
Water/Voids	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400	0.400
RESIDUAL CURRENTS	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees	1.0 fps / 45degrees
WAVE TIME SERIES	No	No	No	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes
BASE BATHY	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T	MOR00T
INCREMENT 1													
Start Date	9/21	9/21	9/21	9/21	9/21	9/21	9/21	1/21	1/21	1/21	1/21	1/21	1/21
INCREMENT 2													
Start Date	1/22		2/22	2/22	12/21	12/21	12/21	4/21	4/21	4/21	4/21	4/21	4/21
INCREMENT 3													
Start Date	5/22		6/22		3/22	3/22	3/22	6/21	7/21	7/21	7/21	6/21	6/21
INCREMENT 4													
Start Date					6/22	6/22	6/22	10/21	11/21	11/21	11/21	10/21	10/21
INCREMENT 5													
Start Date					9/22	9/22	9/22	1/22	1/22	1/22	1/22	1/22	1/22
INCREMENT 6													
Start Date					12/22	12/22	12/22	5/22	4/22	4/22	4/22	5/22	5/22

Appendix D

MDFATE Scenario 1 Graphical Results

MDFATE SCENARIO 1
MOUND GEOMETRY GRAPHICAL AND STATISTICAL RESULTS

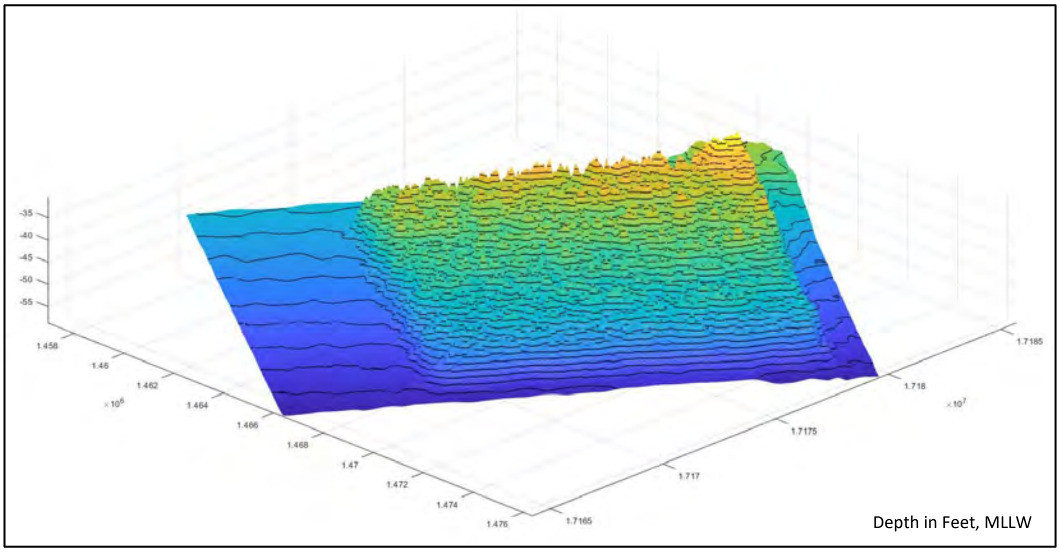

Figure D.1. MDFATE Post-Increment 6 Disposal Mound Bathymetry

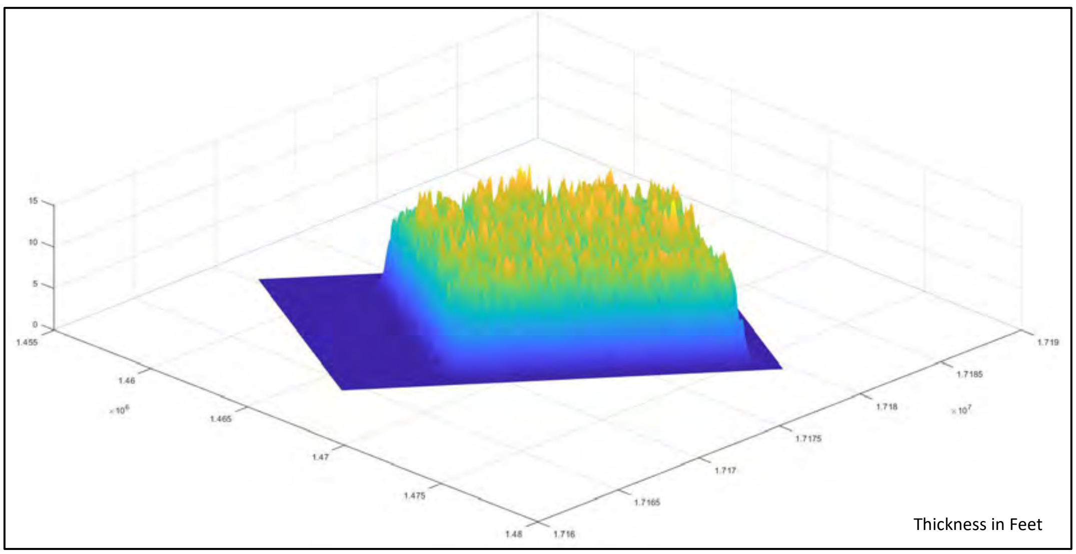

Figure D.2. MDFATE Post-Increment 6 Disposal Mound Thicknesses

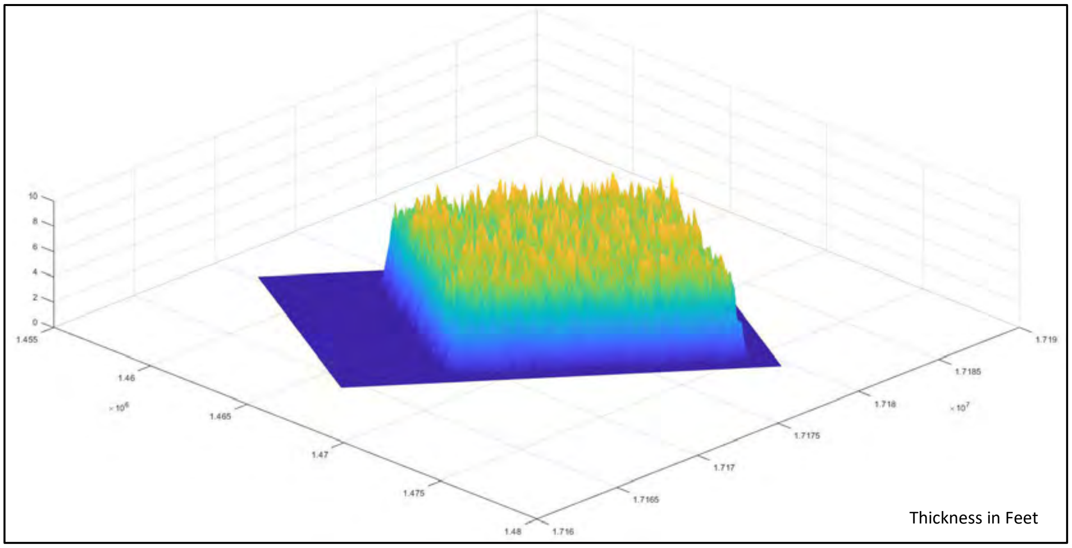

Figure D.3. MDFATE Post-Increment 6 Disposal Mound Thickness
Long-Term Sediment Dispersion Simulation at Day 365

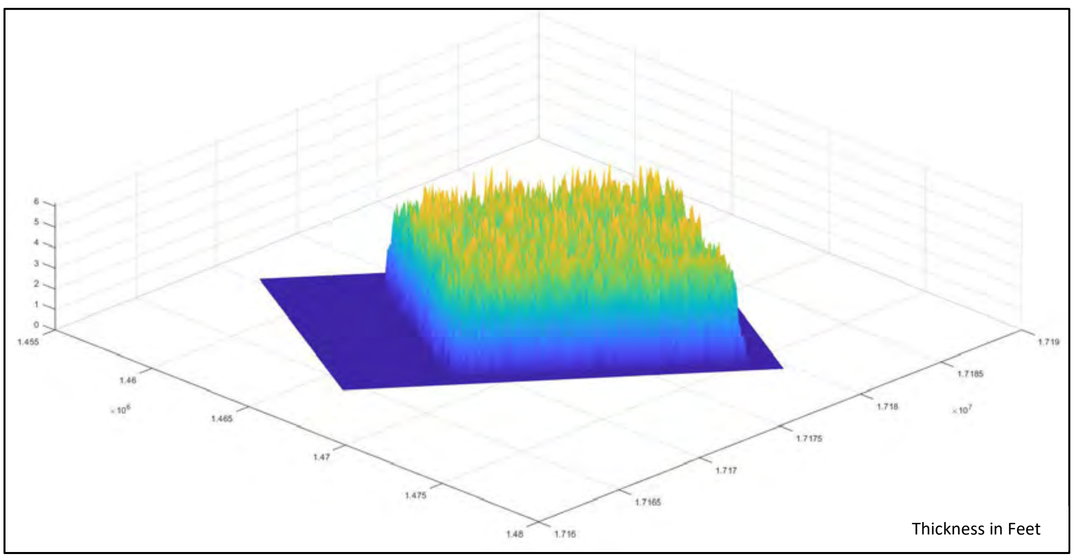

Figure D.4. MDFATE Post-Increment 6 Disposal Mound Thickness
Long-Term Sediment Dispersion Simulation at Day 730

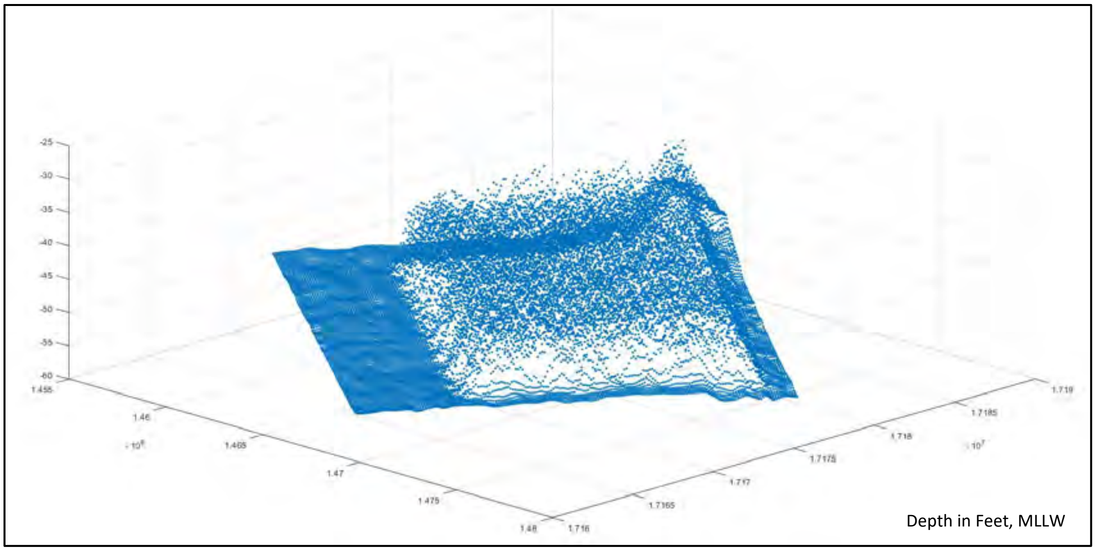

Figure D.5. MDFATE Post-Increment 6 Bathymetry
Scatter Plot of Bathymetric Points

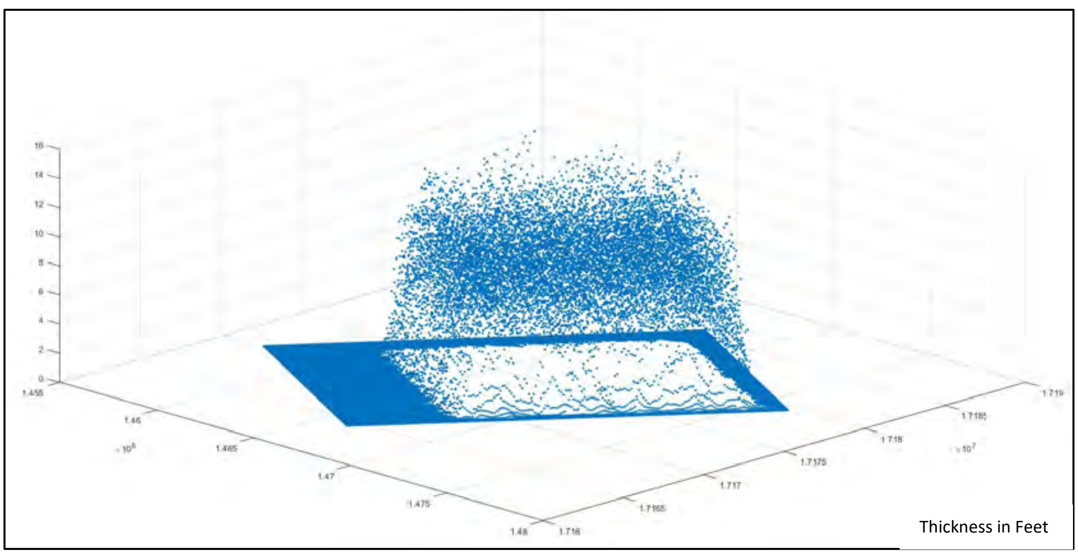

Figure D.6. MDFATE Post-Increment 6 Disposal Mound Heights
Scatter Plot of Relief Points (≥1 ft Thick)

Table D.1. MDFATE Post-Increment 6 Disposal Mound Heights Statistical Description of Relief Points (≥1 ft Thick)

Descriptive Statistics	
Mean	7.61
Median	7.81
Mode	9.25
Standard Deviation	2.56
Minimum	1.00
Maximum	15.54
Count	13268
Confidence Level (95.0%)	0.044

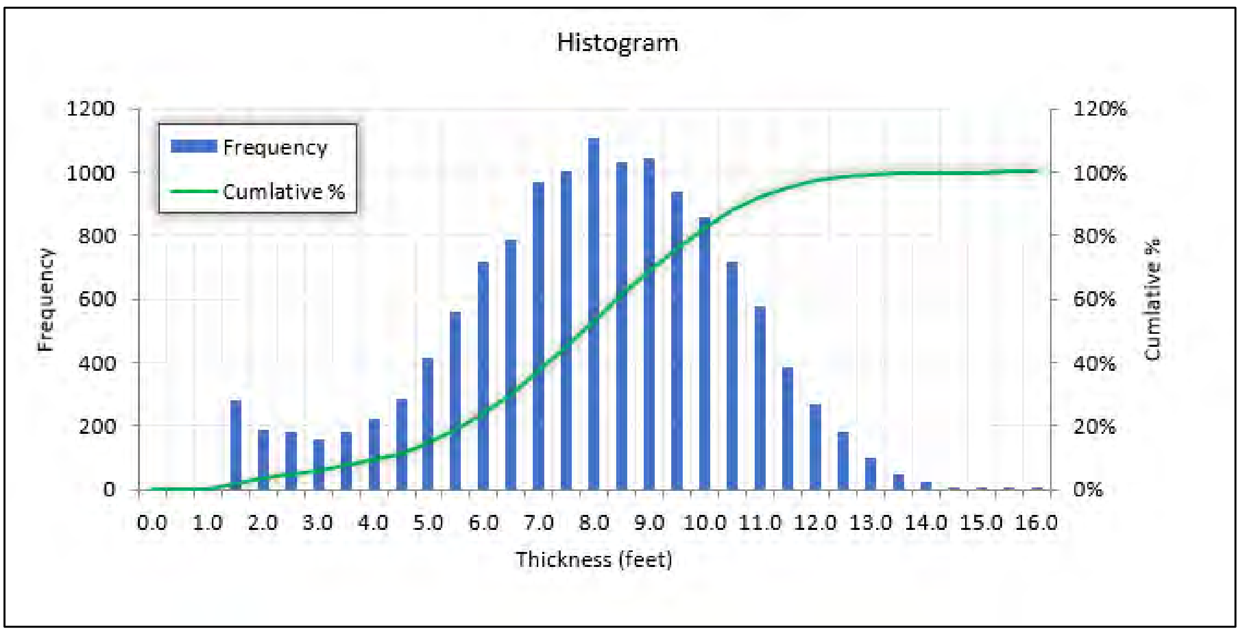

Figure D.7. MDFATE Post-Increment 6 Disposal Mound Heights Frequency Distribution of Relief Points (≥1 ft Thick)

Appendix E

MDFATE Scenario 2 Graphical Results

MDFATE SCENARIO 2
MOUND GEOMETRY GRAPHICAL AND STATISTICAL RESULTS

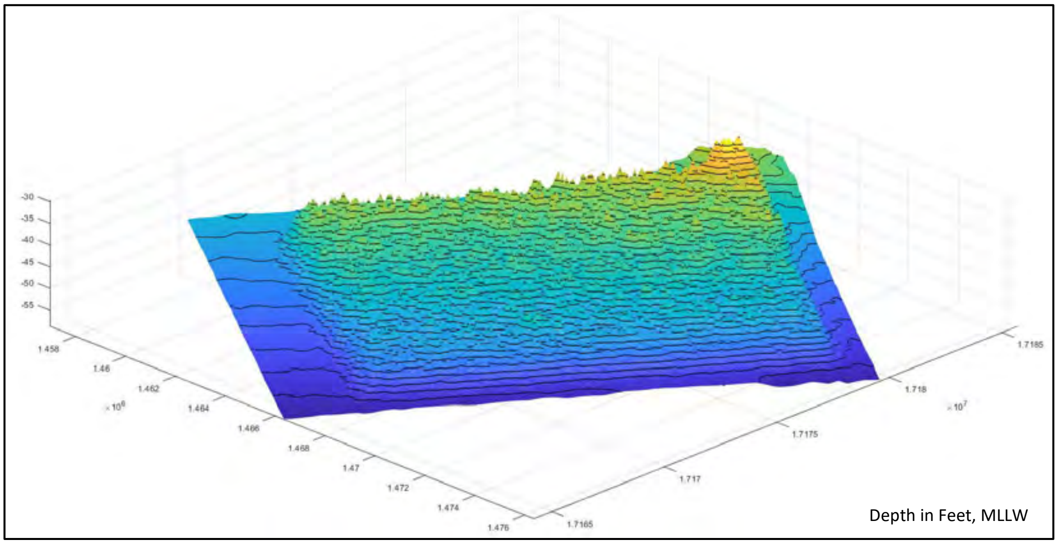

Figure E.1. MDFATE Post-Increment 6 Disposal Mound Bathymetry

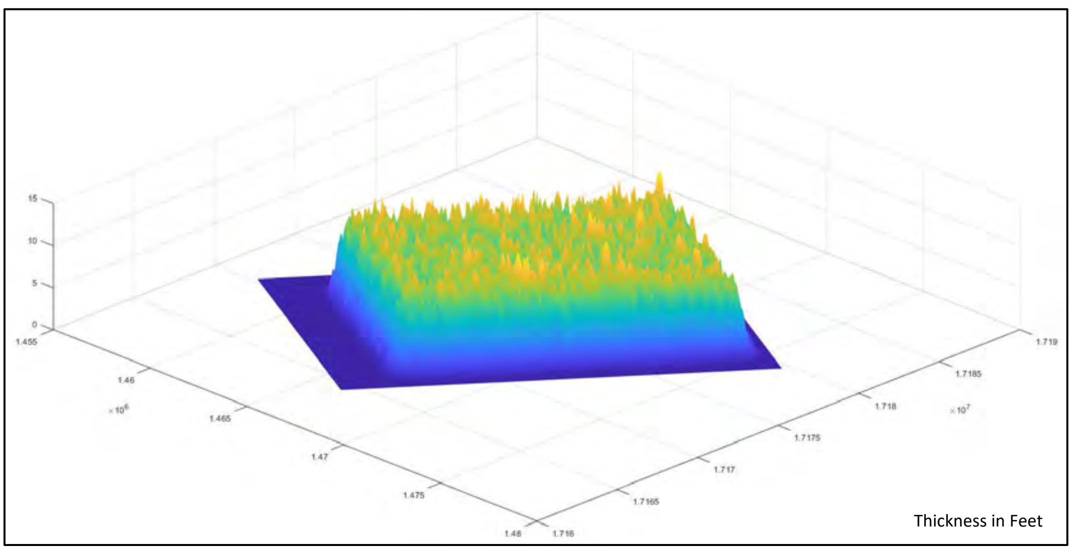

Figure E.2. MDFATE Post-Increment 6 Disposal Mound Thicknesses

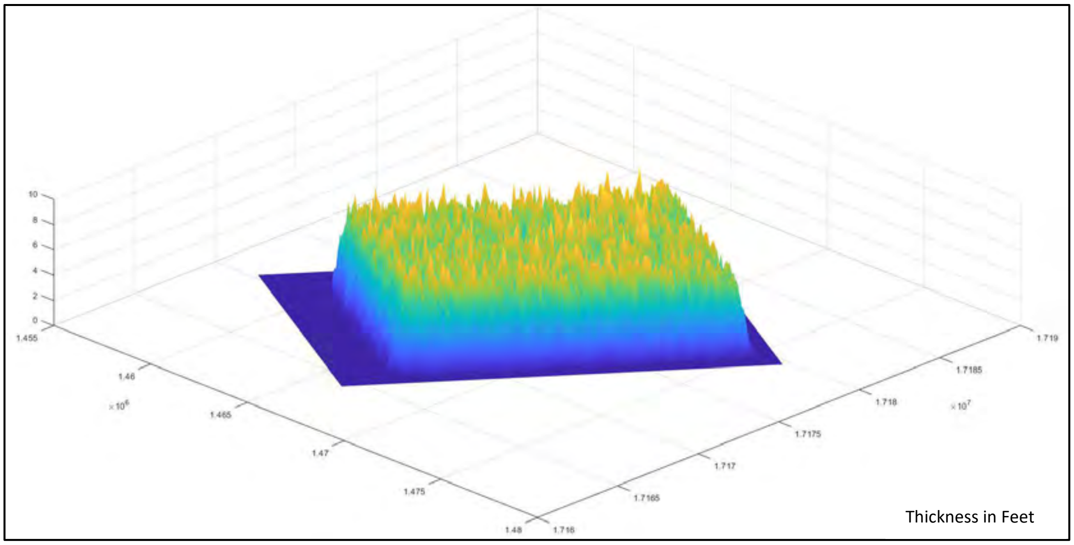

Figure E.3. MDFATE Post-Increment 6 Disposal Mound Thickness
Long-Term Sediment Dispersion Simulation at Day 365

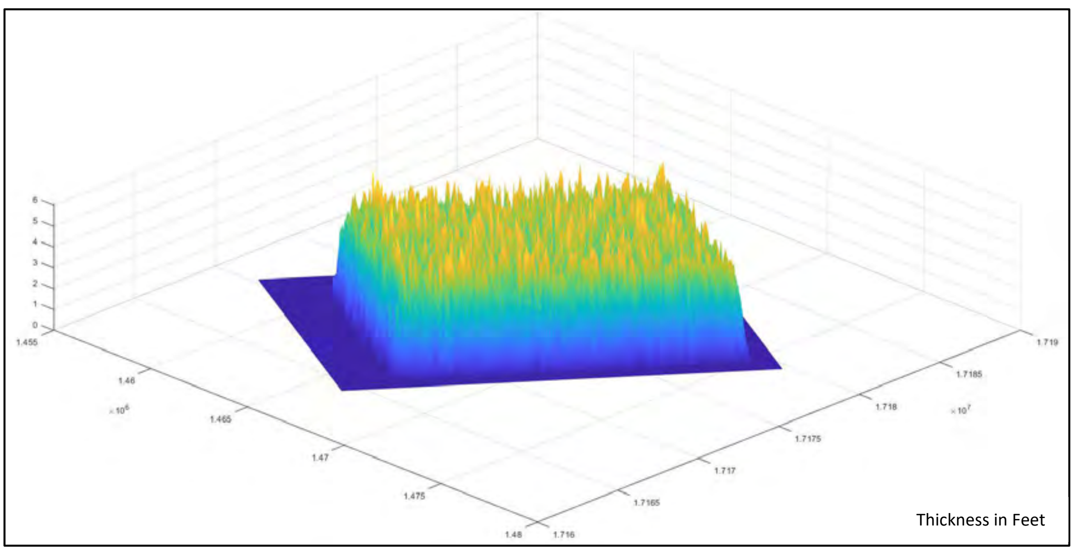

Figure E.4. MDFATE Post-Increment 6 Disposal Mound Thickness
Long-Term Sediment Dispersion Simulation at Day 730

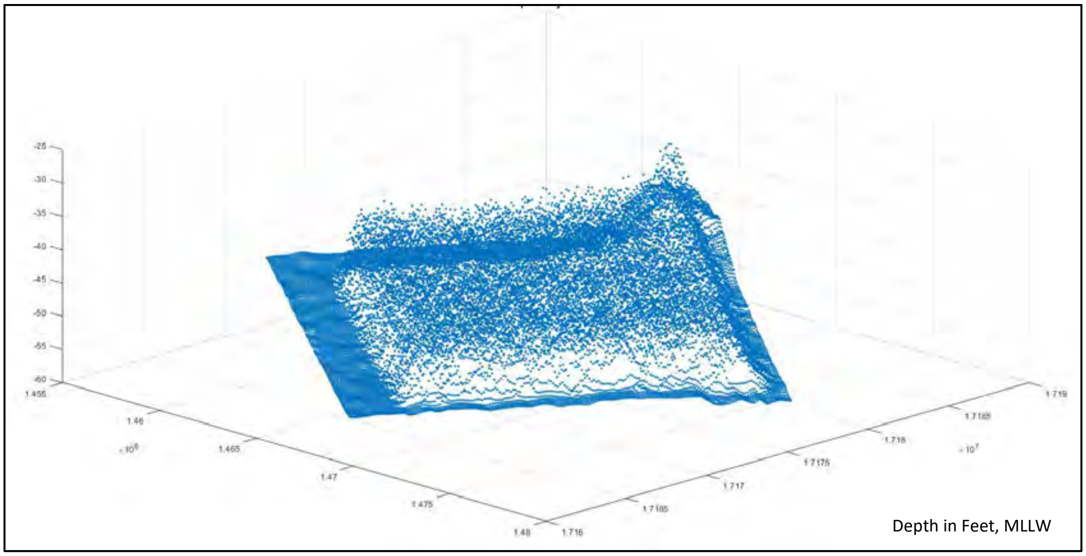

Figure E.5. MDFATE Post-Increment 6 Bathymetry
Scatter Plot of Bathymetric Points

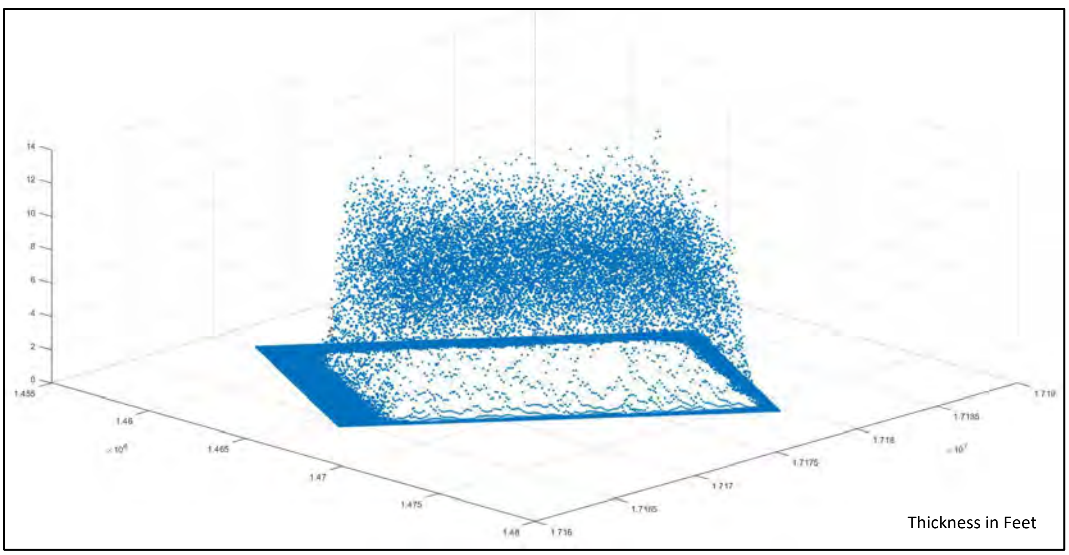

Figure E.6. MDFATE Post-Increment 6 Disposal Mound Heights
Scatter Plot of Relief Points (≥1 ft Thick)

Table E.1. MDFATE Post-Increment 6 Disposal Mound Heights Statistical Description of Relief Points (≥1 ft Thick)

Descriptive Statistics	
Mean	6.65
Median	6.79
Mode	8.25
Standard Deviation	2.22
Minimum	1.00
Maximum	13.25
Count	15676
Confidence Level (95.0%)	0.035

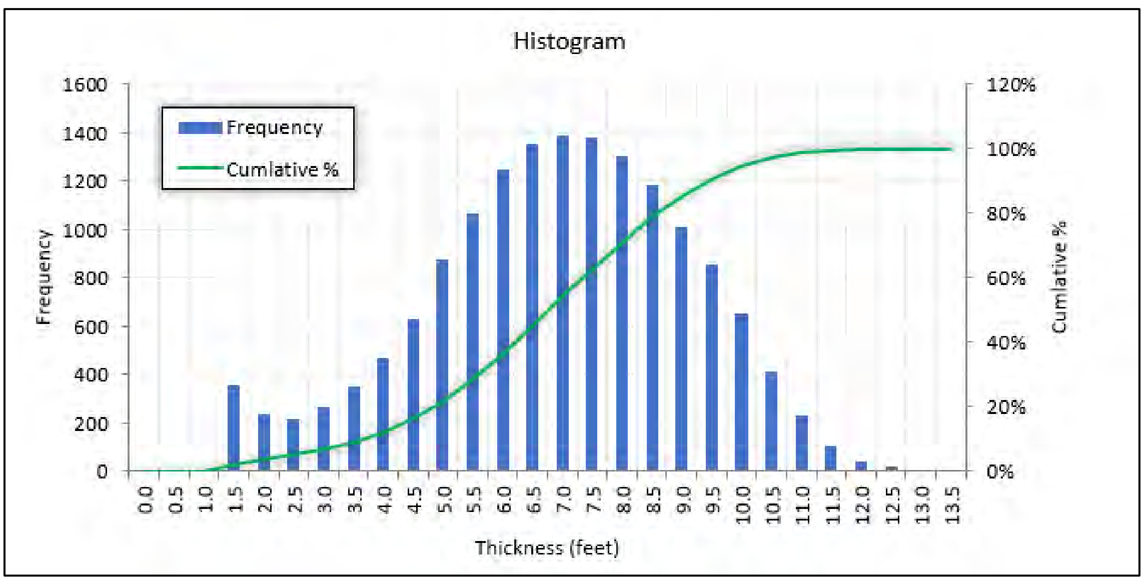

Figure E.7. MDFATE Post-Increment 6 Disposal Mound Heights Frequency Distribution of Relief Points (≥1 ft Thick)

Appendix F

MPFATE Setup and Key Parameters

MPFATE SETUP AND KEY PARAMETERS

Table F.1. MPFATE Setup and Key Parameters

Simulation Settings			Comment
KEY 1	Use default or user modified coefficients	0 - Default coefficients	
KEY 2	Phase/process at which STFATE simulation terminates upon completion	0 - Simulation terminated after long term	
JBFC	option to adjust drag & entrainment coeff. using JBF Scientific coeffcient	0 - alpha0, CD, and CM are either input or default values are used	default drag coefficients used
ISEP	Solid variation between layers	1-Solids can vary between layers	
IPRIT	vertical diffusion coeff. AKY0	0 - AKYO is either input or the default value is used	Used default. Default should be 0.05.
TIME (seconds)			
TREL	Time to empty barge	240	Section 5.7
TCOL	Collapse phase time limit	999	default
DTL	Long term time steps	120	default
TSTOP		600	default
Bathymetry Data			
Common input data from Section 5.2			
Grid Data			
Common input data from Section 5.2			
Placement Boundary			
Common input data from Section 5.2			
Placement			
Common input data from Section 5.2			
Vessel Randomization			
Vessel Origin, x0 (ft)	grid location where vessel originates	0	assumed consistent with PCCA 2018
Vessel Origin, y0 (ft)		0	
Max Random Radius from Point, Rx (ft)	max random distance from placement event target	100	
Min Vessel Speed, spd1 (knts)	min barge/scow speed	1	consistent with avg. dump speed of 2 kts (3.3 fps) in Sect 5.8
Max Vessel Speed, spd2 (knts)	max barge/scow speed	3	

Variance of Approach Angle (deg)	variation from intended placement heading	3	assumed variability of course heading
Specify Approach Angle	approach angle to placement location	Not Selected	
Placement Times			
Volume per Placement (cy)	capacity of hopper or scow	6400	dredge Terrapin Island in Section 4.7
Increment (hours)	duration of each placement event	2	determined from number placement events per day
Currents/Waves			
Load Currents	current speed & direction data	Selected	Section 4.5
Load Waves	wave height & period data	Selected	Section 4.4
Sediment/Barge Characteristics			
BARGL	Length of disposal vessel (ft)	315	based on same or similar typical dimensions consistent with dredge Terrapin Island in Section 4.7
BARGW	Width of disposal vessel (ft)	68	
BINL	Length of each bin (ft)	210	
BINW	Width of each bin (ft)	52	
DREL2	Depth of unloaded vessel (ft)	10	
FDEN (g/cc)	Density of the water at the dredging site	1.02	typical seawater density at 34 psu and 20 C
Theta	Angle of length of vessel with horizontal axis of the grid. Measured clockwise	20	assumed consistent with PCCA 2018
Water Characteristics			
NROA	Number of vertical locations to input the ambient water density	2	minor variability by depth assumed since <55 ft of depth, assumed consistent with PCCA 2018
Y (ft) / ROA (g/cc)	Top depth where water density is input	0 / 1.0206	
Y (ft) / ROA (g/cc)	Bottom depth where water density is input	55 / 1.0207	
ZO	Height of bottom roughness element	0.001	default used

ZREF	Depth from surface where velocity used to compute bottom shear stress is located	20	default used
Sediment Characteristics			
NLAYER	Number of layers of disposal material	1	4 basic material types assumed, consistent with PCCA 2018
NS	Number of solid fractions in each layer	4	

Table F.2. MPFATE Sediment Parameters

Sediment Parameters					
PARAM	CS	VFALL	VOIDS	TAUCR	ISTRIP
CLUMPS	0.077	2	2	99	NO
SAND	0.38	0.06	0.5	0.15	YES
SILT	0.089	0.003	4.5	0.05	YES
CLAY	18	0.001	4.5	0.002	YES

Appendix G

MPFATE / DELFT3D Scenario 2

MPFATE / DELFT3D SCENARIO 2
MOUND GEOMETRY GRAPHICAL AND STATISTICAL RESULTS

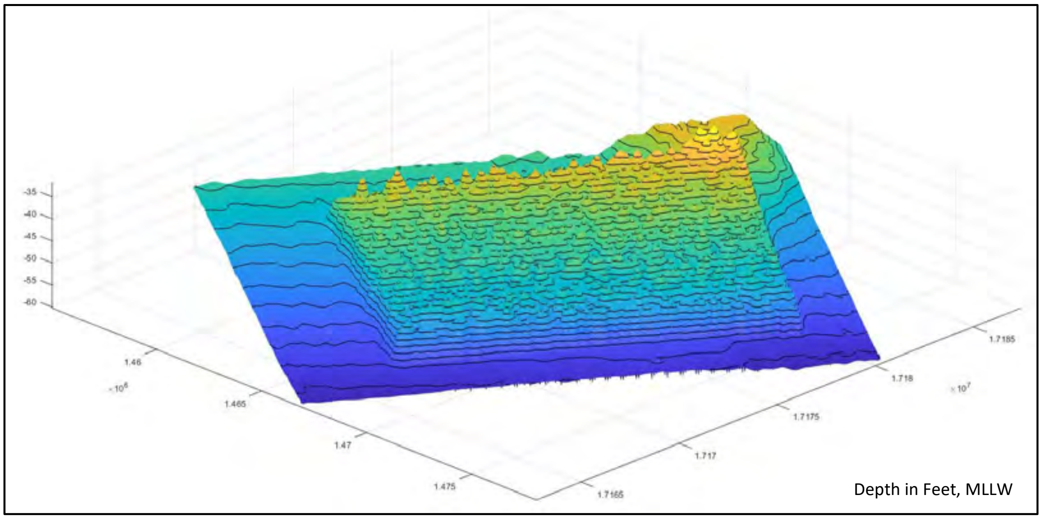

Figure G.1. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Bathymetry

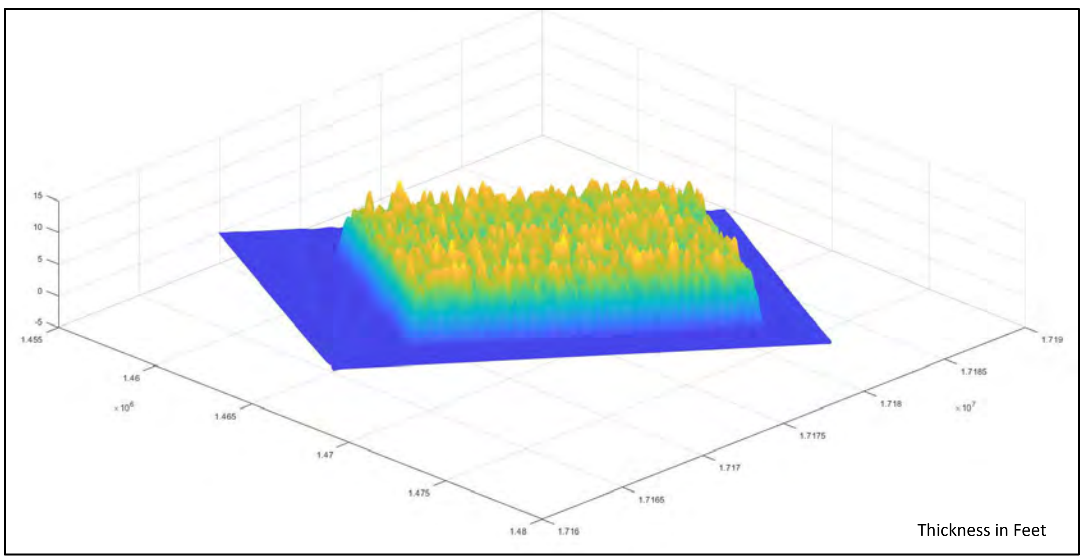

Figure G.2. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Thicknesses

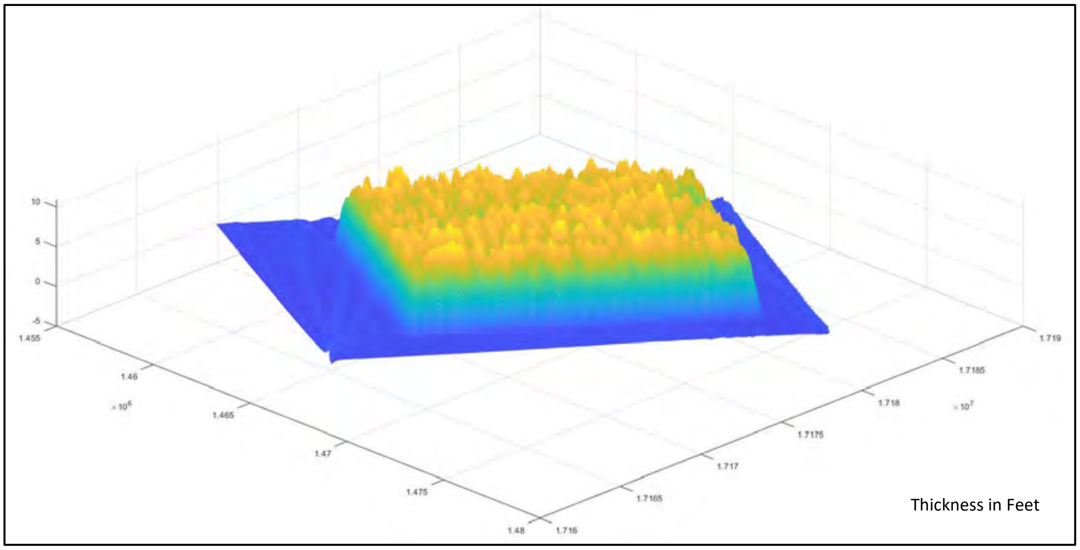

Figure G.3. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Thickness Long-Term Sediment Dispersion Simulation at Day 365

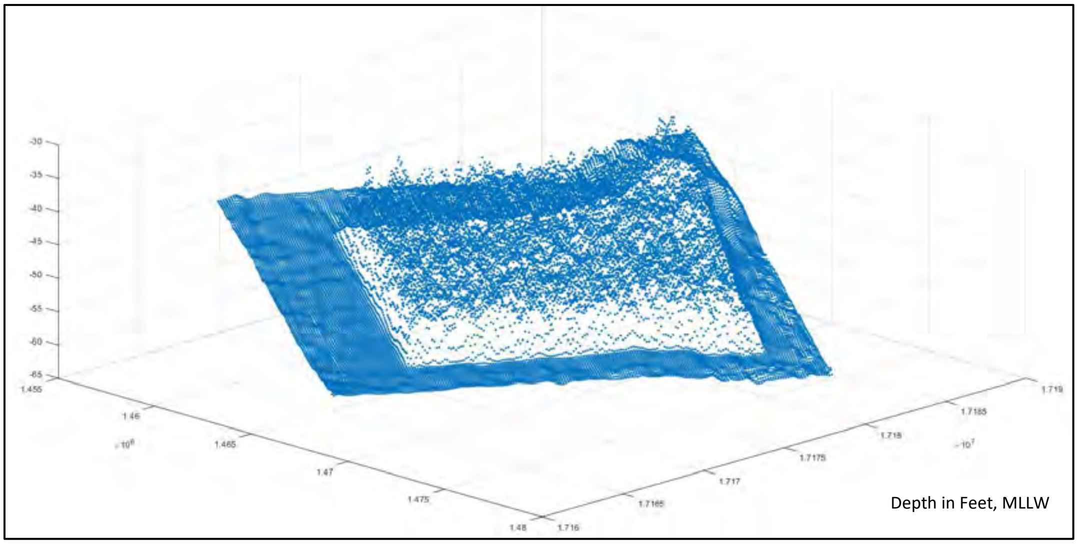

Figure G.4. MPFATE/DELFT3D Post-Increment 6 Bathymetry
Scatter Plot of Bathymetric Points

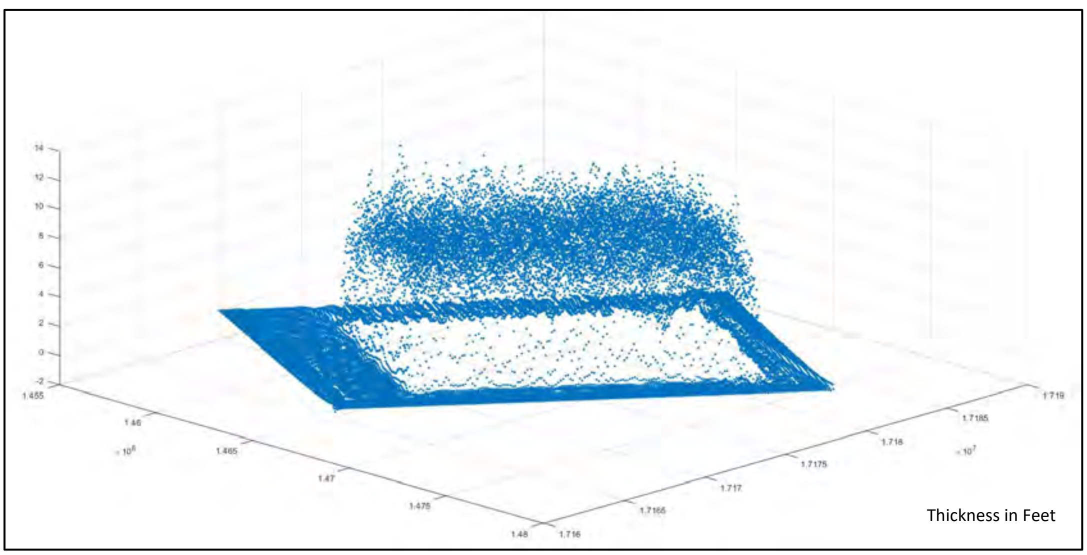

Figure G.5. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Heights
Scatter Plot of Relief Points (≥1 ft Thick)

Table G.1. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Heights
Statistical Description of Relief Points (≥1 ft Thick)

Descriptive Statistics	
Mean	7.36
Median	7.59
Mode	8.96
Standard Deviation	1.87
Minimum	1.00
Maximum	12.72
Count	14360
Confidence Level (95.0%)	0.031

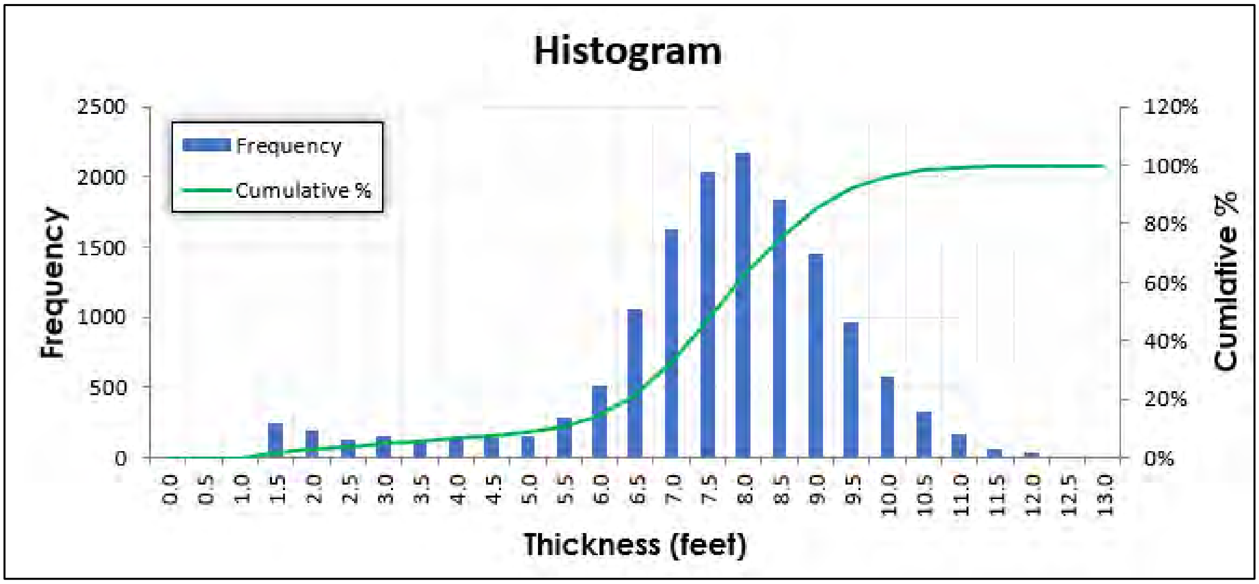

Figure G.6. MPFATE/DELFT3D Post-Increment 6 Disposal Mound Heights
Frequency Distribution of Relief Points (≥1 ft Thick)

DRAFT

AQUATIC SURVEY REPORT

San Jose Island Beneficial Use Site

Port of Corpus Christi Authority Channel Deepening Project

Aransas County, Texas

SWG-2019-00067

January 14, 2022

Prepared for:

Port of Corpus Christi Authority

400 Harbor Drive

Corpus Christi, Texas 78401

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Contents

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Exhibits

1.0 Background and Introduction

The Port of Corpus Christi Authority (PCCA) is requesting authorization from the U.S. Army Corps of Engineers (USACE) to conduct dredge and fill activities to deepen a portion of the existing Corpus Christi Ship Channel (CCSC), as well as a 5.5-mile extension of the ship channel to the natural minus 80-foot bathymetric contour in the Gulf of Mexico. The proposed Corpus Christi Ship Channel Deepening Project (SWG-2019-00067) would deepen the channel from the eastern portion of Harbor Island into the Gulf of Mexico, an overall distance of 13.8 miles. The project is needed to accommodate the transit of fully laden Very Large Crude Carriers (VLCCs), which draft approximately 70-feet. The USACE determined a Draft Environmental Impact Statement (DEIS) will be required for the proposed project.

The PCCA is proposing to utilize six (6) separate Beneficial Use (BU) Placement Area (PA) sites in association with the proposed CCSC Deepening Project. Field surveying and quantification of sensitive resources within and surrounding the proposed BU sites are required to support the DEIS being prepared by the USACE.

Six distinct BU survey areas (PA4, SS1, SS2, HI-E, MI, and SJI) were established and surveyed based on information gathered from both PCCA and the USACE. All BU boundaries were provided to Triton Environmental Solutions, LLC (Triton) by PCCA, excluding PA4. The boundary for PA4 was downloaded from the USACE Geospatial website on April 20, 2021. To create the respective BU Project Study Areas (PSAs), Triton buffered each BU boundary by 500 feet in an effort to delineate any seagrass(s) and live oyster within the project vicinity, per USACE requirements.

Triton established Global Positioning System (GPS) coordinates for survey boundaries, transects, and sample stations. Survey files were loaded onto Trimble real-time kinematic (RTK) and GEO7x GPS units for field mapping, data collection, and navigation. The aquatic survey was conducted within the limits of the survey boundaries shown on the enclosed plans (Exhibit C).

BU survey areas, PA4, SS1, SS2, HI-E and MI were surveyed from April 27 – June 4, 2021, while access agreements for San Jose Island (SJI) were coordinated. The results of the field surveying and quantification of sensitive resources within and surrounding these five (PA4, SS1, SS2, HI-E and MI) proposed BU sites can be found within the October 29, 2021, finalized *Aquatic Survey Report for Five Beneficial Use Sites – Corpus Christi Ship Channel Deepening Project* (Triton, 2021). Once access agreements for SJI were established, Triton conducted the aquatic resource survey of the approximately 1,480.19-acre SJI PSA to document and quantify marine sensitive resource(s) occurrence, distribution, and coverage within the vicinity (i.e., 500-foot buffer) of the SJI PSA (Figure 1). The aquatic resources survey for SJI was conducted on October 18-19, 2021.

Detailed descriptions of the sampling design and data collection methodology, data analysis and results, and representative photographs of the aquatic survey are presented in subsequent sections. The following report documents sensitive resources (primarily seagrass and live oyster) frequency of occurrence, distribution, percent cover (seagrass only), as well as delineated boundaries (acreage extents) for each sensitive resource identified within the SJI PSA.

2.0 Methodology

2.1 Aquatic Sensitive Resource Survey (seagrass and oyster): SJI PSA

2.1.1 Sampling Design and Data Collection

The seagrass and oyster survey was conducted with a systematic, analytical methodology utilizing wading visual and hand detection intercept sampling (i.e., feeling the bay bottom by hand) in conjunction with a modified Braun-Blanquet rapid visual assessment technique (Braun-Blanquet 1972; Fourqurean 2001). The implementation of wading presence/absence (i.e., percent frequency) and Braun-Blanquet techniques allowed for the landward and seaward delineation of seagrass to determine seagrass bed extents (acreage) while also providing species composition and percent cover (i.e., relative abundance) information. Depending on which section of the SJI PSA surveyed, Triton personnel accessed the PSA via air boat or jetty boat, then traversed the survey area on foot. Sample data points were collected along pre-defined transects, orienting from the shoreline and extending waterward. Transects were spaced at 2,000-foot intervals. Transect spacing for SJI was established from pre-approved transects that were developed as part of a prior study component to assist with the development of the DEIS and were consistent with transect spacing at Mustang Island PSA. Orienting from the shoreline, Triton utilized hand detection sampling spaced at 10-foot intervals and a modified Braun-Blanquet rapid visual quadrat assessment conducted at every 5th (i.e., 50-feet) sampling interval. Sample transects and sample stations are shown in Figure 2, and the following were surveyed:

- 516 total sample stations (N = 425 total hand detection feels; N = 91 quadrats)
- 19 total transects

At each sample station, Triton personnel identified composition of substrate, determined presence/absence of seagrass, and identified seagrasses to species. To determine presence or absence of seagrass, survey staff conducted a visual and hand feel detection on the bay bottom, centered on the transect line. For the Braun-Blanquet data collection points, a $0.25m^2$ quadrat was randomly tossed within 1-meter of the transect line. Triton conducted each quadrat assessment by visually identifying each seagrass species present and estimating percent cover for each species within the $0.25m^2$ quadrat. Percent cover, as defined for this purpose, was the fraction of the total quadrat area that was obscured by a particular species when observed from an overhead view. Seagrass was not removed or disturbed with the hand detection or rapid visual assessment techniques. Seagrass species and Braun-Blanquet data were recorded according to Tables 1 and 2, respectively.

Table 1. Seagrass species key

Abbreviation	Common Name	Scientific Name
0	Not present	N/A
A	Algae	N/A
H	Shoalweed	*Halodule wrightii*
Ha	Clovergrass	*Halophila englemannii*
R	Beaked ditch-grass (Widgeon)	*Ruppia maritima*
S	Manatee grass	*Syringodium filiforme*
T	Turtle grass	*Thalassia testudinum*
W	Seagrass wrack material	N/A

Table 2. Braun-Blanquet abundance (S) scoring key

S	Interpretation
0	Species absent from quadrat
0.1	Species represented by a single solitary short shoot, < 5% cover
0.5	Species represented by a few (< 5%) short shoots, < 5% cover
1	Species represented by many (> 5%) short shoots, < 5% cover
2	Species represented by many (> 5%) short shoots, 5 – 25% cover
3	Species represented by many (> 5%) short shoots, 25 – 50% cover
4	Species represented by many (> 5%) short shoots, 50 – 75% cover
5	Species represented by many (> 5%) short shoots, 75 – 100% cover

Wading visual, hand detection, and Braun-Blanquet survey methods terminated at approximately -3.0 feet NAVD88 due to safety concerns (ship traffic, currents, etc.) and inability to effectively and efficiently sample seagrass in deeper waters via wading.

In areas where oyster reef and/or shell were encountered during the wading survey (i.e., ≤ -3.0 feet NAVD88), a grab from the bay bottom was utilized to determine whether the substrate encountered was live oyster or a combination of shell gaper, halves, fragments, or shell hash. A grab was only utilized if shell type could not be visually identified. In waters beyond -3.0 feet NAVD88, Triton staff consolidated readily available current oyster geospatial data from National Oceanic Atmospheric Administration (NOAA) National Centers for Environmental Information; Gulf of Mexico Data Atlas to identify any known existing oyster reef locations within the survey area.

Substrate composition was recorded at each sample point, providing substrate profile and frequency of occurrence information. Substrate was recorded according to the key in Table 3.

Table 3. Substrate key

Abbreviation	Type
M	Mud
S	Sand
C	Clay
G	Gravel
SH	Shell (gaping, halves, fragments, or shell hash)
OY	Live Oyster

At every sample point, representative depth of soft sediment was measured with a sounding rod while bottom elevations were recorded using a Trimble R8 RTK, sub-centimeter GPS unit receiving real-time corrections from the virtual reference station (VRS) network. This technique of measuring bottom elevations along every transect resulted in seafloor bathymetric mapping.

The High Tide Line (HTL) elevation for the survey area (+2.76 ft NAVD88) has been recently verified by the USACE (SWG-2015-00417). The HTL is the upper limit of USACE jurisdiction along tidal shorelines, and in the absence of jurisdictional wetlands, which may extend above the High Tide Line (HTL). The Mean High Water (MHW) line elevation for this area (+1.01 ft NAVD88) was obtained from the National Oceanic and

Atmospheric Administration's (NOAA's) Tide Station No. 8775296: USS Lexington. The MHW line demarcates the upper limit of "navigable waters and USACE jurisdiction under Section 10 of the Rivers and Harbors Act of 1899."

Positional locations of the MHW and HTL tidal elevation lines were recorded along the shoreline of the PSA. Staff biologists surveyed the shoreline at discrete point locations to locate the MHW and HTL elevations using a Trimble R8 RTK, sub-centimeter GPS unit. Once the tidal boundary field survey was complete, positional and elevation data for MHW and HTL tidal boundaries were post-processed in the office and overlaid onto recent aerial imagery.

All survey data was recorded with a Trimble R8 RTK, sub-centimeter GPS unit receiving real-time corrections from the VRS network, or a GEO 7x handheld GPS, and complied with the USACE Standard Operating Procedures (SOP) for recording jurisdictional delineations with a GPS. Benchmarks were surveyed every morning prior to initiation of daily surveying activities and in the evening after daily survey completion. An SOP Table is included in Exhibit D. Position coordinates were plotted in the office with ArcGIS 10.6 and ArcGIS Pro software.

2.1.2 Data Analysis

Determining presence/absence (i.e., frequency of occurrence) of seagrass by hand detection at each sample station was calculated as follows:

$$F_O = (\sum O_S / N_H)$$

where F_O = seagrass percent frequency of occurrence, O_S = seagrass occurrence, and N_H = number of total hand detection sampling stations. The presence/absence component of the survey facilitated delineation of seagrass acreage extent throughout the survey areas.

The data from each Braun-Blanquet data collection point was analyzed to quantify percent cover (i.e., seagrass relative abundance) and frequency by species encountered within the survey areas. These data provided species composition information, frequency of occurrence by species, as well as seagrass percent cover estimates. Percent cover was calculated as follows:

$$VC_S = (\sum Q_S / N_Q)$$

where VC_S = mean seagrass percent vegetative cover, Q_S = quadrat score, and N_Q = number of total quadrats.

Percent frequency by seagrass species was calculated with the following equation:

$$F_{OS1} = (\sum O_{S1} / N_Q)$$

where F_{OS1} = seagrass percent frequency of occurrence by species, O_{S1} = seagrass occurrence by species, and N_Q = number of total quadrats.

Substrate data was quantified by summing the total occurrence of substrate type and dividing by total number of substrate sample stations, providing substrate composition information for each respective survey area. Summary statistics (N, minimum, maximum, and mean) for depth of soft sediment and elevation were calculated.

2.2 Meteorological Observations and Photographic Record

Triton documented general meteorological conditions on daily field sheets. The selected tide station for the project was determined to be the Port Aransas, TX-Station ID: 8775237 and was accessed via the NOAA webpage at: https://tidesandcurrents.noaa.gov/stationhome.html?id=8775237. The Port Aransas Station was selected as the primary tidal reference station for the San Jose Island survey due to its close proximity to the PSA. Meteorological and tidal conditions for both stations are provided in Exhibit B. Additionally, Triton staff photograph documented the field survey collections and have included representative images in Exhibit A.

3.0 Results

3.1 Aquatic Sensitive Resource Survey (seagrass and oyster): SJI PSA

Nineteen transects and 516 total sample points (N = 425 hand detection, N = 91 quadrats) were assessed at SJI (Table 4). No seagrass or live oyster were observed (Figure 2). Bare substrate was encountered with 100.0% frequency and sand (100.0%) was the only substrate type identified.

Table 4. Total number (N) of transects, hand detection points, Braun-Blanquet points, and total sampling points within the survey area

Transects (N)	Hand Detection Points (N)	Braun-Blanquet Points (N)	Total Sample Points (N)
19	425	91	516

Across the survey area, soft sediments were firm (mean depth of soft sediment = 0.0) and bottom elevations ranged from -3.3 feet to +2.8 feet NAVD88 and averaged -0.8 feet NAVD88.

Table 5. Summary of depth of soft sediment (DSS) and elevation data within the survey area. N = number of sample points and range represents the minimum and maximum DSS and elevation (feet) values; Vertical datum: NAVD88

Parameter	N	Range (Feet)	Mean (Feet)
DSS	425	0.0 – 0.0	0.0
Elevation	425	-3.3 – +2.8	-0.8

3.2 Meteorological Observations

Weather conditions during the survey period ranged from clear to cloudy skies. Air temperature ranged from 72.3°F on October 18, 2021, to 80.8°F on October 19, 2021. Winds were light and velocities ranged from 3.1 miles per hour (mph) to 11.8 mph. No precipitation was observed. Tide levels ranged from +1.56 feet NAVD88 to +2.12 feet NAVD88 during the survey period. Tidal areas and Gulf of Mexico beach (i.e., wet beach versus dry beach) varied depending on the day's tidal condition. Additional detail on daily meteorological conditions are presented in Exhibit B.

4.0 Conclusion

Comprehensive sensitive aquatic resources surveying across the SJI PSA allowed for the quantification of marine sensitive resource(s) to document presence/absence, distribution, percent cover (seagrass only) as well as delineated boundaries (i.e., acreage extents) for seagrass and live oyster within the BU placement area. Aquatic resources surveying indicated the absence of both seagrass and live oyster within the SJI survey boundary.

The SJI sensitive aquatic resources survey results and maps can be utilized as a project planning tool to inform the permitting process. Specifically, the delineation or the conclusion of absence of sensitive resources should facilitate decisions regarding avoidance or minimization measures to sensitive aquatic resources, while also informing habitat restoration project locations, such as beach nourishment or other habitat enhancement initiatives. To conclude, the sensitive aquatic resources data contained herein should enable preparation and fully support the DEIS.

5.0 Literature Cited

Braun-Blanquet. 1972. *Plant Sociology: The Study of Plant Communities*. Hafner Publishing Company.

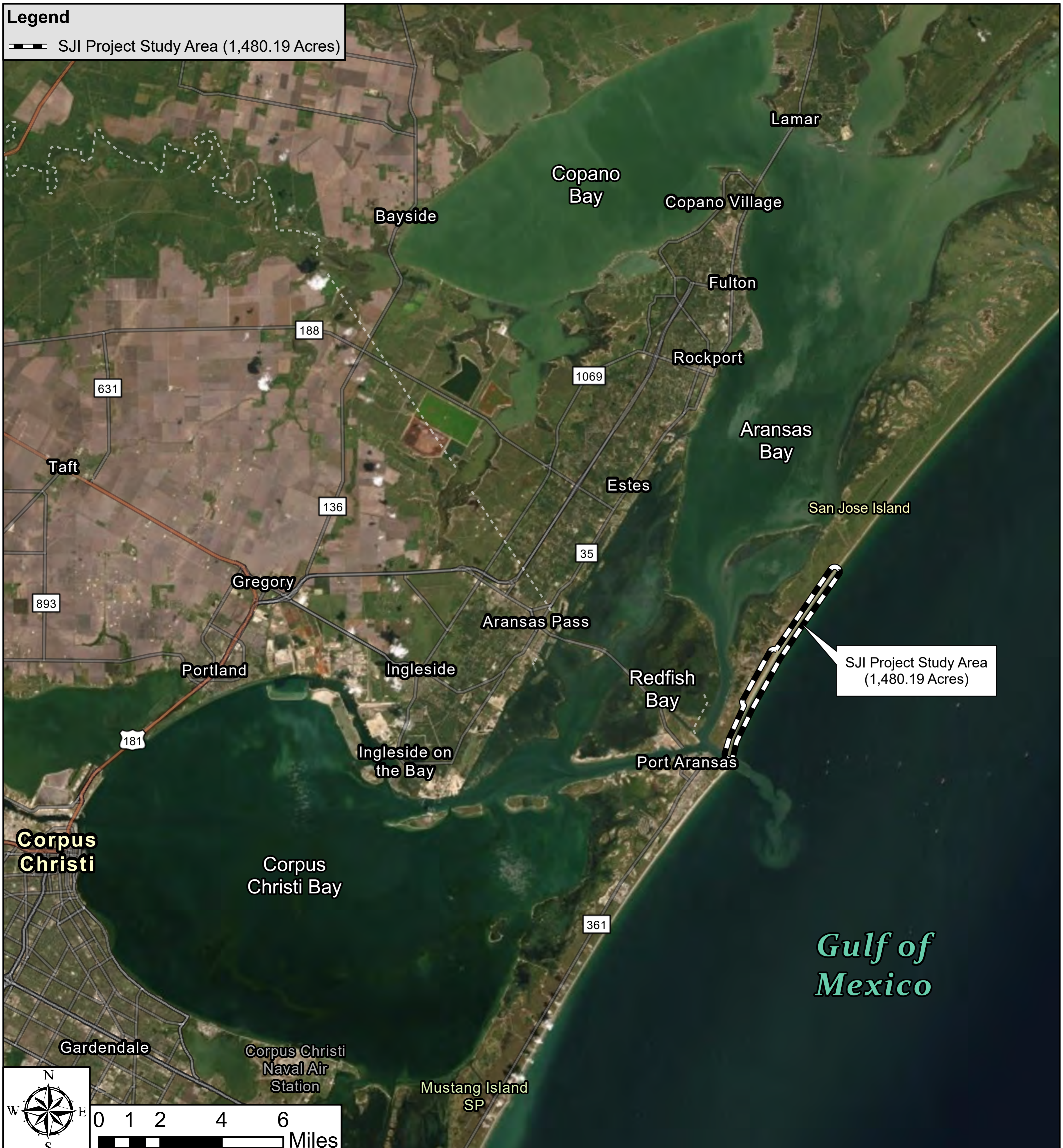
Fourqurean J.W., A. Willsie, C.D. Rose, and L.M. Rutten. 2001. *Spatial and Temporal Patterns in Seagrass Community Composition and Productivity in South Florida*. Marine Biology Journal 138:341-354.

Pulich, W.M., Jr., B. Hardegree, A. Kopecky, S. Schwelling, C. P. Onuf, and K.H. Dunton. 2003. *Texas Seagrass Monitoring Strategic Plan (TSMSP)*. Publ. Texas Parks and Wildlife Department, Resource Protection Division, Austin, Texas. 27 pp.

Triton Environmental Solutions, LLC (Triton). 2021. *Aquatic Survey Report for Five Beneficial Use Sites – Corpus Christi Ship Channel Deepening Project*. June 2021.

DRAFT

Figure 1.
Vicinity Map



SJI Aquatic Survey Vicinity Map

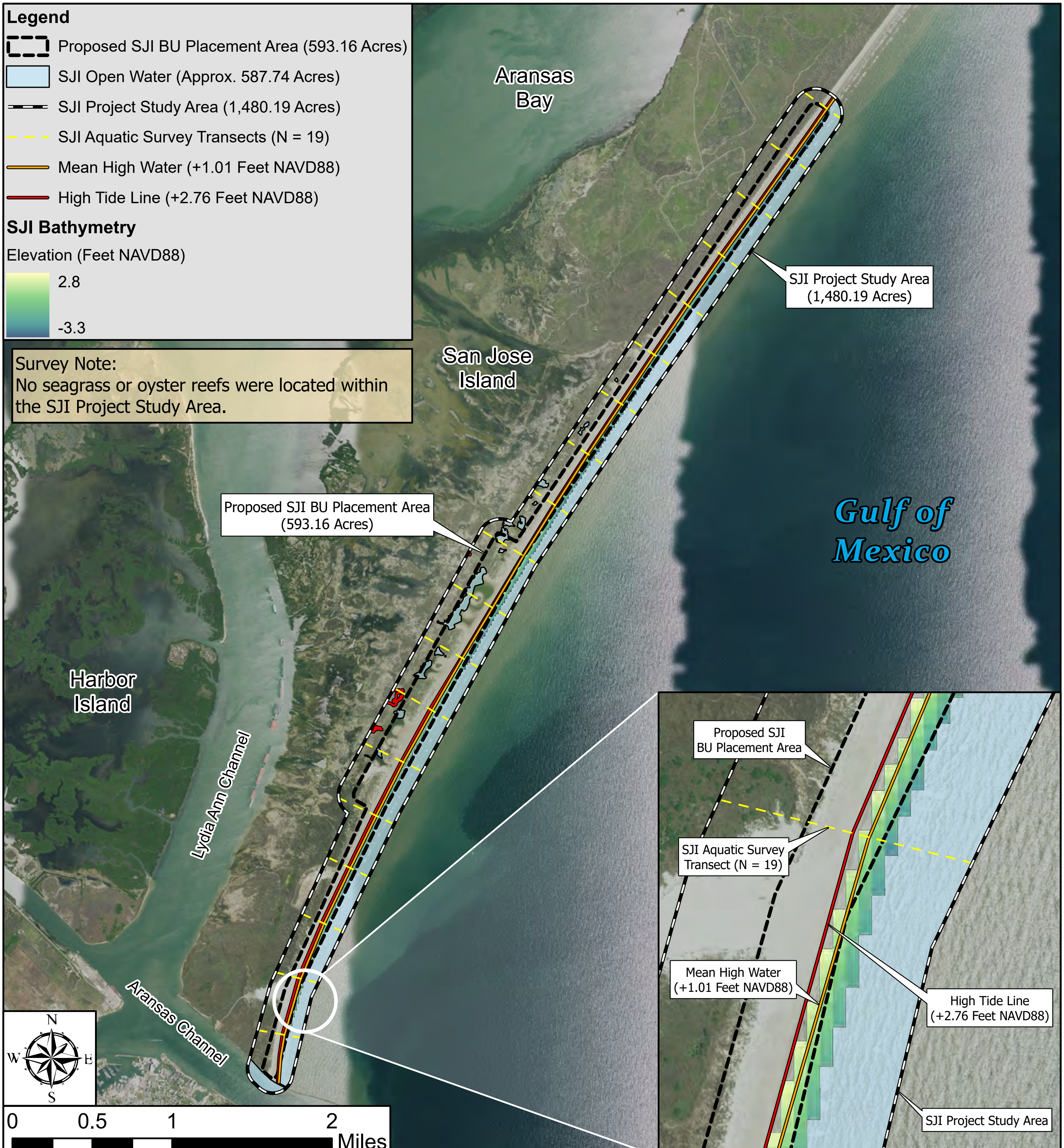
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, Texas 78381

Prepared For: Port of Corpus Christi Authority
400 Harbor Drive
Corpus Christi, Texas 78401

Map Notes:
-Base Map Source: Image obtained from ArcGIS Pro, World Imagery.
-BU Placement Area boundary shapefile provided by the Port of Corpus Christi Authority.
-Map preparation date: January 14, 2022 (JW).

Figure 2.
SJI Aquatic Survey Overview Map



SJI Aquatic Survey Overview Map

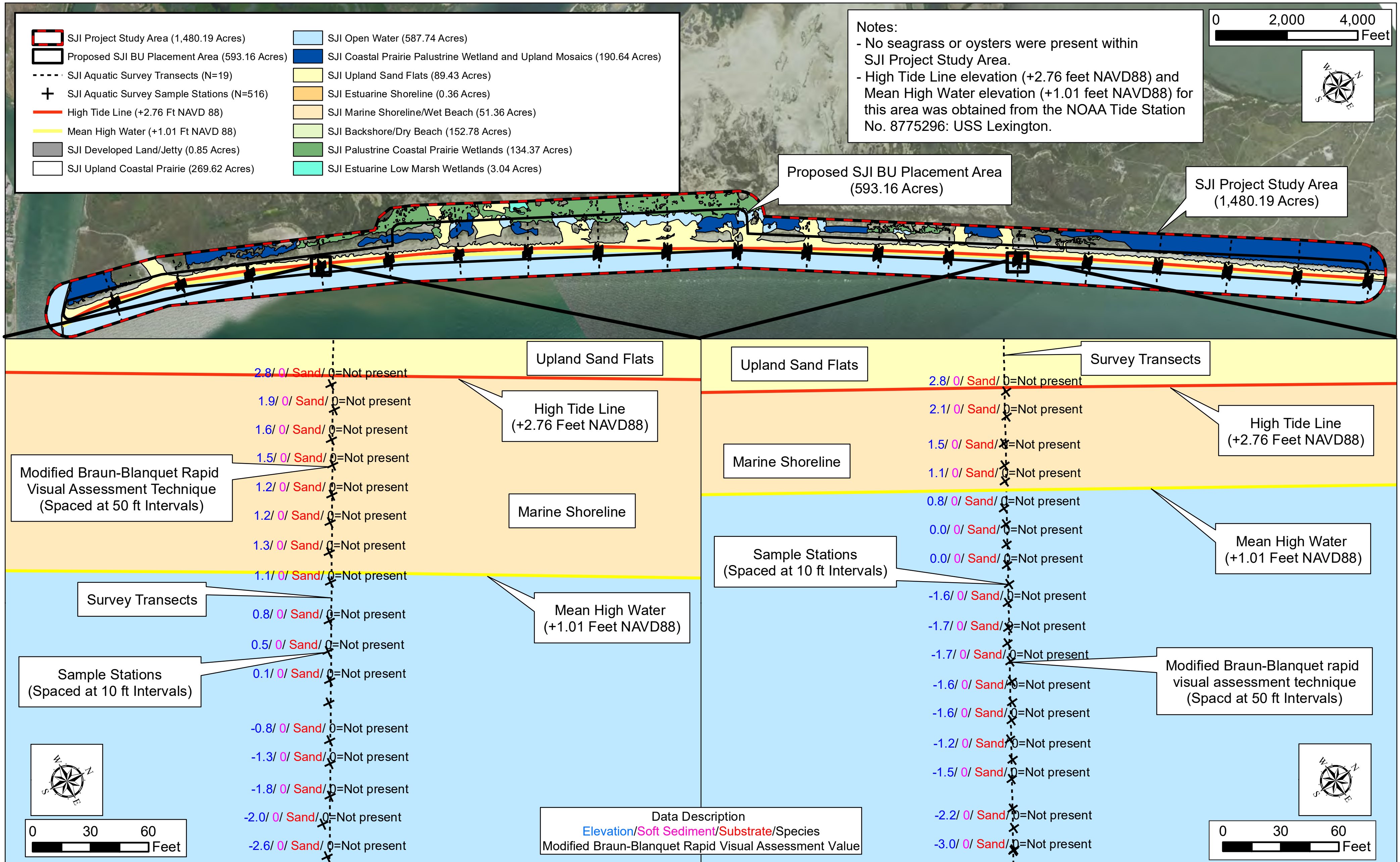
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, Texas 78381

Prepared For: Port of Corpus Christi Authority
400 Harbor Drive
Corpus Christi, Texas 78401

Map Notes:
-Base Map Source: Image obtained from TNRIS; NAIP 2020.
-SJI BU Placement Area shapefile provided by the Port of Corpus Christi Authority.
-HTL elevation (+2.76 Feet NAVD88) & MHW elevation (+1.01 Feet NAVD88) for this area was obtained from the NOAA Tide Station No. 8775296: USS Lexington.
-Map preparation date: January 14, 2022 (JW).

Figure 3.
SJI Aquatic Survey Data View Map



SJI Aquatic Survey Data View Map

Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By:

Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, TX 78381

Prepared for:

Port of Corpus Christi Authority
400 Harbor Drive
Corpus Christi, Texas 78401

Map Notes:
-.BaseMap Source: United States Department of Agriculture (USDA). Texas NAIP Imagery, 2018-12-31. Web. 2021-02-22.
-SJI BU Placement Area boundary shapefile provided by Port of Corpus Christi Authority.
-Habitat boundary shapefiles and acrages providedby Mott MacDonald.
-Map Preparation Date: January 14, 2022 (RW)

Exhibit A.
Aquatic Survey Photographic Documentation

Corpus Christi Ship Channel Deepening Project (SWG-2019-00067) – San Jose Island

Port of Corpus Christi Authority
400 Harbor Drive
Corpus Christi, Texas 78401

Survey Period: October 18-19, 2021

Aquatic Survey Summary:

- 19 total survey transects across survey area.
- 425 total aquatic hand detections across survey area.
- 91 total Braun-Blanquet 0.25m^2 quadrats.
- No seagrass encountered within the SJI survey area.
- No live oyster reef encountered within the SJI survey area.

Corpus Christi Ship Channel Deepening Project (SWG-2019-00067)

San Jose Island – Aquatic Survey Photo Exhibit

Survey Period: October 18-19, 2021

Representative photo of data collection techniques used to quantify sensitive aquatic resources, substrate, elevation, and soft sediment depths within the SJI survey boundary.

Representative photo of 0.25m^2 quadrat used to perform the Braun-Blanquet rapid visual assessment technique within the SJI survey boundary.

Representative photo of airboat utilized to access northern SJI and to minimize disturbance to sensitive aquatic resources.

Exhibit B.

NOAA Tides & Currents Port Aransas Station: Meteorological & Tide Tables

Port Aransas Tide Station (ID: 8775237)
NOAA Tides & Currents

Date	Time (LST)	Air Temp (°F)	Baro Pressure (Mb)	Tide, Verified (Feet NAVD88)	Water Temp (°F)	Wind Speed (mph)	Wind Gusts (mph)	Wind Direction (deg.)	Precipitation (in.)
10/18/2021	7:00	72.3	1018.8	1.83	77.9	5.4	7.4	83	0
10/18/2021	8:00	74.7	1019.5	1.94	77.9	3.4	7.8	102	
10/18/2021	9:00	74.3	1020.0	1.72	77.9	8.1	10.1	73	
10/18/2021	10:00	75.0	1020.0	1.89	78.1	5.1	9.6	73	
10/18/2021	11:00	75.2	1019.6	2.05	78.1	7.2	10.9	74	
10/18/2021	12:00	75.9	1019.0	2.07	78.1	5.1	9.8	108	
10/18/2021	13:00	74.8	1017.8	2.05	78.3	9.6	12.7	63	
10/18/2021	14:00	75.0	1016.9	2.09	78.3	10.7	15.4	67	
10/18/2021	15:00	75.6	1016.5	2.07	78.3	9.4	14.5	73	
10/18/2021	16:00	76.3	1016.3	2.02	78.3	10.7	15.0	85	
10/19/2021	7:00	76.8	1015.3	1.59	76.3	3.1	5.1	122	0
10/19/2021	8:00	78.6	1015.7	1.56	76.3	6.5	9.4	127	
10/19/2021	9:00	79.2	1016.5	1.63	76.3	8.1	10.9	116	
10/19/2021	10:00	78.8	1016.7	1.80	76.1	11.8	16.3	118	
10/19/2021	11:00	79.7	1016.6	1.66	76.1	10.7	15.9	111	
10/19/2021	12:00	80.4	1016.0	1.88	75.6	9.2	14.3	102	
10/19/2021	13:00	79.9	1015.2	2.06	75.6	10.1	14.3	106	
10/19/2021	14:00	80.8	1014.7	2.12	75.6	7.8	13.6	128	
10/19/2021	15:00	80.6	1014.4	2.09	75.7	10.9	14.5	117	
10/19/2021	16:00	80.2	1014.3	2.10	76.5	11.4	15.4	108	

Table Source: Meteorological Observations - NOAA Tides & Currents https://tidesandcurrents.noaa.gov/stationhome.html?id=8775237
Precipitation Source: https://www.ncei.noaa.gov/products/land-based-station

Table Key

- LST: Local Standard Time
- Baro Pressure (Mb): Millibars, unit of measurement for atmospheric pressure
- °F: degrees Fahrenheit
- in.: inches
- deg.: degrees
- mph: miles per hour
- Feet NAVD88: Established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988. Shown in feet.

Exhibit C.
Approved Aquatic Survey Plan

TRITON ENVIRONMENTAL
SOLUTIONS LLC

Aquatic Survey Plan for the

Corpus Christi Ship Channel Deepening Project

SWG-2019-00067

Prepared for: Port of Corpus Christi Authority

(PCCA)

April 20, 2021 (draft)

April 26, 2021 (rev.)

contact@tritonenv.com www.tritonenv.com P.O. Box 1755, Rockport, Texas 78381

1.0 Introduction/Background:

The Port of Corpus Christi Authority (PCCA) is proposing to utilize six (6) separate dredged material Placement Area (PA) sites in association with the proposed Corpus Christi Ship Channel Deepening Project (SWG-2019-00067). Field surveying and quantification of sensitive resources within the proposed PA sites are required to support the Draft Environmental Impact Statement (EIS) being prepared by the U.S. Army Corps of Engineers (USACE). The following aquatic survey plan shall be performed to document and quantify sensitive resource occurrence and coverage within each respective survey area.

Six survey areas have been established, based on spatial data and project plans provided by the PCCA. Triton Environmental Solutions, LLC (Triton) has established Global Positioning System (GPS) coordinates for survey boundaries, transects, and sample stations. To create the respective survey areas, Triton buffered each PA boundary by 500 feet to delineate any seagrasses and/or live oysters within the project vicinity, per USACE requirements. Survey files will be loaded onto Trimble real time kinetic (RTK) and/or GEO7x GPS units for field mapping, data collection, and navigation. The total survey area encompasses roughly 3,878.67-acres across the six survey areas and include SS1/PA4 (Approx. 884.05-acres), SS2 (Approx. 250.60-acres), HI-E (Approx. 269.39-acres), SJI (Approx. 1,482.35-acres) and MI (Approx. 992.28-acres). All PA boundaries were provided to Triton by PCCA, excluding PA4. The boundary for PA4 was downloaded from the USACE Geospatial website on April 20, 2021. As shown on the Preliminary Survey Planning Map for SS1 and PA4, creation of 500-foot buffers around SS1 and PA4 caused the survey area for the two proposed placement areas to merge. The aquatic survey will be conducted within the limits of the survey boundaries shown on the enclosed plans (Appendix A).

Triton anticipates the aquatic survey to be conducted between April 26 – May 31, 2021. The proposed schedule may be affected by inclement weather (i.e., high winds, thunderstorms, high tides, etc.), or other unanticipated factors and circumstances. Triton initially proposed a schedule timeframe of 42 days to conduct the aquatic survey but has revised the timeline to accommodate pressing schedules associated with the project. Triton will make every effort to complete the aquatic field survey by May 31, 2021.

2.0 Methodology

2.1 Aquatic Sensitive Resource Surveys (Seagrass and Oyster): SS1, PA4, SS2, HI-E, SJI, MI Survey Areas

2.1.1 Sampling Design and Data Collection

The seagrass and oyster survey will be conducted with systematic, analytical methodology utilizing wading visual and/or hand detection sampling (i.e., feeling the bay bottom by hand) in conjunction with a modified Braun-Blanquet rapid visual assessment technique (Braun-Blanquet 1972; Fourqurean 2001). The implementation of wading presence/absence (i.e., percent frequency) and Braun-Blanquet techniques will allow for the landward and bayward delineation of seagrass beds to determine seagrass bed extents (acreage) while also providing species composition and percent cover (i.e., relative abundance) information. Triton personnel will travel to the sites in outboard skiffs ranging in length from 17- to 25-feet. Skiffs draw less than one foot of water and prop-washing will be strictly avoided. Sample data points will be collected along pre-defined transects, orienting from the shoreline and extending waterward within each respective survey area. Transects will be spaced at 100-foot intervals. Orienting from the shoreline, Triton will utilize hand detection sampling spaced at 10-foot intervals and a modified Braun-Blanquet rapid visual quadrat assessment conducted at every 5th (i.e., 50-feet) sampling interval. All transects and sample stations are shown in the enclosed Survey Plan Illustrations (Appendix A) and the following will be observed:

a. SS1 and PA4 Sites: 280 total transects (mean total length = 1,015-ft; range: 160 – 2,592-ft); 284,268 linear feet of transects; 34,880 total sample stations (N = 28,799 total hand detection feels; N = 6,081 quadrats)
b. SS2 Site: 117 total transects (mean total length = 686-ft; range: 63 – 1,807-ft); 80,208 linear feet of transects; 13,504 total sample stations (N = 11,734 total hand detection feels; N = 1,770 quadrats)
c. HI-E Site: 82 total transects (mean total length = 504-ft; range: 190 – 1,042-ft); 41,352 linear feet of transects; 5,159 total sample stations (N = 4,227 total hand detection feels; N = 932 quadrats)
d. SJI Site: 19 total transects (mean total length = 1,721-ft; range: 1,449 – 2,175-ft); 32,703 linear feet of transects; 3,976 total sample stations (N = 3,294 total hand detection feels; N = 682 quadrats)
e. MI Site: 14 total transects (mean total length = 1,601-ft; range: 1,537 – 1,673-ft); 22,415 linear feet of transects; 2,730 total sample stations (N = 2,261 total hand detection feels; N = 469 quadrats)
f. *Note: the above represents the maximum number of sample points, transects, etc. and will likely be less, especially if transect or sample station length decreases. Also, attributed to transect termination at deep-water channels* and intersection with land features.

At each sample station, Triton personnel will identify composition of substrate, determine presence/absence of seagrass, and identify seagrasses to species (Braun-Blanquet stations only). To determine presence or absence of seagrass, survey staff will conduct a visual or hand feel detection on the bay bottom, centered on the transect line. For the Braun-Blanquet data collection points, a $0.25m^2$ quadrat will be randomly tossed within 1-meter of the transect line. Triton will conduct each quadrat assessment by visually identifying each seagrass species present and estimating percent cover for each species within the $0.25m^2$ quadrat. Percent cover, as defined for this purpose, is the fraction of the total quadrat area that is obscured by a particular species when observed from an overhead view. Seagrass will not be removed or disturbed with the hand detection or rapid visual assessment techniques. Seagrass species and Braun-Blanquet data will be recorded according to Tables 1 and 2, respectively.

Wading visual hand detection and Braun-Blanquet survey methods will terminate at approximately -3.0 feet NAVD 88 due to safety concerns (ship traffic, currents, etc.) and inability to effectively and efficiently sample seagrass in deeper waters. In waters > -3.0 feet NAVD 88, when necessary, Triton will confirm the bayward edge of seagrass surveying from a vessel using a post-hole grab. Sampling will continue at three consecutive sample stations (i.e., 30-feet) from the last identified seagrass location on the transect line. If any transect intersects a deep-water channel, the survey transect line will terminate at channel edge for safety concerns. Transects will terminate at 30-feet past the bayward edge of seagrass or the leading slope of deep-water channels, whichever occurs first.

In areas where oyster reef and/or shell are encountered during the wading surveys (i.e., ≤ -3.0 feet NAVD 88), a grab from the bay bottom will be utilized to determine whether the substrate encountered was live oyster, dead shell, or shell hash. A grab will only be utilized if shell type cannot be visually identified. All oyster identified will be circumnavigated to delineate the boundary, providing spatial acreage estimates. In waters beyond -3.0 feet NAVD 88, Triton staff will consolidate readily available current oyster geospatial data from National Oceanic Atmospheric Administration (NOAA) National Centers for Environmental Information; Gulf of Mexico Data Atlas to identify any known existing oyster reef locations within the survey areas. Once consolidated, Triton staff will survey these locations by sounding to verify/determine oyster boundaries and acreage extent.

Substrate composition will be recorded at each sample point, providing substrate profile and frequency of occurrence information. Substrate will be recorded according to the key in Table 3. Representative bottom elevations and depth of soft sediment will be collected with a sounding rod (tide-adjusted) within each survey area; primarily in areas of identified sensitive resources (i.e., seagrass beds) and occur at roughly 300-foot transect intervals, every 10-feet. Note: This survey will not result in comprehensive seafloor bathymetric mapping throughout the entire survey areas. All survey data will be georeferenced and recorded with a Trimble RTK GPS receiving real-time corrections from the VRS Network, or into a GEO 7x handheld GPS and will comply with the USACE Standard Operating Procedures for recording jurisdictional delineations with a GPS. Position coordinates will be recorded and then plotted in the office with ArcGIS 10.6 and ArcGIS Pro software.

2.1.2 Data Analysis

Determining presence/absence (i.e., frequency of occurrence) of seagrass by hand detection at each sample station will be calculated as follows:

$$F_O = (\sum O_S / N_H)$$

where F_O = seagrass percent frequency of occurrence, O_S = seagrass occurrence, and N_H = number of total hand detection sampling stations. The presence/absence component of the survey will facilitate delineation of seagrass extent throughout the survey areas.

The data for each 0.25-meter^2 quadrat will be analyzed to quantify percent cover and frequency by species encountered within the survey areas. These data will provide species composition information, frequency of occurrence by species, as well as percent cover values for seagrass species. Percent cover will be calculated as follows:

$$VC_{S1} = (\sum Q_{S1} / N_Q)$$

where VC_{S1} = mean percent vegetative cover by species, Q_{S1} = quadrat score per species, and N_Q = number of total quadrats.

Percent frequency by seagrass species will be calculated with the following equation:

$$F_{OS} = (\sum O_{S1} / N_Q)$$

where F_{OS} = seagrass percent frequency of occurrence by species, O_{S1} = seagrass occurrence by species, and N_Q = number of total quadrats.

Substrate data will be quantified by summing the total occurrence of substrate type and dividing by total number of substrate sample stations, providing substrate composition information for each respective survey area.

2.2 Meteorological Data and Photographic Record

Triton will document general meteorological conditions on daily field sheets. The nearest operational tide station is determined to be USS Lexington, Corpus Christi Bay, TX - Station ID: 8775296 and will be accessed via the National Oceanic and Atmospheric Administration's website. Air and water temperature, salinity, wind speed and direction, and daily tide data will be obtained from https://tidesandcurrents.noaa.gov/stationhome.html?id=8775296.

Additionally, Triton staff will photo-document the field survey collections and include images of representative habitats and general site conditions.

2.3 General Survey Comments

1. At date of this survey plan, Triton understands site access is currently granted for SS1, PA4, SS2, HI-E, and SJI. SJI and MI aquatic survey transects and sample points will need to be accessed via land. PCCA is currently working toward attaining access approval for MI. Triton will not initiate the MI survey until access approval is attained and authorized by the PCCA.
2. Triton has developed this survey plan in accordance with the provided Scope of Work as well as recent correspondence. The transect and sample station spacing of 100- and 10-feet, respectively, could result in a timeframe that does not meet the current project schedule. Triton respectfully requests feedback from the USACE and/or other resource agencies on any acceptable transect and/or sample point spacing variances which could produce sufficient data over the span of the survey areas while also accommodating project timelines. For instance, Triton requests approval to adjust transect and/or sample station spacing, as necessary, to accommodate the compressed project schedule (e.g., from 100- to 200-foot transects and/or 10- to 20-foot sampling spacing).
3. Strategies to increase sampling efficiency (i.e., < timeline)
    a. > transect and sample point (hand feel & B-B assessments) spacing
        i. Transect: 100 to 200 or greater, consider > spacing in buffered areas
        ii. Hand feel: 10 to 20-ft or greater
        iii. B-B: every 50 to 60-ft or greater
    b. Consider > survey spacing in the buffer areas only (example: 100-ft in survey area proper, 200-ft in buffered areas, etc., etc.)
4. If detailed seafloor mapping is required, substantial revisions to the scope and project timeline would need to occur.

3.0 Tables

Table 1. Seagrass species list key

Abbreviation	Common Name	Scientific Name
0	Not present	N/A
H	Shoalweed	*Halodule wrightii*
T	Turtle grass	*Thalassia testudinum*
S	Manatee grass	*Syringodium filiforme*
R	Beaked ditch-grass (Widgeon)	*Ruppia maritima*
Ha	Clovergrass	*Halophila englemannii*
A	Algae	N/A
W	Seagrass wrack material	N/A

Table 2. Braun-Blanquet abundance scores (S). Each seagrass species will be scored in each 0.25-meter^2 quadrat according to Fourqurean et al., 2001 and assigned a percent cover score. (Shoot density applies to *Thalassia* only).

S	Interpretation
0	Species absent from quadrat
0.1	Species represented by a single solitary short shoot, < 5% cover
0.5	Species represented by a few (< 5%) short shoots, < 5% cover
1	Species represented by many (> 5%) short shoots, < 5% cover
2	Species represented by many (> 5%) short shoots, 5 – 25% cover
3	Species represented by many (> 5%) short shoots, 25 – 50% cover
4	Species represented by many (> 5%) short shoots, 50 – 75% cover
5	Species represented by many (> 5%) short shoots, 75 – 100% cover

Table 3. Substrate list key

Abbreviation	Substrate Type
M	Mud
S	Sand
C	Clay
G	Gravel
SH	Shell (gaping, halves, or fragments)
OY	Live Oyster

Table 4. Summary of transect length and number of transects, sample stations, and quadrats by survey area and combined totals.

Survey Area	Transect Length (ft.)	N Transects	N Sample Stations	N Quadrats
SS1 and PA4	284,268	280	28,799	6,081
SS2	80,208	117	11,734	1,770
HI-E	41,352	82	4,227	932
SJI	32,703	19	3,294	682
MI	22,415	14	2,261	469
Combined Totals:	**457,638 (86.67 mi)**	**503**	**49,974**	**9,854**

Note: subject to change based on site conditions and methods discussed above (i.e, land overlap, edge of deepwater channel transect termination).

4.0 Literature Cited

Braun-Blanquet. 1972. Plant Sociology: The Study of Plant Communities. Hafner Publishing Company

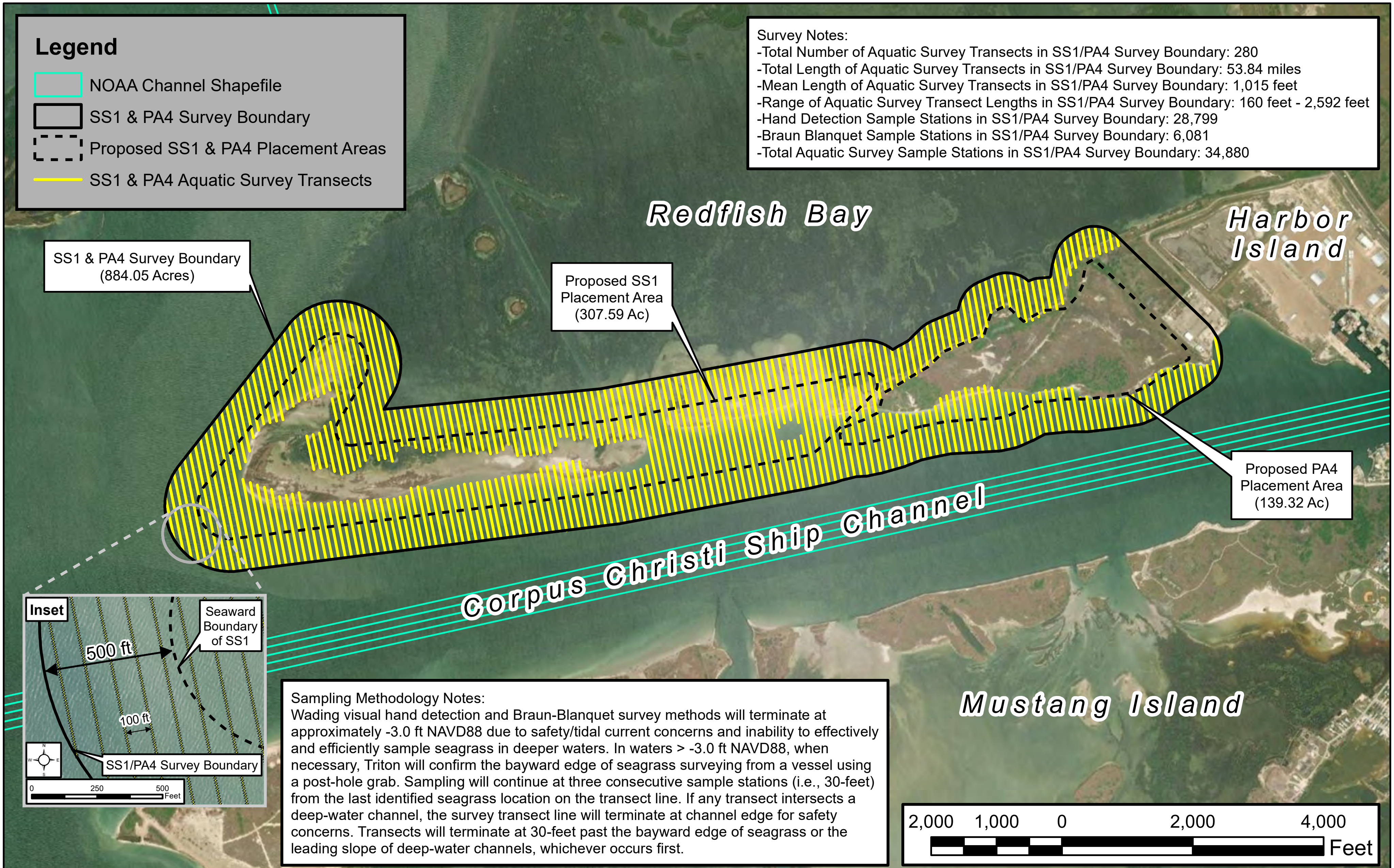
Fourqurean J.W., A. Willsie, C.D. Rose, and L.M. Rutten. 2001. Spatial and Temporal Patterns in Seagrass Community Composition and Productivity in South Florida. Marine Biology Journal 138:341-354

Pulich, W.M., Jr., B. Hardegree, A. Kopecky, S. Schwelling, C. P. Onuf, and K.H. Dunton. 2003. Texas Seagrass Monitoring Strategic Plan (TSMSP). Publ. Texas Parks and Wildlife Department, Resource Protection Division, Austin, Texas. 27 pp.

5.0 Appendices

Appendix A: Survey Plan Maps
Appendix B: Survey Plan Development Reference Materials
- **PCCA Scope of Work,**
- **USACE WOTUS Letter, June 22, 2020**
- **USACE Email Correspondence, Jayson Hudson, January 8, 2021**

Appendix A: Survey Plan Maps



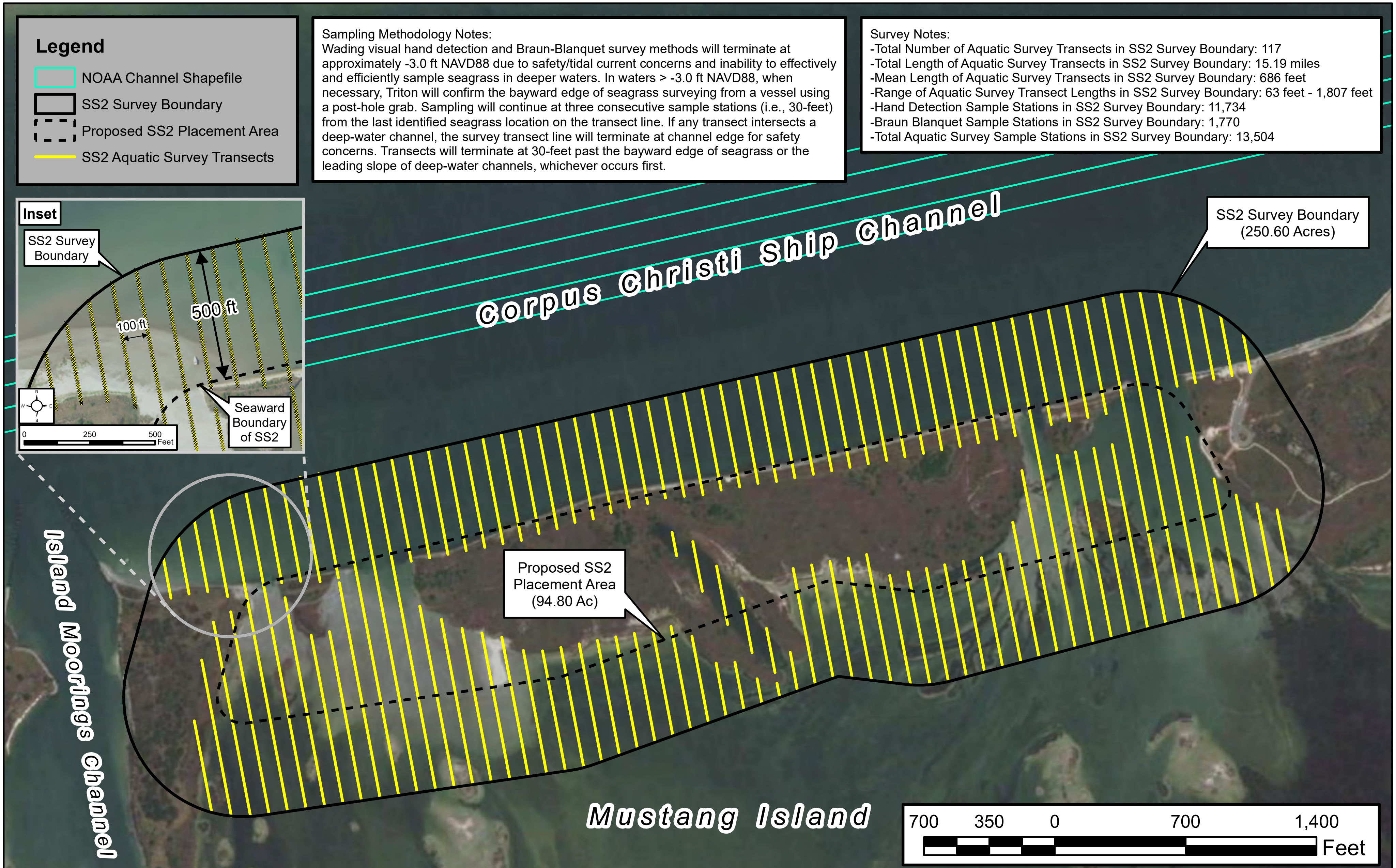
Aquatic Survey Overview Map
SS1 & PA4 Survey Areas & Aquatic Survey Transects
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, TX 78381

N W E S

Prepared for: Port of Corpus Christi Authority
222 Power Street
Corpus Christi, Texas 78401

Map Notes:
-BaseMap Source: -ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
-Placement Area boundary shapefiles for SS1, SS2, HI-E, MI & SJI were provided by the Port of Corpus Christi Authority.
-The shapefile for PA4 was obtained from the U.S. Army Corps of Engineers.
-Map Preparation Date: April 26, 2021 (BPH).



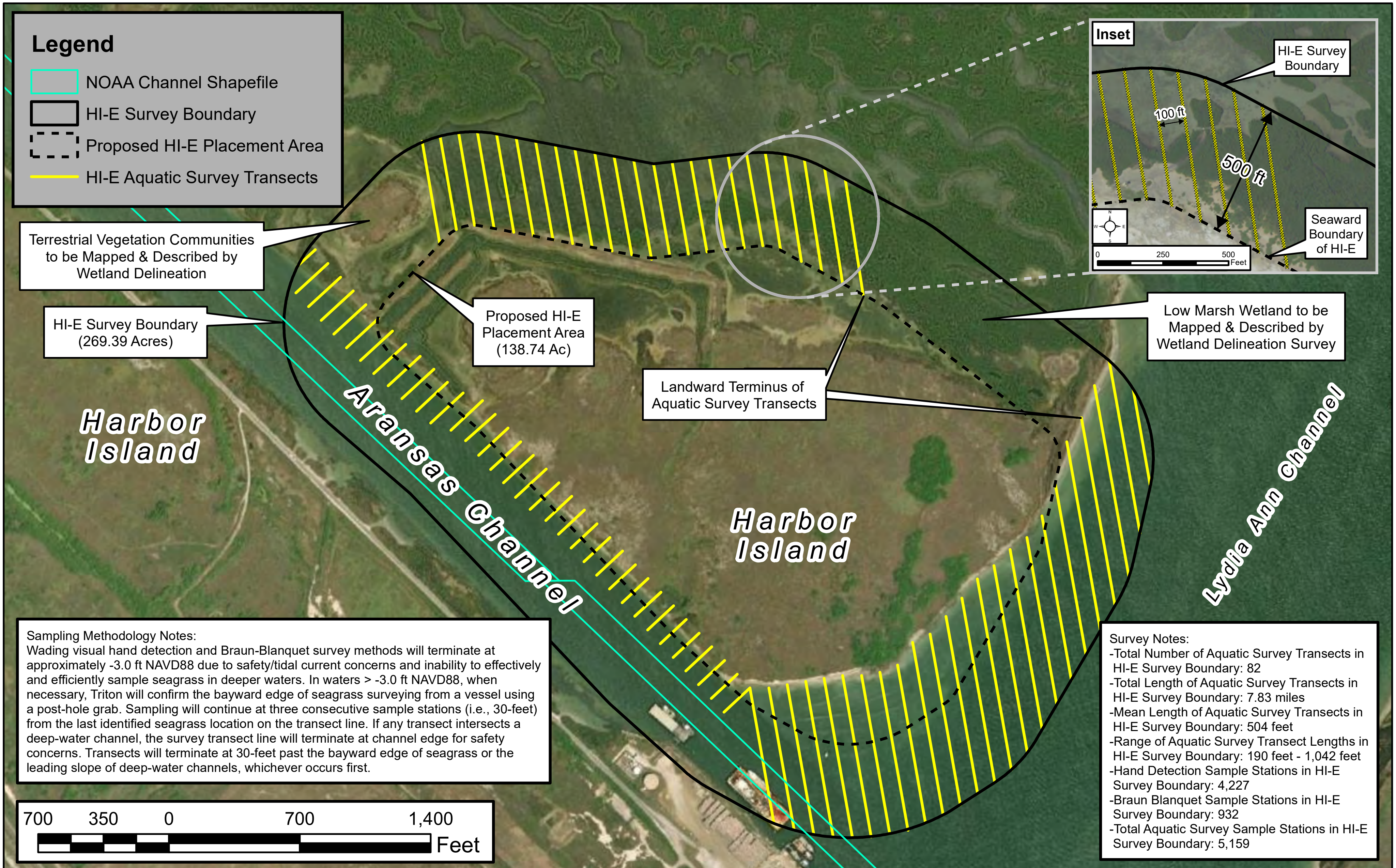
Aquatic Survey Overview Map
SS2 Survey Area & Aquatic Survey Transects
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, TX 78381

N W E S

Prepared for: Port of Corpus Christi Authority
222 Power Street
Corpus Christi, Texas 78401

Map Notes:
-BaseMap Source: -ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
-Placement Area boundary shapefiles for SS1, SS2, HI-E, MI & SJI were provided by the Port of Corpus Christi Authority.
-The shapefile for PA4 was obtained from the U.S. Army Corps of Engineers.
-Map Preparation Date: April 26, 2021 (BPH).



Aquatic Survey Overview Map
HI-E Survey Area & Aquatic Survey Transects
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
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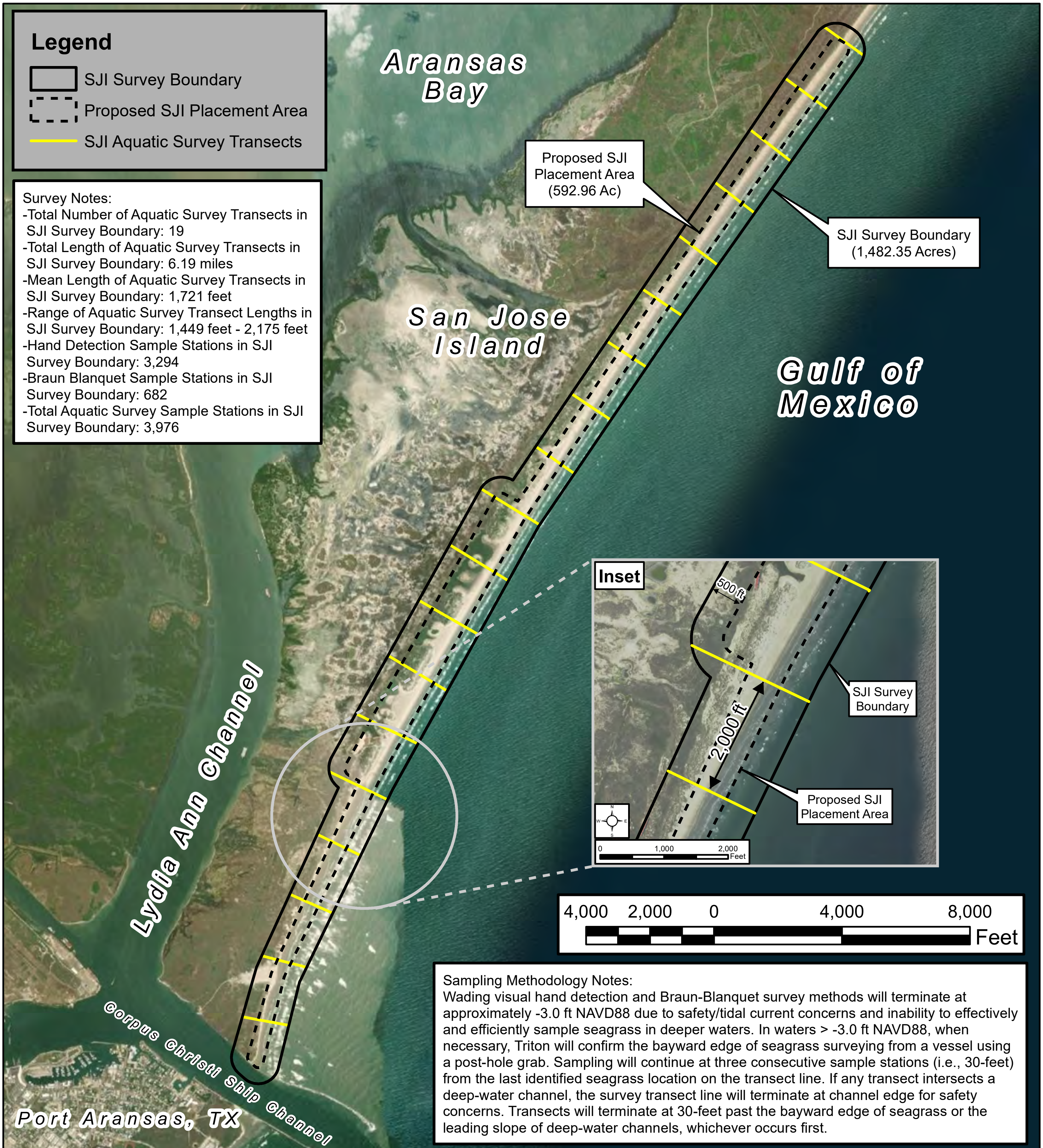
N W E S

Prepared for: Port of Corpus Christi Authority
222 Power Street
Corpus Christi, Texas 78401

Map Notes:
-BaseMap Source: -ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
-Placement Area boundary shapefiles for SS1, SS2, HI-E, MI & SJI were provided by the Port of Corpus Christi Authority.
-The shapefile for PA4 was obtained from the U.S. Army Corps of Engineers.
-Map Preparation Date: April 26, 2021 (BPH).



Aquatic Survey Overview Map
SJI Survey Area & Aquatic Survey Transects
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

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N
W E
S

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Corpus Christi, Texas 78401

Map Notes:
-BaseMap Source: -ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
-Placement Area boundary shapefiles for SS1, SS2, HI-E, MI & SJI were provided by the Port of Corpus Christi Authority.
-The shapefile for PA4 was obtained from the U.S. Army Corps of Engineers.
-Map Preparation Date: April 26, 2021 (BPH).

Aquatic Survey Overview Map
MI Survey Area & Aquatic Survey Transects
Corpus Christi Ship Channel Deepening Project
(SWG-2019-00067)

Prepared By: Triton Environmental Solutions, LLC
P.O. Box 1755
Rockport, TX 78381

N W E S

Prepared for: Port of Corpus Christi Authority
222 Power Street
Corpus Christi, Texas 78401

Map Notes:
-BaseMap Source: -ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.
-Placement Area boundary shapefiles for SS1, SS2, HI-E, MI & SJI were provided by the Port of Corpus Christi Authority.
-The shapefile for PA4 was obtained from the U.S. Army Corps of Engineers.
-Map Preparation Date: April 26, 2021 (BPH).

Appendix B: Survey Plan Development Reference Materials

PCCA Scope of Work,

USACE WOTUS Letter, June 22, 2020

USACE Email Correspondence, Jayson Hudson, January 8, 2021

<u>REQUEST FOR PROPOSAL</u>
Field Delineation and Report for Port of Corpus Christi Authority Channel Deepening Project Draft Environmental Impact Statement Being Prepared By U.S. Army Corps of Engineers

<u>Scope</u>

Scope of work to delineate wetlands and sea grass beds and conduct threatened and endangered species surveys within the project area will include:

Task 1 - Field Investigations
Using the wetland delineation field plan provided in <u>Attachment A</u>, Consultant will conduct a wetland delineation for the project sites identified on <u>Exhibit A</u>. The survey will cover the project site and a 500 ft buffer area around each location. Consultant will also conduct investigations necessary to determine the likely jurisdictional status of any identified wetlands under USACE/Environmental Protection Agency (EPA) regulations or guidance resulting from applicable U.S. Supreme Court decisions. The *Waters of the United States Delineation Report, Part 1: Potentially Jurisdictional Waters of the United States* report is provided in <u>Attachment B</u> and provides supporting detail for each area.

Additionally, The *Waters of the United States Delineation Report, Part 2: Seagrass Investigation* report is provided in <u>Attachment C</u>. Seagrass beds identified within report will be field verified through sampling. Seagrass will be sampled along transects by feeling the substrate of the bay by hand. Sampling will include the project sites identified in <u>Exhibit A</u> and a 500 ft buffer around each project site. Maps which depict proposed sampling transects for sea grass delineation will be developed prior to field work for coordination with USACE.

The KMZ files and high-resolution aerials for each location will be provided upon request.

All work in this task will be completed in accordance with the USACE 1987 Wetland Delineation Manual and the 2010 U.S. Army Corps of Engineers Regional Supplement Manual for the Atlantic and Gulf Coastal Plain Region to identify and delineate all wetlands, which requires transects for areas greater than 5 acres.

Additionally, the Mean (average) High Water and High Tide Line will be delineated where appropriate. Please see definitions for each in Task 2.

A complete threatened and endangered species survey will be performed on each of the project sites identified on <u>Exhibit A</u> as appropriate. Prior to performing the survey, Consultant will develop a work plan for field activities for coordination with USACE. The threatened and endangered species survey will be completed in strict compliance with the finally approved work plan.

Field work will not commence on non-port owned properties until explicit written approval for access is provided by respective landowner(s). PCCA will coordinate approval for access. Other approvals required for fieldwork not specifically mentioned in this scope of work will be the responsibility of the Consultant.

Task 2 - Prepare Delineation Report

Consultant will prepare a formal Water of the United States delineation and seagrass survey and threatened and endangered species survey report based on results from Task 1 above. The report will include all content (e.g. mapping, GPS, coordinate tables, boundary rationales, field data sheets, Navigable Water Protection Rule or the current definition of Wates of the U.S. interpretation for each wetland, and/or jurisdictional status of any wetlands and waters on the property etc.) required by the USACE's current procedures and will include all data and assessments required by USACE methodologies for inclusion in a request for a Jurisdictional Determination. The threatened and endangered species will be detailed in accordance with the approved work plan.

The wetland assessment determination and delineation report will include all necessary exhibits, photos and supporting maps that identify features that could potentially be subject to the USACE jurisdiction under Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act. The report will also include the supporting routine wetland delineation data forms for all features within the surveyed area. The report will contain a map showing the delineated waters and wetland boundaries, sea grass beds, and associated GPS coordinates. Use of GPS, will be done in accordance with the USACE Standard Operating Procedure titled *Recording and Submitting Jurisdictional Delineations Using Global Positioning Systems (GPS) and Geographic Information Systems (GIS) Tools and Technologies* dated 4/21/2016. Geospatial data of all sample locations will also be provided to PCCA in the following formats/files: ESRI ArcGIS shapefile (*.shp, *.shx, and *.dbf), ArcGIS geodatabase file (*.mdb, *.gdb), comma separated values file (*.csv). Raw data, copies of physical field books, and digital data collector files will be included in addition to any processed data along with corresponding metadata for each.

Per 33 CFR 329.12(a)(2) Shoreward limit of jurisdiction, navigable waters of the United States extend to the line on the shore reached by the plane of the Mean (average) High Water (MHW), which is the shoreward limit of Section 10 waters. Per 33 CFR 328.3(d). waters of the United States (Section 404) extend shoreward to the High Tide Line (HTL), which is the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. Maps shall be correctly demarcated with the MHW and HTL. Acreages for both sea grass beds and delineated WOUS and wetlands will also be provided on each map. Placement area boundaries, Section 103 of the Marine Protection, Research, and Sanctuaries Act geographical jurisdictional boundary (as per 33CFR 2.20), and Section 408 Mean Low Low Water (MLLW) will also be clearly depicted on each map. Draft maps will be coordinated with USACE through Authority prior to finalizing.

Datasheets will be properly completed, accurate and free of errors and type-o's.

Consultant will provide PCCA a draft report detailing all field surveys – wetlands, seagrasses, and threatened and endangered species. Consultant will incorporate Authority input into the report for a finalized version for Authority's reference. Consultant will submit all documents in Microsoft Word and a final compiled .pdf document for Authority's use.

Task 3 – Field Verification Support & Follow Up

Consultant will coordinate schedule of field activities with U.S. Army Corps of Engineers Channel Deepening Project – Project Manager to allow personnel to accompany Consultant on fieldwork. Consultant will provide full access to U.S. Army Corps of Engineers to delineation and sea grass verification activities including providing space on work boats.

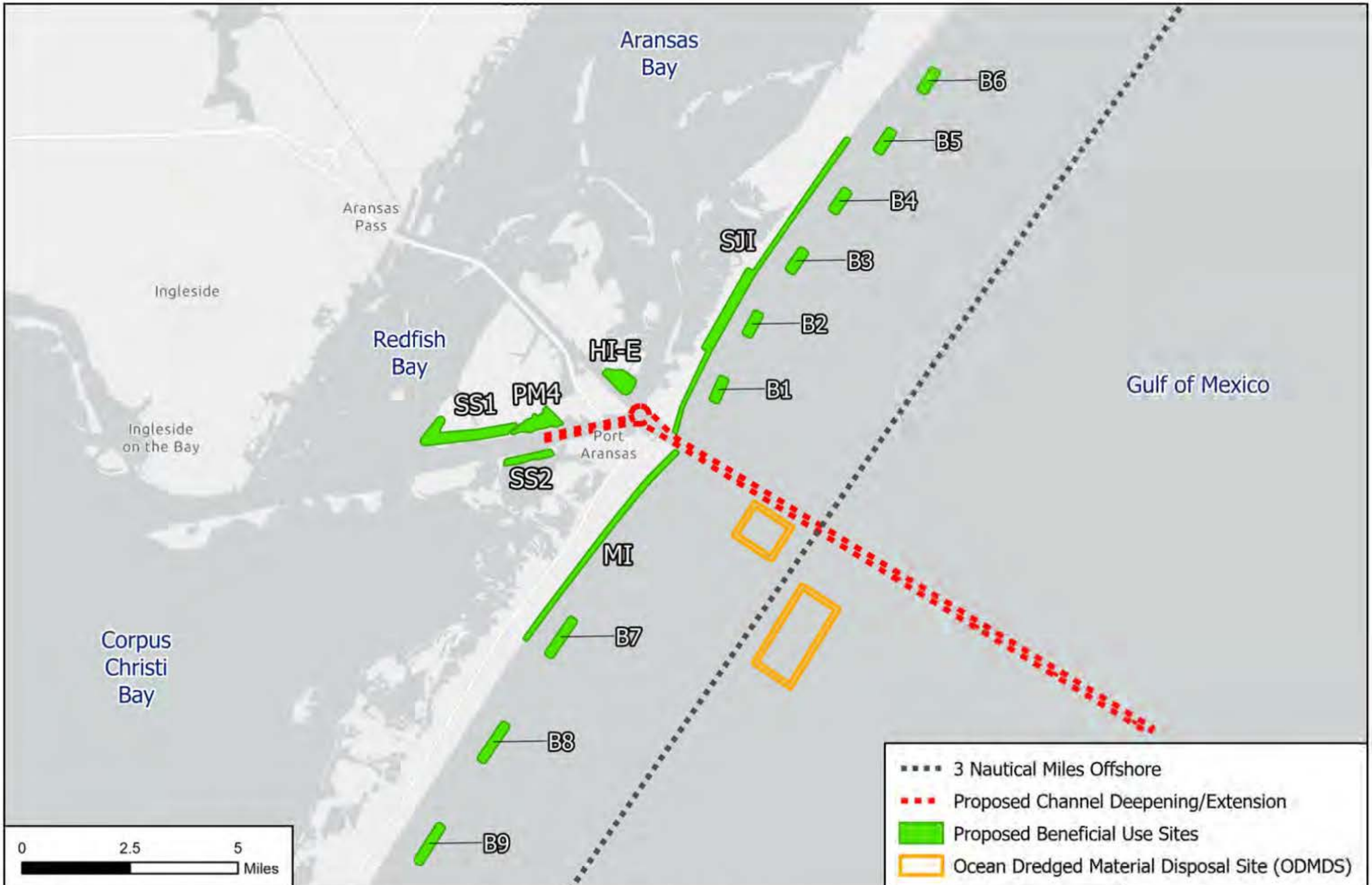
Consultant will also provide additional information or clarification following U.S. Army Corps of Engineers / Third-Party Contractor review of the final report.

Timeline

Consultant will provide appropriate number of teams in order that all field activities will be completed within a two to three-week period to be started not later than March 1, 2021.

The complete draft report will be provided within three weeks of completion of the field activities. The final report will be provided within one week of receiving PCCA comments.

Exhibit A



PROJECT NO.	PCA20166
DATE CREATED	02/11/2021
DATUM & COORDINATE SYSTEM	NAD83 State Plane (feet) Texas South Central
PREPARED BY	DGM

Port of Corpus Christi Authority
Corpus Christi Ship Channel Deepening Project

Site Map

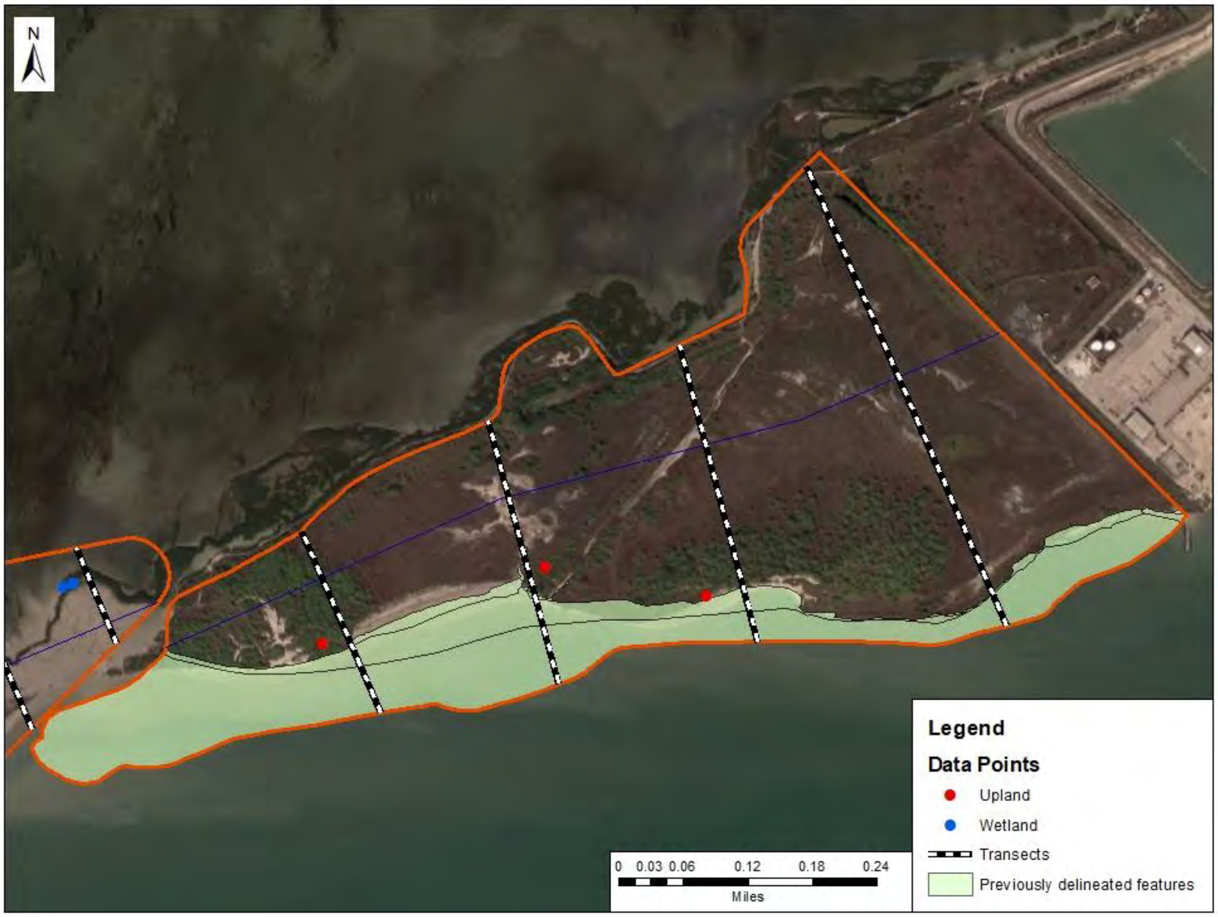
FIGURE 1

Attachment A

Delineation Transects and Previous Results

SJI will be fully delineated within the orange boundary. Proposed transects are shown as dashed lines.

PA4 will be fully delineated within the orange boundary. Proposed transects are shown in dashed lines. Previously delineated wetlands are shown in green, and previous data points are shown in red and blue.



HI-E has been delineated within the orange boundary. Proposed transects are shown in dashed lines. Previously delineated wetlands are shown in green, and previous data points are shown in red and blue.

SS1 has been delineated within the orange boundary. Proposed transects are shown in dashed lines. Previously delineated wetlands are shown in green, and previous data points are shown in red and blue.

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, GALVESTON DISTRICT
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

June 22, 2020

Policy Analysis Branch

SUBJECT: Department of the Army Permit Application SWG-2019-00067

Port of Corpus Christi Authority
Attn: Sarah Garza
222 Power Street
Corpus Christi, Texas 78401

Dear Ms. Garza:

This is in reference to the Jurisdictional Delineation Report and Seagrass Survey for the proposed deepening of the Corpus Christi Ship Channel. The reports were completed by AECOM for the Port of Corpus Christi and covered seven proposed dredged material placement areas, specifically Placement Areas SS1, M10, PA4, PA9-S, M4, M3 and HI-E. The proposed placement areas are located along the Corpus Christi Ship Channel, between Port Aransas and Ingleside on the Bay, Nueces County, Texas.

The Corps requested our delineation Technical Expert, Mr. John Davidson, review the submitted information independent of the EIS team. Mr. Davidson has determined that the reports are incomplete and identified several errors that must be addressed before we can proceed with the development of the Draft EIS. In addition to the comments provided in the April 27, 2020 letter, Mr. Davidson has provided the following comments:

a. The delineation report is not in accordance with the 1987 Corps of Engineers Wetland Delineation Manual (1987 Manual) as AECOM did not run transects in the land portions of the proposed placement areas. Per the 1987 Manual, Part IV - Methods, Section D - Routine Method, Subsection D - Onsite Inspection Necessary, Areas Greater Than 5 Acres, Steps 18-21, which instruct the delineator to establish a baseline, run transects perpendicular to the baseline and take sample points along the transects, were not followed.

b. The delineator identified the Mean High Tide Line as a jurisdictional boundary, however, this is not a proper identification of the jurisdictional line of Section 10 of the Rivers and Harbors Act (Section 10) or Section 404 of the Clean Water Act (Section 404). Per 33 CFR 329.12(a)(2) Shoreward limit of jurisdiction, navigable waters of the United States extend to the line on the shore reached by the plane of the Mean (average) High Water (MHW), which is the shoreward limit of Section 10 waters. Per 33 CFR 328.3(d). waters of the United States (Section 404) extend shoreward to the High Tide Line (HTL), which is the line of intersection of the land with the water's surface at the maximum height reached by a rising tide. The line encompasses spring high tides and other high tides that occur with periodic frequency but does not include storm surges in which there is a departure from the normal or predicted reach of the tide due to the piling up of water against a coast by strong winds such as those accompanying a hurricane or other intense storm. Neither the MHW nor the HTL were demarcated on the delineation.

c. Placement area boundaries are not clearly identified on the delineation maps. The legend states that the boundary is a black line, however, a black line does not encompass the placement areas.

d. Aquatic resources were delineated on land outside the proposed placement areas. For land based delineations, only aquatic resources within the project boundaries are required to be delineated.

e. Placement Area PA4 was not completely delineated or sampled. There are wetland signatures on aerial photos that were not sampled or delineated.

f. Data sheets were also reviewed and found to contain minor errors, including but not limited to, aquatic fauna species name must be listed in the Hydrology section remarks and Geomorphic Position was not identified when appropriate.

g. The seagass survey did not identify the acreage of seagrass present. It appears the seagrass beds were delineated on the overview map, however, there were no seagrass polygons on the inset maps. Additionally, seagrasses must be delineated within a 500-foot buffer surrounding the tidal portions of the placement areas as is standard for projects in known seagrass habitat.

h. Seagrass were sampled by feeling the substrate of the bay by hand. Grab samples, which pull up sediment to evaluate for seagrasses and/or seagrass roots, is the proper way to sample seagrass beds.

The comments in this and the previous letter may not be inclusive and additional revisions may be required. We look forward to your revised reports and are ready to assist you in whatever way is possible, including scheduling a meeting with you, the EIS Team, and Mr. Davidson. Please reference our file number in any future correspondence pertaining to this project. If you have any questions, please call me at 409-766-3108. You may also email him at jayson.m.hudson@usace.army.mil if you prefer.

Sincerely,

Robert W. Heinly
Chief, Policy Analysis Branch

cc
AECOM
Ashley Judith
5444 Westheimer Road, Suite 400
Houston, Texas 77056

Andi Binion

From: Garza, Sarah <Sarah@pocca.com>
Sent: Tuesday, April 6, 2021 12:37 PM
To: Andi Binion; B.J. Hill; Chemaine Koester
Cc: Rivera, Beatriz M; McNeil, Harrison
Subject: FW: Action Plan Status

Sarah L. Garza
Director of Environmental Planning & Compliance
Office (361) 885-6163

From: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Sent: Friday, January 8, 2021 12:29 PM
To: Garza, Sarah <Sarah@pocca.com>
Subject: RE: Action Plan Status

Sarah,

The recommendation from John is a response to recent changes in state law regarding uprooting seagrasses. In order to disturb the roots using grab sample difficult permits will need to be secured; so we are not going to require the grab samples. The methods in the SOW of wading/snorkeling etc. along the transects and identifying seagrasses visually or by hand should suffice. I double checked on the transects in the September seagrass report a similar method can employed. However, the trip plan memo we reviewed last fall and included with the SOW only shows wetland delineation transects. I did not find a map of the proposed seagrass transects, let mw know if I just missed it.

You are correct that the baseline does not need to be surveyed in the field, it is a GIS layer provided by NOAA, but it does need to be on the delineations maps. The baseline is relevant to the 103 permit, but it's not just limited to the designated ODMDS site. Dredged material placed below the baseline elevation can be subject to either Section 404 or Section 103. The purpose of the placement guides which statute to evaluate the project under. At this time, the delineation maps need to demarcate all of the Corps statutory boundaries.

One thing I saw that I missed in my the first review is that if the contractors are going to survey the site using GPS, it needs to be done in accordance with our SOP.
https://www.swg.usace.army.mil/Portals/26/docs/regulatory/Wetlands/2016%20GPS%20SOP.pdf

Jayson M Hudson
Regulatory Project Manager
409.766.3108

Please tell me how I am doing by completing the survey found at:
http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

From: Garza, Sarah <Sarah@pocca.com>
Sent: Friday, January 8, 2021 10:31 AM

To: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Subject: [Non-DoD Source] RE: Action Plan Status

Hello Jayson,

Thank you very much for the feedback on this. We are finalizing in order to request proposals for this work. I do have two clarifying questions on the feedback provided.

1. Mr. Davidson deleted the specification on grab samples to determine presence of sea grass. I don't want to misinterpret that but I also don't want to chance having another situation where a consultant utilizes their own methodology. That was the Corps language from the June correspondence. Any issue on leaving it in? If so, more context for the deletion would be helpful.
2. With regard to your comment on the boundary identification, I think that is just a reminder since 103 applies to the ODMDS and that is not within the footprint of this surveying. However, it will be included on the final maps that are presented to you in the report summarizing the results of this work. I just want to make sure I am not missing your meaning. Also, I will have the consultant provide a draft map that I will submit to the Corps for a quick review prior to the final report, if that is OK with you.

Thank you.

Sarah L. Garza
Director of Environmental Planning & Compliance
Office (361) 885-6163

From: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Sent: Wednesday, January 6, 2021 11:30 AM
To: Garza, Sarah <Sarah@pocca.com>
Cc: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Subject: RE: Action Plan Status

Sarah,

John Davidson and I made our comments in track changes and notes.

Jayson M Hudson
Regulatory Project Manager
409.766.3108

Please tell me how I am doing by completing the survey found at:
http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

From: Hudson, Jayson M CIV USARMY CESWG (USA)
Sent: Tuesday, January 5, 2021 11:09 AM
To: Garza, Sarah <Sarah@pocca.com>
Cc: HEINLY, Robert W CIV USARMY CESWG (USA) <Robert.W.Heinly@usace.army.mil>
Subject: RE: Action Plan Status

I am waiting on John Davidson's review. He was out of the office over the holidays.

Jayson M Hudson
Regulatory Project Manager
409.766.3108

Please tell me how I am doing by completing the survey found at:
http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

From: Garza, Sarah <Sarah@pocca.com>
Sent: Monday, January 4, 2021 3:58 PM
To: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Subject: [Non-DoD Source] RE: Action Plan Status

Thank you Jayson for the update. Does the team have comments to provide yet on the scope of work for the wetland and seagrass fieldwork?

Sarah L. Garza
Director of Environmental Planning & Compliance
Office (361) 885-6163

From: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Sent: Monday, January 4, 2021 8:29 AM
To: Garza, Sarah <Sarah@pocca.com>
Cc: Pollack, Jeff <jpollack@pocca.com>; HEINLY, Robert W CIV USARMY CESWG (USA) <Robert.W.Heinly@usace.army.mil>
Subject: RE: Action Plan Status

Thank you, Sarah. I requested the EIS contractor begin working on SOWs and I provided them the action plan and some of the recent reports (e.g. ship sim, HRI etc.) a few weeks ago. We should start seeing some of the SOWs very soon.

Jayson M Hudson
Regulatory Project Manager
409.766.3108

Please tell me how I am doing by completing the survey found at:
http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

From: Garza, Sarah <Sarah@pocca.com>
Sent: Tuesday, December 22, 2020 4:02 PM
To: Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Cc: Pollack, Jeff <jpollack@pocca.com>; HEINLY, Robert W CIV USARMY CESWG (USA) <Robert.W.Heinly@usace.army.mil>
Subject: [Non-DoD Source] RE: Action Plan Status

Good Afternoon All,

Please see attached updated action plan. Jayson, you and I did discuss last Tuesday that the action plan would be your indication to solicit proposals from FNI. However, I was awaiting an answer on the TPC completing the Section 106 work plan. We haven't received concurrence on that so I show that as pending on the attached plan. Since then we have also had additional exchanges regarding the ship simulations. I have tried to capture the conversations to date to give understanding of where we are still anticipating additional information from the Corps. Also, for convenience, changes made from previous action plan are in red. Please let me know if you have any questions or if I have misrepresented anything.

Thank you and I hope everyone has a happy and restful holiday!

Sarah L. Garza
Director of Environmental Planning & Compliance
Office (361) 885-6163

From: Pollack, Jeff <jpollack@pocca.com>
Sent: Monday, December 21, 2020 9:59 AM
To: HEINLY, Robert W CIV USARMY CESWG (USA) <Robert.W.Heinly@usace.army.mil>
Cc: Garza, Sarah <Sarah@pocca.com>; Hudson, Jayson M CIV USARMY CESWG (USA) <Jayson.M.Hudson@usace.army.mil>
Subject: RE: Action Plan Status

Good morning, Bob.

In talking to Sarah, it sounds like she and Jayson connected this morning about this. Jayson confirmed that FNI can take on the SAP, but Sarah is waiting for word back from y'all as to whether FNI can take on the 106 workplan, after which we will update the implementation plan accordingly.

That said, it sounds like we have clarity on almost all of the FNI scope, so I would think that they could begin generating proposals/RFIs associated with the known tasks even as we iron out final details.

On another front, how is your schedule looking for our bi-weekly call on the 30th? Shall we plan to forgo this in light of the holidays and reconnect after the new year?

Thanks,
Jeff

Jeffrey Pollack, AICP, ENV SP
Chief Strategy Officer
Port of Corpus Christi
p: (361) 885-6230 m: (361) 906-5440
w: portofcc.com e: jpollack@pocca.com

From: HEINLY, Robert W CIV USARMY CESWG (USA) <Robert.W.Heinly@usace.army.mil>
Sent: Monday, December 21, 2020 8:19 AM
To: Pollack, Jeff <jpollack@pocca.com>
Subject: Action Plan Status

Jeff, I had a discussion with Jayson about when you could expect to see information from FNI with proposals to finish out the efforts that AECOM was working. He clarified for me that he is waiting on the modified action plan to make sure we use the latest and greatest information to go off of. When do you think we'll be seeing an updated plan?

Bob Heinly
Deputy Chief, Regulatory Division
Galveston District Corps of Engineers
(409)766-3992

Exhibit D.

USACE Standard Operating Procedures Table

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw01	AHT	1.9	R8s 5840R91052	5/23/2021	8:41:05 AM	6	0.031	0.057	-97.04458003	27.84343821	N/A	2.701	Fixed
SWG-2019-00067	rw02	MHW	1.9	R8s 5840R91052	5/23/2021	8:43:35 AM	6	0.032	0.059	-97.044362	27.84339614	72.1029289	1.022	Fixed
SWG-2019-00067	rw03	MHW	1.9	R8s 5840R91052	5/23/2021	9:23:14 AM	7	0.032	0.06	-97.04436168	27.84339597	0.118338499	0.995	Fixed
SWG-2019-00067	rw04	AHT	1.9	R8s 5840R91052	5/23/2021	9:25:23 AM	6	0.032	0.06	-97.04287525	27.8485638	1939.316176	2.759	Fixed
SWG-2019-00067	rw05	MHW	1.9	R8s 5840R91052	5/23/2021	10:03:31 AM	6	0.033	0.061	-97.04261201	27.84845789	93.37755867	1.054	Fixed
SWG-2019-00067	rw06	AHT	1.9	R8s 5840R91052	5/23/2021	10:06:03 AM	6	0.033	0.062	-97.04036233	27.85359757	2005.08868	2.81	Fixed
SWG-2019-00067	rw07	MHW	2.8	R8s 5840R91052	5/23/2021	10:52:13 AM	6	0.033	0.085	-97.04012505	27.85350144	84.26620542	0.971	Fixed
SWG-2019-00067	rw08	AHT	2.8	R8s 5840R91052	5/23/2021	10:55:47 AM	6	0.035	0.092	-97.03753174	27.85859391	2032.305397	2.773	Fixed
SWG-2019-00067	rw09	MHW	2.9	R8s 5840R91052	5/23/2021	11:38:21 AM	6	0.035	0.093	-97.03733129	27.85847953	76.96921403	0.994	Fixed
SWG-2019-00067	rw10	AHT	2.9	R8s 5840R91052	5/23/2021	11:41:05 AM	6	0.036	0.094	-97.0348553	27.86329316	1924.318001	2.768	Fixed
SWG-2019-00067	rw11	MHW	2.8	R8s 5840R91052	5/23/2021	12:34:16 PM	6	0.04	0.103	-97.03463392	27.86318536	81.56441602	1.003	Fixed
SWG-2019-00067	rw12	AHT	2.1	R8s 5840R91052	5/23/2021	12:36:41 PM	6	0.047	0.106	-97.03196148	27.86811367	1989.026812	2.747	Fixed
SWG-2019-00067	rw13	MHW	2.1	R8s 5840R91052	5/23/2021	1:02:58 PM	6	0.046	0.104	-97.03176033	27.86803205	71.44673977	0.983	Fixed
SWG-2019-00067	rw14	AHT	2	R8s 5840R91052	5/23/2021	1:05:47 PM	6	0.045	0.102	-97.02895593	27.87281094	1959.566062	2.812	Fixed
SWG-2019-00067	rw15	MHW	2	R8s 5840R91052	5/23/2021	1:30:12 PM	0	0.045	0.101	-97.02870425	27.87270285	90.31641822	0.961	Fixed
SWG-2019-00067	rw16	TURTLE	2.5	R8s 5840R91052	5/23/2021	1:58:54 PM	6	0.045	0.086	-97.03803232	27.85812122	6098.400746	5.236	Fixed
SWG-2019-00067	rw18	aht	2.7	R8s 5840R91052	10/18/2021	9:34:07 AM	0	0.044	0.063	-97.00901083	27.90033256	17984.54559	2.749	Fixed
SWG-2019-00067	rw19	mhw	2.7	R8s 5840R91052	10/18/2021	9:36:10 AM	7	0.043	0.061	-97.00888541	27.90025095	50.21712003	1.009	Fixed
SWG-2019-00067	rw20	wet Beach	2.7	R8s 5840R91052	10/18/2021	9:37:35 AM	5	0.045	0.063	-97.00901773	27.90033719	53.00964218	2.909	Fixed
SWG-2019-00067	rw21	cm Start	2.7	R8s 5840R91052	10/18/2021	9:38:56 AM	6	0.054	0.076	-97.00954899	27.90065491	206.8618724	4.952	Fixed
SWG-2019-00067	rw22	cm Stop fd Start	2.7	R8s 5840R91052	10/18/2021	9:42:27 AM	6	4.586	6.46	-97.00979943	27.90078239	93.2304206	1.33	Fixed
SWG-2019-00067	rw23	fd Ridge	2.7	R8s 5840R91052	10/18/2021	9:47:51 AM	7	0.047	0.064	-97.01009184	27.90096207	114.8442475	14.279	Fixed
SWG-2019-00067	rw24	fd Stop Bd Start	2.6	R8s 5840R91052	10/18/2021	9:50:17 AM	6	4.901	6.462	-97.01036031	27.90109309	98.9397222	3.959	Fixed
SWG-2019-00067	rw25	bd Stop cp Start	2.7	R8s 5840R91052	10/18/2021	10:00:30 AM	6	0.087	0.115	-97.01107996	27.90170283	321.2168391	4.417	Fixed
SWG-2019-00067	rw26	data Point	2.6	R8s 5840R91052	10/18/2021	10:01:08 AM	0	0.092	0.119	-97.01040621	27.90210514	262.2133456	4.269	Fixed
SWG-2019-00067	rw27	wet Beach	2	R8s 5840R91052	10/18/2021	10:02:03 AM	6	0.097	0.124	-97.00554434	27.90478058	1847.259433	2.71	Fixed
SWG-2019-00067	rw28	aht	2	R8s 5840R91052	10/18/2021	10:03:29 AM	8	0.087	0.112	-97.00554877	27.90478357	1.798033648	2.758	Fixed
SWG-2019-00067	rw29	mhw	1.9	R8s 5840R91052	10/18/2021	10:04:05 AM	6	0.067	0.1	-97.0054203	27.90469214	53.17111099	1.05	Fixed
SWG-2019-00067	rw30	cm start	1.8	R8s 5840R91052	10/18/2021	10:05:04 AM	6	0.062	0.092	-97.00600764	27.90511401	243.9620997	5.136	Fixed
SWG-2019-00067	rw31	cm Stop fd Start	1.8	R8s 5840R91052	10/18/2021	10:06:10 AM	7	0.059	0.088	-97.00612728	27.90518027	45.5352026	5.492	Fixed
SWG-2019-00067	rw32	fd ridge	1.8	R8s 5840R91052	10/18/2021	10:07:22 AM	6	0.055	0.083	-97.00628895	27.90528159	63.90877965	11.59	Fixed
SWG-2019-00067	rw33	fd ridge	2	R8s 5840R91052	10/18/2021	10:09:38 AM	6	0.054	0.082	-97.00656166	27.90548377	114.7258489	11.954	Fixed
SWG-2019-00067	rw34	fd start bd start	1.8	R8s 5840R91052	10/18/2021	10:35:39 AM	6	0.051	0.077	-97.00686012	27.90565475	114.7060724	6.013	Fixed
SWG-2019-00067	rw35	bd stop cp start	1.8	R8s 5840R91052	10/18/2021	10:36:14 AM	6	0.047	0.074	-97.00755949	27.90596953	253.2320285	6.019	Fixed
SWG-2019-00067	rw36	wet beach	1.8	R8s 5840R91052	10/18/2021	10:37:12 AM	6	0.031	0.056	-97.00205693	27.90923979	2138.325441	3.107	Fixed
SWG-2019-00067	rw37	aht	1.9	R8s 5840R91052	10/18/2021	10:38:29 AM	6	0.031	0.057	-97.00203697	27.90922935	7.480541424	2.756	Fixed
SWG-2019-00067	rw38	mhw	1.9	R8s 5840R91052	10/18/2021	10:39:06 AM	6	0.032	0.059	-97.0019188	27.90915161	47.49364273	0.97	Fixed
SWG-2019-00067	rw39	cm start	1.9	R8s 5840R91052	10/18/2021	10:40:34 AM	6	0.032	0.06	-97.00243231	27.90948497	205.4240989	5.381	Fixed
SWG-2019-00067	rw40	cm stop fd start	1.9	R8s 5840R91052	10/18/2021	10:41:46 AM	6	0.032	0.06	-97.00258943	27.90956764	58.98064855	5.956	Fixed
SWG-2019-00067	rw41	fd ridge	1.9	R8s 5840R91052	10/18/2021	10:54:16 AM	6	0.033	0.061	-97.00298744	27.90981089	156.0366449	13.295	Fixed
SWG-2019-00067	rw42	fd stop bd start	1.9	R8s 5840R91052	10/18/2021	10:54:48 AM	6	0.033	0.062	-97.00321673	27.90997339	94.73701232	5.604	Fixed
SWG-2019-00067	rw43	wetbeach	2.8	R8s 5840R91052	10/18/2021	10:55:36 AM	0	0.033	0.085	-96.99844179	27.913701	2053.098848	3.033	Fixed
SWG-2019-00067	rw44	aht	2.8	R8s 5840R91052	10/18/2021	10:57:23 AM	6	0.033	0.086	-96.99842758	27.9136913	5.786000345	2.775	Fixed
SWG-2019-00067	rw45	mhw	2.8	R8s 5840R91052	10/18/2021	10:58:18 AM	0	0.033	0.088	-96.99828275	27.91361526	54.33660372	1.052	Fixed
SWG-2019-00067	rw46	cm start	2.9	R8s 5840R91052	10/18/2021	10:59:16 AM	7	0.037	0.091	-96.99875584	27.91394326	193.8248222	5.254	Fixed
SWG-2019-00067	rw47	cm Stop fd Start	2.8	R8s 5840R91052	10/18/2021	11:00:13 AM	5	0.035	0.092	-96.99904881	27.91412547	115.5090767	7.049	Fixed
SWG-2019-00067	rw48	fd Ridge	2.9	R8s 5840R91052	10/18/2021	11:01:03 AM	6	0.035	0.093	-96.9992895	27.91425135	90.20952154	12.698	Fixed
SWG-2019-00067	rw49	fd stop wtld Start	2.9	R8s 5840R91052	10/18/2021	11:04:02 AM	6	0.036	0.094	-96.99938399	27.91434505	45.73550481	7.521	Fixed
SWG-2019-00067	rw50	wtld stop bd start	2.9	R8s 5840R91052	10/18/2021	11:26:45 AM	7	0.037	0.096	-96.99958762	27.91443615	73.6357747	7.208	Fixed
SWG-2019-00067	rw51	bd continue	2.8	R8s 5840R91052	10/18/2021	11:27:07 AM	6	0.04	0.103	-97.00044722	27.91506763	360.265057	16.352	Fixed

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw52	wet Beach	2.1	R8s 5840R91052	10/18/2021	11:27:52 AM	6	0.047	0.106	-96.99479754	27.91807152	2126.536929	3.275	Fixed
SWG-2019-00067	rw53	aht	2.1	R8s 5840R91052	10/18/2021	11:29:23 AM	0	0.046	0.104	-96.99476751	27.91805157	12.11304359	2.802	Fixed
SWG-2019-00067	rw54	mhw	2	R8s 5840R91052	10/18/2021	11:30:04 AM	6	0.045	0.102	-96.99462089	27.91797822	54.3430053	1.03	Fixed
SWG-2019-00067	rw55	cm Start	2	R8s 5840R91052	10/18/2021	11:30:58 AM	8	0.045	0.101	-96.99519782	27.91836746	233.9763922	5.533	Fixed
SWG-2019-00067	rw56	cm Stop fd Start	2	R8s 5840R91052	10/18/2021	11:31:59 AM	6	0.045	0.1	-96.99535324	27.9184692	62.35410216	8.2	Fixed
SWG-2019-00067	rw57	fd Ridge	2	R8s 5840R91052	10/18/2021	11:36:05 AM	6	0.045	0.098	-96.99553247	27.91860024	74.96746311	13.403	Fixed
SWG-2019-00067	rw58	fd Stop Bd Start	2	R8s 5840R91052	10/18/2021	12:07:58 PM	6	0.032	0.069	-96.99566641	27.91871001	58.8547789	8.625	Fixed
SWG-2019-00067	rw59	bd_continues	1.9	R8s 5840R91052	10/18/2021	12:08:40 PM	6	0.04	0.086	-96.99693069	27.91941755	482.5931502	9.698	Fixed
SWG-2019-00067	rw60	wet Beach	2	R8s 5840R91052	10/18/2021	12:09:24 PM	6	0.034	0.069	-96.99116242	27.92239413	2154.423566	2.953	Fixed
SWG-2019-00067	rw61	aht	2	R8s 5840R91052	10/18/2021	12:10:48 PM	5	0.04	0.081	-96.99115102	27.9223889	4.142994569	2.753	Fixed
SWG-2019-00067	rw62	mhw	2	R8s 5840R91052	10/18/2021	12:11:27 PM	6	0.042	0.084	-96.99101899	27.92232192	49.10355164	1.027	Fixed
SWG-2019-00067	rw63	cm Start	2	R8s 5840R91052	10/18/2021	12:12:29 PM	6	0.043	0.086	-96.99154327	27.92264422	205.9119218	5.338	Fixed
SWG-2019-00067	rw64	cm Stop fd Start	2	R8s 5840R91052	10/18/2021	12:13:54 PM	6	0.038	0.075	-96.99172323	27.92274834	69.36023325	6.109	Fixed
SWG-2019-00067	rw65	fd Ridge	2	R8s 5840R91052	10/18/2021	12:18:06 PM	6	0.036	0.071	-96.99197736	27.92291629	102.2959082	13.856	Fixed
SWG-2019-00067	rw66	fd Stop Bd Start	2	R8s 5840R91052	10/18/2021	12:32:48 PM	6	0.037	0.072	-96.99234106	27.92321788	160.6818211	5.97	Fixed
SWG-2019-00067	rw67	bd continues	2.2	R8s 5840R91052	10/18/2021	12:33:18 PM	6	0.031	0.059	-96.99295402	27.92370128	264.7183897	14.363	Fixed
SWG-2019-00067	rw68	wet Beach	2.5	R8s 5840R91052	10/18/2021	12:34:02 PM	6	0.045	0.084	-96.98751726	27.9269118	2108.370324	3.299	Fixed
SWG-2019-00067	rw69	aht	2.5	R8s 5840R91052	10/18/2021	12:35:32 PM	6	0.044	0.084	-96.98747159	27.92688222	18.25300732	2.785	Fixed
SWG-2019-00067	rw70	mhw	2.5	R8s 5840R91052	10/18/2021	12:36:00 PM	6	0.045	0.085	-96.98733778	27.92681357	49.90250158	1.038	Fixed
SWG-2019-00067	rw71	cm Start	2.5	R8s 5840R91052	10/18/2021	12:36:51 PM	6	0.045	0.086	-96.98787006	27.92717717	216.8492015	5.671	Fixed
SWG-2019-00067	rw72	cm Stop fd Start	2.5	R8s 5840R91052	10/18/2021	12:37:55 PM	6	0.046	0.088	-96.98794333	27.92722358	29.06075877	7.335	Fixed
SWG-2019-00067	rw73	fd Ridge	2.5	R8s 5840R91052	10/18/2021	12:39:25 PM	6	0.046	0.089	-96.98814026	27.92735162	78.81590322	10.456	Fixed
SWG-2019-00067	rw74	fd Stop Bd Start	2.5	R8s 5840R91052	10/18/2021	2:24:56 PM	6	0.046	0.09	-96.98839144	27.92748511	94.52537395	6.559	Fixed
SWG-2019-00067	rw75	bd continues	2.6	R8s 5840R91052	10/18/2021	2:25:45 PM	6	0.046	0.09	-96.98879168	27.92769531	150.154459	6.106	Fixed
SWG-2019-00067	rw76	data	2	R8s 5840R91052	10/18/2021	2:26:33 PM	6	0.031	0.061	-97.00692449	27.90468848	10211.1492	4.802	Fixed
SWG-2019-00067	rw77	data	2	R8s 5840R91052	10/18/2021	2:27:24 PM	6	0.03	0.058	-97.00731627	27.90474417	128.1540601	5.388	Fixed
SWG-2019-00067	rw78	data	2	R8s 5840R91052	10/18/2021	2:28:06 PM	6	0.029	0.058	-97.00769345	27.90483197	125.9419771	4.636	Fixed
SWG-2019-00067	rw79	data	2	R8s 5840R91052	10/18/2021	2:43:12 PM	6	0.03	0.06	-97.00807112	27.90494181	128.3568565	4.581	Fixed
SWG-2019-00067	rw80	data	2	R8s 5840R91052	10/18/2021	2:44:05 PM	6	0.03	0.06	-97.0083239	27.90509875	99.60847015	4.248	Fixed
SWG-2019-00067	rw81	data	2.2	R8s 5840R91052	10/18/2021	2:44:47 PM	6	0.027	0.061	-97.00889006	27.9018024	1212.364081	4.703	Fixed
SWG-2019-00067	rw82	data	2.2	R8s 5840R91052	10/18/2021	2:45:36 PM	5	0.028	0.063	-97.00932085	27.90196444	151.1081736	4.602	Fixed
SWG-2019-00067	rw83	data	2.2	R8s 5840R91052	10/18/2021	2:47:11 PM	6	0.03	0.066	-97.00949017	27.90215051	86.99250655	4.576	Fixed
SWG-2019-00067	rw84	data	2.2	R8s 5840R91052	10/18/2021	2:48:25 PM	6	0.032	0.073	-97.00940668	27.90233329	71.71980217	3.447	Fixed
SWG-2019-00067	rw85	data	2.2	R8s 5840R91052	10/18/2021	2:49:46 PM	6	0.032	0.072	-97.00967951	27.90243587	95.69095559	3.715	Fixed
SWG-2019-00067	rw86	data	2.2	R8s 5840R91052	10/18/2021	2:51:52 PM	6	0.032	0.072	-97.00983008	27.90196519	177.9045852	4.45	Fixed
SWG-2019-00067	rw87	data	2.2	R8s 5840R91052	10/18/2021	2:53:06 PM	5	0.032	0.072	-97.01056302	27.90149579	291.8477255	5.311	Fixed
SWG-2019-00067	rw88	data	2.2	R8s 5840R91052	10/18/2021	2:53:56 PM	6	0.031	0.07	-97.01039544	27.90202033	198.2468253	4.334	Fixed
SWG-2019-00067	rw89	data	2.2	R8s 5840R91052	10/18/2021	2:54:59 PM	6	0.032	0.073	-97.01069259	27.90269075	261.9658041	3.92	Fixed
SWG-2019-00067	rw90	data	2.2	R8s 5840R91052	10/18/2021	2:55:39 PM	6	0.033	0.074	-97.01094677	27.90294132	122.6403922	3.445	Fixed
SWG-2019-00067	rw91	data	2.2	R8s 5840R91052	10/18/2021	2:56:23 PM	6	0.034	0.075	-97.01116321	27.90336347	168.6583454	3.051	Fixed
SWG-2019-00067	rw92	data	2.2	R8s 5840R91052	10/18/2021	2:57:57 PM	6	0.033	0.073	-97.01106826	27.90354228	71.88398084	2.631	Fixed
SWG-2019-00067	rw93	data	2.2	R8s 5840R91052	10/18/2021	2:59:01 PM	6	0.034	0.076	-97.01103123	27.90352019	14.40830441	2.799	Fixed
SWG-2019-00067	rw94	data	2.2	R8s 5840R91052	10/18/2021	3:00:07 PM	6	0.034	0.075	-97.0109841	27.90360279	33.6700429	2.742	Fixed
SWG-2019-00067	rw95	data	1.9	R8s 5840R91052	10/18/2021	3:01:15 PM	6	0.035	0.069	-97.01099506	27.90369442	33.50166248	2.726	Fixed
SWG-2019-00067	rw96	data	1.9	R8s 5840R91052	10/18/2021	3:02:40 PM	6	0.034	0.067	-97.01080651	27.90379738	71.48502372	2.772	Fixed
SWG-2019-00067	rw97	data	1.9	R8s 5840R91052	10/18/2021	3:03:22 PM	6	0.034	0.067	-97.01078857	27.90399766	73.04689333	2.662	Fixed
SWG-2019-00067	rw98	data	1.9	R8s 5840R91052	10/18/2021	3:04:38 PM	6	0.034	0.066	-97.01115709	27.90369926	161.0551309	2.751	Fixed
SWG-2019-00067	rw99	data	1.9	R8s 5840R91052	10/18/2021	3:05:14 PM	6	0.033	0.065	-97.01116256	27.90374682	17.3821098	2.764	Fixed
SWG-2019-00067	rw100	data	1.9	R8s 5840R91052	10/18/2021	3:05:54 PM	6	0.033	0.064	-97.01118414	27.903771	11.22139586	2.779	Fixed
SWG-2019-00067	rw101	data	1.9	R8s 5840R91052	10/18/2021	3:06:20 PM	6	0.033	0.064	-97.01134827	27.9038263	56.69844274	2.778	Fixed

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw102	data	1.9	R8s 5840R91052	10/18/2021	3:07:12 PM	6	0.032	0.063	-97.0115072	27.90390292	58.40737471	2.791	Fixed
SWG-2019-00067	rw103	data	1.9	R8s 5840R91052	10/18/2021	3:07:50 PM	6	0.034	0.066	-97.01162455	27.90378637	56.85408693	2.788	Fixed
SWG-2019-00067	rw104	data	1.9	R8s 5840R91052	10/18/2021	3:08:53 PM	6	0.033	0.064	-97.01173227	27.90382576	37.62565215	2.786	Fixed
SWG-2019-00067	rw105	data	1.9	R8s 5840R91052	10/18/2021	3:09:14 PM	6	0.033	0.064	-97.01180393	27.90366846	61.69726493	2.774	Fixed
SWG-2019-00067	rw106	data	1.9	R8s 5840R91052	10/18/2021	3:11:18 PM	6	0.033	0.063	-97.01187859	27.90361775	30.35551377	2.858	Fixed
SWG-2019-00067	rw107	data	1.9	R8s 5840R91052	10/19/2021	8:47:43 AM	6	0.033	0.063	-97.01197073	27.90358851	31.60182098	2.762	Fixed
SWG-2019-00067	rw108	data	1.8	R8s 5840R91052	10/19/2021	8:49:00 AM	6	0.032	0.061	-97.01116846	27.902942	349.8630602	3.506	Fixed
SWG-2019-00067	rw109	aht	2	R8s 5840R91052	10/19/2021	8:51:13 AM	6	0.03	0.049	-97.01251001	27.89578321	2638.627559	2.752	Fixed
SWG-2019-00067	rw110	mhw	2	R8s 5840R91052	10/19/2021	8:52:26 AM	6	0.031	0.049	-97.01240888	27.89571217	41.64390111	1.048	Fixed
SWG-2019-00067	rw111	wet Beach	1.9	R8s 5840R91052	10/19/2021	8:53:07 AM	6	0.031	0.047	-97.01248788	27.8957649	31.9199299	2.351	Fixed
SWG-2019-00067	rw112	cm Start	1.9	R8s 5840R91052	10/19/2021	8:54:45 AM	6	0.032	0.048	-97.01294354	27.89611504	194.6033435	5.222	Fixed
SWG-2019-00067	rw113	cm Stop fd Start	1.9	R8s 5840R91052	10/19/2021	8:55:53 AM	6	0.032	0.047	-97.01312384	27.89618327	63.30509695	6.425	Fixed
SWG-2019-00067	rw114	fd Ridge	1.9	R8s 5840R91052	10/19/2021	8:58:36 AM	6	0.033	0.048	-97.01358483	27.89640347	169.0674855	14.453	Fixed
SWG-2019-00067	rw115	fd Stop Bd Start	1.9	R8s 5840R91052	10/19/2021	9:25:33 AM	6	0.034	0.049	-97.01378004	27.89653928	80.08846893	7.164	Fixed
SWG-2019-00067	rw116	bd stop cp start	1.8	R8s 5840R91052	10/19/2021	9:29:01 AM	6	0.034	0.047	-97.01454929	27.89699454	298.5693909	5.826	Fixed
SWG-2019-00067	rw117	sand flat	6.5	R8s 5840R91052	10/19/2021	9:30:04 AM	6	0.092	0.142	-97.01809623	27.89258993	1969.095647	3.643	Fixed
SWG-2019-00067	rw118	cm stop sf Start	5.7	R8s 5840R91052	10/19/2021	9:32:09 AM	6	0.092	0.134	-97.01681057	27.89174478	516.6285027	4.5	Fixed
SWG-2019-00067	rw119	cm Start	5.5	R8s 5840R91052	10/19/2021	9:33:58 AM	6	0.089	0.128	-97.0165295	27.89150813	125.0892661	4.819	Fixed
SWG-2019-00067	rw120	wet Beach	5.2	R8s 5840R91052	10/19/2021	9:35:02 AM	6	0.077	0.107	-97.01588763	27.89119883	235.8794377	2.058	Fixed
SWG-2019-00067	rw121	aht	4.9	R8s 5840R91052	10/19/2021	9:58:17 AM	6	0.077	0.104	-97.01593066	27.89122752	17.379912	2.836	Fixed
SWG-2019-00067	rw122	mhw	4.8	R8s 5840R91052	10/19/2021	9:58:37 AM	6	0.077	0.103	-97.01581302	27.89115106	47.08401826	1.035	Fixed
SWG-2019-00067	rw123	aht	1.8	R8s 5840R91052	10/19/2021	9:59:10 AM	6	0.037	0.051	-97.01925019	27.88662386	1985.499871	2.773	Fixed
SWG-2019-00067	rw124	wet Beach	1.8	R8s 5840R91052	10/19/2021	10:00:53 AM	6	0.037	0.051	-97.01921942	27.88660607	11.8584453	2.097	Fixed
SWG-2019-00067	rw125	mhw	1.8	R8s 5840R91052	10/19/2021	10:03:08 AM	6	0.037	0.051	-97.01915805	27.88656651	24.49454094	1.034	Fixed
SWG-2019-00067	rw126	cm Start	1.7	R8s 5840R91052	10/19/2021	10:15:13 AM	6	0.037	0.051	-97.01978683	27.88692258	240.8764197	5.179	Fixed
SWG-2019-00067	rw127	cm stop bd start	1.7	R8s 5840R91052	10/19/2021	10:16:19 AM	6	0.038	0.054	-97.02072825	27.88745446	360.3978592	5.417	Fixed
SWG-2019-00067	rw128	bd stop wtld start	1.6	R8s 5840R91052	10/19/2021	10:18:00 AM	6	0.034	0.052	-97.02124846	27.887726	194.9073218	4.315	Fixed
SWG-2019-00067	rw129	wtld stop open water start	1.6	R8s 5840R91052	10/19/2021	10:18:37 AM	6	0.038	0.058	-97.02148866	27.8878468	89.16418073	3.592	Fixed
SWG-2019-00067	rw130	open water stop wtld start	1.6	R8s 5840R91052	10/19/2021	10:19:21 AM	6	0.029	0.045	-97.02184423	27.88813349	155.1091899	2.987	Fixed
SWG-2019-00067	rw131	wetland stop open water start	1.6	R8s 5840R91052	10/19/2021	10:20:41 AM	6	0.029	0.045	-97.02188019	27.8881699	17.61221122	3.245	Fixed
SWG-2019-00067	rw132	open water stop wtld start	1.6	R8s 5840R91052	10/19/2021	10:22:41 AM	6	0.029	0.045	-97.02196259	27.88822368	33.02774023	3.729	Fixed
SWG-2019-00067	rw133	data	1.6	R8s 5840R91052	10/19/2021	10:23:23 AM	6	0.028	0.046	-97.02242909	27.88854562	190.8193547	3.396	Fixed
SWG-2019-00067	rw134	wtld stop bd start	1.7	R8s 5840R91052	10/19/2021	10:55:40 AM	6	0.029	0.047	-97.02321829	27.8889075	286.8948438	3.789	Fixed
SWG-2019-00067	rw135	mosaic continues	1.7	R8s 5840R91052	10/19/2021	10:55:57 AM	6	0.028	0.046	-97.02338285	27.88898711	60.52881483	5.226	Fixed
SWG-2019-00067	rw136	aht	2.3	R8s 5840R91052	10/19/2021	10:56:35 AM	6	0.029	0.067	-97.022516	27.88196629	2567.93718	2.726	Fixed
SWG-2019-00067	rw137	wet Beach	2.3	R8s 5840R91052	10/19/2021	10:58:23 AM	6	0.029	0.067	-97.02250441	27.88195732	4.969368671	2.504	Fixed
SWG-2019-00067	rw138	mhw	2.3	R8s 5840R91052	10/19/2021	10:59:34 AM	6	0.029	0.068	-97.02240916	27.88189411	38.40439683	1.007	Fixed
SWG-2019-00067	rw139	cm Start	2.3	R8s 5840R91052	10/19/2021	11:00:25 AM	6	0.03	0.071	-97.02325766	27.88241925	334.0583347	4.705	Fixed
SWG-2019-00067	rw140	cm Stop fd Start	2.3	R8s 5840R91052	10/19/2021	11:02:00 AM	6	0.031	0.072	-97.02370329	27.88272321	181.4928247	5.357	Fixed
SWG-2019-00067	rw141	fd Ridge	2.3	R8s 5840R91052	10/19/2021	11:03:08 AM	6	0.031	0.073	-97.02375838	27.88273239	18.10757093	11.065	Fixed
SWG-2019-00067	rw142	fd stop wtld Start	2.7	R8s 5840R91052	10/19/2021	11:09:07 AM	6	0.084	0.199	-97.02402545	27.88289723	105.0525729	4.882	Fixed
SWG-2019-00067	rw143	wtld stop open water start	2.7	R8s 5840R91052	10/19/2021	11:12:07 AM	6	0.044	0.119	-97.02439376	27.88300523	125.2969827	3.477	Fixed
SWG-2019-00067	rw144	open water stop wtld start	2.4	R8s 5840R91052	10/19/2021	11:42:02 AM	6	0.041	0.103	-97.02508689	27.88342595	271.1849026	2.994	Fixed
SWG-2019-00067	rw145	wtld continues	2.4	R8s 5840R91052	10/19/2021	11:42:19 AM	6	0.041	0.102	-97.02645396	27.88421838	527.3098665	3.018	Fixed
SWG-2019-00067	rw146	aht	3.3	R8s 5840R91052	10/19/2021	11:43:03 AM	6	0.032	0.096	-97.02564549	27.8774698	2467.500445	2.815	Fixed
SWG-2019-00067	rw147	wet Beach	3.2	R8s 5840R91052	10/19/2021	11:44:32 AM	6	0.032	0.094	-97.02563257	27.87746174	5.100007943	2.571	Fixed
SWG-2019-00067	rw148	mhw	3.2	R8s 5840R91052	10/19/2021	11:45:48 AM	6	0.032	0.093	-97.02553774	27.87741347	35.30637366	0.972	Fixed
SWG-2019-00067	rw149	cm Start	3.1	R8s 5840R91052	10/19/2021	11:47:03 AM	6	0.033	0.094	-97.02623964	27.87775216	258.0428385	5.457	Fixed
SWG-2019-00067	rw150	cm Stop fd Start	3.3	R8s 5840R91052	10/19/2021	11:47:47 AM	6	0.033	0.094	-97.02654421	27.87792184	116.1390552	6.613	Fixed
SWG-2019-00067	rw151	fd Ridge	3.3	R8s 5840R91052	10/19/2021	11:50:11 AM	6	0.034	0.096	-97.02690042	27.87816831	145.8557995	14.067	Fixed

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw152	fd stop	3.2	R8s 5840R91052	10/19/2021	11:53:17 AM	5	0.033	0.093	-97.02699831	27.878241	41.21621312	6.086	Fixed
SWG-2019-00067	rw153	bd stop cp start	3.4	R8s 5840R91052	10/19/2021	11:54:17 AM	6	0.051	0.091	-97.02769265	27.87863423	266.0075492	3.946	Fixed
SWG-2019-00067	rw154	wtld continues	3.3	R8s 5840R91052	10/21/2021	1:02:51 PM	6	0.053	0.087	-97.02910624	27.8791787	497.7508667	3.43	Fixed
SWG-2019-00067	rw155	data	3.2	R8s 5840R91052	10/21/2021	1:11:49 PM	6	0.053	0.086	-97.02949198	27.879388	146.0192816	3.114	Fixed
SWG-2019-00067	rw156	elevation	3.4	R8s 5840R91052	10/21/2021	1:14:12 PM	6	0.076	0.044	-97.03176955	27.87604188	1421.794208	3.024	Fixed
SWG-2019-00067	rw157	elevation	1.8	R8s 5840R91052	10/21/2021	1:15:33 PM	6	0.028	0.037	-97.03245603	27.8748585	484.0515881	3.031	Fixed
SWG-2019-00067	rw158	aht1	1.8	R8s 5840R91052	10/21/2021	1:17:38 PM	6	0.028	0.036	-97.03265693	27.87455509	127.9905212	2.782	Fixed
SWG-2019-00067	rw159	aht	1.8	R8s 5840R91052	10/21/2021	1:18:11 PM	6	0.028	0.037	-97.03233859	27.87455249	102.8523038	2.719	Fixed
SWG-2019-00067	rw160	aht	1.8	R8s 5840R91052	10/21/2021	1:19:05 PM	6	0.034	0.045	-97.03207612	27.8745785	85.32708946	2.728	Fixed
SWG-2019-00067	rw161	aht	1.8	R8s 5840R91052	10/21/2021	1:20:36 PM	6	0.029	0.038	-97.03186055	27.87450618	74.44523491	2.741	Fixed
SWG-2019-00067	rw162	aht	1.8	R8s 5840R91052	10/21/2021	1:21:27 PM	6	0.029	0.038	-97.03172089	27.87458943	54.33248435	2.723	Fixed
SWG-2019-00067	rw163	aht	1.8	R8s 5840R91052	10/21/2021	1:22:05 PM	6	0.029	0.038	-97.03168081	27.87450397	33.66267787	2.783	Fixed
SWG-2019-00067	rw164	aht	1.8	R8s 5840R91052	10/21/2021	1:22:46 PM	6	0.029	0.039	-97.03203176	27.87434357	127.5039305	2.639	Fixed
SWG-2019-00067	rw165	aht	1.8	R8s 5840R91052	10/21/2021	1:23:18 PM	6	0.03	0.04	-97.03229197	27.87428729	86.52246284	2.633	Fixed
SWG-2019-00067	rw166	aht	1.8	R8s 5840R91052	10/21/2021	1:23:50 PM	5	0.031	0.042	-97.03234904	27.87419298	38.9309574	2.734	Fixed
SWG-2019-00067	rw167	aht	1.8	R8s 5840R91052	10/21/2021	1:24:26 PM	6	0.03	0.041	-97.03238129	27.8740889	39.24973937	2.762	Fixed
SWG-2019-00067	rw168	aht	1.8	R8s 5840R91052	10/21/2021	1:25:15 PM	6	0.03	0.041	-97.03236833	27.87395209	49.91794592	2.729	Fixed
SWG-2019-00067	rw169	aht	1.8	R8s 5840R91052	10/21/2021	1:26:18 PM	6	0.031	0.041	-97.03240923	27.8738443	41.35731714	2.731	Fixed
SWG-2019-00067	rw170	aht	1.8	R8s 5840R91052	10/21/2021	1:27:03 PM	6	0.031	0.041	-97.03251197	27.87373531	51.69317096	2.735	Fixed
SWG-2019-00067	rw171	aht	1.8	R8s 5840R91052	10/21/2021	1:27:51 PM	6	0.03	0.041	-97.03270055	27.87363667	70.69723415	2.697	Fixed
SWG-2019-00067	rw172	aht	1.8	R8s 5840R91052	10/21/2021	1:28:57 PM	6	0.03	0.04	-97.03268015	27.87350132	49.64899294	2.773	Fixed
SWG-2019-00067	rw173	aht	1.8	R8s 5840R91052	10/21/2021	1:29:49 PM	6	0.032	0.043	-97.03253469	27.87349236	47.10901252	2.786	Fixed
SWG-2019-00067	rw174	aht	1.8	R8s 5840R91052	10/21/2021	1:30:23 PM	6	0.031	0.041	-97.03242375	27.8735934	51.32517799	2.8	Fixed
SWG-2019-00067	rw175	aht	1.8	R8s 5840R91052	10/21/2021	1:31:00 PM	6	0.031	0.042	-97.03217667	27.87369722	88.30168943	2.741	Fixed
SWG-2019-00067	rw176	aht	1.8	R8s 5840R91052	10/21/2021	1:31:43 PM	6	0.031	0.042	-97.03201342	27.87381554	68.06546811	2.74	Fixed
SWG-2019-00067	rw177	aht	1.8	R8s 5840R91052	10/21/2021	1:32:29 PM	6	0.032	0.043	-97.03194228	27.87394936	53.81159995	2.748	Fixed
SWG-2019-00067	rw178	aht	1.8	R8s 5840R91052	10/21/2021	1:33:07 PM	6	0.032	0.044	-97.03190261	27.87405359	40.0019684	2.775	Fixed
SWG-2019-00067	rw179	aht	1.8	R8s 5840R91052	10/21/2021	1:33:52 PM	6	0.032	0.044	-97.03177963	27.87409071	41.96218278	2.784	Fixed
SWG-2019-00067	rw180	aht	1.8	R8s 5840R91052	10/21/2021	1:35:16 PM	6	0.033	0.044	-97.03175574	27.87396419	46.64643219	2.769	Fixed
SWG-2019-00067	rw181	aht	1.8	R8s 5840R91052	10/21/2021	1:36:20 PM	6	0.033	0.045	-97.03185241	27.87383272	57.09939776	2.759	Fixed
SWG-2019-00067	rw182	aht	1.8	R8s 5840R91052	10/21/2021	1:37:23 PM	6	0.034	0.046	-97.03199687	27.87369571	68.26055069	2.77	Fixed
SWG-2019-00067	rw183	aht	1.7	R8s 5840R91052	10/21/2021	1:38:07 PM	6	0.033	0.044	-97.03217796	27.87360838	66.56863469	2.772	Fixed
SWG-2019-00067	rw184	aht	1.7	R8s 5840R91052	10/21/2021	1:39:07 PM	6	0.033	0.044	-97.03229482	27.8735515	43.04886229	2.772	Fixed
SWG-2019-00067	rw185	aht	1.7	R8s 5840R91052	10/21/2021	1:40:00 PM	6	0.032	0.043	-97.03242666	27.87343172	60.91664115	2.662	Fixed
SWG-2019-00067	rw186	aht	1.6	R8s 5840R91052	10/21/2021	1:40:49 PM	6	0.026	0.046	-97.03245354	27.87325943	63.24256043	2.784	Fixed
SWG-2019-00067	rw187	aht	1.6	R8s 5840R91052	10/21/2021	1:41:41 PM	5	0.027	0.046	-97.03266743	27.87316732	76.79285803	2.772	Fixed
SWG-2019-00067	rw188	aht	1.6	R8s 5840R91052	10/21/2021	2:06:06 PM	6	0.026	0.046	-97.0329004	27.87333688	97.2931308	2.726	Fixed
SWG-2019-00067	rw189	aht	1.8	R8s 5840R91052	10/21/2021	2:09:23 PM	6	0.029	0.053	-97.03317411	27.87342767	94.3943417	2.723	Fixed
SWG-2019-00067	rw190	aht	1.8	R8s 5840R91052	10/21/2021	2:11:37 PM	6	0.03	0.055	-97.03343628	27.87349816	88.49451749	2.731	Fixed
SWG-2019-00067	rw191	elevation	1.9	R8s 5840R91052	10/21/2021	2:12:23 PM	6	0.026	0.052	-97.03395574	27.87266345	346.7974102	3.01	Fixed
SWG-2019-00067	rw192	wet Beach	2	R8s 5840R91052	10/21/2021	2:12:52 PM	6	0.023	0.047	-97.03474807	27.87171251	430.1977097	2.899	Fixed
SWG-2019-00067	rw193	aht	2	R8s 5840R91052	10/21/2021	2:13:14 PM	6	0.04	0.083	-97.03480373	27.87117781	195.2343095	2.788	Fixed
SWG-2019-00067	rw194	aht	2	R8s 5840R91052	10/21/2021	2:13:46 PM	6	0.039	0.083	-97.03459881	27.87115509	66.72173634	2.747	Fixed
SWG-2019-00067	rw195	aht	2	R8s 5840R91052	10/21/2021	2:14:19 PM	5	0.04	0.085	-97.03447885	27.87115927	38.79005672	2.745	Fixed
SWG-2019-00067	rw196	aht	2	R8s 5840R91052	10/21/2021	2:14:45 PM	6	0.034	0.071	-97.03442244	27.87120295	24.17291253	2.726	Fixed
SWG-2019-00067	rw197	aht	2	R8s 5840R91052	10/21/2021	2:15:32 PM	6	0.033	0.07	-97.03451217	27.87125319	34.26721033	2.739	Fixed
SWG-2019-00067	rw198	aht	2	R8s 5840R91052	10/21/2021	2:16:13 PM	6	0.031	0.067	-97.03455788	27.87129	19.92912903	2.76	Fixed
SWG-2019-00067	rw199	aht	2	R8s 5840R91052	10/21/2021	2:17:00 PM	6	0.03	0.065	-97.03458997	27.87131811	14.56121976	2.772	Fixed
SWG-2019-00067	rw200	aht	2.1	R8s 5840R91052	10/21/2021	7:14:55 PM	6	0.03	0.065	-97.03435857	27.87122449	82.15122366	2.749	Fixed
SWG-2019-00067	rw201	aht	2.1	R8s 5840R91052	10/21/2021	3:48:30 PM	6	0.029	0.064	-97.03416357	27.87118174	64.8896712	2.709	Fixed

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw202	aht	2.1	R8s 5840R91052	10/25/2021	10:08:02 AM	6	0.029	0.064	-97.03403585	27.87117019	41.4791483	2.729	Fixed
SWG-2019-00067	rw203	benchmark	1.6	R8s 5840R91052	10/25/2021	10:10:35 AM	6	0.02	0.032	-97.047747	28.02609876	56503.99432	5.222	Fixed
SWG-2019-00067	rw204	benchmark	1.7	R8s 5840R91052	10/25/2021	10:12:49 AM	6	0.02	0.039	-97.04774732	28.02609865	0.111427106	5.23	Fixed
SWG-2019-00067	rw205	elevation	1.8	R8s 5840R91052	10/25/2021	11:13:39 AM	6	0.026	0.047	-97.02930646	27.87957843	53604.88569	2.981	Fixed
SWG-2019-00067	rw206	elevation	1.8	R8s 5840R91052	10/25/2021	11:14:24 AM	6	0.026	0.048	-97.02868452	27.88061101	425.8129383	3.505	Fixed
SWG-2019-00067	rw207	elevation	1.8	R8s 5840R91052	10/25/2021	11:15:17 AM	6	0.026	0.047	-97.0284829	27.88089243	121.2909425	3.543	Fixed
SWG-2019-00067	rw208	aht	1.8	R8s 5840R91052	10/25/2021	11:16:40 AM	6	0.027	0.06	-97.02471267	27.88697923	2526.071315	2.78	Fixed
SWG-2019-00067	rw209	aht	1.8	R8s 5840R91052	10/25/2021	11:17:20 AM	6	0.028	0.06	-97.02460746	27.88684993	58.01177074	2.769	Fixed
SWG-2019-00067	rw210	aht	1.8	R8s 5840R91052	10/25/2021	11:18:52 AM	3	0.029	0.062	-97.02461649	27.88676566	30.77673831	2.75	Fixed
SWG-2019-00067	rw211	aht	1.8	R8s 5840R91052	10/25/2021	11:43:10 AM	6	0.029	0.062	-97.02478254	27.88684891	61.59361695	2.768	Fixed
SWG-2019-00067	rw212	aht	2.7	R8s 5840R91052	10/25/2021	11:43:35 AM	7	0.023	0.068	-97.02485639	27.88687752	26.02519796	2.784	Fixed
SWG-2019-00067	rw213	elevation	2.6	R8s 5840R91052	10/25/2021	11:43:56 AM	6	0.027	0.063	-97.02416748	27.88675833	226.7333344	3.209	Fixed
SWG-2019-00067	rw214	eov1	2.2	R8s 5840R91052	10/25/2021	11:44:34 AM	6	0.024	0.055	-97.02216332	27.88693061	650.4652691	3.33	Fixed
SWG-2019-00067	rw215	eov2	2.2	R8s 5840R91052	10/25/2021	11:45:01 AM	6	0.024	0.056	-97.02209545	27.88690212	24.24854686	3.485	Fixed
SWG-2019-00067	rw216	eov3	2.2	R8s 5840R91052	10/25/2021	11:45:25 AM	6	0.025	0.058	-97.02203076	27.88686794	24.3146527	3.651	Fixed
SWG-2019-00067	rw217	eov4	2.2	R8s 5840R91052	10/25/2021	11:45:47 AM	6	0.028	0.064	-97.02191505	27.88692294	42.39176378	2.864	Fixed
SWG-2019-00067	rw218	eov5	2.2	R8s 5840R91052	10/25/2021	11:46:07 AM	7	0.029	0.066	-97.02184137	27.88691141	24.16838017	3.143	Fixed
SWG-2019-00067	rw219	eov6	2.2	R8s 5840R91052	10/25/2021	11:46:37 AM	6	0.029	0.067	-97.02177287	27.8868528	30.72185914	4.054	Fixed
SWG-2019-00067	rw220	eov7	2.2	R8s 5840R91052	10/25/2021	11:47:07 AM	6	0.03	0.068	-97.02169404	27.88685987	25.59342736	3.846	Fixed
SWG-2019-00067	rw221	eov8	2.2	R8s 5840R91052	10/25/2021	11:47:24 AM	6	0.03	0.068	-97.02174114	27.88689659	20.24069663	3.626	Fixed
SWG-2019-00067	rw222	eov9	2.2	R8s 5840R91052	10/25/2021	11:47:51 AM	6	0.03	0.068	-97.02188211	27.88698316	55.35840158	3.151	Fixed
SWG-2019-00067	rw223	eov10	2.5	R8s 5840R91052	10/25/2021	11:48:14 AM	6	0.031	0.073	-97.02183314	27.88706547	33.85071822	2.928	Fixed
SWG-2019-00067	rw224	eov11	2.5	R8s 5840R91052	10/25/2021	11:48:38 AM	6	0.031	0.074	-97.02182632	27.88709987	12.69723655	3.253	Fixed
SWG-2019-00067	rw225	eov12	2.5	R8s 5840R91052	10/25/2021	11:49:04 AM	6	0.033	0.079	-97.02188008	27.88715371	26.16764674	3.211	Fixed
SWG-2019-00067	rw226	eov13	2.5	R8s 5840R91052	10/25/2021	11:49:21 AM	6	0.033	0.079	-97.0219235	27.88716357	14.47579898	3.187	Fixed
SWG-2019-00067	rw227	eov14	2.5	R8s 5840R91052	10/25/2021	11:49:41 AM	6	0.034	0.08	-97.02197738	27.88714498	18.67354235	3.824	Fixed
SWG-2019-00067	rw228	eov15	2.5	R8s 5840R91052	10/25/2021	11:50:02 AM	11	0.034	0.08	-97.02192225	27.88704819	39.44069979	3.314	Fixed
SWG-2019-00067	rw229	eov16	2.5	R8s 5840R91052	10/25/2021	11:50:19 AM	6	0.035	0.082	-97.02189354	27.88702473	12.60181638	3.436	Fixed
SWG-2019-00067	rw230	eov17	2.5	R8s 5840R91052	10/25/2021	11:50:39 AM	8	0.035	0.083	-97.02191114	27.88700387	9.478866442	3.038	Fixed
SWG-2019-00067	rw231	eov18	2.5	R8s 5840R91052	10/25/2021	11:51:10 AM	6	0.036	0.085	-97.0219781	27.8870225	22.66696012	3.894	Fixed
SWG-2019-00067	rw232	eov19	2.5	R8s 5840R91052	10/25/2021	11:51:34 AM	6	0.037	0.087	-97.02200366	27.88699603	12.68081764	3.356	Fixed
SWG-2019-00067	rw233	eov20	2.5	R8s 5840R91052	10/25/2021	11:51:51 AM	9	0.037	0.087	-97.02203373	27.88694455	21.08802826	3.242	Fixed
SWG-2019-00067	rw234	eov21	2.5	R8s 5840R91052	10/25/2021	11:54:09 AM	6	0.037	0.087	-97.02210737	27.88693839	23.89624592	3.4	Fixed
SWG-2019-00067	rw235	eov22	2.5	R8s 5840R91052	10/25/2021	11:54:39 AM	6	0.039	0.092	-97.02214121	27.88695148	11.92179081	2.972	Fixed
SWG-2019-00067	rw236	eov23	2.5	R8s 5840R91052	10/25/2021	11:55:16 AM	9	0.039	0.091	-97.02215612	27.88695719	5.246462046	2.899	Fixed
SWG-2019-00067	rw237	eov2-1	2.4	R8s 5840R91052	10/25/2021	11:55:58 AM	7	0.039	0.089	-97.02153113	27.88715024	213.7565043	3.135	Fixed
SWG-2019-00067	rw238	eov2-2	2.4	R8s 5840R91052	10/25/2021	12:45:14 PM	7	0.039	0.09	-97.02155185	27.88724612	35.49750133	2.761	Fixed
SWG-2019-00067	rw239	eov2-3	2.4	R8s 5840R91052	10/25/2021	12:47:05 PM	7	0.04	0.091	-97.02167265	27.88735171	54.74089696	2.956	Fixed
SWG-2019-00067	rw240	eov2-4	2.4	R8s 5840R91052	10/25/2021	12:49:43 PM	10	0.042	0.095	-97.02170492	27.88757845	83.09460731	3.103	Fixed
SWG-2019-00067	rw241	elevation	2.3	R8s 5840R91052	10/25/2021	12:51:25 PM	6	0.037	0.074	-97.02309085	27.88784004	457.7115358	3.334	Fixed
SWG-2019-00067	rw242	elevation	2.2	R8s 5840R91052	10/25/2021	12:52:09 PM	6	0.036	0.072	-97.0225761	27.88846339	281.1003122	3.504	Fixed
SWG-2019-00067	rw243	elevation	2.2	R8s 5840R91052	10/26/2021	8:56:06 AM	6	0.039	0.077	-97.02201918	27.88946361	405.7275021	3.569	Fixed
SWG-2019-00067	rw244	elevation	2.2	R8s 5840R91052	10/26/2021	8:56:32 AM	6	0.036	0.069	-97.02174613	27.88989872	181.127464	3.296	Fixed
SWG-2019-00067	rw245	elevation	2.2	R8s 5840R91052	10/26/2021	8:57:00 AM	6	0.036	0.068	-97.02149514	27.89001474	91.3948083	3.284	Fixed
SWG-2019-00067	rw246	aht	2.3	R8s 5840R91052	10/26/2021	8:57:30 AM	6	0.037	0.046	-97.03400759	27.87109084	7979.949635	2.646	Fixed
SWG-2019-00067	rw247	aht	2.3	R8s 5840R91052	10/26/2021	8:58:00 AM	8	0.037	0.046	-97.03398851	27.87103128	22.51386881	2.759	Fixed
SWG-2019-00067	rw248	aht	2.7	R8s 5840R91052	10/26/2021	8:58:41 AM	6	0.039	0.057	-97.03395643	27.87102083	11.0413088	2.756	Fixed
SWG-2019-00067	rw249	aht	2.7	R8s 5840R91052	10/26/2021	8:59:11 AM	7	0.039	0.057	-97.0339176	27.87100131	14.4133143	2.795	Fixed
SWG-2019-00067	rw250	aht	2.7	R8s 5840R91052	10/26/2021	8:59:45 AM	6	0.039	0.057	-97.03402386	27.87102224	35.16703712	2.719	Fixed
SWG-2019-00067	rw251	aht	2.7	R8s 5840R91052	10/26/2021	9:00:06 AM	6	0.04	0.057	-97.0341174	27.87109131	39.29349464	2.731	Fixed

USACE Standard Operating Procedures Verification Table

Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement

Survey Area: SJI

Survey GPS: R8s RTK

SWG_No	OID	Feature Code	M_PDOP	Rcvr_Type	GPS_Date	GPS_Time	Epochs	Hz Prec	Vt Prec	Point X (DD)	Point Y (DD)	Distance_prev	Elev	Solution Type
SWG-2019-00067	rw252	aht	2.7	R8s 5840R91052	10/26/2021	9:00:32 AM	6	0.04	0.057	-97.03417575	27.87109379	18.87525282	2.801	Fixed
SWG-2019-00067	rw253	aht	2.7	R8s 5840R91052	10/26/2021	9:00:58 AM	5	0.04	0.057	-97.03418867	27.87110847	6.775755013	2.786	Fixed
SWG-2019-00067	rw254	aht	2.7	R8s 5840R91052	10/26/2021	9:01:20 AM	6	0.04	0.057	-97.03421842	27.87109362	11.02467691	2.777	Fixed
SWG-2019-00067	rw255	aht	2.7	R8s 5840R91052	10/26/2021	9:01:49 AM	6	0.04	0.057	-97.03429685	27.87111206	26.21379072	2.752	Fixed
SWG-2019-00067	rw256	aht	2.7	R8s 5840R91052	10/26/2021	9:02:13 AM	6	0.04	0.057	-97.03427202	27.87107522	15.61260161	2.807	Fixed
SWG-2019-00067	rw257	aht	2.7	R8s 5840R91052	10/26/2021	9:02:45 AM	6	0.04	0.057	-97.03430859	27.87105888	13.22452026	2.806	Fixed
SWG-2019-00067	rw258	aht	2.7	R8s 5840R91052	10/26/2021	9:03:24 AM	6	0.04	0.057	-97.03437475	27.87105832	21.37773676	2.701	Fixed
SWG-2019-00067	rw259	aht	2.7	R8s 5840R91052	10/26/2021	9:04:00 AM	8	0.04	0.057	-97.03443122	27.87104975	18.51000173	2.763	Fixed
SWG-2019-00067	rw260	aht	2.7	R8s 5840R91052	10/26/2021	9:04:24 AM	6	0.04	0.057	-97.03452658	27.87106622	31.38804774	2.766	Fixed
SWG-2019-00067	rw261	aht	2.7	R8s 5840R91052	10/26/2021	9:04:59 AM	6	0.04	0.056	-97.03457329	27.87101834	23.03647475	2.767	Fixed
SWG-2019-00067	rw262	aht	2.7	R8s 5840R91052	10/26/2021	9:05:27 AM	7	0.04	0.056	-97.03456901	27.87098342	12.77197322	2.753	Fixed
SWG-2019-00067	rw263	aht	2.7	R8s 5840R91052	10/26/2021	9:06:16 AM	6	0.04	0.056	-97.03459341	27.87100997	12.46248872	2.731	Fixed
SWG-2019-00067	rw264	aht	2.7	R8s 5840R91052	10/26/2021	9:07:01 AM	6	0.04	0.056	-97.03467582	27.87102614	27.26795095	2.7	Fixed
SWG-2019-00067	rw265	aht	2.7	R8s 5840R91052	10/26/2021	9:07:30 AM	6	0.04	0.056	-97.03467567	27.87096029	23.94220594	2.74	Fixed
SWG-2019-00067	rw266	aht	2.7	R8s 5840R91052	10/26/2021	9:07:58 AM	6	0.041	0.056	-97.03472983	27.87089742	28.78724412	2.731	Fixed
SWG-2019-00067	rw267	aht	2.7	R8s 5840R91052	10/26/2021	9:08:29 AM	6	0.041	0.057	-97.03474993	27.87084214	21.11880634	2.75	Fixed
SWG-2019-00067	rw268	aht	2.7	R8s 5840R91052	10/26/2021	9:08:50 AM	6	0.041	0.057	-97.03476021	27.87081293	11.12936674	2.768	Fixed
SWG-2019-00067	rw269	aht	2.7	R8s 5840R91052	10/26/2021	9:09:29 AM	6	0.042	0.057	-97.03478938	27.87082324	10.14266676	2.728	Fixed
SWG-2019-00067	rw270	aht	2.7	R8s 5840R91052	10/26/2021	9:09:59 AM	7	0.042	0.057	-97.03479895	27.87083924	6.586932595	2.77	Fixed
SWG-2019-00067	rw271	aht	2.7	R8s 5840R91052	10/26/2021	9:10:48 AM	8	0.042	0.057	-97.03477869	27.87083914	6.546122211	2.751	Fixed
SWG-2019-00067	rw272	aht	2.7	R8s 5840R91052	10/26/2021	9:11:20 AM	6	0.043	0.058	-97.03482673	27.87084159	15.54722036	2.791	Fixed
SWG-2019-00067	rw273	aht	2.7	R8s 5840R91052	10/26/2021	9:12:23 AM	6	0.042	0.057	-97.0349075	27.87083161	26.34873462	2.763	Fixed
SWG-2019-00067	rw274	aht	2.7	R8s 5840R91052	10/26/2021	9:56:41 AM	7	0.043	0.057	-97.03506054	27.87082359	49.53110703	2.798	Fixed
SWG-2019-00067	rw275	aht	2.7	R8s 5840R91052	10/26/2021	9:57:47 AM	6	0.043	0.057	-97.03516984	27.8708072	35.81404681	2.803	Fixed
SWG-2019-00067	rw276	aht	2.7	R8s 5840R91052	10/26/2021	9:58:20 AM	6	0.043	0.058	-97.035038	27.87112642	123.6333997	2.748	Fixed
SWG-2019-00067	rw277	elevation	1.8	R8s 5840R91052	10/26/2021	9:58:53 AM	6	0.023	0.039	-97.03620379	27.8692155	790.3020355	3.147	Fixed
SWG-2019-00067	rw278	elevation	1.8	R8s 5840R91052	10/26/2021	9:59:36 AM	9	0.027	0.046	-97.03635207	27.8689703	101.2071485	3.008	Fixed
SWG-2019-00067	rw279	elevation	1.8	R8s 5840R91052	10/26/2021	10:05:03 AM	6	0.026	0.047	-97.03644117	27.86882373	60.56894387	2.811	Fixed
SWG-2019-00067	rw280	elevation	1.7	R8s 5840R91052	10/26/2021	10:09:36 AM	6	0.029	0.051	-97.03649348	27.86864481	67.20874574	3.041	Fixed
SWG-2019-00067	rw281	elevation	1.7	R8s 5840R91052	10/26/2021	10:15:25 PM	6	0.029	0.051	-97.03666397	27.86837398	112.82878	3.352	Fixed

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: Geo1

SWG_No	OID	Max_PDOP	Corr_Type	Rcvr_Type	GPS_Date	GPS_Time	Unfilt_Pos	Horz_Prec	Easting	Northing	Distance_Prev
SWG-2019-00067	0	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:35:39am	11	1.6	-97.044723	27.843873	N/A
SWG-2019-00067	1	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:59:18am	14	1.4	-97.040864	27.843536	3950.73
SWG-2019-00067	2	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:00:19am	7	1.3	-97.040933	27.843522	22.61
SWG-2019-00067	3	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:01:09am	7	1.4	-97.041169	27.843522	83.32
SWG-2019-00067	4	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:02:10am	14	1.3	-97.041425	27.843482	90.84
SWG-2019-00067	5	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:04:04am	13	1.4	-97.042124	27.843511	245.84
SWG-2019-00067	6	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:28:15am	13	1.4	-97.037719	27.848660	2136.43
SWG-2019-00067	7	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:51:37am	5	1.5	-97.035017	27.848704	1932.50
SWG-2019-00067	8	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:28:23am	11	1.6	-97.032178	27.848739	1981.73
SWG-2019-00067	9	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:50:34am	8	1.6	-97.029109	27.848705	1967.05
SWG-2019-00067	10	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	04:27:28pm	514	1.8	-97.047761	27.848772	56041.48

USACE Standard Operating Procedures Verification Table
Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement
Survey Area: SJI
Survey GPS: Geo2

SWG_No	OID	Max_PDOP	Corr_Type	Rcvr_Type	GPS_Date	GPS_Time	Unfilt_Pos	Horz_Prec	Easting	Northing	Distance_Prev
SWG-2019-00067	0	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:43:21am	24	1.4	-97.047089	27.843873	N/A
SWG-2019-00067	1	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:48:00am	6	1.5	-97.045295	27.843536	592.72
SWG-2019-00067	2	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:48:32am	5	1.3	-97.045231	27.843522	21.23
SWG-2019-00067	3	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:49:13am	4	1.3	-97.045181	27.843522	16.23
SWG-2019-00067	4	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:53:39am	3	1.3	-97.045026	27.843482	52.13
SWG-2019-00067	5	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:54:13am	5	1.1	-97.045144	27.843511	39.40
SWG-2019-00067	6	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:12:12am	4	1.4	-97.043341	27.848660	1960.68
SWG-2019-00067	7	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:12:50am	6	1.4	-97.043509	27.848704	56.78
SWG-2019-00067	8	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:13:18am	5	1.3	-97.043556	27.848739	19.47
SWG-2019-00067	9	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:14:40am	4	1.3	-97.043637	27.848705	28.93
SWG-2019-00067	10	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:16:41am	5	1.4	-97.043691	27.848772	30.19
SWG-2019-00067	11	1.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:26:19am	57	1.2	-97.045223	27.849032	503.84
SWG-2019-00067	12	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:26:54am	6	1.3	-97.038113	27.858776	4222.47
SWG-2019-00067	13	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:28:03am	5	1.3	-97.038304	27.858879	72.18
SWG-2019-00067	14	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:28:19am	4	1.2	-97.038335	27.858901	12.68
SWG-2019-00067	15	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:32:49am	9	1.4	-97.038863	27.859166	196.21
SWG-2019-00067	16	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:35:43am	4	1.6	-97.038599	27.859143	85.85
SWG-2019-00067	17	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:36:07am	4	1.6	-97.038526	27.859126	24.33
SWG-2019-00067	18	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:51:40am	7	1.2	-97.035381	27.863501	1887.81
SWG-2019-00067	19	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:53:01am	4	1.2	-97.035643	27.863631	97.13
SWG-2019-00067	20	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:53:45am	4	1.2	-97.035715	27.863682	29.57
SWG-2019-00067	21	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:55:27am	10	1.3	-97.036051	27.863839	122.62
SWG-2019-00067	22	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:57:45am	10	1.4	-97.036051	27.863838	0.42
SWG-2019-00067	23	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:58:43am	5	1.2	-97.036151	27.863833	32.16
SWG-2019-00067	24	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:01:36am	5	1.4	-97.036714	27.864176	220.69
SWG-2019-00067	25	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:00:52am	3	1.5	-97.032657	27.868430	2027.32
SWG-2019-00067	26	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:01:07am	4	1.5	-97.032691	27.868432	11.20
SWG-2019-00067	27	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:01:27am	2	1.4	-97.032723	27.868441	10.66
SWG-2019-00067	28	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:03:00am	4	1.4	-97.033044	27.868627	123.99
SWG-2019-00067	29	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:03:36am	2	1.4	-97.033175	27.868642	42.61
SWG-2019-00067	30	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:06:02am	27	1.4	-97.034059	27.869047	321.45
SWG-2019-00067	31	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:19:32am	30	1.5	-97.032127	27.872076	1265.93
SWG-2019-00067	32	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:43:36am	34	1.4	-97.029325	27.872985	963.92
SWG-2019-00067	33	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:44:20am	4	1.4	-97.029357	27.873001	11.94
SWG-2019-00067	34	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:45:35am	3	1.3	-97.029793	27.873216	161.03
SWG-2019-00067	35	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:46:37am	3	1.4	-97.030030	27.873359	92.63
SWG-2019-00067	36	1.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:48:17am	3	1.4	-97.030287	27.873516	100.92
SWG-2019-00068	37	0.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	11:50:34am	14	1.6	-97.030967	27.873826	246.78
SWG-2019-00069	38	3.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	04:28:47pm	433	11.3	-97.047771	28.026121	55638.09

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SWG_No	OID	Max_PDOP	Corr_Type	Rcvr_Type	GPS_Date	GPS_Time	Unfilt_Pos	Horz_Prec	Easting	Northing	Distance_Prev
SWG-2019-00067	0	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:36:37am	35	1.4	-97.044601	27.843438	N/A
SWG-2019-00067	1	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:38:36am	10	1.5	-97.044572	27.843435	9.44
SWG-2019-00067	2	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:39:05am	18	1.5	-97.044542	27.843430	9.87
SWG-2019-00067	3	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:39:40am	7	1.5	-97.044513	27.843426	9.22
SWG-2019-00067	4	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:40:05am	19	1.4	-97.044479	27.843420	11.42
SWG-2019-00067	5	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:40:39am	28	1.4	-97.044453	27.843414	8.46
SWG-2019-00067	6	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:42:28am	7	1.6	-97.044423	27.843410	9.83
SWG-2019-00067	7	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:42:53am	7	1.4	-97.044392	27.843403	10.45
SWG-2019-00067	8	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:43:11am	10	1.4	-97.044362	27.843398	9.72
SWG-2019-00067	9	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:43:51am	7	1.4	-97.044330	27.843394	10.53
SWG-2019-00067	10	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:44:12am	8	1.4	-97.044300	27.843390	9.82
SWG-2019-00067	11	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:44:40am	15	1.4	-97.044273	27.843386	8.94
SWG-2019-00067	12	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:45:54am	8	1.4	-97.044238	27.843377	11.56
SWG-2019-00067	13	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:46:16am	6	1.4	-97.044210	27.843371	9.47
SWG-2019-00067	14	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:46:39am	9	1.4	-97.044178	27.843366	10.33
SWG-2019-00067	15	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:47:17am	14	1.4	-97.044147	27.843359	10.48
SWG-2019-00067	16	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:47:32am	7	1.4	-97.044116	27.843355	10.08
SWG-2019-00067	17	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:48:16am	6	1.4	-97.044086	27.843349	10.00
SWG-2019-00067	18	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:48:50am	6	1.4	-97.044055	27.843344	10.00
SWG-2019-00067	19	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	07:49:13am	7	1.4	-97.044025	27.843339	10.00
SWG-2019-00067	20	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:16:17am	14	1.5	-97.042811	27.848542	1931.91
SWG-2019-00067	21	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:16:44am	17	1.5	-97.042777	27.848528	11.98
SWG-2019-00067	22	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:17:10am	11	1.6	-97.042749	27.848520	9.55
SWG-2019-00067	23	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:17:37am	9	1.5	-97.042720	27.848516	9.35
SWG-2019-00067	24	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:17:55am	18	1.5	-97.042698	27.848508	7.73
SWG-2019-00067	25	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:18:27am	9	1.4	-97.042675	27.848503	7.81
SWG-2019-00067	26	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:18:57am	13	1.4	-97.042631	27.848484	15.59
SWG-2019-00067	27	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:19:38am	9	1.4	-97.042599	27.848481	10.51
SWG-2019-00067	28	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:20:00am	15	1.5	-97.042572	27.848473	9.25
SWG-2019-00067	29	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:20:43am	9	1.4	-97.042539	27.848477	10.78
SWG-2019-00067	30	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:21:03am	7	1.4	-97.042515	27.848469	8.26
SWG-2019-00067	31	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:21:26am	25	1.5	-97.042492	27.848461	8.03
SWG-2019-00067	32	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:22:23am	15	1.4	-97.042458	27.848452	11.29
SWG-2019-00067	33	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:22:55am	14	1.6	-97.042426	27.848442	11.06
SWG-2019-00067	34	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:23:37am	6	1.4	-97.042393	27.848437	10.72
SWG-2019-00067	35	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:24:07am	11	1.5	-97.042364	27.848431	9.67
SWG-2019-00067	36	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:24:27am	6	1.5	-97.042339	27.848425	8.50
SWG-2019-00067	37	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:24:59am	6	1.4	-97.042309	27.848418	10.00
SWG-2019-00067	38	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:25:21am	6	1.4	-97.042279	27.848411	10.00
SWG-2019-00067	39	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:25:47am	7	1.5	-97.042249	27.848404	10.00
SWG-2019-00067	40	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:40:33am	16	2.3	-97.040371	27.853541	1963.82
SWG-2019-00067	41	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:41:04am	50	1.6	-97.040335	27.853532	12.12
SWG-2019-00067	42	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:42:02am	20	1.3	-97.040307	27.853524	9.55
SWG-2019-00067	43	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:42:36am	9	1.3	-97.040274	27.853514	11.42
SWG-2019-00067	44	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:42:56am	22	1.3	-97.040252	27.853503	8.15
SWG-2019-00067	45	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:43:28am	11	1.3	-97.040226	27.853492	9.25
SWG-2019-00067	46	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:43:50am	14	1.4	-97.040189	27.853480	12.64
SWG-2019-00067	47	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:44:21am	7	1.3	-97.040155	27.853469	11.58
SWG-2019-00067	48	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:44:39am	8	1.3	-97.040132	27.853456	9.06

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SWG-2019-00067	49	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:45:00am	26	1.3	-97.040102	27.853444	10.50
SWG-2019-00067	50	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:45:40am	18	1.3	-97.040080	27.853432	8.47
SWG-2019-00067	51	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:46:18am	6	1.3	-97.040043	27.853422	12.57
SWG-2019-00067	52	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:46:46am	11	1.3	-97.040026	27.853408	7.43
SWG-2019-00067	53	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:47:34am	6	1.3	-97.039989	27.853387	13.96
SWG-2019-00067	54	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:48:02am	20	1.4	-97.039952	27.853394	12.14
SWG-2019-00067	55	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:48:29am	22	1.4	-97.039931	27.853376	9.48
SWG-2019-00067	56	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:48:55am	19	1.4	-97.039884	27.853357	16.76
SWG-2019-00067	57	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:49:17am	21	1.4	-97.039855	27.853346	10.00
SWG-2019-00067	58	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	08:49:33am	18	1.4	-97.039827	27.853335	10.00
SWG-2019-00067	59	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:29:13am	39	1.5	-97.037542	27.858544	2032.96
SWG-2019-00067	60	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:30:08am	29	1.5	-97.037503	27.858518	16.01
SWG-2019-00067	61	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:30:54am	10	1.5	-97.037477	27.858500	10.58
SWG-2019-00067	62	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:31:20am	17	1.5	-97.037449	27.858498	9.23
SWG-2019-00067	63	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:31:49am	9	1.5	-97.037416	27.858480	12.27
SWG-2019-00067	64	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:32:25am	10	1.5	-97.037392	27.858467	9.24
SWG-2019-00067	65	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:32:53am	6	1.4	-97.037360	27.858458	10.91
SWG-2019-00067	66	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:33:22am	9	1.5	-97.037340	27.858442	8.44
SWG-2019-00067	67	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:33:52am	12	1.5	-97.037292	27.858424	17.16
SWG-2019-00067	68	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:34:22am	16	1.5	-97.037260	27.858410	11.45
SWG-2019-00067	69	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:34:56am	14	1.5	-97.037227	27.858396	11.64
SWG-2019-00067	70	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:35:49am	11	1.5	-97.037195	27.858389	10.76
SWG-2019-00067	71	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:36:09am	6	1.5	-97.037159	27.858381	11.83
SWG-2019-00067	72	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:36:26am	7	1.5	-97.037148	27.858363	7.60
SWG-2019-00067	73	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:39:58am	6	1.5	-97.037120	27.858351	10.00
SWG-2019-00067	74	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:40:15am	7	1.5	-97.037092	27.858338	10.00
SWG-2019-00067	75	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:40:34am	7	1.5	-97.037065	27.858326	10.00
SWG-2019-00067	76	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:52:08am	18	1.5	-97.034872	27.863295	1940.51
SWG-2019-00067	77	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:53:04am	18	1.5	-97.034838	27.863277	12.65
SWG-2019-00067	78	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:53:30am	13	1.6	-97.034804	27.863260	12.45
SWG-2019-00067	79	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:53:57am	8	1.5	-97.034776	27.863247	10.31
SWG-2019-00067	80	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:54:21am	11	1.5	-97.034741	27.863234	12.36
SWG-2019-00067	81	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:54:46am	15	1.5	-97.034702	27.863216	14.31
SWG-2019-00067	82	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:55:16am	11	1.5	-97.034676	27.863199	10.31
SWG-2019-00067	83	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:55:41am	7	1.5	-97.034644	27.863185	11.57
SWG-2019-00067	84	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:56:03am	7	1.5	-97.034614	27.863174	10.31
SWG-2019-00067	85	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:56:40am	16	1.5	-97.034587	27.863164	9.56
SWG-2019-00067	86	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:57:12am	6	1.5	-97.034561	27.863146	10.59
SWG-2019-00067	87	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:57:29am	8	1.5	-97.034527	27.863138	11.32
SWG-2019-00067	88	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:57:47am	6	1.5	-97.034498	27.863133	9.66
SWG-2019-00067	89	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:58:07am	12	1.5	-97.034462	27.863113	13.68
SWG-2019-00067	90	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:58:43am	13	1.6	-97.034426	27.863100	12.50
SWG-2019-00067	91	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:59:08am	7	1.5	-97.034396	27.863084	11.21
SWG-2019-00067	92	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	09:59:25am	6	1.5	-97.034369	27.863072	10.00
SWG-2019-00067	93	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:00:03am	6	1.6	-97.034341	27.863060	10.00
SWG-2019-00067	94	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:00:26am	6	1.6	-97.034313	27.863048	10.00
SWG-2019-00067	95	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:00:57am	6	1.6	-97.034285	27.863036	10.00
SWG-2019-00067	96	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:01:29am	8	1.6	-97.034258	27.863024	10.00
SWG-2019-00067	97	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:29:00am	27	1.6	-97.031955	27.868099	1989.80
SWG-2019-00067	98	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:29:38am	6	1.7	-97.031923	27.868091	10.68
SWG-2019-00067	99	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:30:06am	13	1.7	-97.031900	27.868080	8.55

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SWG-2019-00067	100	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:30:29am	12	1.5	-97.031869	27.868066	11.21
SWG-2019-00067	101	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:30:48am	10	1.4	-97.031841	27.868052	10.32
SWG-2019-00067	102	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:31:08am	26	1.5	-97.031804	27.868035	13.50
SWG-2019-00067	103	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:31:45am	13	1.4	-97.031771	27.868018	12.38
SWG-2019-00067	104	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:32:12am	10	1.4	-97.031737	27.868002	12.24
SWG-2019-00067	105	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:32:35am	6	1.4	-97.031707	27.867993	10.49
SWG-2019-00067	106	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:32:52am	14	1.5	-97.031672	27.867981	12.04
SWG-2019-00067	107	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:33:28am	20	1.5	-97.031650	27.867966	8.92
SWG-2019-00067	108	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:34:02am	18	1.5	-97.031612	27.867952	13.19
SWG-2019-00067	109	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:34:27am	8	1.5	-97.031593	27.867945	6.72
SWG-2019-00067	110	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:34:51am	6	1.5	-97.031566	27.867932	10.00
SWG-2019-00067	111	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:35:22am	6	1.5	-97.031538	27.867920	10.00
SWG-2019-00067	112	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:35:48am	7	1.5	-97.031510	27.867907	10.00
SWG-2019-00067	113	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:36:06am	7	1.5	-97.031483	27.867895	10.00
SWG-2019-00067	114	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:51:49am	16	1.9	-97.028930	27.872776	1957.08
SWG-2019-00067	115	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:52:16am	12	1.9	-97.028896	27.872756	13.11
SWG-2019-00067	116	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:52:39am	11	1.8	-97.028868	27.872739	11.25
SWG-2019-00067	117	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:52:59am	8	1.9	-97.028839	27.872721	11.32
SWG-2019-00067	118	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:53:15am	6	1.5	-97.028810	27.872708	10.26
SWG-2019-00067	119	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:53:27am	6	1.6	-97.028793	27.872695	7.24
SWG-2019-00067	120	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:53:40am	11	1.5	-97.028767	27.872681	10.08
SWG-2019-00067	121	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:54:04am	10	1.5	-97.028743	27.872666	9.24
SWG-2019-00067	122	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:54:24am	10	1.5	-97.028711	27.872648	12.36
SWG-2019-00067	123	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:54:45am	6	1.5	-97.028680	27.872638	10.80
SWG-2019-00067	124	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:55:07am	6	1.5	-97.028657	27.872624	9.08
SWG-2019-00067	125	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:55:31am	19	1.6	-97.028629	27.872607	10.96
SWG-2019-00067	126	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:56:03am	14	1.5	-97.028580	27.872583	17.96
SWG-2019-00067	127	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:56:28am	9	1.6	-97.028553	27.872568	10.25
SWG-2019-00067	128	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:57:04am	6	1.5	-97.028518	27.872550	12.98
SWG-2019-00067	129	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:57:23am	8	1.5	-97.028501	27.872539	6.94
SWG-2019-00067	130	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:57:41am	7	1.5	-97.028475	27.872524	10.00
SWG-2019-00067	131	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:58:09am	7	1.5	-97.028448	27.872510	10.00
SWG-2019-00067	132	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-05-23	10:58:24am	6	1.5	-97.028422	27.872496	10.00
SWG-2019-00067	133	2.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:36:04am	97	0.3	-97.008974	27.900310	11905.44
SWG-2019-00067	134	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:38:37am	28	0.3	-97.008946	27.900298	10.23
SWG-2019-00067	135	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:40:18am	8	0.3	-97.008920	27.900283	10.23
SWG-2019-00067	136	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:40:53am	36	0.3	-97.008892	27.900267	10.62
SWG-2019-00067	137	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:41:46am	33	0.3	-97.008870	27.900254	8.53
SWG-2019-00067	138	3.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:42:41am	106	0.3	-97.008841	27.900239	10.91
SWG-2019-00067	139	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:45:29am	39	0.3	-97.008821	27.900222	8.94
SWG-2019-00067	140	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:47:07am	36	0.3	-97.008791	27.900203	11.59
SWG-2019-00067	141	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:48:24am	20	0.3	-97.008767	27.900187	9.83
SWG-2019-00067	142	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:49:25am	19	0.3	-97.008747	27.900172	8.50
SWG-2019-00067	143	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:51:07am	12	0.3	-97.008717	27.900155	11.53
SWG-2019-00067	144	3.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:51:48am	86	0.3	-97.008695	27.900141	8.49
SWG-2019-00067	145	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:54:15am	9	0.3	-97.008675	27.900123	9.54
SWG-2019-00067	146	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:55:41am	12	0.3	-97.008642	27.900108	11.74
SWG-2019-00067	147	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:56:36am	6	0.3	-97.008611	27.900092	11.65
SWG-2019-00067	148	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:57:20am	6	0.3	-97.008592	27.900080	7.61
SWG-2019-00067	149	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	08:58:58am	6	0.3	-97.008563	27.900063	11.25
SWG-2019-00067	150	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:00:09am	6	0.3	-97.008535	27.900047	10.63

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Aquatic Survey for the Corpus Christi Ship Channel Deepening Project Environmental Impact Statement

Survey Area: SJI

Survey GPS: Geo3

SWG-2019-00067	151	3.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:00:59am	8	0.3	-97.008506	27.900034	10.67
SWG-2019-00067	152	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:02:23am	6	0.3	-97.008483	27.900021	8.65
SWG-2019-00067	153	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:02:48am	8	0.3	-97.008464	27.900007	8.03
SWG-2019-00067	154	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:03:13am	8	0.3	-97.008438	27.899992	10.00
SWG-2019-00067	155	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:03:36am	7	0.3	-97.008412	27.899977	10.00
SWG-2019-00067	156	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:28:08am	78	0.3	-97.005533	27.904752	1969.56
SWG-2019-00067	157	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:29:53am	20	0.3	-97.005511	27.904738	8.84
SWG-2019-00067	158	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:30:53am	9	0.3	-97.005488	27.904723	9.08
SWG-2019-00067	159	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:31:22am	11	0.3	-97.005460	27.904707	10.94
SWG-2019-00067	160	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:31:52am	20	0.3	-97.005435	27.904692	9.72
SWG-2019-00067	161	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:32:45am	10	0.3	-97.005409	27.904674	10.47
SWG-2019-00067	162	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:33:25am	6	0.3	-97.005387	27.904663	8.42
SWG-2019-00067	163	2.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:33:48am	16	0.3	-97.005360	27.904647	10.42
SWG-2019-00067	164	2.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:34:20am	30	0.3	-97.005333	27.904631	10.61
SWG-2019-00067	165	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:35:09am	7	0.3	-97.005306	27.904614	10.40
SWG-2019-00067	166	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:36:19am	14	0.3	-97.005283	27.904600	9.09
SWG-2019-00067	167	3.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:36:55am	21	0.3	-97.005259	27.904584	9.89
SWG-2019-00067	168	2.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:37:51am	6	0.3	-97.005231	27.904566	11.04
SWG-2019-00067	169	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:38:41am	7	0.3	-97.005204	27.904555	9.49
SWG-2019-00067	170	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:39:16am	6	0.3	-97.005177	27.904540	10.50
SWG-2019-00067	171	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:40:14am	6	0.3	-97.005149	27.904523	10.72
SWG-2019-00067	172	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:40:57am	6	0.3	-97.005127	27.904508	9.24
SWG-2019-00067	173	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:42:14am	7	0.3	-97.005103	27.904490	9.96
SWG-2019-00067	174	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:42:49am	6	0.3	-97.005075	27.904474	10.59
SWG-2019-00067	175	3.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:43:42am	18	0.3	-97.005051	27.904460	9.38
SWG-2019-00067	176	3.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:44:42am	9	0.3	-97.005024	27.904444	10.65
SWG-2019-00067	177	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:45:01am	6	0.3	-97.005006	27.904433	7.05
SWG-2019-00067	178	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:45:22am	6	0.3	-97.004980	27.904417	10.00
SWG-2019-00067	179	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:45:50am	6	0.3	-97.004955	27.904401	10.00
SWG-2019-00067	180	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	09:59:45am	68	0.3	-97.002014	27.909208	1989.26
SWG-2019-00067	181	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:01:12am	53	0.3	-97.001987	27.909189	11.24
SWG-2019-00067	182	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:02:24am	35	0.3	-97.001973	27.909169	8.51
SWG-2019-00067	183	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:03:34am	11	0.3	-97.001949	27.909151	10.17
SWG-2019-00067	184	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:04:03am	10	0.3	-97.001925	27.909135	9.48
SWG-2019-00067	185	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:04:31am	8	0.3	-97.001900	27.909116	10.80
SWG-2019-00067	186	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:05:00am	14	0.3	-97.001873	27.909100	10.31
SWG-2019-00067	187	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:05:42am	21	0.3	-97.001850	27.909083	9.83
SWG-2019-00067	188	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:06:21am	12	0.3	-97.001827	27.909069	8.89
SWG-2019-00067	189	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:06:57am	6	0.3	-97.001804	27.909051	9.90
SWG-2019-00067	190	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:07:50am	18	0.3	-97.001781	27.909032	10.16
SWG-2019-00067	191	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:08:30am	6	0.3	-97.001754	27.909016	10.53
SWG-2019-00067	192	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:09:15am	7	0.3	-97.001729	27.908999	10.30
SWG-2019-00067	193	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:10:03am	13	0.3	-97.001704	27.908984	9.65
SWG-2019-00067	194	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:10:36am	7	0.3	-97.001678	27.908965	10.74
SWG-2019-00067	195	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:11:07am	6	0.3	-97.001657	27.908948	9.37
SWG-2019-00067	196	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:11:50am	8	0.3	-97.001631	27.908931	10.34
SWG-2019-00067	197	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:12:30am	11	0.3	-97.001606	27.908915	9.96
SWG-2019-00067	198	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:13:09am	6	0.3	-97.001585	27.908900	8.76
SWG-2019-00067	199	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:14:14am	8	0.3	-97.001563	27.908883	9.35
SWG-2019-00067	200	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:14:32am	7	0.3	-97.001541	27.908871	8.47
SWG-2019-00067	201	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:14:57am	7	0.3	-97.001516	27.908854	10.00

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SWG-2019-00067	202	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:15:20am	8	0.3	-97.001492	27.908837	10.00
SWG-2019-00067	203	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:28:43am	47	0.3	-96.998443	27.913687	2019.71
SWG-2019-00067	204	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:29:58am	16	0.3	-96.998416	27.913666	11.65
SWG-2019-00067	205	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:30:43am	9	0.3	-96.998394	27.913650	9.17
SWG-2019-00067	206	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:31:10am	13	0.3	-96.998367	27.913634	10.58
SWG-2019-00067	207	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:31:40am	6	0.3	-96.998344	27.913618	9.44
SWG-2019-00067	208	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:32:07am	6	0.3	-96.998319	27.913600	10.34
SWG-2019-00067	209	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:32:32am	14	0.3	-96.998295	27.913582	10.27
SWG-2019-00067	210	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:33:19am	6	0.3	-96.998274	27.913565	8.99
SWG-2019-00067	211	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:33:42am	7	0.3	-96.998247	27.913548	10.82
SWG-2019-00067	212	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:34:08am	18	0.3	-96.998225	27.913531	9.26
SWG-2019-00067	213	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:34:53am	8	0.3	-96.998203	27.913515	9.14
SWG-2019-00067	214	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:35:23am	15	0.3	-96.998173	27.913497	11.84
SWG-2019-00067	215	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:36:29am	6	0.3	-96.998148	27.913484	9.25
SWG-2019-00067	216	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:36:56am	7	0.3	-96.998125	27.913466	10.12
SWG-2019-00067	217	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:37:33am	10	0.3	-96.998102	27.913448	9.74
SWG-2019-00067	218	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:38:05am	11	0.3	-96.998079	27.913430	9.79
SWG-2019-00067	219	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:38:51am	7	0.3	-96.998051	27.913412	11.53
SWG-2019-00067	220	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:39:38am	13	0.3	-96.998028	27.913396	9.23
SWG-2019-00067	221	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:40:28am	8	0.3	-96.998005	27.913379	9.59
SWG-2019-00067	222	2.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:40:57am	12	0.3	-96.997985	27.913364	8.37
SWG-2019-00067	223	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:41:49am	18	0.3	-96.997960	27.913340	12.19
SWG-2019-00067	224	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:42:10am	8	0.3	-96.997940	27.913334	6.64
SWG-2019-00067	225	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:42:35am	8	0.3	-96.997916	27.913317	10.00
SWG-2019-00067	226	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:42:57am	6	0.3	-96.997891	27.913300	10.00
SWG-2019-00067	227	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:56:17am	40	0.3	-96.994804	27.918058	1996.77
SWG-2019-00067	228	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:57:25am	25	0.3	-96.994778	27.918038	11.18
SWG-2019-00067	229	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:58:23am	7	0.3	-96.994757	27.918022	9.03
SWG-2019-00067	230	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:58:42am	15	0.3	-96.994732	27.918004	10.39
SWG-2019-00067	231	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:59:09am	8	0.3	-96.994706	27.917988	10.19
SWG-2019-00067	232	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	10:59:37am	11	0.3	-96.994683	27.917973	9.24
SWG-2019-00067	233	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:00:06am	15	0.3	-96.994657	27.917954	10.83
SWG-2019-00067	234	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:00:50am	10	0.3	-96.994635	27.917936	9.51
SWG-2019-00067	235	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:01:18am	47	0.3	-96.994608	27.917921	10.47
SWG-2019-00067	236	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:02:37am	9	0.3	-96.994585	27.917903	9.70
SWG-2019-00067	237	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:03:06am	7	0.3	-96.994561	27.917886	10.05
SWG-2019-00067	238	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:03:38am	9	0.3	-96.994538	27.917868	10.14
SWG-2019-00067	239	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:04:08am	9	0.3	-96.994516	27.917854	8.64
SWG-2019-00067	240	2.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:05:06am	9	0.3	-96.994491	27.917832	11.19
SWG-2019-00067	241	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:05:57am	6	0.3	-96.994465	27.917815	10.51
SWG-2019-00067	242	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:06:27am	8	0.3	-96.994440	27.917799	9.87
SWG-2019-00067	243	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:06:59am	7	0.3	-96.994417	27.917782	9.62
SWG-2019-00067	244	2.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:07:28am	12	0.3	-96.994392	27.917768	9.58
SWG-2019-00067	245	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:08:09am	7	0.3	-96.994367	27.917748	10.76
SWG-2019-00067	246	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:08:50am	10	0.3	-96.994346	27.917728	10.01
SWG-2019-00067	247	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:09:22am	7	0.3	-96.994320	27.917716	9.63
SWG-2019-00067	248	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:09:59am	7	0.3	-96.994295	27.917696	10.73
SWG-2019-00067	249	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:10:23am	6	0.3	-96.994276	27.917688	6.70
SWG-2019-00067	250	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:10:49am	6	0.3	-96.994252	27.917671	10.00
SWG-2019-00067	251	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:11:11am	8	0.3	-96.994228	27.917654	10.00
SWG-2019-00067	252	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:26:21am	27	0.3	-96.991124	27.922380	1989.51

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SWG-2019-00067	253	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:27:24am	32	0.3	-96.991097	27.922363	10.84
SWG-2019-00067	254	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:28:15am	8	0.3	-96.991073	27.922346	9.72
SWG-2019-00067	255	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:28:43am	8	0.3	-96.991048	27.922329	10.33
SWG-2019-00067	256	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:29:14am	24	0.3	-96.991025	27.922312	9.42
SWG-2019-00067	257	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:30:09am	12	0.3	-96.991001	27.922295	9.96
SWG-2019-00067	258	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:30:39am	7	0.3	-96.990973	27.922280	10.71
SWG-2019-00067	259	2.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:31:09am	8	0.3	-96.990951	27.922263	9.19
SWG-2019-00067	260	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:31:41am	7	0.3	-96.990924	27.922249	10.21
SWG-2019-00067	261	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:32:13am	27	0.3	-96.990901	27.922229	10.60
SWG-2019-00067	262	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:32:58am	12	0.3	-96.990875	27.922212	10.27
SWG-2019-00067	263	2.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:33:27am	11	0.3	-96.990853	27.922197	8.88
SWG-2019-00067	264	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:34:02am	7	0.3	-96.990828	27.922180	10.11
SWG-2019-00067	265	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:34:37am	7	0.3	-96.990801	27.922163	10.80
SWG-2019-00067	266	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:35:08am	6	0.3	-96.990775	27.922148	9.97
SWG-2019-00067	267	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:35:51am	8	0.3	-96.990751	27.922131	9.87
SWG-2019-00067	268	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:36:27am	11	0.3	-96.990728	27.922113	9.93
SWG-2019-00067	269	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:37:23am	6	0.3	-96.990701	27.922096	10.72
SWG-2019-00067	270	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:37:55am	8	0.3	-96.990681	27.922084	7.95
SWG-2019-00067	271	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:38:23am	12	0.3	-96.990655	27.922067	10.31
SWG-2019-00067	272	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:38:45am	6	0.3	-96.990636	27.922061	6.44
SWG-2019-00067	273	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:39:03am	7	0.3	-96.990611	27.922044	10.00
SWG-2019-00067	274	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	11:39:26am	6	0.3	-96.990587	27.922028	10.00
SWG-2019-00067	275	5.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:10:41pm	35	0.3	-96.987489	27.926891	2031.66
SWG-2019-00067	276	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:12:28pm	24	0.3	-96.987462	27.926877	10.02
SWG-2019-00067	277	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:13:16pm	17	0.3	-96.987438	27.926861	9.69
SWG-2019-00067	278	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:15:51pm	52	0.3	-96.987414	27.926845	9.78
SWG-2019-00067	279	2.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:29:13pm	90	0.3	-96.987393	27.926830	8.71
SWG-2019-00067	280	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:31:16pm	8	0.3	-96.987366	27.926823	8.98
SWG-2019-00067	281	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:31:56pm	7	0.3	-96.987344	27.926801	10.72
SWG-2019-00067	282	2.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:32:27pm	60	0.3	-96.987317	27.926785	10.35
SWG-2019-00067	283	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:33:57pm	31	0.3	-96.987292	27.926764	11.30
SWG-2019-00067	284	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:34:53pm	6	0.3	-96.987266	27.926748	10.18
SWG-2019-00067	285	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:35:27pm	7	0.3	-96.987242	27.926734	9.05
SWG-2019-00067	286	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:35:49pm	9	0.3	-96.987217	27.926718	10.22
SWG-2019-00067	287	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:36:21pm	12	0.3	-96.987192	27.926702	9.94
SWG-2019-00067	288	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:37:05pm	7	0.3	-96.987170	27.926685	9.19
SWG-2019-00067	289	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:37:45pm	7	0.3	-96.987140	27.926667	11.97
SWG-2019-00067	290	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:38:17pm	7	0.3	-96.987115	27.926652	9.57
SWG-2019-00067	291	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:38:57pm	13	0.3	-96.987090	27.926635	10.07
SWG-2019-00067	292	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:39:58pm	7	0.3	-96.987071	27.926624	7.55
SWG-2019-00067	293	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:40:30pm	13	0.3	-96.987046	27.926604	10.66
SWG-2019-00067	294	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:41:22pm	8	0.3	-96.987016	27.926588	11.49
SWG-2019-00067	295	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:41:56pm	24	0.3	-96.986998	27.926573	7.99
SWG-2019-00067	296	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:41:19am	6	0.3	-96.986976	27.926558	8.99
SWG-2019-00067	297	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:41:38am	8	0.3	-96.986951	27.926541	10.00
SWG-2019-00067	298	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-18	12:41:59am	7	0.3	-96.986927	27.926525	10.00
SWG-2019-00067	299	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:29:29am	54	0.3	-97.012460	27.895803	13884.54
SWG-2019-00067	300	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:30:48am	19	0.3	-97.012435	27.895785	10.45
SWG-2019-00067	301	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:31:33am	11	0.3	-97.012410	27.895770	9.75
SWG-2019-00067	302	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:32:06am	9	0.3	-97.012386	27.895757	9.26
SWG-2019-00067	303	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:32:34am	11	0.3	-97.012358	27.895739	11.13

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SWG-2019-00067	304	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:33:04am	10	0.3	-97.012334	27.895726	8.89
SWG-2019-00067	305	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:33:30am	13	0.3	-97.012309	27.895710	10.12
SWG-2019-00067	306	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:34:03am	10	0.3	-97.012283	27.895693	10.24
SWG-2019-00067	307	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:34:27am	13	0.3	-97.012256	27.895677	10.41
SWG-2019-00067	308	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:34:53am	7	0.3	-97.012230	27.895662	10.27
SWG-2019-00067	309	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:35:13am	12	0.3	-97.012203	27.895647	10.11
SWG-2019-00067	310	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:35:43am	6	0.3	-97.012178	27.895632	9.61
SWG-2019-00067	311	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:36:06am	8	0.3	-97.012154	27.895617	9.51
SWG-2019-00067	312	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:36:35am	9	0.3	-97.012127	27.895599	11.22
SWG-2019-00067	313	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:37:05am	6	0.3	-97.012103	27.895584	9.35
SWG-2019-00067	314	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:37:28am	6	0.3	-97.012078	27.895571	9.40
SWG-2019-00067	315	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:37:52am	7	0.3	-97.012049	27.895553	11.17
SWG-2019-00067	316	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:38:17am	14	0.3	-97.012028	27.895541	8.19
SWG-2019-00067	317	3.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:38:54am	11	0.3	-97.012001	27.895528	9.85
SWG-2019-00067	318	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:39:31am	11	0.3	-97.011975	27.895510	10.75
SWG-2019-00067	319	2.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:40:08am	12	0.3	-97.011947	27.895492	11.25
SWG-2019-00067	320	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:40:47am	12	0.3	-97.011927	27.895480	7.71
SWG-2019-00067	321	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:41:24am	10	0.3	-97.011900	27.895465	10.32
SWG-2019-00067	322	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:41:47am	6	0.3	-97.011884	27.895451	7.43
SWG-2019-00067	323	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:42:04am	9	0.3	-97.011858	27.895435	10.00
SWG-2019-00067	324	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	07:42:31am	7	0.3	-97.011832	27.895420	10.00
SWG-2019-00067	325	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:02:26am	34	0.3	-97.015879	27.891187	2019.18
SWG-2019-00067	326	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:03:22am	19	0.3	-97.015855	27.891170	9.84
SWG-2019-00067	327	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:04:01am	10	0.3	-97.015830	27.891154	10.04
SWG-2019-00067	328	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:04:28am	34	0.3	-97.015804	27.891139	9.87
SWG-2019-00067	329	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:05:17am	8	0.3	-97.015788	27.891127	6.87
SWG-2019-00067	330	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:05:41am	6	0.3	-97.015764	27.891113	9.25
SWG-2019-00067	331	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:06:17am	8	0.3	-97.015739	27.891098	9.68
SWG-2019-00067	332	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:06:42am	6	0.3	-97.015714	27.891080	10.48
SWG-2019-00067	333	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:07:03am	6	0.3	-97.015688	27.891063	10.26
SWG-2019-00067	334	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:07:29am	7	0.3	-97.015662	27.891047	10.23
SWG-2019-00067	335	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:07:56am	13	0.3	-97.015635	27.891031	10.63
SWG-2019-00067	336	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:08:25am	7	0.3	-97.015611	27.891015	9.62
SWG-2019-00067	337	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:08:51am	10	0.3	-97.015588	27.891000	9.41
SWG-2019-00067	338	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:09:22am	6	0.3	-97.015561	27.890984	10.35
SWG-2019-00067	339	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:09:47am	6	0.3	-97.015535	27.890969	10.02
SWG-2019-00067	340	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:10:12am	6	0.3	-97.015510	27.890952	10.01
SWG-2019-00067	341	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:10:35am	8	0.3	-97.015486	27.890936	9.75
SWG-2019-00067	342	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:11:05am	10	0.3	-97.015460	27.890919	10.61
SWG-2019-00067	343	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:11:33am	8	0.3	-97.015438	27.890904	8.94
SWG-2019-00067	344	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:12:00am	6	0.3	-97.015408	27.890884	11.87
SWG-2019-00067	345	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:12:37am	8	0.3	-97.015388	27.890870	8.22
SWG-2019-00067	346	2.1	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:13:13am	25	0.3	-97.015360	27.890856	10.56
SWG-2019-00067	347	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:13:39am	6	0.3	-97.015343	27.890843	7.31
SWG-2019-00067	348	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:14:00am	6	0.3	-97.015318	27.890827	10.00
SWG-2019-00067	349	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:14:23am	7	0.3	-97.015293	27.890811	10.00
SWG-2019-00067	350	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:30:27am	63	0.3	-97.019164	27.886620	1971.16
SWG-2019-00067	351	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:31:53am	7	0.3	-97.019138	27.886608	9.57
SWG-2019-00067	352	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:32:17am	13	0.3	-97.019114	27.886596	9.00
SWG-2019-00067	353	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:32:49am	13	0.3	-97.019087	27.886581	10.11
SWG-2019-00067	354	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:33:17am	6	0.3	-97.019061	27.886564	10.49

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Survey Area: SJI
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SWG-2019-00067	355	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:33:38am	6	0.3	-97.019035	27.886549	9.93
SWG-2019-00067	356	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:34:03am	6	0.3	-97.019009	27.886537	9.49
SWG-2019-00067	357	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:34:27am	8	0.3	-97.018981	27.886522	10.67
SWG-2019-00067	358	1.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:34:55am	6	0.3	-97.018957	27.886506	9.52
SWG-2019-00067	359	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:35:18am	10	0.3	-97.018930	27.886491	10.30
SWG-2019-00067	360	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:35:45am	7	0.3	-97.018906	27.886477	9.34
SWG-2019-00067	361	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:36:19am	7	0.3	-97.018878	27.886460	10.89
SWG-2019-00067	362	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:37:00am	6	0.3	-97.018852	27.886447	9.91
SWG-2019-00067	363	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:37:28am	7	0.3	-97.018826	27.886433	9.56
SWG-2019-00067	364	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:38:15am	6	0.3	-97.018801	27.886419	9.66
SWG-2019-00067	365	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:38:43am	9	0.3	-97.018774	27.886403	10.42
SWG-2019-00067	366	1.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:39:19am	7	0.3	-97.018746	27.886390	10.19
SWG-2019-00067	367	1.4	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:39:44am	7	0.3	-97.018721	27.886376	9.61
SWG-2019-00067	368	2.0	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:40:10am	6	0.3	-97.018696	27.886361	9.58
SWG-2019-00067	369	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:40:40am	10	0.3	-97.018668	27.886344	11.30
SWG-2019-00067	370	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:41:21am	10	0.3	-97.018645	27.886330	8.90
SWG-2019-00067	371	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:41:47am	7	0.3	-97.018623	27.886318	8.41
SWG-2019-00067	372	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:42:05am	8	0.3	-97.018596	27.886303	10.00
SWG-2019-00067	373	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:42:28am	8	0.3	-97.018570	27.886289	10.00
SWG-2019-00067	374	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	08:59:45am	24	0.3	-97.022455	27.881966	2011.20
SWG-2019-00067	375	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:00:27am	8	0.3	-97.022426	27.881951	10.70
SWG-2019-00067	376	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:00:53am	7	0.3	-97.022399	27.881937	10.08
SWG-2019-00067	377	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:01:14am	20	0.3	-97.022370	27.881922	10.83
SWG-2019-00067	378	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:01:49am	7	0.3	-97.022345	27.881909	9.35
SWG-2019-00067	379	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:02:12am	6	0.3	-97.022320	27.881894	9.81
SWG-2019-00067	380	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:02:39am	6	0.3	-97.022308	27.881883	5.67
SWG-2019-00067	381	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:02:59am	7	0.3	-97.022285	27.881866	9.58
SWG-2019-00067	382	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:03:29am	6	0.3	-97.022256	27.881851	10.91
SWG-2019-00067	383	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:03:50am	7	0.3	-97.022234	27.881839	8.34
SWG-2019-00067	384	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:04:17am	11	0.3	-97.022206	27.881824	10.36
SWG-2019-00067	385	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:04:48am	14	0.3	-97.022177	27.881809	10.96
SWG-2019-00067	386	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:05:19am	6	0.3	-97.022152	27.881794	9.80
SWG-2019-00067	387	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:05:42am	7	0.3	-97.022128	27.881778	9.62
SWG-2019-00067	388	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:06:07am	11	0.3	-97.022102	27.881765	9.83
SWG-2019-00067	389	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:06:43am	8	0.3	-97.022076	27.881749	10.03
SWG-2019-00067	390	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:07:11am	8	0.3	-97.022046	27.881735	10.91
SWG-2019-00067	391	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:08:14am	7	0.3	-97.022024	27.881724	8.32
SWG-2019-00067	392	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:08:45am	9	0.3	-97.021997	27.881707	10.62
SWG-2019-00067	393	2.3	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:09:32am	6	0.3	-97.021970	27.881691	10.49
SWG-2019-00067	394	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:10:09am	7	0.3	-97.021945	27.881675	9.95
SWG-2019-00067	395	2.2	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:10:42am	12	0.3	-97.021919	27.881661	9.65
SWG-2019-00067	396	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:11:01am	6	0.3	-97.021897	27.881651	8.24
SWG-2019-00067	397	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:11:30am	6	0.3	-97.021871	27.881636	10.00
SWG-2019-00067	398	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:11:51am	7	0.3	-97.021844	27.881621	10.00
SWG-2019-00067	399	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:31:59am	21	0.3	-97.025613	27.877409	1956.62
SWG-2019-00067	400	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:32:36am	6	0.3	-97.025587	27.877393	10.20
SWG-2019-00067	401	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:32:57am	20	0.3	-97.025563	27.877379	9.21
SWG-2019-00067	402	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:33:35am	21	0.3	-97.025534	27.877365	10.68
SWG-2019-00067	403	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:34:11am	6	0.3	-97.025508	27.877351	10.03
SWG-2019-00067	404	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:34:35am	7	0.3	-97.025480	27.877336	10.34
SWG-2019-00067	405	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:34:56am	7	0.3	-97.025454	27.877322	9.96

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SWG-2019-00067	406	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:35:26am	7	0.3	-97.025430	27.877311	8.57
SWG-2019-00067	407	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:35:50am	7	0.3	-97.025405	27.877295	9.91
SWG-2019-00067	408	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:36:15am	7	0.3	-97.025377	27.877280	10.82
SWG-2019-00067	409	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:37:08am	8	0.3	-97.025351	27.877268	9.44
SWG-2019-00067	410	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:37:33am	9	0.3	-97.025324	27.877253	10.31
SWG-2019-00067	411	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:38:01am	7	0.3	-97.025300	27.877240	8.88
SWG-2019-00067	412	1.9	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:38:25am	6	0.3	-97.025271	27.877225	10.86
SWG-2019-00067	413	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:38:51am	8	0.3	-97.025244	27.877212	10.01
SWG-2019-00067	414	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:39:16am	7	0.3	-97.025217	27.877195	10.71
SWG-2019-00067	415	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:39:47am	7	0.3	-97.025189	27.877182	10.24
SWG-2019-00067	416	1.7	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:40:24am	8	0.3	-97.025164	27.877169	9.20
SWG-2019-00067	417	1.5	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:40:55am	6	0.3	-97.025136	27.877156	10.30
SWG-2019-00067	418	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:41:21am	8	0.3	-97.025107	27.877144	10.41
SWG-2019-00067	419	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:41:50am	6	0.3	-97.025083	27.877128	9.58
SWG-2019-00067	420	1.6	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:42:23am	6	0.3	-97.025055	27.877114	10.55
SWG-2019-00067	421	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:42:53am	18	0.3	-97.025033	27.877102	8.13
SWG-2019-00067	422	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:43:16am	6	0.3	-97.025006	27.877091	9.57
SWG-2019-00067	423	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:43:39am	6	0.3	-97.024979	27.877077	10.00
SWG-2019-00067	424	1.8	Real-time SBAS Corrected	Geo 7X (H-Star)	2021-10-19	09:44:02am	6	0.3	-97.024953	27.877063	10.00

MOTT MACDONALD

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DRAFT

Waters and Wetlands Delineation Report for the San Jose Island Beneficial Use Site – Corpus Christi Ship Channel Deepening Project

Port of Corpus Christi Authority, Corpus Christi Ship Channel, Aransas County, Texas

January 2022

Prepared by:
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United States of America

Prepared for:
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Authority
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Waters and Wetlands Delineation Report for the San Jose Island Beneficial Use Site – Corpus Christi Ship Channel Deepening Project

Port of Corpus Christi Authority, Corpus Christi Ship Channel, Aransas County, Texas

January 2022

Issue and revision record

Revision	Date	Originator	Checkout	Approver	Descriptor
V1	12/17/2021	C. Koester		J. Miner	Draft for Internal Review
V2	1/14/2022	C. Koester		K. Thompson	Draft for Client Review

Information class: Standard

Contents

Tables

Figures

Acronyms

AJD	Approved Jurisdictional Determination
AMSL	Above Mean Sea Level
APT	Antecedent Precipitation Tool
CCSC	Corpus Christi Ship Channel
CHHA	Coastal High Hazard Area
CWA	Clean Water Act
BU	Beneficial Use
DD	decimal degrees
E1AB3L	Estuarine, subtidal, aquatic bed, rooted vascular, subtidal
E1UBL	Estuarine, subtidal, unconsolidated bottom, subtidal
E1UBLx	Estuarine, subtidal, unconsolidated bottom, subtidal, excavated
E2EM1N	Estuarine intertidal emergent persistent regularly flooded
E2EM1P	Estuarine intertidal emergent persistent irregularly flooded
E2SS3N	Estuarine intertidal scrub-shrub broadleaf evergreen regularly flooded
E2USM	Estuarine, intertidal, unconsolidated shore, irregularly exposed
E2USN	Estuarine, intertidal, unconsolidated shore, regularly flooded
E2USP	Estuarine intertidal unconsolidated shore, irregularly flooded
EMST	Ecological Mapping Systems of Texas
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
GPS	Global Positioning System
HI-E	Harbor Island East
HTL	High Tide Line
LiDAR	Light Detection and Ranging
M1UBL	Marine subtidal unconsolidated bottom, subtidal
M2USN	Marine intertidal unconsolidated shore, regularly flooded
M2USP	Marine, intertidal unconsolidated shore, irregularly flooded
Manual	USACE 1987 Wetlands Delineation Manual
MAP	Mapping, Assessment, Planning

MHW	Mean High Water
MI	Mustang Island
NAIP	National Agriculture Imagery Program
NASIS	National Soil Information System
NAVD 88	North American Vertical Datum 1988
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OHWM	Ordinary High-Water Mark
PA4	Placement Area 4
PCCA	Port of Corpus Christi Authority
PEM1A	Palustrine, emergent, persistent, temporarily flooded
PEM1Ah	Palustrine, emergent, persistent, temporarily flooded, diked/impounded
PEM1C	Palustrine, emergent, persistent, seasonally flooded
PUSA	Palustrine, unconsolidated shore, temporarily flooded
PUSC	Palustrine, unconsolidated shore, seasonally flooded
PUSCh	Palustrine, unconsolidated shore, seasonally flooded, diked/impounded
PSA	Project Study Area
QA/QC	Quality Assurance/Quality Control
RHA	Rivers and Harbors Act of 1899
RTK	Real-Time Kinematic
SAV	Submerged Aquatic Vegetation
SFHA	Special Flood Hazard Area
SJI	San Jose Island
SS1	Shoreline Stabilization 1
SS2	Shoreline Stabilization 2
SOP	Standard Operating Procedures
SSURGO	Soil Survey Geographic Database

TPWD	Texas Parks and Wildlife Department
Triton	Triton Environmental Solutions
UD	upland determination sample plot
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VLCC	Very Large Crude Carriers
VRS	Virtual Reference Station
WD	wetland determination sample plot
WF	wetland boundary flag
WOUS	Waters of the United States

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1 Introduction

1.1 General Overview

Mott MacDonald, on behalf of the Port of Corpus Christi Authority (PCCA), conducted field delineation surveys during October 18 through October 25, 2021 and on November 11, 2021, to identify potential “Waters of the United States (WOUS)” as defined by the United States Army Corps of Engineers (USACE) (33 CFR 328.3(a)), wetlands (33 CFR 328.3(c)), submerged aquatic vegetation (SAV), and oyster habitat present within the proposed San Jose Island (SJI) Beneficial Use (BU) project site located in Aransas County north of the Corpus Christi Ship Channel near Port Aransas, Texas. The survey covered the SJI BU project site and a 500-foot buffer around this location, referred to within this report as the Project Study Area (PSA). The PSA surveyed area included the SJI BU project site, approximately 593.16 acres, plus the buffered area, for a total of approximately 1,480.2 survey acres.

Figure 1.1-1 provides an overview map of the project location and configuration of the SJI PSA on the United States Geological Survey (USGS) 7.5-minute topographic quadrangles. Figure 1.1-2 shows the SJI BU PSA overlaid onto recent aerial imagery. This waters and wetlands delineation report has been prepared to support a Draft Environmental Impact Statement (EIS) being prepared USACE for the PCCA Corpus Christi Ship Channel (CCSC) Deepening Project.

The findings included in this report are based on review of publicly available mapping and on-site pedestrian field surveys. Publicly available mapping includes historical and recent aerial photography, 7.5-minute USGS topographic quadrangles, United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) soil survey data, United States Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) data, USGS National Hydrography Dataset (NHD), topographic Light Detection and Ranging (LiDAR) elevation one-foot contour data, and Texas Parks and Wildlife Department (TPWD) Ecological Mapping Systems of Texas (EMST). The remainder of this report describes the project’s purpose and need, a discussion of survey methods used to identify and delineate waterbodies, wetlands, and SAV, results of the delineation surveys, and general conclusion and discussion of the survey results.

1.2 Study Area Description

The SJI PSA is comprised of approximately 1,480.2 acres (BU project site approximately 593.16 acres, buffered area approximately 887.04 acres) of gulf beach, upland coastal dunes, dune swale mosaic wetlands, coastal prairie uplands, and estuarine low marsh wetlands located along the Gulf of Mexico beginning at the CCSC and extending north approximately seven miles (See Figure 1.1-3). The SJI PSA varies in width from 1,500 feet wide closer to the CCSC to 2,500 feet wide along the northern part of the PSA. San Jose Island is a natural coastal barrier island that is approximately 21 acres in size and formed by onshore transport of offshore Pleistocene deltaic sands and longshore transport of onshore riverine sands approximately 2,500 years ago (Shew et al., 1981). It is located between the Gulf of Mexico and Aransas Bay. The island is privately-owned except for the beach front portion of the island (waterward from the line of vegetation), which is owned by the state of Texas and open to the general public.

The SJI PSA was significantly altered in several locations when Hurricane Harvey created shoreline breaches in 2017. The shoreline breaches resulted in the formation of unvegetated shallow water ponded areas within and behind the foredune ridge. These ponds have slowly silted in overtime and are significantly reduced in size since the 2017 storm. Habitat types located within the SJI PSA include gulf beach, dune complexes, coastal interdunal wet prairie and upland mosaic wetlands dominated by salt marsh fimbristylis (*Fimbristylis castanea),* saltmeadow cordgrass (*Spartina patens*), and gulfdune paspalum (*Paspalum monostachyum*), coastal prairie uplands dominated by little bluestem (*Schizachyrium scoparium*), partridge pea (*Chamaecrista fasciculata*), four-spike fingergrass (*Eustachys neglecta*), honey mesquite (*Prosopsis glandulosa*), and perennial ragweed (*Ambrosia psilostachya*).

estuarine low marsh wetlands dominated by saltwort (*Batis maritima*), shoregrass (*Distichlis littoralis*), Carolina wolfberry (*Lycium carolinium*), and perennial glassowort (*Sarcocornia ambigua*).

1.3 Purpose and Need

PCCA is proposing to deepen an approximate 13.8-mile section of the CCSC beginning at the southern end of Harbor Island near Port Aransas, Nueces County, Texas and extending into the Gulf of Mexico to accommodate the transit of fully laden Very Large Crude Carriers (VLCCs). The existing channel will be deepened from the current authorized depth of -54 feet and -56 feet mean lower low water (MLLW) to a maximum depth of -79 feet MLLW from Station 110+00 to Station −72+50 (-75 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge) and -81 feet MLLW from Station −72+50 to Station −330+00 (−77 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge). The proposed project includes a 29,000-foot extension of the CCSC from Station -330+00 to Station -620+00 to a maximum depth of -81 MLLW (−77 feet MLLW plus two feet of advanced maintenance and two feet of allowable overdredge) to reach the −80-foot MLLW bathymetric contour in the Gulf of Mexico. The proposed project does not include widening the channel; however, some minor incidental widening of the channel is expected to meet side slope requirements and to maintain stability of the channel.

Approximately 46 million cubic yards (MCY) of new work dredging material (17.1 MCY of clay and 29.2 MCY of sand) will be excavated during project construction. A portion of the dredged material is proposed for placement into the SJI BU site as previously defined under Section 1.2 “Study Area Description” of this report. The purpose of this waters and wetlands delineation report is to evaluate the SJI BU site and a 500-foot buffer around the site for the presence of WOUS and/or wetlands regulated under Section 10 of the Rivers and Harbors Act (RHA) of 1899 and Section 404 of the Clean Water Act (CWA). The waters and wetlands delineation report will support a Draft EIS being prepared for this project by the USACE-Galveston District.

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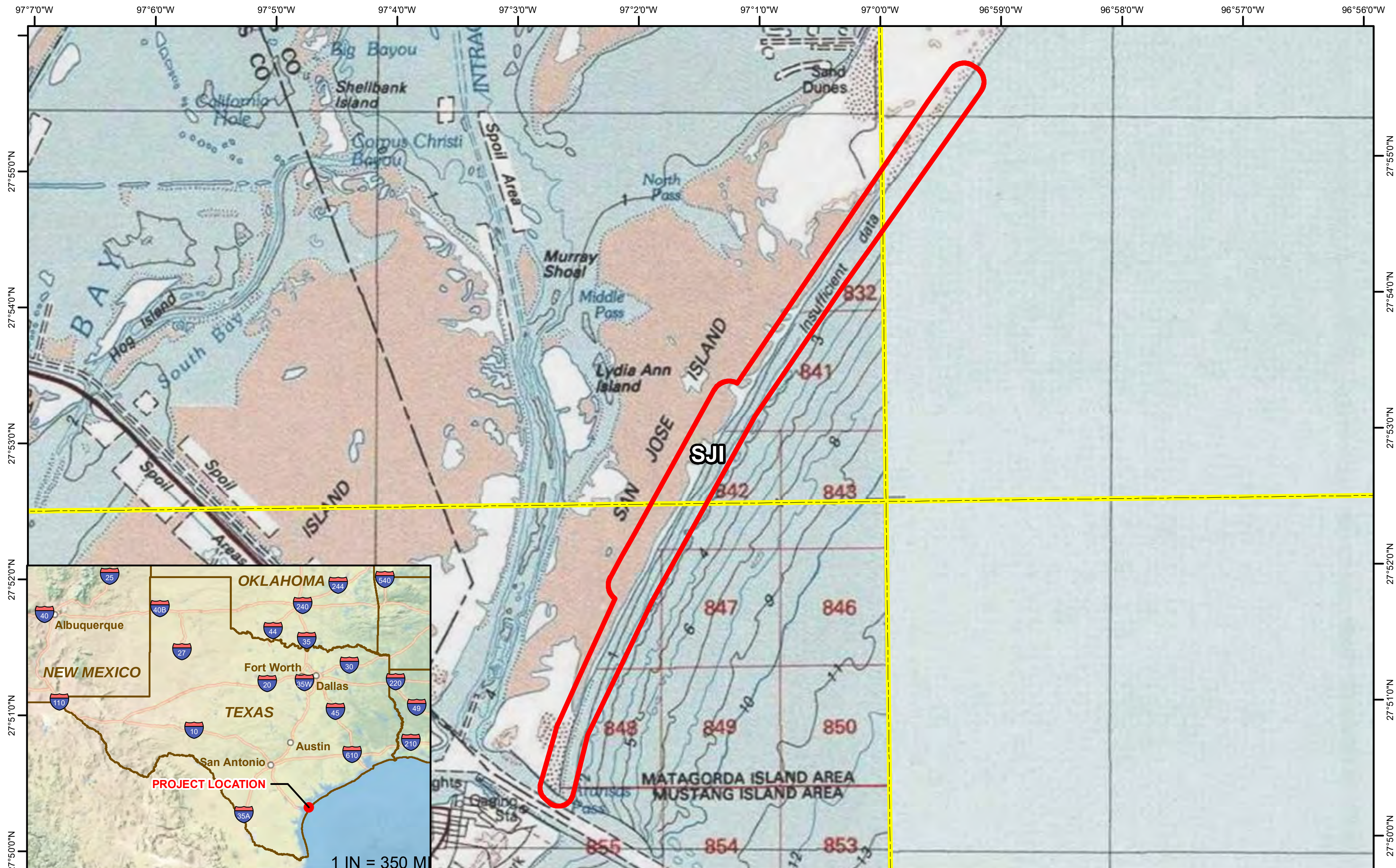

Notes:

Legend

Project Study Area

USGS Quadrangle Boundary

PORT OF CORPUS CHRISTI AUTHORITY
CHANNEL DEEPENING PROJECT
FIGURE 1.1-1 USGS TOPOGRAPHIC MAP

Project Overview Map
Aransas County, TX

6,000 0 6,000 12,000 Feet

N W E S

MOTT MACDONALD
5295 S. Commerce Dr., Ste. 600
Salt Lake City, UT, 84107

ABSOLUTE SCALE:
1:72,000

REFERENCE SCALE:
1 IN = 6,000 FT

Drawn By: CLB
Date: 01/12/2022

PAGE 1 OF 1

COORDINATE LOCATIONS OF PROJECT STUDY AREAS		
PSA NAME	LATITUDE	LONGITUDE
SJI	27° 53' 3.832" N	97° 1' 12.447" W

Latitude/Longitude recorded for the polygon centroid of each PSA

Notes:

Legend

Project Study Area

PORT OF CORPUS CHRISTI AUTHORITY CHANNEL DEEPENING PROJECT FIGURE 1.1-2 AERIAL MAP

Project Overview Map
Aransas County, TX

6,000 0 6,000 12,000 Feet

MOTT MACDONALD
5295 S. Commerce Dr., Ste. 600
Salt Lake City, UT, 84107

ABSOLUTE SCALE: 1:72,000

REFERENCE SCALE: 1 IN = 6,000 FT

Drawn By: CLB
Date: 01/10/2022

PAGE 1 OF 1

Notes:

Data Sources:
ESRI World Imagery
9/20/2020

Legend

Project Study Area (1482.3 Acres)

PORT OF CORPUS CHRISTI AUTHORITY
CHANNEL DEEPENING PROJECT
SJI - FIGURE 1-1.3

Site SJI Overview Map
Aransas County, TX

6,000 0 6,000 12,000 Feet

N W E S

MOTT MACDONALD
5295 S. Commerce Dr., Ste. 600
Salt Lake City, UT, 84107

ABSOLUTE SCALE: 1:72,000

REFERENCE SCALE: 1 IN = 6,000 FT

Drawn By: CLB
Date: 01/12/2022

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2 Regulatory Authority

2.1 Regulatory Overview

This report presents the findings from field surveys to identify and delineate potential WOUS, including wetlands and SAV, which could be considered jurisdictional by USACE. While this report identifies the boundaries of potential jurisdictional features, USACE is the only entity that can verify the jurisdictional boundaries and issue an Approved Jurisdictional Determination (AJD). Jurisdictional WOUS and wetlands are regulated under Section 10 of the RHA of 1899 and/or Section 404 of the CWA.

USACE regulates excavation, installation of structures and the discharge of dredged material within waters of the U.S. below the Mean High Water (MHW) line of tidal waters or the ordinary high-water mark (OHWM) of non-tidal waters under Section 10 of the RHA. Section 10 of the RHA defines jurisdictional waters as all waters which are currently used, or were used in the past, or may be susceptible to future use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.

USACE regulates the discharge of fill material into all jurisdictional waters of the U.S. and wetlands, including waters below the MHW line or OHWM, under Section 404 of the CWA. The CWA defines jurisdictional waters to include navigable waters, intermittent and ephemeral tributaries of truly navigable waters, and adjacent wetlands. Section 404 of the CWA defines the landward limit of jurisdiction as the High Tide Line (HTL) in tidal waters and the OHWM in non-tidal waters; however, when adjacent wetlands are present, the limit of jurisdiction extends to the limit of the wetland boundary. Adjacent wetlands are those located above the HTL line or OHWM, with at least one of the following connections to a jurisdictional waterbody: biological, hydrological, or biochemical. The 1987 USACE Wetlands Delineation Manual (Manual) defines wetlands as areas that have positive indicators for dominant hydrophytic vegetation, wetland hydrology, and hydric soils or as “areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, “with special exemptions”.

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3 Methods

3.1 Field Investigation Methods

The following sections describe the field methods used to identify and delineate WOUS, wetlands, and SAV within the SJI PSA.

3.1.1 Field Survey Methods for Delineation of WOUS (Tidal Boundary Survey)

Prior to conducting field work, a waters and wetlands delineation survey workplan was developed for the SJI PSA, along with five additional PSAs, Harbor Island-East (HI-E), Shoreline Stabilization 1 (SS1), Shoreline Stabilization 2 (SS2), Placement Area 4 (PA4), and Mustang Island (MI) (Appendix B). The five additional PSAs were previously surveyed in April and May 2021 and results of these surveys included in a separate waters and wetlands delineation report ("Waters and Wetlands Delineation Report for Five Beneficial Use Sites - Corpus Christi Ship Channel Deepening Project" - issued on June 2021 and revised in October 2021). The SJI PSA was surveyed subsequent to the first five PSAs due to landowner and schedule constraints.

The survey workplan was reviewed and approved by PCCA and the USACE Project Manager prior to initiating field work. In order to delineate WOUS, positional locations of the MHW and HTL tidal elevation lines, were recorded by Triton Environmental Solutions, LLC (Triton) along the SJI PSA shoreline. For the SJI PSA, the MHW elevation is determined to be +1.01 feet North American Vertical Datum 1988 (NAVD88) and the HTL is determined to be +2.76 feet NAVD88. A Triton biologist surveyed the shoreline at discrete point locations to locate the MHW and HTL elevations using a Trimble R8 Real-Time Kinematic (RTK), sub-centimeter hand-held global positioning (GPS) unit. The R8 RTK unit receives real-time sub-centimeter corrections from the Virtual Reference Station (VRS) network to record accurate (i.e., sub-centimeter accuracy) elevations. Once the tidal boundary field survey was complete, positional and elevation data for MHW and HTL tidal boundaries were post-processed in the office and overlaid onto recent aerial imagery.

Non-tidal waterbodies were delineated using visual identification of the OHWM along the waterbody shoreline. The OHWM was visually identified using physical characteristics such a natural impressed bank and shelving, without utilizing a specific elevation. Mott MacDonald and Triton biologists surveyed non-tidal waterbody shorelines at discrete point locations using a GeoXH 6000 Series, sub-meter hand-held GPS unit. Once the field survey was complete, positional data for OHWM boundaries was post-processed in the office and overlaid onto recent aerial imagery.

3.1.2 Field Survey Methods for Delineation of Wetlands

Prior to conducting field work, a waters and wetlands delineation survey workplan was developed for the SJI PSA, along with five additional PSAs, HI-E, SS1, SS2, PA4, and MI (Appendix B). The five PSAs were previously surveyed in April and May 2021 and results included in a separate waters and wetlands delineation report ("Waters and Wetlands Delineation Report for Five Beneficial Use Sites - Corpus Christi Ship Channel Deepening Project" - issued on June 2021 and revised in October 2021). The SJI PSA was surveyed subsequent to the first five PSAs due to landowner and schedule constraints. The survey workplan was reviewed and approved by the PCCA and the USACE Project Manager prior to initiating field work. The wetlands delineation was conducted by Mott MacDonald in accordance with the USACE *Corps of Engineers Wetlands Delineation Manual* (USACE, 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0)* (USACE, 2010). Wetlands and waterbodies were classified in the field using the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Wetland indicator classification for vegetation identified to the species level were recorded based on the *National Wetland Plant List: 2020* (USACE, 2020).

Hydrology, soils, and vegetation were examined within the SJI PSA at discreet sampling locations located along transects and within different vegetation communities observed in the field. Sampling locations and aquatic resource boundaries were delineated in the field by recording positional locations using six separate GeoXH 6000 Series, sub-meter hand-held GPS units. As directed by PCCA, the waters and wetlands delineation survey was only conducted to the PSA boundaries and did not extend onto private property, even if the wetland extended beyond the PSA boundaries.

During the wetland field evaluation at the SJI PSA, detailed information at sample locations (typically configured as a 30-foot radius circle for all vegetation types) was recorded in each representative vegetation types that occur along the transects identified in the survey workplan. At sample locations, a USACE Routine Wetland Determination Data Form for the Atlantic and Gulf Coastal Plain Region was completed. These sample locations are considered the Wetland Determination (WD) sample plot type and the Upland Determination (UD) sample plot type for this report. For each wetland identified, the boundary was determined and positions recorded in the field using the Wetland Flagging (WF) GPS plot type. Field notes were recorded for each sample location within a Rite-in-the-Rain® field logbook. USACE Wetland Determination Data Forms completed at WD and UD plot locations are provided in Appendix C. Site photos taken at sample locations are included in this report as Appendix D.

In order to identify and delineate coastal interdunal wet prairie and upland mosaic wetlands, procedures and methods detailed in the Wetland/Non-Wetland Mosaics section of the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coast Plain Region (Version 2.0) were utilized. Both field identification mapping with a GPS GeoXH600 series, sub-meter hand-held GPS unit and in-office aerial interpretation of coastal interdunal wet prairie and upland mosaic wetlands boundaries was accomplished. As per the Atlantic and Gulf Coastal Regional Supplement, the following delineation procedures were utilized to delineate coastal interdunal wet prairie and upland mosaic wetlands at the SJI PSA:

1. Once a potential mosaic wetland was identified, five continuous 100-foot transects were selected between each of the previously identified wetland delineation survey transects identified within the waters and wetlands delineation survey workplan discussed in Section 3.1.2 above. A 100-foot measuring tape was stretched along each 100-foot transect to determine distances (in linear feet) of uplands and wetlands. A GPS GeoXH600 series, sub-meter hand-held GPS unit was utilized to mark the beginning of each 100-foot transect, beginning and ends of uplands and wetlands along the 100-foot transect, and the end of each 100-foot transect. Percent wetland for each transect was determined by using the following formula:

   % wetland for each transect = Total wetland distance along each transect x 100

   The total percent wetland for each mosaic wetland was determined by using the following formula:

$$\frac{\textit{\% wetland for each separate identified mosaic wetland}}{} = \frac{\text{Total wetland distance along all transects}}{\text{Total length of all transects}} \times 100$$

2. Separate data forms for swales and ridges/hummocks were utilized to document locations of wetlands and uplands. Sampling of vegetation, soil, and hydrology followed the general procedures described in the 1987 USACE Corps of Engineers Wetlands Delineation Manual and the Atlantic and Gulf Coast Regional Supplement.

3.1.3 Field Survey Methods for Delineation of SAV and Oyster Habitat

An aquatic resources survey, including the delineation of SAV and oyster habitat, was conducted at the SJI PSA by Triton biologists from October 18 through October 25, 2021. A description of field survey methods for the aquatic resources survey are detailed in Triton's Aquatic Resources Field Survey Plan and Aquatic Resources Report included in Appendix E.

3.2 Evaluation of Existing Information Methods

Prior to conducting the field delineation surveys, existing data was acquired and reviewed by Mott MacDonald in order to identify, describe, and document the physical setting and various habitat types within the SJI PSA and to assist in identifying potential locations of waters, wetlands, SAV, and oysters. Background information compiled and reviewed included historical and recent aerial imagery, topography, soils, NWI-mapped wetlands, USGS NHD-mapped streams and waterbodies, Federal Emergency Management Agency (FEMA) mapped flood zones, LiDAR elevation and bathymetric depth data, and TPWD mapped EMST habitats. Results of existing data evaluations are described in Sections 3.2.1 through 3.2.7.

3.2.1 Historical and Recent Aerial Imagery

Aerial imagery, both recent and historical, was obtained from Google Earth Pro, ArcGIS World Imagery Layer, and the National Agriculture Imagery Program (NAIP), with the earliest aerial imagery of the SJI PSA acquired in December 1956 (Google Earth) and the most recent imagery acquired in December 2020 (Google Earth). The 1956 imagery reveals that the SJI PSA was a natural barrier island with no residential or commercial development present, except for a privately owned ranch house compound and associated airplane landing strip. Vegetation is present behind the primary dunes and secondary dunes. In subsequent historical aerial photographs dated 1979, 1990, 2003, and 2016, the island remains in a natural state, with a few roads added for the private landowners to access portions of the island for hunting, ranching, and fishing. Historical aerials also show portions of the island being managed for quail hunting and cattle ranching through vegetation manipulation.

NAIP orthorectified aerial imagery (both true-color and color-infrared) is available for the SJI PSA at resolutions of 1.0- and 2.0-m^2. NAIP imagery was acquired from 2006 (true-color) for the SJI PSA. The ortho-rectified imagery may be viewed and interpreted using ArcGIS software. NAIP is made available to the public by the USDA NRCS Geospatial Data Gateway at https://datagateway.nrcs.usda.gov/.

Recent true-color orthorectified aerial imagery is available for the SJI PSA at a resolution of 0.5-m^2, acquired in 2020. This imagery was acquired by the Maxar satellite system (formerly known as DigitalGlobe) and made available to the public through the World Imagery Layer viewed in ArcGIS software. This imagery, along with Google Earth imagery from August 2020, was used as the mapping base to complete the delineation of WOUS, wetlands and SAV communities within the SJI PSA. Table 3.2-1 summarizes the digital aerial imagery available for the SJI PSA.

Table 3.2-1: Aerial Imagery Source and Acquisition Years for the SJI Project Study Area

Source	Acquisition Years	Type
Google Earth	1956, 1979, 1985, 1990, 1995	Black and white
Google Earth	2003, 2005, 2006, 2008, 2009, 2010, 2011, 2013, 2014, 2016, 2017, 2020	True-color
NAIP	2002, 2005, 2006, 2008	Color infrared, true-color
ArcGIS	2020	True-color

3.2.2 NRCS Soil Survey Geographic (SSURGO) Database

The Soil Survey Geographic (SSURGO) database is a digitized soil mapping GIS dataset developed and maintained by the USDA NRCS. Mapping scales generally range from 1:12,000 to 1:24,000. The SSURGO dataset are digitized duplicates of the original soil survey maps and, therefore, are the most detailed level of soil mapping performed by the NRCS. SSURGO is linked to a National Soil Information System (NASIS) attribute database which provides the proportionate extent of component soils and their properties for each map unit. Map units for the SSURGO database consist of one to three components each. Attribute data in the NASIS database apply to the principal component in each soil mapping unit and were used to identify the SJI PSA soil units including attributes classifying hydric condition and drainage class. Minor components may have hydric conditions or drainage classes that differ from the primary component soils. Table 3.2-2 summarizes the soils mapped by NRCS within the SJI PSA. A map showing locations of soils within the SJI PSA is included as Figure 2, Appendix A.

Table 3.2-2: NRCS Mapped Soils within the SJI Project Study Area

PSA	Soil Code	Soil Name	Drainage Class	Hydric	Area (ac)
SJI	By	Beaches	Very poorly drained	No	614.8
	GM	Galveston-Mustang complex, 0 to 3 percent slopes, occasionally flooded, frequently ponded	Moderately well drained	No	19.3
	Ps	Psamments, rarely flooded	Well drained	No	60.6
	W	Water	N/A	N/A	10.3
	W	Water (unmapped open water)	N/A	N/A	775.2
				TOTAL	**1,480.2**

Note: Open water areas that are not mapped by NRCS have been included to represent full PSA acreages.

3.2.3 National Wetlands Inventory Mapping

The USFWS is the principal Federal agency that provides information to the public on the extent and status of the Nation's wetland and aquatic resources. The USFWS's NWI Program has developed a series of topical maps that show the extent and character of the Nation's wetlands and deepwater habitats. The NWI wetlands mapping is often available in two forms, non-digital hard-copy paper maps and digital geospatial data for use in GIS.

NWI mapping for the SJI PSA is available to the public as a digital GIS data layer. The NWI mapped 17 resources within the SJI PSA. These include estuarine deepwater habitat, estuarine emergent wetlands, estuarine unconsolidated shore, estuarine intertidal habitat, marine deepwater habitat, marine unconsolidated shore, marine intertidal habitat, and palustrine emergent wetlands. Table 3.2-3 provides a summary of NWI mapping within the SJI PSA. A map showing locations of NWI-mapped waters and wetlands within the SJI PSA is included as Figure 3, Appendix A.

Table 3.2-3: NWI Wetlands within the SJI Project Study Area

PSA	Resource	NWI Classification	Number of Mapped Resources	Area (ac)
SJI	Estuarine and Marine Deepwater and Wetland Habitats	E1UBL	1	12.7
		E2EM1P	5	19.1
		E2USN	1	<0.1
		E2USP	5	60.0
		M1UBL	1	611.7
		M2USN	2	74.0
		M2USP	1	260.0
		PEM1Ah	1	1.9
		TOTALS	**17**	**1,039.4**

Note: Uplands and NWI unmapped areas account for 440.8 acres of the SJI PSA, for a total acreage of 1,480.2 acres.

Estuarine wetlands are described as deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines, there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System. According to NWI mapping, the following are descriptions of the Estuarine habitat classes that occur within the SJI PSA:

> E1UBL (Estuarine, subtidal, unconsolidated bottom, subtidal) – Estuarine deepwater habitats that are continuously covered with tidal water (i.e., located below extreme low water). Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%. In this type of estuarine wetlands, tidal saltwater continuously covers the substrate.

> E2EM1P (Estuarine intertidal persistent emergent wetland, irregularly flooded) – Estuarine wetlands characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems. Tides flood the substrate less often than daily.

> E2USN (Estuarine, intertidal, unconsolidated shore, regularly flooded) – Estuarine wetlands having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders or bedrock and (2) less than 30 percent areal cover of vegetation. The substrate in these habitats is flooded and exposed by tides; includes the associated splash zone. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class. Tides alternately flood and expose the substrate at least once daily.

> E2USP (Estuarine intertidal unconsolidated shore, irregularly flooded) – Estuarine wetlands whose substrate is flooded and exposed by tides; includes the associated splash zone. Includes all wetland habitats having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders or bedrock and (2) less than 30 percent areal cover of vegetation. Landforms such as beaches, bars, and flats are included in the unconsolidated shore class. Tides flood the substrate less often than daily.

The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean, and the Water Regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves, are also considered part of the Marine System because they generally support typical marine biota. According to NWI mapping, the following are descriptions of the Marine habitat classes that occur within the SJI PSA:

> M1UBL (Permanently flooded, open ocean deepwater habitat) - The substrate in these habitats is continuously covered with tidal water (i.e., located below extreme low water). Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%. Tidal salt water continuously covers the substrate.

> M2USN (Marine intertidal unconsolidated shore, regularly flooded) - The substrate in these habitats is flooded and exposed by tides; includes the associated splash zone. Includes all wetland habitats having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders or bedrock and; (2) less than 30 percent areal cover of vegetation. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class. Tides alternately flood and expose the substrate at least once daily.

> M2USP (Marine intertidal unconsolidated shore, irregularly flooded) - The substrate in these habitats is flooded and exposed by tides; includes the associated splash zone. Includes all wetland habitats having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders or bedrock and (2) less than 30 percent areal cover of vegetation. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class. Tides flood the substrate less often than daily.

The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 hectares (ha) (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt. According to NWI mapping, the following is a description of the Palustrine habitat class that occurs within the SJI PSA:

> PEM1Ah (Palustrine, emergent, persistent, temporarily flooded, diked/impounded) - Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. Dominated by species that normally remain standing at least

until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems. Surface water is present for brief periods (from a few days to a few weeks) during the growing season, but the water table usually lies well below the ground surface for most of the season. These wetlands have been created or modified by a man-made barrier or dam that obstructs the inflow or outflow of water.

3.2.4 National Hydrography Dataset

The USGS NHD is developed to identify surface water systems throughout the United States primarily at the 7.5-minute topographic quadrangle scale (i.e., 1:24,000 scale). The NHD represents the drainage network with features such as rivers, streams, canals, lakes, ponds, coastline, dams and stream gages. The mapped drainage network is designed to be used for general reference, water resource naming, and in the flow analysis of surface water systems and watersheds. Table 3.2-4 summarizes waterbodies mapped by the USGS NHD within the SJI PSA. A map showing the locations of NHD-mapped waterbodies within the SJI PSA is included as Figure 4, Appendix A.

Table 3.2-4: USGS NHD Streams and Waterbodies within the SJI Project Review Area

Named Resource	Length (linear feet)
Coastline - Corpus Christi Ship Channel	1,149
Coastline - Gulf of Mexico	37,862
TOTAL	**39,011**

3.2.5 FEMA Flood Hazard Data

The National Flood Hazard Layer (NFHL) is a geospatial database that contains current effective flood hazard data. FEMA provides the flood hazard data to support the National Flood Insurance Program (NFIP). Review of FEMA flood hazard mapping for Aransas County identifies that the SJI PSA is located within three different flood zones, including Zone AE, Zone VE, and Zone X. Below is a description of each flood zone within the SJI PSA:

> Zone X – Moderate and Minimal Risk Areas. Zone X is the flood insurance rate zone that corresponds to areas of minimal risk outside the 1-percent and 0.2-percent-annual-chance floodplains. No Base Flood Elevations (BFEs) or base flood depths are shown within these zones. Buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Flood insurance is available in participating communities but is not require by regulation in this zone.

> Zone X with 0.2 Pct Annual Chance Flood Hazard – Areas of minimal flood hazards outside 0.2-percent-annual-chance floodplain.

> Zone AE – Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown on floodplain maps. Mandatory flood insurance purchase requirements and floodplain management standards apply.

> Zone VE – Coastal High Hazard Areas (CHHA) – High Risk. Zone VE is the flood insurance rate zone that corresponds to areas within the 1-percent-annual-chance coastal floodplain that have additional hazards associated with storm waves. Base Flood Elevations derived from the detailed hydraulic coastal analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage.

Table 3.2-5 provides a summary of the FEMA flood hazard zone mapping within the SJI PSA. A map showing the locations of FEMA flood hazard zones within the SJI PSA is included as Figure 5, Appendix A.

Table 3.2-5: FEMA Flood Hazard Zones within the SJI Project Review Area

Flood Hazard Zone	Area (ac)
Zone X AREA OF MINIMAL FLOOD HAZARD	10.5
Zone X with 0.2 PCT ANNUAL CHANCE FLOOD HAZARD	24.0
Zone AE	414.9
Zone VE	1,029.3
Open Water	1.5
TOTAL	**1,480.2**

3.2.6 TPWD EMST Data

The EMST is an interactive GIS mapping tool which was developed and is maintained by TPWD. The EMST is utilized for identifying and categorizing various habitat types relating to soils, hydrology, ecoregion layers, and vegetative communities. The EMST data is separated into habitat types with correlating vegetation descriptions and ecological interpretations provided in the TPWD Texas Vegetation Classification Project: Interpretive Booklet for Phase 3 (TPWD, 2014). Table 3.2-6 summarizes different EMST habitat types and acreage amounts within the SJI PSA. A map showing the locations of EMST-mapped habitats within the SJI PSA is included as Figure 6, Appendix A.

According to EMST mapping, dominant habitat types within the SJI PSA include Active Sand Dune (4.2 acres), Central and Lower Coastal: Beach (90.4 acres), Coastal and Sandsheet: Deep Sand Grassland (75.8 acres), Coastal: Salt and Brackish High Tidal Marsh (0.6 acres), Coastal: Sea Ox-eye Daisy Flats (8.4 acres), Coastal: Tidal Flat (0.3 acres), Gulf Coast: Salty Prairie (245.9 acres), Native Invasive: Baccharis Shrubland (0.3 acres), Native Invasive: Common Reed (0.4 acres), South Texas: Wind Tidal Flats (338.1 acres), Open Water (9.2 acres), and Open Water (Unmapped) (706.6).

Active Sand Dune is described as barren to sparsely vegetated deep sands where active sand movement is occurring. These sites may sometimes be 15 meters (approximately 50 feet) more in height and offer the greatest degree of topographic relief in the region.

Central and Lower Coastal Beach is described as unvegetated to sparsely vegetated sandy shorelines adjacent to the Gulf of Mexico and bays interior to the barrier islands. Species such as goat-foot morning-glory (*Ipomoea pescaprae*), beach morning-glory (*Ipomoea imperati*), and searockets (*Cakile* spp.) provide sparse vegetative cover. These areas generally lie near mean sea level and are often found between foredunes and tidal waters.

Coastal and Sandsheet: Deep Sand Grassland is described as upland, grass-dominated vegetation on deep sands. Dunes are often dominated by sea oats (*Uniola paniculata*), with other species such as Gulf croton (*Croton punctatus*), bitter panicum (Panicum amarum), goat-foot morning glory, beach morning-glory, shoreline purslane (*Sesuvium portulacastrum*) also present. Upland grasslands are often dominated by seacoast bluestem (*Schizachyrium littorale*) and gulfdune paspalum (*Paspalum monostachyum*).

Coastal: Salt and Brackish High Tidal Marsh is described as irregularly flooded marsh dominated by graminoids such as marshhay cordgrass (*Spartina patens*), saltgrass (*Distichlis spicata*), and bulrushes (*Schoenoplectus* spp.).

Coastal: Sea Ox-eye Daisy Flats are described as irregularly flooded sites dominated by sea ox-eye daisy (*Borrichia frutescens*). These flats become extensive from Corpus Christi Bay southward.

Coastal: Tidal Flats are described as described as unvegetated or sparsely vegetated flats affected by tidal fluctuations.

Gulf Coast: Salty Prairie is described as vegetation occupying saline soils, generally near-coast, on level topography of the Beaumont Formation. Sites may be nearly monotypic stands of Gulf cordgrass (*Spartina spartinae*), little bluestem (*Schizachyrium scoparium*), bushy bluestem (*Andropogon glomeratus*), switchgrass (*Panicum virgatum*), and marshhay cordgrass (*Spartina patens*).

Native Invasive: Baccharis Shrubland is described as shrubland on salty or sandy soils and *Baccharis* spp., honey mesquite (*Prosopis glandulosa*), salt cedar (*Tamarix* spp.), shrubby sumpweed (*Iva frutescens*) are the most common dominants. Other shrubs may include Chinese tallow (*Triadica sebifera*), sea ox-eye daisy, Macartney rose (*Rosa bracteata*), swamp privet (*Forestiera acuminata*), and colima (*Zanthoxylum fagara*). Grasses may include Gulf cordgrass (*Spartina spartinae*), saltgrass, bermudagrass (*Cynodon dactylon*), and rat-tail smut grass (*Sporobolus indicus*).

Native Invasive: Common Reed is described as areas often dominated by common reed (*Phragmites australis*) on formerly disturbed soils.

South Texas: Wind Tidal Flats are described as typically unvegetated flats that lack significant development of blue-green algae (*Lyngbya* spp.) on their surface. Some of these areas may develop substantial herbaceous cover, but typically they are unvegetated or very sparsely vegetated with species mentioned in the system description.

Open Water and Open Water (unmapped) are described as large lakes, rivers, marine water, and ephemeral ponds. Some areas may support vegetation with pioneering species such as black willow (*Salix nigra*), eastern cottonwood (*Populus deltoides*), Chinese tallow, seepweeds (*Suaeda* spp.), sea ox-eye daisy, saltwort (*Batis maritima*), rushes (*Juncus spp.),* sedges, cattails (*Typha* spp.), and spikerushes (*Eleocharis* spp.).

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Table 3.2-6: EMST Habitat Types within the SJI Project Review Area

PSA	EMST Habitat Type	Area (ac)
SJI	Active Sand Dune	4.2
	Central and Lower Coastal Beach	90.4
	Coastal and Sandsheet: Deep Sand Grassland	75.8
	Coastal: Salt and Brackish High Tidal Marsh	0.6
	Coastal: Sea Ox-eye Daisy Flats	8.4
	Coastal: Tidal Flat	0.3
	Gulf Coast: Salty Prairie	245.9
	Native Invasive: Baccharis Shrubland	0.3
	Native Invasive: Common Reed	0.4
	South Texas: Wind Tidal Flats	338.1
	Open Water	9.2
	Open Water (unmapped)	706.6
	TOTAL	**1,480.2**

3.2.7 LiDAR Data

LiDAR is a remote sensing method that uses light in the form of a pulsed laser to measure ranges of variable distances to the Earth's surface. These light pulses, combined with other data recorded by the airborne system, generate precise, three-dimensional information about the shape of the Earth and its surface characteristics. LiDAR data was obtained from the USGS National Map Download Client. LiDAR data for the SJI PSA is included within the Figure 8 Map Series in Appendix A.

3.2.8 Antecedent Precipitation Tool (APT) Data

The Antecedent Precipitation Tool (APT) is an automation tool that the USACE developed following implementation of the Navigable Water Protection Rule (NWPR) in 2020. The APT is used to facilitate the comparison of antecedent or recent rainfall conditions for a given location to the range of normal rainfall conditions that occurred during the preceding 30 years. In addition to providing a standardized methodology to evaluate normal precipitation conditions, the APT can also be used to assess the presence of drought conditions, as well as the approximate dates of the wet and dry seasons for a given location. The APT was used to evaluate rainfall conditions at the SJI PSA during the wetland delineation survey time periods of October 18 - October 25, 2021. APT rainfall results for the SJI PSA is included within Appendix G. The APT determined that normal rainfall conditions were present during the SJI survey period.

3.3 Digital Mapping Methods and Process

The process of conducting a digital vegetation mapping inventory requires an ortho-rectified imagery base, ancillary data layers such as elevation, hydrography (i.e., streams and watersheds), field data (i.e., GPS location points, field notes, and site photographs) and the software to analyze and interpret those data layers. The mapping process utilizes the GPS data collected in the field to delineate wetland boundaries, SAV habitat boundaries, and other surface water features (i.e., lakes, ponds, streams, and ditches). Classification systems utilized in the field and entered into GPS point locations are utilized to identify mapped habitat types, characteristics, and other attributes such as dominant species, water regimes, and water depths. For the SJI PSA, waters, wetlands, and SAV habitat mapping polygons were created using ESRI ArcGIS 10.7.1 software packages. The mapping process described herein includes information on vegetation interpretation techniques, application of the classification systems, and discusses quality assurance/quality control (QA/QC) measures.

3.3.1 Interpretation Techniques

The mapping process used for the SJI PSA was a manual interpretation and delineation of the vegetation communities. Manual interpretation of the imagery provides for an accurate delineation of the major vegetation communities, provides statistics on their extent, and nature of their composition. The delineations are completed on-screen, within the GIS mapping environment. This delineation process is known as “heads-up digitizing.” There are no inaccuracies created through a transfer process or software image recognition process; the delineations are as accurate as the ortho-rectified imagery and GPS points allow. All waters, wetlands, and SAV boundaries within the five PSAs were recorded using sub-meter accuracy GPS units. The flagged waterbody, wetland and SAV boundaries were digitized in GIS using the GPS location information.

MHW and HTL elevations were recorded in the field using a sub-centimeter accuracy RTK unit at discreet plot locations along the shoreline of the SJI PSA. Within the project GIS, these elevations points were digitized into line features indicating the MHW and HTL elevation contours between surveyed plot locations.

Wetland boundary flag locations were digitized in the project GIS into polygon features to identify the location and extent of the wetland habitats. No aerial imagery interpretation was performed for the delineation of the wetland boundaries. The wetland boundary locations are as accurate as the sub-meter GPS points allow. SAV habitat boundaries were recorded in the field and mapped using methods described in Triton’s Aquatic Resources Survey Workplan and Report included in Appendix E.

3.4 Quality Control Measures

Quality control measures are in place to check the field data collected and the field forms completed as well as to assure the integrity and accuracy of the digital mapping data. Digital mapping quality control measures include semi-automated GIS systems and senior scientist review. To ensure the integrity of the GIS digital line work, the files are validated through a semi-automated GIS model. This model evaluates the GIS mapping data and inspects for data gaps, slivers, overlapping polygons, duplicate polygons, and multi-part polygons. All data errors are flagged and corrected as needed. This semi-automated quality control process provides for accurate summary statistics such as acreages reported.

The senior scientist review occurred collaboratively with the scientists who conducted the wetland, waterbody, and SAV field surveys. Additionally, field GPS data and field forms were collaboratively reviewed following completion of the field surveys. GIS mapping data was reviewed by senior scientists for consistency and to determine that resources were correctly identified according to the field data collected. The senior scientist review involves manually reviewing each mapped polygon individually across all coded attributes. Discrepancies between the field data collected and the delineated vegetation unit within the GIS are further inspected and rectified by the senior scientists.

After completion of the senior scientist review the mapping file is passed through the semi-automated GIS model once again to identify and rectify any physical discrepancies with the data. Upon a clean pass through the QA/QC model the data is considered final and made available for statistical analysis.

3.4.1 GPS Equipment Used and Quality Control

Field sample positional locations were collected using six Trimble GeoXH 6000 Series, sub-meter hand-held GPS units and a Trimble R8 RTK, sub-centimeter hand-held GPS unit with the capability of recording elevation data. The R8 RTK unit receives real-time sub-centimeter corrections from the VRS network. GPS units are equipped with Terrasync software used for data collection. Prior to mobilizing for field work, GPS units are setup with a Terrasync Data Dictionary to collect specific sample types and to record site characteristics using standard classification systems. Additionally, GPS units are setup with background files to delimit the SJI PSA boundaries and predetermined survey transects to assist field crews with navigation and data collection across the full extent of the SJI PSA.

For quality control, post-processing differential correction of field collected GPS data was completed using Pathfinder Office software. Post-processing was completed individually for each day field surveys were conducted. The differential correction process used to complete the post-processing for this survey is as follows:

Pathfinder Office GPS Differential Correction

Process Used: Automatic Carrier and Code Processing

Single Base Station

GPS and GNSS Enabled (5 second rate)

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4 Waterbodies, Wetlands, SAV, and Oyster Delineation Results

4.1 Introduction

Waterbody, wetlands, and SAV delineations were conducted from October 18 through October 25, 2021 and on November 11, 2021 to identify potential WOUS as defined by the USACE (33 CFR 328.3(a)), wetlands (33 CFR 328.3(c)), SAV, and oyster habitat present within the SJI PSA located just north of the Corpus Christi Ship Channel in Aransas County, Texas. The locations and extent of these features are shown in the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Results of the field delineation surveys document five waterbody types (M1UBL, M2USN, E1UBL, E2USN, and PUB1H), one type of estuarine wetland habitat (E2EM1N1), and two types of palustrine wetland habitats (PEM1C and PEM1C1) within the SJI PSA. No SAV or oyster habitat were identified within the SJI PSA. Locations and acreage amounts of identified waters and wetlands by site are included in Table 4.5-1 (waters) and Table 4.6-1 (wetlands) within Section 4 "Waterbodies, Wetlands, SAV, and Oyster Delineation Results. Table 5.1-1 provides a summary of waters and wetlands delineated within the SJI PSA combined.

4.2 General Waterbody Description

Within the SJI PSA, the field survey identified five waterbody types comprised of marine open water-subtidal (M1UBL), marine unconsolidated shore-intertidal (M2USN), estuarine open water-subtidal (E1UBL), estuarine unconsolidated shore-intertidal (E2USN), and palustrine open water (PUB1H). A description of each waterbody type identified during the surveys, as well as locations of these waterbodies within the SJI PSA is included in section 4.2.1 through 4.2.3 below.

Table 4.5-1 lists waterbodies identified at the SJI PSA and include an acreage summary for each waterbody type. For reference, GPS attribute tables for the MHW, HTL, and OHWM boundary points collected in the field are provided in Appendix F.

4.2.1 Marine Waterbodies

The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from wind and waves, are also considered part of the Marine System because they generally support typical marine biota.

4.2.1.1 Marine Open Water – Subtidal

The one marine open water- subtidal waterbody identified in the field within the SJI PSA included the Gulf of Mexico (M1UBL). According to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), M1UBL is described as Marine, Subtidal, Unconsolidated Bottom, Subtidal. Marine open water bodies were associated with deep water bays, channels, and ocean located along the shoreline of the SJI PSA. Marine open waterbodies are classified by the TPWD EMST Interpretive Booklet for Phase 3 (TPWD, 2014) as Open Water, which includes lakes, rivers, marine water, and ephemeral ponds.

Regulatory limits of the one marine open waterbody are shown within the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Under Section 10 of the RHA, the USACE regulates excavation, installation of structures, and the discharge of dredged material below the MHW elevation of tidal waterbodies, determined to be +1.01 feet NAVD88. Under Section 404 of the CWA, USACE regulates the discharge of dredged or fill material within a WOUS up to the landward limit of jurisdiction for a tidal water as defined by the HTL elevation, determined to be +2.7 feet NAVD88.

4.2.1.2 Marine Unconsolidated Shore - Intertidal

The one marine unconsolidated shore-intertidal water (M2USN) identified in the field within the SJI PSA included the Gulf of Mexico shoreline. According to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), M2USN is described as Marine, Intertidal, Unconsolidated Shore, Regularly Flooded. Marine unconsolidated shore-intertidal mapped within the SJI PSA is classified by the TPWD EMST (TPWD, 2014) as Texas Coastal Beach-Gulf and is described as unvegetated to sparsely vegetated shorelines adjacent to the Gulf of Mexico and bays interior to the barrier islands.

Regulatory limits of the one marine unconsolidated shoreline-intertidal are shown on the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Under Section 10 of the RHA, the USACE regulates excavation, installation of structures, and the discharge of dredged material below the MHW elevation of tidal waterbodies, determined to be +1.01 feet NAVD88. Under Section 404 of the CWA, USACE regulates the discharge of dredged or fill material within a WOUS up to the landward limit of jurisdiction for a tidal water as defined by the HTL elevation, determined to be +2.7 feet NAVD88.

4.2.2 Estuarine Waterbodies

The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines, there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System.

4.2.2.1 Estuarine Open Water – Subtidal

One estuarine open water – subtidal waterbody (E1UBL) was delineated in the field and includes the portion of the CCSC that flows into the Gulf of Mexico along the southern end of the SJI PSA. According to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), E1UBL is described as Estuarine, Subtidal, Unconsolidated Bottom, Subtidal. The estuarine open water body mapped within the SJI PSA is classified by the TPWD EMST (TPWD, 2014) as Open Water, which includes lakes, rivers, marine water, and ephemeral ponds.

Regulatory limits of the estuarine open water-subtidal waterbody are shown on the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Under Section 10 of the RHA, the USACE regulates excavation, installation of structures, and the discharge of dredged material below the MHW elevation of tidal waterbodies, determined to be +1.01 feet NAVD88. Under Section 404 of the CWA, USACE regulates the discharge of dredged or fill material within a WOUS up to the landward limit of jurisdiction for a tidal water as defined by the HTL elevation, determined to be +2.7 feet NAVD88.

4.2.2.2 Estuarine Unconsolidated Shore – Intertidal

Three estuarine unconsolidated shore-intertidal waterbodies (E2USN) were delineated within the SJI PSA. According to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), E2USN is described as Estuarine, Intertidal, Unconsolidated Shore, Regularly Flooded and includes all sand areas located between the MHW and HTL elevation contours. The three unconsolidated shore-intertidal areas at the SJI PSA included estuarine shoreline area along the CCSC between the existing jetty and adjacent coastal dune uplands and grasslands.

The three estuarine unconsolidated shore-intertidal areas mapped within the SJI PSA were observed to include the Texas Coastal Beach-Bay habitat type identified by the TPWD EMST (TPWD, 2014). This habitat type is described as unvegetated to sparsely vegetated shorelines adjacent to the Gulf of Mexico and bays interior to the barrier islands.

Regulatory limits of the three estuarine unconsolidated shore-intertidal waterbodies are shown on the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Under Section 10 of the RHA, the USACE regulates excavation, installation of structures, and the discharge of dredged material below the MHW elevation of tidal waterbodies, determined to be +1.01 feet NAVD88. Under Section 404 of the CWA, USACE regulates the discharge of dredged or fill material within a WOUS up to the landward limit of jurisdiction for a tidal water as defined by the HTL elevation, determined to be +2.7 feet NAVD88.

4.2.3 Palustrine Waterbodies

The Palustrine System includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all four of the following characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.

4.2.3.1 Palustrine Open Water

Seventeen (17) palustrine unconsolidated bottom-open waterbody ponds (PUB1H) were identified in the field within the SJI PSA. According to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979), PUB1H is described as Palustrine, Unconsolidated Bottom, Cobble-Gravel, Permanently Flooded. Palustrine open waterbodies mapped within the SJI PSA are classified by the TPWD EMST (TPWD, 2014) as Open Water, which includes lakes, rivers, marine water, and ephemeral ponds. It should be noted that the 17 palustrine ponds identified in the field were created by the effects of Hurricane Harvey along the SJI PSA shoreline in 2017. The 17 palustrine open waterbodies do not contain vegetation (SAV or hydrophytic vegetation) and are reducing in size over time as water- and wind-driven sand continue to fill in these areas.

Regulatory limits of the palustrine open waterbodies were identified in the field and shown on the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Under Section 404 of the CWA, USACE regulates the discharge of fill material non-tidal waterbodies below the OHWM. The OHWM boundary for the three palustrine waterbodies was visually identified along the ponds' shoreline using physical characteristics such a natural impressed bank and shelving, without utilizing a specific elevation.

4.3 General Wetland Descriptions

Delineated wetlands within the SJI PSA consisted of estuarine and palustrine wetlands. Estuarine wetlands are described by the USFWS NWI as consisting of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land, but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines, there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System (Cowardin et al., 1979). This survey used the HTL elevation contour as the break between estuarine tidal wetlands and palustrine non-tidal wetlands.

Palustrine wetlands are described by the USFWS NWI as including all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. The system also includes wetlands that are lacking vegetation but exhibit the four following characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt (Cowardin et al., 1979).

Locations and extents of delineated wetlands for the SJI PSA are shown in the Figure 7, Figure 8, and Figure 9 Map Series within Appendix A. Table 4.6-1 lists wetlands identified at the SJI PSA.

The USACE Wetland Determination Data Forms completed at WD and UD plot locations are provided in Appendix C. Site photos taken at WD and UD plot locations are included in this report as Appendix D. For reference, the attribute tables for the WD, UD and WF GPS points collected in the field are provided in Appendix F.

Wetlands identified during field surveys are described below and grouped according to NWI Cowardin classifications:

4.3.1 Estuarine Emergent Wetlands

4.3.1.1 Estuarine Low Marsh

Estuarine low marsh wetlands were delineated within the SJI PSA and are classified as Estuarine, Intertidal, Emergent Persistent, Regularly Flooded, Hyperhaline (E2EM1N1) according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Low marsh wetlands occurred primarily along low-lying portions of the backside of the SJI PSA and are associated with a larger complex of low marsh wetlands (located outside of the SJI PSA) that fringe the Lydia Ann Channel and Aransas Bay.

Low marsh wetlands classified as E2EM1N1 were dominated by saltwort (*Batis maritima*), shoregrass (*Distichlis littoralis*), Carolina wolfberry (*Lycium carolinianum*), and perennial glasswort (*Sarcocornia ambigua*). Typical hydric soil indicators found during delineations within low marsh wetlands included sandy redox. Typical hydrological indicators found during delineations within low marsh areas included algal mat, aquatic fauna, drainage patterns, FAC-neutral test, and geomorphic position.

Estuarine low marsh wetlands mapped within the SJI include one distinct habitat type identified by the TPWD EMST (TPWD, 2014). This habitat type includes Coastal: Salt and Brackish Low Tidal Flats, which are described by the TPWD EMST as a system that occurs on flats induced by tidal fluctuations in water level, primarily driven by winds rather than diurnal or semidiurnal tidal fluctuations. Due to the nearly level conditions of these flats, small fluctuations in tidal level may result in extensive changes in inundation patterns. Some sites may have sparse vegetation consisting of dwarf glasswort (*Salicornia bigelovii*), Virginia glasswort (*Salicornia depressa*), saltwort (*Batis maritima*), annual seepweed (*Suaeda linearis*) shoreline seapurslane (*Sesuvium portulacastrum*), shoregrass (*Distichlis littoralis),* and saltgrass*, (Distichlis spicata)*, but are typically unvegetated or covered by a layer of blue-green algae (*Lyngbya* spp).

4.3.2 Palustrine Emergent Wetlands

4.3.2.1 Coastal Wet Prairie Wetlands

Coastal wet prairie wetlands were delineated within the SJI PSA and are classified as Palustrine, Emergent Persistent, Seasonally Flooded (PEM1C) and Palustrine, Emergent Persistent, Seasonally Flooded, Hyperhaline (PEM1C1) according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979). Palustrine emergent wetlands were located above the HTL elevation and are not tidally influenced.

Coastal prairie wetlands were typically located along the backside of primary and secondary dune complexes as large, continuous interdunal wetlands (PEM1C) or occurred as coastal interdunal wet prairie and upland mosaic wetlands (PEM1C/Upland). Large, contiguous interdunal wetlands were dominated by sea ox-eye daisy (*Borrichia frutescens*), saltgrass (*Distichlis spicata*), marsh fimbrystilis (*Fimbristylis castanea*), bigleaf marsh-elder (*Iva frutescens*), saltmeadow cordgrass (*Spartina patens*), and gulfdune paspalum (*Paspalum monostachyum*).

Wetlands located within the coastal interdunal wet prairie and upland mosaics were dominated by marsh fimbristylis, saltgrass, saltmeadow cordgrass, and gulfdune paspalum. Coastal dune uplands and grasslands located within the mosaic wetland complex were dominated by little bluestem (*Schizachyrium scoparium*), Dallas grass (*Paspalum dilatatum*), and Corpus Christi fleabane (*Erigeron procumbens*). Large expanses of mosaic wetlands were delineated at the northern and southern portions of the SJI PSA, as well as smaller mosaic wetlands interspersed within middle interior portions of the PSA. Mosaic wetlands were observed to have small (one to two feet in diameter)-medium sized (eight to ten feet in diameter) upland mounds, mostly associated with the dune complex, and small (one to two feet in width-medium sized (eight to ten feet in width) interspersed interdunal swale wetlands. Wetland percentages for delineated mosaic wetlands ranged between 27.5% - 68.8% (see notes included in Table 4.6-1 for wetland percentages of each delineated mosaic wetland).

Coastal prairie wetlands were also identified as vegetated saline flats (PEM1C1) located above HTL within interior portions of the SJI PSA. The saline vegetated flats are part of a larger estuarine low marsh complex located below HTL that fringes the Lydia Ann Channel and Aransas Bay. Dominant vegetation within the PEM1C wetlands included saltwort (*Batis maritima*), shoregrass (*Distichlis littoralis*), Carolina wolfberry (*Lycium carolinianum*), and perennial glasswort (*Sarcocornia ambigua*), sea purslane (*Sesuvium portulacastrum*), and annual sea blite (*Suaeda linearis*). Typical hydric soil indicators found during delineations within low marsh wetlands included sandy redox. Typical hydrological indicators found during delineations within low marsh areas included algal mat, aquatic fauna, drainage patterns, FAC-neutral test, and geomorphic position.

Palustrine emergent coastal prairie wetlands were observed to include two distinct habitat types identified by the TPWD EMST (TPWD, 2014) as Southeastern Coastal Plain Interdunal Wetlands, and Texas Salty Prairie (vegetated flats above HTL). Southeastern Coastal Plain Interdunal Wetlands are described by the TPWD EMST as wetlands that occur on topographic lows in nearly level to steeply rolling landscapes on sands and deep sands along the coast and inland on the South Texas Sand Sheet. They are alternatively wet and dry due to seasonal rainfall events and typically lack tidal influence but may contain halophytic species due to the influence of salt spray and repeated inundation and evaporation. Texas Salty Prairie is described as a typically herbaceous system that occupies soils of relatively high salinity. Soil salinity of sites occupied by this system result from the deposition of salts from the surrounding landscapes into alluvial sites where repeated flooding and evaporation bring salts to the surface.

4.4 General Upland Descriptions

4.4.1 Coastal Prairie Uplands

Coastal prairie uplands were present at the SJI PSA. Coastal prairie uplands were typically located behind primary and secondary dune complexes and were dominated by little bluestem *(Schizachyrium scoparium)*, partridge pea (*Chamaecrista fasciculata*), four-spike fingergrass (*Eustachys neglecta*), honey mesquite (*Prosopsis glandulosa*), and perennial ragweed (*Ambrosia psilostachya*).

Coastal Prairie uplands are classified by the TPWD EMST (TWPD, 2014) as Texas-Louisiana Coastal Prairie. This habitat is described as mid- to tall grass prairie that occupies Pleistocene surfaces of the Texas and Louisiana coast, on non-saline soils of level to gently rolling topography. It is dominated by graminoid species such as little bluestem, Indiangrass (*Sorghastrum nutans*), brownseed paspalum (*Paspalum plicatulum*), switchgrass (*Panicum virgatum*), and tall dropseed (*Sporobolus compositus*). Honey mesquite and huisache (*Acacia farnesiana*), amongst other woody species, may also be present.

4.4.2 Coastal Dune Uplands and Grasslands

Coastal dune uplands and grasslands were also present within the SJI PSA. Coastal dune uplands and grasslands were located on the higher elevations of active primary and secondary sand dunes, beginning on the Gulf beach side and traversing over the dunes to the backdune landscape. Coastal grasslands were observed interspersed with interdunal swale wetlands described as PEM1C under Section 4.3.6 above. Dominant vegetation present within coastal dune uplands and grasslands include beach morning glory (*Ipomea pes-caprae*), bitter panicum (*Panicum amarum*), coastal groundcherry (*Physalis angustifolia*), Gulf croton (*Croton punctatus*), shoreline sea purslane (*Sesuvium portulacastrum*), and sea oats (*Uniola paniculata*).

Coastal dune uplands and grasslands are classified by the TPWD EMST (TWPD, 2014) as Texas Coast Dune and Coastal Grassland. This habitat system includes upland, grass dominated vegetation on deep sands. Dunes are often dominated by sea oats (*Uniola paniculata*), with other species such as Gulf croton, bitter panicum, beach morning glory, shoreline sea purslane and searocket (*Cakile* spp). Coastal dune uplands and grasslands occur within the primary and secondary dunes, as well as relatively level areas, where deep sands are deposited. Significant local topography, in the form of swales and pothole wetlands, may be present but are excluded from this system.

4.4.3 Other Types of Upland Habitats

Other typical upland habitats observed include upland sand flats and upland beach. Upland sand flat areas included sandy unvegetated areas (less than five percent vegetative cover) located above HTL. Upland beach habitat included sandy unvegetated areas (less than five percent vegetative cover) above HTL along the Gulf beach.

4.5 Summary Table of Waters Delineated Within the SJI PSA

The following tables list marine, estuarine, and palustrine waterbodies identified at the SJI PSA.

Table 4.5-1: Waters Delineated Within the SJI PSA

Count	Waters Name	Cowardin	Acres within PSA[1]	No. of Waters Polygons	TPWD EMST Classification	Date Surveyed	Latitude[2] (DD)	Longitude[2] (DD)
Section 10/404 Tidal Waters								
1	WAT01	E1UBL	13.195	1	Estuarine Open Water - Corpus Christi Ship Channel	10/21/2021	27.839352	-97.046660
2	WAT02	M1UBL	542.604	1	Marine Open Water-Gulf Coast	10/19/2021	27.885003	-97.017592
Section 10/404 Subtotal			**555.799**	**2**				
Section 404 Tidal Waters								
3	WAT03	M2USN	51.359	1	Texas Coastal Beach-Marine	10/19/2021	27.880107	-97.022133
4	WAT04	E2USN	0.355	3	Texas Coastal Beach-Estuarine	10/21/2021; 10/26/2021	27.841313	-97.047881
Section 404 Tidal Subtotal			**51.714**	**4**				
Section 404 Non-Tidal Waters								
5	WAT05	PUB1H	0.138	1	Open water - Pond	10/26/2021	27.868622	-97.035442
6	WAT06	PUB1H	0.883	1	Open water - Pond	10/26/2021	27.868895	-97.034217
7	WAT07	PUB1H	1.955	1	Open water - Pond	10/21/2021	27.872435	-97.032070
8	WAT08	PUB1H	3.305	1	Open water - Pond	10/21/2021	27.876353	-97.029526
9	WAT09	PUB1H	1.066	1	Open water - Pond	10/25/2021	27.877970	-97.027988
10	WAT10	PUB1H	0.039	1	Open water - Pond	10/21/2021	27.877578	-97.027293
11	WAT11	PUB1H	14.274	1	Open water - Pond	10/25/2021	27.882650	-97.025185
12	WAT12	PUB1H	0.466	1	Open water - Pond	10/25/2021	27.887089	-97.021330
13	WAT13	PUB1H	4.537	1	Open water - Pond	10/25/2021	27.888733	-97.021112
14	WAT14	PUB1H	1.787	1	Open water - Pond	10/20/2021	27.889572	-97.019255
15	WAT15	PUB1H	0.285	1	Open water - Pond	10/20/2021	27.891344	-97.017867
16	WAT16	PUB1H	0.299	1	Open water - Pond	10/20/2021	27.891998	-97.018388
17	WAT17	PUB1H	0.050	1	Open water - Pond	10/20/2021	27.892759	-97.017908
18	WAT18	PUB1H	1.574	1	Open water - Pond	10/20/2021	27.893132	-97.017071
19	WAT19	PUB1H	0.994	1	Open water - Pond	10/20/2021	27.898095	-97.012793
20	WAT20	PUB1H	0.196	1	Open water - Pond	10/22/2021	27.902450	-97.009349
21	WAT21	PUB1H	0.092	1	Open water - Pond	10/22/2021	27.905410	-97.007974
Section 404 Non-Tidal Subtotal			**31.942**	17				
TOTALS			**639.455**	**23**				

Notes:

[1] *Difference between the totals reported and the sum of the individual records are due to rounding. The totals reported were derived from GIS data.*

[2] *Latitude/longitude recorded for the polygon centroid of the delineated water. For resources with multiple polygons delineated; a single polygon centroid has been recorded.*

Below is a summary of waters delineated within the SJI PSA:

- A total of 555.799 acres of waterbodies are located below the MHW elevation and are therefore subject to both Section 10 and Section 404 regulations. These include a total of 13.195 acres of estuarine subtidal waterbodies (E1UBL) and 542.604 acres of marine subtidal waterbodies (M1UBL).
- A total of 51.714 acres of waterbodies occur between the MHW and HTL elevation contours, and are therefore subject to Section 404 (tidal) regulation. These include 51.359 acres of marine intertidal unconsolidated shores (E2USN) and 0.355 acres of estuarine intertidal unconsolidated shore (M2USN).
- A total of 31.942 acre of waterbodies are located above HTL elevation contours and are therefore subject to Section 404 (non-tidal) regulation. These include 31.942 acres of palustrine unconsolidated bottom-open water ponds (PUB1H).

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4.6 Summary Table of Wetlands Delineated Within the SJI PSA

The following table lists estuarine and palustrine wetlands identified within the SJI PSA.

Table 4.6-1: Wetlands Delineated Within the SJI PSA

Count	Wetland Name	Cowardin	Acres Within PSA[1]	No. of Wetland Polygons	TPWD EMST Classification	Date Surveyed	Latitude[2] (DD)	Longitude[2] (DD)
Section 404 Tidal Wetlands								
1	WET01	E2EM1N1	0.019	1	Texas Salt and Brackish Tidal Flats	10/21/2021	27.840984	-97.047322
2	WET08	E2EM1N1	0.231	1	Texas Salt and Brackish Tidal Flats	10/26/2021	27.870976	-97.034832
3	WET14	E2EM1N1	2.723	1	Texas Salt and Brackish Tidal Flats	10/21/2021	27.873920	-97.032605
4	WET23	E2EM1N1	0.068	1	Texas Salt and Brackish Tidal Flats	10/25/2021	27.886879	-97.024708
Section 404 Tidal Subtotal			**3.041**	**4**				
Section 404 Non-tidal Wetlands								
5	WET02	PEM1C	0.008	1	Coastal Plain Interdunal Wetland	10/21/2021	27.845535	-97.045597
6	WET03	PEM1C	0.148	2	Coastal Plain Interdunal Wetland	10/25/2021	27.849236	-97.044098
7	WET04	PEM1C	24.287	2	Coastal Plain Interdunal Wetland	10/26/2021	27.864565	-97.037210
8	WET05	PEM1C1	1.969	1	Texas Salty Prairie	10/26/2021	27.867288	-97.037042
9	WET06	PEM1C1	4.693	1	Texas Salty Prairie	10/26/2021	27.869897	-97.035276
10	WET07	PEM1C	4.368	1	Coastal Plain Interdunal Wetland	10/26/2021	27.869695	-97.034646
11	WET09	PEM1C1	0.925	1	Texas Salty Prairie	10/26/2021	27.871450	-97.034371
12	WET10	PEM1C	0.061	1	Coastal Plain Interdunal Wetland	10/26/2021	27.871406	-97.034706
13	WET11	PEM1C1	0.326	1	Texas Salty Prairie	10/26/2021	27.872022	-97.034071
14	WET12	PEM1C	25.093	1	Coastal Plain Interdunal Wetland	10/21/2021	27.876637	-97.029931
15	WET13	PEM1C1	8.499	1	Texas Salty Prairie	10/21/2021	27.875032	-97.031569
16	WET15	PEM1C1	0.044	1	Texas Salty Prairie	10/21/2021	27.872598	-97.031524
17	WET16	PEM1C1	22.539	1	Texas Salty Prairie	10/25/2021	27.882495	-97.027057
18	WET17	PEM1C	0.011	1	Coastal Plain Interdunal Wetland	10/25/2021	27.878305	-97.030256
19	WET18	PEM1C1	0.021	1	Texas Salty Prairie	10/25/2021	27.878115	-97.028269
20	WET19	PEM1C	27.410	2	Coastal Plain Interdunal Wetland	10/25/2021	27.885666	-97.024150
21	WET20	PEM1C1	0.007	1	Texas Salty Prairie	10/25/2021	27.881838	-97.026236
22	WET21	PEM1C1	0.052	1	Texas Salty Prairie	10/19/2021	27.885024	-97.022928
23	WET22	PEM1C	0.087	1	Coastal Plain Interdunal Wetland	10/19/2021	27.884968	-97.022534
24	WET24	PEM1C1	0.019	1	Texas Salty Prairie	10/19/2021	27.886058	-97.021675
25	WET25	PEM1C1	0.027	1	Texas Salty Prairie	10/19/2021	27.886735	-97.021668
26	WET26	PEM1C1	4.001	1	Texas Salty Prairie	10/25/2021	27.888077	-97.023207
27	WET27	PEM1C1	0.007	1	Texas Salty Prairie	10/25/2021	27.888768	-97.021345
28	WET28	PEM1C1	0.010	1	Texas Salty Prairie	10/25/2021	27.888915	-97.021325

Count	Wetland Name	Cowardin	Acres Within PSA[1]	No. of Wetland Polygons	TPWD EMST Classification	Date Surveyed	Latitude[2] (DD)	Longitude[2] (DD)
29	WET29	PEM1C1	0.005	1	Texas Salty Prairie	10/25/2021	27.889366	-97.021152
30	WET30	PEM1C1	0.213	1	Texas Salty Prairie	10/25/2021	27.889827	-97.022034
31	WET31	PEM1C	0.120	4	Coastal Plain Interdunal Wetland	10/25/2021	27.889301	-97.020625
32	WET32	PEM1C	0.085	1	Coastal Plain Interdunal Wetland	10/25/2021	27.889094	-97.020601
33	WET33	PEM1C1	0.022	1	Texas Salty Prairie	10/25/2021	27.889799	-97.020808
34	WET34	PEM1C	6.085	1	Coastal Plain Interdunal Wetland	10/20/2021	27.898543	-97.012739
35	WET35	PEM1C	0.096	1	Coastal Plain Interdunal Wetland	10/20/2021	27.896855	-97.014627
36	WET36	PEM1C	0.153	1	Coastal Plain Interdunal Wetland	10/22/2021	27.902718	-97.009293
37	WET37	PEM1C	0.043	1	Coastal Plain Interdunal Wetland	10/22/2021	27.904750	-97.008531
38	WET38	PEM1C	0.013	1	Coastal Plain Interdunal Wetland	10/22/2021	27.905936	-97.007258
39	WET39	PEM1C	0.262	1	Coastal Plain Interdunal Wetland	10/22/2021	27.905783	-97.006954
40	WET40	PEM1C	1.188	1	Coastal Plain Interdunal Wetland	10/20/2021	27.907702	-97.006124
41	WET41	PEM1C	0.218	1	Coastal Plain Interdunal Wetland	10/20/2021	27.908147	-97.004722
42	WET42	PEM1C	0.485	1	Coastal Plain Interdunal Wetland	10/20/2021	27.909154	-97.003963
43	WET43	PEM1C	0.334	1	Coastal Plain Interdunal Wetland	10/20/2021	27.909945	-97.003242
44	WET44	PEM1C	0.435	1	Coastal Plain Interdunal Wetland	10/20/2021	27.910503	-97.003296
Mosaic Wetlands[3] (*wetland percent acreage reported*)								
45	MOS01	PEM1C	10.075	1	Coastal Plain Interdunal Wetland	10/21/2021	27.842516	-97.046573
46	MOS02	PEM1C	7.746	1	Coastal Plain Interdunal Wetland	10/21/2021	27.852203	-97.043098
47	MOS03	PEM1C	2.927	1	Coastal Plain Interdunal Wetland	11/11/2021	27.855693	-97.040841
48	MOS04	PEM1C	4.171	1	Coastal Plain Interdunal Wetland	10/26/2021	27.864671	-97.035854
49	MOS05	PEM1C	1.908	1	Coastal Plain Interdunal Wetland	10/26/2021	27.869446	-97.033620
50	MOS06	PEM1C	1.225	1	Coastal Plain Interdunal Wetland	10/21/2021	27.873225	-97.030720
51	MOS07	PEM1C	2.570	1	Coastal Plain Interdunal Wetland	10/25/2021	27.886432	-97.021966
52	MOS08	PEM1C	3.645	1	Coastal Plain Interdunal Wetland	10/25/2021	27.890649	-97.019022
53	MOS09	PEM1C	2.599	1	Coastal Plain Interdunal Wetland	10/20/2021	27.894549	-97.015561
54	MOS010	PEM1C	1.844	1	Coastal Plain Interdunal Wetland	10/22/2021	27.903520	-97.009006
55	MOS011	PEM1C	0.878	1	Coastal Plain Interdunal Wetland	10/20/2021	27.907064	-97.005694

Count	Wetland Name	Cowardin	Acres Within PSA[1]	No. of Wetland Polygons	TPWD EMST Classification	Date Surveyed	Latitude[2] (DD)	Longitude[2] (DD)
56	MOS012	PEM1C	64.078	1	Coastal Plain Interdunal Wetland	10/19/2021	27.920256	-96.995310
Section 404 Non-tidal Subtotal			**238.040**	**58**				
TOTALS			**241.081**	**62**				

Notes:

[1] Difference between the totals reported and the sum of the individual records are due to rounding. The totals reported were derived from GIS data.

[2] Latitude/longitude recorded for the polygon centroid of the delineated water. For resources with multiple polygons delineated; a single polygon centroid has been recorded.

[3] Calculated wetland percentage within each mosaic polygon is presented below:

MOS01 – Wetland Percentage 57.4%

MOS02 – Wetland Percentage 68.8%

MOS03 – Wetland Percentage 50.6%

MOS04 – Wetland Percentage 47.5%

MOS05 – Wetland Percentage 37.0%

MOS06 – Wetland Percentage 40.0%

MOS07 – Wetland Percentage 27.5%

MOS08 – Wetland Percentage 54.2%

MOS09 – Wetland Percentage 52.4%

MOS10 – Wetland Percentage 29.4%

MOS11 – Wetland Percentage 43.6%

MOS12 – Wetland Percentage 58.4%

Below is a summary of wetlands delineated within the SJI PSA:

- There are no estuarine wetlands located below the MHW elevation within the SJI PSA. Therefore, there are no estuarine wetlands subject to both Section 10 and Section 404 regulations.
- Estuarine wetlands subject to Section 404 jurisdiction (i.e., tidally influenced wetlands occurring between MHW and HTL elevations) occupy 3.041 acres. Tidal wetlands subject to Section 404 only include 3.041 acres of estuarine emergent low marsh flats (E2EM1N1).
- Non-tidal, palustrine wetlands subject to Section 404 account for 238.040 acres, which include 194.656 acres of palustrine emergent coastal prairie wetlands (PEM1C) and 43.384 acres of palustrine emergent hyperhaline vegetated flats located above HTL (PEM1C1). Of the 194.656 acres of PEM1C wetlands, approximately 103.666 acres are classified as coastal interdunal wet prairie and upland mosaic wetlands with percent wetland ranging between 27.5% and 68.8%.

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5 Discussion and Conclusions

5.1 Discussion of Results and General Conclusions

Field delineation surveys were conducted from October 18 through October 25, 2021 and on November 11, 2021 to identify potential WOUS as defined by the USACE (33 CFR 328.3(a)), wetlands (33 CFR 328.3(c)), SAV, and oyster habitat present within the SJI PSA located just north of the Corpus Christi Ship Channel in Aransas County Texas. Results of the field delineation surveys document five waterbody types (M1UBL, M2USN, E1UBL, E2USN, and PUB1H), one type of estuarine wetland habitat (E2EM1N1), and two types of palustrine wetland habitats (PEM1C and PEM1C1) within the SJI PSA. No SAV or oyster habitat were identified within the SJI PSA. Locations and acreage amounts of identified waters and wetlands by site are included in Table 4.5-1 (waters) and Table 4.6-1 (wetlands) within Section 4 "Waterbodies, Wetlands, SAV, and Oyster Delineation Results." Table 5.1-1 provides a summary of waters and wetlands delineated within the SJI PSA.

Table 5.1-1: Summary of Waters and Wetlands Delineated Within the SJI PSA

Cowardin	No. of Mapped Polygons	Acres within PSA	TPWD EMST Classification
Section 10/404 Waterbodies			
E1UBL	1	13.195	Estuarine Open Water
M1UBL	1	542.604	Marine Open Water
Section 10/404 Waterbodies Subtotal		**555.799**	
Section 404 Tidal Waterbodies			
E2USN	3	0.355	Texas Coastal Beach-Estuarine
M2USN	1	51.359	Texas Coastal Beach-Marine
Section 404 Tidal Waterbodies Subtotal		**51.714**	
Section 404 Non-tidal Waterbodies			
PUB1H	17	31.942	Palustrine -Open Water Pond
Waterbodies Total		**639.455**	
Section 404 Tidal Wetlands			
E2EM1N1	4	3.041	Texas Salt and Brackish Tidal Flats
Section 404 Non-tidal Wetlands			
PEM1C	40	194.659	Coastal Plain Interdunal Wetland
PEM1C1	18	43.381	Texas Salty Prairie
Section 404 Non-tidal Wetlands Subtotal		**238.040**	
Wetlands Total		**241.081**	
Uplands Total		**599.650**	
TOTALS		**1,480.186**	

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6 References

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7 Appendices

A. Map Figures (2-9)

SOIL	DESCRIPTION
Ps	Psamments, rarely flooded
GM	Galveston-Mustang complex, 0 to 3 percent slopes, occasionally flooded, frequently ponded
By	Beaches
W	Water

Notes:

Data Sources:
NRCS SSURGO Soils

Legend

Project Study Area (1482.3 Acres)

NRCS Soil Unit

PORT OF CORPUS CHRISTI AUTHORITY
CHANNEL DEEPENING PROJECT
SJI - FIGURE 2

Site SJI NRCS Soils Map
Aransas County, TX

6,000 0 6,000 12,000 Feet

N E S W

MOTT MACDONALD
5295 S. Commerce Dr., Ste. 600
Salt Lake City, UT, 84107

ABSOLUTE SCALE:
1:72,000

REFERENCE SCALE:
1 IN = 6,000 FT

Drawn By: CLB
Date: 01/12/2022

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