10 DEC 2024

Engineering Considerations and Instructions for Field Personnel
Geotechnical Exploration: Matagorda Ship Channel Design
Deficiency Project
USACE Galveston District (USACE SWG)

1. The proposed field exploration will be conducted along the proposed rock dikes to be constructed parallel to the east jetty and west jetty of the Matagorda Ship Channel (MSC) as shown on Geotechnical Exploration Map presented in Attachment C.
2. The proposed plan includes 17 land soil borings (B-1 through B-17) including 7 borings with 80-ft termination depths and 10 borings with 40-ft termination depths. The corresponding boring bottom elevations will be approximately -70 and -30 feet MLLW for the deep and shallow borings, respectively.
3. The approximate spacing between borings is about 500 feet along the proposed East and west rock dike alignments.
4. Performance Work Statement (Attachment D) - Geotechnical Field Exploration and Laboratory Testing will be used as the basis for administration, review, and approval of submittals/deliverables of subject geotechnical exploration to be performed as Work In-Kind (WIK) by the Non-Federal Sponsor (Calhoun Port Authority)'s Consultants.
5. The Consultant shall submit the acceptable raw field data and logs for soil borings within three (3) business days of completion to the designated USACE Point of Contact (POC). USACE will develop and issue the appropriate Laboratory Testing program to the consultant for the completed soil borings within five (5) business days of receipt of acceptable field logs to ensure the timely performance of Laboratory testing of completed soil borings.
6. Performance of Work (Ref. Attachment D)
   A. The consultant shall follow wet-rotary boring technique to drill and sample the borings.
   B. Borings sampling methods: 3-inch dia. thin-walled tube sampler (ASTM D1587) for cohesive soils & SPT Split-Barrel Sampling of Soils (ASTM D1586) for cohesionless/granular Soils.
   C. A Field Geologist or Engineer onsite shall log the drilling and sampling records (SPT hammer blow counts, visual soil classification, pocket penetrometer readings, water levels, and other field tests and observations) to prepare the field boring logs.
   D. A Professional Geologist or Engineer (CPA Consultant Representative) shall supervise the careful handling and packaging of soil samples. The soil samples shall be packaged to protect them from loss of moisture and disturbance in accordance with the methods shown in Attachment D.
   E. The acceptable field logs of borings shall be completed at the site by the Field Personnel under the supervision of a Professional Geologist or Engineer (Consultant Representative).
   F. The contents of acceptable field boring logs shall include, but will not be limited to the following data: coordinates of boring location, drill rig type, drilling method, auger/drill bit size, type of drilling fluid, sampler type, hammer information, sampling time, any hard drilling or soft soil condition encountered, visual classification of soils, pocket pen readings for cohesive soils samples, SPT blow count for non-cohesive samples, vertical variations in lithology, depth of groundwater upon encountering water and upon borehole completion (for land borings), percentage of sample recovery at each sampling elevation of the boring, etc.
   G. The drilled holes shall be backfilled with bentonite grout after drilling and sampling.
7. Geotechnical boring locations and depths are shown in Table 1, Attachment A.

8. Estimated types and quantities of geotechnical laboratory tests are shown in Table 2, Attachment B.

Consultant's Sub-tasks and Submittals

1. Coordinate and host a pre-exploration coordination meeting with USACE SWG and Calhoun Port Authority (CPA).
2. Submit a Field Exploration Execution Plan for review and approval before mobilization.
3. Submit field boring logs within three (3) business days of completion for the finished work. Field boring logs shall include the sample recovery length for test assignment.
4. Actual sample selection and test assignments will be provided by the USACE SWG on test assignment sheets for each soil boring following completion of drilling and receipt of the field boring logs. Laboratory assignments will be provided to the CPA Consultant by SWG within five (5) business days following the receipt of the handwritten field logs. Sample check and verification prior to test assignments may be necessary.
5. Tests shall be performed on portions of the samples that are considered representative of the predominant material composition of the overall sample. USACE SWG reserves the right to retain soil samples obtained during drilling operations for independent testing and reserves the right to be present during drilling operations and during opening and testing of soil samples at the CPA Consultant's laboratory.
6. Develop and submit the draft Logs for soil borings based on laboratory test results weekly for the completed work.
7. Prepare and submit a Draft Geotechnical Data Report (GDR) report for review within 20 business days after completion of field and laboratory work for review. All report documents shall be submitted electronically in unlocked native and PDF formats. The CPA Consultant shall submit a MicroStation file showing subsurface profiles for sections selected by the Government showing borings and key field and laboratory test results. The following list of deliverables may not all inclusive:
    - vicinity map
    - borehole location plans
    - borehole location survey data, including both proposed and actual locations
    - top of water elevation (MLLW) at time of drilling for each boring
    - water depths to mudline for each boring
    - laboratory test result summary
    - laboratory test results in ASTM report format
    - laboratory raw data sheets
    - final boring logs, SPT (N60) results, and rig specific energy transfer ratio (ETR) record
    - subsurface profiles showing boring sections with descriptions

8. USACE SWG will review the draft report and provide comments to the CPA Consultant within 14 calendar days upon receipt of the draft GDR. The CPA Consultant shall respond to the comments by making corrections or clarification.
9. Submit the final Geotechnical Data Report (GDR) signed and stamped by a Professional Engineer following the review of the draft report within 14 calendar days of completion of the draft GDR review.

ATTACHMENTS

ATTACHMENT A - Table 1 - Boring Locations and Depths
ATTACHMENT B - Table 2 - Geotechnical Laboratory Testing Summary
ATTACHMENT C - Geotechnical Exploration Map
ATTACHMENT D - Performance Work Statement

ATTACHMENT A

TABLE 1

Locations and Depths

Matagorda Ship Channel Design Deficiency Project

Notes:

1. Horizontal Coordinates in Texas State Plane Coordinate System, South-Central Zone, NAD83 in U.S. Survey Feet.
2. Horizontal Coordinates are estimated based on dated survey data. Actual locations shall be field verified using hand-held GPS equipment and adjusted as necessary for field conditions.
3. The driller shall follow wet-rotary technique up to target bottom elevation.
4. Recommended Sampling Methods: 3-inch dia. thin-walled tube sampler (ASTM D1587) for Cohesive/Clayey soils & SPT Split-Barrel Sampling of Soils (ASTM D1586) for Granular Soils. Sampling Interval: Sampling interval every 2.5 feet above -40 ft MLLW and and 5 feet interval below -40 ft MLLW.

ID	Intermittent or Continuous Sampling [4]	Location Description	Horizontal Coordinates[1,2, 3]		Boring Depth
			Northing (Y)	Easting (X)	
B-1	Continuous/ Intermittent	Land	13,349,436.91	2,828,187.87	40
B-2	Continuous/ Intermittent	Land	13,349,854.73	2,827,755.86	80
B-3	Continuous/ Intermittent	Land	13,350,277.57	2,827,320.21	40
B-4	Continuous/ Intermittent	Land	13,350,699.71	2,826,885.55	80
B-5	Continuous/ Intermittent	Land	13,351,120.76	2,826,451.24	40
B-6	Continuous/ Intermittent	Land	13,351,542.90	2,826,016.28	80
B-7	Continuous/ Intermittent	Land	13,351,944.36	2,825,599.16	40
B-8	Continuous/ Intermittent	Land	13,352,408.80	2,825,296.34	80
B-9	Continuous/ Intermittent	Land	13,353,101.05	2,825,175.12	40
B-10	Continuous/ Intermittent	Land	13,348,733.98	2,826,122.50	80
B-11	Continuous/ Intermittent	Land	13,349,100.21	2,825,787.49	40
B-12	Continuous/ Intermittent	Land	13,349,467.14	2,825,450.86	80
B-13	Continuous/ Intermittent	Land	13,349,834.06	2,825,113.92	40
B-14	Continuous/ Intermittent	Land	13,350,203.09	2,824,773.40	80
B-15	Continuous/ Intermittent	Land	13,350,539.27	2,824,459.68	40
B-16	Continuous/ Intermittent	Land	13,350,464.85	2,823,954.70	80
B-17	Continuous/ Intermittent	Land	13,350,360.32	2,823,452.66	40

ATTACHMENT B

TABLE 2

Geotechnical Laboratory Testing Summary
Matagorda Ship Channel Design Deficiency Project

Laboratory Test	Test Method	Estimated Quantity of Testing
Laboratory Determination of Water Content	ASTM D2216	230
Particle-Size Distribution of Soils Using Sieve Analysis	ASTM D6913	50
One-Dimensional Consolidation Properties of Soils	ASTM D2435	16
Liquid Limit, Plastic Limit, and Plasticity Index of Soil (Method A, 3-point)	ASTM D4318	75
Determining the Amount of Material Finer than 75-mm (No. 200) Sieve in Soils by Washing	ASTM D1140	100
Laboratory Determination of Density of Soil Specimens	ASTM D7263	112
Unconfined Compressive Strength of Cohesive Soils	ASTM D2166	70
Consolidated Undrained Triaxial Compression (each test w/3 specimens tested at different loading conditions)	ASTM D4767	12
Unconsolidated-Undrained Triaxial Compression	ASTM D2850	18
Direct Shear Test of Soils under Consolidated Drained Conditions	ASTM D3080	18

ATTACHMENT C

GEOTECHNICAL EXPLORATION MAP

X=2,825,000

X=2,827,500

X=2,830,000

Y=13,352,500

Y=13,350,000

ID	Location Description	Horizontal Coordinates[1,2,3]	
		Northing (Y)	Easting (X)
B-1	Land	13,349,436.91	2,828,187.87
B-2	Land	13,349,854.733	2,827,755.862
B-3	Land	13,350,277.569	2,827,320.210
B-4	Land	13,350,699.706	2,826,885.549
B-5	Land	13,351,120.764	2,826,451.244
B-6	Land	13,351,542.903	2,826,016.280
B-7	Land	13,351,944.359	2,825,599.158
B-8	Land	13,352,408.799	2,825,296.341
B-9	Land	13,353,101.052	2,825,175.115
B-10	Land	13,348,733.981	2,826,122.496
B-11	Land	13,349,100.213	2,825,787.487
B-12	Land	13,349,467.140	2,825,450.862
B-13	Land	13,349,834.061	2,825,113.922
B-14	Land	13,350,203.087	2,824,773.404
B-15	Land	13,350,539.265	2,824,459.682
B-16	Land	13,350,464.848	2,823,954.702
B-17	Land	13,350,360.318	2,823,452.656

B-1 B-2 B-3 B-4 B-5 B-6 B-7 B-8 B-9 B-10 B-11 B-12 B-13 B-14 B-15 B-16 B-17

6+000 5+000 4+000 3+000 2+000 1+000 0+000

POT STA 3+453.56

MATAGORDA SHIP CHANNEL

N

0 400 800

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: R. THARMENDIRA, P.E.
DRAWN BY: A. THAPA
CHECKED BY: D. BOOTHBY, P.E.
SUBMITTED BY: D. BOOTHBY, P.E.
SIZE:

ISSUE DATE: MMMMMMMM YYYY
SOLICITATION NO.: W912HYXXB
CONTRACT NO.: W912HYXXC
SWG FILE NO.: 2705-0251
JOE HORAK, P.E. CHIEF, GENERAL ENGINEERING BR.

U.S. ARMY CORPS OF ENGINEERS
GALVESTON DISTRICT
2000 FORT POINT ROAD
GALVESTON, TEXAS 77550

SWG Geospatial & Water Advanced Modeling Section

MATAGORDA SHIP CHANNEL, TEXAS
MATAGORDA SHIP CHANNEL
JETTY DEFICIENCY

BORING PLAN

SHEET ID

B-001

%STATUS% - NOT FOR CONSTRUCTION

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ATTACHMENT D

PERFORMANCE WORK STATEMENT

PERFORMANCE WORK STATEMENT

GEOTECHNICAL FIELD EXPLORATION AND LABORATORY TESTING

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

1. **GENERAL**. The intent of the work specified herein to be performed by the Contractor is to determine the type, nature, and characteristics of the subsurface materials at existing and proposed project sites under investigation by the United States Government, principally the U.S. Army Corps of Engineers (USACE), Galveston District, Galveston, Texas. The required work will normally be located within the boundaries of the Galveston District, shown on Plate 1 (see *Section J*); however, work may occur outside these boundaries with concurrence of the Contractor and approval of the Contracting Officer. Services may be performed in connection with both military and civil projects assigned to any entity of the United States Government. Project locations will be identified in each task order. The Contractor, operating as an independent contractor and not as an agent of the Government, shall provide all labor, equipment, and transport of equipment and personnel to the site necessary to determine the type, nature, and characteristics of the subsurface materials at the specified locations, utilizing procedures for geotechnical field exploration (sampling using various drilling, direct push, or excavation equipment, and field testing) and laboratory testing, which are acceptable to the U. S. Army Corps of Engineers, and provide to the Contracting Officer the required products with supporting data. The Contractor must be familiar with USACE Engineering Regulations and Manuals, and be capable of providing proper equipment and experienced personnel, and developing and following field exploration procedures that comply with the established requirements. All work shall be performed in accordance with the terms and conditions of the contract and this Performance Work Statement (PWS). During the prosecution of the work, the Contractor shall provide adequate supervision and quality control to assure the accuracy, quality, completeness, and progress of the work.

2. **DIRECTION OF WORK**. The Contracting Officer will direct the Contractor to initiate field exploration operations at designated work areas and to perform related laboratory testing through the issuance of either one or multiple task orders. Task orders will identify the purpose and location of the required field exploration, the location, number, and depth of soil borings, Cone Penetrometer Tests (CPTs), vibracores, or other field sampling or test procedures, the frequency of soil samples to be obtained, the laboratory tests to be performed on the samples, the required completion date of the work, and any special requirements or conditions. The Contractor shall begin the field exploration at the designated work site within fourteen (14) calendar days after receipt of a Notice to Proceed (NTP) for a given task order, unless otherwise approved by the Contracting Officer. The Contractor shall develop and provide a site-specific safety plan to the Contracting Officer for review prior to issuance of an NTP for each task order as specified in Section H of this contract. A

drilling plan, if required for a task order, shall be developed and provided to the Contracting Officer for review prior to issuance of an NTP. If laboratory testing is directed by a separate task order, then the Contractor shall begin laboratory testing of the soil samples within five (5) calendar days after receipt of the NTP for that task order, unless otherwise approved by the Contracting Officer. The Contracting Officer reserves the right to set aside a certain portion of field exploration work to be performed by Government personnel or other commercial sources. Testing of samples obtained by Government personnel may be designated for testing by the Contractor or may be tested at a Government and/or other commercial laboratory as selected by the Contracting Officer. The portion of work to be set aside is not included in the estimate of the quantity of work to be performed under this contract.

3. **SUPERVISION OF WORK**. The Contractor shall be responsible for supervision of geotechnical field exploration and laboratory testing of soil samples. The Contractor shall assign a professional engineer or a professional geologist to supervise the work to be performed under each individual task order. The Contractor's representative shall be responsible for coordinating the field operations to ensure that field procedures and directions specified in this contract are being followed. In addition, the Contractor shall be responsible for ensuring that the soil samples are being properly obtained and handled and that the samples are representative of the subsurface materials being encountered. The Contractor's representative shall communicate with representatives of the Contracting Officer during the field operations to advise the Contracting Officer of any difficulties encountered in the performance of the work. Upon receipt of the Field logs, described in paragraph 14. **RECORDS** of this Section, the Contractor's representative shall review the logs for completeness and for agreement with the samples obtained. Upon receipt of directions for laboratory testing, the Contractor's representative shall inform laboratory personnel of the tests to be performed and shall supervise the testing to ensure that proper testing procedures are followed and that test results are properly recorded. The presence of a representative of the Contracting Officer during the drilling operations and/or the laboratory testing shall not relieve the Contractor of the responsibilities specified in this paragraph.

4. **LOCATION OF WORK**. The location of the field exploration to be performed will be identified in each task order. Locations will include terrain of varying types, steepness, and consistencies ranging from hard-surfaced dry land to soft marsh lands, including swamps and dredged material placement areas, lands with excessive moisture or soft to very soft surface and subsurface conditions, partially to fully submerged areas with varying depths of ponded or standing water, and areas which may be covered by heavy vegetation or brush. Locations may also include inland waterways and channels, portions of other bodies of water, and waters of and in close proximity of deep draft navigation channels including entrance channels offshore. The locations of the projects will at times be on islands that are only accessible by water. The exact location of each field boring, vibracore, CPT, or other field sampling or testing to be performed will either be provided to the contractor in the form of horizontal coordinates, be staked by the Contracting Officer's representative, be provided in relation to an existing physical or topographic feature, or be positioned in accordance with other instructions provided in the individual task orders. The locations of borings specified in the task order or task order attachments shall not be changed unless allowed by the task order or approved by the Contracting Officer.

5. **ACCESS TO BORING LOCATIONS**. The Contractor shall be required to perform clearing of vegetation where necessary to provide access for field exploration equipment. Where clearing is needed as determined by the Government, one or more of the equipment types listed in 13. **EARTHWORK** may be ordered by the Government for use in a given task order. Rights-of-Entry or assurances that field exploration and associated clearing and earthwork activities are permitted in the designated areas will be furnished to the Contractor by the Contracting Officer prior to the initiation of the field work. Access to the project sites accessible only by water may be obtained via public or private boat ramps or other launching sites identified by the Contractor. The Contractor shall exercise care in the use of the public ramps to avoid disturbance to the area and shall be responsible for leaving the area in good condition comparable to conditions prior to the work. If private ramps are used, the Contractor shall make arrangements with the owners for their use.

6. **INCLEMENT WEATHER AND UNFORESEEN SITE CONDITIONS**. Due to the nature of the field work required under this PWS, it is anticipated that inclement weather and unforeseen site conditions may cause field work delays.

a. Weather Delays. Routine inclement weather is considered to be any inclement weather that would reasonably be anticipated for the project site location and season during which the work is planned to be performed. Every effort will be made to accommodate the possibility of routine inclement weather delays in the work schedule, the duration for which will be negotiated for each task order. Full or partial days when field work cannot be accomplished due to routine inclement weather will not be paid for separately. The Contractor should take into account the potential for delays to field work schedules and costs due to the effects of routine inclement weather. The exception to routine inclement weather is the occurrence of unusual weather that causes extended limitations to site access and field operations, for example hurricanes, flooding, winter freezing storms, or other unusual events. Should unusual weather events occur that create extended periods of time whereby the work cannot continue, the Contractor shall contact the Contracting Officer, or his designated representative, at the earliest possible time after these conditions are anticipated or encountered so that a determination can be made whether to pursue a task order modification. No additional time or work will be paid for without a formal task order modification issued in advance of the additional time or work.

b. Unforeseen Site Conditions. The term “unforeseen site conditions” is defined as conditions that could not reasonably be foreseen by the Contracting Officer or the Contractor prior to task order award. The Contractor is responsible for visiting the proposed exploration site, determining access requirements for the exploration sites, including for challenging locations, becoming familiar with existing utilities at the project site, and estimating the field work schedule and costs, based on sound judgment and experience, prior to task order award. Should unforeseen site conditions that result in work delays and/or additional cost to the Contractor be encountered after task order award, the Contractor shall contact the Contracting Officer, or his designated representative, at the time of discovery of the related site conditions so that a determination can be

made whether to pursue a task order modification. Other field work included in the task order, and not affected by the unforeseen site condition, should be continued in order to maintain the completion schedule as closely as possible. No additional time or work will be paid for without a formal task order modification issued in advance of the additional time or work.

7. **FIELD EQUIPMENT**. Equipment to be furnished and utilized by the Contractor for geotechnical sampling shall be dependable equipment in good condition and of sufficient size to efficiently perform the sampling and testing to the required depths, at the required locations, and within the approved time period specified for the work. All equipment is subject to approval by the Contracting Officer prior to the commencement of the required work and shall be maintained in good working condition by the Contractor throughout the drilling operations. The Contracting Officer reserves the right to require the removal and replacement of undependable equipment and will have the final determination of dependability of equipment. Global Position Systems (GPS) and survey equipment shall conform to the requirements in 20. **SURVEYING EXPLORATION LOCATIONS**.

a. Land-Based Site Exploration.

(1) Drilling equipment shall be of the hydraulic feed or chain pulldown type, and mounted on a self-propelled vehicle having the capability to access the drilling sites. Varied conditions at the investigation sites may require the drilling equipment be truck-mounted with regular road tires, or marsh buggy-mounted with rice or cane tires, or terra or floatation tires, or be track-mounted. Supplies shall include, but not be limited to, all casing, pipes, pumps, power, and supplemental equipment necessary to accomplish the required drilling and sampling. All equipment is subject to approval by the Contracting Officer prior to the commencement of the required work and shall be maintained in good working condition by the Contractor throughout the drilling operations. The Contacting Officer reserves the right to require the removal and replacement of undependable equipment and will have the final determination of dependability of equipment.

(2) Cone Penetrometer Test (CPT) Equipment to be furnished and utilized by the Contractor for CPT testing shall be dependable equipment in good condition and of sufficient size to efficiently perform the CPT testing to the required depths at the required locations and within the approved time period specified for the work. CPT equipment shall be of the electronic type, suitable for obtaining the data requested herein in accordance with ASTM D5778, “Electronic Friction Cone and Piezocone Testing of Soils”. CPT equipment shall be mounted on a self-propelled vehicle capable of accessing various investigation sites as described in (1) above for drilling equipment. All equipment is subject to approval in writing by the Contracting Officer prior to commencement of the required work and shall be maintained in good working condition by the Contractor throughout the CPT operations. The Contracting Officer reserves the right to require removal and replacement of undependable equipment

and will have the final determination of dependability of equipment.

b. Water-Based Site Explorations

All floating plants shall conform to U.S. Coast Guard Regulations and shall provide a working environment that will comply with Corps of Engineers safety and health requirements. All pertinent provisions of the latest edition of Engineer Manual (EM) 385-1-1, U.S. Army Corps of Engineers Safety and Health Requirements Manual, shall govern the prosecution of the work. Drilling equipment shall be of the hydraulic feed or chain pulldown type. Vibracore equipment shall be of the type required to penetrate and sample the sediments anticipated at the investigation site(s). GPS electronic positioning equipment used for positioning of drilling, CPT, vibracore, or other specified sampling and testing rigs, shall be as stated above and suitable for use in positioning of vessels or floating plant in areas as required by this contract.

(1) Floating Plant (normal setup). The Floating Plant with normal setup shall consist of a collapsible drilling rig having hydraulic or chain-drive mounted on a self-propelled (any vessels or their crew required to maneuver plants that are not self-propelled shall be included in this rate) boat, skiff, or small barge limited to a maximum of 40 feet in length and capable of being trailered to and launched from a public boat ramp near the work area, then sailed (or towed - cost included) to the work area under its own power. The floating plant shall be capable of maintaining horizontal and vertical stability during drilling operations on inland waters of up to 20-foot depth at locations having minimal exposure to wave, tidal, and current influences. The floating plant should be capable of drilling and obtaining soil samples in predominantly cohesive to cohesionless soils to a maximum depth of 60 feet below the sea floor.

(2) Floating Plant (extra stability 4 point anchor spread & heavy duty casing). The Floating Plant with extra stability capabilities shall consist of a collapsible drilling rig having hydraulic or chain-drive mounted on a self-propelled (any vessels or their crew required to maneuver plants that are not self- propelled shall be included in this rate) boat, skiff, or small barge limited to a maximum of 40 feet in length and capable of being trailered to and launched from a public boat ramp near the work area, then sailed to the work area under its own power. The floating plant shall be capable of maintaining horizontal and vertical stability during drilling operations on inland waters of up to 20-foot depth at locations having moderate exposure to wave, tidal, and current influences. The floating plant may be stabilized using spuds or other reliable methods such as multipoint anchors. Heavy duty casing is typically required to protect the drill string from breakage due to stresses imposed by moderate wave, tidal, and/or current influences. The floating plant should be capable of drilling and obtaining soil samples in predominantly cohesive to cohesionless soils to a maximum depth of 60 feet below the sea floor.

(a) Signal Lights. When working with floating plants, the Contractor shall display signal lights and conduct his operations in accordance with the

General Regulations of the Department of the Army and of the U.S. Coast Guard governing lights and day signals to be displayed by towing vessels with tows on which no signals can be displayed, vessels working on wrecks, dredges, and vessels engaged in laying cables or pipe or in submarine or bank protection operations, lights to be displayed on dredge pipe lines, and day signals to be displayed by vessels of more than 65 feet in length moored or anchored in a fairway or channel, and the passing by other vessels of floating plant working in navigable channels, as set forth in Commandant U.S. Coast Guard Instruction M16672.2, Navigation Rules: International - Inland (COMDTINST M16672.2) or 33 CFR 81 Appendix A (International) and 33 CFR 84 through 33 CFR 89 (Inland), as applicable.

(b) Obstruction of Channel. The Government will not undertake to keep the channel free from vessels or other obstructions, except to the extent of such regulations, if any, as may be prescribed by the Secretary of the Army, in accordance with the provisions of Section 7 of the River and Harbor Act approved 8 August 1917. The Contractor will be required to conduct the work in such manner as to obstruct navigation as little as possible, and in case the Contractor's plant so obstructs the channel as to make difficult or endanger the passage of vessels, said plant shall be promptly moved on the approach of any vessel to such an extent as may be necessary to afford a practicable passage. Upon completion of the work, the Contractor shall promptly remove his plant, including ranges, buoys, piles, and other marks placed by him under the contract.

8. **FIELD PERSONNEL**. The Contractor shall have experienced and thoroughly competent core drillers, soil boring loggers, CPT operators, vibracore operators, earthmoving and clearing equipment operators, and helpers performing the field work at all times. The Contracting Officer reserves the right to require the removal and replacement of incompetent personnel and will have the final determination of whether personnel are incompetent.

9. **ORDER OF WORK**. Unless otherwise specified in the individual task orders, the Contractor may perform the field work in whatever order deemed best for completion in accordance with the approved schedule, and in a well-organized, and cost efficient manner. The Contracting Officer reserves the right to specify in each task order that the work be performed in a designated order based on project priorities.

10. **EXISTING UTILITIES.** The Contractor is advised to clear existing utilities by referring to available maps of gas and oil pipelines, visual inspection of all field exploration sites, and calling appropriate utility locating services before commencing field exploration and earthwork operations as described herein. If a pipeline is detected at a proposed field exploration element (boring, CPT, vibracore, or other exploration type), then the Contractor shall relocate the element 100-feet away from such pipeline and identify the revised locations on the exploration layout. Approval for relocation of an element shall be obtained from the Government point of contact (POC) identified in each task order prior to performing the work.

11. **BORING TYPES AND SAMPLING METHODS**. Required boring and sampling methods will be specified in the individual task orders as undisturbed, disturbed, and/or environmental sample borings. Borings, as defined in this document, include field exploration that requires drilling or direct push to advance sampling equipment used to obtain subsurface samples for examination and testing. Field borings and sampling procedures and equipment shall be appropriate for the type, depth, and purpose of the samples required. Field work shall be performed in accordance with the criteria and guidance provided in EM 1110-1-1804 and the procedures outlined in the applicable ASTM standards (latest edition) for the methods used. When drilling in and near flood embankment dams and levees and/or their earth and rock foundations the Contractor will comply with ER 1110-1-1807.

a. Undisturbed Sample Borings.

(1) General Requirements for Continuous and Intermittent Sampling. Undisturbed sample borings shall be either manually or mechanically driven via industry standard drilling equipment in good working order and shall exhibit properties as close to the *in-situ* properties as can practically be obtained through use of ASTM sampling methods cited herein. Drilling personnel shall exercise care during the drilling operations to assure that changes in materials are detected and that samples are obtained at start of each new material layer and at the prescribed intervals thereafter according to the sampling methods prescribed herein. Sample containers shall be labeled with project name, location, boring number, sample number, depth of sample, and date sample was obtained.

(2) Continuous Sampling.

(a) Cohesive Materials. Where cohesive materials are encountered, continuous sampling shall be performed in accordance with ASTM D1587, “Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes”, using 3-inch diameter thin-walled tube samplers, or as specified in the task orders. Continuous sampling within cohesive materials using thin-walled tubes shall be performed at the rate of one sample every two (2) feet of depth. As cohesive samples are retrieved, they shall be extruded from sample tubes by a mechanical jack or hydraulic piston designed in a manner to minimize disturbance or distortion of the sample during extrusion. The sample shall be supported during the extruding process and shall be moved from the extruder to the wrapping table by a rigid sample supporting device. Pocket penetrometer tests shall be made on each cohesive undisturbed sample after removing all loose disturbed material from the sample. The tests shall be performed according to the standard procedures using a pocket penetrometer in good working order and having a scale range of 0.25 to 4.5 tons per square foot (tsf) in scale divisions of 0.25 tsf. Where pocket penetrometer results yield 0.25 tsf or less, the Contractor shall also perform a field torvane test using the appropriate torvane attachment for soft materials. For every 2-feet of continuous sampling in cohesive soils, and after removal of loose disturbed material, the remaining intact undisturbed sample shall be a

minimum of 1-foot in length to the extent practicable for the consistency of the materials sampled by experience and competent drillers. Cohesive samples shall be wrapped with aluminum foil, placed in containers, to be furnished by the Contractor, and encased and sealed with paraffin or approved equal sample sealing method.

(b) Non-cohesive Materials. Standard Penetration Tests (SPTs) shall be performed in accordance with ASTM D1586, "Standard Test Method for Penetration Test (SPT) and Split- Barrel Sampling of Soils", where cohesionless materials are encountered (such as sands, clayey sands, silty sands, etc.), at the start of each cohesionless layer and at 5-foot intervals thereafter within the cohesionless layer(s) to the required depth of the boring. For each SPT test, the number of blows required to drive the sampler shall be recorded for every 6 inches driven until driven a full 18 inches to complete the test. The cohesionless materials from the sampler shall be placed in quart jars or approved equal sample container, to be furnished by the Contractor, for follow-up lab testing. Sample jars or other approved containers shall be equipped with moisture tight screw caps or approved sealing method.

(3) Intermittent Sampling. Sampling methods and procedures for intermittent sampling shall be the same as that prescribed for continuous sampling above. Unless otherwise directed, sampling intervals for intermittent sampling shall be as follows:

(a) Cohesive materials. Starting at the ground surface, maintain an interval of one sample every two (2) feet to the 10-foot depth, then below the 10-foot depth, the sampling interval shall be one sample every five (5) feet or change in material type, whichever is less.

(b) Non-Cohesive Materials. If non-cohesive materials are encountered at the surface and/or within the top 10 feet of an intermittent boring, then samples shall be obtained at the surface, then at five (5) intervals thereafter within the non-cohesive layer(s) using the SPT procedure.

b. Disturbed Sample Borings. A disturbed sample boring shall be any boring advanced with, and samples obtained with, either a manually or mechanically operated auger, in accordance with ASTM D1452, "Standard Practice for Soil Exploration and Sampling by Auger Borings". Disturbed soil samples shall be obtained at the existing ground surface and at each 5-foot interval thereafter, or change in material type, whichever is the lesser interval, or at the interval required by the task order (not to exceed one every two (2) feet) to the required depth of the boring. Disturbed soil samples shall be placed in quart jars or approved equal sample container, to be furnished by the Contractor, for follow-up lab testing. Sample jars or other approved containers shall be equipped with moisture tight screw caps or approved sealing method. Larger grab bag samples may be required for obtaining materials for laboratory compaction tests. Samples for compaction tests shall consist of bag samples of specified weight that are composed of representative composite samples obtained from designated depths in the boring. In addition to the disturbed samples described

above, a jar sample that is representative of the material composing each bag sample shall also be obtained for material identification purposes. All sample containers shall be furnished by the Contractor. Each sample obtained shall be clearly marked or labeled with the project name, location, boring number, sample number, depth of sample, and date the sample was obtained.

c. Vibracore. Vibracore sampling is a specialized method for obtaining continuous samples of unconsolidated soils underwater or on land in relatively soft soils. The sampler uses a vibratory unit to drive a continuous sample tube (or barrel) through the soil and retrieve samples. The vibratory unit may by electric, pneumatic, or hydraulic; however, must be appropriate for the soil conditions and required sampling depths at the vibracore locations. A core retaining device shall be used to ensure full core recovery. The vibracore apparatus shall include a method to evacuate water from the barrel to create a vacuum in the barrel as it penetrates the soil.

12. **CONE PENETROMETER TESTS**. The CPTs shall be performed at the locations and pushed hydraulically to the depths specified in the task order. CPTs shall be performed in accordance with the requirements outlined in ASTM D5778. Plotted results of each test shall include as a minimum, the depth versus the cone resistance (q_c), the depth versus the cone side friction (f_{sc}), the depth versus the pore water pressure, and the depth versus the friction ratio (R_f). Depth versus the soil behavior type using an accepted friction ratio classification chart shall also be provided. Plotted results of cone resistance, cone side friction, and porewater pressure shall be provided in units of tons per square feet (tsf), and depth shall be provided in feet. In addition to plotted results, raw data files from which the plots are based on shall be provided with the final deliverables, with raw data labeled according to type of information and units. The Contractor shall record the coordinates and elevation (X, Y & Z) of CPT locations with reference to the horizontal and vertical datums specified in paragraph 20. **SURVEYING EXPLORATION LOCATIONS**, or as otherwise specified in the individual task orders. The Contractor shall have experienced and competent personnel and helpers performing the CPT operations at all times. The Contracting Officer reserves the right to require removal and replacement of incompetent personnel and will have the final determination of whether personnel are incompetent.

13. **EARTHWORK.**

a. Earthmoving Equipment. Earthmoving equipment furnished and utilized by the Contractor shall meet the minimum requirements shown below and be dependable equipment in good condition and of sufficient size to efficiently perform the earthmoving operations in order to support the drilling operations in heavily vegetated areas or challenging terrain and within the approved time period specified for the work. All equipment is subject to approval by the Contracting Officer prior to the commencement of the required work and shall be maintained in good working condition by the Contractor throughout the drilling operations. The Contracting Officer reserves the right to require the removal and replacement of undependable equipment and will have the final determination of dependability of equipment.

(1) Small Bulldozer. The small bulldozer shall have a minimum net

engine or flywheel power rating of 70 horsepower, be furnished with an angle type blade and power operated controls, and have a track width and configuration setup for optimal performance for the type of foundation and terrain at the site specific project location.

(2) Large Bulldozer. The large bulldozer shall have a minimum net engine or flywheel power rating of 150 horsepower, be furnished with an angle type blade and power operated controls, and have a track width and configuration setup for optimal performance for the type of foundation and terrain at the site specific project location.

(3) Track-hoe. The track-hoe shall have a minimum net engine or flywheel power rating of 135 horsepower, have a hydraulic system configuration capable of operating up to a 1.8 cubic yard bucket filled with soil, and capable of placing and picking up the matting described below. The track width and configuration shall be setup for optimal performance for the type of foundation and terrain at the site specific project location.

(4) Matting. Each matt shall be of sufficient size and configuration to support operations of the earth moving equipment, drilling rig, or other vehicle as required. Matting shall be configured to allow earthmoving and drilling equipment to pass over the matting when used to bridge over trenches, small to medium size ditches, small dips, or depressions, soft areas, other challenging locations, or when being used as a base from which to operate the earthmoving equipment in soft areas. Matting shall be configured and capable of being disassembled and reassembled to the extent necessary to allow the matting to be placed or picked up with the track-hoe equipment included herein. Matting shall be of sufficient quantity to allow the track-hoe equipment to operate on the matting while also placing another set of matting to complete the earthwork operations and create access necessary for complete drilling operations.

b. Earthmoving Locations. Locations for which earthmoving equipment will be used will be determined by the Government on a case by case basis for a given site and task order. In all cases where the use of the small bulldozer, large bulldozer, track-hoe, matting, or some combination thereof is approved for a given task order, the Contractor shall be responsible for obtaining additional approval in writing from the land owner in which the earthwork or clearing will be done with a description from the owner of the extent, scope, and locations in which the clearing and earthwork is approved. Factors which may be the basis for the Government considering the use of the clearing and earthmoving equipment for approved sites may include, but not be limited to, heavily vegetated sites with no pathways, locations where the digging of test pits are requested, or sites with uneven terrain whereby the use of other land based, marsh terrain, or floating plant equipment covered under the main contract will not allow for successfully traversing, accessing, or navigating the investigation site to the specified boring locations.

c. Selection of Equipment. Depending on the extent and nature of the earthwork

and clearing, the Contracting Officer may direct that any combination of the small bulldozer, large bulldozer, track-hoe, and matting be used, but not necessarily include all these items for a given project. After a task order is officially issued, any deviations from the types or combination of equipment in a given task order shall require a formal modification in advance, otherwise, the use of additional equipment will be at the expense of the Contractor. The Government reserves the right to request the use of the small bulldozer, large bulldozer, track-hoe, matting equipment, or some combination thereof for a particular task order, when in the opinion of the Contracting Officer, Contracting Officer's Representative, or POC, the use of this equipment for a particular site is necessary for a particular application or set of conditions not mentioned above.

d. Equipment Operators and Duration of Operation. The Contractor shall have experienced and thoroughly competent operators performing the earthmoving and clearing operations with equipment specified herein. Costs for qualified operators shall be included in the overall daily rates for using the various types of equipment. The Contracting Officer reserves the right to require the removal and replacement of incompetent personnel and will have the final determination of whether personnel are incompetent. Additional time spent operating the equipment or additional rental days that results from operators performing below normal acceptable standards of production and workmanship, will be incurred at the expense of the Contractor.

e. Preservation and Restoration. Any earthwork permitted under a given task order shall be done in a manner that is kept to the "bare minimum" necessary to facilitate getting the drilling equipment through to the investigation locations, or facilitate other types of investigations specified in a given task order. The Contractor shall exercise care and reasonable judgment in order to ensure any property at the site is not damaged, such as, but not limited to, structures, utilities, pipelines, fences, gates, roads, pathways, landscaped areas, ditches, levees, vehicles, livestock, etc. Property damaged by the Contractor shall be repaired at the Contractor's expense. Additionally, after the earthwork operations are no longer needed to assist the soil investigations, the Contractor shall restore the soil topography to a condition comparable to the conditions before any earthwork at the site began, unless this requirement is specifically waved by the land owner. In some instances for Government owned property, the Government may waive the requirement to restore the soil topography to prior conditions if the new site condition is deemed to be advantageous by the Government for future work at the site.

14. **RECORDS**. The Contractor shall keep accurate field logs and records of all work accomplished and shall deliver complete, legible copies of these logs and records to the Contracting Officer upon completion of the work or at such times as directed. All such records shall be preserved in good condition and order by the Contractor until they are delivered to and accepted by the Contracting Officer. The Contracting Officer reserves the right to examine such records at any time prior to their delivery. The presence of Contracting Officer's representative onsite, or the keeping of separate field records by the Contracting Officer shall not relieve the Contractor of the responsibility for the work specified in this contract. Copies of field

logs and records to be used in determining laboratory test assignments for soil samples shall be forwarded within five (5) calendar days of the completion of sampling or as otherwise specified in the individual task orders.

a. Field Logs. The following information shall be included on the logs or in the records of each boring:

(1) Make and manufacturer's model designation of drilling or other sampling equipment.

(2) Project name, boring number, and location. The location shall include horizontal coordinates and elevation, (X, Y & Z) of each boring location, with coordinates and elevation in reference to the horizontal and vertical datums specified in paragraph 20. **SURVEYING EXPLORATION LOCATIONS**, or as otherwise specified in the individual task orders.

(3) Date and time drilling of each boring begins and date and time drilling of each boring stopped and/or was completed.

(4) Weather conditions.

(5) Horizontal and vertical coordinates of the boring location, including elevation of the top of boring for land borings and elevation of the water surface for borings located in water bodies. For water borings, record the elevation of the tide during drilling operations.

(6) Depths of each sampling run or penetration drive in which samples were obtained and depths of each unsuccessful sampling run or penetration drive.

(7) Depths of each sample taken from each run or drive with logger's comments regarding sample loss, e.g. "sample compressed," "dropped sample," etc.

(8) Length of recovered samples.

(9) Driller's classification or description by depths of the material sampled and penetrated including visual classification, moisture conditions, color, and consistency or relative density of the soil encountered. Consistency and relative density shall be based on results of pocket penetrometer, hand torvane, or Standard Penetration Tests, depending on material type and apparent strength. This classification or description shall be made immediately following the recovery of the sample. The latest version of EM 1110-1-1804, Appendix F (EM 1110-1-1906 Soil Sampling), Appendix F-3 (of EM 1110-1-1906), Table E-5 Density of Coarse-Grained Soils should be followed to describe relative density of coarse-grained soils. Table E-7 Strength or Consistency of Clays, found in the same document, should be followed to describe consistency of fine-grained soils, with the

exception that “Firm”, “Stiff”, and “Very Stiff” shall be substituted for “Medium”, “Firm”, and “Very Firm”, respectively, in accordance with industry standards.

(10) Pocket penetrometer results for cohesive soil samples.

(11) Hand torvane readings for cohesive soil samples having estimated shear strength less than or equal to 0.25 tsf based on pocket penetrometer results.

(12) SPT penetration resistance recorded for three (3) 6-inch increments over the standard 18-inch test depth.

(13) Depth to bottom of borehole.

(14) Depth below existing ground surface at which the water table was encountered, the time water was initially encountered, and the depth below existing ground surface of the water fifteen minutes after first encountering water.

(15) Driller's comments regarding any unusual subsurface conditions encountered during the drilling operations.

(16) Driller's name.

(17) Logger's name.

b. Daily Work Log. The Contractor shall maintain a daily work log documenting the personnel and equipment on site, the operational status of the equipment, and identifying the borings, CPT’s, vibracores, and/or other work accomplished that day for each task order. The Contracting Officer reserves the right to request the daily work logs.

15. **SUPPLEMENTARY BORINGS**. Borings from which, in the opinion of the Contracting Officer, unsatisfactory samples are being or were obtained, and borings abandoned before reaching the required depth and rejected by the Contracting Officer because of mechanical failure of equipment, negligence on the part of the Contractor, or other preventable cause, will not be paid for, including mobilization and demobilization cost, except as specified below. Any boring rejected by the Contracting Officer shall be supplemented by another boring located between 5- and 20-feet away from the original boring location. The supplementary boring may be drilled to the depth of the abandoned boring by any method selected by the Contractor which, in the opinion of the Contracting Officer, will permit completion of the new boring below the elevation where the last satisfactory sample was obtained in the abandoned boring. Payment will be made for only that portion of the abandoned boring from which satisfactory samples were obtained and only that portion of the supplementary boring which extends below the elevation of abandonment of the original boring to the completed depth of the supplementary boring.

16. **BACKFILLING OF BOREHOLES**. The Contractor shall be responsible for thoroughly backfilling all boreholes resulting from drilling operations. Unless otherwise specified, boreholes shall be backfilled with available materials at the location of the work. The Contracting Officer may occasionally specify special types of materials to be used in backfilling for a particular task order or borehole location. If specified in the task order, the Contractor shall backfill the boreholes with bentonite pellets/chips, cement-bentonite grout, or other approved materials. When grout is used, the borehole shall be grouted from the bottom of the borehole using the tremie method. Grout mixture proportions may be specified in the task order; otherwise, the grout must be designed to obtain strength equal to or greater than the soil at the location of the borehole. All boreholes and similar penetrations in the impervious portions of an embankment dam or levee and their foundations must be backfilled by tremie placed cement-bentonite grout or bentonite pellets/chips as specified by task order.

17. **MISPLACED MATERIAL**. Should the Contractor, during the progress of the work in water areas, lose, dump, throw overboard, sink, or misplace any material, plant, machinery, or appliance which, in the opinion of the Contracting Officer, may be dangerous to or obstruct navigation, the Contractor shall recover and remove same with the utmost dispatch. The Contractor shall give immediate notice, with description and location of such obstructions, to the Contracting Officer and, when required, shall mark or buoy such obstructions until the obstructions are removed. Should the Contractor refuse, neglect, or delay compliance with the above requirements, such obstruction may be removed by the Contracting Officer, and the cost of such removal may be deducted from any money due or to become due the Contractor.

18. **CARE OF SAMPLES**. The Contractor shall be solely responsible for preserving all samples obtained for geotechnical purposes in good condition. Preservation and transport of geotechnical samples shall be done in accordance with the requirements of ASTM D4220, “Standard Practices for Preserving and Transporting Soil Samples”. Samples obtained for environmental purposes shall be preserved and transported in accordance with requirements specified in the associated task order. For geotechnical samples, the Contractor shall conform to the sealing requirements specified herein, and be subject to additional or alternative instructions when specified by the task order. The Contractor shall take all necessary precautions to keep the samples from loss of moisture, freezing, and undue exposure to sun and rain. All descriptive markings and labels on samples shall be kept clean and legible during shipment to the Contractor's laboratory for testing. Samples arriving at the laboratory in damaged containers or otherwise showing signs of disturbance prior to testing due to negligence by the Contractor shall be replaced by the Contractor at no additional cost to the Government. Unless otherwise specified, replacement samples shall be obtained from a supplementary boring (see paragraph 15. **SUPPLEMENTARY BORINGS**) at a depth identical to that of the original sample and located between 5-feet to 20-feet away from the original boring. All samples obtained in the field and transported to the laboratory shall be accompanied with a chain-of-custody form or similar documentation. This documentation shall include, at a minimum, the Contract No., Task Order No., Boring No., sample interval (i.e. 2-4), method of transportation, and the signatures of both the field personnel (relinquished by) and the laboratory personnel (received by) with the date(s) when the samples were released and received for each batch of transported samples. The documentation shall be submitted to the POC upon request.

19. **LABORATORY TESTING**. The requirements outlined in ER 1110-1-8100 and ER 1110-1-261 for laboratories, testing equipment, and testing procedures apply to this contract. These regulations may be found at http://www.publications.usace.army.mil/USACEPublications/EngineerRegulations.aspx . Laboratories are required to be validated by the Engineer Research and Development Center's Materials Testing Center (MTC). All contracted laboratories and project Quality Assurance (QA) laboratories testing aggregate, concrete, bituminous materials, soils, rock, and other construction materials, require an initial validation prior to performance of any testing and at least every two (2) years thereafter. Laboratories performing water quality, wastewater, sludge, and sediment testing shall be approved at an interval not to exceed eighteen (18) months.

Required laboratory testing to be performed by the Contractor on the soil samples obtained from the drilling operations will be specified in the individual task orders. Sample selection and test assignment will be provided by the Contracting Officer after completion of drilling and sampling operations or sooner for larger scope projects and as required by task order. All designated testing to be performed by the Contractor shall be performed at the Contractor's validated laboratory and in accordance with the testing procedures defined in the specified ASTM Standards, latest editions, with the exception of bar linear shrinkage, torvane shear, and soil salinity tests, which shall be performed in accordance with publications identified in subparagraph c. Laboratory Tests. All tests shall be performed on portions of the sample that are considered representative of the predominant material contained in the sample. The Government reserves the right to retain soil samples obtained during the drilling operations for independent testing.

a. Testing Equipment. All laboratories and testing equipment furnished and utilized by the Contractor in performing the designated laboratory tests shall be of approved types and shall be maintained in good repair and within the specified tolerances for laboratory equipment shown in the referenced ASTM Standards. Equipment shall be calibrated and/or verified according to frequencies required by the relevant ASTM or other standard procedure and inspected by the Contractor to assure proper operation. Equipment that is out of adjustment or tolerance shall not be utilized. The Government reserves the right to periodically inspect the laboratory and testing equipment and to require the adjustment or removal and replacement of unsatisfactory equipment at no additional cost to the Government. The Contracting Officer will have the final determination of whether equipment is satisfactory.

b. Laboratory Personnel. Laboratory personnel performing the required tests shall be competent personnel, thoroughly familiar with the equipment and testing procedures being utilized and accustomed to good laboratory techniques. The personnel shall be conscientious in the handling and testing of soil samples and shall neatly record all test data produced. The Contracting Officer reserves the right to require the removal and replacement of incompetent personnel and will have the final determination of whether personnel are incompetent.

c. Laboratory Tests. The required number and type of laboratory tests will

be identified in the task orders. Types of tests actually assigned to be performed by the Contractor may include all or some of those listed below.

(1) Soil Description/Classification. All samples shall be classified using the Unified Soil Classification System in accordance with the procedures outlined in ASTM D2487, “Classification of Soils for Engineering Purposes”, and/or ASTM D2488, “Description and Identification of Soils (Visual-Manual Procedure)”. When laboratory test results which would allow classification in accordance with ASTM D2487 are not prescribed, the classification shall be determined as accurately as possible using ASTM D2488 visual-manual method and by checking laboratory test results of adjacent samples or similar material tested in adjacent borings. Development of soil descriptions and classifications shall not be measured for payment or paid for separately.

(2) Water Content. ASTM D2216.

(3) Unit Weight. ASTM D7263.

(4) Specific Gravity of Soil. ASTM D854.

(5) Atterberg Limits. ASTM D4318. Determine the liquid limit (Method A – Multipoint) and plastic limit. Report the liquid limit, plastic limit, and calculated plasticity index to the whole number. Identify the sample as nonplastic as defined in the ASTM Standard if applicable.

(6) Bar Linear Shrinkage. TEX-107-E “Test Procedure for Determining the Bar Linear Shrinkage of Soils”.

(7) Amount Finer than No. 200 Sieve by Washing. ASTM D1140.

(8) Particle-Size Distribution of Soils using Sieve Analysis. ASTM D6913. Determine the distribution of particle sizes by sieving only. Wash the fraction of soil retained on the No. 10 Sieve free of all fine material. Depending on the largest particle size, tests will require the use of all or a portion of the following sieves: 3", 1-1/2", l", 3/4", 3/8", No. 4, No. 10, No. 40, No. 100, and No. 200 to allow classification of the soil sample in accordance with the Unified Soil Classification System.

(9) Particle-Size Distribution of Fine-Grained Soils using Hydrometer Analysis. ASTM D7928. Determine the distribution of particle sizes smaller than 75 µm by hydrometer. Prepare the sample using the No. 10 sieve for separation.

(10) Laboratory Compaction using Standard Effort. ASTM D698.

(11) Laboratory Compaction using Modified Effort. ASTM D1557.

(12) Unconfined Compressive Strength Test. ASTM D2166, with stress strain curves.

(13) Unconsolidated-Undrained Triaxial Compression Test on Cohesive

Soils.
(Q-Test, 1 specimen). ASTM D2850.

(14) Consolidated Undrained Triaxial Compression Test for Cohesive Soils.
(R-Test, 3 specimens). ASTM D4767.

(15) Direct Shear Test of Soils under Consolidated Drained Conditions. (3 specimens). ASTM D3080.

(16) One-Dimensional Consolidation Properties of Soils. ASTM D2435.

(17) Torvane Shear Test. Shall be performed in accordance the pocket shear vane manufacturer's instructions. When performing the torvane shear test on soft clays, use the appropriate size shear vane following the manufacturer's instructions. Torvane shear tests shall not be measured for payment or paid for separately.

(18) Laboratory Miniature Vane Shear Test. ASTM D4648. In cases where the test is requested on a very soft or disturbed sample that would require remolding, the Contractor shall document the remolding process employed and note this in the final report.

(19) Soil Salinity. In accordance with U.S. Department of Agriculture publication, Handbook No. 60, "Diagnosis and Improvement of Saline and Alkali Soils," February 1954.

(20) Organic Content of Soil. ASTM D2974, Methods A and C.

(21) Water-Soluble Sulfate in Soil. ASTM C1580.

(22) Pin Hole Dispersion Test. ASTM D4647, Method A.

(23) pH of Soil. ASTM G51.

(24) Soil Resistivity. ASTM G57.

The Government reserves the right to be present during the opening and testing of soil samples.

d. Reports of Laboratory Test Results. After all testing is concluded under a specific task order, the Contractor shall furnish the Contracting Officer two (2) electronic copies on compact disks (CDs) of test data summary sheets in Microsoft Excel 2013 (or later version of requested in the task order) format and supporting raw lab data for each boring. The summary sheets shall present a written continuous log of the boring and summarize the laboratory test results obtained. Summary sheets shall be carefully prepared in such a manner that the data presented will be readily usable by the Contracting Officer. The Contracting Office will provide an example test data summary sheet for reference. Along with the summary sheets, the supporting test data for each

test shall be attached. Computer-generated test results for laboratory tests including for sieve analysis, particle sized distribution, all strength tests, and consolidation tests shall be provided by the Contractor. The above described deliverables shall be provided with the Final Report as described in paragraph 22. **FINAL REPORTS** unless otherwise specified in an individual task order.

20. **SURVEYING EXPLORATION LOCATIONS**.

a. Equipment. Survey and GPS equipment specifications, and any other requested information pertaining to the equipment to be used by the Contractor for locating exploration locations, shall be submitted to the Contracting Officer for review and approval prior to commencement of work. Survey and GPS equipment, used for locating the exploration locations for a given task order, shall be of a type intended and suitable for use in areas as required by this contract. At land and marsh based locations, the equipment shall provide a minimum of third-order accuracy for both the horizontal and vertical position. For water based locations, the survey equipment shall provide a minimum of third-order accuracy for the horizontal position. Elevations in waters influenced by tide will be determined by comparing tide gauge levels to water depths recorded at each investigation location. Elevations in waters not influenced by tides shall be determined by taking elevation surveys of water edges with minimum third-order accuracy and comparing this to the depth of water at each location or by using some other approved method.

b. Personnel for Third Order Accuracy Surveys. Field survey crews shall include a lead surveyor with minimum of five (5) years combined experience in performing both topographic and hydrographic surveying. Survey helpers working under the lead surveyor shall be thoroughly competent with topographic and hydrographic survey techniques and practices. The Contracting Officer reserves the right to require removal and replacement of incompetent personnel and will have the final determination of whether personnel are incompetent.

c. Datum.

(1) Vertical Control.

a. Land and Marsh. For land and marsh based locations, all vertical control shall be tied to the North American Vertical Datum of
1988 (NAVD88), as established by the National Geodetic Survey (NGS).

b. Waters Influenced by Tide. For locations in waters influenced by tide, elevations shall be determined by comparing recorded tide gauge levels with the water depth at time of investigation for a given investigation location. Tide gauge or tide recording locations utilized by the contractor shall be verified for accuracy prior to use. Tide readings recorded by the Contractor shall be converted by the Contractor to *Mean*

Lower Low Water (MLLW) when reporting to the Government, unless otherwise specified in an individual task order.

c. Waters Not Influenced by Tide. For locations in waters not influenced by tide, all vertical control shall be tied to the NAVD88, as established by the NGS.

(2) Horizontal Control. All horizontal control shall be referenced to the North American Datum of 1983 (NAD83) and shall be tied to the Texas State Plane Coordinate System, South Central, or South Zone depending on the location of the site.

(3) Monument Accuracy Verification. Monuments used by the Contractor as a basis for vertical and horizontal control shall first be verified for accuracy by the Contractor by reference checking the control monument X, Y, & Z coordinates against the published coordinates and elevations of two (2) neighboring NGS monuments in the area.

(4) Conversions. Unless otherwise requested in a given task order, points recorded in final deliverables discussed below shall be provided with reference to the horizontal and vertical datum discussed above for land, marsh, and water based investigations. In some instances, conversions of the data to other horizontal or vertical datums may be requested by the Government for a particular project. This shall be considered a subsidiary obligation of the Contractor.

d. Survey Deliverables.

(1) Driller's Logs. The horizontal coordinates and elevation (X, Y & Z) for each boring or test location shall be included on the Driller's logs as described in paragraph 14. **RECORDS**.

(2) Boring Logs (Bentley OpenGround format). The horizontal coordinates and elevation (X, Y & Z) for each boring location shall be included on the final boring logs developed from field and laboratory test data.

(3) Field Vane Shear, HCPT, Pipe Probing, and Electronic CPT. The horizontal coordinates and elevations (X, Y & Z) for each field investigation location shall be included on the data sheets in which the field test data are included with the Final Report.

(4) MicroStation Files. Surveys of boring locations shall be provided in a digital computer file capable of being loaded directly to the Galveston District's Computer Graphic System. CAD files shall not be submitted in a format other than native MicroStation V8i (SS-2 or above) (.dgn) as stated below. Use of AutoDesk products with conversions to MicroStation format will not be accepted. The files shall be provided on CD and included with the Final Report.

The Contractor shall use the appropriate seed files (furnished to the

Contractor) with the correct working units and geospatial coordinate system attached for all civil, geotechnical, and mapping drawings/layouts for the area of work. The Contacting Officer will furnish the Contractor a CD containing the following files:

border.dgn	(border sheet)
digimap.cel	(cell library)
fontlib.vax	(font library)
galdef.tbl	(color table)
levels.wpd	(level assignments)
seed2d.dgn	(2d seed file)
seed3d.dgn	(3d seed file)
da1959.dgn	(description card)

Submittals shall be delivered on CD and shall include CAD file name(s), compressed file name(s) (if applicable), tape label name (if applicable), contractor name, contract and task order numbers, submittal date, issue description, contact name, and contact phone number. A means to unzip zipped files shall be provided or all files shall be self-extracting. Additionally, a coma delimited ASCII file and a hard copy (on 8.5-inch x 11-inch paper) listing all CAD files included in submittal, the file date, and the sheet title the file corresponds to, shall accompany the CDs when submitted.

The boring and test locations shall be properly geo-referenced in MicroStation to allow for later use as a reference file in other Galveston District MicroStation drawings. The drawing files shall contain the precise location of the investigation location points, shown as a cross hair or dot, with the data point number and elevation in feet to two decimal places. The drawing files shall also contain a table of monument data used in the surveys, a north arrow, grid tick marks, a scale, and a title block with company name, draftsmen, reviewer of draftsmen's work, and date file was created.

(5) ASCII File Format. The surveys points of investigation locations shall be also provided in the ASCII formats. Files may be comma or tab delimited.

Random Points File.RAN
X Coordinates Y Coordinates Z Coordinates Code Description

Breakline Points File.BRK
X Coordinates Y Coordinates Z Coordinates Code Description

Note: First point of breakline starts with code 0. All other points along breakline are code 1.

21. **FINAL BORING LOGS.** Final boring logs in the Bentley OpenGround format shall be provided. All geotechnical field and laboratory data shall be submitted electronically to the Bentley OpenGround Cloud using the portal provided by the Government for submittal. The boring logs are to include soil information from the lab test reports and field logs, such as soil description,

material classification, consistency, and any additional lab observations. The soil descriptions shown on final boring logs shall include at least the color, soil type, consistency (cohesive soils), relative density (cohesionless soils), and the presence of secondary constituents and structural features such as laminations, lenses, pockets, partings and slickensides. The results of pocket penetrometer, torvane, and SPT tests shall be used to determine sample consistency or relative density. Where a difference in material color is noted from the lab versus what was recorded in the field, the initial field assessment shall govern in the boring logs. For other material differences noted, the lab observations shall govern in the boring logs. The final boring logs shall be reviewed by a registered professional engineer for accuracy and completeness. The logs shall also include the horizontal coordinates and elevation (X, Y & Z) of each boring, in accordance with paragraph 20. **SURVEYING EXPLORATION LOCATIONS**, or as otherwise specified in the individual task orders. Electronic (.pdf) copies, and OpenGround files, shall be provided for each boring log report as a deliverable included in the Final Report described in paragraph 22. **FINAL REPORTS** unless otherwise specified in an individual task order.

22. **FINAL REPORTS**. After the required field exploration and laboratory testing is concluded, the Contractor shall furnish the Contracting Officer a final report covering the work performed. The report shall be prepared by a professional engineer or geologist (see paragraph 3. **SUPERVISION OF WORK**). The report shall include, as applicable, the boring layout, test data summary sheets, supporting raw and computer-generated test data and results, the final boring logs and OpenGround files, survey deliverables, and a description of any unusual subsurface conditions or difficulties in drilling that were encountered. The report shall also include CPT data and plotted results as described in paragraph 12. **CONE PENETROMETER TESTS.** The Contractor will provide a separate summary sheet for each investigation location so that information about the boring can be used to populate the District's Geographical Information System. The following list of deliverables may not all inclusive:

- vicinity map
- borehole location plans
- borehole location survey data, including both proposed and actual locations.
- top of water elevation (MLLW) at time of drilling for each boring
- water depths to mudline for each boring
- laboratory test result summary
- laboratory test results in ASTM report format
- final boring logs, SPT (N60) results, and rig specific energy transfer ratio (ETR) record
- subsurface profiles showing boring sections with descriptions.

The Contractor will furnish an electronic version of each final boring and vibracore log, and each CPT plot, containing the information referenced above in PDF format, so that a data link can be established from the geo-referenced location of each boring to the electronic version of each field boring log. The data referenced will be

submitted in electronic (PDF) formats on CD's marked with the project name, contract number, task order number, and date submitted.

The contractor shall submit an electronic version of a Draft Final Report at least four (4) weeks prior to the required completion date unless otherwise stated in the individual task orders or as directed by the Contracting Officer. The draft report shall include all items listed above in this section so that they may be reviewed for completeness and for any deficiencies. If laboratory testing is directed by a separate task order, the contractor will be allotted ample time in their completion schedule to produce a draft report that includes all items listed above that are not laboratory testing related.

23. **METADATA**. Metadata template shall be provided in XML format. All fields shall be populated. The template will be provided by the Government.

24. **CERTIFICATION OF COMPUTER MEDIA**. Deliverables consisting of electronic data media (CDs, portable hard drives, etc.) shall be certified by the Contractor to be free of known computer viruses. The name, version, and release date of the virus scanning software used to analyze the delivery media shall be submitted at the time of each delivery. If analysis of the delivery media by the Government finds evidence of virus infection, then the media shall be returned to the Contractor. The Contractor shall clear the virus and resubmit the media at no cost to the Government.

25. **PRESERVATION AND DELIVERY OF SOIL SAMPLES**. Unless otherwise specified, the portion of soil samples not consumed by laboratory testing shall be resealed in moisture tight pint size jars, or other approved containers, furnished by the Contractor, and marked as described in paragraph 11. **BORING TYPES AND SOIL SAMPLES** of this Section. The sample containers shall be placed in carrier boxes capable of being stacked without collapsing onto the samples within. The samples shall be preserved in good condition as described in paragraph 18. **CARE OF SAMPLES** until final delivery of the samples to the Contracting Officer. The Contractor shall exercise care to reseal samples as soon as practicable after they are no longer needed for identification and testing purposes. Samples awaiting shipment shall be temporarily stored and protected in approved storage areas at the Contractor's laboratory or other areas approved by the Contracting Officer. Following completion of testing and acceptance of the Final Report, the remaining samples shall be shipped prepaid to the U.S. Army Corps of Engineers, Galveston District, 2000 Fort Point Road, Galveston, Texas 77550. Arrangements must be made in advance for the receipt of shipments; therefore, all shipping shall be coordinated with the Contracting Officer.