### PORT OF HOUSTON AUTHORITY

### **TECHNICAL SPECIFICATIONS FOR PROJECT 11 – SEGMENT 3**

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## 95% PRELIMINARY

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW AND IS NOT INTENDED TO BE USED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES. ENGINEER: DAVID R. BROYLES, P.E. 117271

REGISTRATION NO.: \_\_\_\_\_\_\_ 12/08/2020 DATE: \_\_\_\_\_\_

# 95% PRELIMINARY

INTERIM REVIEW AND IS NOT INTENDED TO BE USED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES. ENGINEER: <u>4. CAMERON PERRY, P.E.</u> 94056 REGISTRATION NO.:

12/08/2020 DATE: \_\_\_\_\_

95% PRELIMINARY
THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW AND IS NOT INTENDED TO BE USED FOR CONSTRUCTION, BIDDING, OR PERMIT PURPOSES.
ENGINEER: Samuel Saldivar Jr., P.E.
92683 REGISTRATION NO.:
12/08/2020

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## PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR PROJECT 11 – SEGMENT 3

The Technical Specifications for the above-referenced Project are the Port of Houston Authority Standard Technical Specifications listed herein, inclusive of those that have been amended, supplemented, or otherwise modified herein, and inclusive of added sections as listed herein.

The Port of Houston Authority Standard Technical Specifications listed herein may be obtained from Port of Houston Authority Project & Construction Management Department.

Any Port of Houston Authority Standard Technical Specifications listed herein but not amended, supplemented, or otherwise modified herein shall apply as set forth in the Port of Houston Authority Standard Technical Specifications.

Amendments and other modifications to specific Sections of the Port of Houston Authority Standard Technical Specifications take precedence over such Specification Section language of the Port of Houston Authority Standard Technical Specifications.

Any newly added Technical Specification Sections are in addition to the Port of Houston Authority Standard Technical Specifications.

Subject to the foregoing, the Port of Houston Authority Technical Specifications for the above-referenced Project are as follows.

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### SECTION 01 00 50.00 Add – SCOPE OF WORK

### PART 1 GENERAL

### 1.1 SECTION INCLUDES

### DREDGING:

The work consists of new work channel widening dredging within Project 11 – Segment 3 located within the Barbours Cut Channel near the Houston Ship Channel in La Porte, Texas. Approximate coordinates are as follows: 13,817,906N 3,241,761E (ref. Texas State Plane Coordinate System, South Central Zone, NAD 83, in U.S. Survey Feet). Project includes maintenance dredging within Cedar Bayou Channel located near the Houston Ship Channel and Barbours Cut Channel intersection (reference the following coordinates: 13,818,019N 3,244,050E).

The work includes new work dredging with a pipeline dredge to remove approximately 3,201,600 CY of material within 5,720 ft of Barbours Cut Channel. The channel will be dredged to a required depth of -48.5 ft MLLW. Dredged material from Barbours Cut shall be placed as a hydraulic berm at the M12 Beneficial Use of Dredged Material placement area. The work will also include a channel sweep maintenance dredging with a mechanical dredge of Cedar Bayou Channel of shoaling that occurs due to construction of M12 berms. The channel will be dredged to a required depth of -12.0 ft MLLW. Material will be placed in a scow and transported to the ODMDS for disposal.

The scope of work includes all dredge and pipeline mobilization with multiple setups and relocation; a pre-dredge hazard survey; debris removal from the channel prior to dredging; hydraulic dredging; dredging pipeline management; dredged material discharge management; dredged material placement area management; bathymetric surveys before, during, and after dredging; demobilization and site cleanup; and related ancillary work.

The location of the dredging and placement of material shall occur as indicated on the Drawings and Specifications.

### M12 BENEFICIAL USE SITE:

The work consists construction of berms, shoreline protection, and a drop-outlet structure at the M12 Beneficial Use of Dredged Material placement area located adjacent to the Houston Ship Channel near Atkinson Island (reference the following coordinates: 13,817,555N 3,250,440E).

The work includes using new work material dredge from Barbours Cut Channel as material for a 7,200 ft hydraulically placed berm along Baseline A. Material will be placed to an initial template and then mechanically shaped to a final template. A 3,500 ft mechanically placed berm will be constructed from borrow areas located adjacent to the berm along Baseline B. Shoreline protection will be placed along all of Baseline A and 500 ft of Baseline B. A drop-outlet structure will be constructed and placed at Station 73+00 on Baseline A. Work will also include closing a breach within the existing berm along the southern portion of the M12 site, and also creating a new breach in the existing berm at the southern end of the western borrow area/channel for the berm along Baseline B.

The scope of work for M12 includes equipment mobilization with multiple setups and relocation of discharge point; dredging pipeline management; dredged material discharge management; berm re-shaping to final grades; mechanical excavation and placement to final berm grades; procurement and placement of geotextile material and graded riprap as shoreline protection; closing an existing breach; creating a new breach; construction of out-fall structure; bathymetric/topographic surveys before, during, and after berm placement and breach opening/closure; demobilization and site cleanup; and related ancillary work.

The location of the berm placement of material, placement of shoreline protection, breach opening/closure, and drop-outlet structure shall occur as indicated on the Drawings and Specifications.

### Morgan's Point:

Work on Morgan's Point consists of partial demolition of the existing LASH Dock structure (east approach and west approach), landside demolition / debris removal of existing features within dredge template, and the construction of a bulkhead wall.

The LASH Dock demolition includes partial removal of an existing superstructure that was constructed of reinforced concrete. Reinforced precast concrete piles at the east approach which have been previously cut at mudline which need extracted, in addition, at the east and west approach there are reinforced under-reamed concrete piers which also need removed / extracted. A type III TxDOT barricade, or approved equivalent, and appropriate signage shall be placed at the points of entry to prohibit access, per Section 3.2.E of the 02 41 00 Demolition Specification. Both pre and post demolition marine surveys will be submitted to Owner and Engineer for review.

Remnants of historical structures at Morgan's Point are required to be removed prior to the dredging and bulkhead construction operations. These remnants include but are not limited to abandoned concrete slabs, abandoned utilities, abandoned piles, dilapidated piers, a pre-existing boat launch ramp, buried asphalt road and shoreline protection in the form of concrete rubble, stone, monolithic concrete pours, saw cut concrete sidewalks and various other construction debris. Due to the significant amount of construction debris, all "rip-rap" will be removed and disposed of at Morgan's Point. Under no circumstances is debris to be utilized as fill unless specifically approved in advance by the Engineer and Owner.

All utilities encountered in the clearing of Morgan's Point are to be removed to the bounds of the project limit. It is possible that the Contractor will encounter abandoned sanitary facilities. These facilities will be removed per applicable EPA and TCEQ regulations and in coordination with Port Houston environmental personnel. Contractor and Owner coordination will be required for the location and procedures regarding the waterline located on the north side of Morgan's Point. It is understood that the operation of this valve could affect the Fire Department building and boat dock water supply.

The work for the bulkhead wall includes constructing a steel sheet pile bulkhead wall that is approximately 395 feet long. The work entails excavation for sheet pile installation and construction of the reinforced concrete cap, installation of tie-rods, and backfilling to final grade.

Additional work will include clearing and grubbing, striping of existing topsoil, grading to the bulkhead wall reinforced concrete cap, placement of topsoil, hydromulch seeding, and construction of a chain link security fence.

### SPILMAN ISLAND:

Work on Spilman Island consists of the construction of a bulkhead cutoff wall, construction of a pipeline protection wall, as well as construction and realignment of an existing placement area berm associated with improvements to the Barbours Cut Ship Channel.

The work for the bulkhead cutoff wall includes constructing a steel combi-wall sheet pile bulkhead wall. Work also includes construction of a pipeline protection wall consisting of steel combi-wall sheet pile will with pipe piles raker piles near two gas pipelines. Coordination with and approval of pipeline protection plan and pile installation plan with the pipeline company will be required prior to construction.

Work associated with the berm construction will include clearing and grubbing, striping of existing topsoil, grading, geogrid soil reinforcement, placement of topsoil, and hydromulch seeding. Work will also include excavation and grading to the bulkhead cutoff wall, pipeline protection wall, and that associated with the preliminary phase of dredging for the ship channel improvements. Stone riprap will be provided along the top of the bulkhead cutoff wall with stone riprap splash pads and spreaders at drainage slot locations. Stone revetment will be provided for shore protection. Existing revetment will be removed and stockpiled for reuse.

### 1.2 SAFETY

The Contractor shall complete the work in accordance with the safety requirements of Port Authority.

### PART 2 PRODUCTS

NOT USED

### PART 3 EXECUTION

NOT USED

END OF SECTION

## PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

### SECTION 01 16 60 Add – ENVIRONMENTAL PROTECTION MEASURES

### **PART 1 GENERAL**

### 1.1 SUMMARY

This section covers prevention of environmental pollution and damage as the result of construction operations under this Contract and for those measures set forth in the other Specifications. For the purpose of this specification, environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic, cultural, and/or historical purposes. The control of environmental pollution and damage requires consideration of air, water, and land and includes management of visual aesthetics, noise, solid waste, radiant energy and radioactive materials, as well as other pollutants. The environment shall be protected and all-natural resources shall be preserved during construction. All Federal, State, and local laws and regulations shall be complied with during construction.

### 1.2 SUBMITTALS

- A. Prior to construction, Contractor shall provide a VOC compliance plan (Paragraph 1.7). This information shall be submitted to the Port Authority at or prior to the preconstruction conference.
- B. Refer to Paragraph 1.7, "Protection of Environmental Resources," for reporting requirements for required environmental monitoring.
- C. Prior to construction, Contactor shall provide Environmental Monitoring Plan describing training and credentials for personnel for pollution control and environmental protection/monitoring of air, water, and land resources. This information shall be submitted to the Port Authority at or prior to the preconstruction conference.

### 1.3 CONTRACTOR FACILITIES

Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas approved by Port Authority. Temporary movement or relocation of Contractor facilities shall be made only on approval by Port Authority. Disposal areas shall not be located in any wetlands, water body, or stream bed. Fuel and lubricate equipment in a manner that protects against spills and evaporation. Provide a berm with impervious liner around fuel and liquid chemical storage tanks to contain the tank contents in the event of a leak or spill. No refueling shall be done onsite unless approved by Port Authority in advance with acceptable spill protection measures.

### 1.4 QUALITY CONTROL

Contractor shall establish and maintain quality control for environmental protection of all items set forth herein. Contractor shall record on daily reports any problems in complying with laws, regulations, and ordinances and corrective action taken. Any damage caused by Contractor during construction shall be repaired, replaced, or restored to the satisfaction of Port Authority.

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### 1.5 TRAINING OF CONTRACTOR PERSONNEL IN POLLUTION CONTROL

Contractor shall train his personnel in all phases of environmental protection and provide documentation of course completion. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of facilities (vegetative covers, and instruments required for monitoring purposes) to ensure adequate and continuous environmental pollution control.

### 1.6 VOLATILE ORGANIC COMPOUNDS (VOC)

Contractors are required to comply with local, state, and federal VOC laws and regulations and shall have an acceptable VOC compliance plan. The plan shall demonstrate that the use of paints, solvents, adhesives, and cleaners comply with local VOC laws and regulations governing VOC materials and that all required permits have been obtained or will be obtained prior to starting work involving VOC's, in the air quality district in which the start of work. An acceptable compliance plan shall contain, as a minimum, a listing of each materials subject to restrictions in the air quality management district in question, the rule governing its use, a description of the actions which Contractor will take, a description of the actions which Contractor will use to comply with the laws and regulations, and any changes in the status of compliance during the life of the Contract. Alternatively, if no materials are subject to the restrictions, the compliance plan shall so state.

### 1.7 PROTECTION OF ENVIRONMENTAL RESOURCES

- A. General: The environmental resources within the Project boundaries and those affected outside the limits of permanent work under this Contract shall be protected during the entire period of this Contract. Contractor shall confine his activities to areas defined by the Drawings and Specifications. Environmental protection shall be as stated in the following subparagraphs.
- B. Protection of Land Resources: Prior to the beginning of any construction, Contractor shall identify all land resources to be approved by Port Authority. Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without special permission from Port Authority. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized.
  - 1. Where such special emergency use is permitted, Contractor shall provide effective protection for land and vegetation resources as follows. Trees, shrubs, vines, grasses, landforms, and other landscape features identified by the Port Authority to be preserved for removal by others shall be clearly identified by marking, fencing, or wrapping with boards, or other approved techniques.
  - 2. Contractor shall clean up areas used for construction, including staging areas, on a regular basis.
  - Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas. Restoration shall be in accordance with the Plan submitted for approval. This work will be accomplished at Contractor's expense.
- C. Protection of Water Resources: Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the listed construction activities which are included in this Contract. Contractor is responsible for maintaining area drainage during construction. Water shall not be allowed to pond on any roadway surface, and runoff from adjacent properties shall not be impeded by Project Work.

- 1. Contractor shall conduct his dredging and disposal operations in a manner to minimize turbidity and shall conform to all water sampling and water quality standards prescribed herein and by the permit requirements.
- D. Air Quality: The environmental coordination for this project included review by the Texas Commission on Environmental Quality (TCEQ). Based on TCEQ recommendations the following air quality measures are preferred for this project:
  - 1. Contractor is encouraged to apply for Texas Emission Reduction Plan grants;
  - 2. Contractor should exercise air quality best management practices;
  - Contractor should use tugboats and support vessels that use clean fuels. Contractor shall use ultra-low-sulfur diesel (ULSD) fuel in marine vessels where technically and logistically feasible
  - 4. Select assist tugs based on lowest NO<sub>X</sub> emissions instead of lowest price.
  - 5. Specific to marine engines, air emissions can be reduced when:
    - i. Using shore power instead of marine power when tied to a pier.
    - ii. Voluntarily reducing speed when in port to below normal speeds.
  - 6. For mobile sources of air emissions and their emissions controls, on-road passenger vehicles should adhere by EPA regulations and standards for model years 2017-2025 (most recent issue). Vehicles with the most recent standards established are referred as Phase 2 vehicles. Updates to the regulations and standards are geared towards light-duty and heavy-duty on-road vehicles.
- E. Protection of Fish and Wildlife Resources: Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to and damage of fish and wildlife. Prior to beginning of construction operations, Contractor shall list species that require specific attention and describe measures for their protection. At a minimum, Contactor shall have personnel onsite who are trained to identify and continuously observe the work area for the endangered and/or protected species described under Paragraph 1.7.F. All costs for environmental monitoring shall be borne by Contractor. Environmental monitoring and observations shall be documented in Contractor's daily activities reports each day regardless of whether or not species were observed.
- F. Protected Species: Implement the following measures to avoid and minimize impacts to federaland state-protected species and habitats:
  - 1. Instruct personnel associated with project of the need to identify eagles and colonial nesting birds and avoid impacting them during the breeding season.
  - Port Authority will coordinate with Texas Parks and Wildlife Department to determine the need for any environmental protection measures related to protection of Bald Eagle, Black Rail, Piping Plover, Rufa Red Knot, and other migratory bird species. If directed by Port Authority, Contractor shall provide environmental observers as stated in Paragraph 1.8.E.
  - 3. Contractor shall not disturb bird nests between February 1 and September 1.
  - 4. In the event that migratory birds are encountered onsite during construction, avoid adverse impacts on birds, active nests, eggs, and/or young.
    - a. Do not disturb, destroy, or remove active nests, including ground nesting birds, during the nesting season (February 1 to October 1).

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- b. Avoid the removal of unoccupied, inactive nests, as practicable.
- c. Do not collect, capture, relocate, or transport birds, eggs, young, or active nests without a permit.
- 5. Contractor shall comply with the Sea Turtle and Smalltooth Sawfish Construction Conditions contained in Appendix C.
- 6. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The Port Authority shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act and the Endangered Species Act: All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a fourfoot clearance from the bottom. All vessels will follow routes of deep water whenever possible; Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement; All onsite project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shut down if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving; and Any collision with or injury to a manatee shall be reported immediately to the Texas Marine Mammal Stranding Network (TMMSN) Hotline at 1-888-9-MAMMAL and also reported to the USFWS (1-281-286-8282).
- G. Protection of Cultural Resources

In the event that the Contractor encounters historical or archaeological resources within the project footprint, the Contractor shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archaeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity. If any such items are discovered on the premises, the Contractor shall immediately notify the Port Authority of such discovery, and the site and the items discovered shall be protected by the Contractor from further disturbance until a professional examination of them can be made or until clearance to proceed is authorized by the Port Contract Representative.

#### 1.8 CONTROL AND DISPOSAL OF WASTES

- A. Hazardous Waste: Hazardous wastes are defined in 40 CFR 261. Hazardous wastes that are produced as a result of performing Work under this Contract shall be handled, stored, transported, and disposed of according to 40 CFR 262, where applicable. Prevent hazardous wastes from entering the ground, drainage areas, and surface waters. Immediately notify Port Authority of hazardous material spills. Also refer to Article 3.13 of the General Conditions for requirements if hazardous environmental conditions are encountered at the site.
- B. Sanitary Waste: All sanitary waste shall be collected by a licensed sanitary waste management contractor from the portable units as necessary, or as required by local regulation.
- C. Construction Debris: Contractor shall collect and properly dispose all trash and construction debris in accordance with all local and state solid waste management regulations and practices. No construction waste material shall be buried within the Project limits. Contractor shall store all waste materials in approved metal dumpsters or other containers approved by Port Authority.

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The dumpster shall be emptied as necessary or as required by local and state regulation and the contents hauled away for proper disposal.

### 1.9 POST CONSTRUCTION CLEAN UP

Contractor shall clean up areas used for construction to the satisfaction of Port Authority.

### 1.10 RESTORATION OF DAMAGE

Contractor shall restore all features damaged or destroyed during construction operations outside the limits of the approved Work areas. Such restoration shall be in accordance with the plan submitted for approval by Port Authority. This work will be accomplished at Contractor's expense without compensation.

### PART 2 – PRODUCTS

(NOT USED)

### PART 3 – EXECUTION

(NOT USED)

END OF SECTION

## PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

### SECTION 01 25 00 Add - MEASUREMENT AND BASIS OF PAYMENT

### PART 1 – GENERAL

### 1.1 SUMMARY

The extended prices stated on Contractor's Price Exhibit Form will be considered maximum Contract prices with unit price provisions. Unit price provisions are for Port Authority's convenience in adjusting extended prices based on quantity adjustments resulting from Port Authority-initiated Change Orders. The extended prices shall be full compensation for furnishing all labor, materials, tools, equipment, plant supplies, superintendence, insurance, incidentals, services, overhead, and profit necessary to complete the construction of the various items of Work. Contractor's Price Exhibit Form is not intended to itemize each and every labor, material, or incidental requirement. Any requirement, explicit or implied, as determined by Port Authority for Project completion and not specifically listed on the Contractor's Price Exhibit Form shall be included in items with which they are considered subsidiary. Any item not specifically identified as an Additive/Alternate Price shall be considered as part of the Base Price, unless specified otherwise.

### 1.2 SUBMITTALS

The Port Authority approval is required for:

A. Certificates (Paragraph 1.3 D) – Certified Weight Tickets or Certified Barge Displacement Tickets for debris removal.

### 1.3 QUANTITIES AND MEASUREMENTS

- A. Quantities: All quantities of Work stated on Contractor's Price Exhibit Form are nominal estimates, computed by Engineer, based on the Contract Documents. Contractor shall verify these quantities by preparing its own estimates. In any case, prices stated shall reflect all Work required by the Contract Documents. No quantity adjustment shall be made for work performed outside the specified lines and grades, nor work completed within its specified tolerance.
- B. Measurements: Only length, area, and/or volume measurements shall be made to compute the quantities of Work stated on Contractor's Price Exhibit Form. Weight, load size/counts, and production rate/time shall not be valid measurement techniques, except as specified for debris removal.
- C. Contract Adjustments: Port Authority reserves the right to adjust the quantities of Work stated on Contractor's Price Exhibit Form as it deems appropriate. Adjustments must be in form of a Change Order to the Contract.
- D. Certified Tickets: Submit certified weight tickets or certified displacement tickets for debris removal. Refer to Paragraph 1.4.F.

### 1.4 BASIS OF PAYMENT

- A. Unit Price Provisions:
  - 1. Extended prices stated on the Contractor's Price Exhibit Form shall be considered maximum Contract prices (Lump Sum) unless the quantities of work are adjusted by a Port Authority-initiated Change Order.
  - 2. If quantities of work are adjusted by Port Authority, the cost or credit to Port Authority shall be computed in accordance with the unit prices stated on the Contractor's Price Exhibit Form.
- B. Lump Sum/Progress Payments: Lump Sum Work items listed on the Contractor's Price Exhibit Form will be paid for according to the estimated percentage of Work completed for each item. This amount shall be full compensation for completed in-place Work. Engineer will be the sole judge and make the final decision as to the percentage complete of each item and the monetary amount for progress payments to Contractor.
- C. BCC Dredging Mobilization/Demobilization: Payment Mobilization/Demobilization (Price Item No. 1) will be made on a lump-sum basis. Payment for mobilization will not exceed sixty percent (60%) of the amount stated for Mobilization/Demobilization. The total lump sum amount for Mobilization/Demobilization shall include all costs in connection with the mobilization and demobilization of all plant and equipment associated with Dredging necessary to perform the Work, including costs associated with compliance with the National Dredging Quality Management Program.
- D. Pre-Dredge Hazard Survey: Payment for Pre-Dredge Hazard Survey (Price Item No. 2) will be made on a lump-sum basis for costs associated with performing a Pre-Dredge Hazard Survey (magnetometer or similar) and related work as described in Section 35 20 00 Add, "Construction Surveying."
- E. BCC Dredging Construction Surveying: Payment for Construction Surveying (Price Item No. 3) will be made on a lump-sum basis for costs associated with BD and AD channel surveys. Costs shall include bathymetric surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."
- F. Allowance for Debris Removal from Dredging Template:
  - 1. Payment for Debris Removal from Dredging Template (Price Items No. 4 and 5) will be made on a unit price (per ton) basis for costs associated with materials, labor, and equipment for removal and disposal of debris from the dredging template, as specified in Section 35 20 23 Add, "Dredging."
  - 2. Debris removal during construction shall include all of the debris listed on the drawings that is within the dredging template, and any additional debris encountered within the dredging template during the course of work, that cannot be removed through ordinary dredging. Removal of incidental debris shall not be included in this pay item.
  - 3. The Contract Price for Debris Removal shall include relocating the debris to an offsite disposal facility in accordance with applicable laws and ordinances. All disposal fees are the responsibility of Contractor.

- 4. Measurement for Debris Removal shall be per short ton of 2,000 pounds based on the Contractor's submittal of Certified Weight Tickets or Certified Barge Displacement Tickets for debris actually removed. Sediment shall not be included in the debris weight.
- G. Dredging Pipeline Setup & Management: Payment for Pipeline Management (Price Item No. 6) will be made on a lump-sum basis for costs associated with laying, relocating, removing, and handling shore pipelines to M12 Beneficial Use Placement Area; procurement of the materials and construction of ramps or installation of temporary culvert pipes which may be necessary for maintaining public access and laying the shore pipes; maintenance of pipeline during construction; final cleanup of pipeline routes; and any other related work.
- H. BCC Dredging:
  - 1. Payment for Pipeline Dredging (Price Item No. 7 and 8) will be made for removal, transportation, and placement of material as specified in Section 35 20 23, "Dredging," and as shown on the Drawings. Payment for dredging will include costs for identification and removal of incidental debris and dredging obstructions, and any other related work.
  - 2. Payment for Dredging (Price Item No. 7 and 8) will be based on computations of quantities removed from the pay templates specified in Section 35 20 23, "Dredging," and as shown on the drawings, as measured by cubic yards in place. No payments will be made for material removed beyond the limits shown on the Drawings.
    - a. No payments will be made for material removed beyond the limits shown on the Drawings. Quantity computations will be performed by Port Authority and substantiated with BD and AD surveys conducted in accordance with Section 35 20 00.00, "Construction Surveying."
    - b. Side and End Slopes:
      - i. Dredging of side and end slopes is required. Dredging of the side and end slopes are to follow, as closely as practicable, the lines indicated or specified. Material removed from the required side slope section shown on the contract drawings and within the defined template will be computed and paid for at the dredging unit cost per cubic yard for that acceptance section.
      - ii. For the purpose of dredging, the side slopes constitute a design criterion. Side slopes may fall flatter than those shown on the contract drawings. However, no payment will be made for material removed outside these specified limits and no paid allowable overdepth on the side slopes will be made.
  - 3. Acceptance and payment for Dredging may be requested for Work completed in segments as defined in Section 35 20 23 Add, "Dredging." Contractor may request payment for shorter segments; however, length of pay sections shall not be less than 500 feet.
  - 4. Regardless of actual measured quantities, total payment for Dredging (Price Item No. 8 and 7) will not exceed the associated Extended Prices shown on Contractor's Price Exhibit Form without an Port Authority-initiated Change Order (for example, to increase the Contract quantity).
  - 5. All costs associated with the National Dredging Quality Management Program (Section 35 20 23.33 Add, "National Quality Management Program Pipeline Hydraulic Dredge") shall be considered subsidiary to the dredging cost.
- I. Existing Revetment at Spilman Island Removal/Stockpile: Payment for removal of existing revetment and stockpiling material at Spilman Island (Price Item No. 9) will be made on a lump-sum basis for costs associated with excavating stone from existing revetment, disposal

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of existing geotextile within revetment system, and stockpiling graded riprap in designated area.

- J. Replace Revetment at Spilman Island: Payment for shoreline protection replacement at Spilman Island (Price Item No. 10) will be made on a linear foot basis for costs associated with excavating/preparing revetment subgrade, procurement and placement of geotextile filter fabric (no separate payment for geotextile filter fabric will be made), and placement of stockpiled graded riprap to the lines and grades shown in the Drawings (verified by survey). Acceptance of the revetment shall be based upon onsite observation of completed work and review of the final surveys such that the revetment meets the limits and tolerances specified in the Drawings and Section 35 31 19 Add, "Revetment."
- K. Allowance for Additional Stone Spilman Island Revetment: Payment for additional stone for completion of the revetment replacement at Spilman Island (Price Item No. 11) will be made on a per ton basis for procurement and placement of graded riprap needed (beyond what is available from existing material stockpile) to construct the revetment to the lines and grades shown in the Drawings (verified by survey). Stone will be measured by the short ton for payment by the truck weight tickets or the Barge Displacement Method.
  - 1. Truck Weigh Ticket Method: Truck weight tickets from a certified scale will be accepted for determination of the weight of stone placed in the finished section. To determine the load, measurements will be taken before each truck is loaded and directly after it is loaded with acceptable stone.
  - 2. Barge Displacement Method: Contractor shall provide a barge displacement table and hydrometer test reports for measurement and payment of graded riprap and submit it at least seven (7) days prior to the pre-construction conference and on a monthly basis for approval by the Engineer. It shall show the barge name or number, dimensions, name of owner, and name of fabricator for each barge. Contractor shall furnish a dimensioned drawing or sketch of each barge that is sufficient to verify the barge displacement table. The drawings shall show, at a minimum, the length, width, and depth of the barge, and dimensions of rakes. All new or modified barges shall be field checked for current dimensions by Contractor in the presence of Engineer. Each table shall contain the freeboard of the barge in feet and tenths from zero to the full depth of the barge and the corresponding gross displacement to the nearest ton.

Each barge shall be suitably marked with two displacement gaging lines along each side of the barge. Each gaging line shall be painted perpendicular to the edge of the barge and be no less than 4 inches wide and 1 foot long on both the deck and side of the barge. Barges with rakes shall have the displacement gaging lines placed at each corner of the box section between the rakes. If a barge has a box end or ends, the gaging lines shall be placed 4 feet from the box end. The freeboard will be measured at the 4 gaging locations and the displacement determined by the use of the "CELMV Standard Barge Tables" from the average of these measurements. The displacement shall be determined before and after the barge is unloaded and the difference between these values shall be the quantity delivered.

Barge displacement measurements shall be taken on final barge used to transport graded riprap to the project footprint. For example, if graded riprap is transported via barge to the project vicinity and then light-loaded onto a different barge before final placement of material in the project footprint, payment related measurements shall be taken on the light-loaded barge. Measurements shall be taken when the barge has a minimum of 1 foot clearance between the underside of the barge and the bay bottom. A unit weight of 62.45 pounds/cubic foot is standard for fresh water and shall be applied to the displacement table and graded riprap quantities. The Contractor has the option to obtain water samples and determine alternative densities or unit weights of the water using the procedure explained below. If Contractor does not obtain water samples and densities according to this procedure, then no adjustments will be applied to the displacement table and graded riprap quantities.

Water sampling for density adjustments shall be performed by the Contractor during every barge measurement event, both when barges are fully loaded before material placement and empty. The water samples shall be taken in accordance with ASTM D 3370 (practice A-Grade Sample) at depths of 4 and 8 feet in the area where measurements are taken using a "Polypro" 2000 ml water sampler or approved equal. If water depth at measurement location is less than 8 feet, Contractor shall notify the Engineer and take water samples at half the water depth and at 6 inches above the existing grade. All water samples shall be tested to determine densities according to ASTM D 1429 (Method D¬ Hydrometer method). Certified test results shall be submitted to the Engineer. After review and approval of the test results by the Engineer, the average of the densities for each barge will be used to adjust the measurements.

- L. Spilman Island Revetment Construction Surveying: Payment for Shoreline Protection Construction Surveying (Price Item No. 12) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys. Costs shall include topographic surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."
- M. Morgan's Point Revetment Graded Riprap: Payment for stone for the revetment at Morgan's Point (Price Item No. 13) will be made on a per ton basis for procurement and placement of graded riprap to construct the revetment to the lines and grades shown in the Drawings (verified by survey). Stone will be measured by the short ton for payment by the truck weight tickets or the Barge Displacement Method as described in Section 1.4.K above.
- N. Morgan's Point Revetment Geotextile: Payment for stone for the geotextile used in the revetment at Morgan's Point (Price Item No. 14) will be made on a square yard basis for procurement and placement of geotextile fabric to the lines and grades shown in the Drawings and as described in Section 31 05 19.13 Add, "Geotextiles for Earthwork."
- O. Morgan's Point Revetment Construction Surveying: Payment for Shoreline Protection Construction Surveying (Price Item No. 15) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys. Costs shall include topographic surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."
- P. M12 Berm and Placement Mobilization/Demobilization: Payment Mobilization/Demobilization (Price Item No. 16) will be made on a lump-sum basis. Payment for mobilization will not exceed sixty percent (60%) of the amount stated for Mobilization/Demobilization. The total lump sum amount for Mobilization/Demobilization shall include all costs in connection with the mobilization and demobilization of all plant and equipment associated with building the berms and material placement necessary to perform the Work at M12.
- Q. Hydraulically Placed Berm Initial Placement (Baseline A): Payment for Hydraulically Placed Berm at the M12 site (Price Item No. 17) will be made on a linear foot basis for costs associated with movement of dredge pipe outfall and construction of initial template to the lines and grades as shown in the Drawings and described in Section 35 41 00 Add, "Berm Construction."

- R. Final Shaping (Baseline A): Payment for Final Shaping (Baseline A) (Price Item No. 18) will be will be made on a linear foot basis for costs associated with final shaping and grading of material within recoverable areas along Baseline A to the lines and grades as shown in the Drawings and described in Section 35 41 00 Add, "Berm Construction."
- S. Hydraulically Placed Berm Initial Placement (Baseline B): Payment for Hydraulically Placed Berm at the M12 site (Price Item No. 19) will be made on a linear foot basis for costs associated with movement of dredge pipe outfall and construction of initial template to the lines and grades as shown in the Drawings and described in Section 35 41 00 Add, "Berm Construction."
- T. Final Shaping (Baseline B): Payment for Final Shaping (Baseline B) (Price Item No. 20) will be will be made on a linear foot basis for costs associated with final shaping and grading of material within recoverable areas along Baseline B to the lines and grades as shown in the Drawings and described in Section 35 41 00 Add, "Berm Construction."
- U. Dredging Pipeline Management (Filling within M12): Payment for Pipeline Management within M12 during marsh filling (Price Item No. 21) will be made on a lump-sum basis for costs associated with laying, relocating, removing, and handling pipelines within M12 Beneficial Use Placement Area during marsh fill construction; procurement of the materials and construction of ramps or installation of temporary culvert pipes which may be necessary for maintaining access and laying the shore pipes; maintenance of pipeline during construction; final cleanup of pipeline routes; and any other related work.
- V. Flotation Channel (Baseline A): Payment for Flotation Channel along Baseline A (Price Item No. 22) will be made on a linear foot basis for costs associated with excavation of in-situ material from channel and sidecast of material as shown in the Drawings and described in Section 35 20 23 Add, "Dredging."
- W. Berm-Flotation Channel Hazard Survey: Payment for Berm-Flotation Channel Hazard Survey (Price Item No. 23) will be made on a lump-sum basis for costs associated with performing a Hazard Survey (magnetometer or similar) and related work as described in Section 35 20 00 Add, "Construction Surveying."
- X. Berm-Flotation Channel Construction Surveying: Payment for Berm-Flotation Channel Construction Surveying (Price Item No. 24) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys. Costs shall include topographic surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."
- Y. Berm Revetment Graded Riprap: Payment for M12 Shoreline Protection (Price Item No. 25) will be made on a per ton basis for procurement and placement of graded riprap to construct the revetment to the lines and grades shown in the Drawings (verified by survey). Stone will be measured by the short ton for payment by the truck weight tickets or the Barge Displacement Method as described in Section 1.4.K above."
- Z. Berm Revetment Geotextile: Payment for the geotextile used in the revetment at M12 Beneficial Use Site (Price Item No. 26) will be made on a square yard basis for procurement and placement of geotextile fabric to the lines and grades shown in the Drawings and as described in Section 31 05 19.13 Add, "Geotextiles for Earthwork
- AA. Berm Revetment Construction Surveying: Payment for Berm Revetment Construction Surveying (Price Item No. 27) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys associated with berm construction, shaping, and revetment construction. Costs shall include topographic surveying; preparation of associated quantity

computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."

- BB. Temporary Breach Closure: Payment for Temporary Breach Closure (Payment Item No. 28) will be made on a lump sum basis for costs associated with excavation and placement of insitu material to temporarily close existing breach within berm along Baseline C.
- CC.New Breach Opening: Payment for New Breach Opening (Payment Item No. 29) will be made on a lump sum basis for costs associated with excavation and placement of in-situ material to open a new breach on existing berm of Baseline C.
- DD. Tidal Channel Clearing Atkinson: Payment for tidal channel clearing (Payment Item No. 30) will be made on a lump sum basis for costs associated with clearing the existing tidal channel on Atkinson Island and an access channel to Cell M3 due to mudwaving during Berm B construction.
- EE. Drop-Outlet Structure: Payment for Drop-Outlet Structure (Payment Item No. 31) will be made on a lump sum basis for costs associated with costs associated with procurement of materials, construction, excavation, and placement of the drop-outlet structure as described in the Drawings and Section 35 20 30.00 45 Add, "Drop-Outlet Structure" and associated section.
- FF. Breach Opening/Closure/Outfall Construction Surveying: Payment for Breach Opening Closure/Outfall Construction Surveying (Price Item No. 32) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys. Costs shall include topographic surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00 Add, "Construction Surveying."
- GG. Seeding: Payment for Seeding (Price Item No. 33) will be made on a per acre basis for costs associated with seeding and fertilizing of the berm crown and interior and exterior slopes as described in Section 32 92 19.16, "Turfing."
- HH. Cedar Bayou Monitoring Surveys (during M12 Const.): Payment for Cedar Bayou Monitoring Surveys (Price Item No. 34) will be made on a lump-sum basis for costs associated channel monitoring surveys to evaluate shoaling during M12 construction. Costs shall include bathymetric surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00, "Construction Surveying."
- II. Cedar Bayou Dredging Mobilization/Demobilization: Payment Mobilization/Demobilization (Price Item No. 35) will be made on a lump-sum basis. Payment for mobilization will not exceed sixty percent (60%) of the amount stated for Mobilization/Demobilization. The total lump sum amount for Mobilization/Demobilization shall include all costs in connection with the mobilization and demobilization of all plant and equipment associated with mechanical dredging of Cedar Bayou.
- JJ. Allowance for Cedar Bayou Sweep Dredge:
  - Payment for Cedar Bayou Sweep Dredge through mechanical dredging (Price Item No. 36) will be made for removal, transportation, and placement of material as specified in Section 35 20 23, "Dredging," and as shown on the Drawings. Payment for dredging will include costs for identification and removal of incidental debris and dredging obstructions, and any other related work.
  - 2. Payment will be based on computations of quantities removed from the pay templates specified in Section 35 20 23, "Dredging," and as shown on the drawings, as measured

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by cubic yards in place. No payments will be made for material removed beyond the limits shown on the Drawings. Quantity computations shall be performed by Contractor and substantiated with BD and AD surveys conducted in accordance with Section 35 20 00, "Construction Surveying." Port Authority reserves the right to conduct independent surveys and quantity computations to verify Contractor's payment requests.

- 3. Acceptance and payment for Dredging may be requested for Work completed in segments as defined in Section 35 20 23, "Dredging." Contractor may request payment for shorter segments; however, length of pay sections shall not be less than 500 feet.
- 4. Regardless of actual measured quantities, total payment for Allowance for Cedar Bayou Sweep Dredge (Price Item No. 36) will not exceed the associated Allowance Quantity and Extended Prices shown on Contractor's Price Exhibit Form without an Port Authority-initiated Change Order (for example, to increase the Contract quantity).
- KK. Cedar Bayou Construction Surveys: Payment for Cedar Bayou Construction Surveys (Price Item No. 37) will be made on a lump-sum basis for costs associated with BD and AD channel surveys. Costs shall include bathymetric surveying; preparation of associated quantity computations and drawings; and related work as described in Section 35 20 00, "Construction Surveying."
- LL. Mechanically Placed Berm at Spilman Island: Payment for Mechanically Placed Berm will be made by the cubic yard of excavation and by the cubic yard of embankment. Payment will also be made by the square yard of geogrid soil reinforcement. Payment for acquisition and placement of topsoil will not be made directly but shall be subsidiary to excavation and/or fill. Costs for excavation will include dewatering, excavation and fill and the preparation of subgrade, including application of lime or cement if required, and all other relevant activities and items of work as described in Section 31 23 00.00 Add Excavation and Fill. Costs for embankment will include all relevant items of work and materials for the construction of embankment for the berm as described in Section 31 24 00 Add Embankment Construction. Costs for placement of geogrid soil reinforcement upon completed subgrade prior to construction of embankment shall include all relevant items of work and materials as described in Section 31 05 21.00 Add Geogrid Soil Reinforcement.
- MM. Stone Riprap and Granular Fill: Stone riprap and granular fill at the Spilman Island cut-off wall will be paid for by the cubic yard at the specified riprap or granular fill thickness. Costs for placement of stone riprap and/or granular fill shall include all relevant items of work and materials necessary for the placement of stone riprap and granular fill, including geotextile material when required as shown on the drawings, as described in Section 03 30 53.01 Add Riprap and Granular Fill.
- NN. Finished Grading: Payment for finished grading at Spilman Island from the placement area berm to the bulkhead cutoff wall, pipeline protection wall, and that associated with the preliminary phase of dredging for the ship channel improvements, will be by the cubic yard of excavation and/or fill. Payment for the finished grading at Morgan's Point for transition from existing ground to the bulkhead wall reinforced concrete cap, will be by the cubic yard of excavation and/or fill. Payment for acquisition and placement of topsoil will not be made directly but shall be subsidiary to excavation and/or fill. Costs for excavation and/or fill required for finished grading shall include all relevant activities and items of work required as described in Section 31 23 00.00 Add Excavation and Fill.
- OO. Clearing and Grubbing: Payment for clearing and grubbing necessary for the construction of the placement area berm, bulkhead cut-off wall, pipeline protection wall, and finished grading at Spilman Island, and for the construction of the bulkhead wall and finished grading at Morgan's Point will be by the acre. Costs for clearing and grubbing shall include all

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relevant activities and items of work required as described in Section 31 11 00.00 Add - Clearing and Grubbing

- PP. Hydromulch Seeding: Payment for the furnishing and placement of hydromulch seeding on the placement area berm, and finished grading at Spilman Island, and for the finished grading at Morgan's Point will be by the acre. Preparation of topsoil for application of hydromulch seeding will not be made directly but shall be considered subsidiary to hydromulch seeding. Costs for hydromulch seeding shall include all relevant activities including watering for vegetative establishment and items of work required as described in Section 32 92 13.00 Add Hydromulching.
- QQ. Chainlink Fencing: Payment for furnishing and installation of chainlink fencing will be by the linear foot. Costs for chainlink fencing shall include optional concrete mow pad if used, optional grounding if used, and all relevant activities and items of work required as described in Section 32 31 13.00 Add Fences and Gates.
- RR. Reinforced Silt Fencing: Payment for furnishing and installation of reinforced silt fencing will be by the linear foot. Costs for reinforced silt fencing shall include maintenance and removal of the reinforced silt fencing, and all relevant activities and items of work required as described in Section 01 56 26.00 Add Reinforced Silt Fencing.
- SS. Bulkhead Wall Mobilization/Demobilization: Payment for Bulkhead Wall Mobilization/Demobilization (Price Item No. 38, 78, 103, 108, 129) will be made on a lumpsum basis. Payment for mobilization will not exceed sixty percent (60%) of the amount stated for Mobilization/Demobilization. The total lump sum amount for Mobilization/Demobilization shall include all costs in connection with the mobilization and demobilization of all plant and equipment associated with Structural work necessary to perform the Work for the Base Bid.
- TT. Bulkhead Wall Construction Surveying: Payment for Bulkhead Wall Construction Surveying (Price Item No. 39, 79, 109) will be made on a lump-sum basis for costs associated with initial, interim, and final surveys for the wall structural work. Costs shall include topographic surveying , preparation and submittal of drawings; and related work as described in Section 35 20 00, "Construction Surveying."
- UU.Bulkhead Wall Trench Excavation Safety Protection: Payment for Bulkhead Wall Trench Excavation safety Protection (Price Item No. 40, 80, 110) will be made on a lump-sum basis for costs associated with initial, interim, and final work for the wall structural work. Costs shall include all necessary procedures as governed by OSHA and other applicable authorities.
- VV. Bulkhead Wall Construction Vibration Monitoring: Payment for Bulkhead Wall Construction Vibration Monitoring (Price Item No. 41, 81, 111) will be made on a lump-sum basis for costs associated with initial, interim, and final work for the wall structural work. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 02 22 13 "Construction Vibration Monitoring".
- WW. Bulkhead Wall Pipeline Management / Coordination: Payment for Bulkhead Wall Pipeline Management / Coordination (Price Item No. 42, 82) will be made on a lump-sum basis for costs associated with pre-mobilization, mobilization, construction, demobilization and all other operations for wall structural work that requires pipeline encroachment coordination with the Owner, asset Owner and/or vibration monitoring program. Costs shall include all necessary work described in the drawings and Section XX XX XX "Special Conditions".
- XX. Bulkhead Wall Combi-wall Piles and Sheet Piles: Payment for Bulkhead Wall Combi-wall Piles and Sheet Piles (Price Item No. 43, 56, 57, 83, 112) will be made on a lump-sum basis for costs associated with excavation, temporary earthwork, pile installation, and backfill to the

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limits shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 35 31 16.20 "Steel Sheet Pile Bulkhead" and shown on the drawings.

- YY. Bulkhead Wall Pre-fabricated Steel Cap: Payment for Bulkhead Wall Pre-fabricated Steel Cap (Price Item No. 47) will be made on a lump-sum basis for costs associated with excavation, temporary earthwork, installation, field connection and field coating repairs to the limits shown on drawings. Costs shall include all necessary work described in Section 05 12 00 00 "Structural Steel Framing".
- ZZ. Bulkhead Wall Batter Piles: Payment for Bulkhead Wall Batter Piles (Price Item No. 48, 87, 113) will be made on a lump-sum basis for costs associated with earthwork and installation to the limits shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 31 62 18 "Steel Pipe Piles" or "31 62 16.16 "Steel H Piles".
- AAA. Bulkhead Wall Pile 10' Long Pile Build-up Allowance: Payment for Bulkhead Wall Pile 10' Long Pile Build-up Allowance (Price Item No. 44, 49, 58, 84, 88, 114) will be made on a per unit "each" pile occurrence basis for costs associated with materials, coating, fit-up, and repair coating due to splicing using butt weld. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 31 62 18 "Steel Pipe Piles" or "31 62 16.16 "Steel H Piles".
- BBB. Bulkhead Wall Pile Build-up Splicing using Butt Weld: Payment for Bulkhead Wall Pile Build-up Splicing using Butt Weld (Price Item No. 45, 50, 59, 85, 89, 115) will be made on a per unit "each" pile occurrence basis for costs associated with Batter Pile Build-up Allowance for field welding the additional pile to the partially installed batter pile and performing 100% UT or Radiographic Exam. Costs shall include all necessary materials, equipment, labor, management and other work for welding described in Section 31 62 18 "Steel Pipe Piles" or "31 62 16.16 "Steel H Piles".
- CCC. Bulkhead Wall Pile 10' Build-up Pile Driving Allowance: Payment for Bulkhead Wall Pile 10' Build-up Pile Driving Allowance (Price Item No. 46, 51, 60, 86, 90, 116) will be made on a per unit "each" pile occurrence basis for costs associated with Batter Pile Build-up Allowance after field welding the additional pile to the partially installed batter pile and performing 100% UT or Radiographic Exam. Costs shall include all necessary materials, equipment, labor, management and other work for driving the pile to a re-defined minimum tip elevation and described in Section 31 62 18 "Steel Pipe Piles" or "31 62 16.16 "Steel H Piles".
- DDD. Bulkhead Wall Batter Pile Driving Analyzer (PDA) on Production Test Piles: Payment for Bulkhead Wall Batter Pile Driving Analyzer (PDA) on Production Test Piles (Price Item No. 52, 91, 117) will be made on a lump-sum basis for costs associated with earthwork, equipment installation, monitoring during initial drive and restrike, reporting and submittals. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 31 62 18 "Steel Pipe Piles" or "31 62 16.16 "Steel H Piles".
- EEE. Bulkhead Wall Batter Pile Field Connection to Steel Pre-Fabricated Cap: Payment for Bulkhead Wall Batter Pile Field Connection to Steel Pre-Fabricated Cap (Price Item No. 53) will be made on a lump-sum basis for costs associated with excavation, temporary earthwork, installation of the steel elements for connecting the batter pile to the steel cap sleeve pipe, and field coating as shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 05 12 00 00 "Structural

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Steel Framing", 05 50 00.00 "Miscellaneous Metals", 31 62 18 "Steel Pipe Piles" and 09 96 56.01 "Epoxy Coatings Coal Tar"..

- FFF. Bulkhead Wall Grout of Steel Cap Annulus: Payment for Bulkhead Wall Grout of Steel Cap Annulus (Price Item No. 54) will be made on a lump-sum basis for costs associated with temporary earthwork and installation of the grout into the annulus between batter pile and cap sleeve pipe as shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 05 12 00 00 "Structural Steel Framing".
- GGG. Bulkhead Wall Pipe Steel Cap Plate: Payment for Bulkhead Wall Pipe Steel Cap Plate (Price Item No. 55, 61) will be made on a lump-sum basis for costs associated with works required for installation, welding and field coating, and coating repair of the steel plate to the pipe pile as shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 05 50 00.00 "Miscellaneous Metals" and 09 96 56.01 "Epoxy Coatings Coal Tar".
- HHH. Bulkhead Wall Closeout Structural Inspection Report: Payment for Bulkhead Wall Closeout Structural Inspection Report (Price Item No. 62, 97, 121) will be made on a lumpsum basis for costs associated with inspecting and submitting an inspection report on the completed wall structural work. This item shall be executed after all final grading and dredging is completed. Costs shall include all necessary work described in General Notes on the drawings.
- III. Bulkhead Wall Closeout Baseline Alignment Survey: Payment for Bulkhead Wall Closeout Baseline Alignment Survey (Price Item No. 64, 100, 128) will be made on a lump-sum basis for costs associated with a final survey that provides the final alignment of the wall after all grading on landside of wall is completed and prior to excavation or dredging on the waterside. Costs shall include all necessary work described in General Notes on the drawings.
- JJJ.Bulkhead Wall HDPE Sleeves and Annulus Grout: Payment for Bulkhead Wall HDPE Sleeves and Annulus Grout (Price Item No. 92) will be made on a lump-sum basis for costs associated with all works necessary for installation of the sleeve around the batter pile and grout into the annulus between batter pile and sleeve as shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 05 12 00 00 "Structural Steel Framing".
- KKK. Bulkhead Wall Reinforced Concrete Cap: Payment for Bulkhead Wall Reinforced Concrete Cap (Price Item No. 93, 94, 95, 119) will be made on a lump-sum basis for costs associated with all formwork, installation of reinforcement and embedded items, pile steel shear rings, reinforced concrete pile plug, and delivery and placement of concrete. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 05 50 00.00 "Miscellaneous Metals", 03 21 00.00 "Reinforcing Steel", and 03 31 00.00 "Structural Concrete".
- LLL. Bulkhead Wall Tie-Rods (including Pre-tensioning): Payment for Bulkhead Wall Tie rods (including Pre-tensioning) (Price Item No. 118) will be made on a lump-sum basis for costs associated with all works necessary with delivery, installation and pre-tensioning the tie-rods. Costs shall include all necessary materials, equipment, labor, management and other work described in the drawings and Section 35 31 16.20 "Steel Sheet Pile Bulkhead".

- MMM. Bulkhead Wall Boat Bollard Piles: Payment for Bulkhead Wall Boat Bollard Piles (Price Item No. 96) will be made on a lump-sum basis for costs associated with all works necessary to install the coated piles, pile cap, and splash zone pile wrap to the limits shown on drawings. Costs shall include all necessary materials, equipment, labor, management and other work described in Section 31 62 18 "Steel Pipe Piles".
- NNN. Landside Demolition Removal and Disposal of Debris: Payment for Landside Demolition Removal of Debris (Price Item No. 104, 105) will be made on a per ton basis for costs associated with all works necessary to excavate, demolish, remove, cut, extract, and dispose of the material within the limits and as shown on the drawings. Material/items to be removed/disposed include but not limited to concrete slabs, asphaltic road surface, timber piles, boat ramp, rip-rap and shore protection. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- OOO. Landside Demolition Removal and Disposal of Abandoned Utility Poles: Payment for Landside Demolition Removal of Abandoned Utility Poles will be made on a per unit "each" basis for costs associated with all works necessary to excavate, demolish, remove, cut, extract, and dispose of the abandoned utility poles. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- PPP. Landside Demolition Removal and Disposal of Utilities: Payment for Landside Demolition Removal of Abandoned Utilities will be made on a lump-sum basis for costs associated with all works necessary to excavate, demolish, remove, cut, extract, cap and dispose of the abandoned utilities shown and noted on the drawings. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- QQQ. LASH Dock Demolition Pre-Demolition Marine Survey: Payment for LASH Dock Demolition Pre-Demolition Marine Survey will be made on a lump-sum basis for costs associated with all works necessary to perform a multi-beam bathymetric survey, underwater side-scan survey, and underwater magnetometer survey to serve as a baseline survey of the area prior to mobilization for demolition works. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- RRR. LASH Dock Demolition Non-Pile Extraction Works: Payment for LASH Dock Demolition Non-Pile Extraction Works will be made on a per ton basis for costs associated with all works necessary to demolish, remove and dispose of the material within the limits shown on the drawings excluding the extraction of the existing piles from mudline. Material/items to be removed and disposed of include but not limited to: precast reinforced concrete segments, reinforced concrete caps, light poles, lighting and associated equipment, and railing. Refer to Exhibits in Section 02 41 00 "Demolition" for original construction drawings. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- SSS. LASH Dock Demolition Allowance for Non-Pile Extraction Works: Payment for LASH Dock Demolition Allowance for Non-Pile Extraction Works will be made on a per ton basis for costs associated with all additional works necessary to demolish, remove and dispose of the quantity of material noted within the limits shown on the drawings excluding the extraction of

the existing piles from mudline. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".

- TTT. LASH Dock Demolition Pile Extraction from Mudline: Payment for LASH Dock Demolition Pile Extraction from Mudline (Price Item No. 133, 134, 135, 136) will be made on a per unit linear feet basis for costs associated with all works necessary to demolish, remove, extract and dispose of the pile material (below mudline and above mudline as applicable) and fill voids below mudline with flowable fill for voids caused by extracting piles shown on the drawings. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- UUU. LASH Dock Demolition Structural Evaluation Report of Remaining Structure: Payment for LASH Dock Structural Evaluation Report of Remaining Structure will be made on a lump sum basis for costs associated with site visits, travel, meals, assessments, coordination, analyses and reporting. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- VVV. LASH Dock Demolition Post-Demolition Marine Survey: Payment for LASH Dock Demolition Post-Demolition Marine Survey will be made on a lump-sum basis for costs associated with all works necessary to perform a multi-beam bathymetric survey, underwater side-scan survey, and underwater magnetometer survey to serve as a baseline close-out survey of the area after all demolition works have been completed and before demobilizing. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- WWW. LASH Dock Demolition Post-Demolition Dive Survey: Payment for LASH Dock Demolition Post-Demolition Dive Survey will be made on a lump-sum basis for costs associated with all works necessary to perform an underwater dive survey to serve as a baseline close-out survey of the area after all demolition works have been completed and before demobilizing. Costs shall include all necessary materials, equipment, labor, engineering, management and other work described in Section 02 41 00 "Demolition".
- XXX. Appurtenances Navigation Aids, ladders and Signs (To Be Determined): Payment for Appurtenances – Navigation Aids, ladders and Signs (To Be Determined) (Price Item No. 64, 99,122) will be made on a lump-sum basis for costs associated with all works necessary with delivery and installation of the appurtenance items. Costs shall include all necessary materials, equipment, labor, management and other work described in the drawings.
- YYY. Bulkhead Wall Stand-by Time allowance for DMPA Operations Delays: Payment for Bulkhead Wall Stand-by Time Allowance for DMPA Operations Delays (Price Item No. 65) will be made on a per day basis for costs associated with restricted works due to non-project related DMPA operations that cause delays in the construction activities for bulkhead wall construction and as defined in Section XX XX XX "Special Conditions".
- ZZZ. Spilman Site Access Matting (Roadways and Pads/Storage Area): Payment for Spilman Site Access Matting (Roadways and Pads/Storage Area) (Price Item No. 66) will be made on a per Linear Feet basis for costs associated with works due to preparing the existing site roadway surface for large equipment access to perform construction.

### PART 2 – PRODUCTS

(NOT USED)

### PART 3 – EXECUTION

(NOT USED)

### **END OF SECTION**

Segment 3 - Barbours Cut Channel

<u>Item No.</u>	<u>Description</u>	<u>Estimated</u> Quantity	<u>Unit</u>	<u>Unit Price</u>	<u>Total Amount</u>
1	Mobilization and Demobilization	1	LS	\$	
2	Pre-Dredge Hazard Survey	1	LS	\$	
3	BCC Dredging Construction Surveying	1	LS	\$	
4	Allowance for Debris Removal From Dredging Template - Piles	400	TON	\$	
5	Allowance for Debris Removal From Dredging Template - Misc	150	TON	\$	
6	Dredging Pipeline Setup & Mgmt (Dredge to M12)	1	LS	\$	
7	Dredging (North BCC Template):	1,999,000	CY	\$	
8	Dredging (South BCC Template):	825,700	CY		
9	Existing Revetment at Spilman Island Removal/Stockpile	1	LS	\$	
10	Replace Revetment at Spilman Island	1	LS	\$	

11	Allowance for Additional Stone - Spilman Island Revetment	1,000	TON	\$\$
12	Spilman Island Revetment Construction Surveying	1	LS	\$\$
13	Morgan's Point Revetment Graded Riprap	2,100	TON	\$\$
14	Morgan's Point Revetment Geotextile	1,460	SY	\$\$
15	Morgan's Point Revetment Construction Surveying	1	LS	\$

### M12 Beneficial Use Placement Area

<u>ltem No.</u>	Description	<u>Estimated</u> Quantity	<u>Unit</u>	<u>Unit Price</u>	<u>Total Amount</u>
16	Mobilization / Demobilization - M12 Berm and Placement	1	LS	\$	
17	Hydraulically Placed Berm (Baseline A)	7,800	LF	\$	
18	Final Shaping (Baseline A)	7,800	LF	\$	
19	Hydraulically Placed Berm (Baseline B)	3,500	LF	\$	
20	Final Shaping (Baseline B)	3,500	LF	\$	

24	Dredging Pipeline Mgmt			
21	(Filling within M12)	1	LS	\$\$
22	Flotation Channel (Baseline A)	8,150	LF	\$
23	Berm-Flotation Channel Hazard Surveying	1	LS	\$
24	Berm-Flotation Channel Construction Surveying	1	LS	\$
25	Berm Revetment Graded Riprap	43,500	TON	\$
26	Berm Revetment Geotextile	35,100	SY	\$
27	Berm Revetment Construction Surveying	1	LS	\$
28	Temporary Breach Closure	1	LS	
29	New Breach Opening	1	LS	\$
30	Tidal Channel Clearing - Atkinson	1	LS	\$
31	Drop-Outlet Structure	1	LS	\$
32	Breach Opening/Closure/Outfall Construction Surveying	1	LS	\$
33	Seeding	13.5	AC	\$

### Cedar Bayou Sweep

<u>Item No.</u>	Description	<u>Estimated</u> Quantity	<u>Unit</u>	Unit Price	Total Amount
34	Cedar Bayou Monitoring Surveys (during M12 Const.)	1	LS	\$	
35	Mobilization / Demobilization - Mechanical Dredge	1	LS	\$	
36	Allowance for Cedar Bayou Sweep Dredge	85,000	СҮ	\$	
37	Cedar Bayou Construction Surveys	1	LS	\$	
		Spilman Island			
ltem No.	<u>Description</u> Spilman Island - Cut Off Wall	<u>Estimated</u> Quantity	<u>Unit</u>	<u>Unit Price</u>	<u>Total Amount</u>
38	Spilman Island Cut-off Bulkhead Wall: Mobilization and Demobilization	1	LS	\$	
39	Spilman Island Cut-off Bulkhead Wall: Construction Surveying	1	LS	\$	
40	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$	
Sybibit A. Dri	aa Eyhihit				Maacuramantana

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### PROJECT 11 - PACKAGE 7

	Trench Excavation Safety Protection				
	(Trench Safety and Special Shoring)				
41	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$\$	
	Construction Vibration Monitoring		_		_
42	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$\$	
	Pipeline Management / Coordination				
43	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$\$	
	East End Corner Combi-Wall Piles				
44	Spilman Island Cut-off Bulkhead Wall:	6	EA	\$\$	
	30" DIA. King Pile				
	to long the Build-up Allowance				
45	Spilman Island Cut-off Bulkhead Wall:	6	EA	\$\$	_
	Build-up Splicing using Butt Weld & 100%				
	UT or Radiographic Exam				
46	Spilman Island Cut-off Bulkhead Wall:	6	EA	\$	
	30" DIA. King Pile				_
	10' Build-up Pile Driving Allowance				
47	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$\$	
	East End Corner Pre-fabricated Steel Cap				
48	Spilman Island Cut-off Bulkhead Wall:	1	LS	\$\$	
	East End Corner Batter Piles				
49	Spilman Island Cut-off Bulkhead Wall:	13	EA	\$\$	
	East End Corner Batter Pile				
	10' Long Pile Build-up Allowance				
				••	

50	Spilman Island Cut-off Bulkhead Wall: East End Corner - Batter Pile Build-up Splicing using Butt Weld & 100% UT or Radiographic Exam	13	EA	\$	
51	Spilman Island Cut-off Bulkhead Wall: East End Corner Batter Pile 10' Build-up Pile Driving Allowance	13	EA	\$	
52	Spilman Island Cut-off Bulkhead Wall: East End Corner Batter Pile Driving Analyzer on Production Test Piles	1	LS	\$	
53	Spilman Island Cut-off Bulkhead Wall: East End Corner Field Connection to Pre-Fabricated Steel Cap	1	LS	\$	
54	Spilman Island Cut-off Bulkhead Wall: East End Corner Grout of Pre-Fabricated Steel Cap Annulus	1	LS	\$	
55	Spilman Island Cut-off Bulkhead Wall: 24" DIA Batter Pipe Steel Cap Plate	1	LS	\$	
56	Spilman Island Cut-off Bulkhead Wall: East End Combi-Wall Piles	1	LS	\$	
57	Spilman Island Cut-off Bulkhead Wall: West End Combi-Wall Piles	1	LS	\$	
58	Spilman Island Cut-off Bulkhead Wall: 48" DIA. King Pile 10' Long Pile Build-up Allowance	15	EA	\$\$	

59	Spilman Island Cut-off Bulkhead Wall: 48" DIA. King Pile Build-up Splicing using Butt Weld & 100% UT or Radiographic Exam	15	_ EA	\$
60	Spilman Island Cut-off Bulkhead Wall: 48" DIA. King Pile 10' Build-up Pile Driving Allowance	15	_ EA	\$\$
61	Spilman Island Cut-off Bulkhead Wall: 48" DIA Pipe Steel Cap Plate	1	LS	\$
62	Spilman Island Cut-off Bulkhead Wall: Closeout Level 1 Structural Inspection Report	1	LS	\$
63	Spilman Island Cut-off Bulkhead Wall: Closeout Baseline Alignment Survey	1	LS	\$\$
64	Spilman Island Cut-off Bulkhead Wall: Appurtenances- Navigational Aids,ladders, Signs (To Be Determined)	1	LS	\$
65	Spilman Island Cut-off Bulkhead Wall: DMPA operations Construction Delays Stand-by Time Allowance	30	DAYS	\$
66	Access Matting	24,000	LF	\$
67	Phase 1 Excavation	68,568	CY	\$
68	Phase 1 Embankment	40,494	CY	\$

69	Excavation After Phase 1 (Above EL + 4')	190,085	CY	 \$
70	Embankment After Phase 1 (Above EL + 4')	1,884	СҮ	 \$
71	Clearing and Grubbing	36	AC	 \$
72	Hydromulch Seeding	24	AC	 \$
73	Geogrid	44,261	SY	 \$
74	Silt Fence	44,261	LF	 \$
75	Rip Rap 3 Inch	894	СҮ	 \$
76	Rip Rap 6 Inch	204	СҮ	 \$
77	Outlet Tray	8	EA	 \$
	Spilman Island - Pipeline Protection Wall			
78	Spilman Island Pipeline Protection Bulkhead Wall: Mobilization and Demobilization	1	LS	 \$
79	Spilman Island Pipeline Protection Bulkhead Wall: Construction Surveying	1	LS	 \$
80	Spilman Island Pipeline Protection Bulkhead Wall: Trench Excavation Safety Protection (Trench Safety and Special Shoring)	1	LS	 \$

81	Spilman Island Pipeline Protection Bulkhead Wall: Construction Vibration Monitoring	1	LS	\$ 
82	Spilman Island Pipeline Protection Bulkhead Wall: Pipeline Management / Coordination	1	LS	\$ 
83	Spilman Island Pipeline Protection Bulkhead Wall: Combi-Wall piles	1	LS	\$ 
84	Spilman Island Pipeline Protection Bulkhead Wall: 60" DIA. King Pile 10' Long Pile Build-up Allowance	3	EA	\$ 
85	Spilman Island Pipeline Protection Bulkhead Wall: 60" DIA. King Pile Splicing using Butt Weld & 100% UT or Radiographic Exam	3	EA	\$ 
86	Spilman Island Pipeline Protection Bulkhead Wall: 60" DIA. King Pile 10' Build-up Pile Driving Allowance	3	EA	\$ 
87	Spilman Island Pipeline Protection Bulkhead Wall: Batter Piles	1	LS	\$ 
88	Spilman Island Pipeline Protection	6	EA	\$
Exhibit A: P	rice Exhibit			Measurement and E

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	Bulkhead Wall - Batter Piles: 10' Long Pile Build-up Allowance			
89	Spilman Island Pipeline Protection Bulkhead Wall - Batter Pile: Splicing using Butt Weld & 100% UT or Radiographic Exam	6	EA	\$ 
90	Spilman Island Pipeline Protection Bulkhead Wall - Batter Piles: 10' Build-up Pile Driving Allowance	6	EA	\$ 
91	Spilman Island Pipeline Protection Bulkhead Wall: Batter Pile Driving Analyzer on Production Test Piles	1	LS	\$ 
92	Spilman Island Pipeline Protection Bulkhead Wall - Batter Piles: HDPE Sleeves and Annulus Grout	1	LS	\$ 
93	Spilman Island Pipeline Protection Bulkhead Wall: Reinforced Concrete Cap Lift 1	1	LS	\$ 
94	Spilman Island Pipeline Protection Bulkhead Wall: Reinforced Concrete Cap Lift 2	1	LS	\$ 
95	Spilman Island Pipeline Protection Bulkhead Wall: Reinforced Concrete Cap Lift 3	1	LS	\$ 
96	Spilman Island Pipeline Protection	1	LS	\$ 

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Bulkhead Wall: Steel Boat Bollard Piles

97	Spilman Island Pipeline Protection	1	LS		\$
	Structural Inspection Report				
98					
	Spilman Island Pipeline Protection	1	LS		\$
	Bulkhead Wall:				
	Closeout Baseline Alignment Survey				
99	Spilman Island Cut-off Bulkhead Wall:	1	LS		Ś
	Appurtenances- Navigational Aids, signs				.+
	(To Be Determined)				
400		2 50 4	•		A
100	Excavation Below EI + 0	3,504	Су		\$
101	Excavation Above El + 0'	9,617	СҮ		\$
102	Rip-Rap Behind Wall	2,900	TON		\$
		<u>Morgan's Point</u>			
<u>ltem No.</u>	<u>Description</u>	<u>Estimated</u> Quantity	<u>Unit</u>	<u>Unit Price</u>	Total Amount
	Morgan's Point Landside Demolition				
103	Morgan's Point Landside Demolition:	1	LS		\$
	Mobilization and Demobilization				·
104	Morgan's Point Landside Demolition:	400	TON		\$
	Removal and Disposal of Debris				
Exhibit A. Dric	a Eyhihit				Mossurement and
## Concrete Slabs, Peirs and Boat Ramp

105	Morgan's Point Landside Demolition: Removal and Disposal of Debris Rip-Rap and Shoreline Protection	4,200	TON	\$
106	Morgan's Point Landside Demolition: Removal and Disposal of Debris Abandoned Utility Poles	3	EA	\$
107	Morgan's Point Landside Demolition: Removal and Disposal of Debris Utilities; Cut and Cap if Required	1	LS	\$
	Morgan's Point Bulkhead Wall			
108	Morgan's Point Bulkhead Wall: Mobilization and Demobilization	1	LS	\$
109	Morgan's Point Bulkhead Wall: Construction Surveying	1	LS	\$
110	Morgan's Point Bulkhead Wall: Trench Excavation Safety Protection (Trench Safety and Special Shoring)	1	LS	\$
111	Morgan's Point Bulkhead Wall: Construction Vibration Monitoring	1	LS	\$
112	Morgan's Point Bulkhead Wall: Steel Sheet Pile Wall Piles	1	LS	\$
113	Morgan's Point Bulkhead Wall: Steel Batter Pile	1	LS	\$

114	Morgan's Point Bulkhead Wall: Steel Batter Pile 10' Long Pile Build-up Allowance	4	EA _	\$
115	Morgan's Point Bulkhead Wall: Steel Batter Pile Splicing using Butt Weld & 100% UT or Radiographic Exam	4	EA _	\$
116	Morgan's Point Bulkhead Wall: Steel Batter Pile 10' Build-up Pile Driving Allowance	4	EA _	\$
117	Morgan's Point Bulkhead Wall: Bulkhead Wall: Batter Pile Driving Analyzer on Production Test Piles	1	LS	\$
118	Morgan's Point Bulkhead Wall: Tie-Rods (including Pretensioning)	1	LS _	\$
119	Morgan's Point Bulkhead Wall: Reinforced Concrete Cap	1	LS	\$
120	Morgan's Point Bulkhead Wall: Closeout Level 1 Structural Inspection Report	1	LS _	 \$
121	Morgan's Point Bulkhead Wall: Closeout Baseline Alignment Survey	1	LS _	\$
122	Spilman Island Cut-off Bulkhead Wall: Appurtenances- signs	1	LS	\$

(To Be Determined)

123	Excavation	964	CY	<u> </u>	_
124	Embankment	348	СҮ	\$\$	
125	Hydromulch Seeding	1	AC	\$	
126	Chain Link Security Fence	108	LF	\$	
127	Silt Fence	125	LF	\$	
128	Rip Rap 6 Inch	44	СҮ	\$	
	Morgan's Point LASH Dock Demolition				
129	LASH Dock Demolition: Mobilization and Demobilization	1	LS	\$\$	
130	LASH Dock Demolition: Pre-Demolition Marine Survey	1	LS	\$\$	
131	Morgan's Point: LASH Dock Demolition Non-Pile Extraction Works	2,100	TON	\$	
132	Morgan's Point: LASH Dock Demolition Allowance for Non-Pile Extraction Works	400	_ TON	\$	
133	Morgan's Point: LASH Dock Demolition Pile Extraction from Mudline (Underreamed Bents 7-10)	442	_ LF	\$	
hibit A: Pri	ce Exhibit			Measurement a	and

134	Morgan's Point: LASH Dock Demolition Pile Extraction from Mudline ( Bents 11)	168	_ LF	\$
135	Morgan's Point: LASH Dock Demolition Broken Pile Extraction from Mudline ( Bent 6 East Approachway; 16" DIA )	78	_ LF	\$
136	Morgan's Point: LASH Dock Demolition Broken Pile Extraction from Mudline (Bent 6 East Approach; 30" Underreamed)	28	_ LF	\$
137	Morgan's Point: LASH Dock Demolition Structural Evaluation Report of Remaining Str	<u> </u>	LS	\$
138	LASH Dock Demolition: Post-Demolition Marine Survey	1	LS	\$
139	LASH Dock Demolition: Post-Demolition Dive Survey	1	LS	\$
ſ	TOTAL AMOUNT PROPOSED - Total of Unit (For Comparison of Proposa	: Prices Exten lls)	ded	\$

#### SECTION 01 35 29.00 Add – HEALTH, SAFETY AND EMERGENCY RESPONSE PROCEDURES

Section 01 35 29.00 Std – Health, Safety and Emergency Response Procedures of the Port of Houston Authority Standard Technical Specifications (December 2011) is modified as set forth below.

- 1.2 Delete the following sections:
- 1.3 Bullet 2 is revised as follows:
  - Other federal, state, and local ordinances, statutes, and regulations as applicable.
- 1.4 Subsection C is revised as follows:

The Contractor's Plan shall include but not necessarily be limited to, the following components, as appropriate:

- 1. Safe Work Practices
- 2. Engineering Safeguards
- 3. Personal Protective Equipment (PPE)
- 4. Training
- 5. Standard Operating Procedures
- 6. Emergency and Contingency Planning
- 7. Logs and Reports
- 8. Hazard Communication Program

The Contractor's Plan shall be approved by signature of a designated representative of the Contracting firm, stating that the plan is in compliance with 29 CFR 1910 and 29 CFR 1926. The signed Contractor's Plan shall be submitted to the Port Authority for review, prior to commencing site work activities.

Add the following section:

#### 3.8 DREDGING PIPELINE SAFETY

Contractor shall reference U.S. Army Corps of Engineers EM 385-1-1, Section 19.G.03, "Submerged and floating dredge pipeline," for regulations with the following exceptions:

- A. Whenever buoyant or semi-buoyant pipeline is used, the dredge operator will assure that the pipeline remains fully submerged and on the bottom. When it is necessary to raise the pipeline, proper clearances shall be made and maintained and the entire length of the pipeline shall be adequately marked at an interval not to exceed 400 feet to clearly show the pipeline length and course.
- B. Indicators, such as signs or buoys that state "DANGER SUBMERGED PIPELINE" shall be placed at the beginning and end of the pipeline. In addition, indicators are

TECHNICAL SPECIFICATION Date: December 2020 01 35 29 Add Page 1 required beginning in areas which reduce the charted depth by more than 10 percent, and, as a minimum, every 400 feet to clearly warn of the pipeline length and course.

C. Lengths of submerged pipeline located outside of the navigation channel which reduce the charted depth by more than 10 percent shall be identified with high visibility buoys marked with 360 degree visibility retro-reflective tape, such as orange neoprene buoys, placed at an interval not to exceed 400 feet to clearly show the pipeline length and course. Indicators meeting the requirements of Paragraph 3.8A above shall be placed midway between each high visibility buoy.

No other clauses or requirements of Section 01 35 29.00 Std – Health, Safety and Emergency Response Procedures of the Port of Houston Authority Standard Technical Specifications (December 2011) are modified hereby.

## END OF SECTION

#### SECTION 01 35 53.00 Add – SECURITY PROCEDURES

#### **PART 1 GENERAL**

1.1 SUMMARY

Due to absence of physical access barriers around the project area, Contractor shall expect the potential for security risks to assets, equipment, and staff. Possible security concerns include but are not limited to theft, robbery, burglary, vandalism, and assault. It is the responsibility of the Contractor to protect his assets, equipment, and staff from security threats. Engineer or Port Authority shall not be deemed responsible for damages, losses, and harms incurred to Contractor's assets, equipment, and staff from security threats.

#### 1.2 RELATED SECTIONS

Section 35 20 23 Add - Dredging

#### 1.3 SUBMITTALS

Prior to commencement of work, Contractor shall submit a Security Procedures Plan to Port Authority for approval. It is the responsibility of the Contractor to ensure his proposed security methods and procedures are adequate and comply with all Federal, State, and Local laws, rules and ordinances. Approval of a Security Procedures Plan shall solely confer Port Authority's consent to execution of such plan on Port Authority's property and shall not make the Engineer or Port Authority responsible for losses, damages, injuries, or harms incurred despite or during execution of such plan nor shall it confirm lawfulness of Contractor's Security Procedures Plan.

The Security Procedures Plan shall at minimum include:

- 1. Cover Letter briefly explaining intended Security Procedures;
- 2. Drawings of proposed physical barriers, surveillance cameras, and lamp posts (if any); and
- 3. Name and address of security services subcontractor (if any).

## PART 2 PRODUCTS

#### NOT USED

## PART 3 EXECUTION

3.1 GENERAL

Contractor and his security services subcontractor (if any) shall obey all federal, state, and local laws and rules during conduct of security procedures. All security interventions shall be enacted in a professional, dignified, and humane manner. If necessary, it is the responsibility of the Contractor and his security services subcontractor (if any) to pay all related fees and appear in the court of law as plaintiff or defendant regarding all security-related matters.

#### 3.2 PHYSICAL BARRIERS

If included in the Security Procedures Plan and upon approval by Port Authority, Contractor may install physical barriers at the project site. Physical barriers shall only be installed at locations shown on the Security Procedures Plan. Approval from Port Authority is required should the Contractor wishes to modify locations of physical barriers. All physical barriers shall be removed from the site during demobilization.

#### 3.3 LAMP POSTS

If included in the Security Procedures Plan and upon approval by Port Authority, Contractor may install lamp posts at the project site to maintain adequate lighting for security purposes. Lamp posts may only be installed at locations shown on the Security Procedures Plan. Approval from Port Authority is required should the Contractor wish to modify locations of lamp posts. Contractor is responsible for the energy supply required to operate lamp posts. All lamp posts shall be removed from the site during demobilization.

#### 3.4 SURVEILLANCE CAMERAS

If included in the Security Procedures Plan and upon approval by Port Authority, Contractor may install surveillance cameras at the project site. Surveillance cameras may only be installed at locations shown on the Security Procedures Plan. Approval from Port Authority is required should the Contractor wish to modify locations of surveillance cameras. Contractor is responsible for the energy supply required to operate the cameras. All surveillance cameras shall be removed from the site during demobilization.

#### 3.5 SECURITY PERSONNEL

If included in the Security Procedures Plan and upon approval by Port Authority, Contractor may employ security personnel to patrol the project site. All security personnel employed by the Contractor or his security services subcontractor shall be well-groomed and wear clean and pressed uniforms. Contractor shall ensure that security personnel receive orientation training regarding construction sites and known or potential hazards and methods for recognizing and avoiding known or potential hazards. All security personnel shall have adequate security training and be properly licensed and certified to bear and use service weapons.

#### END OF SECTION

## SECTION 01 56 16.01 Add – DUST CONTROL

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions and of any Federal Permit applicable to the Project, this Section includes; the preparation and implementation of a Dust Control Plan during project construction. Prior to construction, the contractor must submit to and obtain acceptance by the Chief Construction Manager of a Dust Control Plan, which shall include dust control measures and monitoring for the most applicable National Ambient Air Quality Standards (NAAQS) for construction dust and as described and specified herein and as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 16 60 Add - Environmental Protection Measures

SECTION 01 25 00 Add – Measurement and Basis of Payment

#### 1.3 REFERENCES

A. Environmental Protection Agency (EPA) Publication, latest edition: National Ambient Air Quality Standards (NAAQS) for Construction Dust (Particulate Matter).

#### 1.4 SUBMITTALS

A. Project Specific Dust Control Plan:

Develop a project-specific and comprehensive Dust Control Plan subject to acceptance by the Chief Construction Manager prior to beginning work. The plan requires the following information:

#### Dust Control Plan Elements:

- 1. Identification of all possible sources of dust, including material stockpiles, active construction areas, disturbed areas, on-site roads, material handling equipment, and construction exits.
- 2. Specify the method of measurement to control the parameters per NAAQS.
- 3. Preparation and use of control measures (products) for each potential source of fugitive dust.
- 4. Consideration of climatic conditions (rainfall, wind velocity, and other factors) for planning and control.
- 5. Non-working day controls.
- 6. Operational decision matrix.
- 7. Workforce training.

- 8. Identification and use of practicable alternative construction methods.
- 9. Monitoring of plan success.
- 10. Documentation of activities and records.
- B. Daily Compliance Reports

#### PART 2 PRODUCTS

2.1 Project specific and as included in the Dust Control Plan submitted. Any product used on site must be submitted for Chief Construction Manager's approval prior to application or activity.

#### PART 3 EXECUTION

#### 3.1 IMPLEMENTATION OF DUST CONTROL PLAN

Contractor shall implement the Project-specific Dust Control Plan that complies with the requirements below, at a minimum:

- A. Control fugitive dust caused by operation of vehicles and equipment. The Contractor will apply water or, use other methods, subject to acceptance through the submittal process, which will control and minimize the amount of dust generated.
- B. Minimize disturbance of land areas beyond construction limits. Contractor is responsible for control of fugitive dust beyond actual construction limits for which the Contractor has permission to work in or travel through.

#### 3.2 DUST MONITORING

- A. The most effective method of monitoring dust is by on-site visual observation. Contractor shall visually monitor fugitive dust and take appropriate steps to mitigate identified problems.
- B. PHA Chief Construction Manager will assess environmental controls (including dust) in daily work planning. The Construction Management staff will document operational compliance with dust control plans for all construction contracts, provide quality assurance for construction activities, ensure proactive planning is conducted, and will enforce construction operations and use of controls.

#### END OF SECTION

## SECTION 01 56 26.00 Add - REINFORCED SILT FENCING

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the installation of Reinforced Filter Fabric Barrier as an erosion and sedimentation control which shall be utilized as a part of the Storm Water Pollution Prevention Plan (SWPPP), during construction and prior to the final development of the site as described and specified herein and as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 01 57 23.13 Add – Temporary Storm Water Controls

## 1.3 REFERENCES

- A. ASTM International Publications, latest revision:
  - ASTM D-3786 Standard Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method
  - ASTM D-4491 Standard Test Methods for Water Permeability of Geotextiles by Permittivity
  - ASTM D-4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- B. Storm Water Management Handbook for Construction Activities (PHA) latest edition
- C. PHA Municipal Separate Storm Sewer System (MS4) Permit
- 1.4 SUBMITTALS
  - A. Product Data for: Filter Fabric material and Reinforced Filter Fabric.
- 1.5 HANDLING AND STORAGE

NOT USED

## PART 2 PRODUCTS

#### 2.1 REINFORCED FILTER FABRIC BARRIER

- A. Provide woven geotextile filter fabric made of polypropylene, polyethylene, ethylene, or polyamide material.
  - 1. Geotextile fabric shall have minimum grab strength of 100 psi in any principal direction (ASTM D 4632).
  - 2. Mullen burst strength exceeding 200 psi (ASTM D 3786).
  - 3. Equivalent opening size between 50 and 140 for soils with more than 15 percent by weight passing a No. 200 sieve and between 20 and 50 for soils with less than 15 percent by weight passing a No. 200 sieve.
  - 4. Maximum water flow rate of 40 gallons per minute per square feet (ASTM D 4491).
  - 5. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- B. Acceptable Manufacturers:
  - 1. Marifi, Inc.
  - 2. Or approved substitution.
- C. Woven wire shall be galvanized 2" x 4" welded wire fabric, 12-1/2 gauge.
- D. Metal stakes (T Posts).

## PART 3 EXECUTION

#### 3.1 GENERAL

- A. Provide erosion and sedimentation control systems at the locations shown in the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and set out in this Section of the specifications. Reinforced filter fabric barrier design shall be based on guidelines provided in the *Storm Water Management Handbook for Construction Activities* (Latest Edition) prepared by the Storm Water Management Joint Task Force, or other industry-standard document approved by the Chief Construction Manager.
- B. No clearing and grubbing or rough cutting, other than as specifically directed by the Chief Construction Manager, to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.
- C. Install and maintain erosion and sedimentation control systems located within the project site prior to the start of construction under this Contract until final site stabilization or until approval is received from the Chief Construction Manager to remove and discard the existing system.
- D. Inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until final site stabilization. Remove erosion and sedimentation control systems promptly upon approval of the Chief Construction Manager. Discard removed materials offsite.

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- E. All sediment generated during construction will remain on the Project site. Sediment should be spread, compacted and stabilized in accordance with the Port of Houston Authority Municipal Separate Storm Sewer System (MS4) Permit Program. Sediment shall not be allowed to flush into stream or drainage way. If any contaminated sediment is encountered, the Contractor shall notify the Chief Construction Manager.
- F. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.
- G. Conduct all construction operations under this Contract in conformance with erosion control practices described in the project Storm Water Pollution Prevention Plan, or Best Management Practices Plan.

#### 3.2 CONSTRUCTION METHODS

- A. Provide filter fabric barrier systems at locations specified on the Drawings. Reinforced filter fabric barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.
- B. Attach the woven wire support to steel fence posts (minimum of 1.25 lbs. per linear foot and Brinell hardness greater than 140) spaced 6 feet (maximum) apart and embedded a minimum of 1 foot. Maximum spacing of 8 feet is allowed if posts are made of hot rolled steel, at least 4 feet long with Tee or Y-Bar sections with the surface painted or galvanized. Provide safety caps on top of metal posts. The steel posts shall be installed at a slight angle toward the source of the anticipated runoff.
- C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow as shown on the attached drawings. Trench shall be a minimum of 6-inch by 6-inch. Lay filter fabric along the edges of the trench. Backfill and compact trench.
- D. The filter fabric should be provided in continuous rolls and cut to the length of the silt fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6-inch overlap and sealed securely.
- E. When used in swales, ditches, or diversions, the elevation of the barrier at the top of the filter fabric at the flow line location in the channel shall be lower than the bottom elevation of the filter fabric at the ends of the barrier or the top of bank, whichever is less, in order to keep storm water discharge in the channel from overtopping the bank.
- F. Inspect sediment filter barrier systems after each rainfall of 0.5 inches or greater, and daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this section. Remove sediment deposits when silt reaches one-third of the height of the barrier in depth.

## END OF SECTION

## SECTION 01 57 23.13 Add - TEMPORARY STORM WATER CONTROLS

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the installation of erosion and sediment controls during construction activities as shown on the plans, and as described in the construction Storm Water Pollution Prevention Plan (SWPPP), which ensures that project complies with the Port of Houston Authority Municipal Separate Storm Sewer System (MS4) Permit Program as described and specified herein and as shown on the Drawings.

All construction activities which disturb an area equal to or greater than one (1) acre of land and are performed on Port of Houston property must be in compliance with the Texas Pollutant Discharge Elimination System (TPDES) General Permit (TXR 150000) for Storm Water Discharges Associated with Construction Activities as required by the Port of Houston Authority's MS4 Permit.

In situations where construction activities disturb an area less than one (1) acre, where the coverage under Texas Pollutant Discharge Elimination System (TPDES) General Permit and a Storm Water Pollution Prevention Plan (SWPPP) is not required, a Best Management Practices (BMP) Plan is required.

1.2 RELATED SECTIONS

SECTION 01 25 00 Add – Measurement and Basis of Payment

SECTION 01 56 26.00 Add - Reinforced Silt Fencing

SECTION 31 23 00.00 Add – Excavation and Fills

#### 1.3 REFERENCES

- A. Texas Pollutant Discharge Elimination System (TPDES) General Permit
- B. ASTM International Publications, latest revision:
  - ASTM D-3786 Standard Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method
  - ASTM D-4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- C. Port of Houston Authority Construction Guidance Manual Latest Edition
- D. Compliance with all applicable and appropriate local, state and federal waste disposal and sanitary sewer regulations.

#### 1.4 SUBMITTALS

- A. As applicable, Storm Water Pollution Prevention Plan (SWP3) or Best Management Practices (BMP) Plan.
- B. Product Data for materials used in Inlet Protection Barriers and Filter Fabric Fence.
- C. Material Safety Data Sheets (MSDS) for all materials brought on site.
- D. Notice of Intent: (If applicable)
  - 1. The Contractor will submit PHA reviewed Notice of Intent (NOI), with the applicable fee to the Texas Commission on Environmental Quality (TCEQ), as a requirement of the General TPDES Permit for Storm Water Discharges associated with Construction Activities. Before submitting to the TCEQ, the Contractor shall submit the "Draft" NOI to the Port Authority for review and approval.
  - 2. The Contractor, along with its subcontractors, will be required to certify that the terms and conditions of the General TPDES Permit are understood and being implemented.
  - 3. The Construction Manager will coordinate all submittals with the Contractor for the TPDES General Permit.
- E. Notice of Termination (if applicable):
  - 1. The Contractor will submit a Notice of Termination (NOT) to the Texas Commission on Environmental Quality and a copy to the Port Authority (as the MS4) within 30 days, after final stabilization has been achieved on all portions of the site, or another permitted operator has assumed control over all areas of the site that have not been finally stabilized, and all silt fences and other temporary erosion controls have been either removed or transferred to a new operator if the new operator has attained permit coverage before submitting to the TCEQ, the Contractor shall submit the "Draft" NOT to the Port Authority for review and approval.

#### 1.5 HANDLING AND STORAGE

- A. Drums, Fuel and Chemical Storage:
  - 1. An impoundment shall be constructed to hold all drums, aboveground fuel tanks, chemicals and fuel. The area will be lined with visqueen and have a volume of at least 150 percent of the capacity of all containers within its bounds.
  - 2. A 4-inch sand layer shall be placed on the top of the visqueen in order to stabilize it and minimize the damage to the liner. The Contractor should refer to manufacturer's warnings and MSDS to prevent storing materials together that, when mixed, are a hazard. If this potential exists, multiple impoundments should be constructed.
  - 3. The impoundment shall be covered to protect the area from precipitation. The area may be covered by a method of the Contractor's choice. The cover should extend over the edge of the impoundment half the distance of the cover height; if the cover is 7 feet above the impoundment, the edges should extend 3.5 feet horizontally over the edges of the impoundment.

## PART 2 PRODUCTS

#### 2.1 INLET PROTECTION BARRIERS

- A. Filter Fabric Fence:
  - 1. Provide a woven or non-woven geotextile filter fabric made of polypropylene,

<b>TECHNICAL SPECIFICATION</b>	
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01 57 23.13 Add Page 2 TEMPORARY STORM WATER CONTROLS polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140 for soils with more than 15 percent by weight passing a No. 200 sieve and between 20 and 50 for soils with less than 15 percentby weight passing a No. 200 sieve.

- Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at the temperature range of 0 degree F to 120 degrees F. Representative Manufacturers: Marifi, Inc. or approved equal.
- B. Straw Bales:
  - 1. Straw bales will be used to prevent sediment and other pollutants from entering the Storm Sewer. Straw bales will also be used to prevent sediment and other pollutants from entering the proposed junction boxes during construction.
  - 2. Straw bales shall be wither-wire bound or tied with nylon or polypropylene rope. Cotton binding is not allowed. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales to prevent degradation of the bindings.
  - 3. Straw bales deteriorate with time and shall be replaced when no longer effective.

## 2.2 SEDIMENT BASINS

A. Sediment Basins are required, where feasible, for common drainage locations that serve an area with ten (10) or more acres disturbed at one time, a temporary sediment basin that provides storage for a calculated volume of runoff from a minimum of a 2-year, 24-hour storm event from the drainage area.

## PART 3 EXECUTION

## 3.1 PREPARATION

- A. Stabilization Practices:
  - 1. Staging and parking areas will be stabilized by the Contractor using a coarse aggregate.
- B. Offsite Vehicle Tracking:
  - 1. The contractor will minimize offsite vehicles onto the site and minimize the generation of dust. On site vehicle wash downs are prohibited.
  - 2. A stabilized site entrance shall be in place to reduce the tracking of sediments.
- C. Sequence of Major Erosion and Sediment Control Activities:
  - 1. All of the structural controls, including the inlet protection barriers, filter fabric fence and sediment basins, should be installed prior to construction.
  - 2. No excavation or grading shall be permitted until erosion and sedimentation control systems are in place.
  - 3. Projects should be staged to minimize the disturbed area, as practical.
- D. Good Housekeeping:
  - 1. As practicable, the site will be maintained in an orderly manner. Routine site housekeeping in accordance with acceptable industry practices will be conducted on a regular basis.

#### 3.2 INSTALLATION/CONSTRUCTION

- A. Inlet Protection Barriers:
  - 1. Install inlet protection barriers of the type specified on the construction drawings.
- B. Filter Fabric Fence:
  - 1. Provide filter fabric fence systems at locations specified on construction drawings. Filter fabric fence systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.
  - 2. Attach the filter fabric to one (1) inch by two (2) inch wooden stakes spaced a maximum of 3 feet apart and embedded a minimum of 18 inches. The wooden stakes shall be installed at a slight angle toward the source of anticipated runoff.
  - 3. The filter fabric should be provided in continuous rolls and cut to the length of the fabric to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6-inch overlap and sealed securely.
- C. Sediment Basins:
  - 1. Construction of the sediment basin will be performed by excavation or the erection of an earthen embankment across a low area or drainage swale. The design specification will be provided on the Construction Drawings.

#### 3.3 INSPECTION, MAINTENANCE AND REPAIR

- A. Inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project is accepted by the Construction Manager. Remove erosion and sedimentation control systems promptly when directed by the Construction Manager. Discard removed materials offsite at an approved disposal location.
  - 1. Inspect inlet protection barriers after each rain, daily during period of prolonged rainfall, and at a minimum once a week. Repair or replace damage barrier components to restore the requirements of this Item. Remove sediment deposit when the sediment has accumulated to one third the heights of the barrier.
  - 2. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and a minimum of once a week. Repair or replace damaged section immediately to restore the requirements of this Item. Remove sediment deposits when silt reaches one-third of the height of the fence in depth.
  - 3. Damages caused by construction traffic to erosion and sedimentation control system shall be repaired immediately.

#### 3.4 INSPECTION REPORTS

- A. The Contractor will designate a qualified person or persons to perform the following inspections:
  - 1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for pollutants entering the drainage system.
  - 2. Erosion and sediment control measures identified in the plan will be visually inspected to ensure that they are operating correctly.
  - 3. Where discharge locations or points are accessible, they will be inspected to ascertain whether erosion control measures are effective in preventing significant

impacts to receiving waters.

- 4. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking.
- 5. The inspection will be conducted by the responsible person at least once every 14calendar days and within 24 hours after a storm event of 0.5 inch or greater.
- 6. After a portion of the site is finally stabilized, inspection will be conducted at least once every month.
- B. Based on the results of the inspection, the control measures in the storm water pollution prevention plan will be revised as appropriate, but in no case later than 7 calendar days following the inspection.
- C. A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution prevention plan, and actions taken in accordance with Paragraph B above will be made and retained as part of the Storm Water Pollution Prevention Plan for at least three years from the date that the site is finally stabilized. The report will be signed in accordance with Title 30 of the Texas Administrative Code Section 305.128.
- D. Copies of the forms to be used for the Inspection and Maintenance Report are included at the end of this Section.
- E. Maintenance:
  - The maintenance and repairs of the erosion and sediment controls will be conducted within 24 hours of the inspection reports. Sediment will be removed from behind the sediment fences and the inlet protection barriers when it becomes about 1/3 the height of the fence. Sediment must be removed from the sediment basin(s) when design capacity is reduced by 50 percent.

## 3.5 OTHER CONTROLS

- A. Materials Brought On-Site:
  - 1. The Contractor will provide the Port Authority with copies of Material Safety Data Sheets (MSDS) for all materials brought on site. Materials will be managed appropriately in consideration of the MSDS.
- B. Waste Materials:
  - 1. Trash and Debris:
    - a. All waste will be collected and stored on site. Construction debris, trash and any construction chemicals will be stored in a manner that prevents them from potentially impacting the quality of rainfall discharged from the site. Trash and debris will be hauled to an approved landfill regularly, as necessary.
  - 2. Hazardous Waste:
    - a. The contractor is not allowed to bring any hazardous waste on site that has not been generated directly as a result of the construction activity authorized by the Port Authority.
    - b. Any hazardous waste generated directly as a result of the construction activity authorized by the Port Authority will be stored inside a visqueen lined impoundment. Collected hazardous wastes will be appropriately managed complying with all local, state, and federal environmental regulations and requirements.

- c. Spill practices will adhere to industry standards for spill response. Collected spill materials, if any will be managed appropriately including but not limited to proper handling, proper labeling of drums, proper disposal of materials, and proper reporting and recordkeeping.
- 3. Sanitary Waste:
  - a. All sanitary waste will be regularly collected from the portable units by a licensed sanitary waste management contractor.
- 4. Offsite Vehicle Tracking:
  - a. The contractor will minimize offsite vehicle traffic onto the site and minimize the generation of dust. On site vehicle wash downs are prohibited.
  - b. A stabilized site entrance shall be in place to reduce the tracking of sediments.
- 5. Concrete Washout Controls
  - a. When it is required to have a concrete washout area it shall be a lined concrete washout pit which is cleaned out and maintained throughout the term of the project.
- 6. Compliance with State and Local Regulations:
  - a. The proposed project shall be in compliance with all applicable and appropriate local, state and federal waste disposal and sanitary sewer regulations.

## 3.6 COMPLETION

- A. All erosion and sediment control systems should be removed only after the project has been completed or final stabilization has been achieved on all portions of the site. Generally, final stabilization is achieved when all soil disturbing activities at the site have been completed and a 70 percent uniform perennial vegetative cover has been established on all unpaved areas or equivalent permanent stabilization measures have been employed.
  - 1. Removal of the erosion and sediment control systems should be done with the concurrence of the Construction Manager.
  - 2. Erosion controls that are designed to remain in place for an indefinite period, such as mulches are not required to be removed.
- B. The impoundment should be removed only after materials are no longer stored onsite.

## STORM WATER POLLUTION PREVENTION PLAN INSPECTION AND MAINTENANCE REPORT OTHER CONTROLS STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

HOW MUCH SEDIMENT GETS TRACKED ONTO ROAD	ENTRY SURFACE CLEAN OR SEDIMENT FILLED	DOES ALL TRAFFIC USE ENTRANCE

MAINTENANCE REQUIRED FOR STABILIZED CONSTRUCTION ENTRANCE/STAGING AREA:

TO BE REPORTED BY:

ON OR BEFORE:

#### STORM WATER POLLUTION PREVENTION PLAN INSPECTION AND MAINTENANCE REPORT

CHIEF CONSTRUCTION INSPECTOR:

DAYS SINCE LAST RAINFALL:

DATE:

AMOUNT OF LAST RAINFALL:\_\_\_\_\_INCHES

STABILIZATION MEASURES

DATE SINCE LAST DISTURBED	DATE OF NEXT DISTURBANCE	STABILIZED	STABILIZED WITH	CONDITION

STABILIZATION REQUIRED:

TO BE REPORTED BY: \_\_\_\_\_ ON OR BEFORE: \_\_\_\_\_

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## STORM WATER POLLUTION PREVENTION PLAN INSPECTION AND MAINTENANCE REPORT STRUCTURAL CONTROLS **INLET PROTECTION BARRIERS:**

LOCATION	IN PLACE CONDITION	DEPTH OF SEDIMENT	CONDITION OF INLET

MAINTENANCE REQUIRED FOR INLET PROTECTION BARRIER:

TO BE REPORTED BY: \_\_\_\_\_ ON OR BEFORE: \_\_\_\_\_

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## STORM WATER POLLUTION PREVENTION PLAN INSPECTION AND MAINTENANCE REPORT STRUCTURAL CONTROLS FILTER FABRIC FENCE:

LOCATION	BOTTOM OF FABRIC STILL BURIED	FABRIC TORN OR SAGGING	POST TIPPING OVER	HOW DEEP IS THE SEDIMENT

MAINTENANCE REQUIRED FOR SILT FENCE:

TO BE REPORTED BY: \_\_\_\_\_ ON OR BEFORE: \_\_\_\_\_

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## STORM WATER POLLUTION PREVENTION PLAN INSPECTION AND MAINTENANCE REPORT CHANGES REQUIRED TO THE POLLUTION PREVENTION PLAN:

REASONS FOR CHANGES:

CONSTRUCTION MANAGER'S SIGNATURE:

DATE: \_\_\_\_\_

**END OF SECTION** 

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## SECTION 01 71 23.16 Add- CONSTRUCTION SURVEYING

## PART 1- GENERAL

#### 1.01 SUMMARY

Construction Surveying includes furnishing materials, labor, and equipment for topographic where required under the Contract Documents.

#### 1.02 RELATED SECTIONS

Section 01 22 10.00 Std – Measurement of Quantities

Section 31 24 00 Add - Embankment Construction

#### 1.03 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

USACE (2007). Control and Topographic Surveying. EM 1110-1-1005, U.S. Army Corps of Engineers, Washington, DC, misc. paginated.

#### 1.04 SUBMITTALS

- A. Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only. The following shall be submitted in accordance with Section 01 33 00, "Submittal Procedures":
  - 1. Name of Registered Professional Land Surveyor (Paragraph 1.05 A)
  - 2. Surveying Plan (Paragraph 1.05 B); E
  - 3. Survey Submittal Log (Paragraph 3.02 D)
  - 4. Upland Placement Area (PA) Dike Surveys (Paragraph 3.07); E
  - 5. Shoreline Protection Surveys (Paragraph 3.09); E

#### 1.05 QUALITY ASSURANCE

- A. General: All survey plots submitted to Engineer shall be sealed by a professional land surveyor registered in the State of Texas, experienced in topographic surveying, and familiar and experienced with the USACE's surveying guidelines in Engineer Manuals (EM) 1110-1-1005 and 1110-2-1003. Prior to commencing Work, Contractor shall provide name and credentials of professional land surveyor (PLS) who will oversee surveys. Use of a PLS who is certified as an American Congress on Surveying and Mapping (ACSM) Hydrographer is strongly encouraged.
- B. Surveying Plan: Contractor shall provide description of methods and equipment to be applied for required surveys as well as quality control and quality assurance (QA/QC) procedures to

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be applied. No other equipment shall be used for surveying without prior notification to Engineer. Refer to Paragraph 3.08.B for additional QA/QC requirements for multi-beam surveys.

#### PART 2 – PRODUCTS

(NOT USED)

#### **PART 3 – EXECUTION**

3.01 GENERAL

Contractor shall provide Initial, Interim, and Final surveys for measurement and acceptance of Work items. Plots showing lines and grades, and quantity computations, shall accompany all payment requisitions. Refer to Table 1 for a general summary of the required surveys.

#### 3.02 SURVEY PLOTS

- A. All construction surveys submitted to Engineer shall be in the form of plan-view and crosssection plots and digital data. All surveys shall be referenced to the project datums shown on the Drawings. <u>Plots shall be transmitted digitally in PDF and AutoCAD format.</u> All plots shall legibly and clearly display the following information:
  - 1. Project and Owner names
  - 2. Professional Land Surveyor's seal, signature, and business affiliation (required on pdf transmittals)
  - 3. Date(s) surveys were performed
  - 4. Location and description of survey control
  - 5. Vertical and horizontal datums
  - 6. Sheet name and number
  - 7. Name of Contractor
  - 8. Drawing scale(s)
  - 9. Submittal title (e.g., "Berm Existing Grade")

Table 1. Summary of Required Surveys.			
Survey	Intended Purpose	Submittal(s) Schedule	
	Dikes at Upland Placement Areas		
Initial	To establish baseline conditions at perimeter and interior dikes where dike improvements are required.	Prior to dike improvements (as applicable) and discharge of dredged material.	
Interim	Interim surveys shall be performed to document conformance of completed portions of work for monthly progress payments.	With pay requests.	
Final	To document completed condition of dike improvements and establish final pay volumes.	Upon completion of dike improvements, prior to discharge of dredged material.	
	Shoreline Protection		
Initial	To verify existing conditions and for review by Engineer in assessing need for any adjustments to specified templates and/or work limits prior to start of shoreline protection construction.	Prior to commencement of shoreline protection construction.	
Interim	Interim surveys shall be performed to document conformance of completed portions of work for monthly progress payments.	With pay requests.	
Final	Final survey shall be performed to document final lines and grades of any portions of shoreline protection not previously accepted through Interim Surveys.	After completion of shoreline protection (req'd prior to final payment).	

- B. Survey plots shall include the following:
  - 1. Plan sheets clearly documenting locations, limits, and dimensions of completed Work (as applicable) and locations where cross sections were taken.
  - 2. Cross-section sheets providing an overlay of sequential survey transects (as applicable) along with specified templates. A legend shall be provided indicating the date and survey type (e.g., Initial, Interim, Final, etc.) for each transect shown.
  - 3. Cross-sectional areas for each section calculated by comparing the Initial/Interim/Final, as applicable surveys.
- C. <u>Digital Data</u>: In addition to plots in pdf format, all survey submittals shall include digital data on labeled CD or DVD. Digital data shall include the following:
  - 1. A submittal log documenting surveys submitted to date with descriptors for survey dates and locations.
  - 2. AutoCAD files in ".dwg format"

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- 3. 3D ASCII "XYZ" files
- 4. PDF files with signed Registered PLS seal

#### 3.03 SURVEY TRANSECTS

- A. General: The survey transects specified herein apply to all surveys of dikes and shoreline protection at upland placement areas, performed by Contractor for acceptance and/or submittal with monthly pay requests. Survey shots along each transect shall be taken at all significant grade breaks and at a maximum horizontal spacing of 20 ft.
- B. Placement Areas: Where dike improvements are specified on the Drawings, survey transects shall consist of cross-sections of the dikes at 100 ft intervals extending 50 ft (min) beyond the proposed inner and outer toe.
- C. Shoreline Protection: Where shoreline protection is specified on the Drawings, survey transects shall consist of cross-sections of the shoreline protection at 100 ft intervals extending 50 ft (min) beyond the outer toe of the shoreline protection, and 50 ft (min) beyond the inner toe of the dike. For sections of shoreline protection not adjacent to a dike, the cross-sections shall extend 50 ft (min) beyond the limits of the shoreline protection.

## 3.04 PLACEMENT AREA SURVEYS

- A. Initial Survey(s): For any PAs for which dike improvements are specified on the Drawings, Contractor shall perform a topographic survey (i.e., cross-sections) along the dikes prior to construction of dike improvements.
- B. Final Survey(s): For any PAs for which dike improvements are specified on the Drawings, Contractor shall perform a topographic survey (i.e., cross-sections) along the dikes after construction of dike improvements and prior to commencing discharge of dredged material in PA. Monthly surveys shall be performed during dike improvements for progress payments.

#### 3.05 SHORELINE PROTECTION SURVEYS

- A. Initial Survey: Contractor shall perform a topographic survey (i.e., cross-sections) along the specified shoreline protection alignment prior to construction of shoreline protection.
- B. Interim Survey: Upon completion of excavation and grading for preparation of shoreline protection subgrade, Contractor shall perform a topographic survey (i.e., cross-sections) along the specified shoreline protection alignment at the following stages:
  - 1. Upon completion of excavation and grading for preparation of shoreline protection subgrade (prior to placement of any fill).
  - 2. Upon completion of excavation and grading for preparation of shoreline protection subgrade (after placement of fill).
  - 3. After placement of bedding stone.
  - 4. After placement of armor stone (prior to backfilling).
- C. Final Survey: Contractor shall perform a topographic survey (i.e., cross-sections) along the completed shoreline protection.
  - 1. After final backfilling and grading.

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CONSTRUCTION SURVEYING

TECHNICAL SPECIFICATION Date: December 2020

## SECTION 02 22 13 Add – CONSTRUCTION VIBRATION MONITORING

## PART 1 - GENERAL

## 1.1 DESCRIPTION

Subject to the requirements of the General and Special Conditions, this Section includes: the furnishing of all labor, materials, equipment, supervision, and every other think necessary to develop a construction monitoring program and to perform the related vibration monitoring as described herein.

## A. SCOPE:

- Work under this section includes, but is not limited to, pre-construction condition and topographic surveys, post construction condition and topographic surveys, and monitoring of construction-related vibration producing activities completed for this project. Vibration monitoring shall be conducted before, during and after any anticipated vibration producing activities such as, but not limited to:
  - a. Demolition
  - b. Site preparation and excavation activities
  - c. Pile installation
  - d. Sheet pile installation
  - e. Operation of construction equipment, construction traffic and other activities related to new construction or rehabilitation work.

The Contractor shall provide and install the necessary equipment to monitor any potential vibrations caused by their construction operations or as directed by the PHA.

- 2. Existing structures/features which may be susceptible to vibrations effects at the project site include but are not limited to:
  - a. The Fire Boat Dock at Morgan's Point
  - b. Above and below-ground utilities
  - c. Historical structures and other hard structures
  - d. Construction of new maintenance facility at Morgan's Point Barbours Cut Terminal is in master Plan
  - e. The containment dikes at Spilman Island
  - f. Two existing underground pipelines at Spilman Island that are owned by Enterprise Products Partners, LP. Follow the requirements provided in Exhibit A Encroachment Guidelines, Rev, May 2019.

The Contractor shall prepare a well-planned and executed, thorough construction vibration management plan. The construction vibration management plan should include at a minimum:

- a. The qualifications of the staff preparing and executing the plan;
- b. Identify reasonable and appropriate vibration impact thresholds for human and building response to vibration;
- c. Review of geotechnical and other information to assess subsurface conditions and the general propagation characteristics of soil sand subsurface conditions in the project area;
- d. Identifying equipment and activities with potential to cause or contribute to groundborne vibration levels of concern;
- e. A determination of the potential area of effect (AOE) through execution of an appropriate screening process;
- f. An inventory and ranking of buildings, non-building structures and land uses within that AOE based on potential sensitivity to construction-induced ground-borne vibration;
- g. Windshield survey and site visits to enhance the inventory and ranking;
- h. A process for contacting stakeholders to discuss potential concerns;
- i. A determination of where pre- and post-construction site inspections should occur (for photo and video inspections and potential installation of crack gauges and/or vibration monitoring equipment;
- j. The types of monitoring equipment, feedback systems, and reporting requirements that are appropriate and;
- k. Where reasonable and appropriate for controlled surveys of the target structures that are tied to survey monuments, and a right-of-entry process for obtaining access to private properties for the purposes of managing construction vibration.

## B. REQUIRED SUB-CONTRACTORS AND THEIR ROLES

1. Seismologist or Other Qualified Vibration Specialist

The seismologist or other approved qualified vibration specialist collects and analyzes data during the pre-construction stage of the project, and in conjunction with the Port of Houston Authority (PHA) and Contractor uses that information to:

- a. Develop the monitoring plans for the existing structures/features
- b. Evaluate expected levels of construction-related vibrations on the existing structures
- c. And assess means and methods for reducing potential vibrations at the existing structures/features.

The data that is collected shall include baseline ground motions caused by nonconstruction vibration sources near the structures/features that are shown in the monitoring plan.

The seismologist or other approved qualified vibration specialist shall supervise the monitoring and recording of vibration by the vibration monitoring contractor, and shall also be required to recommend values for maximum peak particle velocities (PPV) thresholds and geographic limits of zones of influence for the existing structures/features that are identified in the monitoring plan.

The seismologist or other approved qualified vibration specialist shall prepare and submit a final report to the PHA at the completion of construction.

2. Vibration Monitoring Contractor

The vibration monitoring contractor installs monitoring equipment, routinely observes vibrations during construction, keeps records of the activities that create the vibrations, and will regularly update or inform the seismologist or other approved qualified vibration specialist and Contractor of his findings. The constant monitoring will allow the Contractor to limit the construction related vibrations on the structures/features.

3. Specialty Engineer

The Specialty Engineer performs conditions surveys of the existing structures/features prior to the Contractor's mobilization and documents any existing damage to the structures/features that are identified in the monitoring plan. The Specialty Engineer shall prepare and submit a report to the PHA of the findings prior to start of construction.

During construction operations, the seismologist or other approved qualified vibration specialist may require that the Specialty Engineer check specific structures/features that are identified in the monitoring plan for deformations such as cracks and settlement in real time based on information provided by the vibration monitoring contractor.

The Specialty Engineer also performs post-condition surveys of the structures/features that are identified in the monitoring plan at the completion of all construction-related activities to record any changes to the conditions of the structures/features.

4. Land Surveyor

The land surveyor establishes the existing topographic, layout, and as-built surveys of the existing structures/features that are shown on the monitoring plan prior to any construction-related activities. The land surveyor also maintains monitoring as directed by the PHA and conducts a final survey at the end of the construction project to document any changes to these structures/features or topography that may be the result of the vibration-related work.

## 1.2 QUALITY ASSURANCE

## A. SUB-CONTRACTOR QUALIFICATIONS:

- 1. The Contractor shall employ the services of a qualified seismologist or other approved qualified vibration specialist with verifiable previous experience of a minimum of three projects within the last five years in the installation of vibration monitoring equipment, planning, supervising or performing the required vibration-monitoring operations and interpretation of vibration data.
- 2. The Contractor shall employ the services of a qualified vibration monitoring firm or individual with verifiable previous experience of a minimum of three projects within the last five years in performing the required vibration-monitoring field operations during construction.
- 3. The Contractor shall employ the services of a Specialty Engineer who shall be a Registered Professional Civil or Structural Engineer and is a qualified inspector with the competence to observe and inspect materials, installation, and erection of components and connections that require special expertise to ensure compliance with approved construction documents

and referenced standards. The Specialty Engineer shall have verifiable previous experience of a minimum of three similar projects within the last five years.

4. The Contractor shall employ the services of a Registered Professional Land Surveyor with verifiable previous experience of a minimum of three projects within the last five years in performing land surveying.

## 1.3 SUBMITTALS

A. PRE-CONSTRUCTION:

The Contractor shall submit the following:

- 1. A construction vibration management plan that includes
  - a. Qualifications of the seismologist or other approved qualified vibration specialist
  - b. Qualifications of the vibration-monitoring Contractor
  - c. Qualifications of the Specialty Engineer
  - d. Qualifications of the land surveyor
- 2. A general notice prepared by the seismologist or other approved qualified vibration specialist for at least one (1) public pre-construction consultation with property owners and occupants within the zone of influence advising of the possibility of construction vibrations.
- 3. A pre-construction report that shall include the following:
  - a. Results of the pre-construction condition survey including all records, reports, video, photographs, and recommendations for maximum peak particle velocity (PPV) threshold limits and warning limits in any of the three mutually perpendicular components of particle velocity for all structures/features surveyed that might be affected by construction-induced vibrations. A threshold limit should be recommended for each structure/feature in the zone of influence.
  - b. A vibration-monitoring plan prepared by the seismologist or other qualified vibration specialist which includes, the locations and types of the seismic monitoring sensors and equipment.
  - c. Pre-construction topographical survey of all structures/features within the specified zone of influence and along the project limits, as determined by the seismologist or other qualified vibration specialist.
- 4. The Contractor shall identify and submit for review by the PHA mitigation measures to reduce the effects of construction related vibrations within the zone of influence. The Contractor shall submit for review by the PHA a remedial action plan for the structures/features that are likely to be so affected.
- B. DURING CONSTRUCTION:

The Contractor shall submit the following:

- 1. PPV measurement data of the monitoring activities to the PHA at the end of each workday when vibration inducing activities are conducted.
- 2. A report summarizing when construction vibration monitoring notifications were sent to site and project managers.
- 3. Changes in the physical features of the structures that are identified in the monitoring plan throughout the entire project duration and as determined by the seismologist or other qualified vibration specialist.
- 4. Monthly photographic updates during the entire project duration.

- 5. A monthly report that documents any deviations from the construction vibration monitoring plan, and explains the reasons for the deviations, and consequences and outcomes of those deviations.
- C. POST-CONSTRUCTION:

The Contractor shall submit a vibration monitoring final report that shall include the following:

- 1. All vibration monitoring data associated with the specific construction activities that were observed in the field.
- 2. Results of the post-construction condition surveys including all records, reports, video, and photographs for items that may have been affected by construction-induced vibrations and narratives on comparative pre-construction condition survey information.
- 3. Post-construction topographical survey data of all structures/features potentially impacted by the construction and that were recommended by the seismologist, and written statements of how this data compare to the pre-construction topo survey data.

#### PART 2 - PRODUCTS

NOT USED

## PART 3 - EXECUTION

#### 3.1 CONSTRUCTION REQUIREMENTS

- A. PRE-CONSTRUCTION REQUIREMENTS:
  - 1. The Contractor, through the seismologist or other qualified vibration specialist shall perform a documented pre-construction condition survey as part of determining vibration or settlement effects on any existing structures/features within the influence zone of the proposed constructions activities.
  - 2. The seismologist or other qualified vibration specialist shall determine the predicted and maximum allowable PPV threshold values for the structures/features defined in the vibration monitoring plan based on the analysis of data gathered during the preconstruction condition survey.
  - 3. The seismologist or other qualified vibration specialist shall establish the vibration zone of influence. A vibration zone of influence is defined as the area of land within or adjacent to a construction site, including any structures/features, that potentially may be affected by vibrations emanating from a construction activity where the PPV at the location where measured, is equal to or greater than the limiting PPV threshold value as defined in Section 1.3 (A3) of this document.
  - 4. Pre-construction Survey
    - a. The Contractor, through the seismologist or other qualified vibration specialist shall perform a documented pre-construction condition survey as part of determining vibration or settlement effects on any existing structures/features within the influence zone of the proposed construction activities.
    - b. The pre-construction condition survey shall include tape-recorded observations; videotape and still photography and sketches as needed to fully describe the existing condition of each structure/feature potentially affected by any construction induced vibrations, including the interior and exterior of any building structures. Crack gauges may be used to document existing cracks. Sizes (length and width) of existing cracks in structures/features shall be recorded and documented.
    - c. The Contractor, through the seismologist or other qualified vibration specialist shall use site-specific information about on-site and sub-surface soils to perform a screening assessment that shall be used to determine the distances from the vibration sources

to target features within the influence zones. This pre-construction condition survey shall be completed at least 30 -days prior to the start of onsite activities and a pre-condition survey report shall be submitted to the PHA within 7 days after completion.

- d. The Contractor must perform pre-construction surveys of critical physical features of all structures within the specified zones of vibration influence and of any other structures that are located along the project limits at the direction of the seismologist or other approved qualified vibration specialist.
- e. A report shall be prepared for each feature identified by the seismologist or other approved qualified vibration specialist. The report shall include all of the recorded observations.
- 5. Baseline Ground Motions (Existing, Pre-construction ground borne vibration levels)
  - a. The data that is collected shall include baseline ground motions caused by nonconstruction vibration sources near structures/features that are shown in the monitoring plan.
  - b. Where predicted PPVs are anticipated to exceed the determined threshold, the seismologist or other qualified vibration specialists shall establish protocols for the structures/features that are expected to be negatively affected by the construction-related vibrations as shown in the monitoring plan.
- 6. Specifications for Proposed Vibration Monitoring Equipment
  - a. Equipment for measuring construction-induced ground-borne vibration shall at a minimum measure peak particle velocity, be tri-axial 3-channel (3 seismic channels) units capable of digitally storing collected data an sending out warning and stop work notifications via text message. Equipment shall be capable of printing ground motion time histories and summaries of peak motion intensities, frequencies and USBM R18507 PPV-frequency plots. Printed report records must also include date, time of recording, operator name, instrument number and date of last calibration. Other required system features:
    - i. Instruments must have certifications of factory- or equivalent calibrations within the past 12 months.
    - ii. Instruments shall have a flat frequency response between 2 and 250 Hz for particle velocity.
    - iii. The digitizing sampling rate for peak particle velocity measurements shall be at least 1,024 samples per second.
    - iv. Seismographs shall be capable of performing a self-test of velocity transducers and printed event records shall indicate whether or not the sensor test was successful.
    - v. Seismographs used for compliance monitoring shall be capable of recording particle velocity from 0.01 to 5.0 in/sec.
    - vi. Systems shall be capable of providing printed event reports that include all peak measurements, frequencies and complete waveform plots. At a minimum, the monitors shall employ a two-tiered text messaging notification system so work can be paused or stopped before measured levels reach damage thresholds.
    - vii. Seismographs shall have adequate memory to digitally record the entire duration of the construction-induced motion. The minimum event recording time shall be three seconds.
    - viii. All seismograph software systems-shall be capable of saving back-up copies of all event files on USB flash drives or portable hard drives or provided on a cloud accessible network and copies shall be furnished to the PHA.

- ix. The Contractor shall provide the seismograph reporting software to the PHA with the first submittal of the vibration measurement records.
- B. DURING CONSTRUCTION REQUIREMENTS:
  - 1. Vibration Monitoring:
    - a. Maintaining ground vibration within the limits imposed under this contract is critical to the success of this project. To assure satisfactory results for data acquisition, the collection of these data must be conducted under the supervision of a qualified vibration specialist or seismologist.
    - b. The vibration monitoring contractor and all persons performing monitoring work shall be an independent third party.
    - c. Vibrations shall be monitored at appropriate locations throughout the project. Vibration measured in peak particle velocity in inches per second shall be recorded at the monitoring locations. Monitoring locations shall be determined by the seismologist or other approved qualified vibration specialist within the guidelines in (2) below and approved by the PHA. Each monitoring location shall be a secure, marked and surveyed position and shall remain at the same position. The Contractor may elect at the Contractor's expense to provide additional instrumentation at additional monitoring locations for any purpose.
    - d. Vibration monitors shall run continuously during the duration of the project's activities at the site, and readings on each seismograph shall be checked at the intervals recommended by the seismologist or other qualified vibration measurement specialist. If equipment allows, this data may be downloaded and checked remotely. See Section (2) for additional information.
    - e. The Contractor shall provide and maintain temporary weather protection and remote power and communication capabilities as necessary for all as necessary for all
    - f. Monitor ground crack and install monitors to monitor crack width and changes during construction (i.e. crack growth) and notify PHA.
  - 2. Vibration Control
    - a. The seismologist or other approved qualified vibration specialist shall place at least two (2) seismographs at structures/features of concern (or as recommended and approved by the PHA) to measure and record ground movements during construction. The seismologist or other approved qualified vibration specialist shall provide qualified personnel capable of setting up instruments at designated locations to accurately record data, deploy the instruments, and operate, gather, and analyze the vibration data. The seismologist or other approved qualified vibration specialist shall use the collected data to control future construction vibration so as not to exceed the limits established in these specifications. The instrumentation shall record three orthogonal components (vertical, radial and transverse) of particle velocity direction. The PPV for compliance purposes is the highest measurement made in any of the three measured directions. The instrument records shall consist of instrument readings identified by instrument number; the location of instruments; the date, time and location of the measurements; and the peak particle velocity and dominant frequency it occurred in.
    - b. Construction activities shall be controlled in such a manner that the intensity of ground motion at the nearest existing structures/feature shall be limited to a peak particle velocity as set out in Section 1.3 (A3) above or in accordance with Federal, State or local codes and regulations, whichever is more stringent.
  - 3. Immediate Threshold Adherence
    - a. The PHA shall be notified immediately when the intensity of measured ground motions (PPV) exceed specified warning levels. When the PPV threshold limit is exceeded one

time or warning levels are exceeded more than three times at any type of structure/feature, the Contractor shall submit a revised construction plan to the PHA that outlines specific measures that will be applied to bring ground motion levels into compliance within specified limits. The Contractor shall submit a printed copy of the monitoring records showing PPV values. A digital copy of the monitoring event records on a CD-ROM disk or provided on a cloud accessible network shall also be submitted.

- 4. Reporting
  - a. The Contractor shall provide results of the testing to the PHA at the end of each workday when vibration inducing activities are conducted.
  - b. The PHA shall be notified of any movements detected and the Contractor shall immediately take any remedial measures required to prevent damage to the existing structures/features.
- 5. Damages:
  - a. The Contractor shall make every effort to avoid damage to the existing utilities, appurtenances, levees, embankment, other structures or features within the influence of any construction-induced vibrations including the use of site access routes.
  - b. The Contractor is responsible for all construction related damages caused by, but not limited to, vibration or soil settlement slope or ground instability, structural damage from Project construction operations. Any damage caused by the Contractor's operations shall be repaired by the Contractor, to the satisfaction of the PHA, at no additional cost to the PHA.
  - c. Upon the discovery of any damage, construction operations shall cease until the Contractor has the damage repaired to the satisfaction of the PHA or has agreed with the PHA on an acceptable timeline by which the damage shall be satisfactorily repaired and provides suitable measures to control future disturbance.
  - d. The Contractor may consider stockpiling and performing laboratory tests in advance on materials that are to be used for any levee repairs.
  - e. For repairs that are associated with the levee, excavation and stockpiling will not be permitted within 100 ft of the levee crest or 100 ft from inside the levee toe projection, whichever is less. Stockpiling of materials from inside the levee or dike will not be permitted outside the levee. PHA shall approve the locations for stockpiling.

## C. POST-CONSTRUCTION REQUIREMENTS:

- 1. Post-Construction Survey
  - a. Following the completion of the vibration producing activities, a post-construction condition survey shall be performed for each structure/feature that received a pre-construction condition survey. The pre-construction survey, photographs, video, descriptions and sketches shall be compared to the post-construction condition as described in the post-construction survey to determine if any damage has occurred during the construction activities. The same individual or firm that performed the pre-construction survey shall perform the post-construction survey.
- 2. Vibration Monitoring Report
  - a. A report will be prepared for each structure/feature previously identified with a summary that documents any changes from the pre-condition survey and whether any of the changes noted were a direct result of the construction activities. The qualified seismologist or other approved qualified vibration specialist shall attend the post-construction survey to provide input. Changes in the condition of any structure/feature
impacted shall be documented with video, still photographs, and sketches and a detailed narration.

- 3. Site Restoration
  - a. Any areas or items disturbed by the Contractor's operations shall be restored to preconstruction conditions or replaced by the Contractor at no additional cost to the PHA. The costs for any site restoration or replacement of items damaged as a result of the Contractor's work shall be paid for by the contractor.

#### 3.2 PROTECTION OF SITE

- A. EXISTING STRUCTURES:
  - 1. When the Drawings require excavation, piling or other foundation construction operations in proximity to existing structures, the Contractor shall take precautions to prevent damage to such structures. The requirements described herein apply to all types of structures (within or outside of project limits) that may be adversely affected by construction operations (including phased construction) due to vibrations, ground loss, ground heave, levee slope movements or dewatering. The Contractor shall protect utilities as required.
  - 2. When pile driving or excavating for construction, the Contractor is responsible for evaluating the need for, design of, and providing any necessary precautionary activities to protect adjacent structures/features from damage, including, but not limited to, selecting construction methods and procedures that will prevent damaging caving of the excavation and monitoring and controlling the vibrations from construction activities, including driving of any piles, and their removal (if applicable), casings, and sheeting.
  - 3. The Contractor shall survey and monitor structures for settlement in a manner approved by the PHA, recording elevations to 0.001 foot for building structures and to 0.01 foot for other features. The Contractor shall employ a qualified Specialty Engineer to inspect and document the condition of structures prior to and after completion of all pile installations, sheetpile installations, excavations and other related foundation construction activities, and to inspect and monitor the structures within the following influence zones as a minimum:
    - a. As shown on the monitoring plans
    - a. As determined in Section 3.1 A4 (c)
- 4. The Contractor shall obtain the PHA'S approval of the number and location of monitoring points and shall record survey elevations:
  - a. Before beginning construction
  - b. Daily during the driving of any casings, piling, or sheeting
  - c. Weekly for two weeks after stopping pile driving
  - d. During excavation
  - e. Or as directed by the PHA
- 5. The Contractor shall notify the PHA of any movements detected and immediately take any remedial measures required to prevent damage to the existing structures.
- 6. The PHA will make the necessary arrangements to provide right of way entry to the existing structures.
- B. CONCRETE:
  - The seismologist or other approved qualified vibration specialist shall provide vibration limits to ensure that concrete whose age is less than 7 days is not subjected to vibrations from pile driving, sheet pile driving and/or other construction activities located within 100 feet from the nearest outside edge of said concrete to the vibration source.

#### C. MISCELLANEOUS:

- 1. Upon detecting settlement, heave, or other slope movements, or vibration levels near threshold values, or damage to structures/features, immediately stop the source of vibrations or disturbance, backfill any open excavations, and contact the PHA for instructions.
- 2. When shown in the Contract Documents or when authorized by the PHA, the Contractor shall install the piling to the depth required to minimize the effects of vibrations or ground heave on adjacent structures/features by approved methods other than driving (preformed holes, predrilling, jetting, etc.).
- 3. When shown on the Drawings or as directed by the PHA, the Contractor shall install a piezometer near the property line and near any structure that may be affected by lowering of the ground water when dewatering is required. The Contractor shall monitor the piezometer and record the ground water elevation level daily and notify the PHA of any ground water lowering near the structure of 12 inches or more.

# END OF SECTION



# ENCROACHMENT GUIDELINES

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# INTRODUCTION



# **ENCROACHMENT GUIDELINES**

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# Introduction

**Enterprise Products Partners L.P. and related entities (Enterprise) has over 50,000 miles of pipeline in more than 27 states.** Enterprise pipelines transport a variety of products under pressure such as natural gas, natural gas liquids (NGLs), liquefied petroleum gas (LPG), crude oil and refined petroleum products. As a pipeline owner, operator and your neighbor, Enterprise is committed to safely operating its pipelines.

This publication identifies common encroachments and provides general guidelines on the standards and procedures to be followed by you when planning land use, development or construction activities in the vicinity of a pipeline right-of-way.

# **Definitions**

- Encroachment An improvement, structure, or any activity that (a) intrudes on another's property or (b) adversely affects the rights of an interest holder in the property.
- **Right-of-Way or Rights-of-Way** The right to pass across the land, property or interest in land or property of another for transportation purposes (e.g., roads, public transport, utilities, etc.).

# This Publication is Intended for Use By

Landowners

Utility owners

Engineers

- Developers
- Contractors

- Land surveyors
- Anyone involved in land development near Enterprise pipeline systems

# **Common Encroachments on Pipeline Rights-of-Way Include**

- Foreign utilities/crossings including electrical and communication cables
- Installing fence posts, patios and decks
- Landscaping
- Building or maintaining roads, driveways, sidewalks and parking areas
- Railroads and Waterway Crossings
- Construction Equipment & Large Truck Crossings
- Surface grade or elevation changes or any activity that will result in the removal of soil from the surface of the right-of-way

# WHAT TO DO

# **Encroachment Checklist**

# 811: How it Works

- One easy phone call to 811 prior to digging, starts the process of getting underground utility lines marked for free.
- When calling 811 from anywhere in the country, a representative from the appropriate state One-Call Center will answer the call to find out the location and description of the digging site and will notify affected utility companies, who will then send a professional locator to identify and mark the approximate location of lines within 48-72 hours of the call (depending on the state regulations).
- Once underground lines have been marked, callers will know the approximate location of utility lines.
- Please visit www.call811.com in the "state specific" area of the website for more information about the local One-Call Centers across the country.

Identify the work location.

- Search county public records for pipeline easements.
- Look for any Enterprise Products pipeline markers in the vicinity of the work location.
- Place a One-Call to 811 at least two working days before excavation is scheduled to begin (some states may require 72 hours before excavation). Wait the required amount of time for the lines to be marked (48-72 hours, depending on the state regulations). Respect the line markers.
- Design your plans using this Encroachment Brochure to help guide your decisions.

Submit your plans to the Land Encroachment Group and begin the approval process.





One free, easy call gets your utility lines marked AND helps protect you from injury and expense.

Know what's below. Always call 811 before you dig. Visit call811.com for more information.



Know what's below. Call before you dig.

# WHAT TO LOOK FOR

# WHAT TO SEND



**1** Painted Metal or Plastic Posts

- 2 Pipeline Casing Vent
- 3 Marker for Pipeline Patrol Plane
- 4 Signs located near Roads, Railroads, and along Pipeline Rights-of-Way

Pipeline markers are limited in the information they provide. Markers are placed near pipelines, but not necessarily on top of them. Marker signs do not provide information on the exact location, depth, diameter or number of pipelines they mark. In addition, a pipeline may not follow a straight line between adjacent markers.

#### What does a pipeline marker tell you?

By law, a pipeline marker must provide the approximate location of a pipeline(s), identify the material transported, identify the pipeline operator, and the operator's 24-hour emergency telephone number.

#### It is a federal crime to remove or deface a pipeline marker sign.

Pipeline marker signs such as those pictured above are important to public safety. They are so important, in fact, that in 1988 Congress passed a law making it a federal crime to willfully deface, damage, remove or destroy any pipeline sign or right-of-way marker that is required by federal law (49CFR 190.229(d)).

# **Enterprise Encroachment Notification**

This list of common encroachments is not exhaustive – each situation should be independently evaluated. Therefore, when planning any type of activity that could encroach on Enterprise's pipeline rights-of-way, notify the Land Encroachment Group for approval before construction takes place:

Mail/Courier:	Enterprise Products Attn: Land Encroachments Group PO Box 4324 Houston, TX 77210
Email:	Land_Encroachments@eprod.com
Toll Free:	866-901-8170
Fax:	281-887-7390
Web Page:	www.EnterpriseEncroachments.com

# What to Include in Your Notification

- Description of Project
- **Map of Project Location:** Include geographical references such as legal description, physical address, nearby major road intersections, and/or latitude-longitude coordinates.
- Plans and Profiles: Include detailed construction/development plans, including pipeline location, existing and proposed surface elevations and pipeline depth.
- Name and Contact Information

Enterprise will review the material submitted and may contact you to discuss the project, if needed. The time required to conduct our review varies based upon the nature of the proposed encroachment, the proximity to our pipeline assets, and the amount and quality of details and information in the plans.

In some situations, it may be determined by Enterprise that an adjustment, relocation or lowering of the pipeline may be necessary to ensure the safety of your project and the integrity of the pipeline. In these situations, the encroaching party will be notified to further discuss the necessary changes. These situations are handled on a case-by-case basis.

# Enterprise Standards for New Projects Encroaching on Enterprise's Rights-of-Way

The following is a general summary of Enterprise's standards and guidelines related to common encroachments. Every encroachment presents a unique set of circumstances; as such, *Enterprise recommends you contact our Land Encroachments Group to discuss your project and related safety issues prior to beginning work.* 

# **Excavation Activities**

**Tolerance Zone:** Enterprise defines the tolerance zone as 18 inches from the outer edge of the pipe (in all directions), or as defined by State regulations, whichever is **greater**.

- Mechanized equipment is not allowed within the tolerance zone.
- Any excavation taking place within the tolerance zone must be done by hand.

# **General Excavation Guidelines**

- Always make a One-Call prior to performing any excavation activities. Dial 811 or go to www.call811.com.
- Do not perform any excavation activities on Enterprise's rights-of-way without approval from Enterprise. Enterprise will review your plans for excavation within Enterprise's rights-of-way, locate and mark the pipeline assets (if necessary) and an Enterprise representative will be on-site to monitor the excavation activity.
- No heavy equipment is allowed to work directly over the pipeline. The right-of-way boundary should be marked with temporary fencing or white line to assist the operator with positioning heavy equipment.
- All mechanical digging equipment must dig parallel to the pipelines and have the teeth removed or barred with a plate welded across the bucket.

An Enterprise representative has the authority to suspend excavation activities if an equipment operator appears to be unqualified or equipment maintenance is not in accordance with applicable regulations.

# **STATE TOLERANCE ZONES**

ALABAMA	18 in.	NEW MEXICO	18 in.
ARKANSAS	18 in.	NEW YORK	24 in.
COLORADO	18 in.	N. CAROLINA	24 in.
GEORGIA	24 in.	OHIO	18 in.
ILLINOIS	18 in.	OKLAHOMA	24 in.
INDIANA	24 in.	PENNSYLVANIA	18 in.
IOWA	18 in.	S. CAROLINA	24 in.
KANSAS	24 in.	TENNESSEE	24 in.
KENTUCKY	18 in.	TEXAS	18 in.
LOUISIANA	18 in.	UTAH	24 in.
MINNESOTA	24 in.	W. VIRGINIA	24 in.
MISSISSIPPI	18 in.	WISCONSIN	18 in.
MISSOURI	24 in.	WYOMING	24 in.
NEBRASKA	18 in.		

Tolerance Zones are subject to change per individual State Laws and may include an additional distance equal to 1/2 the nominal diameter of the pipeline (1/2 DOP).



# HAND DIG within the TOLERANCE ZONE

PIPELINE





WHAT TO EXPECT Crossing Types

# **Structures, Fencing & Landscape** Activities

In general, **NO** structures or obstructions are allowed within Enterprise's rights-of-way. **Examples include buildings, houses,** barns, garages, patios, swimming pools, reinforced concrete slabs, utility or flag poles, retaining walls or large debris such as old cars, trailers, scrap metal, and boulders.

Every fence crossing should be approved by Enterprise prior to any construction and follow these specifications:

- Fences should not parallel the pipeline within the rights-of-way.
- Fence posts shall not be allowed within 5 feet of any Enterprise pipeline.
- Fences shall not obstruct access or the line of sight to the rights-of-way for Enterprise personnel.
- Gate(s) may be required for access.

New plantings of **trees or shrubs** over 18 inches tall are **not** permitted on Enterprise's rights-of-way. Enterprise may trim or remove trees, brush, or other vegetation as necessary to maintain the rights-of-way.



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# **Roadways, Driveways, Sidewalks & Parking Lots**

- All proposed roadways, including temporary access roads, field roads and unimproved roads, driveways, sidewalks or parking lots that extend onto the right-of-way should receive written approval from Enterprise before any construction takes place.
- The proposed encroachment should cross as close to 90 degrees as possible, lying perpendicular to the pipeline.
- In general, roadway crossings should have a minimum coverage of 4 feet from the top of the pipeline to the top of the paved surface. A minimum cover of 3 feet between the top of the pipeline and top of other surfaces or bottom of ditches shall be maintained.
- · Minimum cover may vary according to Federal, State and County regulations.
- Depending on the design and intended use of the proposed roadway, additional measures may be required to adequately protect the pipeline.
- All parking lots planned within the Company's right-of-way should incorporate green areas (areas where surface access is not impeded by improvements) over the pipeline at intervals of approximately 60 feet but no more than 100 feet, measured along the pipeline centerline. Location and size will be subject to Enterprise's review and approval.
- Stress analysis results that do not meet Enterprise's minimum requirements may require pipeline adjustments, modification or mechanical protection.

# **Construction Equipment & Large Vehicle Crossings**

• Construction equipment and large vehicles crossing the pipeline easement may present a risk of damage to underground utilities. Therefore, when properly notified, Enterprise will perform stress analysis to ensure that the proposed use of construction equipment or large vehicles will neither damage the pipeline nor present a safety hazard. When submitting a request for heavy equipment crossing, please include the following for any vehicle proposing to cross Enterprise's rights-of-way:



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- 📶 Maximum axle load
- Enterprise will work diligently to perform its analysis, but typically requires a minimum of three working days to complete the review process.
- Construction equipment should only cross the pipeline at Enterprise-designated locations.





Articulated Dump Trucks



Compactors

Pipelayers (Sideboom)







Wheel Tractor Scrapers

Excavators

Dozers





# WHAT TO EXPECT Crossing Types

# **Foreign Pipelines & Utility Crossings**

For your safety and the safety of others, Enterprise should be involved in the planning of any pipeline or utility crossing Enterprise's rights-of-way. There are numerous issues to be considered in any foreign utility crossing, and the following are common utility industry standard guidelines:

- Crossings should be at an angle as close to 90 degrees as possible in order to minimize the area of potential impact.
- Enterprise prefers that no foreign lines run parallel to Enterprise pipelines within the rights-of-way. Any plan to run a foreign line parallel to Enterprise's pipeline should be submitted to Enterprise's Land Encroachments Group for review and approval.
- The preferred method is to have foreign lines cross below Enterprise pipelines.
- In general, foreign pipeline and utility crossings should maintain a minimum clearance of 24 inches between the bottom of Enterprise's pipeline and the top of the pipeline/utility when installed via open cut excavation. Trenchless crossings may require additional clearance, among other things.
- Metallic pipe crossing Enterprise pipelines may be subject to a cathodic protection study. Foreign metallic pipe crossings shall be coated with an appropriate non-conductive coating the full width of Enterprise's rights-of-way.
- All buried electrical cables shall be installed in accordance with the National Electric Safety Code (NESC) or the National Electrical Code (NEC). All power cables shall be installed in non-metallic or high impact PVC conduit. In the event the conduit crosses over or below Enterprise's pipeline by open cut trench excavation, it shall be encased in red concrete the full width of the right-of-way.
- All buried communication cables, such as telephone, TV, internet services and other data lines shall cross Enterprise pipelines with a minimum clearance of 24 inches and encased in a rigid, non-metallic conduit. Exceptions will be reviewed on a caseby-case basis.
- Warning tape shall be placed over the foreign utility for a minimum of 20 feet (perpendicular to the utility and 10 feet on both sides) in such a manner that it would be unearthed before damage could result to the pipeline.
- In general, utility poles and guy anchors are not permitted within Enterprise's rightsof-way. Overhead electrical or telephone lines shall be installed so that a minimum of 25 feet vertical clearance is maintained between the lowest point of the overhead crossing and the natural ground level above Enterprise's pipeline.







# **Waterway Crossings**

The construction of rivers, streams, creeks, canals, ponds, and drainage ditches crossing over Enterprise pipelines must comply with current standards and federal, state and local regulations.

- New drainage channels and irrigation canals should have a minimum of 5 feet of cover from the top of the pipe to the bottom of the channel or canal. Drainage channels and irrigation canals having less than 5 feet of cover must be lined or be protected from damage to withstand anticipated external loads and anticipated scour using an approved method and material.
- Rivers, creeks, and streams shall have a minimum cover of 20 feet, as measured from the top of the pipeline to the waterway bottom/flow line.

Any proposed waterway on Enterprise's rights-of-way needs to be submitted to Enterprise's Land Encroachments Group to determine whether the crossing poses a risk to pipeline assets. There are numerous safety considerations related to the construction of new waterways, but the following are common issues that should be considered with any new waterway:

- If the waterway will cause the pipe to float, the project may require the installation of weights or other devices to ensure the new waterway does not create a safety hazard.
- Enterprise may require that erosion control measures be placed over the pipeline rights-of-way to protect the pipeline and control erosion.
- Crossings should be at an angle as close to 90 degrees as possible in order to minimize the area of potential impact.
- Ponds, lakes, retention ponds, or wetlands should not be constructed on the pipeline rights-of-way without Enterprise's review and approval.
- Irrigation systems, field drain lines and drain tiles should cross as close to 90 degrees as possible. Lateral lines from septic systems should not extend onto the right-of-way.

# **Railroad Crossings**

American Railway Engineering and Maintenance-of-Way Association require new railroads be installed with a minimum compacted cover over the pipeline as measured from the base of the rail to the top of the pipe, as follows:

- Under track structure proper: 6 feet cased; 10 feet uncased.
- Under all other surfaces within the rights-of-way: 4 feet cased; 6 feet uncased.

If the minimum coverage cannot be provided, additional mechanical protection will need to be evaluated and installed accordingly.

# **VIBRATIONS**

# **VIBRATIONS**

# **Construction Induced Vibrations**

- Construction activities that generate ground vibrations, including, but not limited to, pile driving, steel sheet driving, soil compaction, pavement material compaction, hydraulic jack hammering, or any type of surface impact that will induce vibrations, should be reviewed by Enterprise on a case-by-case basis.
- If the encroaching party anticipates this type of activity within 100 feet from the pipeline, then continuous testing monitored by a seismograph located directly over the pipeline at its closest point to the activity should be conducted. The encroaching party shall provide, at their expense, the monitoring service contractor and equipment.
- The encroaching party shall provide the make and model of the vibratory or compaction equipment. If construction-induced vibrations are associated with using pile driving or vibratory driving equipment, then the specifications of the equipment and the maximum anticipated energy shall be provided to Enterprise.
- The encroaching party shall determine and limit the maximum peak force allowed under continuous seismographic vibration monitoring such that the peak particle velocity will not exceed 5 inches per second. The peak particle velocity results shall be provided to Enterprise or field representative. If results are above 5 inches per second, Enterprise reserves the right to halt seismic activities to evaluate the integrity of the pipeline.
- In general, large vibratory compaction equipment poses a risk to underground pipelines and is not allowed within Enterprise's rights-of-way.

# SEISMIC SURVEYING

# SEISMIC SURVEYING



# **Seismic Surveying**

- Encroaching parties planning to conduct seismic surveying operations within 300
  feet from Enterprise's rights-of-way to explore the presence of oil and gas,
  geothermal energy and other mineral deposits underneath the earth's surface should
  be reviewed on a case-by-case basis. Seismic surveying energy sources that
  generate seismic vibrations generally include vibroseis trucks (also referred to as
  thumper trucks or weight-drop trucks) and shot hole blasting (for shot hole blasting
  refer to blasting guidelines on page 22).
  - > Seismic Survey operations within 300 feet of the pipeline right-of-way:
    - The encroaching party must submit a seismic survey plan to Enterprise for review and approval.
    - Seismic survey plans, when using vibroseis trucks to radiate ground vibrations, must include a seismic vibroseis survey report performed using vibroseis truck to determine safe distance and peak particle velocity results from above ground structures and underground pipelines. This survey report should include information on soil conditions, the anticipated number of vibrations, make and model of the vibroseis truck, anticipated peak particle velocity results, map layout of vibroseis truck locations with the anticipated closest horizontal distance to the pipeline right-of-way, safety measures and a copy of the permit approval to perform seismic operations.

- The encroaching party shall also arrange for an Enterprise on-site inspector to be present to witness the seismic survey operations.
- Seismic vibrations shall be monitored by seismograph instruments located directly over the pipeline at its closest point to the vibroseis trucks that provide peak particle velocity results. The encroaching party shall provide, at their expense, the monitoring service contractor and equipment.
- The encroaching party shall determine and limit the maximum peak force allowed under continuous seismographic vibration monitoring such that the peak particle velocity will not exceed 5 inches per second. The peak particle velocity results shall be provided to Enterprise or a field representative. If results are above 5 inches per second, Enterprise reserves the right to halt seismic activities to evaluate the integrity of the pipeline, at the cost of the encroaching party.
- Seismic surveys shall not be conducted closer than 25 feet to the pipeline.

In some areas where vibroseis trucks cannot be used due to topography, it may be necessary to use explosive charges to generate seismic vibrations. If dynamite is used, the blasting operations must be in accordance with federal, state, and local governing agencies.





# **Blasting**

Any proposed blasting operations within 1,320 feet (1/4 of a mile) of an Enterprise rightof-way, shall be submitted with a comprehensive blasting plan for review and approval by Enterprise. All blasting operations shall be in accordance with federal, state and local governing agencies. Where discrepancies occur between Enterprise specifications and federal, state and local agencies, the more stringent application shall apply. CONCLUSION

For your safety and the safety of others, any planned encroachment on Enterprise's rights-of-way should be submitted to Enterprise's Land Encroachments Group. Enterprise will work with you to analyze your plans and incorporate appropriate safety measures. Each encroachment will be handled on a case by case basis. Not all sections of this guidelilne will be applicable to every situation. This information shall not create any duties or responsibilities on the part of Enterprise in favor of any third party.

# Help us keep YOU safe by contacting Enterprise if:

- You will be performing excavation work near our pipelines.
- You are planning construction activity in the vicinity of our pipelines or operating facilities.



Know what's **below. Call** before you dig.





Mail/Courier:	Enterprise Products Attn: Land Encroachments Group PO Box 4324 Houston, TX 77210
Email:	Land_Encroachments@eprod.com
Toll Free:	866-901-8170
Fax:	281-887-7390
Web Page:	www.EnterpriseEncroachments.com

# PORT OF HOUSTON AUTHORITY **TECHNICAL SPECIFICATIONS FOR HSC ECIP – SEGMENT 3 DREDGING**

#### SECTION 02 41 00 DEMOLITION

#### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. General provisions applicable to all demolition and debris removal.
  - 2. Pile extraction and removal
  - 3. Underwater Debris Removal
  - 4. Excavation
  - 5. Structural demolition and removal.
  - 6. Mechanical demolition and removal
  - 7. Electrical demolition and removal.
  - 8. Disposal of demolition debris
  - 9. Post demolition surveys
- B. Scope:
  - 1. Contractor shall provide all labor, materials, equipment, tools, and incidentals as shown, specified and required for demolition, debris removal, and disposal Work.
  - 2. The Work under this Specifications section includes, but is not necessarily limited to:
    - a. Demolition and debris removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work includes demolition of structural concrete, foundations, structural steel, metals, masonry, attachments, appurtenances, piping, electrical systems and equipment, pavement, sidewalks, fencing, and similar existing materials, equipment, and items.
    - b. Demolition and debris removal of all above-grade piping and facilities and Underground Facilities underneath structures shown or indicated for demolition, unless the Underground Facilities or above-grade facilities are shown or indicated as to remain.
    - c. Remove from slabs, foundations, walls, and footings that are to be demolished all utilities and appurtenances embedded in such construction.
  - 3. Demolitions and debris removal indicated in other Specifications sections shall comply with requirements of this Specifications section.
  - Perform demolition Work within areas shown or indicated.
  - 5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition and debris removal Work.

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#### 1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

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DEMOLITION

- Demolition, debris removal, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T – Demolition), and all other Laws and Regulations.
- 2. Comply with requirements of authorities having jurisdiction.
- B. Qualifications:
  - 1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician(s) legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.
  - 2. Plumbing Removals: Entity and personnel performing plumbing removals shall be plumber(s) legally qualified to perform plumbing construction and plumbing work in the jurisdiction where the Site is located.

## 1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Comply with Section 01 14 16 Coordination with PHA Operations.
  - 2. Demolition and debris removal for the project will take place in phases. Review procedures under this and other Specifications sections and coordinate the Work that will be performed before in conjunction with, or after demolition and debris removal.
  - 3. Notify other contractors in advance of demolition and debris removal Work to provide other contractors with sufficient time for performing work and coordinating items included in their contracts that will be performed before, in conjunction with, or after demolition and debris removal Work.

#### 1.4 SUBMITTALS

- A. Informational Submittals: Submit the following:
  - 1. Procedure Submittals:
    - a. Demolition and Debris removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and debris removal Work, including:
      - 1) Equipment proposed for use in demolition and debris removal operations.
      - Recycling/disposal facility(ies) proposed, including facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
      - 3) Planned demolition operating sequences.
      - 4) Detailed schedule of demolition Work in accordance with the Schedule accepted by PHA.
  - 2. Notification of Intended Demolition Start: Submit in accordance with Paragraph 3.1.A of this Specifications Section.

# 1.5 SITE CONDITIONS

- A. PHA makes no representation of condition or structural integrity of area(s) to be demolished or where debris removal is required by the Contract Documents.
- B. PHA makes no representation of Underground Facilities or Utilities. Utility locations and conditions inside area(s) to be demolished or where debris removal is required by the Contract Documents are limited or unknown.

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- C. PHA makes no representation of condition, makeup, or size of abandoned structures or shoreline protection inside area(s) to be demolished or where debris removal is required by the Contract Documents.
- D. PHA makes no representation of condition, makeup, or size of underwater debris inside area(s) where debris removal is required by the Contract Documents.
- E. PHA makes no representation of condition or geotechnical integrity of area(s) to be where debris removal is required by the Contract Documents.

# PART 2 - PRODUCTS - (NOT USED)

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Notification:
  - 1. Not less than 48 HRS prior to commencing demolition or debris removal, advise PHA in writing of planned start of demolition Work. Do not start debris removal without permission of PHA.
  - 2. Entrance to secure sites must be coordinated with Port Houston twenty-four (24) hours prior to arrival. Some areas require workers to have a TWIC card in hand.
  - 3. Where demolition or debris removal has potential to affect adjacent properties, public thoroughfares, transportation facilities, and utilities, furnish required notices to PHAs and occupants of properties, buildings, and structures that may be affected by the demolition of debris removal.
  - 4. In accordance with Laws and Regulations, furnish to authorities having jurisdiction, including emergency services as necessary, appropriate notices of planned demolition and debris removal.
  - 5. Submit to PHA copies of notices furnished to adjacent property PHAs, occupants, and authorities having jurisdiction.
- B. Protection of Adjacent Areas and Facilities:
  - 1. Conduct of the work shall not interfere with PHA operations, including but not limited to PHA Fire Department Boat Docks.
  - 2. Perform demolition and debris removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not interfere with use of, and free and safe access to and from, structures and properties unless allowed by the Contract Documents otherwise allowed in writing by PHA. Stop work immediately if adjacent structures appear to be in danger.
  - 3. Closing or obstructing of roads, access routes, sidewalks, and passageways adjacent to the Work is not allowed.
  - 4. Obstructing the ship channel or PHA Fire Boat channel adjacent to the Work is not allowed.
  - 5. Provide appropriate temporary barriers, lighting, fencing, and other necessary protections pursuant to current and applicable laws and regulations.
  - 6. Repair damage to facilities that are to remain when such damages results from Contractor's operations.

- 7. Qualify remaining structures are sound and safe for operations in accordance with Paragraph 3.2.E of this Specifications Section and other requirements of the Contract Documents, as applicable.
- C. Existing Utilities:
  - 1. There is limited information regarding existing utilities at Morgan's Point. Contractor is to remove all utilities encountered inside the project limits. All utilities are to be verified with Port Houston as abandoned prior to removal.
  - 2. Unforeseen, unknown, or incorrectly shown or indicated Underground Facilities will be encountered. Contractor responsibilities shall be in accordance with the Conditions found in this Specification Section. Cooperate with PHA and utility PHAs in keeping adjacent services and facilities in operation.
  - 3. Sanitary Sewer:
    - a. Before proceeding with demolition, locate and cap all sewer lines and service laterals serving the project area.
  - 4. Water Piping and Related Facilities:
    - a. Before proceeding with demolition, locate and verify waterlines and service laterals serving the project area are inactive and have been abandoned. Ensure compliance with Laws and Regulations regarding water quality.
  - 5. Other Utilities:
    - a. Before proceeding with demolition, locate all other utilities, such as electric and communications serving the project area and ensure these utilities are abandoned.
  - 6. Shutdown of utility services shall be coordinated by Contractor, assisted by PHA as required relative to contacting utility PHAs.
- D. Remediation:
  - 1. Prior to performing demolition Work that disturbs asbestos, remove and dispose of asbestos in accordance with Federal, State and Local laws and regulations.
  - 2. Prior to performing demolition Work involving lead-based paint, remediate lead in accordance with Federal, State and Local laws and regulations.
  - 3. If unanticipated Hazardous Environmental Condition is believed to be encountered during demolition and debris removal, comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

## 3.2 DEMOLITION - GENERAL

- A. Equipment:
  - 1. Locate construction equipment used for demolition Work in a manner not to impede Port Houston operations. Contractor may be required to relocate equipment at the request of Port Houston.
  - 2. Coordinate equipment deliveries and hauling schedules with Port Houston.
- B. Pollution Controls:
  - 1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level.
  - 2. Do not use water when water may create hazardous or objectionable conditions such as flooding, or pollution.

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- 3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions.
- C. Explosives:
  - 1. The use of explosives is prohibited.
- D. Temporary Bracing and Supports:
  - 1. Provide temporary bracing and supports sufficient to maintain safety, stability, and resist all loads to which the structure may be subject during demolition and debris removal, until entirety is permanently removed or permanently stabilized.
  - 2. Temporary bracing and supports shall be sufficient for associated dead load, live load, transient loading, and dynamic loads such as wind, hydraulic, and other loads to which the temporary bracing or support may be subject.
  - 3. Where appropriate, retain a professional structural PHA, duly licensed and registered in the State of Texas, to design temporary bracing and supports.
- E. Existing and Remaining Structures
  - 1. The LASH dock is to be abandoned and access prohibited until structure is deemed sound per Section 3.2.E.2. A type III TxDOT barricade, or approved equivalent, and appropriate signage shall be placed at the point of entry to prohibit access.
  - 2. Retain a professional structural engineer, duly licensed and registered in Texas, to inspect and qualify remaining structures are sound and safe for operations. The Contractor shall repair or structurally enhance the remaining structure to the satisfaction of the retained PE.
    - a. Recommended Minimum Requirements for the LASH Dock Structural Capacity Determination:
      - 1) Review Existing Data
      - 2) Conduct a Condition Assessment
      - 3) Determination of Design Criteria Contractor will coordinate with the PHA to discuss the required information to aid in the development of models to perform the structural analysis.
      - 4) Perform Structural Analysis
      - 5) Prepare and submit a Structural Evaluation Report to the PHA with recommendations on continued use based on design criteria developed by the PHA
    - b. Recommended Minimum Design Criteria
      - 1) Environmental loads defined by ASCE 7
      - 2) Uniform live load of 125 pounds per square foot
      - 3) Loads from a single HS20 truck load on deck
  - 3. Prior to demolition work on the LASH dock structure, a pre-demolition marine survey will be conducted on the area. This marine inspection will include at a minimum a bathymetric multibeam survey, side scan and magnetometer survey. This survey will be submitted for review to the Owner.
  - 4. Upon completion of the Lash dock selective demolition, a post-demolition marine survey will be conducted on the area. This marine inspection will include at a minimum a bathymetric multibeam survey, side scan and magnetometer survey. This survey will be submitted for review to the Owner.
  - 5. Upon completion of the Lash dock selective demolition, a post-demolition dive survey will be conducted on the area. This survey will be submitted for review to the Owner.

## 3.3 PILE REMOVAL

#### A. General

- 1. The contractor must provide and install a containment boom around the work area while extracting piling to contain all sheens produced.
- 2. The Contractor must supply a material barge or contained area on shore to store removed piling until the pilings can be properly disposed.
- 3. The Contractor will be required to log all piles and sheet piles removed and note against the pile plans. Included in the pile debris removal log will be the date the pile was extracted, the overall pile length pulled, the recorded mud line elevation and method used to extract pile. If no pile plan is available an as-built plan will be developed to note the pile location.
- 4. The four (4) voids from pile removal at bent 11 on the LASH dock shall be filled with grout to a depth that is below the proposed dredge profile.
- B. Special Considerations Submerged Timber Pile Removal
  - The contractor shall supply a material barge or a containment area on shore to store removed piling until the pilings can be verified as non-hazardous materials. Testing of the piles is to be at the contractor's expense and schedule. Results will be provided to the PHA prior to hauling material to the disposal site. If the piles are deemed to be hazardous material, the Contractor will dispose of the material pursuant to all Federal, State and local guidelines.

## 3.4 UNDERWATER DEBRIS REMOVAL

- A. Contractor debris may obstruct dredging required under this Contract. Such debris shall be removed from water and disposed by Contractor outside of PHA and Federal property. In the event that existing conditions of debris differ materially from those shown in the side scan sonar report provided by the PHA, an adjustment in contract price or time of completion, or both, will be made in accordance with the following:
- B. Contractor shall promptly and before the site conditions are disturbed, provide notification to PHA of unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.
- C. PHA will investigate the site conditions promptly after receiving Contractor's notice. If conditions do materially so differ and cause an increase or decrease in Contractor's cost of or time required for performing any part of the work under this Contract, whether or not changed as a result of the conditions, an equitable adjustment will be made under this section through a Change order or other written agreement.
- D. No request by Contractor for an equitable adjustment to the Contract under this section shall be allowed unless Contractor has provided written notice prior to disturbing existing site conditions.
- E. Emergency Spill Response Equipment. Prior to commencing dredging activities, sufficient spill response equipment, i.e. boom, etc. shall be on-site and ready for deployment in the event of an emergency or accident.

#### 3.5 EXCAVATION

- A. Marine
  - 1. Contractor may excavate adjacent to structures to be removed and side cast material to facilitate debris removal.

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- Existing structures that are to remain are not to be undermined. Contractor is to verify structural integrity of remaining structures in accordance with Paragraph 3.2.E of this Specifications Section and other requirements of the Contract Documents, as applicable.
- 3. Material excavated is to be returned to its original position.
- 4. The excavated material is subsidiary to structural demolition and debris removal.
- B. Land
  - 1. Contractor may excavate adjacent to structures to be removed.
  - 2. Excavations must follow applicable safety regulations and guidelines.
  - Backfill shall not consist of Unsuitable Material defined in Section 31 23 00 EXCAVATION AND FILL and shall be graded in a manner that drains freely towards the channel.

#### 3.6 STRUCTURAL DEMOLITION AND DEBRIS REMOVAL

- A. Remove structures to lines and grades shown or indicated, unless otherwise directed by PHA. Debris removal beyond limits shown or indicated shall be at Contractor's risk and expense and such excess debris removal shall be reconstructed to satisfaction of PHA without additional cost to PHA.
- B. Recycling and Reuse of Demolition Materials:
  - 1. All concrete, reinforcing steel, structural metals, miscellaneous metals, wire mesh, and other items contained in or upon the project location or structure to be demolished shall be removed, transported, and disposed of away from the Site, unless otherwise approved by PHA.
  - 2. Do not use demolished or removed materials as fill or backfill.
- C. Where parts of existing structures are to remain in service following demolition, remove the portions shown or indicated for debris removal, repair damage, and leave the structure in proper condition for the intended use.
  - 1. Qualify remaining structures are sound and safe for operations in accordance with Paragraph 3.2.E of this Specifications Section and other requirements of the Contract Documents, as applicable.
  - 2. Remove concrete and masonry to the lines shown or indicated by sawing, drilling, chipping, and other suitable methods. Leave the resulting surfaces true and even, with sharp, straight corners that will be satisfactory for the purpose intended.
  - 3. Do not damage reinforcing bars beyond the area of concrete and masonry debris removal.
  - 4. Do not saw-cut beyond the area to be removed.

#### 3.7 MECHANICAL DEMOLITION AND DEBRIS REMOVAL

- A. Mechanical demolition and debris removal Work may include dismantling and removing existing:
  - 1. Potential piping systems inside the project limits.
  - 2. Potential storage tanks inside the project limits.
  - 3. Potential mechanical equipment and appurtenances.

- 4. Mechanical debris removal as required herein apply to systems exposed to view, hidden from view, and Facilities. Mechanical debris removal may require work in spaces that may be classified confined spaces.
- B. Demolition and Debris removal of Piping, Tanks and Similar Items:
  - 1. Scope:
    - a. Remove all existing piping, tanks and similar items inside the project limits.
    - b. Safely purge piping and tanks (as applicable) and make safe for removal and capping. Discharge contents of existing piping and tanks appropriately while avoiding damaging property; restricting access to or use of property; and creating unsafe, unsanitary, nuisances, and noisome conditions.
  - 2. Unknown Underground Facilities:
    - a. Sanitary facilities are expected but are not known. Contractor is to remove all sanitary facilities inside the project limits. These could include but are not limited to drain fields, basins, sumps, tanks and/or pumps.
    - b. Completely remove all sanitary facilities in accordance with the "Mechanical Demolition and Debris removal" Article in this Specifications section. Remove to the project limits as indicated on the Drawings.
    - c. Unless otherwise shown or indicated, cap ends of piping to remain in place in accordance with the "Mechanical Debris removal" Article in this Specifications section.
- C. Special Considerations:
  - 1. Where tank or equipment contains wastewater or liquid sludge dispose of contents appropriately in accordance with Laws and Regulations and the Contract Documents.
  - 2. Where tank or equipment contains solid or slurry-type material, remove, handle, and transport the contents and appropriately dispose of the materials offsite in accordance with Laws and Regulations, unless otherwise indicated in the Contract Documents.
  - 3. Remove equipment supports as applicable, anchorages, base, grout, and piping. Remove anchorage systems in accordance with the "Structural Debris removal" Article in this Specifications section.
  - 4. Remove associated piping to the limits of the project area unless otherwise indicated.

## 3.8 ELECTRICAL DEMOLITION AND DEBRIS REMOVAL

- A. Electrical demolition Work may include, but is not limited to removing existing:
  - 1. Cabling from electrical sources and similar devices and equipment.
  - 2. Abandoned electrical, telecommunications and other miscellaneous wiring or cabling.
  - 3. Conduits, raceways, cable trays, hangers and supports, cabling, and related items.
  - 4. Lighting fixtures and related items.
  - 5. Utility poles, site lighting standards, and overhead cabling not relocated by the utility PHA.
  - 6. Appurtenances and miscellaneous electrical equipment, as shown, specified, or required.

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- B. Electrical Debris removal General:
  - 1. Comply with Laws and Regulations, in accordance with the "Quality Assurance" Article in this Specifications section.
  - 2. Remove existing electrical equipment, fixtures, and systems to avoid damaging systems to remain, to keep existing systems in operation, and to maintain integrity of grounding systems.
- C. Debris removal of Cabling, Conduits, Raceways and Similar Items:
  - 1. Verify the function of each cable before disconnecting and removing.
  - 2. Remove cabling, conduits, hangers and supports, and similar items back to the power source or control panel, unless otherwise shown or indicated.
  - 3. Disassemble and remove exposed conduits, junction boxes, meters, other electrical appurtenances, and their supports.
  - 4. Underground Conduits and Cabling:
    - a. Conduits located in the project limits of demolition shall be removed to the extents of the project area.
    - b. Where found inside the project area, remove direct-burial cabling to the extents of the project area.
- D. Overhead Utilities:
  - 1. It is the responsibility of the contractor to coordinate with Port Houston and utility PHA.
    - a. Existing lines, transformers and poles owned by electric utility will be relocated by the electric utility.
    - b. Existing fiber optic and telecom lines that are to remain will be relocated by the utility PHA.
  - 2. Remaining poles and overhead cabling shall be verified as abandoned with Port Houston and removed as specified within the project area.
  - 3. Completely remove from the Site poles not owned by a utility, including site lighting standards and appurtenances, shown or indicated for debris removal.
    - a. Backfill all voids in accordance with the "Mechanical Debris removal" Article in this Specifications section.
- E. Lighting, meters, fixtures and other miscellaneous electrical equipment, not designated as remaining as PHA's property, shall be removed and properly disposed off-Site as required in accordance with Laws and Regulations.

#### 3.9 DEMOLITION AND REMOVAL OF SITE IMPROVEMENTS

- A. Pavement, Sidewalks, Patios, Slabs, Piles, and Foundations:
  - 1. Demolition of asphalt or concrete pavement, sidewalks, patios, slabs, piles, piers, foundations and other miscellaneous site improvements shall be total. Complete debris removal of these items within the project limits is required.
  - 2. Existing shoreline protection material shall be removed and stored in a site coordinated with PHA.
- B. Fencing, Guardrails, and Bollards:
  - 1. Remove to the limits shown or indicated on the Drawings.

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- Completely remove below-grade posts and concrete, including potential below grade concrete from preexisting fence structures designated on the drawings and in historical imagery.
- C. Unknown Underground Facilities:
  - 1. Sanitary facilities are expected but are not known. Contractor is to remove all sanitary facilities inside the project limits.
  - 2. Completely remove all underground facilities in accordance with the "Mechanical Debris removal" Article in this Specifications section. Remove to the project limits as indicated on the Drawings.
  - 3. Unless otherwise shown or indicated, cap ends of piping to remain in place in accordance with the "Mechanical Debris removal" Article in this Specifications section.
- D. Other Site Improvements: When the Contract Documents require debris removal of other site improvements not addressed above, copy with Contract requirements for debris removal of buildings or structures.

## 3.10 DISPOSAL OF DEMOLITION DEBRIS

- A. Disposal General:
  - 1. Promptly remove from the Site all debris, waste, rubbish, material, and equipment resulting from demolition and debris removal operations.
- B. Transportation and Disposal:
  - 1. Non-Hazardous Materials, Equipment, and Debris:
    - a. Properly transport and dispose of non-hazardous demolition materials, equipment, and debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations.
    - b. Non-hazardous material does not contain Constituents of Concern such as (but not limited to asbestos, arsenic, chromium, creosote, PCBs, petroleum, hazardous waste, radioactive material, or other material designated as hazardous in Laws or Regulations.
  - 2. Hazardous Materials and Debris:
    - a. When handling and disposal of items containing Constituents of Concern is included in the Work, properly transport and dispose of such items in accordance with the Contract Documents and Laws and Regulations.

## 3.11 POST-DEMOLITION MARNE SURVEY

- A. At the conclusion of the demolition operations, the contractor shall perform a postdemolition multi-beam bathymetric survey, side scan sonar survey and magnetometer survey to confirm all structures/debris has been removed.
- B. The USACE standards for Hydrographic Surveying shall be followed where appropriate. The survey shall follow "Other General Surveys and Studies (Coastal Engineering Surveys)" specifications according to USACE manual No. 1110-2-1003. Quality control and quality assurance (QA/QC) procedures as presented in the manual shall be followed where applicable.
- C. The survey shall focus on the areas where the plans indicated the location of structures / debris that required demolition. The Contractor shall submit a drawing that indicates the findings of the survey to confirm that all structures / debris has been removed from the site. The Contractor shall not demobilize from the site until the PHA has reviewed and accepted the report findings.

TECHNICAL SPECIFICATION	
Date: December 2020	

## 3.12 POST-DEMOLITION DIVE SURVEY

- A. At the conclusion of the demolition operations, the contractor shall perform a postdemolition dive survey to confirm all structures / debris has been removed.
- B. The survey shall focus on the areas where the plans indicated the location of structures / debris that required demolition. The Contractor shall submit a report that indicates the findings of the dive survey to confirm that all structures / debris has been removed from the site. The Contractor shall not demobilize from the site until the PHA has reviewed and accepted the report findings. Any items identified as remaining by dive survey will require the Contractor to initiate removal of these remaining items and perform a subsequent dive survey, all at no additional cost to the PHA.

# PART 4 - ATTACHMENTS

02 41 00 Exhibit A - PHA LASH Dock Demolition Removal Plans (NOV 2018) 02 41 00 Exhibit B.1 Morgan's Point Geophysical Survey Report 02 41 00 Exhibit B.1) Morgan's Point HydroEx Results & Notes

**END OF SECTION** 



# PORT OF HOUSTON AUTHORITY

PART C: LASH DOCK DEMOLITION AT BARBOURS CUT TERMINAL

DWG NO: C60-D01-012 NOVEMBER 2018



ЮМ & GAY ENGINERS, INC. \ЛXH?Propeta?PHA14610-00\_Rehab\_of\_M3\_at\_BCT\03\_САФО\SHEETS\WHARF 3 REHABILITATION\C60-D01-012-C-XXX.4Mg Nov 12, 2018-3:58pm Ipi

SITE LOCATION -PART C: LASH DOCK DEMOLITION GALVESTON BA

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R1.dwg





APPROVA	PORT OF HOUSTON AUTHORITY
Drawn By:	
Date:	SPILMAN ISLAND PLACEMENT AREA
Survey By:	
Date:	
Designed By:	
Date:	
Approved By:	SCALE: DWG NO.
Date:	1"= 800' Lash Dock discharge.dwg
Date:	1"= 800" Lash Dock discharge.dwg

# DREDGE PLACEMENT AREA 4



# NOTES:

,51,<sup>2</sup> ,50,56 ,49,58 ,49,91 ,49,81

49.81

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.44.24

A3.13 A2.08

A0.6

10.5 175 1,35 7,96 7,16 ,9,45 ,11,56 ,9,45

1. CLOUDED AREAS SHOW DOLPHINS TO BE DEMOLISHED IN THE PROJECT.

2. THE DOLPHINS SHALL BE EXTRACTED COMPLETELY USING TURBIDITY CURTAINS TO KEEP DEBRIS CONTAINED.

#### NOTE:

- 1. TURNING BASIN DIAMETER IS SHOWN SCHEMATICALLY ONLY AND CORRESPONDS TO THE MAXIMUM POSSIBLE TO AVOID IMPACT ON EXISTING BULKHEAD.
- 2. A SLOPE OF 3H:1V IS SHOWN SCHEMATICALLY ONLY FOR THE FUTURE TURNING BASIN. THE TURNING BASIN INCLUDING ITS SLOPE, DIAMETER, LOCATION AND ASSOCIATED DREDGING TO BE DESIGNED BY OTHERS.
- DRILLED SHAFT SCHEDULE PER ORIGINAL DESIGN DWGS "BARBOURS CUT LASH/SEABEE MOORING FACILITY FOUNDATION PLAN & PROFILE", SHEET 3, DATED DEC 3, 1071.
- 4. CONTOURS DATA PER BATHYMETRIC SURVEY PROVIDED BY THE PHA ON JUNE 23, 2016.

MARK	SHAFT DIA	UNDREAM DIA	BOTTOM EL	TOP EL
A-1, A-2	30"	68"	-56'-0"	+11'-4 1/2"
A-3, A-3a	36"	82" & 94"	-56'-0"	+11'-4 1/2"
A2-4	30"	62"	-56'-0"	+11'-4 1/2"
A2-5	30"	74"	-27'-0"	+2'-7"
A-6	30"	58"	-27'-0"	+2'-7"
A-7,8,9,10,12,13,14,15	30"	66"	-16'-0"	+11'-8"
A-11	30"	NONE	- 30'-0"	+11'-8"
A-16	24"	54"	-16'-0"	+9'-5"

# FOR DISCUSSION ONLY

# PORT OF HOUSTON AUTHORITY **BARBOURS CUT TERMINAL** HOUSTON, TEXAS

PLAN & WEST BRIDGE SECTION AT EXISTING LASH DOCK & FUTURE TURNING BASIN INTERFACE

DRAWING NO.	S-1
PROJECT NO.	A16.0247
DATE:	6/30/16
SHEET NO.	1 OF 1

# **DEMOLITION OF DOLPHINS 5**





2

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SELECTIVE DEMOLITION 7



1- .

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001117.tif ()





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**SELECTIVE DEMOLITION 10**






X.









**REFERENCE DRAWING 15** 





BANBOURS CUT LASH SEABLE MOORING FACILITY SECTIONS H-H & J-J BEAMERED BT D. F.V. BRAWH BT D. F.V. BRAWH BT H.T.K CHOLLEN C. Shallen C100-15

CHECKED BY U. ... DATE MAR.3).197 NEVISIONS DATE MAR.3).197 MARTING DATES A RAMAN



**REFERENCE DRAWING 17** 





**REFERENCE DRAWING 19** 





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HOUSTON SHIP CHANNEL, TEXAS EXPANSION CHANNEL IMPROVEMENT PROJECT SEGMENT 3 - BARBOURS CUT CHANNEL WORK ORDER 3 - MORGANS POINT

BULKHEAD CONSTRUCTION CONFLICTS HYDROEXCAVATION PLAN HYDRO 1

OCTOBER 2020 FIGURE



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1695 END SIRVEY		- 060 1900
1700 DEPART SUTE	RE DESC H. ANT REMARKS	8255 8307 9
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# **Geophysical Survey Report**

Port Houston – Project 11, Barbours Cut | La Porte, Texas

04.00172106-R1(00) | September 3, 2020 Final **HDR** 



## **Document Control**

#### **Document Information**

Project Title	Port Houston – Project 11, Barbours Cut, La Porte, Texas
Document Title	Geophysical Survey Report
Fugro Project No.	04.00172106
Fugro Document No.	04.00172106-R1
Issue Number	00
Issue Status	Final

#### **Client Information**

Client	HDR
Client Address	4828 Loop Central Drive, Suite 800, Houston, TX 77081
Client Contact	Mr. Scott Marr
Client Document No.	

### **Revision History**

Issue	Date	Status	Comments on Content	Prepared By	Checked By	Approved By
00	Sep 3, 2020	Final	For Client Review and Use	AB	EC	DV

#### **Project Team**

Initials	Name	Role
AB	Austin Butler	Geophysicist
EC	Eric Calderon	Project Geophysicist
DV	David Valintine	Manager, Geophysics Americas





Fugro USA Land, Inc. 6100 Hillcroft Houston, TX 77081 USA

HDR

4828 Loop Central Drive, Suite 800 Houston, TX 77081

September 3, 2020

#### Mr. Scott Marr

Fugro USA Land, Inc. (Fugro) is pleased to submit this report on the geophysical survey recently conducted in relation to the Port Houston – Project 11 at a site adjacent to Barbours Cut in La Porte, Texas. Our services were performed in general accordance with Fugro Proposal No 04.00172106-P1(00) dated July 6, 2020, which was authorized by HDR via an email to Ms. Danielle Rung of Fugro on August 7, 2020.

We appreciate this opportunity of providing geophysical survey services and look forward to working with you on future projects. Please contact the undersigned if you have any questions or comments regarding this report, or when we may be of further assistance.

Yours faithfully,



**David Valintine PG** Manager, Geophysics Americas T +1 713 369 5474 | E <u>dvalintine@fugro.com</u>

TBPG Firm Registration No. 50337

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## 1. Introduction

#### 1.1 Project Overview

We understand that HDR have been retained for engineering and design services associated with Project 11 for the Port of Houston. As part of this project, it is understood that channel widening will be conducted at Barbours Cut in La Porte, Texas. Prior to any excavations, HDR wishes to determine the possible presence of any subsurface utilities, obstructions, and other underground conflicts that may hinder the proposed channel widening..

#### 1.2 Purpose and Scope

The objective of our geophysical survey services was to use non-intrusive techniques to seek to determine the possible presence of subsurface utilities, obstructions, and other underground conflicts. It is understood that this information will then be used by others to assist with the planning and execution of subsequent excavation activities. Based on the information provided by HDR, the scope of work covered an area measuring approximately 95,000 square-feet.

#### 1.3 Service Constraints

It should be noted that the use of geophysical techniques to identify subsurface utilities and obstructions has limitations; specifically, with regards to the depth of investigation and resolution of the equipment under the subsurface conditions specific to each site. Geophysical techniques can only measure the presence of variations in compositional, electrical, or chemical properties within the subsurface, and through professional judgment, logic, and prior experience, associate these variations with the subsurface features being sought. Fugro has performed the required services according to the local state of practice. However, due to inherent limitations of subsurface locating technologies, it is possible that some of the features being sought or other subsurface anomalies may not have been detected during our survey.

Additional insight into potential subsurface utilities that may be present, along with the origins of the utilities interpreted from geophysical data may be gained by reviewing desk top information (such as public and private utility plans, historical drawings, findings from services such as Texas OneCall, etc.), which, for this study, were not included in our scope of work. Considering this, it may still be prudent to consider conducting limited hand probing and/or soft-dig exploration methods to verify the findings of our proposed geophysical survey prior to using mechanical excavation methods.

#### 1.4 Applicability of Report

The data collection and analyses for this study, as well as the conclusions and recommendations in this report, were selected or developed based on our understanding of the project as described above. If there are differences, we should be authorized to review the changes and, if necessary, to modify our conclusions and recommendations.



We have prepared this report for HDR to assist with their assessment of the project site at Barbours Cut in La Porte, Texas, as described herein. We have conducted this study using the standard level of care and diligence normally practiced by recognized geosciences firms currently performing similar services under similar conditions. We intend for this report, including all illustrations, to be used in its entirety. This report is solely for information purposes only and should not be construed to represent a warranty of subsurface conditions.

## 2. Geophysical Survey

Based on the information made available to Fugro prior to the geophysical survey, we recommended the use of the Electromagnetic Mapping, Ground Penetrating Radar, and Radiodetection techniques. The theory, method, and limitations of these techniques are presented below. Further information, including equipment specifications, can be provided upon request.

### 2.1 Electromagnetic Mapping

This technique was conducted to map the presence of buried metallic objects. A Geonics EM61 was used to collect the data, which is designed to record the time decay response of a pulsed electromagnetic field. The magnitude of this response is typically proportional to the metallic content of the subsurface and as such, the technique is analogous to a high-sensitivity metal detector. The resolution of the EM61 is suitable for detecting small, discrete objects, such as unexploded ordnance, metallic utilities and more extensive features such as former foundations. The depth of detection is dependent upon the size of the feature (specially, the amount of metal it contains) and the background conditions on site. As per the manufacturer's specifications, a single 55-gallon drum can be detected at depths greater than 10 feet. For subsurface utilities, the depth is typically within the range of 4 to 10 feet, for small cables through to larger pipelines, respectively.

Prior to data collection, the equipment is "nulled" (or calibrated) on site, which involves selecting a base station in an area free from surface metal and zeroing the data. The effect of the nulling process is that the background conditions display values near zero and the values increase notably when in proximity of objects with more metal.

For this survey, the Electromagnetic Mapping data was collected along a series of parallel profiles at 2½foot centers across the survey area, with additional tie-lines (in a perpendicular direction) for quality control purposes at 25-foot centers. Data were recorded at walking pace with a 5 Hz sampling rate, equal to a maximum station interval of about 1 foot along each profile. Positional data was provided by an integrated Trimble R1 differential GPS with sub-meter accuracy.

It was anticipated that subsurface metallic utilities, located within the depth of detection, would manifest as continuous, linear anomalies with high time decay response value. Other man-made metallic obstructions should manifest as regions of anomalously high time decay response value, yet their outlines are generally expected to be orthogonal or geometric in plan.



It should be noted that the Electromagnetic Mapping technique is influenced by metallic features both below and above the ground surface. As such, in the immediate vicinity of aboveground features (such as existing structures, fence lines, reinforced concrete, etc.) the recorded data is saturated, which prohibits the detection of subsurface features.

#### 2.2 Ground Penetrating Radar

This geophysical technique was conducted to image the shallow subsurface to aid the detection of nonmetallic features. The technique uses a short duration, high frequency electromagnetic signal that is transmitted into the subsurface. Whenever a contrast in dielectric properties is encountered, some of the transmitted signal is reflected back to the surface. The technique is analogous to marine depth finders in that the data depicts a vertical depth section under the antenna, from which the presence of subsurface features can be interpreted.

The depth penetration and resolution of the Ground Penetrating Radar technique is primarily a function of the signal frequency. Low frequency antennas penetrate to the greatest depths but display the lowest resolution. For example, a 400 MHz antenna can sample to ten feet (under favorable ground conditions) with a resolution suitable for detecting pipelines and utilities, whereas a 1500 MHz antenna can only sample to two feet with a resolution suitable for detecting reinforcement within concrete. A second and sometimes more dominant factor that affects the depth penetration and resolution are the properties of the groundmass being investigated, with significant decreases in clayey or saturated soils (as typically found along the Gulf Coast). Thus, the antenna frequency selection for any survey is always a trade-off between desired resolution and the expected depth penetration (under the ground conditions anticipated on site).

For this survey, we utilized a GSSI SIR3000 radar system with a 400 MHz antenna. The equipment was configured to sample for 50 ns (nanoseconds), which in the clayey soils expected on site, equates to a depth penetration of about 4 to 5 feet. As per the Electromagnetic Mapping technique, the data collection parameters are adjusted (or calibrated) on site in an attempt to minimize the response from the background conditions and heighten the response from foreign subsurface features.

The data was collected on an orthogonal grid basis, with individual profiles at 5- to 10-foot centers across the survey area. It was anticipated that the presence of subsurface utilities (and other man-made obstructions) would manifest within the data as anomalies with elevated amplitudes that can be traced to similar locations and depths on adjacent profiles, depicting distinct linear, orthogonal or geometric patterns in plan.

In addition, the Ground Penetrating Radar technique is also susceptible to other variations in subsurface properties, such as construction / strata boundaries (between different material types) and variations in soil properties (such as increase water or clay content). It should be noted that, in some instances, these anomalies may dominate the data and hinder the detection of the anomalies being sought. Although these variations may manifest within the data, they do not necessarily represent a significant risk (such as



changes in engineering or mechanical properties) and as such the technique can sometimes to considered to be over-sensitive to minor subsurface variations.

#### 2.3 Radiodetection

This is a relatively straightforward approach that can be used to detect subsurface utilities. The technique can be used in two different modes of operations depending upon the type of utility being detected. For energized utilities (such as electrical cables and pipelines with cathodic protection systems), the instrument can detect the electromagnetic field around the utility due to the electrical current within it. If the utility is not energized but can be easily accessed (i.e. pipes with valves, tracer cables etc.), a transmitter unit can be used to induce an electromagnetic field and the instrument is tuned to detect trace this known signal.

The survey approach with this technique is to perform a reconnaissance sweep of the survey area to detect any energized utilities, followed by connecting the transmitter to any utilities at readily apparent and accessible surface features and tracing them. Due to the simplicity of the technique, the findings are marked onto plans / sketches of the site and are primarily used to assist with the data interpretation of other techniques. The expected detection depth is typically between 4 and 10 feet, depending upon how strongly energized the utility being detected is.

#### 2.4 Scope of Works Conducted

The following outlines the scope of work conducted for this study:

- Mobilized survey team and equipment to site;
- Acquired Electromagnetic, Ground Penetrating Radar, and Radiodetection data across accessible portions of the site;
- Demobilized and took the data to our offices for detailed processing and analysis; and
- Issued this final report.

The geophysical data was acquired by Mr. Eric Calderon and Mr. Austin Butler of Fugro on August 12 and 13, 2020. The extents of the survey area requested by HDR have been overlaid on an aerial photograph of the site, presented on the accompanying Plate 1.

At the time of data collection, several areas of the site were inaccessible with our survey equipment due to the presence of gravel stockpiles (in the southern, central region) and the presence of dense / overgrown vegetation around the northern and eastern perimeter. The remainder of the site was either covered with short grass or gravel surfacing. The extent of the geophysical survey area covered by the Electromagnetic Mapping technique, and the locations of the individual Ground Penetrating Radar profiles collected are also presented on the accompanying Plate 1.



## 3. Geophysical Data Processing & Analysis

The office-based processing of the geophysical data and the interpretations that have been developed are discussed in this section of the report.

#### 3.1 Electromagnetic Mapping Data

The Electromagnetic Mapping data was downloaded at our offices and imported into Geosoft's Oasis montaj software for processing and presentation. The majority of the collected data is considered to be of good quality and with the omission of a few spurious points, has simply been plotted as a contour map of the measured time decay response. This plot has been presented on the accompanying Plate 2.

The color scale adopted for the Electromagnetic Mapping data ranges through pink, red and orange denoting elevated time decay response values, which are indicative of metallic objects above or below the ground surface. Areas shaded yellow, green and blue have been interpreted to be representative of the site background conditions.

Two different types of anomalies were identified in the Electromagnetic Mapping data and their locations have been annotated on the accompanying Plate 2 using the following classification:

- EM Anomaly Type 1 areas displaying saturated, extreme high time decay response values (shaded solid pink), indicative of a significant metallic feature within the subsurface. This anomaly type is likely to be related to a man-made metallic obstruction. The most prominent of these anomalies are located in the northeast and southeast of the survey area and display extents that are sizeable enough to be related to possible former foundations. Another prominent anomaly in the central southern portion of the site depicts a linear feature and therefore is possibly related to a subsurface utility.
- EM Anomaly Type 2 regions displaying elevated time decay response values (shaded orange through red and pink) that are related to the presence of a minor metallic feature within the subsurface. In general, occurrences of this anomaly type tend to be isolated, discrete and randomly distributed and have therefore been associated with trash or debris-like objects within the subsurface.

### 3.2 Ground Penetrating Radar Data

The Ground Penetrating Radar data collected during the survey is generally considered to be of acceptable quality. Each of the individual profiles acquired were analyzed using specialist data processing software at our offices. Basic processing was conducted on the data, which comprised filtering and amplification of the radar signal, to enhance the various reflections present within the raw data. After processing, it was noted that the majority of the anomalies present within the data were at two-way travel times of less than 20 ns, which equates to a depth of about 2 to 2½ feet. Below this, the data appeared attenuated (a lower signal to noise ratio) due to the soil conditions encountered on site (presumably



clayey soils, saturated with brackish water). This lower than expected depth of investigation prohibited the detection of deeper anomalies and it is possible that the anomalies that have been detected are related to variations in the surficial soils and/or fill material present.

Various types of anomalies were identified in the data and their locations have been annotated on the accompanying Plate 3 in accordance with the following categorization:

- **GPR Anomaly Type 1** a series of high amplitude, hyperbolic shaped reflections with uniform spacing. This type of anomaly is characteristic of reinforced concrete.
- GPR Anomaly Type 2 high amplitude, horizontally lying reflections displaying some reverberation with depth. From all the anomalies identified, this type displays the most evidence of subsurface obstructions. The high amplitude is indicative of a strong contrast in (dielectric) properties, and reverberation is a characteristic commonly associated with metallic obstructions, or possibly voids. With regards to the proposed excavation activities, it would be prudent to investigate this anomaly type further, prior to using mechanical excavation methods.
- GPR Anomaly Type 3 Elevated amplitude reflections with a chaotic appearance. This type of anomaly is characteristic of areas of disturbed or backfilled ground conditions with the chaotic appearance being related to the heterogeneous texture of the soil. Potentially, this anomaly type could be related to a backfilled pit or trench and therefore could be masking a deeper reflection from a buried feature; it would be prudent to use caution while excavating this anomaly type.
- GPR Anomaly Type 4 Continuous, horizontally lying reflections with elevated amplitude. The elevated amplitude of these reflections suggests a contrast in (dielectric) properties within the subsurface and their continuous, horizontal appearance is characteristic of a definitive boundary within the subsurface, such as a notable strata boundary, or possibly a subsurface obstruction. It has been noted that this anomaly type is most prevalent over areas with gravel at the ground surface and therefore it is likely that it is simply related to the transition from gravel to the underlying clayey soils, or variations in moisture (both of which are inconsequential to the proposed excavations). As the occurrences of this anomaly type his anomaly type do not display any geometric outlines, they are unlikely to be related to buried man-made obstructions.
- GPR Anomaly Type 5 isolated, high amplitude, hyperbolic shaped reflections. This type of anomaly
  is indicative of a discrete object within the subsurface such as an isolated debris-like obstruction, or a
  pocket of variable ground conditions. It is anticipated that as these features are small, their presence
  will have a negligible impact on the excavation activities.

#### 3.3 Radiodetection Data

The Radiodetection technique did not detected any (energized) utilities during the reconnaissance sweep of the site. Three aboveground features were found in the southwest of the site, which allowed the use of the transmitter; but in all instances, the utilities that were traced appeared to abruptly stop, suggesting they are abandoned. The locations of these utilities are also presented with the Ground Penetrating Radar results on Plate 3.

UGRO

It should be appreciated that for subsurface utilities to be accurately detected, the Radiodetection technique requires utilities to be energized or metallic and accessible so the transmitter unit can be used to induce a signal. Utilities such as PVC, concrete, clay pipes and utilities with no apparent surface features would therefore have gone undetected with this technique.

## 4. Summary of Findings

The objective of our geophysical survey services was to use non-intrusive techniques to seek to determine the possible presence of subsurface utilities, obstructions, and other underground conflicts to assist HDR with the planning and execution of subsequent excavation activities on site. Electromagnetic Mapping, Ground Penetrating Radar and Radiodetection data was collected across the site and numerous different anomalies have been identified and presented on the accompanying plates. Although the exact origin of these anomalies is unknown from the geophysical data alone, they do represent some variation in subsurface properties.

The Electromagnetic Mapping data displayed good success at this site identifying several metallic obstructions within the subsurface (EM Anomaly Type 1). In addition, numerous small anomalies, indicative of trash or debris have also been identified.

The data collected with the Ground Penetrating Radar technique appears to be limited in the depth of investigation obtained, which is believed to be a reflection of the clayey soils, and/or soils saturated with brackish water on site. Although some reflections that display characteristics of subsurface obstructions have been identified (GPR Anomaly Type 1 and 2), the majority of the anomalies are likely to be related to strata boundaries, changes in soil type and/or moisture.

Although the Radiodetection technique successfully mapped three subsurface utilities, their extents were all limited and therefore they seem to terminate abruptly, suggesting they are abandoned and may have been partially excavated.

It has bee noted that publicly available aerial photographs of the site indicate a structure was present in the norther portion of the site until as recent as 2006. The approximate location of this former structure correlates well with an area displaying anomalies indicative of reinforced concrete. It is therefore likely that foundations may remain in-situ. However, the geophysical data does not display any appreciable evidence of possible subsurface utilities leading to or from this location.

#### 4.1 Limitations

It should be noted that the use of geophysical techniques to identify subsurface features has limitations and therefore, it may not have been possible to identify all of the subsurface features being sought. Geophysical methods can only measure the presence of variations in compositional, electrical or chemical properties within the subsurface, and through professional judgment, logic and prior experience, potentially associate these variations with the subsurface features being sought. Although the exact origin of these



features is unknown from the geophysical data alone, they do represent some variation within the subsurface properties

Further insight into potential subsurface utilities that may be present, along with the origins of the features interpreted from geophysical data may be gained by reviewing desk top information (such as public and private utility plans, historical drawings, findings from services such as Texas OneCall, etc.), which were not included in the scope of work authorized for this study.

Fugro has conducted this study using the standard level of care and diligence normally practiced by recognized geosciences firms performing similar services under similar conditions. Due to inherent limitations of geophysical techniques, it is possible that some of the subsurface features being sought (and other subsurface anomalies) may not have been detected during our survey. This report is solely for information purposes only and should *not* be construed to represent a warranty of subsurface conditions.



## **List of Plates**

Title	Plate No.
Geophysical Survey Layout Plan	1
Electromagnetic Mapping Survey Results	2
Ground Penetrating Radar Survey Results	3





## Plate 1 | Geophysical Survey Layout Plan

Project 11 - Barbours Cut | La Porte, Texas

04.00172106-R1(00) | Geophysical Survey Report

Legend Project limits

- Approximate extent of geophysical survey area
- Ground Penetrating Radar profile locations
- ---- Overhead electrical lines
- --- Approximate limit of gravel fill







## Plate 2 | Electromagnetic Mapping Survey Results

Project 11 - Barbours Cut | La Porte, Texas

Legend EM Anomaly Type 1 - high time decay response values indicative of man-made metallic obstructions EM Anomaly Type 2 - discrete, isolated, elevated time decay response values indicative of metallic debris or trash Time Decay Response (mV) 42 81 119 165





## Plate 3 | Ground Penetrating Radar Survey Results

Project 11 - Barbours Cut | La Porte, Texas

04.00172106-R1(00) | Geophysical Survey Report

Legend GPR Anomaly Type 1 - reflection characteristic of reinforced concrete obstructions GPR Anomaly Type 2 - reverberating reflection - possible metallic subsurface obstruction GPR Anomaly Type 3 - chaotic reflections - disturbed or backfilled ground GPR Anomaly Type 4 - elevated amplitudes - changes in ground conditions (moisture, soil type...) • GPR Anomaly Type 5 - hyperbolic reflections - isolated, trash or debris-like obstructions --- Radiodetection Anomaly - possible subsurface utilities


# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 03 21 00.00 Add - REINFORCING STEEL

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing and placing of reinforcing steel of the type, size, and quality designated for use in structures, pavements and appurtenances thereof, as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std - Measurement of Quantities

SECTION 03 31 00.00 Add – Structural Concrete

# 1.3 REFERENCES

A. ASTM International Publications, latest editions:

ASTM A-82	Standard Specification for Steel Wire, Plain, for Concrete Reinforcement				
ASTM A-185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete				
ASTM A-496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement				
ASTM A-497	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete				
ASTM A-615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement				
ASTM A-675	Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties				
ASTM A-706	Standard Specification for Low Alloy Steel Deformed and Plain Bars for Concrete Reinforcement				
ASTM A-775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars				
ASTM A-884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement				
ASTM A-934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars				
ASTM D-3963	Standard Specification for Fabrication and Jobsite Handling of Epoxy- Coated Steel Reinforcing Bars				

- B. American Concrete Institute (ACI) Publications, latest editions:
  - ACI-315 Details and Detailing of Concrete Reinforcement
  - ACI-318 Building Code Requirements for Structural Concrete
- C. American Welding Society (AWS), latest editions:

AWS D1.4 Recommended Practices for Welding Reinforcing Steel

D. Concrete Reinforcing Steel Institute (CRSI), latest editions: Manual of Standard Practice

Placing Reinforcing Bars

# 1.4 SUBMITTALS

- A. Shop Drawings: Submit shop drawings for all reinforcing steel and related accessories. Shop drawings shall show layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars, mechanical connections, proposed welding locations and details, and shall be prepared in accordance with ACI 315.
- B. Product Data: Submit product data sheets for dowels, dowel baskets, sleeves, supports, spacers, mechanical couplers, tapered thread dowels and inserts, dowel bar substitution or rebar splice systems, and any other reinforcement hardware or accessories to be incorporated into the work. Submit epoxy coating product data and repair procedures.
- C. Mill Certificates: Submit authentic, legible mill certificates for all reinforcement bars, signed by producer.
- D. Samples: Provide samples of reinforcement bars in the quantity and length requested by Construction Manager.
- E. Welding: Prior to welding any reinforcing steel, the Contractor shall submit for approval, the specification and chemical composition of the reinforcements to be welded, the filler metal to be used, proposed preheating and cooling procedures, and welder qualifications.

# 1.5 HANDLING AND STORAGE

- A. Store steel reinforcement above the ground on platforms, skids, or other supports, and protect it from damage and deterioration. Ensure that reinforcement is free from dirt, paint, grease, oil, and other foreign materials when it is placed in the work. Wire-brush excessive rust and mill scale prior to placement. Rust, surface seams, surface irregularities, or mill scale will not be cause for rejection if the minimum cross-sectional area of a hand wire-brushed specimen meets the requirements for the size of steel specified.
- B. Reinforcing steel delivered to the job site shall be tagged so as to identify the heat from which the bars were rolled. Material not so identified may be rejected.

# PART 2 PRODUCTS

# 2.1 MATERIALS

- A. Reinforcement:
  - Reinforcing Steel: Unless otherwise specified in this Section or on the Drawings, all bar reinforcement shall be manufactured from billet steel bars conforming to the requirements of Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement (ASTM A-615), Grade 60. Plain bars and dowels shall conform to ASTM A-675, Grade 60. Carbon content shall be limited to 0.60 percent maximum.

Reinforcing steel to be welded shall conform to ASTM A-706.

Reinforcing steel delivered to the job site shall be tagged so as to identify the heat from which the bars were rolled. Material not so identified may be rejected.

- 2. Deformed Bar Anchors: Deformed Bar Anchors shall conform to ASTM A-496 with minimum yield strength of 75,000 psi. Standard ASTM A-615 Grade 60 or Grade 60 reinforcing bars may not be substituted for deformed bar anchors.
- 3. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge. Provide only plastic coated or stainless steel tie wire in exposed concrete structures.
- B. Mechanical Couplers: Mechanical couplers may be sleeve-filler, sleeve-threaded, sleeveswaged, or sleeve-wedged. Sleeve-wedge type couplers will not be permitted on coated reinforcing.
- C. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations.
  - 1. Slabs-on-Grade: Use supports with sand plates.
  - 2. Exposed to View Concrete: Provide supports with legs, which are plastic protected (CRSI Class 1) or stainless steel protected (CRSI Class 2).

# **PART 3 EXECUTION**

# 3.1 SPLICES

- A. Bars shall not be spliced at points of maximum stress, i.e., bottom bars at mid-span or top bars over supports. Splices shall be permitted only at the locations shown on the plan drawings or approved shop drawings, or as permitted by the PHA.
- B. Lap splices shall conform to ACI 318 and the drawings. Tension splices not at points of maximum stress shall be Class B.
- C. Where welding of reinforcing steel is required, this work shall be performed by experienced, certified welders in accordance with Recommended Practices for Welding Reinforcing Steel, AWS Designation D1.4. Do not weld reinforcing without prior written approval from the Chief Construction Manager.
- D. Splices in slabs shall be well distributed. Bars shall be rigidly clamped or wired together at all splices.
- E. Unless otherwise shown on the Drawings, all the reinforcement in outer face of all corners of grade beams and spandrels shall be returned around corners or shall be provided with at least one No. 5 bent splice bar top and bottom. At ends of beams where they intersect cross beams or walls, at least No. 5 horizontal dowels shall be provided in the top and in the bottom. At corners of walls, all horizontal bars in the outer face shall be returned at corners, or bent dowels of equal size shall be provided. At the end of a wall where it intersects a cross wall, all horizontal bars shall be bent to lap with steel in the cross wall. Splices of such dowels or of bars bent around corners shall be Class B.

#### 3.2 FABRICATION

All details of fabrication not otherwise specified or shown on the Drawings shall be in accordance with latest edition of "Manual of Standard Practice for Detailing Reinforced Concrete Structures: of the American Concrete Institute (ACI 315).

Do not heat reinforcement for bending. Do not flame-cut reinforcement.

# 3.3 PLACING

A. Metal reinforcement at the time concrete is placed shall be free from all loose rust and scale,

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and oil or grease, dirt, concrete, or any other coating that will impair bond.

- B. Metal reinforcement shall be placed accurately and adequately secured in position in the forms by metal chairs or spacers. The clear distance between bars, except in columns, shall be the greatest of (a) the nominal diameter of the larger of two adjacent bars, (b) 1-1/3 times the maximum size of coarse aggregate in the concrete, or (c) one inch. Where reinforcement in beams is placed in two layers, the clear distance between layers shall be one inch, and the bars in the upper layers shall be directly above those in the bottom layer. The clear distance between bars shall apply to the clear distance between contact splices or bars.
- C. Reinforcing steel in concrete columns and walls shall be held at the required distance from face of forms by approved spacers.
- D. All reinforcing bars shall be tied together in the form. Two-way mats of steel shall be tied at alternate intersections both ways, except that in floor and pavement slabs that bear on ground or on flexible base, all bars shall be wired at every intersection.
- E. In the plane of the steel parallel to the nearest surface of concrete, bars must not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars must not vary from plan placement by more than 1/4 inch.
- F. Scheduled reinforcing steel shall not be tack welded for any reason.
- G. Reinforcement must be approved by the Port of Houston Authority (PHA) prior to concrete placement. Placement of concrete without prior approval of reinforcement by the PHA may be rejected.

#### 3.4 BAR SUPPORTS

- A. Reinforcement in bottom of structural slabs and beams shall be supported on approved plastic, galvanized, or plastic tipped metal chairs. Plastic or plastic tipped chairs shall be used for soffits exposed to view. Use high chairs and bar raisers to support top bars of slabs and beams. All raisers in each line shall be continuous from side to side of the slab and shall be securely tied, with splices lapped 6 inches. Tie raiser bars to high chairs and tie top of each reinforcing bar to each raiser bar that it crosses.
- B. Reinforcement in columns and walls that are formed shall be spaced at the correct distance from face of walls by approved plastic or galvanized metal spacers of approved design.
- C. Galvanized wire for spacers and chairs shall not be smaller than No. 6 gage. Lines of low chairs shall be spaced at four-foot centers maximum and each bottom bar shall be tied to each row of chairs that it crosses.
- D. Reinforcement in drilled shafts, pipe piles, spread footings, floor and pavement slabs poured on ground, and on surfaces of walls and beams poured against earth, may be supported and spaced from sides either by plastic or galvanized metal supports and spacers of approved design or by concrete blocks. Blocks for supporting horizontal steel shall be 3" wide by 6" long and of such thickness as to support bars at the required elevation above bottom and below top of concrete. Blocks for spacing vertical steel from sides of columns and walls shall be 3" x 3" and of such thickness as will result in the cover of concrete over reinforcing steel shown on the Plans. Blocks shall have No. 16 gage wire ties embedded in the face. Concrete roller spacers may be used in drilled shafts.
- E. Space blocks 3 feet on centers each way and tie each block to principal reinforcement.
- F. Contractor shall provide spacers between layers of bars in beams, and, where continuous top steel in beams is not required by the Drawings, shall provide ties of sufficient size to hold vertical stirrups in position. The Contractor shall provide any other accessories or tie bars necessary to hold the reinforcement rigidly in correct position during placement.
- 3.5 DOWEL BARS

Furnish and place dowel bars at all floor slab and pavement expansion, contraction, and construction joints, for roadway curbs, and at other locations, as detailed and specified on the Drawings or as prescribed elsewhere in the specifications.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 03 30 53.00 Add - MISCELLANEOUS CAST-IN-PLACE CONCRETE

# PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; cast-inplace concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, in-place liners for manhole rehabilitation, fence post foundations and stone riprap grout or mortar filler as described and specified herein and as shown on the drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 03 21 00.00 Add - Reinforcing Steel

SECTION 03 31 00.00 Add - Structural Concrete

#### 1.3 REFERENCES

- A. ASTM International Publications, latest editions:
  - ASTM A-82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
  - ASTM A-185 Standard Specifications for Steel Welded Wire Reinforcement, Plain, for Concrete
  - ASTM A-615 Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
  - ASTM A-767 Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
  - ASTM A-775 Standard Specification for Zinc-Coated Steel Reinforcing Bars
  - ASTM A-820 Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
  - ASTM A-884 Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
  - ASTM C-31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
  - ASTM C-33 Standard Specification for Concrete Aggregates

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- ASTM C-39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- ASTM C-42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
- ASTM C-138 Standard Test Method for Density, Yield and Air Content of Concrete
- ASTM C-143 Standard Test Method for Slump of Hydraulic-Cement Concrete
- ASTM C-150 Standard Specification for Portland Cement
- ASTM C-94 Standard Specification for Ready-Mixed Concrete
- ASTM C-172 Standard Practice for Sampling Freshly Mixed Concrete
- ASTM C-173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- ASTM C-231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- ASTM C-260 Standard Specification for Air-Entraining Admixtures for Concrete
- ASTM C-309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM C-494 Standard Specification for Chemical Admixtures for Concrete
- ASTM C-618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ASTM C-685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
- ASTM C-1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- ASTM C-1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation
- ASTM C-1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- ASTM C-1260 Standard Test Method for Potential Alkali Reactivity of Aggregates
- B. American Concrete Institute (ACI) Publications, latest editions:
  - ACI 117 Standard Specifications for Tolerances for Concrete construction and Materials
  - ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

MISCELLANEOUS CAST-IN-PLACE CONCRETE

- ACI 301.1R Guide for Concrete Floor and Slab Construction
- ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
- ACI 308R Guide for Curing Concrete
- ACI 309R Guide for Consolidation of Concrete
- ACI 311.5R Guide for Concrete Plant Inspection and Field Testing of Ready-Mixed Concrete
- ACI 315 Details and Detailing of Concrete Reinforcement
- ACI 318 Building Code Requirements for Structural Concrete and Commentary
- ACI 347 Guide to Formwork for Concrete
- ACI 544.3R Guide for Specifying, Proportioning, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete
- C. Federal Specification SS-S-210 Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.
- D. Concrete Reinforcing Steel Institute (CRSI) Publication, latest edition:

CRSI 403 Placing Reinforcing Bars

CRSI MSP-1 Supports and Spaces

E. National Ready Mixed Concrete Association (NRMCA) Publication, latest edition:

CPMB 100 Concrete Plant Manufacturers Bureau - Plant Certification

F. Corps of Engineers Publication, latest edition:

COE UFGS-03150A PVC Waterstops

#### 1.4 SUBMITTALS

- A. Submit proposed mix design and test data, prepared by a certified testing laboratory employed and paid by the Contractor, for each type and strength of concrete in the Work.
- B. Submit laboratory reports prepared by an independent testing laboratory stating that materials used comply with requirements of this Section.
- C. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required.
- D. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Section.

- E. Submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
- F. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.
- G. MSDS for products.

#### 1.5 HANDLING AND STORAGE

- A. Cement: Store cement off of the ground in a well-ventilated, weatherproof building.
- B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.
- C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to the coating.

# PART 2 PRODUCTS

### 2.1 CONCRETE MATERIALS

- A. Cementitious Material:
  - 1. Portland Cement: Portland cement shall conform to the requirements of ASTM C 150, for Type I or Type II cement. Type II cement shall be used for marine application.
  - 2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of Na<sub>2</sub>O + 0.658K<sub>2</sub>O.
- B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.
- C. Aggregate:
  - Coarse Aggregate: ASTM C 33. Unless otherwise indicated in other specification sections or in the plans, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
  - 2. Fine Aggregate: ASTM C 33.
  - 3. Determine the potential reactivity of fine and coarse aggregate in accordance with the Appendix to ASTM C 33.
- D. Air Entraining Admixtures: ASTM C 260.
- E. Chemical Admixtures:
  - 1. Water Reducers: ASTM C 494, Type A.
  - 2. Water Reducing Retarders: ASTM 494, Type D.
  - 3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.
- F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.
- G. Reinforcing Steel:
  - 1. Use new billet steel bars conforming to ASTM A 615, ASTM 706, or ASTM A 775, grade 60, as applicable, and will be uncoated unless noted on the Drawings. Use deformed bars

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03 30 53.00 Add MISCELLANEOUS CAST-IN-Page 4 PLACE CONCRETE except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

- 2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply the gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
- 3. Wire: ASTM A 82. Use 16-1/2 gauge minimum for tie wire, unless otherwise indicated.
- H. Fiber:
  - 1. Fibrillated Polypropylene Fiber:
    - a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
  - 2. Physical Properties:
    - a. Material: Polypropylene.
    - b. Length: 1/2 inch or graded.
    - c. Specific Gravity: 0.9.
  - 3. Acceptable Manufacturer: W. R. Grace Company, Fiber mesh, or approved substitution.
    - a. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
    - b. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
  - 4. Physical Properties:
    - a. Material: Steel.
    - b. Aspect Ratio (for fiber lengths of 0.5 to 2.5-inch, length divided by diameter or equivalent diameter): 30:1 to 100:1.
    - c. Specific Gravity: 7.8.
    - d. Tensile Strength: 40-400 ksi.
    - e. Young's Modulus: 29,000 ksi.
    - f. Minimum Average Tensile Strength: 50,000 psi.
    - g. Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to an angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking.
- I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.
- J. Fly Ash for Reactive Aggregates: ASTM C 618, Type F only (8 percent maximum CaO), have maximum of 1.5 percent available alkali, and 3 percent loss on ignition.
- K. Fly Ash for Non-Reactive Aggregates: ASTM C 618 Type F only, have maximum of 1.5 percent available alkali, a 3 percent loss on ignition, and Calcium Oxide (CaO) variation in percentage points from the average of the last 10 samples (or less provided 10 have not been tested) shall not exceed plus or minus 4.0 percent.

# 2.2 FORMWORK MATERIALS

- A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-inch (nominal) lumber or 3/4-inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.
- B. Formwork for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.
- C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.
- D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.
- E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in a gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

# 2.3 PRODUCTION METHODS

- A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.
- B. Pre-packaged grouts must conform to ASTM C-1107.

#### 2.4 MEASUREMENT OF MATERIALS

- A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.
- B. Measure water and liquid admixtures by volume.

# 2.5 DESIGN MIX

- A. Use design mixes prepared by a certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.
- B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this Section. Prepare mix design of structural concrete so minimum cementitious material content is 564 pounds per cubic yard, except for mix designs containing only non-reactive aggregates or potentially reactive aggregates. Submit concrete mix designs to the Construction Manager for review.
- C. Proportioning on the basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, if approved.

# D. Classification:

Түре	TYPE MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)		Maximum W/C Ratio	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)	
	7-day	28-DAY				
Misc. Structural	3200	4000	0.45	4 <u>+</u> 1	2 to 4*	
Misc. Non-structural	2000	2500	0.45	4 <u>+</u> 1	5 to 7	
*When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.						

- E. Add steel or polypropylene fibers only when called for on the Drawings or in this section of the Specifications.
- F. Determine air content in accordance with ASTM C 138, ASTM C 173, or ASTM C 231.
- G. Use of Concrete Classes: Use classes of concrete as indicated on the Drawings and other Specifications. Use non-structural concrete for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise. Use structural concrete for all other applications.
- H. Mix Designs Containing Only Non-Reactive Aggregate: Fly ash shall be 20-30 percent of cement content by weight. Refer to the Paragraph 2.1J or 2.1K of this section for fly ash details.
- I. Mix Designs Containing Potentially Reactive Aggregate: Mix design shall contain fly ash in the range of 20-30 percent of cement content by weight. The mix design shall be considered effective to prevent deleterious alkali-silica reactivity if the expansion as measured by ASTM C 1260 is not greater than 0.08 percent at 16 days. Any mix design containing potentially reactive aggregate not meeting this requirement will be rejected. Refer to the Paragraph 2.1J or 2.1K of this section for fly ash details.

# 2.6 PVC WATERSTOPS

- A. Extrude from virgin polyvinyl chloride elastomer. Do not use reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds COE UFGS-03150A and other specified requirements.
- B. Flat Strip and Center-Bulb Waterstops:
  - 1. Thickness: not less than 3/8 inch
  - 2. Acceptable Manufacturers:
    - a) Kirkhill Rubber Co., Brea, California
    - b) Water Seals, Inc., Chicago, Illinois
    - c) Progress Unlimited, Inc., New York, New York
    - d) Greenstreak Plastic Products Co., St. Louis, Missouri
    - e) Approved substitution.

# 2.7 RESILIENT WATERSTOP

- A. Resilient Waterstop: Where shown on the Drawings; shall be either a bentonite or adhesivetype material.
- B. Bentonite Waterstop:
  - 1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
  - 2. Manufacturers rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
  - 3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.
  - 4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.
- C. Adhesive Waterstop:
  - 1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
  - 2. Meets or exceeds requirements of FED-STD SS-S-210 A.
  - 3. Supplied wrapped completely by a 2-part protective paper.
  - 4. Submit independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.
  - 5. Provide primer, to be used on hardened concrete surfaces, from the same manufacturer who supplies the waterstop material.
  - 6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved substitution.

# PART 3 EXECUTION

- 3.1 FORMS AND SHORING
  - A. Forms and Shoring shall be designed in accordance with ACI 347 Guide to Formwork for Concrete.
  - B. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.
  - C. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.
  - D. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per square foot; live load, 50 pounds per square foot.
  - E. Back formwork with a sufficient number of studs and wales to prevent deflection.
  - F. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4-inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

- G. Unless otherwise indicated, form outside corners and edges with triangular 3/4-inch chamfer strips (measured on sides).
- H. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.
- I. Treat facing of forms with approved form coating before concrete is placed. When directed by the Construction Manager, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

#### 3.2 PLACING REINFORCEMENT

- A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI 403. Request inspection of reinforcing steel and obtain acceptance before concrete is placed.
- B. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
- C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI MSP-1. Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.
- D. Do not splice bars without approval from the Construction Manager. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

#### 3.3 EMBEDDED ITEMS

- A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.
- B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

#### 3.4 BATCHING, MIXING AND DELIVERY OF CONCRETE

- A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA CPMB100.
- B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 through 8.
- C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval before adjustment and change of mix proportions.
- D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing the information required by ASTM C 685, Section 14.

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- E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until the concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.
- F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.
- G. Hand-mix only when approved by the Construction Manager.

#### 3.5 PLACING CONCRETE

- A. Give sufficient advance notice to the Port Construction Manager (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to approval.
- B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the work.
- C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.
- D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken an initial set; do not place any strain on projecting reinforcement or anchor bolts.
- E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.
- F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.
- G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.
- H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.
- I. After stone riprap has been placed, prevent earth, sand, or foreign material from filling the spaces between the stones when the plans require grouting of stone riprap. Wet the stones thoroughly after they are in place, fill the spaces between them with grout, and pack. Sweep the surface with a stiff broom after grouting. Grout for this purpose shall be Misc. Non-Structural concrete as shown in 2.5 D Classification.

#### 3.6 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

03 30 53.00 Add Page 10 MISCELLANEOUS CAST-IN-PLACE CONCRETE

- B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
- C. Splicing PVC Waterstops:
  - 1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.
  - 2. Butt end-to-end joints of two identical waterstop sections may be made in the forms during placement of waterstop material.
  - 3. Prior to placement in formwork, prefabricate waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.
- D. Setting PVC Waterstops:
  - 1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete and to prevent folding over of the waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
  - 2. Where a waterstop in a vertical wall joint does not connect with any other waterstop and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.
- E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with the Specifications.
- F. Resilient Waterstop:
  - 1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
  - 2. Provide technical assistance by manufacturer's representative in the field at no additional cost to the Port of Houston Authority.
  - 3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
  - 4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.
  - 5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.
  - 6. Bentonite Waterstop:
    - a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

- b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4-inch-deep and 1-1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
- c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
- d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary, to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
- e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.
- f. Adhesive Waterstop:
  - (i) With a wire brush thoroughly clean the concrete surface on which the waterstop is to be placed and then coat with primer.
  - (ii) If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.
  - (iii) Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with protective paper.
  - (iv) Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.
- 3.7 CONSTRUCTION JOINTS

Definitions:

- A. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
- B. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
- C. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.
- 3.8 CURING
  - A. Comply with ACI 308R. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or I cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be

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counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at the end of calendar days equal to twice the required number of curing days. However, leave soffit forms and shores in place until concrete has reached the specified 28-day strength.

- B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.
- C. Rubbed Finish:
  - 1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging the surface.
  - 2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.
- D. Unformed Surfaces: Cure by membrane curing compound method.
  - 1. After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by manufacturer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.
  - 2. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
  - 3. Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

# 3.9 REMOVAL OF FORMS AND SHORING

- A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.
- B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength.

## 3.10 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace the entire section.

# 3.11 FINISHING

- A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one-part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.
- B. Apply a rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet the surface with a brush and perform first surface rubbing with No. 16 carborundum stone, or approved substitution. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce a smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved substitution. After rubbing, allow paste on the surface to reset; then wash surface with clean water. Leave structure with a clean, neat and uniform-appearing finish.
- C. Apply a wood float finish to concrete slabs.

# 3.12 FIELD QUALITY CONTROL

- A. Testing shall be performed by an independent commercial testing laboratory by the Port of Houston Authority, except as set out herein, in accordance with material Testing in the General Conditions.
- B. Unless otherwise directed, the following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C 1077.
  - 1. Take concrete samples in accordance with ASTM C 172.
  - 2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C 31 and ASTM C 39.
  - 3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
  - 4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311.5.
- C. Test Cores: Conform to ASTM C 42.
- D. Testing High Early Strength Concrete: When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.
- E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. If additional curing fails to produce the required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required at no additional cost to the Port of Houston Authority.

# 3.13 PROTECTION

- A. Protect concrete against damage until final acceptance by the Port of Houston Authority.
- B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.
- C. Do not backfill around concrete structures or subject them to design loadings until components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength.

# END OF SECTION

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## SECTION 03 30 53.01 Add – RIPRAP AND GRANULAR FILL

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; furnishing materials and the performance of all work necessary for furnishing and installing riprap and granular fill.

#### 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment SECTION 31 05 19.13 Add - Geotextiles for Earthwork SECTION 31 23 00.00 Add - Excavation and Fills

# 1.3 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American Society for Testing and Materials (ASTM) Publications
  - C 127 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
  - C 136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
  - D 75 Standard Practice for Sampling Aggregates
  - D 3740 Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
  - D 4791 Flat Particles, Elongated Particles, or flat and Elongated Particles in Coarse Aggregate
  - D 4992 Evaluation of Rock to be Used for Erosion Control
  - D 5519 Particle Size Analysis of Natural and Man-Made Riprap Materials
  - D 6092 Standard Practice for Specifying Standard Sizes of Stone for Erosion Control
  - E 329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

# 1.4 SUBMITTALS

- A. Product Data:
  - 1. Riprap
  - 2. Filter Material
  - 3. Bedding Material

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- B. Test Reports:
  - 1. Gradation Test
  - 2. Evaluation Testing of Stone
  - 3. Bedding Material
  - 4. Bulk Specific Gravity
- C. Certifications:
  - 1. Stone
  - 2. Bedding Material
  - 3. Filter Material
  - 4. Sampling/Testing Laboratory
  - 5. Weigh Scale and Weigh Scale Tickets

# 1.5 DELIVERY, STORAGE AND HANDLING

- A. Keep the storage area clean, firm, smooth and well drained in order that the product can be placed with a minimum of foreign matter.
- B. Stockpile and handle riprap and granular fill to minimize segregation of particle sizes either in the stockpile or while loading, hauling and handling.

# PART 2 PRODUCTS

#### 2.1 RIPRAP

- A. Provide riprap consisting of stone. Provide riprap that is dense, durable and hard material free from cracks, seams and other defects which would increase deterioration from handling and natural causes.
- B. Shape and Dimensions.
  - 1. Provide riprap in cubic form, rather than elongated (flat)shapes.
  - 2. Provide riprap with a minimum thickness of 6 inches.
  - 3. No more than 25 percent shall have a length greater than 2-1/2 times the width or thickness. No length shall exceed 3 times the width or thickness.
- C. Do not provide spalls, fragments and chips exceeding 5 percent by weight. The dimension and shape limitations do not apply to this portion of the riprap.
- D. Provide riprap conforming to the following tables:

# TABLE 1

# **RIPRAP GRADATION**

# <u>NO. 1</u>

	Stone	Weight	Vol	ume	Cubica	l Shape	Spherica	l Shape
Percent	Lb	<u>)S.</u>	<u>Cubic</u>	<u>; Ft (2)</u>	<u>Ft (Eac</u>	: <u>h Side)</u>	<u> </u>	<u>Dia.)</u>
Lighter	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
by Weight	<u>Limit</u>	Limit	<u>Limit</u>	Limit	<u>Limit</u>	Limit	<u>Limit</u>	Limit
100	180	265	1.20	1.77	1.06	1.21	1.31	1.50
50	80	110	0.53	0.73	0.81	0.90	1.01	1.12
15	40	60	0.27	0.40	0.64	0.74	0.80	0.91

Notes:

1. The theoretical cube and sphere size is presented for guidance only. Paragraph 2.1 shall control riprap shape and dimensions.

2. Volume is based on 150 pcf, unit weight.

3. Riprap Gradation No. 1 is to be used where an 18 inch thick riprap mat is noted on the Plans.

		<u>F</u>	<u>RIPRAP (</u>	GRADATI	<u>ON NO. 2</u>			
	Stone <u>Lb</u>	Weight s.	Vol <u>Cubic</u>	ume Ft(2)	Cubica <u>Ft (Eac</u> l	l Shape <u>h Side)</u>	Spherica <u>Ft (E</u>	al Shape <u>Dia.)</u>
Percent	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Úpper
Lighter by Weight	l imit	l imit	l imit	l imit	Limit	l imit	Limit	l imit
100	260	640	1.73	4.27	1.20	1.62	1.49	2.01
50	130	200	0.87	1.33	0.95	1.10	1.18	1.37
15	40	150	0.27	1.00	0.64	1.00	0.80	1.24

# TABLE 2

Notes:

1. The theoretical cube and sphere size is presented for guidance only. Paragraph 2.1 shall control riprap shape and dimensions.

2. Volume is based on 150 pcf, unit weight.

3. Riprap Gradation No. 2 is to be used where a 24 inch thick riprap mat is noted on the Plans.

# 2.2 GRANULAR FILL

- A. Provide granular fill consisting of stone. Provide granular fill that is dense, durable and hard material.
- B. Provide granular fill, as shown on the Plans and/or as directed by the Engineer, to the following dimensions:
  - 1. Provide 3 inches to 5 inches granular fill with no material diameter less than 3 inches and no material diameter greater than 5 inches.
  - 2. Provide 4 inches to 9 inches granular fill with no material diameter less than 4 inches and no material diameter greater than 9 inches.
  - 3. Provide riprap Gradation No. 1 and Gradation No. 2 as shown on the Plans or as directed by the Engineer.

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- C. Do not provide spalls, fragments and chips exceeding 5 percent by weight.
- D. Where broken concrete is used, cut exposed metal flush with the surface prior to placing granular fill.

# 2.3 GEOTEXTILE

A. Refer to Section 31 05 19.13 Add - Geotextiles for Earthwork.

# PART 3 EXECUTION

#### 3.1 GRADE PREPARATION

- A. Refer to Section 31 23 00.00 Add Excavation and Fills.
- B. Trim and dress the channel bottom and side slopes to proper lines and grade prior to placing riprap or granular fill. Where shown on the Plans, place geotextile in accordance with Section 31 05 19.13 Add Geotextiles for Earthwork.
- C. The Engineer will inspect prepared section prior to placing geotextile, riprap or granular fill.

# 3.2 EXCAVATION AND FILL

- A. Excavate the channel. Refer to Section 31 23 00.00 Add Excavation and Fills.
- B. Excavate for riprap. Refer to Section 31 23 00.00 Add Excavation and Fills.

#### 3.3 RIPRAP OR GRANULAR FILL PLACEMENT

- A. Place the riprap or granular fill to the slopes, lines and grades as shown on the Plans.
- B. To establish a well-graded mass of riprap with minimal voids, fill voids between larger riprap blocks with spalls and smaller blocks of the largest feasible size to form a compact mass. Do not place spalls and small blocks in place of larger size riprap or granular fill.
- C. Install riprap and granular fill mat to the thickness as shown on the Plans. Riprap shall have minimum mat thickness as shown on the gradation tables.
- D. Place the riprap and granular fill to avoid displacement or damage to the prepared surface or geotextile and in a manner to avoid segregation of particle sizes.
- E. Fill riprap voids and bury riprap a minimum of 6 inches with topsoil on side slopes as directed by the Engineer.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 03 31 00.00 Add - STRUCTURAL CONCRETE

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, material, tools, equipment, and the performance of all operations required to complete all normal weight structural concrete work for wharves, beams, columns, structural slabs, foundations and other structures as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std - Measurement of Quantities

SECTION 03 21 00.00 Std - Reinforcing Steel

# 1.3 REFERENCES

A. ASTM International Publications, latest editions:

ASTM C-31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C-33	Standard Specification for Concrete Aggregates
ASTM C-42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C-39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C-143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C-172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C-150	Standard Specification for Portland Cement
ASTM C-157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
ASTM C-138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C-94	Standard Specification for Ready-Mixed Concrete
ASTM C-231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C-260	Standard Specification for Air-Entraining Admixtures for Concrete

- ASTM C-295 Standard Guide for Petrographic Examination of Aggregates for Concrete
- ASTM C-618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- ASTM C-1077 Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
- ASTM C-1152 Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete
- ASTM C-1218 Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
- ASTM C-1260 Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
- ASTM C-1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- ASTM C-309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- ASTM D-1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- ASTM C-171 Standard Specification for Sheet Materials for Curing concrete
- ASTM C-567 Determining Density of Structural Lightweight Concrete
- ASTM D-1752 Standard Specification for preformed Sponge Rubber Cork and Recycled PVC Expansion
- ASTM D-6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
- B. American Concrete Institute (ACI) Publications, latest editions:
  - ACI 117 Specification for Tolerances for Concrete Construction and Materials Commentary
  - ACI 301 Specifications for Structural Concrete
  - ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete
  - ACI 305R Hot Weather Concreting
  - ACI 318 Building Code Requirements for Structural Concrete Commentary
  - ACI 347 Guide to Formwork for Concrete
- C. Texas Department of Transportation (TXDOT) Publications, latest Editions:
  - TXDOT 420 Concrete Structures
  - TXDOT 421 Hydraulic Cement Concrete
- D. Encyclopedia of Industrial Chemical Analysis Volume 15
- E. U.S. Army Corps of Engineers (COE) Standards and Specifications:
  - CRD-C 61 Test Method for Determining the Resistance of Freshly Mixed Concrete to Washing Out in Water

#### 1.4 SUBMITTALS

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- A. Laboratory Test Reports: submit laboratory test reports for concrete materials and mix design test in accordance with ASTM C 33, ASTM C 157, ASTM C 1152, ASTM C1218, ASTM C 1260, and ASTM C 295.
- B. Material Certificates: Provide material certificates in lieu of material laboratory test reports. Materials certificates shall be signed by the manufacturer and CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
- C. Test Data submitted for review shall be current to within one (1) years of submission unless otherwise reviewed and accepted by the submittal reviewer.
- D. Contractor shall submit Mill Certificates for bulk cement and cementitious materials like fly ash, furnace slag, silica fume, etc.
- E. Design Mixes:
  - At least 60 days prior to concrete placement, submit test data on proposed design mixes for each type of concrete in the Work, including each class, and variations in type, source or quantity of material. Include type, brand and amount of cementitious materials; type, brand and amount of each admixture; slump; air content; aggregate sources, gradations, specific gravity and absorption; total water (including moisture in aggregate); water/cement ratio; compressive strength test results for 7 and 28 days; and results of tests in accordance with ASTM C 33, ASTM C 157, ASTM C 1152, ASTM C1218, ASTM C 1260, and ASTM C 295.
  - 2. Testing of aggregates, including sieve analysis, shall be performed by a certified independent testing laboratory. Tests shall have been performed no earlier than 3 months before Notice to Proceed.
  - 3. Provide standard deviation data for plant producing concrete. Data shall include copies of laboratory test results and standard deviation calculated in accordance with ACI 301-16, Item 4.2.3. Laboratory tests shall have been performed within past 12 months. When standard deviation data is not available, comply with ACI 301, Table 4.2.3.1.
  - 4. Review and acceptance of mix design does not relieve Contractor of responsibility to provide concrete of quality and strength required by this Specification.
- F. Admixtures: Submit manufacturer's technical information, including the following:
  - 1. Air-Entraining Admixture requirements to control air content under all conditions, including temperature variations and presence of other admixtures.
  - 2. Chemical Admixture requirements for quantities and types to be used under various temperatures and job conditions to produce uniform, workable concrete mix. Submit evidence of compatibility with other admixtures and cementitious materials proposed for use in design mix.
- G. High-range Water Reducer (Superplasticizer): When proposed for use, submit manufacturer's technical information and instructions for use of superplasticizer. When superplasticizer is to be added at ready-mix plant, submit contingency plans for adding additional superplasticizer at job site when required due to delay in placing concrete. Identify portions of Work on which superplasticizer is proposed for use.
- H. Hot and Cold Weather Concreting: Submit, when applicable, proposed plans for hot and cold weather concreting. Review and acceptance of proposed procedure will not relieve Contractor of responsibility for quality of finished product.
- I. Project Record Drawings: Accurately record actual locations of embedded utilities and components which are concealed from view.

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- J. Shop Drawings include pour schedule, pour sequence and construction joints.
- K. Material Safety Data (MSDS) for products.
- L. Quality Control Plan: The Contractor shall develop and submit for approval a concrete quality control program in accordance with the guidelines of ACI 121R and as specified herein. The plan shall include standard forms and checklists to be completed by Contractor's QC Manager for the concrete supplier, the reinforcing steel supplier, and installer and shall address aspects of the mix design, materials, and workmanship that may affect the ultimate performance of the structure. The Contractor shall provide direct oversight for the concrete qualification program. The QC plan shall include, as a minimum, developing, submitting for review by the Port of Houston Authority (PHA), and use of standard forms to:
  - 1. Record and check off the pre-placement preparatory work.
  - 2. Form to be completed by Contractor's QC Manager prior to notification of the PHA for inspection.
  - 3. Record items that include the concrete batch tickets and a brief description of work (times, dates, equipment used, crews on site, batch, quantities, etc.) performed during the placement. These forms shall be submitted every month during the course of concrete work.
  - 4. Record shop drawing review.
- M. Quality Control Personnel: The contractor shall submit for approval an organizational chart defining the quality control hierarchy, the responsibilities of the various positions, including the names and qualifications of the individuals in those positions. Submit American Concrete Institute certification for the following:
  - 1. Contractor's Quality Control (CQC) personnel responsible for inspection of concrete operations.
  - 2. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews.
  - 3. Concrete Batch Plant Operator: National Ready Mix Concrete Association (NRMCA) Plant Manager Certification at the Plant Manager level.
- N. Laboratory Qualification: The contractor shall submit for approval by PHA documentation indicating laboratory qualifications as specified herein. The laboratories performing the tests shall be accredited in accordance with ASTM C1077. The accreditation shall be current and shall include the required test methods, as specified
- O. Installer Qualifications: An experienced installer with a minimum of five (5) years of experience and who has completed concrete work similar in material, design, and extent to that indicated for this project and whose work has resulted in construction with a record of successful inservice performances.
- P. Field Testing Technician and Testing Agency: Submit data on qualifications of proposed testing agency and technicians for approval by the Owner prior to performing testing on concrete.
  - 1. Work on concrete under this contract shall be performed by an ACI Concrete Field-Testing Technician Grade 1 qualified in accordance with ACI SP-2 or equivalent. Equivalent certification programs shall include requirements for written and performance examinations as stipulated in ACI SP-2.
  - 2. Testing agencies that perform testing services on reinforcing steel shall meet the requirements of ASTM E329.

## 1.5 HANDLING AND STORAGE

A. Cement shall be stored in weather-tight buildings, bins, or silos which will exclude moisture and contaminants.

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- B. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. To ensure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen aggregates shall not be used.
- C. Natural or manufactured sand shall be allowed to drain until it has reached a relatively uniform moisture content before it is used.
- D. Admixtures shall be stored in such a manner as to avoid contamination, evaporation, or damage. For those used in the form of suspensions or non-stable solutions, agitating equipment shall be provided to assure thorough distribution of the ingredients. Liquid admixtures shall be protected from freezing and from temperature changes which would adversely affect their characteristics.

#### 1.6 QUALITY ASSURANCE

- A. Provide necessary controls during evaluation of materials, mix designs, production and delivery of concrete, placement and compaction to assure that the Work will be accomplished in accordance with Contract Documents. Maintain records of concrete placement. Record placement dates, placement locations, volume of concrete, batch ticket numbers, air temperatures, and test samples taken. The batch tickets shall indicate amounts of mix water to be withheld at the plant for later addition at Project site.
- B. Contractor shall conduct preconstruction meeting at the project site prior to submitting design mixes. The intent of the meeting is to discuss "Quality Control" requirements of the specifications, review concrete mix design requirements and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following
  - 1. Contractor's Project Manager (shall conduct the meeting)
  - 2. Contractor's Superintendent
  - 3. Contractor's Lead Foreman
  - 4. Contractor's Concrete Placement Foreman
  - 5. Form Designer
  - 6. Admixture Representative for each Admixture
  - 7. Contractor's Concrete CQC personnel
  - 8. Independent Testing Agency responsible for concrete design mixes.
  - 9. Ready-mix concrete batch plant operator
  - 10. Chief Construction Manager
  - 11. PHA Representative

The contractor shall conduct regular quality control team meetings with above-said attendees to review plans for future placements, review test results, and discuss dispensation of non-conforming materials. It is recommended that the meetings be held on a weekly or bi-weekly basis during the submittal phases and then monthly, as the construction progresses and in coordination with the PHA.

The Contractor shall prepare quality control team meeting minutes for each meeting. The minutes shall include the date of each meeting, attendees, key discussion points, findings, recommendations, assigned tasks, assigned personnel, task completion dates and status of each task.

C. Concrete construction shall conform to ACI 318.

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# PART 2 PRODUCTS

# 2.1 MATERIALS

- A. Portland Cement: Portland cement shall conform to the requirements of ASTM C 150, for Type II cement.
- B. Fly Ash for Reactive Aggregates: ASTM C 618, Type F only (8 percent maximum CaO), have maximum of 1.5 percent available alkali, and 3 percent loss on ignition.
- C. Fly Ash for Non-Reactive Aggregates: ASTM C 618 Type F only, have maximum of 1.5 percent available alkali, a 3 percent loss on ignition, and Calcium Oxide (CaO) variation in percentage points from the average of the last 10 samples (or less provided 10 have not been tested) shall not exceed plus or minus 4.0 percent.
- D. Normal Weight Aggregates: ASTM C 33, including Appendix IX, and as herein specified. Only materials free from chlorides and other deleterious coatings or substances shall be used. Aggregate shall be considered non-reactive if both of the following conditions are met:
  - 1. The quantities to be retained on each sieve may be adjusted only where available aggregates are elongated or slivered and cause interference with mix mobility, or available aggregate gradations do not comply with the 18-8 requirement explained below. The combined aggregates in the mixture (coarse, intermediate, and fine) shall be well graded with no more than 18 percent nor less than 8 percent of the combined aggregate retained on any individual sieve. The No. 50 sieve may have less than 8 percent retained; sieves finer than No. 50 shall have less than 8 percent retained, and the coarsest sieve may have less than 8 percent retained. Use intermediate sizes for blending where necessary, to provide a well graded combined aggregate. Perform mechanical analysis (one test for each aggregate size) in accordance with ASTM C136.
    - a. Provide ASTM C1260 or ASTM C1567 test results within 6 months of the submittal date showing the proposed coarse and fine aggregates are either: innocuous to alkali silica reaction; or that reactivity has been mitigated by the proposed cementitious materials as modified herein. Conduct ASTM C1260 tests on each aggregate source separately. Fine and coarse aggregates to be used in all concrete shall be evaluated and test for alkali-aggregate reactivity. Both coarse aggregate size groups shall be tested. Test results of the individual aggregates shall have a measured expansion equal to or less than 0.08 percent after 16 days of immersion in a 1M NaOH solution at 176 degrees.
    - b. Should the test data indicate an expansion of greater than 0.08 percent, the aggregate(s) shall be rejected or additional testing shall be performed as follows: utilize the Contactor's proposed low alkali Portland cement, and/or complimentary cementing materials, in combination with each individual aggregate. If Supplemental Cementitious Materials (SCMs) are being evaluated, the testing shall be in accordance with ASTM C1567. Determine the quantity that will meet all the requirements of these specifications and that will lower the expansion equal to or less than 0.08 percent after 16 days of immersion in a 1MN NaOH solution. Mixture proportioning shall be based on the highest percentage of SCM required to mitigate ASR reactivity.
    - c. Current data is required. Current data means data shall be not more than 180 days from the date of concrete mixture submittal.

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- d. Marine aggregate may be used when conforming to ASTM C33/C33M and if it originates from the up-current side of the land mass and it has been washed by the fresh water so that the total chloride and sulfate content of the concrete mixture does not exceed the limits defined herein.
- 2. Mineral content, as determined by ASTM C 295, is not greater than the following, based on the total aggregate sample:
  - a. Optically strained, microfractured, or microcrystalline quartz, 5.0 percent.
  - b. Chert or chalcedony, 3.0 percent.
  - c. Tridymite or cristobalite, 1.0 percent.
  - d. Opal, 0.5 percent.
  - e. Natural volcanic glass, 3.0 percent.
  - f. All aggregates not meeting Conditions (2) and (3) above shall be considered potentially reactive.
- E. Water: Mixing water for concrete shall be fresh, clean and potable.
- F. Admixtures:
  - 1. Air Entrainment: An approved brand of air entraining agent conforming to ASTM C 260 shall be used with all concrete. It shall be introduced in the mixture at the mixer in such quantities as to provide not more than five percent nor less than three percent entrained air as determined by tests performed in accordance with ASTM C 138. Entrained air in concrete floor slabs shall not exceed 4.5 percent.
  - 2. Water-Reducing, Retarding and Accelerating Admixtures:
    - a. Water-reducing, retarding and accelerating admixtures shall conform to the requirements of ASTM C 494. Acceptable manufacturers are:
      - i. W. R. Grace and Co.
      - ii. BASF
      - iii. Sika Chemical Co.
      - iv. Fox Industries, Inc.
      - b. Products of other manufacturers may be submitted for approval. No admixture containing calcium chloride as a functional ingredient may be used at any time.
      - c. The manufacturer shall submit a statement of conformance to ASTM C 494, including test results. In addition, the manufacturer shall state, in writing, the chloride content of the admixture and whether or not chloride has been added during its manufacture.
  - 3. Provide anti-washout or viscosity modifying admixtures for underwater concrete placement. Provide certification that the admixture is compatible with the cementitious materials and other chemical admixtures in the proposed concrete mixture. The anti-washout or viscosity modifying admixture shall have a proven record of performance with

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a minimum of five similar projects. Test per COE CRD-C 61 to determine cumulative mass loss shall be performed once for each 350 cubic yards of underwater concrete and results submitted to PHA for approval prior to continued use.

4. Corrosion inhibitor shall be 30 percent water solution of calcium nitrite. Allow for the free water in the admixture within the total water in concrete mixture. Accelerating and set adjusted versions are acceptable, however, the concrete set time effects and mixture workability shall be considered.

# 2.2 FORM MATERIALS

- A. Form materials shall be of wood, metal, fiberglass, or other approved material. Wherever rubbed surfaces are indicated on the Drawings or hereinafter specified, the forms shall be lined, plywood, or approved metal forms. Forms shall conform to the following requirements:
  - 1. Unlined Wood Forms: Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness, and shall be free from loose knots, splits, or other defects. Undressed lumber may be used for unexposed surfaces. Joints in forms shall be horizontal or vertical.
  - 2. Lined Forms: Lining material shall be moisture resistant concrete-form plywood, form grade hardboard, metal, plastic, or other approved material.
  - 3. Universal Standard Plywood Form Panels: Panels shall be designed to produce and maintain shape, lines and dimensions of the concrete as called for on the Drawings.
  - 4. Metal Forms: Metal forms shall be an approved type that will produce surfaces equal to those produced by specified wood forms. Headers, bridging, appurtenances, or special metal forms in accordance with requirements peculiar to the design of the forms shall be provided and installed where required.
  - 5. Plywood Forms: Plywood shall be moisture resistant concrete-form plywood at least 9/16inch in thickness, and not less than 5-ply.

#### 2.3 CLASSIFICATION

A. The Drawings and/or the Technical Specifications for each item of work indicate the class of concrete to be used for each element of the work. Each class of concrete shall meet the requirements tabulated below:

	Minimum Compressive Strength		Gradation of Aggregate
Class	at 28 Days	at 7 Days	
Н	5000	4000	1" max (see
			Section 2.1 D)
E	4000	3000	1" max.

# 2.4 PROPORTIONING OF CONCRETE

- A. The concrete shall be composed of Portland cement, coarse aggregate fly ash, fine aggregate, approved admixtures and water. Concrete used for all bulkhead walls shall contain fly ash as specified below. Concrete shall meet all requirements herein for strength, cementitious material content, water-cement ratio, slump, etc. Concrete shall have adequate workability and proper consistency to be worked readily into the forms and around reinforcement under the conditions of placement to be employed without excessive segregation or bleeding.
- B. Mix Designs Containing Only Non-Reactive Aggregate: Fly ash shall be 20-30 percent of cement content by weight. Refer to paragraph 2.1 C of this section for fly ash details.

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C. Mix Designs Containing Potentially Reactive Aggregate: Mix design shall contain fly ash in the range of 20-30 percent of cement content by weight. The mix design shall be considered effective to prevent deleterious alkali-silica reactivity if the expansion as measured by ASTM C 1260 is not greater than 0.08 percent at 16 days. Any mix design containing potentially reactive aggregate not meeting this requirement will be rejected. Refer to paragraph 2.1 B of this section for fly ash details.

Test Requirements	Maximum
Initial acid-soluble chloride content in cast-in-place and precast concrete per ASTM C1152/C1152M, percent/cement	0.10
Initial acid-soluble chloride content in prestressed concrete determined following ASTM C1152/C1152M, percent/cement	0.06
Water Soluble Chloride Ion Content in cast-in-place and precast concrete per ASTM C1218/C1218M, percent/cement	0.08
Water Soluble Chloride Ion Content in prestressed concrete per ASTM C1218/C1218M, percent/cement	0.06

D. Mix Designs for Marine applications shall meet the requirements listed in the table below:

E. Underwater concrete: When the concrete is intended for placement under water using the tremie technique, the concrete shall be proportioned to be cohesive and flow with minimal segregation. Viscosity modifying admixtures are permitted for underwater concrete. Proportioning guidance in ACI 304R shall be considered. Concrete mixtures shall be qualified for tremie placement methods based on a trial placement approved by the PHA.

For underwater concrete, cast compressive strength trial samples by placing concrete in four 5-gallon buckets below water using similar placement as the project. Permanently mark buckets as "3 days," "7 days," "28 days," and "Extra." Include date and station. Provide specimen sets at every 50 cubic yards per structure with a minimum of one set per day of underwater concrete placement. Retrieve buckets at specified intervals and extract three cores from each bucket. Conduct compressive strength test in accordance with ASTM C42/C42M. Strength of underwater concrete shall be satisfactory if the compressive strength result from extracted cores at the age of the specified strength is greater than 0.85 f'c with no individual strength test result less than 0.75 f'c.

- F. Contractor shall engage a testing laboratory acceptable to the PHA to perform material evaluation tests and to design concrete mixes. Mix design shall be based on the procedures of ACI 318. Proportions may be established on the basis of field experience with the materials to be employed or on the basis of laboratory trial batches. All Laboratory testing except for concrete mix design, welder certification, and timber inspection will be paid for by the Port Authority by a lab selected by the PHA. Re-testing due to Contractors failures will be done at the Contractors expense.
- G. Design Mix:
  - 1. Where mix design is based on trial batches, the Contractor, at least sixty days prior to placing concrete, shall submit a mix design and samples of all concrete materials. The laboratory will make up at least two batches of each class of concrete using the proportions of materials as submitted. A minimum of four standard size cylinders from each batch shall

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be molded, properly cured, and tested for seven-day compressive strengths as outlined in the latest ASTM test standards. If these cylinders fail to meet the required breaking strength, the mix shall be redesigned, and more batches and specimens made and tested as above. This procedure shall be repeated until a satisfactory batch design has been determined. After the mix proportions and water-cement ratio required to produce

- 2. New Concrete Mixtures
  - a. Submit complete ingredient material test data, including applicable reference specifications. Submit additional data regarding concrete aggregates if the source of aggregate changes.
  - b. Submit copies of test reports by independent test lab conforming to ASTM C1077 showing that the mixture has been successfully tested to produce concrete with the properties specified and that mixture will be suitable for the job conditions as described. Test reports shall be submitted along with the concrete mixture proportions. Obtain approval before concrete placement.
  - c. Test a minimum of one trial batch of production concrete to establish the tolerance limits which correlates to anticipated transport time for placement of concrete (i.e.: time from batch to product placement location). Obtain samples after anticipated duration has occurred.
    - i. Test and report fresh concrete property tests of each trial batch as follows:
      - (a) Slump in accordance with ASTM C143/C143M.
      - (b) Air content in accordance with ASTM C231/C231M or ASTM C173/C173M.
      - (c) Unit weight in accordance with ASTM C138/C138M.
      - (d) Temperature in accordance with ASTM C1064/C1064M.
    - ii. Cast specimens, test, and report hardened concrete property tests of each trial batch as follows:
      - (a) Compressive strength at 3, 7, 28, 56 and 90 days in accordance with ASTM C39/C39M. Use of unbonded caps in accordance with ASTM C1231/C1231M is permitted.
      - (b) Drying shrinkage may be determined from one batch.
      - (c) Tensile strength (if required) may be determined using specimens cast from one batch.
      - (d) Freeze-thaw durability factor (if required) shall be determined as the mean of six test specimens comprised of at least two specimens cast from each batch.
      - (e) Initial chloride ion content may be determined from one batch.
    - iii. Moist cure concrete intended for cast-in-place applications in accordance with the standard moist curing conditions described in ASTM C192/C192M unless otherwise specified. Moist cure concrete intended for precast applications in the manner proposed for use on the project.
    - iv. Cast twelve 4 by 8 inch cylinders, test and report ion transport properties as follows:
      - (a) Determine the porosity at 28-days and 90-days of standard moist curing. Calculate the mean porosity and standard deviation at each test age.
    - v. Special handling will be necessary for shipments of transport property specimens. These cylinders shall be wrapped completely with slightly damp paper towels with

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- 3. Concrete Qualification Process
  - a. Concrete quality for the project shall meet the specification requirements for the mixing method. The governing requirements between specification 03 31 00.00 Structural Concrete and ACI 304.6R shall be followed.
- 4. Fresh Concrete Properties
  - a. Air Content: Concrete that is air entrained shall conform to the air limits specified in ACI 301 for exposure and the aggregate size used and tested in accordance with ASTM C231/C231M. Variations outside the limits specified shall not be reason to reject the concrete in locations not subject to freeze-thaw conditions.
  - b. Slump: The concrete mixture shall be proportioned to have, at the point of deposit, a maximum slump of 4 inches as determined by ASTM C143/C143M when admixtures that affect slump are not used. Where an ASTM C494/C494M, Type For G admixture is used, the slump after the addition of the admixture shall not exceed 8 inches. Slump tolerances shall comply with the requirements of ACI 117.
  - c. Underwater concrete: When the concrete is intended for placement under water using the tremie technique, the concrete shall be proportioned to be cohesive and flow with minimal out segregation. Viscosity modifying admixtures for underwater concrete shall be approved by PHA. Proportioning guidance in ACI 304R shall be considered. Concrete mixtures shall be qualified for tremie placement methods based on a trial placement approved by the PHA.
- 5. Hardened Concrete Properties
  - a. Compressive Strength: The structural engineer shall specify the minimum compressive strength results at 28 days. Determine compressive strength (f'cr) for qualification of concrete mixtures and for quality acceptance testing. A compressive strength test result is defined as the mean of three properly conducted tests on 4 by 8 inch cylinders in accordance with ASTM C39/C39M. Alternatively and for concrete mixtures containing a maximum size aggregate greater than 1 inch, a strength test result shall be defined as the mean of two properly conducted 28-day tests on 6 by 12 inch cylindrical specimens in accordance with ASTM C39/C39M. In addition:
    - i. Specified Compressive Strength: For structural concrete elements exposed in a marine environment, the minimum specified 28-day design strength is denoted as (f<sup>c</sup>).
    - ii. Required Average Strength: The concrete shall be proportioned such that the minimum required average compressive strength (f'cr) exceeds the specified design strength (f'c) as per ACI 301.
    - iii. The average compressive strength may not exceed the specified strength at the same age by more than 20 percent unless approved by the PHA.
    - iv. Strength of any individual concrete placement shall be considered satisfactory if both the following requirements are met:
      - (a) The arithmetic mean of any three consecutive lot strength tests is between 1.0 and 1.2f'c, and;
      - (b) No individual strength test result is less than 0.90 f'c.

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- v. In the event that a placement is represented by single sampling lot, strength shall be considered satisfactory if either:
  - (a) The mean of the initial test is between 1.0 and 1.2 f'c, or;
  - (b) The mean of the initial test and retest is between 1.0 and 1.2 f'c, and neither strength test result is less than 0.90 f'c.
- vi. For underwater concrete, cast compressive strength samples by placing concrete in four 5-gallon buckets below water using similar placement as the project. Permanently mark buckets as "3 days," "7 days," "28 days," and "Extra." Include date and station. Provide specimen sets at every 75 cubic yards of concrete for the first 100 cubic yards, then every with a minimum of one set per day of underwater concrete placement.
  - (a) Retrieve buckets at specified intervals and extract three cores from each bucket. Conduct compressive strength test in accordance with ASTM C42/C42M.
  - (b) Strength of underwater concrete shall be satisfactory if the compressive strength result from extracted cores at the age of the specified strength is between 0.85 and 1.2 fc with no individual strength test result less than 0.75 fc.
- 6. Drying Shrinkage: Determine drying shrinkage for qualification of concrete mixtures prior to the fabrication of the Test Section and from samples made during the fabrication of the Test Section (see the subpart entitled "Test Section"). All test results shall not exceed 0.05 percent. A drying shrinkage test result shall be the mean value rom three or more individual specimens constituting a test set. If an individual specimen's measurements deviate from the mean value by more than 0.009 percent length change the specimen's measurements shall be discarded and a new average established. Casting more than three specimens for each set is permitted. Test procedures and test specimens shall conform to the following:

Drying shrinkage specimens, typically 3 by 3 by 11.25 inch prisms for 1 inch maximum size aggregate or smaller, shall be fabricated, cured, dried, and measured at 28 days in the manner delineated in ASTM C157/C157M except as modified by ACI 364.3R. Mixtures containing 50 percent or more complementary cementing materials shall meet the shrinkage criteria at 56 days.

a. Water Soluble Chloride Ion Content: Determine the chloride ion content only for qualification of concrete mixtures. Determine water soluble chloride ion content in accordance with ASTM C1218/C1218M. The limits for allowable water-soluble chloride ion concentrations in hardened concrete are listed in the Table below.
Maximum water-soluble Chloride Ion Content for Corrosion Protection				
Type of Member	Maximum water-soluble chloride ion in concrete, percent by weight of cement			
Prestressed concrete	0.06 percent			
Reinforced concrete exposed to chloride in service	0.08 percent			
Reinforced concrete that will be dry or protected from moisture in Service	0.15 percent			
Other reinforced concrete construction	0.30 percent			

- H. Where mix design is based on prior performance record, the laboratory will verify the experience required by ACI 318 and that those materials and proportions to be furnished are the same as those on which experience records are based. Submit a copy of the prior approvals indicating the project name, project number, and project location. Include ingredient material test data conducted within 12 months of submittal date, copies of previously approved trial batch test data. If the Contractor changes material type, class, sources, or suppliers; chemical composition; and/or mix proportions, the Contractor shall provide a written opinion of the significance of the change(s). The change(s) may require additional testing at the discretion of the PHA.
- I. Cement content shall be based on the following water cement ratios, except that minimum cementitious material content shall be 470 pounds per cubic yard:

Type of Structure	Max. Water-Cement Ratio	
Structures constructed in, above or immediately adjacent to the water; other structures exposed to the action of water	0.40	
Moderate sections, such as retaining walls, abutments, piers, girders and beams; concrete protected from weather or below ground	Determined by strength requirements, unless otherwise noted	

- J. Unless indicated otherwise on the Drawings, Technical Specifications or other Specifications, the maximum slump shall be four inches (4") for structural concrete without high range water reducers. A maximum slump of 8" for concrete mixes with high range water reducers may be approved if achieved without detrimental effects to the concrete.
- K. Maximum Size of Coarse Aggregate: See Table in Section 2.3 A
- L. Use of Admixtures:
  - 1. Water-reducing admixtures may be added to improve workability or reduce the amount of water required for hydration.
  - 2. All concrete placed in slabs when the ambient temperature is 85 degrees F., or higher, shall contain a set-retarding admixture.

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- 3. Amounts of admixtures to be added to the mix shall be in accordance with the manufacturer's instructions to achieve the desired results.
- 4. All concrete shall contain Calcium Nitrite corrosion inhibitor at a rate of 4.0 gallons per cubic yard of concrete.

## PART 3 EXECUTION

## 3.1 ENVIRONMENTAL REQUIREMENTS

Contractor shall comply with standards for air quality or air emissions associated with concrete production during construction.

# 3.2 FORMS

- A. General:
  - Forms shall conform to the shape, lines and dimensions of the concrete as called for on the Drawings and shall be sufficiently tight to prevent leakage of mortar. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall have sufficient rigidity to maintain specified tolerances. Forms placed on successive units for continuous surfaces shall be fitted to accurate alignment to assure a smooth completed surface area free from irregularities.
  - 2. Earth cuts shall not be used to form vertical surfaces unless so indicated on the Drawings or in the Technical Specifications.
  - 3. Drawings of complex or prefabricated forming systems shall be submitted for review. Since formwork is the Contractor's responsibility, these Drawings will not be approved or disapproved, but are submitted for information and comments only.
- B. Design and Installation of Formwork:
  - 1. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor.
  - 2. The formwork shall be designed for the loads, lateral pressure, and allowable stresses as outlined in ACI 347.
  - 3. Forms shall be designed, signed, dated and sealed by a professional engineer licensed in the State of Texas.
- C. Chamfer Strips: Chamfer strips shall be placed in the corners of forms to produce a 3/4" bevel or radius on all exterior corners.
- D. Form Ties: Bolts and rods or rigid metal form ties of an approved type which are especially designed for use in connection with concrete work shall be used for temporary internal ties. They shall be coated with grease and so arranged that when the forms are removed no metal will be within one inch of any concrete surface. Wire ties will be permitted only for minor or special form areas where the use of rigid type metal ties would be impracticable. Wire ties will not be permitted where the concrete surface will be exposed to weathering, or at any point where discoloration will be objectionable. Voids left in the cured concrete surface from ties shall be dry packed with nonshrink grout.
- E. Camber: To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete.
- F. Adjustment: Positive means of adjustment (wedges or jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Wedges shall

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be secured in position after final adjustment. Forms shall be securely braced against lateral deflections.

- G. Inspection: Temporary openings shall be provided at the base of column forms and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- H. Formwork: Formwork shall be so anchored to shores or other supporting surfaces or members that upward or lateral movement of any part of the formwork system during concrete placement will be prevented.
- I. Preparation of Form Surfaces:
  - 1. All surfaces of forms and embedded material shall be cleaned of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed in them.
  - 2. Before placing of either the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an approved coating material that will effectively prevent absorption of moisture and prevent bond with the concrete and will not stain the concrete surfaces. A field applied form release agent or sealer of approved type or a factory applied nonabsorptive liner may be used.
  - 3. Excess form coating material shall not be allowed to stand in puddles in the forms nor shall such coating be allowed to come in contact with hardened concrete against which fresh concrete is to be placed.
- J. Unless otherwise specified, provide form tolerances that comply with the most restrictive requirements from ACI 117.

## 3.3 REMOVAL OF FORMS AND FALSEWORK

- A. General: Forms and falsework shall not be removed without prior approval. The removal of forms and falsework shall be accomplished in such a manner as to prevent injury to the concrete. All forms shall be removed before completion of the work; if necessary, temporary access openings shall be provided for removal of forms from otherwise inaccessible places. The size and method of closing such openings shall be submitted and approved.
- B. Removal of Side Forms: Except as hereinafter provided, forms may be removed from the sides of beams, columns, and walls, and from other parts of formwork not supporting the weight of the concrete when the concrete has been cured for 48 hours. The exposed surfaces shall then be cured for the remaining curing period, as specified. Alternatively, the forms can be stripped at the end of curing period of four days.
- C. Other Formed Surfaces: All other formed surfaces may have their forms and falsework removed after the concrete has achieved the required seven-day compressive strength, but in no case until the concrete has been cured for four days.
- D. Removal Strength: When removal of formwork or reshoring is based on the concrete reaching a specified strength, the concrete shall be presumed to have reached this strength only when test cylinders, field cured along with the concrete they represent, have reached the strength specified for removal of formwork. The cost of testing shall be borne by the PHA; however, the Contractor is responsible for making and providing the cylinders to the testing laboratory.

## 3.4 CONSTRUCTION JOINTS

A. Joints not shown in the contract documents shall be submitted in the concrete placement plan (see 1.4 J) for review, so made and located not to impair the strength of the structure and shall be approved. Joints shall be perpendicular to the main reinforcement.

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- B. All reinforcement shall be continued across construction joints. Keys and dowels shall be provided as shown in the Drawings.
- C. The surface of the concrete at all joints shall be thoroughly cleaned and all laitance removed prior to placing adjoining concrete and roughened to  $\frac{1}{4}$ " minimum amplitude.

## 3.5 EXPANSION JOINTS

- A. Reinforcement or other embedded metal items bonded to the concrete (except dowels bonded on only one side of joints) shall not be permitted to extend continuously through any expansion joint.
- B. Premolded expansion joint filler shall conform to ASTM D 1751, ASTM D 1752, or ASTM D 6690.

# 3.6 EMBEDDED ITEMS

A. All sleeves, inserts, anchors, conduits and embedded items required for adjoining work or for its support shall be placed prior to placing concrete. Such items shall be accurately positioned and secured against displacement. Voids in sleeves inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete. Embedded steel items projecting from or within three inches of the edge of the concrete shall be galvanized or shall be stainless steel, as indicated in the Drawings or Technical Specifications. Embedded steel items no closer than three inches from the edge of concrete are not required to be galvanized, unless specified otherwise

# 3.7 PRODUCTION OF CONCRETE

- A. Ready-Mix Concrete:
  - 1. Except as otherwise provided in these Specifications ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94. Plant equipment and facilities shall be NRMCA certified.
  - 2. Discharge of the concrete shall be completed within ninety (90) minutes after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregate.

# 3.8 PLACING

- A. Preparation before Placing:
  - 1. Hardened concrete and foreign materials shall be removed from the inner surfaces of the conveying equipment.
  - 2. Formwork shall be completed; water and construction debris shall be removed; reinforcement shall be secured in place; expansion joint material, anchors and other embedded items properly located and secured prior to placing concrete. The Contractor shall give sufficient advance notice that those items may be inspected and approved before concrete placement begins.
  - 3. Subgrade shall be dampened prior to placement, but without puddles, muddy or soft places.
  - 4. Concrete shall not be placed on frozen or frosty ground or in forms containing ice, frost or snow.
- B. Conveying:

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- 1. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients and in a manner, which will assure that the required quality of the concrete is maintained.
- 2. Conveying equipment shall be approved and shall be of a size and designed such that detectable setting of concrete shall not occur before adjacent concrete is placed. Conveying equipment shall be cleaned at the end of each operation or workday. Conveying equipment and operations shall conform to the following additional requirements.
  - a. Truck mixers, agitators, and non-agitating units and their manner of operation shall conform to the applicable requirements of ASTM C 94.
  - b. Belt conveyors shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved arrangement shall be used at the discharge end to prevent segregation. Mortar shall not be allowed to adhere to the return length of the belt. Long runs shall be discharged into a hopper or through a baffle.
- 3. Chutes shall be metal or metal-lined and shall have a slope not exceeding 1 vertical and 2 horizontal and not less than 1 vertical to 3 horizontals. Chutes more than 20 ft. long and chutes not meeting the slope requirements may be used provided they discharge into a hopper before distribution.
- 4. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity. Pneumatic placement shall be controlled so that segregation is not apparent in the discharged concrete. The loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 inches. Concrete shall not be conveyed through pipe made of aluminum or aluminum alloy.
- C. Depositing:
  - 1. General: Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. Retempering is not permitted. If a section cannot be placed continuously, construction joints shall be located as shown in the contract documents or as approved. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. They may remain embedded in the concrete only if made of metal or concrete and if prior approval has been obtained.
  - 2. Placing: Placing of concrete in supported elements shall not be started until the concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
  - 3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.
  - 4. Consolidation:
    - a. All concrete shall be consolidated by vibration so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honeycombing, pitting, or planes of weakness. Internal vibrators shall have a minimum frequency of 8000 vibrations per min. and sufficient amplitude to consolidate the concrete effectively. They shall be

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operated by competent workmen. Use of vibrators to transport concrete within forms shall not be allowed. Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. At each insertion, the duration shall be sufficient to consolidate the concrete but not sufficient to cause segregation, generally from 5 to 15 sec. A spare vibrator shall be kept on the jobsite during all concrete placing operations. Where the concrete is to have an as-cast finish, a full surface of mortar shall be brought against the form by the vibration process, supplemented if necessary, by spading to work the coarse aggregate back from the formed surface.

- b. Any placing or finishing operation requiring more than ten hours or night work shall have prior approval. Nighttime operations shall be adequately lighted.
- c. Concrete shall not be dropped freely more than five feet in unexposed work or more than three feet in exposed work. Where greater drops are required, especially in columns and drilled shafts, an approved tremie or other suitable method shall be employed to lower the concrete into place.
- d. Grade strips (screeds) shall be set at the proper elevations. They shall be substantial enough to maintain their proper position during placement of concrete. Screeds and grade strips shall be removed after finish has been applied. Voids remaining shall be filled with stiff concrete tamped into place. Finish making surface uniform with adjacent areas.
- D. Protection:
  - 1. Unless adequate protection is provided and approval is obtained, concrete shall not be placed during rain, sleet, or snow.
  - 2. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish.
- E. Placing Temperature: When the temperature of the surrounding air is expected to be below 40 degrees F during placing or within 24 hrs. thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 55 degrees F. for sections less than 12 inches in any dimension nor 50 degrees F for any other sections. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints, and should not exceed 90 degrees F. When the temperature of the concrete exceeds 90 degrees F, measures to keep the concrete temperature below 90 degrees F shall be implemented, such as adding ice to the mix. Any added ice shall be added at the batch plant and shall not change the water cement ratio of the mix design. When the temperature of the steel is greater than 120 degrees F, steel forms and reinforcement shall be sprayed with water just prior to placing the concrete. Salt, chemicals or other foreign materials shall not be added to the concrete for the purpose of preventing freezing.
- F. Bonding:
  - 1. The surface of joints shall be prepared in accordance with one of the methods specified in Paragraph 3.4, CONSTRUCTION JOINTS. Forms shall be tight against previously placed concrete.
  - 2. Unless noted otherwise, the hardened concrete of joints shall be saturated surface dry concrete surface for bonding freshly placed concrete against existing concrete.
  - 3. Joints receiving bonding agent shall have been prepared and adhesive applied in accordance with the manufacturer's recommendations prior to placing of fresh concrete.
- G. Concreting under Water: When required or permitted, concrete shall be deposited under water by an approved method in such a way that the fresh concrete enters the mass of previously placed concrete from within, causing water to be displaced with minimum disturbance at the

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surface of the concrete. Forms shall be constructed to contain fresh concrete and to allow the controlled escape of water being replaced in the form by the fresh concrete. Placement plans shall be submitted for review prior to placing concrete under water by the tremie method.

H. Installation of dowels and anchor bolts shall conform to TxDOT Item 420.4.G.10.

# 3.9 REPAIR OF SURFACE DEFECTS

- A. General: Surface defects, including tie holes, unless otherwise specified by the contract documents, shall be repaired immediately after form removal.
- B. Repair of Defective Areas:
  - 1. All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary, the edges shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted. The area to be patched and an area at least 6 in. wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. A bonding grout shall be prepared using a mix of approximately 1 part cement to 1 part fine sand passing a No. 30 mesh sieve, mixed to the consistency of thick cream, and then well brushed into the surface.
  - 2. The patching mixture shall be made of the same materials and of approximately the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than 1 part cement to 2-1/2 parts sand by damp loose volume. Cement shall be the same used in the concrete. The quantity of mixing water shall be no more than necessary for handling the placing. The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.
  - 3. After surface water has evaporated from the area to be patched, the bond coat shall be well brushed into the surface. When the bond coat begins to lose the water sheen, the premixed patching mortar shall be applied. The mortar shall be thoroughly consolidated into place and struck off so as to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, it shall be left undisturbed for at least 1 hr. before being finally finished. The patched area shall be kept damp for 7 days. Metal tools shall not be used in finishing a patch in a formed wall which will be exposed.
- C. Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.
- D. Proprietary Materials: If permitted or required, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching procedures. Such compounds shall be used in accordance with the manufacturer's recommendations.

## 3.10 FINISHING OF CONCRETE SURFACES

- A. After removal of forms and patching defects, the surfaces of concrete shall be given one or more of the following treatments. Locations of the various finishes shall be as indicated on the Drawings.
- B. Finishing Tolerances:
  - 1. Finishes with Class A tolerances shall be true planes within 1/8 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.
  - 2. Finishes with Class B tolerances shall be true planes within 1/4 in. in 10 ft., as determined by a 10-ft. straightedge placed anywhere on the slab in any direction.
  - 3. Finishes with Class C tolerances shall be true planes within 1/4 in. in 2 ft. as determined by a 2 ft. straightedge placed anywhere on the slab in any direction.
- C. Description of Finishes:

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- 1. Rough Form Finish: No form facing materials are required for rough form finish surfaces. Tie holes and defects shall be patched. Fins exceeding 1/4 in. in height shall be chipped off or rubbed off. Otherwise, surfaces shall be left with the texture imparted by the forms.
- 2. Smooth Form Finish: The form facing material shall produce a smooth, hard, uniform texture on the concrete. It may be plywood, tempered concrete-form-trade hardboard, metal plastic, or other approved material capable of producing the desired finish. The arrangement of the facing material shall be orderly and symmetrical, with the number of seams kept to the practical minimum. It shall be supported by studs or other backing capable of preventing excessive deflection. Material with raised grain, torn surfaces, worn edges, patches, dents, or other defects which will impair the texture of the concrete surface shall not be used. Tie holes and defects shall be patched. All fins shall be completely removed.
- Broom or Belt Finish: Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

# 3.11 CURING AND PROTECTION

- A. General: Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be submitted for review. Poor procedures or materials shall be cause to stop all concrete work on the project until proper provisions for curing are made.
- B. Preservation of Moisture: For concrete surfaces not in contact with forms one of the following procedures shall be applied immediately after completion of placement and finishing:
  - 1. Ponding or continuous sprinkling.
  - 2. System of wet absorptive mats and impervious sheeting: Completely cover surface and edges of the concrete with wet cotton mats (12 oz./SY). Overlap mats 12 inches over adjacent mats. Mats shall be at least as long as the width of the surface to be cured. During application, do not drag the mats over the finished concrete nor over mats already placed. Wet mats thoroughly and keep continuously wet throughout the curing period. After applying wet cotton mats, cover with impervious sheeting throughout the curing period. Lay impervious sheeting with an overlap edges 12 inches minimum. Impervious sheeting shall be a clear or white (10 mil minimum) polyethylene film. Provide sheeting not less than 18 inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting; overlap and continuously tape sheeting joints; and introduce sufficient water to soak the entire surface prior to completely enclosing.
- C. Moisture Loss: Moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by the sun shall be minimized by keeping the forms wet until they can be safely removed. After form removal the concrete shall be cured until the end of the prescribed curing time by one of the methods of Paragraph 3.11 B Preservation of Moisture.
- D. Curing Time:
  - 1. Concrete shall be wet cured a minimum of 7 days. If one of the curing procedures of Section 3.11 B., Preservation of Moisture, Items 1. and 2. above is used initially, it may be replaced by one of the other procedures any time after the concrete is one day old, provided the concrete surface is not permitted to become dry during the transition.
  - 2. The length of time the concrete has been cured in the structure shall be determined by the cumulative number of days or fractions thereof, not necessarily cumulative, during which

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the temperature of the air in contact with the concrete is above 50 degrees F. and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

- E. Temperature, Wind and Humidity:
  - Cold Weather: When the mean daily outdoor temperature is less than 40 degrees F., the temperature of the concrete shall be maintained between 50 degrees F. and 70 degrees F. for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hrs. unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.
  - 2. Hot Weather: When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.
  - 3. Rate of Temperature Change: Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5 degrees F. in any 1 hr. or 50 degrees F. in any 24-hr. period.
  - 4. Protection from Mechanical Injury: During the curing period, the concrete shall be protected from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration. All finished concrete surfaces shall be protected from damage by construction equipment, materials, or methods, by application of curing procedures, and by rain or running water. Self-supporting structures shall not be loaded in such a way as to overstress the concrete. Pile driving and earth compaction operations shall not be closer than 100 feet to concrete elements whose age is 7 days or less.

## 3.12 SAMPLING AND TESTING FOR CONCRETE

- A. Concrete testing required in this section will be performed by an independent commercial testing laboratory employed and paid by the PHA, except as set out herein, in accordance with Material Testing in the General Conditions. Tests to be made at the PHA's expense shall be ordered by the PHA, and not by the Contractor.
- B. Standard Services: The testing agency will perform the following services:
  - 1. Verification that plant equipment and facilities conform to NRMCA certification requirements.
  - 2. Testing of proposed materials for compliance with this Section.
  - 3. Review of proposed mix design submitted by Contractor.
  - 4. Obtaining production samples of materials at plants or stockpiles during work progress and testing for compliance with this Section.
  - 5. Strength testing of concrete according to following procedures:
    - a. Obtaining samples for field test cylinders from every 50 cubic yards and any portion less than 50 cubic yards for each mix design placed each day, according to ASTM C 172, with each sample obtained from a different batch of concrete on a representative, random basis. Selecting test batches by any means other than random numbers chosen before concrete placement begins is not allowed.
    - b. Molding four specimens from each sample according to ASTM C 31 and curing under standard moisture and temperature conditions as specified in Sections 7(a) and (b) of ASTM C 31.

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- c. Testing two specimens at 7 days and two specimens at 28 days according to ASTM C 39, reporting test results averaging strengths of two specimens. However, when one specimen evidences improper sampling, molding or testing, it will be discarded, and remaining cylinder considered test result. When high-early-strength concrete is used, specimens will be tested at 3 and 7 days.
- 6. Air content: For each strength test, determination of air content of normal weight concrete according to ASTM C 231.
- 7. Slump: For each strength test, and whenever consistency of concrete appears to vary, conducting slump test in accordance with ASTM C 143.
- 8. Temperature: For each strength test, checking concrete temperature in accordance with ASTM C 1064.
- 9. Lightweight concrete: For each strength test, determination of air content by ASTM C 567 and unit weight by ASTM C 567.
- 10. Monitoring of current and forecasted climatic conditions to determine when rate of evaporation, as determined by Figure 2.1.5 of ACI 305R, will produce loss of 0.2 pounds of water, or more, per square foot per hour. Testing lab representative will advise Contractor to use hot weather precautions when such conditions will exist during concrete placement and note on concrete test reports when Contractor has been advised that hot weather conditions will exist.
- 11. Concrete Shrinkage Tests: Performance of drying shrinkage tests for trial batches as follows:

Preparation and Testing of Specimens: Compression test specimens will be taken in each case from the same concrete sample. 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10 inches, fabricated, cured, dried and measured in accordance with ASTM C 157, modified as follows:

- Wet curing: Remove specimens from molds at an age of 23 hours 1 hour after trial batching and immediately immerse in water at 70 degrees F ±3 degrees F for at least 30 minutes;
- b. Measure within 30 minutes after first 30 minutes of immersion to determine original length (not to be confused with "base length");
- c. Then submerge in saturated limewater, at 73 degrees F ±3 degrees F, for 7 days;
- d. Immediately store specimens in a temperature- and humidity-controlled room maintained at 73 degrees F, ±3 degrees F and 50 percent ±4 percent relative humidity, for the remainder of the test.
- C. Additional Testing and Quality Control Services: The following will be performed by an independent commercial testing laboratory employed and paid by the PHA.
  - 1. Checking of batching and mixing operations.
  - 2. Review of manufacturer's report of each cement shipment and conducting laboratory tests of cement.
  - 3. Molding and testing reserve 7-day cylinders or field cylinders.
  - 4. Conducting additional field tests for slump, concrete temperature and ambient temperature.

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- D. Authority of the Testing Agency: Representatives of the agency shall inspect, sample and test the materials and monitor the production of concrete as required by the Managing Director, Engineering & Construction. When it appears that any material furnished or work performed by the Contractor fails to fulfill specification requirements, the testing agency shall report such deficiency to the PHA and the Contractor. The testing agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of the contract documents, nor to approve or accept any part of the work.
- E. Contractor's Responsibility:
  - 1. It shall be the responsibility of the Contractor to furnish materials and construction in full compliance with the contract documents. As specified previously, he shall submit mix design and representative samples for approval.
  - 2. To facilitate testing and inspection, the Contractor shall furnish any necessary labor to assist the designated testing agency in obtaining and handling samples at the project or other sources of materials. The Contractor shall cooperate fully with the laboratory and shall correct or replace any defective work.
  - 3. The Contractor shall employ an independent commercial testing laboratory, acceptable to the PHA, and shall pay the costs of laboratory services required to establish mix designs for Portland cement concrete. The Contractor shall pay for the costs of analyzing aggregates, fixing gradations, preparing and testing of design cylinders or specimens and other such services required to establish mix design, or to redesign any mix when required due to any change in source of materials or other conditions.
  - 4. The Contractor shall notify the PHA Chief Construction Manager 24 hours prior to placing concrete to allow for completion of quality tests and for the assignment of personnel.
- F. Testing of Deficient Concrete in Place:
  - 1. When averages of three consecutive strength test results fail to equal or exceed specified strength, or when any individual strength test result falls below specified strength by more than 500 psi, strength of concrete shall be considered potentially deficient and core testing, structural analysis or load testing may be required.
  - 2. When concrete in place proves to be deficient, Contractor shall pay costs, including costs due to delays, incurred in providing additional testing and analysis services, or the independent commercial testing laboratory selected by the PHA.
  - 3. Replace concrete work judged inadequate by core tests, structural analysis or load tests at no additional cost to the PHA.
  - 4. Core Tests:
    - a. Obtain and test cores in accordance with ASTM C 42. here concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60 percent) for 7 days before test; test dry. Where concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning in accordance with ASTM C 42.
    - b. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient. Location of cores shall be determined so as to least impair strength of structure. When, before testing, one or more cores shows evidence of having been damaged during or after removal from structure, replace the damaged cores.
    - c. Concrete in area represented by core test will be considered adequate when average strength of cores is equal to at least 85 percent of specified strength, and when no single core is less than 75 percent of specified strength.

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- d. Patch core holes in accordance with the guidelines of this Section.
- 5. Structural Analysis: When core tests are inconclusive or impractical to obtain, the PHA may perform additional structural analysis at Contractor's expense to confirm safety of structure.
- 6. Load Tests: When core tests and structural analysis do not confirm safety of structure, load tests may be required, and their results evaluated, in accordance with ACI 318.
- 7. Testing by impact hammer, sonoscope, probe penetration tests (Windsor probe), or other nondestructive device may be permitted to determine relative strengths at various locations in structure, to evaluate concrete strength in place, or for selecting areas to be cored. However, such tests, unless properly calibrated and correlated with other test data, shall not be used as basis for acceptance or rejection of structure's safety.

# END OF SECTION

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# SECTION 31 41 33.00 Add - TRENCH SAFETY SYSTEM

#### PART 1 GENERAL

## 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of a Trench Excavation and Shoring Safety Plan, including detailed plans and specifications for a trench safety system and requirements for a safety program for the trench system (including a plan for ingress and egress of the trenches, manholes and structures) for any trench excavation, and all labor and materials for installation, inspection, and maintenance of trench safety system as described and specified herein and as shown on the Drawings and all other applicable safety standards and regulations.

## 1.2 RELATED SECTIONS

SECTION 01 25 00.00 Std – Measurement of Basis of Payment

SECTION 31 23 00.00 Std - Excavation and Fill

SECTION 35 31 16.20 Std - Steel Sheet Pile Bulkhead

## 1.3 REFERENCES

- A. OSHA 2226, OSHA OTM-Section V Chapter 2
- B. Code of Federal Regulations 29 CFR 1926.65 0 Trenching and Excavation Plan; 29 CFR, Part 1926, Excavations Subpart P.
- C. Texas Health and Safety Code Chapter 756 Sub Chapter C. Trench Safety
- D. AWS D1.1 Structural Welding Code
- E. ASTM International Publications, latest editions:
  - ASTM A-36 Standard Specification for Carbon Structural Steel
  - ASTM A-307 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
  - ASTM A-328 Standard Specification for Steel Sheet Piling

- ASTM A-572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- ASTM A-588 Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
- ASTM A-690 Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments

# 1.4 SUBMITTALS

A. The successful Contractor to submit its Proposed Trench Excavation and Shoring Safety Plan for approval prior to commencement of trenching activities on the project. Trench safety system to be in accordance with Contractor's Trench Excavation and Shoring Safety Plan, OSHA 2226, OSHA OTM-Section V Chapter 2 and (Code of Federal Regulations) 29 CFR 1926.650 Safety and Health Regulations for Construction, latest editions.

The plan to incorporate detailed PLANS and SPECIFICATIONS for a trench safety system conforming to OSHA standards that accounts for project site conditions, Contractor's trench construction means, methods, techniques or procedures, the relationship of spoil to edge of trench, and Contractor's equipment to be used in construction of project facilities requiring trench system(s). Contractor to provide a statement signed and sealed by a Registered Professional Engineer licensed in the State of Texas stating that the Trench Excavation and Shoring Safety Plan and the detailed plans and specifications for the trench safety system are designed in compliance with the Contractor's plan and the detailed PLANS and SPECIFICATIONS for the trench safety system to be incorporated into the proposal documents and the Construction Contract

B. Modifications: All modifications to the Contractor's Trench Excavation and Shoring Safety Plan or the detailed plans and specifications necessitated by the site conditions, Contractor's trench construction means, methods, techniques or procedures and Contractor's equipment to be used in construction of project facilities to be submitted to the Chief Construction Manager. All such modifications to be signed and sealed by a Registered Professional Engineer licensed in the State of Texas and a statement provided stating that the modified plan and/or the modified detailed plans and specifications for the trench safety system are designed in compliance with the Contractor's Standard of Care and is in conformance with appropriate OSHA standards. Such modifications to Contractor's plan and/or the Contractor's detailed plans and specifications for the trench safety system to thereafter be incorporated into the Construction Contract.

# PART 2 PRODUCTS

# 2.1 MATERIALS

A. Timber: Trench sheeting materials to be full size, a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.

TRENCH SAFETY SYSTEM

- B. Sheet Piling: Steel sheet piling to conform to one or more of ASTM A328, ASTM A572, ASTM A690 material requirements.
- C. Steel for stringers (wales) and cross braces to conform to ASTM A588.
- D. Steel trench boxes to be constructed of steel conforming to ASTM A36. Connecting bolts to conform to ASTM A307. Welds to conform to the requirements of AWS D1.1.
- E. Miscellaneous Materials: Miscellaneous materials to be utilized to conform to applicable ASTM standards.

# PART 3 EXECUTION

## 3.1 GENERAL

Trench safety system to be constructed, installed, and maintained in accordance with the Trench Excavation and Shoring Safety Plan as outlined in Paragraph 3.5A of this Section.

# 3.2 INSTALLATION/CONSTRUCTION

- A. Timber Sheeting: Timber sheeting and size of uprights, stringers (wales), and cross bracing to be installed in accordance with the Contractor's plan. Place cross braces in true horizontal position, spaced vertically, and secured to prevent sliding, falling, or kickouts. Cross braces to be placed at each end of stringers (wales), in addition to other locations required. Cross braces and stringers (wales) to be placed at splices of uprights, in addition to other locations required.
- B. Steel Sheet Piling: Steel sheet piling of equal or greater strength may be used in lieu of timber trench shoring shown in the OSHA tables (proposed standards). Drive steel sheet piling to at least minimum depth below trench bottom as recommended by Contractor's Registered Professional Engineer providing design. Place cross braces in true horizontal position, spaced vertically and secured to prevent sliding, falling, or kickouts. Cross braces to be placed at each end of stringers (wales), in addition to other locations required.
- C. Trench Boxes: Portable trench box may be used in lieu of timber trench shoring shown in the OSHA tables and to be designed to provide equal or greater protection than timber trench shoring shown in the OSHA tables. In cases where top of portable trench box will be below top of trench, the trench must be sloped no steeper than the maximum (steepest) allowable slope for the soil conditions existing on the Project. In areas where a sloped trench will affect the integrity of existing structures, Contractor to protect structures prior to sloping trench.
- D. Trench Jacks: When trench jacks are used for cross bracing and/or stringers (wales), the trench jacks to provide protection greater than or equal to the timber cross bracing shown in the OSHA tables (proposed standards). Trench jacks to be placed at each end of stringers (wales) in addition to other locations required.

## 3.3 REPAIR/RESTORATION

A. Bed and backfill pipe to a point at least one (1) foot above top of pipe or other embedded items prior to removal of any portion of trench safety system. Bedding and backfill to be in accordance with other applicable specification Sections.

B. Backfilling and removal of trench supports to be in accordance with Contractor's Trench Excavation and Shoring Safety Plan. Removal of trench safety system to be accomplished in such a manner to cause no damage to pipe or other embedded items. Remove no braces or trench supports until all personnel have evacuated the trench.

Backfill trench to within 4 feet of natural ground prior to removal of entire trench safety system.

# 3.4 FIELD QUALITY CONTROL

- A. Supervision: Provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment, and materials pertaining to the safety systems in this Section are sufficient to meet requirements of OSHA Standards.
- B. Inspection: Contractor is to make daily, before the start of each shift, and at the end of each rainstorm, inspection of the trench safety system to ensure that the system meets OSHA requirements. Inspection to be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench is to cease until necessary precautions have been taken to safeguard personnel entering trench. Contractor to maintain permanent record of daily inspections on site, available to the Chief Construction Manager.
- C. Hazardous Conditions: Contractor shall use a trained, certified and competent person to make daily checks for hazardous atmosphere of all excavations 4 feet or deeper. Contractor must provide employee controls such as respiratory protection/ventilation adjacent to any trench being worked in. Contractor must ensure personnel are trained in equipment use and potential hazards.

# 3.5 PROTECTION

- A. Maintenance of Safety System: The safety system is to be maintained in the condition as shown on the Trench Excavation and Shoring Safety Plan as designed by the Contractor's Registered Professional Engineer. The Contractor is to take all necessary precaution to ensure the safety systems are not damaged during their use. If at any time during its use a safety system is damaged, personnel to be immediately removed from the trench excavation area and the safety system repaired. The Contractor is to take all necessary precautions to ensure no loads, except those provided for in the plan, are imposed upon the trench safety system.
- B. Removal: Back filling and removal of trench supports shall progress together from the bottom of the trench upward. Remove no trench safety system component until all personnel have evacuated the trench.
- C. Means of Egress: Means of egress from trench excavations. A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 05 12 00.00 Add – STRUCTURAL STEEL FRAMING

## PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, equipment, appliances and materials, and performing all operations in connection with the performance of all work necessary to fabricate and erect all structural steel framing as described and specified herein and as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities SECTION 09 96 56.01 Std – Epoxy Coatings – Coal Tar

## 1.3 REFERENCES

- A. American Institute of Steel Construction (AISC):
  - AISC 360: Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings
  - AISC 303: Code of Standard Practice for Steel Buildings and Bridges
- B. American Welding Society (AWS) Structural Welding Code

Serial Designation D1.1: Specifications for Carbon Steel Electrodes

- C. ASTM International Publications, latest editions:
  - ASTM A-6 Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet piling
  - ASTM A-36 Standard Specification for Carbon Structural Steel
  - ASTM A-53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - ASTM A-108 Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
  - ASTM A-153 Standard Specification for Zinc Coating (Hot-Dipped) on Iron and Steel Hardware
  - ASTM A-216 Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service

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- ASTM A-490 Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
- ASTM A-500 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- ASTM A-563 Standard Specification for Carbons and Alloy Steel Nuts
- ASTM A-588 Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
- ASTM A-668 Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
- ASTM A-847 Standard Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
- ASTM A-992 Standard Specification for Structural Steel Shapes
- ASTM B-695 Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
- ASTM C-1107 Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
- ASTM E-94 Standard Guide for Radiographic Examination
- ASTM E-164 Standard Practice for Contact Ultrasonic Testing of Weldments
- ASTM E-165 Standard Practice for Liquid Penetrant Examination for General Industry
- ASTM E-709 Standard Guide for Magnetic Particle Testing
- D. Steel Structural Painting Council (SSPC)
- E. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs)
- F. The Society for Protective Coating (SSPC) Surface Preparation Guides:
  - 1. SSPC-SP 2, "Hand Tool Cleaning"
  - 2. SSPC-SP 3, "Power Tool Cleaning"
  - 3. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning"
  - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal"
  - 5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning"
  - 6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning"
  - 7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning"
  - 8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning"
  - 9. SSPC-SP 8, "Pickling"

G. International Accreditation Service (IAS) Accreditation Criteria AC472 – Inspection Programs for Manufacturers of Metal Building Systems

# 1.4 SUBMITTALS

A. Shop Drawings:

Show fabrication of structural-steel components.

- 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
- 2. Include embedment drawings.
- 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
- 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
- 5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the professional engineer registered in the state of Texas responsible for their preparation.
- B. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs):

Provide according to AWS D1.1, "Structural Steel Welding Code-Steel," For each welded joint whether prequalified or qualified by testing, the power source (constant current or constant voltage).

C. Qualification Data:

For qualified installer, fabricator, professional engineer, and testing agency.

1. Fabricator Qualifications:

A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD. For metal building manufacturers, a manufacturer that participates in the accreditation program IAS AC 472.

2. Installer Qualifications:

A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE, or CSE as specified in the Special Provisions.

3. Shop-Painting Applicators:

Qualified according to AISC's Sophisticated Paint Endorsement or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

4. Welding Qualifications:

Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code -

## Steel."

The Chief Construction Manager, who is the Port of Houston Authority (PHA) Construction Representative as defined in Division 00- Procurement and Contracting Requirements, Section: Special Conditions, will limit the period of effectiveness of welders, welding operators, and tackers as set out below. These provisions shall supersede the provisions of corresponding sections of the Structural Welding Code cited heretofore.

Certificate of qualification submitted for a welder, welding operator or tacker in a fabricating shop, or manufacturing plant, will be accepted provided that such person has been tested by an approved testing laboratory within the preceding twelve months, and that the Operator has been doing satisfactory welding of the required type within the preceding three months.

If the quality of the work of any welder, welding operator or tacker is substandard, such person may be required to retake qualification tests.

- 5. Comply with applicable provisions of the following specifications and documents:
  - a. AISC 303
  - b. AISC 360
- D. Welding Certificates
- E. Paint Compatibility Certificates:

From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

- F. Mill test reports for structural steel, including chemical and physical properties (two certified copies).
- G. Product Test Reports for the Following:
  - 1. Shear stud connectors.
  - 2. Shop primers.
  - 3. Non-shrink grout.
  - 4. Other products as described in Special Provisions.
- H. Source Quality-Control Reports

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

- 1. Fasteners may be repackaged provided PHA's testing and inspecting agency observes repackaging and seals containers.
- 2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
- 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## PART 2 PRODUCTS

- 2.1 STRUCTURAL STEEL MATERIALS
  - A. Plate and Bar: ASTM A 572 GR50
  - B. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, GRADE 50 (345)
  - C. Steel Pipe: ASTM A 572 Grade 50, unless noted as otherwise on drawings.
    - 1. Weight Class: As specified or shown on drawings.
    - 2. Finish: As specified or shown on drawings.
  - D. Welding Electrodes: Comply with AWS requirements.

# 2.2 PRIMER

A. Primer: according to manufacturer's requirements and Specification Section 09 96 56.01

## 2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout:

ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

Minimum compressive strength as indicated on drawings.

## 2.4 FABRICATION

A. Structural Steel:

Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

- 1. Camber structural-steel members where indicated.
- 2. Fabricate beams with rolling camber up.
- 3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
- 4. Mark and match-mark materials for field assembly.

- 5. Complete structural-steel assemblies, including welding of units, before starting shoppriming operation
- B. Thermal Cutting:

Perform thermal cutting by machine to greatest extent possible.

Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes:

Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing:

Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning:

Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP1, "Solvent Cleaning.

F. Shear Connectors:

Prepare steel surfaces as recommended by the manufacturer of shear connectors. Use automatic and welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes:

Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

- 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
- 2. Baseplate Holes:

Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

# 2.5 SHOP CONNECTIONS

A. Weld Connections:

Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

In all lapped or "Tee" splices or other joints using intermittent fillet welds, the edges of faying surfaces shall be continuously seal welded in addition to the required strength weld.

## 2.6 SHOP PRIMING

Shop priming and surface preparation for coating system shall be performed according to manufacturer's requirements and Specification Section 09 96 56.01

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar.
  - 2. Surfaces to be field welded.

# 2.7 SOURCE QUALITY CONTROL

A. Testing Agency:

PHA will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

- B. Correct deficiencies in work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Welded Connections:

In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

- 1. Liquid Penetrant Inspection: ASTM E 165
- 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
- 3. Ultrasonic Inspection: ASTM E 164
- 4. Radiographic Inspection: ASTM E 94 Test 100% of Complete Joint Penetration (CJP) welds using ultrasonic or radiographic inspection. Randomly inspect 50% of all Partial Joint Penetration (PJP) welds and fillet welds or as indicated by magnetic particle or liquid penetrant inspection.
- D. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
  - 1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360degree flash or welding repairs to any shear connector.
  - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## PART 3 EXECUTION

3.1 COORDINATION

TECHNICAL SPECIFICATION Date: December 2020

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## 3.2 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedment for compliance with requirements.

Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.3 PREPARATION

Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

## 3.4 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 AND AISC 360.
- B. Base Bearing and Leveling Plates:

Clean concrete surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.

- 1. Set plates for structural members on wedges, shims, or setting nuts as required.
- 2. Weld plate washers to top of baseplate.
- 3. Tighten as specified anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
- 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will

be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

- 1. Level and plumb individual members of structure.
- 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by PHA. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors:

Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

# 3.5 FIELD CONNECTIONS

A. Weld Connections:

Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

- 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
- 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
- 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency:

Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Welded Connections:

All field welds will be visually inspected according to AWS D1.1/D1.1M.

In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- 1. Liquid Penetrant Inspection: ASTM E 165
- 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld.

<b>TECHNICAL SPECIFICATION</b>
Date: December 2020

05 12 00.00 Add Page 9 Cracks or zones of incomplete fusion or penetration will not be accepted.

- 3. Ultrasonic Inspection: ASTM E 164
- 4. Radiographic Inspection: ASTM E 94

Test 100% of Complete Joint Penetration (CJP) welds using ultrasonic or radiographic inspection. Randomly inspect 50% of all Partial Joint Penetration (PJP) welds and fillet welds or as indicated by magnetic particle or liquid penetrant inspection.

# **END OF SECTION**

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 05 50 00.00 Add - MISCELLANEOUS METALS

# PART 1 GENERAL

## 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, materials, equipment, supervision, and other things necessary to provide all miscellaneous metal work, including but not limited to: Pipe Sleeves, Angle Frames for manholes, inlets, vaults, trenches or other openings, Expansion Joint Armoring, Floor Plates, Mooring Devices and other Metal Constructions of a nature similar to those above as described and specified herein and as shown on the Drawings, or otherwise required to complete the work.

## 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities

SECTION 35 31 16.20 Add – Steel Sheet Pile Bulkhead

SECTION 05 12 00.00 Add – Structural Steel Framing

SECTION 09 96 56.01 Add – Epoxy Coatings – Coal Tar

#### 1.3 REFERENCES

- A. ASTM International Publications, latest editions:
  - ASTM A-36 Standard Specification for Carbon Structural Steel
  - ASTM A-53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
  - ASTM A-123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Product
  - ASTM A-148 Standard Specification for Steel Castings, High Strength, for Structural Purposes
  - ASTM A-153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - ASTM A-240 Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
  - ASTM A-269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
  - ASTM A-276 Standard Specification for Stainless Steel Bars and Shapes
  - ASTM A-283 Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
  - ASTM A-307 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

MISCELLANEOUS METALS

- ASTM A-434 Standard Specification for Steel Bars, Alloy, Hot-Wrought or Cold-Finished, Quenched and Tempered
- ASTM A-489 Standard Specification for Carbon Steel Lifting Eyes
- ASTM A-501 Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
- ASTM A-511 Standard Specification for Seamless Stainless-Steel Mechanical Tubing
- ASTM A-653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- ASTM F-593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- ASTM F-594 Standard Specification for Stainless Steel Nuts
- B. American Society of Mechanical Engineers (ASME) Publications, latest editions:
  - B18.21.1 Lock Washers (Inch Series)
  - B18.22.1 Plain Washers
- C. American Welding Society (AWS) Designation
  - A 5.1 Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding

## 1.4 SUBMITTALS

- A. Product Data and shop drawings for: Steel, pipes, plates, shapes, tubing, bars, bolts, rods and nuts, electrodes, sleeves, and anchors.
- B. Samples
- 1.5 HANDLING AND STORAGE

NOT USED

## PART 2 PRODUCTS

2.1 CARBON STEEL

Steel shapes, plates and rods shall comply with the Standard Specifications for Carbon Structural Steel, ASTM A-36, unless otherwise noted on drawings

No carbon steel shapes, plates, pipe, tubing, bars, or rods shall be used in work governed by this Technical Specification that has become rusted and pitted to a degree more severe than that defined by "Pictorial Surface Preparation Standards for Painting Steel Structures" (Designation SSPC-Vis-1 of the Steel Structures Painting Council) as Condition "B". When the surface is more severely corroded than that defined as Condition "B", the Inspector may require a higher grade of surface preparation than is set out herein or in 1.2 Related Sections prior to applying shop coating.

#### 2.2 ARC-WELDING ELECTRODES

Electrodes for arc-welding structural steel plates and shapes shall conform to the requirements of Specification for Mild Steel Arc-Welding Electrodes AWS Specification A5.1 for E6010, E6011, or E6012 electrodes, and shall be suitable for the positions of the welds and the type and polarity of the current used. For A-36 steel one inch or more in thickness, only the E70 series of electrodes shall be used.

TECHNICAL SPECIFICATION Date: December 2020

05 50 00.00 Add Page 2 MISCELLANEOUS METALS

Electrodes for welding stainless steel shall conform to the requirements of Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Covered Welding Electrodes, AWS Specifications A5.4 Class E308L rods will be used for welding stainless steel to stainless steel. Class E309 rods shall be used to weld stainless steel to carbon steel. Welding rods shall be suitable for the position of the weld and the type and polarity of current used.

2.3 SHOP PAINT

Coating to be applied under these specifications shall be as specified in Sections found in Division 9.

2.4 OTHER MISCELLANEOUS METALS

Miscellaneous metals not specified herein shall be furnished to details shown on the Drawings and to the provisions of the Related Sections.

# 2.5 GALVANIZING

- A. Cast iron, malleable iron, and cast steel parts, all rolled, pressed or forged articles, and all rods, nuts, bolts, washers, rivets and similar items required to be galvanized, shall be coated in accordance with Standard Specification for Zinc Coating (Hot-Dip Galvanized) on Iron and Steel Hardware (ASTM A-153).
- B. Fabricated welded construction of rolled, pressed, or forged steel shapes, plates, bars or sheets, including steel gratings, when required to be galvanized shall be coated after fabrication is complete in accordance with Standard Specifications for Zinc Coatings (Hot-Dipped Galvanized) on Iron and Steel Products (ASTM A-123).
- C. All galvanized surfaces that have become damaged during shipping, handling, erection, or installation, or that have been burned by welding or flame-cutting, or damaged in any other way, shall be repaired with a cold-applied galvanizing compound conforming to this Section applied in strict compliance with the manufacturer's specifications.

# PART 3 EXECUTION

- 3.1 FABRICATION
  - A. Workmanship:

All cuts shall be sheared or flame-cut with automatic, guided equipment. Edges cut with a hand torch shall be ground neat, smooth, and straight. All edges shall be ground free of sharp edges, burrs, and weld splatters. All fits shall be accurate.

B. Bolt Holes:

Bolt holes shall be punched, drilled, or sub-punched and reamed. If holes are flame-cut they shall be burned undersize and reamed to correct size.

C. Welding:

All welding shall be performed in accordance with the provisions of Code for Welding in Building Construction (AWS Designation D1.1). Multipass welds for stainless steel shall be chipped or ground completely free of slag between passes. All welds shall be of uniform quality. Butt welds shall be continuous. Edges of faying surfaces of lapped joints shall be continuously seal welded in addition to welding required for strength.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 09 96 56.01 Add - EPOXY COATINGS - COAL TAR

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing and the application of a two-component polyamide coal tar epoxy coating to steel surfaces as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std - Measurement of Quantities

SECTION 05 50 00.00 Mod – Miscellaneous Metals

SECTION 31 62 18 Add - Steel Pipe Piles

SECTION 35 31 16.20 Add - Steel Sheet Pile Bulkhead

# 1.3 REFERENCES

A. National Association of Corrosion Engineers

SP0188-2006-SG Discontinuity (Holiday) Testing of New Protective Coatings on Conducive Substrates

B. The Society for Protective Coatings (SSPC) Publications, latest edition:

SSPC 16	Coal Tar Epoxy Polyamide Black (or Dark Red) Coating
SSPC SP-10	Near White Blast Cleaning
SSPC Vis-1	Guide and Reference Photographs for steel surfaces Prepared by Abrasive Blast Cleaning

# 1.4 SUBMITTALS

- A. Product Data for: Coatings with certified affidavit attesting SSPC Paint No.16.
- B. Material Safety Data Sheets (MSDS)
- 1.5 HANDLING AND STORAGE
  - A. All material shall be delivered to the point of application in unopened factory containers with labels intact and shall be accompanied by the manufacturer's instruction for use. Any material found to not comply with these Specifications shall be removed from the job site immediately after notification by the Chief Construction Manager.
  - B. All coating materials shall be stored as required to protect them from the weather. Exposure to heat or cold in excess of that recommended by the manufacturer shall be cause for rejection. The coating shall be stored in areas complying with City, County, State and Federal safety codes for flammable materials.

09 96 56.01 Add Page 1 dry

# PART 2 PRODUCTS

- 2.1 MATERIAL
  - A. Color shall be black unless red is approved by the Chief Construction Manager.
  - C. The coating shall consist of a two-component polyamide cured coal tar epoxy conforming to The Society of Protective Coatings Specification No. 16 – latest ed., formulated with Type 1 coal tar pitch. The coating manufacturer shall furnish a certified affidavit attesting that his products conforms to SSPC Paint No. 16 – latest ed., specifications. The Inspector reserves the right to take samples and perform tests as required to establish the quality of the coating materials (see Paragraph titled "Material Testing" of the General Conditions). The sample shall be a complete unopened kit selected at random and furnished at the Contractor's expense.

# PART 3 EXECUTION

## 3.1 GENERAL

The manufacturer shall furnish the services of one of his representatives who is qualified with the application of the material and who shall be on call while coating is applied to advise the Contractor and the Chief Construction Manager concerning the preparation of surfaces and the application of coating.

## 3.2 SURFACE PREPARATION:

All surfaces to be coated shall be solvent cleaned to remove all grease, dirt or wax and shall be blast-cleaned in accordance with the Society for Protective Coatings Specification SP-10 – latest ed., (near-white blast). All rust, burrs, mill scale and welding slag and splatter shall be removed. Sharp irregular protuberances of weld metal and irregular edges and burrs on flame-out or sheared pieces shall be ground smooth. Blast cleaning shall extend six inches beyond the area to be coated and shall be continuous on the entire circumference or perimeter of the member. The type and size of abrasive shall be grit or a mixture of grit with not more than fifteen percent of steel shot. If used grit is reclaimed, all makeup shall consist entirely of grit. The air supply system for blast cleaning shall be provided with means for removing all entrained moisture before air reaches the nozzle.

All work blast cleaned in any day shall be coated the same day before the atmospheric temperature drops to within 5 degrees above the dew point. Any blast-cleaned areas not coated on the same day as cleaned shall be whip-blast cleaned to remove rust bloom. All surfaces shall be completely free of moisture, dirt, sand, grit, oil, grease, or other contaminants at the time coating is applied. Oil or grease smudges shall be removed by cleaning with a solvent complying with the coating manufacturer's recommendation.

Blast cleaning of each piece to be coated shall be inspected and approved by the Chief Construction Manager before any coating is applied. The coating contractor shall schedule his work and notify the Chief Construction Manager in adequate time so that arrangements can be made for inspection. Safe access to all areas to be inspected, shall be provided by the Contractor.

All cleaning shall be performed so that dust or other contaminants do not fall on uncured painted surfaces. Surfaces not to be painted shall be protected from the effects of cleaning or painting operations.

## 3.3 MIXING OF COATING

The two components shall be mixed strictly in accordance with the manufacturer's instructions and only in quantities that will be used within the mixed materials pot-life. No additives shall be used to extend the pot-life except as may be specifically set out in the manufacturer's instructions. Mixed materials not used within the pot-life shall be discarded. No thinner shall be used without prior approval by the Chief Construction Manager. Thinner, if used, shall be that specified by the manufacturer of the coating. Except when specifically waived in writing by the Chief Construction Manager, all mixing shall be done in the presence of the Chief Construction Manager.

# 3.4 AIRLESS SPRAY EQUIPMENT

The coating shall be applied with the "airless spray" method using Grayco or equal airless spray equipment which has a minimum ratio of fluid pressure to air pressure of 30:1. Hose shall be aromatic solvent resistant nylon or "Teflon". Tips shall be selected to produce a uniform coating of the thickness required by these specifications, free of pinholes, and without running, curtaining or sagging.

Equipment shall be completely clean and free of any other coating material and shall be thoroughly cleaned after each use, using a solvent that will remove the specified coating from the equipment. When resuming operations, sufficient coating materials shall be pumped through the system so that any residual solvent will be completely removed before applying coating.

## 3.5 APPLICATION OF COATING

The surfaces to be coated shall be sandblasted, dry and free of dust, burrs, grit, sand, dirt, rust, mill scale, welding slag, splatter, oil, grease, or other contaminants at the time coating is applied. No coating shall be applied when the air temperature is under 50 degrees F. or when the temperature is less than 5 degrees F. above the dew point.

The coal tar-epoxy shall be applied in a minimum of two uniform coats of eight to ten mil dry film thicknesses to produce not less than a total of 16 mils (0.016 inch) or more than 20 mils of dry film thickness for the system.

All areas not easily accessible by spray equipment such as sharp edges, interlocks, drilled holes, welds, cracks, crevices, rivets, bolts and nuts, may be pre-coated by brush or other suitable means approved by the Chief Construction Manager.

Where feasible, the entire area shall be coated as one continuous operation applying the first coat and following with the second coat approximately one hour later. In the case of steel sheet piling, H piles and steel pipe piles that are to receive welded attachments or joints after being driven, coating shall be interrupted for at least one foot each way from such welding or at least two feet from any flame cutting that may be required. The uncoated areas shall be coated if required, after welding is complete. The edge of the first phase coating shall be feather-edged for at least one foot. Just prior to applying the second phase of coating, the first phase shall be lightly blasted, lightly sanded or hand-wire brushed to produce a tooth and shall be wiped generously with methyl isobutyl ketone (MIBK).

## 3.6 APPEARANCE

The finished coating shall be smooth, glossy, free of sharp protuberances, and shall be free of pin holes. Minor sags, dimpling or curtaining that does not exceed two percent of the entire surface of a pile or other element, will be allowed provided they do not present sharp edges. Protuberances and sharp edges shall be cut off carefully with sharp wood chisel laid flat against the surface. The zones from which excess has been removed shall be sanded or hand wire-brushed, lightly wiped with MIBK and re-coated to a smooth surface.

# 3.7 INSPECTION

Only after the Contractor has made his own thorough inspection and is satisfied that he has performed the work in accordance with the specifications, shall he request an inspection.

Surface preparation of each piece of material to be coated shall be inspected and approved by the Chief Construction Manager prior to the application of coating. The quality of surface preparation will be determined by comparison with Pictorial Surfaces Preparation Standards for Painting Steel Surfaces (The Society for Protective Coatings Designation SSPC-Vis-1). Inspection for thickness and coating will be by means of a magnetic dry film thickness gauge; and inspection for pin holes and holidays will be made with non-destructive electrical equipment.

All areas having insufficient thickness of coating shall be recoated to the required thickness, and all areas containing pinholes shall be over-coated sufficiently to close these imperfections. When more than five such areas are found on any one piece, the Chief Construction Manager may require the entire piece to be over-coated.

All areas to be over-coated shall be lightly blasted or hand-wire brushed lightly and wiped with MIBK before applying additional material.

Hand wire brushing will only be permitted in the first 48 hours after application.

# 3.8 HANDLING OF COATED MATERIAL

Coated material shall be handled carefully with slings that will not mar the coating. All areas marred in handling, shipping, erecting, welding or pile-driving shall be recoated as soon as possible after they are discovered, using the techniques set out in this specification.

Coated pieces shall be shipped and stored with padded dunnage separating pieces and with pads under tie down chains or straps. Coated material shall be stacked during delivery and storage so as to protect the coatings.

The Contractor is required to paint one-foot markings on the piles. No markings shall be made on members with lead-based paints, grease crayon or other material incompatible with the coating. If marking is necessary, coal tar enamel or stamp markings shall be used.

Surfaces coated with coal tar-epoxy shall not be immersed in water until the coating has cured for at least 72 hours. Piling coated with coal tar epoxy shall not be driven until the coating has cured for at least seven days.

## 3.9 COATING CONTAMINATION

The Contractor shall take precautions to prevent contamination of the coating. Contaminated coating shall be cause for rejection and shall be removed and recoated at no cost to the PHA.

# 3.10 DAMAGE AVOIDANCE PRECAUTIONS

The Contractor shall take all precautions to control overspray and shall be liable for all damage incurred.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – SEGMENT 3 DREDGING

## SECTION 31 05 19.13 Add - GEOTEXTILES FOR EARTHWORK

## PART 1 – GENERAL

## 1.1 DESCRIPTION OF WORK

Work includes furnishing materials, labor, and equipment for the installation of geotextile filter fabric beneath the graded riprap (GRR) used to construct the shoreline protection in accordance with these Specifications and applicable Drawings.

## 1.2 RELATED SECTIONS

Section 01 25 00 Add– Measurement and Basis of Payment Section 35 20 00 Add - Construction Surveying Section 35 31 19 Add - Revetment

## 1.3 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American Society for Testing and Materials (ASTM) Publications
- D 4354 Standard Practice for Sampling Geosynthetics for Testing
- D 4355 Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light (Xenon-Arc Type Apparatus)
- D 4533 Standard Test Method for Trapezoidal Tearing Strength of Geotextiles
- D 4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
- D 4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile
- D 4759 Standard Practice for Determining the Specification Conformance of Geosynthetics
- D 4884 Standard Test Method for Seam Strength of Sewn Geotextiles
- D 6241 Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

## 1.4 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only.

- 1. Manufacturer's Product Data (Paragraph 2.1, C)
- 2. Manufacturer's Installation Instructions (Paragraph 3.3, C)
- 3. Certified Test Reports (Paragraph 2.1, D), E

- 4. Sewn Seam Details and Laboratory Test Reports (Paragraph 2. 1, E), E
- 5. Initial Survey (Paragraph 3. 2), E
- 1.5 DELIVERY, STORAGE AND HANDLING OF MATERIALS

Materials delivered to the site shall be inspected for damage, unloaded, and stored with the minimum of handling. Materials shall not be stored directly on the ground without a fabric or plastic liner beneath and shall be kept free of dirt and debris.

# PART 2 – PRODUCTS

- 2.1 GEOTEXTILE FILTER FABRIC
  - A. Filter Fabric: Filter fabric shall be pervious nonwoven sheet, consisting of long-chain synthetic polymers composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. Sheets shall be formed into a stable network such that filaments or yarns retain their relative position to each other. Sheets shall be inert to chemicals commonly encountered in natural water, the soil conditions encountered at the site, and UV stabilized. The edges of sheets shall be selvedged or otherwise finished to prevent outer filaments or yarns from pulling away from the sheet. Geotextile fabric shall be free from defects or tears.
  - B. Physical Properties: Conformance of filter fabric shall be in accordance with ASTM D 4759. Filter fabric shall be sampled in accordance with ASTM D 4354 and tested to verify the following minimum physical properties and requirements as shown in Table 1:

Table 1. Filter Fabric Properties					
Physical Properties	Unit	Test Method	Measure		
Apparent Opening Size	U.S. Sieve	ASTM D 4751	#100		
Grab Tensile Strength	lb	ASTM D 4632	250 min.		
Tensile Elongation	%	ASTM D 4632	50 (max.)		
CBR Puncture Strength	lb	ASTM D 6241	625 min.		
Trapezoidal Tear Strength	lb	ASTM D 4533	100 min.		
Ultraviolet Resistance (500 Hours)	%	ASTM D 4355	70 min.		

- C. Acceptable Products: The following products may be used for geotextile filter fabric:
  - 1. US Fabrics 250NW
  - 2. Mirafi 1100N
  - 3. Mirafi FW 404
  - 4. Propex Geotex 1001

Listing of specific manufacturer's products shall not be construed as product approval without certified tests. Actual physical properties of the products furnished must conform to the minimum physical properties specified under paragraph 2.1, B. In addition to the minimum physical properties listed, other properties (such as fabric weight and weave type) shall be

considered by the manufacturer in providing a product that is appropriate for the native material, method of installation, and method of GRR placement for the proper functioning of the filter.

- D. Certified Test Reports: Submit manufacturer's certified test results to the Engineer showing actual test values of the filter fabric physical properties. Certified test results shall be for tests performed within one year prior to the Notice to Proceed.
- E. Sewn Seams: Submit details for sewn seams if sewn seams are planned. Details shall address, but not be limited to, thread type, thread tension (sewing device), stitch density and type, overlap, and number of rows and type of chainstitch. Also submit laboratory test reports evaluating the load-transfer capability of the proposed seams in accordance with ASTM D 4884.

## PART 3 – EXECUTION

## 3.1 SUBGRADE PREPARATION

The surface to receive the geotextile filter fabric shall be prepared by locating and removing obstructions or debris.

## 3.2 INITIAL SURVEY

Lines and grade of graded riprap (GRR) subgrade shall be surveyed by the Contractor and submitted to the Engineer prior to placement of geotextile fabric. Refer to Section 35 00 01, Construction Surveying.

# 3.3 GEOTEXTILE FILTER FABRIC

- A. General: Geotextile fabric shall be placed over the prepared subgrade as indicated on the drawings.
- B. Protection: Work shall be sequenced so that geotextile filter fabric are not exposed more than 7 days from the time rolls are removed from their protective covering and are fully covered by GRR or opaque temporary coverings. During periods of shipment and storage, geotextile fabric shall be protected from direct sunlight, ultra-violet rays, and high temperatures and in accordance with any other instructions of the manufacturer. Unpackaged rolls or sheets shall be protected with temporary opaque coverings.
- C. Placement: Geotextile fabric shall be free from defects or tears and placed in accordance with the manufacturer's instructions, but placement method shall meet, as a minimum, the following criteria:
  - 1. Construction equipment and vehicles shall not operate directly on geotextile fabric, unless otherwise permitted by the Engineer.
  - 2. Geotextile fabric sheets shall be loosely laid and conform to surface irregularities so as to minimize tension in the sheets when subsequent stone is placed.
  - 3. Laps between geotextile sheets shall be no less than 3 ft except where specified on the drawings. When used, sewn seams must be pre-approved by Engineer. Sewn seams shall be installed in accordance with manufacturer's recommendations.
  - 4. Geotextile fabric sheets shall not be staked down such that they are taut and subject to significant puncture or tearing during stone placement.
  - 5. Loose staking of geotextile fabric or placement of GRR to tack edges of geotextile fabric prior to loading central portion of breakwater to maintain alignment may be required.
6. Method of GRR placement shall be such that geotextile fabric sheets are not pulled apart at the laps or significantly punctured or torn.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 31 05 21.00 Add – GEOGRID SOIL REINFORCEMENT

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the installation of Geogrid Soil Reinforcement.

1.2 RELATED SECTIONS

SECTION 31 23 00.00 Add - Excavation and Fills

SECTION 31 24 00 Add - Embankment Construction

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. ASTM International Publications, latest revision:

ASTM D4355/D4355M	(2014) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4595	(2017) Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D4873/D4873M	(2017) Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D5262	(2007; R 2016) Standard Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics
ASTM D5321/D5321M	(2020) Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear
ASTM D6637	(2011) Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
ASTM D6706	(2001; R 2013) Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil

B. Geosynthetic Institute (GSI)

GSI GRI GG4a	(2012) Determination of the Long-Term Design Strength of Stiff Geogrids
GSI GRI GG4b	(2012) Determination of the Long-Term Design Strength of Flexible Geogrids
GSI GRI GG6	(1996) Grip Types for Use in Wide Width Testing of Geotextiles and Geogrids

### 1.4 SUBMITTALS

- A. Shop Drawings: Installation.
- B. Product Data: Allowable Strength and Manufacturer.
- C. Samples: Geogrid Reinforcement.
- D. Test Reports: Geogrid Reinforcement, Coefficient of Interaction, Interface Friction Testing

Splices, and Conformance Testing.

E. Certificates: Certificates of Compliance.

# 1.5 QUALITY ASSURANCE

A. Submit a summary of the manufacturer's qualifications and a copy of the manufacturer's quality control (QC) manual a minimum of 7 days prior to delivery of geogrid to the site. The reinforcement manufacturer shall provide a qualified and experienced representative to be available on an as-needed basis during construction. The representative shall visit the site for consultation at least once during construction.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Check products upon delivery to ensure that the proper material has been received and is dry and undamaged. Protect the materials from damage and exposure following the guidelines presented in ASTM D4873/D4873M.
  - 1. Labeling
    - a. Label each roll with the manufacturer's name, product identification, roll dimensions, lot number, and date manufactured.
  - 2. Handling
    - a. Handle and unload geogrid rolls by hand, or with load carrying straps, a forklift with a stinger bar, or an axial bar assembly. Geosynthetic rolls shall not be dragged, lifted by one end, lifted by cables or chains, or dropped to the ground.
  - 3. Storage
    - a. Protect geogrid from deleterious materials, chemicals, sparks and flames, temperatures in excess of 160 degrees F, and any other environmental condition that may degrade the physical properties. If stored outdoors, the rolls shall be elevated from the ground surface. Protect geogrids, except for extruded grids, with an opaque waterproof cover.

# PART 2 PRODUCTS

#### 2.1 GEOGRID REINFORCEMENT

Submit one properly identified 24 by 24 inches minimum size geogrid sample with the fasteners proposed for use. Provide a geogrid that is a geosynthetic manufactured for reinforcement applications and a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials.

- A. Submit manufacturer's certified raw and roll material test reports including ultimate strength performed in accordance with ASTM D6637 or ASTM D4595 (modified). Test results not meeting the requirements in Table 1 or in the approved Manufacturer's Quality Control Manual will result in rejection of applicable rolls. Provide certified test reports a minimum of 7 days prior to delivery of geogrid to the site.
- B. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. The geogrid shall be manufactured with 100 percent virgin resin consisting of polyethylene, polypropylene, polyester, or other approved material and with a maximum of 5 percent in-plant regrind material. Polyester resin shall have a minimum molecular weight of 25,000 and a carboxyl end group number less than 30. Polyethylene and polypropylene shall be stabilized with long term antioxidants.
- C. Submit Certificates of Compliance for the materials provided and results of conformance testing. Submit an affidavit certifying raw and roll material test results submitted are accurate and that the reinforcement meets the requirements of the project specifications. The affidavit shall be signed by an official authorized to certify on behalf of the manufacturer. If the affidavit is dated after award of the contract and/or is not specific to the project, the supplier shall attach a statement certifying that the affidavit addressed to the wholesale company is representative of the material supplied. The documents shall include a statement confirming that all purchased resin used to produce reinforcement is virgin resin. Provide affidavit a minimum of 7 days prior to delivery of geogrid to the site.
  - 1. Geogrid Reinforcement Properties
    - a. The reinforcement shown on the contract drawings shall meet the property requirements listed in Table 1. Reinforcement strength requirements represent minimum average roll values in the machine direction.

TABLE 1			
PROPERTY	REQUIREMENT	TEST DESIGNATION	
Allowable Strength (Ta) at 10 percent strain	800 lb/foot	GSI GRI GG4a or GSI GRI GG4b	
UV Resistance	90 percent after 500 hours	ASTM D4355/D4355M	
Coefficient of Interaction* for Pullout	0.85	ASTM D6706	

\*Submit the coefficient of interaction for pull-out resistance of the proposed geogrid in a soil of similar gradation and texture to the material that will be used for fill in the reinforced zone. Establish the coefficient of interaction in accordance with ASTM D6706. Provide certified test results a minimum of 7 days prior to delivery of geogrid to the site.

- 2. Allowable Strength
  - a. Submit Geogrid allowable strength calculated in accordance with GSI GRI GG4a or GSI GRI GG4b. The calculations shall itemize each reduction factor. Account for splice

efficiency in the calculations. Provide calculations a minimum of 7 days prior to delivery of geogrid to the site. Allowable strength is based on reduction factors for installation damage, durability, and creep that are applicable to site specific conditions. Determine reduction factors in accordance with the test procedures documented in GSI GRI GG4a or GSI GRI GG4b. The minimum reduction factor for durability shall be 1.1 for polyethylene and polypropylene geogrids and 1.15 for coated polyester geogrids. The minimum reduction factor for creep shall be based on testing performed in accordance with ASTM D5262 at the strain specified in Table 1.

# 2.2 SPLICES

A. Splices shall consist of a standard method or device recommended by the manufacturer of the geogrid. Splices will not be allowed unless identified on the approved layout drawings. Splices shall be at least 75 percent efficient. Demonstrate the splice efficiency through tests performed in accordance with GSI GRI GG4a or GSI GRI GG4b. Splicing may consist of overlaps, fusion wedge welding, sewing, or bodkin connections. Splicing methods that are dependent on installer experience and skill level, such as hot air and torch-applied open flame, are not acceptable. Construct overlap splices by placing a minimum of 2 inches of soil between the layers of geogrid.

# PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Submit Geogrid layout plan along with anchorage and joint details, sequencing and construction procedures, a minimum of 7 days prior to geogrid placement.
  - 1. Subgrade Preparation
    - a. Immediately prior to placement of the geogrid, the surface on which the geogrid will be placed shall be free of rock and other material that could damage the geogrid or the underlying geosynthetics.
    - b. Subgrade which falls within the interior of the Dredge Material Placement Area that is excessively wet, shall have unacceptable material excavated and replaced with compacted fill material.
- B. Anchor Trench
  - Place the anchor trench a minimum of 24 inches back from the edge of the slope to be covered. The anchor trench shall be a minimum of 24 inches deep and 24 inches wide. Remove ponded water from the anchor trench while the trench is open. Trench corners shall be rounded to avoid sharp bends in the geogrid. Remove loose soil, rocks larger than 2 inches in diameter, and any other material which could reduce the effectiveness of the geogrid from the surfaces of the trench. Extend the geogrid down the front wall and across the bottom of the anchor trench. Perform backfilling and compaction of the anchor trench in accordance with Section 31 23 00.00 Add - Excavation and Fills and Section 31 24 00 Add - Embankment Construction.
- C. Placement
  - 1. Install the geogrid in accordance with the Manufacturer's recommendations. Unroll the geogrid in the direction of reinforcement. After a layer of geogrid has been placed, use suitable means, that do not damage the underlying geosynthetics, to hold the geogrid flat and in place until cover soil can be placed. Geogrid damaged during placement and covering shall be removed and replaced at no additional cost to the Government.

- D. Overlaps and Fasteners
  - 1. Adjacent rolls of geogrid shall be positioned edge-to-edge and loosely fastened to maintain alignment during fill placement. Adjacent rolls shall not be overlapped. Use fastener type and spacing as recommended by the manufacturer and approved by the Contracting Officer. Metallic fasteners will not be allowed.
- E. Splices
  - Submit test data showing splice efficiency. Provide certified test results a minimum of 7 days prior to delivery of geogrid to the site. Locate splices, if allowed, within the bottom one-third of the slope. Limit splicing to only one splice per reinforcing strip and no two consecutive reinforcing strips shall include a splice. Individual reinforcing lengths less than 10 feet shall not be used. Splices in geogrid reinforcement shall be pulled and held taut during cover soil placement.
- F. Penetrations
  - 1. For small penetrations through geogrids, only transverse members of the geogrid shall be cut. The load-carrying longitudinal (machine direction) members shall be spread around the penetration. For larger penetrations, additional geogrid shall be placed on each side of the penetration and spliced to the adjacent geogrid to compensate for any longitudinal tensile members that must be cut.

# 3.2 COVER SOIL PLACEMENT

A. Cover geogrid with soil within 5 calendar days of acceptance. Keep the geogrid smooth and taut during placement of cover materials. Cover soil shall not be dropped onto the geogrid from a height greater than 3 feet. The soil shall be pushed out over the geogrid in an upward tumbling motion. Place soil from the bottom of the slope upward. The initial loose soil lift thickness shall be 12 inches. Use equipment with ground pressures less than 7 psi to place the first lift over the geogrid. A minimum of 18 inches of soil shall be maintained between construction equipment with ground pressures greater than 7 psi and the geogrid. Equipment placing cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 5 mph. Additional cover soil material and placement requirements are described in Section 31 23 00.00 Add - Excavation and Fills and Section 31 24 00 Add - Embankment Construction.

# 3.3 OVERSIGHT

A. QA Representative(s) shall be present at all times during geogrid installation.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 31 11 00.00 Add - CLEARING AND GRUBBING

# PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this section includes, the Clearing and Grubbing of existing terrain as described and specified herein and as shown on the drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 31 23 00.00 Add - Excavation and Fills

SECTION 31 24 00 Add - Embankment Construction

#### 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### A. U.S. DEPARTMENT OF DEFENSE (DOD)

DODI 4150.07 (2019) DOD Pest Management Program

#### 1.4 SUBMITTALS

- A. Preconstruction Submittals: Herbicide Application Plan.
- B. Product Data: Tree Wound Paint and Herbicides.
- C. Certificates: Qualifications.
- D. Closeout Submittals: Pest Management Report.

#### 1.5 QUALITY CONTROL

- A. Regulatory Requirements
  - Comply with DODI 4150.07 for requirements on Contractor's licensing, certification, and record keeping. Maintain daily records using the Pest Management Maintenance Record, DD Form 1532-1, or a computer-generated equivalent. These forms may be obtained from the main web site: <u>http://www.dtic.mil/whs/directives/forms/eforms/dd1532-1.pdf</u>

- B. Qualifications
  - 1. For the application of herbicides, use the services of an applicator who is commercially certified in the state where the work is to be performed as required by DODI 4150.07. Submit a copy of the pesticide applicator certificates.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the site, and handle in a manner which will maintain the materials in their original manufactured or fabricated condition until ready for use.
  - 1 Storage
    - a. Storage of herbicides on the site will not be permitted unless it is written into the contract.
  - 2 Handling
    - a. Handle herbicides in accordance with the manufacturer's label and Safety Data Sheet (SDS), preventing contamination by dirt, water, and organic material. Protect herbicides from weather elements as recommended by the manufacturer's label and SDS. Spill kits must be maintained on herbicide control vehicles. Mixing of herbicides on the site will not be permitted unless it is written into the contract.

# PART 2 PRODUCTS

- 2.1 MATERIALS
  - A. Tree Wound Paint
    - 1. Use bituminous based paint from standard manufacture specially formulated for tree wounds.
  - B. Herbicide
    - 1. Provide herbicides currently registered by the EPA or approved for such use by the appropriate agency of the host county and approved by the Contracting Officer. Select an herbicide that is suitable for the climatic conditions at the project site. Submit manufacturer's label and SDS for herbicides proposed for use.

#### PART 3 EXECUTION

- 3.1 PREPARATION
  - A. Herbicide Application Plan
    - Prior to commencing application of herbicide, submit an herbicide application plan with proposed sequence of treatment work including dates and times of application. Include the herbicide trade name, EPA registration number, chemical composition, formulation, application rate of active ingredients, method of application, area or volume treated, and amount applied. Include a copy of the pesticide applicator certificates.
  - B. Protection
    - 1. Roads and Walks
      - a. Keep roads and walks free of dirt and debris at all times.
    - 2. Utility Lines
      - a. Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing

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utility line. The Contractor is responsible for the repair of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed are encountered within the area of operations, notify the Contracting Officer in ample time to minimize interruption of the service. Refer to Section 01 16 60 ENVIRONMENTAL PROTECTION MEASURES for additional utility protection.

# 3.2 APPLICATION

- A. Herbicide Application
  - 1. Adhere to safety precautions as recommended by the manufacturer concerning handling and application of the herbicide.
  - 2. Clean Up, Disposal, And Protection
    - a. Once application has been completed, proceed with clean up and protection of the site without delay. Clean the site of all material associated with the treatment measures, according to label instructions, and as indicated. Remove and dispose of excess and waste material off Government property.
    - b. Disposal of Herbicide
      - 1) Dispose of residual herbicides and containers off Government property, and in accordance with the approved disposal plan, label instructions and EPA requirements.

# 3.3 CLEARING

- A. Clearing consists of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within the areas to be cleared. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except such trees and vegetation as may be indicated or directed to be left standing. Trim dead branches 1-1/2 inches or more in diameter on trees designated to be left standing within the cleared areas and trim all branches to the heights indicated or directed. Neatly cut close to the bole of the tree or main branches, limbs and branches to be trimmed. Paint, with an approved tree-wound paint, cuts more than 1-1/2 inches in diameter. Apply herbicide in accordance with the manufacturer's label to the top surface of stumps designated not to be removed.
  - 1. Tree Removal

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work includes the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Dispose of trees as specified in paragraph DISPOSAL OF MATERIALS.

2. Pruning

[Prune] [Trim] trees designated to be left standing within the cleared areas of dead branches 1-1/2 inches or more in diameter; and trim branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/4 inches in diameter with an approved tree wound paint.

3. Grubbing

Grubbing consists of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Remove material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation

purposes, to a depth of not less than 18 inches below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Fill depressions made by grubbing with suitable material and compact to make the surface conform with the original adjacent surface of the ground.

### 3.4 DISPOSAL OF MATERIALS

- A. Dispose of excess materials in accordance with the approved solid waste management permit and include those materials in the solid waste management report.
- B. All wood or wood like materials, remaining from clearing, pruning or grubbing such as limbs, treetops, roots, stumps, logs, rotten wood, and other similar materials shall become the property of the Contractor and disposed of as specified.

# 3.5 CLOSEOUT ACTIVITIES

A. Herbicides

Upon completion of this work, submit the Pest Management Report DD Form 1532, or an equivalent computer product, to the Integrated Pest Management Coordinator. This form identifies the type of operation, brand name and manufacturer of herbicide, formulation, concentration or rate of application used.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 31 23 00.00 Add - EXCAVATION AND FILL

# PART 1 GENERAL

# 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; all clearing and grubbing and all excavating, filling, backfilling, grading and compacting of soils for preparation of subgrade for pavement and railroad trackage and for preparation of other soil areas as described and specified herein and as shown on the Drawings.

Drilled shafts, lime or cement stabilization of subgrade, cement stabilized sand fill, flowable fill, and trenching and backfill for sewers, water lines and other underground utilities, clearing and grubbing, topsoil, hydromulching and sodding are not included in this Section.

Preparation of subgrade and other designated areas shall include the excavation, loading, hauling, dumping and spreading of soil; undercutting to remove unstable soil areas; compacting existing soil surfaces, and bottom of excavated areas to receive fills and backfills; compacting excavated areas for subgrade; placing and compacting soil in fills and backfills; pumping and other acceptable means to de-water areas of proposed grading and/or excavation to keep excavated areas dry; finish grading for subgrades and other designated soil areas; disposing of unsuitable and excess excavated material; and all work incidental to such work, all as shown on the Drawings and specified herein.

#### 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std - Measurement of Quantities

### 1.3 REFERENCES

ASTM International Publications, latest editions:

ASTM D-422	Standard Test Method for Particle Size Analysis of Soils
ASTM D-698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
ASTM D-1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lbf/ft3 (2,700 kN m/m3))
ASTM D-2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

**EXCAVATION AND FILL** 

# 1.4 SUBMITTALS

- A. Test Data for Fill Material: Proctor, Atterberg Limits, Gradation, Soil Classification.
- B. Topographic Surveys: Topographic surveys before and after construction, with calculations, to establish final quantities for payment, in the medium or software designated in the contract documents.
- C. Borrow Sources: Location, extent, quantity and planned depth of each on-site borrow source. For off-site borrow sources, submit site name, location, and contact information.
- D. Where shoring is required due to depth of excavation: Shoring Plan, certified by a Texas registered professional engineer, describing the methods for shoring of excavations.
- E. Where water levels will impact excavation operations: Dewatering Plan.

#### 1.5 HANDLING AND STORAGE

Refer to the General Conditions.

# PART 2 PRODUCTS

# 2.1 COMMON FILL

Common fill for areas that do not require compaction shall be free of organic matter such as roots and other vegetable matter subject to decay and any other material which would affect the stability of the fill. Fill may be obtained from the areas indicated on the plans or from borrow sources approved by the Chief Construction Manager.

#### 2.2 COMPACTED FILL OR BACKFILL

Soil classification GW, GP, SW, or SP, free of organic matter such as roots and other vegetable matter subject to decay and any other material which would affect the stability of the fill, and shall have the following characteristics:

Plasticity Index - Between 25 and 35(unmodified) (ASTM D-4318)

2.3 TOPSOIL

Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 1", brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

#### PART 3 EXECUTION

#### 3.1 USE AND MAINTENANCE OF ROADS

The Contractor shall conduct its grading and hauling operations in an orderly and safe manner, and shall protect the traveling public, the operations of the Port Authority and the operations of other contractors. The Contractor's hauling equipment operating on public roads and streets shall comply with the load limit, speed limit, and other Applicable Law. On the property of the Port Authority, the Contractor's hauling operations shall not interfere with the normal operations of the Port Authority's port facilities or with truck and rail traffic to and from such facilities.

The Contractor shall maintain dirt surfaced haul roads used by it and leave them in a condition acceptable to the Chief Construction Manager upon completion of their use. Flexible base surfaced and paved roads used by the Contractor shall be repaired by the Contractor at its expense wherever damaged by Contractor's operations, and Contractor shall restore such roads to the condition existing prior to such damage.

The Contractor shall prevent spillage of earth and other materials being hauled. Where material is spilled on public roads or streets, or on the Port Authority's surfaced and paved roads, the Contractor shall promptly remove such material so as to maintain such roads and streets in a reasonably clean condition.

#### 3.2 CROSSING FENCES

In the event fences must be crossed by the Contractor, such fences shall be opened only as directed by the Chief Construction Manager and be kept closed between passage of traffic except as permitted by the Chief Construction Manager. Upon completion of the work, the fences shall be repaired to their condition existing prior to the beginning of the Contractor's work.

#### 3.3 STRIPPING

Strip suitable topsoil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled or disposed as approved by the Chief Construction Manager.

# 3.4 EXCAVATION

Excavation is defined as the removal of earth, loose rock, gravel, shell, and any other materials encountered in securing the proper subgrade in each area as shown on the Drawings. Excavation shall include the removal of unsuitable materials from the subgrade or existing ground to receive fill and the excavation of drainage ditches, side slopes of cuts, and shoulder areas adjoining subgrades for pavements and railroads.

All excavation will be unclassified as to type.

Only acceptable excavated materials shall be used in making fills and backfills, as required, within the limits of the project.

The Contractor shall remove from pavement and railroad subgrades, from all other areas to be graded, and from areas to receive fill, all muck and spongy or unstable materials which will not consolidate to a depth to be determined by the Chief Construction Manager and refill the space with acceptable material. Backfill material shall be placed in accordance with the requirements for compacted fills and backfills.

If the Contractor for any reason fails to comply with its Standard of Care in excavating and preparing rough grade for compaction and there is a deficiency of earth after compacting of finish subgrade surfaces, then Contractor shall fill such low areas and recompact as directed by Chief Construction Manager without extra compensation.

Excavations shall be made to the cross sections, lines and elevations shown on the Drawings.

#### 3.5 DRAINAGE AND DEWATERING

Provide for the collection and disposal of surface and subsurface water encountered during construction.

#### A. Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish storm drainage to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, dikes, swales, pumps, and other drainage features and equipment as required to maintain dry soils. It is the responsibility of the Contractor to assess the soil and ground water conditions prior to excavation or fill, and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and any other area affecting operations at the site shall be continually and effectively drained.

# B. Dewatering

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of the work. In the event of heavy rain fall or high tides, the surface and groundwater control may necessitate the use of temporary berms, diversion ditches, pumps, and/or other acceptable means. French drains, sumps, ditches or trenches will not be permitted within 3 feet of the foundation of any structure.

# 3.6 COMPACTION OF NATURAL GROUND AND SUBGRADE

# A. Compaction Requirements:

All-natural ground and excavated areas which are to receive compacted embankment shall be compacted to a depth of eight inches (8"). All railroad subgrades shall be compacted to a depth of not less than eight inches (8") for a width of not less than ten feet (10') each side of the center line of each track. All pavement subgrades shall be compacted likewise over the area of such pavement and its sub-base. Shoulders for roadway pavements and other areas, if designated to be compacted on the Drawings or in the Technical Specifications, shall be compacted likewise.

The top six inches (6") of natural ground and cut sections to be compacted within the above limit shall be scarified, wetted or dried to produce optimum moisture content, and compacted to a density of not less than 95 percent of maximum laboratory dry density as determined in accordance with ASTM D-698 (Standard Proctor compaction test). Compaction tests will be performed by the Chief Construction Manager or by a commercial testing laboratory retained and paid for by the Port Authority.

# 3.7 CONSTRUCTION OF COMPACTED FILLS AND BACKFILLS

The hauling, placing and compaction of excavated material for earth embankments, fills or backfills, shall be performed in accordance with Section 31 24 00 Embankment Construction and the following requirements.

The Chief Construction Manager shall be the judge of the suitability or unsuitability of excavated materials for use in fills and backfills. Unsuitable materials shall be disposed of as provided in this specification.

In the event that ground water or natural ground conditions warrant, at the discretion of the Chief Construction Manager, the following techniques may be used to "bridge" the existing material. Semicompacted fill or backfill may be placed from the bottom of the excavation to one foot above the elevation of ground water. Fill or backfill shall be placed in maximum lifts of one foot each (loose measurement) and compacted by crawler tractor or other approved means to obtain the maximum practical density. Bottom of excavation will not require compaction in this event. All compacted fill or backfill called for under these specifications or as shown on the Drawings shall be placed from one foot above groundwater level, from the bottom of the excavation or from natural ground as the case may be, in maximum lifts of 1-foot each (loose measurement). If it is demonstrated that required density is not being achieved throughout the depth of the compacted lift, the maximum allowable loose lift may be reduced to 8-inches. Each layer shall extend across an entire fill or backfill section. Each layer shall be wetted or dried to produce optimum moisture content, and compacted to a density of:

- 1. For subgrade and embankment under proposed pavement or structures, not less than ninetyfive percent of maximum laboratory dry density at +/-3 percent of optimum moisture in accordance with ASTM D-698 (Standard Proctor), including the top layer.
- 2. For embankment and fill areas outside the limit of proposed pavement compacted to a minimum density of ninety percent (95%) of maximum density at +/-3 percent of optimum moisture in accordance with ASTM D 698 (Standard Proctor).

If the material to be compacted contains excessive or insufficient moisture to permit compaction in accordance with the above requirement, the Contractor shall manipulate the material to reduce moisture content or add water to increase moisture content to obtain the specified density. The Chief Construction Manager may test soil for moisture content before compaction, and in the event the soil has less than optimum moisture, or is likely to lose enough moisture prior to completion of compaction to bring the moisture content below optimum, the Contractor shall add water and thoroughly mix the soil layer before compacting.

When necessary to key in the previous layer, the upper surface of each compacted layer of the fill or backfill and the upper surface of ground compacted in place shall be scarified to a depth of one inch (1") just prior to the placing of the succeeding layer of embankment thereon, to provide a blending and interlocking of the adjoining surfaces of the two layers. In areas where the previous compacted layer has compactor roller teeth indentations one-half inch (1/2") to one inch (1") deep and, in the opinion of the Chief Construction Manager, has good anchorage for the next layer, no scarification shall be necessary. The soil shall be placed in layers not greater than eight inches (8") in depth (compacted depth) after each preceding layer has been prepared as described hereinabove.

After the compaction of each layer of soil is completed, density tests will be made by Chief Construction Manager. If the material fails to meet the density specified the course shall be reworked as necessary, at the expense of the Contractor, to obtain the specified density. Subject to the approval of the Chief Construction Manager, the Contractor may alter his compaction method on subsequent work to obtain the specified density.

Compacted strips that are to be left temporarily or overnight may be partially sealed by rolling with pneumatic tire or smooth drum roller to reduce the loss or gain of moisture.

Contractor shall blade-off areas for compaction testing, as requested by the Chief Construction Manager.

#### 3.8 FINISH GRADING

Compacted subgrades and the top surfaces of fills and backfills in areas to receive pavements or railroad tracks or in other areas specified shall be sealed with a pneumatic or smooth drum roller and finished to a smooth surface with a grader blade to the line and grade required.

All grading shall conform to the location, size and elevations shown on the Drawings. Railroad and pavement subgrades shall be graded to the planned elevations so that the thickness of pavement base and pavement and track sub-ballast and ballast will not be less than that shown on the Drawings.

31 23 00.00 Add Page 5 No equipment or hauling shall be permitted on finished subgrades unless approved by the Chief Construction Manager. Any damage caused to such portions of the subgrade by the operations of the Contractor shall be repaired by Contractor at the Contractor's expense.

Should the subgrade, for any reason or cause, lose the required stability, density or finish before the pavement base or railroad sub-ballast is placed, it shall be recompacted and refinished at the expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling and/or sealing.

For pavement only, the subgrade shall be thoroughly wetted down sufficiently in advance of the placing of any base course to insure its being in a firm and moist condition for at least two inches (2") below the surface.

Sufficient subgrade shall be prepared in advance to ensure satisfactory prosecution of the work of placing pavement base or railroad sub-ballast.

#### 3.9 BACKFILL BEHIND CURBS

The space behind curbs or roadway pavements, except areas to be paved, shall be backfilled with selected material and compacted with truck traffic or by other suitable means. The first layer of backfill may be of sufficient depth to permit the use of truck traffic for compacting the material. Succeeding layers shall not exceed eight inches (8") in depth, loose measurement.

Backfill shall be placed above the top of the curbs and finished to the roadway cross sections shown on the Drawings or, if not shown, to a rounded surface to provide drainage of the area behind the curbs.

#### 3.10 DITCHES AND SLOPES

Drainage ditches, including the bottom and side slopes thereof, and the side slopes of cut sections and subgrade for railroads in cut sections beyond ten feet (10') from the center line of any track shall be excavated without undercutting and fine graded to the cross sections, lines and elevation shown on the Drawings. Any of these areas undercut below finish grade shall be backfilled with acceptable material and compacted to a dry density equal to or greater than that of the surrounding undisturbed natural ground. No other compaction will be required for these areas except as may be provided by these Technical Specifications.

The side slopes of embankment fills shall be compacted in each layer of compacted fill from base to top of embankment. The width of embankment layers shall be constructed slightly in excess of the planned width to permit the blading of side slopes to remove the loose edge material, to eliminate irregularities in the sloping surfaces, to complete the embankment to the cross section shown on the Drawings and to insure compaction of the entire fill.

# 3.11 DISPOSAL OF EXCESS MATERIALS

Unless otherwise provided in these Technical Specifications, all unstable excavated materials and all excess unsuitable earthen materials, trash, and debris shall become the property of the Contractor and shall be removed and disposed from Port Authority's premises at the Contractor's expense as per requirements stated in the General Conditions.

#### 3.12 PROTECTION OF EXISTING STRUCTURES

The Contractor will be held responsible for any damage to manholes, inlets, valves, pipes, or other facilities that are caused by him in making the necessary excavation and fills. The Contractor shall repair all such damage at Contractor's expense.

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EXCAVATION AND FILL

### 3.14 PROOF ROLLING

The Contractor shall proof roll earthwork, base or subbase using pneumatic tire rollers, dump trucks or other compaction equipment approved by the Chief Construction Manager. Use equipment that when loaded weighs at least 10 tons. The maximum acceptable load is 50 tons. Material that exhibits rutting or pumping shall be undercut and replaced, at Contractor's expense.

### 3.15 UTILITIES

The Contractor shall be responsible for identifying and locating utilities in the vicinity of the excavation. Contractor shall be responsible for obtaining permits and/or approvals from utility owners to cross and/or excavate or fill in or around utilities or utility rights-of-way. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 31 23 00.02 Add - TOPSOIL

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes requirements for topsoil in support of turf establishment.

1.2 MEASUREMENT AND PAYMENT

SECTION 01 25 00 Add - Measurement and Basis of Payment SECTION 31 11 00.00 Add - Clearing and Grubbing SECTION 31 23 00.00 Add - Excavation and Fills SECTION 31 24 00 Add - Embankment Construction

# 1.3 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only

A. American Association of State Highway and Transportation Officials (AASHTO) Publications

AASHTO T 194 Determination of Organic Matter in Soils by Wet Combustion.

B. American Society for Testing and Materials (ASTM) Publications

ASTM D 422 Particle-Size Analysis of Soils. ASTM D 4972 pH of Soils.

# 1.4 SUBMITTALS

- A. Refer to Section 01 00 50.00 Scope of Work.
- B. For imported topsoil, submit a topsoil analysis and fertilizer and/or amendment recommendations from a Texas certified agronomist for approval. Analysis shall include:
  - 1. Routine Analysis (Macronutrients) NO<sub>3</sub>, P, K, Ca, Mg, Na, pH and conductivity.
  - 2. Micronutrients Zn, Fe, Cu and Mn.
  - 3. Organic matter.
  - 4. Textural analysis.
  - 5. Particle size analysis including hydrometer test.
  - 6. Indicate to the laboratory the type vegetation to be grown, e.g. Bermuda-grass, whether to be irrigated and whether site was previously fertilized. Indicate to the laboratory that fertilizer recommendations are to be based on new establishment of forage using the minimum fertilizer requirement for establishment unless directed otherwise by the Chief

Construction Manager.

- C. Imported topsoil samples.
  - 1. When requested by the Chief Construction Manager, submit sufficient samples of topsoil for additional testing.
  - 2. When additional samples are required, submit samples at least 60 days prior to delivery or placement of topsoil.
  - 3. Supply samples from the same source and stockpile as the topsoil for the project.

# PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Import topsoil or provide from suitable on-site material. Topsoil shall be easily cultivated, free from objectionable material including, gravel, rocks larger than 1" diameter, large roots, stumps, wood, brush, debris, hard clods, clay balls, hardpan, refuse or other deleterious materials and be of reasonably uniform quality.
- B. In the case of on-site or nearby source, topsoil is the surface layer of material containing decaying vegetable matter and fine hair-like roots.
- C. When available topsoil has been depleted, common fill material may be used as topsoil if approved by the Chief Construction Manager.
- D. Imported topsoil shall satisfy the following property values or as directed by the Chief Construction Manager:

	TEST DESCRIPTION	UNIT	VALUE
1.	Soil Reaction	рН	6-8(a)
2.	Passing No. 4 Sieve	%	95-100
3.	Sand Size, 2.0-0.05 mm	%	10-70
4.	Silt Size, 0.05-0.005 mm	%	0-40
5.	Clay Size, <0.005 mm	%	20-50
6.	Easily Oxidized Organic Matter	%	2.5-10(b)

Notes:

- (a) Determine pH by Method A, pH meter. If the imported topsoil does not satisfy the specified pH range, achieve the desired pH by applying soil amendments as recommended by the certified agronomist s report of soil sample analysis.
- (b) Soil testing company shall identify test method used if different than listed under Paragraph 1.3 References. Chief Construction Manager must approve alternate test methods.

# PART 3 EXECUTION

- 3.1 TOPSOIL DELIVERY, STORAGE AND HANDLING
  - A. Deliver, stockpile and handle topsoil in such a way as to not contaminate the material with other soils or objectionable materials.
- 3.2 TOPSOIL EXCAVATION (ON-SITE)
  - A. Strip suitable topsoil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be

stockpiled or disposed as approved by the Chief Construction Manager.

# 3.3 TOPSOIL PLACEMENT

- A. Prior to placing topsoil, the subgrade shall be scarified to a minimum depth of 4 inches for bonding of topsoil with subsoil. The topsoil shall be evenly spread to a minimum depth of 6 inches. Irregularities in finished surfaces shall be corrected to eliminate depressions. Debris and stones larger than 1-inch remaining on the surface after tillage shall be removed. Additional topsoil may be obtained from a local off-site source at no additional cost to the Owner.
- B. Place top elevation of topsoil at the design finish grade elevation shown on the Plans.
- C. Do not spread topsoil when it is excessively wet or dry.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

# SECTION 31 23 16.30 Add - DROP-OUTLET STRUCTURE EXCAVATION, FILLING AND BACKFILLING

### **PART 1 GENERAL**

#### 1.1 DESCRIPTION OF WORK

The work includes furnishing labor, equipment, and other incidentals necessary to perform excavation, stockpiling, structural excavation and backfill for the drop-outlet structures and other incidental work specified.

#### 1.2 RELATED SECTIONS

Section 01 25 00 Add – Measurement and Basis of Payment Section 35 20 30 Add – Drop-Outlet Structure Section 35 41 00 Add – Berm Construction

#### 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Society for Testing and Materials (ASTM) Publications

ASTM C33 Standard Specification for Concrete Aggregates (2018)

# 1.4 SUBMITTALS

A. Construction Plan (Paragraph 3.1.B).

#### 1.5 QUALITY CONTROL

Establish and maintain quality control for excavation operations to assure compliance with specified requirements, and maintain records of quality control for construction operations including but not limited to the following:

- 1. Equipment: Type, size, and suitability for construction of the prescribed work.
- 2. Structural Evaluation: Check grade, slopes, and dimensions for compliance with design sections.
- 3. Tolerances: Check fills to determine if placement conforms to prescribed grade and design section.
- 4. Construction: Layout, maintaining existing drainage, moisture control, thickness of layers, spreading and compacting.
- 5. Soil: Classification of soils, placing and compacting of structural fill, and density tests.

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31 23 16.30 Add Page 1 DROP-OUTLET STRUCTURE EXCAVATION – FILING AND BACKFILLING

- 6. Control Testing: Perform control testing, including particle size analysis. No separate measurement and payment will be made for control testing required in this Subparagraph. Include the costs for control testing in the Contract prices for items of work to which the work is incidental thereto.
- 7. Reporting: Records of inspections and tests, as well as the records of corrective action taken, shall be documented in Contractor's daily activities reports.

# PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Fill Materials for Perimeter Berm Construction: Refer to Section 35 41 00 Add, "Berm Construction."
- B. Granular Fill: Aggregate meeting gradation set forth in ASTM C33/C33M Size Number 8.
- C. Bentonite Fill: Sodium Bentonite Chips, Southwestern Materials Inc. 3/8-inch Chips, or Wyo-Ben Enviroplug, or approved equivalent.

#### 2.2 EQUIPMENT FOR COMPACTION AROUND STRUCTURES

- A. Hand Tamping: Hand tamping shall be used in the compaction of structural fill within 3 feet of a structure and near structures where vehicular equipment cannot be used. These hand tampers shall be power driven, hand operated type.
- B. Alternative Compaction Equipment: Contractor may propose alternative types of compaction equipment not included in these specifications. The suitability of the alternative equipment shall be demonstrated to the Owner by a field test conducted by and at the expense of Contractor. The alternative compaction equipment shall be capable of properly compacting the soil so that no planes of weakness or laminations are formed in the fill. Additionally, the alternative compaction equipment shall not detrimentally affect adjacent structures. The field test shall consist of compacting a minimum of three layers of an area of embankment with the alternative type equipment.
- C. Miscellaneous Equipment: Scarifiers, disks, spring-tooth or spike-tooth harrows, spreaders, power tampers and other equipment shall be of types suitable for the required construction. Sprinkling equipment shall be designed to apply water uniformly and in controlled quantities to variable widths of surface.

#### **PART 3 - EXECUTION**

#### 3.1 STRIPPING

- A. General: Stripping shall be done in accordance with Section 35 41 00 Add, "Berm Construction."
- B. Construction Plan: Prior to construction, Contractor shall submit a detailed Construction Plan outlining work sequence and scheduling of earthwork at drop-outlet structures with respect to any adjacent embankment work. Excavation shall be performed using a method that will ensure that the area within and immediately surrounding the site are continually and effectively drained. Water shall not be permitted to accumulate in the excavation areas. The excavation shall be drained to prevent softening of the foundation bottom, undercutting of footings, or other actions detrimental to proper construction procedures. Normal ground water level in the project

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31 23 16.30 Add Page 2 DROP-OUTLET STRUCTURE EXCAVATION – FILING AND BACKFILLING area varies. Silt and sand materials in the area may become saturated or water bearing and during excavation the slopes may be subject to sloughing. Prior to making the compacted fills and backfills, foundation areas shall not be permitted to accumulate water.

# 3.2 EXCAVATION

- A. Common Excavation: Common excavation shall consist of removal of materials to install new footing and new drainage pipes. Care shall be exercised by Contractor not to excavate below the grades shown to remove unsatisfactory materials, unless otherwise directed. Unsatisfactory materials include man-made fills; trash; refuse; deleterious materials, backfills from previous construction; and materials containing root and other organic matter, frozen material or any contaminated materials. Excessive excavation, as determined by Engineer, due to the fault or negligence of Contractor shall be backfilled to grade. Excessive excavations shall be backfilled with satisfactory fill materials as specified in Section 35 41 00 Add, "Berm Construction.". Limited areas within the inside slope that cannot be compacted due to space constraints can be backfilled with granular bentonite.
- B. Structural Excavation: Make the required excavations for the construction of the drop-outlet structures. Fill material from required structural excavation shall be used in the structural backfill that is placed and compacted as specified in Section 35 41 00 Add, "Berm Construction." Excavation for the structures shall conform to the dimensions and elevations for the structures as shown. Excavation carried below indicated depths of the structures will not be permitted except to remove unsatisfactory materials. Unsatisfactory materials shall be excavated 2 feet below the depth of concrete foundation and the drainage pipes and replaced with satisfactory material. Material removed below these depths shall be replaced to the indicated excavation grade with satisfactory materials placed and compacted as specified in Section 35 41 00 Add, "Berm Construction", at no additional cost to Owner.
- C. Grade Tolerances: Excavation of side slopes shall not be more than 0.2-foot above or below the grade indicated and shall not vary more than 0.2-foot in 10 feet as measured with a straightedge.
- D. Removal of Unsatisfactory Soils: The removal of soils that are considered to be unsatisfactory shall be required in certain areas where compacted fill is to be placed. Soft yielding material encountered in the surface that will not adequately support construction equipment shall be removed to a minimum depth of 3 feet. Contractor shall excavate these areas and backfill them as specified in the Paragraph "Backfill" below and Section 35 41 00 Add, "Berm Construction." Unsatisfactory materials may be disposed in the interior of the DMPA. Unsatisfactory material at surfaces to receive fill shall be removed and replaced with satisfactory materials. The placing and compaction of satisfactory materials shall be as specified in the Section 35 41 00 Add, "Berm Construction."
- 3.3 SLIDES

In areas of saturated soils, the soils become very soft and loses its strength which may cause settlement of the embankment. Some sliding is expected during construction. If sliding occurs in the fill or excavation during construction, or after completion but prior to acceptance, Contractor may be required to cut out and remove the slide and backfill the excavated area with compacted fill. If the slide is caused through fault of Contractor, the foregoing operation shall be performed without cost to Port Authority.

#### 3.4 BACKFILL

A. Backfill Around Piles and Other Structures: Material shall consist of satisfactory material and shall be obtained from the required excavation. The moisture content of the material shall be

TECHNICAL SPECIFICATION Date: December 2020 31 23 16.30 Add Page 3 DROP-OUTLET STRUCTURE EXCAVATION – FILING AND BACKFILLING adjusted to within the moisture content range specified in Section 35 41 00 Add, "Berm Construction." Material shall be placed in maximum 4-inch to 6-inch thick layers prior to compaction and shall be thoroughly compacted with power-driven hand tampers to the density of the surrounding earth. Backfilling shall be carried out in areas that are continually and effectively drained.

B. Bedding and Backfilling Around Pipe: Except in zone of impermeable clay on interior slope of embankment, the pipe foundation areas shall be backfilled with Granular Fill as shown on the drawings which shall be densified with applicable equipment. The Granular Fill shall be in maximum 6-inch thick layers and compacted with power-driven tampers to the density of the surrounding earth. Granular Fill shall completely bed the pipe.

After bedding pipe in Granular Fill or Bentonite, backfill with material over pipe in 6-inch layers and compact with power-driven hand tampers until the pipe has a minimum of 2 feet of cover. The remainder of the backfill or fill over pipe shall be placed and compacted as specified for compacted fill in Section 35 41 00 Add, "Berm Construction." At no time will heavy equipment for spreading and compaction of material be operated within 2 feet of a pipe. Backfilling shall be carried out in areas that are continually and effectively drained.

C. Final Subgrade: Soft spots encountered within the subgrade foundation area shall be removed, replaced by approved random fill materials of similar soil type, and compacted as specified.

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# SECTION 31 24 00 Add – EMBANKMENT CONSTRUCTION

#### PART 1 - GENERAL

#### 1.01 SUMMARY

The work covered in this Section consists of furnishing labor, equipment, and other incidentals necessary to perform the construction, relocation, and repair of perimeter and stability berms with excavated materials at Placement Areas (PAs), and for other earthwork incidental to the PA berm construction. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown on the plans.

#### 1.02 RELATED SECTIONS

Section 01 25 00 - Measurement and Basis of Payment

Section 01 71 23.16 - Construction Surveying

Section 31 23 00.00 - Excavation and Fill

#### 1.03 REFERENCES

The publication listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

#### A. American Society for Testing Materials (ASTM) Publications

SPECIFICATION	03 24 00 Add	EMBANKMENT CONSTRUCTION
ASTM D3740 (2012)	Standard Practice for N Engaged in Testing an Used in Engineering D	Minimum Requirements for Agencies d/or Inspection of Soil and Rock as esign and Construction
ASTM D2487 (2017)	Standard Practice for 0 Purposes (Unified Soil	Classification of Soils for Engineering Classification System)
ASTM D2216 (2010)	Laboratory Determinat and Rock by Mass	ion of Water (Moisture) Content of Soil
ASTM D1556 (2015)	Standard Test Method Place by the Sand-Cor	for Density and Unit Weight of Soil in ne Method
ASTM D1140 (2017)	Standard Test Methods Material Finer than 75- Washing	s for Determining the Amount of ∙µm (No. 200) Sieve in Soils by
ASTM D698 (2012)	Standard Test Method f Characteristics of Soil L (12,400 ft-lbf/cu ft (600	or Laboratory Compaction Jsing Standard Effort kN-m/cu. m.))

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ASTM D4318 (2017)	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4643 (2017)	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D5255 (2015)	Standard Practice for Certification of Personnel Engaged in the Testing of Soil and Rock
ASTM D6913 (2017)	Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6938 (2017)	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928 (2017)	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

# U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2014)	Safety and Health Requirements Manual
ER 1110-1-261 (1999)	Quality Assurance of Laboratory Testing Procedures

# 1.04 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only. The following shall be submitted in accordance with Section 01 33 00, "Submittal Procedures":

- A. Work Plan: At least 21 days prior to commencement of site work, submit a Work Plan for review by Engineer. Work Plan shall outline Contractor's approach for accomplishing the berm construction, for the location and construction of any temporary haul roads, temporary construction roads, staging areas, storage areas (as applicable), and for dewatering borrow areas and any other excavations. This Plan shall include, but not be limited to, the following:
  - 1. Planned sequence of construction for berms, and shoreline protection, as applicable. Include excavation of borrow areas and berm foundation areas. Include plan and crosssectional schematic drawings showing starting and final work locations and clearing, grubbing and stripping limits.
  - 2. Show locations of planned ingress/egress routes and any temporary facilities as well as provisions taken to minimize access issues and work delays caused by inclement weather.
  - 3. Methods and types of equipment to be utilized for excavation, handling, placing, and compaction.
  - 4. Plan for locating/identifying and testing borrow areas within the PAs.
  - 5. Planned erosion control measures and other environmental controls, including work exclusion areas.
  - 6. Methods for protecting existing utilities.
  - 7. Material distribution and stockpiling plan.

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- 8. Trenching and shoring plan, as applicable.
- 9. Planned methods for dewatering including control of surface and ground water in the DMPA cell ditches along the proposed berm area, borrow areas and any other excavations. Describe equipment types and planned durations.
- B. Planned methods for demobilization and site control, including measures to address flooding, if an extreme coastal storm impacts the work area. Refer to Site storm protection requirements in TBD.
- C. If necessary, modify the Plan as required to meet field conditions; any modifications to the plan will require an additional submittal to Engineer for review.
- D. Submit geotechnical engineer report showing placement of fill or excavation associated with the Work Plan (outside of the placement of fill and excavation shown on the contract Plans) will meet US Army Corps of Engineers required factors of safety for stability.
- E. Daily Activities Reports: Refer to General Specifications for daily reporting requirements
- F. Borrow Material Testing: Regular testing is required to verify suitability of the borrow material placed for berm construction (see Section 1.05 Quality Assurance)

# 1.05 QUALITY ASSURANCE

- A. Excavation: Establish and maintain quality control for excavation operations to assure compliance with Contract requirements, and maintain records of the quality control for construction operations including the following:
  - 1. Lines, grades and tolerances.
  - 2. Disposition or stockpiling of materials, including any Unsuitable Materials.
  - 3. Conditions that may induce seepage or weaken the foundation of berms.
  - 4. Stability of excavations.
  - 5. Drainage condition of the DMPA cell, borrow areas and any associated dewatering performed.
- B. Berms: Establish and maintain field quality control for foundation preparation and berm construction operations to assure compliance with Contract requirements. Contractor's quality control shall include the following:
  - 1. Foundation Preparation: Document work performed to prepare foundations in advance of berm construction, and methods for providing drainage or dewatering of the foundation and partially completed fills.
  - 2. Borrow material for construction of perimeter berm(s) shall be tested for compliance with the requirements for Perimeter Berm Materials as stated in Paragraph 2.02.C, Testing documentation and results shall be submitted weekly with Contractor's Daily Reports (Paragraph 1.04.B). At a minimum, testing frequency shall be as follows:
    - a. Gradation Tests (ASTM D6913 and D1140): One test per 10,000 cubic yards or per change in material.

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- b. Moisture-Density Relationship Tests (ASTM D698): One test per 10,000 cubic yards or per change in material.
- c. Atterberg Limits (ASTM D4318): One test per 10,000 cubic yards or per change in material.
- d. "Change in material" shall be determined by Contractor's geotechnical testing agency based on changes in location of material source, or readily observable changes in material type, color, plasticity, and/or grain size distribution.
- 3. Layout, drainage control, moisture control, thickness of layers, removal of oversized material, and spreading and compaction for perimeter berms shall be documented.
- 4. Perform in-place moisture/density testing for cohesive materials placed for construction of perimeter berm(s). The in-place moisture/density tests of the cohesive materials shall be determined and reported in accordance with ASTM D1556 or ASTM D6938. At least one in-place moisture/density test shall be performed at a frequency of 1 test per 5,000 sq. ft of each compacted lift (8 inches maximum). Nuclear density testing equipment shall not be used during rain.
- C. Construction Surveys: Perform surveys to verify that the dimensions, slopes, lines, and grades conform to specified requirements. Refer to specification Section 01 71 23.16, Construction Surveying, for survey requirements.
- D. Testing by Engineer: During the life of this Contract, Engineer may perform independent quality assurance tests. Contractor shall make the equipment needed to perform these tests available to Engineer.
- E. Testing Agencies: Laboratories performing Contractor's tests shall be accredited in accordance with ASTM D3740. Personnel engaged in the testing shall be certified in accordance with ASTM D5255. Engineer or Engineer's designated representative shall be provided advance notification of field sampling and testing so that he/she may observe the sampling/testing.
- F. Records: A copy of the records of inspections and corrective actions taken shall be included in the daily quality control reports.

#### 1.06 DEFINITIONS

Berm and Embankment: The terms "Embankment" and "Berm" are interchangeable in these specifications and drawings. "Embankment" and "Berm" are defined as the earth fill portions of the berm system, or other fills related to a berm construction, including interior berms, stability berms, and perimeter berms.

#### 1.07 SITE CONDITIONS

A. Surface Drainage: Contractor shall be aware that the project site is subject to ponding during and after rain and high tide events. Surface water shall be directed away from excavations and construction sites to prevent erosion and undermining of foundations. Diversion ditches and grading shall be provided and maintained as necessary during construction. Ponding water and undrained water in the excavation areas in the PAs shall be drained through pumps or other approved available methods. Newly constructed slopes and backfill surfaces shall be protected to prevent slope surface erosion and sloughing. Excavation shall be performed so that the excavated areas and surrounding areas are drained continuously and effectively.

- B. Changes in Berm Alignment: The right is reserved by Engineer to make changes in the berm alignments as may be found necessary before completion of the work. If it becomes necessary, through no fault of Contractor, to abandon a line or location on which work has been done, payment for materials placed will be made as specified in the associated payment item.
- C. Subsurface Soil Information: Geotechnical investigation data is provided in Appendix A. This data represents the most recent information available. Variations may exist in the soil conditions between sample locations. In addition, groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater level in the PAs can vary significantly depending on time of year, the amount of precipitation, and tides. Contractor shall also be aware that debris is likely to be encountered during excavation. Contractor shall draw his own conclusions as to the character of the in-situ soil materials, groundwater levels, and amount and type of debris that may be encountered.
- D. Stockpiling: When the excavation from designated borrow sources progresses at a faster rate than placement of the fill is being accomplished, such excavated material shall be stockpiled at approved locations adjacent to the work until its use. No separate payment will be made for such stockpiling nor for the loading and hauling of this material to its final position.
- E. Construction Access Roads: Access roads shall be constructed to facilitate transportation of equipment and materials to the construction areas as necessary and shall be located within approved limits. Access roads shall be constructed to accommodate the intended loads and frequency and be maintained in well-drained and functional condition during the Contract period. Access roads shall be planned so as not to pond water or otherwise impede site drainage and shall be maintained during the Contract period to provide required drainage as described herein. Site access roads shall be maintained in a passable condition to minimize construction delays due to inclement weather. The costs associated with construction of access roads shall be considered a subsidiary obligation of the Contractor.

# PART 2 – PRODUCTS

2.01 GENERAL

Materials for embankment fills shall be secured from required excavations as indicated on the Drawings. The intention is to use the most suitable materials obtainable from these sources. Material to be wasted will be specifically designated by Contractor at the time the material is excavated. Materials containing brush, roots, sod or other perishable or organic materials shall not be considered suitable for berm construction. Available soil profiles are provided in Appendix B for borrow excavation references; however, the soil materials may vary from the sampled locations. Actual suitability of the materials shall be subject to testing by Contractor, and to field review by Engineer.

#### 2.02 FILL MATERIALS

- A. Location: Fill materials shall be obtained from borrow area locations within the PA as identified and tested by Contractor and approved by Engineer. All fill material shall be subject to testing by Contractor prior to placement for perimeter berm construction.
- B. Soil Classification: Materials shall be classified in accordance with ASTM D2487 (Unified Soil Classification System).

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- C. Suitable Materials:
  - Perimeter Berm Material: Perimeter Berm materials shall consist of impervious fill as defined herein and in Technical Specification 31 23 00.00 Excavation and Fill. Perimeter berms, including any backfill required due to excavation and dewatering beneath berm foundation areas, shall be constructed with fill materials consisting of soil classified as CL, CH, or SC obtained from borrow areas designated on the drawings or approved by Engineer. Borrow areas for impervious fill materials (CL, CH or SC) shall be located/identified and tested by Contractor and approved by Engineer. Perimeter Berm Materials shall meet the following requirements:
    - a. Maximum particle size: 2 inches when tested in accordance with ASTM D6913.
    - b. Minimum percent passing No. 200 Sieve: 30% when tested in accordance with ASTM D1140.
    - c. Minimum Plasticity Index: 15 when tested in accordance with ASTM D4318.
  - 2. Interior Berm Material: Interior berm material may be constructed with Common Fill material consisting of generally any type of soil listed in Paragraph 2.01.B, per Technical Specification 31 23 00.00 Excavation and Fill.
- D. Unsuitable Materials: Materials such as rubbish, brush, organic material, timber and metal debris, roots over ½-inch in diameter, rope, plastic, and rocks larger than 6 inches in diameter shall be considered Unsuitable Materials and not be placed as fill. These materials will be placed in designated areas on the interior of the PA.

# PART 3 – EXECUTION

# 3.01 GENERAL

- A. Lines and Grades: The berms shall be constructed to the lines, grades, and cross sections indicated on the Drawings. Engineer reserves the right to increase or decrease the foundation widths and berm slopes, or to make other changes in the berm or berm sections, as may be considered necessary to produce a safe and functional earthen structure.
- B. Conduct of the Work: Contractor shall maintain and protect the newly constructed and/or improved berms in a satisfactory condition during construction until final completion and acceptance of the work under this Contract. If, in the opinion of Engineer, Contractor's hauling activities cause horizontal shear planes or slickensides, rutting, quaking, heaving, cracking, or excessive deformation of the berms or backfill areas, Contractor shall subsequently limit the type, load, or travel speed of the hauling equipment. Contractor may be required to remove, at no additional payment, berm material placed outside of prescribed slope lines. Approved berm or backfill and before final acceptance of the work shall be replaced using a satisfactory method at no additional cost to Engineer. Any Unsuitable Material shall be excavated and removed from the berm or backfill and disposed, and the excavated area shall be refilled, at no additional cost to Engineer.
- C. Volume: The "neat-line volumes" have been used by Engineer to prepare the estimates shown on the Bid Proposal Form. The volumes are estimates only and Contractor is responsible for interpreting the volume numbers in preparing his estimate for bidding. "Neat-line volumes" is defined as the unadjusted, raw quantities computed from the berm templates. The percentage for items including overbuilding, compaction, settlement,

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foundation displacement, or construction waste, is the responsibility and decision of Contractor.

- D. Tolerances: The berms shall be constructed to the grades, lines, and cross-sections shown on the Drawings. At every point a tolerance of 6 inch above or 0 inches below the prescribed grade will be permitted in the final dressing, provided that excess material is distributed to ensure that the crown of the berms drain to the PA interiors and that there are no abrupt humps or depressions in the surfaces.
- E. Utilities: Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Work inside the pipeline easement may require excavation efforts to run parallel with the pipeline. Some utility engineers may require prior notification and/or onsite supervision of excavation operations. <u>Coordination with the utility owner is the responsibility of the Contractor</u>. Support uncovered lines or other existing work affected by the Contract excavation until approval for backfill is received. Report damage to utility lines immediately to Engineer.

#### 3.02 SITE DRAINAGE AND DEWATERING

- A. Drainage: Berm foundation areas, borrow areas, temporary stockpiles, and partially completed fill shall be kept continuously drained. Contractor shall establish/construct and maintain temporary drainage features (ditches, swales, ponds, basins, etc.) throughout the duration of construction, and grade the construction area to provide positive surface water runoff away from the construction activity. Prior to placement of fill, the areas shall be completely drained of standing water and allowed to dry so that the surface areas are firm enough for the operation of equipment thereon. Once drainage of the work area and sufficient drying of the foundation surfaces have been accomplished, excavation and the berm construction can proceed. It is the responsibility of Contractor to assess the soil and groundwater conditions and to employ necessary methods that will permit construction to proceed.
- B. Dewatering: Surface and groundwater control shall be accomplished in coordination with the required excavation and berm construction to prevent sloughing of excavation slopes, boils, uplift and heave in the excavation and to eliminate interferences with orderly progress of construction. In the event of heavy rain fall or high tides, the surface and groundwater control may necessitate the use of temporary berms, diversion ditches, pumps, and/or other acceptable means. A dewatering plan shall be submitted for review and approval. The borrow areas shall be drained continuously via drainage ditches which shall be connected to either interior or perimeter ditches during and after the completion of the work.

# 3.03 EXCAVATION

- A. General: Excavation shall consist of removal of material in preparing the foundations to the lines and grades shown on the drawings, removal of material from ditches to the lines and grades shown on the drawings, removal of objectionable materials and obtaining required fill materials from the borrow areas.
- B. Borrow Areas:
  - 1. Borrow areas shall be located/identified and tested by Contractor as required to complete the work. Borrow areas shall be located within the PA, however, will include areas outside the existing perimeter berm and above the proposed dredge profile down to

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groundwater. Borrow areas are subject to the restrictions stated on the drawings. Any other borrow areas need to be approved by the Engineer.

- 2. The soil profiles shown in Appendix A Geotechnical Report, only represent general selective samples taken during initial subsurface soil investigation. Borrow areas shall be selected and tested by Contractor for conformance with the Perimeter Berm Material requirements stated in this specification. Contractor shall be aware that the PAs have received dredged materials periodically throughout the years. Contractor shall anticipate variable and extremely soft/wet recently dredged materials. Contractor's Work Plan shall be revised, resubmitted, and approved by Engineer prior to use of any supplemental borrow areas.
- 3. Prior to performing any material excavation at borrow areas to obtain fill for berm construction, and before connecting new or improved berms to existing berms, the following surface preparation shall be performed:
  - a. Clearing and Grubbing: Unless indicated otherwise on the drawings, or as specified in Section 31 11 00.00 Clearing and Grubbing, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations. Remove stumps entirely. Grub out matter roots and roots over 2 inches in diameter to at least 18 inches below existing surface.
  - b. Stripping: Strip the topsoil of the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil meeting the requirements of Section 31 23 00.02 Topsoil, shall be stockpiled or disposed as approved by the Chief Construction Manager.
  - c. Unsuitable Material: Remove vegetation, debris, oversized materials, decayed vegetable matter, sod, mulch, and rubbish.
- 4. Borrow areas shall be excavated to the extent necessary to obtain Suitable Materials but within the maximum limits stated on the drawings. Borrow areas shall be drained continuously and kept relatively dry during excavation. Interior stockpiles of Suitable Materials located within PAs shall be utilized as borrow materials if the material complies with the Perimeter Berm Material requirements of this specification.
- 5. The bottom of borrow areas shall be graded relatively smooth. Interior borrow areas shall be graded to drain towards the nearest drop-outlet structure, during and after the borrow excavation is completed. External borrow areas shall be graded to drain towards Barbors Cut both during and after the borrow excavation is completed.
- C. Degrading Existing Berms: Excavate existing berms at the specified locations and to the lines and grades shown on the drawings. Excavated materials meeting the requirements for Perimeter Berm Material as defined in Paragraph 2.02, "Fill Materials", may be reused to construct the new berms and for improvements to existing berms. Keep excavations relatively free from water. Excavations below indicated depths will not be permitted except to remove Unsuitable Material. Any over-excavated areas shall be backfilled to grade.
- D. Disposition and Stockpiling of Excavated Materials: Excavated Suitable Material shall be incorporated in the appropriate zones of the berm templates. When direct placement is not practicable, Suitable Material from the excavation shall be stockpiled only in approved areas for subsequent use in other parts of the work for which it is specified herein or as indicated. Suitable Material in excess of the quantity necessary to construct backfills and berm shall be stockpiled for future construction work. No payment will be made for such stockpiling, nor for the reloading and hauling of this material to its final position in the berms.

E. <u>Blending Materials</u>: Blending materials from borrow areas may be performed to provide Perimeter Berm Material. If blending is performed, the material shall be mixed to create a relatively homogeneous material with clods less than 2 inches in diameter, and the material shall not contain any Unsuitable Materials as defined in Paragraph 2.02.D. The material shall be sampled and tested to show compliance with the properties in Paragraph 2.02.C.1.

#### 3.04 EMBANKMENT CONSTRUCTION

- A. General: Prior to beginning placement of fill materials on the berm foundation, notify Engineer that the foundation is ready to receive fill. No fill shall be placed on the berm foundation until these areas have been observed by Engineer or Engineer's designated representative and surveyed by Contractor.
- B. Gradation and Distribution: The materials throughout the berms shall be graded and distributed so that the overall berm is free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding material of the same class. If lenses, pockets, or layers of materials differing substantially in texture or gradation from surrounding material occur in the spread material, the layer shall be mixed by harrowing or another approved method to blend the materials. During the placing and spreading process, continuously maintain a force of workers adequate to remove roots, debris, and oversize stones from the berm materials.
- C. Surface Preparation for Embankments: Prior to placing material for new berms, adding material to improve existing berms, and prior to connecting new berm sections to existing berms, the following surface preparation shall be performed:
  - 1. Clearing and Grubbing: Unless indicated otherwise on the drawings and as specified in Section 31 11 00.00 Clearing and Grubbing, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations. Remove stumps entirely. Grub out matter roots and roots over 2 inches in diameter to at least 18 inches below existing surface.
  - 2. Stripping: Strip suitable topsoil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil meeting the requirements of Section 31 23 00.02 Topsoil, shall be stockpiled or disposed as approved.
  - 3. Unsuitable Material: Remove vegetation, organics, debris, decayed vegetable matter, sod, mulch, and rubbish.
- D. Foundation Preparation for New Embankments: Proof roll subgrade with one to two passes of a rubber tired tandem dump truck with a gross weight of 50,000 pounds or approved equivalent equipment in a systematic manner to ensure testing over all areas at speeds between 2 to 4 mph. Repair unstable areas identified during the proof rolling as specified.
- E. Foundation Preparation of Existing Embankments: If there are holes, cavities and depressions in the foundation areas, including where the new berm will interface with existing berm, the foundation areas shall be scarified to a depth of 6 inches to provide bond between the foundation material and the fill; these areas shall then be back-filled with the same materials that is to be placed immediately above the foundation and fully compacted prior to the initial fill. The fill shall be placed in layers up to a maximum of 12 inches (loose), moistened as required, and compacted in accordance with the applicable provisions of this specification for the specific material type. Remove and replace Unsuitable Materials or very soft dredged materials with material by methods of displacing or excavation.

- F. Foundation Preparation of Existing Dredge Material: In areas where the berms will be raised atop existing dredge material, the dredge material should be improved or replaced with semicompacted fill. The intent is to prepare about a 3-ft thick layer of semi-compacted material or improved dredge material to bridge the softer dredge material and allow the placement of compacted fill material above.
- G. Equipment Traffic: Equipment traffic on a berm zone shall be routed to distribute the compactive effort as much as practicable. Ruts formed in the surface of a layer of spread material shall be filled before that material is compacted.
- H. Compacted Material: Material for perimeter berms shall be placed and compacted as specified in Paragraph 3.04.K. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the berm centerline with sufficient crown or slope as shown on the plans to provide satisfactory drainage during construction. Compaction is not required for interior berms.
- I. Benching into Existing Slopes: "Benches" or "steps" shall be cut into the existing perimeter berms before placing Perimeter Berm Material in horizontal compacted lifts in accordance with 3.04.K. The benches would be on the order of 2 to 4 feet in height and 4 to 6 feet in width. Sloping ground surfaces steeper than 1-Vertical to 6-Horizontal shall be stepped or benched to form a proper bond with the existing surface.
- J. Moisture Control:
  - 1. Compacted Perimeter Berm Material: The moisture content after compaction shall be as uniform as practicable throughout any one layer of impervious materials. Material that is too wet shall be spread on the embankment and permitted to dry, assisted by discing or harrowing, if necessary, until the moisture content is reduced to an amount within the specified limits. When the material is too dry, Contractor will be required to sprinkle each layer of the fill. Harrowing or other approved methods will be required to work the moisture content of Perimeter Berm Material shall be controlled so that hauling, spreading, and compacting equipment can operate with normal procedure without excessive rutting of the fill.
  - 2. Insufficient Moisture for Suitable Bond: If, in the opinion of Engineer, the top or contact surfaces of a partial fill section become too dry to permit a suitable bond between these surfaces and the additional fill to be placed thereon, loosen the dried materials by scarifying or discing, dampen the loosened material to an acceptable moisture content, and compact this layer to densities comparable to the underlying embankment and in accordance with the applicable requirements of Paragraph 3.04.H.
  - 3. Excessive Moisture for Suitable Bond: If the top or contact surfaces of a partially filled section become too wet to permit suitable bond between these surfaces and the additional fill to be placed thereon, the wet material shall be scarified and permitted to dry, assisted by discing or harrowing, if necessary. The material shall then be compacted in accordance with the applicable requirements of Paragraph 3.04.H.
  - 4. Drying Wet Material: Material that is too wet shall be spread on the berm and permitted to dry, dried in the borrow area prior to bringing it to the berm, or disced or harrowed to promote drying, until the moisture content is reduced to workable condition.
  - 5. Increase Moisture in Dry Materials: Contractor shall take measures to increase the moisture content of material that is too dry. The moisture content of material that is too

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dry can be adjusted on the berm or in the borrow area prior to bringing it to the berm. Add water to the fill material and then work the moisture into the material by harrowing or other approved methods until a uniform distribution of moisture within the specified limits is obtained. Water applied on a layer of fill on the berm shall be accurately controlled in amount so that free water will not appear on the surface during or subsequent to rolling. If too much water is added to a part of the berm, the rolling on that section of the berm shall be delayed until the moisture content of the materials is reduced to an amount within the specified limits.

- 6. Treating Source Material: If it is impracticable to obtain the specified moisture content by wetting or drying the material on the fill, Contractor shall pre-wet or dry the material at the source of excavation or in the borrow area.
- K. Compaction
  - 1. Compaction Equipment: Contractor shall apply appropriate means and methods for compacting fill material to achieve the compaction requirements stated herein.
  - 2. Compacted and Semi-Compacted Requirements:
    - a. Where compaction is specified, material shall be placed or spread in horizontal layers, each layer not more than 8 inches in compacted lift thickness.
    - b. Where semi-compaction is specified, material shall be placed or spread in horizontal layers, each layer not more than 12 inches in compacted lift thickness.
    - c. After a layer of material has been dumped and spread it shall be harrowed as required to break up and blend the fill materials and to obtain uniform moisture distribution. Harrowing shall be performed with a heavy disc plow, or other approved harrow, to the full depth of the layer. If one pass of the harrow does not accomplish the breaking up and blending of the materials, additional passes of the harrow shall be required.
    - d. When the moisture content and the condition of the layer are satisfactory, the lift shall be compacted to the moisture density criteria presented herein.
    - e. In areas which are not accessible by roller, the fill shall be placed in layers not more than 6 inches in compacted depth and compacted with an approved hand operated compactor to a density equal to that obtained in other areas which are accessible to rollers.
    - f. Dumping, spreading, sprinkling, and compacting may be performed at the same time at different points along a section when there is sufficient area to permit these operations to proceed simultaneously.
    - g. Compacted material shall be compacted to at least 95 percent of the maximum dry density at a moisture content between 3 percent "dry" and 3 percent "wet" of the optimum moisture content as determined by ASTM D698.
    - h. Semi-compacted material shall be compacted to at least 85 percent of the maximum dry density at a moisture content between 3 percent "dry" and 3 percent "wet" of the optimum moisture content as determined by ASTM D698. Semi-compacted material used for construction of berms shall be compacted to at least 95% of the maximum dry density.

# 3.05 EROSION AND SLIDES

If erosion or sliding of any part of the berms occur during or after construction, but prior to acceptance, that portion of the berm shall be rebuilt with no additional expense to Owner. Where settlement of the berm, due to weak foundation conditions, develops to an extent that will make it inadvisable, in the opinion of Engineer, to continue placement of additional materials, Engineer may omit further work on these portions of the embankment and to accept it as completed.

#### 3.06 TURFING

Disturbed areas to include the repaired side slope, newly constructed outside slope and the crown of the containment dike shall be seeded per 32 92 19.16 Turfing.
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## SECTION 31 62 16.16 Add - STEEL H PILES

## PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, materials, equipment, supervision, and every other thing necessary to furnish and drive steel H piles as described and specified herein and as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities

SECTION 05 12 00.00 Mod – Structural Steel Framing

SECTION 35 31 16.20 Mod - Steel Sheet Pile Bulkhead

## 1.3 REFERENCES

A. ASTM INTERNATIONAL Publications: Latest Editions:

ASTM A 36	Standard Specification for Carbon Structural Steel
ASTM A 572	(2007) Standard Specification for High-Strength Low-Alloy Columbium- Vanadium Structural Steel
ASTM D4945	(2012) High-Strain Dynamic Testing of Piles

## B. AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010; Errata 2011) Structural Welding Code - Steel

## 1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction Submittals
  - 1. Pile Installation Plan:
    - a. Installation sequence
    - b. Installation equipment
    - c. Test Pile Plan and Equipment

2. Wave Equation Analysis	
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- 3. Welding Plan
- 4. Delivery, Storage and Handling Plan (include forms showing dimensional tolerance)
- B. Shop Drawings
  - 1. Pile Placement Plan
  - 2. Pile Fabrication and Details
- C. Product Data
  - 1. Pile Driving Equipment
  - 2. Delivery, storage, and handling
- D. Test Reports
  - 1. Mill Test Reports
  - 2. Wave equation analysis
  - 3. Dynamic pile analysis
- E. Closeout Submittals
  - 1. Pile driving records

## 1.5 DELIVERY, STORAGE, AND HANDLING

Materials delivered to the site shall be in new and undamaged condition and shall be accompanied by certified material test reports. The manufacturer's logo and mill identification mark shall be stamped on each unspliced pile at a minimum of two locations and shall also be stamped on the mill test reports.

The Contractor shall confirm all delivery, storage, and handling of materials are to the requirements specified herein. The Contractor shall develop and submit delivery plans for the delivery, storage, and handling of piles at least 21 days prior to delivery of piles to the job site.

A. Delivery and Storage

Stack piles during delivery and storage so that each pile is maintained in a straight position and is supported every 10 feet or less along its length, ends inclusive, to prevent exceeding the maximum camber.

- B. A sufficient number of skids shall be used to prevent deflection in the stored piling and prevent contact with the ground. The methods of handling shall prevent damage to the piling and when stored, piles shall be kept clean and fully drained at all times.
- C. Handling

Lift piles using methods which do not cause permanent damage to the piles. Lift methods

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include the use of a cradle or multiple points pick-up to ensure that the maximum permissible camber or sweep is not exceeded due to insufficient support, except that a one-point pick-up may be used for lifting piles that are not extremely long into the driving leads. Point pick-up devices must be of the type that clamp to both pile flanges at each pick-up point. Holes maybe burned in the flanges or webs of piles above the cutoff length for lifting piles into the leads. Do not drag piles across the ground.

The Contractor shall, in the presence of the Port of Houston Authority (PHA) check piles for damage, straightness, out- of-roundness, radial offset, weld reinforcement height, misalignment of weld beads, wall thickness and outside diameter or any other defect causing the pile to be not in conformance with the specifications or drawings. This shall be done immediately prior to placement. Damaged piles or piles that do not meet the dimensional tolerances as listed under PART 2 will be rejected for use and replaced at no additional cost to the Owner. Submit the findings on a form developed by the Contractor and approved by the PHA presenting the measurements taken and indicating compliance per criteria specified prior to installation.

Inspect piles for excessive camber and sweep and for damage before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads. Camber, curvature in the pile in the direction normal to the pile flanges, must be measured with the pile flange base laying on a flat surface and is the distance between the flange base at the mid-length of the pile and the flat surface. Sweep, curvature in the pile in the direction parallel to the pile flanges, must be measured with the pile flange tips laying on a flat surface and is the distance between the flange tips at the mid-length of the pile and the flat surface. The maximum permissible camber and sweep is 2 inches over the length of the pile. Piles having excessive camber or sweep will be rejected.

## PART 2 PRODUCTS

#### 2.1 MATERIALS

A. H Piles

Steel H piles shall be furnished in conformity with the requirements of Standard Specification for Carbon Structural Steel, ASTM A-572, Grade 50. All splice weld shall be complete joint penetration butt welds and shall be 100% inspected per AWS D1.1. All H pile material shall be new and supplied in full length. Mark the piles with the following information: name and location of the piling producer, contract number, heat number, welding process, outside diameter, nominal wall thickness, length and the year that the piling was produced. Certified copies of mil test reports shall be submitted for each material shipment and shall be identified with specific lots. Test reports shall indicate all pertinent data on strength, ductility, notch toughness, chemical analysis, heat treatment and Nondestructive Testing (NDT). Charpy V-Notch (CVN) testing shall be submitted with the mill certifications as specified herein.

## 2.2 FABRICATION OF H PILING

#### A. Welding

Perform all welding for H piles in accordance with AWS D1.1/D1.1M, (except as modified in this section) using certified welders, welding operators, and tackers and qualified joint welding procedures.

Submit the welding plan at least 30 days prior to commencement of fabrication. Welding plan shall be stamped and signed by a certified Welding Inspector per AWS QC1. The welding

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plan shall include:

- 1. Qualifications for the Quality Control Inspector.
- 2. Welder Qualifications, Procedure Qualification Records (PQR) and Welding Procedure Specifications (WPS): Welder qualifications and a WPS with supporting PQR shall be submitted on any welding process utilized in the manufacturing of the pile and for pile splices. The welder qualifications, PQR and WPS shall be submitted in accordance with the requirements of AWS D1.1 and Specification 01 33 00 Add Submittals Procedures.
- 3. NDT (Nondestructive Testing) : Certified copies of all visual testing (VT), ultrasonic testing (UT) and magnetic particle testing (MT) conducted shall be submitted. The inspection and NDT shall comply with the requirements of AWS D1.1.
- 4. Macrotech Sampling: At the beginning of the fabrication process, 3 representative Macrotech weld samples, to be furnished, shall be removed from locations at the top, bottom and side of the pile and will be inspected to verify complete penetration welds. Samples shall indicate that the weld is free of cracks and has thorough fusion between adjacent layers of weld metal and between weld metal and base metal.
- B. Weld Processes

Welds made at a permanent manufacturing facility shall be performed by either a submerged arc weld (SAW) or a double submerged arc weld process (DSAW). Welds shall have complete joint penetration. All welds shall be pre-qualified welds in accordance with AWS D1.1/D1.1M. Welds other than AWS pre-qualified welds shall be qualified under AWS acceptance procedures.

C. Weld Testing Requirements

A minimum of ten percent of each longitudinal weld made at a permanent manufacturing facility shall receive non-destructive testing (NDT) by either radiographic, radioscopic, real time imaging systems or ultrasonic methods that are in conformance with the requirements of AWS D1.1/D1.1M. Submit H pile weld NDT records to the Port Authority. The repair criteria shall conform to the requirements of AWS D1.1/D1.1M, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed. The additional NDT shall be made on both sides of the repair for a length equal to 10 percent of the length of the H pile perimeter. After the additional NDT is performed, and if more repairs are required that have a cumulative length equal to or more than 100 percent of the length of the circumference pile perimeter, then the entire weld shall receive NDT. All testing shall be performed by a certified welding inspector per AWS QC1. Submit reports of the testing prior to shipment of H piles to the site.

D. Splices

Submit shop drawings showing location of splices and weld details for approval by Owner prior to fabrication. The required non-destructive testing (NDT) of welds shall also be shown on the shop drawings.

All splices for H piling shall be made with continuous butt welds. All the butt welds shall be complete penetration, pre-qualified welds. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1/D1.1M. Construct splices to maintain the true alignment and position of the pile sections.

## 2.3 COATING OF H PILES

Coating of H piles is not required.

## PART 3 EXECUTION

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## 3.1 PILE DRIVING EQUIPMENT

Select the proposed pile driving equipment at least 14 days prior to commencement of work, including hammers and other required items, and submit complete descriptions of the proposed equipment. Changes in the selected pile driving equipment will not be allowed after the equipment has been approved except as directed. No additional contract time will be allowed for Contractor proposed changes in the equipment.

## A. Pile Driving Hammers

Provide impact and/or vibratory type pile driving hammers.

Submit information on the type of equipment proposed to be used, proposed methods of operation, pile driving plan including proposed sequence of driving production piles and dynamic testing, and details of all pile driving equipment and accessories.

Provide details of pile driving equipment and a Wave Equation Analysis of pile drivability for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Engineer for each test pile location where different subsurface conditions exist or for different size piles in the same bulkhead wall and is to include the following information pertaining to the proposed pile driving equipment:

- 1. Submit Pile and Driving Equipment data, for each proposed pile hammer and pile type combination.
- 2. Copies of computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count. Analysis shall be run for the full driven length of the pile.
- B. Impact Hammers

Provide steam, air, or diesel-powered impact pile hammers of the single-acting, double-acting, or differential-acting type. Provide boiler, compressor, or engine capacity sufficient to operate hammers continuously at the full rated speed. Hammers must have a gage to monitor hammer bounce chamber pressure for diesel hammers (except for open ended diesel hammers) or pressure at the hammer for air and steam hammers. This gage must be operational during the driving of piles and be mounted in an accessible location for monitoring by the Contractor and Engineer. Provide bounce chamber pressure gage correction tables and charts for the type and length of hose to be used with the pressure gage to the Engineer. Obtain driving energy by use of a heavy ram and a short stroke with low impact velocity, rather than a light ram and a long stroke with high impact velocity. Position a pile cap or drive cap between the pile and hammer. Place hammer cushion or cap block between ram and the pile cap or drive cap. Hammer cushion or cap block must have consistent elastic properties, minimize energy absorption, and transmit hammer energy uniformly and consistently during the entire driving period. Submit the following information for each impact hammer proposed:

- 1. Make and model.
- 2. Ram weight (pounds).

- 3. Anvil weight.
- 4. Rated stroke (inches).
- 5. Rated energy range (foot-pounds).
- 6. Rated speed (blows per minute).
- 7. Steam or air pressure, hammer, and boiler and/or compressor (psi).
- 8. Rated bounce chamber pressure curves or charts, including pressure correction chart for type and length of hose used with pressure gage (pounds per square inch).
- 9. Pile driving cap, make, and weight (pounds).
- 10. Cushion block dimensions and material type.
- 11. Power pack description.
- C. Vibratory Hammers

The use of vibratory hammers is dependent upon the Contractor's ability to satisfactorily drive the piles. All piles initially driven using a vibratory hammer shall be driven to the required capacity or tip elevation as shown in the Drawings in accordance with the approved refusal criteria using a power hammer. The vibratory hammer must provide for maintaining a rigid connection between the hammer and the pile. Submit the following information for each vibratory hammer proposed:

- 1. Make and model.
- 2. Eccentric moment (inch-pounds).
- 3. Dynamic force (tons).
- 4. Steady state frequency or frequency range (cycles per minute).
- 5. Vibrating weight (pounds).
- 6. Amplitude (inches).
- 7. Maximum pull capacity (tons).
- 8. Non-vibrating weight (pounds).
- 9. Power pack description.
- D. Pile Driving Leads

Support and guide hammers with leads capable of driving piles to their intended location and within tolerances specified.

E. Pile Extractors

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Pile extractors may be vibratory and/or impact pile driving hammers. Impact hammers are required for pulling piles not extractable with vibratory hammers. Faulted piles shall be extracted.

F. Jetting Equipment

Jetting of piles is not permitted.

## 3.2 PRELIMINARY WORK

- A. Wave Equation Analysis of Pile Drivability
  - 1. Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by the Contractors' Engineer. This analysis shall take into account the proposed hammer assembly, pile cap block and cushion characteristics, the pile properties and estimated lengths and the soil properties anticipated to be encountered throughout the installed pile length based on static capacity analysis with consideration of driving gain/loss factors. Only one specific model of pile hammer may be used for each pile type and capacity.
  - 2. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained within the limits below and indicate the blow count necessary to achieve the required ultimate static pile capacities, stated within the contract drawings.

## Allowable Driving Stresses

Steel

Compression: 0.9  $f_y$ Tension: 0.9  $f_y$ Where  $f_y$  is yield strength of steel.

## 3.3 INSTALLATION

The Contractor shall mark each pile prior to driving with horizontal lines (perpendicular to the longitudinal axis of pile) at one-foot intervals, and the number of feet from pile tip at five-foot intervals. For test piles to be re-struck, mark the pile with horizontal lines at one-inch interval for at least a foot above the reference line used for monitoring penetration. Inspect piles when delivered and when in the leads immediately before driving. Handle piles so as to protect pile coatings. Repair damage or defects in pile coatings as specified in 09 96 56.01 Std- Epoxy Coatings- Coal Tar. Cut piles at cutoff grade by an approved method.

A. Pile Driving Records

Submit proposed form for compiling pile driving records 14 days prior to commencement of work. Submit complete and accurate job pile driving records on a daily basis after completion of driving. Compile and submit accurate records of the pile driving operations on the approved sample pile driving records form. Include in driving records for each pile date driven, pile identification number, number of splices and their locations, cross section shape and pile dimensions, location, deviations from design location, original length, ground elevation, top elevation, tip elevation, description of hammer used, number of blows required for each foot of penetration throughout the entire length of the pile and for each inch of penetration in the last foot of penetration, total driving time in minutes and seconds, and any other pertinent information as required or requested such as unusual driving

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Additional data required to be recorded for impact hammers includes the stroke height/rate of hammer operation (blows per min (BPM)), fuel settings throughout pile driving, make, size, and the length of the bounce hose. Additional data required to be recorded for vibratory hammers includes hammer power pack description, make, size, horsepower applied to pile, and hammer operating frequency.

## B. Pile Placement and Tolerances in Driving

Develop and submit a pile placement plan at least 14 days prior to delivery of piles to the job site, which shows the installation sequence and the methods proposed for controlling the location and alignment of piles. Complete all foundation preparations in the area prior to the placement of piles for driving. Accurately place piles in the correct location and alignments, both laterally and longitudinally, and to the vertical lines indicated. Establish a permanent base line to provide for inspection of pile placement by the PHA during pile driving operations prior to driving piles. Baseline to be maintained during the installation of the piles.

A final lateral deviation from the correct location at the cutoff elevation of not more than 1 1/2 inches will be permitted for plumb and batter piles. Manipulation of piles will not be permitted, unless approved by the PHA. A variation of not more than 1/2 inch per 10 feet of pile length from the vertical for vertical piles nor more than 0.25 inch per foot of pile length from the required angle for batter piles will be permitted. A vertical deviation of not more than 2 inches from the correct cutoff elevations shown is permitted. Inspect piles for heave. Redrive heaved piles to the required tip elevation. Maintain the correct relative position of all piles by the use of templates or by other approved means such that the piles are not displaced during the installation of the pile cap. Redesign of pile caps or additional work required due to improper location of piles is the financial responsibility of the Contractor. Piles damaged or not located properly (unless pile head movements allowed) or exceeding the maximum limits for lateral and vertical deviation, or variation in alignment must be pulled and new piles redriven, or provide additional piles at locations directed by Engineer to no additional cost to the Owner.

C. Pile Penetration Criteria

The tip elevation for job/production piles will be verified based on the dynamic testing of selected piles during installation for the project.

Pile acceptance should be determined by the Geotechnical Engineer's representative based primarily on tip elevation as shown on the drawings and the pile penetration data from dynamic testing. The available geotechnical data for the project shall also be referenced for acceptance of the pile penetration acceptance. After piles have achieved tip elevation, the secondary requirement is that the minimum axial resistance shown on drawings shall be achieved as estimated blow count and hammer performance.

Excess material from pile cutoffs will become the property of the Contractor and shall be at no additional expense to the PHA. Where there is the need for additional pile buildup due to insufficient axial capacity after the pile is driven to the minimum tip elevation, the PHA will bear the additional cost for pile buildup and driving to meet the required axial capacity at the unit rate provided in the Bid Form.

## D. Pile Driving

Pile driving operations should be observed by an Engineering Technician under the Geotechnical Engineer's supervision to determine whether the piles are encountering expected driving resistances and to note any problems during installation. Pile acceptance should be determined by the Geotechnical Engineer's representative based on tip elevation and with blow count and hammer performance.

Notify the Port Authority 10 days prior to the date pile driving is to begin. Do not drive piles within 100 feet of concrete less than 7 days old. Drive like piles with hammers of the same model and manufacturer, same energy and efficiency, and using the same driving system. Operate hammers at all times at the speed and under the conditions recommended by the manufacturer. Where heave is anticipated, the sequence of installation must be such that pile heave is minimized by starting pile driving at the center of the group and proceeding outward. Prior to driving and with the pile head seated in the hammer, check each pile to ensure that it has been aligned correctly. Once pile driving has begun, keep conditions such as alignment constant. Drive each pile continuously and without interruption until the required tip elevation has been attained. Deviation from this procedure will be permitted only when driving is stopped by causes that reasonably could not have been anticipated. A pile that cannot be driven to the required depth because of an obstruction, as indicated by a sudden unexplained change in blow count or drifting, must be pulled and re-driven or cut off and abandoned, whichever is directed by the PHA. After piles are driven, cutoff square as required at the indicated cutoff elevation. If, in driving, it is found that pile is not of sufficient length to give the capacity specified, notify the PHA and submit pile driving logs.

1. Heaved Piles

When driving piles in clusters or under conditions of relatively close spacing, perform observations to detect heave of adjacent piles. Backdrive heaved piles to original depth of penetration.

2. Pulled Piles

Pull and replace piles damaged or impaired for use during driving with new piles or cut off and abandon and drive new piles as directed. Redrive piles pulled as directed and found to be in suitable condition at another location as directed. Replace piles pulled as directed and found to be damaged with new piles.

3. Long Piles

Handle and drive piles carefully to prevent overstress of long slender piles.

4. Welding

AWS D1.1/D1.1M. Provide 100 percent radiographic or ultrasonic examination of complete penetration butt welds.

## 3.4 PILE TESTING

## A. Test Piles

Perform dynamic testing on piles as indicated on drawings noted as Production Test Piles to measure and verify the axial capacities meet design requirements. Contractor shall test the first pile driven for the representative typical pile type for the structure. Order verification test piles a minimum of ten (10) feet longer in length than production piles. The Contractor is responsible for providing adequate length of the test piles to meet project design requirements to accommodate for testing equipment, templates, and other means and methods to install piles. The additional test pile length shall be driven only at the direction of the Contractor's Geotechnical Engineer. The Contractor's Geotechnical Consultant will use test pile data to determine "calculated" pile tip elevation. Drive test piles at the locations indicated. Drive test piles to indicated tip elevation. The

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31 62 16.16 Add Page 9 test piles shall become a part of the finished work. A pile dynamic analyzer shall be provided and operated as specified in paragraph DYNAMIC PILE ANALYSIS during the driving of each test pile. Modify driving as required based upon recommendation of Contractor's Geotechnical Consultant and approval of the PHA.

The Contractor shall notify the Port Authority of the date and time for dynamic testing at least 10 days, and again at 72 hours, prior to testing.

B. Dynamic Pile Analysis

The purpose of dynamic testing is to provide supplemental information for evaluating pile hammer performance, driving stresses, and ultimate axial capacity. Dynamic testing shall be conducted during the entire time test piles are initially driven or re-driven and during pile restrike testing. Use test piles of type as specified elsewhere in this section. Equipment to obtain dynamic measurements, record, reduce and display its data shall be furnished and meet the requirement of ASTM D4945. The equipment shall have been calibrated within 12 months. Drive test piles at the locations indicated. The contractor shall employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile driving process, monitoring of test pile installation, and in the use of the Pile Driving Analyzer and its related equipment. The Contractor's Geotechnical Consultant and the dynamic monitoring operator shall have a minimum of five years' experience in data acquisition from high strain dynamic pile testing and successful performance on at least two projects of similar size and scope and in similar geotechnical conditions in past two years. Dynamic pile analysis shall be performed as follows:

- 1. Each dynamic pile analysis shall be performed in two steps. The first step is to check the hammer, pile and soil performance, and to determine the suitability of the proposed hammer for the size, length and type of pile being installed for the soil types encountered as the piles are driven. This initial monitoring shall determine, efficiency of the hammer relative to specified efficiency, level of compressive and tensile stress in pile and extent/location of any pile damage caused by the initial driving. With each blow of the pile the information listed below shall be electronically recorded and analyzed by the Pile Driving Analyzer:
  - a. Blow number
  - b. Blow rate per minute and/or stroke.
  - c. Input and reflected values of force and velocity.
  - d. Value of upward and downward traveling force wave with time.
  - e. Maximum and final transferred energy to pile, hammer system efficiency.
  - f. Maximum compressive stress, velocity, acceleration and displacement.
  - g. Maximum tensile stress in pile.
  - h. Pile structural integrity, damage detection, extent and location.
  - i. Ultimate axial capacity of pile by Case method.

If the pile, hammer and soil performance evaluation recommend changes to the hammer stroke or any other aspect for the pile driving operation these changes shall be incorporated into production pile driving in an effort to control excessive stresses and pile damage. Test piles damaged or broken during installation shall be replaced, incorporating driving modifications as determined by the Contractor's Geotechnical Consultant and reviewed and approved by the PHA. This procedure shall be repeated until allowable tensile and compressive stresses are achieved in the pile and/or pile damage is minimized. Selected initial driving records shall be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, and soil resistance.

- 2. Upon completion of test pile driving the piles shall be allowed to set-up for at least 72 hours. After evaluation of pile, hammer and soil performance by the Contractor's Geotechnical Consultant, the second step of the dynamic pile analysis may proceed. This portion of the evaluation requires striking the set-up piles a minimum of 20-50 times, or as directed by the Contractor's Geotechnical Consultant using the same hammer which was used for the test pile driving and which will be used for production pile driving. The hammer shall be "warmed up" and in optimal readiness prior to restriking, in order to avoid capacity losses during evaluation of restrike data. Maximum hammer energy shall be applied during restrike in order to fully mobilize the soil resistance. However, care should be exercised as to not overstress the pile. In addition to those items listed above, restrike driving records are to be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, soil resistance and properties, and plot of applied load vs. average pile displacement.
- 3. Performance Report:
  - a. Upon satisfactory completion of each dynamic load test a minimum of three copies of a Pile Performance Report shall be submitted for the Contractor by the Contractor's Geotechnical Consultant. The submittal shall be prepared and sealed by a registered Professional Engineer, registered with a minimum of five years' experience, at least two of which shall have been in data interpretation from high strain dynamic pile testing and successful completion of at least five projects of similar size and scope and in similar geotechnical conditions. The report shall be made within seven working days of the completion of the dynamic load test.
  - b. Submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing within one (1) week after dynamic testing is completed.
  - c. The report for the Dynamic Pile Analysis shall contain the following information:
    - i. Ultimate axial capacity of pile from Case Pile Wave Analysis Program (CAPWAP). Information resulting from analysis of a selected restrike blow.
    - ii. Maximum and final transferred energy, hammer system efficiency during pile installation.
    - iii. Maximum compressive stress, velocity, acceleration and displacement.
    - iv. Maximum tensile stress in pile.
    - v. Pile structural integrity, damage detection, extent and location.
    - vi. Blows per minute and blow number.
    - vii. Input and reflection values of force and velocity, upward and downward traveling force wave with time.

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- viii. Pile skin friction and toe resistance distribution.
- ix. Maximum energy transferred to pile.
- d. The maximum allowable pile design load will be proposed by the Contractor's Geotechnical Consultant based upon the results of a satisfactory pile load test conducted on a pile driven as specified herein and shall include the effects of load transfer to the soil above the foundation stratum. If the soil resistance measured on restrike is less than the Nominal Pile Resistance shown on the plans, the Engineer may direct the Contractor to drive all or a portion of the remaining test pile length and repeat the restrike testing. The Contractor will be notified by the Engineer of the necessity to perform a second restrike test within 3 days of the receipt of the test results from the initial restrike.
- e. After submission of all dynamic pile driving analyses and a report from testing agency, the Engineer will review information, make a final determination of production pile lengths, and modify and issue revised drawings. The revised drawings shall be provided to the Contractor 14 days after submittal and acceptance of Dynamic Pile Test Report. The Engineer will also develop acceptance criteria for installation of production piles based on the Dynamic Pile Test Report.
- 4. The equipment to be used for dynamic testing of the pile hammer and soil performance and for dynamic load testing of the test pile shall be either a model GCPC or a PAK Pile Driving Analyzer as manufactured by Pile Dynamics, Inc., of Cleveland Ohio or approved equivalent.
- 5. The Contractor's Geotechnical Consultant shall be available throughout the pile driving operation to consult with the Owner when required by the Owner.

## End of Section

# **Pile Driving Log**

Project:								Contractor:										
Contract No.										Reco	rding D	ate:						
Wo	rk Orde	r No.										Recording Scribe:						
Har	nmer Da	nta			Vibr	atory	,				Imp	npact Rig:						
Mał	e & Mo	del:													Ram	Weight	:	
Тур	e:													Hamı	ner Cus	shion:		
Pile	Data										Cutoff I	Elevat	ion:				Time	
Stru	cture &	Pile No:					Batter:				Ground	Eleva	tion:				Finish:	
Size	, Length	, & Type	e:								Driven	Lengtl	1:				Start:	
Stat	ion / Coo	ordinates	3:								Pile Tip	Eleva	tion:				Drive Time	e:
DR	VING I	RECOR	DS															<b>^</b>
		Stroke or					Stroke or				Stroke or			Stroke or				CUT OFF LENGTH
Ft.	Blows	BPM	Ft.	Blows	Stroke	Ft.	BPM	Stroke	Ft.	Blows	BPM	Ft.	Blows	BPM	LAST	f foot		
1			21			41			61			81			In.	Blows	Stroke	CUT OFF ELEVATION
2			22			42			62			82			-1"			
3			23			43			63			83			-2"			+ + ₩
4			24			44			64			84			-3"			GROUND ELEVATION
5			25			45			65			85			-4"			
6			26			46			66			86			-5"			VEN LE
7			27			47			67			87			-6"			EPHH
8			28			48			68			88			-7"			
9			29			49			69			89			-8"			
10			30			50			70			90			-9"			
11			31			51			71			91			-10"			↓ 闘 ↓
12			32			52			72			92			-11"			TIP ELEVATION /
13			33			53			73			93			-12"			
14			34			54			74			94			Fuel	Setting	From (ft)	To (ft)
15			35			55			75			95						
16			36			56			76			96						
17			37			57			77			97						
18			38			58			78			98						
19			39			59			79			99						
20			40			60			80			100						
REI	REMARKS:																	
Driv	ing Fore	eman:							Phone	e:					Fax:			
Sup	erintende	ent:							Phone	e:					Fax:			
Proj	ect Man	Project Manager: Phone:										Fax:						

Note: When advancing pile with a vibratory hammer, enter time of day (HH:MM:SS) in "Blows" Column.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 31 62 18 Add - STEEL PIPE PILES

## PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing of all labor, materials, equipment, supervision, and every other thing necessary to furnish and drive steel pipe piles as described and specified herein and as shown on the Drawings.

## 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities SECTION 05 12 00.00 Mod – Structural Steel Framing SECTION 35 31 16.20 Mod – Steel Sheet Pile Bulkhead

## 1.3 REFERENCES

A. AMERICAN PETROLEUM INSTITUTE (API)

API Spec 5L (2012) Specification for Line Pipe

B. AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010; Errata 2011) Structural Welding Code - Steel

## C. ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2004; R 2010) Standard Specification for Electric-Fusion ARC)-Welded Steel Pipe (NPS 4 and over)
ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM A572/A572M	(2007) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A709/A709M	(2013a) Standard Specification for Structural Steel for Bridges
ASTM D4945	(2012) High-Strain Dynamic Testing of Piles

## 1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

- A. Preconstruction Submittals
  - 1. Pile Installation Plan:

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- a. Installation sequence
- b. Installation equipment
- c. Test pile plan and equipment
- 2. Wave Equation Analysis
- 3. Welding Plan
- 4. Delivery, Storage and Handling Plan (include forms showing dimensional tolerance)
- B. Shop Drawings
  - 1. Pile Placement Plan
  - 2. Pile Fabrication and Details
- C. Product Data
  - 1. Pile Driving Equipment
  - 2. Delivery, storage, and handling
- D. Test Reports
  - 1. Mill Test Reports
  - 2. Wave equation analysis
  - 3. Dynamic pile analysis
- E. Closeout Submittals
  - 1. Pile driving records
- 1.5 DELIVERY, STORAGE, AND HANDLING

Materials delivered to the site shall be in new and undamaged condition and shall be accompanied by certified material test reports. The manufacturer's logo and mill identification mark shall be stamped on each unspliced pile at a minimum of two locations and shall also be stamped on the mill test reports.

The Contractor shall confirm all delivery, storage, and handling of materials are to the requirements specified herein. The Contractor shall develop and submit delivery plans for the delivery, storage, and handling of piles at least 21 days prior to delivery of piles to the job site.

A. Delivery and Storage

Stack piles during delivery and storage so that each pile is maintained in a straight position and is supported every 10 feet or less along its length, ends inclusive, to prevent exceeding the maximum camber.

- B. A Sufficient number of skids shall be used to prevent deflection in the stored piling and prevent contact with the ground. The methods of handling shall prevent damage to the piling and when stored, piles shall be kept clean and fully drained at all times.
- C. Handling

Lift piles using methods which do not cause permanent damage to the piles. Do not drag piles across the ground.

The Contractor shall, in the presence of the PHA, check piles for damages, straightness, outof-roundness, radial offset, weld reinforcement height, misalignment of weld beads, wall thickness and outside diameter or any other defect causing the pile to be not in conformance with the specifications or drawings. This shall be done immediately prior to placement.

TECHNICAL SPECIFICATION Date: December 2020 Damaged piles or piles that do not meet the dimensional tolerances as listed under PART 2 will be rejected for use and replaced at no additional cost to the PHA. Submit the findings on a form developed by the Contractor and approved by PHA presenting the measurements taken and indicating compliance per criteria specified prior to installation.

Inspect piles for damage before transporting them from the storage area to the driving area and immediately prior to placement in the driving leads.

## PART 2 PRODUCTS

#### 2.1 MATERIALS

A. Pipe Piles

Pipe shall conform to the requirements of ASTM A252 or A572, seamless or welded with a minimum yield strength of 50 ksi. All pipe material shall be new and supplied in full length. Mark the piles with the following information: name and location of the piling producer, contract number, heat number, welding process, outside diameter, nominal wall thickness, length and the year that the piling was produced. Certified copies of mil test reports shall be submitted for each material shipment and shall be identified with specific lots. Test reports shall indicate all pertinent data on strength, ductility, notch toughness, chemical analysis, heat treatment and Nondestructive Testing (NDT). Charpy V-Notch (CVN) testing shall be submitted with the mill certifications as specified herein.

## 2.2 FABRICATION OF PIPE PILING

A. Welding

Perform all welding for piles in accordance with AWS D1.1/D1.1M, (except as modified in this section) using certified welders, welding operators, and tackers and qualified joint welding procedures.

Submit the welding plan at least 30 days prior to commencement of fabrication. Welding plan shall be stamped and signed by a certified Welding Inspector per AWS QC1. The welding plan shall include:

- 1. Qualifications for the Quality Control Inspector.
- 2. Welder Qualifications, Procedure Qualification Records (PQR) and Welding Procedure Specifications (WPS): Welder qualifications and a WPS with supporting PQR shall be submitted on any welding process utilized in the manufacturing of the pile and for pile splices. The welder qualifications, PQR and WPS shall be submitted in accordance with the requirements of AWS D1.1 and Specification 01 33 00 Submittals Procedures.
- NDT (Nondestructive Testing) : Certified copies of all visual testing (VT), ultrasonic testing (UT) and magnetic particle testing (MT) conducted shall be submitted. The inspection and NDT shall comply with the requirements of AWS D1.1.
- 4. Macrotech Sampling : At the beginning of the fabrication process, 3 representative Macrotech weld samples, to be furnished, shall be removed from locations at the top, bottom and side of the pipe and will be inspected to verify complete penetration welds. Samples shall indicate that the weld is free of cracks and has thorough fusion between adjacent layers of weld metal and between weld metal and base metal.
- B. Weld Processes

Welds made at a permanent manufacturing facility shall be performed by either a submerged arc weld (SAW) or a double submerged arc weld process (DSAW). Welds shall have complete joint penetration. All welds shall be pre-qualified welds in accordance with AWS D1.1/D1.1M. Welds other than AWS pre-qualified welds shall be qualified under AWS acceptance procedures.

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## C. Weld Testing Requirements

A minimum of ten percent of each longitudinal weld made at a permanent manufacturing facility shall receive non-destructive testing (NDT) by either radiographic, radioscopic, real time imaging systems or ultrasonic methods that are in conformance with the requirements of AWS D1.1/D1.1M. Submit pipe weld NDT records to the PHA. The repair criteria shall conform to the requirements of AWS D1.1/D1.1M, Section 6, for cyclically loaded non-tubular connections subject to tensile stress. If repairs are required in a portion of the weld, additional NDT shall be performed. The additional NDT shall be made on both sides of the repair for a length equal to 10 percent of the length of the pipe outside circumference. After the additional NDT is performed, and if more repairs are required that have a cumulative length equal to or more than 100 percent of the length of the pipe outside circumference, then the entire weld shall receive NDT. All testing shall be performed by a certified welding inspector per AWS QC1. Submit reports of the testing prior to shipment of pipe piles to the site.

D. Splices

Submit shop drawings showing location of splices and weld details for approval by PHA prior to fabrication. The required non-destructive testing (NDT) of welds shall also be shown on the shop drawings.

All splices for pipe piling shall be made with continuous butt welds. All the butt welds shall be complete penetration, pre-qualified welds. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1/D1.1M. Construct splices to maintain the true alignment and position of the pile sections.

#### 2.3 COATING OF PIPE PILES

Coat pipe piles to the extent shown on contract drawings in accordance with 09 96 56.01 Std-Epoxy Coatings- Coal Tar.

## PART 3 EXECUTION

## 3.1 PILE DRIVING EQUIPMENT

Select the proposed pile driving equipment at least 14 days prior to commencement of work, including hammers and other required items, and submit complete descriptions of the proposed equipment. Changes in the selected pile driving equipment will not be allowed after the equipment has been approved except as directed. No additional contract time will be allowed for Contractor proposed changes in the equipment.

A. Pile Driving Hammers

Provide impact and/or vibratory type pile driving hammers.

Submit information on the type of equipment proposed to be used, proposed methods of operation, pile driving plan including proposed sequence of driving production piles and dynamic testing, and details of all pile driving equipment and accessories.

Provide details of pile driving equipment and a Wave Equation Analysis of pile drivability for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Engineer for each test pile location where different subsurface conditions exist or for different size piles in the same bulkhead wall and is to include the following information pertaining to the proposed pile driving equipment:

- 1. Submit Pile and Driving Equipment data, for each proposed pile hammer and pile type combination.
- 2. Copies of computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count.

Analysis shall be run for the full driven length of the pile to define maximum stress levels in the pile during driving.

B. Impact Hammers

Provide steam, air, or diesel-powered impact pile hammers of the single-acting, double-acting, or differential-acting type. Provide boiler, compressor, or engine capacity sufficient to operate hammers continuously at the full rated speed. Hammers must have a gage to monitor hammer bounce chamber pressure for diesel hammers (except for open ended diesel hammers) or pressure at the hammer for air and steam hammers. This gage must be operational during the driving of piles and be mounted in an accessible location for monitoring by the Contractor and Engineer. Provide bounce chamber pressure gage correction tables and charts for the type and length of hose to be used with the pressure gage to the Engineer. Obtain driving energy by use of a heavy ram and a short stroke with low impact velocity, rather than a light ram and a long stroke with high impact velocity. Position a pile cap or drive cap between the pile and hammer. Place hammer cushion or cap block between ram and the pile cap or drive cap. Hammer cushion or cap block must have consistent elastic properties, minimize energy absorption, and transmit hammer energy uniformly and consistently during the entire driving period. Submit the following information for each impact hammer proposed:

- 1. Make and model.
- 2. Ram weight (pounds).
- 3. Anvil weight.
- 4. Rated stroke (inches).
- 5. Rated energy range (foot-pounds).
- 6. Rated speed (blows per minute).
- 7. Steam or air pressure, hammer, and boiler and/or compressor (psi).
- 8. Rated bounce chamber pressure curves or charts, including pressure correction chart for type and length of hose used with pressure gage (pounds per square inch).
- 9. Pile driving cap, make, and weight (pounds).
- 10. Cushion block dimensions and material type.
- 11. Power pack description.
- C. Vibratory Hammers

The use of vibratory hammers is dependent upon the Contractor's ability to satisfactorily drive the piles. All piles initially driven using a vibratory hammer shall be driven to the required capacity or the tip elevation as shown in the Drawings in accordance with the approved refusal criteria using a power hammer. The vibratory hammer must provide for maintaining a rigid connection between the hammer and the pile. Submit the following information for each vibratory hammer proposed:

- 1. Make and model.
- 2. Eccentric moment (inch-pounds).
- 3. Dynamic force (tons).
- 4. Steady state frequency or frequency range (cycles per minute).
- 5. Vibrating weight (pounds).
- 6. Amplitude (inches).

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- 7. Maximum pull capacity (tons).
- 8. Non-vibrating weight (pounds).
- 9. Power pack description.
- D. Pile Driving Leads

Support and guide hammers with leads capable of driving piles to their intended location and within tolerances specified.

E. Pile Extractors

Pile extractors may be vibratory and/or impact pile driving hammers. Impact hammers are required for pulling piles not extractable with vibratory hammers. Faulted piles shall be extracted.

F. Jetting Equipment

Jetting of piles is not permitted.

## 3.2 PRELIMINARY WORK

- A. Wave Equation Analysis of Pile Drivability
  - Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by the Contractors' Engineer. This analysis shall take into account the proposed hammer assembly, pile cap block and cushion characteristics, the pile properties and estimated lengths and the soil properties anticipated to be encountered throughout the installed pile length based on static capacity analysis with consideration of driving gain/loss factors. Only one specific model of pile hammer may be used for each pile type and capacity.
  - 2. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained within the limits below and indicate the blow count necessary to achieve the required ultimate static pile capacities, stated within the contract drawings.

## Allowable Driving Stresses

Steel

Compression: 0.9 fy

Tension: 0.9 fy

Where f<sub>y</sub> is yield strength of steel.

## 3.3 INSTALLATION

The Contractor shall mark each pile prior to driving with horizontal lines (perpendicular to the longitudinal axis of pile) at one-foot intervals, and the number of feet from pile tip at five-foot intervals. For test piles to be re-struck, mark the pile with horizontal lines at one-inch interval for at least a foot above the reference line used for monitoring penetration. Inspect piles when delivered and when in the leads immediately before driving. Handle piles so as to protect pile coatings. Repair damage or defects in pile coatings as specified in 09 96 56.01 Std- Epoxy Coatings- Coal Tar. Cut piles at cutoff grade by an approved method.

A. Pile Driving Records

Submit proposed form for compiling pile driving records 14 days prior to commencement of work. Submit complete and accurate job pile driving records on a daily basis after completion of driving. Compile and submit accurate records of the pile driving operations on the approved sample pile

TECHNICAL SPECIFICATION Date: December 2020 driving records form. Include in driving records for each pile date driven, pile identification number, number of splices and their locations, cross section shape and pile dimensions, location, deviations from design location, original length, ground elevation, top elevation, tip elevation, description of hammer used, number of blows required for each foot of penetration throughout the entire length of the pile and for each inch of penetration in the last foot of penetration, total driving time in minutes and seconds, and any other pertinent information as required or requested such as unusual driving conditions, interruptions or delays during driving, damage to pile resulting from driving, heave in adjacent piles, redriving, weaving, obstructions, and depth and description of voids formed adjacent to the pile.

Additional data required to be recorded for impact hammers includes the stroke height/rate of hammer operation (blows per min (BPM)), fuel settings throughout pile driving, make, size, and the length of the bounce hose. Additional data required to be recorded for vibratory hammers includes hammer power pack description, make, size, horsepower applied to pile, and hammer operating frequency.

## B. Pile Placement and Tolerances in Driving

Develop and submit a pile placement plan at least 14 days prior to delivery of piles to the job site, which shows the installation sequence and the methods proposed for controlling the location and alignment of piles. Complete all foundation preparations in the area prior to the placement of piles for driving. Accurately place piles in the correct location and alignments, both laterally and longitudinally, and to the vertical lines indicated. Establish a permanent base line to provide for inspection of pile placement by the PHA during pile driving operations prior to driving piles. Baseline to be maintained during the installation of the piles.

A final lateral deviation from the correct location at the cutoff elevation of not more than 1 1/2 inches will be permitted for plumb and batter piles. Manipulation of piles will not be permitted, unless approved by the PHA. A variation of not more than 1/2 inch per 10 feet of pile length from the vertical for vertical piles nor more than 0.25 inch per foot of pile length from the required angle for batter piles will be permitted. A vertical deviation of not more than 2 inches from the correct cutoff elevations shown is permitted. Inspect piles for heave. Redrive heaved piles to the required tip elevation. Maintain the correct relative position of all piles by the use of templates or by other approved means such that the piles are not displaced during the installation of the pile cap. Redesign of pile caps or additional work required due to improper location of piles is the financial responsibility of the Contractor. Piles damaged or not located properly (unless pile head movements allowed) or exceeding the maximum limits for lateral and vertical deviation, or variation in alignment must be pulled and new piles redriven, or provide additional piles at locations directed by Chief Construction Manager at no additional cost to the PHA.

#### C. Pile Penetration Criteria

The tip elevation for job/production piles will be verified based on the dynamic testing of selected piles during installation for the project.

Pile acceptance should be determined by the Geotechnical Engineer's representative based primarily on tip elevation as shown on the drawings and the pile penetration data from dynamic testing. The available geotechnical data for the project shall also be referenced for acceptance of the pile penetration acceptance. After piles have achieved tip elevation, the secondary requirement is that the minimum axial resistance shown on drawings shall be achieved as estimated blow count and hammer performance.

Excess material from pile cutoffs will become the property of the Contractor and shall be at no additional expense to the PHA. Where there is the need for additional pile buildup due to insufficient axial capacity after the pile is driven to the minimum tip elevation, the PHA will bear the additional cost for pile buildup and driving to meet the required axial capacity at the unit rate provided in the Bid Form.

## D. Pile Driving

Pile driving operations should be observed by an Engineering Technician under the Geotechnical Engineer's supervision to determine whether the piles are encountering expected driving resistances and to note any problems during installation. Pile acceptance should be determined by the Geotechnical Engineer's representative based on tip elevation and with blow count and hammer performance.

Notify the PHA 10 days prior to the date pile driving is to begin. Do not drive piles within 100 feet of concrete less than 7 days old. Drive like piles with hammers of the same model and manufacturer, same energy and efficiency, and using the same driving system. Operate hammers at all times at the speed and under the conditions recommended by the manufacturer. Where heave is anticipated, the sequence of installation must be such that pile heave is minimized by starting pile driving at the center of the group and proceeding outward. Prior to driving and with the pile head seated in the hammer, check each pile to ensure that it has been aligned correctly. Once pile driving has begun, keep conditions such as alignment constant. Drive each pile continuously and without interruption until the required tip elevation has been attained. Deviation from this procedure will be permitted only when driving is stopped by causes that reasonably could not have been anticipated. A pile that cannot be driven to the required depth because of an obstruction, as indicated by a sudden unexplained change in blow count or drifting, must be pulled and re-driven or cut off and abandoned, whichever is directed by PHA. After piles are driven, cutoff square as required at the indicated cutoff elevation. If, in driving, it is found that pile is not of sufficient length to give the capacity specified, notify the PHA, and submit pile driving logs.

1. Heaved Piles

When driving piles in clusters or under conditions of relatively close spacing, perform observations to detect heave of adjacent piles. Backdrive heaved piles to original depth of penetration.

2. Pulled Piles

Pull and replace piles damaged or impaired for use during driving with new piles or cut off and abandon and drive new piles as directed. Redrive piles pulled as directed and found to be in suitable condition at another location as directed. Replace piles pulled as directed and found to be damaged with new piles.

3. Long Piles

Handle and drive piles carefully to prevent overstress of long slender piles.

4. Welding

AWS D1.1/D1.1M. Provide 100 percent radiographic or ultrasonic examination of complete penetration butt welds.

## 3.4 PILE TESTING

## A. Test Piles

Perform dynamic testing on piles as indicated on drawings noted as Production Test Piles to measure and verify the axial capacities meet design requirements. Contractor shall test the first pile driven for the representative typical pile type for the structure. Order verification test piles a minimum of ten (10) feet longer in length than production piles. The Contractor is responsible for providing adequate length of the test piles to meet project design requirements to accommodate for testing equipment, templates, and other means and methods to install piles. The additional test pile length shall be driven only at the direction of the Contractor's Geotechnical Engineer. The

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Contractor's Geotechnical Consultant will use test pile data to determine "calculated" pile tip elevation. Drive test piles at the locations indicated. Drive test piles to indicated tip elevation. The test piles shall become a part of the finished work. A pile dynamic analyzer shall be provided and operated as specified in paragraph DYNAMIC PILE ANALYSIS during the driving of each test pile. Modify driving as required based upon recommendation of Contractor's Geotechnical Consultant and approval of the PHA.

The Contractor shall notify the PHA of the date and time for dynamic testing at least 10 days, and again at 72 hours, prior to testing.

B. Dynamic Pile Analysis

The purpose of dynamic testing is to provide supplemental information for evaluating pile hammer performance, driving stresses, and ultimate axial capacity. Dynamic testing shall be conducted during the entire time test piles are initially driven or re-driven and during pile restrike testing. Use test piles of type as specified elsewhere in this section. Equipment to obtain dynamic measurements, record, reduce and display its data shall be furnished and meet the requirement of ASTM D4945. The equipment shall have been calibrated within 12 months. Drive test piles at the locations indicated. The contractor shall employ an independent inspection firm, hereinafter referred to as the "Contractor's Geotechnical Consultant", experienced in the pile driving process, monitoring of test pile installation, and in the use of the Pile Driving Analyzer and its related equipment. The Contractor's Geotechnical Consultant and the dynamic monitoring operator shall have a minimum of five years' experience in data acquisition from high strain dynamic pile testing and successful performance on at least two projects of similar size and scope and in similar geotechnical conditions in past two years. Dynamic pile analysis shall be performed as follows:

- 1. Each dynamic pile analysis shall be performed in two steps. The first step is to check the hammer, pile and soil performance, and to determine the suitability of the proposed hammer for the size, length and type of pile being installed for the soil types encountered as the piles are driven. This initial monitoring shall determine, efficiency of the hammer relative to specified efficiency, level of compressive and tensile stress in pile and extent/location of any pile damage caused by the initial driving. With each blow of the pile the information listed below shall be electronically recorded and analyzed by the Pile Driving Analyzer:
  - a. Blow number
  - b. Blow rate per minute and/or stroke.
  - c. Input and reflected values of force and velocity.
  - d. Value of upward and downward traveling force wave with time.
  - e. Maximum and final transferred energy to pile, hammer system efficiency.
  - f. Maximum compressive stress, velocity, acceleration and displacement.
  - g. Maximum tensile stress in pile.
  - h. Pile structural integrity, damage detection, extent and location.
  - i. Ultimate axial capacity of pile by Case method.

If the pile, hammer and soil performance evaluation recommend changes to the hammer stroke or any other aspect for the pile driving operation these changes shall be incorporated into production pile driving in an effort to control excessive stresses and pile damage. Test piles damaged or broken during installation shall be replaced, incorporating driving modifications as determined by the Contractor's Geotechnical Consultant and reviewed and approved by the PHA. This procedure shall be repeated until allowable tensile and compressive stresses are achieved in the pile and/or pile damage is minimized. Selected initial driving records shall be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, and soil resistance.

- 2. Upon completion of test pile driving the piles shall be allowed to set-up for at least 72 hours. After evaluation of pile, hammer and soil performance by the Contractor's Geotechnical Consultant, the second step of the dynamic pile analysis may proceed. This portion of the evaluation requires striking the set-up piles a minimum of 20-50 times, or as directed by the Contractor's Geotechnical Consultant using the same hammer which was used for the test pile driving and which will be used for production pile driving. The hammer shall be "warmed up" and in optimal readiness prior to restriking, in order to avoid capacity losses during evaluation of restrike data. Maximum hammer energy shall be applied during restrike in order to fully mobilize the soil resistance. However, care should be exercised as to not overstress the pile. In addition to those items listed above, restrike driving records are to be subjected to rigorous computer analysis by the Case Pile Wave Analysis Program (CAPWAP) for determination of resistance distribution, soil resistance and properties, and plot of applied load vs. average pile displacement.
- 3. Performance Report:
  - a. Upon satisfactory completion of each dynamic load test a minimum of three copies of a Pile Performance Report shall be submitted for the Contractor by the Contractor's Geotechnical Consultant. The submittal shall be prepared and sealed by a registered Professional Engineer, registered with a minimum of five years' experience, at least two of which shall have been in data interpretation from high strain dynamic pile testing and successful completion of at least five projects of similar size and scope and in similar geotechnical conditions. The report shall be made within seven working days of the completion of the dynamic load test.
  - b. Submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing within one (1) week after dynamic testing is completed.
  - c. The report for the Dynamic Pile Analysis shall contain the following information:
    - i. Ultimate axial capacity of pile from Case Pile Wave Analysis Program (CAPWAP). Information resulting from analysis of a selected restrike blow.
    - ii. Maximum and final transferred energy, hammer system efficiency during pile installation.
    - iii. Maximum compressive stress, velocity, acceleration and displacement.
    - iv. Maximum tensile stress in pile.
    - v. Pile structural integrity, damage detection, extent and location.
    - vi. Blows per minute and blow number.
    - vii. Input and reflection values of force and velocity, upward and downward traveling force wave with time.
    - viii. Pile skin friction and toe resistance distribution.
    - ix. Maximum energy transferred to pile.
  - d. The maximum allowable pile design load will be proposed by the Contractor's Geotechnical Consultant based upon the results of a satisfactory pile load test conducted on a pile driven as specified herein and shall include the effects of load transfer to the soil above the foundation stratum. If the soil resistance measured on restrike is less than the Nominal Pile Resistance shown on the plans, the Engineer may direct the Contractor to drive all or a portion of the remaining test pile length and repeat the restrike testing. The Contractor will be notified by the Engineer of the necessity to perform a second restrike test within 3 days of the receipt of the test results from the initial restrike.

- e. After submission of all dynamic pile driving analyses and a report from testing agency, the Engineer will review information, make a final determination of production pile lengths, and modify and issue revised drawings. The revised drawings shall be provided to the Contractor 14 days after submittal and acceptance of Dynamic Pile Test Report. The Engineer will also develop acceptance criteria for installation of production piles based on the Dynamic Pile Test Report.
- 4. The equipment to be used for dynamic testing of the pile hammer and soil performance and for dynamic load testing of the test pile shall be either a model GCPC or a PAK Pile Driving Analyzer as manufactured by Pile Dynamics, Inc., of Cleveland Ohio or approved equivalent.
- 5. The Contractor's Geotechnical Consultant shall be available throughout the pile driving operation to consult with the PHA when required by the PHA.

## End of Section

# **Pile Driving Log**

Project:								Contractor:										
Contract No.										Reco	rding D	ate:						
Wo	rk Orde	r No.										Recording Scribe:						
Har	nmer Da	nta			Vibr	atory	,				Imp	npact Rig:						
Mał	e & Mo	del:													Ram	Weight	:	
Тур	e:													Hamı	ner Cus	shion:		
Pile	Data										Cutoff I	Elevat	ion:				Time	
Stru	cture &	Pile No:					Batter:				Ground	Eleva	tion:				Finish:	
Size	, Length	, & Type	e:								Driven	Lengtl	1:				Start:	
Stat	ion / Coo	ordinates	3:								Pile Tip	Eleva	tion:				Drive Time	e:
DR	VING I	RECOR	DS															<b>^</b>
		Stroke or					Stroke or				Stroke or			Stroke or				CUT OFF LENGTH
Ft.	Blows	BPM	Ft.	Blows	Stroke	Ft.	BPM	Stroke	Ft.	Blows	BPM	Ft.	Blows	BPM	LAST	f foot		
1			21			41			61			81			In.	Blows	Stroke	CUT OFF ELEVATION
2			22			42			62			82			-1"			
3			23			43			63			83			-2"			+ + ₩
4			24			44			64			84			-3"			GROUND ELEVATION
5			25			45			65			85			-4"			
6			26			46			66			86			-5"			VEN LE
7			27			47			67			87			-6"			EPHH
8			28			48			68			88			-7"			
9			29			49			69			89			-8"			
10			30			50			70			90			-9"			
11			31			51			71			91			-10"			↓ 闘 ↓
12			32			52			72			92			-11"			TIP ELEVATION /
13			33			53			73			93			-12"			
14			34			54			74			94			Fuel	Setting	From (ft)	To (ft)
15			35			55			75			95						
16			36			56			76			96						
17			37			57			77			97						
18			38			58			78			98						
19			39			59			79			99						
20			40			60			80			100						
REI	REMARKS:																	
Driv	ing Fore	eman:							Phone	e:					Fax:			
Sup	erintende	ent:							Phone	e:					Fax:			
Proj	ect Man	Project Manager: Phone:										Fax:						

Note: When advancing pile with a vibratory hammer, enter time of day (HH:MM:SS) in "Blows" Column.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 32 11 13.13 Add – LIME TREATED SUBGRADE

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the stabilization of sub-grade for pavements and foundational layers for other structures by the pulverization, addition of lime, mixing and compacting the mixed material to the required density. This item applies to natural ground, embankment, or existing pavement structures as described and specified herein and as shown on the Drawings.

## 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 31 23 00 Add - Excavation and Fills

SECTION 31 24 00 Add - Embankment Construction

## 1.3 REFERENCES

- A. ASTM International Publications, latest editions:
  - ASTM D-698 Standard Test Methods for Laboratory Compaction of Soil using Standard Effort
  - ASTM D 2922 Standard Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods
- B. Texas Department of Transportation Test Procedures, latest editions:

Test Method Tex-600-J Sampling and Testing Lime

- Test Method Tex-120-E Soil-Lime Testing
- Test Method Tex-121-E Soil-Lime Testing

Test Method Tex-128-E Determining Soil pH

## 1.4 SUBMITTALS

- A. Product Data: Test Reports and Certification from the Manufacturer that Lime meets this Section.
- B. Equipment List
- C. Manufacturer Details

## 1.5 HANDLING AND STORAGE

A. Lime shall be stored and handled in closed weatherproof containers until immediately before distribution on the road. If storage bins are used, they shall be completely enclosed. If Lime is furnished in trucks, each truck shall have a weigh ticket from a certified scale. If Lime is furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more 5 percent from that weight may be rejected.

## PART 2 PRODUCTS

## 2.1 MATERIALS

The following specifications establish the requirements for commercial lime slurry of the type and grade considered suitable for use in the stabilization of sub-grade.

- A. Commercial Lime Slurry:
  - 1. This material shall be a pumpable suspension of solids in water. The water or liquid portion of the slurry shall not contain dissolved material in sufficient quantity and/or nature injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of "solids content", shall consist principally of hydrated lime of a quality and fineness sufficient to meet the following requirements as to chemical composition and residue.
  - 2. Chemical Composition:

The "solids content" of the lime slurry shall have a hydrate alkalinity Ca(OH) of not less than 90 percent by weight. Provide lime with no magnesium hydroxide.

- 3. Residue:
  - a. The percent by weight of residue retained in the "solids content" of lime slurry shall conform to the following requirements:
    - 1) Residue retained on a No. 6 (3360-micron) sieve......Max. 0.0 percent
    - 2) Residue retained on a No. 10 (2000-micron) sieve......Max. 1.0 percent
    - 3) Residue retained on a No. 30 (590-micron) sieve......Max. 2.5 percent
- 4. Commercial Lime Slurry shall conform to one of the following two grades:
  - a. Grade 1: The "Dry Solids Contents" shall be at least 31 percent by weight of the slurry.
  - b. Grade 2: The "Dry Solids Contents" shall be at least 35 percent by weight of the slurry.
- B. The sampling and testing of lime slurry shall be as determined by Test Method Tex-600-J, "Lime Testing Procedure", of the Texas Department of Transportation (TxDOT).
- C. When commercial lime slurry is specified in the Technical Specifications, the Contractor shall select, prior to construction, the grade to be used and shall notify the Chief Construction Manager in writing before changing from one grade to another.

## PART 3 EXECUTION

3.1 The sub-grade for the concrete and asphalt pavement or foundational layers for other structures, shall be lime stabilized as follows:

- A. Hydrated lime shall be applied in the slurry form (mixed with water) as detailed herein. The slurry shall be commercial lime slurry mixed at a plant and delivered to the jobsite in tank trucks.
- B. The lime stabilization of soil in areas too confined for normal road machinery shall be accomplished by methods that are suitable for such confined areas. The end result, however, shall be a stabilized sub-grade that meets the thickness, density, finished grade and lime content requirements of the Drawings and these Technical Specifications.

## 3.2 EQUIPMENT

A. The machinery, tools and equipment necessary for proper prosecution of the work shall be on the project prior to the beginning of construction operations. All machinery, tools and equipment used shall be maintained in a satisfactory working condition.

## 3.3 CONSTRUCTION

A. It is the primary requirement of this Section to secure a completed course of treated material containing a uniform lime mixture, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface. It shall be the responsibility of the Contractor to regulate the sequence of his work, to use the proper amount of lime, maintain the work and rework the courses as necessary to meet the specified requirements.

## B. Preparation

- 1. Prior to beginning any lime treatment, the subgrade layer shall be constructed and shaped to conform to the required lines and grades as shown on the Drawings. The Contractor may use a cutting and pulverizing machine that will remove the sub-grade material accurately to the secondary grade and pulverize the material at the same time. The sub-grade shall be proof rolled with a minimum of 25 ton roller and the Contractor shall correct any soft areas that this proof rolling may reveal. This method will be permitted only where a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut. The machine shall be of such design that visible indication is given at all times that the machine is cutting to the proper depth.
- 2. For deeper subgrade treatment, the material to be treated shall then be excavated to the secondary grade (proposed bottom of lime treatment) and removed or windrowed to expose the secondary grade. Any wet or unstable materials below the secondary grade shall be corrected by drying or by replacement with selected, compacted backfill (at unit price for replacement of unsuitable material.) The excavated material shall then be spread to the desired cross section.
- C. Application:
  - 1. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.
  - 2. The dry weight of lime applied shall be not less than five and one-half percent nor more than six and one-half percent of the dry weight of the soil treated so as determined by the Lime series content test (pH).
  - 3. The lime shall be mixed with water in trucks with suitable distributors and applied as a thin water suspension or slurry. Commercial Lime Slurry shall be applied with a lime percentage not less than that applicable for the grade used. The distribution of lime at the rates required by this Section shall be attained by successive passes over a measured section of subgrade until the proper moisture and lime content has been

32 11 13.13 Add Page 3 secured. The distributor truck shall be equipped with an agitator which will keep the lime and water in a uniform mixture.

- D. Mixing:
  - 1. First Mixing:
    - a. The soil material and lime shall be thoroughly mixed by suitable road mixers or other suitable equipment and the mixing continued until, a homogeneous, friable mixture of material and lime is obtained, free from all clods or lumps. Materials containing plastic clays or other material which will not readily mix with lime shall be mixed as thoroughly as possible at the time of the lime application. Bring mixture to the proper moisture content and leave to cure for 3 days, unless otherwise directed by the Chief Construction Manager. During the curing period the material shall be kept moist.
  - 2. Final Mixing:
    - a. After the required curing time, the material shall be uniformly mixed.
    - b. If the soil binder-lime mixture contains clods, they shall be reduced in size by raking, blading, disking, harrowing, scarifying or the use of other suitable pulverization methods so that when all non-slaking aggregates retained on the No. 4 sieve are removed, the remainder of the material shall meet the following requirements when tested dry by laboratory sieves:

	<u>Percent</u>
Minimum Passing 1-3/4" Sieve	100
Minimum Passing No. 4 Sieve	60

- c. During the interval of time between application and mixing, hydrated lime that has been exposed to the open air for a period of 6 hours or more, or to excessive loss due to washing or blowing, will not be accepted for payment.
- E. Compaction:
  - 1. Compaction shall be accomplished by using sheep foot roller and finish with smooth drum.
  - 2. Compaction of the mixture shall begin immediately after final mixing and in no case later than 3 calendar days after final mixing. The material shall be aerated or sprinkled as necessary to provide the optimum moisture.
  - 3. If the total thickness of the material to be treated cannot be mixed in one operation, the previously mixed material shall be bladed to a windrow just beyond the area to be treated and the next layer mixed with lime as specified in this Section. The first layer of the treated material shall be compacted in such a manner that the treated material will not be mixed with the underlying material.
  - 4. The course shall be sprinkled as required and compacted to a density of 98 percent of maximum dry density determined in accordance with ASTM D-698. The moisture content of the lime stabilized layer, when compacted, shall be plus or minus 2 percent of the optimum moisture content.
  - 5. In addition to the requirements specified for density, the full depth of the material shown on the Drawings shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Port Authority. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation the shape of the course shall be maintained by blading and the surface upon completion shall be

32 11 13.13 Add LIME TREATED SUBGRADE Page 4 smooth and in conformity with the requirements shown on the Drawings and to the established lines and grades. Should the material, due to any reason, or cause, lose the required stability, density, and finish before the pavement or railroad sub-ballast is placed, it shall be re-compacted and refinished at the sole expense of the Contractor.

## 3.4 FINISHING, CURING AND PREPARATION FOR SURFACING

A. After the final layer or course of the lime treated sub-grade has been brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling with a pneumatic or other suitable roller sufficiently light to prevent hair cracking. The completed section shall be moist-cured and/or when asphalt or emulsion is permitted for curing purposes, finish material for a minimum of 7 days before further courses are added or any traffic is permitted. In cases where PI of soil is less than 35 and sub-grade treatment sets up sufficiently to prevent damage from traffic, such layers may be opened to traffic 2 days after compaction.

## 3.5 TOLERANCES

- A. Completed Surface: Smooth and conforming to typical section and established lines and grades.
- B. Top of compacted surface: Plus or minus one quarter inch in cross section.
- C. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1000 square yards of surface area.

## 3.6 PROTECTION

- A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.
- B. Repair defects immediately by replacing material to full depth with 2-5 percent lime.
- C. Moist cure to avoid cracking.

## END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 32 15 00.00 Add – AGGREGATE SURFACING

## PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the application of Aggregate Surfacing for staging areas, storage areas, haul and service roads, and crane roads if indicated in the plan set.

## 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment SECTION 31 23 00 Add - Excavation and Fills SECTION 31 24 00 Add - Embankment Construction

## 1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

A. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

## B. ASTM INTERNATIONAL (ASTM)

TECHNICAL SPECIFICATION Date: December 2020	32 15 00.00 Add Page 1	AGGREGATE SURFACING
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method fo Soil in Place by Sand-Cone Method	or Density and Unit Weight of
ASTM D75/D75M	(2019) Standard Practice for Sampling	Aggregates
ASTM C136/C136M	(2019) Standard Test Method for Sieve Aggregates	Analysis of Fine and Coarse
ASTM C131/C131M	(2020) Standard Test Method for Resist Size Coarse Aggregate by Abrasion and Machine	ance to Degradation of Small- d Impact in the Los Angeles
ASTM C117	(2017) Standard Test Method for Materi Sieve in Mineral Aggregates by Washin	als Finer than 75-um (No. 200) g

ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3) (2700 kN- m/m3)
ASTM D2167	(2015) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D3740	Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5255	Standard Practice for Certification of Personnel Engaged in the Testing of Soil and Rock
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

## 1.4 SUBMITTALS

- A. Product Data: Plant, Equipment, and Tools, Waybills and Delivery Tickets.
- B. Test Reports: Initial Tests; In-Place Tests.

## 1.5 DEGREE OF COMPACTION

A. Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve will be expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

## 1.6 EQUIPMENT, TOOLS, AND MACHINES

A. All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Provide adequate equipment having the capability of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

## 1.7 QUALITY ASSURANCE

A. Sampling and testing are the responsibility of the Contractor. Laboratories performing Contractor's tests shall be accredited in accordance with ASTM D3740. Personnel engaged in the testing shall be certified in accordance with ASTM D5255. The Contracting Officer shall be provided advance notification of field sampling and testing so that he/she may observe the

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32 15 00.00 Add Page 2 AGGREGATE SURFACING

sampling/testing. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

- B. Sampling
  - 1. Take samples for laboratory testing in conformance with ASTM D75/D75M.
- C. Testing
  - 1. Sieve Analysis
    - a. Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11.
  - 2. Liquid Limit and Plasticity Index
    - a. Determine liquid limit and plasticity index in accordance with ASTM D4318.
  - 3. Moisture-Density Determinations
    - a. Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph COMPACTION.
  - 4. Field Density Tests
    - a. Measure field density in accordance with ASTM D1556/D1556M, ASTM D2167 or ASTM D6938. For the method presented in ASTM D1556/D1556M use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.
  - 5. Wear Test
    - a. Perform wear tests on aggregate surface course material in conformance with ASTM C131/C131M.

## 1.8 ENVIRONMENTAL REQUIREMENTS

A. Perform construction when the atmospheric temperature is above 35 degrees F. It is the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Bring surfaces damaged by freeze, rainfall, or other weather conditions to a satisfactory condition.

## PART 2 PRODUCTS

- 2.1 AGGREGATES
  - A. Provide aggregates consisting of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved materials processed and blended or naturally combined. Provide aggregates free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor is responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness

32 15 00.00 Add Page 3 requirements specified herein after all compaction and proof rolling operations have been completed.

- B. Coarse Aggregates
  - 1. The material retained on the No. 4 sieve is known as coarse aggregate. Use only coarse aggregates that are reasonably uniform in density and quality. Use only coarse aggregate having a percentage of wear not exceeding 50 percent after 500 revolutions as determined by ASTM C131/C131M. The amount of flat and/or elongated particles must not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source must meet the requirements set forth herein.
- C. Fine Aggregates
  - 1. The material passing the No. 4 sieve is known as fine aggregate. Fine aggregate consists of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.
- D. Gradation Requirements
  - 1. Gradation requirements specified in TABLE I apply to the completed aggregate surface. It is the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. TABLE I shows permissible gradings for granular material to be used for this specification. Use sieves conforming to ASTM E11.

TABLE I. GRADATION FOR AGGREGATE SURFACE COURSES (Percentage by Weight Passing Square-Mesh Sieve)									
Sieve Designation	No. 1	No. 2	No. 3	No. 4					
1 inch	100	100	100	100					
3/8 inch	50-85	60-100							
No. 4	35-65	50-85	55-100	70-100					
No. 10	25-50	40-70	40-100	55-100					
No. 40	15-30	24-45	20-50	30-70					
No. 200	8-15	8-15	8-15	8-15					

## 2.2 LIQUID LIMIT AND PLASTICITY INDEX

A. The portion of the completed aggregate surface course passing the No. 40 sieve must have a maximum liquid limit of 35 and a plasticity index of 4 to 9.

## 2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

- A. Initial Tests
  - 1. Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements

when furnished. Complete this testing for each source if materials from more than one source are proposed.

- a. Sieve Analysis.
- b. Liquid limit and plasticity index.
- c. Moisture-density relationship.
- d. Wear.
- 2. Submit certified copies of test results for approval not less than 30 days before material is required for the work.
- B. Approval of Material
  - 1. Tentative approval of material will be based on initial test results.

## PART 3 EXECUTION

- 3.1 OPERATION OF AGGREGATE SOURCES
  - A. Perform clearing, stripping, and excavating. Operate the aggregate sources to produce the quantity and quality of materials meeting these specification requirements in the specified time limit. Upon completion of the work, leave aggregate sources on Government property in a satisfactory condition so that they readily drain. Finalize aggregate sources on private lands in agreement with local laws or authorities.
- 3.2 STOCKPILING MATERIAL
  - A. Prior to stockpiling the material, clear and level the storage sites. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates in such a manner that will prevent segregation. Stockpile aggregates and binders obtained from different sources separately.
- 3.3 PREPARATION OF UNDERLYING SUBGRADE
  - A. Clean the subgrade of all foreign substances. Correct ruts or soft yielding spots in the subgrade, areas having inadequate compaction, and deviations of the surface from the requirements set forth in the plans and specifications. Correction shall be made by loosening and removing soft or unsatisfactory material, by adding approved material, reshaping to line and grade, and recompacting to density requirements as specified in Section 31 23 00 Add Excavation and Fills and Section 31 24 00 Add Embankment Construction. Do not allow construction vehicles or other operations to disturb the completed subgrade and maintain the completed subgrade in a satisfactory condition until the surface course is placed.
- 3.4 GRADE CONTROL
  - A. During construction, maintain the lines and grades indicated for the aggregate surface course, as approved by the Contracting Officer.
- 3.5 MIXING AND PLACING MATERIALS
  - A. Mix and place the materials to obtain uniformity and a uniform optimum water content for compaction. Make adjustments as necessary in mixing, placing procedures, and/or in equipment to obtain the true grades, minimize segregation and degradation, and to obtain the desired water content to ensure an acceptable surface course.

## 3.6 LAYER THICKNESS

A. Place the aggregate material on the subgrade in layers of uniform thickness. Compact the completed aggregate surface course to the required thickness. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the aggregate surface course to a total thickness that is within 1/2 inch of the required thickness. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the required thickness. Measure the total thickness of the aggregate surface course at intervals of one measurement for each 500 square yards of surface course. Measure total thickness using 3-inch diameter test holes penetrating the aggregate surface course.

## 3.7 COMPACTION

A. Degree of compaction is a percentage of the maximum density obtained by the test procedures presented in ASTM D1557 abbreviated herein as percent laboratory maximum density. Compact each layer of the aggregate surface course with approved compaction equipment, as required in the following paragraphs. Maintain the water content during the compaction procedure at optimum or at the percentage specified by the Contracting Officer. Compact the mixture with mechanical tampers in locations not accessible to rollers. Continue compaction until each layer through the full depth is compacted to at least 100 percent of laboratory maximum density. Remove any materials that are found to be unsatisfactory and replace them with satisfactory material or rework them to produce a acceptable condition.

## 3.8 PROOF ROLLING

A. In addition to the compaction specified above, proof roll the designated areas by application of 30 coverages of a heavy rubber-tired roller having four tires abreast with each tire loaded to 30,000 pounds and tires inflated to150 psi. In the areas designated, proof roll the top lift of layer on which surface course is laid and to each layer of the surface course. Maintain the water content of the lift of the layer on which the surface course is placed and each layer of the aggregate surface course at optimum or at the percentage directed from the start of compaction to the completion of a proof rolling. Remove and replace materials in the aggregate surface course or underlying materials indicated to be unacceptable by the proof rolling with acceptable materials as directed.

## 3.9 EDGES OF AGGREGATE SURFACE COURSE

A. Place approved material along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. Simultaneously roll and compact at least 1 foot of border width with the rolling and compacting of each layer of the surface course when the course is being constructed in two or more layers.

## 3.10 SMOOTHNESS TEST

A. Construct each layer so that the surface shows no deviations in excess of 3/8 inch when tested with a 10-foot straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Correct deviations exceeding this amount by removing material, replacing with new material, or reworking existing material and compacting, as directed.
## 3.11 FIELD QUALITY CONTROL

- A. In-Place Tests
  - 1. Perform each of the following tests on samples taken from the placed and compacted aggregate surface course. Take samples and test at the rates indicated.
    - a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 250 square yards, or portion thereof, of completed area.
    - b. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 500 square yards, or portion thereof, of material placed.
    - c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.
    - d. Measure the thickness of the aggregate surface course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the aggregate surface course.
- B. Approval of Material
  - 1. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and full compacted aggregate surface course.

## 3.12 MAINTENANCE

A. Maintain the aggregate surface course in a condition that will meet all specification requirements until accepted.

# END OF SECTION

# PORT OF HOUSTON AUTHORITY

## **TECHNICAL SPECIFICATIONS FOR**

# HSC ECIP – PACKAGE #7

## SECTION 32 31 13.00 Add - FENCES AND GATES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; furnishing materials and the performance of all work necessary to construct new chain link fencing and gates with barbed wire extensions and visibility screen fabric as described and specified herein and/or as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment.

SECTION 03 30 53.00 Add - Miscellaneous Cast-in-Place Concrete.

#### 1.3 REFERENCES

- A. ASTM International Publications, latest editions:
  - ASTM A-53 Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
  - ASTM A-90 Test Method for Weight of Coating for Iron and Steel Articles with Zinc or Zinc Alloy Coatings.
  - ASTM A-121 Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
  - ASTM A-123 Specification for Zinc (Hot Dipped Galvanized) Coatings for Iron and Steel Products.
  - ASTM A-153 Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
  - ASTM A-392 Specification for Zinc-Coated Steel Chain Link Fence Fabric.
  - ASTM A-475 Specification for Zinc-Coated Steel Wire Strand.
  - ASTM F-900 Specification for Industrial and Commercial Swing Gates.

#### 1.4 SUBMITTALS

- A. Product Data for: Chain Link wire mesh, steel posts, tension wire, barbed wire, touch-up galvanized paint, and visibility screen fabric.
- B. Mix Design for: Concrete.
- C. Shop Drawings for: Fence and Gate.

<b>TECHNICAL SPECIFICATION</b>
Date: December 2020

FENCES AND GATES

## 1.5 HANDLING AND STORAGE

A. Handling and storage shall be according to the material manufacturer's recommendations to prevent any damage to materials.

# PART 2 PRODUCTS

## 2.1 GENERAL

- A. All materials incorporated into the work shall be new and of first class manufacturing and construction.
- B. Style of Fence: Chain link with three strands of barbed wire.
  - 1. Full Height Chain Link Fence: Chain link with three strands of barbed wire on 45-degree arms. Tension wires top and bottom. Overall height 8 feet, excluding barbed wire strands. Heavy-duty industrial type fence fittings and gates shall be used throughout.

## 2.2 CHAIN LINK FENCE

- A. Fabric: All fence fabric shall be <u>one</u> of the following:
  - 1. No. 9 gauge chain link steel wire fabric 96 inches wide, woven in a 2-inch mesh, with top and bottom selvages twisted and barbed, having a Class I hot-dipped zinc coating (1.2 oz. per sq. ft. of wire surface), and having a breaking strength of 1,290 pounds, all in accordance with ASTM A 392. Galvanized coating shall be applied after weaving of the fabric; or
  - 2. No. 9 gauge chain link steel wire fabric 96 inches wide, woven in a 2-inch mesh, with top and bottom selvages twisted and barbed, having a Class II aluminum coating (0.40 oz. per sq. ft. of wire surface), and having a breaking strength of 1,290 pounds, all in accordance with ASTM A 491.
  - 3. All fence fabric for fencing at Morgan's Point shall be number 1 above.
- B. Posts:
  - 1. Posts shall be spaced on 8-foot 0-inch centers and installed as detailed on the Drawings.
    - a) Line Posts shall be galvanized steel Schedule 40 pipe, 2-3/8-inch OD, weighing 5.79 pounds or more per foot, complying with ASTM A 53 and be equipped with 6gauge galvanized steel coated or aluminum clips spaced on 16-inch maximum centers. A minimum of 30 inches of length shall be embedded in 2,500 pounds per square inch concrete.
    - b) End, Corner and Pull Posts: End, corner, and pull posts shall be Schedule 40 pipe 3-1/2-inch OD weighing 7.58 pounds or more per foot complying with ASTM A 53, equipped with 3/16-inch by <sup>3</sup>/<sub>4</sub>-inch tension bars, No. 11 gauge by 1-inch bands spaced on 16" maximum centers, and 3/8-inch carriage bolts and nuts. Posts, bars, bands, bolts, and nuts shall be hot-dip galvanized. A minimum of 42 inches of length shall be embedded in 2,500 pounds per square inch concrete.
    - c) Gate Posts: Hinge posts for gates shall be galvanized steel pipe of size and length shown in Tabulation of Gates and Hinge Posts in the Drawings. Furnish galvanized steel closure caps for all gate posts. A minimum of 42 inches of length shall be embedded in 2,500 pounds per square inch concrete.

- C. Extension Arms for Posts:
  - 1. Use pressed steel extension arms at all line posts and use pressed steel or malleable iron extension arms at all corner posts. Extend post pipe above wire mesh to anchor ends of extension arm barbed wire strands at all gate posts and posts at the ends of the fence to be constructed (in lieu of separate extension arms at these gate and fence end posts) of sufficient length to support top strand of barbed wire at 12 inches above top of fabric.
  - 2. All extension arms shall be designed to carry three strands of barbed wire, with the top strand to be 12 inches above and 12 inches horizontally out from top of fabric, <u>except</u> where the Drawings show the open gates folded back against the fence on the same side as extension arms use vertical extension arms with top strand 12 inches above top of fabric.
  - 3. All 45-degree extension arms shall support safely a minimum weight 250 pounds applied at the end of the arm. Vertical arms shall have bending strength equivalent to that specified for 45-degree arms. All extension arms shall be hot-dip galvanized after fabrication.
- D. Top and Bottom Tension Wires: Use either No. 7 gauge aluminum coated steel wire with a minimum tensile strength of 80,000 psi and a minimum 0.40 oz. coating per square foot of wire, or No. 7 gauge galvanized coil spring steel wire of good commercial quality and having a minimum coating of 0.80 oz. per square foot of uncoated surface when tested in conformance with ASTM A 90, to be attached to chain link fabric with hog rings on 24-inch maximum centers.
- E. Barbed Wire: Each line of barbed wire shall have two strands of 12-1/2 gauge aluminum coated steel wire, twisted together, with 4-point aluminum or aluminum coated barbs of 14 gauge spaced on 5-inch centers. Minimum weight of aluminum coating shall be 0.30 oz. per square foot of wire surface for strands and 0.25 oz. per square foot of wire surface for barbs in accordance with ASTM A 121. Galvanized barbed wire meeting the requirements of ASTM A 121, Class 3 coating, of the same wire gauges and construction as above may be substituted for aluminum coated wire.
- F. Braces: Brace rails shall be furnished at all end, corner, and gate posts, as detailed on the Drawings. Use 2-3/8-inch OD galvanized pipe weighing 3.65 pounds per foot or galvanized steel roll-formed "C" section, 1.625-inches wide and 1.25-inches deep weighing 1.35 pounds per foot with a minimum yield strength of 45,000 psi for horizontal and diagonal struts. Truss back from connection of horizontal strut at the line post to the base of the end, corner or gate post with 3/8-inch diameter galvanized rod complete with threaded truss tightened.
- G. Gates:
  - Gate frames shall be a minimum of 1-7/8 inch galvanized tubing weighing 2.28 pounds or more per foot. The Contractor shall furnish gates with welded joint construction or pressed steel corner ells, riveted with four rivets per corner, and galvanized after fabrication. Intermediate vertical strut braces shall be of the size shown on the Drawings, 1-5/8-inch OD galvanized pipe weighing 2.27 pounds per foot or more per foot.
  - 2. All gates shall also conform to the details shown as on the Drawings or approved alternative design. Hinges of all gates shall be heavy-duty industrial type of adequate strength to support the weight of the gate and a Factor of Safety of 2.0, without permanent distortion. The bottom hinge of all gates preferably shall be ball and socket type made of malleable iron. Gates shall have 3/8-inch diameter adjustable truss rods. Gates shall be complete with malleable iron latch and locking hardware, center rest, and hold-back catches. Gates shall have fork at top and bottom of plunger rod. All components shall be hot-dip galvanized.
- H. Fittings: Fittings shall be hot-dip galvanized pressed steel or wrought iron as specified in Table 2.

- I. Mow Strip: Optional 1 foot wide 2,500 pounds per square inch concrete Mow Strip shall be provided along fence centerline according to the details as shown on the plans.
- J. Fencing Ground: Optionally ground all fences at each corner, at brace panels, and at a spacing of 500 feet max. Provide ground conductor consisting of No. 6 AWG solid copper wire. Provide copper-clad steel rod grounding electrodes 3/4 inch diameter and 10 feet in length. Electrodes shall be buried below grade a minimum of 12 inches deep and radially from the fence no less than 2 feet nor more than 8 feet. Clamp ground conductor to the fence with a bronze grounding clamp (connect with metal ground to bright metal). Connect ground conductor to the electrode by molded exothermic weld, or a clamp type fitting of copper or bronze. Continuity must be established between fence posts, fence fabric, and ground rods. Total resistance of the fence to ground shall not exceed 25 ohms.

# 2.3 COATINGS

A. All posts, wire mesh, gate frames, struts, rods, fittings, hinges, and latches, shall be coated as specified in Table 1.

ltem	Minimum Wt. Of Coating Oz. Per Sq. Ft.	ASTM	ASTM Class
1. Fabric			
A. Galvanized	1.2 Zinc	A 392	I
B. Aluminum Coated	0.40 Aluminum	A 491	I
2. Line Posts	1.8 Avg. Zinc	A 53 for Pipe Post	
	1.6 Zinc for 1 Specimen	A 123 or A 153 for "C" Section	
3. End, Corner, Pull	1.08 Avg. Zinc	A 53	
and Gate Posts	1.6 Zinc for 1 Specimen		
4. Extension Arms	2.0 Avg. Zinc	A 123	
	1.8 Zinc for 1 Specimen		
5. Tension Wire			
A. Galvanized	0.80 Zinc	A 90	
B. Aluminum Coated	0.40 Aluminum	A 491	=
6. Barbed Wire			
A. Galvanized	0.80 Zinc	A 121	3
B. Aluminum Coated	0.30 Aluminum	A 585	2
7. Brace Pipes	1.8 Avg. Zinc	A 53	
	1.6 Zinc for 1 Specimen		
8. Gate Frame	1.8 Avg. Zinc	A 53	
	1.6 Zinc for 1 Specimen		
9. Fittings			
A. Castings	2.0 Avg. Zinc		
	1.8 Zinc for 1 Specimen	A 153	
B. Rolled, Pressed			
or Forged	2.0 Avg. Zinc		
(i) 3/16″ thick and	1.8 Zinc for 1 Specimen	A 153	
over			
(ii) Under 3/16″	1.5 Avg. Zinc		
thick	1.25 Zinc for 1 Specimen	A 153	

# **TABLE 1 - COATING REQUIREMENTS**

TECHNICAL SPECIFICATION Date: December 2020

ltem	Minimum Wt. Of Coating Oz. Per Sq. Ft.	ASTM	ASTM Class
10. Bolts, Nuts & Washers			
A. Over 3/8" Dia.	1.25 Avg. Zinc 1.00 Zinc for 1 Specimen	A 153	
B. 3/8" Dia. and under	1.25 Avg. Zinc 1.00 Zinc for 1 Specimen	A 153	

Item	Test or Measurement Description	Requirement
1. Fabric		0
A.	Gauge of wire	9 1 200 lba
B. 2 Line Posts	Breaking Strength	1,290 lbs.
A. Schedule 40 Pipe		
(i)	Cross Section	2-3/8" OD
(ii)	Min. Weight	5.79 lbs. per ft.
B. "C" Section		
(1)	Cross Section	2.25" x 1.70"
(ii)	Min. Yield Strength	45,000 psi
(iii)	Min. Weight	2.64 lbs. per ft.
3. End, Corner & Pull Posts		
A. Schedule 40 Pipe	Cross Section	3-1/2″ OD
(ii)	Min. Weight	7.58 lbs. per ft.
4. Extension Arms	Support Weight on End	250 lbs.
5. Tension Wires		
A.	Gauge Wire	7
B. 6. Borbod Wiro	Min. Tensile Strength	80,000 psi
A Wire	Gauge	12-1/2
B. Barbs	Gauge	14
7. Brace Pipes	Size & Min. Wt.	2-3/8" OD,
8 Gate Posts	Size & Min W/t	2-7/8" OD
A.		5.79 lbs. per ft.
P	Size & Min. Wt.	3-1/2"OD
D.		7.58lbs. per ft.
C.	Size & Min. Wt.	4" OD
		9.11 lbs. per ft.
D.	Size & Min. Wt.	6-5/8" OD
F	Sizo & Min W/t	
L.		43.39 lbs. per ft.
9. Gate		
A. Frame Pipe	Size & Min. Wt.	1-7/8" OD, 1.9 lbs. per.ft
		1.0 100. por 10.
B. Inter. Frame Tubing	Size & Min. VVI.	1-5/8 Square,
C Strut Brosse Dour -		Der Manufacturer

# **TABLE 2 - OTHER PHYSICAL PROPERTIES**

## PART 3 EXECUTION

#### 3.1 GENERAL

- A. Fencing shall be installed by experienced fence erectors on lines established by the Port of Houston Authority. Elevation of fencing shall conform to the existing ground surface unless otherwise shown on the Drawings;
- B. Gates and Turnstiles shall be installed in accordance with manufacturer's instructions and in locations as shown on the Drawings.

#### 3.2 POSTS

- A. Posts shall be set plumb to line and spaced 8-foot 0-inch maximum on centers. Gate posts shall be spaced to suit gate hinges as shown in detailed gate layouts on the Drawings. Posts shall be secured as specified in this section, and as shown in the Drawings.
- B. All concrete shall be placed in dry holes. Bottoms of holes shall be solid earth in the undisturbed state, and all loose dirt and debris shall be removed prior to placing concrete.
- C. Excavated soil removed from post holes shall be spread and raked out to a neat and uniform surface over existing ground along the fence line, except none of the material shall be placed in existing ditches or other drainage courses or upon road or parking area pavements or surfaced road shoulders.

## 3.3 FABRIC

- A. Fabric shall be pulled tight and secured to line posts at intervals not exceeding 16 inches on centers and to top and bottom tension wires at intervals not exceeding 24 inches on centers.
- B. Fasten fabric at end, corner, angle, and gate posts with ¼ inch by ¾ inch hot-dip galvanized tension bar through mesh, securely strapped to posts as specified in this section. Splices will be permitted if made with two ¼ inch by ¾ inch tension bars through mesh and strapped together.

#### 3.4 BARBED WIRE

A. Apply three strands of barbed wire to extension arms and to pipe extensions at gate and end posts. Barbed wire shall be pulled tight between end anchorages before attachment is made to extension arms.

#### END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 32 92 13.00 Add – HYDROMULCHING

# PART 1 GENERAL

1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes; the furnishing and placing of permanent Hydromulch Seeding as described and specified herein and as shown on the Drawings.

1.2 RELATED SECTIONS

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 31 23 00 Add - Excavation and Fills

SECTION 31 23 00.02 Add - Topsoil

SECTION 31 24 00 Add - Embankment Construction

SECTION 32 92 19.16 Add - Turfing

#### 1.3 REFERENCES

- A. Federal Seed Act.
- B. Texas Seed Law.
- C. Texas Fertilizer Law.
- 1.4 SUBMITTALS
  - A. Product Data for: Seed and Mulch.
  - B. Certification from supplier that seed complies with the Texas Seed law and fertilizer complies with the Texas Fertilizer Law.
- 1.5 HANDLING AND STORAGE
  - A. All material brought on site shall be available for inspection.

# PART 2 PRODUCTS

- 2.1 MATERIAL
  - A. SEED
    - 1. All seed must meet the requirements of the U.S. Department of Agriculture Rules and Regulations as set forth in the Federal Seed Act and Texas Seed Law.

HYDROMULCHING

Туре	Application Rate Pounds Per Acre	Planting Date
Hulled Common Bermuda	85	Apr. 1 to Sep. 30
Foxtail Millet	15	Apr. 1 to Sep. 30
Hulled Common Bermuda	50	Oct. 1 to Mar. 31
Gulf Coast Rye	50	Oct. 1 to Mar. 31

2. Type of seed, purity and germination requirements, rate of application and planting dates are as follows:

## B. FERTILIZER

1. Fertilizer shall be water soluble with an analysis of 15 percent nitrogen, 15 percent phosphoric acid and 15 percent potash. Rate of application shall be 500 pounds per acre. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled, conforming to the applicable State Fertilizer Laws and bearing the name and warranty of the producer.

## C. CELLULOSE FIBER MULCH

- 1. Mulch shall be virgin wood cellulose fiber made from whole wood chips. Within the fiber mulch material, at least 20 percent of the fibers will be 10 mm in length and 0.3 mm in diameter. Rate of application shall be 2,000 pounds per acre.
- 2. Wood cellulose fiber mulch, for use in the grass seed and fertilizer, shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like ground cover which readily absorbs water and allows infiltration to the underlying soil.
- 3. Weight specifications from suppliers, shall refer only to the air dry weight of the fiber. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and must be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that the laboratory and field testing of their product has been accomplished and that it meets all of the foregoing requirements.

# D. WATER

1. Water shall be clean and salt-free. The water source shall be subject to approval prior to use.

#### PART 3 EXECUTION

Immediately after the finished grade has been approved, begin hydro-mulching operations to reduce erosion and excessive weed growth.

#### 3.1 EQUIPMENT

- A. Hydraulic equipment used for the application of fertilizer, seed and slurry of prepared wood fiber mulch shall have a built–in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to forty pounds of fiber plus a combined total of 70 pounds for each 100 gallons of water.
- B. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the area to be seeded. The slurry tank shall have a minimum capacity of 800 gallons and shall be mounted on a traveling unit, which may either be self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded, so as to provide uniform distribution without waste.

## 3.2 SLURRY PREPARATION

- A. Care shall be taken that the slurry preparations take place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good re-circulation shall be established and seed shall be added. Fertilizer shall then be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water.
- B. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spray the area with a minimum visible coat, by using the green color of the wood pulp as a guide.

# 3.3 APPLICATION

- A. Hydromulch preparation area shall be designated by the Chief Construction Manager prior to application. Operators of hydromulching equipment shall be thoroughly experienced in this type of application. Apply the specified slurry mix in a motion to form a uniform mat at the specified rate. Operators shall keep hydromulch within the areas designated and prevent contact with other plant material. Immediately after application, thoroughly wash off any plant material, planting areas or paved areas not intended to receive the slurry mix.
- 3.4 MOWING, TRIMMING AND EDGING
  - A. Mow, trim and edge the designated locations throughout final acceptance. Mow, trim and edge every 15 days, to 3 4 inches in height unless otherwise directed by Chief Construction Manager. Keep cord trimmers at least 1 ft. from plants to prevent damage to plant stems, if applicable.

# 3.5 SLOPES

A. Contractor to use a dry application process on any slopes 10H:1V or steeper. Process shall include disking, raking, seeding, fertilization and cultipacting the seed and fertilizer mixture.

# 3.6 CONTRACTORS MAINTENANCE AND GUARANTEE PERIOD

A. The hydromulch seeding shall be adequately watered until established. New grass areas shall be maintained by the Contractor for 60 days after final acceptance of the project and shall consist of watering, weeding, repair of all erosion and reseeding, as necessary to establish a uniform stand of the specified grasses. Contractor shall guarantee growth and coverage of hydro-mulch planting under this contract to the effect that a minimum of 95 percent of the area planted will be covered with the specified planting after 60 days. B. The contractor shall water the entire hydromulch area to a saturated depth of one inch at least once a week between the months of April to September and at least once a month between the months of October to March.

# **END OF SECTION**

# PPORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

## SECTION 35 20 00 Add - CONSTRUCTION SURVEYING

## PART 1 GENERAL

1.1 SUMMARY

Construction Surveying includes furnishing materials, labor, and equipment for hazard, topographic, and hydrographic surveying where required under the Contract Documents.

#### 1.2 RELATED SECTIONS

Section 01 25 00 Add – Measurement and Basis of Payment Section 35 20 23 Add – Dredging Section 35 31 19 Add – Revetment Section 35 41 00 Add – Berm Construction

#### 1.3 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. Army Corps of Engineers (USACE) Publications:EM 1110-1-1005(2007) Control and Topographic SurveyingEM 1110-2-1003(2004) Hydrographic Surveying.

#### 1.4 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only.

- 1. Name of Registered Professional Land Surveyor (Paragraph 1.5 A)
- 2. Surveying Plan (Paragraph 1.5 B), E
- 3. Survey Submittal Log (Paragraph 3.2 B)
- 4. Pre-Dredge Hazard Survey (Paragraph 3.3)
- 5. Channel Dredging Quantity Computations (Paragraph 3.5 F), E
- 6. Multi-Beam Surveys (Paragraph 3.5), E
- 7. Berm Initial, Interim, Final Grading, and Final Acceptance Surveys (Paragraph 3.4 B), E
- 8. Revetment Initial, Interim, and Final Surveys (Paragraph 3.4 C), E

#### 1.5 QUALITY ASSURANCE

A. General: All survey plots submitted to Engineer shall be sealed by a professional land surveyor registered in the State of Texas, experienced in topographic and bathymetric surveying, and familiar and experienced with the USACE's surveying guidelines in Engineer

TECHNICAL SPECIFICATION Date: December 2020

35 20 00 Add CONSTRUCTION SURVEYING Page 1 Manuals (EM) 1110-1-1005 and 1110-2-1003. Prior to commencing Work, Contractor shall provide name and credentials of Registered Professional Land Surveyor (RPLS) who will oversee surveys. Use of a PLS who is certified as an American Congress on Surveying and Mapping (ACSM) Hydrographer is strongly encouraged.

B. Surveying Plan: As part of the Dredging Work Plan required under specification Section 35 20 23, "Dredging," Contractor shall provide description of methods and equipment to be applied for required surveys as well as quality control and quality assurance (QA/QC) procedures to be applied. Contractor shall also provide documentation that survey equipment meets the Minimum Performance Standards for Corps of Engineers Hydrographic Surveys, as shown in Table 3-1 of Engineer Manual (EM) 1110-2-1003, and a description of calibration and other QA/QC procedures to be applied. No other equipment shall be used for surveying without prior notification to Engineer. Refer to Paragraph 3.5.B for additional QA/QC requirements for multi-beam surveys.

A survey plan for surveying the berms at M12 Beneficial Use Site and shoreline protection (M12 Beneficial Use Site and Barbours Cut Channel) shall also be prepared. Contractor shall provide Engineer a plan that coordinates surveying activities with construction sequence. The plan shall also describe surveying methods, equipment, and accuracy. Minimum vertical and horizontal accuracies for all surveying methods shall be  $\pm 1.5$ " and 1 ft Root Mean Squared, respectively. GPS-based systems shall not be applied without establishing a local base station unless approved by Engineer.

C. Transducer Frequency: Where electronic fathometers/echosounders are applied for bathymetric surveys, transducer frequency shall be consistent between "Before Dredging" (BD) and "After Dredging" (AD) surveys within any particular area. Measurements shall normally be determined based on high frequency (200 kHz) data. Low frequency (40 kHz) data shall require prior written concurrence from Engineer.

# PART 2 PRODUCTS

(NOT USED)

# PART 3 EXECUTION

- 3.1 GENERAL
  - A. Dredging: Contractor shall provide pre-dredge hazard survey; and Before Dredge (BD) and After Dredge (AD) surveys for measurement and acceptance of Work items. Plots showing lines and grades, and quantity computations shall accompany all payment requisitions. Refer to Table 1 for a general summary of the required surveys.
  - B. Berm Construction: Contractor shall provide initial pre-construction, interim (initial placement), final grading, and final acceptance surveys for measurement and acceptance of Work items. Plots showing lines and grades, and quantity computations shall accompany all payment requisitions. Refer to Table 1 for a general summary of the required surveys.
  - C. Revetment: Contractor shall provide initial (post-dredge, revetment pre-construction), interim (revetment grading), and final acceptance surveys for measurement and acceptance of Work items. Plots showing lines and grades, and quantity computations shall accompany all payment requisitions. Refer to Table 1 for a general summary of the required surveys.

Table 1. Sum	nmary of Required Surveys			
Survey	Intended Purpose	Submittal(s) Schedule	Туре	Completed By
Pre-Dredge Hazard Survey	Magnetometer or similar survey required to locate and avoid pipelines, utilities, hazards, and obstructions.	Prior to commencement of dredging	Magnetometer or similar	Contractor
BD Surveys	To verify existing conditions and document pre-dredging grades and volumes	Prior to commencement of dredging	Multibeam	Port Authority
Contractor Dredging Surveys	Channel surveys conducted by the Contractor to measure its own construction progress and compliance.	Daily (as safety and weather allows).	Minimum of Single Beam	Contractor
Interim AD Surveys for Progress Payment	Channel surveys performed to monitor dredging and to determine quantities for payment and percentage completion of work performed during pay period.	Approximately, but not more frequently than, once per week.	Multibeam	Port Authority
AD Surveys for Dredging Section Acceptance	Channel surveys performed to determine that the dredging template within an acceptance section has been dredged to the required lines and grades.	Upon request of Contractor to have an acceptance section accepted.	Multibeam	Port Authority
Initial Survey - Berm	To verify the existing condition prior to commencement of berm construction. Transects: 50 ft intervals.	Before commencing physical dredging/excavation at each survey transect.	Single beam, RTK, or similar	Contractor
Interim Survey - Berm	To determine in-place fill quantities, retention rates, etc. for berm construction. Transects: 50 ft intervals.	Daily upon filling sections.	RTK or similar	Contractor
Final Shaping and Grading Survey - Berm	To ensure the constructed berms meet the required lines and grades for interim measurement and payment. Transects: 50 ft intervals.	Upon completion of 50 foot sections.	RTK or similar	Contractor
Final Acceptance Survey - Berm	To provide for final acceptance of the work. Transects: 50 ft intervals.	Upon completion of final shaping and grading.	RTK or similar	Contractor
Initial Survey – Access Channel	To verify the existing condition prior to access channel excavation. Transects: 100 ft intervals.	Before commencing physical dredging/excavation at each survey transect.	Single beam	Contractor

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Interim Survey - Access Channel	To verify the existing condition prior to access channel excavation. Transects: 100 ft intervals	Upon completion of access channel sections	Single beam	Contractor
Final Survey - Access Channel	To verify the condition of channel after backfilling. Transects: 100 ft intervals	Upon completion of channel backfill	Single beam	Contractor
Initial Survey – Revetment	To verify the existing condition of post-dredge slopes prior to commencement of revetment construction. Transects: 50 ft intervals.	Upon completion of dredging and prior to revetment construction.	RTK or similar	Contractor
Interim Survey - Revetment	To verity existing conditions upon completion of excavation and grading for revetment installation. Transects: 50 ft intervals.	Upon completion of 50 foot sections.	RTK or similar	Contractor
Final Survey - Revetment	To ensure the constructed revetment meets the required lines and grades for measurement, payment, and acceptance. Transects: 50 ft intervals.	Upon completion of 50 foot sections and final geotextile and riprap installation.	RTK or similar	Contractor

# 3.2 SURVEY PLOTS

- A. General: All construction surveys submitted to Engineer shall be in the form of plan-view, cross section plots, and digital data. All surveys submitted by contractors are being used to certify pay volumes and will be used for pay requests, and so must be signed and sealed by an RPLS. All surveys shall be referenced to the project datums shown on the Drawings. Plots shall be transmitted digitally in PDF and AutoCAD format. All plots shall legibly and clearly display the following information:
  - 1. Project name and owner (Port Authority)
  - 2. Professional Land Surveyor's seal, signature, and business affiliation (required on pdf transmittals)
  - 3. Date(s) surveys were performed
  - 4. Location and description of survey control
  - 5. Vertical and horizontal datums
  - 6. Sheet name and number
  - 7. Name of Contractor
  - 8. Drawing scale(s)
  - 9. Transducer frequency (where fathometer/echo sounders used)
  - 10. Submittal title (e.g., "Segment 3 BD")

Survey plots shall include the following:

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- 1. Plan sheets clearly documenting locations, limits, and dimensions of completed Work (as applicable) and locations where cross sections were taken. Bathymetry and topography shall be plotted using an elevation color scale.
- 2. Cross-section sheets providing an overlay of sequential survey transects (as applicable) along with specified templates. A legend shall be provided indicating the date and survey type (e.g., BD, AD, etc.) for each transect shown.
- 3. Cross-sectional areas calculated by comparing the BD and AD surveys.
- B. <u>Digital Data</u>: In addition to plots in pdf format, all survey submittals shall include digital data on labeled CD or DVD. Digital data shall include the following:
  - 1. A submittal log documenting surveys submitted to date with descriptors for survey dates and locations.
  - 2. AutoCAD files
  - 3. ASCII files containing the following Northing, Easting, Elevation, and Station for Single Beam and Topographic surveys; and Northing, Easting, and Elevation for Multi-beam survey.
  - 4. PDF files with signed Registered PLS seal

## 3.3 PRE-DREDGE HAZARD SURVEY

Prior to commencing dredging, Contactor shall perform a hazard survey (magnetometer, sidescan sonar, sub-bottom profiler, and/or similar method) over the entire area to be dredged to search for surface debris, uncharted pipelines, and/or other anomalies on or below the existing seafloor. Hazard survey shall be supplemented with probing as required to determine depth of uncharted hazards/obstructions. Probing shall be coordinated with utility owners. Contractor shall be solely responsible for determining necessary extent and methods of pre-dredge hazard survey. Planned scope of pre-dredge hazard survey shall be summarized in Surveying Plan (Paragraph 1.5.B). Results of the pre-dredge hazard survey shall be provided with a summary of findings, interpretation of any located anomalies, and considerations for dredging.

#### 3.4 SURVEY TRANSECTS

- A. Dredging/Excavation Transects: The survey transects specified herein apply to all Single-Beam and Topographic surveys performed by Contractor. Survey transects shall be collected at location of cross-sections shown on the Drawings and 100 ft intervals within the extents of the channels. Shot spacing along each transect shall not exceed 20 ft.
- B. Berm Transects: The survey transects specified herein apply to all topographic surveys performed by Contractor for acceptance and/or submittal with monthly pay requests. Survey shots shall be taken along each 50 ft station along the berm alignment within the limits of construction shown on the drawings. Survey shots along transects shall be taken at all significant grade breaks and at maximum horizontal spacing of 5 ft on center. At a minimum, transects shall extend from 20 feet either side of the berm toe.
- C. Revetment Transects: The survey transects specified herein apply to all topographic surveys performed by Contractor for acceptance and/or submittal with monthly pay requests. Survey shots shall be taken along each 50 ft station along the revetment alignment within the limits of construction shown on the drawings. Survey shots along transects shall be taken at all significant grade breaks and at maximum horizontal spacing of 5 ft on center. At a minimum, transects shall extend from 20 feet either side of the revetment section.

## 3.5 MULTI-BEAM SURVEYS

- A. General: Multi-beam (acoustic sweep) surveys shall be performed before and after dredging. Contractor shall provide Port Authority and USACE a minimum of 24-hour notice prior to the request of a multi-beam survey. The Port Authority and USACE shall afford Contractor representatives the opportunity to be present on the survey vessel during collection of multibeam survey data.
- B. Survey Equipment and QA/QC: Equipment applied for multi-beam surveys shall comply with the guidelines stated in EM 1110-2-1003. Contractor shall perform patch tests and quality assurance tests as described in Chapter 11 of EM 1110-2-1003. Documentation of tests shall be submitted to Port Authority with overall survey results.
- C. Survey Limits: Surveys shall provide 100% coverage of required dredging limits.
- D. Before Dredging (BD) Multi-Beam Surveys: BD Multi-Beam survey will be performed by the Port Authority within 15 days prior to commencement of dredging.
- E. After Dredging (AD) Multi-Beam Surveys: AD Multi-Beam survey will be performed by Port Authority as soon as practicable after completion of dredging. Should any shoals, lumps, or other lack of contract depth be disclosed by this examination, Contractor shall remove same and Port Authority will repeat surveys to show that acceptance area is clear. Quantities, included on the cover sheet of the survey and signed and sealed by a Texas Professional Surveyor or Engineer, will subdivide Maintenance and New Work volumes by Acceptance Section.
- F. Quantity Computations: After completion of dredging, Port Authority will provide volume calculations to Contractor based on comparison of BD and AD surfaces. Port Authority will create BD and AD surfaces (triangulated irregular network or similar) using BD and AD Multi-Beam surveys supplemented by topographic BD and AD survey shots collected at Survey Transects (refer to Paragraph 3.4).
- G. Data Processing:
  - 1. Selected representative "shot," "average," and "minimum" depths shall be derived from the entire edited multi-beam dataset. Extraneous noise and spikes shall be removed from the raw dataset before any other data processing is performed.
    - a. Shot depth shall be applied to represent the general condition of the bottom for plotting and graphical purposes. Shot depth shall be defined as the depth reading closest to the center of 5 ft x 5 ft cells.
    - b. Average depth shall be applied for volume computations (not for pay purposes). Average depth shall be defined as the average of all depths within 3 ft x 3 ft cells. Volume calculations shall be performed through development of a triangulated irregular network (TIN) as described on page 15-11 of EM 1110-2-1003.
    - c. Minimum depth shall be applied to determine acceptance to the required depth as described on page 11-44, "Dredge Clearance & Acceptance Surveys (Shoal/Strike Detection)" of EM 1110-2-1003. Minimum depth shall be defined as the "shoalest" depth within a 3 ft x 3 ft cell. Shoals shall be delineated by a minimum of 3 hits over successive passes. A single high spot unsupported by other data will be disregarded.
- H. Plots: For required Contractor surveys, Contractor shall provide survey data plots within 10 days of completion of field surveys. Plots shall consist of surface renderings for visualization

of each BD and AD survey. A color scheme shall be applied that clearly highlights shoals and/or locations that exceed the allowable dredging depth.

- 1. Shot depth plots shall be printed at a scale of one inch = 200 feet with a cell size of 40 ft x 40 ft.
- 2. Average depth plots are not required.
- 3. Minimum depth plots shall be printed at an overall scale of one inch = 200 ft. In addition, a surface rendering of each shoal shall be printed on separate sheets at a scale of one inch = 20 ft.
- I. Acceptance: Port Authority will accept the dredging work as being complete based on "minimum depth" plots showing no depths above the required contract depth.

# END OF SECTION

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#### SECTION 35 20 23 Add – DREDGING

#### PART 1 GENERAL

#### 1.1 SUMMARY

Dredging work includes furnishing materials, labor, and equipment for dredging, transport of dredged material, and placement of dredged material in accordance with these Specifications and applicable Drawings. Material shall be excavated by Cutterhead/Suction Pipeline Dredge for material in Barbours Cut Channel. Hopper and mechanical (e.g., clamshell) dredging is not permitted. Dredging within Cedar Bayou and to construct flotation channels shall be performed using mechanical (e.g., clamshell) dredging.

#### 1.2 EXISTING CONDITIONS

The drawings represent conditions existing as of the date of their preparation based on surveys performed by the Port Authority. However, to reflect anticipated shoaling occurring between the dates of preparation of the drawings and the dates of the "Before Dredging (BD)" sections, the estimated dredging quantities stated in the attached Exhibit A: Price Exhibit have been adjusted accordingly. The depths and elevations shown will be verified and corrected by fathometer soundings taken by Contractor before dredging.

#### 1.3 RELATED SECTIONS

A. Technical Specifications:
Section 01 25 00 Add – Measurement and Basis of Payment.
Section 01 16 60 Add – Environmental Protection Measures
Section 35 20 00 Add – Construction Surveying
Section 35 20 23.33 Add – National Quality Management Program Pipeline Hydraulic Dredge

B. Appendices:
Appendix A – Geotechnical Investigation Data
Appendix B – Geophysical Investigation Data

C. Attachments: Attachment 1 – Quantity Summary Table

#### 1.4 REFERENCES

The publications listed below form a part of this specification to the extent reference. The publications are referred to within the text by the basic designation only.

U.S. Army Corps of Engineers (USACE) Publications:EM 1110-2-5025(2015) Dredging and Dredged Material ManagementEM 385-1-1(2014) Safety and Health Requirements

#### 1.5 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only.

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- 1. Daily Activities Reports (Paragraph 1.11 G)
- 2. Logs/Records (Paragraph 1.11 B)
- 3. Dredging Work Plan (Paragraph 1.11 D)
- 4. Documentation of USACE and USCG Notification (Paragraphs 1.11 A and 1.14)
- 5. Request for Temporary Removal of Aids to Navigation (Paragraph 1.12)
- 6. Dredge Pipeline Map (Paragraph 3.9 A), E
- 7. Spill Contingency Plan (Paragraph 3.10)
- 8. Surveys (Refer to Section 35 20 00, "Construction Surveying"), E

## 1.6 CHARACTER OF MATERIAL

- A. Barbours Cut Channel: The material to be removed is primarily new-work (virgin-cut) material. Bidders are expected to examine the worksite and geotechnical data and, after investigation, decide for themselves the character of materials.
- B. M12 Beneficial Use Site Access Channel: The material to be removed is primarily new-work (virgin-cut) material. Bidders are expected to examine the worksite and geotechnical data and, after investigation, decide for themselves the character of materials.
- C. Cedar Bayou Channel: The material to be removed is maintenance material.

## 1.7 UTILITIES ACROSS THE LIMITS OF DREDGING

It is Contractor's responsibility to investigate the location of utility and pipeline crossings. Contractor shall take precautions against damages which can result from dredging operations in the vicinity of the utility and pipeline crossings. If damage to utilities or pipelines occurs as a result of dredging operations, Contractor shall suspend dredging until the damage is repaired and approved. Costs of these repairs and downtime of the dredge and attendant plant shall be at Contractor's expense.

## 1.8 KNOWN PIPELINE/UTILITY CROSSINGS

There are pipelines and utilities which are within the work limits. Pipelines and utilities identified by Port Authority and Engineer are shown on the Drawings. Additional pipelines and utilities may exist. The Contractor shall notify and coordinate work with pipeline companies at least 10 days before performing work near the pipelines in the vicinity of the site as shown. At Contractor's expense, necessary protective measures shall be provided as required by the Pipeline Company when crossing pipelines with a dredge submerged pipeline. Possible protective measures include but are not limited to, floating the dredge pipeline over and 100 feet each side of the pipeline or installing a protective padding between the submerged pipeline and pipeline.

1. Coordination with Pipeline Companies. Every effort has been made to give all pertinent details on the location of the pipelines. The data shown are believed to be substantially correct. However, the exact locations may vary from that shown; therefore, the Contractor shall cooperate with Port Authority to establish the actual position of the pipelines. The following is furnished for information on verifying pipeline ownership:

Lone Star Notification Service (Texas One-Call) 1-800-545-6005 or 800-344-8377

Enterprise Products, John Sanchez, 832-692-2223, JFSanchez@eprod.com

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## Texas Wide Location Service Agency (Dig Test) 1-800-344-8377

## 1.9 WORK BY OTHER CONTRACTORS IN THE VICINITY

During the course of this Contract, other contractors may be performing work in the vicinity, such as mowing the dikes of the Placement Areas (PAs). Port Authority may hold coordination meetings between the various contractors, the U.S. Army Corps of Engineers, the U.S. Coast Guard Vessel Traffic Service, Houston Pilots Association, dock/facility operators, and users of the channel on an as-needed basis. Contractor will be expected to attend these coordination meetings.

#### 1.10 ORDER OF WORK

Contractor shall commence work no later than 21 days after issuance of Notice to Proceed.

#### 1.11 QUALITY ASSURANCE

- A. Permits
  - Port Authority -Obtained Permits: The Federal authorizations for this project included completion of an Environmental Impact Statement (EIS) by the U.S. Army Corps of Engineers for the Houston Ship Channel Expansion Channel Improvement Project. Refer to the following report for documentation of the environmental regulatory approvals for this work: "Final Integrated Feasibility Report – Environmental Impact Statement for Houston Ship Channel Expansion Channel Improvement Project, Harris, Chambers, and Galveston Counties, Texas," prepared by USACE Galveston District. A copy of this report is available from Port Authority.
  - 2. Contractor-Obtained Permits: Contractor shall be responsible for all permits not provided by Port Authority, including but not limited to the following:
    - a. Water Quality: Contractor shall be responsible for coordination of Texas Commission on Environmental Quality (TCEQ) Storm Water Program TPDES General Permit TXR150000 as applicable for any land-based work on this project.
    - b. Notice to Mariners: Contractor shall provide U.S. Coast Guard a work schedule within seven days after the construction Notice to Proceed has been received so that a Notice to Mariners can be issued by the U.S. Coast Guard. A copy of this correspondence shall be provided to Engineer. Should Contractor encounter any objects on the seafloor which could be a hazard to navigation, it shall notify the U.S. Coast Guard, any other pertinent agencies, and Engineer immediately as to the location of said object and any other pertinent information necessary for the U.S. Coast Guard to issue a Notice to Mariners.
  - 3. Contractor shall make application for and pay for any necessary permit fees, temporary or permanent utility interruption fees, and/or re-location fees for any Contractor-obtained permits.
- B. Logs/Records: Contractor shall provide documentation as may be required for Port Authority to comply with its obligations under the Permits listed in Paragraph 1.11 A.
- C. Environmental Protection Requirements: Refer to Section 01 16 60, "Environmental Protection Measures."

- D. Dredging Work Plan: Prior to commencing Work, Contractor shall provide a Dredging Work Plan containing the planned procedure and timing for the work to be performed. The plan will be reviewed by Engineer for general conformance with the project design intent. The plan shall include the following:
  - 1. The planned number and type of dredges to be used.
  - 2. Dredging sequence.
  - 3. Dredged material placement area sequence.
  - 4. Dredge pipeline route(s) (Paragraph 3.9 B).
  - 5. Description of bed leveling apparatus and operation (Paragraph 3.7 C).
  - 6. Spill Contingency Plan (Paragraph 3.10).
  - 7. Site specific management plan for water quality monitoring (Paragraph 3.11.H).
- E. Easements: Permits authorizing the laying of shore pipe, and for placement of dredged material in M12, shall be requested from Port Authority. The instruments authorizing the laying of dredge pipelines on shore may contain certain restrictions relative to specific route, location, and general use of the land. These instruments form a part of these specifications and Contractor is to strictly comply with the terms thereof.
- F. Construction Observation: At the request of Port Authority /Engineer, Contractor shall provide boats, boatmen, laborers, and materials necessary for Port Authority /Engineer to observe the Work.
- G. Daily Activities Reports: Contractor shall provide daily reports documenting completed/ongoing/upcoming work, comparison of scheduled versus actual work completed, adverse weather or other problems that cause delays, and other items as may be required throughout these specifications. Reports shall be completed for every calendar day from the Notice to Proceed to the date of complete demobilization. Reports shall be submitted via email to Port Authority and Engineer daily. Reports shall include the following information:
  - 1. Weather and marine conditions.
  - 2. Problems that cause delays.
  - 3. Equipment and personnel on site.
  - 4. Percent of project completion.
  - 5. Status of pre-construction submittals.
  - 6. Mobilization/demobilization.
  - 7. Approximate cubic yards dredged.
  - 8. Approximate quantity and location of debris removed from channel.
  - 9. Locations where dredging occurred and material was placed.
  - 10. Dredge pipeline locations/routes and discharge points.
  - 11. General composition and consistency of material dredged.

H. DQM System: The work requires use of the National Dredging Quality Management Program (DQM), formerly known as Silent Inspector (SI), to monitor status of the dredge at all times during this Contract. Refer to Specification Section 35 20 23.33, "National Quality Management Program Pipeline Hydraulic Dredge," for Dredge Quality Management System requirements.

## 1.12 TEMPORARY REMOVAL OF AIDS TO NAVIGATION

The temporary removal or changes in locations of channel markers may be required to facilitate dredging operations. Refer to Paragraph 1.14.C for notification requirements.

## 1.13 SUBSURFACE DATA

- A. Geotechnical investigation data are provided in Appendix A. These data represent the most recent information available. Detailed laboratory test data from the geotechnical investigation are available upon request. Variations may exist in the soil conditions between sample locations. Contractor shall draw its own conclusions as to the character of the in-situ soil materials.
- B. Contractor shall be aware that debris will be encountered during dredging. Refer to Paragraph 3.8 regarding Contractor's requirements for locating surface and subsurface debris and potential dredging obstructions.
- C. Geophysical Investigation Data (i.e., magnetometer and side scan sonar data) obtained by Port Authority are provided in Appendix B. This information is made available as a courtesy to Contractor but is not necessarily complete, accurate, or correct.

## 1.14 NOTIFICATION PRIOR TO COMMENCEMENT OF DREDGING OPERATIONS

- A. Contractor shall notify the Resident Engineer at the Northern Area Office of the U.S. Army Corps of Engineers (USACE), Galveston District, in writing and electronically at least 10 days prior to commencement of dredging activities. Documentation of notice shall be provided to Engineer prior to commencement of dredging.
- B. Contractor shall notify the U.S. Coast Guard (USCG) to arrange a pre-dredging Safety Coordination Meeting at least 15 days prior to commencement of dredging activities. It is Contractor's responsibility to contact Vessel Traffic Service Houston/Galveston (VTS) at 281-464-4837 to coordinate and schedule this meeting. Contractor is to inform the Port Authority at least 48 hours prior to the scheduled meeting so that Port Authority Representative may attend. In addition, comply with all other USCG requirements including submittal of a Channel Obstruction Request and submittal of a work schedule for issuance of Notice to Mariners (see paragraph 1.12.A). The following items shall be discussed at the pre-dredging Safety Coordination Meeting regarding the VTS Area:
  - 1. Location of intended operation.
  - 2. Description of intended operation including channel obstructions anticipated by Contractor.
  - 3. Configuration of dredge pipelines and equipment in or along the channel, including pipeline staging.
  - 4. Termination point of dredge pipelines in or along the channel.
  - 5. Time required to re-open channel or move for vessel traffic.
  - 6. Plan for managing operating impairments, including VHF-FM radios.
  - 7. Names of the dredges and assist boats being used.

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- 8. Traffic consideration required. For example: slow bell, no meeting or overtaking, and advance notice requirements.
- 9. Point of contact phone numbers and working frequencies.
- 10. The master of dredge or floating plant is to immediately notify the VTS of changes to the above report, and at the completion of operations.
- 11. The VTS operating area includes the Houston Ship Channel from the sea buoy to the Buffalo Bayou Turning Basin, Galveston Channel, Texas City Channel, Bayport Ship Channel, Barbours Terminal Channel, and 10 miles of the Intracoastal Waterway.
- 12. Communications with the Vessel Traffic Center, call sign "HOUSTON TRAFFIC," is to be accomplished via VHF-FM Channel 12 or 13. The Traffic Center guards both Channel 12 and Channel 13 on a 24-hour basis.
- 13. The master of a dredge or floating plant is to be aware of and comply with the provision of the order relating to lighting and bunkering operations and multiple vessel moorings and will notify the VTS when refueling operations are to be conducted.
- C. The temporary removal or changes in locations of channel markers may be required to facilitate dredging operations. Notify Port Authority at least 30 days prior to the date that the removal or change in location of channel markers will be required so USCG can perform the work and so navigation interests may be informed sufficiently in advance of the proposed removal or change in location. Contractor shall not remove, change the location of, obstruct, willfully damage, make fast to, or interfere with aids to navigation.

## 1.15 SIGNAL LIGHTS

A. Contractor shall display signal lights and conduct his operations in accordance with the general regulations of the Department of the U.S. Army and the USCG. These general regulations govern lights and day signals on towing vessels with tows, vessels working on wrecks, dredges, vessels engaged in laying cables or pipe, dredge pipelines, vessels of more than 65 feet in length moored or anchored in a fairway or channel, and 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 33CFR81 Appendix A (International) and 33 VFR 84 through 89 (inland) as applicable.

# 1.16 PLANT

- A. General Requirements: Keep the necessary dredge equipment and attendant plant on the job to meet the requirements of the work. The dredge equipment and attendant plant is to be in satisfactory operating condition and capable of safely and efficiently performing the work as set forth in specifications and be subject to inspection by the Port Authority's representative at all times.
- B. Capacity: No reduction in the capacity of the dredge equipment and attendant plant employed to execute the work shall be made without written approval of the Port Authority. The measure of the capacity of the dredge equipment and attendant plant is to be its actual performance on the work to which these specifications apply.

# 1.17 INSPECTION

A. The presence of the Port Authority's on-site representative will not relieve Contractor of responsibility for the proper execution of the work in accordance with the specifications. Contractor is required to furnish the following items.

- 1. Equipment: At the request of the Port Authority, furnish the use of boats, boatmen, laborers, and material forming a part of the ordinary and usual equipment and crew of the dredging plant as may be reasonably necessary for Port Authority and its representatives to inspect and observe the work.
- 2. Transportation: At the request of Port Authority, furnish suitable transportation from all points on shore designated by Port Authority to and from the various pieces of plant, and to and from the PAs. If Contractor refuses, neglects, or delays compliance with these requirements, the specific facilities may be furnished and maintained by Port Authority, and the cost thereof will be deducted from the amounts due or to become due Contractor.

# PART 2 PRODUCTS

## 2.1 BRIDGE-TO-BRIDGE RADIO TELEPHONE EQUIPMENT

All dredge and self-propelled attendant floating plant shall be radiotelephone equipped to comply with the provisions of the Vessel Bridge-to-Bridge Radiotelephone Act (Public Law 92-63). This will require, as a minimum, radiotelephone equipment capable of transmitting and receiving on 156.6 MHZ (Channel 12) and 156.65 MHZ (Channel 13). Multi-channel equipment also requires 156.8 MHZ (Channel 16). Dredge tugs and tenders shall be considered towing vessels within the meaning of these requirements.

## 2.2 LOOKOUTS AND RADIO COMMUNICATIONS

Contractor shall have a lookout posted in the dredge control room at all times to monitor the movement of vessels around the dredge plant, perform radio communications with company work boats, and deliver passing arrangements with other commercial, fishing, and recreational vessels. The lookout shall be competent in USCG and Federal Communication Commission's radio communications procedures and requirements and be trained in the Vessel Bridge-to-Bridge Radiotelephone Act. Lookout shall maintain up-to-the-minute information as required to prevent collisions. Each company work boat shall check in with the lookout when arriving at the dredge and shall receive radio clearance from the lookout before departing the dredge.

FAILURE TO COMPLY WITH THIS REQUIREMENT WILL BE CONSIDERED A VIOLATION OF THE SAFETY PROTOCOL ESTABLISHED HEREIN. PURSUANT TO THE DIRECTION OF ENGINEER, CONTRACTOR MAY BE REQUIRED TO CEASE OPERATIONS UNTIL THIS PROVISION IS COMPLIED WITH. ANY SUSPENSION, DELAY, OR INTERRUPTION OF WORK ARISING FROM NONCOMPLIANCE OF THIS PROVISION SHALL NOT BE CONSTRUED AS STANDBY TIME.

# 2.3 MATERIAL TO BE REMOVED

- A. Dredged Material: Dredged Material includes any material—including but not limited to soil, mud, sediment, sand, clay, silt, gravel, and incidental debris within the specified dredging template. The dredged material to be removed is primarily new-work material. As described in Paragraph 1.13, explorations, including core borings, to determine the character of materials to be removed have been obtained by Port Authority.
- B. Debris: Debris includes material such as metal bands, pallets, pieces of broken cable, rope, stumps, broken piles, and other miscellaneous objects that cannot be removed through ordinary dredging. As described in Paragraph 1.13, explorations, including sidescan sonar and magnetometer surveys, have been obtained by Port Authority to help identify debris.

# PART 3 EXECUTION

## 3.1 AREAS TO BE DREDGED

Required dredging areas are shown on the Drawings.

- 3.2 CONDUCT OF DREDGING WORK
  - A. Pre-Dredging Safety Coordination Meeting: Prior to arrival on location and commencing dredge operations, Contractor shall arrange a pre-dredging safety coordination meeting between the dredge operators, pilots, towing industry representatives, Vessel Traffic Service (VTS), USCG, Port Authority, and USACE. Refer to Paragraph 1.14.B for additional requirements.
  - B. Protection of Existing Waterways: Conduct dredging operations using a method that will ensure that material or other debris are not pushed outside of the dredging limits or be otherwise deposited in existing side channels, basins, docking areas, or other areas being used by vessels. Contractor will be required to change its method of operations as may be required to comply with the above requirements. If bottom material or other debris is pushed into areas noted above as a result of Contractor's operations, the same is to be promptly removed by and at the expense of Contractor to the satisfaction of the Port Authority.
  - C. Adjacent Property and Structures: No dredging shall occur within 10 feet of an existing bulkhead, dock, wharf, revetment, mooring structure, pile, or other existing structure unless specifically stated or shown otherwise on the drawings. Damage to private or public property or structures resulting from the disposal or dredging operations are to be repaired promptly by and at Contractor's expense. Damage to structures as a result of Contractor's negligence will result in suspension of dredging and require prompt repair at Contractor's expense as a prerequisite to the resumption of dredging. Where dredging to obtain the required dimensions might endanger a structure, the Port Authority shall be notified. Upon notification, the Port Authority may reduce the required excavation in the vicinity of this structure.

#### 3.3 PREPARATION

- A. Pre-Dredge Hazard Survey: Prior to dredging, a magnetometer survey, side-scan sonar survey, sub-bottom profile survey, and/or other similar survey shall be performed to search for uncharted pipelines and other anomalies within the dredging template. Refer to Section 35 20 00, "Construction Surveying," for requirements of pre-dredge hazard survey. In addition to performing pre-dredge hazard survey, Contractor shall locate and avoid pipelines, cables, and other hazards prior to anchoring, spudding, laying/removing dredge pipeline, etc. throughout the course of the Work. If utility damage occurs as a result of dredging operations, Contractor shall suspend dredging until the damage is repaired and approved. Costs of these repairs and downtime of the dredge and attendant plant shall be Contractor's responsibility.
- B. Debris Removal: Prior to dredging, Contractor shall rake the dredging areas and remove any surface debris from the dredging template. Refer to Paragraph 3.8 for debris removal requirements.
- C. Emergency Spill Response Equipment: Prior to commencing dredging activities, sufficient spill response equipment, i.e. boom, etc. shall be on-site and ready for deployment in the event of an emergency or accident.

#### 3.4 SURVEYING

Refer to Specification Section 35 20 00, "Construction Surveying," for surveying requirements.

<b>TECHNICAL SPECIFICATION</b>
Date: December 2020

## 3.5 AUTOMATIC IDENTIFICATION SYSTEM

A Class "A" Automatic Identification System (AIS) in accordance with the Code of Federal Regulations (CFR) title 33, CFR 164.46, as amended, is required for dredges used under this Contract.

## 3.6 OBSTRUCTION OF NAVIGATION AND USACE COORDINATION

- A. Port Authority will not undertake measures to keep the channel free from vessels or other obstructions. All work shall be conducted in such manner to obstruct navigation as little as possible. If the plant does obstruct the use of channels or passages and makes traffic movement difficult or endangers the passage of vessels, said plant shall be promptly moved on the approach of any vessel to the extent necessary to afford a practicable passage. Refer to Paragraph 1.14 for required coordination with the USCG. Contractor shall comply with all "moving security zone" requirements set forth by USCG. Delays caused by vessel traffic shall not be considered justification for Standby Time.
- B. Project site is located adjacent to existing ship docks which may be utilized by others during construction. Contractor shall coordinate with Port Authority and schedule work so that dredging operations do not impact use of adjacent docks, and so that use of adjacent docks by others does not impact Contractor's dredging work schedule. Delays caused by use of docks by others shall not be grounds for standby time, claims, changed conditions, or time extensions to the Contract.

## 3.7 DREDGING

- A. Material Removal: All dredging shall be performed within the limits and depths shown on the drawings.
- B. Dredging Limits/Tolerance: Dredging shall not extend below the allowable depths shown on the Drawings and/or specified herein. Contractor shall establish such control as may be necessary to ensure that the allowable dredging depths are not exceeded. The dredge cut tolerance/allowable overdepth shall be as indicated on the Drawings and specified herein.
- C. Bed Leveling: Final leveling of a dredged area may be performed with a drag bar or other approved apparatus. Bed leveling by dragging the bottom shall be allowed only in areas specified for dredging. Shop drawings and photographs showing proposed dragging apparatus shall be included in Contractor's Dredging Work Plan (Paragraph 1.11.F).
- D. Excessive Dredging: Contractor shall not dredge any material beyond the allowable overdepth and specified limits shown on the Drawings. Such dredging shall be considered excessive Overdepth dredging, or excessive side or end slope dredging. Contractor shall be responsible for damage to adjacent property due to overdredging and shall pay for all repairs or refilling and compacting to the designed grade.
- E. Protection of Existing Waterways: Contractor shall conduct dredging operations in a manner that prevents displacement of material or debris outside of the dredging limits or otherwise causes deposition within adjacent portions of existing channel or side channels, basins, docking areas, or other navigable areas. Such material shall be removed immediately at Contractor's expense.

## 3.8 DEBRIS WITHIN THE DREDGING LIMITS

A. Contractor shall remove debris including but not limited to broken cable, rope, chains, stumps, rock, concrete rubble, tires, piles, and other miscellaneous trash from the dredging template. Port Authority has no knowledge of existing wrecks, wreckage, or other material of

the size or character that would require the use of explosives or special or additional plant for its economical removal.

- B. Removed debris shall become the property of Contractor and shall be disposed of in accordance with applicable law and applicable codes and standards. Contractor shall dispose debris at a disposal facility outside Port Authority's property.
- C. In the event that existing conditions of debris differ materially from those shown on the drawings and described in the geotechnical and geophysical data in Appendices A and B, an adjustment in contract price or time of completion, or both, will be made in accordance with the following:
  - 1. Contractor shall promptly, and before the site conditions are disturbed, provide notification to Port Authority of unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.
  - 2. Port Authority will investigate the site conditions promptly after receiving Contractor's notice. If conditions do materially so differ and cause an increase or decrease in Contractor's cost of, or time required for, performing any part of the work under this Contract, whether or not changed as a result of the conditions, an equitable adjustment will be made under this section through a Change Order or other written agreement in accordance with and subject to Section 8.09, "Claims for Changed Conditions," of the General Conditions.
- D. Pay requests for debris removal shall substantiated by supporting evidence including but not limited to weight tickets and/or barge displacement measurements, timestamped and georefrenced photos of the debris, journal entries describing the debris, and log entries for delays caused specifically by the debris.
- E. Port Authority and Engineer assume no responsibility for failure to show any or all debris and other obstructions on the Drawings, or to show them in their exact location. Failure to show will not be considered sufficient basis for claims for additional compensation for extra work in any manner whatsoever, unless the obstruction encountered necessitates substantial changes in the lines or grades, or requires the building of special work for which no provision is made in the Drawings and which is not essentially subsidiary to some item of work for which provision is made. It is assumed that as elsewhere provided Contractor has thoroughly inspected the site, is informed as to the correct location of surface structures, and has included the cost of such incidental work in the price bid, and has considered and allowed for all foreseeable incidental work due to variable subsurface conditions, whether such conditions and such work are fully and properly described on the drawings or not. Minor changes and variations of the work specified and shown on the Drawings shall be expected by Contractor and allowed for as incidental to the satisfactory completion of a whole and functioning work or improvement.

# 3.9 DREDGE PIPELINES

- A. Pipeline Map: Contractor shall provide drawings showing all planned dredge pipeline routes, channel crossing details, pipeline anchor locations, and pipeline markings as part of the Dredging Work Plan (Paragraph 1.11.F). Drawings shall include pipe section joining methods. Pipeline maps shall be provided for each PA.
- B. Pipeline Routes:

- 1. Dredge pipeline route to M12Beneficial Use Site shall follow the pipeline corridors shown on the Drawings. Contractor shall obtain approval from Port Authority for any alternate pipeline routes.
- The dredge pipeline route to M12Beneficial Use Site is to follow closely the location shown or approved. Detailed right-of-way drawings showing the location of the pipeline routes with respect to property lines are available from Port Authority. Refer to Paragraph 1.11.G regarding pipeline easements obtained by Port Authority.
- 3. Pipeline corridors shown on Drawings may utilize drainage ditch easements and/or existing streams for a portion of the routes. The ditches and streams are prone to rapid water rise and strong currents from short-duration rain events. Routes may require passing pipeline through culverts along ditches. Contractor shall ensure security of pipelines for stability and leak control within steams, ditches and culverts, plus be responsible for protecting streams and ditches such that proper drainage is maintained. Contractor shall coordinate with Port Authority prior to placement of pipeline through Port Authority's property and/or any private property, through culverts, and along any improved drainage ditches.
- C. Pipeline in Water: Pontooned or submerged dredge pipeline shall be located, marked, and maintained so as not to interfere with navigation or present a hazard to boats and other channel users. Contractor shall mark navigation openings following USCG regulations as required in 33 C.F.R. 88.15. Should Contractor elect to use a submerged section in the dredge discharge pipeline for crossing a navigable channel, detailed Drawings of the submerged section shall be submitted as part of (or as an amendment to) the Dredging Work Plan (Paragraph 1.11.D). The Drawings shall indicate the width and depth of the navigation opening and the method used to mark it by day and by night for the safety of navigation. The minimum bottom width of the submerged section shall match the bottom width of the channel template. The highest point on the pipe or ball connection across the bottom width of a submerged section shall not be higher than the authorized depth in the channel. Lighted buoys meeting the requirements of USCG Regulation 33 C.F.R. 62.25 shall be provided by Contractor to mark the navigation opening. A red buoy exhibiting a quick flashing red light shall mark the right side of the opening, and a black buoy exhibiting a quick flashing green light shall mark the left side of the opening. The frequency of the flashes shall not be less than 60 per minute. "Right side" and "left side" of the opening shall be in conformance with the lateral system of buoyage established by USCG. Requirements for the lighted buoys and descriptions of the lateral system shall be as found in the USCG publication CG 208 entitled "Aids to Navigation."
- D. Pipeline over Land: Pipelines shall not interfere with road traffic. Where pipeline is adjacent to existing roadway, signs shall be provided in both approach directions indicating "Utility Construction Ahead."
- E. Pipeline Interferences: To the extent such information was available to Port Authority/Engineer, pertinent details on the locations of existing utility pipelines and other facilities which may be encountered in trenching or jacking operations have been provided on the Drawings. Contractor shall investigate existing conditions to determine if additional interferences may exist.
- F. Pipeline Leaks: Pipeline leaks or breaks shall be promptly reported to Engineer and repaired. Dredged material that is improperly placed due to leaks and/or breaks shall be removed immediately. Refer to Paragraph 3.12," Unauthorized Placement of Material."
- G. Cleanup: Upon removal of pipeline, pipeline corridor shall be restored to original or better condition. Refer to Paragraph 3.13, "Preservation of Public and Private Property."

## 3.10 SPILL CONTINGENCY PLAN

Contractor shall ensure that all hazardous material spills are immediately reported to the proper authorities, to Port Authority, and to Engineer. All hazardous material spills shall be immediately cleaned up in accordance with the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, and all changes and amendments thereto. In accordance with EM 385-1-1, Contractor shall use suitable methods such as dikes or curbs to prevent the spread of hazardous materials from above ground storage tanks and piping in case of leakage. Contractor shall provide and maintain an effective Spill Contingency Plan that includes the following as a minimum:

- A. During all hours of operation, placement of dredged material within upland PAs shall be monitored continuously by field personnel experienced with dredging and operation/management of dredged material placement areas.
- B. Contractor's Spill Contingency Plan shall include the following procedures to be followed in the event of a spill of (1) dredged material outside of the specified PAs and/or (2) fuel, oil, hydraulic fluid, etc.:
  - 1. Dredging shall cease immediately.
  - 2. Contractor shall notify Port Authority and Engineer immediately.
  - 3. Contractor shall submit a specific cleanup plan to Engineer. No cleanup actions will commence until the plan has been submitted to Engineer. All cleanup actions shall be at Contractor's expense.
  - 4. Contractor shall identify and have available the names and contact information of companies having portable hydraulic dredged or vacuum pumps that would be ready to clean up any dredged material discharge from the project due to being misplaced or associated with a spill.

# 3.11 DREDGED MATERIAL PLACEMENT

- A. Dredged material shall be transported by hydraulic means and placed in the Baseline A and Baseline B berm footprints at M12 Beneficial Use Site shown on the Drawings. Upon completion of the M12 Beneficial Use Site berms and approval by Engineer, Contractor may place additional dredged material within the M12 Beneficial Use Site. Material shall be discharged within the discharge corridors shown on the drawings. Material from Cedar Bayou shall be placed in the ODMDS. Material excavated from the M12 Beneficial Use Site access channel shall be sidecast to the bay side of the channel and used to backfill channel upon completion of shoreline protection along Baseline A.
- B. Contractor shall have sole responsibility for safe operation and maintenance of the placement during dredging activities. Refer to Section 35 41 00 Add, "Berm Construction" for details on dredged material placement at M12 Beneficial Use Site.
- C. Every effort has been made to give pertinent details of the location of utilities, pipelines, and other facilities which may be encountered in trenching or jacking operations. Investigate existing conditions and be satisfied that no additional construction which may interfere with dredge pipeline laying specified herein exists.
- D. The perimeter berms and any constructed training berms of the M12 Beneficial Use Site PA shall be maintained as necessary for the duration of this Contract. Repairs to the breaches or low areas shall be constructed to the lines and grades of the existing adjacent berms.

Discharge shall not be directed towards nearby berms. Refer to drawings for required separation between the dredge pipeline discharge point and adjacent berms.

- E. Placement of dredged material within designated PA shall commence at the locations stated on the Drawings. Denser material that tends to build up or stack within the discharge corridors shall be retained/stockpiled and roughly shaped as specified on the drawings. If, in the opinion of Engineer, the initial discharge point becomes full or otherwise overloaded, Contractor shall relocate the discharge pipe, adding pipe as needed to advance the discharge point, and deposit remaining material in succeeding discharge points.
- F. A spreader shall be used on the end of the discharge pipe to reduce scour and help distribute the material evenly. Contractor shall monitor and control the movement of the discharge pipe throughout PA to ensure an even build-up of material and to prevent overflowing the berms. The effluent ditches shall be maintained and excavated, as necessary, to prevent overflowing of the ditches.
- G. Contractor shall maintain a minimum of 2 feet of freeboard between pool level and berm crest throughout the dredging and placement operations. Sediments shall not be allowed to stack higher than the crest of adjacent perimeter dikes.
- H. Contractor shall operate and maintain decant structures (drop-outlet structure) through the duration of Contract as required to restrict the flow of effluent over the weirs while efficiently draining water from the PA. Water quality standards shall be maintained for all return water. If satisfying water quality standards requires Contractor to provide additional weir boards or additional settling time by temporarily ceasing dredging, Contractor shall do so at no additional cost to Port Authority. Existing outfall pipes shall be cleared of all debris and accumulated sediment to allow for unimpeded drainage on a regular basis or as needed. Care shall be taken to not damage outfall pipes.
- I. Contractor shall collect samples from the PA outfalls for total suspended solids (TSS) analysis. EPA method 160.2 requirements for detection limits, holding times, and preservation for TSS shall be the standard for measuring TSS. Samples shall be collected from the outfalls daily. Sampling shall occur at the same time each day at the same location. Contractor shall utilize an appropriately qualified and licensed laboratory for collection and analysis of the TSS samples.
- J. Contractor shall develop a site specific management plan for water quality monitoring that will include dredging production/placement modifications prior to reaching a threshold of 300 mg/L for TSS. The management plan shall include specific management actions for measurements exceeding 200 mg/L, and additional limitations when 250 mg/L is observed. Management plans may include weir board management, reduced production, and/or end of pipe management. At no time shall Contractor exceed 300 mg/L. Contractor shall provide daily updates to Port Authority on water quality issues associated with weir operations and water quality measurements.
- K. Contractor shall maintain daily records of TSS results and make them part of the Daily Activities Reports. Contractor shall notify Port Authority when TSS levels exceed 200 mg/L and indicate which portions of management plan will be implemented. If Contractor exceeds the 300 mg/L TSS requirement, immediate actions (e.g., add boards, cease dredging) shall be implemented to improve water quality, and Port Authority shall be notified immediately. Contractor shall be solely responsible for developing and implementing the necessary response measures to maintain acceptable effluent water quality, at no additional cost to Port Authority. No payment will be made for delays that occur due to noncompliance with water quality criteria.

- L. Contractor shall be aware that upland PAs are located adjacent to sensitive environmental habitat. Movement of equipment outside of dikes is prohibited except as otherwise shown on Drawings.
- M. Contractor shall inspect containment dikes daily during dredged material discharge. Inspections shall be recorded in Daily Activities Reports. If a dike, weir, or drop-outlet structure failure occurs while materials are being discharged, dredging shall cease and Port Authority shall be notified immediately. Discharge of material into the PA shall not resume until the confining structures have been restored by Contractor to a condition that is acceptable to Port Authority.
- N. Contractor shall perform site management operations at each PA for a period of 30 calendar days after placement operations are complete. This 30-day period is NOT included in the construction Contract Time. During the site management period, the boards on the drop-outlet structures shall be removed at a proper rate to allow continued drainage of the PAs. Water quality standards shall continue to be maintained. Daily water quality tests shall continue to be taken and submitted on Contractor's daily activities reports. During this period, Contractor shall not allow deposited material to impound water or impede natural drainage. Contractor shall, if necessary, excavate and maintain ditches to drain low areas in the PAs to the drop-outlet structure. The ditches shall be of adequate number and size to eliminate ponding of water within the limits of the PAs.

# 3.12 UNAUTHORIZED PLACEMENT OF MATERIAL

- A. Contractor will not be paid for dredged material that is not deposited in specified location. Contractor may be required to remove misplaced material and deposit it where directed by Port Authority /Engineer without cost to Port Authority/Engineer.
- B. During the progress of the Work, worn out discharge pipe, wire rope, scrap metal, timbers, broken concrete, or any other such type of rubbish or obstructive material shall not be discarded in M12 Beneficial Use Site, ODMDS, water, along the shoreline, or anywhere else on public or private property. Such material that may be encountered during the dredging activities shall become the property of Contractor and be removed from the Project Site and disposed of in accordance with applicable law, codes, and standards.
- C. Contractor shall indemnify and hold harmless Port Authority/Engineer from any and all losses, expenses, damages, demands, and claims asserted against or sustained by Port Authority/Engineer as a result of or alleged to be the result of illegal, improper, or unauthorized disposal of dredged material or objectionable material.

# 3.13 PRESERVATION OF PUBLIC AND PRIVATE PROPERTY

Unless otherwise shown on the drawings for removal and relocation, all existing navigation channels, docks, mooring piles, seawalls, jetties, groins, bulkheads, informational and directional signs, fences, roads, ditches, houses/decks, driveways, ramps, private or public grounds, camp facilities, water wells and tanks, station markers, mile markers, and other structures or improvements that are damaged as a result of Contractor's operations under these Specifications shall be repaired or rebuilt by Contractor at his expense. The areas used by Contractor in laying and maintaining his pipelines shall be restored to the same or better condition as existed prior to commencement of the Work. Upon completion of the Work, all trenches and cuts shall be backfilled to original ground level, the ends of temporary culverts shall be fully closed with wooden bulkheads, and trenches and bank cuts shall be backfilled to the original ground level.

## 3.14 HOUSTON-GALVESTON VESSEL TRAFFIC SERVICE AREA

Comply with the following requirements while operating within the VTS Area.

- A. General: When Contractor's dredge or floating plant is to be operated within the VTS Area, Contractor shall furnish the Vessel Traffic Center the following report at least 30 minutes prior to beginning operations:
  - 1. Location of intended operation.
  - 2. Description of intended operation including Channel obstructions.
  - 3. Configuration of pipelines and equipment in or along the Channel.
  - 4. Termination point of pipelines in or along the Channel.
  - 5. Time required to re-open Channel or move for vessel traffic.
  - 6. Operating impairments, including VHF-FM radios.
  - 7. Names of the assist boats being used.
  - 8. Traffic considerations required, for example: slow bell, no meeting or overtaking, and advance notice requirements.
  - 9. Point of Contact phone numbers and working frequencies.
- B. Report Changes: Contractor shall immediately notify the VTS of changes to the above report and at the completion of operations.
- C. Vessel Traffic Service Location: The VTS Area consists of the navigable Channels between the Galveston Entrance Channel Buoy 1 and the Houston Turning Basin, Galveston Channel, Texas City Channel, the Gulf Intracoastal Waterway, Bayport Channel and Galveston-Freeport Cutoff from mile 346 to mile 352.
- D. Communications: Communications with the Vessel Traffic Center, call sign "HOUSTON TRAFFIC," shall be accomplished via VHF-FM Channel 12. The Traffic Center guards both Channel 12 and Channel 13 on a 24-hour basis.
- E. Operations: The master of a dredge of floating plant is to be aware of and comply with the provisions of the Order Relating to Lightering and Bunkering Operations and Multiple Vessel Moorings and will notify the VTS when refueling operations are to be conducted.

# 3.15 WORK IN THE VICINITY OF OTHER CONTRACTORS

Coordinate dredging operations, through the Port Authority, with other Contractors who may be working in the vicinity (for example: revetment, jetty repairs, and berm construction).

## 3.16 DREDGE PLANT INSTRUMENTATION

The Dredge Plant Instrumentation is a part of the dredge plant and shall be functional at all times. If failure of any part thereof occurs, repair the failed part within the next 36 hours restoring full operations. If the system is not fully functional within this period, the particular plant affected will be considered non-responsive to this Contract requirement and shall either be replaced or a redundancy part added to render the plant fully operational to include the monitored data at no additional increase in price or time to this Contract.

## 3.17 ESTIMATED QUANTITY OF MATERIAL

Within the limits of available funds, Contractor shall excavate the entire quantity of material necessary to complete the work specified whether the quantities involved are greater or less than those estimated. The work is to be done in accordance with this Contract and at the Contract price or prices, subject to the provisions of Paragraph 3.20, "Variations in Estimated Quantities – Dredging."

## 3.18 QUANTITY SURVEYS

A. Dredging quantity surveys will be conducted by Port Authority in accordance with Section 35 20 00, "Construction Surveying." The data derived from these surveys will be applied to compute the quantities of work performed and the actual construction completed and in place.

## 3.19 FINAL EXAMINATION AND ACCEPTANCE

- A. General: Port Authority will perform AD survey as soon as practicable after the completion of any Channel Segment. If shoals, lumps, or other lack of Contract depth are disclosed by this survey, Contractor shall remove same by dragging the bottom or by dredging at the Contract rate for dredging. If the bottom is soft and the shoal areas are small and form no material obstruction to navigation, the removal of the shoal may be waived at the discretion of the Port Authority. Port Authority will notify Contactor when final surveys are to be made so they have opportunity to accompany Port Authority's survey party. When the area is found to be in a satisfactory condition, it will be accepted finally.
- B. Determination of Pay Quantities: The total estimated amount of material to be removed from within the specified limits, including side and end slopes, anticipated shoaling occurring prior to the dates of the BD surveys, incidental material during dredging (see Paragraph 3.19.D), and overdepth, is shown in the Quantity Summary Table attached to this specification. Pay quantities for actual work will be determined based on AD surveys performed by Port Authority for each Channel Segment. Refer to Section 01 25 00, "Measurement and Basis of Payment," for additional conditions of payment, and Section 35 20 00, "Construction Surveying," for additional conditions of Acceptance.
- C. Overdepth: To cover inaccuracies of the dredging process, material actually removed from within the specific area(s) to be dredged to depths as specified on the Drawings will be estimated based on the BD and AD surveys and paid for at the Unit Price rate for Dredging. The maximum amount of allowable overdepth dredging is listed in the Quantity Summary Table (attached).
- D. Side and End Slopes: Dredging for side slopes shall follow, as closely as practicable, the lines indicated or specified. There shall be no vertical faces greater than 6 feet alongside slopes. Material actually removed from within approved limits to provide for final side and end slopes as specified on the Drawings, but not in excess of the amounts originally above these limiting side and end slopes, will be estimated based on BD and AD surveys and paid for at the Unit Price for Dredging. In computing the limiting amount of side and end slopes, net dimensions, without allowance for Overdepth, shall be applied.
- E. Incidental Material: Any adjacent material that migrates into the required dredging limits as physical dredging is being performed shall be considered incidental material. No adjustments in pay volume will be made for such incidental material.

- F. Final Examination: If more than two surveys by Port Authority of a Segment are necessary for removal of shoals disclosed at prior surveys, the cost of the third and any subsequent surveys will be charged against Contractor.
- G. Excessive Dredging: Material taken from beyond the limits specified will be deducted from the total pay volume as excessive overdepth dredging or excessive side or end slope dredging, for which payment will not be made. Nothing herein shall be construed to prevent payment for the removal of shoals performed in accordance with Paragraph 3.19.F.

## 3.20 VARIATIONS IN QUANTITIES

- A. Contractor is cautioned that funding on this Contract is based on the quantities shown in the Price Exhibit. Therefore, Contractor is not to exceed the estimated quantities in the Contract bid line items without prior specific authorization, and only with a signed modification issued by the Port Authority. Contractor shall specifically notify Port Authority, in writing, once Contractor reaches approximately 75 percent of the quantities specified in the Contract Line Items. This notification will be separate and in addition to other reporting required elsewhere in this Contract. Contractor shall notify Port Authority as soon as it recognizes that the estimated quantities are not sufficient to complete the work indicated and specified.
- B. If the actual total quantity of material within the required dredging prism varies from the Quantity Summary Table (attached), an equitable adjustment will be processed in accordance with FAR 52.211-18, Variation in Estimated Quantity. The equitable adjustment applies only to the quantity within the required dredging prism, which does not include the allowable overdepth. If the total quantity of material to be paid for and actually removed under this Contract exceeds the limit established by FAR 52.211-18, Variation in Estimated Quantity, an additional time will be allowed at the rate of 1 calendar day for each 5,000 cubic yards in excess of the established limit. Contractor shall not exceed the estimated quantities in the Contract Line Items without prior authorization and only with a signed modification issued by the Port Authority.
- C. If Contractor exceeds the estimated quantities without a signed modification in place, it will be considered unauthorized work for which Contractor may not be reimbursed. Once the potential quantity overrun is identified, Port Authority may, among other choices, provide additional funds (if available) to complete the work and equitably adjust the quantities in the Contract Line Item, modify the work to fit within the estimated quantities, consider the Contract complete once the contractually indicated quantities have been reached, or terminate the Contract for the convenience of Port Authority.
- D. This provision is not to be interpreted as an order for Contractor to stop work upon reaching 75 percent of the estimated quantities, it merely requires notice and potential corrective action at that point. However, absent further specific direction, Contractor shall be prepared to stop work at no additional cost to Port Authority once 100 percent of the line item quantity has been obtained.

# 3.21 DISPOSAL FEES

There are no disposal fees imposed by Port Authority for placement of dredged material in the PAs shown on the Drawings.

3.22 CLEANUP

Upon completion of the work, dredging plant, including pipeline, ranges, buoys, survey stakes, piles, signage, cables, and any other markers or obstructions placed by of for Contractor shall be removed.

# END OF SECTION
BCC DREDGING QUANTITY SUMMARY TABLE									
	ACCEPTANC	E SECTIONS		CON					
Section No.	From Station	To Station	Length of Station (ft)	Required Depth (CY)	RequiredAllowableDepthOverdepth(CY)(CY)		Placement Area		
			NEW WORK DR	EDGING					
North Template	15+27	67+11	5,184	1,910,500	88,500	1,999,000	M12 Berm		
South Template	9+63	31+98	2,235	781,500	44,200	M12 Berm			
	TOTAL (New Work Dredgin	g)	7,419	2,692,000	132,700	2,824,700			

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

#### SECTION 35 20 23.33 Add – NATIONAL QUALITY MANAGEMENT PROGRAM PIPELINE HYDRAULIC DREDGE

#### PART 1 GENERAL

#### 1.1 DESCRIPTION

The work under this Contract requires use of the US Army Corps of Engineers (USACE) National Dredging Quality Management Program (DQM) to monitor the dredge's status at all times during the Contract and manage data history.

This performance-based specification section identifies the minimum required output as well as the precision and instrumentation requirements. The requirements may be satisfied using equipment and technical procedures selected by the Contractor.

#### 1.2 RELATED SECTIONS

Section 35 20 23 Add – Dredging

#### 1.3 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only.

- 1. Preconstruction Submittals: Dredge Plant Instrumentation Plan Revisions or Addendum (Paragraph 1.7) E
- 2. Test Reports: Data Appropriately Archived e-mail, Contractor Data Backup (Paragraph 3.3.D); E
- 3. Certificates: Letter of National Dredging Quality Management Program Certification (Paragraph 1.6); E

#### 1.4 PAYMENT

No separate payment will be made for the installation, operation, and maintenance of the DQMcertified system as specified herein for the duration of the dredging operations; all costs in connection therewith will be considered a subsidiary obligation of the Contractor and covered under the Contract unit price for dredging in the bid schedule.

#### 1.5 NATIONAL DREDGING QUALITY MANAGEMENT PROGRAM CERTIFICATION

The Contractor is required to have a current certification from the DQM Program for the cutter/suction head hydraulic dredge instrumentation system to be used under this Contract. Standard Operating Procedures (SOP) and criteria for certification are presented on the DQM website at <a href="https://dqm.usace.army.mil">https://dqm.usace.army.mil</a>.

#### 1.6 DREDGE PLANT INSTRUMENTATION PLAN (DPIP)

TECHNICAL SPECIFICATION Date: December 2020 35 20 23.33 Add Page 1

The Contractor shall have a digital copy of the Dredge Plant Instrumentation Plan (DPIP) on file with the DQM Support Center. While working on site, the Contractor shall also maintain on the dredge a copy of the DPIP, which is easily accessible to Port Authority/Engineer personnel at all times. This document shall accurately describe the sensors used, the configuration of the system, how sensor data will be collected, how quality control on the data will be performed, and how the sensors/data-reporting equipment will be calibrated and repaired if it fails. A description of the computed dredge-specific data and how the sensor data will be transmitted to the DQM database shall also be included. Prior to the start of work, the Contractor shall submit to the DQM Support Center any addendum or modifications made to the plan subsequent to its original submission. Requirements and a template for the DPIP are available on the DQM website at https://dqm.usace.army.mil.

#### PART 2 PRODUCTS

NOT USED

# PART 3 EXECUTION

#### 3.1 REQUIREMENTS FOR REPORTED DATA

Provide, operate, and maintain all hardware and software to meet these specifications. Also be responsible for the replacement, repair, and calibration of the sensors and other necessary data acquisition equipment needed to supply the required data.

The procedure to complete a repair shall be documented and completed as soon as practical. If repair is not possible within two business days of any sensor failure, a plan and timeline to complete the repair shall be submitted. Upon completion of a repair, replacement, installation, modification, or calibration, the Contractor shall notify the Engineer. The Engineer may request recalibration of the sensors or other hardware components at any time during the Contract as deemed necessary.

Keep a log of sensor repair, replacement, installation, modification, and calibration in the dredge's onboard copy of the DPIP. The log shall contain a three-year history of sensor maintenance, including the time of the sensor failures (and subsequent repairs), the time and results of sensor calibrations, the time of sensor replacements, and the time that backup sensor systems were initiated to provide the required data. It shall also contain the name of the person responsible for the sensor work.

Sensors installed shall be capable of collecting parameters within the specified accuracies and resolutions indicated in the following subparagraphs and transmit these parameters to the DQM database. All data shall be transmitted in JSON message bundles. Each bundle can contain multiple message types. Sensor data shall be transmitted as work event messages, and data which relates to the operational state of the dredge or its sensors shall be transmitted as state event messages (See Paragraph titled "Parameter Transmission to the Web Service.").

- A. <u>Message Bundle Data</u>: Every message bundle shall contain descriptive data that relates the message to a given dredge plant and date/time. The start of a message bundle shall be identified by the tag "DQM\_data".
  - 1. <u>Messages</u>: Messages contain operational data that populates the DQM database for a dredge plant. A message shall consist of an event type and its associated data (as defined in Paragraph titled "Dredge Events"), a date/time stamp indicating when the event occurred or started, and a comment providing clarification or metadata about the

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situation. There are multiple event types, but they all fall into one of two categories - work events and state events.

- a. Message Time: In a work event message, message time is the date and time that the data is collected from the sensors; in a state event message, message time is the date and time that the state event begins. The message time shall be reported to the nearest second and referenced to Coordinated Universal Time (UTC) time based on a 24-hour format (YYYY-MM-DD HH:MM:SS). In order to ensure accuracy and reliability, the time stamp shall be synchronized to UTC format from an accurate, unchangeable source (for example, a GPS National Marine Electronics Association (NMEA) datastring). Message time shall be identified by the tag "msg\_time".
- b. Comment: Comments concerning the work event or state event messages being transmitted provide descriptive information that relates to the data. An example of a comment for work event data is information about a sensor issue; an example of a comment for state event data is a description of operations. A comment shall be identified by the introductory tag "comment", and the comment shall consist of no more than 250 characters.
- <u>Dredge Events Work Event</u>: There are two types of dredge event messages work event messages and state event messages. Work event messages contain data that are instantaneously collected or calculated from sensors and are logged as a series of events. Work events are triggered by a time interval change (as described in Paragraph titled "Work Event Messages"). All work event messages shall be initiated by the header tag "work\_event".
  - a. Vertical Correction: The variation of the water level from the vertical datum for the river stage or tidal gage described in the state events shall be obtained using appropriate equipment to give the water level with an accuracy of plus/minus 0.1 ft. Vertical correction values above project datum described in the dredging specification shall be entered with a positive sign and those below with a negative sign. The tag for vertical correction shall be "vert\_correction".
  - b. Cutter/Suction Head Location and Movement: The X, Y, and Z components of the cutter/suction head location shall be monitored. Additional calculations made from the observed values determine the rates of movement to track the progress of the dredge.
    - b.1. Cutter/Suction Head Horizontal Position: The forwardmost point of the cutter/suction head shall be obtained using a positioning system operating with a minimum accuracy level of 3-10 feet horizontal Circular Error Probable (CEP). It shall be reported as Latitude/Longitude WGS 84 in decimal degrees with West Longitude and South Latitude values reported as negative. Position values shall be identified by the tags "ch\_latitude" and "ch\_longitude".
    - b.2. Cutter/Suction Invert Depth: Cutter/suction invert depth is the depth of the invert of the suction mouth relative to the surface of the water. Instrumentation shall be capable of reporting to an accuracy of plus/minus 0.5 foot and a resolution to the nearest 0.1 foot with no tidal adjustments. Minimum accuracies are conditional to relatively calm water. The tag "ch\_depth" shall be used to identify the cutter/suction head depth.
    - b.3. Cutter/Suction Head Heading: The cutter/suction head heading is the angle of the centerline of the cutter/suction head and dredge ladder measured relative to true north. All headings shall be provided using industry-standard equipment. The heading shall be accurate to within 5 degrees and reported to the nearest

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whole degree with values from 000 (true north) to 359 degrees referenced to a clockwise positive direction convention. The tag "ch\_heading" shall be used to identify the cutter/suction head heading.

- c. Dredge Activity: Dredge activity shall be monitored using a combination of the following parameters.
  - c.1. Slurry Velocity: A flow-metering device, calibrated according to the manufacturer's specifications, shall be used to record the slurry velocity to the nearest 0.01 fps with an accuracy of plus 0.1 fps. If the manufacturer does not specify a frequency of recalibration, calibration shall be conducted prior to the commencement of work. The slurry velocity shall be measured for the same pipeline inside diameter as that used for the slurry density measurement. The tag "slurry\_velocity" shall be associated with this value.
  - c.2. Slurry Density: A density-metering device, calibrated according to the manufacturer's specifications, shall be used to record the slurry density to the nearest 0.01 g/cc. It is understood that the accuracy of this sensor can vary based on several factors, including the type of material, the magnitude of the cut, and the length of time since calibration. If the manufacturer does not specify a frequency of recalibration, calibration shall be conducted prior to the commencement of work. Continuous monitoring of this sensor ensures that drift and other factors inherent in the dredging process can be accounted for in monitoring dredge activity. The tag "slurry\_density" shall be associated with this value.
  - c.3. Pump RPM: The pump rpm is the number of revolutions per minute measured for the slurry pump shaft. The shaft revolution rate (rev/min) shall be measured with the highest level of accuracy that is standard on the vessel's operational displays either at the bridge or in the engine room. This value shall be identified by the tag "rpm".
  - c.4. Pump Vacuum: The vacuum pressure of the dredge pump(s) (inches of mercury) shall be measured as near to the eye as practicable in the pump's suction pipe with the highest level of accuracy that is standard on the vessel's operational displays either at the leverman's controls or in the engine room. Vacuum pressure shall be identified by the tag "vacuum".
  - c.5. Pump Outlet Pressure: The pump outlet pressure shall be measured in the discharge line on the pump side of the flap valve in terms of pounds per square inch (psi) on a gauge. Pump outlet pressure shall be identified by the tag "outlet\_psi".
- d. Outfall Information (Open Water/Spill Barge Disposal): The X and Y position of the terminal end of the outfall pipe shall be monitored continuously and the position reported as part of the work event string.
  - d.1. Discharge Horizontal Position: The horizontal position of the outfall end of the discharge pipe shall be obtained using a positioning system operating with a minimum accuracy level of 3-10 feet horizontal Circular Error Probable (CEP). It shall be reported as Latitude/ Longitude WGS 84 in decimal degrees with West Longitude and South Latitude values being reported as negative. Position values shall be identified by the tags "outfall\_latitude" and "outfall\_longitude".

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- 3. <u>Dredge Events State Event</u>: There are two types of dredge event messages work event messages and state event messages. State event messages provide information about the current state of the dredge equipment or operations. They are created and sent only when a state changes. Since state events often cannot be collected in real time, state events are tagged with a date time stamp (referenced to Coordinated Universal Time (UTC)) that indicates when the state change happened relative to the work event message tag. This data is considered to be "true" until another state event tag is received. Each type of state event message shall be indicated by a specific header tag as enumerated in the following subparagraphs. State events can be transmitted along with work event message bundles directly by the Contractor using the indicated format, or they can be entered on the "State" tab in the DQM-provided software.
  - a. Message Time: The state event time is the date and time that the event starts. The leverman's time shall be entered to the nearest second as local time and automatically converted to and reported in UTC based on a 24-hour format (YYYY-MM-DD HH:MM:SS). Message time shall be identified by the tag "msg\_time".
  - b. Contract Event: Information concerning the Contract under which dredging is being performed shall be reported at the start and completion of each Contract using the header tag "contract\_event".
    - b.1. Contract Number: The Port Authority-assigned Contract number for the project shall be reported using the tag "contract\_number".
    - b.2. Contract Start and End: The start and end of a Contract shall be reported using the tag "event\_type" with the appropriate value of "start" or "end".
  - c. Tide Station/River Stage Gage Event Properties associated with the vertical correction (see Paragraph titled "Vertical Correction") for the tide station/river stage gage shall be grouped together under the header tag "station\_event". This information shall be sent at the start of the Contract and each time the dredge has moved enough to change the station being used.
    - c.1. Station Name: The station name is a concise name defining the tide station/river stage gage begin referred to. It shall be introduced by the tag "station\_name", and it shall consist of a descriptor of no more than 25 characters.
  - d. Length of Pipe Event: The leverman's estimate of the length of pipe downflow from the dredge pump, measured to the nearest whole foot, shall be reported under the header tag "pipe\_length\_event". This information shall be sent at the start of the Contract and at the completion of each 24-hour period ending at midnight local time.
    - d.1. Floating Pipe: The total length of floating pipe shall be reported with the tag "length\_floating".
    - d.2. Submerged Pipe: The total length of floating pipe shall be reported with the tag "length\_submerged".
    - d.3. Shore Pipe: The total length of shore pipe shall be reported with the tag "length\_land".
    - d.4. Booster Pump Event: Information concerning the booster pumps being used shall be included under the header tag "booster\_pump\_event". A message shall be sent to indicate any change in the status of the booster pumps being used.

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- e. Dredge Advance: The dredge advance, the total forward progress of the dredge relative to the centerline of the cut, shall be measured to the nearest whole foot and cumulatively calculated over a 24-hour period from midnight to midnight local time. It shall be identified by the tag "advance\_daily". The msg\_time associated with this tag shall be reported as the first timestamp of the following 24-hour period (based on the local time) rather than as midnight of the day for which the value was calculated, and it shall be reported in Greenwich Mean Time (GMT).
- f. Outfall Information: The X and Y position of the terminal end of the outfall pipe shall be monitored and sent at the start of the Contract and thereafter according to the following table. Discharge Heading and Pipe Elevation may be omitted if the dredge is not discharging into an upland disposal site. For beach nourishment, the horizontal X and Y position of the outfall shall be sent at the start of the Contract and at the completion of each 24-hour period ending at midnight local time.

Discharge Location	Horizontal Position	Discharge Pipe Elevation	Discharge Outfall Heading		
Open Water	Continuous Work Event	N/A	N/A		
Scow	Upon Change	N/A	N/A		
Beach	Every 24 Hours	N/S	N/S		
Upland	Upon Change	Upon Change	Upon Change		

- f.1. Discharge Location: Information on where the slurry is being discharged shall be reported with the tag "outfall\_location". Acceptable values include "upland", "open water", "beach", and "scow".
- f.2. Discharge Horizontal Position: The horizontal position of the outfall end of the discharge pipe shall be obtained using a positioning system operating with a minimum accuracy level of 3-10 feet horizontal Circular Error Probable (CEP). It shall be reported as Latitude/ Longitude WGS 84 in decimal degrees with West Longitude and South Latitude values being reported as negative. Position values shall be identified by the tags "outfall\_latitude" and "outfall\_longitude".
- f.3. Discharge Outfall Heading: The discharge outfall heading is the angle relative to true north measured from the centerline of the pipe in the direction of discharge. All headings shall be provided using industry-standard equipment. They shall be accurate to within 5 degrees and reported to the nearest whole degree with values from 000 (true north) to 359 degrees referenced to a clockwise positive direction convention. The discharge heading shall be identified by the tag "outfall\_heading".
- f.4. Discharge Outfall Heading: The discharge pipe elevation is the height of the outfall measured in feet and tenths of a foot relative to the project datum. The required accuracy is contingent upon Contract requirements. The tag "outfall\_elevation" shall be used to identify this elevation.
- g. Non-effective Work Event: Delays and dredge downtime shall be reported at the conclusion of the event. The reason for the non-effective work time shall be submitted under the header tag "non\_eff\_event" within 24 hours of the event
  - g.1. Non-effective Work Interval: The start and end times for the non-effective work event shall be reported using the tags "msg\_start\_time" and "msg\_end\_time".
  - g.2. Dredge Function Code: The dredge operator indication of production delays shall be transmitted at the end of the non-effective interval. Dredge function event

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messages shall be identified by the tag "function\_code" and shall consist of one of the following standardized entries to indicate the operation:

AGV	Assisting Grounded Vessels
CCH	Change Cutterhead
CCSH	Clear Cutter Suction
CLPJ	Change Location Bar
COLL	Collision
CPPL	Clear Pump Pipeline
CPR	Change Impeller
DR	Dike Repair
FBD	Fire Boat Drills
HPL	Handling Pipe Line
HSL	Handling Swing Line
HSP	Handling Shore Pipe
LDNE	Loss Due to Natural Elements
LDPV	Loss Due to Passing Vessel
LNL	Transfer to New Location
MISC	Miscellaneous
MOB	Mobilization & Demobilization
MSC	Miscellaneous/Non-pay
OC	Out of Commission
OR	Operating Repairs
Р	Preparation
PREP	Preparation & Making Up Tow
RPL	Repair Pipeline
SB	Sounding & Buoying
SBT	Stand-By Time as Directed
SH	Sundays-Holidays
TFS	Taking on Fuel & Supplies
TOW	Time on Tow
WAP	Waiting Attendant Plant

g.3. Additional Comments: The "comment" tag shall be used to provide additional explanation for the noted delays or downtimes. For example, when the code "LDPV" (Loss Due to Passing Vessel) is indicated, the name of the vessel and the number of tows shall be listed with the "comment" tag.

#### 3.2 NATIONAL DREDGING QUALITY MANAGEMENT PROGRAM SYSTEM REQUIREMENTS

The Contractor's DQM system shall be capable of collecting and transmitting information to the DQM onboard computer. The applicable parameters from Paragraph titled "Requirements for Reported Data," shall be recorded as events locally and continuously transmitted to the DQM database anytime an Internet connection is available. The dredge shall be equipped with a DQM computer system consisting of a computer, monitor, keyboard, mouse, data modem, Universal Power Supply (UPS), and network hub. The computer system shall be a standalone system, exclusive to the DQM monitoring system, and shall have USACE DQM software installed on it. If a hardware problem occurs, or if a part of the system is physically damaged, then the Contractor shall be responsible for repairing it within two business days of the determination of the condition or submitting a plan and timeline for repair if the repair will take more than two business days.

A. <u>Computer Requirements</u>: Provide a dedicated onboard computer for use by the Dredging Quality Management system. This computer shall run the USACE DQM software and receive data from the Contractor's data-reporting interface. This computer must meet or exceed the following performance specifications:

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CPU	Intel or AMD processor with a (non-overclocked) clock speed of at least 1.8 gigahertz (GHz)
Hard Drive	250 gigabytes (GB); internal
RAM	4 gigabytes (GB)
Ethernet Adapter Connector	10 or 100 megabit (Mbit) internal network card with an RJ 45
Video Adapter	Must support a resolution of 1024x768 at 16-bit color depth
Keyboard	Standard 101-key keyboard
Mouse	Standard 2-button mouse
Monitor	Must support a resolution of 1024x768 at 16-bit color depth
Ports	2 free serial ports with standard 9-pin connectors; 1 free USB port
Other Hardware	Category 5 (Cat-5) cable with standard RJ-45 plugs connecting the network adapter to the network hub; one spare cable

Install a fully licensed copy of Windows 10 Professional Operating System (or newer) on the computer specified above. Also install any necessary manufacturer- provided drivers for the installed hardware.

This computer shall be located and oriented to allow data entry and data viewing as well as to provide access to data ports for connection of external hardware.

- B. Software: The DQM computer's primary function is to transmit data to the DQM shoreside database. No other software which conflicts with this function shall be installed on it. The DQM computer shall also have the USACE-provided Dredging Quality Management Onboard Software (DQMOBS) installed on it by DQM personnel.
- C. UPS: Supply an Uninterruptible Power Supply (UPS) for the computer and networking equipment. It shall interface with the DQM computer to communicate UPS status, and it shall provide backup power at 1 kVA for a minimum of 10 minutes. Ensure that sufficient power outlets are available to run all specified equipment.
- D. Internet Access: Maintain an Internet connection capable of transmitting real-time data to the DQM server as well as enough additional bandwidth to clear historically queued data when a connection is re-established. The telemetry system shall always be available and have connectivity in the Contract area. If connectivity is lost, unsent data shall be queued and transmitted upon restoration of connectivity. The Contractor shall acquire and install all necessary hardware and software to make the Internet connection available for data transmission to the DQM web service. The hardware and software shall be configured to allow the DQM Support Center remote access to this computer, and the telemetry system

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In areas with poor cellular service and at the local District's discretion, it may be required to manually download the data on a daily basis using the protocol for retrieving and submitting backup files provided by the DQM Support Center. This method of data transmission should be used only if Internet connectivity is unavailable at the dredging site, and it should be considered a temporary measure.

E. Data Routing Requirements: Onboard sensors continually monitor dredge conditions, operations, and efficiency and route this information to the shipboard dredge-specific system (DSS) computer to assist in guiding dredge operations. Portions of this Contractor-collected information, as described in this specification, shall be routed to the DQM computer on a real-time basis. Standard sensor data shall be sent to the DQM computer via an RS-232 serial interface with a baud rate of 9600 or 19200bps. The serial interface shall be configured as 8 bits, no parity, and no flow control

Information regarding changes in the state of the dredge shall be digitally logged and transmitted as close to the time of the occurrence as possible. These events can either be included in a separate message bundle going to the DQM onboard computer, or they can be entered on the "State" tab in the DQM Pipeline Software

#### 3.3 DREDGE MONITORING DATA

- A. General: Onboard sensors continuously collect dredging data in support of the dredge Contractor's operations. Portions of this Contractor-collected information, as described in this specification, and calculations based on them shall be stored and transmitted to the DQM database on a near real-time basis. Additionally, information regarding the state of the dredge shall be digitally logged and transmitted.
- B. Data Measurement Frequency: The frequency of data transmission is dependent on the type of message being sent. Work Event messages contain data that are instantaneously collected or calculated from sensors and are logged as a series of events. State event messages are activated by a change in the dredge state.
  - 1. Work Event Messages: Data shall be logged as a series of events. Each event shall consist of a dataset containing dredge information (as defined in Paragraph titled "Requirements for Reported Data"). Each set of measurements (for example, time and position) shall be considered an event, and there shall be a 6-12 second interval between work events. This interval shall remain consistent across event types for the dredge plant.

A standard data string shall be recorded within one second of an event trigger with the time stamp and all parameters reflecting when the event happened.

- 2. State Event Messages: A set of descriptive information (event name, time, description, comment) shall be considered a state event. These events shall be recorded within 24 hours of a change in state with the time stamp reflecting when the event happened.
- C. Parameter Transmission to the Web Service: The data shall be formatted as JSON (JavaScript Object Notation, as defined at http://www.json.org) strings of arbitrary length. These JSON strings represent a hierarchical data structure consisting of a message bundle which may contain 0-3 automatic data messages and any number of manual data messages.

A tag/parameter is reported only when it contains a value. No "Null" value strings shall be included in a message bundle.

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```
*****
Message bundle
{
   "DQM_Data": { "messages":
        {
             "work_event": {
                                      <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
             "msg_time":
                                      <floating point 100th decimal place>,
               "vert_correction":
               "ch latitude":
                                      <decimal to 6 decimal places>,
               "ch longitude":
                                      <decimal to 6 decimal places>,
               "ch_depth":
                                      <floating point 100th decimal
place>,
               "ch_heading":
                                      <integer value 000-359>,
               "slurry_velocity":
                                      <floating point 100th decimal place>,
               "slurry_density":
                                       <floating point 100th decimal place>,
               "pump_rpm":
                                       <integer>,
               "vacuum":
                                      <floating point 100th decimal place>,
                                      <floating point 100th decimal place>,
               "outlet_psi":
               "comment":
                                      <string>},
          }
        },
        {
             "contract_event": {
                                      <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
               "msg_time":
               "contract_number":
                                      <string>,
                                      <string - "start" or "end">,
               "event_type":
               "comment":
                                      <string>
          }
        },
        {
             "station_event": {
                                      <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
               "msg time":
               "station name":
                                      <string>,
               "comment":
                                      <string>
          }
        },
        {
             "pipe_length_event": {
               "msg_time":
                                      <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
               "length_floating":
                                       <integer>,
               "length_submerged":
                                      <integer>,
               "length_land":
                                      <integer>,
               "comment":
                                      <string>
                   }
                },
                {
             "booster_pump_event": {
               "msg_time": <24-hour UTC time YYYY-MM-DDHH:MM:SS>,
               "booster_total": <integer>,
               "comment": <string>
                   }
                },
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```
{
     "advance Event": {
       "msg_time": <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
       "advance_daily": <integer>,
        "comment": <string>
           }
        },
    "outfall_position": {
       "msg_time": <24-hour UTC time YYYY-MM-DD HH:MM:SS>,
       "outfall location": <string-"upland", "beach", "scow", "open water">
       "outfall latitude": <decimal to 6 decimal places>,
       "outfall longitude": <decimal to 6 decimal places>,
       "outfall_heading": <integer value 000-359>,
       "outfall elevation": <floating point 10th decimal place>,
        "comment": <string>
           }
        },
        {
     "non_eff_event": {
       "msg_start_time": <24-hour UTC time YYYY-MM-DD HH:MM:SS>, "msg_end_time":
<24-hour UTC time YYYY-MM-DD HH:MM:SS>, "function_code": <string - 1 to 4 characters>,
"comment": <string>
       }
   }
```

D. Contractor Data Backup: Maintain an archive of all data sent to the DQM computer during the dredging Contract. The COR may require, at no increase in the Contract price, that the Contractor provide a copy of these data covering specified time periods. The data shall be provided in the same JSON format as would have been transmitted to the DQM computer. There shall be no line breaks between the parameters, and each record string shall be on separate line. The naming convention for the files shall be <dredgename> <StartYYYYMMddhhmmss> <EndYYYYMMddhhmmss>.txt. Data submission shall be via a storage medium acceptable to the COR.

At the end of the dredging Contact, the Contractor shall call the National DQM Support Center prior to discarding the data to ensure that it has been appropriately archived. Record the following information in a separate section at the end of the dredge's onboard copy of the DPIP:

- Person who called the National DQM Support Center
- Date of the call

}

}

- DQM representative who gave permission to discard the data

On the same day that the call is made, but prior to discarding the data, the Contractor shall submit a "Data Appropriately Archived" e-mail to the local USACE District's COR with the above information and cc: the DQM Support Center representative who granted the permission. In addition to the above information, the following shall also be included in the e-mail:

- Project name and Contract number
- Dredge start and end dates
- Name of the dredge

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# 3.4 PERFORMANCE REQUIREMENTS

The Contractor's National Dredging Quality Management Program's data transmission shall be fully operational at the start of dredging operations. To meet Contract requirements for operability, the Contractor's system shall provide an accurate data string return and be compliant with hardware requirements. Data string return is defined as the number of quality records within an event or state tag sent by the Contractor's system to the DQM database. Quality data strings are considered to be those providing accurate values for all parameters reported when operating according to the specification. Repairs necessary to restore data return compliance shall be made within two business days, or a plan and timeline for repair shall be submitted if the repair will take more than two business days. Failure by the Contractor to report quality data within the specified time window for dredge measurements as stated in the specifications (see Paragraphs titled "Internet Access", "Data Measurement Frequency" and "Parameter Transmission to the Web Service"), may result in withholding of up to 10 Percent of item payment.

#### 3.5 QUALITY ASSURANCE CHECKS

Quality assurance (QA) checks are a part of the DQM dredge certification procedure. They are required prior to the commencement of dredging and, at the discretion of the COR, periodically throughout the duration of the Contract. The SOP and criteria for QA checks are presented on the DQM website at https://dqm.usace.army.mil.

#### 3.6 CONTRACTOR QUALITY CONTROL:

The dredging Contractor shall designate a Quality Control Systems Manager (QCSM), who shall develop and maintain daily procedures to ensure quality control (QC) of the dredge Contractor's DQM system. These methods shall include the procedure by which data being collected is checked against known values, and verification that the telemetry is functioning. These procedures shall be outlined in the DPIP and submitted prior to the Notice to Proceed. In the event a Contractor Quality Control (CQC) Report is required, daily annotations shall be made in the Daily CQC Report, documenting all actions taken on each day of work, including all deficiencies found and the corrective actions taken.

#### 3.7 LIST OF ITEMS PROVIDED BY THE CONTRACTOR

- DPIP Paragraph 1.6.
- DQM System Paragraph 3.2
- Dredge Data Paragraph 3.3

END OF SECTION

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#### SECTION 35 20 30.00 45 Add - DROP-OUTLET STRUCTURE

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

The work covered in this Section consists of furnishing labor, materials, equipment and performing the work in connection with constructing a new Drop-outlet Structures. All structure member materials used for the new drop-outlet structure fabrication shall be new. The term "Drop-outlet Structure" includes, but is not limited to, steel framework made of columns, beams, and bracings, steel platform, lumber walls, concrete footings, steel walkway, grating, and handrails, steel piles, discharge pipes, and other miscellaneous items as shown on the Drawings.

#### 1.2 RELATED SECTIONS

SECTION 01 16 60 Add – Environmental Protection Measures

SECTION 01 25 00 Add - Measurement and Basis of Payment

SECTION 03 21 00.00 Add – Reinforcing Steel

SECTION 03 31 00.00 Add - Structural Concrete

SECTION 05 12 00 00 Add - Structural Steel Framing

SECTION 09 96 56.01 Add – Epoxy Coatings – Coal Tar

SECTION 31 23 16.30 Add – Drop-Outlet Structure Excavation, Filling, and Backfilling

SECTION 31 62 16.16 Add – Steel H Piles

#### 1.3 REFERENCES

# AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2017) Steel Construction Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (2020) Structural Welding Code - Steel

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA (2020) AWPA Book of Standards

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DROP OUTLET STRUCTURE

AWPA M4	(2015) Standard for the Care of Preservative-Treated Wood Products								
	ASTM INTERNATIONAL (ASTM)								
ASTM A53/A53M	(2018) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless								
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products								
ASTM A307	(2014) Standard Specification for Carbon Steel Bolts and Studs 60,000 PSI Tensile Strength								
ASTM A436	(2020) Standard Specification for Austenitic Gray Iron Castings								
ASTM A500/A500M	(2018) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes								
ASTM A510	(2008) Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel								
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts								
ASTM A1011/A1011M	(2018a) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength								
ASTM F844	(2013) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use								
	SOCIETY FOR PROTECTIVE COATINGS (SSPC)								
SSPC AB 1	(2015; E 2017) Mineral and Slag Abrasives								
	U.S. ARMY CORPS OF ENGINEERS (USACE)								
EM385-1-1	(2014) Safety and Health Requirements Manual								
U.S. NA	TIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)								
40CFR 261	Identification and Listing of Hazardous Waste								
40CFR 262.22	Number of Copies								
40CFR 263	Standards Applicable to Transporters of Hazardous Waste								
49CFR 171	General Information, Regulations, and Definitions								

# 1.4 SUBMITTALS

TECHNICAL SPECIFICATION Date: December 2020 DROP OUTLET STRUCTURE

- A. Shop Drawings for: Structure, Steel Railings and Handrails, Grating, and Protective Coatings.
- B. Certificates for: Lumber.
  - 1. Submit certificates of compliance with the applicable specifications for lumber material and its treatment.
  - 2. The producer of the treated wood products is to provide certification at WWPI 08, Best Management Practices (BMP) for the use of Treated Wood in Aquatic Environments were utilized, including a written description and appropriate documentation of the BMP used.
- C. Refer to submittal requirements of the RELATED SECTIONS mentioned above.
- D. Closeout Submittals for: Inspection Reports Pile, Driving Records Inspection, and Forms.

#### 1.5 PROTECTION

- A. Safety: The Contractor is to be responsible for instructing its employees in appropriate safety practices. The Contractor and its personnel is to adhere to the applicable safety requirements as outlined in the U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1.
- B. Working on the Drop-Outlet Structure: Provide the following items when workers are working on the drop-outlet structure:
  - 1. Life jackets when water is present.
  - 2. A method of communication other than cellular phones.
  - 3. At least two individuals are required to be present when working on the structure.

#### 1.6 ENVIRONMENTAL PROTECTION

In addition to the requirements of the Section 01 16 60 Environmental Protection Measures, comply with the following environmental protection criteria:

- A. Waste Classification, Handling, and Disposal: Contractor shall be responsible for the proper disposal of hazardous and non-hazardous waste generated during this project. Waste generated from abrasive blasting lead-containing paints with recyclable steel or iron abrasives are to be disposed as a hazardous waste or be stabilized with propriety pre-blast additives regardless of the results of 40 CFR 261, App 11, MTD 1311. Where stabilization is preferred, employ a propriety blast additive that has been blended with the blast media prior to use. Hazardous waste is to be placed in properly labeled closed containers and be shielded adequately to prevent dispersion of the waste by wind or water. Evidence of improper storage will be cause for immediate shutdown of the project until corrective action is taken. Non-hazardous waste is to be stored in closed containers separate from hazardous waste storage areas. Hazardous waste is to be transported by a licensed transporter in accordance with 40 CFR 263 and 49 CFR 171, Subchapter C. Non-hazardous waste shall be transported in accordance with local regulations regarding waste transportation. In addition to the number of manifest copies required by 40 CFR 262.22, one copy of each manifest is to be supplied to the Owner prior to transportation.
- B. Containment: Contain debris generated during paint removal operations in accordance with the requirements of SSPC Guide 6, Class 3A. Where required, the containment air pressure is to be verified visually. Where required the minimum air movement velocity is to be 100 fpm for cross draft ventilation or 60 fpm for downdraft ventilation.

#### 1.7 DELIVERY, HANDLING, AND STORAGE

Materials are to be delivered in their original, unopened containers bearing the manufacturer's name, shelf-life, product identification, and batch number.

Coatings, thinners, and cleaners are to be stored in tightly closed containers in a covered, wellventilated area where they will be protected from exposure to extreme cold or heat, sparks, flame, direct sunlight, or rainfall. Manufacturer's instructions for storage limitations are to be followed.

Additionally, refer to the requirements of the RELATED SECTIONS mentioned above.

#### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Concrete: Concrete shall be Class E and conform to the requirements in the Section 03 31 00.00 Add, "Structural Concrete."
- B. Structural Steel: Structural Steel shall conform to the ASTMs and grades as indicated on the drawings. Refer to Section 05 12 00 00 Mod, "Structural Steel Framing" for other requirements.
- C. Grating: Grating shall be as specified on the drawings. The top surface of the bearing bars shall be serrated for slip resistance. The grating material is to meet the requirements of ASTM A1011/A1011M and ASTM A510 and be galvanized in accordance with ASTM A123/A123M.
- D. Drainage Pipe: Drainage Pipes for the drop-outlet structures shall conform to the requirements of ASTM A139, Grade D (yield strength = 46 ksi). Only intact new pipe will be accepted.
- E. Lumber: Lumber shall be southern yellow pine rough No. 1, dense, minimum allowable bending stress of 1,350 psi. Cuts in lumber or abraded surfaces of new work are to receive a field treatment in accordance with AWPA M4.
  - 1. Treated Lumber: Treated lumber shall be furnished and installed by the Contractor on the sides of the structures from the top of the concrete slab or headwall to height shown on the drawings. Lumber width, thickness, and length shall be as shown. Lumber to be furnished shall be straight, even sawed, sound, and entirely free from defects which can impair its durability or its usefulness for the purpose intended. Lumber shall bear the official Grade mark of the association under whose rules it is purchased or, in lieu thereof, each shipment shall be accompanied by a certificate of inspection issued by the inspection association. Lumber shall have a Chromated Copper Arsenate (CCA) preservative treatment and be accompanied by a certificate with Best Management Practices from a recognized treatment company certifying the amount of treatment.
  - 2. Preservative Treatment: Preservative Treatment by pressure processes shall be in accordance with AWPA Use Category UC5C, per 2020 AWPA Book of Standards. Lumber shall receive a treatment of 2.5 pcf of CCA solution.
- F. Granular Fill: Aggregate meeting gradation set forth in ASTM C33/C33M Size Number

#### 2.2 FABRICATION

A. Structural Steel: Structural Steel is to be fabricated in accordance with Section 05 12 00 00 Add, "Structural Steel Framing."

#### 2.3 PROTECTIVE COATINGS

A. Coating: Structural steel and its connections shall be coated as indicated on the drawings, in accordance with Section 09 96 56.01 Add, "Epoxy Coatings – Coal Tar." Structural steel is to be entirely painted from concrete foundation to the top of the drop-outlet structure. Clearly show the limits of shop coating and field coating on the shop drawings. The drainage pipes shall be coated full length with 16 mil DFT Coal Tar Epoxy per Section 09 96 56.01 Add, "Epoxy Coatings – Coal Tar."

#### 2.4 ABRASIVE BLASTING MATERIAL

Abrasive blasting materials are to be per SSPC Painting Manual, Chapter 2.4, and SSPC AB 1.

#### PART 3 EXECUTION

#### 3.1 EARTHWORK RELATED TO DROP-OUTLET STRUCTURE

Refer to SECTION 31 23 16.30 Add – Drop-Outlet Structure Excavation, Filling, and Backfilling.

3.2 PILES

Sizes and locations of the steel piles shall be as shown on the drawings. Refer to SECTION 31 62 16.16 Add – STEEL H PILES for installation requirements.

- A. Placement of Piles: Piles shall be driven as accurately as practicable in the correct locations true to line laterally, longitudinally and vertically. Pile tips shall be driven to the minimum tip elevation shown on drawings. The final locations of piles shall be placed so that the framing members may be erected without excessive straining, crimping or bending of the member or piles. Piles shall be one piece. Piles shall terminate near the mid-depth of the slab and be field cut and welded to the original pile as shown on the drawings.
- 3.3 STRUCTURAL CONCRETE

All concrete work will be carried out in accordance with Section 03 31 00.00 Add, "Structural Concrete."

3.4 ERECTION OF STRUCTURAL STEEL

Erection of structural steel is to be in accordance with Section 05 12 00 00 Add, "Structural Steel Framing."

- 3.5 DRAINAGE PIPES
  - A. Each pipe shall be carefully examined for flaws before being laid, and if found defective or damaged it shall not be used. Pipe shall be laid to the grades and alignment shown. Proper equipment shall be provided for lowering sections of pipe into the trenches. Pipe in place shall be tested and inspected before backfilling.
  - B. Excavation needed for installation of the pipes shall be sufficiently sloped back or shored up with sheeting and bracing to prevent the excavation walls from caving in. Excavation shall only be carried to the extent necessary to properly join and install the pipe. Care shall be taken not to excavate below the line and grade of the pipeline as shown. Excavation for the pipe which has been carried below the line and grade shown shall be backfilled with satisfactory material to establish a firm bedding for the pipe at the required alignment and grade. When backfilling around the pipe, care shall be taken to ensure that areas underneath the haunches of the pipe are thoroughly filled and compacted, leaving no voids. For backfilling around the pipes refer to SECTION 31 23 16.30 Add Drop-Outlet Structure Excavation, Filling, and Backfilling.
  - C. Drainage pipes shall be spliced with complete joint penetration butt weld, as shown on the drawings. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1. Submit all records of non-destructive examination to owner for records. Welding shall be performed in accordance with qualified procedures using qualified welders and welding operators with Welder Qualification Certificates. Welders and welding operators shall have valid Qualifications prior to performing any welding operation. Refer to Section 05 12 00 00 Add, "Structural Steel Framing." for the requirements, including submittals.

#### 3.6 COATING

Protective coating shall be applied in accordance with Section 09 96 56.01 Add, "Epoxy Coatings – Coal Tar."

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#### 3.7 FIELD WELDING

Field welding shall be in accordance with Section 05 12 00 00 Add, "Structural Steel Framing."

#### 3.8 COATING INSPECTION

On-site work as described herein is to be inspected for compliance with this specification by Contractors testing agency.

For all protective coatings applied on-site and off-site locations, the Contractor is to be responsible coating inspection. Inspector is to be present at the pre-work conference to address necessary clarification of inspection and specification requirements. Apparent deviation from the specified requirements or any out of tolerance condition is to be immediately reported to the Owner for determination of corrective action. Submit Inspection Reports performed by the Coating Inspector in accordance with Section 09 96 56.01 Add, "Epoxy Coatings – Coal Tar."

Inspection Forms are to be submitted at the pre-work conference which are to be used by the Coating Inspector and forwarded to the Owner prior to delivery of the coated work to the job site.

#### 3.9 CONTRACTOR QUALITY CONTROL

- A. Compliance Inspection: Inspect for compliance with Contract requirements and record the inspection of the operations including but not limited to the following:
  - 1. Materials. Certificates are to be submitted to show conformance with applicable specification requirements.
  - 2. Lumber Installation. Boards are to meet minimum height. Length and width are to meet the specification requirements.
- B. Records: A copy of the records of inspections and corrective actions taken are to be included in the daily quality control reports

# END OF SECTION

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

#### SECTION 35 31 16.20 Add - STEEL SHEET PILE BULKHEAD

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

Subject to the requirements of the General and Special Conditions, this Section includes:

- A. Furnishing all material necessary to complete the bulkhead and anchorages as shown on the Drawings, except material to be furnished by the Port of Houston Authority (PHA) as specifically provided in these Technical Specifications.
- B. Receiving and hauling to the site materials furnished by the PHA.
- C. Furnishing all labor, equipment, supervision, and any other thing necessary to complete the bulkhead and its anchorage system, including coating of sheet piles, steel caps, and steel batter piles, and wrapping.

#### 1.2 RELATED SECTIONS

SECTION 01 22 10.00 Std – Measurement of Quantities

SECTION 03 31 00.00 Add- Structural Concrete

SECTION 03 21 00.00 Add – Reinforcing Steel

SECTION 31 62 16.16 Add – Steel H Piles

SECTION 31 62 18 Add – Steel Pipe Piles

- 1.3 REFERENCES
  - A. ASTM International Publications, latest editions:

ASTM A-6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A-36	Standard Specifications for Structural Steel
ASTM A-108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
ASTM A-307	Standard Specifications for Carbon Steel, Bolts and Studs
ASTM A-325	Standard Specifications for Structural Bolts
ASTM A-490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

- ASTM A-572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
- ASTM A-668 Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
- ASTM A-690 Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments
- ASTM A992 Standard Specification for Structural Steel Shapes
- B. AASHTO Publications, latest edition:
  - AASHTO M-36 Standard Specifications for Corrugated Metal Culvert Pipe

ASSHTO M-190 Standard Specifications for Bituminous Coasted Riveted Corrugated Metal Culvert Pipe and Pipe Arches

- C. SP 10 Steel Structures Painting Council 'Near-White" Blast Cleaning
- D. AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings
- E. American Welding Society, latest edition:

Structural Welding Code – Steel; Serial Designation AWS D1.1

#### 1.4 SUBMITTALS

- A. Submit description of proposed pile-driving equipment at least 30 days prior to driving piling. Data shall include:
  - 1. Make and model of pile driving hammer, including capacity and rated energy.
  - 2. Weight of cap block assembly, cushion dimensions, type of cushion material, and cushion stiffness.
  - 3. Submit a Wave Equation Analysis of pile drivability (WEAP) for selection of the hammer along with a statement of driving procedures. The Wave Equation Analysis is to be completed by the Contractor's Geotechnical Consultant for each pile type and for each location where different subsurface conditions exist and is to include the following information pertaining to the proposed pile driving equipment:
    - a. Complete Pile and Driving Equipment data, for each proposed pile hammer and pile type combination.
    - b. Copies of WEAP computer input and output sheets and graphs showing soil resistance versus blow count as well as maximum tension and compression stresses versus blow count. Analysis shall be run at the estimated tip elevation as well as other required elevations to define maximum stress levels in the pile during driving.
    - c. The Wave Equation Analysis shall demonstrate that the piles will not be damaged during driving, shall indicate that the driving stresses will be maintained at less than 0.9 times fy (yield strength of steel), in both tension and compression.

- d. The services of an independent, Registered Professional Geotechnical Engineer, licensed in the State of Texas, and experienced in soil mechanics and Pile Foundation analysis, shall be hired by the Contractor to perform the work stated above. The Geotechnical Consultant shall be independent of the Contractor and shall have no employee or employer relationship which could constitute a conflict of interest.
- B. Submit detailed fabrication and erection drawings for steel sheet piles, king/ pipe piles, and accessories prior to installation. Drawings shall include:
  - 1. Detailed bulkhead wall layout drawings, indicating each standard steel sheet pile, each king/ pipe pile, each special fabricated section, each corner section, and showing quantity and length of each type.
  - 2. Details of special fabricated sections, including complete dimensions and minimum section properties.
  - 3. Details and dimensions of templates and other temporary guide structures for installing the steel sheet pile bulkhead system.
- C. Submit manufacturer's product data and material certification that steel sheet piles, connectors, king/ pipe piles, and hardware meet the specified requirements.
- D. Submit certification that surface preparation and protective coating have been applied in conformance with specifications.
- E. During pile driving, submit records to the Chief Construction Manager, the Port Construction Representative of PHA, as defined in DIVISION 00 Procurement and Contracting: Special Conditions of the Project Specifications, each day, including the following for king/ pipe piles, and steel sheet pile:
  - 1. Name of bulkhead, king/ pipe pile number or steel sheet pile pair number.
  - 2. Driven pile length.
  - 3. Pile length after cut off (if required).
  - 4. The Top of pile elevation.

The Chief Construction Manager is the Port Construction Representative of PHA, as defined in DIVISION 00 – Procurement and Contracting: Special Conditions of the Project Specifications.

- F. Statements
  - 1. Pile pulling method.
  - 2. Material certificates:
    - a. Submit for each shipment of piling, and king/ pipe piling; certificates identified with specific lots prior to installing piling. Identification data should include piling type, dimensions, chemical composition, mechanical properties, section properties, heat number and mill identification mark.

- b. Submit certificates and statements of conformance and acceptability for turnbuckles and ultrasonic test results.
- c. Submit mill certificates, with chemical composition and mechanical properties, and product cut-sheet data on headed anchor stud connectors.
- 3. Pile driving equipment: Submit descriptions of pile driving equipment to be employed in the Work to the Chief Construction Manager for approval. Descriptive information should include manufacturer's name, model numbers, capacity, rated energy, hammer details, cushion material, helmet and templates.
- G. Records: Submit Pile Driving/ Installation Records:
  - a. Maintain a pile driving record for steel sheet piles and king/ pipe piles
  - b. Indicate on the installation record installation date and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows required per foot of each foot of penetration, final driving resistance in blows for final 6 inches, pile locations, tip elevations, ground elevations, and any reheading or cutting of piles.
  - c. Record any unusual pile driving problems during driving.
- H. Submit noise reduction and emission monitoring program.

# 1.5 HANDLING AND STORAGE

- A. Deliver steel sheet piles in pairs.
- B. Handle piling using handling holes or lifting devices. Handle long length piles with multiple lifting points and care to prevent damage. Handling of epoxy coated piles shall be by sling.
- C. Support piling off the ground on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Supports between multiple lifts shall be aligned in a vertical plane.
- D. Protect piling to prevent damage to coatings and to prevent corrosion prior to installation.
- Pile shall not have a camber or sweep in excess of the permitted mill tolerance and ASTM A 6.

# PART 2 PRODUCTS

# 2.1 STEEL SHEET PILES AND PIPE PILES

- A. Steel sheet piles and king/ pipe piles shall be manufactured of hot-rolled steel conforming to the following:
  - 1. Pipe Piles and Connectors: ASTM A-690,A-252, or A 572, minimum yield strength 50,000 psi. The 60" king piles for the Pipeline Protection wall shall be rolled and welded pipe.
  - 2. Steel Sheet Piles: ASTM A-690 or A-572 may be installed in pairs.

- a. Morgan's Point piles shall be Grade 60 minimum yield strength of 60,000 psi.
- b. Spilman Island piles shall be Grade 50 minimum yield strength of 50,000 psi.
- B. The connectors shall be continuously welded to the pipe full length on both sides, as shown on the drawings, in accordance with AWS D1.1, latest edition. Interlocks of sheet piling shall be free sliding, allowing a swing angle of at least 5 degrees when threaded and maintain continuous interlocking when installed.
- C. Sheet piling, including corner sections, king/ pipe pile connectors, and special fabricated sections, shall be full-length sections to the dimensions shown, or required to complete the bulkhead to the overall dimensions indicated.
- D. Fabricated sections shall conform to the requirements herein and the piling manufacturer's recommendations for fabricated sections. Fabricated corners, tees and cross pieces shall be fabricated of piling sections with a minimum thickness of ½-inch.
- E. Provide piling with standard pulling holes.
- F. Provide elevation reference and mark each pile to permit determination of the pile tip and top elevation.

#### 2.2 STEEL BATTER PILES

Steel batter piles shall be in accordance with the requirements set out in the Section for Steel Pipe Piles and H-Piles, as applicable.

- 2.3 TIE RODS
  - A. Conform to ASTM A-615, Grade 75, with 75ksi yield strength.
  - B. High strength bars with rolled threads, complete with compatible, high-strength heavy hex nuts, splicing couplers.
  - C. Welded tie rod splices will not be permitted.
  - D. Protection system shall be DensylTape wrapping system or equal and approved by Owner. The wrapping system shall be applied according to manufacturer's requirements. Tie rods shall be further protected and supplied with protective smooth-walled HDPE pipe sleeve, as indicated on the drawings.

# 2.4 COUPLERS

- A. Conform to ASTM A -669, heat treated and ultrasonic tested, hot dipped galvanized.
- B. Manufactured to carry 133 percent tie rod tensile capacity.
- C. Couplers shall be manufactured by the all-thread bar tie rod manufacturer.
- D. Provide couplers, as required, to splice tie rods and tak-up excess slack in tie rods.
- 2.5 BOLTS AND NUTS

- A. Bolts shall conform to ASTM A-325X, hot-dipped galvanized.
- B. Nuts shall conform to ASTM A-564, heavy hex head, hot-dipped galvanized.
- C. Washers shall conform to ASTM F-436, plain carbon steel, hardened, hot-dipped galvanized.

#### 2.6 PREFABRICATED STEEL CAPS

The prefabricated steel cap shall be in accordance with the requirements set out in the Section for Structural Steel Framing, unless noted otherwise. The pipe material used for the steel cap shall meet the requirements in this Specification and be compatible with the steel plate elements for welding requirements and fabrication tolerances. The coating requirements for the steel cap shall meet the requirements in this specification.

#### 2.7 SHOP PROTECTIVE COATING

A. Bulkhead sheet pile, king/ pipe pile, and other structural steel not otherwise specified, shall be coated as specified in the Section for Epoxy Coatings to the limits noted on the Drawings.

#### 2.8 CONCRETE CAP AND ENCASEMENT

- A. Concrete, Forms and Reinforcement: As specified in Sections for Structural Concrete and Reinforcing steel.
- B. Surface preparation: remove all rust and mill scale, earth and other deleterious materials from the pile surfaces, which reduce or destroy bond with concrete.

#### PART 3 EXECUTION

#### 3.1 COATING OF STEEL SHEET PILING AND OTHER STEEL MEMBERS

- A. General: Material coating shall be protected during handling, transportation, and final installation.
- B. Touch-Up: After the sheet piling is erected into position in the bulkhead wall, and before it is driven to its final position, the Contractor shall touch-up all holidays, scratches, abrasions, etc. with the same materials and methods used on the original coating as required by the Inspector. Should any of such touch-up points fall below the ground or water line in final position, that pile shall remain undriven for at least 24 hours after being touched-up.

After excavation of earth from against any coated surface, all scratches or abrasions caused by driving, excavating, or other causes that are disclosed, shall be touched-up.

After welding of brackets, caps, or other attachments, all damaged areas of coating that are accessible shall be cleaned and recoated.

#### 3.2 EARTHWORK

Perform in accordance with applicable Division 31 sections. Backfill bulkhead retaining wall system as indicated, on the Drawings.

# 3.3 CUT-OFFS, SPLICES AND BUILD-UPS

All splices for steel piling shall be made with continuous butt welds including interlocks. All the butt welds shall be complete penetration, pre-qualified welds. Provide 100% radiographic or ultrasonic examination of the welds in accordance with AWS D1.1, latest edition. The welding shall be performed in accordance with the requirements of specifications, Section 05 12 00.00, STRUCTURAL STEEL FRAMING.

After the piling has been driven to the penetration required by the Drawings, the surplus length of piling, if any, shall be cut to the design grade or the grade established by the Chief Construction Manager. If the head of the piling is appreciably distorted or otherwise damaged below cutoff level, the damaged portion shall be cut off and built up to correct elevation with an undamaged section at the Contractor's expense. All cutoffs, regardless of reason for cutoff, shall be delivered to the Chief Construction Manager at the end of each day's work. When piling is furnished by the Port Authority, an allowance of one foot of extra length will be made for damage to the top.

Where pile heads are required by the Drawings, the end surfaces of the piling shall be made as smooth as practical before the pile head is welded in place. The pile head shall conform to the Drawing details.

Welding shall comply with the requirements of the American Welding Society Structural Welding Code, Serial Designation D1.1.

# 3.4 TOLERANCES

- A. Piling shall be driven at the locations and to the depths shown on the Drawings. The piles shall be driven vertically and in correct alignment so that the top of straight walls will not deviate from a straight line more than one and one-half 1-1/2 inch in either direction after driving. The driven pile shall not deviate more than one-sixteenth inch per foot from the vertical.
- B. All sheet piling shall be driven to within one inch of the elevation of top of pile as shown on the Drawings, or, if a cutoff is necessary, the pile may be cut off to grade with an acetylene torch within a tolerance of plus or minus 1/2-inch. In the event a pile is overdriven, a piece shall be spliced on to building the pile to the elevation called for on the Drawings. No increase in contract price will be allowed by reason of such cutting, splicing or overdriving.
- C. The Contractor shall remove and replace any pile that deviated from its correct position as shown on the Drawings. If permitted tolerances result in closures or intersections that vary in dimension from those shown on the Drawings, the Contractor shall alter or provide the closure section as directed by the Chief Construction Manager at no cost to the PHA.
- D. Piling must be driven so that the interlocks will be completely engaged. Any pile ruptured at the interlock or injured in any other way, shall be removed, the hole filled with sand, and other pile driven. Such work is to be done at the Contractor's expense.

#### 3.5 PROTECTION OF PILE HEADS

A structural steel driving head suitable for the type and size of pile being driven shall be used. Wood cushion blocks shall be used as necessary to prevent damage to the pile. Rope mat, belting, or other similar cushioning material may be used in addition to wood cushion blocks.

#### 3.6 DRIVING EQUIPMENT

Pile Hammer: Use a hammer having a delivered force of energy suitable for the total weight of the pile and the character of the sub surface materials to be encountered. Operate hammer at the rates

recommended by the manufacturer throughout the entire driving period. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

Gravity hammers, if permitted, shall be of suitable weight and shall have a maximum height drop of 10 feet Pile drivers shall be equipped with leads which are constructed in such a manner as to afford freedom of movement of the hammer and which provide adequate support to the pile during driving. The vertical axis of the leads and hammer shall coincide with the vertical axis of the pile. Free swinging leads will not be permitted, and arrangements shall be made to hold the pile firmly in the correct position by braces or templates while it is being driven. Leads must extend down to the lowest point the hammer must reach. When driving through water, the bottom of the leads must be braced to the working platform. When the pile driver is mounted on a barge, the barge shall be equipped with spuds of sufficient length to hold the barge in position during the driving operation.

#### 3.7 PENETRATION

All piles shall be driven to the penetration shown on the Drawings. Allowance for loss of pile length due to damage of the top shall be made in ordering pile lengths or welded extensions at no cost to the PHA.

When the pile cannot be driven to the required penetration without excessive damage, or within the aforesaid tolerances, the Contractor shall notify the Chief Construction Manager and provide recommendations for advancing the pile to meet design tip.

# 3.8 JETTING

Jetting of piles is not permitted

3.9 PILOT HOLES

Pilot holes may not be used without the written permission from the Chief Construction Manager, and their use shall not be grounds for any increase or decrease in the Contract price. Pilot holes shall be centered on the diagonal web of the pile and shall be at least one inch less in diameter than the depth of the sheet pile. Pilot holes shall be filled with graded gravel passing a 3/4-inch sieve after the piles are in place.

# 3.10 PILE DRIVING METHODS AND PROCEDURES

- A. The Contractor shall be responsible for the selection of methods and procedures for driving piles and for the design of templates and bracing that will advance the piles within the tolerance required by these Specifications. The methods and procedures shall be consistent with the requirements set out in these Specifications. All piles shall be kept under close observation during driving in order that drift or other tendency toward misalignment may be detected and corrections made before misalignment become serious. When misalignments occur, the Chief Construction Manager may order the Contractor to modify his methods and rigging and remove and replace the misaligned piles at no extra cost to the PHA.
- B. Pile Driving:
  - 1. Sheet piles shall be driven vertically. Drive piles in such a manner as to prevent damage to the piles and to provide a continuous closure. Where possible, drive sheet piles with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into the socket and ease driving for the next.

- 2. Incrementally sequence driving of individual piles such that the tip of any king/ pipe pile and steel sheet pile combination shall not be more than 4 feet below that of any adjacent pipe/ king pile and sheet steel pile combination, nor ¼ of its length between adjacent sheet piles. When the penetration resistance exceeds five blows per inch, the tip of any pile combination shall not be more than 2 feet below that of any adjacent pile combination.
- 3. Do not drive piles within 100 feet of concrete less than 7 days old.
- C. Templates and guides shall be used while driving all steel sheet piling. The design, arrangement, and anchoring of templates and guides shall be adequate to ensure that the piling will be driven to the proper location, and, as otherwise required by these Specifications.

#### Templates:

- 1. Prior to driving, provide template or driving frame suitable for aligning, supporting, and maintaining bulkhead wall piling in the correct position during setting and driving. The piles shall be erected between two well-braced sets of templates (two-tier system), one at/near ground level and the other at or above mid-height of the piling. The templates shall be rigid and shall support and guide both the interior and exterior of the piling. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the piling until design tip elevation is achieved.
- 2. Templates shall not move when supporting piling. Fit templates with wood blocking to hold the piling at the design location alignment. Provide outer template straps or other restraints as necessary to prevent piling from warping or wandering from the alignment.
- 3. Mark template for the location of the leading edge of each piling.
- D. The distance between the guide wales shall not exceed the depth of the pile plus one inch. When driving is difficult, the Chief Construction Manager may require blocking between the trough of the pile and the guide wale. The piles shall be erected in a true vertical position and shall be so maintained throughout the driving operation.
- E. When the sheet piling to be driven under this Contract form an extension of an existing wall or bulkhead, driving shall start at the last existing pile and shall proceed in one direction to the far end of the wall being constructed. In constructing a new wall that does not connect with an existing bulkhead, driving may start at either end and proceed in one direction toward the other end, or, may start at an intermediate point and proceed toward each end. In no case shall the driving of two portions of a bulkhead be advanced toward a common meeting point.
- F. Before driving, the correct location of each pile shall be marked on the bottom template so that drift may be detected as soon as it begins. Piles shall be prevented from drifting or "walking", by pulling on the pile as it is driven, by directing the hammer blows so as to correct drift, or by other effective means. If necessary, "anchor" piles may be driven at suitable intervals and advanced ahead of intervening piles to assist in holding alignment and to prevent drift.
- G. Changes in direction shall be made with fabricated corners in accordance with details on the Drawings. Expansion joints shall be constructed where shown in the Drawings and in accordance with the accompanying details.

#### 3.11 INSPECTION

- A. Perform continuous inspection during pile driving. Inspect all piles for compliance with tolerance requirements. Bring any unusual problems which may occur to the attention of the Chief Construction Manager.
- B. Inspection of Driven Piling:
  - 1. Contractor shall inspect the interlocks of the portion of driven piles that extend above ground. Remove and replace piles found to be out of interlock.
  - 2. Contractor shall be required to use divers to inspect the underwater portions of sheet piling to verify the integrity of interlocks between sheets.
- C. Pulling and Redriving:
  - 1. Contractor shall be required to pull selected piles after driving to determine the condition of the underground portions of pile.
  - 2. Contractor shall be required to pull and redrive piles that do not meet specified tolerances.
  - 3. The pile pulling method must be approved by the Chief Construction Manager.
  - 4. Remove and replace at the Contractor's expense any pile pulled and found to be damaged to the extent that its usefulness in the structure is impaired.
  - 5. Redrive piles pulled and found to be in satisfactory condition.

#### 3.12 STRUCTURAL STEEL FABRICATION AND INSTALLATION

- A. Description:
  - 1. The Contractor shall furnish, fabricate and install, all structural steel caps, brackets, or other attachments shown on the Drawings.
  - 2. The Contractor shall furnish, fabricate and install all fittings, corners and connections to the sheet piling necessary to construct the bulkhead in the location and to the alignment shown on the Drawings.
- B. Formation of Holes: Except as set out hereafter, holes for bolts, rivets, and pins shall be punches, drilled, or sub-punched and drilled as called for on the Drawings, and in accordance with Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings of the American Institute of Steel Construction; however, field holes may be made by gas burning the hole undersize all around and reaming to the proper size.
- C. Steel Wales: Steel wales shall be installed, using shims where necessary so that the wale members contact the bearing face of each pile in at least two places. Weld, or bolt wale to piling as shown on the drawings.
- D. Holes for Anchor Rods: When anchor rods are to be inserted through bored holes, the diameter of the holes through the bulkhead and anchor wall shall be only large enough to insert the boring tool. In all other cases, the hole diameters shall be more than ¼" larger than the anchor rod diameter. The excess opening around rods through the bulkhead shall be made watertight to prevent the loss of the backfill.

E. Coated Members: Wherever burning, drilling, welding, or other operations cause damage to coating, such damage shall be repaired by recoating in accordance with Specification 09 96 56.01. Where such damage is to the back side of the piling and would require excavation of more than three feet of earth solely in order to make the damaged area accessible, such inaccessible areas need not be repaired unless otherwise ordered by the Chief Construction Manager, in which case the cost of such excavation will be borne by the PHA.

#### 3.13 ANCHORAGE STRUCTURES

- A. The Contractor shall construct all anchorage structures as they are shown on the Drawings.
- B. All concrete anchor walls, caps, walers, and waler encasement, shall be constructed in accordance with the section for Structural Concrete.
- C. All reinforcing steel shall be furnished, fabricated, and placed in accordance with applicable provisions of the section for Reinforcing Steel.
- D. All steel bearing piles, including batter piles shall be furnished and driven in accordance with applicable provisions of the sections for Steel H-Piles and Steel Pipe Piles. Steel piles shall be driven to the batter lines shown on the Drawings. The tops of piles shall not vary from planned locations by more than 1-1/2 inches in a plane through the axis of the pile that is normal to the face of the bulkhead.

#### 3.14 INSTALLATION OF TIE RODS

A. Tie Rods in Pipe Casings:

- 1. Anchor rods shall be installed in HDPE pipe casings wherever trenches are required by the Drawings and wherever they are installed in a zone to be filled after the rods are in place. Fill at the bottoms of rods and the bottoms of trenches shall be accurately fine graded so that the rods, when laid in a straight line from the wale to the anchorage, will rest on the invert (inside bottom) of the casing.
- 2. Fill below the anchor rods shall be placed and compacted carefully so as not to disturb the rods. Fine grading of fill beneath rods and of bottoms of trenches may be accomplished by accurate and careful cutting of the soil, or by use of compacted bank sand or cement stabilized sand.
- 3. The casing shall be carefully slipped over the rods so as not to damage the wrapping on the rods or the coating on the casing. The casing shall be settled into the subgrade accurately to the correct alignment, and couplings shall be installed and tightened. Ends of casings not set into concrete shall be caulked with an approved compound and plugged with at least 4-inches of concrete.
- 4. Filling above rods shall be carried out carefully to avoid forcing the casing into the subgrade.

Where a casing is placed in a trench, the trench shall be filled to a depth of at least two feet above the top of the casing with well compacted cement stabilized sand. In area fills, the casing shall be covered with compacted cement stabilized sand in a mound at least two feet above the top of the pipe, having bottom width at the invert of the pipe of five feet and top width of two feet.

# 3.15 DRAIN WELLS AND WEEP HOLES

Drain wells where shown on the Drawings, shall be constructed to the size and depth and at the locations, as shown on the Drawings. The wells shall be filled with a mixture of graded gravel and

sand meeting the requirements for coarse and fine aggregates for concrete, well mixed in the proportions of three parts of gravel passing a 1-1/2-inch screen and two parts of sand.

Prior to filling the drain wells, install a weep hole consisting of a length of 4-inch steel pipe extending through and welded to the steel sheet piling as shown on the Drawing. The pipe is to be coated as required for steel sheet piling. Damage to coating due to welding shall be repaired on the front face of bulkhead in accordance with the requirements for coating.

Horizontal drains, where called for on the Drawings, shall be constructed using the gravel and sand fill specified above, laid down on the lines and grades required by the details. The drain fill shall be compacted to a stable density.

# END OF SECTION

# **Pile Driving Log**

Project:										Contractor:									
Contract No.										Reco	rding D	ate:							
Wo	Work Order No.											Recording Scribe:							
Har	nmer Da	nta	Vibratory Im										npact Rig:						
Mał	e & Mo	del:										Ram Weight							
Тур	e:														Hamı	ner Cus	shion:		
Pile	Data										Cutoff I	Elevat	ion:				Time		
Stru	cture &	Pile No:					Batter:				Ground	Eleva	tion:		Finish:				
Size	, Length	, & Type	e:								Driven	Lengtl	1:				Start:		
Stat	ion / Coo	ordinates	3:								Pile Tip	Eleva	tion:				Drive Time:		
DR	VING I	RECOR	DS															<b>^</b>	
		Stroke or					Stroke or				Stroke or			Stroke or				CUT OFF LENGTH	
Ft.	Blows	BPM	Ft.	Blows	Stroke	Ft.	BPM	Stroke	Ft.	Blows	BPM	Ft.	Blows	BPM	LAST	r foot			
1			21			41			61			81			In.	Blows	Stroke	CUT OFF ELEVATION	
2			22			42			62			82			-1"				
3			23			43			63			83			-2"			+ + ₩	
4			24			44			64			84			-3"			GROUND ELEVATION	
5			25			45			65			85			-4"				
6			26			46			66			86			-5"			VEN LE	
7			27			47			67			87			-6"			EPHH	
8			28			48			68			88			-7"				
9			29			49			69			89			-8"				
10			30			50			70			90			-9"				
11			31			51			71			91			-10"			↓ 闘 ↓	
12			32			52			72			92			-11"			TIP ELEVATION /	
13			33			53			73			93			-12"				
14			34			54			74			94			Fuel	Setting	From (ft)	To (ft)	
15			35			55			75			95							
16			36			56			76			96							
17			37			57			77			97							
18			38			58			78			98							
19			39			59			79			99							
20			40			60			80			100							
REMARKS:																			
Driv	ing Fore	eman:							Phone	e:					Fax:				
Sup	erintende	ent:							Phone	e:					Fax:				
Proj	Project Manager: Phone: Fax:																		

Note: When advancing pile with a vibratory hammer, enter time of day (HH:MM:SS) in "Blows" Column.

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

#### SECTION 35 31 19 Add – REVETMENT

#### PART 1 – GENERAL

#### 1.1 DESCRIPTION OF WORK

The work includes furnishing materials, labor, and equipment for construction of graded riprap (GRR) structures in accordance with these specifications and applicable drawings.

#### 1.2 RELATED SECTIONS

Section 01 25 00 Add – Measurement and Basis of Payment Section 31 05 19.13 Add– Geotextiles for Earthwork Section 35 41 00 Add – Berm Construction

#### 1.3 REFERENCES

Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

- A. American Society for Testing and Materials (ASTM) Publications
- C 535 Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine
- D 75 Standard Practice for Sampling Aggregates
- D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
- D 5519 Standard Test Method for Particle Size Analysis of Natural and Man-Made Riprap Materials
- D 6092 Standard Practice for Specifying Standard Sizes of Stone for Erosion Control
- D 6473 Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control
- E 329 Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

#### 1.4 SUBMITTALS

Submittals under this section include the following:

- 1. Name, Location, and Historical Quality Reports from Quarry (Paragraph 1.6, B)
- 2. Qualifications/Certifications for Sampling/Testing Agency (Paragraph 1.6, B)
- 3. GRR Quality and Test Report Schedule and GRR Delivery Schedule (Paragraph 1.6, B)
- 4. GRR Quality Test Reports (Paragraph 1.6, B)

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REVETMENT

- 5. GRR Gradation Test Reports (Paragraph 1.6, B)
- 6. GRR Gradation Test Methodology Description (Paragraph 1.6, B)
- 7. Daily Activities Reports (Paragraph 1.6, C)
- 8. Initial Survey (Section 35 00 01 "Construction Surveying")
- 9. Final Survey (Section 35 00 01 "Construction Surveying")

#### 1.5 STORAGE OF CONSTRUCTION MATERIALS

Construction materials unloaded from the barges, trucks, or railroad cars that cannot be immediately used for construction shall be stored in approved storage areas. Storage areas shall be located reasonably near the job site and approved by Port Authority. The storage areas shall be prepared by Contractor and made relatively smooth in order that all of the stored material may later be recovered free from dirt or other foreign materials.

#### 1.6 QUALITY CONTROL / QUALITY ASSURANCE

- A. Environmental Protection Requirements: Refer to Section 01 16 60, "Environmental Protection Measures."
- B. Materials Testing:
  - 1. Contractor/Quarry shall provide all equipment and facilities for testing construction materials.
  - 2. Acceptable GRR shall meet the quality acceptance criteria in paragraph 2.01, A, when tested in accordance with the procedures listed below:
    - a. Sampling of the GRR shall be performed in accordance with ASTM D 75.
    - b. The absorption of GRR shall be determined in accordance with ASTM D 6473.
    - c. The unit weight of GRR shall be provided based on the apparent specific gravity determined in accordance with ASTM D 6473.
    - d. The loss by abrasion of GRR shall be determined in accordance with ASTM C 535, processed and tested for No. 1 grading.
    - e. The gradation of the GRR shall be determined in accordance with ASTM D 5519, Test Method C.
  - 3. Throughout the duration of the work, Contractor/Quarry shall inspect, sample, and test construction materials for compliance with the specified requirements and record the inspection of all operations. All sampling and testing shall be performed by a qualified testing laboratory meeting the requirements of ASTM D 3740 and ASTM E 329, or a commercial testing facility qualified by U.S. Army Corps of Engineers (USACE) Materials Testing Center (MTC). A copy of the records of inspection, as well as the records of corrective action taken, shall be provided to Engineer. As a minimum, Contractor/Quarry shall perform quality control inspection and testing in accordance with the following requirements and Table 1, or approved alternative submittal schedule (see GRR Submittal No. 3).
    - a. **Gradation:** Sample sizes shall consist of at least 50 stones per test and weigh at least 10 tons per test. Refer to paragraph 2.01 for gradation requirements.
    - b. **Quality:** Refer to paragraph 2.01 for quality requirements.

- c. **Placement:** Continuous inspection of placement to ensure proper thickness and that material is not segregated. Refer to paragraph 3.03 for placement requirements.
- 4. Prior to performing quality or gradation testing of stone, Contractor shall provide at least 3 days advance notice, in writing, so that Engineer may have the opportunity to attend and observe the testing. Contractor shall conduct gradation tests at the quarry, not at the project site.
- 5. Table 1 provides required submittals associated with GRR quality. Detailed descriptions of submittals are below.

Table 1. GRR Submittal Schedule				
GRR Submittal Number	Submittal Description	Required Submission Timeframe		
1	Name, Location, and Historical Quality Reports from Quarry	With Contractor's Proposal Form.		
2	Testing Laboratory Qualifications	With Contractor's Proposal Form.		
3	GRR Delivery, Staging, and Testing Schedule	Prior to transport or delivery of any GRR from quarry.		
4	GRR Quality and Gradation Test Report 1	With or after GRR delivery, staging, and testing schedule but prior to transport or delivery of any GRR from quarry.		
5 and up	GRR Quality and Gradation Test Reports	Every 10,000 tons and prior to shipment of GRR from quarry.		

- 6. GRR Submittal 1: Contractor shall provide the name and location of the quarry that will be the source of the GRR for the project when submitting Contractor's Proposal Form. Contractor shall also provide historical quality reports from the selected quarry with the Proposal Form to determine the acceptability of the GRR from the proposed source. Historical quality reports are not considered suitable alternatives to the quality and gradation reports required during construction. Quality and gradation reports during construction shall be from new tests performed on actual GRR to be used on the project.
- 7. GRR Submittal 2: Testing laboratory qualifications shall be submitted with Contractor's Proposal Form.
- 8. GRR Submittal 3: Prior to commencing GRR delivery to project site, Contractor shall submit a GRR delivery, staging, and testing schedule, and a description of the planned gradation test procedure. The schedule shall describe when GRR quality and gradation testing will be performed to ensure that test results are available for Engineer's review **prior to GRR being shipped from the quarry**. A minimum of 2 quality and 2 gradation tests are required and shall be provided at specified intervals to ensure compliance with quality and gradation requirements. The first quality and gradation test reports shall be performed, submitted, and reviewed by Engineer prior to delivery of any stone. The remaining quality and gradation tests shall be performed, submitted, and reviewed by Engineer prior to shipment from quarry and prior to shipment of final half (½) of total GRR quantity.
- 9. GRR Submittals 4-5 and up: Contractor shall obtain Engineer's review and confirmation of compliance of gradation and quality tests **prior to shipment of GRR** in the increments stated in Table 1. If a single shipment of GRR is planned to encompass multiple

increments, Contractor shall submit the required number of test submittals and receive review and confirmation of compliance prior to shipment of GRR from quarry. Contractor may request variations to timeframes in Table 1 in GRR delivery, staging, and testing schedule.

C. Daily Activities Reports: Contractor shall provide a daily record of activities. Daily reports shall include approximate quantity (including tonnage of GRR transported from quarry) and locations of GRR placement, and percent project completion.

# PART 2 – PRODUCTS

- 2.1 GRADED RIPRAP (GRR) MATERIAL
  - A. Stone: All stone for GRR shall be a durable natural stone. It shall be free from visible cracks, clay pockets, cavities (vugs or "honeycombs"), laminations, and other defects that would tend to increase unduly its deterioration from natural causes. Stone shall not include objectionable quantities of dirt, sand, clay, and/or rock fines. Stone shall comply with quality parameters in Table 2.

Table 2. Gradation Quality Parameters				
Parameter	Value	Max/Min		
Unit Weight	165 PCF	Min		
Absorption	3%	Max		
Loss by Abrasion	36%	Max		

The GRR shall be reasonably well graded and shall include essentially all stone sizes between the two extremes specified which will result in a dense, fairly well-graded material not having noticeable voids or a lack of the larger sizes. Bi-modal or gap graded stone gradation test results may result in rejection of the stone material. GRR armor stone size range (gradation) shall conform to the requirements specified below for M12 shoreline protection (Table 3-Figure 1) and Barbours Cut Channel/Spilman Island shoreline protection (Table 4-Figure 2). The specified gradation is for the installed (in-place) condition. The contractor shall consider breakage during material handling, delivery and installation in order to provide the specified in-place stone gradations.

Table 3. Gradation Limits for GRR – M12				
Particle Mass, Ib	Stone Diameter (ft)	Percent Lighter than the Mass Specified		
260 – 650	1.2 – 1.6	100		
130 - 280	0.9 – 1.2	50		
40 - 130	0.6 - 0.9	15		
<40	0.6	5 (MAX)		
* Ensure that at least 97% of the material by weight is smaller than Weight Maximum Pounds.				


Figure 1. Graphical Gradation Limits of GRR – M12

Table 4. Gradation Limits for GRR – Barbours Cut Channel/Spilman Island/Morgan's Point				
Particle Mass, Ib	Stone Diameter (ft)	Percent Lighter than the Mass Specified		
1000 – 1500	1.8 – 2.1	100		
500 - 760	1.5 – 1.7	50		
200 - 520	1.1 – 1.5	15		
<55	<0.7	0		
* Ensure that at least 97% of the material by weight is smaller than Weight Maximum Pounds.				



Figure 2. Graphical Gradation Limits of GRR – Barbours Cut Channel/Spilman Island

B. Stone Shape: The greatest dimension of each stone shall not be more than three times its least dimension. The faces of individual stones shall be roughly angular, not rounded, in shape.

## PART 3 – EXECUTION

3.1 GEOTEXTILE FILTER FABRIC

Refer to Section 31 05 19.13, "Geotextiles for Earthwork."

#### 3.2 COORDINATION WITH QUARRY

Contractor shall be knowledgeable of the methods used at the quarry to produce the GRR gradations specified, especially the effects of repeated handling. Contractor shall coordinate with the quarry and use loading and unloading methods that ensure that required gradations are provided for placement.

#### 3.3 GRR PLACEMENT

- A. General: GRR shall be placed over the prepared subgrade and geotextile fabric within the limits indicated on the drawings.
- B. Slope Preparation: Slope of berm or shoreline to receive riprap protection shall be shaped and prepared as shown in Drawings. The excavated material shall be placed within the berm template either on top of the berm crown or on the interior of berm slope to the grades shown. Along Spilman Island and Morgan's Point shoreline excavated material shall be placed within placement area or approved area at direction of Engineer. Excess material shall be placed on the inside of the berm and graded smooth to allow water runoff.
- C. Placement: The GRR layer shall be constructed as indicated on the drawings, and include the following characteristics:
  - 1. A placement technique and drop height less than 1 foot shall be used that will not damage the geotextile materials.
  - 2. Contact between individual stones shall be maximized on all sides. Each stone shall have at least three (minimum) points of contact with other stones.
  - 3. GRR shall be placed and spread in such a manner that the various stone sizes produce a relatively uniform surface and a completed layer that is a reasonably well-graded, compact mass of rock with minimal percentage of voids. Smaller stones shall be placed as required to produce a relatively uniform finished outer surface.
  - 4. Actual GRR limits shall be such that the finished surface of GRR is within the specified tolerance limits. Requirements with respect to the finished GRR crest elevation, crest width, and side slopes are provided in the drawings. Refer to drawings for tolerances.

#### 3.4 MISPLACED MATERIALS

If any stone is deposited elsewhere than in places designated or approved, the Contractor may be required to remove such misplaced material and redeposit it where directed at no additional cost to the Port Authority.

#### 3.5 SURVEYING AND ACCEPTANCE

A. General: Contractor shall provide initial and final surveys, as described in Section 35 00 01, "Construction Surveying," for measurement and acceptance of GRR placement. B. Acceptance Criteria: Acceptance of the GRR shall be based upon field observations and review of the final surveys to verify that the GRR meets the limits and tolerances specified in the drawings and the requirements of paragraph 3.3.

#### 3.6 CLEANUP

Upon completion of the work, all plant, including ranges, buoys, stakes, piles, excess stone, and other markers or obstructions placed by or for Contractor shall be promptly removed.

# **END OF SECTION**

# PORT OF HOUSTON AUTHORITY TECHNICAL SPECIFICATIONS FOR HSC ECIP – PACKAGE #7

#### SECTION 35 41 00 Add - BERM CONSTRUCTION

#### PART 1 - GENERAL

#### 1.1 DESCRIPTION OF WORK

The work in this Section consists of furnishing all plant, labor, equipment, supplies, and materials for performing the operations to construct required berms to the lines and grades shown. The design of hydraulically placed berms at Atkinson Island is based on displacement of soft bay bottom material and founding the berm on firm foundation.

A. Changes in Berm Alignment: The Engineer reserves the right to make changes in the berm alignments as may be found necessary before completion of the work.

## 1.2 RELATED SECTIONS

Section 01 25 00 Add – Measurement and Basis of Payment Section 35 20 00 Add – Construction Surveying Section 35 20 23 Add – Dredging Section 35 31 19 Add – Revetment

## 1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications
- D 2487 Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

#### 1.4 DEFINITIONS

- A. Clearing: Clearing consists of the removal and satisfactory disposal of all above ground and below ground trees, downed timber, snags, slash, brush, garbage, trash, debris, fencing, and other items occurring in the designated areas to be cleared.
- B. Grubbing: Grubbing consists of the removal and satisfactory disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Grubbing also includes filling of holes from the grubbing operation.
- C. Stripping: Stripping consists of the removal and satisfactory disposal of crops, weeds, grass, and other vegetative materials to the ground surface and topsoil to a depth of 8 inches.
- D. Satisfactory Materials: Satisfactory materials consists of materials classified in accordance with ASTM D 2487 as CL, CH, CL-ML, ML, SC, SP, SW, or SP-SW, free from: roots and other organic matter; contamination from hazardous, toxic or radiological substances; trash and debris.
- E. Unsatisfactory Materials: Unsatisfactory materials shall not be used in any berm or other required fill. Unsatisfactory materials include all other materials that are not defined above as satisfactory materials.

- F. Embankment: The terms "berm" or "embankment" as used in these specifications are defined as the earth fill portions of the berm structure or other fills related to the berm structure, and all other fills within the limits of the berm.
- G. Excavation: Excavation consists of removal of material to the lines and grades shown in the Drawings and specified in the Contract Documents, or as otherwise directed or approved by the Engineer.
- H. Initial Placement: The Initial Placement shall be hydraulic fill discharged from the dredge pipe along the alignment for the required hydraulically constructed berms. The Initial Placement quantity along the berm shall provide sufficient material within the Recovery Limits to accomplish Final Shaping and Grading to Final Grade and shall be to the minimum lines and grades shown on the Drawings.
- I. Final Shaping and Grading: This term is used to depict the construction work performed after Initial Placement of material, to bring the hydraulically placed material up to Final Grade.
- J. Final Grade: The constructed elevations and grades, shown by cross sections, after completion of Shaping and Grading.
- K. Limits of Recovery: For the work on this contract, this term will be used to refer to the limits of depth and distance from the newly constructed berm, within which material shown by cross sections after Initial Placement can be recovered during Final Shaping and Grading, to construct the berm to Final Grade. The bottom limit of recovery shall be minus 3 foot Mean Lower Low Water (MLLW) or existing bay bottom prior to Initial Placement, whichever is higher. The distance limit shall be determined by the Contractor as to the distance to the minus 3-foot MLLW contour, or existing bay bottom as applicable, and shown on the plotted surveys of Initial Placement cross sections, as specified. At no time shall displaced foundation materials (mud wave) be used to construct or shape the berms. Such unsuitable berm material incorporated into the berm construction shall be deemed misplaced material.
- L. Net Retention Rate: The neat-line fill quantity, computed from minimum required Final Grade cross sections shown, divided by the gross quantity of material dredged, for a particular berm reach.
- M. Gross Retention Rate: The sum of the actual quantity of fill measured within the Limits of Recovery, by Quality Control cross section surveys, divided by the gross quantity of material dredged, for a particular berm.

#### 1.5 NOTIFICATION AND COORDINATION OF WORK

- A. Pipeline Companies: The Contractor shall notify and coordinate work with pipeline companies at least 10 days before performing work near the pipelines in the vicinity of the site as shown. At Contractor's expense, necessary protective measures shall be provided as required by the Pipeline Company when crossing pipelines with a dredge submerged pipeline. Possible protective measures include but are not limited to, floating the dredge pipeline over and 100 feet each side of the pipeline or installing a protective padding between the submerged pipeline and pipeline.
  - Coordination with Pipeline Companies. Every effort has been made to give all pertinent details on the location of the pipelines. The data shown are believed to be substantially correct. However, the exact locations may vary from that shown; therefore, the Contractor shall cooperate with the Port Authority to establish the actual position of the pipelines. The following is furnished for information on verifying pipeline ownership:

Lone Star Notification Service (Texas One-Call) 1-800-545-6005 or 800-344-8377

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Enterprise Products, John Sanchez, 832-692-2223, JFSanchez@eprod.com

Texas Wide Location Service Agency (Dig Test) 1-800-344-8377

#### 1.6 GENERAL PROVISIONS

- A. Lines and Grades: The berms shall be constructed to the minimum lines, grades, and cross sections shown, unless otherwise directed. The Port Authority/Engineer reserves the right to increase or decrease the foundation widths and slopes of the berms or make changes in the berms as may be deemed necessary to produce a safe structure.
- B. Conduct of Work: The Contractor shall maintain and protect the berms in a satisfactory condition until completion and acceptance of the work in this contract. If in the opinion of the Engineer, the Contractor's equipment causes shears, rutting, quaking, heaving, cracking or excessive deformation of the berms, the Contractor shall limit the type, load or travel speed of the equipment on the berms and make necessary repairs at no additional cost to Port Authority.
- C. Failures: The Contractor shall be advised that soft to very soft foundation materials are located at the project site and shall plan to execute construction accordingly. If a failure, including but not limited to slides, slumps, settlement, or erosion, of a portion of the berms occurs during its construction or after its completion, but prior to its acceptance, the Contractor shall reconstruct or repair that portion of the berms without additional cost to Port Authority. Failures occurring after acceptance that are caused by Contractor operations or negligence shall be repaired by the Contractor without additional cost to Port Authority. Should a failure occur, the Contractor shall cease all operations in the immediate vicinity of the failure and promptly notify the Engineer. No repairs shall be made until the Engineer approves the method of repair. Unless approved by the Engineer, any delays incurred by the Contractor for the failure or the investigation of the failure shall be at the expense of the Contractor.
- D. Protection of Existing Service Lines and Pipeline Structures: Existing pipelines that are shown or the locations of which are made known to the Contractor prior to excavation or fill placement and that are to be retained, as well as pipelines encountered during excavation operations, shall be protected from damage during construction and, if damaged, shall be repaired by and at the expense of the Contractor. In the event that the Contractor damages existing pipelines that are not shown or the locations of which are not known to the Contractor, report of this damage shall be made immediately to the Engineer.

## 1.7 SUBMITTALS

Engineer's approval is required for submittals with an "E" designation; submittals not having an "E" designation are for information only.

- A. Preconstruction Submittals:
  - 1. Hydraulic Berm Construction Plan, E. The Contractor shall submit a Construction Plan for placement and shaping of the hydraulically placed dredge materials to the required lines and grades shown. The plan shall be submitted at least 14 days prior to starting work on this project, including but not limited to the following:
    - a. The phasing and methodology to be used for construction of hydraulically constructed berm including discharge pipeline placements, with sketches when applicable, and techniques to maximize use of available satisfactory material.
    - b. Approximate Barbours Cut Channel (BCC) stations and elevations between which the material to be dredged is used to construct the hydraulically constructed berms at M12 Beneficial Use Site.

- c. Estimated start and completion dates for berm construction at M12 Beneficial Use Site.
- d. Proposed pipeline routes (within the confines of the available routes shown) for the different sequencing of dredge fill placement and hydraulic fill berm construction.
- e. A complete list of plant and equipment, with accompanying specification information to be used for the work.
- f. A brief description of the proposed execution of required monitoring of the Initial Hydraulic Berm Fill Placement, as specified in Paragraph 3.10. The description shall include details on how the monitoring information will be used by the Contractor to monitor and control placement of hydraulic fill, to achieve the specified requirements to place sufficient hydraulic material at all locations along the berm. The description shall include details and calculations to be made during this contract to assess the production rate throughout this contract, and a description of the format the Contractor will use to report the hydraulic fill berm construction progress during the hydraulic fill placement.
- g. Anticipated Placement Rate. The Contractor shall provide estimated rate of berm construction per 1,000-foot section expressed as cubic yards per linear foot of berm.
- 2. Quality Control Plan, E. Prior to construction the Contractor shall submit a Quality Control Plan prior to construction, detailing the requirements specified in Paragraph 3.7.
- 3. Site Erosion Protection Plan. The Contractor shall submit a Site Erosion Protection Plan detailing the approach and methods to protect the construction site from erosion and other damage that may occur due to the exposure of the site to open Bay and to ship wakes. The Plan shall be submitted within 14 days after acknowledgment of Notice to Proceed and before mobilization. In preparing the Site Erosion Protection Plan, the Contractor shall consider the following:
  - a. The Contractor shall be responsible for constructing the total amount of berm to the lines and grades shown. Recovery and use of bay bottom material will not be acceptable and shall be deemed misplaced material.
  - b. The Contractor shall be responsible for installation of shore protection to the lines and grades shown.
  - c. The Contractor shall be responsible for controlling the discharge of material during construction of the berm.
  - d. The Contractor shall recognize the limited amount of available acceptable berm building material when considering over-placement of material to compensate for erosion.
  - e. Port Authority will not compensate the Contractor for repairs to berms due to erosion or for other failures. The Contractor is solely responsible for protecting the site and shall place shore protection as soon as practical to ensure protection and reduce erosion.
  - f. The Contractor shall consider applicable means and methods, compatible with the Plan of construction, for protection of the construction site. Temporary physical barriers, if utilized, shall be removed upon completion of the work at no cost to Port Authority.
  - g. The phasing Plan and Schedule for construction of berms and installation of shore protection.
- 4. Project Schedule, E. The overall project schedule shall identify the construction phases as separate line items.

- B. <u>Surveys:</u>
  - 1. The Contractor shall submit the results of the Quality Control Surveys taken during construction of the berms within 24 hours of survey. Survey requirements are specified in Section 35 23 00 "Construction Surveying."

## PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

A list of equipment, with accompanying specifications information shall be submitted prior to commencement of construction.

- A. Crawler-Type Tractors: Crawler-Type Tractors used for spreading and compacting on mechanically constructed berms shall weigh not less than 30,000 pounds; shall exert a unit tread pressure of not less than 5 pounds per square inch, and shall not be operated at a speed to exceed 5 miles per hour for mechanical berm placement.
- B. Power-Driven Tampers: Compaction of material in areas where it is impracticable to use a crawler-type tractor shall be performed by the use of approved power-driven tampers of the rammer-type having a static weight of at least 70 pounds or by approved hydraulic-actuated tractor-mounted tampers.
- C. Dragline Equipment: Dragline equipment used shall be approved types suitable for dragline and borrow berm construction.
- D. Miscellaneous Equipment: Scarifiers, disks, motorized graders, spreaders and other equipment shall be of approved types suitable for construction of berm. Trucks, scrapers and other types of earth-hauling equipment, if used, shall be of approved types suitable for construction. Matting, if used, shall be of sufficient size, quantity and strength for the types of equipment that will work from or cross over the mats, and for the types of foundation on which matting will be placed upon during the period of construction that the matting is used.
- E. Equipment for Placement and Shaping of Hydraulic-Fill Berms: Equipment used to facilitate movement of the dredge pipes to place hydraulic fill, construction of training berms to maximize retention of hydraulic fill, and grading and shaping of hydraulic-fill berms, shall be of low ground pressure design, suitable for work in marsh and other soft foundation conditions and may also consist of a spillbarge, shorepipe, or dredge.

#### 2.2 MATERIALS

A. Hydraulic Berm: Satisfactory materials for construction of the hydraulic fill berms shall consist of available soils (classified as CL, CH, CL-ML, ML, SC, SP, SW, or SP-SW in accordance with ASTM D 2487) from material in the BCC new work (widening and flare) template.

#### **PART 3 - EXECUTION**

#### 3.1 SITE CONDITIONS

Explorations to determine the character of materials at the site have been made, including core borings and the results are as shown in the Drawings and Appendices of the Contract Documents. Displacement and settlement of the foundation material can be expected and shall be anticipated by the Contractor during construction of the mechanically constructed berms and hydraulically constructed berms. The templates shown do not represent the total volume of excavated satisfactory materials needed to construct the mechanically constructed berms and hydraulically

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constructed berms to the lines and grades specified. The Contractor shall carefully review all geotechnical information provided and make their own conclusions regarding the amount of material excavation that will be needed to construct the specified berm templates prior to preparing the bidding documents.

#### 3.2 FOUNDATION PREPARATION

No berm foundation preparation, other than specified clearing, grubbing and stripping will be required for berm construction

## 3.3 EXCAVATION

Excavation shall consist of removal of material in preparing the foundations to the lines and grades shown in the Drawings, removal of material for the purpose of providing flotation for plant and equipment, removal of unsatisfactory material, and obtaining required fill materials for berm construction.

## 3.4 HYDRAULIC BERM

- A. General: Satisfactory materials used for "Hydraulic Berm, Baseline A" and "Hydraulic Berm, Baseline B" shall be obtained from the dredging of new work widening and flare templates in BCC. The Contractor shall evenly distribute sufficient hydraulic material at all locations along the berm so that the initial and final new berm section can be constructed to the minimum lines and grades. Discharge of hydraulically placed materials shall be placed in a direction away from or bayward from the existing berms and structures.
- B. Unsatisfactory Materials: Unsatisfactory materials shall be disposed of in an appropriate manner and placed in a location approved by the Engineer.
- C. Initial Placement: The initial placement of material for "Hydraulic Berm, Baseline A" and "Hydraulic Berm, Baseline B" shall consist of controlled discharge of the dredged material along the alignment of the required berms as shown in the Drawings, and as specified herein. The Contractor shall take reasonable measures available to retain satisfactory material within the specified limits of recovery, including the control of discharge actions specified herein. The limits of recovery as specified in the Paragraph 1.4.K may be extended by the Contractor, with approval of the Engineer, based on observed behavior of the discharged material. The limits, that generally identify materials to be used for construction, shall be identified on individual cross sections to allow monitoring of initial placement as required by the specifications. Details of initial placement shall be included in the Construction Plan.

Initial placement by land based techniques and methods of placement via a discharge pipeline advanced and manipulated by shore based personnel and equipment such as dozers, backhoes, and marsh excavators is to be used within 200 ft of existing berms and along "Hydraulic Berm, Baseline B" unless otherwise approved by Engineer. The initial placement of material for the hydraulically constructed berm consisting of controlled discharge of the dredged material through the use of a spillbarge techniques along the alignment of the required berm is required in all other locations.

D. Control of Discharge: In order to maximize retention of hydraulically placed material within the required fill template, the Contractor shall use a floating spillbarge or similar technique to control placement of the hydraulically transported berm material. The spill-barge should be equipped with spuds and/or anchor systems that will allow the barge to be moved both perpendicular and parallel to the centerline of berm as the material is discharged. In this manner, the material

can be spread and brought up evenly to an elevation above the water surface. Additionally, the spill-barge shall be capable of varying the discharge elevation from an elevation of 3 feet below the water surface to a sufficient height above the specified construction template so that material may be hydraulically placed to the minimum lines and grades shown. The spill-barge should be fitted with a spreader, diffuser, or other effective means that will promote the displacement of soft materials. Where practical, the initial discharge shall be beneath the water surface, and the discharge point shall be raised vertically as the material increases in elevation. The Contractor shall include details in the Construction Plan regarding the proposed technique and equipment to be used to accomplish the required "Control of Discharge." The method used to place the hydraulic fill shall maximize the use of the material and minimize waste of satisfactory materials. The location of the discharge point of the spill-barge system shall be continuously monitored by electronic survey techniques and recorded at five-minute intervals while the spillbarge is at the work site. The data will be submitted on digital media in X,Y,Z,Time,Date ASCII format.

In those areas where the use of shoreline pipe and land-based discharge is permitted the Contractor shall take reasonable measures available to retain satisfactory material within the specified limits of recovery, including the control of discharge actions specified herein. The contractor shall use frequent movement of the discharge point during the initial placement, along with an effective directing of the discharge flow in the same direction as the berm advancement to retain the maximum quantity of material possible within the limits of recovery. Direction of the discharge flow, when discharging, shall be accomplished using marsh excavation equipment or suitable, approved alternative equipment, to provide for continuous removal of material mounding in front of the discharge or other locations that can result in lateral-direction "wash" of material from the limits of recovery. Materials shall be placed in a manner that displaces the soft foundation materials and prevents the "bridging" of soft sediments that may result in the failure or adverse settlement of the berm. The Contractor shall use a "Y" valve or lateral "shunt" discharge line for discharging water and unsatisfactory materials toward the inside of the planned placement area to minimize erosion of previously place berm. Training berms may be used to maximize the retention rate of the hydraulically placed fill.

- E. Mechanical Placement: Satisfactory material placed on top of the hydraulic berms during shaping and dressing shall be placed in loose lifts not exceeding 18 inches and shall be mechanically compacted by not less than three (3) passes of a crawler-type tractor which shall not be operated at a speed to exceed 5 miles per hour. Satisfactory material that becomes mixed with unsatisfactory materials, including displaced foundation materials, is no longer satisfactory material and shall be disposed of in the interior of Cell M12.
- F. Final Shaping and Grading: Upon acceptance of the initial placement hydraulic fill sections, final shaping and grading may commence. Recoverable material shall be used to construct the berms to the final grade template as shown in the Drawings. To the maximum extent practicable, satisfactory recoverable material on the bay side of the cells shall be used to raise the berms to the final grade template. Excess satisfactory recoverable material shall not be wasted. Recoverable satisfactory material on the bay side of the berms shall be stockpiled on top of or on the interior slope of the initial placement hydraulic berms and graded and shaped to allow for drainage. No separate payment will be made for the stockpiles. It shall be the Contractor's responsibility to protect the work site and to repair eroded or otherwise damaged accepted sections of berm prior to placement of shore protection at no additional cost to the Port Authority.
- G. Grade Tolerances:
  - 1. Initial Placement: For acceptance, berms shall be constructed, as a minimum, to the grades and elevations shown. Tolerances shall include minus 1.0 to plus 1.0 foot on the crown

height. For initial placement, slopes shall be at the angle of repose of the material as shown in the Drawings.

2. Final Shaping and Grading: For acceptance, berms shall be constructed, as a minimum, to the grades and elevations shown. Tolerances shall include minus 0.5 to plus 0.5 foot on the crown height, crown width, and slopes. Final alignment of the "Hydraulic Berm, Baseline A" and "Hydraulic Berm, Baseline B" shall be within 20 feet of the berm baseline shown unless otherwise approved. Transitions in alignments shall be smooth and no more than 2 feet in a 100-foot length. Abrupt changes in alignment, as determined by the Engineer, will not be permitted.

## 3.5 PROTECTION OF THE WORKSITE

The location of Atkinson Island in Upper Galveston Bay is subject to ship wakes from the Houston Ship Channel, Cedar Bayou Channel and significant fetch length and storm influences on wave height. The Contractor shall expect erosion of unprotected berms. The Contractor shall be responsible for protecting the work site and for repair of eroded or otherwise damaged berms at no additional cost to the Government. Considerations to be made for the design of the Site Erosion Protection System are specified.

## 3.6 ACCEPTANCE AND CORRECTIVE ACTION

- A. Acceptance of Completed Berms: The berms will be accepted as described in Section 01 25 00, "Measurement and Basis of Payment". There will be no intermediate acceptance of the berms. Acceptance will be based on topographic surveys performed by the Contractor as specified in Section 35 20 00, "Construction Surveying." Request for acceptance shall be in writing. The Port Authority may perform field check surveys. The Port Authority survey checks will govern discrepancies. If the final survey cross sections for a particular acceptance section show that the acceptance template as shown has been achieved, the berm section will be accepted as complete.
- B. Corrective Action: Sections not conforming to the minimum acceptance template shall be corrected by the Contractor at no additional cost to the Port Authority. The Contractor shall be responsible for repair of damages to the berms resulting from construction equipment operation, settlement, subsidence, slides, displacement and handling of foundation materials, normal seasonal weather-related damage, and Contractor negligence. After acceptance of a section, the Contractor shall be responsible for damages to the berms resulting from its operations or negligence.

## 3.7 CONTRACTOR QUALITY CONTROL

- A. Quality Control Inspections: The Contractor shall conduct daily Quality Control inspections of the construction activities for compliance with these contract requirements and record the information as specified herein. A copy of the records of Quality Control inspections, as well as corrective action taken, shall be filed daily and submitted as directed. The Quality Control Reports shall be submitted on an approved Quality Control Report form. Retention Rate Monitoring information shall be submitted on an approved Retention Rate Spreadsheet. Required survey information and plots of the surveys shall be attached to the Quality Control Reports and Retention Rate Spreadsheets, as specified.
- B. Monitoring of Initial Placement: Monitoring of the initial placement material shall be made based on Contractor Quality Control cross section surveys, taken as specified herein. Quantity calculations required for completing the Retention Rate Spreadsheet shall be made for each 24-hour period. The required Report information and entries to the Spreadsheet shall be recorded daily. In areas where surveys indicate the quantity of material within the limits of recovery is below the calculated amount required to construct the required berm, the Contractor

shall hydraulically place additional material and perform additional surveys to verify material quantity is within the specified tolerance. Corrective action is required in areas where surveys indicate replacement and is at the Contractor's expense. If volume calculations indicate insufficient material placement or excessive replacement, a note of this shall be made on the Quality Control Daily Report. The Contractor shall then make required adjustments to the work procedure to accomplish proper distribution of initial material placement.

- C. Retention Rate Spreadsheet: A Retention Rate Spreadsheet, programmed to make appropriate calculations, shall be set up on a Microsoft Excel 2000, or later, spreadsheet computer program, with the following column headings which are required for Retention Rate Monitoring and reporting: Date, End Stations of Berm Constructed (last 24 hours), End Stations of Berm Constructed to Date, Berm Cross Section Station, Neat Line Cross Section Area computed to the original Bay bottom (cubic yards per linear foot of berm), Actual Cross Sectional Area (as placed by the dredge expressed in cubic yards per linear foot of berm), Over-placement Ratio, Average End Area (Actual), Distance, Volume Between Cross Sections, Cumulative Berm Volume as placed by the dredge, Quantity of Cross Sectional Area retained in the Acceptance Template, Gross Dredging Between Stations, Gross Dredging to Date (cubic yards and cubic yards per linear foot of berm), Anticipated Placement Rate, Gross Retention Rate, Net Retention Rate, Over-placement (or Under-placement) Quantity and Acceptance (check). Copies of a previously used example spreadsheet and explanation of use will be provided to the Contractor at the Pre-construction Conference.
- D. Quality Control Report: A copy of the records of Quality Control inspections and tests, as well as the records of corrective action shall be submitted as directed. In addition, the Quality Control Report shall include the information required to accomplish monitoring of Initial Placement, including ongoing Retention Rates, as specified. The Report shall include a description of the Control of Discharge and a discussion of prior and ongoing placement activities during the previous 24 hours, to include the following items:
  - 1. Date
  - 2. Gross dredging quantity for the last 24 hours
  - 3. Gross dredging quantity to date
  - 4. End stations of Initial Placement, Shore Protection Placement, and Final Shaping and Grading for the last 24 hours
  - 5. End stations of Initial Placement, Shore Protection Placement, and Final Shaping and Grading to date
  - 6. Station and Offset Boundaries of dredging for the last 24 hours
  - 7. Control of Discharge, other comments
- E. Quality Control Daily Report: A Quality Control Daily Report form, containing blanks for required information shall be developed by the Contractor for use during this contract. A copy of the Quality Control Report form shall be submitted with the Quality Control Plan for approval.
- F. Submittal of Reports: Daily reports shall be submitted in both hard copy and electronic form as directed. A copy of the completed spreadsheet shall be attached to the Daily Quality Control Report on the Thursday of each week, or as directed. Additionally, on the Thursday of each week or as often as directed, the Contractor shall send the spreadsheet to email addresses that will be provided at the Pre-construction Conference.
- G. Compliance Inspection: The Contractor shall inspect for compliance with contract requirements and record the inspection of operations including, but not limited to the items specified below:

- 1. Placement of fill
- 2. Unsatisfactory materials, including silts and sandy silts, are not used in berm construction
- 3. Construction to lines and grades shown
- 4. Misplaced materials Monitoring and removal if required
- 5. Length of berm constructed and quantity of satisfactory material utilized, and estimated quantity of remaining satisfactory material required for berm construction
- 6. Drainage of ponded water, as required between hydraulically-placed fill and existing berms
- H. Records: A copy of the records of the compliance inspections, tests, and records of corrective action shall be submitted as directed.

# END OF SECTION