

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>				1. CONTRACT ID CODE <b>J</b>		PAGE OF PAGES <b>1   81</b>	
2. AMENDMENT/MODIFICATION NO. <b>0002</b>		3. EFFECTIVE DATE <b>17-May-2016</b>		4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable)	
6. ISSUED BY  USA ENGINEER DISTRICT, JACKSONVILLE CONTRACTING DIVISION 701 SAN MARCO BLVD JACKSONVILLE FL 32207-8175		CODE <b>W912EP</b>		7. ADMINISTERED BY (If other than item 6)  <b>See Item 6</b>			
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)				X		9A. AMENDMENT OF SOLICITATION NO. <b>W912EP-16-R-0010</b>	
				X		9B. DATED (SEE ITEM 11) <b>26-Apr-2016</b>	
						10A. MOD. OF CONTRACT/ORDER NO.	
						10B. DATED (SEE ITEM 13)	
CODE		FACILITY CODE					
<b>11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS</b>							
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input checked="" type="checkbox"/> is extended, <input type="checkbox"/> is not extended. Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning <u>1</u> copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.							
12. ACCOUNTING AND APPROPRIATION DATA (If required)							
<b>13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS.</b> <b>IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.</b>							
A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.							
B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).							
C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:							
D. OTHER (Specify type of modification and authority)							
E. IMPORTANT: Contractor <input type="checkbox"/> is not, <input type="checkbox"/> is required to sign this document and return _____ copies to the issuing office.							
14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)  <b>HERBERT HOOVER DIKE REHABILITATION, STRUCTURE REPLACEMENTS, S-291 (IP-3) RECONSTRUCTION, GLADES COUNTY, FLORIDA</b>  Please see Continuation Sheet for Summary of Changes.  Also included are the Site Visit Roster dated 12 May 2016 and the Pre-Proposal Conference Slides  Proposal due date has changed from 27 May 2016 to 02 June 2016.							
Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.							
15A. NAME AND TITLE OF SIGNER (Type or print)				16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)			
				TEL: _____ EMAIL: _____			
15B. CONTRACTOR/OFFEROR		15C. DATE SIGNED		16B. UNITED STATES OF AMERICA		16C. DATE SIGNED	
_____ (Signature of person authorized to sign)				BY _____ (Signature of Contracting Officer)		17-May-2016	

SF 30 CONTINUATION SHEET

HERBERT HOOVER DIKE REHABILITATION, STRUCTURE REPLACEMENTS  
S-291 (IP-3) RECONSTRUCTION, GLADES COUNTY, FLORIDA

**SUMMARY OF CHANGES**

**1. SPECIFICATIONS:**

A. In some Volume 1 sections, asterisks appear before and after the line or lines where revisions have been made to the text, and pertain only to changes made by this amendment. In some cases, replacement clauses are attached to this amendment.

B. In Volume 2 sections, the text changes have been updated with additions noted by underlined text and deletions noted by line/cross-outs, and pertain only to changes made by this amendment. The entire section is replaced if there is any change.

**Changes to Specifications:**

**Volume 1 of 2 - Contract Documents:**

**DELETE** Section 00010A and **REPLACE** with the attached revised Section 00010A.

**Volume 2 of 2 - Technical Specifications:**

**DELETE** Section 01 22 00 and **REPLACE** with the attached revised Section 01 22 00.

**DELETE** Section 05 50 15 and **REPLACE** with the attached revised Section 05 50 15.

**DELETE** Section 31 62 13 and **REPLACE** with the attached revised Section 31 62 13.

**DELETE** Section 35 41 00 and **REPLACE** with the attached revised Section 35 41 00.

**2. DRAWINGS:**

**DELETE** Drawing No. G-02 and **REPLACE** with the attached revised Drawing No. G-01.

**DELETE** Drawing No. S-45 and **REPLACE** with the attached revised Drawing No. S-45.

**DELETE** Drawing No. S-45A and **REPLACE** with the attached revised Drawing No. S-45A.

**DELETE** Drawing No. S-47 and **REPLACE** with the attached revised Drawing No. S-47.

**DELETE** Drawing No. S-49 and **REPLACE** with the attached revised Drawing No. S-49.

**DELETE** Drawing No. S-50 and **REPLACE** with the attached revised Drawing No. S-50.

**DELETE** Drawing No. S-51 and **REPLACE** with the attached revised Drawing No. S-51.

**DELETE** Drawing No. S-52 and **REPLACE** with the attached revised Drawing No. S-52.

**DELETE** Drawing No. S-62 and **REPLACE** with the attached revised Drawing No. S-62.

**DELETE** Drawing No. M-01 and **REPLACE** with the attached revised Drawing No. M-01.

**DELETE** Drawing No. M-02 and **REPLACE** with the attached revised Drawing No. M-02.

**DELETE** Drawing No. M-03 and **REPLACE** with the attached revised Drawing No. M-03.

**DELETE** Drawing No. E-01 and **REPLACE** with the attached revised Drawing No. E-01.

**DELETE** Drawing No. E-02 and **REPLACE** with the attached revised Drawing No. E-02.

**DELETE** Drawing No. E-05 and **REPLACE** with the attached revised Drawing No. E-05.

**DELETE** Drawing No. E-12 and **REPLACE** with the attached revised Drawing No. E-12.

**DELETE** Drawing No. T-01 and **REPLACE** with the attached revised Drawing No. T-01.

**DELETE** Drawing No. T-02 and **REPLACE** with the attached revised Drawing No. T-02.

**DELETE** Drawing No. T-03 and **REPLACE** with the attached revised Drawing No. T-03.

**DELETE** Drawing No. T-06 and **REPLACE** with the attached revised Drawing No. T-06.

**DELETE** Drawing No. T-09 and **REPLACE** with the attached revised Drawing No. T-09.

**DELETE** Drawing No. T-10 and **REPLACE** with the attached revised Drawing No. T-10.

**3. OTHER AVAILABLE INFORMATION:** IP-3 DTM.zip (survey zip file).

(End of Summary of Changes)

SECTION 00010A  
LINE ITEMS AND PRICING SCHEDULE

HERBERT HOOVER DIKE REHABILITATION, STRUCTURE REPLACEMENTS  
S-291 (IP-3) RECONSTRUCTION  
GLADES COUNTY, FLORIDA

LINE ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
0001	ACCESS		LUMP SUM		\$ _____
0002	TURBIDITY MONITORING		LUMP SUM		\$ _____
0003	COFFERDAM STEEL PILE		LUMP SUM		\$ _____
0004	EARTHEN COFFERDAM AND PLUGS		LUMP SUM		\$ _____
* 0005	COFFERDAM ARMORING (ESTIMATED QUANTITY)	110	SQUARE YARD	\$ _____	\$ _____
0006	COFFERDAM SEEPAGE PROTECTION (ESTIMATED QUANTITY)	275	SQUARE YARD	\$ _____	\$ _____
0007	DEWATERING		LUMP SUM		\$ _____
0008	EXCAVATION		LUMP SUM		\$ _____
0009	DEMOLITION		LUMP SUM		\$ _____
0010	SHEETPILE SCOUR CUTOFF WALLS		LUMP SUM		\$ _____
0011	MUD MAT		LUMP SUM		\$ _____
0012	LAKESIDE HEADWALL REINFORCED CONCRETE		LUMP SUM		\$ _____
0013	LAKESIDE WING WALLS REINFORCED CONCRETE		LUMP SUM		\$ _____
0014	LANDSIDE HEADWALL REINFORCED CONCRETE		LUMP SUM		\$ _____
0015	LANDSIDE WING WALLS REINFORCED CONCRETE		LUMP SUM		\$ _____
0016	CULVERT STRUCTURE REINFORCED CONCRETE		LUMP SUM		\$ _____
0017	LAKESIDE HEADWALL EMBEDDED METALS		LUMP SUM		\$ _____
0018	LANDSIDE HEADWALL EMBEDDED METALS		LUMP SUM		\$ _____
0019	MISCELLANEOUS METALS		LUMP SUM		\$ _____
0020	COMBINATION SLIDE/FLAP GATE WITH ACTUATOR	2	EACH	\$ _____	\$ _____
0021	MANATEE SCREEN/DEBRIS BARRIER	2	EACH	\$ _____	\$ _____
0022	EMBANKMENT FILL		LUMP SUM		\$ _____
0023	SOIL-BENTONITE CORE		LUMP SUM		\$ _____
0024	CHIMNEY DRAIN, DRAINAGE BLANKENT AND FILTER COLLAR		LUMP SUM		\$ _____
0025	LIMEROCK SURFACE (ESTIMATED QUANTITY)	2,800	SQUARE YARD	\$ _____	\$ _____

SECTION 00010A  
LINE ITEMS AND PRICING SCHEDULE

HERBERT HOOVER DIKE REHABILITATION, STRUCTURE REPLACEMENTS  
S-291 (IP-3) RECONSTRUCTION  
GLADES COUNTY, FLORIDA

LINE ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
0026	RESTORATION RIPRAP (ESTIMATED QUANTITY)	650	SQUARE YARD	\$_____	\$_____
0027	INTAKE AND OUTLET CHANNEL		LUMP SUM		\$_____
0028	SITE SIGNAGE		LUMP SUM		\$_____
0029	CONTROL BUILDING		LUMP SUM		\$_____
0030	ELECTRICAL AND TELECOMMUNICATIONS WORK AND EQUIPMENT		LUMP SUM		\$_____
0031	SODDING (ESTIMATED QUANTITY)	21,500	SQUARE YARD	\$_____	\$_____
0032	TEMPORARY SAFETY BARRIER		LUMP SUM		\$_____
0033	ELECTRICAL UTILITIES		LUMP SUM		\$150,000.00
0034	DUAL LEAF GATES	2	EACH	\$_____	\$_____
0035	ABANDONMENT GROUTING (ESTIMATED QUANTITY)	250	CUBIC YARD	\$_____	\$_____
0036	STILLING WELLS		LUMP SUM		\$_____
0037	EMBANKMENT SEEPAGE PROTECTION (ESTIMATED QUANTITY)	153	SQUARE YARD	\$_____	\$_____
0038	CONTRACTING OFFICER'S FIELD OFFICE	29	MONTH	\$_____	\$_____
TOTAL BID (LINE ITEMS 0001 THROUGH 0038)					\$_____

NOTES: (1) See Section 00100 INSTRUCTIONS TO OFFERORS.

(2) Quantities shown are estimated, actual quantities may vary. See Clause 52.211-18 "Variation in Estimated Quantity" of Section 00700 CONTRACT CLAUSES.

(3) Offerors must price all line items.

(4) Failure to complete and return all required submissions (see Section 00100A) could render your proposal ineligible for award.

SEE NEXT PAGE FOR NOTES 5 AND 6.

SECTION 00010A  
LINE ITEMS AND PRICING SCHEDULE

HERBERT HOOVER DIKE REHABILITATION, STRUCTURE REPLACEMENTS  
S-291 (IP-3) RECONSTRUCTION  
GLADES COUNTY, FLORIDA

(5) Digital Terrain Models (DTM) and requisite raw data in XLM format are available for informational purposes only. The Government assumes no responsibility for any apparent errors that may be present in the DTM or raw data; nor does the Government assume responsibility for any conclusions or interpretations made by the Contractor based on the provided DTM or raw data. The DTM and raw data are available in compressed (zip) format for download by offerors with the solicitation on the Federal Business Opportunities ([www.fbo.gov](http://www.fbo.gov)) web site. The available information may include DTM surfaces for the existing site grades, excavation grades, and finished grades. The excavation DTM may not fully define surfaces related to temporary cuts required for site features such as stormwater management and erosion control components. Further, the excavation DTM may not reflect embankment foundation details such as soil benching. The finished DTM may not fully define surfaces related to site features such as stormwater management and erosion control components. Further, the finished grade DTM may not reflect embankment penetrations, internal embankment components such as seepage collection systems, nor embankment slope protection.

(6) The Contractor shall provide a certificate of insurance evidencing worker's compensation insurance in the amount prescribed in 999.228-4000 of Section 00800 SPECIAL REQUIREMENTS.

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SECTION 01 22 00

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SUMMARY

This section describes how Line Items will be measured and paid for when making progress payments. Work to be measured is described in specification sections listed for each Line Item. Measurement procedures for payment, required quantity survey or procurement documentation and payment restrictions are described in applicable specification sections. Allocate costs for work not specifically mentioned to the Line Item most closely associated with work involved. Unless there is a specific Line Item for administrative costs, such as Quality Control and Safety, allocate such costs proportionally across all Line Items.

1.2 QUALITY CONTROL SYSTEM (QCS)

1.2.1 Definition

The terms "Contract Line Item Number (CLIN)" and "Line Item" are interchangeable herein (e.g.: CLIN 0001 is Line Item 0001). The term "CLIN" is a contracting term used in the Quality Control System (QCS) payment data base.

1.2.2 Instructions

See Section 01 45 04 CONTRACTOR QUALITY CONTROL for instructions on linking a CLIN to a schedule of values of pay activities and construction schedule, and in-depth payment procedure.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Transmit submittal items in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. Submit the following preconstruction submittal items no later than 20 calendar days after award or 5 calendar days after Notice to Proceed, whichever is later:

**SD-01 Preconstruction Submittals**

**Schedule of Values; G, RO**

Provide a breakdown of lump sum items into proposed pay activities as part of the initial project schedule. Schedule of Values will become basis for CLIN and Pay Activity data in the QCS payment data base.

**Utility Invoices**



Submit invoices from the utility company indicating payment for services covered in Line Item 0033 "Electrical Utilities". Payment under this line item will not be made prior to submission of valid invoices to the Government. The Contractor will be reimbursed for costs indicated on these invoices only.

#### 1.4 PAYMENT PROCEDURES

Payment items for the work in this contract on which the contract payments will be made are listed in the LINE ITEMS AND PRICING SCHEDULE and described below. The price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided. All costs for items of work, which are not specifically mentioned to be included in a particular payment item, shall be included in the listed item most closely associated with the work involved.

##### 1.4.1 Lump Sum

Progress payments for lump sum CLINs will be made in accordance with the Payments Under Fixed-Price Construction Contracts clause of Section 00700 CONTRACT CLAUSES in Volume 1. Submit a list of pay activities, (Schedule of Values) to breakdown bid for each lump sum CLIN. The Schedule of Values shall be submitted for Government approval with the baseline schedule submittal (see Section 01 32 01 PROJECT SCHEDULE. An unbalanced Schedule of Values and Pay Activity Schedule will be returned for revision. If this contract contains either the Continuing Contracts clause or the Continuing Contracts (Alternate) clause, the Contractor should take into account the amount reserved for contract payments when preparing the construction schedule.

##### 1.4.2 Unit Price

Each Unit Price CLIN may be a single pay activity item or may be broken down into pay activities with smaller quantities equal to CLIN total. Contract unit price multiplied by agreed quantity is full compensation.

#### 1.5 LINE ITEMS

Line items will be paid in accordance with the paragraph PAYMENT PROCEDURES above and as required below. The following line items are included in Section 00010A LINE ITEMS AND PRICING SCHEDULE in Volume 1:

##### 1.5.1 Access (Line Item 0001)

Lump sum payment will be made for costs associated with or incidental to clearing and grubbing; silt fence; cattle fence; and the construction, maintenance and removal of site access as indicated on the drawings. See Section 35 41 00 EMBANKMENT CONSTRUCTION.

##### 1.5.2 Turbidity Monitoring (Line Item 0002)

Payment will be made for costs associated with or incidental to obtaining, analyzing, and reporting the results of monitoring for turbidity. See Section 01 57 25 TURBIDITY AND DISPOSAL MONITORING.

1.5.3 Cofferdam Steel Pile (Line Item 0003)

Lump sum payment will be made for costs associated with or incidental to construction, maintenance and removal of pile cofferdams, including cutting and abandoning in place.

1.5.4 Earthen Cofferdam and Plugs (Line Item 0004)

Lump Sum payment will be made for costs associated with or incidental to placement, maintenance and removal of earthen cofferdams and plugs.

1.5.5 Cofferdam Armoring (Line Item 0005)

Unit price payment will be made for costs associated with or incidental to placement, maintenance and removal of import riprap, bedding stone, and geotextile. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.6 Cofferdam Seepage Protection (Line Item 0006)

Unit price payment will be made for costs associated with or incidental to placement, maintenance and removal of seepage protection, including Bedding Stone and geotextile. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.7 Dewatering (Line Item 0007)

Lump sum payment will be made for costs associated with or incidental to installation, operation, maintenance and removal of dewatering equipment and drainage facilities. This includes permitting and preparation of the Dewatering Work Plan.

1.5.8 Excavation (Line Item 0008)

Lump sum payment will be made for costs associated with or incidental to excavation, transportation, and disposal of all materials not otherwise defined; excavation, hauling and stockpiling of topsoil; providing and maintaining access to the work site(s) and disposal area(s); noise control; erosion control; and debris removal.

1.5.9 Demolition (Line Item 0009)

Lump sum payment will be made for costs associated with or incidental to demolition, hauling, offsite disposal, and stockpiling of existing structures and features, including existing riprap and existing pavement, necessary to complete work. Demolition shall also include cost of decommissioning existing monitoring wells/piezometers.

1.5.10 Sheetpile Scour Cutoff Walls (Line Item 0010)

Lump sum payment will be made for costs associated with or incidental to construction and completion of the sheetpile scour cutoff walls under the headwalls and the wingwalls on both sides of each culvert.

1.5.11 Mud Mat (Line Item 0011)

Lump sum payment will be made for costs associated with or incidental to placement and completion of the unreinforced concrete mud mat required for the entire culvert structure foundation as shown on the drawings.

1.5.12 Lakeside Headwall Reinforced Concrete (Line Item 0012)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.13 Lakeside Wing Walls Reinforced Concrete (Line Item 0013)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.14 Landside Headwall Reinforced Concrete (Line Item 0014)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.15 Landside Wing Walls Reinforced Concrete (Line Item 0015)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.16 Culvert Structure Reinforced Concrete (Line Item 0016)

Lump sum payment will be made for costs associated with or incidental to placement and completion of reinforced concrete required for the structure.

1.5.17 Lakeside Headwall Embedded Metals (Line Item 0017)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of embedded metals required for bulkhead slots, sills and armors as shown on the drawings.

1.5.18 Landside Headwall Embedded Metals (Line Item 0018)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of embedded metals required for bulkhead slots, sills and armors as shown on the drawings.

1.5.19 Miscellaneous Metals (Line Item 0019)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of miscellaneous metals not paid for under the line item "Embedded Metals" above.

1.5.20 Combination Slide/Flap Gate with Actuator (Line Item 0020)

Unit price payment will be made for costs associated with or incidental to furnishing and installation of combination slide/flap gates with actuators. Measurement will be by the number of gates installed. Unit of measure is each.

1.5.21 Manatee Screen/Debris Barrier (Line Item 0021)

Unit price payment will be made for costs associated with or incidental to furnishing and installation of manatee screen/debris barriers. Measurement will be by the number of screen/barriers installed. Unit of measure is each.

1.5.22 Embankment Fill (Line Item 0022)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, and placement of embankment or other fill to the lines and grades shown on the drawings; noise control; erosion control; and debris removal. Payment under this line item includes compaction and placement of subgrades for roads, foundations and revetment, embankment and placement of topsoil. Payment under this line item does not include Soil-Bentonite Core, Chimney Drain, Drainage Blanket, or Filter Collar.

1.5.23 Soil-Bentonite Core (Line Item 0023)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, mixing, placement and testing of Soil-Bentonite Fill to the lines and grades shown on the drawings; providing and maintaining access to the work site(s) and borrow area(s); noise control; and debris removal.

1.5.24 Chimney Drain, Drainage Blanket, and Filter Collar (Line Item 0024)

Lump sum payment will be made for costs associated with or incidental to borrow, transportation, placement and testing of all components of the Chimney Drain, Drainage Blanket, Filter Collar and internal drainage system, including Filter Soil, Filter Gravel and drain pipe to the lines and grades shown on the drawings; providing and maintaining access to the work site(s) and borrow area(s); noise control; and debris removal.

1.5.25 Limerock Surface (Line Item 0025)

Unit price payment will be made for costs associated with or incidental to processing, transportation, and placement of aggregate surface coarse (limerock) to the lines and grades shown on the drawings. Compaction and placement of the subgrade will not be paid for under this line item. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.26 Restoration Riprap (Line Item 0026)

Unit price payment will be made for costs associated with or incidental to processing, transportation, and placement of permanent geotextile, bedding stone and import riprap on the restored embankment slope and the restored channel to the lines and grades shown on the drawings. Compaction and placement of the subgrade will not be paid for under this line item. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.27 Intake and Outlet Channel (Line Item 0027)

Lump sum payment will be made for costs associated with or incidental to excavation, transportation, and disposal of materials; excavation, hauling and stockpiling of topsoil; providing and maintaining access to the work site(s) and disposal area(s); installation of the bulkheads, associated grading; noise control; and, debris removal.

1.5.28 Site Signage (Line Item 0028)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of site signage as shown in the drawings, including all necessary assemblies and appurtenances.

1.5.29 Control Building (Line Item 0029)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of the control building.

1.5.30 Electrical and Telecommunications Work and Equipment (Line Item 0030)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of electrical and telecommunication equipment including antenna and solar panel pole.

1.5.31 Sodding (Line Item 0031)

Unit price payment will be made for costs associated with or incidental to placement and establishment of sod. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.32 Temporary Safety Barrier (Line Item 0032)

Lump sum payment will be made for costs associated with or incidental to furnishing, installation, maintenance and removal of a temporary safety barrier.

1.5.33 Electrical Utilities (Line Item 0033)

Payment will include full compensation for the charges paid to the utility company by the Contractor for furnishing all materials, equipment, and labor required to install electrical utility services in accordance with detailed work as shown in the drawings. Payment will be made for actual cost incurred for utility relocation and installation. Actual cost incurred will be based on utility invoices indicated in paragraph SUBMITTALS above.

1.5.34 Dual Leaf Gates (Line Item 0034)

Unit price payment will be made for costs associated with or incidental to installation of the manually operated double leaf gate systems including gate hardware and accessories. Measurement will be by the number of gates installed. Unit of measure is each.

1.5.35 Abandonment Grouting (Line Item 0035)

Unit price payment will be made for costs associated with or incidental to fully grouting culverts to be abandoned. Measurement will be made by the pumped volume of grout required to fill the culverts. Unit of measure is cubic yard.

1.5.36 Stilling Wells (Line Item 0036)

Lump sum payment will be made for costs associated with or incidental to furnishing and installation of stilling wells, including metal grates, pre-cast concrete piles, and hand-rails.

1.5.37 Embankment Seepage Protection (Line Item 0037)

Unit price payment will be made for costs associated with or incidental to the placement of seepage protection features on the landside of the culvert abandonment phase, including bedding stone, filter soil, riprap, and

geotextile. Measurement will be made by the area placed. The unit of measure is square yard.

1.5.38 Contracting Officer's Field Office (Line Item ~~0036~~ 0038)

Unit price payment will be made for costs associated with or incidental to providing, maintaining, and final disposition of the Contracting Officer's field office including all costs for rent and provision of all services indicated in Section 01 52 10 CONTRACTING OFFICER'S FIELD OFFICE. Costs for such provision and maintenance of the Contractor's own field office and other facilities will not be paid for under this line item. Measurement will be the amount of time that the Contracting Officer's field office is available to the Government within the duration of the contract. Unit of measure is by month.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PAYMENT PROCEDURES

Upon receiving initial Resident Management System import file, go to "Pay Activities" and establish a link between bid breakdown schedule of values of "Pay Activities" to contract CLINs using "Schedule Activities" data entry page.

3.1.1 Requesting Progress Payment

For progress payments, ensure "Activity Schedule", "Feature Schedule", submittal register, and punchlists are all up to date. Use "Progress Payments" to "request Activity Earnings" for both "Activity Earnings" data entry page and "Other Earning". Provide hard copies of supporting invoices and quantity measurements to support all requested earnings. Ensure that sum of payment activities do not exceed contract award CLIN funding amounts, or "unbalanced" CLINs error will prevent processing the payment.

3.1.2 Options and Modification CLINs

When additional work is added by modification, existing CLINs funding amounts must be updated, or new CLINs for modification will be created. If contract has option CLINs not yet awarded, option CLINs will appear as zero dollar CLINs until option is awarded by modification. No payment may be requested for Options or Modification CLINs until contract modification has been funded and signed.

-- End of Section --

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SECTION 05 50 15

CIVIL WORKS FABRICATIONS

PART 1 GENERAL

1.1 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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303 (2010) Code of Standard Practice for Steel Buildings and Bridges

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2012; Errata 2011) Structural Welding Code - Steel

AWS D1.2/D1.2M (2008) Structural Welding Code - Aluminum

AWS D1.6/D1.6M (2007) Structural Welding Code - Stainless Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2010) Square and Hex Bolts and Screws (Inch Series)

ASME B18.2.2 (2010) Standard for Square and Hex Nuts

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASME B18.3 (2003; R 2008) Socket Cap Shoulder and Set Screws, Hex and Spline Keys (Inch Series)

ASME B18.6.2 (1998; R 2010) Slotted Head Cap Screws, Square Head Set Screws, and Slotted Headless Set Screws: Inch Series

ASME B18.6.3 (2010) Machine Screws, Tapping Screws, and Machine Drive Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A1 (2000; R 2010) Standard Specification for Carbon Steel Tee Rails

ASTM A123/A123M (2012) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A240/A240M	(2012a) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A269	(2010) Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
ASTM A276	(2010) Standard Specification for Stainless Steel Bars and Shapes
ASTM A29/A29M	(2012) Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought General Requirements for
ASTM A307	(2012) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A312/A312M	(2012) Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A320/A320M	(2011a) Standard Specification for Alloy/Steel and Stainless Steel Bolting Materials for Low-Temperature Service
ASTM A322	(2007) Standard Specification Steel Bars, Alloy, Standard Grades
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A36/A36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A484/A484M	(2012) Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings
ASTM A490	(2012) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A493	(2009; R 2013) Standard Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
ASTM A500/A500M	(2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A572/A572M	(2012) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A576	(1990b; R 2012) Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A752	(2004; R 2010) Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Alloy Steel
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A786/A786M	(2005; R 2009) Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
ASTM A924/A924M	(2010a) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B148	(1997; R 2009) Standard Specification for Aluminum-Bronze Sand Castings
ASTM B209	(2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B211	(2012) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire
ASTM B241/B241M	(2012) Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
ASTM B271	(2011) Standard Specification for Copper-Base Alloy Centrifugal Castings
ASTM B308/B308M	(2010) Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
ASTM B505/B505M	(2012a) Standard Specification for Copper-Base Alloy Continuous Castings
ASTM C955	(2011c) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and

Bracing or Bridging for Screw Application  
of Gypsum Panel Products and Metal Plaster  
Bases

ASTM D1187/D1187M

(1997; E 2011; R 2011) Asphalt-Base  
Emulsions for Use as Protective Coatings  
for Metal

ASTM F436

(2011) Hardened Steel Washers

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531

(2009) Metal Bar Grating Manual

NAAMM MBG 531S

(1989) Guide Specification for Stainless  
Steel Grating

RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC)

RCSC S348

(2004) RCSC Specification for Structural  
Joints Using ASTM A325 or A490 Bolts

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J514

(2012) Hydraulic Tube Fittings

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 20

(2002; E 2004) Zinc-Rich Primers (Type I,  
Inorganic, and Type II, Organic)

SSPC Paint 29

(2002; E 2004) Zinc Dust Sacrificial  
Primer, Performance-Based

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1

Safety and Health Requirements Manual

The most recent USACE EM 385-1-1 can be viewed at the web site indicated in  
Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410

(Rev G) Wire Rope and Strand

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;  
submittals not having a "G" designation are for information only. When  
used, a designation following the "G" designation identifies the office  
that will review the submittal for the Government. Submit the following in  
accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Quality Control Plan; G, DO  
Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

Submit fabrication drawings showing layout(s), member sizing, description of connections to structural system, and anchoring details as specified in AISC 303. Drawings shall be signed and sealed by a qualified Licensed Professional Engineer registered in the state of Florida and experienced in the design of metal fabrications.

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the culverts construction.

Control Dimensions; G, DO

#### SD-03 Product Data

Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

Lists of materials and records which identify the disposition of approved material and fabricated items in the work. Also comply with Product Data as specified in Section 05 50 14 STRUCTURAL METAL FABRICATION.

#### SD-06 Test Reports

Miscellaneous Metals & Standard Metal Articles; G, DO  
Shop Fabricated Metal Items; G, DO

#### SD-07 Certificates

NDT Equipment Calibration Records; G, DO  
Welder Qualification Records; G, DO  
Inspector Qualifications; G, DO

#### SD-08 Manufacturer's Instructions

Welding Procedure Specifications; G, DO  
NDT Written Practice; G, DO

### 1.3 QUALITY ASSURANCE

Material shall be straight before being laid off or worked. If straightening is necessary, it shall be done by methods that will not impair the metal. Sharp kinks or bends will be cause for rejection of the material. Material with welds will not be accepted except where welding is definitely specified, indicated or otherwise approved. Bends shall be made by approved dies, press brakes or bending rolls. Where heating is required, precautions shall be taken to avoid overheating the metal and it shall be allowed to cool in a manner that will not impair the original properties of the metal. Shearing shall be accurate and all portions of the work shall be neatly finished. Corners shall be square and true unless otherwise shown. Re-entrant cuts shall be filleted round to a minimum radius in accordance with AWS D1.1/D1.1M unless otherwise indicated or approved. Members shall be free of twists, bends and deformation. Straighten material without shearing, fracturing, stressing, or damaging the bolts, welds, or base metal. Use heat straightening methods approved by the Engineer. Replace material damaged during straightening operations with new material at no additional cost to the Government. Do not heat

metal to temperatures greater than 1200 degrees F. The use of cutting heads for heating and straightening will not be permitted. After heating and straightening, allow the metal to slowly cool to ambient before inspecting for evidence of fracture or other damage. If the Engineer determines it is not possible to straighten a member as part of an assembly, remove the bent material from the assembly, straighten, and re-assemble or replace the component as required by the Engineer.

a. Diminsional Tolerances for Structural Work.

(1) The overall dimensions of an assembled structural unit shall be within the tolerances indicated on the drawings or as specified for the item of work. Where tolerances are not specified in other sections of these specifications or shown, a variation of 1/32 inch is permissible in the overall length of component members with both ends milled, and component members without milled ends shall not deviate from the dimensions shown by not more than 1/16 inch for members 30 feet or less in length and by not more than 1/8 inch for members over 30 feet in length.

(2) Structure dimensions indicated on the drawings are based on a structure temperature of 70 degrees F. The Contractor shall be responsible for any and all dimensional adjustments to compensate for actual temperature variations during construction. Measure tolerances of the final assembly with the structure in the orientation in which it will be used.

b. Structural Steel Fabrication. Structural steel may be cut by mechanically guided or hand-guided torches, provided an accurate profile with a surface that is smooth and free from cracks and notches is obtained. Surfaces and edges must be prepared in accordance with AWS D1.1/D1.1M. Hand-guided cuts must be chipped, ground or machined to sound metal.

c. Seal Welding. See drawings for areas that require seal welding.

d. Qualify welders, perform welding, welding inspection, and corrective welding, in accordance with AWS D1.1/D1.1M, AWS D1.2/D1.2M and AWS D1.6/D1.6M. GRIND ALL BUTT WELDS FLUSH IN THE FINISHED INSTALLATION. Use procedures, materials, and equipment of the type required for the work.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F above the dew point of the surrounding air, or when surface temperature is below 45 degrees F or over 95 degrees F, unless approved by the Contracting Officer.

PART 2 PRODUCTS

2.1 MISCELLANEOUS METALS & STANDARD METAL ARTICLES

Conform to the respective specifications and other designated requirements for miscellaneous metal materials and standard metal articles. Sizes shall be as specified or shown. Where material requirements are not specified, furnish materials suitable for the intended use and subject to approval.

2.1.1 Structural Steel

ASTM A572/A572M, Grade 50.

2.1.2 Steel Plates

2.1.2.1 Structural

ASTM A572/A572M, Grade 50.

2.1.3 Steel Pipes

2.1.3.1 Posts and Rails

ASTM A53/A53M, Type S, Grade B, or ASTM A500/A500M Grade C, seamless galvanized, nominal size and weight class or outside diameter and nominal wall thickness as shown, plain ends.

2.1.4 Stainless Steel

2.1.4.1 Plate, Sheet, and Strip

ASTM A240/A240M, UNS S30403 or S31603. Plate finish shall be hot-rolled and annealed or heat treated, and blast cleaned or pickled. Provide No. 1 sheet and strip finish.

2.1.4.2 Bars and Shapes

ASTM A276, UNS S30403 or S31603 with a maximum carbon content of 0.08 percent, Condition A, hot-finished or cold-finished, Class C.

2.1.4.3 Roller Axle, Shaft, Pins

ASTM A276, UNS S20910, Condition A, cold-finished or hot-rolled and machine-finished to the tolerances specified in ASTM A484/A484M for cold-finished round bars, Class C.

2.1.4.4 Grease Fittings

Heavy-duty, push type, with built-in flush ball check. The stainless steel fittings shall be straight or 90 degree angle style as required by the installation.

2.1.4.5 Tubing and Fittings

Tubing shall be stainless steel, Type 304 or 316, ASTM A269, full finished welded or seamless drawn, annealed and pickled. Tube fittings shall be of stainless steel type 304 and shall be of the flareless type with SAE straight threads and Buna N or Viton O-ring seals. The fittings shall conform with SAE J514. Allowable Working Pressure rating shall be 4000 psi, minimum.

2.1.4.6 Pipe

ASTM A312/A312M, seamless, UNS S30400, NPS and schedule number or outside diameter and nominal wall thickness as shown.

#### 2.1.4.7 Sleeves and Shaft Collars

Sleeves and shaft collars shall be stainless steel, Type 316L, [ASTM A276](#), Condition A, cold finished and machine finished as shown on the drawings.

#### 2.1.5 Steel Machinery

##### 2.1.5.1 Sleeves and Shaft Collars

[ASTM A29/A29M](#), [ASTM A576](#) UNS G 10400 with a minimum tensile strength of 87,000 psi, yield strength of 52,500, and Brinell Hardness of 180.

##### 2.1.5.2 Rods, Rocker, Arm, Cam

[ASTM A322](#), [ASTM A752](#) UNS G 4140 with a minimum tensile strength of 98,000 psi, yield strength of 61,000 psi, and Brinell Hardness of 197.

##### 2.1.5.3 Pickup Beam Rollers

[ASTM A322](#) UNS G 43400 with a minimum tensile strength of 106,000 psi, yield strength of 85,500 psi and Brinell Hardness of 217.

#### 2.1.6 Aluminum

##### 2.1.6.1 Sheets and Plates

[ASTM B209](#), Alloy 6061, Temper T6.

##### 2.1.6.2 Bars, Rods and Wire

[ASTM B211](#), Alloy 6061, Temper T6.

##### 2.1.6.3 Structural Shapes

[ASTM B308/B308M](#), Alloy 6061, Temper T6.

##### 2.1.6.4 Pipes and Tubes

[ASTM B241/B241M](#), Alloy 6063, Temper T6, size and schedule number or outside diameter and wall thickness as shown.

#### 2.1.7 Aluminum Bronze Rods, Bars, Shapes and Bushings

##### 2.1.7.1 Bushings

[ASTM B148](#), Copper Alloy UNS No. C95400. [ASTM B505/B505M](#)

##### 2.1.7.2 Sleeve (SAE 660)

[ASTM B505/B505M](#). [ASTM B271](#), Copper Alloy UNS C93200.

#### 2.1.8 Ductile Iron Casting

[ASTM A536](#) Grade 80-55-06.

#### 2.1.9 Bolts, Nuts, and Washers

Bolts, nuts, and washers shall be of the material, grade, type, class, style and finish indicated or best suited for intended use.



2.1.9.1 High-Strength Bolts, Nuts, and Washers

- a. [ASTM A325](#), Type 1, hot-dip galvanized or [ASTM A490](#), Type 1.
- b. Meet the requirements of [RCSC S348](#) for Slip Critical Connections. Conduct Rotational-capacity testing for all fastener assemblies. Test as an assembly each combination of bolt production lot, nut lot, and washer lot. Assign a rotational-capacity lot number to each combination of lots tested. Test bolts in a Skidmore-Wilhelm Calibrator or an acceptable equivalent device.

2.1.9.2 Bolts, Nuts, and Washers (Other Than High-Strength)

- a. Bolts and Nuts - [ASTM A307](#), Grade A, hot-dip galvanized or [ASTM A320/A320M](#), Ferritic Steel, Grade L73 Austenitic Steel, Class 2.
- b. Bolts - [ASME B18.2.1](#).
- c. Nuts - [ASME B18.2.2](#).
- d. Washers
  - (1) Plain Washers - [ASME B18.21.1](#), Type B.
  - (2) Lock Washer - [ASME B18.21.1](#).
  - (3) Beveled Washers - [ASTM F436](#), Type 1, Beveled.

2.1.10 Screws

Provide screws of the material, grade, type, style, and finish indicated or best suited for use intended.

2.1.10.1 Cap Screws

[ASME B18.2.1](#), [ASME B18.3](#), or [ASME B18.6.2](#) as required.

2.1.10.2 Machine Screws

[ASME B18.6.3](#).

2.1.10.3 Set Screws

[ASME B18.6.2](#).

2.1.11 Expansion Anchors

Type 304 or 316 stainless steel.

2.1.12 Safety Treads

Provide slip-on skid resistant treads made from aluminum alloy as best suited for the intended location.

2.1.13 Wire Rope

[FS RR-W-410](#), Type I, Class 2, Construction IWRC, 0.50 inch diameter with a minimum breaking strength of 22,800 pounds.

#### 2.1.14 Steel Rails

ASTM A1, ASCE 60 pound, as shown.

#### 2.1.15 Gratings

NAAMM MBG 531 and NAAMM MBG 531S.

a. Description of grating: W-19-4 (2 x 3/16) stainless steel 304L or 316L.

b. Anchorage: Grating shall be anchored to the support frame with removable fasteners.

c. Finish: stainless steel.

#### 2.1.16 Steel Floor Plate

ASTM A786/A786M, Pattern No. 5.

#### 2.1.17 Submittals Requirements

This applies to SHOP FABRICATED METAL ITEMS also. Submit the following:

a. Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Include in the drawings catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items: slide/flap gate and actuator, manatee screen, gate recess armor, thimble, and bulkhead seal plates.

b. Lists of materials, and records which identify the disposition of approved material and fabricated items in the work.

c. Certified test reports for materials tests and analyses.

#### 2.1.18 Stainless Steel Studs

Studs shall be made from cold drawn bar stock conforming to ASTM A493 or ASTM A276. The following 300-series alloys may be used; 304L and 316L or the low carbon version thereof. Other Type 300 series alloys may be used with the approval of the Contracting Officer; however, Type 303 shall not be used. Where studs are to be cyclically loaded, they shall be tested and furnished in the annealed condition.

### 2.2 SHOP FABRICATED METAL ITEMS

Conform shop fabricated metal items to the requirements and details as specified or shown and to the workmanship provisions and other applicable fabrication requirements as specified in Section 05 50 14 STRUCTURAL METAL FABRICATIONS.

#### 2.2.1 Railings

Provide railings as type specified and show, furnish, and install complete with all fittings, brackets, fasteners, sleeves, anchors, and other appurtenances as shown and as required for proper installation. Design handrails to resist a minimum concentrated load of 200 lbf in any direction

at any point of the top of the rail or 50 lb/ft applied horizontally to top of the rail, whichever is more severe.

#### 2.2.1.1 Materials

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A53/A53M, Grade B, Schedule 80; or ASTM A500/A500M, Grade B, minimum 0.200 inch wall thickness. Provide steel railings with 1-1/2 inch nominal size. Railings shall be hot-dip galvanized. Pipe collars shall be hot-dip galvanized steel. Provide all fasteners of Series 300 stainless steel.

#### 2.2.1.2 Fabrication

Rigid joints in railings shall be of welded assembly and be flush-finished. Reinforce welded joints with tight-fitting interior sleeves assembled by welding rails and posts to flush-type fittings, or by mitering and welding joining rails and posts. Provide stainless steel fasteners for steel fittings. Expansion joints in railings shall be an inner-sleeved slip-joint, with one end of the sleeve secured to one rail and the ends of the adjoining rails separated a minimum of 1 inch in the installed position. Locate expansion joints in rails near the intersection of rails and posts. Make bends in railings in a manner that railings are not crushed and maintain their original cross-sectional shape. Ground welds smooth. Provide railings free of burrs, sharp corners, and sharp edges. For railings of other than welded assembly, manufacturer design calculations, showing that the installed railings are capable of withstanding a design working load of 200 lbf applied in any direction at any point on the top rail without permanent deformation, shall be submitted and approved prior to installation.

#### 2.2.2 Gratings and Cover Plates

Provide grating and cover plates of the material and size shown, and fabricated in sectional panels of the width and length shown, or as appropriate, to accurately fit within the supporting recess frames. Provide openings through panels as shown or as required.

##### 2.2.2.1 Grating

Gratings are as specified in previous paragraph titled GRATINGS. Band edges of gratings and openings through gratings which require the cutting of more than one bearing bar. Provide fasteners of the type recommended by the manufacturer and approved. Provide nonslip nosing on stair tread gratings.

##### 2.2.2.2 Cover Plates

Provide cover plates as specified in paragraph titled STEEL FLOOR PLATE. Provide cover plate panels with holes for insertion of removal tool as shown. Remove sharp edges and burrs from plates.

#### 2.2.3 Steel Stairs

Provide steel stairs complete with structural or formed channel stringers, grating treads, slip-resistant metallic treads, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Close exposed ends of stringers and continue around landings which they support. Conform to ASTM A36/A36M for structural steel. Stairs and accessories

shall be galvanized after fabrication. Integral nosings shall have braces extended into the concrete fill. Fabricate stair treads and landings of steel gratings of the type specified in paragraph GRATING. Provide grating treads with slip-resistant nosings. Provide bolts, nuts and other fastenings as shown and as required for proper installation. Use lock washers under all nuts. Anchor railings of the type specified above in paragraph RAILINGS to stairs as shown.

#### 2.2.4 Recess Frames

Fabricate recess frames of structural shapes of the type shown. Grind welded joints in frames smooth. Anchor frames to supports in the manner shown and not be continuous across contraction or expansion joints.

#### 2.2.5 Ladders

Provide fixed-rail metal ladders conforming to the requirements of [EM 385-1-1](#) and to details shown. Fabricate ladders of aluminum as shown. Fabrication of ladders shall consist of solid-section rod rungs fitted into holes in bar side rails and welded. Make splices in side rails using full penetration welds and provide a flush and smooth transition between connecting ends. Grind all welds smooth. Weld ladder rails to bent-bar supporting brackets anchored to supporting structure as shown. The Contractor shall install a rigid rail fall protection system as shown.

#### 2.2.6 Ladder Rungs, Grab Bars, Safety Fall Arrest Anchors

Fabricate Ladder rungs, grab bars, and safety fall arrest anchors from stainless steel rods in accordance with [ASTM C955](#), Grade 75, Alloy S31653 or S31803.

#### 2.2.7 Surface Finishes

##### 2.2.7.1 Galvanizing and Zinc Repair

Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanize in accordance with [ASTM A123/A123M](#), [ASTM A653/A653M](#), or [ASTM A924/A924M](#), as applicable. Regalvanize areas where zinc coatings are destroyed by cutting, welding or other causes. Coatings **2 ounces** or heavier shall be regalvanized with a suitable low-melting zinc base alloy similar to the recommendations of the American Hot-Dip Galvanizers Association to the thickness and quality specified for the original zinc coating. Repair coatings less than **2 ounces** in accordance with [ASTM A780/A780M](#).

##### 2.2.7.2 Nonferrous Metal Surfaces

Protect by plating, anodic, or organic coatings.

##### 2.2.7.3 Aluminum Surfaces

Before finishes are applied, remove roll marks, scratches, rolled-in scratches, kinks, stains, pits, orange peel, die marks, structural streaks, and other defects which will affect uniform appearance of finished surfaces. Unexposed sheet, plate and extrusions may have mill finish as fabricated. Unless otherwise specified, provide all other aluminum items with standard mill finish.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Install items at locations indicated, according to manufacturer's instructions. Verify all measurements and take all field measurements necessary before fabrication. Exposed fastenings shall be compatible materials, generally match in color and finish, and harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners will be cause for rejection. Conceal fastenings where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Form joints exposed to the weather to exclude water. Items listed below require additional procedures.

### 3.2 ANCHORAGE, FASTENINGS, AND CONNECTIONS

Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.

### 3.3 FINISHES

#### 3.3.1 Dissimilar Materials

Where dissimilar metals are in contact, protect surfaces with a coat conforming to [SSPC Paint 20](#) or [SSPC Paint 29](#) to prevent galvanic or corrosive action. Where aluminum is in contact with concrete, plaster, mortar, masonry, wood, or absorptive materials subject to wetting, protect with [ASTM D1187/D1187M](#), asphalt-base emulsion.

#### 3.3.2 Field Preparation

Remove rust preventive coating just prior to field erection, using a remover approved by the rust preventive manufacturer. Provide surfaces, when assembled, free of rust, grease, dirt and other foreign matter.

### 3.4 ATTACHMENT OF HANDRAILS

Install railings as specified and shown. Railing posts anchored to concrete surfaces perpendicular to the posts shall be as shown. Railing posts anchored to structural metal shall be rigidly secured to flange fittings to structural metal. Rigidly secure ends of rails anchored to concrete or masonry to flange fittings anchored to concrete or masonry with expansion anchors. Install toeboards and brackets where indicated. Splices, where required, shall be made at expansion joints. Install removable sections as indicated.

#### 3.4.1 Installation of Steel Handrails

Perform installation by means shown. Secure rail ends by steel pipe flanges anchored by expansion shields and bolts.

### 3.5 COVER PLATES AND FRAMES

Install the tops of cover plates and frames flush with floor.

### 3.6 LADDERS

Secure to the adjacent construction with the clip angles attached to the stringer. Secure to masonry or concrete with not less than two 1/2 inch diameter expansion bolts. Install intermediate clip angles not over 48 inches on center. Install brackets as required for securing of ladders welded or bolted to structural steel or built into the masonry or concrete.

### 3.7 STEEL STAIRS

Provide anchor bolts, grating fasteners, washers, and all parts or devices necessary for proper installation. Provide lock washers under nuts.

### 3.8 INSTALLATION OF GUARD POSTS (BOLLARDS/PIPE GUARDS)

Set pipe guards vertically in concrete piers. Piers shall be constructed as shown.

-- End of Section --

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SECTION 31 62 13

PRESTRESSED CONCRETE PILES

PART 1 GENERAL

1.1 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 CONCRETE INSTITUTE INTERNATIONAL (ACI)

- |           |  |
|-----------|--|
| ACI 214R  | (2011) Evaluation of Strength Test Results of Concrete   |
| ACI 304R  | (2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete                     |
| ACI 318   | (2011; Errata 2011; Errata 2012) Building Code Requirements for Structural Concrete and Commentary |
| ACI SP-66 | (2004) ACI Detailing Manual  |

AMERICAN WELDING SOCIETY (AWS)

- |          |   |
|----------|---|
| AWS D1.4 | (2005; Errata 2005) Structural Welding Code - Reinforcing Steel |
|----------|---|

ASTM INTERNATIONAL (ASTM)

- |                 |   |
|-----------------|---|
| ASTM A416/A416M | (2012) Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete      |
| ASTM A421/A421M | (2010) Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete    |
| ASTM A615/A615M | (2012) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement |
| ASTM A82/A82M   | (2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement                   |
| ASTM C136       | (2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates                      |
| ASTM C143/C143M | (2012) Standard Test Method for Slump of Hydraulic-Cement Concrete                                |
| ASTM C150/C150M | (2012) Standard Specification for Portland Cement   |

ASTM C172	(2010) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C260/C260M	(2010a) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C31/C31M	(2012) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2012) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2013) Standard Specification for Chemical Admixtures for Concrete
ASTM C566	(2013) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C666/C666M	(2003; R 2008) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C70	(2013) Standard Test Method for Surface Moisture in Fine Aggregate
ASTM D4945	(2012) High-Strain Dynamic Testing of Piles
ASTM G109	(2007) Determining the Effects of Chemical Admixtures on the Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments E(2000)

PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI JR-119	Grouting of Post-Tensioned Prestressed Concrete
PCI MNL-116	(1999) Manual for Quality Control for Plants and Production of Structural Precast Concrete Products, 4th Edition
PCI STD-112	(1984) Standard Prestressed Concrete Piles Square, Octagonal and Cylinder

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation; G, DO

Drawings including shop and erection details and details of collars, shoes, splices, build-ups and embedded or attached lifting devices, prior to commencing the work or ordering materials. Drawings shall indicate pick-up and support points for piles. Reinforcing steel details shall conform to **ACI SP-66**.

Pile Driving; G, DO

A complete and accurate record of all driven piles. The record shall include the pile number or identification, location, size, length, elevation of tip and top of pile, and the number of blows required for each foot of penetration throughout the entire length of the pile, and the number of blows per inch for the last **18 inches** of penetration. The record shall include the type and size of the hammer, the rate of operation, the type and dimensions of driving helmet, and the cap-block and pile cushion used. Any unusual occurrence during driving of the pile shall be recorded and immediately reported to the Contracting Officer. The Contractor shall notify the Contracting Officer 10 days prior to the driving of piles.

Wave Equation Analysis; G, DO

Submit wave equation analysis including pile driving criteria at least 30 days prior to installing any test piles. Revise analysis based on the results of pile load test program and submit updated analysis prior to driving permanent piles.

Professional Engineer; G, DO

The Contractor shall submit a letter certifying who will be the Professional Engineer with a minimum of 5 years of pile design and construction experience, licensed in the state of Florida, who will perform design work related to this section, and sign and seal calculations and as-built drawings/conditions for that work.

SD-03 Product Data

Pile Driving Equipment; G, DO

Submit descriptions of pile driving equipment to be employed in the work, 10 days prior to commencement of pile installations, including details of the pile hammer, power plant, lead, cushion material, cap block, and helmet.

Epoxy Bonding Compound for Pile Build-Ups; G, DO

SD-05 Design Data

Calculations; G, DO

Submit calculations showing the pile is capable of handling ultimate loadings specified in subparagraph "Pretensioned Piles" below prior to commencing work or ordering materials. Calculations shall be signed and sealed by the Professional Engineer indicated in the above submittal.

#### SD-06 Test Reports

Pile Dynamic Test Reports; G, DO

Field Tests and Inspections; G, DO

Pile Dynamic Test Reports: A complete report on the dynamically test piles including, but not limited to, a description of the pile driving equipment, driving records, complete test data, analysis of test data, and recommended pile driving criteria for permanent piles within 10 days of completion of dynamic test. The report shall be prepared by or under the direct supervision of a registered professional engineer experienced in pile dynamic load testing and analysis. The Pile Testing Engineer shall be employed by the Contractor with the approval of the Contracting Officer's Representative.

Material Test Reports: Copies of material test reports including concrete compression and mix proportioning studies, within 24 hours after completion of tests.

Aggregates; G, DO

Silica Fume; G, DO

Concrete Compressive Strength; G, DO

Test piles; G, DO

Load tests; G, DO

Submit concrete cylinder compressive strength test results.  
Submit test pile records and load test data.

Dynamic Pile Analysis; G, DO

Submit a summary report of dynamic test results for test piles within 7 calendar days of completing field work. For permanent piles, submit a field summary report within one (1) day of testing. Submit a typed report summarizing the results of dynamic testing of permanent piles on a monthly basis.

#### SD-07 Certificates

Aggregates; G, RO

Admixtures; G, RO

Silica fume manufacturer's representative; G, RO

Prestressing steel; G, RO

Cement; G, RO

Fly ash and pozzolan; G, RO

Ground Slag; G, RO

Epoxy coating; G, RO

Load Test Supporting Data; G, RO

SD-11 Closeout Submittals

File records; G, DO

Submit pile and test pile records. Submit load test data and results.

### 1.3 QUALIFICATIONS

The work shall be performed by a firm specializing in the specified foundation system and having 5 years experience in constructing and installing the specified foundation system under similar subsurface conditions.

### 1.4 SUBSURFACE DATA

Subsurface soil data logs are shown in Section 00 31 32 GEOTECHNICAL DATA.

### 1.5 DELIVERY, STORAGE, AND HANDLING

Piles shall be stored, handled, and transported in accordance with **PCI MNL-116** except as follows. Methods used for handling and storage of piles shall be such that the piles are not subjected to excessive bending stress, cracking, spalling, or other damage.

#### 1.5.1 Damaged Piles

The Contractor shall inspect each pile for sweep and structural damage such as cracking and spalling before transporting them to the project site and immediately prior to placement in the driving leads. Any unusual cracks (cracks other than crazing, surface drying, shrinkage cracks and end cracks) shall be brought to the attention of the Contracting Officer. Piles which are damaged during delivery, storage, or handling to the extent they are rendered unsuitable for the work, in the opinion of the Contracting Officer, shall be rejected and removed from the project site, or may be repaired, if approved, at no cost to the Government.

##### 1.5.1.1 Repairable Cracks

Piles with cracks equal to or greater than **0.006 inches** but less than **0.06 inches** shall be rejected or repaired. As an alternate to pile rejection, the Contractor may submit a proposal to repair deficient piles, which shall be restored prior to driving to provide its required design capacity, perform its intended function in the structure, and take into consideration long term durability in corrosive environment.

##### 1.5.1.2 Non-Repairable Cracks

Piles with cracks equal to or greater than **0.06 inches** shall be rejected.

#### 1.5.2 Pile Sweep

Sweep shall be limited to **1/8 inch per 10 feet** over the length of the pile. Piles having excessive sweep shall be rejected.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Admixtures

Chemical admixtures shall conform to [ASTM C494/C494M](#). Air-entraining admixture shall conform to [ASTM C260/C260M](#). Admixtures containing chlorides shall not be used.

##### 2.1.1.1 Corrosion Inhibitors

Corrosion inhibitors shall meet the requirements of [ASTM G109](#) and all requirements in this section. Calcium nitrite is a chemically reactive admixture used in concrete to inhibit the corrosion of embedded reinforcing steel and other metallic components. The calcium nitrite supplier shall furnish the Contracting Officer with test certificates from an independent laboratory indicating compliance with this specification. The test certificates shall include corrosion inhibiting properties per [ASTM G109](#) and results of physical tests included in this section. Calcium nitrite shall be supplied by the same manufacturing source throughout the project. If a single primary source of calcium nitrite cannot be maintained throughout the project, new test certificates shall be submitted. The Contracting Officer will determine specification compliance of a new supplier's product, and evaluate the effectiveness of the new calcium nitrite product before approving the source.

The active ingredient shall be calcium nitrite  $\text{Ca}(\text{NO}_2)_2$ . The calcium nitrite shall be furnished in solution containing not less than 29 percent calcium nitrite solids. The concentration of the calcium nitrite solution shall be verified by spectrophotometric analysis or other comparable methods. A volume of one gallon of calcium nitrite solution shall weigh within the range of 10.40 to 11.92 pounds. The calcium nitrite solution shall be added to the concrete mixture at a rate of 4.50 to 4.60 gallons per cubic yard of concrete. The addition of calcium nitrite to the concrete mix shall not adversely affect the properties of fresh and hardened concrete. Calcium Nitrite concrete shall meet the following physical requirements when mixed and tested in accordance with [ASTM C494/C494M](#):

- a. Water Content percent of control 95 to 100.
- b. Time of setting, allowable deviation from control no more than 1 hour earlier nor 1 hour and 30 minutes later, initial and final.
- c. Compressive strength, minimum of 100 percent of control for all ages.
- d. Flexural strength, minimum of 100 percent of control for all ages.
- e. Length change, max shrinkage (alternative requirements), 135 percent of control.
- f. Increase over control, 0.010.
- g. Relative durability factor, minimum of 80.

##### 2.1.2 Aggregates

###### 2.1.2.1 General Requirements

Aggregates shall conform to [ASTM C33/C33M](#), except as specified otherwise herein. Aggregates shall be free from any substance which may be deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of the concrete.

#### 2.1.2.2 Fine Aggregates

Fine aggregates from different sources of supply shall not be mixed or stored in the same stock pile, or used alternately in the same concrete mix or the same structure without approval. The fineness MODULUS of fine aggregate shall be not less than 2.40 or greater than 3.0. For piles that will be exposed to freezing and thawing, fine and coarse aggregate subjected to five cycles of the sodium sulfate soundness test shall show a loss not greater than 10 percent. If the selected aggregates fail the soundness test, the Contractor may use the aggregate source, provided concrete specimens made with the aggregates to be used for the piles shall have a durability factor of not less than 80 based on 300 cycles of freezing and thawing when tested in accordance with [ASTM C666/C666M](#).

#### 2.1.3 Anchorage

Anchorage and end fittings for post-tension assemblies shall conform to [ACI 318](#).

#### 2.1.4 Cement

Cement shall conform to [ASTM C150/C150M](#). Type II or Type III (with a maximum tricalcium aluminate (C3A) content of 8 percent and low alkali) cement, a minimum cementitious materials content of [658 pounds per cubic yard](#) and a maximum water to cementitious materials ratio of 0.40.

#### 2.1.5 Grout

Grout materials used in prestressed piles shall conform to the requirements specified herein for concrete mixes. Grout for post-tensioned ducts and bonds shall conform to [PCI JR-119](#). Admixtures, when required for grout, shall have no injurious effects on steel or concrete. Calcium chloride shall not be used.

#### 2.1.6 Prestressing Steel

Prestressing steel shall be seven-wire stress-relieved strand conforming to [ASTM A416/A416M](#) or stress-relieved wire conforming to [ASTM A421/A421M](#), Type WA. The minimum ultimate strength shall be [250,000 psi](#). Prestressing steel shall be free from grease, oil, wax, paint, soil, dirt, loose rust, kinks, bends, or other defects.

#### 2.1.7 Reinforcing Steel

Non-prestressed reinforcing steel shall conform to [ASTM A615/A615M](#) Grade 60. Welding of reinforcing steel shall be in accordance with [AWS D1.4](#).

#### 2.1.8 Ties and Spirals

Steel for ties and spirals shall conform to [ASTM A82/A82M](#).

#### 2.1.9 Water

Water for mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalies, salts, organic materials, or other substances that may be deleterious to concrete or steel. Mortar cubes made with nonpotable mixing water shall have 7-day and 28-day strengths equal to at least 90 percent of the strengths of similar specimens made with potable water.

## 2.2 MANUFACTURED UNITS - GENERAL REQUIREMENTS

Concrete piles shall be designed and fabricated by a precast concrete manufacturer certified under the PCI Plant Certification Program.

### 2.2.1 Pretensioned Piles

Pretensioned piles shall be solid and shall be cast as monolithic units of homogenous high-strength concrete from head to tip and stressed with high-tensile cold-drawn stress-relieved steel strands. Piles shall be capable of resisting an ultimate load combination (LRFD) of 10 kips axial, 20 kips lateral and 70 foot-kips bending moment.

### 2.2.2 Conveying

Concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will not cause segregation or loss of ingredients in accordance with [ACI 304R](#). It shall be deposited as nearly as practicable in its final position in the forms. At any point in conveying, the free vertical drop of the concrete shall not exceed [3 feet](#). Chuting will be permitted only where the concrete is deposited into a hopper before it is placed in the forms. Conveying equipment shall be cleaned thoroughly before each run. Concrete shall be deposited as soon as practicable after the forms and the reinforcement have been inspected. Concrete that has segregated in conveying shall be removed.

## 2.3 FABRICATION OF PRETENSIONED PILES

### 2.3.1 Workmanship

Workmanship shall conform to [PCI MNL-116](#). Pile pick-up points shall be located where indicated. Unless special lifting devices are attached for pick-up, pick-up points shall be plainly marked on all piles after removal of the forms, and all lifting shall be done at these points. Piles shall be lifted by a suitable bridge or sling attached to the pick-up points. Piling shall not be driven until the concrete attains a compressive strength of not less than 6,000 [psi](#) as indicated by breaking test cylinders.

### 2.3.2 Forms

Forms shall be of metal, shall be well braced and stiffened against deformation, and shall be accurately constructed and watertight. Forms shall permit movement of the pile without damage during release of the prestressing force. Bottom of the form shall be within [1/4 inch](#) of a true plane in a length of [50 feet](#). Inside forms or void tubes may be of treated fiberboard, plywood, or other material and/or method approved by the Contracting Officer. Void forms shall be anchored firmly so they will not move, float, or collapse during the placing of concrete. If a moving mandrel is used for forming the inner void, special precautions shall be taken to prevent fallout of inner surfaces, tensile cracks, and separation of concrete from strands.

### 2.3.3 Reinforcement and Embedments

Reinforcing steel, prestressing steel, and embedded items shall be accurately positioned in the forms and secured to prevent movement during concrete placement. All steel shall have a minimum concrete cover of [3 inches](#).



#### 2.3.4 Concrete Work

The concrete mix shall have an ultimate compressive strength of 6,000 psi at 28 days and a slump of 2 to 4 inches. Concrete piles exposed to conditions of freezing and thawing shall contain from 4 to 7 percent entrained air provided by the use of an air-entraining admixture conforming to ASTM C260/C260M. Concrete shall not be deposited in the forms until the placement of reinforcement and anchorages has been inspected and approved by the Contracting Officer. Each pile shall be produced of dense concrete with smooth surfaces. Concrete shall be placed promptly after mixing is completed and shall be deposited close to its final position in the form. Vibrator heads shall be smaller than the minimum distance between steel for pretensioning. Dimensional tolerances shall conform to PCI MNL-116. Side forms shall not be removed until concrete has attained 4000 psi compressive strength.

#### 2.3.5 Pretensioning

Pretensioning shall be in accordance with PCI MNL-116. Anchorages for tensioning the prestressing steel shall be a type approved by the Contracting Officer. The tension to which the steel is to be pretensioned shall be measured by the elongation of the steel and verified by the jack pressure reading on a gauge. The gauge shall have been recalibrated by a calibration laboratory approved by the Contracting Officer within 12 months of commencing work and every 6 months thereafter during the term of the contract. Means shall be provided for measuring the elongation of the steel to at least 1/8 inch. When the difference between the results of measurement and gauge reading is more than 5 percent, the cause of the discrepancy shall be corrected. The tensioning steel shall be given a uniform prestress prior to being brought to design prestress. The same initial prestress shall be induced in each unit when several units of prestressing steel in a pile are stretched simultaneously.

#### 2.3.6 Detensioning

Releasing of prestressing force in pretensioned piles shall be performed in a manner that minimizes eccentricity of prestress. Tension in the strands shall be released from the anchorage gradually. In no case shall the stress be released after casting without approval by the Contracting Officer. The transfer of prestressing force shall be done in accordance with the prestressed concrete pile design.

#### 2.3.7 Casting

##### 2.3.7.1 Conveying

Convey concrete to formwork in accordance with PCI MNL-116, and as specified herein. Clean conveying equipment thoroughly before each run. During placing, make any free vertical drop of the concrete less than 3 feet. Remove concrete which has segregated in conveying or placing.

##### 2.3.7.2 Placing and Casting

Perform concrete casting within 3 days after pretensioning steel; however, do not deposit concrete in forms until placement of reinforcement and anchorages has been inspected and approved by pile manufacturer's quality control representative. Produce each pile of dense concrete straight with smooth surfaces with reinforcement retained in its proper position during

fabrication. Use vibrator with heads smaller than the minimum distance between steel for pretensioning. Make surface of pile ends perpendicular to axis of pile. Chamfer, between 3/4 inch and 1 1/4 inch, ends of piles and corners of square piles.

#### 2.3.8 Curing of Piles

Prior to the start of curing operations, the methods and details of curing shall be submitted for record and shall be approved by the Contracting Officers. All piles shall be cured in accordance with Section 4 of [PCI MNL-116](#).

#### 2.3.9 Build-Ups

If, in driving pretensioned piles, the Contracting Officer determines that the pile length is insufficient so that the final elevation of the pile head is below the indicated cut-off elevation, the pile section may be extended to the required elevation by means of a cast-in-place reinforced concrete build-up in accordance with procedures for build-up without driving as detailed in [PCI STD-112](#). Details of means for protecting the joints by a suitable epoxy compound shall be approved by the Contracting Officer. [Epoxy bonding compound for pile build-ups](#) shall have an ultimate compressive strength of 6,000 psi. Build-ups to be driven shall conform to the details of "Build-up with Driving" shown in the standard drawings referenced above. Where build-ups are exposed to water, the Contractor shall protect the cast-in-place section from the water during the curing period. Concrete in build-up shall have a minimum ultimate compressive strength of 6,000 psi. Build-ups will not be permitted on more than 5 percent of the total number of piles. If this percent figure is exceeded or if in the judgment of the Contracting Officer the clustered location of the build-ups is undesirable, piles of insufficient length shall be withdrawn and replaced with longer piles. Payment for such withdrawal and replacement will be made in accordance with the CONTRACT CLAUSES.

#### 2.3.10 Splices

Splices shall not be allowed.

### 2.4 MANUFACTURING CONTROLS

#### 2.4.1 Product Quality Control

Where piling is manufactured in a plant with an established quality control program as attested to by a current certification in the PCI "Certification Program for Quality Control" perform product quality control in accordance with [PCI MNL-116](#). Where piling is manufactured by specialists or in plants not currently enrolled in the PCI "Certification Program for Quality Control," set-up a product quality control system in accordance with [PCI MNL-116](#) and perform concrete and aggregate quality control testing using an independent commercial testing laboratory approved by the Contracting Officer in accordance with the following.

##### 2.4.1.1 Aggregates

Fine and coarse aggregates shall be tested for conformance with [ASTM C33/C33M](#).

#### 2.4.1.2 Cement Test

Cement shall be tested at the mill or at the mixing plant for conformance with [ASTM C150/C150M](#).

#### 2.4.1.3 Mix Proportions

Prior to commencing pile fabrication, the Contractor shall furnish a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete and lightweight concrete, proposed for use. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory. The statement shall also be accompanied by test results demonstrating compliance of aggregate and cement, as specified herein.

#### 2.4.2 Sampling and Testing During Fabrication

##### 2.4.2.1 Aggregate

Twice during each shift when the concrete plant is operating, the gradation of each size of aggregate shall be tested in accordance with [ASTM C136](#). At least one test of moisture content of coarse aggregate, in accordance with [ASTM C566](#), and at least two tests of moisture content of fine aggregate, in accordance with [ASTM C70](#) or [ASTM C566](#), shall be made per shift.

##### 2.4.2.2 Slump and Strength of Concrete

Two slump tests in accordance with [ASTM C143/C143M](#) shall be made for each [50 cubic yards](#) of concrete produced per shift. Samples of fresh concrete shall be taken in accordance with [ASTM C172](#). Cylinders shall be molded and cured in accordance with [ASTM C31/C31M](#), and tested in accordance with [ASTM C39/C39M](#). Samples for each class of concrete shall be taken not less than once a day nor less than once for each [30 cubic yards](#) of concrete placed. Each strength test result shall be the average of two cylinders from the same sample tested at 28 days. Additional specimens shall be molded as needed by the Contractor or pile manufacturer. The Contractor or pile manufacturer shall mold, ship, cure, and test the cylinders. The cylinders shall be cured in the same manner as the piles and shall be placed at the point where the poorest curing conditions are offered. Evaluation of the compressive test results tested at 28 days shall be in accordance with [ACI 214R](#). The Contractor or pile manufacturer shall certify that the sampling and test methods conform to the requirements of [ASTM C31/C31M](#) and [ASTM C39/C39M](#) and that sufficient samples were taken to evaluate the concrete as follows: The average of three consecutive strength tests shall equal or exceed the specified strength and no individual strength test result shall have less than the specified strength by more than 500 [psi](#). All test results shall be submitted to the Contracting Officer.

#### 2.4.3 Changes in Proportions

If the test results of the laboratory cured cylinders at 28 days fall below the specified compressive strength, adjustments in the proportions, the water content, or both shall be made as necessary; if the test results of

the field-cured specimens fall below the specified strength, changes in the casting, handling, or storage method and the moisture and curing procedures of such specimens shall be made as necessary to secure the specified strength. All changes shall be submitted in writing to the Contracting Officer. The slump shall be as specified.

PART 3 EXECUTION

3.1 PRELIMINARY WORK

3.1.1 Wave Equation Analysis of Pile Drivability

- a. Prior to driving any pile, the Contractor shall submit a pile Wave Equation Analysis, performed by his Geotechnical Consultant, for each size pile and distinct subsurface profile condition. These analyses 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.
- b. 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.

**Allowable Driving Stresses**

Steel Piles

Compression - 0.9 fy  
Tension - 0.9 fy

Where fy is yield strength of steel

Concrete

Compression -  $0.85f'_c$  minus UPL  
Tension - (3 times (the square root of  $f'_c$ )) plus UPL

$f'_c$  is compressive strength of concrete

UPL = Unit Prestress after Losses

(Obtain values from pile manufacturer)

- c. Upon completion of the dynamic and static testing programs outlined in this specification section, a refined Wave Equation Analysis shall be performed taking into consideration the evaluated capacities, gain/loss factors and recommended production pile lengths. Production pile driving criteria shall be developed based on the results of the refined Wave Equation Evaluations.
- d. All pile driving equipment furnished by the Contractor shall be subject to the approval of the Contractor's Geotechnical Consultant. Complete the attached pile and driving equipment data form, including hammer information, in full as part of the submittal of the results of the Wave Equation Analyses.
- e. The cost of performing the Wave Equation Analyses shall be paid for by

the Contractor and included in the base bid.

### 3.2 INSTALLATION

#### 3.2.1 Handling and Driving

Piles or pile sections shall not be handled or moved in any manner that would result in cracking or permanent damage to the concrete or to the grout surrounding the prestressing cables. Piles shall not be driven until the concrete has attained a minimum strength of 6,000 psi. Piles may be driven without pile guides or leads providing a hammer guide frame is used to keep the pile and hammer in alignment.

#### 3.2.2 Pile Driving

Excavation shall be stopped at 1 foot above foundation grade before piles are driven. When pile driving is completed, excavation shall be completed to lines and grade shown. Piles shall be driven continuously and without interruption to or below the tip elevation established from the load test program to reach a driving resistance in accordance with the schedule which the Contracting Officer will prepare. The pile hammer used for driving shall be the same type, operated at the same rate and in the same manner, as that used for driving the test piles. Diesel-powered hammers shall be operated at the rate recommended by the manufacturer throughout the entire driving period. Sufficient pressure shall be maintained at the steam hammer so that:

- a. For a double-acting hammer, the number of blows per minute during and at the completion of driving of the pile is equal approximately to that at which the hammer is rated.
- b. For a single-acting hammer, there is a full upward stroke of the ram.
- c. For a differential type hammer, there is a slight rise of the hammer base during each upward stroke.

If a pile fails to reach the required tip elevation or if a pile reaches the tip elevation without reaching the required driving resistance, the Contractor shall notify the Contracting Officer and perform corrective measures as directed by him.

#### 3.2.3 Cutting of Piles

When necessary and approved by the Contracting Officer, cutting of piles shall be with pneumatic tools, sawing, or other approved methods. The use of explosives for cutting will not be permitted.

#### 3.2.4 Protection of Piles

Care shall be taken to avoid damage to the piles in handling piles, in placing the pile in the leads, and during the pile driving operations. Where pile or projecting reinforcement orientation is essential, special care shall be taken to maintain the orientation during driving. The top of the pile shall be squared to the longitudinal axis of the pile. If the Contractor elects to use a pile head with projecting strands or mild steel reinforcing, a special driving head shall be used to prevent damage to the reinforcement and prevent direct impact forces from being transmitted through the reinforcement.

### 3.2.5 Tolerances in Driving

All piles shall be driven with a variation of not more than 0.20 inch per foot of pile length from the vertical for plumb piles. Top of pile shall be within 3 inches of the location indicated. Manipulation of piles to force them into position will not be permitted. All piles will be checked for heave. Piles found to have heaved shall be redriven to the required point elevation.

### 3.2.6 Build-Ups

If any pile does not attain sufficient resistance or penetration when the pile head is at the established cut-off elevation, driving shall continue until the required resistance or penetration is reached. The pile shall be built-up to the specified cut-off elevation by a cast-in-place extension of the pile, by a pile section, or by use of an acceptable length of pile cut-off. The splice between the pile and build-up shall be accomplished by a poured plug of reinforced concrete extending a minimum of one outside-pile-diameter into the pile and an equal length into the build-up where possible. The splice plug may be an extension of the pile-to-cap connecting plug. If pile tops are damaged during driving, the damaged portion shall be removed and the pile built-up as necessary.

## 3.3 PILE DRIVING EQUIPMENT

### 3.3.1 Pile Hammers

The hammer used shall have a delivered energy suitable for the total weight of the pile, the character or subsurface material to be encountered, and the pile capacity to be developed. The driving energy of the hammer shall be as recommended by the manufacturer for the piling weight and subsurface material to be encountered. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

### 3.3.2 Driving Helmets and Pile Cushions

A driving helmet or cap including a pile cushion shall be used between the top of the pile and the ram to prevent impact damage to the pile. The driving helmet or cap and pile cushion combination shall be capable of protecting the head of the pile, minimize energy absorption and dissipation, and transmit hammer energy uniformly over the top of the pile. The driving helmet or cap shall fit loosely around the top of the pile so that the pile is not restrained by the driving cap if the pile tends to rotate during driving. The pile cushion may be of solid wood or of laminated construction, shall completely cover the top surface of the pile, and shall be retained by the driving helmet. The minimum thickness of the pile cushion shall be 3 inches and the thickness shall be increased so as to be suitable for the size and length of pile, character of subsurface material to be encountered, hammer characteristics, and the required driving resistance. The pile cushion shall be replaced if it has been highly compressed, charred, or burned or has become deteriorated in any manner during driving.

### 3.3.3 Capblocks

The capblock used between the driving cap and the hammer ram may be of solid hardwood block with grain parallel to the pile axis and enclosed in a close fitting steel housing or may consist of aluminum and approved

industrial type plastic laminate discs stacked alternately in a steel housing. Steel plates shall be used at the top and the bottom of the capblock. Where the block is other than that specified above, the Contractor shall submit to the Contracting Officer at least 2 weeks before the start of test pile driving operations, detailed drawings of the capblock he proposes to use accompanied by records of the successful use. The capblock shall be replaced if it has been damaged, highly compressed, charred, or burned or has become spongy or deteriorated in any manner. If a wood capblock is used, it shall not be replaced during the final driving of any pile. Under no circumstances will the use of small wood blocks, wood chips, rope, or other material permitting excessive loss of hammer energy be permitted.

### 3.4 PILE TESTS

Pile Tests - Pile dynamic load tests shall be performed as specified and as shown or as directed. The Pile Testing Engineer will develop the correlation between pile driving resistance and pile capacity, and the pile driving criteria during the pile tests for the selected pile driving system. Based on the correlations developed, the Pile Testing Engineer will determine the minimum tip elevations, required driving resistance or refusal blow count for the permanent piles. Changes in the approved pile driving system during or after completion of tests will not be allowed unless additional tests are performed as directed to establish the correlation between driving resistance and pile capacity for the proposed changed system. For changes in the approved pile driving system proposed by the Contractor, required additional pile tests shall be performed at the Contractor's expense and no additional contract time will be allowed.

The Contractor shall appoint a Professional Engineer with a minimum of 5 years experience in pile design and construction, licensed in the state of Florida, who will perform design work and prepare calculations related to the work in this section, and sign and seal calculations and as-built drawings/conditions for that work.

#### 3.4.1 Test Piles

Test piles shall be of the indicated lengths and shall be placed at the indicated or directed locations. Test piles shall be driven with the same equipment specified in paragraph PILE DRIVING EQUIPMENT and in the same manner specified in paragraph DRIVING for permanent piles. The driving record data shall be recorded for each test pile driven. A pile driving analyzer shall be provided and operated as specified by the manufacturer during the driving of each test pile.

#### 3.4.2 Dynamic Testing of Piles

Dynamic testing of piles shall be performed as specified herein and in accordance with [ASTM D4945](#) for dynamic load tests. The purpose of this testing shall be to determine velocity of stress wave propagation, acceleration, monitor hammer and drive system performance, assess pile installation stresses and integrity, evaluate pile capacity, and develop pile driving criteria. The Contractor shall inform the Contracting Officer at least 21 days before beginning all load tests and shall make provisions available for the Contracting Officer or his Authorized Representative to be presented during all load tests. Dynamic Load Tests will be performed by a Testing Engineer supplied and paid for by the Contractor with the approval of the Contracting Officer. The Contractor shall cooperate with the Testing Engineer for installation and removal of instrumentation along

with pile monitoring during driving. The Contractor's driving system shall not cause damage to the required instrumentation. All power requirements for operating the equipment shall be supplied by the Contractor. Prior to commencing pile driving, a wave equation analysis shall be performed and the results submitted in accordance with paragraph SUBMITTALS. Test piles for which dynamic load tests have been performed and in which the test pile has been damaged to the extent of making the test pile data of insufficient value, in the opinion of the Contracting Officer, shall be replaced with a new test pile, with an equivalent dynamic load test, driven at the same location. Damaged piles shall be extracted and disposed of.

#### 3.4.2.1 Dynamic Test Piles

Dynamic testing shall be performed on ~~6~~ 1 test piles as indicated in the drawings or at a location directed by the Contracting Officer. ~~These~~ test piles shall be at a permanent pile location. Test piles shall be provided ~~in~~ at a length sufficient to install the piles to at least 15 feet below the target tip elevations indicated on the drawings and to allow the piles to sufficiently extend above the ground surface. If undamaged, the test piles may be used as a permanent piles. Testing shall be performed during the full length of pile driving. All piles installed as part of "dynamic" pile test program shall be restruck after a minimum waiting period of 7 days. The hammer shall be warmed up prior to restriking. Restriking shall consist of restriking the pile for 50 blows or until the pile penetrates an additional 3 inches, whichever occurs first. In the event the pile movement is less than one-quarter inch during restrike, the restrike may be terminated after 20 blows. All restrikes shall include dynamic testing. The Contractor shall develop the pile driving criteria based on the pile test program for use of production pile installation.

#### 3.4.2.2 Reports

A summary report of dynamic test results for test piles shall be prepared by the Testing Engineer and submitted in accordance with paragraph SUBMITTALS. The report shall discuss pile capacity obtained from dynamic testing, and also include velocity of stress wave propagation, acceleration, evaluation of hammer and driving system performance, driving stress levels, and pile integrity. A CAPWAPC, or similar, analysis of the dynamic test data shall be performed on data obtained from the end of initial driving and the beginning of restrike for all test piles. The analysis shall be used to predict pile capacity, establish resistance distribution, and predict quake and damping factors. Refined wave equation analyses incorporating the results of dynamic testing and analysis shall be included. The Contracting Officer will make the report available to the Contractor to be included in the pile driving record as an attachment. The report shall also include the recommended pile driving criteria for production pile installation.

#### 3.4.2.3 Dynamic Testing Permanent Piles

In addition to the ~~six~~ test piles, ~~ten~~ one dynamic load test on production piles shall be performed at piles selected by the Contracting Officer in accordance with all of the requirements of the paragraph DYNAMIC TESTING OF PILES above, and all of the appertaining subparagraphs, to verify pile capacities. If the dynamic load test demonstrates a change in the Contractor's pile driving system, which requires recalibration of the system in order to have confidence in obtaining the required pile capacities, the cost of the dynamic load test shall be paid by the Contractor.



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EMBANKMENT CONSTRUCTION

PART 1 GENERAL

1.1 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.

ASTM INTERNATIONAL (ASTM)

ASTM C136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2010) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C294	(2012) Standard Descriptive Nomenclature for Constituents of Concrete Aggregates
ASTM C33/C33M	(2013) Standard Specification for Concrete Aggregates
ASTM C88	(2005) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	(2012) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft <sup>3</sup> ) (2700 kN-m/m <sup>3</sup> )
ASTM D2216	(2010) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2487	(2011) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2974	(2007a) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D4253	(2000; R 2006) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4318	(2010) Liquid Limit, Plastic Limit, and

Plasticity Index of Soils

ASTM D4373	(2014) Standard Test Method for Rapid Determination of Carbonate Content of Soils
ASTM D4643	(2008) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	Safety and Health Requirements Manual
ER 1110-1-1807	(2014) Engineering and Design -- Drilling in Earth Embankment Dams and Levees

The most recent USACE EM 385-1-1 can be viewed at the web site indicated in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

1.2 DEFINITIONS

1.2.1 Clearing

Clearing consists of the removal and satisfactory disposal of all trees, downed timber, snags, slash, brush, garbage, trash, debris, fencing, rock larger than 3 inches in diameter and other items occurring in the designated areas to be cleared.

1.2.2 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 at least 6 inches.

1.2.3 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 3 inches in diameter, and matted roots from the designated grubbing areas. Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed 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. Depressions made by grubbing shall be filled with embankment fill and compacted to make the surface conform with the original adjacent surface of the ground.

1.2.4 Topsoil

Topsoil is defined in Section 32 92 23 SODDING.

1.2.5 Embankment Fill

Satisfactory materials for Embankment Fill shall consist of materials

classified in accordance with ASTM D2487 as SP-SM, SW-SM, SP-SC, SW-SC, or SM, with a Uniformity Coefficient ( $C_u$ ) greater than 2 (ASTM D422), and shall have a gradation grade no finer than as shown in the table below. Embankment fill shall be free from contamination from hazardous, toxic or radiological substances; trash, and debris. Not all satisfactory materials can be used in embankment or backfill construction. Only the satisfactory materials stated above, meeting the additional requirements of paragraph TYPES OF FILL MATERIALS and subparagraph "Embankment and Backfill Materials" below, can be used for embankment construction. SM soils may retain excess moisture and may be difficult to compact unless proper measures to control moisture are taken. Embankment Fill shall not contain particle sizes greater than 3 inches in any direction. Organic content shall be less than 3 percent in accordance with ASTM D2974. In no case shall the proportion of gravel (material larger than the U.S. No. 4 Standard Sieve) exceed 20 percent by weight of the embankment or backfill material.

U.S. Standard Sieve Size	Maximum Percent Passing
50	90
70	65
100	35
200	20

#### 1.2.6 Select Fill

Select fill consists of satisfactory materials classified in accordance with ASTM D2487 as SP or SW, and with a Uniformity Coefficient greater than 3 (ASTM D422).

#### 1.2.7 Filter Soil

Filter Soil, composed of the material silica sand, in-place shall meet the quality requirements of ASTM C33/C33M grading for fine aggregate with additional limits on the allowable percentage passing the No. 200 sieve as specified in TYPES OF FILL MATERIALS. Silica minerals (quartz) are defined in ASTM C294 (Section 5.1), a referenced document in ASTM C33/C33M. The provided Filter Soil shall contain no calcareous and/or carbonaceous materials. Particle shapes must be angular, and must not be well rounded, rounded or sub-rounded. Friable particle content must be no greater than 3 percent per ASTM C33/C33M, Table 1. The percentage of friable particles must be determined per ASTM C142/C142M. Therefore, the provided fine aggregate material must be composed of at least 95 percent silica sand, with no more than 2 percent silica fines (particles passing the No. 200 sieve) and 3 percent friable particles, to meet the project specification requirements. Laboratory testing must be performed as outlined in ASTM C33/C33M, Sections 5 through 8, and must include, but is not limited to, particle size distribution (ASTM C136), test method for soundness (ASTM C 88), standard test method for rapid determination of carbonate content of soils (ASTM D4373), and percent of friable particles (ASTM C142/C142M). All testing must be representative of the materials delivered to the project site. Test results must be signed and sealed by a licensed Professional Engineer or Geologist, licensed in the state from which the material is tested, and must clearly state that the fine aggregate to be furnished is silica sand (per this specification).

#### 1.2.8 Soil Bentonite Fill

Soil Bentonite Fill shall be in accordance with Section 35 42 00  
SOIL-BENTONITE FILL

#### 1.2.9 Unsatisfactory Materials

Unsatisfactory materials shall not be used in any embankment or other required fill and shall not be allowed to remain beneath embankment or structures. Unsatisfactory materials includes all other materials that are not defined as satisfactory materials.

#### 1.2.10 Satisfactory Materials

Satisfactory materials shall consist of all fill and soil needed for the embankment construction which includes Embankment Fill, Select Fill, Soil Bentonite Fill, Filter Soil, Filter Gravel, Bedding Stone and Riprap.

#### 1.2.11 Embankment

The terms "levee" or "embankment" as used in these specifications are defined as the earth fill portions of the embankment structure or other fills, including the temporary earthen plugs and earthen cofferdam, related to the embankment structure.

#### 1.2.12 Backfill

Backfill as used in this section is defined as that fill material which cannot be placed around or adjacent to a structure until the structure is completed or until a specified time interval has elapsed after completion.

#### 1.2.13 Excavation

Excavation consists of removal of material to the lines and grades shown on the drawings, or as otherwise directed or approved by the Contracting Officer and as described in the paragraph EXCAVATION in PART 3 EXECUTION.

#### 1.2.14 Classification of Soils

Materials used to construct the embankments and for backfills shall be classified in accordance with ASTM D2487 (Unified Soil Classification System). Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, SP-SM, SP-SC and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

#### 1.2.15 Degree of Compaction

Degree of compaction for all fill types except Filter Soil is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D1557, abbreviated hereinafter as percent of the maximum dry density. Degree of compaction for Filter Soil is expressed as a percentage of the maximum dry density obtained in accordance with ASTM D4253, abbreviated hereinafter as relative compaction.

#### 1.2.16 Hard/Unyielding Materials

Hard unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials with stones greater than 8 inches in



any dimension. These materials usually require the use of heavy excavation equipment, ripper teeth or jack hammers for removal.

### 1.3 SYSTEM DESCRIPTION

The work covered by this section consists of furnishing all equipment, labor, materials, and incidentals, and performing all operations necessary for the clearing, grubbing, and stripping of the areas specified herein or indicated on the drawings, and for the removal and disposal of cleared, grubbed, and stripped materials, removal of existing drainage structures, and refilling of holes resulting from grubbing; excavation of existing levees, and for all other excavations incidental to the construction of levees as specified and shown; foundation preparation and the construction of levee embankments, including new levee, enlargement of existing levee, backfill of berms, road crossings, backfill at drainage structures, and other incidental earthwork as may be necessary to complete the construction as specified herein and as shown on the drawings. All work under this section shall comply with the requirements of COE EM 385-1-1.

#### 1.3.1 Embankment and Backfill Materials

Materials for embankment and backfill construction shall be obtained from offsite sources provided by the Contractor ~~-, or if the Contractor chooses to use in situ~~ or onsite materials obtained from excavations, will require the material shall be processed ~~ing~~ to meet the requirements for Embankment Fill. The Government will not be responsible for assumptions made by the Contractor regarding the suitability of materials obtained nor the quantity of suitable materials available after processing. No additional compensation over the bid price for imported borrow material from offsite sources will be given for processing or transportation of onsite materials from required excavations.

#### 1.3.2 Haul Roads

Haul roads shall be located and constructed as approved by the Contracting Officer within the project boundaries shown on the drawings. Prior to the commencement of construction submit for approval a site plan detailing the location of all haul roads within the project limits. Haul roads shall be constructed to maintain the intended traffic, be free draining, and be maintained in good condition throughout the contract period. Any haul road which crosses any creek or drainage channel shall be constructed, and maintained so as to not flood either upstream areas by restricting stream flows or flood downstream areas by the release of any stored water in the event that the crossing fails for any cause. Haul roads constructed during the contract duration shall be removed after work is completed and the impacted area restored to its preconstruction conditions. All costs associated with these haul roads shall be considered as a subsidiary obligation of the Contractor.

#### 1.3.3 Stockpiling

Any on-site stockpiling of embankment materials shall be in accordance with paragraph STOCKPILES below. No payment will be made for such stockpiling nor for the reloading and hauling of these materials to their final position.

#### 1.3.4 Slides and Foundation Failures

When sliding occurs in any part of the embankment and backfills prescribed

in this section after they have been placed, but prior to final acceptance of all work under the contract, repair the slide as directed by the Contracting Officer. When the slide is caused through the fault of the Contractor, the repair shall be made at no cost to the Government. When the slide is not the fault of the Contractor, an equitable adjustment in the contract price shall be made pursuant to the Contract Clause CHANGES to cover the cost of the repairs.

#### 1.3.5 Drainage Requirements

The Contractor shall not block or restrict the flow in a natural drain, existing culvert, ditch or channel at any time without obtaining prior written approval from the Contracting Officer. This approval will not relieve the Contractor from responsibility for any damage caused by the operation. Diversion ditches, dikes, and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

##### Dewatering Work Plan; G, DO

A Dewatering Work Plan detailing how surface and groundwater will be controlled throughout construction shall be submitted within 30 calendar days after receiving Notice to Proceed. The Contractor shall demonstrate a minimum of ten (10) years experience in the construction of dewatering systems including, but not limited to, sheet pile, pumping, well point installation and extraction, and earthen cofferdams. For proposed drilling work, the Contractor shall submit a Drilling Program Plan as required in Section 01 57 50 DRILLING PROGRAM PLAN. The dewatering system design engineer shall be a Florida licensed professional engineer with a minimum of ten (10) years experience in performing similar work. Surface and/or groundwater control will require as a minimum the use of a single stage or multistage well point or deep well system. The use of temporary diversion ditches, containment berms, sloping the subgrade, and dewatering by the use of pumping and sumps may also be required to maintain a dry excavation. All wells shall be decommissioned in accordance with Section 33 29 00 DECOMMISSIONING WELLS. The information submitted in the dewatering plan shall be in accordance with Federal, State and local laws and regulations, F.A.C. Rule Chapters 40E-2 and 40E-20, and the Florida Department of Environmental Protection (FDEP) permit indicated in Section 01 57 20 ENVIRONMENTAL PROTECTION.

The following information shall be included in the Dewatering Work Plan:

- a. Qualifications of the design professional(s) responsible for design and operation of the dewatering system and safety inspection procedures. The dewatering plans and calculations for the dewatering system shall be signed and sealed by a registered professional engineer licensed in the State of Florida.
- b. Site plan of the project component with a description of the dewatering system and equipment, layout including the location of sumps, wells, well points, backup pumps, temporary containment berms, cofferdams, or diversion ditches as necessary; installation methods; description and layout of the onsite water detention system; location of the proposed discharge point(s), discharge rate flow meters, and the associated water quality monitoring locations; and re-watering procedures. All effluent generated during dewatering operations shall be discharged into Canal 40.
- c. A detailed description of the sequence of construction and dewatering, including a description of control elevations during cofferdam/stability berm construction, and control elevations during construction.
- d. The location and type of turbidity control devices and methods necessary to ensure State Water Quality will be met.
- e. Calculations estimating the area of influence of dewatering, depth of dewatering, pumpage rates, duration and volumes, and stability of system, consistent with planned construction activities.
- f. A plan for construction of each temporary cofferdam system. The plan shall contain a description of the type of cofferdam, a list of materials to be used, and a detailed installation and removal sequence.
- g. An operational plan, which demonstrates that the discharge to the receiving water body meets all applicable State Water Quality standards prior to discharge, and also contains the proposed sampling locations and daily turbidity measurements.
- h. A contingency plan, which includes procedures for ceasing dewatering operations and corrective actions (to include a contingency plan in the event proper dewatering as per the Contractor's own design is not achieved) until water quality standards are met.
- i. A plan for rewatering the site so that no adverse impacts to the structure occur. At a minimum, include the proposed rate of groundwater level rise.

Earthwork operations shall not commence until the Dewatering Work Plan is approved. The Contractor shall allow 45 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittal of the Dewatering Work Plan is required due to deficiencies in the plan.

#### Shoring, Sheeting, and Bracing; G, DO

Submit a detailed shoring, sheeting and bracing plan 30 days

prior to the beginning of installation of such features or any excavation so supported, whichever occurs first. The plan for shoring, sheeting and bracing shall be prepared and certified by a Florida licensed professional engineer. Include in the plan drawings and design computations of the proposed shoring, sheeting, and bracing, and documentation, showing details of the coordination and approval of shoring, sheeting, and bracing by the applicable parties. Approval of the detailed plan shall be obtained from the Contracting Officer prior to starting the work. If necessary, modify the plan as required to meet field conditions, and the modifications shall be approved prior to use.

#### Excavation; G, DO

Submit a written excavation plan 30 days prior to the beginning of any excavation. Approval of the detailed plan shall be obtained from the Contracting Officer prior to starting the work. If necessary, modify the plan as required to meet field conditions, and the modifications shall be approved prior to use. As a minimum, the plan shall contain, the following:

- a. Proposed methods for preventing interference with, or damage to, existing underground or overhead utility lines, trees designated to remain and other man-made facilities or natural features designated to remain within or adjacent to the construction rights-of-way.
- b. Provision for coordinating the work with other Contractors working in the construction rights-of-way or on facilities crossing or adjacent to this work.
- c. Stockpiling plan for reusable excavated soil on site (meeting the criteria for Embankment Fill) showing locations, stockpile heights, slopes, limits, and drainage around the stockpile areas.
- d. Stockpiling plan for Embankment Fill before it is transported to the project site showing locations, stockpile heights, slopes, limits, and drainage around the stockpile areas.
- e. A complete listing of equipment used for excavation and to transport the excavated material.
- f. The Contractor's proposed road pattern, and plan for implementing dust control measures.

#### Plan of Operations; G, DO

Thirty (30) days prior to commencement of haul road construction or placing embankment and backfill which ever is earlier, submit for approval a Plan of Operations for accomplishing all embankment and backfill construction and for the location and construction of haul roads. This plan shall include, but not be limited to, the proposed sequence of construction for embankment and backfill items, and methods and types of equipment to be utilized for all embankment and backfill operations, including transporting, placing, and compaction. This plan shall also include the names and addresses of the commercial testing labs which will perform the soil testing and inspection and describe how all required soils testing will be performed.

#### Embankment and Backfill Materials; G, DO

At least 30 days prior to delivery of any Contractor-furnished material to the site of the work, submit soil classification test results, moisture-density curves, gradation curves, and laboratory results of the required tests of the proposed material.

#### Survey of Restored Embankment; G, DO

After placement of fill to required grades and prior to placement of sod and other surface treatment, perform a topographic survey of the restored embankment. Submit the topographic survey (drawings) for approval by the Government prior to removal of the cofferdam system.

#### SD-06 Test Reports

##### Foundation Inspection Checklist; G, RO

Submit a Foundation Inspection Checklist notifying the Government that the foundation is ready for inspection. Approval of this checklist by the Contracting Officer will serve as notification from the Contractor that the foundation is ready for mapping and inspection. Notify the Contracting Officer at least seven (7) days before foundation preparation will be completed and ready for inspection by the Government. The checklist shall include, but is not limited to the following:

- a. Excavation bottom and side slopes are to the lines and grades indicated on the drawings.
- b. Dewatering system is fully installed and operational and all dewatering requirements outlined in these specifications are met. Surfaces of excavation bottom and side slopes shall be dry and free from standing water, seepage, sloughing, boils, uplift or heave. Groundwater monitoring via open pipe piezometers shall be ongoing.
- c. Temporary ramps covering excavated side slopes are removed such that the excavated side slopes can be documented and mapped.
- d. Equipment for foundation excavation and mapping are on site and provisions for equipment operating personnel have been coordinated.

##### Nuclear Density; G, RO

Use nuclear density testing equipment in accordance with **ASTM D6938**. In addition, the following condition shall apply:

- a. Prior to using the nuclear density testing equipment on the site, submit to the Contracting Officer a certification that the operator has completed a training course approved by the nuclear density testing equipment manufacturer, the most recent data sheet from the manufacturer's calibration, and a copy of the most recent statistical check of the standard count precision.
- b. The nuclear density testing equipment shall be capable of

extending a probe a minimum of 12 inches down into a hole.

#### Measurement of Fill Material; G, RO

Submit a copy of the records of each compliance survey the next work day following the survey.

#### Testing

Within 24 hours of conclusion of physical tests, 3 copies of test results, including calibration curves and results of calibration tests.

#### SD-07 Certificates

#### Testing; G, RO

Qualifications of the Contractor's COE validated commercial testing laboratory.

### 1.5 REGULATORY REQUIREMENTS

The state statutory and regulatory requirements are indicated in Section 01 57 20 ENVIRONMENTAL PROTECTION.

### 1.6 PERMITS

In accordance with Contract Clause PERMITS AND RESPONSIBILITIES, obtain all necessary permits required for disposal, hauling, erosion control, burning, and pay all fees associated with permitting and compliance.

### 1.7 BLASTING

Blasting will not be permitted.

### 1.8 PROJECT SITE CONDITIONS

#### 1.8.1 Protection of Cultural and Natural Resources

All work and operations shall comply with the requirements of Section 01 57 20 ENVIRONMENTAL PROTECTION and with the requirements of this section.

#### 1.8.2 Protection of Man-Made Facilities and Natural Features

Trees within the clearing area shall be felled in such a manner as to avoid damage to trees left standing and trees outside the clearing area, existing buildings, man-made facilities and natural features, with due regard to the safety of employees and others, and in compliance with COE EM 385-1-1. Excavation shall follow the same requirements specified above for felling trees and shall be in compliance with COE EM 385-1-1.

#### 1.8.3 Subsurface Data

Subsurface soil boring logs are included in these specifications. Subsurface investigation reports and samples of materials obtained from subsurface investigations may be examined at the Jacksonville District Office as indicated in Section 00 31 32 GEOTECHNICAL DATA REPORT. These data represent subsurface information at the boring locations; however, variations may exist in the subsurface between boring locations.

Groundwater levels indicated on the soil boring logs were levels found at the time of exploration. The groundwater table can vary significantly depending on time of year, variation from normal precipitation, and river stage, lake stage or tide level.

## PART 2 PRODUCTS

### 2.1 TYPES OF FILL MATERIALS

#### 2.1.1 Embankment Fill

The embankment fill material shall consist of satisfactory materials classified in accordance with subparagraph "Embankment Fill" of paragraph DEFINITIONS, and subparagraph "Embankment and Backfill Materials" of paragraph SYSTEM DESCRIPTION above.

#### 2.1.2 Filter Soil

Filter soil material shall consist of material classified in accordance with subparagraph "Filter Soil" of paragraph DEFINITIONS above, and shall meet gradation requirements listed below.

##### 2.1.2.1 Gradation

Furnish following gradation:

Sieve	Percent Passing
3/8"	100
#4	95-100
#8	80-100
#16	50-85
#30	25-60
#50	10-30
#100	2-10
#200	0-2 when measured at the source and 0-5 when measured as fill in the embankment after proper compaction.

##### 2.1.2.2 Characteristics

Provide silica minerals (quartz) as defined in [ASTM C294](#) (Section 5.1), a referenced document in [ASTM C33/C33M](#). The provided fine aggregate shall contain no calcareous and/or carbonaceous materials. Friable particle content shall be no greater than 3 percent per [ASTM C33/C33M](#), Table 1. The percentage of friable particles shall be determined per [ASTM C142/C142M](#). Therefore, the provided fine aggregate material shall be composed of at least 95 percent silica sand, with no more than 2 percent silica fines (particles passing the No. 200 sieve), and no more than 3 percent friable particles to meet the project specification requirements.

##### 2.1.2.3 Contamination

Filter soil shall be protected from contamination from equipment traffic, runoff or any other source throughout construction. Any filter soil contaminated by other soil types or debris shall be wasted and replaced at no expense to the Government.

## 2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

### Warning Tape Color Codes

Red: Electric  
Yellow: Gas, Propane, Dangerous Materials  
Orange: Telephone and Other Communications

### 2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

### 2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

## 2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

## PART 3 EXECUTION

### 3.1 CONSTRUCTION

#### 3.1.1 Lines and Grades

The embankment and backfill shall be constructed to the lines, grades, and cross sections indicated on the drawings, unless otherwise directed by the Contracting Officer. The Government reserves the right to increase or decrease the foundation widths and embankment slopes or to make such other changes in the embankment or backfill sections as may be deemed necessary to produce a safe structure. Increases in height of section, made to compensate for settlement or consolidation of the embankment material subsequent to the completion of the embankment, shall not exceed 24 inches or 5 percent (whichever is less) of the height above the foundation at the centerline of the project feature indicated on the drawings.

#### 3.1.2 Conduct of the Work

Maintain and protect the embankment and backfill in a satisfactory



condition at all times until final completion and acceptance of all work under the Contract. If, in the opinion of the Contracting Officer, the hauling equipment causes horizontal shear planes or slicken sides, rutting, quaking, heaving, cracking, or excessive deformation of the embankment or backfill, limit the type, load, or travel speed of the hauling equipment on the embankment or backfill and repair any damaged areas at no additional cost to the Government. The Contractor may be required to remove, at no additional payment, any embankment material placed outside of prescribed slope lines. Any approved embankment or backfill material which is lost in transit or rendered unsuitable after being placed in the embankment or backfill and before final acceptance of the work shall be replaced in a satisfactory manner and no additional payment will be made therefor. Excavate and remove from the embankment or backfill any material which is unsatisfactory, dispose of such material, and refill the excavated area as directed, all at no cost to the Government.

### 3.2 CLEARING AND GRUBBING

All clearing, including any grubbing work, shall be completed prior to embankment construction. If regrowth of vegetation or trees occurs after clearing and grubbing and before placement of embankment, the Contractor shall clear again prior to embankment construction. Clearing and grubbing shall be accomplished in all areas requiring earthwork and any others necessary to complete construction. Trees and vegetation designated to be left standing or to remain shall be protected from damage from construction operations. Clear all riprap rock greater than 3 inches and stockpile for reuse. Clear all remaining debris including gabions, remove from the site, and dispose in accordance with paragraph DISPOSITION OF CLEARED, GRUBBED, AND STRIPPED MATERIAL below.

### 3.3 STRIPPING

After inspection and acceptance of cleared and grubbed areas, stripping shall proceed. All stripping work shall be completed not more than 250 feet in advance of embankment construction. The entire area within the limits of existing ground to receive embankment fill shown on the drawing shall be stripped to remove weeds, grass, and other vegetative materials to the ground surface and topsoil to a depth of at least 6 inches. Topsoil shall be completely stripped where greater depths are encountered.

### 3.4 DISPOSITION OF CLEARED, GRUBBED, AND STRIPPED MATERIAL

Except as otherwise specified or indicated on the drawings, all materials resulting from clearing and grubbing operations shall, at the Contractor's option, be disposed of either by windrowing or stockpiling within construction limits, chipping, removal from the site, or a combination thereof. In no case shall any material resulting from clearing and grubbing operations be buried or permanently placed within any embankment or levee foundation or any structural foundation. Make a reasonable effort to channel merchantable material into the commercial market and to make beneficial use of the materials resulting from clearing and grubbing. The topsoil material resulting from the stripping operations shall be temporarily stockpiled within the rights-of-way. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2 inches in diameter and other materials that would interfere with planting and maintenance operations.

### 3.4.1 Windrows

Cleared, grubbed and stripped material shall be placed in a neat windrow or in piles with tree limbs trimmed sufficiently to make the windrow as small as practicable. No cleared, grubbed or stripped material shall extend beyond the construction limits.

### 3.4.2 Removal from Site

The Contractor may elect to remove all or part of the cleared and grubbed materials from the site in accordance with Section 01 57 20 ENVIRONMENTAL PROTECTION. The Contractor may opt either to retain any such materials of value or dispose of them by sale or otherwise. The Contractor shall not sell such material on site. The Government is not responsible for the protection and safekeeping of any materials retained by the Contractor. Such materials shall be removed from the site before the date of completion of the work.

## 3.5 REMOVAL OR PLUGGING OF ABANDONED PIPE AND CONDUITS

The old existing culvert barrels for IP-3 shall be abandoned in place by grouting them full. See Section 31 23 24 CONTROLLED LOW STRENGTH MATERIAL (CLSM, FLOWABLE FILL) for information on grouting with CLSM. The existing canals adjacent to the landside culvert headwalls shall be de-mucked and backfilled as shown. The headwalls shall be partially demolished as needed to backfill the canals and allow reconstruction of the embankment up to the crest elevation indicated on the drawings.

## 3.6 DEWATERING AND DIVERSION

The Contractor is responsible for the design, construction, installation and operation of the dewatering system. The Contractor shall dewater the coffered area to a minimum of 24 inches below the bottom of excavation, at least one foot below localized excavations, and a minimum of 36 inches below side slopes. At all locations within the coffered area, surface or groundwater flowing toward or into the excavation shall be controlled to prevent seepage, sloughing, boils, uplift or heave, sediment transport, ground pumping, standing water or areas weakened by seepage forces, and to prevent interference with the orderly progress of construction. The presence of any of these conditions is not acceptable. The dewatering system shall be designed and constructed to prevent such conditions. Should these situations occur, the Government shall be notified immediately and the Contractor shall take immediate measures to correct the issues, so as to not jeopardize dam safety. The area shall remain dewatered until at least 2 feet of compacted fill is placed above native groundwater level. Surface and groundwater control shall be accomplished in coordination with the required excavation and embankment construction. Groundwater and surface water control may necessitate the use of deep wells, well points, temporary diversion ditches, cofferdams, sumps, and any other practical means that would meet the requirements. All wells, well points, sumps, ditches and all water collection features shall include properly designed filter materials that will prevent the movement of soil particles into the dewatering system components. Given that Herbert Hoover Dike is a dam, penetrations of dewatering features into the excavation shall be kept to a minimum; similarly the Contractor shall not install piling within the footprint of Herbert Hoover Dike, except as shown on drawings. Methods for care and control of surface and groundwater levels shall be subject to Contracting Officer approval. It shall be understood that the steel sheetpile cofferdam will not be water tight, unless the Contractor takes

measures to that effect. Therefore, the Contractor's dewatering work plan shall accommodate or consider all possible sources of seepage, including water seeping through any and all joints or the sheetpile cofferdam, whether above or below the level of the excavation. Any and all borings, wells, well points, monitoring wells or piezometers, or similar penetrations into the embankment or its foundation shall first be authorized by the Contracting Officer (refer to Section 01 57 50 DRILLING PROGRAM PLAN), and shall be in accordance with ER 1110-1-1807. Well installation with the aid of a water jetting is not allowed within 20 feet of proposed or newly constructed structural features, excluding temporary sheet piling. Use of this method is limited to a depth of 10 feet below excavation subgrade. Wells installed into the dam foundation with the aid of water jetting cannot be abandoned in place and must be extracted to allow for grout permeation into the adjacent soils during well abandonment. Also, any rim ditches used for dewatering shall be limited to 2 feet in depth, and shall be maintained at that depth.

### 3.6.1 Diversion Ditches

Rim ditches, diversion ditches, trenches or swales; known as diversion ditches in this section, can be used to collect and divert rainwater runoff from the excavation bottom and side slopes only and shall not be used for groundwater lowering. Groundwater seepage into these diversion ditches is not permitted. The invert of all diversion ditches shall not exceed 24 inches in depth, as measured from the bottom of proposed permanent concrete foundations. Prior to backfilling and compacting the diversion ditches, prepare slopes to 3H: 1V, maximum. Diversion ditches are localized excavations that require ground water to be maintained a minimum of one foot below the ditch invert in order to facilitate placement and compaction of Embankment Fill in the dry. Diversion ditches shall not be continuous transverse to the embankment centerline (upstream to downstream) so as to minimize potential creation of a preferential seepage path.

### 3.6.2 Groundwater Level Monitoring in Coffered Area

Groundwater levels shall be monitored via the use of open pipe piezometers. A minimum of 5 piezometers shall be installed at such locations as to permit the measurement near the ends of the excavation (e.g. headwalls areas, the center of excavation and side slope(s)). Additional piezometers may be required at the discretion of the Contracting Officer.

### 3.6.3 Inspection of Cofferdam and Coffered Area

The Contractor shall inspect the excavation bottom and side slopes and dewatering system each morning and immediately following any rain event. This inspection shall be made by a qualified individual experienced in dewatering, soil classification and slope stability. The Contractor's inspector shall have the authority to stop work and direct remedial action.

### 3.6.4 Dewatering Equipment and Equipment Capacity

All dewatering equipment shall be in prime condition and shall at all times be maintained and operated at the efficiency and capacity necessary for maintaining the coffered area free from standing water or wet conditions. The Contractor shall provide dewatering facilities with stand-by pumps for 25 percent stand-by capacity. Contractor shall also provide 100 percent backup power so that pumping operation may continue in the event of loss of the primary power system. The backup pumping and backup power systems

shall be tested and proven fully operational prior to starting excavation. Once excavation and dewatering operations begin, the system will operate continuously, without interruption; until backfill is complete to a point that dewatering is no longer needed. No power source will be provided by the Government for dewatering. Provide backup pumping and backup power systems configured to automatically start upon failing of the primary system. Dewatering pumps shall not be used for bypass pumping until dewatering operations cease.

### 3.6.5 Removal of Dewatering System and Cofferdams

All wells shall be decommissioned in accordance with Section 33 29 00 DECOMMISSIONING WELLS. The Contractor shall remove the dewatering system in such a manner as to allow groundwater to slowly return to natural elevations. The Contractor shall slowly flood the dewatered area to establish water surface elevations upstream of the structure and equal to tailwater downstream of the structure prior to removal of temporary cofferdam. Rewatering shall be addressed as part of the [Dewatering Work Plan](#).

### 3.7 EXCAVATION

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 and channels to the lines and grades shown on the drawings, removal of objectionable materials and obtaining required fill materials from the borrow areas. Over excavation outside the limits of embankment foundations or structures shall be backfilled to grade with similar over excavated material that are free of organics or satisfactory material and compacted to a density of at least that of the surrounding material.

#### 3.7.1 Over Excavation

##### 3.7.1.1 Within Limits of Embankment Foundations or Structures

Over excavation within the limits of the foundations of embankments or structures shall be backfilled to grade in accordance with paragraph PREPARATION OF FOUNDATION, PARTIAL FILL SURFACES AND ABUTMENTS.

#### 3.7.2 Structures

Excavations for structures shall conform to the dimensions and elevations indicated for each structure, except as specified herein, and shall include trenching for utility and foundation drainage systems, and all incidental work. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Satisfactory material removed below the depths indicated without specific direction of the Contracting Officer shall be replaced at no additional cost to the Government and filled in accordance with the subparagraph "Over Excavation" above. It is anticipated that excessively wet (exceeding moisture tolerances) and/or soft (not meeting minimum specified density or pumping/yielding soil) materials may be present at the final excavation for structures. When determined by the Contracting Officer, the material shall be excavated to a minimum depth of 24 inches and a minimum of 5 feet from the foundation footprint and replaced with an initial 6-inch thick bridging lift (above the water table) of select fill and the remaining lifts compacted in accordance with paragraph COMPACTION (subparagraphs "Compaction Below Structures" and "Compaction Adjacent to Structures")

below until elevation matches with the surrounding grades.

### 3.7.3 Slopes and Surcharges

Temporary excavation slopes for any channel, structure excavation, or other required excavation shall not be steeper than the specified finished slope or the specified construction slope, as applicable, and subject to the approval of the Contracting Officer. Where undefined, slopes shall be no steeper than 1V on 3H, and height shall be no greater than 5 feet. This may be accomplished by benching the temporary slope so that the average slope is not steeper than the specified slope. In addition, no temporary, permanent, or construction slope shall be surcharged with excavated or stockpiled material or with heavy construction equipment which would have the same effect as the surcharge material. The toe of stockpiled material shall be maintained a minimum distance back from the top of the finished excavation equal to the depth of the excavation. Determine the maximum height of such stockpile without causing instability of the excavation slope. Any slide or other adverse conditions caused by failure of the Contractor to maintain these conditions shall be considered the responsibility of the Contractor and remedial measures shall be at the Contractor's expense.

### 3.7.4 Existing Embankments and Spoil Banks

Existing embankment shall be removed as shown on the drawings. Existing embankment located within the rights-of-way landward of the embankment and berms to be constructed, may be utilized as borrow material if satisfactory, but only after equal protection has been provided by construction of the cofferdams. When excavated for borrow material, the existing embankment shall be removed to the adjacent ground surface in a uniform manner, and shaped to maintain drainage.

### 3.7.5 Riprap and Bedding

Excavations for riprap and bedding shall be performed at the locations and to the lines and grades shown. Riprap and bedding shall be placed as specified in Section 35 31 19 STONE PROTECTION FOR STRUCTURES.

## 3.8 TOLERANCES

Finish the surface of excavations, embankments, and backfills to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded embankment areas with plus 4 inches and minus 0 inches of the grades and elevations indicated, prior to the placement of surface treatments (sod, limerock base, asphalt, etc.). The degree of finish for underwater excavation shall be plus 0 feet and minus 1 foot of the grades and elevations indicated on the drawings. The degree of finish for temporary excavation surfaces shall be plus 0 inches and minus 6 inches. The degree of finish for filter soil and soil bentonite fill shall be plus 3 inches and minus 0 inches. Finish embankment fill in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Contractor shall repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes at no additional cost to the Government.

### 3.9 SLIDES

In case sliding occurs in any part of the excavations prescribed in this section after they have been excavated, but prior to final acceptance of all work under the contract, repair the slide as directed by the Contracting Officer. In case the slide is caused through the fault of the Contractor, it shall be repaired at no cost to the Government. In case the slide is due to no fault of the Contractor, an equitable adjustment in the contract price will be made for the repairs in accordance with the Contract Clause CHANGES.

### 3.10 STOCKPILES

Provisions of paragraph SLOPES AND SURCHARGES are applicable to all stockpiled materials. Upon completion of construction operations, all remaining stockpiled material shall be removed and disposed of by the disposal methods specified in paragraph DISPOSITION OF EXCAVATED MATERIALS.

### 3.11 SURFACE DRAINAGE OF COMPLETED AREAS

The areas shown on the drawings designated as "GRADE FOR SURFACE DRAINAGE", the borrow areas, and the finished embankment areas shall be graded to the lines and grades shown on the drawings. The surface shall be free from sharp ridges, gullies, potholes, sinkholes, and any other surface irregularities. A tolerance of 4 inches above the prescribed grade will be allowed provided that the surface drains in the direction as indicated on the drawings.

### 3.12 MAINTENANCE OF WORK

#### 3.12.1 Debris Removal

Maintain all ditch and channel excavations free from leaves, brush, sticks, trash, and other debris until final acceptance of all work under the contract at no additional cost to the Government.

#### 3.12.2 Sediment Removal

Prior to final acceptance of all work under this contract, the removal of sediments from ditch or channel excavations shall be required to restore design grade and section at no additional cost to the Government.

### 3.13 DISPOSITION OF EXCAVATED MATERIALS

#### 3.13.1 Satisfactory Materials

Satisfactory materials in excess of the quantity necessary to construct backfills and embankments, shall remain the property of the Government.

#### 3.13.2 Unsatisfactory Materials

Unsatisfactory materials shall be temporarily stockpiled during construction and uniformly spread over the Contractor's staging area upon completion of work. The side slopes shall not exceed 1V:5H, and the maximum height of the spread unsatisfactory materials shall not exceed 2 feet above existing grade. The final spread area shall be sodded.

### 3.14 PREPARATION OF FOUNDATION, PARTIAL FILL SURFACES AND ABUTMENTS

#### 3.14.1 Earth

After clearing, grubbing, stripping and excavation of the embankment foundation to the extent indicated or otherwise required, the sides of stump holes, test pits, and other similar cavities or depressions shall be broken down so as to flatten out the slopes, and the sides of the cut or hole shall be scarified to provide bond between the foundation material and the fill. Any lift of fill placed adjacent to slopes 4 horizontal on 1 vertical or steeper shall be benched into the existing slope. Unless otherwise directed, any depression shall be filled with the same material type that is to be placed immediately above the foundation. The fill shall be placed in layers, moistened, and compacted in accordance with the applicable provisions of paragraphs PLACEMENT, MOISTURE CONTROL, and COMPACTION for the specific material type. Materials which cannot be compacted by roller equipment because of inadequate clearances shall be compacted with power tampers in accordance with the paragraph COMPACTION for the specific material type. After filling of depressions and immediately prior to placement of compacted fill in any section of the embankment, the foundation of such section shall be loosened thoroughly by scarifying, plowing, discing or harrowing to a minimum depth of 6 inches, and the moisture content shall be adjusted to the amount specified in paragraph MOISTURE CONTROL for the appropriate type of material. Immediately prior to placement of compacted fill on or against the surfaces of any partial fill section, all soft or loose material, all material containing cracks or gullies, and all material that does not conform with the specified zoning of the embankment shall be removed. The remaining surface of the partial fill shall be loosened by scarifying, plowing, discing or harrowing to a minimum depth of 6 inches, and the moisture content shall be adjusted as specified in paragraph MOISTURE CONTROL for the appropriate type of material. The surface of the partial fill section upon which fill is to be placed shall then be compacted as hereinafter specified for the appropriate type of fill. No separate payment will be made for loosening and rolling the foundation area, the abutment area, or the surfaces of partial fill sections, but the entire cost thereof shall be included in the applicable contract price for fill.

#### 3.14.2 Settlement of Embankment Foundation

The Contractor may elect to furnish and install settlement gages for determination of settlement of the embankment foundation during construction. The Contractor shall monitor settlement of the concrete structures' foundations as required in Section 13 51 00 INSTRUMENTATION. A written description shall be included in the Plan of Operations submittal showing location of gages, settlement gage details, placement procedures and surveys.

#### 3.14.3 Hard/Unyielding Materials Below Structures

##### 3.14.3.1 Preliminary Cleanup

When hard/unyielding material is found at the excavation bottom, the Contracting Officer will require that the excavation be continued until a satisfactory foundation surface is reached free of uneven surfaces so that a uniform lift of fill material can be placed.

### 3.15 FOUNDATION INSPECTION AND GEOLOGIC MAPPING

Notify the Contracting Officer at least seven (7) days before foundation preparation will be completed and ready for evaluation by the Government. As used in this section, evaluation shall mean inspection, testing, geologic mapping, exploratory test pits, interpretation, and decision making. Maintain the foundation in a cleaned condition for Government evaluation. Allow 5 working days for Government evaluation.

Foundation shall mean any area of the excavation to receive concrete, fill or backfill, including the entire excavation bottom and side slopes. Inspections to determine the adequacy of the foundations will be performed by the Contracting Officer in all foundation areas prior to placement of any fill or concrete. The Contractor will cooperate to the extent necessary to assist in the inspection. This will include having equipment and personnel available to assist excavating, compacting, proof rolling, etc. The Contractor shall coordinate his schedule for foundation preparation and inspection and mapping with the Contracting Officer to ensure that the preparation and inspection proceed in an orderly manner.

Foundation mapping will require excavated surfaces to be closely inspected and documented. The Government will require surfaces to be cleaned by the Contractor to facilitate mapping. Cleaning will require cutting of fresh surface on the excavation bottom and on excavated slopes to expose in-situ material. Areas that have been overexcavated shall remain overexcavated until foundation mapping is complete. During evaluation, any temporary ramps covering side slopes shall be removed such that the excavation side slopes can be documented and mapped by the Government. The Contractor shall provide equipment to perform test pits as deemed necessary by the Government geologist and engineers performing the evaluation.

The Contractor will not be entitled to any compensation for delays, standby time, reduced efficiencies, or other similar costs due to the time required for foundation inspection and mapping.

Immediately following the foundation inspection and mapping period, the Contracting Officer will either approve the foundation section for permanent construction or will direct the Contractor to perform additional excavation.

- a. Government will conduct an evaluation of foundation surfaces to receive backfill or structures.
- b. Permit and facilitate safe access to the excavation by Government personnel for evaluation.
- c. The foundation shall be proof rolled by a fully loaded dump truck or approved roller to detect and eliminate soft spots in the foundation.
- d. During evaluation, if the Contracting Officer determines that additional excavation is required to improve foundation conditions, perform additional excavation as directed. Clean the areas of additional excavation. The Government will evaluate the surfaces of additional excavation.

#### 3.15.1 Equipment for Foundation Excavation and Mapping

The Contractor shall have on site and make available to Government personnel performing mapping and inspection the following equipment with



equipment operators to aid in performing excavations for test pits, sampling, inspection and cutting fresh surfaces for inspection and mapping:

- a. Excavating equipment - Backhoe with smooth edge bucket and bulldozer.
- b. Proof roller - Fully loaded dump truck or approved roller.
- c. Hand tools - Shovels, bars, picks, wedges, marking paint, and brooms.

### 3.16 PLACEMENT AND SPREADING

Prior to beginning embankment placement on the embankment foundation, notify the Contracting Officer that the foundation is ready to receive fill. No embankment or backfill shall be placed on or against concrete until the concrete has reached design strength without prior approval by the Contracting Officer. Fill shall be brought up in lifts evenly on both sides of culvert and headwall structures with no more than 2 feet difference in elevation on opposing sides of the structure.

#### 3.16.1 Gradation and Distributions

The gradation and distribution of materials throughout each zone of the embankment shall be such that the embankment will be 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 any other approved method to blend the materials. During the placing and spreading process, maintain at all times a force of workers adequate to remove all roots, debris, and oversize stone from all embankment materials. All stones and rock fragments larger than 3 inches in any dimension shall be removed from the fill.

#### 3.16.2 Foundations and Partial Embankment Fills

The foundations and all partial embankment receiving fills shall be kept thoroughly drained. Placing operations will be such as to avoid mixing of materials from adjacent sections as much as practicable.

##### 3.16.2.1 Fill in Wet Areas

Where fill is required in the wet, place Select Fill first by end-dumping and advancing with a V-shaped leading edge such that the center of fill is most advanced, thereby displacing silt material to both sides. Refer to the applicable Geotechnical Data Report (referenced in Section 01 11 00 SUMMARY OF WORK) for silt/muck thickness at each of the boring and muck probe locations. Select Fill shall be placed by this method to a height of 2 feet above the water level existing at the time of construction. Proof rolling shall then be performed using safe methods, after which Embankment Fill shall be placed and compacted as described herein. No fill shall be placed in the wet within the excavation area inside the limits of the cofferdam, unless it is an overexcavated, isolated zone or area and the Contractor has implemented the required dewatering within the excavation.

##### 3.16.3 Equipment Traffic

Equipment traffic on any embankment zone shall be routed to distribute the

compactive effort as much as practicable. Ruts formed in the surface of any layer of spread material will be filled before that material is compacted. If, in the opinion of the Contracting officer, the compacted surface of any layer of material is too smooth to bond properly with the succeeding layer, the surface shall be loosened by scarifying or other approved methods before material from the succeeding layer is placed. No equipment except approved compaction equipment shall operate on filter soil or filter gravel.

#### 3.16.4 Fill

Fill material shall be placed and spread in layers not more than 12 inches in uncompacted thickness when compacted with a vibratory roller with a minimum weight of 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at a minimum frequency of 1,200 times per minute or by equivalent approved method. Uncompacted lift thickness shall not exceed 6 inches when a hand operated (walk behind) plate compactor is used or in areas where such is required. Walk behind compactors shall only be used in confined spaces not accessible by vibratory roller or restricted near steel cofferdam. Layers should be started full out to the slope stakes and shall be carried substantially horizontal and parallel to the embankment centerline with sufficient crown or slope to provide satisfactory drainage during construction. Contractor may have to decrease the loose lift thickness or use different equipment to attain the required degree of compaction.

#### 3.17 MOISTURE CONTROL

##### 3.17.1 General

Satisfactory subgrade and fill materials shall contain the amount of moisture, within the limits specified below or as directed by the Contracting Officer, necessary to obtain the required compaction. Material that is not within the specified moisture content limits or is observed to be pumping after compaction shall be reworked to obtain the specified moisture content, regardless of density.

##### 3.17.1.1 Insufficient Moisture for Suitable Bond

If the top or contact surfaces of a partial fill section becomes too dry to permit suitable bond between these surfaces and the additional fill to be placed thereon, the Contractor shall loosen the dried materials by scarifying or discing to such depths as may be directed by the Contracting Officer, shall dampen the loosened material to an acceptable moisture content, and shall compact this layer in accordance with the applicable requirements of paragraph COMPACTION.

##### 3.17.1.2 Excessive Moisture for Suitable Bond

If the top or contact surfaces of a partial fill section becomes 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, to such depths as may be directed by the contracting officer. The material shall be dried to an acceptable moisture content, and shall be compacted in accordance with the applicable requirements of paragraph COMPACTION.

### 3.17.1.3 Drying Wet Material

Material that is too wet shall be permitted to dry, be assisted by discing or harrowing, if necessary, until the moisture content is reduced to an amount within the specified limits. Material with high fines content may be difficult to dry or require additional time to dry and compact if excessively wet due to close proximity to the water table, wetted from rainfall or surface water control is inadequate.

### 3.17.1.4 Increasing Moisture in Dry Material

The moisture content of material that is too dry, will be adjusted on the embankment. The Contractor shall add water to the fill material and by harrowing, or other approved methods, work the moisture into the material until a uniform distribution of moisture within the specified limits is obtained. Water applied on a layer of fill on the embankment shall be accurately controlled in amount so that free water will not appear on the surface during or subsequent to rolling. Should too much water be added to any part of the embankment, the rolling on that section of the embankment shall be delayed until the moisture content of the materials is reduced to an amount within the specified limits. If it is impracticable to obtain the specified moisture content by wetting or drying the fill material, the Contractor may be required to pre-wet or dry back the material at the source of excavation or in the borrow area.

### 3.17.2 Moisture Tolerance of Fill and Subgrade Material

a. The moisture content of embankment fill and subgrade material during compaction shall be within the limits of 3 percentage points above optimum to 2 percentage points below optimum moisture content as determined by [ASTM D1557](#). Material that is not within the specified moisture content limits or is observed to be pumping shall be reworked to obtain the moisture content appropriate for that material type, regardless of density.

b. Filter soil shall be wet during compaction. Each lift of filter soil shall be saturated immediately prior to compaction.

## 3.18 COMPACTION

Lift thickness shall be in accordance with subparagraph "Fill" of paragraph PLACEMENT AND SPREADING above. Compaction equipment shall be operated such that the strip being traversed by the vibratory roller shall overlap the rolled adjacent strip by not less than [3 feet](#). In areas which are not accessible by roller, the fill shall be compacted with an approved hand operated compactor to a density equal to that obtained in other areas which are accessible to rollers.

### 3.18.1 Compaction of Filter Gravel

Compaction of Filter Gravel shall be in accordance with Section [35 42 35](#) FILTER GRAVEL.

### 3.18.2 Compaction of Embankment Fill

After a layer of material has been dumped and spread, it shall be harrowed to break up and blend the fill materials and to obtain uniform moisture distribution. Harrowing shall be performed with a heavy disk 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, but in no case will more than three passes of the harrow on any one layer be required for this purpose. When the moisture content and the condition of the layer are satisfactory, the lift shall be compacted by use of vibratory roller to a minimum of 95 percent of the maximum dry density as determined by the Contractor in accordance with ASTM D1557. 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.

When placing embankment fill against highly organic material, such as peat, that material shall be cut vertically, creating a bench within the suitable underlying material. The vertical cut, or near-vertical cut if required for safety reasons, within the peat shall itself be benched if it exceeds 3 feet in height.

### 3.18.3 Compaction of Filter Soil

For the areas outside the limits of concrete placement, such as the chimney drain, the drainage blanket and portions of the Filter Collar and the ditch backfill at the IP-3 abandonment, compaction of Filter Soil shall be accomplished using the compaction equipment described in subparagraph FILL of paragraph PLACEMENT AND SPREADING above using a smooth drum vibratory roller. The roller shall make a minimum of two (2) passes, acting in vibratory mode, across the initial lift of Filter Soil. Upon completion of these first two passes, the density of the Filter Soil shall be checked in accordance with ASTM D1556. Additional passes of the vibratory roller shall be made until a relative compaction between 90 and 96% is attained. The number of passes required to achieve a relative compaction of 90% shall be the minimum required number of passes on subsequent lifts of Filter Soil. Additional density tests shall be conducted on intervals as required in subparagraph MATERIALS TESTING of paragraph FIELD QUALITY CONTROL.

For the areas under concrete, compaction of Filter Soil shall be such as to attain a minimum relative compaction of 95% of the maximum dry density obtained in accordance with ASTM D4253.

Compaction equipment shall be clean and free from other fill types or debris and shall not result in contamination of the Filter Soil.

Adjacent lifts of other fill types shall be sloped slightly to drain away from the Filter Soil. Any contaminated Filter Soil shall be removed and replaced by the contractor at no additional cost. Placement methods shall not result in segregation of the Filter Soil (such as but not limited to placement via conveyor or chute).

### 3.18.4 Compaction Above and Adjacent to Internal HDPE Drain Pipe

Within 3 feet of the perforated internal drainage pipe and up to 3 feet of cover above the pipe, compaction shall be made with walk behind plate compactor. Uncompacted lift thickness within this area shall be restricted to 6 inches. A minimum of 2 complete passes of this compaction equipment will be required for each lift of material within this area. Contractor shall ensure that compaction equipment used does not result in excessive deformation or collapse of the drainage pipe.

### 3.18.5 Subgrade Compaction

Upon completion of excavation, removal of unsatisfactory materials and preparation of subgrade, compact the top 12 inches of subgrade below the excavation limit to 95 percent of the maximum dry density as determined by the Contractor in accordance with ASTM D1557. Unsuitable material encountered within the excavation side slope shall be cut vertical and will not require compaction. The vertical cut on unsuitable material shall not exceed 2 feet in height per cut.

### 3.18.6 Compaction Adjacent to Structures

Crawler-type tractors, vibratory roller equipment and other similar compaction equipment shall not be used within 10 feet of the temporary sheet pile cofferdam. Compaction within this zone shall be accomplished by the use of mechanical hand tampers, vibrating plates or other approved methods and equipment. The Contractor shall ensure that compaction operations do not damage any existing utilities or structures. Any damage caused by the Contractor's operation shall be repaired at no additional expense to the Government. Backfill shall not be placed adjacent to any concrete prior to reaching 80 percent of its design strength. All fill placed adjacent to the culvert (within an area not less than two times the width of the compaction equipment) shall be placed on a 6-horizontal to 1-vertical (6:1) slope, sloping downward away from the culvert.

### 3.19 PLACING TOPSOIL

Place topsoil in accordance with Section 32 92 23 SODDING.

### 3.20 FIELD QUALITY CONTROL

#### 3.20.1 Clearing, Grubbing, and Stripping

Establish and maintain quality control for clearing, grubbing, and stripping operations to assure compliance with contract requirements, and maintain records of the quality control for all construction operations including but not limited to the items indicated below. These records, as well as the records of corrective actions taken, shall be furnished to the Government in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

##### 3.20.1.1 Clearing

Station to station limits, transverse clearing limits from applicable centerline; percentage of area complete; types of materials cleared.

##### 3.20.1.2 Grubbing

Station to station limits, transverse grubbing limits from applicable centerline; percentage of area complete; type of material; filling of grubbed holes.

##### 3.20.1.3 Stripping

Station to station limits, transverse stripping limits from applicable centerline; percentage of area complete; type of material; depth of stripping.

### 3.20.2 Excavation

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

- a. Lines, grades and tolerances,
- b. Segregation of materials,
- c. Disposal and/or stockpiling of materials,
- d. Unsatisfactory materials,
- e. Conditions that may induce seepage or weaken the foundation or embankment,
- f. Stability of excavations.

Records of inspections and tests, as well as the records of corrective actions taken, shall be furnished to the Government in accordance with Section 01 45 04 CONTRACTOR QUALITY CONTROL.

### 3.20.3 Embankment

#### 3.20.3.1 General

As a part of the Contractor Quality Control (CQC) system required by Section 01 45 04 CONTRACTOR QUALITY CONTROL, establish and maintain field quality control for foundation preparation, embankment and backfill operations to ensure compliance with contract requirements and maintain detailed records of field quality control for all operations including but not limited to the following:

- a. Earthwork Equipment  
  
Type, size, number of units and suitability for construction of the prescribed work.
- b. Foundation Preparation  
  
Methods of preparing the foundations in advance of embankment and backfill construction and methods for providing drainage of the foundation and partially completed fills.

#### 3.20.3.2 Materials Testing

The Contractor shall perform sufficient testing to ensure that the fill is being constructed as specified. The testing program specified below shall be considered the minimum acceptable frequency of testing. This does not relieve the Contractor from the responsibility of performing additional testing, if required to ensure compliance with these specifications.

- a. Soil Classification Tests for Fill Material  
  
Soil classification tests shall be performed in accordance with ASTM D2487. One initial classification test shall be required for each different classification of material to be utilized as

embankment fill or backfill. As prescribed in ASTM D2487, grain size analyses in accordance with ASTM D422 and Atterberg limits in accordance with ASTM D4318 shall be performed on each different classification. The Contractor shall submit additional tests for every 2,500 cubic yards of embankment or backfill material as well as compaction tests, as described below in subparagraph "Compaction Testing". Soil classification tests shall be performed on foundation material as required to determine the acceptability of the in-situ soils. Additional tests will be required if noticeable changes in the material occur.

b. Soil Classification Tests for Filter Soil

Soil classification tests shall be performed in accordance with ASTM C33/C33M, Sections 5 through 8, and shall include, but is not limited to, particle size distribution (ASTM C136), test method for soundness (ASTM C88), and percentage of friable particles (ASTM C142/C142M). Testing shall be performed by a testing laboratory validated by the U.S. Army Corps of Engineers (USACE) within the last 12 months, and results shall be provided to the Contracting Officer. During delivery, subsequent testing shall be performed, by an USACE validated lab, for every 250 tons (or fraction thereof) of aggregate to be delivered. All testing shall be representative of the materials delivered to the project site. Test results shall be signed and sealed by a licensed Professional Engineer or Geologist, licensed in the state from which the material is tested, and shall clearly state that the fine aggregate to be furnished is silica sand (per this specification).

c. Compaction Testing

(1) Compaction Tests. Run not less than one modified proctor test (ASTM D1557) for every 2,500 cubic yards of Embankment Fill or whenever a new source or soil type is used. Run not less than three vibratory table tests (ASTM D4253) per source or per culvert location for Filter Soil.

(2) In-Place Density Tests. The in-place density of the Embankment Fill shall be determined in accordance with ASTM D1556 or ASTM D6938. Run not less than four (4) field in-place density test on each lift of material or every 250 cubic yards of completed embankment fill or backfill, whichever is more stringent, evenly distributed along the open excavation area. As a minimum, at least 3 density tests shall be performed per lift below each culvert headwall structure, at least 5 density tests shall be performed per lift along the alignment of the culvert barrels, and at least 2 density tests shall be performed per lift below the wing wall structures. Horizontal locations shall be randomly staggered in the fill. When nuclear method is used for in-place density testing according to ASTM D6938, the first daily test and every tenth test thereafter for each material type shall include a sand cone correlation test in accordance with ASTM D1556. The sand cone test shall be performed adjacent to the location of the nuclear test, and shall include a nominal 6 inch diameter sand cone, and shall include a minimum wet soil weight of 6 pounds extracted from the hole. The density correlations shall be submitted with test results. The in-place density of Filter Soil shall be determined in accordance with ASTM D1556. Perform at least one Sand Cone test per lift on Filter Soil. In-place

density using the nuclear method will not be allowed in Filter Soil. Each transmittal including density test data shall include a summary of all density correlations for the job neatly prepared on a summary sheet including at a minimum:

- (i) Meter serial number and operators initials.
- (ii) Standard count for each test.
- (iii) Material description (including USCS classification and color description).
- (iv) Probe depth.
- (v) Moisture content by each test method and the deviation.
- (vi) Wet and dry density by each test method and the deviation.
- (vii) Test location and date.
- (viii) Corresponding Laboratory Density and Moisture Test (e.g. Mod. Proctor) for field density test results included w/ the submittal.
- (ix) Whether material passed or failed.

(3) Water (Moisture) Content Tests. Determination of water content shall be performed in accordance with ASTM D6938 when nuclear density test method is used. When nuclear method is used for in-place moisture content, the first and every tenth test thereafter for each material type shall include determination of moisture content based on ASTM D2216. ASTM D4643 may be used when rapid moisture content results are needed or as a substitute to ASTM D6938 or if it is determined that the latter is not reliable. All rapid results obtained by ASTM D4643 shall be confirmed by a test on a duplicate sample performed in accordance with ASTM D2216. In the event of significant disagreement (more than 2%) between the ASTM D6938 and ASTM D2216 tests, ASTM D2216 shall govern and ASTM D6938 shall no longer be used until calibration tests show agreement between methods. In the event that ASTM D6938 can not be calibrated to provide accurate results, ASTM D4643 and ASTM D2216 shall be used exclusively to determine moisture. One (1) moisture content test will be performed each time a density test is performed on any given lift.

d. Additional Testing

The Contracting Officer may request additional tests if there is reason to doubt the adequacy of the compaction, or special compaction procedures are being used, or materials change or if the Contracting Officer determines that the Contractor's testing is inadequate or the Contractor is concentrating backfill and fill operations in a relatively small area.

3.20.3.3 Testing by the Government

During the life of this contract, the Government or its QA Contractor(s) will perform quality assurance tests. The Contractor shall make materials available for testing and expose materials for testing at the request of the Contracting Officer for the duration of this contract. Provide safe access at no additional time or cost to the Government.

3.20.3.4 Reporting

On a daily basis, furnish the inspection records and all material testing results, the quantity of fill placed, as well as the records of corrective action taken, in accordance with Section 01 45 04 CONTRACTOR QUALITY



CONTROL. Also, provide monthly summary of all density/compaction tests.

-- End of Section --