Substation Construction

Specifications

For

Greenland Energy Center Switchyard

230kV Bay and Breaker Addition for Circuit 909

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I GENERAL INFORMATION

1. Scope

1.1. Scope

1.1.1. This Specification covers labor, equipment, and material requirements for the installation of the switchyard electrical equipment. The Contractor shall erect in place, test, and leave ready for service, the facilities shown on the Drawings and herein specified. The Contractor shall also have responsibilities for receiving, off-loading, and transporting certain structures, equipment, and miscellaneous materials. The Contractor shall furnish and install materials and equipment only as specified or approved by the JEA Project Engineer.

1.2. Usage

1.2.1. **Sections within this document that do not apply to this particular project shall be disregarded.**

1.2.2. **Ultimately, the Drawings supersede this document when duplicate information conflicts with each other for a particular project.**

1.3. Codes and Standards

1.3.1. The installation covered by these Specifications shall conform to the practices set forth in the latest edition of the National Electrical Code (NEC) and the National Electrical Safety Code (NESC), unless otherwise specified in these Plans and Specifications.

1.4. Equipment and Materials

1.4.1. **All Contractor-furnished materials, unless otherwise indicated, shall be new, of the first quality and of the proper type for use intended.** When applicable, all material will be in accordance with the latest published NEMA Standards and/or carry the approval of the Underwriter's Laboratories.

1.4.2. Owner-furnished items, with a general description of the items and their storage location, are listed in a separate document. The Contractor shall coordinate the receiving of the items with the JEA Project Representative. It is the Contractor's responsibility, unless otherwise specified, to furnish labor and equipment for loading, for transporting, and for off-loading the items at the job site.

1.4.3. All material and equipment stored on the substation site or other areas including Owner-furnished material and equipment shall be in the care, custody, and control of the Contractor. The Contractor shall be responsible for any necessary repairs or replacement of materials and equipment damaged, lost, or stolen while in the care and custody of the Contractor.

2. Electrical Clearances

JEA STANDARD SUBSTATION DESIGN CRITERIA								
System Voltage (kV)	Maximum Phase-to-Phase Voltage (kV)	BIL (kV)	Minimum Metal-to-Metal for Rigid Conductors (inches)	Centerline-to-Centerline Phase Spacing for Rigid Buses (inches)	*Minimum Phase to Grounded Parts for Rigid Conductors (inches)	**Minimum Clearance Above Grade [Between Bare Overhead Conductors and Ground for Personal Safety] (feet)	Minimum Between Bare Overhead Conductors and Roadways Inside Substation Enclosure (feet)	Minimum to Fence Horizontal (feet)
13.2	15.5	110	12”	24”	7”	9’	21’	10’
26.4	38	200	18”	36”	13”	10’	22’	10’
69	72.5	350	31”	60”	25”	11’	23’	12’
138	145	650	63”	96”	50”	13’	25’	14’
230	242	900	89”	132”	71”	15’	27’	16’
*ANSI C37.32, **NESC								

2.1. Safety

2.2. JEA Substation Safety/Access Training shall be required if work is to be performed within any JEA Substation. Proof of training must be available and presented to JEA before the worker begins work for the first time and on demand if requested.

2.3. All workers are required to wear the proper PPE while in a substation or active construction site.

2.4. Refer to JEA’s Contractor Safe Work Practices Manual for more information.

3. As-Built Drawings

3.1. The Contractor shall provide JEA accurate As-Built Drawings that reflect all field changes. The documents shall be signed and dated.

II SITE WORK

1. General

1.1. Permits

1.1.1. Contractor shall comply with all permit requirements accompanying these specifications and shall obtain additional permits, if required, at no additional cost to the JEA.

1.1. Transportation Standards

1.1.1. These specifications refer to all transportation regulations at local, state, and national levels.

1.1.2. The latest FDOT Standard Specifications can be found online at the following website: http://www.fdot.gov/programmanagement/Implemented/SpecBooks/

1.2. Maintenance of Traffic

1.2.1. The Contractor shall follow the Maintenance of Traffic (MOT) plan adhering to all applicable DOT regulations.

2. Surveying

2.1. Surveyor Services

2.1.1. The Contractor **shall** engage the services of a State of Florida Registered Land Surveyor to perform the limits of construction, total clearing, and the structure staking.

2.1.2. The Owner will provide the Contractor the contact information of the Surveyor used for the Drawings. It is strongly recommended that the Contractor use the same Surveyor to perform survey services.

2.2. Survey Datum

2.2.1. The horizontal and vertical datum(s) shall be the North American Datum (NAD) 1983 and North American Vertical Datum (NAVD) 1988 respectively. Any exceptions must be approved by the Project Manager prior to the commencement of work.

2.2.2. Standards

2.2.2.1. Vertical: Work shall be Third Order, as outlined in the Federal Geographic Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management.

2.2.2.2. Horizontal: Work shall be done using either standard surveying techniques or Global Positioning Satellite (GPS) system. If standard surveying techniques are used, all horizontal work shall comply with Third Order Class II, as outlined in the Federal Geographic Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management. If GPS is used, the relative horizontal accuracy shall conform to the Federal Geographic Data Committee (FGDC) Geospatial Positioning Accuracy Standards, Part 2: National Standard for Spatial Data Accuracy.

2.3. As-Builts

2.3.1. The Contractor shall provide coordinates in the appropriate State Plan Coordinates (SPCS) and Zone (latest adjustment) for all new structures.

3. Erosion Control

3.1. Contractor shall provide erosion and sediment control measures conforming to current Land Development Procedures of the City of Jacksonville, Florida, for all land-disturbing construction activities.

3.2. The Contractor shall erect silt fences around the entire jobsite in accordance with the applicable DEP requirements and the construction drawing requirements.

4. Clearing and Grubbing

4.1. The Contractor shall engage the JEA Project Engineer, JEA Project Representative, and their consulting civil engineer prior to any clearing on the job site.

4.2. The Contractor shall remove and dispose, in accordance with the provisions of this specification and associated drawings, of all standing trees including their root systems along with all brush, bushes, shrubs, stumps, vines and their associated root systems, as well as other logs, trees cut by others, wood fencing, wood structures, debris, rubbish and all other obstructions to the work area.

4.3. In accordance with the project drawings, the Contractor shall stake every 50 feet along the boundary of the areas to be cleared. The Contractor shall obtain JEA approval of the stake out prior to the removal of any trees or shrubs.

4.4. Certain trees within the property have been designated to remain. Protect these trees by providing a fence or barricade around each tree of sufficient distance away and of sufficient height to prevent damage to the tree in any way as part of this work.

4.5. The Contractor shall obtain JEA approval prior to the proposed removal of any trees or shrubs located on a boundary between areas to be cleared and those that are to remain. The

JEA Project Representative may make adjustments to the tree and shrub locations depicted on the drawings depending on actual site conditions at the time.

4.6. Total clearing and grubbing shall be accomplished within the areas designated on the plans and other areas, if/as required for construction or landscaping.

4.7. Stump Removal

4.7.1. All stumps and roots larger than 2 inches in diameter shall be removed to a depth at least 2 feet below the existing ground surface, or new final grade, whichever is lower.

4.8. Services

4.8.1. Contractor shall remove all timber by logging and/or chipping.

4.8.2. Contractor may employ any practical means for performing the work, including such equipment as tractors and chains, bulldozers with brush hooks and rakes, or axe and chain saw, such that the specified requirements for clearing and grubbing are accomplished to the satisfaction of the JEA Project Representative.

4.8.3. In areas to be cleared and grubbed that are accessible to bulldozers, Contractor shall, wherever possible, push or pull trees extracting roots all in one piece, and push out with the bulldozer blade the stumps of trees cut by others.

5. Dewatering

5.1. Prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding construction site and surrounding areas. Provide for the collection and disposal of surface and subsurface water encountered during construction. Dispose of water as approved by the Owner.

5.2. Protect subgrades from softening, undermining, washout, and damage by surface or groundwater accumulation. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.

5.3. During Construction, provide and maintain at all times during construction, ample means and devices with which to remove promptly and dispose of all water from every source entering the excavations or other parts of the work. The Contractor shall utilize quiet pumps and socks, with noise deflectors installed around the pumps, to comply with all allowable night time local noise ordinances. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades of bottoms of excavations. If dewatering is performed by use of a sock system, Contractor shall completely grout fill the abandoned

sock(s) upon completion of dewatering activities. Locations of all abandoned socks shall be indicated on Contractor submitted "as-built' drawings.

5.4. Control groundwater and surface runoff flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, and excavation uplift and heave to eliminate all interference with orderly progress of construction. Remove water by pumping or other suitable methods. Use filters on dewatering devices to avoid removal of fines from soil. Provide erosion protection at discharge locations to avoid erosion. Install dewatering system prior to the excavation reaching the groundwater in order to maintain the integrity of the in-situ material.

5.5. Verify the groundwater level prior to excavation. While the excavation is open, maintain the water level continuously, at least two (2) feet below the working level. Submit a dewatering work plan, as necessary.

5.6. Operate the dewatering system continuously until dewatering is no longer required and construction work is complete within two (2) feet of the water level.

5.7. Should ground water be encountered, the Contractor shall be responsible for utilizing a dewatering system(s) to remove water from the excavations. Prior to any dewatering, Contractor is responsible for applying for all applicable dewatering permits.

5.8. Should the above requirements not be followed, the Contractor shall be held liable for any fines and/or violations incurred by JEA.

6. Excavation for Site

6.1. Erosion Plan

6.1.1. Contractor shall provide erosion and sediment control measures conforming to current Land Development Procedures of the City of Jacksonville, Florida, for all land-disturbing construction activities.

6.2. Excavation

6.2.1. Perform excavation of every type of material encountered within the limits of the work to the lines, grades and elevations indicated on the drawings, and/or as required for foundation or other subsurface construction.

6.2.2. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.1 foot, unless over-excavation is required. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

6.2.3. Soil stockpiles should be located, constructed, and maintained to minimize unwanted changes in the natural moisture content of the excavated soils, i.e.: protect soils near optimum moisture from becoming too wet to be readily reused for backfill, or prevent soils drier than optimum from further drying. Stockpiles can be protected

from saturation by sloping and compacting the surface and side slopes to promote rainfall runoff. If additional protection is required, cover stockpile with plastic membranes. Failure to protect stockpiled soil shall not be accepted as a reason to replace the material with imported fill materials at the Owner's cost.

6.2.4. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials and obstructions. If excavated materials intended for fill and backfill include unsatisfactory materials and rock, replace with satisfactory soil materials as described herein.

6.2.5. Conduct excavation operations so that material outside the excavation limits is not disturbed or loosened. Restore material disturbed or loosened to its original condition.

6.3. Precautions

6.3.1. Safety

6.3.1.1. Contractor shall comply with all requirements of all applicable OSHA excavation safety standards and regulations. Contractor shall comply with all applicable trench safety standards. Contractor shall adhere to special shoring requirements, if any, of the state or other political subdivisions, which may be applicable to this project scope. For any project that contains a trench excavation deeper than four feet, the Contractor shall submit with his bid the cost of compliance with the applicable trench safety standards.

6.3.2. Sheeting and Shoring

6.3.2.1. The stability of previously constructed structures and facilities shall not be impaired or endangered by excavation work. Previously constructed structures and facilities include both structures and facilities existing when the work under these specifications begins and structures and facilities already provided under these specifications.

6.3.2.2. Adequate sheeting and shoring in accordance with OSHA regulations 29 CFR Part 1926 shall be provided to protect and maintain the stability of previously constructed structures and facilities and the sides of excavations and trenches until they are backfilled. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall maintain the shape of the excavation under all circumstances. Certified/stamped drawings prepared by a registered professional engineer of all shoring details as required by OSHA shall be furnished to the Project Engineer before any excavation begins. When "sloping" of the sides of the excavation or trench is used in lieu of sheeting or shoring the name of the "Competent Person" in charge for the Contractor shall be submitted in writing to the Contract Administrator before any excavation begins.

6.3.3. Depressions

6.3.3.1. Where depressions result from, or have resulted from, the removal of surface or subsurface obstructions, remove all debris and soft material as directed by the JEA Project Representative.

6.3.4. Over-Excavation

6.3.4.1. Backfill and compact all over-excavated areas as specified for fill below, and at no additional cost to the Owner.

6.3.5. Protection of In-Place Structures

6.3.5.1. Excavation likely to misalign, damage or impair the strength of structures already in place shall be made only after adequate protection has been provided. The Contractor shall repair any damage that occurs as a result of insufficient protection at no cost to the Owner. It is the responsibility of the Contractor to coordinate with the utility owners to adjust any utilities conflicting with the work under this contract at no additional cost to JEA. It is the Contractor's responsibility to locate all underground utilities prior to digging.

6.3.6. Underground Utilities

6.3.6.1. The Contractor shall determine the location of underground piping, conduit and cable before proceeding with the work. Should any utilities be encountered that were not expected, work in the area shall be halted and the Engineer notified immediately.

6.3.7. Classification

6.3.7.1. All material shall be unclassified and considered as excavation regardless of the material encountered and no additional compensation will be allowed because of difficulties met in removing such materials.

6.3.8. 1.8.8. Muck and/or Organic Removal

6.3.8.1. Where muck or other soft material occurs, the Contractor shall remove such material by excavation to suitable foundation soil or to a depth designated by the Engineer and backfill in accordance with Section VIII. The Contractor is responsible for removal of a maximum of one (1) foot of the muck. Where the Engineer directs the removal of such material to a depth in excess of one (1) foot, an adjustment in the contract price will be allowed.

6.3.9. Contaminated Soils

6.3.9.1. No hazardous materials or contaminated soil are expected to be encountered during excavation. However, in the event contaminants are found, the Contractor shall dispose of them in accordance with Chapters 62-780, and 777, Florida Administrative Code (F.A.C.), the Florida Department oif

Environmental Protection (FDEP) “Mineral Oil Dielectric Fluid Emergency Response Protocol (April 2007)”, and any other applicable federal, state, or local rules or regulations. The Contractor shall notify the JEA Contractor Administrator immediately upon contaminant discovery.

7. Excavation for Structures

7.1. General

7.1.1. All excavations shall be carried to foundation materials satisfactory to the Engineer, regardless of the elevation shown on the plans. In the event unsuitable soil is encountered at the required elevation, the Engineer shall determine the depth of removal of such soil. Unless otherwise specified, the bottoms of all excavations shall be compacted to at least 100% of maximum density per ASTM D 698 or 95% of maximum density per AASHTO T180. Prior to such compaction, the ground water shall be lowered to a depth of at least 2.0 foot below the bottom of the excavation.

7.1.2. Should ground water be encountered, Contractor shall be responsible for utilizing a dewatering system(s) to remove water from the excavations. JEA Environmental will obtain any necessary FDEP Dewatering Permit for the project. Contractor shall ensure that permit is onsite and comply with all monitoring requirements with documentation listed in FDEP Dewatering Permit for the entire time dewatering occurs on this project site. Additionally, prior to any dewatering, Contractor shall apply for a St. Johns River Water Management District (SJRWMD) Generic Permit for Short Term Dewatering, and comply with all SJRWMD requirements listed in Form No. 40C-22-0590-1.

7.1.3. **If the above requirements are not followed, the Contractor shall be held liable for any fines and/or violations incurred by JEA.**

7.2. Payment for Extra Excavations

7.2.1. If extra excavation is authorized due to unforeseen, unsatisfactory soil conditions, an adjustment in contract price will be allowed. Extra depth of footings or fill due to error in excavation shall be at the Contractor's expense.

7.3. Footings

7.3.1. To minimize differential settlement, it is essential that earth surfaces upon which footings will be placed be compacted to the approval of the JEA Project Representative and in accordance with the compaction requirements established in this section of these specifications. Excavate to the established lines and grades. Cut off bottoms of excavations level, and remove all loose soil. Where soft spots are encountered, remove all defective material and replace with lean concrete (flowable fill) or suitable backfill at no additional cost to the Owner.

7.4. Slabs

7.4.1. When undercutting of slabs is required in order to remove unsuitable material, the excavation shall be backfilled to the required elevation and compacted.

7.5. Trenches

7.5.1. The trench shall be of sufficient width and depth below the proposed final grade to ensure that all conduit spacing is maintained per the details on the Drawings.

7.5.2. Trench excavation shall be accomplished so as to ensure the conduit may be laid on a firm, undisturbed, native earth bed. In the event excavation below the required elevation is made, bedding material is to be placed and compacted so as to bring the excavation to grade.

7.5.3. Accurately shape trench bottoms so that the pipe or utilities are in continuous and uniform contact with either undisturbed soil or bedding material as shown on the Drawings. Do not backfill any trenches until all joints are made, required tests are performed, pipe encased as necessary, and Owner approval is granted to proceed.

7.6. Backfill for Structures

7.6.1. Backfill shall be deposited in layers not exceeding six (6) inches in thickness and shall be compacted to a density of not less than 100% of the maximum density per ASTM D 698 or 95% of maximum density per AASHTO T180. No backfill shall be placed against masonry or concrete walls and piers until the structure has been in place five days or until permission has been given by the Engineer. When backfilling against masonry walls, each side shall be backfilled simultaneously to prevent excessive stress.

8. Disposal

8.1.1. JEA has approved the following facilities for disposal of non-hazardous solid waste:

8.1.1.1. Trail Ridge (Waste Management), Baldwin, FL

8.1.1.2. Pecan Row (GeoWaste), Valdosta, GA

8.1.1.3. Okeechobee Farms (Chambers), Okeechobee, FL

8.1.1.4. Springhill Regional (Waste Management) Graceville, FL

8.1.1.5. Use of any other landfills is subject to approval by JEA

8.1.2. All rubbish such as tires, roofing materials, concrete, etc., resulting from clearing shall be considered to be property of the Contractor and shall be removed from the job site for proper disposal. All fees for disposal of rubbish and/or other items related to clearing shall be paid by the Contractor.

8.1.3. Contractor shall dispose of the following solid wastes if found on the property: anti-freeze containers, aerosol lubricant and solvent cans, rusted 55 gallon drums,

automobile gasoline tanks and batteries, domestic trash, oil filters and containers, appliances, demolition debris, tires, concrete, roofing materials, boards, metal, soil piles, etc.

8.1.4. All solid wastes shall be disposed in accordance with FAC 62-701 (Solid Waste/Construction and Demolition Debris), 62-710 (Used Oil and Used Oil Filters), 62-711 (Tires) and 62-730 (Hazardous Waste). Several of these materials (whole tires, appliances, batteries, oil filters, non-empty containers) are prohibited from disposal in permitted, non-hazardous solid waste landfills.

8.1.5. Any liquids discovered on-site must be properly screened (sampled and analyzed) before developing a disposal plan. Containers may be required to be crushed or cut open to demonstrate that they are empty.

8.1.6. If asbestos is determined to be present, proper precautions shall be followed when removing and transporting the material (wet material, use Type C respirators, and transport in covered vehicle)

8.1.7. No Burning will be permitted on the site.

9. Soil Testing

9.1.1. The Contractor shall employ an approved independent laboratory to do all testing. Two copies of test reports shall be submitted to the JEA Engineer.

9.1.2. The Contractor shall submit an analysis of borrow material proposed for site fill including the following tests: Particle Size Analysis of Soils (per AASHTO T88) and Permeability of Granular Soils - Constant Head (per AASHTO T215).

9.1.3. Three (3) additional Particle Size and Permeability tests shall be performed on truck loads of fill material randomly selected by the JEA Project Representative. If any of the truck loads tested does not comply with the A-3 group of AASHTO M145 containing less than 5% fines, the material shall be rejected, and the Contractor shall perform six (6) additional sets of tests on material in place. Any material in place that does not comply with the A-3 group of AASHTO M145 containing less than 5% fines shall be removed and replaced with acceptable material at no additional cost to the Owner. The Contractor shall pay for all of the above testing.

9.1.4. Compaction: In-place density tests shall be made in accordance with AASHTO T191-61, ASTM D1556-74, ASTM D2167-77, or ASTM D2922-78 at the following locations:

9.1.4.1. Ten (10) tests per layer of site fill at locations determined by the JEA Project Representative for site compaction.

9.1.4.2. One (1) test under each of ten (10) foundations as selected by the JEA Project Representative. Compaction tests shall be made no sooner than one day

before the placing of a succeeding layer of fill or the pouring of a foundation, as the case may be. The intent of the time stipulation is to minimize the loss of compaction due to moisture loss after the compaction test has been made.

9.2. Soils Investigation

9.2.1. The Owner may share a geotechnical exploration report used for design and study purposes only. The Owner does not assume any responsibility with respect to the sufficiency or accuracy of the borings, or of the interpretations made thereof. There is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations are representative of those existing throughout the site, or any part thereof, or that unforeseen developments may not occur. The Contractor shall make an inspection of the site to determine the conditions under which the work is to be performed and may obtain additional core borings, if deemed necessary.

10. Site Fill

10.1. All soil for fill shall be of a quality acceptable to the Engineer and shall be free from roots, rubbish or other extraneous material.

10.2. Rock Yard

10.2.1. The fill material for the rock yard shall be sand with less than 5% fines similar to materials classified in the A-3 group as shown in AASHTO M145.

10.2.2. No fill material for the rock yard shall be placed until receipt of a Letter of Certification from an independent testing company stating that the fill material is in compliance with the A-3 group of AASHTO M145 containing less than 5% fines.

10.2.3. Fill shall be placed in successive layers of not more than twelve (12) inches in thickness, loose measure. Each layer shall be compacted to a density of at least 95% of the maximum density as terminated by AASHTO T99. The top underlying twelve (12) inches shall be compacted to 98% of maximum density as per ASTM D-1557. Elevations after final grading shall be within 0.1 foot above or below plan dimensions.

10.2.4. Material: All soil for fill (if required) shall be of a quality acceptable to the JEA Engineer and shall be free from roots, rubbish or other extraneous material. The fill material shall be sand-clay or sand-silt mixture similar to materials classified in the A-2 or A-3 group as shown in AASHTO M145. At least the top nine (9) inches of the site shall be stabilized with a mixture of three (3) inches of limerock and six (6) inches of sand, compacted to 98% of maximum density as per AASHTO T99. Borrow, where necessary, shall be provided from sources off the site in areas provided by the Contractor. The borrow pit shall be available for inspection by the Engineer.

10.2.5. Placement: Embankments shall be constructed true to lines, grades and cross sections shown on the plans. Fill shall be placed in successive layers of not more than twelve (12) inches in thickness, loose measure. Each layer shall be compacted to a

density of at least 95% of the maximum density as determined by AASHTO T99 except that the final 9 inches of stabilized fill shall be compacted to maximum density as per AASHTO T99. Elevations after final grading shall be within 0.1 foot above or below plan dimensions.

10.2.6. No fill material shall be placed until receipt of a Letter of Certification from an independent testing company stating that the fill material is in compliance with the A-2 or A-3 group of AASHTO M145.

10.3. Outside Rock Yard

10.3.1. The fill material for areas outside the rock yard shall be sand similar to materials classified in the A-3 group as shown in AASHTO M145. Fill shall be placed in successive layers of not more than twelve (12) inches in thickness, loose measure. Each layer shall be compacted to a density of at least 95% of the maximum density as determined by AASHTO T99 except that the final 9 inches of stabilized fill shall be compacted to maximum density as per AASHTO T99. Elevations after final grading shall be within 0.1 foot above or below plan dimensions.

10.4. Embankments

10.4.1. Embankments shall be constructed true to lines, grades and cross sections shown on the plans

10.5. Borrow

10.5.1. Borrow, where necessary, shall be provided from sources off the site in areas provided by the Contractor. The borrow pit shall be available for inspection by the Engineer.

11. Rocking

11.1. Triax Geogrid and Filter Fabric System

11.1.1. Tensar TriAx TX140 geogrid shall be placed over filter fabric on all areas to be rocked and SHALL develop the structural support previously attained with limerock stabilization which is now only allowed under impervious surfaces.

11.1.2. Filter Fabric and TriAx TX140 Geogrid: The exposed subgrade soils shall be lined with a soil stabilization geotextile nonwoven filter fabric. The filter fabric shall be Mirafi 140N or approved equal, which shall be installed as per manufacturer's instructions and precautionary statements. Once the filter fabric is in place on all areas to be rocked, Tensar TriAx TX140 Geogrid shall be placed on top of the filter fabric as detailed in the plan drawings. After the filter fabric and TX140 geogrid are in place and secured per manufacturer requirements, then the rock can be placed as directed in the plan drawings.

11.2. Aggregate Fill

11.2.1. Aggregate fill (rock) shall be **washed** blue/gray limestone or granite (natural). All rock shall be a gradation equal to **Size #5**, as shown in AASHTO M43 or ASTM D448 **(Note: Size #57 will not be acceptable).** The Contractor shall submit a sample and sieve analysis of the aggregate for approval before proceeding with the rocking. Before placement of the aggregate, the subgrade shall be dressed and compacted.

11.2.2. A representative list of suppliers is:

Conrad Yelvington	Daytona Beach, FL	(904) 767-5500
Conrad Yelvington	Jacksonville, FL	(904) 358-6740
Vulcan Materials	Birmingham, AL	(205) 877-3086

12. Herbicide

12.1. **Prior to spreading aggregate in the substation area**, the Contractor shall have the area treated with DuPont Krovar I DF for selective control of weeds. Substation area shall be defined as the structure area and areas between the pavement and the fence. Areas outside of the fence where rock is to be installed shall not be treated. Application shall be by a licensed pesticide applicator in accordance with the manufacturer's instructions and precautionary statements. Personal protective equipment recommendations on the MSDS shall be strictly followed. Federal, State and local regulations regarding handling, transportation and spills shall be observed by the applicator.

III FOUNDATION

1. Concrete

1.1. Applicable Standards

1.1.1. ACI 318 (latest revision) "Building Code Requirements for Reinforced Concrete."

1.1.2. ACI 301 (latest revision) "Building Code Requirements for Structural Concrete."

1.1.3. ACI 306 (latest revision) "Recommended Practice for Cold Weather Concreting."

1.1.4. ACI 305 (latest revision) "Recommended Practice for Hot Weather Concreting."

1.1.5. ACI 613 (latest revision) "Recommended Practice for Selecting Proportions for Concrete."

1.2. Materials

Material	For Drilled Piers	For Others
Cement	Portland Cement, Type 1 (ASTM C150) Low Alkali, Max. of 0.6% equivalent Na_2O	Portland Cement, Type 1 (ASTM C150)
Fine Aggregate	Sand (ASTM C33)	Sand (ASTM C33)
Coarse Aggregate	** Gravel, crushed stone, or slag (ASTM C33)	Gravel, crushed stone, or slag (ASTM C33)
Water	Potable water, clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other delirious substances	Potable water, clean and free from injurious amounts of oils, acids, alkalis, organic materials, or other delirious substances
* Must conform to the standard in parenthesis ( ) ** Coarse aggregate shall be tested for potential alkali reactivity according to ASTM C-289; reactive aggregate will not be permitted.		

1.3. Concrete Proportioning

1.3.1. **The concrete mix design for the class of concrete specified shall be prepared and submitted to the JEA Project Engineer for approval. No concrete shall be placed without prior approval of the mix design.**

1.3.2. Composition: The concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water. The ingredients shall be proportioned to produce a dense, workable concrete, free from voids. The concrete shall be designed in accordance with applicable ACI standards to attain the properties of strength, slump and rate of hardening required by these specifications.

1.3.3. Maximum Size of Coarse Aggregate: Maximum size of coarse aggregate shall not be larger than 3/4 the minimum clear spacing between the reinforcing bars.

1.3.4. Strength and Slump: The following are the minimum compressive strength and slump ranges for the various types of concrete construction:

Type of Construction	Compressive Strength 28 Days, (psi)	Slump (in.)
Footings, Slabs on Grade, Bond Beam, and Lintel	3000	3±1
Headwalls and Drop Inlets	3000	5±1
Paving	3000	3±1
Curb and Gutter, Ditch Pavement	2500	3±1
Drilled Piers	4000	7-9

1.3.1. All slump tests shall be in accordance with ASTM C143 and shall be performed by the Contractor as directed by the JEA Project Representative.

1.4. Air Content

1.4.1. The air content in the concrete shall be maintained in accordance with the following requirements:

Maximum Size Coarse Aggregate (in.)	Air Content by Volume (%)
1 ½	3±1
¾ or 1	4±1
3/8 or ½	5±1

1.5. Admixtures

1.5.1. Air entrainment shall be produced by the addition of an air-entraining admixture meeting the requirements of ASTM C260. Air entraining cement will not be permitted. If required, an approved water reducing retarder may be used in the proportions recommended by the manufacturer.

1.6. Proportioning of Ingredients

1.6.1. Proportions, including water-cement ratio, shall be established on the basis either of laboratory trial batches or of field experience with the materials to be

employed. The mix design together with supporting data shall be submitted to the Engineer for approval. The Engineer may, at his discretion, require only a letter from the concrete supplier indicating compliance with the specifications in lieu of submission of a mix design.

1.7. Reinforcing Steel

1.7.1. Reinforcing Bars: Reinforcing bars shall conform to ASTM A615, ASTM A616 or ASTM A617, Grade 60. Grade 40 for #5 bars and smaller, where applicable.

1.7.2. Welded Wire Fabric: Welded wire fabric shall conform to ASTM A185. Welded wire fabric shall not be used for drilled piers.

1.7.3. Shop Drawings: **Shop drawings for fabrication and placing of the reinforcing steel and accessories shall be submitted to the Engineer for approval.**

1.7.4. Cleaning and Bending: Metal reinforcement at the time concrete is placed shall be free from loose, flaky rust, loose scale, mud, oil or other coatings that will destroy or reduce the bond. All bars shall be bent cold. Details of hooks and bends for reinforcement shall be in accordance with ACI 318.

1.7.5. Placing Reinforcement: Metal reinforcement shall be accurately placed and adequately secured in position by concrete or metal chairs and spacers. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in the concrete. Reinforcing steel shall be handled and placed in accordance with ACI 318.

1.8. Embedded Items

1.8.1. All sleeves, inserts, anchors, ground rods and other embedded items shall be placed prior to concreting. Anchor bolts shall be set to the exact horizontal dimensions shown. The Contractor shall provide adequate protection for all threaded sections of the anchor bolts above the surface of the concrete. Any threaded section of the anchor bolts above the surface of the concrete which becomes damaged or encrusted with concrete during and/or after pouring shall be returned to their original threaded condition at no cost to the Owner. Apply cold galvanizing after re-threading and again after setting structures in their final position.

1.9. Mixing and Delivery of Concrete

1.9.1. Mixer: Unless otherwise authorized, the mixing of concrete shall be done in a batch mixer of approved AGC type or in ready-mix equipment conforming to ASTM C94. The volume of the mixed material for each batch shall not exceed the manufacturer's rated capacity of the mixer.

1.9.2. Mixing Time: The concrete shall be mixed until there is a uniform distribution of the materials and shall be discharged completely before the mixer is recharged. For job-mixed concrete, the mixer shall be rotated at the speed recommended by the manufacturer and mixing shall be continued for at least one and one-half (1-1/2)

minutes after all materials are in the mixer. For mixers larger than one cubic yard capacity, the minimum mixing time shall be increased 15 seconds for each additional 1/2 cubic yard of concrete or fraction thereof.

1.9.3. Delivery: **A TICKET OR TIME SLIP SHALL ACCOMPANY EACH BATCH, SHOWING THE TIME OF THE BATCHING OF THE CEMENT AND THE AMOUNT OF WATER THAT CAN BE ADDED ON SITE.** Each batch of concrete shall be delivered to the site of the work and discharged completely within 90 minutes after addition of the cement to the aggregates. Exceptions to this 90 minute time limit will be permitted only upon special permission from the JEA Engineer. The production and delivery of ready-mixed concrete shall be such that not more than 20 minutes shall elapse between the depositing of successive batches of concrete in any monolithic unit of concrete.

1.9.4. Cold Weather Batching: When the temperature is below 40°F or is likely to fall below 40°F during the 24-hour period after placing, adequate equipment shall be provided for heating the concrete materials. No frozen material or materials containing ice shall be used. Temperatures of the separate materials, including the mixing water, when placed in the mixer, shall not exceed 140°F. When placed in forms, the concrete shall have a temperature of between 50°F and 90°F.

1.9.5. Addition of Water: Indiscriminate addition of water to increase slump shall be prohibited. When concrete arrives at the site with slump below that suitable for placing, water may be added only if neither the maximum water-cement ratio nor the maximum slump is exceeded. The concrete supplier must submit, at the time of delivery of each batch of concrete, a signed letter stating the maximum amount of water that may be added to the **entire** load of concrete in the truck. This will be a **one time** addition of water. The letter must also state that addition of the specified amount of water will not affect the design requirements of the approved concrete mix design. Acceptance of this by JEA does not relieve the Contractor from meeting the design specifications required herein. If addition of water results in a failure of any test of any kind of the concrete placed, the Contractor shall remove and replace the concrete at no cost to JEA.

1.9.6. Any addition of water above that permitted by the limitation on water-cement ratio must be accompanied by a quantity of cement sufficient to maintain the proper water-cement ratio.

1.10. Forms

1.10.1. Installation: Forms shall conform to the shape, lines and dimensions of the members as called for on the plans, shall be substantially free from surface defects and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape.

1.10.2. Removal: Forms shall be removed in such a manner and at such a time as to insure the complete safety of the structure. Form work for drilled piers and other parts not supporting the weight of the concrete may be removed as soon as the concrete has

hardened sufficiently to resist damage from removal operations. In no case shall the supporting forms or shoring be removed until the members have acquired sufficient strength to safely support their own weight and the load thereon.

1.10.3. Footings: Earth cuts may be utilized for forms provided the sides are stable at time of placing.

1.10.4. Chamfers: Exposed corners of columns, beams and piers shall be chamfered ¾".

1.11. Placing of Concrete

1.11.1. Preparation of Equipment and Place of Deposit: Before placing concrete, all equipment for mixing and transporting the concrete shall be cleaned; all debris and ice shall be removed from the spaces to be occupied by the concrete and all reinforcement shall be thoroughly cleaned of ice or other coatings. Water shall be removed from the place of deposit before concrete is placed unless otherwise permitted by the JEA Engineer.

1.11.2. All reinforcement, forms, fillers and ground with which the concrete is to come in contact shall be free from frost. Concrete shall not be deposited during rain unless adequately protected and, in any case, preparations shall be on hand to protect newly placed concrete from rain until it has hardened sufficiently so that it will not be damaged.

1.11.3. Conveying: Concrete shall be conveyed from the mixer to the place of final deposit by methods which will prevent the separation or loss of the materials. Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery end and without separation of the materials.

1.11.4. Placing: No concrete shall be placed until the JEA Engineer or JEA Project Representative has inspected forms, reinforcing and conditions incidental to the pour. Concrete shall be deposited as nearly as practicable in its final position to avoid separation due to re-handling or flowing. All concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around the reinforcement and embedded items and into the corners of forms.

1.12. Finishing

1.12.1. Patching: Immediately after stripping forms, all defective areas shall be patched with mortar similar to the concrete mix. Proprietary compounds for patching may be used provided they are used in accordance with the manufacturer's recommendations.

1.12.1.1. Major defective areas, including those resulting from leakage of forms, excessive honeycomb, large bulges and large offsets at form joints shall be chipped away to expose sound material and the surfaces that are to be

patched shall be coated with an epoxy-polysulfide adhesive. The patching mortar shall be pressed in for a complete bond and finished to match adjacent areas.

1.12.1.2. Minor defective areas, including honeycomb, air bubbles, holes resulting from removal of ties and those resulting from leakage of forms shall be patched with grout without resorting to chipping.

1.12.2. Finishing: After patching, finish exposed-to-view surfaces as follows:

1.12.2.1. Standard Finish - Trim remaining bulges and offsets to remove fins and form blemishes, and dress rough edges. Rub with carborundum and water as necessary to achieve this finish. The result should be a solid concrete surface in a true and accurate plane.

1.12.2.2. Rubbed Finish: In addition to the work required for a "standard finish," rub all the surfaces with carborundum and water to provide the hereinafter specified results. Wood grain pattern from wood forms need not be removed but shall be rubbed to provide uniformity of surface. Smooth surfaces resulting from overlaid plywood and metal shall be rubbed to remove the glaze. The result should be a solid concrete surface in a true and accurate plane, having a uniformly rubbed finish and free of glazed areas.

1.12.2.3. Areas to be finished as described above:

Rubbed Finish: Control house bond beam surfaces.

Standard Finish: All other exposed-to-view surfaces.

1.13. Finishing of Uniformed Surfaces

1.13.1.1. General: Grade and screed the surfaces to the exact elevation or slope shown or required. After screeting, tamp the mixture thoroughly to drive the coarse aggregate down from the surfaces and apply the finish below.

1.13.1.2. Float Finish: Finish the surface with a wood or machine float to a true and uniform plane with no coarse aggregate visible. Dusting to absorb surface water will not be permitted.

1.13.1.3. Broom Finish: Finish the surface with a wood or machine float to a true and uniform plane with no coarse aggregate visible. In addition, lightly broom the surface to make skid resistant. Dusting to absorb water will not be permitted.

1.13.1.4. Finish Schedule: Apply indicated finish as scheduled below:

Foundation	Trowel	Broom	Float
Control House	X		

Transformer		X	
Circuit Breaker		X	
All Others			X

1.14. Joints

1.14.1. Construction joints shall not be permitted except in the locations shown on the plans. All reinforcing steel and welded wire fabric shall be continued across joints. Bond shall be obtained by either the use of an approved adhesive or by roughening the surface of the concrete in an approved manner.

1.14.2. Isolation Joints shall be provided to separate concrete slabs from columns, footings or walls. There shall be no connection across the joint by reinforcement, keyways or bond. Joints shall be filled with preformed joint filler material conforming to ASTM D994 and sealed with a material compatible to the joint filler.

1.14.3. Control Joints made of pre-molded joint material shall be installed in floor slabs to allow for contraction caused by drying/shrinkage. Joints shall be spaced at a maximum of 20 feet with the joint spacing chosen so that the panels are approximately square. Depths of control joints shall be one-fifth the slab depth.

1.15. Curing and Protection

1.15.1. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. The approved practices of cold weather and hot weather concreting are those outlined in ACI 306 and ACI 305, respectively.

1.16. Vapor Barrier

1.16.1. All floor slabs on grade or fill shall be waterproofed with one ply of polyvinyl chloride (PVC) 6 mils thick. The PVC sheet shall be laid on the subgrade after it has been dressed and compacted. Joints shall be lapped six inches and sealed continuously with a pressure-sensitive tape, especially made for this purpose, or with an approved water-resistant adhesive. PVC sheets shall be turned up four (4) inches at walls, columns, and all other items projecting above the slab. Before concrete is placed, the sheets shall be carefully inspected and all punctures shall be patched with the pressure-sensitive tape or additional plies of strips of PVC sheeting laid down on approved adhesive.

1.17. Concrete Sealer

1.17.1. Interior concrete floor slab in Control House shall be dustproofed and sealed with a sealer similar or equal to Sherwin Williams Tru-Glaze 4508. Color shall be gray. The sealer shall be installed and finished in strict accordance with the manufacturer's directions. The JEA Project Representative shall be present during application.

1.17.2. Interior concrete floor slab in Control House Battery Room shall be given two (2) coats of “Sonoplex” floor sealer. Prior to application, all surfaces shall be cleaned and free of soil, dust, loose material, oil, grease, paint, parting, and curing compounds and all other foreign matter. All dirty or contaminated floors shall be cleansed with hot TSP solution (trisodium phosphate) and rinsed thoroughly with clean water. The floor shall be thoroughly rinsed with clean water and a squeegee and allowed to dry thoroughly before coating with “Sonoplex”. The floor sealer shall be applied in strict accordance with the manufacturer’s recommendations. The JEA Project Representative shall be present during application.

2. Concrete Testing

2.1. Testing Laboratory: The Contractor shall, at his expense, employ an approved independent laboratory to prepare cylinders and perform all concrete testing. Two (2) copies of all test reports shall be submitted to the Engineer.

2.2. Tests: **Each truckload or partial truckload of concrete shall be tested for air content, slump and compressive strength.**

2.2.1. Air Content: Tests for air content shall be made in accordance with ASTM C173 or ASTM C231.

2.2.2. Slump: Tests for slump shall be made in accordance with ASTM C143.

2.2.3. Compressive Strength: For each compressive test, one set of four (4) cylinders shall be made. Test cylinders shall be prepared in accordance with ASTM C31 and ASTM C172. One cylinder shall be tested at 7 days, two at 28 days and the fourth held in reserve. The 28-day strength shall be the average of the two cylinders tested. The strength level of the concrete will be considered satisfactory if the average equals or exceeds the required f'c. Compressive strength tests shall be made in accordance with ASTM C39.

2.3. Core Test: If compressive tests do not conform to the requirements of these specifications, approval may be given by the Engineer for the Contractor to have alternate strength tests made, provided that the concrete satisfies all other requirements of these specifications. Alternate strength tests shall be made on specimens secured from the structure in accordance with ASTM C42 (Core Test). These alternate tests shall be made at the Contractor's expense. If the concrete does not meet the required specifications, the concrete so represented or the entire structure, if concrete not meeting these specifications is a part thereof, shall be removed and replaced by the Contractor at his expense. In structure elements for which the strength of the concrete is not critical and the structural integrity is not affected, the Engineer may, at his discretion, allow the concrete to remain in place.

3. Drilled Pier Installation

3.1. General

3.1.1. For purposes of this specification, a drilled pier shall be defined as a foundation element constructed by excavating a circular shaft in the soil which subsequently is filled with concrete, reinforcing steel and anchor bolt cage as required.

3.1.2. It is not the intent of these specifications to unnecessarily restrict the contractor in his construction methods, techniques or equipment. However, methods, techniques or equipment herein specified are considered necessary to provide adequate pier installation. Deviations from these techniques or equipment may be made only if approved by the Engineer in advance. All work shall be done and completed in an acceptable manner in accordance with best modern practices for construction of drilled pier foundations, notwithstanding any omissions from the specifications or drawings.

3.2. Familiarization

3.2.1. Prior to all work of this section, the Contractor shall become thoroughly familiar with the site, the site conditions, and accessibility to all drilled pier locations.

3.3. Installation Personnel

3.3.1. The Contractor shall have a minimum of four (4) years of experience in reinforced concrete drilled pier installation. A resume indicating this experience shall be included with the bid. Drilled piers shall be installed by personnel experienced in this rotary excavation and pouring operation. In addition to the familiarity which the contractor may have with the process, the key operating personnel must have had prior experience in drilled pier installations, preferably relevant to anticipated subsurface materials, water conditions, shaft sizes and special techniques required.

3.4. Pier Alignment and Dimensions

3.4.1. All drilled piers shall be installed from the ground surface as existing. The maximum variation of the center of any pier from its design location shall be three inches (3"), and no pier shall be out of plumb more than one percent (1%) of its length. All piers shall be at least as large in diameter as shown on the drawings. Tolerance of top elevation shall be plus one inch (1"), minus three inches (3"). If these tolerances are exceeded, proper additional construction (including costs of engineering and redesign) as required by the Engineer shall be provided without additional cost to the Owner.

3.5. Excavation

3.5.1. Shafts for piers shall be either drilled or augured by the use of a combination of power driven rotary type rig and bits or augers of a size and type to excavate the required diameter and depth as specified on the drawings.

3.5.2. Removal of materials from the shaft shall be by the use of the auger or a drilling mud slurry re-circulated from a sump through the hollow drill stem back up the

open shaft and into the sump. Excavated material shall be disposed of in a manner subject to the approval of the Owner.

3.6. Drilling Mud

Commercially produced drilling mud should be compatible with existing soil conditions at the construction location. If salt or brackish water is used to mix the drilling fluid, or if a salt or brackish formation is to be penetrated by the drilled shaft, an attapulgite clay or "salt-gel" shall be used as the mineral additive. In an acid environment, it may be necessary to neutralize the drilling fluid and/or use bentonite as the mineral additive. Bentonite shall not be left in the excavated shaft longer than 8 hours

3.6.1. The drilling fluid must be maintained above the natural water table at all times and must have a viscosity or consistency capable of maintaining a stable excavation. Shaft depth should be measured upon completion of the initial cleaning process and again immediately prior to pouring concrete. If there is six inches (6") or more difference, the shaft must be re-cleaned. In addition to measuring the hole depth just prior to placing concrete, a sample of the drill fluid, two feet (2') above the bottom of the shaft should be obtained. If the concrete pouring time will be less than 45 minutes, the fluid density may be a maximum of 85 pcf as measured by a mud density balance. If the concrete pouring time exceeds 45 minutes, the fluid density shall be 80 pcf or less. If it can be demonstrated that there is no sand precipitation from the 85 pcf fluid after 45 minutes, the heavier fluid density will be allowed.

3.6.2. The responsibility for obtaining the sample of drilling fluid and determining the specific gravity will be the Contractor's and will be observed by the JEA Project Representative. The method of obtaining the sample and determining the fluid specific gravity or density will be subject to approval by the owner.

3.7. Temporary Casings

3.7.1. Temporary casings will be required at locations where the soil will not stand without support, or where, because of ground water conditions, sloughing of the sides of the piers may seriously delay or endanger the satisfactory completion of excavation and placement of concrete. The Contractor shall have immediately available for use on the job an ample supply of casings for each size which may be required and shall provide additional amounts, if required, to ensure orderly progress of the work. The casings shall be of such strength and rigidity as to maintain the required excavation lines and to resist crushing due to hydrostatic and/or earth pressure. All temporary casings shall be removed as concrete is placed or immediately thereafter, and in such a manner as to prevent sloughing material from dropping to the bottoms of the piers or falling on top of freshly placed concrete.

3.8. Permanent Casings

3.8.1. When piers penetrate very soft strata, the contractor may use corrugated metal pipe as forms to maintain the shape of the pier through these layers. The inside diameter of the casing shall be at least the nominal shaft diameter. Insertion into the

excavated hole shall not unduly disturb side walls. When such casings are utilized, they shall not be removed, but shall remain in place.

3.9. Reinforcing

3.9.1. Reinforcing steel shall be the lengths and sizes shown on the drawings and shall conform to the requirements of the subsection Concrete except as modified below.

3.9.2. The pier reinforcement shall be assembled as a cage above ground and sufficiently braced to enable placing of the cage into the pier hole as a unit, without deforming, twisting or bending.

3.9.3. The contractor shall provide guides on the outside of the reinforcing cage to allow the cage to be centered in the open shaft. The guides shall be of such size and design as to be able to furnish the concrete cover for the reinforcing steel as shown on the drawings. Guides shall be placed in sufficient quantities to stabilize the reinforcing cage during concrete placement. A sample of the guide shall be submitted for approval.

3.10. Concrete

3.10.1. Except as modified below, concrete shall conform to the requirements of the subsection Concrete.

3.10.2. Concrete shall be placed as soon as practicable after completion of excavation and installation of reinforcing and in a manner that will not cause segregation of materials.

3.10.3. When holes cannot be kept free of groundwater, concrete shall be placed by the use of a tremie pipe. The diameter of the tremie pipe should be as large as possible, but not greater than 1/3 the diameter of the shaft being poured. Drilled shafts less than thirty (30) feet deep may be poured with either a bottom sealed or traveling plug tremie. The traveling plug must be sufficiently tight so as to prevent the mixing of the drill fluid and concrete. The reinforcing steel cage shall be in place before any concrete is placed in the tremie. With the tremie on the bottom of the shaft, the tube shall be filled to the top extending above the ground. The filled tremie shall be picked up approximately one (1) foot off the bottom of the shaft to allow the weight of the concrete to displace the seal at the bottom of the tremie. During this initial pouring operation, the tremie is not to be pulled to such a height so as to clear the surface of the concrete already placed in the shaft. All concrete shall be poured through the now open tremie, with care taken to maintain a sufficient head of concrete to completely displace all drilling mud and suspended cuttings of material and to provide sufficient pressure so as to prevent reduction in pier diameter by earth pressure on the fresh concrete. The concrete in each pier shall be overpoured sufficiently to assure that clean, uncontaminated concrete is present at the top of the shaft.

3.10.4. During concrete pouring operations through the tremie, should the surface of the concrete in the pier be breached by the tremie, the tremie tube shall immediately

be withdrawn from the hole, resealed and inserted below the surface of the concrete and pouring operations resumed. It may be necessary during large pours to replace the original long tremie with a shorter one. The replacement tremie should be sealed and inserted at least one hole diameter. Should the Engineer deem it necessary, when a breach occurs (and contamination is suspected), the Contractor shall retrieve the reinforcing steel cage, re-drill the shaft to reopen the hole, and begin the concreting operations from the bottom of the pier shaft.

3.10.5. Temporary casings shall be withdrawn as the concrete is deposited. A sufficient head of concrete shall be maintained to insure that no extraneous material enters the concrete and that necking has not occurred. An initial jerk of 2 to 4 inches will be permitted to start the lift; thereafter, while being removed from the pier hole, the casing must be kept plumb and must be pulled with a smooth vertical motion, without jerks.

3.10.6. The concrete along the full length of the anchor bolts shall be vibrated if the Engineer so directs.

3.10.7. Under certain circumstances, construction joints in pier shafts may be permitted. Prior approval must be obtained from the Engineer. Any such construction must be accomplished under dewatered conditions using approved ACI procedures, and must be properly recorded in the drilled pier report.

3.11. Checking Completed Piers

3.11.1. If the engineer has reason to suspect that the concrete was breached by the tremie, or that the pier, for any other reason, may contain extraneous material or otherwise fail the specifications, he may order the pier cored for inspection and/or testing. If the core recovery and/or test results indicate non-compliance with the specifications, the Contractor shall bear the expense of the investigation and/or testing and shall also, at no cost to the Owner, install proper additional construction as required by the Owner. Should the investigation and/or testing indicate compliance with the specifications, the Owner shall bear the cost of such investigation and/or testing.

3.12. Reports

3.12.1. A complete report of each pier installed shall be made for the Engineer. This report shall contain all dimensions, location of pier, elevation of bottom and top as actually poured, measured amount of concrete placed in each pier hole, and any other pertinent data. All cavities encountered should be clearly indicated. All lengths of permanent and/or temporary casings should be clearly shown. All unusual conditions shall be clearly described. This information shall be forwarded as soon as possible for review of condition/s encountered.

3.13. Extra Compensation

3.13.1. It is the Contractor's responsibility to familiarize himself with the site and subsurface conditions before submitting his proposal. Ignorance of conditions will not be accepted as the basis of a claim for additional compensation. Payment for extra concrete due to overdrilling will not be made.

IV HIGH VOLTAGE

1. Switchyard Structures

1.1. Furnish, Delivery, & Storage

1.1.1. The Owner shall furnish the substation structures as shown in the Drawings.

1.1.2. The Contractor shall furnish labor and equipment for receiving, off-loading, and storing these materials at the job site.

1.1.3. The Contractor shall notify the Owner of any damage to the structures and errors in the structure fabrication before and during the installation, so that the Owner may coordinate with the Manufacturer and make good any such damage to equipment.

1.1.4. The Contractor shall provide dry storage containers, as required, for all items (including but not limited to cardboard boxes, fragile items, etc.) requiring inside storage until assembly and installation by the Contractor. Tarps and/or covers placed on top of the material and stored outdoors do not qualify as dry storage.

1.2. Bid Information

1.2.1. The Contractor shall include in the bid and be responsible for the correction of minor errors and minor modifications in the structures in order to provide for a complete installation as indicated on the Drawings. Corrections shall include but not be limited to the following: reaming misaligned holes, punching new holes, and clipping or punching support angles as required. Approximately 100 punched holes shall be considered minor modifications. All modifications shall be cold galvanized to resist corrosion.

1.3. Substation Steel Structures

1.3.1. The steel structures, as shown on the Drawings, will be furnished by the Owner and are fabricated for bolted field assembly. Mounting holes for equipment have been included in the fabrication of the structures.

1.3.2. The Contractor shall install all substation structures as indicated in the Drawings. Assembly of the structures shall be in accordance with the Manufacturer's assembly drawings, unless otherwise specified.

1.4. Substation Aluminum Structures

1.4.1. The Contractor shall provide and install a bit-u-mastic coating for the bases of all aluminum structures which come into direct contact with concrete foundations.

1.5. Mounted Equipment

1.5.1. Any equipment mounted on the structures by the Contractor (e.g. AC panels, outlet boxes, etc.) shall be mounted utilizing galvanized or stainless steel materials and hardware. Whenever practical, the Contractor shall mount miscellaneous equipment to the structures using non-penetrating methods such as back-to-back unistrut. All holes drilled to mount such equipment shall be cold galvanized to resist corrosion.

1.6. Lightning Masts (Probe Poles)

1.6.1. Erection of the lightning masts shall be in accordance with the Manufacturer's assembly drawings.

2. Circuit Breakers

2.1. Furnish, Delivery, & Storage

2.1.1. The Owner shall furnish the circuit breakers.

2.1.2. The Contractor shall receive, off-load, and store the equipment and accessories in accordance with the Manufacturer's instructions. In some instances, the Contractor will be required to transport the equipment from an off-site location in Duval County to the job site.

2.1.3. The Contractor shall ground the circuit breaker, including each high-voltage bushing, immediately upon arrival at the job site. This may be done by means of temporary attachment to the ground grid, when approved by the JEA Project Representative.

2.1.4. The Contractor shall run temporary AC power for the heater inside the control panel immediately upon arrival at the job site.

2.2. Assembly

2.2.1. The Owner, the Equipment Manufacturer's Contractor, or representative acting as an agent for the Owner, will furnish and operate the filtering equipment, vacuum drying equipment or SF-6 gas handling equipment, and provide the insulating oil or SF-6 gas. The Owner will be responsible for filling and final adjustment of the circuit breakers.

2.2.2. The Contractor shall be responsible for minor assembly of the breaker at the job site, which includes such things as supports, control panel doors, etc. Items shall be assembled according to Manufacturer's instructions.

2.2.3. The Contractor shall place the circuit breakers on the foundations. The Contractor shall install the circuit breakers as indicated by the drawings. The breakers shall comply with NESC clearance requirements for energized parts.

2.2.4. The Contractor shall install high-voltage conductors, conduit, low-voltage cable, fiber optic cable, grounding, and foundations for the circuit breakers per the Drawings and Manufacturer's instructions.

2.2.5. The Contractor shall terminate the low-voltage cables at the breaker and control house per the Drawings. The Contractor shall **NOT** terminate or disconnect low-voltage cables if the substation is energized, unless instructed by the Project Engineer. The Contractor will not be responsible for terminations of fiber optic cable.

2.3. Labeling

2.3.1. The Contractor shall provide and install all labeling of all circuit breakers in the switchyard. The paint shall be Rust-oleum spray on #7777-830, flat black. The labels shall be with a block stencil with six (6") inch high letters.

2.3.2. The equipment designations to be used are shown on the Single-Line Drawing, for example: 931, 25T1.

2.3.3. The Contractor shall prepare the surface of the breakers prior to painting, in a manner approved by the JEA Project Representative.

2.3.4. The labeling shall be applied, at approximately eye level, in two (2) places: on the right hand side of the cabinet door and another location as specified by the JEA Project Representative.

3. Air Switches

3.1. Furnish, Delivery, & Storage

3.1.1. The Owner shall furnish all switchyard air switches.

3.1.2. The Contractor shall receive, off-load, and store the equipment and accessories in accordance with the Manufacturer's instructions.

3.2. Installation

3.2.1. The Contractor shall install the switches, motor operating mechanisms, and load break devices as shown in Drawings and in accordance with the Manufacturer's instructions.

3.2.2. The Contractor shall align all operating handles such that the mechanism may be locked in the "OPEN" or "CLOSED" position.

3.2.3. The minimum clearance between contacts of each pole in the open position shall be adjusted to meet the requirements of NESC and NEMA standards.

3.2.4. The Contractor shall ensure that all control and power (AC and DC) cables are installed and in service prior to the requesting that JEA perform testing and final checkout.

3.3. Switch Inspection and Acceptance

3.3.1. The Owner's responsibility will be limited to inspection and acceptance of switch and operator alignment. Final alignment or adjustment shall be by the Contractor.

3.3.2. The Contractor shall adjust and align all switch blades and contacts according to the Manufacturer's recommendations unaccepted by the JEA Project Representative.

3.3.3. The Contractor shall assist and provide equipment required for the factory servicemen to perform testing, final checkout, and approval of placing the circuit switcher in service.

3.4. Labeling

3.4.1. JEA shall provide and the Contractor shall install labeling on all newly-installed switches. These switches include high-voltage hook switches, group-operated switches, circuit switchers, and fused disconnect switches which interconnect to the buswork.

3.4.2. The Contractor shall apply labels on the switch support structures as shown on the Single Line Drawing. The labeling shall be applied at a location approved by the JEA Project Representative.

3.4.3. The Contractor shall label the switches using reflective labeling to be provided by JEA through the JEA Project Representative.

4. Instrument Transformers & Surge Arresters

4.1. Furnish, Delivery, & Storage

4.1.1. The Owner shall furnish the instrument transformers and surge arresters. The Contractor shall receive, off-load, and store these materials in accordance with the Manufacturer’s instructions.

4.1.2. The Owner shall furnish, operate, and supervise the filtering equipment and oil for the instrument transformers as required.

4.1.3. Meter-class instrument transformers shall be tested by JEA before installation. Contractor shall coordinate with JEA to deliver & pick-up the transformers at JEA Meter Shop located at JEA Commonwealth Service Center.

4.2. Installation

4.2.1. The Contractor shall install outdoor instrument transformers and arresters as indicated on the Drawings.

4.2.2. All associated primary wiring, secondary wiring, instrument and control wiring, and grounding connections shall be installed by the Contractor in accordance with the Manufacturer's instructions.

5. Insulators, Buswork, & Connectors

5.1. Furnish, Delivery, & Storage

5.1.1. 5.1.1. The Owner shall furnish the insulators, bus, and connectors as shown in the Drawings. The Contractor shall receive, off-load, and store these materials in accordance with the Manufacturer’s instructions. That includes providing dry storage for the material, boxes, crates, cartons, etc. not suited for outdoor storage.

5.1.2. Any chipped or damaged insulators shall be brought to the Owner's attention prior to installation. The Contractor shall repair minor insulator damage after review of the damage and approval of the Contractor's proposed repair process is made by the Project Engineer.

5.2. Installation

5.2.1. The Contractor shall install station type insulators, bus, conductor, and connectors as indicated on the Drawings.

5.2.2. The minimum clearance between bus and overhead conductors of different phases and from conductors to ground shall be as indicated on the Drawings.

5.2.3. The Contractor shall install all bus, conductors, and connectors as indicated on the Drawings. The Owner will furnish all items on the substation structures, including hardware, unless noted otherwise.

5.2.4. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner. When applicable, the copper component shall be installed below the aluminum component to mitigate contamination.

5.3. Aluminum Welding Requirements

5.3.1. The welding process and all welding operators shall be qualified in accordance with the Aluminum Association Aluminum Construction Manual, "Specifications for Aluminum Structures", Section 7/2/4 (Qualification of Welding Procedure and Welding Operators).

5.3.2. All joints to be welded shall be free of moisture and hydrocarbons. Degreasing shall be done with a non-toxic solvent. Sufficient time must be allowed for the evaporation of the solvent prior to welding. Wire brushing with a stainless steel wire brush should be employed after solvent cleaning to remove all oxide films, water stains, etc.

5.3.3. All aluminum welds shall be by the gas metal-arc (MIG) or the gas tungsten-arc (TIG) welding process.

5.3.4. The working area should be substantially draft-free and protected from atmospheric contamination.

5.3.5. All welds shall be made with clean metal and the completed weld shall have a smooth finish and shall indicate good fusion with the parent metal.

5.3.6. All connections shall be checked for the proper edge penetration and alignment before, during, and after the weld is made. The cross sectional area of the weld should not be less than that of the smallest member being joined.

5.3.7. To repair a defective weld, the defective portion must be entirely removed. The area to be repaired should be re-cleaned as in Paragraph 7.6.2 above and the weld made in a manner similar to the original.

5.3.8. Tackwelding should be used to prevent misalignment of the members being joined during the welding process.

5.4. Tinned connectors shall be installed when a copper to aluminum connection is made. The tinned connectors shall be furnished by the Owner. When applicable, the copper component shall be installed below the aluminum component to mitigate contamination.

V LOW VOLTAGE

1. Lighting

1.1. Furnish, Delivery, & Storage

1.1.1. The Owner shall furnish the lighting as shown in the Drawings.

1.1.2. The Contractor shall furnish labor and equipment for receiving, off-loading, and storing these materials at the job site.

1.2. Light Perimeter Poles

1.2.1. Standard Items

Item	Mfg. / JEA Item	P/N / JEA ID
Beacon Viper S, 136W, Type III Fixture	Beacon	VPS-60L-135-5K7-3-120-MAF-DBT
Bracket, Street Light, Tapered Aluminum, 8' Length, 3' Rise, Universal Base, with Pole Plate Grounding Assembly	JEA	BKTSL002
Pole, Concrete, 30', Type 1	JEA	POLCO001

1.2.2. The Contractor shall install perimeter lighting poles complete with anchor bases, arms, conduit, wiring, light fixtures, and photocells in locations as shown on the Drawings. Lighting poles, anchor bases, arms, and light fixtures will be furnished by the Owner.

1.3. Switchyard Lights

1.3.1. Standard Items

Item	Mfg. / JEA Item	JEA ID
Luminaire, 40W LED, 70W HPS Equivalent, Cobrahead, 120VAC, PE Receptacle, 7-pin	JEA	STLLE001
Photocontrol, 1280 Joule MOV, Fail Off, Green	JEA	STLPC010

1.3.2. The Contractor shall install lighting fixtures mounted on the lightning probe poles and on the takeoff structures complete with conduit, wiring, light fixtures, and switches, in locations as shown on the Drawings. Conduit, switches, and wiring as specified on the Drawings shall be furnished by the Contractor.

2. Electrical Panels

2.1. Labeling

2.1.1. The Contractor shall provide and install all labeling of all electrical panels in the switchyard.

2.1.2. The Contractor shall apply electrical labels to the branch circuits as shown on the Drawings. The label should be adjacent to the corresponding breaker.

2.1.3. The Contractor shall clearly fill out the manufacturer-provided circuit directory index with a ball-point pen. The index shall be stored inside the panel.

3. Switchyard Relay Boxes

3.1. The Contractor shall be responsible for furnishing the bus differential boxes, potential transformer fuse boxes, terminal blocks, fuse blocks, test switches, and heaters as specified in the Drawings.

3.2. The Contractor shall be responsible for installation of all switchyard relay boxes, and their related components according to the Drawings.

3.3. The Contractor shall be responsible for securely mounting the switchyard relay boxes to the substation structures. Mounting brackets may have been incorporated into the structure design for most of these boxes. The Contractor shall furnish and install galvanized unistrut channels and stainless steel mounting hardware as required to mount the relay boxes to the structure mounting brackets. Details for mounting and wiring the switchyard relay boxes (if applicable) are included in the Drawings. Should any alteration or modification be necessary for mounting the relay boxes, the Contractor shall submit details of the proposed alteration to the Project Engineer for approval prior to installation.

3.4. All above grade conduit to the relay boxes shall be either rigid galvanized steel or UV resistant PVC, Schedule 40. Installation and termination of control and instrument wiring shall be in accordance with the Specifications and Drawings.

3.5. The bus differential and PT fuse boxes shall be stainless steel.

4. Low Voltage Cables

4.1. Furnish, Delivery, Storage

4.1.1. The Owner shall provide all control cable, and fiber optic cable, unless specified in the Drawings. The Contractor shall locally transport, off-load, and store these materials in accordance with the Manufacturer's instructions.

4.1.2. The Contractor shall furnish all other cables listed in the Cable Schedule. Estimated lengths and cable specifications are given for each cable run. The Contractor will be responsible for furnishing actual quantities required.

4.1.3. The Contractor shall furnish ring type compression terminals. They shall be used at both ends of all control cables and wiring. They shall be non-insulated, tin-plated, barrel-type with brazed seam and sized for the wire being terminated.

4.2. Installation

4.2.1. The Contractor shall pull and terminate all cables listed in the Cable Schedule. If work site is an energized site then the JEA Project Engineer shall direct the Contractor on responsibilities.

4.2.2. All control cable runs shall be continuous. Splices shall NOT be permitted.

4.2.3. Splices made in non-control cable should be avoided. When necessary, splices shall conform to all applicable NEC and NESC standards.

4.2.4. The Contractor is responsible for providing the Owner with accurate "As Built" revisions of the Cable Schedule, Conduit Schedule, and related Drawings.

4.3. Grounding of Shielded Cable

4.3.1. A terminal block has been provided at the top of each relay control panel for terminating the ground conductor of each shielded control cable. Each ground conductor from the shielded cables will land individually on a terminal space, and be identified with its appropriate cable name. The Contractor shall provide amp type Termi-foil connectors for jumper connections between the control cable shields to the panel ground terminal block. The jumper wire size shall be a stranded #10 AWG.

4.4. Interconnection Drawings

4.4.1. The control cable Interconnection Drawings will be supplied at a later date by the Owner to show all terminations of the cables as listed on the Conduit and Cable Schedules.

4.4.2. The Contractor shall be responsible for terminating all cables listed on the Conduit and Cable Schedules. The Contractor shall also be responsible for the termination of any jumpers on terminal blocks in the equipment or on the control panels that may be shown on the Interconnection Drawings.

4.4.3. The Bid shall be based on the assumption of a termination at both ends of every conductor in each cable of the Cable Schedule and an additional fifty (50) #10 cables with 500 total terminations between panels and/or control house equipment. These jumpers may be Class B multi-conductor cables running between panels, including termination.

4.4.4. The Owner shall terminate all cables to existing control panels which are energized. The Contractor shall pull cables to these panels, fan ends, install terminals, and leave ample cable for making terminations.

4.5. Control Panels

4.5.1. All cables pulled to the control panels shall be sized to reach the floor of the panel and back to the top of the relay panel or RTU. The insulation jacket shall then be stripped back to the top of the panel and all cables terminated without cutting individual wires.

4.6. Labeling

4.6.1. The Contractor shall provide and install labels on all newly-installed cables. Labels shall be Dymo ½" flexible nylon labels, with black text, white background, part # 18488. Other label types must be approved by the JEA Project Representative.

4.6.2. The cable's label shall correspond to the Cable # as shown on the Cable Schedule.

4.6.3. All cables are to be labeled at both ends and near the conduit where entering and leaving the cable trench.

4.6.4. The labels shall be placed at a location visible to the average worker. The ends of the label shall be wrapped, with the text still visible, with black electrical tape to further secure the label.

VI GROUNDING

1. Scope

1.1. Scope

1.1.1. The Contractor shall install the ground grid, ground rods, and ground wells as shown on the Drawings and herein specified. The Contractor shall also be responsible for the connection of all switchyard electrical equipment, control house electrical equipment, substation structures, fences and gates to the station ground grid system as shown on the Drawings and herein specified.

2. Below-Grade Connections

2.1. Furnish, Delivery, and Storage

2.1.1. The Contractor shall provide the below-grade connectors. The Contractor shall store these materials in accordance with the Manufacturer's instructions.

2.1.2. Ground grid connections (including connections to ground rods and ground wells) shall be made by an approved exothermic process utilizing Cadweld Plus molds and materials manufactured by Cadweld. The Contractor shall use the Cadweld Plus System with the corresponding molds and electronic control unit for weld metal ignition. Molds for each type of connection are to be replaced after a maximum use of fifty (50) welds.

2.1.3. Ground grid connections shall be of the type that avoids cutting and/or splicing of the main grid conductor.

2.2. Installation

2.2.1. A Manufacturer's representative is required to demonstrate the proper installation procedures of the exothermic system being used prior to installation of any ground grid connection. The Contractor shall be responsible for arranging the demonstration. Any Contractor representative that may install the ground grid connections and the JEA Project Representative shall be present at the demonstration.

2.2.2. The Contractor shall strictly follow the Manufacturer's installation procedures.

2.2.3. All surfaces to be joined by the weld shall be thoroughly cleaned and dried prior to final placement of the mold. Worn, damaged, or incorrectly sized molds which in the opinion of the JEA Project Representative do not make satisfactory welds shall be removed from the job site.

2.2.4. All welded connections made by the exothermic process shall encompass 100% of the end of the material being welded. Welds which do not meet this requirement shall be remade at the Contractor's expense.

2.3. Testing

2.3.1. All welded connections made by the exothermic process shall be visually inspected by the JEA Project Representative and may be subjected to testing.

2.3.2. Testing shall be in the form of moderate hammer blows, from which a properly formed connection will easily resist any visible damage.

2.3.3. Any connection which fails such a test or which, upon visual inspection, indicates a porous or deformed weld shall be remade at the Contractor's expense. Should different molds or materials be required to facilitate the corrected connection of a failed weld, such material shall be furnished at the Contractor's expense.

3. Above-Grade Connections

3.1. Furnish, Delivery, and Storage

3.1.1. The Owner shall provide the above-grade connectors. The Contractor shall locally transport, off-load, and store these materials in accordance with the Manufacturer’s instructions.

4. Switch Grounding

4.1. Pre-Approved Materials

Item	Mfg.	Part #
7#5 Copperweld * 7-strand #5, .0546” diameter, 40% conductivity per ASTM B-227 and B-228, high strength – 17,949 lbs	Copperweld	

4.2. The Owner shall furnish the operator platforms for group-operated switches.

4.3. The Contractor shall install the operator platforms as shown on the Drawings.

4.4. The operator platform shall be located on the rocked surface and be connected on one side to the station ground grid. A continuous grounding conductor shall extend from the other side of the operator platform through the parallel ground clamp, provided for structure grounding, to the operating mechanism. This conductor shall be connected to the operating pipe by means of a flexible copper braid. The remaining groove of the parallel grounding clamp shall contain a conductor connected directly to the station ground grid. Details for grounding the operator platform (if applicable) are included in the Drawings.

4.5. Every switch structure shall be connected to the station ground grid in at least two (2) locations, as shown on the Drawings. One (1) switch structure ground conductor shall be installed as specified above.

4.6. Grounding switches shall have a continuous ground conductor from the blades to the station ground grid. This conductor shall be routed on the structure column opposite of the operating mechanism to facilitate complete grounding of the switch structure. The operating pipes for both the line and ground switches shall be connected by flexible copper braid as specified above.

5. Equipment Grounding

5.1. Pre-Approved Materials

Item	Mfg.	Part #
7#5 Copperweld * 7-strand #5, .0546" diameter, 40% conductivity per ASTM B-227 and B-228, high strength – 17,949 lbs	Copperweld	

5.2. The Contractor shall be responsible for connecting electrical equipment such as circuit breakers, station service transformers, potential transformers, instrument transformers, surge arresters, etc., directly to the station ground grid as shown on the Drawings.

5.3. Electrical equipment shall be furnished by the Owner, unless otherwise specified. The Contractor shall be responsible for installing the equipment ground conductor on the side of the structure designed to accommodate the ground conductor.

5.4. The Owner shall furnish all above grade ground connectors necessary to connect the equipment to the station ground grid. The Contractor shall furnish the 7#5 Copperweld grounding conductor and all other material, equipment, and labor necessary to complete the connection of the electrical equipment to the station ground grid.

5.5. The Contractor shall install the equipment ground conductor such that the continuity of the conductor from the equipment to the station ground grid is maintained as much as practical.

6. Structure Grounding

6.1. Pre-Approved Materials

Item	Mfg.	Part #
7#5 Copperweld * 7-strand #5, .0546" diameter, 40% conductivity per ASTM B-227 and B-228, high strength – 17,949 lbs	Copperweld	

6.2. The Contractor shall be responsible for connecting all steel structures directly to the station ground grid as shown on the Drawings.

6.3. The structures are furnished by the Owner and are designed to accept the ground connectors provided. The Contractor shall be responsible for installing the structure ground conductor on the proper side of the structure to facilitate the connection of the structure to the station ground grid.

6.4. The Owner shall furnish all above grade ground connectors and 7#5 Copperweld necessary to connect the structures to the station ground grid. The Contractor shall furnish all other material, equipment, and labor necessary to complete the connection of the steel structures to the station ground grid.

6.5. The Contractor shall install all structure ground conductors such that they conform to the structure and foundation.

6.6. Structures must be grounded to the station grid within the same working day the structure is erected.

7. Cable Trench & Control House Grounding

7.1. Pre-Approved Materials

Item	Mfg.	Part #
7#5 Copperweld * 7-strand #5, .0546” diameter, 40% conductivity per ASTM B-227 and B-228, high strength – 17,949 lbs	Copperweld	

7.2. The Contractor shall install the cable trench and control house grounding as specified and shown on the Drawings. The Contractor shall furnish the 7#5 Copperweld conductor necessary to ground the cable trench and control house to the station ground grid and all other required material and labor to complete the installation.

7.3. The Contractor shall install the cable trench and control house ground conductors. The ground conductor shall run the entire length of the cable trench and connect to the station ground grid at all points of intersection. Two (2) ground conductors shall be brought into the control house through the cable trench and attached to the outside of the cable tray. The Contractor shall furnish and install 7#5 Copperweld cable clips on one side of the cable trench to support the ground conductor.

7.4. Connection of the ground conductor to the cable tray shall be made utilizing Burndy Type GC2929CT connection or approved equal. The ground conductor shall be secured to the cable tray at each cable tray fitting or at intervals not exceeding four (4') feet throughout the length of the tray. Provide ground wire lugs and hardware (as required). The cable tray shall NOT be used as a ground path.

7.5. Control house equipment, including electrical panels shall be connected to the control house ground by means of Anderson Type K3 connector or approved equal.

7.6. Where a reinforced concrete floor is installed in the control house, the Contractor shall bond the control house slab reinforcement to the ground grid to provide equipotential surfacing as shown on the drawings. Metal floor decking within modular buildings should be bonded internally by the manufacturer, with connections to the grid on the exterior of the building at the points designated.

VII RACEWAYS

1. General

1.1. Scope

1.1.1. This Section covers the labor, equipment, and material requirements for the installation of conduits and cable trenches in the switchyard. See Section Control House for raceways installed in the control house. The Contractor shall furnish all materials necessary and install the conduits, cable trenches, and cable risers as shown on the Drawings and specified herein.

1.2. Furnish, Delivery, Storage

1.2.1. The Contractor shall provide all the materials for installation of the cable trench system, cable trench riser, and conduits. The Contractor shall store these materials in accordance with the Manufacturer's instructions.

2. Direct-Buried Conduit

2.1. The Contractor shall furnish and install all conduit materials, as described in the "Conduit Schedule" and the Drawings. All direct-buried conduits shall be UV resistant Schedule 40 PVC.

2.2. The conduits under six (6) inch diameter shall be installed 18" minimum below finished subgrade (compacted earth) elevation, unless otherwise specified on the Drawings. The area shall be backfilled and compacted to the same density as surrounding areas.

2.3. The conduits six (6) inch diameter or larger shall be 48" minimum below finished subgrade (compacted earth) elevation, unless otherwise specified on the Drawings. The area shall be backfilled and compacted to the same density as surrounding areas.

2.4. **Factory bends are required.** All field bends shall be approved by the JEA Project Representative. Bends shall be made so that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Field bends shall be made only with bending equipment identified for that purpose. The radius of the bends shall comply with the NEC.

2.5. When installing conduit in an existing switchyard, the Contractor shall compact the area to the same density, and with similar material, as with the adjacent undisturbed materials. In every such case, the resultant soils will be re-poisoned to eradicate future plant growth, using the herbicide. See Subsection Herbicide.

3. Above-Ground Conduit

3.1. The Contractor shall furnish and install all conduit materials. All above-ground conduits shall be UV resistant Schedule 40 PVC.

3.2. The Contractor shall form all above grade conduits to conform to the surfaces of the foundations and structures.

3.3. Bends shall be made so that the conduit will not be damaged and the internal diameter of the conduit will not be effectively reduced. Field bends shall be made only with bending equipment identified for that purpose. The radius of the bends shall comply with the NEC.

3.4. The conduit should be routed to mitigate tripping hazards.

3.5. Slip-on PVC caps shall be installed on any conduits openly exposed to the environment. The caps are to be used to prevent the intrusion of water and animals.

3.6. Bell ends shall be installed at end of conduits to mitigate damage to cables, where applicable.

4. Cable Trench & Riser

4.1. Pre-Approved Materials

Item	Mfg.	Part #
Pedestrian		
1-Piece Multi-Duty Trench Base 10’ Length, 30’ Internal Width, 15” Deep	Trenwa	BM3015-120
Pedestrian Rated Fibrelite Lid & Section For 30” Wide Multi-Duty Trench (60”L x 30”W x 2.25”D)	Trenwa	LPF36-60
Ground Clips for BM Trench	Trenwa	GC5
Road Crossing		
1-Piece Multi-Duty Trench Base 10’ Length, 30’ Internal Width, 15” Deep, HS20 Rated	Trenwa	BHF3016-120
HS20 Rated Fibrelite Lid & Section for 30” Wide Multi-Duty Trench (60”L x 30”W x 4”D)	Trenwa	LHF36-60
Ground Clips for HS20 Trench	Trenwa	GC3
Cable Riser		
	Trenwa	
Miscellaneous		
Guard Posts (Bollards)	Trenwa	GP-78

4.2. Cable Trench Specifications

4.2.1. The Contractor shall submit the Manufacturer's layout drawings to the JEA Project Engineer for approval.

4.2.2. The trench system shall consist of precast concrete U-shaped bases and removable covers, manufactured by Trenwa.

4.2.3. The trench bases shall be in 10 foot lengths except where required by the Drawings. The base shall have openings in the bottom for conduit penetration. All precast lids shall be in lightweight sections, sized to permit removal by a single person. The lids shall have slots for lifting tools.

4.2.4. The pedestrian trench base shall have an interior clear cross sectional area of 30" wide and 15" deep, suitable for pedestrian traffic, and with Trenwa Fibrelite Pedestrian Lids.

4.2.5. The road crossing trench shall have an interior clear cross sectional area of 30" wide and 16" deep, HS20 rated, with Trenwa Fibrelite HS20 Lids.

4.2.6. The precast trench system shall be designed and constructed so that neither the covers, nor temporary side-side braces need to be installed to facilitate installation of subsequent backfilling and tamping.

4.2.7. The Contractor shall provide the Owner with a new set of Manufacturer's cover removal tools as well as the tools used during construction. The Contractor shall deliver these tools to the JEA Project Representative.

4.3. Cable Trench Installation

4.3.1. The Contractor shall install the cable trench system by following the Manufacturer's instructions.

4.3.2. The trench base shall be set only on firm, compacted earth, sand, or gravel mix, at an elevation such that the top of the wall will be two (2") inches above final grade (top of crushed rock).

4.3.3. Place geotextile fabric the full length of the trench excavation, overlapping a minimum of two (2') feet at each joint of fabric. The fabric shall cover the bottom and both sides of the cable trench to top of compacted grade. Geotextile fabric shall be Mirafi 140N.

4.3.4. Place a minimum four (4") inches of **bedding sand** in the trench to form a level bottom, just covering the bottom of the section members.

4.3.5. The Contractor shall protect the trench against entrance of construction debris, rock, and earth during the construction and after placing of the sand bedding. The trench shall be cleaned out of any such foreign material prior to placing control cables and just before final placing of covers.

4.3.6. The conduit should penetrate through the open bottom of the trench and extend at least 1” inch above the sand (from the bottom of the exposed conduit hole). The conduits shall be angled 45 degrees toward the control house and include a bell end.

4.3.7. When transitioning from a pedestrian rated trench to road crossing trench, raise the road crossing trench higher to align the base with the pedestrian trench.

4.4. Cable Riser Specification

4.4.1. The cable riser is a ladder-like structure that supports and encloses cables as they transition out of the trench and into the control house. The covers shall be weather sealed and removable for easy access. The material shall be made of aluminum.

4.4.2. The Contractor shall submit the Manufacturer’s cable riser drawings to the JEA Project Engineer for approval.

4.5. Cable Riser Installation

4.5.1. The Contractor shall install the cable riser as per Manufacturer’s drawings.

4.5.2. The wall opening for the cable riser’s entrance into the control house shall be sealed with 1/4” thick aluminum plates on inside of the wall. The exposed area where the cables rest shall be sealed with fiberglass insulation.

4.6. Bollards

4.6.1. The Contractor shall furnish and install bollards as shown on the Drawings.

5. Labeling

5.1. The Contractor shall provide and install stick-on labels on all newly installed conduits at both ends. The label shall have black text with a white background. The text shall correspond to the conduit # as shown on the Drawings

5.2. The labels shall be placed and reasonably sized to be visible by the average person.

VIII CONTROL HOUSE

1. Electrical Panels

1.1. Labeling

1.1.1. The Contractor shall provide and install all labeling of all newly-installed electrical panels in the switchyard.

1.1.2. The front outside cover shall be labeled as shown on the Conduit Plan or Low Voltage Drawing. The paint shall be Rust-oleum spray on #7777-830, flat black. The labels shall be with a block stencil with three (3") inch high letters. The labeling shall be applied, at approximately eye level, centered on the cover.

1.1.3. The Contractor shall apply electrical labels to the branch circuits as shown on the Drawings. The label should be adjacent to the corresponding breaker.

1.1.4. The Contractor shall clearly fill out the manufacturer-provided circuit directory index with a ball-point pen. The index shall be stored inside the panel.

2. Control Relay Panels

2.1.1. The Owner will furnish and install all communications, network, and security switchboard panels within the control house. The Owner will only furnish the relay panels. The quantity and location are shown on the Drawings.

2.1.2. The Contractor shall off-load, and install the relay panels by setting them in the correct location, anchor to the floor, and properly ground them. The Contractor shall be responsible for properly leveling the panels and ensuring that all access doors are operable. The panels should be installed only after the Control House is substantially complete, including the installation of the floor sealant.

2.1.3. The Contractor shall be responsible for all additional incurred cost by JEA if the Contractor is unable to unload and place the relay panels into the control house upon delivery from the Manufacturer.

IX OTHER

1. References

1.1. Where the codes and standards referenced herein contain recommendations in addition to requirements, consider the recommendations as requirements and follow unless stated otherwise by this Specification.

1.2. In the event of any conflict between codes, or this Specification and codes, the more stringent requirement applies.

1.3. The latest edition and published addenda of the referenced publications herein effect on the date of Contract Award are a part of this Section and, where referred to by title or by basic designation only, are applicable to the extent indicated by the specific reference:

American Association of State Highway and Transportation Officials (AASHTO):

1. M 43 - Standard Specification for Sizes of Aggregate for Road and Bridge Construction
2. M 145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
3. T 99 – Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
4. T 180 - Moisture-Density Relations of Soils Using a 10-lb Rammer and 18-inch Drop
5. T 191 - Standard Method of Test for Density of Soil In-Place by the Sand Cone Method

A. American Concrete Institute (ACI):

1. 117 – Specification for Tolerances for Concrete Construction and Materials
2. 229R - Report on Controlled Low-Strength Materials
3. 301 - Specifications for Structural Concrete
4. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete
5. 305R - Hot Weather Concreting
6. 306R - Cold Weather Concreting
7. 309R - Guide for Consolidation of Concrete
8. 318 - Building Code Requirements for Structural Concrete
9. 347 - Guide to Formwork for Concrete
10. 530/530.1 – Building Code Requirements and Specification for Masonry Structures

American Institute of Steel Construction (AISC):

1. 303 - Code of Standard Practice for Steel Buildings and Bridges

American National Standards Institute (ANSI):

1. A 185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

American Society for Testing and Materials (ASTM) International:

2. A 36 - Standard Specification for Carbon Structural Steel
3. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
4. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. A 153 - Specification for Zinc Coating (Hot-Dip) on iron and Steel Hardware
6. A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
7. A 370 - Standard Test Methods and Definitions for Mechanical Testing of Steel Products
8. A 497 - Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
9. A 563 - Standard Specification for Carbons and Alloy Steel Nuts
10. A 615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement
11. A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
12. A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
13. A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
14. A 924/A 924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
15. A 992 - Standard Specification for Structural Steel Shapes
16. B 695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
17. C 5 – Standard Specification for Quicklime for Structural Purposes
18. C 29 - Standard Test Method for Bulk Density (Unit Weight) and Voids in Aggregate

19. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field
20. C 33 - Standard Specification for Concrete Aggregates
21. C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
22. C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete
23. C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
24. C 88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
25. C 90 – Standard Specification for Loadbearing Concrete Masonry Units
26. C 91 – Standard Specification for Masonry Cement
27. C 94 / C94M - Standard Specification for Ready Mixed Concrete
28. C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 in. or 50 mm Cube Specimens)
29. C 117 - Standard Test Method for Materials Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
30. C 123 - Standard Test Method for Lightweight Particles in Aggregate
31. C 127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
32. C 128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
33. C 131 - Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
34. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
35. C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
36. C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates
37. C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete
38. C 144 – Standard Specification for Aggregate for Masonry Mortar

39. C 150 - Standard Specification for Portland Cement
40. C 172 - Standard Practice for Sampling Freshly Mixed Concrete
41. C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
42. C 192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
43. C 207 – Standard Specification for Hydrated Lime for Masonry Purposes
44. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
45. C 260 - Standard Specification for Air Entraining Admixtures for Concrete
46. C 270 – Standard Specification for Mortar for Unit Masonry
47. C 289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
48. C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
49. C 403 – Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
50. C 404 – Standard Specification for Aggregates for Masonry Grout
51. C 451 - Standard Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
52. C 470 - Standard Specification for Molds for Forming Concrete Test Cylinders Vertically
53. C 476 – Standard Specification for Grout for Masonry
54. C 494/C494M - Standard Specification for Chemical Admixtures for Concrete
55. C 535 - Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
56. C 566 - Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
57. C 617 - Standard Practice for Capping Cylindrical Concrete Specimens
58. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

59. C 920 - Standard Specification for Elastomeric Joint Sealants
60. D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
61. C 1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
62. C 1077 - Standard Practice for Laboratories Testing Concrete, and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
63. C 1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
64. 1602 - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
65. D 422 - Standard Test Method for Particle-Size Analysis of Soils
66. D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction
67. D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
68. D 854 – Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer
69. D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
70. D 1140 - Standard Test Methods for Determining the Amount of Material Finer Than 75 m (No. 200 Sieve) in Soils by Washing
71. D 1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
72. D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
73. D 1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
74. D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
75. D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

76. D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
77. D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
78. D 2940 - Standard Specification Graded Aggregate Material for Bases or Subbases for Highways or Airports
79. D 3282 - Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
80. D 3740 – Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
81. D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
82. D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
83. D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
84. D 4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
85. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
86. D 4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile
87. D 4832 – Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders
88. D 5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
89. D 5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles
90. D 6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe
91. D 6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
92. E 4 - Standard Practices for Force Verification of Testing Machines

93. F 436 - Standard Specification for Hardened Steel Washers

94. F 1554 - Standard Specification for Anchor Rods, Steel, 36, 55, and 105-ksi Yield Strength

American Society of Civil Engineers (ASCE):

1. 5-11/6-11 - Building Code Requirements and Specifications for Masonry Structures.

2. 7-10 – Minimum Design Loads for Building and Other Structures

American Welding Society (AWS):

1. D1.1 - Structural Welding Code - Steel

Concrete Reinforcing Steel Institute (CRSI):

1. MSP-2-01 - Manual of Standard Practice

National Ready Mixed Concrete Association:

1. Certification of Ready-Mixed Concrete Production Facilities

The Society for Protective Coatings (SSPC):

1. PA-1 - Shop, Field, and Maintenance Painting of Steel

2. SP-6 - Commercial Blast Cleaning

U.S. Army Corps of Engineers:

1. CRD-C572 - Specifications for Polyvinyl Chloride Waterstops

U.S. Department of Labor, Occupational Safety and Health Administration Standards (OSHA):

1. 29 CFR, Part 1926, Safety and Health Regulations for Construction, Standard Number: 1926.652, Requirements for Protective Systems, Subpart P – Excavations

2. 29 CFR, Part 1926, Safety and Health Regulations for Construction, Standard Number: 1926.652, Requirements for Protective Systems, Subpart T – Demolition

2010 Florida Building Code

City of Jacksonville, Florida (COJ)

1. Land Development Procedures Manual

2. City Standard Specifications, Department of Public Works

Florida Department of Environmental Protection:

1. Florida Stormwater Erosion and Sedimentation Control Inspector's Manual
2. State of Florida, Erosion and Sediment Control, Designer and Reviewer Manual

Florida Department of Transportation:

1. FM 5-515 - Florida Method of Test for Limerock Bearing Ratio (LBR)
2. Standard Specifications for Road and Bridge Construction

Florida Administrative Code:

1. 62-621 – Generic Permits
2. 62-701 – Solid Waste Management Facilities
3. 62-710 – Used Oil Management
4. 62-711 – Waste Tire Rule
5. 62-730 – Hazardous Waste

X REVISION HISTORY

Revision	Date	Author	Change Summary
0	8/29/2018	Ryan Szoke	Initial Version