ATTACHMENT D: BIDDER'S EXCEPTION STATEMENT TO TECHNICAL SPECIFICATIONS - RFP #10275

All Bidder representations will be relied on by GRDA in its evaluation of the bid to this RFQ. One of GRDA's evaluation criteria will be the number and extent of the exceptions to GRDA's specifications. Bidders shall be presumed to agreement with GRDA's specifications unless the Bidder takes specific exception to one or more of the specifications as stated in the table below. Whether or not exceptions are taken, Bidders must submit this statement as part of their bid.

Bidders must clearly identify all exceptions to specifications. Bidders must also state with specificity the reasons for taking exceptions and the proposed alternatives/specification. Bidders are cautioned against an exception that may be materially deviating from the specifications included in this RFQ. A material deviation is an exception which results in the Bidder providing goods and/or services that are substantially different than the goods and/ or services GRDA requested in the RFQ. If exceptions are not identified in this statement, any exception raised following the notification of the award could result in the revocation of bid award and being rejected from further consideration.

PRINT THE WORDS "NO EXCEPTIONS" HERE _____ IF THERE ARE NO EXCEPTIONS TAKEN TO ANY OF THE SPECIFICATIONS OF THIS RFQ.

IF THERE ARE EXCEPTIONS TAKEN TO ANY OF THE SPECIFICATIONS, THEY MUST BE CLEARLY STATED IN THE TEXT BOX BELOW AND SUBMITTED AS PART OF YOUR PROPOSAL.

ANY EXCEPTION THAT MATERIALLY DEVIATES FROM A SPECIFICATION IN THIS RFQ MAY RESULT IN THE REJECTION OF THE BID FROM FUTHER CONSIDERATION.

EXCEPTIONS TO TECHNICAL SPECIFICATIONS:

_____

_____

_____

_____

_____

_____

_____

_____

ENGINEERING &
TECHNOLOGY CENTER
9933 E. 16th Street, Tulsa, OK 74128
918-256-5545, 918-610-9888 Fax

Exhibit L – Substation Specifications

We deliver affordable, reliable ELECTRICITY, with a focus on EFFICIENCY and a commitment to ENVIRONMENTAL STEWARDSHIP.

We are dedicated to ECONOMIC DEVELOPMENT, providing resources and supporting economic growth.

Our EMPLOYEES are our greatest asset in meeting our mission to be an **Oklahoma Agency of Excellence.**

CONSTRUCTION SPECIFICATION

Tonnece 69 KV Terminal Addition - Substation

Abstract

Construction of new 69 kV terminal addition at Tonnece Substation to support a Generation Interconnection customer, including associated equipment, bus modifications, protection, and control upgrades.

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0	6/16/2022	Larry Copeland	Steven Kroll, P.E.
Template Revision No.	**Date**	**Project Manager**	**Director, Engineering**

1 General

1.1 Miscellaneous

The Contractor shall abide and follow the attached "Technical Requirements" to perform the work described in the "Construction Specifications".

1.1.1 Water:

Water is not available at the job site.

1.1.2 Electricity:

Electric power will NOT be provided for this construction by GRDA. All temporary connections for electricity shall be subject to approval of GRDA. All temporary lines necessary for Contractor's execution of the work will be furnished, installed, connected and maintained by the Contractor in a workmanlike manner satisfactory to GRDA and shall be removed by Contractor in like manner at his expense prior to completion of the construction. Contractor's temporary electrical power, if furnished by GRDA, will be 60 Hz, single phase, 240/120 volt AC.

1.1.3 Sanitary Facilities:

Contractor shall provide an adequate number of portable toilets at each construction site for use by workers at the site during the duration of the contract. Portable toilets shall be maintained and cleaned on a regular basis. Rental costs for the toilets and maintenance services shall be included in the contract price.

1.1.4 Telephone:

Contractor shall provide his own telephone lines, if needed.

1.1.5 Contacts:

The GRDA Assistant General Manager has assigned the following Designated GRDA Representatives for purposes of this Contract.

a) The **Project Manager** for this project is Larry Copeland at 918-864-6185.

1.1.6 Correspondence:

A copy of all correspondence and letters of transmittal shall be sent to: Grand River Dam Authority

Grand River Dam Authority
PO BOX 669
Chouteau, OK 74337
Attention: Larry Copeland, Project Manager
E-mail: larry.copeland@grda.com

1.1.7 Invoices:

Invoices for this work shall include the task order number, work order and work step, name of project, and a listing of the percentage of the units on the bid that have been completed as of the time period claimed in the invoice. Invoices shall be mailed to:

Accounts Payable
Grand River Dam Authority
P.O. Box 669
Chouteau, OK 74337
accounts.payable@grda.com

A copy of each invoice shall be sent to the GRDA Project Manager: Larry Copeland
larry.copeland@grda.com

1.1.8 Safety:

The Contractor and his subcontractors shall follow all applicable OSHA and GRDA Safety Manual rules. In addition, the contractor shall have at least one person, on site that is OSHA 30 certified, as a minimum.

In addition, the Contractor shall have in place a safety program that is specific to this type of construction, including any site-specific safety measures needed. The details of the program shall be included in the proposal.

The contractor is responsible for ensuring that all sub-contractors also adhere to all OSHA and GRDA safety standards. The Contractor on-site Supervisor shall provide a weekly report to the GRDA Construction Coordinator/inspector, with daily safety talks, and will include any near misses, safety issues, etc. This shall be provided by Monday at noon the following week.

All Contractor and Subcontractor employees, while at the work site, shall wear appropriate clothing and protective equipment for the work being done.

All accidents shall be reported to the Construction Coordinator/inspector immediately.

Contractor and Subcontractor personnel, who are not following the safety rules, will be immediately removed from the site by the contractor, and be banned from returning.

No pets shall be allowed at the jobsite.

2 Scope of Work

2.1 Location

The work will be performed at the following existing GRDA substations located in Pryor, Oklahoma:

- Tonnece Substation, 23801 E 530 Rd, Colcord, OK 74338

2.2 Project Description

This project consists of substation modifications at Tonnece Substation to support a new Generation Interconnection customer. The work includes the addition of a new 69 kV terminal position, along with associated equipment, bus modifications, and protection, and control upgrades required to safely and reliably integrate the new circuit into the existing system.

At Tonnece Substation, the project includes installation of a new 69 kV breaker, 69 kV line switch, 69 kV metering units, substation steel, first T-Line structure, line protection panel, and metering panel.

Work at the substation includes installation of circuit breaker, disconnect switch, instrument transformers, substation steel, bus work, and all necessary modifications to the existing facility. The project also includes protection, control, and communication upgrades, including new or modified relay panels, control wiring, and SCADA integration, along with testing and commissioning to place the new terminal facility into service.

Contractor shall provide all materials except those materials specifically listed as to be furnished by GRDA. Contractor shall provide all installation and construction services necessary for and reasonably incidental to the proper completion of all work shown on the drawings and herein specified, excepting only such items as are specified or noted as being done or furnished by others.

All construction shall be performed in strict accordance with these specifications and the attached applicable drawings and shall be subject to the terms and conditions of the contract. See the attachments for a complete listing of the drawings.

All Electrical connections are to be made with DMC Power Swage fittings unless specified in the drawings. Fittings provided by GRDA per BOM, all tooling to be provided by contractor.

The construction shall be as indicated on the drawings and shall include, but is not limited to the following scope of work:

2.2.1 FOUNDATIONS

Contractor shall install the foundations in accordance with the drawings. Refer to the drawings for the count and details of each foundation. The contractor is to submit the batch mix for GRDA approval, which should include the name and manufacturer for each admixture and for curing compound. The proposed mix design shall include test data at seven (7) and twenty-eight (28) days of cure from date of pour. A cylinder break will be required along with verification from the engineer before steel & equipment can be placed on the foundation. The concrete mix design strength shall be as listed in the Technical Specification section. Before the foundations are poured, the anchor bolt pattern for the related steel shall be verified by the contractor to ensure that the steel will mount on the foundation correctly.

2.2.1.1 Foundations Drawings List

Tonnece Substation	
DWG	**DESCRIPTION**
S877PG31	FOUNDATION PLAN
S877PG34	69kV SUBSTATION FOUNDATION DETAILS

2.2.2 STRUCTURAL STEEL ERECTION

Contractor shall assemble and erect the following galvanized steel structures provided by GRDA in accordance with the referenced drawings.

Tonnece Substation		
QTY	**STR ID**	**STRUCTURE**
1	507	STEEL DEADEND H-FRAME STRUCTURE 69kV 40' w/ ANCHOR BOLTS
1	513	STEEL THREE PHASE V" BREAK SWITCH STAND
6	525	STEEL SINGLE PHASE STRUCTURE 69kV LOW BUSS w/ ANCHOR BOLTS

2.2.2.1 Structural Steel Drawing List

Tonnece Substation	
S877PS08	345/161/69kV SUBSTATION STEEL STRUCTURE DETAILS
S877PS09	69Kv Substation Structures

2.2.3 ELECTRICAL EQUIPMENT

Contractor shall install the following electrical equipment per drawings. The following items will be provided by GRDA.

69kV Breaker
69kV CVT's
69kV Metering CT/PT Combo Unit
69kV Break V Break Type Switches
69kV Arresters
69kV Bus, Insulators, and Fittings
Structural Steel
Cable Trench
Pull Boxes
Conduit

2.2.4 STATION GROUNDING

Contractor shall install station grounding in accordance with the drawings.

Tonnece Substation	
DWG	**DESCRIPTION**
S877PG01	SITE LAYOUT
S877PG21	GROUNDING PLAN
S877PG23	GROUNDING DETAILS

Below grade ground connections are to be made with DMC Power Swage fittings. Fittings provided by GRDA per BOM, all tooling to be provided by contractor.

2.2.5 CONDUIT AND CABLE

Contractor shall furnish and install all conduits in accordance with the drawings. The contractor is to provide a pull string in all conduits and seal them off with plugs on all open ends. The Contractor is to pull and install cables. Approximate cable lengths are given in the cable schedule; the Contractor is to verify and determine actual cable lengths.

Tonnece Substation	
DWG	**DESCRIPTION**
S877PG51	RACEWAY & LIGHTING PLAN
S877PG52	345/161/68Kv RACEWAY DETAILS

2.2.6 CONTROL & POWER CABLE TERMINATION

Termination of control cable is to be completed by GRDA. The Contractor shall pull all control and power cables listed in the Cable Schedule drawings as specified in the cable schedule, specifications and drawings to sufficient length as to be able to terminate at any point in the end enclosure.

2.2.7 PROJECT CONSTRUCTION MEETINGS

During the course of the construction, there will be weekly construction coordination meetings held at the site. The contractor site superintendent (or his representative) shall attend and share those items of information as needed for the proper coordination of the activities at the site.

2.3 Construction Schedule

Contractor shall allocate crews and equipment as necessary to meet the following dates and those costs should be included in the bid. Contractor may be required to work around other crews. GRDA Utility crews may also be on the worksite during the construction period. Because of the nature of the work, ALL phases of the construction shall be coordinated with the GRDA inspector.

a) This project shall begin work on or before: **<December 1, 2026>**
b) This project shall be completed on or before: **<February 5, 2027>**

The Contractor shall provide a schedule of work to the Project Engineer at the beginning of construction. **This schedule is to be updated every two weeks**, reflecting the actual work completed and the expected timeline of the work remaining, and resubmitted to the Project Engineer.

2.4 Work to be Performed by Others

The following work will be accomplished by others. The contractor shall schedule his construction activities to coordinate with the activities of others and install the associated electrical connections as required to complete the installation and make ready for operation. Such items of this work include, but are not limited to, the following.

a) Control cable terminations
b) Relay Settings and Commissioning
c) Apparatus Commissioning
d) Transformer Inspections & Servicing

2.5 Examination of Site

Prior to submitting a quotation, Contractor should carefully examine the work site and adjacent premises and should conduct necessary investigations to inform himself thoroughly of any difficulties involved in the completion of all work in accordance with the specifications and drawings. No plea of ignorance of conditions that exist or of difficulties that may be encountered in the execution of the work (due to failure in making the necessary preliminary examination and investigations) will be accepted as an excuse for any failure or omission on part of the Contractor to fulfill in every detail all of the requirements of the specifications and/or drawings.

2.6 Material Furnished by GRDA

See the bill of material in the drawing packages for the list of material to be furnished by GRDA.

All work of unloading, sorting, bundling, storing, and caring for GRDA furnished materials shall be performed by the Contractor and the costs are to be included in the bid price. Material furnished by GRDA shall be picked up at the Transmission & Engineering Storeroom, 4.5 miles East of HWY 69 on HWY 69A, Pryor, OK by the Contractor and transported to the job site. Costs associated with this material hauling shall be included in Contractor's bid. Not all of the material will be available at the start of the job.

2.7 Receiving of Material

a) All material will be checked out with written forms signed by both the Contractor and GRDA personnel, and charged to the proper work order and account. After the Contractor has accepted the materials furnished by GRDA as being in good condition and the correct quantity at the time of issuance, the Contractor is responsible for loss or damage of any nature until the finished structure and surplus materials are accounted for and accepted by GRDA.

b) Contractor shall be charged the replacement cost for any materials lost or damaged after delivery.

c) GRDA will periodically furnish Material Status Reports to Contractor indicating GRDA furnished materials on hand and materials on order but not delivered.

d) Contractor shall accept delivery of the materials provided by GRDA at job site or at the warehouse and shall provide the Construction Coordinator/Inspector with an accurate record of all materials received, condition of material received, and of the disposition and use of such materials.

e) Contractor shall furnish Supervision, manpower and equipment to unload at the site, handle, haul, sort, store, block, and protect the received materials. Contractor shall reload and re-haul GRDA-furnished materials as required to transport all previously delivered materials from the existing marshaling yards to the work site or storage sites, the cost of which shall be included in the various unit prices where such materials are used.

f) Hardware shall be handled in such a manner as to protect the finish and shall be clean and bright and free from nicks, chips, or other marks when installed on the structures.

g) Materials received in damaged condition shall be processed as directed by GRDA. Contractor shall report any shortage or damaged materials, in writing, to GRDA within forty-eight (48) hours of receipt of materials. If any damage is encountered, the damaged materials may be replaced by GRDA, or it may be repaired by Contractor, if so directed by GRDA. Contractor shall cooperate with GRDA in the event claims for damage against the transportation company are required. If shortage and/or damage reports are not furnished to GRDA within forty-eight (48) hours after receipt of materials by Contractor, the cost of the shortage and/or damage shall be borne by Contractor, if not otherwise collectable.

h) Delivery schedules will be established with various suppliers by GRDA to provide materials in sufficient quantities for orderly and timely incorporation in the work.

2.8 Surplus and Scrap Material

a) Contractor shall separate surplus material and scrap material as required by the Construction Inspector and GRDA Warehouse personnel.

b) Surplus and scrap Material shall be taken to the GRDA facility designated by the Construction Inspector and placed in a manner that will facilitate the return of the Surplus Material to the GRDA Warehouse and for the disposal of the material that has been determined to be Junk Material.

c) An inventory of returned Surplus Material, in units, will be kept by Contractor. Construction Inspector will initial the inventory when acceptable as accurate and complete. The inventory shall be provided to GRDA Stores Personnel when the Surplus Material is returned.

d) All returned conductor and shield wire shall be rolled onto wood reels, or coiled and banded.

e) GRDA may furnish bins at the site for selected recyclable material, depending on the specific project. This will be identified at the pre-bid. The contractor shall make efforts to keep the material separated correctly. At present the bins will be for copper, aluminum, and small steel items.

2.9 Material Furnished by the Contractor

Contractor shall furnish all material (not specifically furnished by GRDA, see the BOM) needed to make this a complete Substation. Below is a partial list (not inclusive) of items to be furnished by the Contractor.

a) Crushed rock
b) Fill dirt
c) Conduit and fittings
d) Concrete
e) Rebar and ties
f) Concrete forms and braces

g) Fencing materials
h) Exothermic shots and molds needed in excess of those provided by GRDA
i) Equipment mounting bolts and miscellaneous fasteners needed in excess of those provided by GRDA
j) Bus and terminal bolts and miscellaneous fasteners needed in excess of those provided by GRDA
k) Grounding terminal bolts and miscellaneous fasteners needed in excess of those provided by GRDA
l) Control cable termination fittings
m) Contractor shall furnish all expendable tools, supplies, and services that are not provided by GRDA.

2.10 Contractor's Responsibility

a) The Contractor shall provide all machinery, tools, equipment, conveyances, permits, materials, supervision, and labor for construction. The only exceptions are GRDA furnished materials as defined in this specification.

b) Any material furnished by the Contractor shall be shown as "Material Provided" on the Contractor's billing. Copies of backup invoices from the vendors shall be provided to GRDA.

c) Contractor shall bring any discrepancy or error found on GRDA drawings to the attention of the Construction Coordinator/Inspector immediately.

d) The Contractor shall provide a qualified on-site Supervisor who is experienced and familiar with all the aspects of construction of this type substation, foundations, and transmission line work. The Supervisor shall be knowledgeable of the safety considerations and rules involved in performing construction work within an energized high voltage substation. The supervisor shall be present at all times that the Contractor's crews are at the site and whenever any subcontractor(s) is at the site. This supervision shall be at the Contractor's expense and included in the bid price.

e) The work under this contract may be in progress concurrent with other construction activities. The Contractor shall coordinate his activities and cooperate with the other Contractors or GRDA crews in the best interests of the project.

f) The Contractor shall make provisions for an area for storage of materials at or near the site. The Contractor shall use mats, dunnage, pallets, or other approved items on which the materials shall be stored, and shall keep the area clean. Equipment should be stored in a manner to prevent damage, and allow easy access for removal of material as required.

g) The Contractor shall keep the site graded smooth and the yard clean of excess material to the satisfaction of GRDA's and/or CPN's Coordinator/Inspector at all times.

h) All work shall be done and completed in a skillful and workmanlike manner using GRDA standards and manufacturer or GRDA drawings.

i) Should the Contractor desire a field office, telephone, or water at the substation, it shall be at the Contractor's expense.

j) If, during spreading of substation rock, mechanical equipment used by the Contractor comes in contact with a foundation in such a manner that causes chips, broken corners, or cracks in the concrete, the foundation shall be repaired or replaced at the Contractor's expense.

k) The contractor shall be responsible for prompt unloading of any materials delivered to the job site (required for the work scope defined herein) during a regular 5-day work-week and shall pay any demurrage resulting from delays in unloading.

l) Contractor shall collect all surplus material and return it to GRDA's designated warehouse. Loading and transporting this material shall be at the Contractor's expense and included in the bid price.

m) Upon completion of work, the Contractor shall dispose of any and all non-usable excess materials (less surplus material). All usable materials are to be returned to GRDA.

n) Any additional work and/or changes to the scope of work described herein (after award of the contract) and/or considered to be an extra cost to the contract price shall be brought to the attention of the GRDA's Coordinator/Inspector and Project Engineer prior to initiation of said work for additional payments to be considered. Extra payments will be made only when authorized by GRDA and pre-approved according to the Change Order process defined in Section 3.7 of the Contract. The value of any work not covered by the unit prices will be negotiated between contractor and GRDA.

o) If work is to be performed in an energized substation, Contractor is responsible for maintaining safe working clearances.

p) No employee of Contractor shall have firearms, alcohol, or illegal drugs on his/her person or in any vehicle while on site, or while crossing the adjacent lands going to and from said rights-of- way or site. No employee of the Contractor who is under the influence of alcohol or illegal drugs shall be allowed on the work site.

q) Contractor shall use due care to minimize all construction damages. GRDA will be responsible for construction damages to crops, furrows, lands, or personal property which GRDA deems normal and reasonably necessary, provided Contractor has complied with specifications and Contract provisions. Contractor shall pay for all other construction damages.

r) Contractor will not leave holes open overnight. Open holes are to be properly covered and/or fenced, if required, to avoid property damage or injury to personnel. All holes left by the Contractor shall be filled with native soils and machine tamped to surrounding grade.

s) Contractor will be responsible for restoring the surrounding area, disturbed by the construction, to the conditions found at the time construction began as near as reasonably possible.

t) Contractor shall be responsible for the maintenance of existing roads, drainage ditches, and levees, including construction easements if any, from the date any work is begun on the job to the date of its final acceptance.

u) Contractor shall be responsible for the accuracy of all dimensions within the various sections of work according to the figured dimensions of the drawings. Figured dimensions shall, in all cases, be taken in preference to scale measurements, and detailed drawings consistent with general drawings, in preference to general drawings of the same part of the work.

v) Contractor shall exercise care with its operations near existing roads, drainage ditches, and levees. It is a requirement that Contractor maintain the roads, levees, and waterways in such condition that damage to the roads, levees, ditches, or to abutting property shall not result from his operations. Obstruction of natural flow in waterways by stockpiling or storing materials or by placement of equipment or supplies will not be permitted. Collections of debris that prohibit or inhibit normal functioning of drainage facilities shall be removed.

w) Contractor shall make all necessary provisions and do all work required by its operations under the Contract to prevent any interference with power or communications lines, with their operation or maintenance or services thereon, all in a manner satisfactory to GRDA or operator thereof and all costs incidentals thereto shall be included in the bid price.

x) Permanent relocation of communication and power lines, if any, made necessary by this construction work will be the responsibility of GRDA. Any damage done by Contractor to power lines or communication lines shall be Contractor's responsibility and may be settled and paid for by GRDA and charged to Contractor.

y) Contractor and sub-contractor(s) personnel shall not be permitted to enter substation property without prior arrangement and approval from the Construction Coordinator/Inspector.

z) Contractor shall not use the control building for storage or use its sanitation facilities. Contractor shall enter control building only when necessary to perform work as described in Contract.

aa) No mechanical diggers may be used for the installation of new conduits or grounding in areas where existing active conduits, direct-buried conductors, and/or grounding are located. This work must be done by hydro-excavation or by hand.

bb) Contractor shall take proper means to protect the adjacent areas, structures, and apparatus in any way encountered. The Contractor or sub-contractor(s) shall cooperate with the Construction Inspector and do its work in such a manner as to make as little annoyance as possible to the adjacent property owners and residents.

cc) Contractor's employees will properly conduct themselves at all times, keeping in mind the good customer relations which GRDA maintains.

dd) Contractor is to keep personnel, material, and vehicles on the designated landowner roads or rights-of way.

ee) It is Contractor's responsibility to ensure the base line stakes are intact, and if not, to notify GRDA 48 hours before re-staking is required.

ff) Contractor shall install all GRDA furnished signs, switch numbers, feeder numbers, and phase letters. Contractor shall furnish bolts, nuts, washers, and conduit clamps necessary for mounting.

gg) Contractor shall make minor modifications required to manufacture, assemble, or mount GRDA furnished material (i.e. making small straps or brackets, drilling, re-drilling, or tapping holes, etc.). All minor modifications requiring ten man-hours or fewer shall be at Contractor's expense and included in bid price. Any modifications requiring more than ten man-hours and any additional cost shall be mutually agreed to with the Construction Coordinator/Inspector and authorized by GRDA using the procedure outlined for Change Orders in Section 3.7 of the Contract in advance of performing the work.

hh) Contractor shall field assemble all equipment (except transformer(s)) per manufacturer's instructions and connect it per GRDA's drawings and specifications.

ii) Contractor shall, at all times, have at least two crewmembers who speak fluent English. In addition, the site supervisor shall be fluent in English.

jj) The Contractor shall provide temporary fencing, as required, such that the energized substation equipment is never accessible to the general public or grazing animals on the properties.

kk) Contractor shall provide only qualified journeymen workers for each task, with no more than 1 apprentice per 1 journeyman, and all workers shall perform their work in a safe manner at all times. In this sub-paragraph, a journeyman shall mean a person who has had a minimum of 4 years of relevant on-the-job experience in all aspects of the work to be performed, under the guidance of a qualified journeyman, or as defined by Oklahoma State Statutes.

ll) Contractor shall use only Oklahoma licensed electrical journeymen (industrial, commercial) for the work consisting of conduit installation, cable pulling, and control cable terminations.

mm) The contractor shall install and maintain a silt fence or other SWPPP items around the site, if required by the drawings and other parts of this specification.

2.11 GRDA Construction Field Inspector's Responsibilities

1. The GRDA's Construction Field Inspector shall:
    a. Assist Contractor in coordinating and issuing of material.
    b. Maintain a schedule of the project with information provided by Contractor.
    c. Inspect Contractor's work for conformance to specifications.

d. Collect and maintain foundation logs and other construction documentation.
e. Coordinate any electrical switching clearances required for construction.
f. Prepare regular weekly reports of construction progress as required for the Project Engineer and others.
g. Assist in resolving any material delivery problems.
h. Assist Contractor in the preparation of field-initiated Contract Change Order Requests as required for approval through the Change Order process defined in the Contract.
i. Be responsible for "As Built" drawings and Equipment Capabilities Drawings.
j. Document and submit design adjustments and technical questions to Project Engineer.
k. Record any changes during construction that would improve future designs.
l. Assist in preparation of completion reports for work orders.
m. Other tasks as required to complete the project correctly and safely.
n. Require the removal from the site (in the view of GRDA or CPN) of any unqualified or unsafe contractor worker.

2. In no event shall the Construction Coordinator/Field Inspector's actions excuse the Contractor from its responsibility under the contract (1) to meet all technical specifications and (2) provide all safety precautions necessary in the performance of the work.

2.12 GRDA Project Manager's Responsibility

1. The GRDA's Project Manager shall:
   a. Review and approve payment invoices prior to forwarding them to the AGM.
   b. Review and, if acceptable, approve the engineering and technical changes proposed by the Contractor within any Contractor-initiated Change Order Requests.
   c. Initiate and prepare and GRDA-initiated Change Order Requests.
   d. Act as the GRDA resource to provide decisions to the Contractor concerning technical and engineering questions that may arise during the construction project.
2. In no event shall the Project Manager's actions excuse the Contractor from its responsibility under the contract (1) to meet all technical specifications and (2) provide all safety precautions necessary in the performance of the work.

2.13 GRDA Project Engineer's Responsibilities

1. The GRDA's Project Engineer shall:
   a. Assist in the review of invoices prior to forwarding them to the AGM.
   b. Review and, if acceptable, approve the engineering and technical changes proposed by the Contractor within any Contractor-initiated Change Order Requests.
   c. Initiate and prepare and GRDA-initiated Change Order Requests.
   d. Make regular visits to the site to review progress.
   e. Act as the GRDA resource to provide decisions to the Contractor concerning technical and engineering questions that may arise during the construction project.
2. In no event shall the Project Engineer's actions excuse the Contractor from its responsibility under the contract (1) to meet all technical specifications and (2) provide all safety precautions necessary in the performance of the work.

3 Exceptions and Bid Schedule

Any and all exceptions to the requirements of these specifications shall be clearly documented by bidder in bidder's proposal.

Contractor shall begin work promptly (see section 3.3) after receipt of official Notice to Proceed. Before start of work, Contractor shall update the schedule provided to GRDA on the bid proposal with a written work schedule or a Gantt Chart, relating the sequence, approximate duration, and approximate start/end dates for each phase of the required work.

The successful Contractor shall be required to attend a pre-construction meeting at the Engineering office in Pryor. The meeting will be held within two weeks after the award of the contract.

4 SUBSTATION CONSTRUCTION TECHNICAL REQUIREMENTS

TR-1 SURVEYING

1. All work shall be done to the lines, grades, and elevations indicated on the drawings. The Contractor shall provide suitable equipment and competent workmen who shall locate and layout the work.

2. The Contractor shall preserve all monuments, benchmarks, reference points, and stakes. The Contractor will be charged with the expense of replacement of any such items destroyed, and shall be responsible for any error or loss of time that he may have caused. Permanent monuments or benchmarks, which must be removed or disturbed, shall be protected until they can be properly relocated. The Contractor shall furnish materials and assistance for the proper replacement of such monuments or benchmarks.

3. The Contractor is to protect and not disturb any of the centerline hubs, which are set or will be set.

TR-2 EARTHWORK

1. The Contractor shall make efforts to locate all underground utilities such as direct burial electrical and communication cables, fluid-carrying pipelines whether they be gas or liquid drainage lines such as storm sewer or sanitary sewage, and any other obstructions. Should an underground utility interfere with the site work, it shall be the Contractor's responsibility to contact the owners and have the exact location of the underground utility made known. GRDA does not guarantee their location by GRDA's plot plan dimensions or guarantee that all underground items have been found.

2. Ground surfaces within the construction areas shall be cleared of all trees, brush, debris, surface vegetation, topsoil, and humus materials down to the subsoil. Stumps and roots larger than two inches in diameter shall be completely grubbed and removed. Matted roots shall be removed regardless of size. Surface vegetation shall be removed complete with roots to a depth of not less than four (4) inches below the ground surface.

   The Contractor shall remove all combustible and other waste materials from the construction areas and dispose of it at the Contractor's expense.

   Organic topsoil that is free of trash, vegetation, rocks, and roots, shall be stockpiled for later use under these specifications. Other topsoil shall be removed at Contractor's expense.

3. Trees outside the construction area shall be preserved and protected. Unless specifically authorized by GRDA, trees shall be removed from only those areas which will be cut or filled. Consideration will be given to the removal of additional trees only where deemed essential by GRDA, for the safe, effective execution of the work. Trees left standing shall be adequately protected from permanent damage by construction operations. Trimming of standing trees, where required, shall be directed by GRDA's Construction Coordinator/Inspector.

4. All materials necessary for the construction of fills and embankments shall be obtained from contractor procured borrow areas if soil on site is determined to be inadequate by GRDA.

   The fill material shall be classified by ASTM D2487 as GW, GP, GM, GC, SW, SP, SW, SC or other material approved by the GRDA Project Engineer with a maximum liquid limit of 35, a maximum plasticity index of 12 and a maximum of 25 percent by weight passing a No. 200 sieve.

   All material placed in fills and embankments shall be free from rocks or stones larger than six (6) inches at their greatest dimension, brush, stumps, logs, roots, debris, and organic or other deleterious materials. No rock or stones shall be placed in the upper 18 inches of any fill or embankment. Rocks or stones within the allowable size limit may be incorporated in the remainder of fills and embankments provided they are distributed so that they do not interfere with proper compaction.

5. After preparation of the fill or embankment site, the subgrade shall be leveled and rolled so surface materials of the subgrade will be as compact and well bonded with the first layer of the fill or embankment as specified for subsequent layers.

6. All fill and embankment materials shall be placed in 2 or more horizontal layers not to exceed eight (8) inches in uncompacted thickness. Material deposited in piles or windrows by excavating and hauling equipment shall be spread and leveled before compaction. Each layer of material being compacted shall have the best practicable uniform moisture content to ensure satisfactory compaction. The Contractor shall add water, and harrow, disc, blade, or otherwise work the material in each layer as required to ensure uniform moisture content and adequate compaction. Each layer shall be thoroughly compacted by rolling and/or by sheep footing. The compacted density of each layer shall be at least 95 percent of the maximum density at optimum moisture content as determined by ASTM D698 when that test is appropriate or 70 percent of relative density as determined by ASTM D2049 when that test is appropriate. If the material fails to meet the density specified, compaction methods shall be altered.

7. After all construction work under these specifications has been completed; all ground surface areas shall be graded. The grading shall be finished to the contours and elevations indicated on the drawings, or, if not indicated, to the matching contours and elevations of the original, undisturbed ground surface. In any event, the final grading shall provide smooth, uniform surfacing and effective drainage of the ground areas.

8. Materials, which are not suitable for fills and embankments, shall be disposed of in a manner and location as approved by GRDA's Construction Coordinator/Inspector. Materials shall be deposited in the disposal areas and leveled and compacted in 12-inch maximum layers. Compaction shall be by not less than three passes by appropriate equipment.

9. Fills and embankments that settle or erode and facilities damaged by such settlement or erosion, shall be repaired, as set out in the general conditions to the contract. The settled or eroded areas shall be refilled, compacted, and graded to conform to the elevation indicated on

the drawings or to the elevation of the adjacent ground surface. Damaged facilities shall be repaired in a manner acceptable to GRDA.

10. All field and laboratory testing required, to determine compliance with the requirements of this section, will be provided by the Contractor. One density test shall be conducted per 10,000 square feet of each lift of fill material placed or fraction thereof. A minimum of one density test per lift of fill material shall be performed. Density tests may be conducted using either ASTM D1556 “Density and Unit Weight of Soil in Place by the Sand Cone Method” or ASTM D2922 “Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)”. The Contractor will furnish two (2) copies of the test results to the GRDA’s and/or CPN’s Construction Coordinator/Inspector within 2 working days of the test.

11. Maximum density for cohesive compacted materials placed under this section will be determined in accordance with ASTM D698. The term “relative maximum density” shall be as defined in ASTM D698.

12. Relative density for non-cohesive compacted materials placed under this section will be determined in accordance with ASTM D2049. The term “relative density” shall be as defined in ASTM D2049.

13. If silt fences are required for the project, the contractor shall install and maintain them for the project duration. At the end of the project they are to be removed. If these are required, see the Storm Water Discharge Plan, as furnished by GRDA for details.

14. After subgrade preparation and prior to applying the final aggregate layer, areas to receive aggregate surfacing shall be treated with a weed eradicator and soil fumigant, by the Contractor. Weed eradicator and soil fumigant shall be applied in strict accordance with the manufacturer's instructions. The weed eradicator and soil fumigant shall be Allied Chemical "UROX" or "URAB"; Du Pont "Hyvar-X" or "Hyvar XL"; or U.S. Borax "Ureabor".

TR-3 <u>SEEDING</u>

1. General: This section covers the seeding of disturbed earth and sloped areas created by the construction covered by this specification. All areas disturbed during site preparation, shall be seeded except for finished driveway areas, the area inside the substation fence, and the 3’ – 5’ substation perimeter apron.

   This work shall include the furnishing of all labor and materials including fertilizer, seed, and all equipment necessary for the preparation of the seedbed, planting of seed, the application of fertilizer, rolling, watering and maintenance. Eroded areas shall be repaired prior to preparation of the seedbed. Additional material shall be added and compacted as required to provide uniform slopes with effective drainage.

   The seeding contractor shall furnish equipment manufactured expressly for the work.

2. Materials for seeding:

   Fertilizer. Fertilizer shall be applied in appropriate portions if required to ensure adequate establishment of grass to prevent erosion of finished grade.

   Commercial fertilizer shall be uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be stored in a weatherproof storage place in such a manner that it will be kept dry and its effectiveness will not be impaired.

   Seed. Rye grass seed (or approved substitute) in appropriate quantity to establish growth sufficient to prevent erosion of finished grades, shall be applied to all required areas.

3. Seed Application:

   Topsoil. The Contractor shall be responsible for the procurement and distribution of suitable topsoil, as approved by the GRDA/ Inspector. The topsoil, as specified, may be obtained from stockpiles on GRDA's property, if available. If GRDA has no available topsoil, the Contractor shall locate and furnish suitable topsoil.

   Topsoil for planting operations shall be fertile friable, natural loam containing a liberal amount of humus, and shall be capable of sustaining vigorous plant growth. Topsoil shall be free of subsoil and shall be reasonably free to stone, lumps, clods of hard earth, plants or their roots, stalks, and other extraneous matter.

4. Watering. Watering will be required over the entire seeded area if rainfall is not sufficient to germinate the seed immediately. Water shall be applied to penetrate three inches into the soil immediately after compaction is completed. Watering should be sufficient to establish a complete cover of green before the weather retards growth.

   It shall be the responsibility of the Contractor to furnish all pipes, pumps, hose, sprinklers, water, and all other necessary materials to apply water as necessary for maximum growth.

5. Guarantee. The Contractor shall guarantee all work and materials for a period of one year after completion of seeding work. During the guarantee period, all seed that dies shall be replaced by and at the expense of the Contractor.

TR-4 <u>FOUNDATION EXCAVATION AND BACKFILL</u>

The specific type of foundation to be used at each structure location shall be shown on the drawings.

The foundation concrete shall cure a minimum of seven (7) days before erecting steel or applying any loads.

Mat foundations and grade beams should be neatly excavated. Excavation should be accomplished with a smooth-mouthed bucket. If a toothed bucket is used, excavation with this bucket should stop 6-inches above bottom (invert) grade and the excavation completed with a smooth-mouth bucket or by hand labor. Steel should be placed and the foundation concrete placed the same day as excavation. Debris in the bottom of the excavation should be removed prior to steel placement. If

for some reason the foundation concrete cannot be placed the same day as excavation, the Construction Coordinator/Inspector may require it be sealed to protect the exposed foundation site.

The excavation should be sloped sufficiently to create an internal sump for the runoff collection and removal. Surface runoff water accumulating at the bottom of the excavation should be pumped out prior to concrete placement.

Under no circumstances should accumulated water be allowed to affect the quality of the bearing surface adversely.

Drilled piers should be dry augured and constructed in an expeditious manner. Concrete should be placed in the footing excavations immediately following drilling, under-reaming, and inspection. Under no circumstances should the excavation remain open more than eight (8) hours unless permitted by GRDA's and/or Inspector. Surface runoff or ground water influx accumulating in the excavation should be pumped out prior to placing concrete in drilled pier.

No concrete shall be placed in water except with the written permission of GRDA, and the method of depositing the concrete shall be approved by GRDA.

Top surfaces of substation foundations shall be steel trowel finish with a permissible variation of elevation shown of plus or minus 1/16 inch. The edges of slab type foundations, shall have a ¾ inch chamfer, unless otherwise shown on the drawings.

Pier type foundations with round caps shall be formed using “Sonotube” or reusable round metal forms. The top edge of all round cap foundations shall have a ¾” chamfer. A “bolt-on” chamfer strip shall be used to obtain the necessary ¾” chamfer. Sides of all substation foundations, including round caps and chamfers (above finished grade to a minimum of six (6) inches below finished grade) shall be rubbed with carborundum stones. That portion of forms covering the concrete to be rubbed may be removed as soon as concrete has set a minimum of twelve (12) hours. All other forms must be allowed to remain in place a minimum of seven (7) days. Concrete work is not to proceed without authorization of the Construction Coordinator/Inspector.

EXCESS EXCAVATION SOIL AND DEBRIS SHALL BE REMOVED FROM THE PROPERTY AND PROPERLY DISPOSED OF BY THE CONTRACTOR.

All reinforcement bar must have 3” (minimum) clearance on all sides, top and bottom.

The Contractor shall furnish all concrete, reinforcing steel, chamfer strips, and other form material.

For concrete cast-in-place foundation piers, the volume of over excavation shall be filled with concrete. Concrete shall not be placed against backfill or disturbed earth.

The cost of additional concrete used in the foundation (due to over excavation) shall be borne by the Contractor, unless otherwise approved in writing by GRDA.

The quality of the hole will be approved by GRDA before any concrete is placed in the excavation. Where water is encountered, the hole shall be kept dry by pumping during the installation of the foundation.

If unsuitable material is encountered at the bottom of cast-in-place concrete piers, GRDA may direct that a deeper cylinder be installed and the basis of payment will be the Contract unit price for the depth of circular pier actually installed.

GRDA will furnish all anchor bolts unless otherwise specified in the Drawings.

The Contractor shall maintain accurate records which shall contain the following information for each pier:

1. Contractor's name
2. Drill rig operator's name Pier number and location Shaft diameter
3. Ground elevation Top elevation of shaft
4. Top elevation of rock, when applicable Bottom elevation of shaft
5. Ground water elevation
6. Caving or sloughing of excavation Drilling difficulties
7. Casing insertion, size and length, and whether or not removed Date and time of start and finish excavation
8. Length and diameter of reinforcing bar cage Date and time concrete placed
9. Calculated volume of excavation based on diameter of shaft and bell Total quantity of concrete placed

TR-5 <u>CONCRETE</u>

1. General.
   This section covers all cast-in-place concrete and includes reinforcing steel, forms, finishing, curing and other appurtenant work. The Contractor shall notify GRDA 24 hours prior to concrete placement. No concrete shall be placed without the approval of the Construction Coordinator/Inspector.

2. Materials: Where the use of the following material is specified herein, such material shall be in accordance with these requirements:

   Cement - ASTM C150, Type I, II

   Fine Aggregate - Clean natural sand, ASTM C33. Artificial or manufactured sand will not be used unless specific prior approval of the GRDA is obtained.

   Coarse Aggregate - Crushed stone, washed gravel, or other approved inert granular material conforming to ASTM C33. The size of the aggregate shall conform to be ASTM 57 unless otherwise required or permitted by GRDA.

   Water - Fresh, clean and free from injurious amounts of oils, acids, alkalis, salts, organize materials or other substances that may be deleterious to concrete or steel.

   Admixtures - Admixtures to be used in concrete, when required or permitted, shall conform to the listed specifications.

   Air-Entraining Agent - Shall conform to ASTM C260

   Water Reducing Agent - Shall conform to ASTM C494, Type A (water reducing)

Water Reducing Retarder - Shall conform to ASTM C494, Type D (water reducing and retarding)

Water Reducing Accel. - Shall conform to ASTM C484, Type E (water reducing and accelerating)

Reinforcing Steel ASTM 615, Grade 60 - Rebar yield strength should match the yield strength used for design

3. Forms:

   Pier Form - Sonatube, Sonoco Products, Co., Hartsville, S.C., or approved equal. Lumber - Straight, uniform width and thickness.

   Form Oil - Light colored paraffin oil or other approved non-staining material. Polyethylene Film - Fed. Spec. L-P-378, Type I; 6 mil

   Membrane Curing - Fed. Spec. TT-C-800, chlorinated rubber, compound minimum 18 percent solids.

4. Limiting Requirements – Concrete shall be controlled within the following limiting requirements:
   a. Specified compressive strength @ 28 days shall be a minimum of 4,000 psi.
      i. Average strength of a single pour shall exceed specified compressive strength as required in accordance with ACI 318.
   b. Concrete shall be air-entrained.
      Total air content required (air-entrained and entrapped air) shall be:

Normal Max Size Coarse Aggregate	Total Air Content
3/4"	6% ±1
1"	5% ±1

      Air content shall be measured by ASTM C231, "Test for air content of freshly mixed concrete by pressure method".

   c. Concrete shall be proportioned and produced to have a slump between 3” and 5". No concrete shall be placed with a slump greater than 5”.

      Slump shall be determined by ASTM C143, "Standard Method of Test for Slump of Portland Cement Concrete".

   d. Maximum size of coarse aggregate shall not exceed:
      i. One-fifth narrowest dimension between forms.
      ii. Three-fourths minimum clear spacing between reinforcing bars.
      iii. One-third thickness of slabs.

   e. Concrete may be adjusted to produce the required rate of hardening for varied climatic and job site conditions by incorporation of appropriate admixtures. Prior approval by GRDA is required before these adjustments may be made.

Concrete mix proportions shall be determined on the basis of field experience of trial mixtures in accordance with the provisions of ACI 318. All concrete mix designs shall be approved by GRDA prior to their use on this project.

5. Batching and Mixing – Batching and mixing shall conform to ASTM C94, except as otherwise specified herein.

   Before unloading the concrete at the site, a copy of the delivery ticket shall be furnished to the GRDA's Representative. The ticket shall include the following information:

   a. Ticket number.
   b. Time batched.
   c. Time arrived on jobsite.
   d. Time at start of discharge from truck.
   e. Time at end of discharge from truck.
   f. Amount of concrete (by volume).
   g. Mix number.
   h. Batch Type.
   i. Amount of all water added at jobsite by Contractor.
   j. Number of revolutions on the truck's revolution counter before batching and after placement is completed.
   k. Truck number.
   l. Truck driver's name.
   m. Types and quantities of admixtures added to the batch.
   n. Slump of concrete.

   When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be complete within 1-1/2 hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates, or the introduction of the cement to the aggregates, unless a longer time is specifically authorized by the Construction Coordinator/Inspector. In hot weather, or under conditions contributing to quick stiffening of the concrete, a time less than 1-1/2 hours may be required by GRDA.

6. Placement – Concrete shall be conveyed to the point of final deposit and placed by methods which will prevent the separation or loss of the ingredients. During and immediately after depositing, all concrete shall be thoroughly compacted, worked around all reinforcements and embedment's, and worked into the corners of the forms. Unless otherwise authorized, compaction shall be by immersion-type vibrators only.

   Concrete shall be placed in accordance with ACI 304, ACI 305, and ACI 306, as applicable.

   Excavation where practicable, shall be dewatered before placing concrete.

Concrete shall be placed with an approved drop pipe in excavations deeper than 10 feet. Concrete shall be placed with an approved funneling device in excavations less than 10 feet.

Contractor shall not place concrete that has partially hardened or has been contaminated by foreign materials. Mud or foreign materials shall be prevented from entering the concrete or forms during placement operations. Should soil, rock or other foreign material enter the excavation and contaminate the concrete, the contaminated concrete shall be removed before completing the pour.

Concrete shall be placed at a sufficient rate to assure that lifts below have not taken set before fresh concrete is deposited.

Vibrators shall not be dragged through the concrete. Vibrator should be inserted and withdrawn slowly with the vibrator running continuously so that no hole will be left in the concrete. Contractor shall not flow concrete from one location to another by use of a vibrator.

Concrete shall remain in the forms for a minimum of 12 hours.

When loose soil, a high-water table, or other condition which causes the sides or bottom of the excavation to be unstable is encountered, the excavation shall be advanced through use of slurry, a temporary casing, or other approved method. Slurry, temporary casing, or permanent casing shall be used only with the approval of GRDA's Representative.

Concrete placed through slurry or under water shall be pumped with an approved concrete pump as follows:

a. Concrete shall be placed using a rigid pipe or flexible hose. Placement shall be started with the lower end of the pipe or hose sealed with a rubber gasket wood plug with a line attached, or similar device, lowered to the bottom with the pipes or hose dry. The plug shall be displaced by the concrete and retrieved from the work. The water shall be displaced as the concrete is placed and the end of the pipe or hose shall be kept embedded 2 to 5 feet in the concrete as the concrete is placed.

b. Should the end of the pipe or hose be accidentally pulled out of the concrete during the placement, the pour shall be immediately discontinued, and the pipe or hose withdrawn from the hole. The pipe or hose shall be resealed at the bottom and returned to the hole with the sealed end inserted into the concrete. Pouring may then be resumed.

c. The cutoff point shown on the drawings shall be over poured. The excess concrete shall then be dipped out, and visual inspection made of the concrete at the top of the pour. If any contamination of the concrete is observed, it will be necessary to reinsert the pipe or hose a sufficient distance into the concrete and to continue pouring fresh concrete until the contaminated concrete has been replaced by uncontaminated concrete.

Water added to concrete shall be at the Contractor's risk. If water or any admixtures are added at the site, the concrete shall be remixed for a minimum of 25 revolutions.

Cold joints and construction joints are not permitted unless otherwise indicated or specified.

7. Hot Weather Concreting – Except as modified herein, hot weather concreting shall comply with ACI 605. At air temperatures of 90 degrees F or above, special procedures shall be adopted to keep the concrete as cool as possible during placement and curing. The temperature of the concrete shall not exceed 90 degrees F when it is placed in the work.

   Whenever the air temperature exceeds 95 degrees F, membrane cured slabs shall be kept wet to promote cooling of the concrete during the curing periods.

8. Cold Weather Concreting – Except as modified herein, cold weather concreting shall comply with ACI 306. The temperature of concrete at the time of mixing shall be not less than that shown in the following table for corresponding outdoor temperature (in shade) existing at the time of placement:

Outdoor Temperature	**Concrete Temperature**
Below 30°F	70°F
Between 30°F & 45°F	60°F
Above 45°F	45ºF (50º F if temperatures are expected to decrease during curing period)

   When deposited, the temperature of heated concrete shall not be over 80º F.

   When freezing temperatures may be expected during the curing periods, suitable means shall be provided for maintaining the concrete at a temperature of not less than 50 degrees F for five days or 70 degrees F for three days after the concrete is placed. Concrete and adjacent form surfaces shall be kept moist at all times. Sudden cooling of concrete shall not be permitted.

   The use of calcium chloride will be permitted **PROVIDED THAT** justification for its use is provided to GRDA and the use of it is approved by GRDA prior to its use.

9. Reinforcement – Reinforcing bars shall conform to ASTM Standard Specification for Deformed Billet Steel Bars for Concrete Reinforcement, Designation A615, Fy = 60 ksi.

   Steel reinforcing bars shall be supplied by the contractor. Bars shall be placed in the concrete where shown on the drawings. Unless otherwise shown on the drawings or directed, measurements made in placing the bars shall be to the centerlines of the bars. Reinforcement drawings show bar placement details and bar bending details, including bar lists and bending schedules. Before the reinforcing bars are placed, the surfaces of bars and the surfaces of any metal bar supports shall be cleaned of heavy flaky rusts, loose mill scale, dirt, grease or other foreign substances. After being placed, the reinforcing bars shall be maintained in a clean condition until they are completely embedded in concrete. Main reinforcement shall have a minimum clear protective cover to the face of concrete as shown on the drawings. Reinforcing bars shall be accurately placed and secured in position so that they will not be displaced during

the placing of concrete, and special care shall be exercised to prevent any disturbance of the reinforcing bars in the concrete that has already been placed. Precast concrete blocks may be used for supporting reinforcing bars.

Rustproof metal chairs, metal hangers, metal spacers, or other satisfactory metal supports may be used for supporting reinforcing bars.

Welding on reinforcing bars in lieu of tie wire will not be permitted. A minimum of 50% of the rebar in rebar cages shall be tied with wire.

Reinforcing cages outside their final position in the foundation shall be of sufficient rigidity to permit lifting and handling without deformation.

Lap splices in reinforcing bars shall be a minimum length as calculated for Class B splices in accordance with ACI 318 latest revision, unless otherwise shown on the drawings or approved in writing by GRDA. Welded splices shall not be used for reinforcing bars.

10. Forms – Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions shown on the drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar and shall be maintained in proper position and accurate alignment. Forms shall be thoroughly cleaned and oiled before concrete is placed and shall not be removed until the concrete has hardened sufficiently to support all loads without damage.

    Where concrete is placed against dry or porous surfaces, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be sealed with waterproof sealing tape. Unless otherwise permitted by GRDA, all concrete except pier concrete which is in contact with earth or granular fill shall be placed against 10 mil polyethylene film.

    Vertical concrete surfaces above extended footings shall be formed.

    Form ties shall be of the removable end, permanently embedded body type. Outer ends of the permanently embedded portions of form ties shall be at least one inch back from adjacent outer concrete faces.

    Chamfer strips shall be placed in forms to bevel all foundation edges and corners except where otherwise noted. Bevel dimensions shall be 3/4 inch by 3/4 inch unless otherwise shown on the drawings.

11. Embedment's – Materials that are to be embedded in the concrete shall be accurately positioned and securely anchored. Embedment's shall be clean of all concrete spatter and other foreign substances.

12. Finishing Formed Surfaces – All fins and other surface projections shall be removed from all formed surfaces from which the forms are stripped except exterior surfaces that will be in contact with earth backfill. The surfaces shall be rubbed down using a mortar mix made from the same cement the foundation concrete is made of. This will assure color blending.

The removable ends of all form ties shall be removed and the recesses resulting from such removal shall be filled with mortar.

13. Finishing Unformed Surfaces – The unformed surfaces of concrete shall be screeded and given an initial float finish followed by a second floating at the time of initial set.

14. Curing – Concrete shall be protected from loss of moisture for at least seven (7) days by polyethylene film or membrane curing compound. Membrane curing compound shall be applied as recommended by the manufacturer. Concrete shall not be permitted to freeze for at least seven (7) days following placement.

15. Repairing Defective Concrete – Defects in formed concrete surfaces shall be repaired to the satisfaction of GRDA within 24 hours, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is porous, honey combed, and otherwise defective to a depth in excess of one inch shall be cut out and removed.

    Concrete repair work shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Mortar and concrete used in repair work shall be adequately cured and rubbed out.

16. Concrete Testing – The contractor shall provide an A.C.I. certified concrete testing company, acceptable to the owner, to conduct quality control testing of the concrete used on this project.

    The Contractor's independent testing laboratory shall furnish test equipment, test cylinder molds, and trained personnel (ACI Concrete Laboratory Testing Technician – Grade 1 or equivalent) to perform all required field tests, make the required concrete test cylinders and deliver test cylinders to the testing laboratory. Concrete sampling for tests and cylinder making shall be done conforming to ASTM C172.

    All test cylinders shall conform to the size and shape of requirements conforming to ASTM Specifications C 470/C and 470M.

    The Field Testing Technician shall perform the following tests:

    a. Prepare test cylinders conforming to ASTM C31, with not less than one set of cylinders (minimum four cylinders) from each concrete foundation or each 30 cubic yards or fraction thereof. Each set shall be taken from only one batch of concrete. Any additional random testing will be done at the discretion of GRDA's Representative up to approximately every 15 cubic yards of concrete.

    b. Cylinders shall be identified with the following information:

        i. Date and time prepared.
        ii. Delivery ticket number.
        iii. Sequential cylinder numbers indicating structure number and cylinder number (e.g. 1/1-01).

c. Slump Test conforming to ASTM C143.
d. Air Content Test conforming to ASTM C231.
e. Temperature determination conforming to ASTM C1064.

The Field-Testing Technician shall discard concrete used for slump and air tests and deliver the test cylinders to the Testing Laboratory for compressive strength tests. Slump and Air Test results shall be furnished to the Testing Laboratory for inclusion in the Cylinder Test Reports.

The Testing Laboratory will cure and test concrete cylinders conforming to ASTM C192 and C39, testing two cylinders at seven days of age and two at 28 days of age.

The Contractor shall make arrangements with the Testing Laboratory to receive a copy of all test reports and for the Testing Laboratory to send 1 hard copy and 1 electronic copy of all test reports to GRDA. The costs of providing the reports will be paid by the Contractor.

Should the statistical data indicate an unacceptable combination of average strength and standard deviation, the Contractor shall take immediate corrective action as instructed by GRDA.

17. Submittals – The Contractor shall provide the following submittals to GRDA prior to foundation installation for GRDA's approval:
    a. Concrete Mix Design.
    b. Reinforcing steel bar schedule, details and erection drawings.
    c. Selected Testing Laboratory name and address.
    d. Name and address of ready-mix plants that will supply the concrete.
    e. Grouts and curing agents.

TR-6 <u>ROADS</u>

1. GRDA assumes no responsibility for securing right to use or the condition of maintenance of any road (including public roads) or structure that may be used by the Contractor in performing the work under this Contract or in the transferring of materials to and from the site of the work. Roads must be returned to their original condition.

2. GRDA will make no payment to the Contractor for any work done in constructing, improving, repairing, or maintaining any road or structure for use in the performance of work under this Contract, unless the road construction is part of the contract and included as a pay item.

3. Roads subject to interference by the work shall be kept open. The Contractor shall provide, erect and maintain, at its own expense, effective barricades on which shall be placed acceptable warning and/or detour signs at each side of any road obstruction caused by the operations of the Contractor and shall comply with Federal, State, and Local regulations.

TR-7 <u>CULVERTS</u>

1. GRDA's Grading Layout and/or Plot Plan drawing will show culverts that will be required for the

project.

2. Culverts and associated materials shall conform to the following requirements:

   Reinforced concrete pipe: ASTM C-76 - Size, shape, gage, and lengths as indicated on the GRDA drawings.

   Steel pipe: 16 gauge corrugated hot dipped galvanized, round, lengths and sizes as directed by the GRDA.

3. Culvert trenches shall be carefully graded to the required slopes then carefully tamped to receive and fit the lower part of the pipe. If rock is encountered in the excavation it shall be removed and replaced with suitable earth or granular fill material to a minimum depth of six (6) inches below the bottom of the pipe.

4. Culvert pipe shall be laid on the prepared bed starting at the outlet end with sections firmly joined, and with the outside laps of circumferential joints (if any) pointing upstream. Longitudinal seams shall be placed at the side of the trench.

5. Backfill shall be placed adjacent to and over the pipe in six (6) inch lifts, with each layer thoroughly compacted (minimum 12 inch covering).

TR-8 CRUSHED ROCK SURFACING

1. Subgrade preparation: Immediately prior to surfacing, the subgrade shall be shaped to the grade and cross-section indicated on the drawings.

2. The surface course shall be five (5) inches compacted thickness per attached drawings. Initially spread to (6) inches before compaction.

3. The compacted surfaces shall be free of ruts, depressions, and other surface disturbances and shall be finished to the lines and grades indicated on the drawings.

4. Surfaced areas shall be maintained by the Contractor until final acceptance of the work under these specifications.

   Material shall conform to the following:

   Crushed Stone. Crushed stone surface for the substation surface shall conform to Type 'A', of Oklahoma Department of Transportation Section 703.01 – Mineral Aggregate, Miscellaneous Use. Any sub base stone specified on the drawings shall be Type 'C' of the Oklahoma Department of Transportation Section 703.01 – Mineral Aggregate, Miscellaneous Use.

   Crushed stone shall consist of fragments of hard, durable particles of stone showing an abrasion loss of not more than 40%, containing not more than 5% soft, friable material (No Fines), and shall be free from an excess of flat or elongated pieces. Below, for reference, is the gradation

requirements (refer to the ODT standard for the most current standard and the complete requirements):

Sieve Size Percent Passing (By Weight)

	TYPE A	TYPE C
2 inch		100
1 ½”	100	90 - 100
1”		80 - 100
¾ ”	40 – 100	
½ ”		60 - 80
3/8 ”	30 – 75	
No. 4	25 – 60	40 – 60
No. 10	20 – 43	25 – 45
No. 40	8 – 26	15 – 30
No 200	4 – 12	0 - 5

The material passing the 40 sieve shall conform to the following requirements:

Liquid Limit (Max) 25

Plasticity Index (Max) 6

Measurement. The stone will be measured by the ton, the weight determined by weighing the transporting vehicle loaded and empty.

Stone Revetments. Shall be hard, durable stone that will not disintegrate upon exposure to the elements or be easily broken from handling. Stone shall be well mixed and reasonably free from earth, dust, and other objectionable materials. Stone used for erosion control or for retention ponds, shall be as specified in the Grading Detail.

Placing. The stone revetment shall be dumped or rolled into place in such a manner that the smaller stones will be uniformly distributed through the mass. Sufficient handwork shall be done to procure a neat and uniform surface.

Measurement. The stone revetment will be measured by the ton, the weight determined by weighing the transporting vehicle loaded and empty. The quantity, installed and accepted, will be paid for at the contract unit price.

Payment will be made under:

Pay Item: Pay Unit:

Stone Revetment for Square Yard Erosion Control

(12” thick)

Stone Revetment for Square Yard Pond (4” thick)

Surface Rock Cubic Yard (6” thick)

TR-9 GROUNDING

1. The station grounding system consists of a buried main grid, which is interconnected with driven ground rods and/or ground wells. The grounding system shall be connected to all structures and noncurrent carrying metal parts of electrical equipment such as tanks, switch mats, switch handles, frames, bases, cabinets, and connections from equipment neutrals.

2. The main below-grade ground grid shall consist of soft-drawn copper cable buried a minimum of 24" below dirt grade arranged in the pattern shown on the plan view. Above grade ground connections are to be constructed with Copper Weld conductor. Each structure is to be connected to a minimum of two (2) #4/0 cables (unless noted otherwise on the drawings).

3. Ground rods shall be $^{5}/_{8}$" or $^{3}/_{4}$" diameter, 10' minimum, copper-clad steel rods furnished for this purpose. Connections between the rod and the ground grid shall be copper wire, size as per GRDA Drawings.

4. All below grade grounding system connections shall be made using the exothermic process or Swage Compression as shown on GRDA drawings. Connections shall include all cable-to-cable splices, T's, X's, etc.; all cable to ground rods; and cable lug terminations to steel unless otherwise shown.

5. Once the grounding system is complete, GRDA shall test the designed ground system and if additional ground rods and/or grounding materials are required, these shall be installed in accordance with GRDA's directions.

6. Grounding of all equipment frames, tanks, switch handles, switch mats, or bases shall be connected to the main ground grid as shown on GRDA drawings by Copper Weld cable. The ground connections, when bolted, shall be bolted to the equipment with 1/2" S.S. bolts, (2) flat and (1) Belleville washer with silicon bronze nuts. Bolt length shall not exceed five threads showing past nut, after nut is torqued. All bolts to point north, east, or down when feasible. When other methods of grounding are used, such as a single groove clamp, these shall be used as shown on the drawings.

7. Group operated switch mechanism shafts shall be grounded to the operating handle with approved grounding (Braid) devices.

8. All grounding shall be performed as shown on GRDA Construction drawings and details. All nut and bolt connections shall be made with bolts long enough to have at least one full thread of the bolt past the nut, and no more than 5 full threads past the nut.

9. Electrical equipment mounted by bolts to a well-grounded steel structure shall be considered adequately grounded. A copper bus is not required between equipment and structure unless specified in drawings.

10. Switch ground mats shall be installed being held down with rebar stakes. Switch ground plates shall be installed by being placed on the final rock grade and held in place with rebar stakes. The Contractor shall furnish rebar stakes.

11. All exothermic and Swage ground grid connections shall not be buried until inspected and approved by the Construction Coordinator/Inspector.

12. Exothermic Welds:

    The Contractor shall supply all shots required in excess of those provided by GRDA. All shots and molds shall either be Cadweld or Thremoweld brand. The shots must be from the same manufacturer. The exothermic welds shall be installed as per the following specifications:

    a. Conductor General
        i. Clean and dry the conductor removing any contaminants (oil, insulation, water, etc.) present in conductors.

        ii. Use a safety solvent to wash the conductor, and then dry it.

        iii. Remove oxides with a wire brush.

        iv. Dry conductors with a torch.

        v. If slag deposits cover more than 20% of the connection surface, or any strands are exposed after slag has been removed, the connection must be rejected.

        vi. The connection should be essentially free from porosity.

    b. Mold, General
        i. A mold is designed to last for an average of 50 connections. This will vary according to the care given the mold during use.

        ii. If the mold is excessively worn, replace it with a new mold.

        iii. Molds shall not be altered in the field.

        iv. Heat mold with torch (to above 212°) to dry the mold after each use.

        v. Remove any mold packing material or contaminants in weld cavity of the mold.

        vi. Clean the mold with a soft brush, cloth, or newspaper. DO NOT USE A WIRE BRUSH.

        vii. Apply Cadweld / or equal “mold sealer” external to the mold around the

conductor or rod to retard leakage of the weld metal.

c. Welding to Steel and/or Ground Rods
   i. Clean the steel and/or ground rod with a rasp or grinder to bright metal. All scale, paint, and/or other coating must be removed. Wire brush will NOT suffice. Grease must be removed with safety solvent before cleaning.

   ii. Clean galvanized surfaces with a wire brush or emery cloth. Extra heavy-galvanized steel must be cleaned with a rasp.

   iii. If the steel and/or ground rod is moist, heat with a torch (from the back side if possible). Any carbon deposit from the flame must be removed.

13. Ground Wells
   a. The construction of the ground wells shall be as detailed on the drawings.

   b. The backfill material shall be BENTONITE.

   c. The bentonite shall be mixed with water to form a slurry mixture with the consistency of pancake batter. The water mixture shall be between 14 and 18 gallons of water to 50 pounds of bentonite.

   d. The copper electrode shall be installed, with a weight on the end, extending to the bottom of the well before the bentonite is installed.

   e. The well shall be filled with bentonite to within 6” of the horizontal run of ground cable (within 2’-6” of the surface).

   f. All wells shall be filled with the electrode and bentonite on the same day as the well is drilled. If this becomes impossible and is approved by the Construction Coordinator/Inspector, the filling may be delayed. However, the well must be cleaned out just before the electrode and bentonite is installed, using a method approved by the Construction Coordinator/Inspector.

TR-10 STATION POST INSULATOR ASSEMBLY

1. General

GRDA will supply insulators in quantities and strengths required for use in the assemblies. The insulators shall be assembled in accordance with the drawings.

The strength of insulator to be used on each structure is shown on the drawings furnished by GRDA. The Contractor shall exercise care that the correct strength of insulator is used at each structure.

Hardware shall be handled in such a manner as to prevent contacting the ground. All hardware items shall be clean when installed.

Horizontal bolts or pins shall have the nut and/or cotter on the structure side of the connection. In the case of the horizontal conductor configurations, horizontal bolts or pins of center-phase connections shall have the nut and/or cotter consistently on one side or the other of the connections. On steel towers, these nuts and/or cotters shall face the ladder leg side. Vertical bolts or pins shall have the nut and/or cotter on the underside of the connection.

Ball and socket connections in a horizontal or semi-horizontal plan, as in dead-end or vee string configurations, shall have the cotter pins installed with the eyes on top so that the spread portions may be viewed from the ground. Ball and socket connections in a vertical plan shall have the eyes of the cotter pins on the tower side with the long axis of the pins perpendicular to the conductor.

Humpback cotters shall not be spread. Straight cotters shall have the ends spread and turned back to an opening of 180 degrees. Cotter pins in the suspension insulators must not be spread.

Heat-treated "U" bolts of suspension and dead-end clamps shall be properly seated and nuts uniformly tightened, as indicated on an approved torque wrench, to the following torque limits.

"U" Bolt Size (in.)	Minimum (ft. – lbs.)	Maximum (ft. – lbs.)
1/2	45	50
9/16	65	70
5/8	80	85
3/4	95	100

After the initial tightening of dead-end clamps, the "U" bolt shall be further seated by firmly driving them down with a hammer. The nuts shall then be fully retightened to the proper torque.

All other bolted fittings shall be installed with bolts properly seated and nuts securely and uniformly tightened.

Bolted electrical contact surfaces of jumper terminals, paralleled groove clamps, terminal lugs, tee connectors, etc., shall be cleaned, coated with Alcoa No. 2 electrical joint compound, abraded through the grease with emery cloth or wire brush, and then bolted together with grease in place. All bolted electrical connections shall be torqued in accordance with the manufacturer's recommendations.

2. Handling of Insulators

All insulators shall be handled carefully during transportation, assembly and installation on the structures or equipment to avoid chipping or damage of any kind.

All insulators shall be clean when installed and all other parts free from dirt.

Only clean rags, or other methods acceptable to GRDA, free from any abrasive material, shall be used for cleaning insulators.

Wire brushes shall not be used for the cleaning of any parts, metal or otherwise. Workmen shall not climb on insulators at any time.

In the completed substation, all insulators and insulator assemblies shall be clean.

3. Damaged Insulators

Damaged insulators shall not be installed.

All damaged or defective insulators shall be returned to GRDA's designated yard for inspection and disposition by GRDA.

TR-11 DISCONNECT SWITCHES

Disconnecting switches shall be field assembled by the Contractor on station post insulators and installed on structures intended for these purposes. The control mechanism for the switch shall be installed and the switches shall be aligned for perfect and free operation in accordance with the manufacturer's instructions or recommendations. Switches shall be connected to the station bus per the GRDA drawings and manufacturer specifications.

Motor operated switches should have 180° degree CCW rotation to open, as viewed from the top.

Set screws shall not be set until the switches have been inspected by GRDA's construction coordinator/inspector or GRDA substation personnel.

TR-12 CONDUIT AND RACEWAY

1. General

All wiring is to be inspected by GRDA for adherence to practices and GRDA standards and all devices used for installing the control cable will be checked for proper operation.

Contractor shall install all cables in accordance with drawings and the Cable Schedule included there with.

Immediately after cables are cut from the reels, they shall be identified at both ends with cable markers. The cable markers shall be securely fastened to the cables to make certain that they will not become separated from the cables during the training and termination process. Where more than one cable is installed in a conduit there shall be a tag for each cable. The cables shall be identified individually where they enter into the conduit. The cable tags shall be located at convenient locations for inspection and shall not be concealed by equipment or other material.

The Contractor shall store reels in an area reserved only for that purpose and shall protect them from damage by construction activities or the handling of other material in storage. Wire in

coils, and any wiring accessories, which can be damaged by moisture or rough handling, shall be kept in a storeroom or suitable trailer.

In handling reels, proper precaution shall be taken by the Contractor to prevent any damage to the cable or any reel that is returnable for reel credit. Reels shall be rolled only in the direction indicated by the manufacturer and no reel containing cable shall be dropped from a truck or from any other comparable height, under any circumstances. In turning reels, particularly after the lagging has been removed, bars shall be used in such a manner that they will not bear against the cable. Reels shall not be rolled over rocks or other projecting objects that are liable to damage the cable, and when it is necessary to roll unlagged reels over soft ground, plank tracks shall be provided by the Contractor to keep the reel from sinking causing possible damage to the cable.

2. Direct Buried

Where new cable trench is required, a trench with a minimum 12” width shall be excavated to a depth of 18” below finished grade. A 3” layer of sand shall be placed in the trench and cables, then laid in place in the center of the ditch. An additional 3” layer of sand shall be placed over the cables, then covered with the 2” X 8” pressure treated timbers.

Cable shall be installed in the trenches or raceways in accordance with GRDA’s Substation Cable Tabulation and Drawings. Allowances should be made for proper lead length to all equipment. Under no circumstances shall a cable be spliced in the substation.

3. Conduit and Cable

Conduit runs shall be installed a minimum of 18” below final yard grade. The Contractor shall leave sufficient length of cable at each end of the conduits so that connections can be made to all electrical equipment. The Contractor shall identify each cable at both ends with T&B Ty – Raps and T&B markers provided by the Contractor.

All rigid PVC conduits, condulets, and conduit fittings will be supplied by the Contractor. All material should be of the same type (manufacturer) and color when feasible. (Minimize mix and match for appearance and consistency). Conduit and connectors shall be Electrical Grade Schedule 40. Minimum conduit size in the yard shall be 1 ½” in inside diameter, except as noted on the drawings. When three or more conduits are installed in one trench, the conduits shall be held in place with spacers (of the proper size) to assure that the spacing between the conduits is held in a uniform manner. Spacers shall be installed at least every three (3) feet along the conduit run.

All field cut conduits shall be cut square, and then reamed to remove any sharp edges. Conduit bends shall be made so that the internal diameter of the conduit will not be effectively reduced and the protective coating on the inside and outside of the conduit is not injured.

Conduit mounting brackets must adequately anchor and support the weight of the conduit and the contents without visible deflection. Whenever such brackets are not adequate to withstand

the tensions incurred during the cable pulling operation, the Contractor shall temporarily brace such conduits and supports.

Conduit terminations shall be provided by the Contractor with a bushing or suitable protector to guard against damage to the insulation or outside covering of the cables.

Any cable pulled in a manner resulting in damage to the shielding shall be removed and replaced at the direction of the Construction Coordinator/Inspector and at the

Contractor's expense. The Contractor shall utilize non-hardening cable pulling lubricant at all times.

Openings beneath equipment shall be closed with Carboline Pyrofoam 700 or acceptable equal where the cables are in conduits and the conduits project through the openings.

Where the cables entering the equipment are not in enclosing raceways, the openings shall be closed with Dow Corning 3-6548 silicone RTV foam, Manville Type 103 Cera Form board, or acceptable equal flame retardant materials. The Cera Form boards shall be not less than 1 inch thick and shall be cut to fit closely around the outside surfaces of the cable where the cable passes through the boards. The boards shall be securely placed in the floor opening and all openings around the cables and the boards shall be sealed with Manville Cerablanket or acceptable equal and all exposed surfaces of the board and Cerablanket shall be covered with a 1/8 inch thick coating of Carboline Intumastic 285.

Openings shall not be closed until all the cables through the openings have been installed and tested.

Unused openings beneath equipment shall be closed with Carboline Pyrofoam 700, Manville Cera Form board coated with a 1/8 inch thick coating of Carboline Intumastic 285, Dow Corning 3-6548 silicone RTV foam, or acceptable equal flame retardant materials.

Installation of materials shall be in accordance with the manufacturer's recommendations. The materials shall be finished to provide a smooth, neat appearance.

Liquid tight flexible conduits shall be installed with sufficient slack and with large enough radius bends to prevent kinking or straining that might damage the conduit joints or jacket. In terminating such conduit, the Contractor shall not remove any of the jacket material from the flexible steel edges. No flexible conduit or fittings shall extend below the finished rock surface. Flexible conduit shall not exceed 4' in length without expressed permission from GRDA. All flexible conduits longer than 6' shall be secured with conduit clamps at a maximum of every 4'.

The Contractor shall install pull-tape or pull-rope in all spare conduits.

Contractor shall repair driveways cut during control cable installation. Repairs shall be completed in accordance with the requirements outlined in Earthwork section.

TR-13 ALUMINUM BUS AND CONNECTORS

1. The GRDA will furnish all aluminum bus, bus bar, bus connectors, and bus support fittings.

2. The Contractor shall install aluminum tubular bus, welded (or Deutsch, whichever is provided) connections and joints, including any "A" frames, flexible risers and runs to switches and other equipment in the yard. Install 336 MCM ACSR in 2" or 2½" runs over 19 feet in length and 795 MCM ACSR in 4" or 6" aluminum bus runs over 23 feet in length.

3. To minimize corona loss, any roughness of welds shall be stainless steel wire brushed and sanded with emery paper or crocus cloth to present a smooth finish.

4. All bolted and compression connectors and equipment terminals which join aluminum to aluminum shall have Contractor provided oxide inhibitor such as "NO-OX-ID A Special" compound liberally applied to such contact surfaces in accordance with the manufacturer's instructions. Bus connections shall be bolted with ½" S.S. bolts, (2) flat and (1) Belleville washer with silicon bronze nuts with maximum five threads showing past nut once torqued. All bolts to point North, East, down or to the outside of equipment frames (i.e. breakers, transformers, etc.).

5. All connections involving aluminum and copper shall be buffered by aluminum-copper bi-metal transition pad furnished by the GRDA.

6. All bus connections to terminal connectors shall be completed by the Contractor either by welding, bolting, compression, or all, as may be required. The Contractor shall complete the attachment and connection of all aluminum or copper wire to equipment connectors and bus supports, as required for a complete installation ready for service.

7. Production welds shall be examined visually. Any weld with a linear crackline indication shall be rejected. All welds shall be to the satisfaction of the Construction Coordinator. Any weld deemed not satisfactory by the Construction Coordinator/Inspector shall be removed and replaced at the Contractor's expense.

8. All tubing lengths used in connections to equipment shall be formed from one continuous piece, whenever feasible. All tubular bus shall be installed straight, level and/or plumb. Installation, support, or alignment of bus components which does not produce these conditions <u>will not</u> be accepted. The Contractor shall use particular care in the storage, handling, and installation of the tubular bus, fittings, and connectors to avoid indentations and/or abrasions of any kind. Prior to installation, the Contractor shall inspect the tubular bus, fittings, and connectors for indentations, abrasions, pits, burs, and defects of any kind, which shall be repaired by hand rubbing with a fine emery cloth. Upon completing the tubular bus installation, the Construction Coordinator/Inspector will inspect the work to assure compliance with the above requirements. Improperly installed and/or damaged tubular bus, fittings, and connectors, shall be repaired or replaced to the satisfaction of the Construction Coordinator/Inspector by the Contractor at no additional cost to GRDA.

9. All bends in tubing shall be made in a neat manner, without damage to the tubing, and shall be free of kinks, indentations, or flattened surfaces. All bends shall be made at normal temperature and the use of heat in making bends will not be permitted.

10. All tube cutting shall be done with an approved pipe cutter. No flame cutting will be permitted.

11. The Contractor shall furnish all welding rods or wire, as necessary, for completing any welded electrical installations required by this specification. For compression type fittings (Deutsch/or similar), the Contractor shall supply the necessary equipment to install the connectors properly.

12. Expansion connectors shall be installed per manufacturer's instructions and properly adjusted for ambient temperature.

13. The Contractor shall cut, drill, and bend aluminum bus bar as needed to complete the aluminum bus installation, as per the GRDA Drawings. Bus bar shall be furnished by GRDA.

14. The Contractor shall be responsible for the aluminum alloy 4043 welding wire, consumable gases, tools, machinery, safety, equipment and manpower to clean, weld and fabricate, erect or install the bus, drill a minimum of two (2), ¼" weep holes per each run, and make all connections to the equipment in accordance with GRDA Drawings and in a manner satisfactory to GRDA.

15. Welder Qualifications - The Contractor is responsible for the quality of welding. ASME Section IX, "Welding Qualifications", shall be used as a guide for the qualification of welding procedures and operators. The welder must be a certified welder of aluminum and show evidence of proficiency by welding a series of samples as a prerequisite to making the final weld. If GRDA desires, the samples are to be tested in the field by bending to the fatigue point or taking a cross section of the joint and inspecting it visually. Welders, after qualifying, shall not be replaced on this welding duty unless such action is acceptable to GRDA. All welds shall be made by reversed-polarity direct current, gas metal-arc (MIG) or alternating current gas tungsten-arc (TIG) welding process. The shielding gas shall be welding grade argon, helium, or a mixture of the two.

16. Welds - All joints to be welded shall be free of moisture and hydrocarbon. Degreasing shall be done with a non-toxic solvent (naphtha, mineral spirits, alcohol, or acetone) to leave a minimum of residual on the parts. Sufficient time must be allowed for evaporation of the solvent prior to welding. Wire brushing with a stainless steel wire brush should be employed after solvent cleaning to remove any oxide films, water stains, etc. and to permit optimum fusion and soundness of the weld. The working area shall be shielded from winds and drafts by barriers and covers and protected from atmospheric contamination. All welds shall be made with clean metal and the completed weld shall have a smooth finish and shall indicate good fusion with parent metal. Defective areas must be entirely removed by chipping or machinery prior to application of subsequent weld passes. The cross sectional area of the weld should not be less than that of the smallest member being joined. Members being joined should be tack welded in

place to prevent misalignment during the welding process. Support and alignment shall be as required to provide a finished bus arrangement with correct centerlines to adjacent sections.

17. Torque Values - If the equipment manufacturer's erection instructions do not include recommended torque values for bolt tightening or specify an alternate method for tightening bolted electrical connections, torque values shall be in accordance with those listed in the table which follows (torque values listed on the issued for construction drawings, if present, overrule this table). This table is not to be used when Belleville washers are used.

Torque Values For Dry, Unplated, Nonlubricated Bolts

Bolt Size	18-8 Stainless Steel	Brass	Silicon Bronze	Aluminum 24ST-4	316 Stainless Steel
	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.
1/4"-20	6	5	6	4	7
1/4"-28	8	6	7	5	8
5/16"-18	11	9	10	7	12
5/16"-24	12	10	11	7	12
3/8"-16	20	16	18	12	21
3/8"-24	22	18	20	13	23
7/16"-14	31	26	29	19	33
7/16"-20	33	27	31	20	35
1/2"-13	43	35	40	26	45
1/2"-20	45	37	42	27	47
9/16"-12	57	47	53	34	59
9/16"-18	63	51	58	38	66

Bolt Size	18-8 Stainless Steel	Brass	Silicon Bronze	Aluminum 24ST-4	316 Stainless Steel
	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.	ft.-lb.
5/8"-11	93	76	86	60	97
5/8"-18	104	85	96	67	108

3/4"-10	128	104	118	82	132
3/4"-16	124	102	115	80	130
7/8"-9	194	159	178	125	202
7/8"-14	193	158	178	124	202
1"-8	287	235	265	184	300
1"-14	259	212	240	166	271

TR-14 STRUCTURES AND STEEL

1. General

Each separate component of the structure will be distinctly marked (by mfg.) with letters and numbers to identify the position of the component in the structure.

Bolts, nuts, washers, plates, brackets and other small parts will be bundled in packages convenient for handling and marked for identification (by mfg.).

Any shipping lists prepared by the fabricator will be furnished to the Contractor.

There may be some redrilling or adjustment needed to the structures, in order to make the components correctly fit. The contractor shall plan on 5% redrill of mounting holes.

2. Unloading and Handling Structure Components

When unloading the structures, the Contractor shall note the condition of all components and report any damage to the galvanizing or the structure components to the Construction Coordinator/Inspector and confirm such damage on the carrier's shipping papers at the time of delivery.

If damaged components are encountered, GRDA shall direct whether the component is to be repaired or replaced.

Stored structures shall be placed on adequate blocking to prevent dirt, mud, and other foreign materials from adhering to the structures.

Care shall be exercised during unloading and handling to avoid the bending of the components, damaging the galvanizing, or otherwise damaging the structure.

Structure components shall not be dragged. Slings for picking up the structures shall be of such material or protected in such a way as not to cut into the steel components or otherwise damage the galvanizing.

Components bent, twisted, or damaged during unloading or in transit from the point of delivery to the structure site, or at the structure site, shall not be erected, but shall be reported

immediately to the Construction Coordinator/Inspector. Such damaged components shall be replaced or repaired at the direction of the Construction Coordinator/Inspector, and at the expense of the Contractor.

When approved by GRDA, materials on which galvanizing has been broken or otherwise damaged may be cleaned by wiping with clean rags saturated in mineral spirits or xylene and then painted with Galvanox or other equivalent protection as approved by GRDA.

3. Erection Procedures

The Contractor shall assemble and erect the structures in accordance with the fabricator's erection drawings, bills of material, bolt lists, and other drawings furnished by GRDA.

The structure type, pole heights, location, and orientation shall be in accordance with the construction Drawings furnished by GRDA.

The weight of each component of the structure will be shown on the fabricator's erection drawings. The erection drawings will also show the center of gravity of each component and the lifting points for one or two point erection lifting of each component.

The method of structure assembly and erection by the Contractor is subject to review and approval by GRDA. However, the Contractor shall remain fully responsible for the erection operation regardless of such review and approval by GRDA.

The structures shall be erected square and plumb, or in the correct cambered position if required.

The method of assembling and erecting shall be such that no component is subjected to an erection stress greater than that for which it is designed.

All erection limitations or procedures shown on the fabricator's erection drawings shall be strictly observed.

Extreme care shall be taken to establish and maintain the true geometric shape of the component or complete structure being assembled and erected.

Misalignment or misfit of adjacent sections or members due to the method of assembly or erection shall be corrected by adjusting the assembly or erection method as required to eliminate the problem.

Bolts shall be of the type, length, and diameter shown on the drawings. Only wrenches of proper size, which will not deform the nuts nor cut the protective coating, shall be used.

Bolts shall be installed in the orientation shown on the erection drawings and included in these specifications.

All components shall be clean at the joints before being bolted together.

Nuts shall be installed with the flat surfaces against the face of the component being bolted, and torqued to the specified value.

After the structure is completely erected, the structure shall be inspected by the Contractor to verify that all bolts are installed correctly.

Any bolts of incorrect diameter and length shall be replaced.

A standard nut and jam nut shall be used at each bolt unless otherwise shown or directed by GRDA or the fabricator's drawings.

After all bolting is completed on an erected structure; GRDA will make spot checks to verify bolt tightness.

4. Ground Assembly

When portions of structures are being pre-assembled on the ground before erection, such assembly shall be on surfaces or blocking which will provide support to prevent distortion of the components and prevent dirt, mud and other foreign materials from adhering to the component.

All bolts shall be installed in all connections of pre-assembled structures and bolts shall be at least finger tight.

Poles, components and complete structures shall be handled and erected with slings and other equipment of such materials and suitably protected so as not to cut, bend or otherwise damage the structure components or finish.

All necessary measures shall be taken by the Contractor during handling and erection to prevent damage to the structure and its finish

Components of structures shall be erected in such a manner that no dragging against other components already connected shall occur.

A reasonable amount of drifting will be permitted with suitable measures taken to minimize or eliminate damage to the finish coating.

Re-drilling, reaming, or other corrective measures, if required, shall be undertaken only as directed by GRDA.

5. Misfabrication Correction

The Contractor shall notify the Construction Coordinator/Inspector of any fabrication errors or damaged components.

No correction, repair, or replacement of misfabricated or damaged components shall be undertaken without the approval of GRDA.

No drilling, welding or other modification will be allowed on the steel poles without the approval of GRDA.

6. Structure Identification

Any structure number signs shall be mounted on the arm of steel pole structures.

The signs and attachment devices for these signs will be furnished by the Contractor and are to be mounted according to instructions.

The Contractor shall drill pilot holes in the face of the structure arm and attach signs with self-tapping screws.

7. Existing Steel Structures

Existing steel may require modifications to the members to accommodate the new equipment. This may require the relocation of web members and/or drilling new mounting holes. In some cases additional brackets may need to be added to mount equipment or components on. The contractor shall plan on drilling 100% of needed mounting holes of new equipment or components.

The contractor shall plan to install all added brackets that, as identified on the drawings, are needed to either relocate or install new equipment and components. These added brackets may require the contractor to drill new holes in the steel.

TR-15 ROCK EXCAVATION

Rock excavation shall consist of boulders exceeding one-half cubic yard in volume or solid ledge rock which in the opinion of GRDA, requires its removal, drilling, wedging, sledging, or barring.

No soft or disintegrated rock which can be removed with a pick or digging machine, no loose, shaken or previously blasted rock, no broken stones, and no rock which may fall into the opened excavation from outside the limits of excavation will be considered as rock excavation.

When solid rock is encountered in the excavation, it shall be stripped of earth, and GRDA notified and given proper time to measure the same before removal; all rock removed which has not been measured by GRDA will not be estimated as rock excavation.

Blasting shall not be allowed unless authorized by GRDA and shall be subject to all landowners' within a three-quarter mile radius signed approval.

Explosives shall be stored, handled and used as prescribed by the laws and regulations of the United States and the political subdivisions thereof. Special attention shall be given to the immediate disposal of paper wrappings from explosives, which are poisonous to livestock.

All permits for the use of explosives required by Federal, State, and Local authorities shall be obtained by the Contractor.

The use of explosives will be considered as incidental, included in the unit price and not as a separate work unit.

The Contractor is responsible for, and hereby indemnifies GRDA from any and all damage resulting from the use of explosives.

After rock has been measured, a cylindrical excavation shall be cut by drilling, sledging or such other means as may be necessary to the normal foundation depth and of a diameter equal to the normal foundation diameter.

In estimating the number of cubic yards of rock excavation, the radius squared of the foundation excavated will be multiplied by the average depth from the surface of the rock to the normal depth of the foundation. This result, multiplied by the number "pi" and recorded in cubic feet and divided by 27 will give the number of cubic yards allowed.

In general, the natural earth at each structure site shall be disturbed as little as possible during construction.

In all cases, the ground surface at each structure site shall be graded to provide drainage away from structure legs and completed reasonably smooth and compact.

No additional payment shall be made for rock excavation. The Contractor shall include the cost of rock excavation in the unit price for the concrete installation.

TR-16 TEMPORARY CASINGS

Temporary casings, if required to maintain the dimensions of the excavation, shall be of sufficient strength and rigidity to maintain the excavation lines against the soil and water pressures present in the excavation.

The temporary casing shall fit the augured hole tightly and be one inch greater than the diameter of the caisson.

Preferably, the casings shall follow the excavation without driving; but if the site conditions prevent this, driving or jacking will be permissible.

All casings shall be removed from the excavation as the concrete is being placed to prevent soil or other matter from sloughing into the excavation. Permanent casings will be used only with the written permission of GRDA.

The Contractor shall furnish the temporary casings and shall bear all costs associated with the installation and removal of the casings, unless otherwise stated by GRDA.

TR-17 SHIELD WIRE INSTALLATION

The Contractor shall install the shield wires in accordance with the drawings, specifications and data furnished by GRDA.

The method proposed by the Contractor for stringing the shield wires shall be reviewed by GRDA prior to commencement of stringing.

Particular care shall be taken to ensure that the shield wire does not become kinked, twisted, abraded, or damaged in any manner.

The shield wire shall be attached to the hardware assembly by bolted suspension clamps or compression connections as shown on the drawings. All assemblies shall be installed to the recommendations of the manufacturer.

Shield wire jumper loops shall be of sufficient length and formed to provide a uniform curving transition from dead-end assembly to dead-end assembly. The minimum distance from the jumper loop to the structure shall be 3".

TR-18 BARBED WIRE FENCE

1. This section covers the material and construction of a five (5) strand barbed wire fence to stand 4' –2" above surface grade when erected. The location of the fence, if required on this project, is identified on the drawings.

2. MATERIALS:

   Barbed Wire (manufactured in U.S.A.) shall consist of two #12 ½ gauge, class 3 twisted galvanized steel line wires with four point hardened #14 gauge barbs. Barbs shall be spaced no more than 5" apart. Gaucho wire is unacceptable.

   Corner/Gate Posts shall be 8" dia. X 8' –0" long ACA or CCA treated southern pine set 3' – 6" deep, and shall be plumb in appearance.

   Pull Post/Braces shall be 4" dia. X 8' –0" long ACA or CCA treated southern pine set 3' –6" deep, and shall be plumb in appearance.

   Line Posts shall be 6' –6" long heavy-duty steel "T" posts with anchor plate and tie wire notches. Posts shall be hot-dip galvanized or painted with an anti-corrosive paint. Posts shall be set 2' –0" deep, and be plumb in appearance.

   Gates with materials for locking will be provided by the GRDA.

   Staples shall be 1 ½" long galvanized cut point type.

   Wire Ties shall be #9 gauge galvanized steel.

3. INSTALLATION: All materials shall be new and both materials and workmanship be first quality. The fence shall be erected true to the established lines shown on the fence site plan drawing. Fence wire shall be taut.

   a. At grade depressions where stresses tend to pull the line posts out of the ground, a corner post shall be installed at the critical point. In situations where a corner post is not adequate, the project engineer will determine an alternate method of construction.

   b. An intermediate brace (pull post assembly) shall be installed at intervals in the fence span as follows:

FENCE SPAN (FT.)	NUMBER OF BRACES REQUIRED
400 - 600	One at center of span
600 - 1000	Two at equal intervals
1000 - 1400	Three at equal intervals
1400 - 1800	Four at equal intervals
1800 - 2200	Five at equal intervals

c. All wood posts are to be set in concrete.

TR-19 CHAIN LINK SUBSTATION FENCE

1. Fence shall consist of one of the following alternatives. The specific option shall be detailed on the project drawings. In all cases the bottom of the fabric shall be installed such that it is 4" above the soil. Fence Posts are to be installed on 10'spacing normally. Any adjustment needed from this shall be at one end of a run. The 10' shall be a maximum spacing.

   a. New eight-foot high fence

      The Contractor shall furnish the material and perform the labor for erecting a seven- foot high (7') galvanized chain-link fence topped with three strands of barbed wire one- foot high (1'), complete with gates, as shown on the drawings and specified herein. The overall height of the fence, with barbed wire is eight feet – four inches (8'- 4") [from the top of dirt grade to the bottom of the fabric is 4", the fabric is 7', and the barbed wire is 1'].

   b. Fencing with razor wire

      If fencing is to be topped with razor wire, the specifications below apply as applicable for providing and installing the razor wire on an existing fence. Existing fencing will usually be eighty-four inches (84") high and above that will be a combination of the three strands of barbed wire. The Contractor will remove the existing extension arms and barbed wire, supply and install 90° V-shaped extension arms, and supply and install new barbed wire and razor wire as shown on the drawings and specified herein. The overall fence height will remain at eight feet (8').

   c. Drawings

      Vendor shall submit drawings on all component parts. Samples and test certificates on materials will be furnished as requested by GRDA.

2. MATERIAL:

   a. Fabric

      The fabric shall be eighty-four inches (84") high, woven in a two-inch (2") diamond shaped "chain link" mesh. Top selvage shall have a twisted and barbed finish and the bottom

selvage to have a knuckle finish. Fabric shall be constructed from zinc coated steel (hot-dip galvanized after weaving). Wire shall be nine-gauge (9 ga.) with tensile strength of 80,000 pounds per square inch. Fabric shall be true and even, so that when installed the weave will not be irregular or uneven but will be free of "waves" andwill present a neat appearance.

The fabric shall be zinc coated in accordance with the latest ASTM A392 for Class II, two ounces (2.0 oz.) of zinc per square foot of wire surface.

b. Bottom Tension Wire

One (1) strand of nine-gauge (9 ga.) galvanized steel spring coil wire, with fasteners, shall be furnished for entire length of fence by fence supplier, installed at the bottom of fabric when fence is erected, and fastened with eleven-gauge (11 ga.) hog rings on twenty-four inch (24") centers. The coating shall be same type as fabric.

c. Barbed Wire

Barbed wire shall consist of three (3) strands each (6 strands required for razor wire installations) of galvanized #12-1/2 gauge wire, twisted, with large four (4) point hardened aluminum #14 gauge barbs or steel barbs, with complete barbed wire assembly galvanized after fabrication. Barbs shall be spaced no more than five inches (5") apart.

d. Razor Wire

Razor wire shall be manufactured with a continuous one-inch (1”) wide by 0.020” thick stainless steel tape containing clusters of four (4), needle-sharp barbs located on four- inch (4”) centers. Sharpened blades in the clusters are in an elongated “H” pattern with each leg being approximately 1.2” long measured from the center of the cluster. The stainless steel tape is cold pressed around a high tensile spring steel core wire and formed into a coil to produce eighteen-inch (18”) diameter loops.

e. Fabric Ties

Fabric ties shall be furnished for attaching fence fabric to line posts every fourteen

(14”) inches and for attaching fabric to top rail every twenty-four (24”) inches. The fabric ties for the top rail and the line posts; nine-gauge (9 ga.) galvanized steel tie wires shall be used.

f. Extension Arms

All line and corner posts shall be fitted with galvanized 45° extension arms (90° extension arms required for razor wire installations). Arms to carry the three (3) barbed wires (6 wires for razor wire installations) shall be securely fastened to the line posts. Top most barbed wire shall be twelve inches (12”) above fabric and twelve inches (12”) out from top rail. Extension arms on intermediate posts shall be made of heavy duty pressed steel or malleable iron and those on all corner posts shall be made of eleven- gauge (11 ga.) heavy pressed steel or heavy malleable iron. Arms having projections that bend down over the barbed wires are not acceptable. Wires must fit in slot on the arm and be locked in place.

Arms are to be riveted or welded to base before galvanizing. Arms shall withstand a minimum weight of 250 pounds from end of arm.

g. Line Post

Line posts shall be pipe, two (2") Nominal Pipe Size, Schedule 40 or greater, minimum yield strength 25,000 PSI. Posts are to be hot-dip galvanized 2 oz. per sq. ft. Posts shall be of sufficient length to be set in two-feet, six-inches (2'– 6") deep concrete foundation.

h. End, Corner Post

Corner posts shall be constructed of three-inch (3") Nominal Pipe Size, hot-dip galvanized pipe, Schedule 40 or greater. Used, re-rolled, or open seam posts are not permitted. Posts shall be of sufficient length to be set in a three-foot, six-inch (3'-6") deep concrete foundation.

i. Gate Posts

Gate Post Size	Wt Per Foot	Gate Opening Dimension
3"	Nominal Pipe Size - 7.58 Lbs.	Single to 7' or double 14'
3-1/2"	Nominal Pipe Size - 9.11 Lbs.	Single 8' or double to 20'
6"	Nominal Pipe Size - 18.97 Lbs.	Single to 18' or double to 36'
8"	Nominal Pipe Size - 28.55 Lbs.	Over 36'

j. Gate Frames

Gate frames shall be constructed of hot-dip galvanized pipe. Corner fittings are to be heavy pressed steel or heavy malleable iron ells with four rivets per corner. Barbed

wire and fittings shall be included. For gates fourteen-feet (14') and larger, the contractor shall furnish one and one-quarter inch (1-1/4") Nominal Size Pipe, Schedule 40 or greater, for internal bracing. Pipe bracing shall be in the pattern shown on the drawings. Gate fabric shall be the same as that used for the fence.

k. Walk-in Gates

Walk-in gates shall be single-hung gates normally for a four-foot (4') wide opening, constructed in accordance with items in this specification.

l. Drive-in Gates

Drive-in gates shall be double-hung gates, width as specified, constructed in accordance with items in this specification.

m. Locking

All gates shall have provision for padlocking. Latch and locking hardware is to be heavy malleable iron or heavy duty pressed steel and must be hot dipped galvanized after fabrication.

n. Miscellaneous Gate Fittings

Hinges shall be heavy pattern with large bearing surfaces of adequate strength for the gate and shall not turn under the action of the gate. Hinge action shall be such that gates may be easily opened and closed by one person. Hinges shall provide for full 120-degree inward swing of gate leaf.

Latches shall be plunger bar type and arranged to engage the gate stop as shown on the drawings. Single gates less than ten-feet (10’) wide may be provided with a forked latch. Latches shall be arranged for padlocking with the padlock accessible from both sides of the gate.

Stops shall consist of a roadway plate with anchor set in concrete and arranged to engage the plunger.

Keepers shall consist of mechanical devices for securing and supporting the free end of gates when in the full-open position.

Gates shall be installed so that they cannot be removed without disassembly of the hardware.

o. Top Rail

Top rail shall be constructed of one and one-quarter inch (1-1/4") Nominal Size Pipe, hot-dip galvanized, Schedule 40 or greater, provided with outside sleeve type couplings

not less than seven inches (7”) long. Couplings must fit top rail snugly to prevent sagging of top rail at joints. Top rail to pass through base of line post tops and form a continuous brace from end to end of each stretch of fence. Top rail to be securely fastened to end, gate, or corner posts by heavy duty pressed steel connections. Top rail is to be provided in random lengths averaging not less than twenty (20’) feet in length. The Contractor shall provide expansion couplings in straight sections longer than 100 feet.

p. Braces

Horizontal braces are to be used on end gate and corner posts. Braces are to be one- piece, constructed of same material as top rail, to be spaced midway between top rail and ground, and to extend from end, gate, or corner post to first adjacent line post.

q. Tension Bars and Bands

Tension bars for attaching fabric to terminal posts shall be one-quarter inch (1/4") by three-quarter inch (3/4") high carbon steel. Bands for attaching tension bar to terminal posts shall be eleven-gauge (11 ga.), one-inch (1") wide with three-eights inch (3/8") carriage bolts and nuts spaced on fourteen-inch (14") centers. Banding for braces at ends and corners is to be eleven-gauge (11 ga.), one and one-quarter inch (1-1/4") wide.

r) Miscellaneous Fittings

All fittings required for proper installation of fence shall be malleable iron or heavy duty pressed steel and must be hot dipped galvanized after fabrication.

s) Galvanizing

All items shall be hot-dip galvanized after fabrication in accordance with the latest approved ASTM Specifications. Unless specified otherwise, minimum galvanizing shall be 2.0 ounces of zinc per square foot of surface.

t) Tolerance

Standard Mill Tolerance on all framework members and chain link fabric will apply.

2) CONSTRUCTION:

a) Concrete:

All concrete shall conform to the General Specifications for Concrete Work. The cost of the concrete shall be included in the fencing pricing.

b) Galvanized Chain-Link Fence:

The fenced areas are shown on the plot plan and the fence shall be installed in accordance with the manufacturer's recommendation and these specifications.

The fence shall be either eight (8’) or nine (9’) feet high (as per the drawing and application) above finished rock grade when erected (including barbed wire). The fence fabric shall be stretched tight.

All line posts shall be spaced not more than ten (10') feet apart on centers. They shall be set not less than two and one-half (2-1/2') feet in concrete, the concrete to be not less than ten (10") inches in diameter. Posts shall be centered in the concrete and holes.

Extension arms are to be in the shape of a forty-five degree (45º), designed to extend at a forty-five (45°) degree angle to the outside from vertical, with lock wire for securely fastening the barbed wire, equally spaced with the top strands located twelve (12") inches above the fabric and twelve (12") inches out from the fence line. The barbed wire shall be so attached to the extension arm in an angle slot that it will automatically lock in place by tension. The barbed wire will be stretched tight the full length before locking in.

The razor wire (if required on the drawings) shall be attached to the barbed wire and extension arms using hog rings. The razor wire shall be positioned so that one complete coil extends approximately eighteen inches (18”) horizontally along the barbed wire.

Braces are to be installed midway between the top rail and ground, and to extend from terminal post to first adjacent line post. Braces are to be securely fastened to posts by heavy

duty pressed steel connections, then trussed from line post back to base of terminal post with three-eights (3/8”) inch galvanized rod, complete with truss tightener.

Terminal end and corner posts shall be set not less than three-feet, six-inches (3’-6”) deep in concrete, the concrete to be not less than eighteen (18”) inches in diameter. Gate posts shall be set not less than three-feet, six-inches (3’-6”) deep in concrete, the concrete to be not less than twenty-four inches (24”) in diameter.

The chain-link fabric shall be securely fastened to the line post with six-gauge (6 ga.) wire clips spaced approximately fourteen (14") inches apart. The chain-link fabric shall be securely fastened to the top rail with nine-gauge (9 ga.) tie wires on approximately twenty-four inch (24") centers and to the bottom tension wire with eleven-gauge (11 ga.) hog rings on twenty-four inch (24”) centers. The chain-link fabric shall be securely fastened to all terminal posts by one-fourth (1/4") inch by three-fourth (3/4") inch

tension bars with heavy eleven gauge (11 ga.) pressed steel bands spaced approximately fourteen (14") inches apart.

The fence shall be installed level with finish grade as directed by GRDA. The finished job will leave the bottom portion of the fabric even with the top of the crushed rock.

c) Gates:

The gates shall be located as shown on the drawings and shall be installed in accordance with the manufacturer's recommendations. Post spacing must be such that the gate may be located beginning at any ten (10') foot interval in any side, except within the first ten-foot (10’) distance from any corner post.

The gate stop (for latch plunger) and gate keepers shall be installed in concrete that is eighteen inches (18”) in diameter and a minimum of two-feet (2’) deep. Gate stop shall be positioned with its edges at the elevation of the finished grade.

Gate keepers shall be positioned to support and hold the gate in the open position. Keepers shall be located approximately two-thirds (2/3) of the gate section length away from the gate post and elevated above the finished grade to engage the bottom gate pipe rail.

Three strands of barbed wire shall be attached to the gate-frame posts using bands above the fabric, as shown on the drawing. Razor wire, if required on the drawings, shall be installed around the barbed wire strands, and attached to the barbed wire with hog rings.

TR-20 TECHNICAL DRAWINGS

A list of drawings that pertain to this project is included on the project cover or index drawings.

TR-21 MATERIAL LIST

The material listed on the attached drawings is the material being furnished by GRDA. All other materials required for the completion of this work but not listed herein are to be furnished by the Contractor.

TR-22 CABLE TABULATION

The cable tabulation for the project is found on the attached drawing. The contractor is responsible for furnishing the raceway and installing cables and raceway. Cables shall be pulled between field equipment and control panels. Termination on both ends by GRDA crews.

TR-23 INSULATED CONDUCTORS

1) General:

Insulated cable, conductors, and conductor accessories shall be furnished by GRDA (unless listed elsewhere to be furnished by the Contractor) and installed by the Contractor in accordance with the requirements of this section of these specifications. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in the circuit lists, on the drawings, and in these specifications.

The Contractor shall test the insulation on the cable prior to removing the cable from the warehouse. An acceptable value will be provided at the beginning of the project. The Contractor shall test the insulation of the cable after it is installed, and before terminating the cable.

In general, all devices furnished under these specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks.

Terminal blocks shall be furnished for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

Splices will not be permitted.

All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be readily accessible. Auxiliary equipment shall be located in compartments, enclosures, or junction boxes in such an arrangement that service personnel will have direct access to the equipment without removal of barriers, cover plates, or wiring.

Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility, unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

Terminal blocks shall not be mounted in compartments containing uninsulated conductors operating at voltages above 1000 volts.

Materials containing asbestos shall not be used in any of the wiring devices or cable.

Cable reels shall be stored and handled in a manner which will prevent physical damage to the cable. Cable reels shall be stored on a hard surface to prevent contact between cable insulation and earth due to sinking of the reel.

Installation shall be defined to include placement, terminating conductors, coiling and taping of spare conductors, identification, testing, and verification of each circuit, cable, and conductor. Installation of cable in existing trays or cable trench shall also include removal and replacement of existing cable tray or cable trench covers.

Terminating a conductor shall include installing cable termination kits for shielded cable, attaching the conductor at its designated location and insulating the entire connection where specified or required by the application.

2) Cable Specifications:

The cable furnished shall conform to the Cable Specification Sheet(s) included at the end of this section.

The term "Type" used in the circuit list, on the drawings, and in these specifications refers to the letter identification indicated on each Cable Specification Sheet.

a) Coaxial Cable:

Coaxial cable (when specified) used for connection between carrier cabinets and line tuning units shall be 52 ohm RG-8A/U coaxial cable. The cable shall have an 8 mil thick aluminum flat tape water block and an overall chlorinated polyethylene jacket. The cable shall be Belden Catalog No. 9251-A282-BV. This cable is a special run item.

b) Test Reports:

Unless otherwise specified, the Contractor shall submit three copies of manufacturers' test reports on each cable to the Engineer.

c) Color Coding:

The color code used for multiconductor, shielded control cable shall be in accordance with Table E-2 of ICEA S-73-532 as indicated on the Specification and Data Sheet(s). The color code used for cables consisting of 4 conductors or less will utilize Table E-1. All of the wiring diagrams being prepared by the Engineer are based on the color code specified on the Specification and Data Sheet(s). The Table E-2 color codes are as follows:

Conductor	Method 1 Table E-2
1	Black
2	Red
3	Blue
4	Orange
5	Yellow
6	Brown
7	Red/Black
8	Blue/’Black
9	Orange/Black
10	Yellow/Black
11	Brown/Black
12	Black/Red
13	Blue/Red

Conductor	Method 1 Table E-1
14	Orange/Red
15	Yellow/Red

3) Conductor Accessories:

All conductor accessories including connectors, terminations, insulating materials, support grips, markers, and cable ties shall be furnished and installed.

Supplier's installation instructions shall be obtained for cable accessories. These instructions shall be in the possession of the craftsmen while installing the accessories and shall be available to the designated Work Inspector for reference.

a) Terminal Connectors for Conductors 8 AWG and Larger:

Terminal connectors for conductors 8 AWG and larger shall be pressure or bolted clamp type, Burndy Qiklug, Varilug, or acceptable equal; or compression type, Burndy Type YAV or YA (long barrel), Panduit Type LCA or LCC, or acceptable equal. Acceptable connectors included with Owner-furnished equipment may be used.

b) Terminal Connectors for Conductors Smaller than 8 AWG:

Terminal connectors for conductors smaller than 8 AWG shall be compression type connectors properly sized for the conductor and the terminal. The connectors shall be constructed of fine grade high conductivity copper in accordance with QQ-C-576 and shall be tin plated in accordance with MIL-T-l0727. The interior surface of the connector wire barrel shall be serrated, and the exterior surface of the connector wire barrel shall be provided with crimp guides.

Noninsulated terminal connectors shall be provided on conductors terminated on devices equipped with individual fitted covers, such as General Electric Type SB-l control switches and General Electric Type HEA lockout relays. Preinsulated ring type terminal connectors shall be used on all current and potential transformer circuits. All other terminal connectors for conductors smaller than 8 AWG shall be preinsulated ring type or preinsulated spade type.

Preinsulated terminal connectors shall include a vinyl insulating sleeve, color coded to indicate conductor size. Preinsulated terminal connectors shall include a metallic support sleeve bonded to the vinyl insulating sleeve and designed to grip the conductor insulation.

Ring type connectors shall be manufactured by AMP, 3M, Panduit, or acceptable equal. Spade type connectors shall be AMP slotted spring spade, 3M Scotchlok Series 6l snap spade, or Panduit locking fork terminal connectors.

c) Terminal Blocks:

Terminal blocks for conductors rated 600 volts or less shall be strap screw type, rated 600 volts, shall have 20 percent more terminal points than the quantity of conductors requiring termination, and shall have white marking strips. Terminal blocks shall be sized for the conductor being terminated except that terminal blocks for all conductors 10 AWG and smaller shall be Marathon 1500 Series or acceptable equal.

Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices shall be permanently labeled to coincide with the identification indicated on the drawings. All terminals provided for termination of external circuits shall be identified by inscribing terminal designations acceptable to GRDA on the terminal block white marking strips with permanent black ink. All internal wiring terminations shall be identified by printing on conductor identification sleeves. A conductor identification sleeve shall be provided on each end of each internal conductor. Each sleeve shall be marked with the opposite end destination identification using permanent black ink. Conductor identification

shall be permanent, unaffected by age, heat, or solvents, and not easily dislodged. Adhesive labels are not acceptable.

The arrangement of connections on terminal blocks shall be acceptable to GRDA.

All connections requiring disconnect plug and receptacle type devices shall be provided with factory terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket. The plug-receptacle assemblies shall have provisions for locking the devices together. The assembly shall also be watertight when installed outdoors.

All temporary wiring installed in the factory for equipment testing shall be removed prior to shipment of the equipment.

Reference to NEC means the codes and standards as defined by the USA National Electrical Code, ANSI/NFPA 70.

d) Crimping Tools:

Crimping tools used to secure conductors in compression type connectors or terminal lugs shall be those made for that purpose and for the conductor sizes involved. The crimping tools shall accurately crimp the connector barrel and shall accurately crimp the conductor insulation support sleeve where provided. Crimping tools shall be

provided with guides to position connectors in the tool, shall be provided with stopsto prevent overcrimping, and shall be of a type which prevents the tools from opening until the crimp action is completed. Crimping tools shall be a product of the connector manufacturer or shall be as recommended by the connector manufacturer and acceptable to the Construction Coordinator/Inspector for use with the connectors. The Contractor shall establish and maintain a tool certification program to ensure that crimping tools are kept in accurate operating condition.

e) Insulating Materials:

Insulating materials for termination insulation shall be in accordance with the following.

i) 600 Volt Cable:

Insulating materials for terminal connectors or compression type connectors shall consist of varnished cambric tape, rubber tape, and vinyl tape. Taping materials shall be as listed below or acceptable equal:

Varnished Cambric Tape--3M Company Irvington 2520. Rubber Tape--3M Company Scotch 130C.

Vinyl Tape--3M Company Scotch 33+.

f) Support Grips:

Cable support grips shall be either split or closed woven wire type as manufactured by The Kellems Division, Harvey Hubbell Incorporated, Stonington, Connecticut.

g) Wire and Cable Markers:

Markers for wire and cable circuits shall be of an opaque nylon material arranged to include a marker board, nonreleasing holding device, and cable fastening tail. The marker board shall not be less than 3/4 inch wide, 2-1/2 inches long, and 15 mils thick and shall be Panduit Corp. Part No. MP250 marker plates or acceptable equal. One side shall be roughened to hold black nylon marking ink from a fine tip pen similar to Thomas & Betts Company "TY-RAP" marking pen, Catalog No. WTl63M-l, or Panduit Corp. Part No. PFX-0 marking pen. Identification shall be permanent and waterproof. The holding device shall be designed to allow the fastening tail to pass around the cable through the holding device and prevent the removal of the tail without cutting it loose from the marker.

h) Cable Ties:

Lacing materials for field installed cable shall be nonreleasing weather-resistant black nylon ties manufactured by Thomas & Betts Company, Elizabeth, New Jersey; Panduit Corp., Tinley Park, Illinois; 3M Company; or acceptable equal.

i) Arcproofing Material:

Material for arcproofing cable shall be an unsupported intumescent self-extinguishing elastomer tape, 3M Company Scotch Brand No. 77 or acceptable equal, and a pressure sensitive silicone adhesive backed glass cloth holding tape, 3M Company Scotch Brand No. 69 or acceptable equal.

j) Cable Shield Bonding Connectors:

Cable shield bonding connectors for use with shielded power, control, and instrumentation cable shall be Scotchlock 4460, manufactured by the 3M Company; Nicopress Shield Connector B-2974, manufactured by National Telephone Supply Company; Surgegard Shield Bond Connector, manufactured by Brand-Rex Company; or acceptable equal.

Cable shield bonding connectors shall be installed on one end of each shielded power, control, and instrumentation cable listed in the circuit lists.

4) Installation:

Conductor installation shall be in accordance with the cable manufacturer’s recommendations and the articles which follow.

a) Cable Placement:

All cable described in the circuit lists shall be routed as indicated therein. Routing of other cable shall be as indicated on the drawings.

Cable shall not be handled when the cable temperature is below the minimum temperature recommended by the manufacturer. If cable heating is required prior to placement, the cable shall be stored in a heated building in accordance with the manufacturer's recommendations for at least 24 hours. Cable shall be placed the same day it is removed from heated storage.

If at any time during the progress of the work the Contractor finds raceways which appear inadequate to accommodate the assigned cable, he shall notify the Construction Coordinator/Inspector at once and shall discontinue any further work on the questionable raceway until advised by the Construction Coordinator/Inspector as to how he shall proceed.

Immediately prior to the placement of each cable or cable group, the raceway route to be followed shall be inspected and ascertained to be complete in installation and free of all materials detrimental to the cable or its placement. All cable assigned to a particular duct or conduit shall be grouped and pulled in simultaneously using cable grips and acceptable lubricants.

All cable shall be carefully checked both as to size and length before being pulled into conduits or ducts. Cable pulled into the wrong conduit or duct or cut too short to rack, train, and splice as specified herein shall be removed and replaced by and at the expense of the Contractor. Cable removed from one conduit or duct shall not be pulled into another conduit or duct.

i) Cable in Trays:

All cable shall be carefully laid in or pulled through the tray system so that neither the cable nor the trays are damaged. Cable may be laid along the side of the tray system during placement provided it is protected from dirt, water, oil, or other detrimental materials and from mechanical injury. Cable shall be cut sufficiently long to conform to the contour of the trays, with particular attention paid to vertical inside bends. All excessive slack shall be removed from the cable so that it lies parallel to the sides of the trays. Multiple single conductor cable which constitutes a single power circuit shall be grouped together to minimize magnetic influence on other cable in the area. The cable shall be tied to the trays with nylon ties at 10 foot intervals to hold it in place. Cable clamps designed for holding the cable inside the trays shall be installed at all vertical bends.

ii) Cable Pulling:

Fishing and pulling shall be done with flexible round metal tape, CO_2 propelled polyethylene cord, nylon rope, or manila rope.

Unless specified otherwise or acceptable to the Construction Coordinator/Inspector, cable shall not be pulled in a single pull through two sections of Engineer-designed raceway connected by a manhole or pull box. Cable shall be pulled out at each manhole and pull box to the length required for termination. Prior to repulling of the pulled out

cable, the cable shall be thoroughly inspected, cleaned, and relubricated. Damaged cable shall be removed and replaced by and at the expense of the Contractor.

Cable may be pulled in a single pull through two sections of Engineer-designed raceway connected by a manhole or pull box only if it can be determined by calculation to the satisfaction of the Construction Coordinator/Inspector, that the pulling tension will not exceed the maximum tension allowed by the cable manufacturer.

iii) Cable Grips:

Factory installed pulling eyes shall be used for pulling cable where they are available. Woven wire cable grips shall be used to pull all single conductor cable 2/0 AWG and larger, where pulling eyes are not available, and all multi-conductor cable. Pulling loops shall be used to pull single conductor cable smaller than 2/0 AWG. All sharp points and edges on the hardware attaching the pulling rope to the cable shall be taped to prevent snagging or damaging the raceway.

When a cable grip or pulling eye is used for pulling, the area of the cable covered by the grip or seal plus 6 inches shall be cut off and discarded when the pull is completed. When pulling loops are used, the entire loop shall be cut off and discarded when the pull is completed.

As soon as the cable is pulled into place, the pulling eyes, cable grips, or pulling loops shall be removed and any cable which was sealed shall be resealed.

iv) Swivels:

A reliable nonfreezing type of swivel, or swivel connection, shall be inserted between the pulling rope and the cable pulling eye, grip, or loop to prevent twisting under strain.

v) Feeding Tubes:

A 4 inch or larger flexible feeding tube, with a removable nozzle sized to fit the ducts, shall be used in pulling all underground cable. The bending radius of the tube shall not be less than the minimum bending radius of the cable specified in this section under the article titled Cable Bends.

vi) Pulling Lubricants:

Only lubricants recommended by the cable manufacturer and acceptable to the Construction Coordinator/Inspector shall be used. Lubricants shall be applied liberally and continuously during the pull.

vii) Inspection:

The outside of each cable reel shall be carefully inspected and protruding nails, fastenings, or other objects which might damage the cable shall be removed. A thorough visual inspection for flaws, breaks, or abrasions in the cable sheath shall be made as the cable leaves the reel, and the pulling speed shall be slow enough to permit this inspection. Damage to the sheath or finish of the cable shall be sufficient cause for

rejecting the cable. Cable damaged in any way during installation shall be replaced by and at the expense of the Contractor.

viii) Pulling Tension:

The pulling tension of any cable shall not exceed the maximum tension recommended by the cable manufacturer. Pulling mechanisms of both the manual and power types used by the Contractor shall have the rated capacity in tons clearly marked on the mechanism. Whenever the capacity of the pulling mechanism exceeds the recommended pulling tension of the cable as given by the cable manufacturer, a dynamometer shall be used to show the tension on the cable and the indicator shall be constantly watched. If any excessive strain develops, the pulling operation shall be stopped at once and the difficulty determined and corrected.

ix) Sidewall Pressure:

To avoid insulation damage from excessive sidewall pressure at bends, the pulling tension in pounds at a bend shall not exceed 300 times the radius of the bend in feet.

x) Cable Bends:

Tape shielded, flat tape armored, and wire armored cable shall not be bent to a radius of less than 12 times the overall cable diameter. All other cables shall not be bent to a radius of less than eight times the cable diameter.

xi) Supports:

All cable supports and securing devices shall have bearing surfaces located parallel to the surfaces of the cable sheath and shall be installed to provide adequate support without deformation of the cable jackets or insulation.

Adequate cable end lengths shall be provided and properly placed in junction boxes to avoid longitudinal strains and distorting pressures on the cable at conduit bushings and duct end bells.

Final inspection shall be made after all cable is in place and, where supports or raceway fittings deform the cable jacket, additional supports shall be provided as directed by the designated Work Inspector. Additional cable protection such as a wrapping of light rubber belting, friction tape, or similar material shall be provided where required.

Cable in vertical runs shall be supported by woven wire grips in accordance with the NEC requirements, except that the distance between supports shall conform to the following:

Vertical Cable Support Spacing		
Conductor Size	**Aluminum Conductor**	**Copper Conductor**
1/0 AWG and smaller	150 feet	150 feet
2/0 AWG thru 500 Mcm	100 feet	50 feet
Larger than 500 Mcm	70 feet	30 feet

xii) Spare Conductors:

All spare conductors of a multi-conductor cable shall be left at their maximum lengths for possible replacement of any other conductors in the cable. Each spare conductor shall be neatly coiled and then taped to the conductors being used.

xiii) Lacing:

Nylon ties shall be used to neatly lace together conductors entering switchboards and similar locations after the conductors have emerged from their supporting raceway and before they are attached to terminals.

xiv) Cable Identification:

The Contractor shall identify the ends of all circuits listed in the circuit lists.

Each marker shall bear the number of the circuit according to the circuit lists and drawings.

At terminations, the Contractor shall identify each conductor of power circuits, each multi-conductor cable, and each conductor of circuits consisting of multiple single conductors where the conductors are not otherwise identified. Markers shall be attached where the first individual conductor is routed away from the assembly. Each phase of multiphase power circuits shall be individually identified.

One end of each marker board shall remain free of the fastening tail, and the entire marker shall be so attached that it is readily visible for circuit identification.

xv) Splices:

No splices shall be made in conductors for instrument circuits or control circuits. Shields may be spliced where necessary to permit connection to the station ground.

Power cable circuits may be spliced only by methods and at locations acceptable to the Construction Coordinator/Inspector.

b) Terminations:

Cable shall be terminated in accordance with the following requirements: Train cable in place and cut squarely to required length. Avoid sharp bends.

Remove necessary amount of cable jacket and insulation without damage to the conductor.

Install terminals or terminal connectors as required, ensuring a firm metal-to-metal contact.

Insulate each connection of cable to an insulated conductor (whether cable, bus, or equipment bushing). The insulation shall cover all exposed surfaces of theconductors; the insulation voltage level of the completed termination shall be not less than the insulation voltage level of the connected conductors.

i) Insulation of 600 Volt Cable Connections:

Where connections of cable rated 600 volts or less require insulation, all exposed conductor, and connector surfaces shall be covered with tape in accordance with the following:

One half-lapped layer of varnished cambric tape.

A minimum of three half-lapped layers of rubber tape, elongated not more than 20 percent, applied over the varnished cambric tape.

A minimum of three half-lapped layers of vinyl tape applied over the rubber tape. The vinyl tape shall extend a minimum of two cable diameters over the cable jacket and a similar distance over the insulation of the conductor to which the cable is connected.

c) Tests after Placement:

All insulated conductors shall be electrically tested after placement.

All circuits, including lighting circuits, shall be tested with the circuit complete except for connections to equipment. All splices, stress cones on shielded cable, and terminal connector attachments shall be complete prior to testing.

In addition to the tests performed after cable placement is complete, continuity tests and insulation tests shall be performed on all supervisory and communication cable before and after each splice is made.

Any circuit failing to test satisfactorily shall be replaced or repaired and then retested. All equipment and labor required for testing shall be furnished by the Contractor.

i) Continuity and Identification Tests:

All insulated conductors shall be tested for continuity and conductor identification.

(1) Continuity tests:

Continuity tests shall include all tests necessary to confirm that eachconductor is continuous throughout its entire length.

(2) Identification tests:

Identification tests shall include all tests necessary to confirm that the conductor being investigated originates and terminates at the locations designated in the circuit lists or indicated on the drawings.

ii) Insulation Tests:

Resistance from ground provided by the insulation on all field installed insulated conductors shall be measured.

(1) Cable rated 600 volts and below:

All insulated conductors except supervisory and communication cable, rated 600 volts and below shall be tested with a 1000 volt megger or an equivalent testing device. Insulation resistance measurements shall be made betweeneach conductor and ground and between each conductor and all other conductors of the same circuit. Minimum acceptable resistance values shall be approximately 10 megaohms.

(2) Supervisory and communication cable:

All insulated conductors of supervisory and communication cable shall be tested with a 500 volt megger or an equivalent testing device. Insulation resistance measurements shall be made between each conductor and the cable

shielding tape and between the two conductors in each pair. Minimum acceptable resistance values shall be 10 megaohms divided by the actual cable length in miles.

d) OPGW Line Termination:

The OPGW outdoor splice enclosure shall be installed as indicated on the drawings. The splice closure shall be sized to accommodate fusion splice tray(s). The OPGW splice closure shall be complete with splice tray and all accessories required for splicing the cable and sealing the splice closure.

TR-24 SEDIMENT EROSION AND ENVIRONMENTAL CONTROL

1) General:

This section covers materials and procedures selected to control erosion during construction, to assure that sediment is trapped for removal, and to provide direction should environmental artifact be discovered during construction.

Sediment and erosion control facilities shall be constructed in such a manner as to insure that sediment and sediment laden water do not enter the drainage system, public roadways, or violate applicable water standards.

It is the intent of these specifications that the substation shall be constructed with a minimum of disruption to the natural surroundings and ground cover.

2) Description of Control Methods:

Sediment and erosion control procedures and methods shall be in accordance with applicable State, County, and City requirements and as specified herein. Silt fence or straw bales may be used to control soil erosion and sediment runoff at the Contractor's option.

a) Silt Fence:

The silt fence is intended to intercept water runoff and reduce the transport of sediment from the construction site by providing a temporary barrier to sediment and reducing runoff velocities. Silt fencing shall be installed where ground cover is removed and sloping grades are present. Filter fabric material shall be Synthetic Industries 401 or acceptable equal.

b) Straw Bales:

Straw bales are intended to intercept water runoff, filter runoff of sediment from the construction site, and reduce runoff velocities. Straw bales shall be installed where ground cover is removed and sloping grades are present.

3) Maintenance:

Sediment and erosion control facilities shall be inspected and maintained according to the SWPPP. At no time shall more than one foot of sediment be allowed to accumulate behind the silt fence and straw bales. Accumulated sediment shall be removed and any damaged silt fence or straw bales repaired.

4) Removal of Facilities:

Silt fences and straw bales shall be removed when they have served their useful purpose, but not before the upslope area has been repaired, seeded, and permanently stabilized as directed by the designated Work Inspector.

5) Environmental Artifacts:

Construction personnel shall be cautioned to watch for buried artifacts and bones during earth moving. If any such items are found, work should cease immediately and the Inspector notified.

6) Erosion and Environmental Planning and Permitting:

The following permits and plans shall be developed and implemented by the Contractor.

a) Spill Prevention Control and Countermeasure (SPCC) Plan:

If the contractor will have oil and fuel storage in excess of 1,320 gallons on one site during construction, the Contractor shall design, implement, manage, and maintain a SPCC Plan.

The Contractor shall be responsible for its development and implementation, with concurrence from GRDA.

b) NPDES General Storm Water Permit for Construction:

The Contractor shall obtain a NPDES General Storm Water Permit for Construction, unless furnished by GRDA.