TOWN OF PECOS CITY, TEXAS

PROJECT MANUAL

FOR

SCADA SYSTEM IMPROVEMENTS

OCTOBER 2020

Enprotec / Hibbs & Todd
402 Cedar, Abilene, Texas 79601
Phone: (325) 698-5560 Fax: (325) 690-3240
Website: e-ht.com
PE Firm Registration No. 1151
PG Firm Registration No. 50103
RPLS Firm Registration No. 10011900

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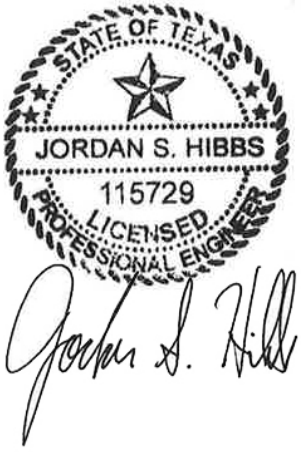
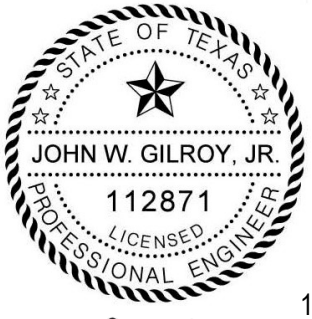
Contract Documents, Divisions 1 and 2



10/02/2020

Jordan S. Hibbs, P.E. #115729

Divisions 13 and 16



10/02/2020

John Gilroy, P.E. #112871
Baird Gilroy and Dixon, LLC.
PE Firm Registration No. 16575

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DIVISION 16 – ELECTRICAL

BID DOCUMENTS

ADVERTISEMENT FOR BIDS

TOWN OF PECOS CITY
PECOS, TEXAS
SCADA SYSTEM IMPROVEMENTS

General Notice

Town of Pecos City (Owner) is requesting Bids for the construction of the following Project:

SCADA System Improvements

Bids for the construction of the Project will be received at the **Town of Pecos City, City Hall** located at **115 W. 3rd Street, Pecos, Texas 79772**, until **Thursday, November 5, 2020** at **2:00 p.m.** local time. At that time the Bids received will be **publicly** opened and read.

The Project includes the following Work:

SCADA System Improvements.

Bids are requested for the following Contract: **SCADA System Improvements**

Obtaining the Bidding Documents

Information and Bidding Documents for the Project can be found at the following designated websites:

www.civcastusa.com and www.pecostx.gov

Bidding Documents may be downloaded from the designated websites. Prospective Bidders are urged to register with CivCast as a plan holder, even if Bidding Documents are obtained from a plan room the Town's website or source other than CivCast either electronic or paper format. CivCast will be updated periodically with addenda, lists of registered plan holders, reports, and other information relevant to submitting a Bid for the Project. All official notifications, addenda, and other Bidding Documents will be offered only through CivCast. Neither Owner nor Engineer will be responsible for Bidding Documents, including addenda, if any, obtained from sources other than CivCast.

The Issuing Office for the Bidding Documents is:

Enprotec / Hibbs & Todd, Inc.
402 Cedar Street, Abilene, Texas 79601

Prospective Bidders may obtain or examine the Bidding Documents at the Issuing Office on Monday through Friday between the hours of **8:00 am – 5:00 pm,** and may obtain copies of the Bidding Documents from the Issuing Office as described below. Partial sets of Bidding Documents will not be available from the Issuing Office. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including addenda, if any, obtained from sources other than the Issuing Office.

Pre-bid Conference

A PRE-BID CONFERENCE will not be held for this project.

Instructions to Bidders.

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner: **Town of Pecos City**
By: **Seth Sorensen**
Title: **City Manager**
Date: **October 2, 2020**

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.

2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.

2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.

2.04 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

2.05 *Electronic Documents*

A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.

1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee

that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.

B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.05.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:

A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.

B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.

C. Bidder's state or other contractor license number, if applicable.

D. Subcontractor and Supplier qualification information.

E. Other required information regarding qualifications.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

4.01 A Pre-bid conference will not be held for this project. Prospective bidders may visit the site by coordinating with the Town of Pecos City.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:

a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.

b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference: **N/A**

B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.

C. The other Site-related documents are not part of the Contract Documents.

D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.

5.04 *Site Visit and Testing by Bidders*

A. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner contact for visiting the Site: **Seth Sorensen, 432-445-2421**. Bidder must conduct the required Site visit during normal working hours.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.

D. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Express Representations and Certifications in Bid Form, Agreement*

A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.

B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. **Jordan Hibbs, P.E., via email to jordan.hibbs@e-ht.com.**

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **10%** percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.

9.02 Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.

9.03 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.01 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the Work within five days after Bid opening.

11.02 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

11.03 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.

12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.

12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.

12.06 A Bid by an individual must show the Bidder's name and official address.

12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.

12.08 All names must be printed in ink below the signatures.

12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.

12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.

12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on

the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.

13.02 *Base Bid with Alternates*

A. Bidders must submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.

B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

13.03 *Unit Price*

A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents are included in the Project Manual posted on the designated website. A copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.

14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.

15.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.

18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.

18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

C. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver two fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 Owner is exempt from **Texas** state sales and use taxes on materials and equipment to be incorporated in the Work. Said taxes must not be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to: **Town of Pecos City, 115 W. 3rd Street, Pecos, Texas 79772.**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

2.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;

E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids; and

F. Required Bidder Qualification Statement with supporting data.

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Unit Price Bids*

BID PROPOSAL
FOR LABOR, MATERIAL, EQUIPMENT, AND INCIDENTALS:

ITEM NO	ESTIMATED QUANTITY	DESCRIPTION AND UNIT PRICE (Price to be written in words)	UNIT PRICE	TOTAL PRICE
1	1 LS	Mobilization, bonds and insurance (not to exceed 5 percent of total base bid) for _____ _____ Dollars and _____ Cents per lump sum.	N/A	$_____
2	1 LS	Owner's Allowance for work directed in writing by the Owner for Legitimate project-related issues at the direct cost (all costs for bonds/insurance/overhead/profit associated with this allowance shall be included in Bid Item #3 below), for such work at a lump sum amount Fifty thousand Dollars and No Cents per lump sum.	N/A	$ 50,000.00

ITEM NO	ESTIMATED QUANTITY	DESCRIPTION AND UNIT PRICE (Price to be written in words)	UNIT PRICE	TOTAL PRICE
3	1 LS	Furnish and install all electrical and SCADA work, as shown and as specified, for _____ _____ Dollars and _____ Cents per lump sum.	N/A	$_____
4	1 LS	Complete an on-site radio path survey for wireless radios and Verizon Wireless cellular modems for each proposed radio and modem as specified in Section 13332, for _____ _____ _____ Dollars and _____ Cents per lump sum.	N/A	$_____
5	1 LS	Program and application development of the programmable logic controllers (PLC) and Human Machine Interface (HMI) per section 13325, for Eighty thousand Dollars and No Cents per lump sum.	N/A	$ 80,000.00
Total Base Bid Proposal Price (Items 1 thru 5)			**$ _____**	

ALTERNATES PRICE – CIRCLE ADDITIVE OR DEDUCTIVE

ITEM NO	ESTIMATED QUANTITY	DESCRIPTION AND UNIT PRICE (Price to be written in words)	Additive or Deductive	TOTAL PRICE
A1	1 LS	Furnish and install a 100' antenna tower for Ward Tank Site in lieu of installing wireless radios on existing tank, as shown and as specified, for _____ _____ Dollars and _____ Cents per lump sum.	Additive Or Deductive	$_____

A. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 4—TIME OF COMPLETION

4.01 Bidder agrees that the Work will be substantially complete within **300** calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **330** calendar days after the date when the Contract Times commence to run.

4.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 5—BIDDER'S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

5.01 *Bid Acceptance Period*

A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

A. In submitting this Bid, Bidder represents the following:

1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and

procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.

2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.

3. Bidder has not solicited or induced any individual or entity to refrain from bidding.

4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 6.02.A:

a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.

b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.

c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

_____

(typed or printed name of organization)

By: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____

(individual's signature)

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Date: _____

(typed or printed)

Address for giving notices:

_____

_____

Bidder's Contact:

Name: _____

(typed or printed)

Title: _____

(typed or printed)

Phone: _____

Email: _____

Address:

_____

_____

_____

Bidder's Contractor License No.: (if applicable) _____

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Bid**
Name: **Town of Pecos City, Texas**	Project *(name and location)*:
Address *(principal place of business)*:	**SCADA System Improvements**
115 W. 3rd Street **Town of Pecos City, Texas**	Bid Due Date:

Bond

Penal Sum:

Date of Bond:

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

Bidder	Surety
_____ *(Full formal name of Bidder)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature) (Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title:	Title:

Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
    3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
    3.2. All Bids are rejected by Owner, or
    3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

QUALIFICATIONS STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

1.02 Provide information on the Business's organizational structure:

Form of Business:	☐ Sole Proprietorship ☐ Partnership ☐ Corporation		
☐ Limited Liability Company ☐ Joint Venture comprised of the following companies:			
	1.		
	2.		
	3.		
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?	☐ Yes ☐ No ☐ Pending		

1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	
Authorized to sign contracts: ☐ Yes ☐ No		Limit of Authority:	$
Name:		Title:	

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
☐ Disadvantaged Business Enterprise		
☐ Minority Business Enterprise		
☐ Woman-Owned Business Enterprise		
☐ Small Business Enterprise		
☐ Disabled Business Enterprise		
☐ Veteran-Owned Business Enterprise		
☐ Service-Disabled Veteran-Owned Business		
☐ HUBZone Business (Historically Underutilized) Business		
☐ Other		
☐ None		

ARTICLE 4—SAFETY

4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		☐ Attached
Date of Business's most recent audited financial statement:		☐ Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

ARTICLE 6—SURETY INFORMATION

6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	☐ Yes ☐ No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? ☐ Yes ☐ No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?			☐ Yes ☐ No
Does provider have an A.M. Best Rating of A-VII or better?			☐ Yes ☐ No
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? ☐ Yes ☐ No				
Been released from a bid in the past 5 years? ☐ Yes ☐ No				
Defaulted on a project or failed to complete any contract awarded to it? ☐ Yes ☐ No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? ☐ Yes ☐ No				
Been a party to any currently pending litigation or arbitration? ☐ Yes ☐ No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.

B. Diverse Business Certifications if required by Paragraph 3.01.

C. Certification of Business's safety performance if required by Paragraph 4.02.

D. Financial statements as required by Paragraph 5.01.

E. Attachments providing additional information as required by Paragraph 8.02.

F. Schedule A (Current Projects) as required by Paragraph 8.03.

G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.

H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.

I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

Schedule A—Current Projects

Name of Organization					
Project Owner		Project Name			
General Description of Project					
Project Cost		Date Project			
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name			
General Description of Project					
Project Cost		Date Project			
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name			
General Description of Project					
Project Cost		Date Project			
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule B—Previous Experience with Similar Projects

Name of Organization				
Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner		Project Name		
General Description of Project				
Project Cost		Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				

Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Schedule C—Key Individuals

Project Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
Project Superintendent			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Safety Manager			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

Quality Control Manager			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

OFFICE USE ONLY

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

1 Name of business entity filing form, and the city, state and country of the business entity's place of business.

2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.

3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.

4 Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 Check only if there is NO Interested Party. ☐

6 UNSWORN DECLARATION

My name is _____, and my date of birth is _____.

My address is _____, _____, _____, _____, _____.
(street) (city) (state) (zip code) (country)

I declare under penalty of perjury that the foregoing is true and correct.

Executed in _____ County, State of _____ , on the _____ day of _____, 20_____.
(month) (year)

_____
Signature of authorized agent of contracting business entity
(Declarant)

ADD ADDITIONAL PAGES AS NECESSARY

CONTRACTOR COMPLIANCE WITH
WORKER'S COMPENSATION LAW

Pursuant to Article 8308-3.23 of Vernon's Annotated Civil Statutes, Contractor certified that it provides worker's compensation insurance coverage for all of its employees employed on this Town of Pecos City project.

_____
CONTRACTOR

By:_____

_____
Title

_____
Date

STATE OF TEXAS

COUNTY OF _____

BEFORE ME, the undersigned authority, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same as the act and deed of _____ for the purposes and consideration therein expressed and in the capacity therein stated.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____day of _____, 20____.

_____
Notary Public in and for
the State of Texas

NON-COLLUSION AFFIDAVIT OF PRIME BIDDER

State of _____ §

County of _____ §

_____, being first duly sworn, deposes and says that:

(1) He/She is _____ of _____, the Bidder that has submitted the attached Bid;

(2) He/She is fully informed respecting the preparation and contents of the attached bid and of all pertinent circumstances respecting such Bid;

(3) Such Bid is genuine and is not a collusive or sham Bid;

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived, or agreed, directly or indirectly, with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other bidder, or to fix an overhead, profit or cost element of the bid price or the Bid price of any other bidder, or to secure through any advantage against the Town of Pecos City, or any person interested in the proposed contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees or parties in interest, including this affiant.

(signed) _____

_____
Title

Subscribed and sworn to before me

this _____ day of _____, 20____.

By: _____
Notary Public

My commission expires _____, 20____.

SPECIAL PROVISION –
SALES TAX NOTICE TO CONTRACTORS

The **Town of Pecos City** is an exempt organization in accordance with Section 151.309 of Chapter 151, Subchapter E, Tax Code, also known as the Limited Sales, Excise, and Use Tax Act. Any contract awarded for this project shall meet the criteria in Chapter 151, Subchapter E, Tax Code for an exempt contract.

Contractor's should be knowledgeable of Chapter 151, Subchapter E, Tax Code and the applicable rules of the Comptroller of Public Accounts, specifically 34 TAC 3.291 (Contractors) and 34 TAC 3.287 (Exemption Certificates) and shall assure that the **Town of Pecos City** receives all tax exemptions provided by State law.

Contractor's may obtain additional information, including sample exemption certificates, by contracting the Comptroller of Public Accounts, Tax Policy Division, 111 West 6th Street, Austin, Texas 78701-2913. The Comptroller of Public Accounts can be reached by calling their toll-free number 1-800-252-5555 or in Austin 512-463-4600.

CONTRACT DOCUMENTS

NOTICE OF AWARD

Date of Issuance:			
Owner:	Town of Pecos City, Texas	Owner's Project No.:	
Engineer:	Enprotec / Hibbs & Todd, Inc.	Engineer's Project No.:	7469
Project:	SCADA System Improvements		
Contract Name:	SCADA System Improvements		
Bidder:			
Bidder's Address:			

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

SCADA System Improvements

The Contract Price of the awarded Contract is $_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

4 unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **4** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): **None**

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **Town of Pecos City**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between **Town of Pecos City** ("Owner") and _____ ("Contractor").

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **SCADA System Improvements**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **SCADA System Improvements**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Enprotec / Hibbs & Todd, Inc.** ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by **Engineer**.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Days*

A. The Work will be substantially complete within **300** days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within **330** days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $**500** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $**500** for each day that expires after such time until the Work is completed and ready for final payment.

B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

4.04 *Special Damages*

A. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

B. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents.

A. For all Work at the prices stated in Contractor's bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **10th** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

    a. **95** percent of the value of the Work completed (with the balance being retainage).

    b. **95** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **95** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **5** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. No interest will be paid on retainage.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of ___ sheets with each sheet bearing the following general title: **SCADA System Improvements**
7. Addenda (numbers 0 to _, inclusive).

8. Exhibits to this Agreement (enumerated as follows):

    a. **None**

9. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

    a. Notice to Proceed.

    b. Work Change Directives.

    c. Change Orders.

    d. Field Orders.

    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.

2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.

4. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

5. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

6. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

7. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

8. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

9. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner: **TOWN OF PECOS CITY**

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

*(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)*

Contractor:

_____
(typed or printed name of organization)

By: _____
(individual's signature)

Date: _____
(date signed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

*(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

_____

_____

_____

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

_____

_____

_____

Phone: _____

Email: _____

License No.: _____
(where applicable)

State: _____

NOTICE TO PROCEED

Owner:	Town of Pecos City	Owner's Project No.:	
Engineer:	Enprotec / Hibbs & Todd, Inc.	Engineer's Project No.:	7469
Contractor:		Contractor's Project No.:	
Project:	SCADA System Improvements		
Contract Name:	SCADA System Improvements		
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on _____, 2020 pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

> The number of days to achieve Substantial Completion is ___ from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of _____, 2021; and the number of days to achieve readiness for final payment is ___ from the commencement date of the Contract Times, resulting in a date for readiness for final payment of _____, 2021.

Before starting any Work at the Site, Contractor must comply with the following:

Owner:	**Town of Pecos City**
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

PERFORMANCE BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Town of Pecos City, Texas**	Description *(name and location)*:
Mailing address *(principal place of business)*:	**SCADA System Improvements**
115 W. 3rd Street **Town of Pecos City, Texas**	Contract Price:
	Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:

    3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;

    3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

    3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

    5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

    5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

    5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

    5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

   7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

   7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

   7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.

12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

    14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

    14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

    14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

    14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

    14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

16. Modifications to this Bond are as follows: **None**

PAYMENT BOND

Contractor	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Contract**
Name: **Town of Pecos City** Mailing address *(principal place of business)*: **115 W. 3rd Street** **Town of Pecos City, Texas**	Description *(name and location)*: **SCADA System Improvements** Contract Price: Effective Date of Contract:

Bond

Bond Amount:

Date of Bond:

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

Contractor as Principal	Surety
_____	_____
(Full formal name of Contractor)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature)(Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond will arise after the following:

    5.1. Claimants who do not have a direct contract with the Contractor

        5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2. Pay or arrange for payment of any undisputed amounts.

    7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

    16.1. *Claim*—A written statement by the Claimant including at a minimum:

        16.1.1. The name of the Claimant;

        16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;

        16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;

        16.1.4. A brief description of the labor, materials, or equipment furnished;

16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;

16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;

16.1.7. The total amount of previous payments received by the Claimant; and

16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.

18. Modifications to this Bond are as follows: **None**

CERTIFICATE OF INSURANCE

TO:

Date _____
Project No _____
Type of _____
Project _____

_____
Owner

_____
Address

THIS IS TO CERTIFY THAT _____
(Name and address of Insured)

is, at the date of this certificate, insured by this Company with respect to the business operations hereinafter described, for the types of Insurance and in accordance with the provisions of the standard policies used by this Company, and further hereinafter described. Exceptions to standard policy noted on reverse side hereof.

TYPE OF INSURANCE

	Policy No.	Effective	Expires	Limits of Liability
Workmen's Compensation				
Public Liability				1 Person $_____ 1 Accident $ _____
Contingent Liability				1 Person $ _____ 1 Accident $_____
Property Damage				
Builder's Risk				
Automobile				
Other				

The foregoing Policies (do) (do not) cover all sub-contractors.

Locations Covered: _____

Descriptions of Operations Covered: _____

The above policies either in the body thereof or by appropriate endorsement provide that they may not be changed or canceled by the insurer in less than five days after the insured has received written notice of such change or cancellation.

Where applicable local laws or regulations require more than five days actual notice of change or cancellation to the assured, the above policies contain such special requirements, wither in the body thereof or by appropriate endorsement thereto attached.

_____
(Name of Insurer)

By _____

Title _____

STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions. Supplementary Conditions are established by redline edits to these Standard General Conditions of the Construction Contract.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

5. Weather-Related Delays

    a. If "abnormal weather conditions" as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.

    b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:

        1) Every workday on which one or more of the following conditions exist will be considered a "bad weather day":

            i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **1.0"** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.

        2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by Painter and Associates weather monitoring station in Pecos City.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

    1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

    2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

    3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

    1. The circumstances that form the basis for the requested adjustment;

    2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

    3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such

reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Investigation	August 28, 2020	Boring Information

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely. These drawings are provided in Appendix B.

Drawings Title	Date of Drawings	Technical Data
None		

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
2. is of such a nature as to require a change in the Drawings or Specifications;
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

   a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

   b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

   c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days

after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None		

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in

Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable

Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the Project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon

request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

    1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

    2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: None

E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Each accident	$1,000,000
Each employee	$1,000,000
Policy limit	$2,000,000

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,

2. damages insured by reasonably available personal injury liability coverage, and

3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial

general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	$2,000,000
Products—Completed Operations Aggregate	$2,000,000
Personal and Advertising Injury	$1,000,000
Bodily Injury and Property Damage—Each Occurrence	$1,000,000

J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	$500,000
Each Accident	$1,000,000
Property Damage	
Each Accident	$1,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$2,000,000
General Aggregate	$2,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $**1,000,000** after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$N/A
General Aggregate	$N/A

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$2,000,000
Annual Aggregate	$5,000,000

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an

endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or

description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

    a. in the exercise of reasonable judgment Engineer determines that the proposed item:

        1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

        3) has a proven record of performance and availability of responsive service; and

        4) is not objectionable to Owner.

    b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that

Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
    a. will certify that the proposed substitute item will:
        1) perform adequately the functions and achieve the results called for by the general design;
        2) be similar in substance to the item specified; and
        3) be suited to the same use as the item specified.
    b. will state:
        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
    c. will identify:
        1) all variations of the proposed substitute item from the item specified; and
        2) available engineering, sales, maintenance, repair, and replacement services.
    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a

Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation.

Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as

being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

B. Owner is exempt from payment of sales and compensating use taxes of the State of Texas and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.

2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the

Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or

indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for

Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier,

or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners,

employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not

be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress

and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:

1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.

3. *Liaison*

    a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

    b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

    c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.

4. *Review of Work; Defective Work*

    a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.

    b. Observe whether any Work in place appears to be defective.

    c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.

5. *Inspections and Tests*

    a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.

    b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

6. *Payment Requests:* Review Applications for Payment with Contractor.

7. *Completion*

    a. Participate in Engineer's visits regarding Substantial Completion.

    b. Assist in the preparation of a punch list of items to be completed or corrected.

    c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

    d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Authorize Owner to occupy the Project in whole or in part.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

    a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

    b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

    c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

    d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

    e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

    f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the

proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and

decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which

include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

        1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

~~2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.~~

2) The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of the Rental Rate Blue Book for Construction Equipment.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered

by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

   a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

   a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

   b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

      1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

      2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

~~E. *Adjustments in Unit Price*~~

~~1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:~~

~~a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and~~

~~b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.~~

~~2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.~~

~~3. Adjusted unit prices will apply to all units of that item.~~

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then

Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work

completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress,

or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

   e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects,

and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents;

b. consent of the surety, if any, to final payment;

c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect

to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the

Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due,

Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

TECHNICAL SPECIFICATIONS

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Contract Description:

1. SCADA Improvements for Pecos City's Water System. Included in the work will be the following:

a. Installation of new communication radios at multiple locations.

b. Installation of new antennas to support radios.

c. New control panels at multiple locations.

d. Miscellaneous electrical work to support new systems.

1.2 CONTRACTOR USE OF SITE:

A. Limit use of existing sites to allow:

1. Owner occupancy.

2. Uninterrupted delivery of water. Work with City staff regarding shutdowns, as necessary. Shutdowns shall be limited to two (2) hours.

END OF SECTION

SECTION 01019

CONTRACT CONSIDERATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Materials Testing.

B. Schedule of Values.

C. Application for Payment.

D. Change Procedures.

E. Measurement and Payment.

1.2 MATERIALS TESTING:

A. Engineer will engage a recognized construction materials testing firm.

B. Contractor shall be responsible for:

1. Costs of incidental labor and facilities required to assist testing firm.

2. Costs of testing laboratory services used by Contractor separate from Contract Document or Owner requirements.

3. Costs of retesting upon failure of previous tests as determined by Engineer.

1.3 SCHEDULE OF VALUES:

A. Submit a printed schedule on EJCDC C-620. Contractor's standard form or electronic media printout will be considered.

B. Submit Schedule of Values at the Preconstruction Conference. Provide four (4) reproducible copies.

C. Format: Provide itemized schedule breakdown of Lump Sum Bid. Coordinate schedule with Engineer for approval.

D. Revise schedule to list approved Change Orders, with each Application for Payment.

1.4 APPLICATIONS FOR PAYMENT:

A. Contractor's electronic media driven form or EJCDC C-620.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: Submit by the 25th of each month.

D. Include executed Contractor Affidavit for Partial Payment with each Application for Payment.

E. Submit certification by Contractor of Labor Standards compliance with each Application for Payment.

1.5 CHANGE PROCEDURES:

A. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions in writing.

B. The Engineer may issue a Notice of Change which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications, a change in contract time for executing the change and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within 10 days.

C. The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01600.

D. Stipulated Sum/Price Change Order: Based on Notice of Change and Contractor's fixed price quotation or Contractor's request for a Change Order as approved by Engineer.

E. Work Directive Change: Engineer may issue a directive, on EJCDC C-940 Work Directive Change signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

F. Change Order Forms: EJCDC C-941 or Engineer’s standard electronic media driven form.

G. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

1.6 MEASUREMENT AND PAYMENT:

A. Authority: Work under this Contractor shall be measured by the Item Lump Sum Price as indicated on the Bid Schedule. Where the Item Lump Sum Price applies, the work will be considered as a complete installation as shown and specified.

Unit Quantities: Quantities and measurements indicated in the Bid Form are for contract purposes only. Quantities and measurements supplied or placed in the Work shall determine payment. The bid price for any Unit Price

method item shall be in effect for any actual quantity encountered within plus or minus 25 percent of the estimated quantity. Payment or adjustment for quantities greater than plus or minus 25 percent will be subject to negotiation.

B. Payment Includes: Full compensation for required labor, Products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

C. Defect Assessment: Replace the Work, or portions of the Work, not conforming to specified requirements. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Coordination.

B. Field Engineering.

C. Preconstruction Meeting.

1.2 COORDINATION:

A. Coordinate scheduling, submittal, and Work of the various sections of the Project Manual to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion.

C. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 FIELD ENGINEERING:

A. Contractor to provide field engineering services as required to support his work. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

1.4 PRECONSTRUCTION MEETING:

A. Engineer will schedule a meeting after Notice of Award.

B. Attendance Required: Owner, Engineer, and Contractor.

C. Agenda:

1. Distribution of Owner-Contractor Agreement / Contract Document.

2. Submission of executed bonds and insurance certificates.

3. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.

4. Designation of personnel representing the parties in Contract, and the Engineer.

5. Procedures and processing of field decisions, submittal, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

6. Scheduling.

7. Coordination with other agencies/organizations.

D. Engineer to record minutes and distribute copies after meeting to participants.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01090

STANDARD REFERENCES

Whenever used in the Project Manual, the following abbreviations will have the meanings listed:

When documents are referenced, they are a part of the Specification as specified and modified. In case of conflict between the requirements of these Specifications and those on the referenced documents, these Specifications shall prevail.

AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, Ste. 249 Washington, DC 20001
ACI	American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48331
AISC	American Institute of Steel Construction One East Wacker Drive, Ste. 700 Chicago, IL 60601-1802
AISI	American Iron and Steel Institute 1140 Connecticut Ave., Ste. 705 Washington, DC 20036
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Ste. 140 Centennial, CO 80112
ANSI	American National Standards Institute, Inc. 1899 L Street, NW, 11th Floor Washington, DC 20036
APA	American Plywood Association 7011 S. 19th Street Tacoma, WA 98466-5333
API	American Petroleum Institute 1220 L Street, NW Washington, DC 20005-4070
APSP	Association of Pool and Spa Professionals 2111 Eisenhower Ave., Ste. 500 Alexandria, VA 22314
ASCE	American Society of Civil Engineers 1801 Alexander Bell Drive Reston, VA 20191

ASCII	American Standard Code for Information Interchange United States of American Standards Institute 25 West 43rd Street, 4th Floor New York, NY 10036
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers United Engineering Center 1791 Tullie Circle, NE Atlanta, GA 30329
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016
ASTM	American Society for Testing and Materials 100 Bar Harbor Drive West Conshohocken, PA 19428 (http://www.astm.org)
AWPA	American Wood Preservers Association 100 Chase Park South, Ste. 116 Birmingham, AL 35244
AWS	American Welding Society 550 LeJeane Road Miami, FL 33126
AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, CO 80235
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173
EEI	Edison Electric Institute 701 Pennsylvania Ave., NW Washington, DC 20004
ENGINEER	Enprotec / Hibbs & Todd, Inc. 402 Cedar Street Abilene, Texas 79601
FEDSPEC	Federal Specifications General Services Administration Specification and Consumer Information Distribution Branch 1275 First Street, NE Washington, DC 20417
FEDSTDS	Federal Standards (see FEDSPECS)

HI	Hydraulic Institute 6 Campus Drive, First Floor North Parsippany, NJ 07054
IBC	International Building Code (Published by ICC)
ICC	International Code Council 500 New Jersey Ave., NW, 6th Floor Washington, DC 20001
ICEA	Insulated Cable Engineers Association P.O. Box 1568 Carrolton, GA 30112
IEEE	Institute of Electrical and Electronic Engineers, Inc. 3 Park Avenue, 17th Floor New York, NY 10016
IES	Illuminating Engineering Society c/o United Engineering Center 120 Wall Street, Floor 17 New York, NY 10005
IMC	International Mechanical Code (Published by ICC)
IPC	International Plumbing Code (Published by ICC)
ISA	Instrument Society of America 67 Alexander Drive Research Triangle Park, NC 27709
MILSPEC	Military Specifications Navy Publications and Forms Center 5801 Tabor Avenue Philadelphia, PA 19120
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd., Bldg. C, Ste 312 Glen Ellyn, IL 60137
NACE	National Association of Corrosion Engineers 1440 South Creek Drive Houston, Texas 77084
NEC	National Electrical Code National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169

NEMA	National Electrical Manufacturer's Association 1300 North 17th Street, Ste. 1752 Rosslyn, VA 22209
NFPA	National Forest Products Association 1111 19th Street, NW, Ste. 800 Washington, DC 20036
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169
NSF	National Sanitation Foundation 789 N. Dixboro Road Ann Arbor, MI 48113
OSHA	Occupational Safety and Health Act Occupational/Safety and Health Administration Lubbock Area Office 1205 Texas Avenue Lubbock, TX 79401
OWNER	Town of Pecos City 115 West 3rd Street Town of Pecos City, Texas 79772
SBCC	Southern Building Code Congress 900 Montclair Road Birmingham, AL 35213
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 4201 Lafayette Center Drive Chantilly, VA 20151-1209
SSPC	Steel Structures Painting Council 4516 Henry Street, Suite 301 Pittsburgh, PA 15123-3728
SSPWC-NCT	Standard Specifications for Public Works Construction-- North Central Texas North Central Texas Council of Governments P O Box 5888 Arlington, Texas 76005-5888
TCA	Tile Council of America, Inc. 100 Clemson Research Blvd. Anderson, SC 29625
TCEQ	Texas Commission on Environmental Quality P O Box 13087 Austin, TX 78711-3087

TDSHS	Texas Department of State Health Services 1100 West 49th Street Austin, Texas 78756-3199
TWDB	Texas Water Development Board 1700 North Congress Avenue Austin, Texas 78711
TXDOT	Texas Department of Transportation 125 E. 11th Street Austin, TX 78701
UBC	Uniform Building Code Published by ICB
UL	Underwriters Laboratories, Inc. 2600 NW Lake Road Camas, WA 98607
USBR	Bureau of Reclamation U.S. Department of Interior Engineering and Research Center Denver Federal Center, Building 67 Denver, CO 80225
WWPA	Western Wood Products Association 522 SW Fifth Ave, Ste. 500 Portland, OR 97204

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Submittal Procedures.

B. Construction Progress Schedules.

C. Shop Drawings.

D. Product Data.

E. Manufacturer's Installation Instructions.

F. Manufacturers' Certificates.

1.2 SUBMITTAL PROCEDURES:

A. Transmit each submittal with Engineer accepted form.

B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

C. Each submittal shall be limited to a single specification section or material topic. Where equipment packages, assemblies, and the like are interrelated, the submittals should be provided together facilitating review of the Contractor’s purposed offering. When related portions of an equipment package or system are not provided, the submittals may be returned without review.

D. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing and detail number, and Specification section number, as appropriate.

E. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

F. Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

G. For each submittal for review, allow 20 days excluding delivery time to and from the Contractor.

H. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

I. Provide space for Contractor and Engineer review stamps.

J. Revise and resubmit, identify all changes made since previous submission.

K. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with provisions.

L. Submittals not requested will not be recognized or processed.

1.3 CONSTRUCTION PROGRESS SCHEDULES:

A. Submit initial schedule in duplicate within 20 days after date established in Notice to Proceed.

B. Revise and resubmit as required.

C. Submit revised schedules with each Application for Payment, identifying changes since previous version.

D. Submit a horizontal bar chart with separate line for each major section of Work or operation, identifying first work day of each week.

E. Indicate estimated percentage of completion for each item of Work on each Application for Payment submission.

1.4 SHOP DRAWINGS:

A. Submit the number of reproductions which Contractor requires, plus three copies which will be retained by Engineer.

B. Shop Drawings: Submit for review. After review, produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article above and for record documents purposes described in Section 01700--CONTRACT CLOSEOUT.

1.5 PRODUCT DATA:

A. Submit the number of copies which the Contractor requires, plus three copies which will be retained by the Engineer.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

C. After review, distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01700 - CONTRACT CLOSEOUT.

1.6 MANUFACTURER INSTALLATION INSTRUCTIONS:

A. When specified in individual Specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and operating, to Engineer in quantities specified for Product Data.

1.7 MANUFACTURER OPERATION AND MAINTENANCE INSTRUCTIONS:

A. When specified in individual specification sections, submit printed instructions for operations and maintenance (O&M), to Engineer, in quantities specified for Product Data.

B. O&M information shall include but not necessarily be limited to parts lists, disassembly drawings, electrical schematics, and other information required for proper operation and maintenance.

1.8 MANUFACTURER CERTIFICATES:

A. When specified in individual Specification sections, submit certification by manufacturer to Engineer, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Quality Assurance--Control of Installation.

B. Tolerances.

C. References.

D. Testing Laboratory Services.

E. Manufacturers' Field Services and Reports.

1.2 QUALITY ASSURANCE--CONTROL OF INSTALLATION:

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce workmanship of specified quality.

F. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES:

A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.4 REFERENCES:

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.

C. Obtain copies of standards where required by product Specification sections.

D. The contractual relationship, duties, and responsibilities of the parties in Contract and of the Engineer, shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.5 TESTING LABORATORY SERVICES:

A. Engineer will appoint and employ services of an independent firm to perform inspecting and testing.

B. The independent firm will perform inspections, tests, and other services specified in individual Specification sections and as required by the Engineer or the Owner.

C. Inspecting, testing, and source quality control may occur on or off the project site. Perform off-site inspecting or testing as required by the Engineer or the Owner.

D. Reports will be submitted by the independent firm to the Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.

1. Notify Engineer and independent firm 24 hours prior to expected time for operations requiring services.

2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing or inspecting does not relieve the Contractor of his responsibility to perform Work to contract requirements.

G. Retesting required because of non-conformance to specified requirements shall be performed by the same independent firm on instructions by the Engineer. Payment for retesting shall be the Contractor's responsibility.

1.6 MANUFACTURERS' FIELD SERVICES AND REPORTS:

A. When specified, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Engineer for information.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Temporary Utilities: Electricity, telephone service, water, and sanitary facilities.

B. Temporary Controls: Barriers, protection of the work, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, and material storage areas.

1.2 TEMPORARY ELECTRICITY:

A. Cost: By Contractor; provide and pay for power service required from utility source.

B. Complement existing power service capacity and characteristics as required.

C. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

1.3 TELEPHONE SERVICE:

A. Provide, maintain and pay for telephone service to job site at time of project mobilization. Cell phones with service in project area will be allowed.

1.4 TEMPORARY WATER SERVICE:

A. Connect to existing water source for construction operations.

B. Owner will pay cost of water used. Exercise measures to conserve water.

1.5 TEMPORARY SANITARY FACILITIES:

A. Provide and maintain required facilities and enclosures.

1.6 BARRIERS:

A. Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.7 WATER CONTROL:

A. Grade site to drain. Provide, operate, and maintain pumping equipment.

B. Protect site from puddles or running water. Provide water barriers as required to protect site from soil erosion.

1.8 PROTECTION OF INSTALLED WORK:

A. Protect installed work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

1.9 ACCESS ROADS:

A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.

B. Extend and relocate as work progress requires. Provide detours necessary for unimpeded traffic flow.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

1.10 PARKING:

A. Arrange for temporary surface parking areas to accommodate construction personnel.

B. When site space is not adequate, provide additional off-site parking.

1.11 PROGRESS CLEANING AND WASTE REMOVAL:

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.

1.12 REMOVAL OF UTILITES, FACILITIES, AND CONTROLS:

A. Remove temporary utilities, equipment, facilities, and materials prior to final inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Transportation and Handling.

B. Storage and Protection.

C. Product Options.

D. Substitutions.

1.2 TRANSPORTATION AND HANDLING:

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. Pipe to be transported with exposed ends tarped to prevent accumulation of airborne contaminates during transport.

1.3 STORAGE AND PROTECTION:

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible.

B. Store sensitive products in weather tight, climate controlled enclosures.

C. For exterior storage of fabricated products, place on sloped supports, above ground.

D. Provide off-site storage and protection when site does not permit on-site storage or protection.

E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.

F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.4 PRODUCT OPTIONS:

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by naming one or more Manufacturers: Products of manufacturers named and meeting Specifications, no options or substitutions allowed.

C. Products Specified by naming one or more Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article. Where terms such as "or equal," "or equivalent" are used in this Contract, they shall be taken to mean "or approved equivalent." Proposed equivalents shall be offered as substitutions.

1.5 SUBSTITUTIONS:

A. Engineer will consider requests for Substitutions only within 20 days after date established in Notice to proceed.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the Substitution as for the specified product.

3. Will coordinate installation and make changes to other work which may be required for the work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension which may subsequently become apparent as a result of the Substitution.

E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

F. Substitution Submittal Procedure:

1. Submit copies of request for Substitution for consideration. Number of copies as specified in Sub-Section 01300-1.5. Limit each request to one proposed Substitution.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.

3. The Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Closeout procedures.

B. Final Cleaning.

C. Adjusting.

D. Project record documents.

E. Operation and Maintenance Data.

F. Warranty.

G. Spare parts and maintenance materials.

1.2 CLOSEOUT PROCEDURES:

A. Submit written certification that contract documents have been reviewed, work has been inspected, and that work is complete in accordance with contract documents and ready for Engineer's review.

B. Provide submittals to Engineer that are required by governing or other authorities.

C. Submit final Application for Payment identifying total adjusted Contract sum, previous payments, and sum remaining due.

D. Submit executed Affidavit of Bills paid with final Application for payment. Affidavit shall state all bills for labor, materials, and incidentals incurred in the construction of the project have been paid in full, and that there are no claims pending of which the Contractor has been notified.

1.3 FINAL CLEANING:

A. Execute final cleaning prior to final project assessment.

B. Clean surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean debris from roofs, gutters, downspouts, and drainage systems.

D. Clean site; sweep paved areas, rake clean landscaped surfaces.

E. Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.4 ADJUSTING:

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

1.5 PROJECT RECORD DOCUMENTS:

A. Maintain on site, one set of the following record documents; record actual revisions to the work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed Shop Drawings, Product Data, and Samples.

6. Manufacturer's instruction for assembly, installation, and start-up of products and equipment.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Documents and shop drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.

3. Field changes of dimension and detail.

4. Details not on original contract drawings.

G. Remove Engineer title block and seal from all documents.

H. Submit documents to Engineer with claim for final Application for Payment.

1.6 OPERATION AND MAINTENANCE DATA:

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Submit two sets of revised final volumes, within 10 days after final inspection.

1.7 WARRANTY:

A. The Contractor shall guarantee the work performed under this contract against defective materials and workmanship for a period of one year from the date of Substantial Completion or acceptance of individual work elements. The Contractor shall arrange to have his performance bond remain in effect for a period of one year after this date to cover his guarantee as stipulated under this item and in the General Conditions.

B. If defective materials and/or workmanship are discovered which require repairs made under this guarantee, all such repairs shall be done by the Contractor at his own expense within ten days after written notice of such defect. Should the Contractor fail to repair of correct such deficiency within ten days after notification, the Owner may make the necessary repairs and charge the Contractor with the applicable costs of all labor and materials required to correct the deficiency.

1.8 SPARE PARTS AND MAINTENANCE MATERIALS:

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.

B. Deliver to project site and place in location as directed; obtain receipt prior to final payment.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 13300
I&C SYSTEM – GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. The overall I&C System general requirements are given in this section. These requirements apply to each additional section of these Division 13 specifications as noted herein and as specified in the associated sections.

2. The Control System shall be furnished by a single SYSTEM SUPPLIER who shall assume responsibility for providing a complete and integrated system.

3. All equipment, components and materials required shall be furnished by the single SYSTEM SUPPLIER who shall assume the responsibility for adequacy and performance of all items.

4. The SYSTEM SUPPLIER shall identify those system components, which are not of their manufacture.

5. The SYSTEM SUPPLIER shall supply its company's Quality Assurance Plan, and for components that are not of its manufacture, the component manufacturer's Quality Assurance Plan. The plans shall include but not necessarily be limited to: method of testing, raw material criteria, methods of documentation, station control, "Burn-In", final tests and serialization coding and packaging

6. SYSTEM SUPPLIER shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete Control System. System shall be as specified in Division 13 and as shown. The system includes, but is not limited to the following major equipment

    a. Autosensory Panel or SCADA Control Panel
    b. Remote I/O Panels
    c. PLCs
    d. Radio Antennas
    e. Cellular Routers, Radio Modems, and Network Communications Equipment

7. The CONTRACTOR shall coordinate all work with the INTEGRATION ENGINEER as outlined under Specification Section 13325, System Programming.

8. Items specifically excluded from the SYSTEM SUPPLIERs scope include the following:

a. Programmable Logic Controller (PLC) programming, testing of PLC logic, and startup/training activities associated with programming portion of the PLC. These services shall be supplied by the Integration Engineer, Baird Gilroy & Dixon, LLC as a construction allowance as indicated on the bid form of the construction documents.

b. Human Machine Interface (HMI) related graphics development, software configuration, database development, report development, and startup/training activities associated with the programming and configuration portions of the HMI system. These services shall be supplied by the Integration Engineer, Baird Gilroy & Dixon, LLC as a construction allowance as indicated on the bid form of the construction documents.

9. Control System shall control, monitor, store, display and log process and equipment operating information and to perform various process control functions and generate various alarms & reports. The unit processes, which the Control System shall monitor, and control are shown and described herein.

10. It is the intent of these Contract Documents that the SYSTEM SUPPLIER be retained by the CONTRACTOR to have overall responsibility for furnishing, interfacing, adjusting, testing, documenting, and starting-up the various Control System equipment described in the Contract Documents. The specified intent is that the SYSTEM SUPPLIER will have overall responsibility for making sure the various systems, trades, suppliers, vendors, subcontractors, etc. come together as a complete coordinated system which will reliably perform the specified functions.

11. The CONTRACTOR shall ensure that the SYSTEM SUPPLIER coordinates closely with suppliers of other specialty equipment to ensure the required inputs and outputs for the Control System are available.

12. Instrumentation and control systems for this project are intended to be supplied completely under this section.

B. Division of Work.

1. It is the ultimate responsibility of the CONTRACTOR to furnish a complete and fully operable Control System that reliably performs the specified functions. The CONTRACTOR is to assume full responsibility for additional costs which may result from unauthorized deviations from the specifications. The CONTRACTOR is to establish the actual division of work with the minimum requirements as specified herein.

2. The SYSTEM SUPPLIER shall be responsible for:

a. The integration of the system including the PLC networking, computer system network, panel layouts, wiring, and network communications.

b. All hardware and software submittals. The SYSTEM SUPPLIER shall develop the panel shop drawings, wiring diagrams, plumbing diagrams, PLC and computer hardware configuration drawings and layouts,

software documentation, and all other submittals defined herein and in the specification sections identified in paragraph 1.01 hereof. Coordination with the CONTRACTOR and other subcontractors shall be the responsibility of the SYSTEM SUPPLIER.

c. The final system operation and reliability. All required tests and training shall be under the on-site supervision of the SYSTEM SUPPLIER.

d. Ordering, fabrication, assembly, delivery and start-up of the Control System. All panel fabrication defined in Specification Section 13315 shall be performed at the SYSTEM SUPPLIER's shop.

e. Obtaining from the CONTRACTOR the required information on those field elements, equipment starters, valve actuators, chemical feed equipment, local control panels, and other control equipment or devices that are required to be interfaced with, but that are not provided with the SCADA in order to provide full system coordination regarding interface, function, testing, and adjustment requirements.

f. Providing accessory devices including furnishing and installation of networking interface cards, interposing relays, control switches and signal converters necessary to perform the intent as described by the control strategies and services necessary to achieve a fully integrated and operational system as shown on the Contract Drawings and defined in the Specifications.

g. Coordinating all interface requirements with mechanical and electrical system suppliers and furnishing any signal isolation devices that might be required in order to insure compatibility between all equipment.

h. Providing any special manufacturer's cables required.

i. Defining the final installation and connection requirements of the SCADA at the jobsite through development of interconnection diagrams.

j. Termination and final test of serial, ethernet, and fiber optic cabling, installed and terminating within control panels supplied hereunder.

k. Verifying correctness of all final power and signal connections to the SCADA. The SYSTEM SUPPLIER shall make final adjustments to and calibrate all field elements provided with the SCADA.

l. Ensuring that:

(1) All components provided under this section are properly installed.

(2) The proper type, size and number of control wires with their conduits and junction boxes are provided and installed.

(3) Proper electric power circuits are provided for all components and systems.

3. The CONTRACTOR shall be responsible for:

    a. Including within any subcontractor's scope:

        (1) Provision, installation and termination of field and power wiring to SCADA supplied control panels and field elements. Termination shall be made in accordance with final accepted interconnection diagrams developed by the SYSTEM SUPPLIER. The electrical subcontractor shall mark on the interconnect diagram the field wire numbers used for each termination point. The SYSTEM SUPPLIER shall finalize the interconnect diagrams by including these field wire numbers in the final as built version.

        (2) Installation and termination of all specialty cables furnished by the SYSTEM SUPPLIER.

    b. Including within the scope installation of any instrumentation. Installation shall be made in accordance with the manufacturer’s recommendations and under the direction of the SYSTEM SUPPLIER.

    c. Equipment storage and protection until installed following the storage and handling instructions recommended by the SYSTEM SUPPLIER. Antistatic and winterization requirements shall be per the SYSTEM SUPPLIER's instructions and the SYSTEM SUPPLIER shall periodically verify that these instructions are followed.

    d. Incorporating all necessary components into the system. Schedules included in the referenced specification sections do not necessarily indicate the complete component requirements of the SCADA.

    e. Ensuring that the SYSTEM SUPPLIER coordinates work with the OWNER.

    f. Requiring the SYSTEM SUPPLIER to observe and advise on the installation of equipment furnished by SYSTEM SUPPLIER and installed by CONTRACTOR to the extent required to certify, with the operational check-out tests, that the equipment will perform as required.

    g. Ensuring that information on existing equipment and needed by the SYSTEM SUPPLIER to coordinate the SCADA is provided in a timely manner.

4. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

5. In the bid price, the SYSTEM SUPPLIER shall provide for obtaining the services of authorized field personnel and from the suppliers of application software packages as necessary. Should these personnel be required during installation, start-up and checkout of the respective portions of the SCADA, such services shall be provided at no additional cost to the OWNER.

1.02 SUBMITTALS

A. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

B. Submit complete, neat, orderly, and indexed submittal packages. Handwritten diagrams are not acceptable and all documentation submittals shall be made using CADD generated utilities.

C. Partial submittals or submittals that do not contain sufficient information for complete review or are unclear will not be reviewed and will be returned by the Engineer as not approved.

D. Provide all shop drawing submittals on thumb drive in PDF format.

E. In addition to the shop drawing submittals required in the related specification sections, submit the submittals defined below covering the complete system.

1. System Performance. This submittal shall be a written description of how the operator will control the system and the system's subsequent response. Every piece of controllable equipment shall be separately described and the following information included:

    a. Use of local manual controls.

    b. Use of HMI software controls.

    c. Use of automatic controls.

2. Each functional description shall specifically identify any interlocks (hardware and software) and HMI alarms generated.

3. Display Screens. This submittal shall include color copies of all proposed new and modified HMI operator screens. Modified graphics shall specifically indicate the revised portions.

4. Field Acceptance Test Plan. This submittal shall define the steps to be conducted during the required witnessed acceptance testing. The test shall be conducted in accordance with the general requirements set forth in Part 3 hereof. The submitted plan shall meet the following requirements:

    a. Each of the equipment covered in the system performance submittal shall be tested.

    b. For each equipment test, the required operator control actions and system response shall be demonstrated on the complete system, including each operator action, the response and appropriate HMI display/alarm updates.

5. The Contractor and System Supplier are hereby specifically advised that the above submittals shall be Approved or Approved As Noted prior to any witnessed performance testing.

6. Test Procedures: Submit the procedures proposed to be followed during all required testing. Procedures shall include test descriptions, forms, and check lists to be used to control and document the required tests.

7. Test Reports: Upon completion of each required test, document the test by submitting a copy of the signed off test procedures to the Engineer.

F. Product Data:

1. Manufacturer & Model information

2. Dimensions, ratings, and data on features and components

3. Equipment Brochure

4. Accessories

1.03 DELIVERY, STORAGE, AND HANDLING

A. Store and protect equipment until installation following the storage and handling instructions recommended by the equipment manufacturers. Place special emphasis on proper anti-static protection of sensitive equipment.

B. Protection During Construction: Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items in indoor, dry locations. Provide heating in storage areas for items subject to corrosion under damp conditions. Provide covers for panels and other elements that may be exposed to dusty construction environments. Specific storage requirements shall be in accordance with the SYSTEM SUPPLIER's recommendations.

C. Corrosion Protection: Protect all consoles, panels, enclosures, and other equipment containing electrical or instrumentation and control devices, including spare parts, from corrosion through the use of corrosion-inhibiting vapor capsules. Prior to shipment, include capsules in the shipping containers, and equipment as recommended by the capsule manufacturer. During the construction period, periodically replace the capsules in accordance with the capsule manufacturer's recommendations. Replace all capsules just prior to Final Acceptance.

D. Inspect the material prior to removing it from the carrier. Do not unwrap equipment until it is ready to be installed. If any damage is observed, immediately notify the carrier so that a claim can be made. If no such notice is given, the material shall be assumed to be in undamaged condition, and any subsequent damage that is discovered shall be repaired and replaced at no additional expense to the OWNER.

E. The CONTRACTOR shall be responsible for any damage charges resulting from the handling of the materials.

1.04 SYSTEM SUPPLIER QUALIFICATIONS

A. The SYSTEM SUPPLIER shall be a "systems house," regularly engaged in the design and installation of control and instrumentation systems and their associated subsystems as they apply to the municipal water or wastewater industry. For the purposes of this and

other applicable Divisions, a "systems house" shall be interpreted to mean an organization that complies with all the following criteria:

B. Employs a registered professional Control Systems Engineer or Electrical Engineer in the state of Texas to supervise or perform the work required by this Specification Section.

C. Employs personnel on this project who have successfully completed a manufacturer's training course on the hardware configuration and implementation of the specific programmable controllers, computers, and software proposed for this project.

D. Has been in the wastewater industry performing the type of work specified in this specification section for a minimum of five (5) continuous years.

E. The SYSTEM SUPPLIER shall maintain a fully equipped office/production facility with full-time employees capable of fabricating, configuring, installing, calibrating, troubleshooting, and testing the system specified herein. Qualified repair personnel shall be available and capable of reaching the facility within 24 hours.

F. SYSTEM SUPPLIER shall have an Electrical Contractor's license in the State of Texas.

G. SYSTEM SUPPLIER shall be UL508A listed panel shop.

H. The SYSTEM SUPPLIER shall be one of the following:

1. Thunderhorse Automation
2. Prime Controls
3. BL Technology - BLTI
4. Texas Industrial Controls Manufacturing – TICM
5. Weimar Manufacturing
6. ACE Controls
7. Trac-N-Trol
8. Control Panels USA
9. SOAP Engineering
10. W-Industries
11. Or approved equal

PART 2 PRODUCTS – (NOT USED)

PART 3 EXECUTION

3.01 SEQUENCE OF WORK

A. Coordination Meetings: In order to ensure timely performance of the Contract and the system's conformance with these specifications. The first meeting will be held 30 days after award of the Contract to the CONTRACTOR. The CONTRACTOR and SYSTEM SUPPLIER shall provide for their attendance at this meeting in their quotation. A schedule for additional coordination meetings (approximately one each month) will be derived at this initial meeting for periodic update, coordination, and conflict resolution during the project duration.

B. Prerequisite Activities and Lead Times: Do not start the following key project activities until the listed prerequisite activities have been completed and lead times have been satisfied:

1. Hardware Purchasing, Fabrication, and Assembly: Associated design related submittals completed (no exceptions or approved as noted).

2. Shipment: Completion and approval of all design related submittals.

3. Startup: Operational Checkout Tests.

4. OWNER Training: Owner training completed, and O&M manuals delivered.

5. Demonstration Tests: Operational Check-out Tests, Startup, OWNER Training, and Demonstration Test Procedures must be complete. Give 4 weeks' notice prior to the planned test start date.

C. Consoles, Panels, and Panel Mounted Equipment: Consoles, panels, and panel mounted equipment shall be assembled as far as possible at the SYSTEM SUPPLIER's shop. No work, other than correction of minor defects or minor transit damage, shall be done on the panels at the jobsite.

3.02 INSTALLATION

A. Material and Equipment Installation: Install the SCADA in locations indicated on the Drawings and follow manufacturers' installation instructions explicitly, unless otherwise indicated. Wherever any conflict arises between manufacturers' instruction and these Contract Documents, follow ENGINEER's decision, at no additional cost. Keep a copy of manufacturers’ instructions on the jobsite available for review.

B. Install materials and equipment in a workmanlike manner utilizing craftsmen skilled in the particular trade. Provide work which has a neat and finished appearance. Coordinate I&C work with the OWNER and work of other trades to avoid conflicts, errors, delays, and unnecessary interference with operation of the existing plant during construction.

C. Provide finish on instruments and accessories that protects against corrosion by the elements in the environment in which they are to be installed. Finish both the interior and exterior of enclosures. Provide extra paint of each color used in the material from the manufacturer for touch-up purposes.

D. Equipment Finish: Provide materials and equipment with manufacturer's standard finish system. Provide manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment with light gray color.

E. Cleaning and Touch-up Painting: Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from premises and from interior and exterior of all devices and equipment. Touch-up scratches, scrapes, or chips in interior and exterior surfaces of devices and equipment with finishes matching as nearly as possible the type, color, consistency, and type of surface of the original finish. Clean and polish the exterior of all panels and enclosures upon the completion of the demonstration tests.

3.03 TESTING, START-UP, CALIBRATION, AND TRAINING

A. Testing

1. All elements of the Control System, both hardware and software, shall be tested to demonstrate that the total system satisfies all of the requirements of the Contract Documents

2. As a minimum, the testing shall include shop tests, operational check-out tests, and Demonstration Tests.

a. Factory Shop Testing

(1) The control system shall be tested via a full simulation at the factory, prior to shipment, so as to demonstrate that each component is operational and meets the requirements of these specifications.

(2) The SYSTEM SUPPLIER shall conduct test routine for all I/O wiring and interconnect wiring of components. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Factory testing may be witnessed by the Engineer or Owner.

b. Onsite Readiness Test

(1) CONTRACTOR shall schedule ORT with Electrician, Panel Fabricator, Integration Engineer, and other related sub-contractors to conduct field stat-up tests, field I/O checkout, and control strategy testing. The I/O checkout will demonstrate I/O functionality, analog scaling confirmation, historical data collection, alarm confirmation, security configuration, and network communications. The control strategy testing will confirm manual and automatic operation of the equipment from the Control System, tuning of loops, and process set point adjustments.

c. Functional Site testing

(1) Perform functional testing of all equipment controlled or monitored by control system. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval. Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion.

d. Acceptance testing

(1) The Contractor shall notify the Owner and Engineer at least two (2) weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 7 days without failure. Any failures shall be repaired, and test shall start over again.

3. Each test shall be in the cause and effect format. The person conducting the test shall initiate an input (cause) and, upon the system producing the correct result (effect), the specific test requirements will have been satisfied.

4. All tests shall be conducted in accordance with, and documented on, prior approved procedures, forms, and checklists. Each specific test to be performed shall be described and a space provided after it for signoff by the appropriate party after its satisfactory completion. Copies of these signoff test procedures, forms, and checklists will constitute the required test documentation.

5. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment, and data. Where it is not practical to test with real process variables, equipment, and data, provide suitable means of simulation. Define these simulation techniques in the test procedures.

6. The SYSTEM SUPPLIER shall coordinate all of their testing with the CONTRACTOR, the ENGINEER, all affected suppliers, and the OWNER.

7. The ENGINEER reserves the right to test or retest any and all specified functions whether or not explicitly stated in the approved test procedures. The ENGINEER's decision shall be final regarding the acceptability and completeness of all testing. The Contractor shall bear all cost for any retesting.

8. Make the tests and checks prior to energizing instrumentation equipment in accordance with the individual Specification sections.

9. Testing shall be scheduled and coordinated with the Owner/Engineer at least two weeks in advance. Provide qualified test personnel, instruments and test equipment, including manufacturer’s services, as specified in the individual Specification sections.

B. Training

1. The cost of training programs to be conducted with OWNER's personnel shall be included in the Contract price. The training and instruction, insofar as practicable, shall be directly related to the System being supplied.

2. The SYSTEM SUPPLIER shall provide detailed manuals to supplement the training courses. The manuals shall include specific details of equipment supplied and operations specific to the project.

3. The SYSTEM SUPPLIER shall make use of teaching aids, manuals, slide/video presentations, etc. After the training services, such materials shall be delivered to

4. OWNER.

5. The training program shall represent a comprehensive program covering all aspects of the operation and maintenance of the system.

6. All training schedules shall be coordinated with, and at the convenience of the OWNER. Shift training may be required to correspond to the OWNER's working schedule.

7. Specific details of the nature and duration of training to be provided are defined in the individual specification sections.

END OF SECTION

SECTION 13310
I&C FIELD INSTRUMENTATION

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. This Specification Section covers work related to the various field instruments to be supplied with the Control System.

2. Field instrumentation, as specified herein, shall be furnished by the same SYSTEM SUPPLIER furnishing services and equipment as outlined in 13300.

1.02 RELATED WORK

A. Specification Section 13300 defines work associated with the overall Control System

B. Specification Section 13315 defines work associated with control panels and enclosures housing the various elements of the Control System

C. Specification Section 13321 defines work associated with the Programmable Logic Controllers (PLCs) that will interface the system with the field instruments defined hereunder.

D. Provision of all field and power wiring, except manufacturer-supplied cables, and installation of all wiring is performed under Division 16, Electrical.

1.03 SUBMITTALS

A. Submit the following Field Instrumentation Shop Drawings in a single package:

1. Catalog information, descriptive literature, wiring diagrams, and shop drawings on all components of the field instruments, including all miscellaneous electrical and mechanical devices furnished under this section.

2. Individual data sheets for all components of the field instruments to supplement the above information by citing all specific features for each specific component (e.g. scale range, materials of construction, special options included, etc.). Each component data sheet shall bear the component name and instrument tag number designation shown in the Drawings and Specifications.

3. Installation details for all field mounted devices to show conformance with the Contract Documents.

4. Configuration documentation for all programmable devices to indicate actual settings used to set the device scale, range, trip points, and other control parameters.

5. Proposed tag numbers for each specific instrument.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Equipment to be installed in a hazardous area shall meet Class, Group, and Division classification as shown on the Contract Electrical Drawings, or comply with the local or National Electrical Code, whichever is the most stringent requirement.

B. All instruments requiring plumbing shall utilize stainless steel components as follows:

1. Test Tap: Shall consist of Crawford Fitting Co. Swagelock quick connects Series QC4-DE, or equal.

2. Tubing, Stainless Steel: Shall be ASTM A 312, TP 316, seamless, soft annealed with 0.065 inch wall. Fittings shall be ASTM A 276, TP 316 compression or socket weld type.

3. Valve, Ball: Shall be stainless steel ball valves, Whitey Series 40, Hoke Flamite Series 7100, or equal.

C. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks.

D. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent. Indicator readouts shall be linear in process units.

E. Electronic equipment shall utilize printed circuitry suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 100 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

2.02 FIELD INSTRUMENTS

A. Provide the filed instrumentation shown the Special Device Table included on the contract drawings, or as specified herein.

2.03 SPARE AND EXPENDABLES

A. Provide the following spare parts:

1. One spare sensor of each type used.

2. Ten spare fuses of each type and rating installed.

3. One spare surge protection device.

B. Provide the following expendables:

1. One year’s (or shelf life worth if less than one year) supply of buffer and reagents used for analyzers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Control System field instrumentation in strict accordance with the respective manufacturer's instructions and recommendations, in locations as shown on the Drawings, and as indicated on the installation details of the Drawings.

B. Fully Calibrate each instrument.

C. Provide surge protection enclosures to the electrical sub-contractor for mounting and installation. The enclosures shall be fully wired internally. Coordinate grounding requirements with Division 16, Electrical.

3.02 TRAINING

A. Two days of on-site (field) training shall be conducted at the OWNER's plant site and shall provide detailed hands-on instruction to OWNER's personnel covering all supplied field instruments.

B. Training shall include:
   1. calibration procedures.
   2. preventive maintenance methods and timing.
   3. fault-finding techniques.

END OF SECTION

SECTION 13312
I&C CONTROL DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pilot Devices:

   a. Selector switches.
   b. Pushbuttons.
   c. Indicating lights.
   d. Potentiometer.

2. Relays/timers

   a. Control relays
   b. Time delay relays.

3. Pump alternators.

4. Phase failure relays.

5. Signal isolators.

6. Miniature circuit breakers.

1.02 REFERENCES

A. National Electrical Manufactures Association (NEMA)

1. 250, Enclosures for Electrical Equipment (1000 volts Maximum)

2. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts

B. ANSI/NFPA 70 - National Electrical Code (NEC).

C. Underwriters Laboratories, Inc. (UL).

D. Factory Mutual (FM).

E. American National Standards Institute (ANSI).

1.03 SUBMITTALS

A. Conform to Sections regarding submittal procedures.

B. Product Data: Provide manufacturer's product literature and specifications.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (NEC).

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown; install in accordance with UL requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers

1. Subject to compliance with the Contract Documents, the manufactures listed in the applicable articles below are acceptable.

2. Provide similar components from the same manufacturer for uniformity of appearance, operations, and maintenance.

B. Substitutions: Comply with sections regarding substitutions.

2.02 Selector Switches, Pilot Lights, and Pushbuttons

A. Manufactures:

1. Square D Class 9001, Type K

2. Allen Bradley 800T

3. Eaton 10250T

4. Pre-approved equal

B. Construction:

1. NEMA 4X

2. Heavy duty

3. Oil-tight

4. Dust-tight

5. Water-tight

6. 30.5 mm diameter

7. Provide nameplates as required for application or as indicated on drawings.

C. Selector Switches:

1. Position switches

    a. Maintained contact type.

    b. Knob type operator.

    c. Provide position switches as required to perform functions specified or shown in drawings:
        (1) Two-position
        (2) Three-Position
        (3) Four-Position

2. Contact Blocks:

D. Provide contacts as required to perform functions specified or shown in drawings.

    a. Double break.

    b. AC Rating:
        (1) 7,200 VA make
        (2) 720 VA break

E. Pilot Lights

1. LED type

2. Lenses:
    a. Glass type
    b. Color as appropriate for application or as indicated on drawings.
    c. Interchangeable
    d. Push to test
    e. Voltage as required

F. Pushbuttons

1. Flush mounted.

2. Black button color, unless otherwise noted.

3. Contacts

    a. Double break.

    b. Momentary or maintained contacts as appropriate for application or as indicated on drawings.

    c. AC Rating:
        (1) 7,200 VA make
        (2) 720 VA break

G. Potentiometers

1. Linear adjustment through 0-1,000 ohm with 1 percent resolution.
2. Three-wire interface.
3. Dial plate with 0-100 percent scale.
4. One-turn adjustment knob.

2.03 Control Relays

A. Manufacturers:

1. Square D
2. Allen Bradley
3. IDEC
4. Pre-approved equal

B. DIN rail mounted Plug-in socket.

C. Clear polycarbonate dust cover with clip fastener.

D. Internal LED indicator when coil is energized.

E. Check button.

F. Temperature rise:

1. Coil 85 DegF max.
2. Contact 65 DegF max.

G. Insulation resistance: 100 Meg min.

H. Frequency response: 1800 operations/hour.

I. Operating temperature: -20 to +150 DegF.

J. Lift expectancy:

1. Electrical: 500,000 operations or more
2. Mechanical: 50,000,000 operations or more.

K. Four (4) single-pole double-throw contacts rated 10A at 120V.

L. Coil voltage as required.

2.04 Time Delay Relays

A. Manufacturers:

1. ATC
2. Idec
3. Macromatic
4. Eagle Signal Controls
5. Pre-approved equal

B. Melt design test and performance requirements of NEMA ICS 2-218.

C. Heavy-duty.

D. Solid-state construction.

E. External adjustment dial.

F. DIN rail mounted Plug-in socket.

G. Two (2) single-pole double-throw switches rated 5A at 120V.

H. Auxiliary relays as required to perform functions specified or shown in drawings.

I. LED indication during time cycle.

J. Power source voltage as required.

K. Operation Modes:

1. On-Delay Relay
    a. Five (5) time ranges.
    b. .02 seconds to 30 minutes or as required to perform functions specified or shown in drawings.
2. Instantaneous Open, Time Delay Close.
    a. 1.5 seconds to 15 seconds or as required to perform functions specified or shown in drawings.
3. Or operation modes as required to perform functions specified or shown in drawings.

2.05 Elapsed Time Meters

A. Manufacturers:

1. Cramer 635s/Hrs
2. Quartz 722-0004

B. Six (6) digits.

C. Non-resettable.

D. Voltage as required.

2.06 Timers

A. 24 Hour Clock Timer (Repeat Cycle)

1. Manufacturers:
    a. Tork Time Controls
    b. Intermatic
    c. Pre-approved equal
2. Surface mount.
3. 24-hour LCD display.
4. One (1) single-pole double-throw contact rated 20A at 120V.
5. 288 setpoints per 24 hours.
6. 1 to 7-day skip feature.
7. Time cycle programmable by keyboard.

B. Interval/Duration Timer

1. Manufactures:
    a. ATC
    b. Pre-approved equal
2. DIN rail mounted plug-in base with dust tight cover.
3. Time range as indicated on drawings.
4. Two (2) single-pole, double-throw contacts rated 10A at 120V.

2.07 Pressure Switches

A. Manufacturers:

1. Mercoid (No substitutions).

B. Electronic Pressure Switch

C. ¼" male NPT process connection

D. 316L SS

E. 4-20mA Output

F. Pressure Ranges

1. As required for process:

a. 0-20 psig EDAW-N1-E1-02-T1

b. 0-60 psig EDAW-N1-E1-03-T1

c. 0-100 psig EDAW-N1-E1-04-T1

2.08 Exterior Mounted Flashing Beacon

A. Manufactures:

1. Edwards Model No. 48XBRMR120A

2. Or Equal

B. NEMA 4X

C. Red Polycarbonate Lens

D. -31 to +150 DegF Operating Range

2.09 Alternators

A. Provide the following types of alternators to perform functions specified or shown in drawings:

1. Two (2) Pump Lead/Lag

a. Alternate two pumps in a lead/ lag sequence.

b. Toggle switch to lock operating sequence.
c. Din rail mounted plug-in base.

d. LED indicating lights.

e. 120VAC.

f. 10A contacts at 120V.

g. Time Mark 2611 or equal.

2. Two (2) Pump Duplexer

a. Toggle switch to lock operating sequence.

b. DIN rail mounted plug-in base.

c. LED indicating lights.

d. 120VAC.

e. 10A contacts at 240V.

f. Diversified Electronics ARA-120-ABA

3. Three (3) Pump Triplexor

a. Selector switch to lockout pump.

b. DIN rail mounted plug-in base.

c. LED indicating lights.

d. 120VAC.

e. 10A contacts at 240V.

f. Diversified Electronics ARA-120-AHE

2.10 Phase Failure Protection Devices

A. Diversified Electronics Model No. SLD-440-ALE, 480 Volt, three-phase.

B. Diversified Electronics Model No. SLD-220-ALE, 240 Volt, three-phase.

C. Macromatic Model No. PMDU, 208-480 Volt, three-phase.

2.11 Float Switch

A. Manufactures:

1. Siemens 9G

2. Anchor Scientific

3. Pre-approved equal

B. Direct acting switch.

C. Teflon coated 316 SS Float Switch

D. 60’ cable

2.12 Submersible Pump Protection Module

A. As provided by pump vendor.

B. Winding overtemp alarm, indication, and protection.

C. Seal leak alarm, indication, and protection.

D. Manual reset pushbutton.

END OF SECTION

SECTION 13315
I&C CONTROL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: SYSTEM SUPPLIER Control Panels and Motor Controllers for use on AC circuits rated 600 V or less.

1.02 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. ANSI/NFPA 70 - National Electrical Code (NEC).

C. Underwriters Laboratories, Inc. (UL).

D. Factory Mutual (FM).

E. American National Standards Institute (ANSI).

1.03 SUBMITTALS

A. Conform to Section 01300 - Submittal Procedures.

B. Product Data: Provide manufacturer's product literature and specifications.

C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

D. CPT Sizing Information: Provide Manufacturer's 120V load analysis as required in Section 2.06.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70 (NEC).

B. Furnish products listed and classified by Underwriters Laboratories, Inc., as suitable for purpose specified and shown; install in accordance with UL requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers

1. Hennessey Products, Inc.

2. Hoffman Engineering.

3. The EMF Company.

4. Weigman Company.

5. N.E.M.A. Enclosure Mfg. Co.

B. Substitutions: Comply with Section 01630 - Product Substitutions and Procedures.

2.02 PANEL MATERIALS

A. All outdoor enclosures are to be stainless steel rated NEMA 4X or NEMA 3R as indicated on plans.

B. All indoor enclosures in non-air conditioned spaces are to be stainless steel rated NEMA 4X or NEMA 3R as indicated on plans.

C. All indoor enclosures in air conditioned spaces are to be painted steel rated NEMA 1 or NEMA 12.

D. Backpanel for mounting components is to be 12 gauge steel minimum finished in white enamel.

E. Power Supplies.

1. Uninterruptible power supplies (UPS) or battery backup system shall be provided in all SCADA monitoring and control panels as follows:
   a. Size the supplies for all internal equipment plus an additional 20% spare capacity.
   b. Provide 60 minutes battery back-up capability at full load.
   c. Provide relay option card for indication of “On UPS Power” and “Low Battery Level”.
   d. For outdoor panels provide an UPS and battery rated for operation at up to 50 degrees C.
   e. Provide manufacturer’s hot-swappable maintenance bypass switch.

2. Provide isolated DC power for field transmitters and devices as specified and/or shown in the Contract Drawings.

F. Wiring:

1. Power wiring shall be 300 volt, type THWN stranded copper, No. 14 AWG size, for 120V service.

2. Discrete wiring shall be 300-volt type THWN stranded copper, sized for the current carried, but not smaller than No. 16 AWG.

3. Analog signal wiring shall be 300 volt, stranded copper in twisted shield pairs, no smaller than No. 18 AWG.

4. Panel wiring shall be routed within wire troughs or panduits.

5. Hinge wiring shall be secured at each end with the bend portion protected by a plastic sleeve.

6. Analog or dc wiring shall be separated from any ac power or control wiring by at least six inches.

7. Each wire shall be uniquely identified using plastic, snap-on or permanent adhesive wrap-on numbered tags.

8. Terminal blocks shall be provided for all field wiring entering the panel. Surge suppression shall be provided for all outdoor field wiring entering or leaving the panel. Five (5) spare terminal blocks shall be provided.

9. No more than one wire per screw and yoke termination.

G. Doors:

1. All control panels shall have a hinged door for ease of access. A minimum of 80% of the panel interior shall be exposed by doors.

2. Panel door openings shall be sealed and fully gasketed.

3. The inside of each door shall be equipped with a print pocket.

4. Two-door enclosures shall have a removable center post.

5. Sealed panel doors shall be equipped with quick-release latches

H. Miscellaneous Equipment:

1. All panels shall be protected from internal corrosion by the use of corrosion – inhibiting vapor capsules, Northern Instruments Model Zerust VC, Hoffman, model A-HCI, or equal.

2. All sealed panels shall be equipped with combination drain/breathers, Crouse-Hinds model ECD18; or equal.

3. When noted on drawings, panels shall be equipped with thermostatically controlled space heaters to maintain internal temperatures above dew point.

2.03 MOTOR PROTECTION

A. Motors Powered and Controlled by SYSTEM SUPPLIER'S Control Panel.

1. Motor disconnects shall be MCP type circuit breakers.

2. All three phase motors controlled by the SYSTEM SUPPLIER'S Control Panel shall have phase failure protection via phase failure monitoring relay or solid state overloads that feature phase failure protection.

3. For motors of 75HP or greater, include an adjustable cool down timer to prevent

exceeding motor manufacturer's recommended starts per hour limit.

B. Motors Powered by Others and Controlled by SYSTEM SUPPLIER'S Control Panel.

1. A phase failure contact (open on fail) will be provided by others for use by the SYSTEM SUPPLIER'S Control Panel.

2. For motors of 75HP or greater, include an adjustable cool down timer to prevent exceeding motor manufacturer's recommended starts per hour limit.

2.04 PLANT MAINS AND GENERATOR PROTECTION

A. All individual motors or other loads powered by the SYSTEM SUPPLIER'S Control Panel or powered by others but controlled by the SYSTEM SUPPLIER'S Control Panel of 15 HP or greater shall have adjustable power on time delays of up to three minutes. Timer adjustments are to be coordinated with other plant loads to avoid simultaneous starts of multiple loads affecting feeders, mains, and generators.

2.05 DESIGN FOR CONTINUOUS OPERATION

A. Excluding specifically intended batch operation panels, all control panels shall be configured to remain operable after short duration power failures using HAND-OFF-AUTO switches or RUN/STOP maintained toggle switches. START/STOP pushbuttons, PLC, or other control functions that interrupt continuous operations for non-batch applications and require operator action to reactivate panel processes require submittal and prior approval.

2.06 CONTROL POWER TRANSFORMER (CPT) SIZING

A. SYSTEM SUPPLIER is to submit a CPT sizing load analysis as part of product submittals. CPT size should include all loads indicated on the plans and all supplied loads required as part of this specification plus an additional 50%.

2.07 DEAD FRONT OPERABILITY

A. Panel construction shall result in dead front operability for all operator functions. If normal operator functions require opening of the panel door, the panel shall be equipped with a 3-point latch and the operator shall remain shielded from any live exposed components.

2.08 CONTROLS DOCUMENTATION

A. Control diagrams submitted under Section 1.03 shall be electrically complete and encompass all control components and their location. This shall include phase failure relays, RUN/STOP switches, SCADA contacts, emergency STOP push buttons, permissive switches, and other components that may be remote to the SYSTEM SUPPLIER'S Control Panel. Operating entity will have a single document for troubleshooting specific equipment items. Failure to comply with this Section will result in rejection of SYSTEM SUPPLIER'S Control Panel.

2.09 OTHER FEATURES

A. Space Heaters: Provide minimum 150 watt strip-type space heaters with an individual thermostat in each section. Use heaters rated for 240V, producing the required wattage when operated at 120V.

B. All panel indicators are to push-to-test type LED.

C. Circuit breakers and starters are to be NEMA rated.

D. Panel layout shall facilitate bottom entry of all conduits utilizing myers hubs.

E. Panels larger than 24” X 24” shall include a troubleshooting light, LED, 400 lumen minimum.

F. For customer control connections, provide a separate 30A terminal block. Contacts closures intended for alarm, autodialer, or PLC use shall be rated 5A minimum. Contacts that carry control currents used for starter coils shall be rated 10A minimum.

G. Panel shall be equipped with integral surge protection for incoming 480V power. Panels that use telephone lines shall include telephone surge protection.

H. Panel internal wiring shall not be smaller than #14 AWG for all 120V circuitry and #12 AWG for all 240V and 480V circuitry.

I. Maintain NEC required minimum spacing for intrinsically safe circuits. Label intrinsically safe circuits.

J. Supplied display screens, TFT panels, HMI panels, touch screens, LCD screens, or any operator interface panels shall be full sunlight viewable utilizing “Actively Enhanced Bright Active Matrix TFT Display” or similar technology. Minimum brightness in candelas per square meter (Cd/M2) or nits shall be 1000 for displays of 17” and below. Contrast ratio as measured in full sunlight shall be greater than 5:1. Shields, covers, shades, and screens are not allowed for achieving this contrast. Display screens shall be CrystalVue, VBond, StealthVU, High-Bright, Vartech Systems, Panel Bright or equal manufacturer or technology capable of achieving required full sunlight viewing. All display panels shall be NEMA 4/4X rated minimum.

PART 3 EXECUTION

3.01 INSTALLATION

A. Transport, handle and install products in accordance with manufacturer's instructions.

B. All panel mounting hardware shall be stainless steel.

C. Free standing panels shall be mounted with four corner stainless steel anchors minimum.

D. Field mounted panels shall include an equipment pad with 3’ minimum front operator area clear of obstructions. Maintain NEC required clear front (or rear if applicable) working space free from obstructions or grounded components.

E. Ground in accordance with Section 16170 - Grounding and Bonding.

F. Label all wires with heat shrink markers per Section 16195.

END OF SECTION

SECTION 13320
I&C - HMI HARDWARE & SOFTWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Control System HMI hardware and software requirements.

B. The Work specified herein shall be performed by the same SYSTEM SUPPLIER as that defined in Specification Section 13300.

1.02 RELATED WORK

A. Specification Section 13300: General Requirements

B. Specification Section 13325: System Programming.

C. Division 16 - Electrical. All conduits are provided and installed under Division 16, Electrical. With the exception of certain specified special manufacturer's cables, all wiring and cables are provided and installed under Division 16, Electrical.

1.03 SUBMITTALS

A. Conform to Section 01300 - Submittal Procedures.

B. Product Data: Provide manufacturer's product literature and specifications.

C. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

D. Descriptive literature covering the HMI application software and its capabilities.

E. Identification of any features that are optional additions beyond those provided by the base package

F. Licensing costs and break-points for additional users, including all options.

PART 2 PRODUCTS

2.01 TECHNOLOGY OBSOLESCENCE MITIGATION

A. Due to rapidly evolving technology of the equipment specified herein, the requirements specified are to establish a baseline for the type of equipment required. Provide the latest hardware and software of similar specification at the time of purchase equivalent in cost to that which is specified. The procedure for submitting and releasing the equipment shall be as follows:

1. SYSTSEM SUPPLIER shall submit for approval the required data for the

equipment as part of the Hardware submittal.

2. Equipment shall be ordered as late as possible dependent on the construction schedule to ensure the latest equipment available is provided. Just prior to ordering, resubmit for approval the required data of the latest available hardware and software equivalent in cost to that which is specified. No equipment shall be ordered more than 3 months prior to when it is needed to be continuously used on the project, unless it is determined to impede the construction schedule.

2.02 OPERATOR INTEREFACE - DESKTOP PC

A. General

1. Desktop PC HMI server installed at City Yard Administration Building.

2. Operator interfaces shall be compatible with programmable logic controllers specified.

3. PLC shall be designated “Master”. Other network connected components such as an autodialer shall monitor data registers, PLC addresses, or I/O points for the purpose of providing alarm or monitoring functions only but shall not be allowed to alter data registers, PLC addresses, I/O points, or PLC program in any way.

4. Provide an operator interface unit in administration building that will allow operator to view and change all set points

B. CPU

1. Intel Core i5 (latest generation)

C. RAM

1. 8GB or Greater

D. Storage

1. 1TB HDD or SSD

E. Operating System

1. Windows 10 Pro 64 bit

F. Displays

1. Dual 24” LED Monitors

2. 1024x768 resolution

3. 50,000 Backlight Lifetime Hours

G. Electrical

1. 9-36 VDC

H. Ratings

1. Operating Temperature 32°F-113°F

2. Certification CE/ FCC Class A/ RoHS

I. Acceptable Manufacturers

1. Dell Optiplex XE3

2.03 TOUCHSCREEN INTEREFACE - PANEL PC

A. General

1. Touchscreen Panel PC installed at Airport EST.

2. Operator interfaces shall be compatible with programmable logic controllers specified.

3. PLC shall be designated “Master”. Other network connected components such as an autodialer shall monitor data registers, PLC addresses, or I/O points for the purpose of providing alarm or monitoring functions only but shall not be allowed to alter data registers, PLC addresses, I/O points, or PLC program in any way.

4. Provide an operator interface unit in face of auto-sensory panel that will allow operator to view and change all set points.

B. CPU

1. Intel Core i5

C. RAM

1. 8GB or Greater

D. Storage

1. 1TB HDD or SSD

E. Operating System

1. Microsoft Windows 10 Pro 64bit

F. Display

1. 15” TFT-LCD

2. 1024x768 resolution

3. 50,000 Backlight Lifetime Hours

4. Touch Screen: 5 wire resistive

G. Electrical

1. 9-36 VDC

H. Ratings

1. IP65 Front Panel/ NEMA 4X
2. VESA 100 x 100
3. Fanless design
4. Operating Temperature 32°F-113°F
5. Certification CE/ FCC Class A/ RoHS

I. Acceptable Manufacturers

1. Maple Systems PC2315A
2. Phoenix Contact VL2-PPC-7000
3. Advantech PPC-3151

2.04 SOFTWARE

A. General

1. SCADA software shall be commercially available off-the shelf and shall be non-proprietary.
2. Software shall be a Client/Server architecture. No Microsoft Client Access Licenses (CAL) shall be required for full installation (thick) or browser-based (thin) clients. Terminal Services shall not be required.
3. Software shall be compatible with commercially available, off-the shelf PC hardware running 32 and 64 bit Microsoft Windows client and server operating systems currently available at the time of installation.
4. Software shall not require dedicated server-level PC hardware for any individual system components.
5. Software shall support an automatic, orderly shutdown when switching to UPS backup power and power levels drop to a predefined setpoint. Software shall support automatically restart to full operation without user intervention.
6. Software shall provide a mechanism to backup and restore the entire application configuration.

7. Integrated software help manuals shall be provided to assist operators and maintenance personnel with operational and configuration tasks.

B. Historian

1. Software shall include an integrated, no-cost historian and historical database, but also be capable of using a 3rd party database such as Oracle, SQL or MySQL.

2. The historian and its historical data storage shall not require dedicated server computers.

3. Historian shall be capable of logging up to 4,000 values per second.

C. Trending

1. Software shall support preconfigured plots of real-time and historical data as integrated elements of graphical process displays.

2. Software shall allow users to generate ad-hoc plots of historical data by clicking on each of the values to be trended. Selected groups shall be recordable for future recall.

3. Software shall display historical and real-time data in both plot and tabular format. Historical and real-time plotted values shall be shown in a continuous, uninterrupted, scrolling fashion,

D. Drivers

1. Software shall support an unlimited number of field devices and different I/O drivers in the same application.

2. Software shall include I/O drivers for a variety of devices and protocols such as:

   a. Protocols - Modbus, DF1, Ethernet/IP (CIP), DNP3, Hostlink, FINS, BSAP, SNMP Client.

   b. Manufacturers - Rockwell/Allen Bradley, Schneider (Bristol Babcock, Control Microsystems), Siemens, GE, Omron.

   c. Other - DDE Client, OPC Client to support OPC Servers from 3rd party software providers.

3. Software shall support the development of additional I/O drivers where necessary.

4. Software shall support multiple communications protocols over a single communications port.

5. Software shall provide tools for polling telemetry devices (e.g. RTUs) directly. Software shall allow real-time tuning of each device's polling frequency without interrupting the polling cycle or restarting the application. To optimize I/O communications for telemetry applications, the polling order shall be configurable

and polling shall be asynchronous (if permitted by the remote telemetry unit.)

6. Software shall support writing to multiple output tags via a single write request. This shall allow writing a set of default values to a set group of field device registers.

7. Tools shall include methods for monitoring communication statistics and reporting errors for each I/O driver. Software shall support radio diagnostics monitoring for radio modems (e.g. Dataradio/Calamp, MDS.)

E. Security

1. Software shall include a security system with privilege and role based user accounts. Level-based access shall not be acceptable.

2. Security system shall support an unlimited number of user accounts, roles, and access privileges. System shall allow creation of an unlimited number of additional security privileges where necessary.

3. User passwords must be configurable to require a minimum length, contain alphanumeric characters, and expire after a pre-set period. User passwords shall be stored in an encrypted format.

4. System shall allow changes to user accounts, roles and privileges while the application is running. Changes shall become effective immediately.

5. User login and logout activity shall be recorded in the application event log. Disabling accounts after X failed attempts shall be supported.

6. System shall provide a mechanism to limit client access to specific IP addresses.

F. Tag Count

1. Minimum Tag Count 4,000

G. Licenses

1. Provide one development license for each project

2. Provide one full runtime license for each interface, computer, or display installed at the following locations:

a. City Yard Desk PC

b. Airport EST Panel PC

3. Provide a minimum of three (3) thin client or mobile access client licenses.

H. Acceptable Manufacturers:

1. VTScada

2. Or pre-approved equal

PART 3 EXECUTION

3.01 GENERAL

A. Refer to Section 13300

END OF SECTION

SECTION 13321
I&C PLC HARDWARE

PART 1 GENERAL

A. Description of System:

1. Section describes programmable control and monitoring for specific processes specified in other sections.

2. Provide enclosures to enclose power supplies, processor/memory card, and I/O cards.

3. PLC Hardware, as specified herein, shall be furnished by the same SYSTEM SUPPLIER furnishing services and equipment as outlined in 13300.

1.02 SYSTEM DESCRIPTION

A. Design Requirements.

1. Design to meet following minimum criteria:

a. NEMA ICS 2-230 arc test.

b. ANSI C37.90A 1974 Surge withstand capability.

c. NEMA ICS 3-304-42.

d. Section 2 of IEEE 472-1974.

1.03 SUBMITTALS

A. Submit all products covered under this specification to Engineer for approval.

1.04 RELATED WORK

A. Specification Section 13300 defines work associated with the overall Control System

B. Specification Section 13315 defines work associated with control panels and enclosures housing the various elements of the Control System

C. Specification Section 13320 defines work associated with the HMI system that will interface the system with the PLC Hardware defined hereunder.

D. Physical Installation of field instruments is performed per manufacturer's recommendations.

E. Provision of all field and power wiring, except manufacturer-supplied cables, and installation of all wiring is performed under Division 16, Electrical.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric – SCADApack32

B. Siemens – S7-1200

C. Allen Bradley – MicroLogix 1400

2.02 GENERAL

A. System(s) shall consist of following.

1. Processor with memory.

2. I/O hardware.

3. Power supplies.

4. Operator interface.

5. Cables necessary for compliance with specification.

2.03 PROCESSOR WITH MEMORY

A. Total minimum I/O interface capability as specified and shown on Drawings.

B. Program execution of time of less than 20 ms/k.

C. Expandable.

D. Accept digital and analog input signals.

E. Control digital and analog output devices.

F. Continuously monitor signal status of input and output devices.

G. Provide with necessary mounting hardware and interconnecting cable.

H. Circuit cards shall be capable of following.

1. Operating in temperatures of 0C to 55C.

2. Operating in humidity of 0% to 95%, noncondensing.

3. Easy replacement.

I. Utilize 120 vac, 60 Hz power.

J. Provide circuitry to communicate between processor, I/O hardware, and programming terminal.

K. Size memory with minimum reserve capacity of 30%.

L. Internal diagnostics shall be available to user for troubleshooting.

M. PLC shall halt if any of following occur.

1. Memory parity error.

2. Communications error between CPU AND I/O.

3. Loss of logic power to any part of the system.

4. Halt or interruption of the memory scan.

5. Detection of incomplete ladder rung in memory.

N. Processor shall have battery backup to prevent program loss on power failure.

O. PLC Features:

1. Symbols to resemble conventional relay logic symbols.

2. Functions:

a. Contact/coil status.
b. Latching/unlatch.
c. Force I/O.
d. Data transfer.
e. Four function math.
f. Counting.
g. Timing.
h. Self-monitoring diagnostics.
i. Shift registers.
j. Transitional coils.
k. Master control relay.

2.04 POWER SUPPLIES

A. 120 vac, 60 Hz power input.

B. Integral PI filter.

C. On-Off circuit breaker or finger-safe fused disconnect.

D. 0.2% load regulation.

E. Short circuit current limit protection.

F. Crowbar overvoltage protection.

G. 4 hour un-interruptible Power Supply.

2.05 I/O HARDWARE

A. General:

1. Shield against electrical noise and RF.

2. Provide optical isolation to give 1,500 vdc isolation from wiring on other I/O modules.

3. Provide with field wiring arm terminal strips.

B. Analog Input Modules:

1. Accept 1-5 vdc, 4-20 ma, 05 vdc, 10 vdc, 5 vdc, 10 vdc analog signals.

2. Analog conversion resolution of 12 bits.

C. Analog Output Modules:

1. Output of 4-20 mAdc, 05 vdc, 10 vdc, 5 vdc, 10 vdc available.

2. Analog conversion resolution of 12 bits.

3. Output isolation available.

D. Discrete Input Modules:

1. Monitor contact openings and closures from external devices.

2. Isolated 120 vac type.

3. LED lights for each input to indicate status.

E. Discrete Output Modules:

1. Provide contact openings and closures to external devices.

2. Each output fused with blown fuse indicator light.

3. Each output to have indicator light to show output status.

4. Isolated output, 120 vac.

F. Spares:
   1. At minimum, the Contractor shall provide the spare parts under this contract as follows:
      a. Power Supply: Provide spare power supply for each model installed.
      b. Memory Cards: Provide spares for each type of card installed.
      c. I/O Cards: Provide spares for each unique I/O module type installed. Provide two or 10 percent of installed quantity, whichever is greater.
      d. Network interface and communication modules: Provide one spare communication module for each unique communication module installed.
   2. All parts to be in original protective packages and stored on site after acceptance by Engineer.

2.06 PLC SOFTWARE PACKAGES:

A. Include necessary hardware and software to perform minimum following function.
   1. Provide capability to program PLC functions on-line and off-line.
   2. Display on-line status of I/O and registers.
   3. Force I/O.
   4. Search any option.
   5. Edit PLC program.
   6. Display comprehensive error code registers.
   7. Direct connect to PLC or network.
   8. Operational security shall be provided via user-defined password.
   9. Capable of producing hard copy printout of ladder logic program.
   10. Provide full annotation including rung comments, I/O, and register labels.
   11. Load and record contents of memory

B. Provide software and any required licenses or serial keys to INTEGRATION ENGINEER immediately after approval of PLC submittal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and wire in accordance with manufacturer's written instructions and approved submittals.

3.02 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Supplier's or manufacturer's representative for equipment specified herein shall be present at job site or classroom designated by Owner for minimum of 1 manday, travel time excluded, for assistance during plant startup, and training of Owner’s personnel for plant operation.

3.03 TRAINING

A. Hardware Maintenance: Provide a minimum of one 8-hour day of hardware training for up to three of the OWNER’s personnel in the maintenance of the PLC hardware which shall include:

1. Training in standard hardware maintenance for the equipment provided.

2. Specific training for the actual hardware configuration to provide a detailed understanding of how the equipment and components are arranged, connected, and set up.

3. Test, adjustment, and calibration procedures.

4. Troubleshooting and diagnosis.

5. Component removal and replacement.

6. Periodic maintenance.

3.04 INPUTS/OUTPUTS (Refer to Drawings)

END OF SECTION

SECTION 13322
I&C – NETWORK & COMMUNICATIONS EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. This Section of the Specifications describes the requirements for Network and Communications Equipment and Systems to be furnished under other Sections of the Specifications as listed in the Related Work paragraph of this Section.

2. The SYSTEM SUPPLIER defined in Specification Section 13300 shall be responsible for coordinating all aspects of the network communications system.

3. It is the ultimate responsibility of the Contractor to furnish a complete and fully operable system that supports the required functions specified elsewhere. The Contractor is to assume full responsibility for additional costs which may result from unauthorized deviations from the specifications.

4. Equipment found to be defective prior to system acceptance shall be replaced and installed at no additional cost to the OWNER.

1.01 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other Sections. Individual submittals for equipment specified herein will not be accepted and will be returned un-reviewed.

B. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the equipment provides every specified requirement. Any options or exceptions shall be clearly indicated.

C. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

D. Provide all shop drawing submittals on thumb drive in PDF format.

E. Product Data:

1. Manufacturer & Model information

2. Dimensions, ratings, and data on features and components

3. Equipment Brochure

4. Accessories

PART 2 PRODUCTS

2.01 PANEL MOUNTED INDUSTRIAL ETHERNET SWITCH

A. General

1. Provide an industrial managed Ethernet switch for connection to the control network backbone as shown in the Drawings and specified herein.

B. Physical Features

1. Minimum copper ports: 8 x 10/100/1000 TX RJ45 ports.

2. Operating temperature: -40 to 75 °C.

3. Smart Switch with Modbus TCP Communication.

4. Enclosure: Metal case, DIN-rail mountable.

C. Network Features:

1. Fault tolerant for use in a ring topology if shown on drawings. The switch shall be able to detect a blocked port and redirect data flow in the opposite direction within 30ms.

2. The switch shall come equipped with a dry contact rated for 120 VAC 5A that shall be used for common trouble alarm. The alarm shall be programmable. If the contact cannot use 120 VAC 5A, provide the necessary 24 VDC power from the PLC panel and provide interposing relays in the PLC panel.

D. Manufacturers

1. MOXA SDS-3008-T

2. Or Approved Equal

2.02 ETHERNET COMMUNICATION CABLES

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Ubiquiti

2. Belden

B. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

C. Cables for Ethernet installed Outdoors: Category 5e Above Grade Cable installed:

1. Conductors: 4 bonded pair 24 AWG Bare Copper

2. 26 AWG integrated ESD drain wire.

3. PE outdoor-rated, weatherproof jacket

4. Multi-layered shielding

5. Anti-crosstalk divider

6. Transmission Standards: ANSI/TIA568C

7. Model: Ubiquiti TOUGHCable CARRIER Model TC-CARRIER with TOUGHCable Connectors

D. Cables for Ethernet installed indoors or inside panels: Category 6 Above Grade Cable: Sunlight and Oil Resistant U/UTP

1. Cable, non-plenum.

2. Conductors: 4 bonded pair 23 AWG Bare Copper

3. Insulation: Polyolefin

4. Overall Cabling Separator Material of Foamed Polyolefin Tape

5. Jacket: PVC with 300 volt rated Color of jacket to match as follows:

6. Green – Phone / Data

7. Red – FIRE Alarm

8. Blue – SCADA

9. Transmission Standards: Category 6 - TIA 568.C.2

10. Nominal Velocity of Propagation: 72 %

11. Flame Test Method: UL1666 Vertical Riser

12. Model: Belden 7953A

2.03 ETHERNET SURGE PROTECTOR

A. Subject to compliance with the contract documents, the following manufacturers are acceptable:

1. Ubiquiti ETH-SP-G2 (For use with all Ubiquiti installed products, install at panels and at radios)

2. Phoenix Contact

3. PolyPhaser

4. Cooper Bussman

B. Environmental

1. Operating temperature: -40 degrees F to 176 degrees F

2. Operating humidity: 95% non-condensing for indoor applications

3. Storage Temperature: -40 to 176 degrees F

C. Physical

1. DIN Rail Mountable indoors and pole mountable outdoors applications

2. I/O connectors: RJ-45

3. Power over Ethernet POE+ to IEEE802.3 at up to 57VDC

D. Functional Performance

1. Protection: handles 100 or more lightning strikes at surge levels of 8/20uSec at 6kV/3kA

2. Standard: Compliant to IEC61000-4-5

2.04 CELLULAR ROUTER

A. Cellular Router shall be high performance mobile 3G/4G-LTE, with all related power supplies, cabling, mounting devices, adapters, Wi-Fi antenna, and documentation. Provide and install according to Manufacturer's instructions, per Plans and Specifications, and to fit space in control cabinets.

B. Provide and install one Verizon capable 3G/4G-LTE USB modem or SIM card for each router supplied. Provide model as recommended by manufacturer for best results at time of deployment.

C. Provide and install 3G/4G Cellular Amplifier to boost signal reception as required. Include all required appurtenances for a complete operating system.

D. Provide outdoor rated antennas with length of cable required for connection to router or cards with antenna located in outdoor location shown on Plans, or for optimum signal reception at site. Antenna cables to be complete with SMA connector, or as required by devices supplied. Wrap all outdoor antenna and cable connectors with 3M weatherproof tape. Antenna shall have swivel base for adjustment of antenna. Multiband cellular antennas shall be rated 2 dbm or better, as required for optimum signal strength.

E. Router Characteristics

1. Open Upgradable Architecture: High Speed 3G/4G Modem Slot with Modem-Lock and External Antenna Ports.

2. Supports LTE, HSPA+ EV-DO Rev-A, EV-DO Rev-0, 1xRTT, HSUPA, HSDPA, UMTS, EDGE, GPRS USB Modems

3. IPsec VPN (up to 100 concurrent sessions or 5 concurrent sessions as specified on plans) and GRE Tunneling option, also support pass through VPN connections (IPsec, L2TP, PPTP) Automatic Fail-Over Between 3G/4G Cellular and Ethernet WAN

4. Web Interface and SMNP

5. (IPsec) Tunnel, NAT-T, and transport modes; connect to CradlePoint, Cisco/Linksys, CheckPoint, Watchguard, Juniper, SonicWall, Adtran, etc.; certificate support; Hash (MD5, SHA128, SHA256, SHA384, SHA512), Cipher (AES, 3DES, DES), support for 5 concurrent connections, GRE tunneling, multiple networks supported in a single tunnel, site-to-site dynamic VPN with NHRP, L2TP,

F. ACCESSORIES

1. 3G/4G Verizon Wireless Cellular Antenna – Laird TRA6927M3PB-001 unless otherwise specified on plans.

2. Waveform MIMO Log Periodic LTE/5G Dual 11 dBi Yagi Antennas (At locations specified on plans)

3. Wilson weBOOST signal 4G booster kit #460119 unless otherwise specified on plans.

4. Verizon 4G in-line Signal Amplifier Cel-Fi GO X 100dB Gain (At locations specified on plans)

5. MSNSwitch Remote power cycle device Model #UIS522b (All sites with cellular modems)

G. MANUFACTURERS

1. CradlePoint AER4250 with integrated 3G/4G Modem and VPN Concentrator with 5-Year Netcloud Essentials subscription (City Yard Site)

2. CradlePoint IBR600C with integrated 3G/4G Modem and no Wifi (Locations as shown on plans)

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions, Contract Documents, and approved submittals.

B. Sim Cards for each Cellular router shall be purchase and activated by Owner. Contractor shall provide written notification to owner and engineer 4 weeks prior to installation of

cell routers for installation coordination. Any delay in construction due to failure of providing written notice is at Contractor's risk.

END OF SECTION

SECTION 13325
I&C SYSTEM PROGRAMMING

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. This section defines requirements associated with programming the Control System, PLC, HMI and other application software.

2. Program and application development of the PLC and HMI shall be performed by Baird Gilroy & Dixon LLC's INTEGRATION ENGINEER. Contractor shall include programming allowances as indicated on Bid Tabulation.

1.01 SUBMITTALS

A. The INTEGRATION ENGINEER shall supply the CONTRACTOR a written instruction manual to be included with the O&M Manual for the project

B. Software Version and Revision Control: Once development begins all software versions shall be confirmed with the OWNER to ensure compatibility in deployment, including operating system, database, and application versions.

C. A final documentation package that includes:

1. Licenses in the OWNER's name for all software supplied

2. Final copies of all programming files on Compact Disk

3. A complete printout of all PLC program logic.

4. A complete Printout of device configuration settings, including but not limited to

a. Soft Starts

b. ATS

c. Multilin (motor protection relays)

d. Ethernet Switch

e. Cellular Router

f. Radio Modem

PART 2 PRODUCTS – (NOT USED)

PART 3 EXECUTION

3.01 GRAPHICAL STANDARDS

A. All operator graphic screens shall include an alarm list at the bottom indicating the most recent alarms colored as defined below under color standards and, at the top, tabs to allow the user to switch to key graphics including the process overview and the alarm list.

B. All graphic screens shall, as closely as possible, depict the actual process equipment in three dimensional symbols with fill color depicting current status in accordance with the graphic standards defined below.

C. For detailed process graphics where the process is continued on or continued from another graphic, software pushbuttons shall be provided to lead to the appropriate other graphic.

D. The following colors shall be used:

1. Dark Grey – Screen background.

2. Light Grey – Piping.

3. White - Chemical injection points.

4. Bright Green – Running equipment or open valve. Modulating valves shall have the current percentage open in text adjacent to the symbol.

5. Bright Green Flashing – Equipment starting or valve opening or Equipment stopping or valve closing

6. Red– Equipment with an acknowledged, but not yet cleared alarm.

7. Red Flashing – Equipment with an unacknowledged alarm

E. For all level signals:

1. Color fill the symbol for the tank or vessel proportionally to indicate the amount contained.

2. Indicate in text the volume contained.

F. Equipment Status. Color the symbol for each piece of equipment to reflect its current status (e.g. running, stopped, failed, etc.) in accordance with the graphic standards.

G. Equipment Control Status. Adjacent to each piece of equipment indicate its control status, where such is available, as follows:

H. Local Hardware Hand/Off/Auto switch position in context sensitive text: Hand, Off , Auto.

I. Process Graphic Detail Screens. Where necessary to give complete details of a specific process area, provide an additional screen that is accessible by clicking the equipment symbol on the Process Overview screen.

J. Alarm Log. Provide a log of all alarms issued by the system. The log shall include the date and time of detection. Provide the operator with the ability to sort the displayed log by any combination of the following:

1. Specific equipment.

2. Alarm description

3. Date and time. (occurrence, Acknowledgement, and return to normal)

K. Event Log. Provide a log of all events issued by the system. The log shall include all alarms, operator control commands and set point changes, alarm acknowledgements and return to normal occurrences following an alarm condition. The date and time of occurrences shall be included together with, where applicable, the identity of the operator. Provide the operator with the ability to sort the displayed log by any combination of the following:

1. Operator.

2. Specific equipment.

3. Event description.

4. Date and time.

3.02 General Features

A. Ease of operation. Fine tuning and adjustment of all operational setpoints.

B. Lead/Lag booster pump control and alternation.

C. Automated reports to reduced operator man-hours spent hand recording information for TCEQ reports.

D. 24hr pump run-time report at 12:00am (time is user adjustable).

E. Well pump production report.

F. Total system production report.

G. Alarm reports on demand.

H. Any parameter monitored via SCADA can be added to a customized report upon request.

I. Preventative maintenance based on pump runtimes or other operating parameters.

J. Detailed record and trending of facilities operations to help troubleshoot unexpected failures.

K. Trending data available for review and analysis to help optimize pumping operations.

L. Secure remote access to allow for detailed look at alarms.

M. Store PDFs and electronic records of As-Builts, operational procedures, and reports on HMI. Access manuals and As-Builts within the SCADA screens.

N. Electronic alarm notification (SMS/email) for alarms.

O. Provide overview screen to monitor entire facility single screen.

P. Power consumption and pump efficiencies with integration to power monitors and Multilin devices.

Q. Open source programming – the City owns the program and has complete control over it. Any integrator or programmer can modify or troubleshoot existing programs with the owner's login credentials.

3.03 General Program Functions and Requirements

A. The following general conditions will apply to all equipment and devices controlled or monitored by the SCADA system.

1. All I/O points monitored by the SCADA system will be recorded and trended at a pre-defined intervals on the Historian Server. Critical points such as levels and pressures used for state agency reports will be recorded indefinitely, while non-critical points will only be recorded for 3-6 months unless otherwise requested.

2. Equipment & Device Status

a. The On/Off status of all equipment and devices monitored by the SCADA system will be displayed on the appropriate HMI screen(s).

3. Elapsed Time Meters on HMI

a. Elapsed time meters will be provided for all equipment with a "Run" status input to the SCADA system.

(1) ETMs for the respective equipment will be displayed on the detailed HMI screens that show the run status of that equipment.

(2) 4 ETM types

(a) Current Runtime

(b) Previous Runtime

(c) Daily Runtime

(d) Overall Runtime

4. Operational Control Modes

a. Manual Operation

Pumps are manually controlled will two modes of operation. The status of the MCC or control panel mounted Hand-Off-Auto (HOA) and Primary-Backup selector switches will determine the mode of operation for the equipment, and the status will be displayed on the HMI.

i. **Local Mode:** When the selector switch is in the Hand or Off positions, the SCADA system will indicate that the pump is in Local mode and unavailable to be controlled by the PLC. The SCADA system cannot control the equipment when it is in local mode.

ii. **Primary Mode - Manual:** when the selector switch is in the Primary position and the HOA in the Auto position, the SCADA system will indicate that the equipment is in Primary mode. While in Primary mode, the user will have the ability to place the equipment in Manual. This allows the user to control the equipment via HMI start and stop push buttons.

iii. All equipment automatically controlled by the SCADA system will have a "Primary Mode – Manual" means of operation as described above. This mode allows the users to override the automatic control and manually operate the equipment from the HMI via onscreen push buttons.

b. Automatic Operation

i. **Primary Mode - Automatic:** when the selector switch is in the Primary position and the HOA in the Auto position, the SCADA system will indicate that the pump is in Primary mode. While in Primary mode, the user will have the ability to place the equipment in Automatic. This allows for the PLC to control the equipment automatically based on the process variables and operator setpoints.

ii. **Backup Mode - Automatic:** When the selector switch is in the Backup position and the HOA is in the auto position, the SCADA system will indicate that pump control is in the backup mode. While in Backup mode, the SCADA system cannot control the equipment. All parameters will still be monitored and recorded while in backup mode by the SCADA system.

5. All HMI setpoints will be password protected.

6. All HMI control push buttons will be password protected. Menu and screen navigation buttons do not require passwords.

7. Flow Rate Totalizer

a. Each instantaneous flow rate signal will include a totalized value in the PLC program.

b. The daily totalized flow will be recorded on the Historian Server.

c. When a valve or pump is closed or stopped, the totalizer will stop accumulating.

3.04 Warnings and Alarms

A. The PLC will be responsible for generating system warnings and alarms based on the status and measurements received from the input point to the system. Warnings and alarms can also be considered as non-critical and critical alarms respectively. Warnings will notify the operator that a condition or an event has occurred that is not normal. Warnings provide notifications to the operator only and do not affect the overall process control of a facility, whereas an alarm is an indication of a system parameter that might no longer be safe to operate. As such, the PLC will return the equipment to the designated safe state in order to prevent damage or reduce the risk of a dangerous condition.

1. System Alarms

a. All system alarms will be displayed and recorded on the HMI. The Alarm tag name along with a plain English description will be provided. The SCADA system will have two types of alarm classifications: System Warnings and System Alarms

(1) **System Warnings:** Non-Critical alarms that do not affect or stop a process or equipment operation.

(2) **System Alarms:** Critical alarms that stop or inhibit equipment operation.

b. System Warnings and Alarms will be displayed in the alarm window on the HMI screens. The type of alarm will be clearly displayed next to the alarm message. For example, “High Current Alarm” may shut down a pump where “High Current Warning” allows the pump to continue to operate but notifies the operator of the abnormal condition.

c. All alarms will include operator adjustable time delays such that momentarily input “flickers” caused by electrical disturbances do not cause false or “ghost” alarms. Alarms must be active for the duration of the time delay prior to displaying on the HMI and notifying the operator.

2. Analog Inputs

a. The PLC program will contain a user adjustable alarm setpoint for the following conditions:

(1) Extra Low

(2) Low

(3) High

(4) Extra High

(5) Signal Loss

b. Signal-Loss alarms will be an indication that the analog 4-20mA signal is either under-range or over-range.

c. Analog inputs shall have an adjustable max scaling setpoint via the HMI.

d. Typical Analog Alarms might include the following:

(1) GST Level

(2) System Pressure

(3) Well Flow

(4) System Voltage/Current

(5) Motor Voltage/Current

3. Fail to Respond Alarm

a. All pumps, valves, and other equipment controlled by the PLC will generate a “Fail to Respond” Alarm when the device is called to operate and the feedback state is not received by the PLC within the preset time delay.

b. Where the device stops operating prior to the PLC releasing the call command, the “Fail to Respond” Alarm will be generated.

c. An active “Fail to Respond” Alarm will prevent that device from being called by the PLC until the alarm has been acknowledged and reset at the HMI.

d. Typical Alarms might include the following:

(1) Booster Pump Fail to Respond

(2) Well Pump Fail to Respond

(3) Flow Control Valve Fail to Respond

4. Process Equipment Off Warning

a. If all equipment for a process is off, and that process that requires a pump, valve, or device to be on continuously, a System Warning will be generated after a preset time-delay.

b. A “Disable” button will be available on the HMI to disable and bypass the alarm.

5. Device Malfunction

    a. Equipment may have auxiliary devices that are monitored by SCADA. A device Malfunction alarm will be generated if the auxiliary device does not operate at the appropriate times.

    b. Such alarms may include:

        (1) Motor Heater Failure

        (2) Chlorinator Solenoid Valve Failure

        (3) Air Compressor Solenoid Valve Failure

6. Excessive Run-Time Warning

    a. The PLC program will initiate a warning when equipment operates for an extended amount of time. The time setting is user adjustable.

    b. Booster Pumps

    c. Fans

    d. Well Pump

    e. Air Compressor

3.05 Control Descriptions

A. Remote Well Control

1. Allow for automatic or manual control of well pump and flow control valves. Automatic control to be based on tank level transmitter(s) 4-20mA signal.

2. The program will allow for user adjustable settings to alternate between water sources or set a fixed lead/lag sequence between the water sources.

3. The program will automatically skip to next water source if called source is unavailable.

B. System Pressure (High Service Pump Control)

1. Allow for automatic or manual control of 6 high service pumps. Automatic control to be based on pressure transmitter(s) 4-20mA signal.

2. The program will allow for user adjustable settings to alternate between booster pumps or set a fixed lead/lag sequence between the pumps.

3. The program will automatically skip to next pump if called pump is unavailable.

4. The high service pumps can include daily exercise cycles if the pressure does not drop low enough to operate the pumps.

3.06 PROGRAMMING ACCEPTANCE

A. Regardless of any submittal approvals, final acceptance of the system programming will occur during the final Demonstration Test.

B. The ENGINEER/OWNER reserves the right to require minor changes in the graphics and programming during the test.

3.07 TESTING, START-UP, CALIBRATION, AND TRAINING

1.01 Programming Schedule.

A. It is the contractor's responsibility to incorporate the following programming schedules and milestones within the project's overall construction schedule. Failure to include the required milestones which may result in project delays are at the contractor's expense and at no additional cost to owner.

1. Kick-off Meeting

a. Notify Engineer and Owner of project start date and submit overall construction schedule.

2. Internal Testing

a. 4 weeks prior to the required control panel Factory shop testing, contractor to notify Engineer of Shop testing date. During this time the programmer shall internally test all programs and develop testing reports as needed to ensure program functionality.

3. Factory Shop Testing

a. The control system shall be tested via a full simulation at the factory, prior to shipment, so as to demonstrate that each component is operational and meets the requirements of these specifications.

b. The Panel fabricator shall conduct test routine for all I/O wiring and interconnect wiring of components. Test results shall be certified, with written documentation provided to the Engineer upon test completion. Factory testing may be witnessed by the Engineer or Owner.

4. Onsite Readiness Test

a. Contractor shall schedule ORT with Electrician, Panel Fabricator, Integration Engineer, and other related sub-contractors to conduct field stat-up tests, field I/O checkout, and control strategy testing. The I/O checkout will demonstrate I/O functionality, analog scaling confirmation,

historical data collection, alarm confirmation, security configuration, and network communications. The control strategy testing will confirm manual and automatic operation of the equipment from the SCADA system, tuning of loops, and process set point adjustments.

5. Functional Site testing

   a. Perform function testing of all equipment controlled or monitored by control system. Contractor shall provide a checklist for all electrical, control and instrumentation functions and send to Engineer for approval. Each function shall be demonstrated to the satisfaction of the Owner and Engineer on a paragraph-by-paragraph basis. Each test shall be witnessed and signed off by the Contractor and the Engineer upon satisfactory completion.

6. Acceptance testing

   a. The Contractor shall notify the Owner and Engineer at least two (2) weeks prior to the commencement date of the field tests. After tests are completed and with system fully operational, system shall run continuously for a period of 7 days without failure. Any failures shall be repaired and test shall start over again.

7. Training

   a. The programmer shall conduct a training session with the facility's operators utilizing the actual system. Training time shall be dedicated to actual operation and use of the control system as encountered in day-to-day operations. The training shall provide Owner personnel with basic proficiency in display screen navigation and control functions pertaining to the specified system.

END OF SECTION

SECTION 13331
TOWERS

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

2. Tower Erection Company shall have a written safety manual and shall allow only trained workers to erect or work on towers in general vicinity of high voltage lines. Submit qualifications and evidence of training to Engineer before starting work. Follow all safety codes and publications. Tower erection or work in the vicinity of aerial high voltage lines shall be supervised by a trained professional tower erector. Lethal voltages may be nearby.

3. Refer to Section 13332 – Wireless Radios and provide radio path study and conduct path test with bucket truck and 5 Ghz radios to confirm acceptable signal level, for Engineer’s review before ordering tower.

4. Antenna feed line protection is a part of this Section.

5. Lightning protection is a part of this Section.

1.02 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other Sections. Individual submittals for equipment specified herein will not be accepted and will be returned un-reviewed.

B. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the equipment provides every specified requirement. Any options or exceptions shall be clearly indicated.

C. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

D. Provide all shop drawing submittals on thumb drive in PDF format.

E. Product Data:

1. Manufacturer & Model information

2. Dimensions, ratings, and data on features and components

3. Equipment Brochure

4. Accessories

F. Tower foundation to be per Manufacturer's requirements and shall bear the seal of a Texas Registered Engineer.

G. Wind loading calculations for all proposed equipment and accessories installed on tower per TIA-22-H standards.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Rohn Industries, Inc.

B. American Towers

C. Universal Towers

D. Titan Towers

E. Pre-approved equal.

2.02 TOWER

A. Triangular self-supporting heavy-duty steel or aluminum tower with steel tube legs and continuous steel aluminum rod bracing in a zigzag pattern, and with tapered sections when over 25 ft. high. Towers are to be free standing without guy wires. Tower to be assembled such that two additional sections may be added to increase overall height by 20 ft. if required, with top section remaining as is.

B. Each section is to be joined to the next with a swaged hardened stainless steel double bolted connection in each leg.

C. Steel tower to be completely hot dip galvanized after fabrication and shipped in 10 foot or 7 foot sections.

D. All required hardware to be furnished by Tower Manufacturer.

E. Tower to be self-supporting, capable of supporting wind load of 120 mph sustained winds for towers shorter than 100' and 110 mph sustained winds for towers 100' and taller for all equipment and accessories installed on tower. Submit TIA-222-H wind loading calculations to Engineer verifying tower meets wind loading requirements.

F. Not Used.

G. Verify Manufacturer's requirements for constructing towers. Where plans conflict with Manufacturer's recommendations, contact Engineer before starting work. Provide foundation drawings with Texas Registered Structural Engineer's Seal. Failure to do so is at Contractor's risk and at no additional cost to Owner.

H. Provide climbing ladder safety track and related devices for towers exceeding 50 feet in height.

I. Tower height selection shall be based on radio path study and on actual signal strength measurements at each site as described in Section 13332 – Wireless Radios. Provide recordings of spectrum analyzer measurements of all signal present in the 5 GHz range at each site. Use bucket truck for field measurements.

2.03 LIGHTNING PROTECTION

A. Lightning protection system shall be installed and tested by approved, licensed Lightning Protection Company. No exceptions.

B. Lightning Terminal:

1. Install approved polished aluminum rod at top of tower, extending 24 inches above top of antennas, fastened to a 1 ½ inch minimum diameter, aluminum pipe mast, with an approved mast clamp.

C. Grounding Conductor:

1. Install minimum #1/0 bare stranded copper ground conductor from lightning terminal rod to base of tower. Attach ground conductor to tower using stainless steel bands at minimum 4 foot intervals. Attach ground conductor to terminal rod with an approved lug. Use exothermic weld or compression tool to connect lug to ground conductor.

2. Bond all metallic parts to ground conductor in an approved manner.

D. Additional Grounding: Where ground conditions at tower location prevent a satisfactory low impedance path, enhanced grounding systems are required. Use a low resistance carbon based backfill, Harger “Ultrafill” or equal. Use Harger recommended system of installation.

2.04 GROUNDING

A. Ring Ground:

1. Where ground tests indicate a high resistance conductive path. Install a 20 ft. diameter tower ring halo grounding system around perimeter of tower foundation using minimum #2/0 bare, stranded, copper conductor buried at 36 inches below grade. Ground each tower leg to ring grounding system using exothermic welded connections to ground lugs and using exothermic welded connection of leg grounding conductors to the ring conductors.

2. Ground foundation rebar, anchor bolts, and coaxial feed line to ring ground system using approved devices and connections.

3. Install one (1) each 5/8 diameter, 20 ft. long copper clad ground rod at intersection of leg grounding conductor and ring conductor. Use exothermic welded connections only.

4. Route a minimum #2 bare, stranded copper ground conductor from tower grounding system to radio equipment, tower lighting equipment and other equipment with tower connections.

2.05 LIGHTING

A. Provide FAA approved lighting fixtures and devices where tower exceeds FAA height and proximity limits to airports. Route circuit from nearest 120-volt source. Verify location with Engineer before bidding. Provide submittal drawings for Engineer's review. Indicate compliance with FAA requirements. Provide approved surge protector on all power circuits. Use proper grounding as noted in other parts of this Specification Section.

2.06 MARKINGS

A. Provide painted markings where required by FAA due to proximity to airports and due to height restrictions. Verify location with Engineer before bidding. Provide submittal drawings for Engineer's review. Indicate compliance with FAA requirements.

PART 3 EXECUTION

3.02 INSTALLATION

A. Install tower and foundation in accordance with Manufacturer's instructions.

B. Provide all FAA and other required lighting and markings according to Item 2.06.

C. Provide grounding and lightning protection system as required for tower safety and for protection of radio system. Only licensed, approved Lightning Protection Installers shall perform this work.

E. Locate tower such that a clearance of height plus 10 feet is maintained from overhead aerial power lines at closest point in event tower falls in storms.

END OF SECTION

SECTION 13332

WIRELESS RADIOS

PART 1 GENERAL

1.01 SUMMARY

A. Scope:

1. Coordinate radio frequency and radio tower location with Owner. Provide radio equipment as required accordingly.

2. Coordinate radio installation with SCADA RTU/PLC Contractor to assure compatibility and proper operation.

3. Refer to Section 16012 - “Electrical Work” for additional requirements. Failure to do so will be at expense of Contractor and at no additional cost to Owner.

4. Provide radio path study, spectrum analysis, and frequency coordination for Engineer’s review.

5. Avoid interference between proposed and existing radio systems. Where antenna is to be installed near other antennas, assure no cross-talk will occur. This may require relocation of proposed antennas and/or radios.

6. Install a complete and operating wireless radio system for all the proposed sites.

7. **No equipment shall be purchased or submitted for approval prior to the completion of the radio path study described in 1.04.**

1.02 GENERAL DESCRIPTION

A. All radio, antenna, mast and transmission line work shall all be conducted by a professionally qualified Contractor approved by Engineer.

B. All radios to be Ethernet compatible or compatible with any other network utilized as indicated on plans, or as described in specification.

C. Radios shall have means to observe and display received signal strength, SWR, transmitted power, and similar parameters. These signals shall be interfaced to SCADA System HMI. Provide one new original copy of radio programming and diagnostics software for Engineer’s evaluation in addition to one new original copy for Owner in O&M submittal. Provide original on CD.

D. Set radio band rate as recommended by Engineer for optimum SCADA system performance.

1.03 SUBMITTALS

A. Submittals for equipment specified herein shall be made as a part of equipment furnished under other Sections. Individual submittals for equipment specified herein will not be accepted and will be returned un-reviewed.

B. Submit catalog data for all items supplied from this specification Section as applicable. Submittal shall include catalog data, functions, ratings, inputs, outputs, displays, etc., sufficient to confirm that the equipment provides every specified requirement. Any options or exceptions shall be clearly indicated.

C. Furnish, as prescribed under the General Requirements, all required submittals covering the items included under this section and its associated sections of the work.

D. Provide all shop drawing submittals on thumb drive in PDF format.

E. Product Data:

1. Manufacturer & Model information

2. Dimensions, ratings, and data on features and components

3. Equipment Brochure

4. Accessories

F. Network Data:

1. IP Addresses for all radios.

2. Network map depicting communication between all sites.

3. Configuration settings for all radios.

1.04 RADIO PATH STUDY

A. An onsite radio path loss and topographic study shall be conducted by an approved, qualified firm experienced in radio signal propagation studies. Provide calculations on CD and provide **a licensed development copy of software** on CD to allow Engineer's verification and approval of path study. Said firm shall utilize good quality professional instruments for SWR, signal strength, signal power measurements and for spectrum analysis. Provide a written report that includes the following for each site:

1. Height of existing tower or structure used for mounting existing antenna.

2. Photos of existing site conditions and inside each control/ SCADA panel.

3. Photos of any nearby obstructions in radio path.

4. Recommended antenna height(s) for each location.

5. Recommended antenna type and gain.

6. Recommended radio type.

7. Recording of spectrum analysis and all instruments.

8. Recommended frequency.

9. Recommended channel width.

10. Recommended radio output power.

11. Recommended antenna orientation.

12. Verizon wireless cellular strength.

13. Recommended cellular antenna height.

14. Recommended cellular antenna orientation.

15. Expected cellular upload and download speeds.

B. Report recommendations and expected results shall take into account worst case atmospheric conditions for region.

PART 2 PRODUCTS

2.01 RADIOS

A. Radios shall be 5 GHz ethernet radio with maximum throughput of 450+ Mbps. The radios shall be configured in a point-to-point or point-to-multipoint configuration as shown on Plans to complete an overall network between all proposed sites.

B. The Contractor shall furnish and install all devices required to interface the radios' data connection to an ethernet network used by the RTU's/PLC's.

C. Radio system shall include radio system, transmission cable, antenna, tower, pole or mast, all cabling, devices & power supplies with UPS, switches or routers, remote terminal unit, calibration and testing as required to provide data that is compatible with all equipment, hardware, and software described in plans and specifications.

D. License Free Wireless IP/Ethernet:

1. Characteristics:

a. Use as access point or station.

b. Embedded webserver with status and spectrum analysis.

c. Over-air firmware upgradeable.

d. Frequency: 5 GHz.

e. Max Channel Width: 80 MHz.

f. GPS frame synchronization.

g. Dedicated management radio.

h. Weatherproof.

i. Power: 24V passive POE.

j. Gigabit ethernet.

k. Ethernet RJ-45.

l. FCC approved.

2. Manufacturer and Model:

a. Ubiquiti Powerbeam 5AC Gen 2.

b. Ubiquiti Rocket 5AC Prism Gen 2.

c. Pre-approved equal.

2.02 ANTENNAS

A. Antennas shall be compatible with radios.

B. Provide antennas with gain required to establish a constant connection between.

C. Provide antennas with all necessary mounting hardware and cabling for connection to radios.

D. Install antenna and radios per manufacturer recommendations.

C. Antenna Mast

1. Refer to other specification sections and plan sheet details for antenna tower, pole or mast requirements.

2.03 ACESSORIES

A. Install radios with Ubiquiti TOUGHCable Carrier TC-CARRIER Outdoor shielded CAT 5e ethernet cables with TOUGHCable Connectors.

B. Power radios with grounded Ubiquiti POE power supplies.

C. Install Ubiquiti ETH-SP-G2 ethernet surge protectors on both ends of each ethernet cable run between radio and ethernet switch (at radio and at each SCADA panel).

D. Install antennas with radomes (where available).

2.03 SCADA RADIO SYSTEM INSTALLATION

A. Installation of all radio equipment shall be performed in accordance with manufacturer's recommendations, good and accepted radio installation practices and these

specifications. All miscellaneous installation material, tools, and test equipment shall be suitable for the tasks to be performed.

B. All work shall be performed by qualified trained personnel experienced in the trade.

C. Contractor shall visit sites to determine extent of radio hardware requirements to interface with SCADA system and to provide a complete working system for data exchange with SCADA system.

D. Coordinate all work with other equipment suppliers to assure proper interface with all SCADA system devices.

E. The existing SCADA system shall remain operational throughout construction, except where specific outages are scheduled and approved by the Owner and Engineer. All work shall be coordinated with Owner and Engineer to minimize impact on daily operation.

PART 3 EXECUTION

3.01 CALIBRATION, TESTING, AND STARTUP

A. All instruments and systems provided shall be calibrated after installation, in conformance with the component manufacturer's instructions. This shall provide that those components having adjustable features are set carefully for the specific conditions and applications of this installation, and ensure that the components and/or systems are within the specified limits of accuracy. Defective elements, which cannot achieve proper calibration or accuracy, either individually or within a system, shall be replaced. This calibration work shall be accomplished by appropriately experienced technical field representatives. The Contractor shall certify in writing to the Engineer that all calibrations have been made and that all radio equipment is ready to operate. The Contractor shall provide a complete record of all calibrations, adjustments, and settings.

B. All systems shall be exercised through complete operational tests in the presence of the Engineer in order to demonstrate achievement of the specified performance. Operational tests depend upon completion of work specified elsewhere in these Contract Documents. The scheduling of tests shall be coordinated by the Contractor among all parties involved so that the tests may proceed without delays or disruption by uncompleted work. Final test shall include the complete SCADA/radio system operation.

C. Start-up: When all equipment and systems have been assessed by the Contractor to have been successfully carried through complete operational tests with not less than a minimum of simulation, and the Engineer concurs in this assessment, switchover and system start-up can follow.

D. Provide adequate person-hours to coordinate radio operation with SCADA programming and to instruct the "Programmer" on operation of radio with SCADA system.

E. All radio programming to be performed by Manufacturer's Representative or factory

trained, qualified Technician.

3.03 SCADA RADIO SYSTEM TESTING

A. After all equipment has been installed, placed in operation, and optimized, the Contractor shall conduct final radio tests. Should any item of equipment fail to meet specifications, it shall be the responsibility of the Contractor at his sole expense to repair or replace in a timely manner any or all equipment causing said failure.

B. R.F. System Testing: Final R.F. system testing shall be conducted with all paths in a normal un-faded condition and with paths faded 30db. In both cases, the bit error rate (BER) shall be measured in both directions. The measured BER shall be 10 to the -6, or better. Other standards that may apply are acceptable if approved by Engineer.

C. Provide spectrum analyzer recordings for Engineer's review. Show proposed radio signal frequencies and all other signals on nearby frequencies. Note any conflicts in radio submittals.

D. Antenna height selection to be based on radio path study and on actual signal strength measurements with a spectrum analyzer. Use bucket truck and specified radios and antennas for field measurements. Radios shall be adjusted for operation in that portion of the band with least interference and lowest noise level.

E. Provide SWR testing for overall antenna and coax system. Submit for Engineer's review.

3.04 WARRANTY

A. All equipment and devices covered in this specification shall be warranted for a period of not less than one (1) year from date of owner-accepted substantial completion.

B. 24 hour, 7 days per week repair service shall be available from Radio Manufacturer Representative. Where Owner attempts to contact repair facility and there is no response within 8 hours, Owner may contact another qualified service facility for repairs at expense of Contractor. This condition must be included in warranty agreement.

C. During first year warranty period, Contractor shall test radio system (2) two times for interference based on spectrums analyzer measurements at all locations. Also, provide cable loss, SWR, power output received signal strength, and receiver sensitivity tests. Allow for this cost in base bid proposal.

3.05 MEASUREMENT REPORT

A. After system is installed and all adjustments made, provide the following measured data for all locations for Engineer's review prior to acceptance testing:

1. Power Output

2. Received Signal Strength

3. Noise Level

4. SWR Measurement (actual - not relative)
5. Baud Rate
6. Time and Duration of any Signal Dropouts in a 24 Hr. Period
7. Antenna Aiming
8. Antenna Type (directional or Omni)
9. Antenna Gain
10. Coax Cable Type and Length
11. Coax Cable Loss
12. Spectrum Analyzer Recordings
13. List Manufacturer and Model of Test Equipment
14. Radio Site Coordinates and Antenna Height

END OF SECTION

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic requirements specifically applicable to the work of Division 16 - Electrical Requirements.

B. The Contractor shall furnish equipment, materials, and labor for assembly and installation plus checkout and start-up of the complete electrical system as shown on the Drawings and stipulated in the Specifications.

1.02 REFERENCES

A. As a minimum requirement, the electrical system shall be constructed in accordance with:

1. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No. 70 - National Electrical Code (NEC).

2. Local Building Code.

3. Other applicable Codes and Standards as referenced in other Master Specifications.

B. Comply with local, county, state and federal regulations and codes in effect as of date of purchase.

C. Equipment of foreign manufacture must meet U.S. codes and standards.

D. Equipment and materials shall conform to requirements of specification and to the criteria provided in data sheets for the project.

1.03 CONTRACTOR QUALIFICATIONS

A. All electrical work shall be performed only by a Texas State Licensed Electrical Contractor.

B. Electrical Contractor shall have Master Electrician License for City or County; in which project is located and shall have a State issued Master Electrician License.

C. Contractor’s Project Manager or his Assistant shall be familiar with types of electrical construction required by this project in order to determine that all subcontractor and vendor’s work is in conformance with the plans and specifications.

D. Contractor shall have an established safety-training program in effect for the duration of this project and will be required to submit proof of safety training for all employees working on this project.

1.04 QUALITY ASSURANCE

A. Product Conformance Certificate and Quality Assurance Release.

1. Submit an overall conformance certificate for electrical components signed by the person responsible for product quality. Specifically identify the purchased material or equipment by project name and location, purchase order number, supplements, and item number where applicable, including materials and services provided by others. Indicate that all requirements have been met and identify any approved deviations.

2. Field Inspection:

a. Electrical work shall be inspected and approved by the local code inspector and the Engineer.

b. Contractor shall give a minimum of one-day notice to the Inspector that the installation is ready for inspection and two days' notice to the Engineer.

c. Concealed work shall be inspected before it is covered:

(1) Conduit with stub-ups, underground in duct banks before concrete is poured.

(2) Conduit in slabs, walls and ceilings, complete with boxes.

d. Electrical equipment and materials shall be inspected upon arrival by the Engineer for compliance with specifications.

1.05 SITE CONDITIONS

A. Take the following site conditions into consideration when fabricating, erecting, installing and wiring electrical equipment under this contract:

1. Plant Location (Refer to site coordinate table on drawings)
2. Plant Type and Size (Refer to site coordinate table on drawings)
3. Plant Site Elevation 2601'
4. Seismic Zone Zone 1
5. Wind Velocity 90 mph

6. Temperature, Min/Max.:

a.	Coldest Winter Month:	High 64 degrees F	Low 31 degrees F
b.	Warmest Summer Month:	High 101 degrees F	Low 68 degrees F
c.	Lowest Expected:	11 degrees F	
d.	Highest Expected:	107 degrees F	

7. Rainfall:

a.	Annual	12 inches
b.	Design hours	3.4 inches/hour, 8.4 inches/24 hours

8. Design Relative Humidity: 98%

9. Station Barometric Pressure:

   a. Average Annual 29.5 inches Hg Absolute.

10. Utility Water Systems:

		Design Pressure	Design Temp.
a.	River Water	_____ PSI	____ degrees F
b.	Well Water	_____ PSI	____ degrees F
c.	City Water	55 PSI	70 degrees F

11. Electric Power Supply Characteristics (Available to Contractor):

	Voltage	Phase	Hz	Wire	Delta or Wye
1	480	3	60	TBD	TBD
2					
3					

PART 2 PRODUCTS

2.01 COMPONENT DESIGN

A. Components utilized in the construction of the material or equipment shall be of the latest proven design, new and in current production. Do not use obsolete components or components to be phased out of production.

2.02 FACTORY INSPECTION

A. Provide free access with prior notice for the Engineer at all times to the shop where the material or equipment is being fabricated or tested. Provide reasonable facilities for inspection, witnessing tests, and examining records. Give 7 days notice prior to starting tests, which are scheduled for factory inspection.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify dimensions and ratings of equipment and materials to ensure proper fit and performance.

3.02 INSTALLATION

A. Install equipment and materials in accordance with the Drawings and manufacturer's written instructions. If field conditions necessitate changes in electrical installation, obtain approval from the Engineer.

B. All electrical equipment shall be mounted at an elevation of twenty-four (24) inches above the base water surface flood elevation (500 YR WSEL) of the construction site. Should there be a difference in the mounting elevation on the construction Drawings that is in conflict with the previous directive the Contractor shall immediately bring such conflict to the attention of the Engineer for resolution.

3.03 DEMONSTRATION

A. Test the electrical system to specification requirements and to demonstrate correct installation and operation of equipment.

B. Before 7-days test, demonstrate the system to the Engineer. Show the system to be fully operational. All alarms, safety's, and communication points to central and locally must operate in both full-automatic and back-up modes. Use fresh water in the test medium.

C. Operate the system continuously for a period of 7 days in full automatic, without failure, to qualify as acceptable. "Failure" is considered any problem that requires correction by maintenance personnel, such as: high or low water level, any motor alarm, power failure, phase failure, communication failure, PLC failure, or UPS failure. This would exclude conditions not under the control of Contractor, such as: evident lightning strikes, 25-year rains, purchased power failure longer than the specified duration of service from UPS. Failures due to uncontrollable situations would allow the 7-day test to continue, as soon as test conditions are restored and the Engineer is notified.

D. The existing station shall remain in service during this test.

END OF SECTION

SECTION 16012
ELECTRICAL WORK

PART 1 GENERAL

1.01 DESCRIPTION

A. The work shall include providing materials and equipment required for installation of complete and functioning electrical system as specified and as shown on the drawings.

B. This section is an integral part of all Specification Sections related to electrical, control and instrumentation construction under this contract. Conditions of this section are paramount to all other conditions in applicable sections and shall supercede all other conditions and requirements.

C. Electrical Control and Instrumentation Plans & Specifications are representative of the design intent and may not contain minute details normally associated with normally accepted electrical construction, as described in applicable codes or as described in manufacturer's literature. Contractor shall provide all appurtenances normally associated with a particular equipment or device, and as required for a properly operating system.

1.02 SUBMITTALS

A. Submit all products covered under this specification for Engineer's approval.

B. Where submittals for a particular equipment, device or material item vary from that specified or shown on plan drawings, and where that item is not specifically noted as acceptable and, where installation of submitted item results in improper or undesirable operation of the system, Contractor shall be liable for removal and/or replacement of that item with the item specified or shown on plan drawings at no additional cost to Owner.

1.03 CONTRACTORS RESPONSIBILITIES

A. It is Electrical Contractors sole responsibility to assure that utility company and owner are notified and are kept aware of requirements.

B. Contractor shall provide all conduit, conductors and termination equipment as needed for utilities and shall coordinate with utility companies for installation requirements and shall provide installation constructed according to the utility company standards whether or not such is shown in detail or plans.

C. Electrical Contractor shall review all sections of the plans including Civil, Structural, Mechanical, Instrumentation, Process, Architectural, and Electrical and shall note all electrical and/or requirements for devices and equipment shown or implied, and shall provide service accordingly for a complete operating electrical system.

D. Electrical Contractor shall provide all programming set-up, adjustments and testing of devices or equipment included under this contract unless specifically excluded or unless

equipment is not provided by Electrical Contractor.

E. General Contractor is specifically responsible for coordination of all electrical systems, devices and equipment provided or installed under this contract and shall assure that all requirements by all trades are met such as to insure a complete and operating electrical, control, process or instrumentation system.

F. Electrical Contractor shall be experienced with all types of electrical systems covered under this contract. No work shall be undertaken where Contractor's firm, project supervisors and project electrical workers have not had recent experience in similar projects in area or project location. Contractor will be required to furnish proof of experience where requested by Owner or Engineer or their Representatives.

G. General Contractors Project Manager or his Assistant shall be familiar with types of electrical construction required by this project in order to determine that all subcontractors work in conformance with the plans and specifications.

H. Contractor shall assure that all systems have been properly installed, adjusted and tested prior to final inspection, unless, Engineer has been duly notified in writing that certain equipments are not ready for final testing and such is acceptable with Engineer.

I. Additional site visits, inspections, and tests conducted by Engineer due to systems not being ready at designated time of final inspection may result in charges to Contractor by Engineer to pay for additional time of electrical inspectors not covered in Electrical Engineers scope of work. All charges will be at Engineers Standard rates.

J. Contractor shall fully inspect all motors and nameplates, controls, conduit, wiring devices and other items before starting work, ordering materials or submitting shop drawings in order to verify existing conditions are as shown on plans and shall immediately notify Engineer of any discrepancies between plans & specifications and existing conditions. Failure to do so may result in responsibility for any required changes in construction.

K. At completion of project and before final inspection, Contractor shall provide the Electrical Engineer with full size blue prints, red-lined to reflect the As-Built electrical installation. Any variation from plans shall be shown on each applicable plan sheet.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials provided under all sections of the specifications shall be new and the standard products of manufacturers regularly engaged in the production of such equipment. All materials shall conform to the National Electrical Code and shall be approved and listed by the Underwriters' Laboratories. Materials described by manufacturer's name and catalog number are selected to set a definite standard of design and quality to be required. There is not any intention to discriminate against a product of another manufacturer, which is equally durable in construction, similar in design, and will serve the purpose for which it is intended. Within 30 days after award of the contract and

before any materials and equipment are placed on order, the Contractor shall submit to the Engineer for approval a complete list including catalog numbers and descriptive matter, of all materials and equipment he proposes to provide.

B. Materials and equipment specifications are general in coverage and may contain reference to construction items that apply in only particular situations and may not apply as a general rule for materials installed on this project.

2.02 PLANS AND SPECIFICATIONS

A. Electrical plans and specifications are not intended to discriminate against any particular manufacturer. Specific values shown for a particular manufacturer's product may vary slightly for another product. The Electrical Engineer reserves the right to interpret the electrical specifications and to make judgement as to acceptance of a product, regardless of minute details in the specifications or on the Plans.

B. Specifications shall be reviewed for applicability of materials under certain conditions and in certain environments and, where not shown otherwise on plan drawings. These application directions shall be adhered to.

C. Where a particular reference on drawing plans does not conform to standard acceptable construction methods for a particular type project, the Contractor shall immediately notify the Engineer and request a clarification before ordering materials or starting construction.

PART 3 EXECUTION

3.01 WORKMANSHIP

A. All wiring shall be installed in accordance with current NEC and local codes. Conduits exposed to the weather shall be rigid galvanized steel (RGS) unless noted otherwise on plans. Conduit placed underground shall be schedule 40 PVC unless noted otherwise on plans.

B. A fish wire shall be left in all conduits in which the permanent wiring is not installed.

C. All fixtures, switch, and receptacle locations shall be approved by Engineer.

D. Refer to other sections of this specification for controls. Under this section of the specifications, the Contractor shall install the control devices and provide control wiring switches, outlet boxes, and shall make all final connections. Control wiring and interlocks shall conform to wiring diagrams furnished by equipment manufacturers.

E. The Contractor shall provide services of his Engineer or a factory trained technician to instruct plant-operating personnel for a period of at least one (1) full day after completion of the contract work.

3.02 EXCAVATION AND BACKFILL

A. All underground conduits shall be buried to a minimum depth of 24-inches below finished grade. All trenches shall be uniform width and shall be backfilled and compacted to 95% that of original density. Any damage to underground conduits caused by other Contractors shall be repaired by this Contractor and shall be compensated accordingly by the party or parties responsible for the damage.

3.03 CLEAN UP

A. The Contractor shall upon completion of the work, remove all materials, empty containers, and any other materials that are not incorporated into the work.

END OF SECTION

SECTION 16060
ELECTRICAL DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical Demolition

1.02 REFERENCES

A. Temporary wiring of systems to maintain operation of facilities while undergoing modifications and demolition shall he provided in accordance with:

1. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), No.70 - National Electrical Code (NEC), Article No. 305-Temporary Wiring

1.03 SUBMITTALS

A. Annotate existing drawings to sequence the demolition of systems, equipment removal and temporary hook-ups.

B. Schedule with Engineer or required shut-downs to accommodate system demolition and installation of temporary facilities.

1.04 QUALITY ASSURANCE

A. Verify field measurements and circuiting arrangements are as shown Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents. Report discrepancies to Engineer before disturbing existing installation.

D. By beginning demolition, installer accepts existing conditions and warrants that he will maintain service to equipment and items not scheduled or indicated for removal, and that he will return to the Owner all items and systems in good operating condition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work. As specified in individual Sections.

2.02 DESIGN AND CONSTRUCTION

A. The temporary electrical wiring and facilities shall be designed and constructed in strict compliance with NEC-Article No. 305.

PART 3 EXECUTION

3.01 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

B. Coordinate utility service outages with Utility Company to provide continuous service to operating equipment.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must he performed on energized equipment or circuits. Use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Engineer at least one week before partially or completely disabling system. Minimize outage duration.

3.02 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

1. Remove abandoned wiring to source of supply.

2. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

3. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets, which are not removed.

4. Disconnect and remove abandoned panelboards and distribution equipment.

5. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

6. Repair adjacent construction and finished damaged work.

7. Maintain access to existing installations which remain active. Modify installation or provide access panel as appropriate.

8. Extend existing installations using materials and methods as specified for new work.

3.03 DISPOSAL AND SALVAGE

A. Salvage electrical and instrumentation equipment removed from existing facilities for reuse as applicable.

B. Material and equipment which can be reused or salvaged remains the property of the Owner unless specifically indicated in the Specifications or Drawings or as designated by the Engineer.

C. Materials and equipment which cannot be reused or salvaged will be removed and disposed of by the Contractor.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces amid check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 16110
RACEWAYS AND BOXES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Material and installation requirements for:

a. Conduits.
b. Conduit fittings.
c. Conduit supports.
d. Wireways.
e. Outlet boxes.
f. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 1 – General Requirements

1.02 DEFINITIONS

A. Underfloor Conduits.

1. Conduits which run underground within perimeter of building walls under building floor. This may consist of one conduit, or several conduits grouped together.

B. Duct Bank Conduits

1. Conduits which run underground outside perimeter of building walls. This may consist of one conduit, or several conduits grouped together.

C. Underground Conduits

1. Underground conduits are both under floor conduits and duct bank conduits.

1.03 SUBMITTALS

A. Shop Drawings:

1. See Division 1 – General Requirements for requirements for mechanics and administration of the submittal process.

2. Product technical data:

a. Provide submittal data for all products specified in PART 2 of this Specification Section.

3. Fabrication and/or layout drawings:

a. Identify dimensional size of pull and junction boxes to be used.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Referenced Standards:

1. Aluminum Association (AA).

2. American Iron and Steel Institute (AISI).

3. ASTM International (ASTM):

a. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

b. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

c. D2105, Standard Test Method for Longitudinal Tensile Properties of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Tube.

d. D2564, Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems.

e. F512, Standard Specification for Smooth-Wall Polyvinyl Chloride (PVC) Conduit and Fittings for Underground Installation.

4. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC).

c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.

5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):

a. C80.1, Electric Rigid Steel Conduit (ERSC).

b. C80.3, Steel Electrical Metallic Tubing (EMT).

c. C80.5, Electrical Aluminum Rigid Conduit.

d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

6. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC)

7. Underwriters Laboratories, Inc. (UL):

a. 1, Standard for Flexible Metal Conduit.

b. 6, Standard for Electrical Rigid Metal Conduit – Steel.

c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.

d. 360, Standard for Liquid-Tight Flexible Steel Conduit.

e. 467, Grounding and Bonding Equipment.

f. 514A, Metallic Outlet Boxes.

g. 514B, Conduit, Tubing, and Cable Fittings.

h. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.

i. 797 Electrical Metallic Tubing – Steel.

j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

k. 886, Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

l. 1660, Liquid-Tight Flexible Nonmetallic Conduit.

C. Comply with NECA "Standard of Installation."

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufactures are acceptable:

1. Rigid metallic conduits:

    a. Allied Tube and Conduit Corporation.
    b. Triangle PWC Inc.
    c. Western Tube and Conduit Corporation.
    d. Wheatland Tube Company.
    e. LTV Steel Company.
    f. EASCO Aluminum.
    g. Indalex.
    h. VAW of American, Inc.

2. PVC coated rigid metallic conduit and repair kits:

    a. Calbond
    b. KorKap
    c. Perma-Cote
    d. Rob-Roy Ind.
    e. Raychem “GelTek” tape.
    f. Thomas & Betts O-Cal
    g. NEC Black Guard

3. Rigid non-metallic conduit:

    a. Carlon.
    b. Cantex.
    c. Heritage Plastics.
    d. Osburn Associates.
    e. Prime Conduit
    f. Champion Fiberglass.
    g. United Fiberglass of America, Inc.

4. Flexible metallic conduit:

    a. AFC Cable Systems.
    b. Anamet, Inc.
    c. Carlon.
    d. Electri-Flex.
    e. Flexible Metal Hose Company.
    f. International Metal Hose Company.
    g. Triangle PWC Inc.
    h. LTV Steel Company.

5. Flexible non-metallic conduit.

    a. Carlon
    b. Carflex.

6. Wireway:

    a. Hoffman Engineering Company.
    b. Weigmann.
    c. Square D.

7. Conduit fittings and accessories:

    a. Appleton.
    b. Carlon.
    c. Cantex.
    d. Crouse-Hinds.
    e. Killark.
    f. Osburn Associates.
    g. OZ Gedney Company.
    h. RACO.
    i. Steel City.
    j. Thomas and Betts.

8. Support systems:

    a. Unistrut Building Systems.
    b. B-Line Systems Inc.
    c. Kindorf.
    d. Minerallac Fastening Systems.
    e. Caddy.

9. Outlet, pull, and junction boxes:

    a. Appleton.
    b. Crouse-Hinds.
    c. Killark.
    d. OZ Gedney Company.
    e. Steel City.
    f. RACO.
    g. Bell.
    h. Hoffman Engineering Company.
    i. Wiegmann.
    j. B-Line Circle AW.
    k. Adalet.
    l. Rittal.

10. Anti-seize compound:

    a. Crouse-Hinds

2.02 RIGID METALLIC CONDUITS

A. PVC-Coated Rigid Steel Conduit (PVC-RGS):

1. Nominal 40 mil Polyvinyl Chloride (PVC) exterior coating:

    a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.

    b. The bond between the PVC coating and the conduit surface: Greater than

the tensile strength of the coating.

2. Nominal 2 mil, minimum, urethane interior coating.

3. Urethane coating on threads.

4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.

5. Female Ends:

   a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 in, whichever is less beyond the opening.

   b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.

6. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.

B. PVC-Coated Rigid Aluminum Conduit (PVC-RAC):

1. Nominal 40 mil Polyvinyl Chloride (PVC) exterior coating:

   a. Coating: Bonded to rigid aluminum conduit conforming to NEMA/ANSI C80.1.

   b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.

2. Nominal 2 mil, minimum, urethane interior coating.

3. Urethane coating on threads.

4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.

5. Female Ends:

   a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 in, whichever is less beyond the opening.

   b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.

6. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.

C. Rigid Galvanized Steel Conduit (RGS):

1. Mild steel with continuous welded seam.

2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.

3. Threads galvanized after cutting.

4. Internal coating: Backed lacquer, varnish, or enamel for smooth surface.

5. Standards: NEMA/ANSI C80.1, UL 6.

6. Rigid Aluminum Conduit (RAC) is an acceptable alternative to RGS.

D. Electrical Metallic Tubing (EMT):

1. Mild steel with continuous welded seam.

2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.

3. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.

4. Standards: NEMA/ANSI C80.3, UL 797.

E. Rigid Aluminum Conduit (RAC):

1. AA Type 6063 aluminum allow, T-1 temper.

2. Maximum copper content of 0.10 percent.

3. Extruded, seamless.

4. Standards: NEMA/ANSI C80.5, UL 6.

2.03 RIGID NON-METALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80)

1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.

2. Rated for direct sunlight exposure.

3. Fire retardant and low smoke emission.

4. Shall be suitable for use with 90 DegC wire and shall be marked “maximum 90 DegC”.

5. Standards: NEMA TC 2, UL 651.

B. Fiberglass:

1. Epoxy based resin system using an anhydride curing agent.

2. Continuous E-glass roving.

3. Winding angle approximately 54.75 degrees.

4. Halogen free additive for flame spread and smoke control.

5. Ultraviolet inhibitor: Carbon black.

6. Two (2) step curing process.

7. Tensile strength: 9000 psi per ASTM D2105.

8. Integral bell and spigot.

9. Conduits and fittings to be joined with an epoxy adhesive creating a water tight connection.

10. Standard: UL 1684.

2.04 Flexible Conduit

A. Flexible Galvanized Steel Conduit (FLEX):

1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.

2. Standard: UL 360.

B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):

1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.

2. Extruded PVC outer jacket positively locked to the steel core.

3. Liquid and vaportight.

4. Standard: UL 360.

C. Flexible non-metallic (liquid-tight) conduit (FLEX-NM):

1. Formed of a helically wound spiral of rigid PVC reinforcement embedded within a flexible PVC wall.

2. Layered construction with a smooth seamless inner core of flexible PVC that is bonded to a covering of flexible PVC.

3. Between the layers is a woven nylon mesh for reinforcement.

4. Standard: UL1660

2.05 Wireway

A. General:

1. Suitable for lay-in conductors.

2. Designed for continuous grounding.

3. Covers:

    a. Hinged or removable in accessible areas.

    b. Non-removable when passing through partitions.

    c. Finish: Rust inhibiting primer and manufacturer's standard paint inside and out except for stainless steel type.

    d. Standards: UL 870, NEMA 250.

B. General Purpose (NEMA 1 rated) Wireway:

1. 14 or 16 gage steel without knockouts.

2. Cover: Non-gasketed and held in place by captive screws.

C. Raintight (NEMA 3R rated) Wiring Trough:

1. 14 or 16 gage galvanized steel without knockouts.

2. Cover: Non-gasketed and held in place by captive screws.

D. Watertight (NEMA 4X rated) Wireway:

1. 14 gage type 304 or 316 stainless steel bodies and covers without knockouts and 10 gage stainless steel flanges.

2. Cover: Fully gasketed and held in place with continuous piano hinge with three-point latch.

3. Flanges: Fully Gasketed and bolted.

E. Dusttight (NEMA 12 rated) Wireway:

1. 14 gage steel bodies and covers without knockouts and 10 gage steel flanges.

2. Cover: Fully gasketed and held in place with continuous piano hinge with three-point latch.

3. Flanges: Fully gasketed and bolted.

2.06 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for use with RGS:

1. General:

    a. In hazardous locations, provide fittings listed for use in Class I, Groups C and D locations.

2. Locknuts:

    a. Threaded steel or malleable iron.
    b. Gasketed or non-gasketed.
    c. Grounding or non-grounding type.

3. Bushings:

    a. Threaded, insulated metallic.
    b. Grounding or non-grounding type.

4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.

5. Couplings:

    a. Threaded straight type: Same material and finish as the conduit with which they are used on.

    b. Threadless type: Gland compression or self-threading type, concrete tight.

6. Unions: Threaded galvanized steel or zinc plated malleable iron.

7. Conduit bodies (ells and tees):

    a. Body: Zink plated cast iron with threaded hubs.

    b. Standard and mogul size.

    c. Cover:

        1) Clip-on type with stainless steel screws.

        2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron.

8. Conduit bodies (round):

    a. Body: Zinc plated cast iron.

    b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron.

9. Sealing fittings:

    a. Body: Zinc plated cast iron with threaded hubs.

    b. Standard and mogul size.

    c. With or without drain and breather.

    d. Fiber and sealing compound: UL listed for use with the sealing fitting.

B. Fittings for use with RAC:

1. General:

   a. In hazardous locations, provide fittings listed for use in Class I, Groups C and D locations.

2. Locknuts:

   a. Threaded stainless steel.
   b. Gasketed or non-gasketed.
   c. Grounding or non-grounding type.

3. Bushings:

   a. Threaded, insulated metallic.
   b. Grounding or non-grounding type.

4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.

5. Couplings:

   a. Threaded straight type: Same material and finish as the conduit with which they are used on.

6. Unions: Threaded copper free cast aluminum.

7. Conduit bodies (ells and tees):

   a. Body: Copper free cast aluminum with threaded hubs.

   b. Standard and mogul size.

   c. Cover:

      1) Clip-on type with stainless steel screws.

      2) Gasketed or non-gasketed copper free cast aluminum.

8. Conduit bodies (round):

   a. Body: Copper free cast aluminum.

   b. Cover: Threaded screw on type, gasketed, copper free cast aluminum.

9. Sealing fittings:

   a. Body: Copper free cast aluminum with threaded hubs.

   b. Standard and mogul size.

   c. With or without drain and breather.

d. Fiber and sealing compound: UL listed for use with the sealing fitting.

C. Fittings for use with PVC-RGS:

1. The same material and construction as those fittings listed under paragraph “Fittings for use with RGS” and coated as defined under paragraph “PVC Coated Rigid Steel Conduit (PVC-RGS).

D. Fittings for use with PVC-RAC:

1. The same material and construction as those fittings listed under paragraph “Fittings for use with RAC” and coated as defined under paragraph “PVC Coated Rigid Steel Conduit (PVC-RGS).

E. Fittings for use with EMT:

1. Connectors:

a. Straight, angle and offset types furnished with locknuts.

b. Zinc plated steel.

c. Insulated gland compression type.

d. Concrete and raintight.

2. Couplings:

a. Zinc plated steel.

b. Gland compression type.

c. Concrete and raintight.

3. Conduit bodies (ells and tees):

a. Body: Copper free aluminum with threaded hubs.

b. Standard and mogul size.

c. Cover:

1) Screw down type with steel screws.

2) Gasketed or non-gasketed galvanized steel or copper free aluminum.

4. Standard: UL 514B

F. Fittings for use with FLEX:

1. Connector:

    a. Zinc plated malleable iron.
    b. Squeeze or clamp type.

2. Standard: UL 514B.

G. Fittings for use with FLEX-LT and FLEX-NM:

1. Connector:

    a. Straight or angle type.
    b. Metal construction, insulated and gasketed.
    c. Composed of locknut, grounding ferrule and gland compression nut.
    d. Liquid tight.

2. Standards: UL 467, UL 514B.

H. Fittings for use with Rigid Non-Metallic PVC Conduit:

1. Coupling, adapters, and conduit bodies:

    a. Same material, thickness, and construction as the conduits with which they are used.

    b. Homogeneous plastic free from visible cracks, holes, or foreign inclusions.

    c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.

2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.

3. Standards: ASTM D2564, NEMA TC3, UL 651, UL 541B.

I. Fittings for use with Rigid Non-Metallic Fiberglass Conduit:

1. Coupling and adapters shall be of the same material, thickness, and construction as the conduit.

2. Epoxy adhesive for joining conduits and fittings shall be supplied by the same manufacturer as the conduit and fittings and shall provide a water tight connection.

3. Standard: UL 1684.

J. Weather and Corrosion Protection Tape:

1. PVC based tape, 10 miles thick.

2. Protection against moisture, acids, alkalis, salts and sewage and suitable for

direct bury.

3. Used with appropriate pipe primer.

2.07 ALL RACEWAY AND FITTINGS

A. Mark Products:

1. Identify the nominal trade size on the product.

2. Stamp with the name or trademark of the manufacturer.

2.08 OUTLET BOXES

A. Metallic Outlet Boxes:

1. Hot-dip galvanized steel.

2. Conduit knockouts and grounding pigtail.

3. Styles:

a. 2 IN x 3 IN rectangle.
b. 4 IN square.
c. 4 IN octagon.
d. Masonry/tile.

4. Accessories:

a. Flat blank cover plats.
b. Barriers.
c. Extension, plaster or tile rings.
d. Box supporting brackets in stud walls.
e. Adjustable bar hangers.

5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:

1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.

2. Threaded hubs and grounding screw.

3. Styles:

a. "FS" of "FD".
b. Single or multiple gang and tandem.
c. "EDS" or "EFS" for hazardous locations.

4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.

5. Standards: UL 514A, UL 886.

C. Non-metallic Outlet Boxes:

1. Polyvinyl-chloride (PVC) plastic compound.

2. Rated for direct sunlight exposure.

3. Fire retardant and low smoke emission.

4. Suitable for use with 90 DegC wire.

5. Styles:

a. “FS” or “FD”.
b. Single or multiple gang.

6. Standard: UL 514A, NEMA TC 3.

D. See Specification 16140 for wiring devices, wallplates, and cover plates.

2.09 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:

1. Body and cover: 14 gage minimum, galvanized steel or steel finished with rust inhibiting primer and manufacturer’s standard paint inside and out.

2. With or without concentric knockouts on four (4) sides.

3. Flat cover fastened with screws.

B. NEMA 3R Rated:

1. Body and cover: 14 gage minimum steel finished with rust inhibiting primer and manufacturer’s standard paint inside and out.

2. No knockouts.

3. Seams continuously welded and ground smooth.

4. Door with hinge and latch

C. NEMA 4X Rated (metallic):

1. Body and cover: 14 gage type 304 or 316 stainless steel.

2. Seams continuously welded and ground smooth.

3. No knockouts.

4. External mounting flanges.

5. Door with oil-resistant gasket.

D. NEMA 4X Rated (non-metallic):

1. Body and cover: Ultraviolet light protected fiberglass-reinforced polyester boxes.

2. No knockouts.

3. External mounting flanges.

4. Hinged door with quick release latches and padlocking hasp.

5. Door with oil resistant gasket.

E. NEMA 7 and NEMA 9 Rated:

1. Cast gray iron allow or copper-free aluminum with manufacturer's standard finish.

2. Drilled and tapped openings or tapered threaded hub.

3. Cover bolted down with stainless steel bolts or threaded cover with neoprene gasket.

4. External mounting flanges.

5. Grounding lug.

6. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.

F. NEMA 12 Rated:

1. Body and cover:

a. 14 gage steel finished with rust inhibiting primer and manufacturer's standard paint inside and out.

b. Type 5052 H-32 aluminum, unpainted.

2. Seams continuously welded and ground smooth.

3. No knockouts.

4. External mounting flanges.

5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.

6. Flat door with oil resistant gasket.

G. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.

2. Split covers when heavier than 25 LBS.

3. Weldnuts for mounting optional panels and terminal kits.

4. Tamper proof screws.

5. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

H. Standards: NEMA 250, UL 50

2.10 SPECIAL PURPOSE BOXES

A. Pedestal-Type Floor-Mounted or Counter-Mounted Duplex Receptacles:

1. Horizontal design housing with threaded conduit fittings in base with satin chromium finish.

B. Flush in Floor Duplex Receptacles:

1. Dual level, full adjustable box with power fittings and brass carpet flange.

2.11 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:

1. Material Requirements.

a. Galvanized steel: ASTEM A123 or ASTM A153.

b. Stainless steel: AISI Type 304 or 316.

c. PVC coated galvanized steel: ASTM A123 or ASTM A153 and 20 mil PVC coating.

d. Aluminum: AA Type 6063-T6.

e. Fiberglass: Fire-retardant polyester or vinylester resin, ASTM E84, UL 94.

B. Single Conduit and Outlet Box Support Fasteners:

1. Material Requirements:

a. Zinc plated steel.
b. Stainless steel, Type 304 or 316.
c. Malleable iron.
d. PVC coated malleable iron or steel: 20 mil PVC coating.
e. Steel protected with zinc phosphate and oil finish.

2.12 RACEWAY/DUCT SEALING COMPOUND

A. Use with explosion-proof fittings to separate hazardous areas from non-hazardous areas:

1. UL Listed compound

2. Crouse-Hinds Chico or approved equal.

3. Use fiber dam for vertical installation.

B. All other areas:

1. Non-hardening, putty-like consistency workable at temperatures as low as 35 F.

2. Compound shall not slump at temperature of 300 F and shall readily adhere to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

PART 3 EXECUTION

3.01 RACEWAY INSTALLATION – GENERAL

A. Shall be in accordance with requirements of:

1. NFPA 70- NEC.
2. Manufacturer's instructions.

B. Size of Raceways:

1. Raceway sizes are shown on Drawings. If not shown on the Drawings, then size in accordance with NFPA 70.

2. Unless specifically indicated otherwise, the minimum raceway size shall be:
   a. Conduit: 1 IN.
   b. Wireway: 2-1/2 IN x 2-1/2 IN.

C. Field Bending and Cutting of Conduits:

1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.

2. Do not reduce the internal diameter of the conduit when making conduit bends.

3. Prepare tools and equipment to prevent damage to the PVC coating. Use strap wrenches only to tighten joints in PVC-RGS. Replace all conduit and fittings with damage to the PVC coating, such as cuts, nicks, and threader chuck jaw marks.

4. Degrease threads after threading and apply a zinc rich paint.

5. Deburr interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.

1. Repair galvanized components utilizing a zinc rich paint.

2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.

3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicon composition strip, followed by a protective coating of vinyl tape.

a. Total nominal thickness: 40 mil.

4. Repair surface which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.

1. Pull mandrel with diameter nominally ¼ IN smaller than the interior of the conduit, to remove obstructions.

2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.

3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Install pull wires in empty raceways. Leave not less than 12 IN of slack at each end of the pull wire.

I. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

J. Fill openings in walls, floor, and ceilings and finish flush with surface.

1. Where penetrating CMU block walls, repair with cementitious grout and paint to match.

2. Where conduit terminates at a cable tray system, fit conduit with an insulated bushing.

3. When conduits are passing through a firewall or fire-rated floor into different

rooms, cabinets, or enclosures, use a fire-rated seal.

K. Install explosion-proof seals in conduit runs crossing or entering a hazardous classified area. Install CSBE removable sealing fittings to seal submersible pump cables in the wet well and at the first junction box outside the well.

L. Conduit Stub-ups

1. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above finished slab.

2. Transition underground conduit to aboveground conduit at 90 DEG elbow where conduit transitions from horizontal to vertical conduit.

3. Where RGC or RAC is in contact with earth or concrete, wrap conduit with corrosion protective tap to 4 IN above finished grade.

4. Stub-up connections: Extend conduits for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with finished floor.

3.02 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.

1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.

2. Run in straight lines parallel to or at right angles to building lines.

3. Install raceways level and square and at proper elevations. Provide adequate headroom.

4. Do not route conduits:

a. Through areas of high ambient temperature or radiant heat.
b. In suspended concrete slabs.

5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.

6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 270 degrees of bends or 3-90 degree bends in the conduit run or in long straight runs to limit pulling tensions.

7. Make changes in direction of conduit using elbows or fittings. Do not use pull boxes to make direction changes unless specifically designated otherwise.

B. All rigid conduits within a structure shall be installed exposed except as follows:

1. As indicated on the Drawings.

2. Concealed above gypsum wall board or acoustical tile suspended ceilings.

3. Concealed within stud frame, poured concrete, concrete block and brick walls of an architecturally finished area.

4. Embedded in floor slabs or buried under floor serving equipment in non-architecturally finished areas that are not locate on or near a wall or column and the ceiling height is greater than 12 FT.

5. Embedded in floor slabs or buried under floor slabs where shown on the Drawings or with the Engineer's permission.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when runs are greater than 30 FT:

1. Between instrumentation and telecommunication: 1 IN.

2. Between instrumentation and 125 V, 48 V, and 24 Vdc: 2 IN.

3. Between instrumentation and 600 V and less AC power or control: 12 IN.

4. Between instrumentation and greater than 600 Vac power: 12 IN.

5. Between telecommunication and 125 V, 48 V, and 24 Vdc: 2 IN.

6. Between telecommunication and 600 V and less AC power or control: 6 IN.

7. Between telecommunication and greater than 600 Vac power: 12 IN.

8. Between 125 V, 48 V, and 24 Vdc and 600 V and less AC power or control: 1 IN.

9. Between 125 V, 48 V, and 24 Vdc and greater than 600 V power or control: 2 IN.

10. Between process, gas, air, and water pipes: 6 IN.

D. Conduits shall be installed to eliminate moisture pockets.

1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.

1. Repair penetrations to existing condition or better.

H. Conduit embedded in columns and floor slabs or buried under slab-on-grade:

1. Run in the most direct, practical route.

2. Not to be installed under equipment pads unless approved by Engineer.

3. No crossovers unless approved by Engineer.

4. To be backfilled with concrete during the installation of the slab-on-grade or to be placed, backfilled, and compacted in the slab subgrade, as indicated on drawings.

5. Secured in place to prevent movement during the backfill and pour.

I. Conduits and accessories embedded in concrete where shown on the Drawings:

1. Shall not be considered to replace structurally the displaced concrete except as indicated in the following:

   a. Conduit and fittings shall not displace more than 4 percent of the area of the cross-section of a column on which stress is calculated or which is required for fire protection.

   b. Size and locate sleeves or conduits passing through floors, walls, or beams so as not to significantly impair the strength of the construction.

   c. Sleeves or conduits passing through floors, walls or beams may be considered as replacing the displaced concrete structurally in compression.

      1) Shall not be exposed to rusting or other deterioration.
      2) Nominal inside diameter shall not exceed 2 IN.
      3) Minimum spacing: 3 DIA OC.

2. Shall not be larger in outside diameter than one-third the thickness of the slab, column, or beam.

3. Shall have a minimum spacing of 3 DIA OC.

4. In reinforced concrete construction:

   a. Conduit shall not be run in beams.

   b. Place conduit after reinforcing steel has been laid.

   c. The reinforcement steel shall not be displaced by the conduit.

   d. Provide a minimum of 1-1/2 IN of cover over conduit, excluding surface finish.

   e. Conduits parallel to main reinforcement shall be run near the center of the wall.

f. Conduits perpendicular to main reinforcement shall be run midway between wall or slab supports.

3.03 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Area Designations (unless specifically indicated on Drawings):

1. Dry areas:

a. RGS.
b. RAC.

2. Wet areas:

a. RGS.
b. RAC.

3. Exterior Corrosive areas (includes, but not limited to wastewater project sites):

a. PVC-RGS.
b. PVC-RAC.

4. Interior Corrosive areas (includes, but not limited to chemical rooms):

a. PVC-40.
b. PVC-80.
c. Fiberglass.
d. As indicated on drawings.

B. Permitted Raceway types per Routing Locations:

1. In stud framed walls:

a. EMT.

2. In concrete block or brick walls:

a. PVC-40.

3. Above acoustical tile ceilings:

a. EMT.
b. NEMA 1 rated Wireway.

4. Embedded in poured concrete walls and floors:

a. PVC-40
b. PVC-80
c. Fiberglass
d. PVC-RGS when emerging from concrete into areas designated as exterior and corrosive.

5. Beneath floor slab-on grade:

    a. PVC-40
    b. PVC-80
    c. Fiberglass

6. Direct buried conduits and ductbanks:

    a. PVC-40.

    b. PVC-80.

    c. Fiberglass.

    d. 90 degree elbows for transition to above grade:

        1) PVC-RGS.
        2) Fiberglass.

    e. Long sweeping bends greater than 15 degrees.

        1) PVC-RGS.
        2) Fiberglass.

7. Concrete encased ductbanks:

    a. PVC-40.

    b. PVC-80.

    c. Fiberglass.

    d. 90 degree elbows for transition to above grade:

        1) PVC-RGS.
        2) Fiberglass.

    e. Long sweeping bends greater than 15 degrees.

        1) PVC-RGS.
        2) Fiberglass.

C. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above the ceilings.

1. The maximum length shall not exceed:

    a. 6 FT to light fixtures.
    b. 3 FT to all other equipment.

D. FLEX-LT and FLEX-NM conduits shall be installed as the final conduit connection to light

fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.

1. The maximum length shall not exceed:

   a. 6 FT to light fixtures.
   b. 3 FT to motors.
   c. 2 FT to all other equipment.

E. NEMA 1 Rated Wireway:

1. Surface mounted in electrical rooms.

2. Surface mounted above removable ceilings tiles of an architecturally finished area.

F. NEMA 3R Wiring Trough:

1. Surface mounted in exterior, non-corrosive locations.

G. NEMA 4X Rated Wireway:

1. Surface mounted in areas designated as corrosive.

H. NEMA 12 Rated Wireway:

1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.

3.04 CONDUIT FITTINGS AND ACCESSORIES

A. Conduit Seals:

1. Install in conduit systems located in hazardous areas as required by the NEC or as shown on Drawings.

B. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.

1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated ¼ turn to provide uniform contact.

C. Install Expansion Fittings:

1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.

2. Elsewhere as identified on the Drawings.

D. Install Expansion/Deflection Fittings:

1. Where conduits enter a structure.

   a. Except electrical manholes and handholes.

b. Except where the duct bank is tied to the structure with rebar.

2. Where conduits span structural expansion joints.

3. Elsewhere as identified on the Drawings.

E. Threaded connections shall be made wrench-tight.

F. Conduit joints shall be watertight:

1. Where subjected to possible submersion.

2. In areas classified as wet.

3. Underground.

G. Terminate Conduits:

1. In metallic outlet boxes:

a. RGS and RAC:

1) Conduit hub and locknut.
2) Insulated bushing and two (2) locknuts.
3) Use grounding type locknut or bushing when required by NEC.

b. EMT: Compression type connector and locknut.

2. In NEMA 1 rated enclosures:

a. RGS and RAC:

1) Conduit hub and locknut.
2) Insulated bushing and two (2) locknuts.
3) Use grounding type locknut or bushing when required by NEC.

b. EMT: Compression type connector and locknut.

3. In NEMA 12 rated enclosures:

a. Watertight, insulated and gasketed hub and locknut.
b. Use grounding type locknut or bushing when required by NEC.

4. In NEMA 3R, 4 and NEMA 4X rated enclosures:

a. Watertight, insulated and gasketed hub and locknut.

5. In NEMA 7 and NEMA 9 rated enclosures:

a. Into an integral threaded hub.

6. When stubbed up through the floor into floor mounted equipment:

a. With an insulated grounding bushing on metallic conduits.
b. With end bells on non-metallic conduits.

H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.05 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:

1. Dry or wet and/ or hazardous areas:

a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit straps.

b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.

c. Stainless steel system consisting of: Type 304 or 316 stainless steel channels and fittings, nuts and hardware and conduit straps.

2. Corrosive areas:

a. PVC coated steel system consisting of: PVC coated galvanized steel channels and fittings and conduit clamps with stainless steel nuts and hardware.

b. Fiberglass system consisting of: Fiberglass channel and fittings, and conduit clamps with stainless steel nuts and hardware.

c. Stainless steel systems consisting of Type 304 or 316 stainless steel channels and fittings, nuts and hardware and conduit straps.

3. Conduit type shall be compatible with the support system material.

a. Galvanized steel system may be used with RGS and EMT.

b. Stainless steel system may be used with RGS, PVC-RGS and RAC.

c. PVC coated galvanized steel system may be used with PVC-RGS, RAC, PVC-40, PVC-80, and Fiberglass.

d. Aluminum system may be used with RAC and PVC-RGS.

e. Fiberglass system may be used with PVC-40, PVC-80, PVC-RGS, and Fiberglass.

B. Permitted single conduit support fasteners per area designations and conduit types:

1. Architecturally finished areas:

    a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.

    b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts, and bolt on beam clamps.

    c. Provide anti-rattle conduit supports when conduits are routed through metal studs.

2. Dry or wet and/or hazardous areas:

    a. Material: Zinc plated steel, stainless steel and malleable iron.

    b. Types of fasteners: Straps, hangers with bolts, clamps with bolts, and bolt on beam clamps.

3. Corrosive areas:

    a. Material: Type 304 or 316 stainless steel or PVC coated malleable iron or steel. For indoor corrosive areas, non-metallic PVC or fiberglass straps may be used.

    b. Types of fasteners: Straps, hangers with bolts, clamps with bolts, and bolt on beam clamps.

4. Conduit type shall be compatible with the support fastener material.

    a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS and EMT.

    b. Stainless steel system may be used with RGS, PVC-RGS, and RAC.

    c. PVC coated fasteners may be used with PVC-RGS, RAC, PVC 40, and PVC-80.

    d. Non-metallic fasteners may be used with PVC-40, PVC-80, and fiberglass.

C. Conduit Support General Requirements:

1. Maximum spacing between conduit supports per NEC.

2. Support conduit from the building structure.

3. Do not support conduit from process, gas, air, water piping or other conduits.

4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load. Recommended by the manufacturer if the support is rated less than 25 LBS.

a. Do not exceed the maximum concentrated load recommended by the manufacturer on any support.

b. Conduit hangers:

1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.

c. Do not use suspended ceiling support systems to support raceways.

d. Hangers in metal roof decks:

1) Utilize fender washers.
2) Not extend above top of ribs.
3) Not interfere with vapor barrier, insulation, or roofing.

5. Conduit support system fasteners:

a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.

b. Do not use concrete nails and powder-driven fasteners.

3.06 OUTLET, PULL, AND JUNCTION BOX INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.

2. Install approved thread grease on all plugs prior to installation.

3. Fill unused punched-out tapped, or threaded hub openings with insert plugs. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:

1. Permitted uses of metallic outlet boxes:

a. Housing of wiring devices:

1) Recessed in all stud framed walls and ceilings.

2) Recessed in poured concrete, concrete block, and brick walls of architecturally finished areas and exterior building walls.

b. Pull or junction box:

1) Above gypsum wall board or acoustical tile ceilings.

2) Above 10 FT in an architecturally finished area where there is no ceiling.

2. Permitted uses of cast outlet boxes:

    a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, and hazardous areas.

    b. Pull and junction box surface mounted in non-architecturally finished dry, wet, and corrosive areas.

3. Permitted uses of non-metallic outlet boxes:

    a. Housing of wiring devices surface mounted in non-architecturally finished corrosive areas.

    b. Pull and junction boxes mounted in non-architecturally finished corrosive areas.

4. Mount devices outlet boxes where indicated on the Drawings and at the following heights:

    a. Light switch (to center): 48 IN.
    b. Receptacle in architecturally finished areas (to center): 18 IN.
    c. Receptacle on exterior wall of building (to center): 18 IN.
    d. Receptacle in non-architecturally finished areas (to center): 48 IN.
    e. Telephone outlet in architecturally finished areas (to center): 18 IN.
    f. Telephone outlet for wall-mounted phone (to center): 54 IN.
    g. Pushbutton or selector switch control station (to center): 48 IN.

5. Set device outlet boxes plumb and vertical to the floor.

6. Outlet boxes recessed in walls:

    a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.

    b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.

7. Place barriers between switches in boxes with 277 V switches on opposite phases.

8. Back-to-back installations are not permitted.

9. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.

C. Pull and Junction Boxes:

1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.

a. Make covers of boxes accessible.

2. Permitted uses of NEMA 1 enclosure:

   a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.

   b. Pull or junction box surface in a non-architecturally finished area.

3. Permitted uses of NEMA 3R enclosure:

   a. Pull or junction box surface mounted in dry and wet areas, unless stated otherwise in Drawings.

4. Permitted uses of NEMA 4X metallic enclosure:

   a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.

5. Permitted uses of NEMA 4X non-metallic enclosure:

   a. Pull or junction box surface mounted in indoor areas designated as wet and/or corrosive where used with PVC-40 or PVC-80 conduit.

6. Permitted uses of NEMA 7 enclosure:

   a. Pull or junction box surface mounted in Class I hazardous areas.

      1) Provide PVC coating in corrosive areas when PVC-RGS conduit is used.

7. Permitted uses of NEMA 9 enclosure:

   a. Pull or junction box surface mounted in Class II hazardous areas.

      1) Provide PVC coating in corrosive areas when PVC-RGS conduit is used.

8. Permitted uses of NEMA 12 enclosure:

   a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION

SECTION 16120
600-VOLT BUILDING WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for 600-volt building wire and cable.

1.02 REFERENCES

A. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA 70 - National Electrical Code (NEC), Article 310 - Conductors for General Wiring.

B. Underwriter's Laboratories (UL)

1. UL 83: Thermoplastic Insulated Wires and Cables

2. UL 1063: Machine Tool Wires and Cables

C. American Society for Testing and Materials (ASTM)

1. ASTM B3: Soft or Annealed Copper Wires

2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft

D. Insulated Cable Engineers Association (ICEA), ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).

1.03 SUBMITTALS

A. Submit the following for Engineer’s approval.

1. Manufacturer's cut sheets and catalog data

2. Instruction for handling and storage

3. Dimensions and weight

1.04 QUALITY ASSURANCE

A. Tests. Cable shall meet all the requirements of Part 6 of ICEA S-61-402.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship wire and cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by using manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Alan Wire

B. American Insulated Wire Corporation

C. Cerro Wire

D. General Cable Company

E. Houston Wire & Cable

F. Okonite Company

G. Interstate Wire Company

H. Southwire

I. Service Wire Company

J. Encore Wire

2.02 MATERIALS AND EQUIPMENT

A. Design. Provide cable designated as THWN/THHN or XHHW single conductor type and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at maximum conductor temperature of 90 degrees C in dry locations and 75 degrees C in wet locations while installed in underground duct, conduit or in control panels (MTW).

B. Conductors. Provide conductors which are Class B, concentric stranded, annealed un-coated copper with physical and electrical properties complying with ASTM B3 and B8 and Part 2 of ICEA S-61-402.

C. Insulation. Each conductor shall be PVC insulated and nylon jacketed to meet the requirements of Part 3 of ICEA S-61-402. The insulation thickness shall match the dimensions listed in NEC Table 310-13 for type THHN and THWN wire.

D. Wire Marking

1. Wire marking shall be in accordance with NEC Article 310-11 and shall be printed on the wire insulation at 2-foot intervals.

2. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.

E. The single conductor color coding shall be as follows:

System Voltage	A	B	C	Neutral
120/208 Volt 3Ph/4w	Black	Red	Blue	White
120/240 Volt 3Ph/4w	Black	Orange	Blue	White
277/480 Volt 3Ph/4w	Black	Purple	Yellow	Grey

Motor Control	1	Black
	2	Red
	3	Blue
Ground		Green

PART 3 EXECUTION

3.01 PREPARATION

A. Complete the cable raceway systems and underground duct banks before installing cables.

B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.

C. Check the length of the cable raceway system against the length of cable on the selected reel.

D. Clean conduits of foreign matter before cables are pulled.

3.02 INSTALLATION

A. Wiring Methods

1. Use wiring methods indicated on the Drawings

2. In general, use THHN/THWN or XHHW building wire for lighting, power and control wiring were conductors are enclosed in raceways such as above ground conduit system, underground duct banks, or inside control panels.

3. Do not use solid conductors.

4. Use conductors not smaller than No. 12 AWG stranded for lighting circuits.

5. Use conductors not smaller than No. 14 AWG for control circuits, except when part of a multiconductor cable or internal panel wiring.

6. In general, do not splice conductors unless approved by the Engineer.

7. Splices associated with taps for lighting and control circuits are allowed without approval.

8. Make splices in accessible junction boxes.

9. Use wire nuts with insulated caps for lighting wiring splices. Splice control circuit with insulated crimp connectors.

B. Single Conductor in Conduit and Ductbank

1. Install cables in accordance with the manufacturer's instructions and NEC Chapter 3 – Wiring Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.

2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.

C. Preparation for Termination

1. Make 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.

2. Terminal lugs and connectors for all sizes of conductors shall be crimp-on type.

3. For size 1/0 AWG and larger, crimp-on lugs shall have the long barrel with 2-hole tongues except in places where termination space is limited.

D. Tests

1. In general, test insulation integrity of the wiring system before terminating.

2. Make sure to disconnect sensitive electronic equipment before testing insulation.

3. Use a 500 VDC megohmmeter and perform the wire system insulation test in accordance with the operating instructions.

E. Termination

1. After the 600-volt wiring system has been tested with satisfactory results, reconnect wire.

END OF SECTION

SECTION 16122
600-VOLT POWER CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for 600-volt power cable.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B3: Soft or Annealed Copper Wires.
2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

C. Insulated Cable Engineers Association (ICEA):

1. ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).

2. ICEA S-66-524: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-7).

3. ICEA S-68-516: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).

D. Underwriters' Laboratories (UL):

1. UL 44: Rubber Insulated Wires and Cables.
2. UL 83: Thermoplastic Insulated Wire and Cables.

E. National Fire Protection Association (NFPA), No. 70 - National Electrical Code (NEC), Chapter No.3 - Wiring Methods and Materials.

1.03 SUBMITTALS

A. Submit the following under the provisions of Section 01300 - Submittal Procedures:

1. Completed engineer's data sheets
2. Completed manufacturer's data sheets
3. Manufacturer's cut sheets, catalog data
4. Installation, terminating and splicing procedure
5. Instruction for handling and storage
6. Dimensions and weight

7. Conformance certificate

1.04 QUALITY ASSURANCE

A. Tests:

1. Cable shall be tested at the factory to confirm that the cable complies with requirements of Part 6 of ICEA S-61-402, S-66-524 or S-68-516. Refer to data sheet for additional test requirements.

2. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5

1.05 DELIVERY STORAGE AND HANDLING

A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURES

A. Alan Wire
B. American Insulated Wire Corporation
C. Cerro Wire
D. General Cable Company
E. Houston Wire & Cable
F. Okonite Company
G. Interstate Wire Company
H. Southwire
I. Service Wire Company
J. Encore Wire

2.02 MATERIALS AND EQUIPMENT

A. Design: Provide cable with the following design characteristic. Cable shall be UL 44 or UL 83 listed, rated 600 volts and certified for continuous operation at the temperature as specified on the 600 Volt Power Cable Data Sheets while installed in underground duct, conduit, or cable tray. Cables shall be single-conductor or multi-conductor (with ground) as specified on the data sheets.

B. Conductors: Provide conductors which are Class B, concentric stranded, annealed copper coated, unless otherwise specified on the data sheets, with physical and electrical properties conforming to ASTM B3, B8 or B33 and Part 2 of ICEA S-61-402, S-66-524, or S-68-516. The number and size of conductors supplied in each cable shall correspond to the quantities specified on the data sheets.

C. Insulation: Insulate each conductor as specified on the 600 Volt Power Cable Data Sheets to meet the requirements of Part 3 of ICEA S-61-402, S-66-524 or S-68-516. The insulation thickness shall match the dimensions listed in Section 3.2, Table 3-1 of ICEA S-61-402, S-66-524 or S-68-516, as specified on the data sheets.

D. Jacket:

1. When power cables are to be enclosed in conduit, ducts or in other raceway systems, multiconductor power cables shall be of the non-metallic type and shall be covered by an overall nonmetallic jacket as specified on the Data Sheets, which complies with the requirements of Section 4.4 of ICEA S-66-524 or S-68-516, Section 4.3 of ICEA S-61-402, or Table 21-5 of Part 21 of UL 83.

2. Single-conductor cables shall have a jacket thickness which meets the requirements of Table 4-4 of Part 4 of ICEA S-66-524, Table 4-2 of Part 4 of ICEA S-68-516, or Table 4-2 or 4-6 of Part 4 of ICEA S-61-402. Multi-conductor cables shall have a jacket thickness, which complies with Table 4-7 of Part 4 of ICEA S-66-524, Table 4-2 of Part 4 of ICEA S-68-516, Table 4-5 of Part 4 of ICEA S-68-516, or Table 4-6 of Part 4 of ICEA S-61-402, unless otherwise specified on the data sheets.

E. Armor: When power cables are to be exposed in a cable tray, cable channel or other cable support systems, the multiconductor power cables shall be protected by an interlocked metal armor made of galvanized steel which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524 unless otherwise specified on the data sheets. An over-all jacket shall be provided as specified in the data sheets.

F. Cable Marking: Print cable marking information on the overall cable jacket at 2-foot intervals. Use a permanent printing method color with a sharply contrasting the jacket color. Identify individual conductors as specified on the data sheets in conformance with Part 5 of ICEA S-61-402, S-66-524, and S-68-516.

PART 3 EXECUTION

3.01 PREPARATION

A. Complete cable raceway systems, underground duct banks, and cable support systems before installing cables.

B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.

C. Check the length of the cable raceway system against the length of cable on the selected reel.

D. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.

3.02 INSTALLATION

A. Cable in Conduit and Ductbank:

1. Clean conduits of all foreign matter before cables are pulled.

2. Install cables in accordance with the manufacturer's instructions and the National Electrical Code (NEC), Chapter 3 - Wiring Methods and Materials. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.

3. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation.

B. Cable in Tray:

1. Install medium voltage (5 Kv and 15 Kv) and 600V cables in separate trays or separated cables by a barrier in a single tray in accordance with NEC 318-6(f).

2. Install cables in trays in a neat and orderly manner. Tie cables to the tray rungs at approximate 15-foot intervals by use of cable ties.

3. Only one layer of 3-conductor No. 4/0 AWG and larger 600-volt power cables are allowed in a cable tray per NEC 318-9(a).

4. Using cable ties, make a triplex of single conductors used for 3-phase systems. Install in cable tray in accordance with NEC 318-10.

C. Preparation for Termination:

1. Make up 600-volt power cable terminations and splices with heat shrinkable sleeves and seals.

2. Use crimp-on terminal lugs and connectors for all sizes of conductors.

3. Use crimp-on lugs with long barrel and two-hole tongues, except in places where terminations space is limited.

D. Tests:

1. Before connecting the cables, test insulation integrity.

2. Use a 500 VDC megohmmeter and perform the cable insulation test in accordance with the operating instructions.

E. Termination:

1. After the 600-volt cable has been tested with satisfactory results, terminate the cable at both ends to designated terminal points.

2. Tighten connection bolts with a torque wrench to specified torque levels.

END OF SECTION

SECTION 16126
INSTRUMENTATION CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for instrumentation cable.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

1. ASTM B3: Soft or Annealed Copper Wires.
2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft.
3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes.

B. Institute of Electrical and Electronics Engineers (IEEE), IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

C. Insulated Cable Engineers Association (ICEA):

1. ICEA S-61-402: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-5).

2. ICEA S-66-524: Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-7).

3. ICEA S-68-516: Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy (NEMA WC-8).

D. Underwriters' Laboratories (UL):

1. UL 44: Rubber Insulated Wires and Cables.
2. UL 83: Thermoplastic Insulated Wire and Cables.

E. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA No. 70 - National Electrical Code (NEC), Chapter No. 3 - Wiring Methods and Materials, Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling, and Power-Limited Circuits.

1.03 SUBMITTALS

A. Submit the following under the provisions of Section 01300 - Submittals:

1. Completed engineer's data sheets from this specification or manufacturer's data sheets, cut sheets, and catalog data.

2. Installation, terminating and splicing procedure (including bending radius and pulling tension data).

3. Instruction for handling and storage.

4. Dimensions and weight.

1.04 QUALITY ASSURANCE

A. Tests:

1. Cable shall be tested at the factory to confirm that the cable complies with requirements of ICEA Section 7.7.9 of S-66-524 or 7.5.9 of S-68-516. Refer to data sheet for additional test requirements.

2. Where applicable, the cable shall meet the requirements of the vertical tray flame test as described in IEEE 383-2.5.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Reels shall be of the type specified on the data sheets. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Provide moisture protection by manufacturer's standard procedure or heat shrinkable self-sealing end caps applied to both ends of the cable.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Alpha Wire Corporation
B. Belden Division, Cooper Industries, Inc.
C. Cablec Continental Cables Company
D. Dekoron Wire & Cable, LLC
E. General Cable Company
F. Manhattan Electric Cable Corporation
G. Okonite Company

2.02 MATERIALS AND EQUIPMENT

A. Design: Provide cable with the following design characteristics. The cable shall consist of multiple conductors. The cable assembly shall be UL listed, flame, oil and sunlight resistant, and certified for continuous operation at the temperature specified on the Instrumentation Cable Data Sheets in wet or dry locations while installed in underground duct, conduit, or cable tray. The number and size of conductors supplied in each cable shall correspond to the quantities specified on the Instrumentation Cable Data Sheets. Each conductor shall be individually insulated. Pairs and triads shall have conductors, which are twisted together with a drain wire, shielded, and covered with a jacket. Multi-pair/triad cables shall consist of the required number of electrically isolated, shielded pairs or triads, which are bundled together and covered by an overall jacket as specified on the Instrumentation Cable Data Sheets.

B. Conductors: Provide conductors which are Class B, concentric stranded, annealed tinned copper whose physical and electrical properties comply with ASTM B3, B8 or B33

and Part 2 of ICEA S-61-402, S-66-524, or S-68-516, unless otherwise specified on the Instrumentation Cable Data Sheets.

C. Insulation: Each conductor shall be insulated as specified on the Instrumentation Cable Data Sheets in compliance the requirements of Part 3 of ICEA S-61-402, S-66-524, or S-68-516. The average insulation thickness shall not be less than the dimensions shown in Table 7-32 or 7.5.1 of ICEA S-66-524 or S-68-516 for 600-volt insulation unless otherwise specified on the Instrumentation Cable Data Sheets. The minimum insulation thickness shall not be less than 90 percent of the value given in the table.

D. Drain Wire: Provide drain wire which is Class B, seven-stranded, tin-coated copper in accordance with ASTM B3, B8, or B33 and as specified on the Instrumentation Cable Data Sheets. The drain wire shall not be less than two AWG sizes smaller than the insulated conductor's size, except for multiple pair triad drain wires, which shall not be less than the insulated conductor size.

E. Shielding: Provide shielding consisting of laminated, nonburning, mylar-backed aluminum tape applied helically around a twisted pair or triad with the aluminum side in continuous contact with the drain wire unless otherwise specified on the Instrumentation Cable Data Sheet. Wrap the tape around each twisted pair or triad with a 25 percent minimum overlap unless otherwise specified on the Instrumentation Cable Data Sheets.

F. Jacket: The physical and electrical properties of the jacket used to cover single or multi-pair or triad cables shall meet the requirements of section 7.7.7 or ICEA S-66-524 or section 7.5.6 of ICEA S-68-516. Jacket material is specified on the Instrumentation Cable Data Sheets. The jacket thickness shall be equal to the dimensions shown in Table 7-33 or 7.5.2 of ICEA S-66-524 or S-68-516. The jacket material is specified on the Instrumentation Cable Data Sheets. The jacket thickness shall be equal to the dimensions shown in Table 7-33 or 7.5.2 of ICEA S-66-524 or S-68-516.

G. Armor: Where requested, use instrumentation cables protected by an interlocked metal tape armor coating made of galvanized steel which meets the requirements of paragraph 4.5 of ICEA S-68-516 or S-66-524, unless otherwise specified on the Instrumentation Cable Data Sheets.

H. Conductor Identification: Use individual conductors in single-pair and single-triad cables which are color coded black and white; and black, white and red, respectively. Multi-pair-triad cables shall have one conductor in each pair or triad colored white, and all other conductors are color coded in sequence according to Table L-2 of Appendix 2 of ICEA S-66-524, and as specified on the Instrumentation Cable Data Sheets.

I. Cable Marking: Print cable-marking information on the jacket of each cable at 2-foot intervals. Use a permanent printing method with color sharply contrasting the jacket color. See the Instrumentation Cable Data Sheets for the minimum information required.

PART 3 EXECUTION

3.01 PREPARATION

A. Complete cable raceway systems, underground duct banks and cable support systems before installing cables.

B. Verify sizing of raceways and pullboxes to ensure proper accommodation for the cables.

C. Check the length of the cable raceway system against the length of cable on the selected reel.

D. Do not install or work on PVC insulated or jacketed cables in temperatures below 32 degrees F.

E. Clean conduits of foreign matter before cables are pulled.

F. Provide at least 30 percent spare conductors or pairs.

3.02 INSTALLATION

A. Cable in Conduit and Ductbank

1. Install cables in accordance with the manufacturer's instructions and NEC Article 725 - Class 1, Class 2, and Class 3 Remote Control, Signaling and Power Limited Circuits. Do not exceed maximum wire tension, maximum insulation pressure and minimum bending radius.

2. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation or cable jacket.

3. Conduits carrying low-level signal cables shall be PVC-coated rigid steel.

B. Cable in Tray: Install instrument and signal cable in cable tray only when the tray is dedicated for this type cable and cables are approved for tray installation.

C. Termination:

1. Do not splice conductors. For termination use crimp-on type ring tongue non-insulated tin-plated copper lugs.

2. For shielded control cable, terminate the shield and ground it at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables. Shield on ungrounded cable end to be wrapped cylindrically around cable end and thoroughly insulated with Scotch 33 electrical tape. Grounded end to be of sufficient length to reach ground screw or terminal strip and insulated with transparent tubing.

3. If splicing is required, maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.

4. Mark wiring on both ends with circuit numbers or loop tag numbers. Heat shrink wire markers after the ring tongue terminal has been installed. Extend the marker over the crimp or base of the terminal.

D. Tests:

1. Before connecting the cables, test insulation integrity and conductor continuity.

2. Test shielded cable shields with an ohmmeter for continuity along the length of the cable and for shield continuity to ground.

3. Connect shielded instrumentation cables to a calibrated 4-20 milliamp DC signal transmitter and receiver. Test at 4,12, and 20 milliamp transmitter settings.

4. Test each electrical circuit after permanent cables are in place to demonstrate that the circuit and connected equipment perform satisfactorily and that cables are free from improper grounds and short circuits.

E. Termination: After the instrumentation cable has been tested with satisfactory results, the cable can be terminated at both ends to their designated terminal points.

END OF SECTION

SECTION 16131
DEVICE, PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for device, pull, and junction boxes.

1.02 REFERENCES

A. American National Standards Institute/National Electrical Manufacturers Association (ANSI/NEMA).

1. FB1 - Fittings and Support for Conduits and Cable Assemblies

2. 250 - Enclosures for Electrical Equipment (1000 volts maximum)

B. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA70 - National Electrical Code (NEC) - Article 370 - Outlet Device, Pull and Junction Boxes, Conduit Bodies and Fittings.

C. Underwriters Laboratories (UL):

1. 50 - Safety Cabinets and Boxes

2. 508 - Safety Industrial Control Equipment

3. 514B - Safety Fittings for Conduit and Outlet Boxes

4. 886 - Safety Outlet Boxes and Fittings for Use in Hazardous Areas

1.03 SUBMITTALS

A. Submit all products covered under this specification for Engineer’s approval.

B. Manufacturer's cut sheets, catalog data

C. Instruction for handling and storage

1. Installation instructions

2. Dimensions and weights

1.04 DELIVERY, STORAGE AND HANDLING

A. Pack and crate boxes to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cast Device Boxes

1. Appleton Electric Company

2. Crouse-Hinds, Division of Cooper Industries

3. Killark Electric Manufacturing Company

2.02 MATERIALS AND EQUIPMENT

A. Device Boxes

1. Provide UL-approved boxes designed and manufactured to house electrical devices like receptacles and switches, and in conformance with NEMA FB1 and NEC Article 370.

2. Supply boxes that are hot-dip galvanized on cast iron suitable for corrosive and 0 wet atmosphere.

B. Hardware

1. Mounting Hardware: Stainless steel

2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

PART 3 EXECUTION

3.01 PREPARATION

A. Review the drawings and determine how many boxes of each kind are required and check if supplied quantity is sufficient.

3.02 INSTALLATION

A. Boxes described in this specification shall be used both in dry and wet, corrosive areas, both inside and outside locations.

B. Install boxes in accordance with NEC Article 370 in locations indicated on the Drawings.

C. Install junction and pull boxes in readily accessible places to facilitate wire pulls, maintenance and repair.

D. Plug unused conduit openings.

E. Make conduit connections to sheet metal boxes with watertight conduit connectors.

END OF SECTION

SECTION 16160
CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specifications for cabinets and enclosures for housing of control panels and motor controls.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. 250 - Enclosures for Electrical Equipment (1000 volts maximum).

a. NEMA 3R - Enclosures for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, and sleet; undamaged by formation of ice on the enclosure.

b. NEMA 12 - Enclosures for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

c. NEMA 4X – Enclosures for outdoor use primarily to provide a degree of protection against wind-blown dust, rain, sleet, hose directed water, and corrosion; undamaged by formation of ice on the enclosure.

B. American National Standards Institute/National Fire Protection Association (ANSI/NFPA), NFPA 70 - National Electrical Code (NEC), Article 373 - Cabinets, Cutout Box, and Meter Socket Enclosures.

C. Underwriters Laboratories (UL), UL 50 - Safety for Cabinets and Boxes.

1.03 SUBMITTALS

A. Submit the following under provisions of Section 01300 - Submittals:

1. Manufacturer's cut sheets and catalog data.
2. Instruction for handling and storage.
3. Installation instructions.
4. Dimensions and weights.

1.04 DELIVERY, STORAGE AND HANDLING

A. Have cabinets and enclosures packed and crated to permit ease of handling and to provide protection from damage during shipping, handling and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The EMF Company
B. Hennessey Products, Inc.
C. Hoffman Industrial Products
D. Pauluhn Electric Manufacturing Company
E. Weigman Company
F. Rose Enclosure
G. N.E.M.A. Enclosure Mfg. Co.

2.02 MATERIALS AND EQUIPMENT

A. Sheet Metal Boxes:

1. Provide enclosures manufactured in accordance with NEMA 250 and NEC Article 373. Fabricate outdoor NEMA 3R and NEMA 4X panels from 0.125- inch thick type 5052 H32 aluminum or 14 gauge, 316 stainless steel. NEMA 12 indoor panels shall be painted steel.

2. Dimensions and special features are shown on the Drawings.

3. Construct outdoor enclosures with continuously welded seams ground smooth.

4. Additional material thickness and bracing requirements shall be determined by the manufacturer to provide the strength required by the standard listed. The bracing shall be provided in such a way as to minimize the protrusion into the wiring and the equipment spaces.

5. Install the door with a stainless steel continuous hinge, stainless steel padlock handle with gasket and stainless steel hardware.

6. Furnish the door with oil-resistant neoprene gasket attached with oil-resistant adhesive and held in place with aluminum retaining strips.

7. Use a single, 3/4-inch minimum, door handle that provides a 3-point latching through latch rods with rollers. Provide rollers with at least 3/4-inch diameter.

8. Gasketed overlapping doors may be used instead of a center post.

9. Provide heavy duty lifting eyes of suitable material.

10. Fabricate the enclosure with a stud-mounted panel inside. Make panels from 12-gauge steel painted with white enamel finish.

11. Equip NEMA 12, NEMA 3R, and NEMA 4X enclosures with thermostatically controlled space heaters and corrosion inhibitors. Provide heaters rated for 240V for 120V operation.

12. Weld mounting feet to the enclosure if called for on the Drawing.

13. Include a high impact plastic data pocket in the enclosure.

14. Provide ground connections on the enclosures to enable grounding of the enclosure with a No. 2 AWG conductor.

15. Equip free-standing outdoor cabinets with inner and outer door restraint bars to prevent door swing during windy conditions.

16. Supply indoor enclosures with filtered passive air intake and exhaust openings, 4-inch square in the side near the top and near the bottom of the adjacent side panel.

B. Hardware:

1. Mounting Hardware: Stainless steel
2. Conduit Connectors: Watertight as manufactured by Myers Hubs, or equal.

2.03 TESTING

A. Test cabinets and enclosures in accordance with UL 50 so unit qualifies for a UL label.

PART 3 EXECUTION

3.01 PREPARATION

A. Review Drawings and determine how many enclosures of each kind are required and check if supplied quantity is sufficient.

B. Check the mounting pads or foundations for proper mounting dimensions and features, including grounding conductor stub-up.

3.02 INSTALLATION

A. Use enclosures described in this specification only above grade.

B. Install enclosures in accordance with NEC Article 373 in locations as indicated on the Drawings.

C. Install enclosures in readily accessible locations to facilitate general operations, wire pulls, maintenance and repair.

D. Plug unused conduit openings.

E. Make conduit connections to the enclosures with watertight conduit connectors.

END OF SECTION

SECTION 16170
GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors
B. Equipment grounding conductors
C. Bonding
D. Power system grounding
E. Communication system grounding
F. Electrical equipment and raceway grounding and bonding
G. Control equipment grounding

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B3: Soft or Annealed Copper Wires
2. ASTM B8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, Soft
3. ASTM B33: Tinned Soft or Annealed Copper Wire for Electrical Purposes

B. Institute of Electrical and Electronics Engineers (IEEE):

1. IEEE 142-82: Recommended Practice for Grounding of Industrial and Commercial Power Systems

2. IEEE 383-2.5: IEEE Standard for Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations.

C. Underwriters' Laboratories (UL):

1. UL 83: Thermoplastic Insulated Wire and Cables
2. UL 467: Grounding and Bonding Equipment

D. National Fire Protection Association (NFPA), NFPA No. 70 - National Electrical Code (NEC), Article No. 250 - Grounding.

1.03 SUBMITTALS

A. Submit the following under the provisions of Section 01300 - Submittals:

1. Manufacturer's cut sheets and catalog data
2. Installation, terminating and splicing procedure
3. Instruction for handling and storage
4. Dimensions and weight

B. Submittals after construction

1. Report of field tests and observations certified by Contractor.

1.04 QUALITY ASSURANCE

A. Tests:

1. Use insulated cable conforming to requirements of the vertical tray flame test as described in IEEE 383-2.5.

2. Test grounding system in the field in accordance with procedures outlined in Part 3 - Execution.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship grounding cable on manufacturer's standard reel sizes unless otherwise specified. Where cut lengths are specified, mark reel footage accordingly. Each reel shall contain one continuous length of cable. Provide impact protection by wood lagging or suitable barrier across the traverse of the reel. Pack and crate other materials specified to withstand normal abuse during shipping, handling and storage.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cable:

1. American Insulated Wire Company
2. Houston Wire & Cable
3. General Cable Company
4. Okonite Company
5. Interstate Wire Company
6. Southwire
7. Encore Wire

B. Ground Rods and Connectors:

1. Blackburn
2. Copperweld
3. Thomas & Betts

C. Exothermic Connections:

1. Burndy Corporation (Therm-O-Weld)
2. Erico Products (Cadweld)

D. Grounding Connectors:

1. Burndy Corporation
2. O.Z. Gedney
3. Thomas & Betts

2.02 MATERIALS AND EQUIPMENT

A. Design:

1. Provide grounding cable and materials with the following characteristics:

a. Use a grounding system designed in accordance with NEC Article No. 250 - Grounding, and the IEEE 142-82 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

B. Materials:

1. Use grounding conductors, bare or insulated, which are manufactured and tested in accordance with applicable standards ASTM B3, ASTM B8 and ASTM B33.

2. Where specified on Drawings, provide a main ground loop of No. 4/0 AWG, Class C stranded, bare copper cable. Small groups of isolated equipment may be grounded by a No. 2 AWG minimum insulated conductor connected to the main loop. Generally, taps shall be sized as follows:

a. Main ground loop or grid: #4/0 minimum
b. Switchgear, motor control centers and power transformers: #4/0
c. Motors 200 hp and above: #4/0
d. Power panels - AC and DC: #2/0
e. Control panels and consoles: #2
f. Building columns: #4/0
g. Fencing posts: #2/0

3. Where single conductor insulated grounding conductors are called for, use 600-volt insulation. Use ground conductors identified with green insulation or green tape marking.

4. Supply identifying ribbon which is PVC tape, 3 inches wide, red color, permanently imprinted with "CAUTION BURIED ELECTRIC LINE BELOW" in black letters as specified in Section 16195, Electrical Identification.

5. Utilize flexible copper braid across hinged chain link or fence gates to bond the movable portion to the grounded fence post.

PART 3 EXECUTION

3.01 PREPARATION

A. Complete site preparation and soil compaction before trenching and driving ground rods for the underground grid.

B. Verify from Drawings the exact location of stub-up points for grounding of equipment, fences and building or steel structures.

3.02 CONSTRUCTION CRITERIA

A. Install the main ground loop at a depth of at least 30 inches below earth surface. Connect the ground loop to ground rods and to tap connections to form a complete system as indicated on the electrical Drawings. The Contractor shall give special attention to the grounding of service equipment, structures and fences to comply with the NEC, local authorities and the serving utility company.

B. Electrical equipment, buildings, tanks, and other structures and equipment shall be grounded as indicated on the Drawings. Where ground rods are required, the rods shall be 10 feet long, 3/4-inch diameter, copper-clad steel ground rods, or as specified on the Drawings. Rods shall be driven vertically, and the top of the rods shall be a minimum of 18 inches below finished grade, or as specified on the Drawings.

C. Local pushbutton and selector switch stations, two-wire control devices, disconnect switches, lighting transformers, panelboards, operator panels, benchboards, and the enclosures of other electrical apparatus shall be grounded through an equipment grounding conductor run with the power supply or control circuit conductors or shall be grounded as shown on the Drawings.

D. Ground medium voltage motors, in addition to the grounding conductors in the motor feeder cable, with a separate No. 4/0 AWG cable to motor frame.

E. Motors having power supplied by multiconductor cable shall be grounded by a separate grounding conductor in the cable and where supplied by single conductor cable in conduit by a grounding conductor pulled in the conduit. Connect ground conductors to the ground bus in the motor control center and to the ground terminal provided in the motor conduit box.

F. Do not ground the insulated bearing pedestals of large motors.

G. Connect ladder-type cable trays to the grounding electrode system.

H. Install a warning ribbon approximately 12 inches below finished grade directly above the ground grid.

I. Connect fence posts of chain link and metal fences to the main ground loop at least every 50 feet.

3.03 INSTALLATION

A. Equipment Grounding:

1. Make grounding connections to surfaces, which are dry and cleaned of paint, rust, oxides, scales, grease and dirt to ensure good conductivity. Clean copper and galvanized steel to remove oxide before making welds or connections.

2. Use the exothermic welding process for below-grade grounding connections, except at ground rods. Use mechanical connectors or thermal connections for above-grade grounding connections as shown on the Drawings.

3. Make grounding connections to electrical equipment, vessels, mechanical equipment and ground rods in accordance with the Drawings.

4. Ground tanks and vessels by making connections to integral structural supports or to existing grounding lugs or pads, and not to the body of the tank or vessel.

5. Leave ground connections to equipment visible for inspection. Protect them with PVC non-metallic conduit as indicated on the Drawings.

6. Make connections to motor frames and ground buses with lugs attached to the equipment by means of bolts. Do not use motor anchor bolts or equipment housing for fastening lugs of grounding cable.

7. Where the wiring for lighting systems consists of single conductor cables in conduit, provide each conduit with an equipment-grounding conductor. Use a grounding conductor with green colored insulation and ground equipment in the lighting system.

B. Raceway and Support Systems Grounding:

1. Install raceway, cable rack or tray and conduit so that it is bonded together and permanently grounded to the equipment ground bus, according to the Drawings. Connection to conduit may be grounding bushing or ground clamp.

2. Install raceway at low voltage motor control centers or other low voltage control equipment so that it is bonded and grounded, except that any conduit which is effectively grounded to the sheet metal enclosure by bonding bushing or hubs need not be otherwise bonded.

3. Where a grounding conductor is run in or on a cable tray, bond the grounding conductor to each section of cable tray with a cable tray ground clamp.

4. Where only grounding conductor is installed in a metal conduit, bond both ends of the conduit to the grounding conductor.

5. Provide flexible "jumpers" around raceway expansion joints. Use copper bonding straps for steel conduit. Install jumpers across cable tray joints, which have been parted to allow for expansion and any hinged cable tray connections.

C. Fences and Gates:

1. Ground fences, fence posts and gates to the underground grid as shown on the Drawings.

D. Power System Grounding:

1. Solidly ground the secondary neutral of the main power supply transformer either to the ground grid or through an impedance. See Drawings for details.

2. Solidly ground the neutral of lighting, instrument and control transformers.

E. Cable Armor and Shields:

1. For shielded control cable, terminate and ground the shield at one end only, preferably at the control panel end for instrument and communication cable and at the supply end for electronic power cables. Maintain shield continuity by jumpering the ground shield across connection point where it is broken at junction boxes, or other splice points. Insulate these points from ground.

2. Connect the ground wire in power cable assemblies at each terminal point to a ground bus, if available, or to the equipment enclosure. Do not carry these ground wires through a "doughnut" current transformer (CT) used for ground fault relaying; do carry ground leads from stress cones through CTs. Ground power cable armor and shield at each terminal point.

F. Test Wells:

1. Provide access (test wells) for testing the ground grid system at one or several ground rod locations. Make test wells of a pipe surrounding the rod and connections with a cover placed on top at grade level. See Drawings for details.

3.04 FIELD QUALITY CONTROL

A. Test:

1. Perform ground resistance tests after underground installation and connections to building steel are complete, unless otherwise noted on applicable Drawings.

2. Make tests at each ground test well using a "fall of potential" test method. Each ground test well shall not exceed a maximum resistance of 5 ohms. Where measured values exceed this figure, install additional ground rods as required to reduce the resistance to the specified limit.

B. Inspection:

1. Inspection of the grounding system by the Engineer and the local Code Inspector must take place before the grid trenches are backfilled.

3.05 RESTORATION

A. Restore surface features at areas disturbed by excavation and reestablish original grades except as otherwise indicated.

B. Where sod has been removed, replace it as soon as possible after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other Work to their original condition.

D. Include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching.

E. Restore disturbed paving as indicated.

END OF SECTION

SECTION 16190
SUPPORTING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Requirements of Division 16 "Basic Electrical Requirements" apply to this Section.

1.02 SECTION INCLUDES

A. Conduit and equipment supports.
B. Anchors and fasteners.
C. Strut.
D. Fittings.
E. Hangers.
F. Hanger rod.
G. Brackets.
H. Cable ties.
I. Spring vibration isolators.
J. Concrete Equipment Pads.

1.03 SUBMITTALS:

A. Submit the following in accordance with Section 16010:

1. Provide strut by no more than two (2) manufacturers.

2. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.

3. Shop drawings indicating details of fabricated products and materials.

4. Submittals in this section shall also be signed by the Structural Engineer and/or System Building Manufacturers where applicable.

1.04 QUALITY ASSURANCE:

A. Comply with the following:

1. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

2. Comply with Federal Specification W-C-582A, FF-B-575C and FS-S-760A(2).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:

1. Slotted Metal Angle and U-Channel Systems:

    a. Allied Tube & Conduit
    b. American Electric
    c. B-Line Systems, Inc.
    d. GS Metals Corp.
    e. Unistrut Corporation

2. Hangers:

    a. Erico/Caddy
    b. Allied
    c. American Electric
    d. B-Line
    e. GS Metals
    f. Unistrut

3. Brackets:

    a. Erico
    b. Bowers
    c. Raco
    d. Steel City

4. Vibration Isolators:

    a. Amber/Booth
    b. Dynasonic
    c. Grinnell
    d. Mason Industries

2.02 COATINGS

A. Coating: Strut, fittings, hangers and hanger rod shall be ASTM A123 hot dip galvanized after fabrication. Hardware fasteners and clamps shall have ASTM B633 Type III SCI electroplated zinc coatings.

2.03 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps. Purlin hangers shall mount to the vertical member of the purlin or as otherwise required by building manufacturer and/or structural engineer.

B. Fasteners: Types, materials, and construction features as follows:

1. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using beam clamps.

2. Use steel springhead type toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

4. Do not use powder-actuated anchors.

5. Do not drill structural steel members.

C. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems (Strut): 12-gauge steel 1-5/8" x 1-5/8" minimum channels, with 9/16" x 1-1/8" maximum short slots at 2" on center maximum. Strut shall be cold formed per ASTM A570 GR33. Joints in strut system shall be made with 4 bolt accessories as a minimum. Conduit clamps to strut shall be bolt unistrut 1100, 1200, 1400 Series or equal.

F. Recessed Box Supports Brackets: Mount boxes with Erico/Caddy SGB Series, FBS Series or equal.

2.04 FIELD FABRICATED SUPPORTING DEVICES

A. General: Shop or field-fabricated supports or manufactured supports assembled from U-channel components.

B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

C. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:

a. 3-inch and smaller: 20-gauge.
b. 4-inch to 6-inch: 16-gauge.

c. over 6-inch: 14-gauge.

2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

D. All Thread Rod: Hot dip galvanized, 1/4" minimum.

2.05 VIBRATION ISOLATORS

A. Hangers: Spring steel hangers shall be amber/booth BS Series or equal.

B. Pads: Provide ribbed neoprene pads amber/booth Type NR or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Install supporting devices to fasten electric components securely and permanently in accordance with NEC, NECA and manufacturers requirements.

B. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration and shock resistant fasteners for attachments to concrete slabs.

C. Exclusions:

1. Do not fasten supports to ceiling system, pipes, ducts, mechanical equipment and conduit.

2. Tie wires and perforated pipe straps shall not be used for securing conduits.

3. Do not support loads from the bottom chord member of trusses or open web steel joists.

4. Do not attach conduit to ceiling support wires or ceiling tees.

5. Do not use powder-actuated anchors unless indicated by Architect or Structural Engineer.

6. Do not drill or cut structural members unless directed by Architect or Structural Engineer.

D. Touch up all scratches or cuts on steel components with an approval zinc chromate or a 90 percent zinc paint. Use PVC compound on PVC coated components.

3.02 CONDUIT, RACEWAYS AND SLEEVES

A. Fabricate supports form structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nut unless otherwise noted.

B. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four.

C. Install individual and multiple raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

D. Support parallel runs of horizontal raceways together on trapeze-type hangers. Where conduit is of different sizes, use the same trapeze hanger space supports for the smallest size conduit on the rack.

E. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use ¼-inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

F. Branch circuit raceways which are 1-inch or smaller may be attached to wall studs by use manufactured clips.

G. Space supports for raceways in accordance with NEC.

H. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.

I. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire-rated wall or floor construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables.

3.03 BOXES AND WIRING DEVICES

A. Structural Mounting: They shall be rigidly supported from a structural member of the building either directly or by using a metal or wood brace. Support wires that do not provide rigid support shall not be permitted as the sole support.

B. Outlet or junction boxes in exposed or concealed ceilings, all thread rod, manufactured brackets shall be mounted to building structure, strut suspended from building structure. Do not support boxes with conduit only or with all thread rod.

C. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

D. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

E. Use stamped steel bridges to fasten flush mounting outlet box between studs.

F. Metal braces shall be protected against corrosion and formed from metal not less than .020 inch (508 micrometers) thick uncoated.

G. Use adjustable steel channel fasteners for hung ceiling outlet box.

H. Do not fasten boxes to ceiling support wires or tees.

3.04 WIRES AND CABLES

A. Vertical Conductor Supports: Install simultaneously with installation of conductors.

3.05 INDOOR AND OUTDOOR WALL MOUNTED EQUIPMENT

A. This shall include but not be limited to cabinets, enclosures, disconnect switches, panelboards, motor controllers, VFD's, small transfer switches and wireways.

B. All cabinets and panelboards shall be wall mounted unless otherwise indicated.

C. Install surface-mounted cabinets and panelboards with minimum of four anchors.

D. In wet and damp locations use steel channel supports to stand cabinets and panelboard one inch off wall.

E. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

3.06 INDOOR FLOOR MOUNTED EQUIPMENT

A. This shall include but not be limited to switchboards, dry type transformers and large transfer switches.

B. Free standing equipment shall be installed on concrete pads unless noted otherwise.

C. Concrete pads shall be 3" tall and be 2" wider than equipment on all 4 sides.

D. Concrete shall be 3000 PSI, 28 day compressive strength.

E. Concrete, forms and reinforcing shall be in accordance with Division 3.

F. Floor mounted transformers shall also be provided with neoprene vibration isolation pads.

3.07 INDOOR SUSPENDED EQUIPMENT

A. Equipment to be suspended shall be supported with strut, with all thread rod and beam clamps.

B. Transformers shall also have spring steel hanger vibration isolators.

3.08 INDOOR AND OUTDOOR RACK OR PEDESTAL MOUNTED EQUIPMENT

A. Equipment shall be rack or pedestal mounted only where indicated or required by installation.

B. Mount on strut bolted to concrete or anchored with concrete base when located outside.

3.09 OUTDOOR PAD MOUNTED EQUIPMENT

A. This shall include but not be limited to distribution transformers, switchgear, switchboards, dry type transformers, motor control centers and generators.

B. Concrete pads shall have a footprint 12" larger than equipment on all sides.

C. Concrete pads shall be 6" thick with 18" deep by 12" wide grade beams on all sides.

D. Concrete shall be 3000 PSI, 28 day compressive strength.

E. Provide 6" wire mesh in pad.

F. Provide 4#4 bar with #3 stirrups at 18" on center in grade beams.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification of electrical materials, equipment, and installations.

1.02 SUBMITTALS

A. Submit all products covered under this specification for Engineer’s approval.

B. Product Data:

1. Submit for each type of product specified.

C. Samples:

1. Submit for each color, lettering style, and or graphic representation required for identification materials, samples of labels and signs.

D. Miscellaneous:

1. Schedule of identification nomenclature to be used for identification signs and labels.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

B. Comply with ANSI C2.

PART 2 PRODUCTS

2.01 RACEWAY AND CABLE LABELS

A. Manufacturer's Standard Products:

1. Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.

B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.

1. Color: Black legend on orange field.

2. Legend: Indicates voltage.

C. Adhesive Labels:

1. Preprinted, flexible, self-adhesive vinyl. Legend is over-laminated with clear, wear and chemical resistant coating.

D. Pre-tensioned, Wraparound Plastic Sleeves:

1. Flexible, preprinted, color-coded, acrylic bands sized to suit diameter of line it identifies and arranged to stay in place by pre-tensioned gripping action when placed in position.

E. Colored Adhesive Tape:

1. Self-adhesive vinyl tape not less than 3-mils thick by 1 to 2-in. wide (0.08-mm thick by 25 to 51-mm wide).

F. Underground Line Warning Tape:

1. Permanent, bright-colored, continuous printed, vinyl tape with following features:

a. Size: Not less than 6-in. wide by 4-mils thick (152-mm wide by 0.102-mm thick).
b. Compounded for permanent direct burial service.
c. Embedded continuous metallic strip or core.
d. Printed Legend: Indicates type of underground line.

G. Tape Markers:

1. Vinyl or vinyl cloth, self-adhesive, wraparound type with preprinted numbers and letters.

H. Aluminum, Wraparound Marker Bands:

1. Bands cut from 0.014-in. (0.4-mm) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

I. Plasticized Card Stock Tags:

J. Vinyl cloth with preprinted and field printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.

K. Aluminum Faced Card Stock Tags:

1. Wear resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002-in. (0.05-mm) thick, laminated with moisture

resistant acrylic adhesive, and punched for fastener. Preprinted legends suit each application.

L. Brass or Aluminum Tags:

1. Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2-in. (51 by 51-mm) by 0.05-in. (1.3-mm).

2.02 ENGRAVED NAMEPLATES AND SIGNS

A. Manufacturer's Standard Products:

1. Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.

B. Engraving stock, melamine plastic laminate, 1/16-in. (1.6-mm) minimum thick for signs up to 20-sq. in. (129-sq. cm), 1/8-in. (3.2-mm) thick for larger sizes.

1. Engraved Legend: Black letters on white face.
2. Punched for mechanical fasteners.

C. Baked Enamel Signs for Interior Use:

1. Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for application. 1/4-in. (6.4-mm) grommets in corners for mounting.

D. Exterior, Metal Backed, Butyrate Signs:

1. Wear resistant, non-fading, preprinted, cellulose acetate butyrate signs with 0.0396-in. (1-mm), galvanized steel backing, with colors, legend, and size appropriate to application. 1/4-in. (6.4-mm) grommets in corners for mounting.

E. Fasteners for Plastic Laminated and Metal Signs:

1. Self-tapping stainless steel screws or No. 10/32 stainless steel machine screws, with nuts, flat washers and lock washers.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties:

1. Fungus inert, self-extinguishing, 1 piece, self-locking, Type 6/6 nylon cable ties with following features:

a. Minimum Width: 3/16-in. (5-mm).
b. Tensile Strength: 50-lb (22.3 kg) minimum.
c. Temperature Range: Minus 40 to 185°F (Minus 4 to 85°C).
d. Color: As indicated where used for color-coding.

B. Paint:

1. Alkyd-urethane enamel. Primer as recommended by enamel manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install identification devices according to manufacturer's written instructions.

B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

C. Lettering, Colors, and Graphics:

1. Coordinate names, abbreviations, colors, and or designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards. Use consistent designations throughout Project.

D. Sequence of Work:

1. Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

E. Self Adhesive Identification Products:

1. Clean surfaces of dust, loose material, and oily films before applying.

F. Identify feeders over 600 V with "DANGER HIGH VOLTAGE" in black letters 2-in. (51-mm) high, stenciled with paint at 10-ft (3-m) intervals over continuous, painted orange background. Identify following:

1. Entire floor area directly above conduits running beneath and within 12-in. (305-mm) of basement or ground floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to conduits concealed within wall.

3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

4. Entire surface of exposed conduits.

G. Install painted identification as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.

2. Prime Surfaces:

a. For galvanized metal, use single component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use

heavy duty, acrylic resin block filler. For concrete surfaces, use clear, alkali resistant, alkyd binder type sealer.

3. Apply one intermediate and one finish coat of silicone alkyd enamel.

4. Apply primer and finish materials according to manufacturer's instructions.

H. Identify Raceways and Exposed Cables of Certain Systems with Color Banding:

1. Band exposed and accessible raceways of systems listed below for identification.

a. Bands: Pre-tensioned, snap around, colored plastic sleeves; colored adhesive tape; or combination of both. Make each color band 2-in. (51-mm) wide, completely encircling conduit, and place adjacent bands of 2 color markings in contact, side by side.

b. Locate bands at changes in direction, at penetrations of walls and floors, at 50-ft (15 m) maximum intervals in straight runs, and at 25-ft (7.6 m) in congested areas.

c. Colors: As follows:

(1) Fire Alarm System: Red.
(2) Fire Suppression Supervisory and Control System: Red and yellow.
(3) Combined Fire Alarm and Security System: Red and blue.
(4) Security System: Blue and yellow.
(5) Mechanical and Electrical Supervisory System: Green and blue.
(6) Telecommunications System: Green and yellow.

I. Install Caution Signs for Enclosures Over 600 V:

1. Use pressure sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.

J. Install Circuit Identification Labels on Boxes:

1. Label externally as follows:

a. Exposed Boxes: Pressure sensitive, self-adhesive plastic label on cover.
b. Concealed Boxes: Plasticized card stock tags.
c. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

K. Identify Paths of Underground Electrical Lines:

1. During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8-in. (150 to 200-mm) below finished grade. Where multiple lines installed in common trench or concrete envelope do not exceed an overall width of 16-in. (400-mm), use single line marker.

a. Install line marker for underground wiring, both direct buried and in raceway.

L. Color Code Conductors:

1. Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.
   a. Field applied, color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.

      (1) Colored, pressure sensitive plastic tape in half-lapped turns for distance of 6-in. (150-mm) from terminal points and in boxes where splices or taps are made. Apply last 2 turns of tape with no tension to prevent possible unwinding. Use 1-in. (25-mm) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.

2. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3-in. (76-mm) from terminal and spaced 3-in. (76-mm) apart. Apply with special tool or pliers, tighten to snug fit, and cut off excess length.

System Voltage	A	B	C	Neutral
120/240 Volt 1Ph/3w	Black	Red		White
120/208 Volt 3Ph/4w	Black	Red	Blue	White
120/240 Volt 3Ph/4w	Black	Orange	Blue	White
277/480 Volt 3Ph/4w	Brown	Purple	Yellow	Gray
Motor Control	1	Black		
	2	Red		
	3	Blue		
Ground				Green

M. Power Circuit Identification:

1. Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.

   a. Legend: ¼-in. (6.4-mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.

   b. Fasten tags with nylon cable ties; fasten bands using integral ears.

N. Apply identification to conductors as follows:

1. Conductors to Be Extended in Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.

3. Multiple Control and Communications Circuits in Same Enclosure: Identify each conductor by its system and circuit designation. Use consistent system of tags, color-coding, or cable marking tape.

O. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

2. Emergency Operating Signs:

a. Install engraved laminate signs with white legend on red background with minimum 3/8-in. (9-mm) high lettering for emergency instructions on power transfer, load shedding, and or emergency operations.

P. Install identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide single line of text with ½-in. (13-mm) high lettering on 1-1/2-in. (38-mm) high label; where 2 lines of text are required, use lettering 2-in. (51-mm) high. Use white lettering on black field. Apply labels for each unit of following categories of equipment:

a. Panelboards, electrical cabinets, and enclosures.
b. Access doors and panels for concealed electrical items.
c. Electrical switchgear and switchboards.
d. Electrical substations.
e. Motor control centers.
f. Motor starters.
g. Push button stations.
h. Power transfer equipment.
i. Contactors.
j. Remote controlled switches.
k. Dimmers.
l. Control devices.
m. Transformers.
n. Inverters.
o. Rectifiers.
p. Frequency converters.
q. Battery racks.
r. Power generating units.
s. Telephone switching equipment.
t. Clock/program master equipment.
u. Call system master station.
v. TV/audio monitoring master station.
w. Fire alarm master station or control panel.

x. Security monitoring master station or control panel.

2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION

SECTION 16291
LOW VOLTAGE SURGE PROTECTION DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. This specification covers over-voltage transient and surge protection of low-voltage power applications for service entrances and sub-distribution panels used to power a facility or equipment.

1.02 SECTION INCLUDES

A. Performance Specifications

B. Approved Manufacturers

C. Functional and Operational Guidelines

1.03 REFERENCE

A. IEC 1024-1: 1990/ENV 61 024-1:1995/DIN V ENV 61 024-1/VDE V0185 Part 100: 1996-08. Protection of Structures Against Lightning - Part 1: General Principles

B. NEC, The National Electrical Code

C. EN50022: 1977/DIN EN 50 022: 1978-05. Low Voltage Switchgear and Control Gear for Industrial Use; Mounting Rails for Fixing Terminal Blocks

D. ANSI/IEEE (C62.41-1991) IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits and ANSI/IEEE (C62.45-1992) IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

E. IEC 529: 1989/EN 60 529: 1991/DIN VDE 0470-1: 1992-11. Type of Protection Through Housing (IP Code).

F. DIN VDE 0675-6: 1989-11, draft. Surge Arresters for use in AC Supply Systems with Rated Voltages Ranging from 100 to 1000V.

G. UL 1449 Transient Voltage Surge Suppressors 3rd Edition.

PART 2 PRODUCTS

2.01 GENERAL

A. Equipment power protection shall be accomplished by two-stage protection.

B. All wiring, hardware, and connection means shall be in compliance with the National Electrical Code and/or applicable local codes.

2.02 MOUNTING

A. All suppressors' components shall have integral mounting brackets to attach to 35mm DIN rail conforming to DIN EN50022. The suppressors may be pre-mounted on a rail or electrical enclosure. The DIN rail and enclosure will be electrically grounded.

B. The suppressor shall be mounted as close as possible to the equipment.

C. Mounting guidelines will be followed as indicated in installation instruction provided by manufacturer.

2.03 WIRE CONNECTIONS

A. Wires shall be attached to the suppressor by means of a cable-clamping terminal block activated by a screw. Connections shall be gas-tight, and the terminal block shall be fabricated of non-ferrous, non-corrosive materials.

B. All wiring points and plug connections shall be "touch safe" with no live voltages that can make contact with a misplaced finger in accordance with IEC 529.

C. Service Entrance and Sub-Distribution protection devices shall be wired on the load side of the Service Entrance Disconnect or Sub-Distribution Disconnect.

2.04 MANUFACTURERS

A. EATON

B. Advanced Protection Technologies

C. General Electric

D. Square D

E. Or Approved Equal

2.05 EQUIPMENT

A. SPD shall be UL 1449 labeled with 200 kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL 1449 labeled as Type 1 or 2 intended for use without the need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal over-

temperature controls. SPDs relying upon external or supplementary install safety disconnectors do not meet the intent of this specification.

C. SPD shall be UL 1449 labeled with 200 kA I-nominal (I-n) for compliance to UL 96A Lighting Protection Master Label and NFPA 780.

D. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

E. SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L and N-G for Wye systems: L-L, L-G in Delta and impedance grounded Wye systems.

F. If a dedicated breaker for the SPD is not provided in the switchboard or MCC, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPDs.

G. Combination Service Entrance Lightning Protection AND Transient Voltage Surge SPD shall meet or exceed a minimum surge current capability of:
   1. Service Entrance Applications: 200 kA per phase

H. UL 1449 listed Voltage Protection Rating (VPR) shall not exceed:

Voltage	L-N	L-G	N-G	L-L
120/240V, 1ϕ	700V	700V	700V	1500V
120/240V, 3ϕ	700V	700V	700V	1800V
208Y/120V, 3ϕ	700V	700V	700V	1500V
240V, 3ϕ		1500V		1500V
480Y/277V, 3ϕ	1500V	1500V	1500V	2000V
480V, 3ϕ		1800V		1800V

I. UL 1449 listed Maximum Continuous Operating Voltage (MCOV):

Voltage	Allowable System Voltage Fluctuation (%)	MCOV
120/240V, 1ϕ	25	150
120/240V, 3ϕ	25	320
208Y/120V, 3ϕ	25	150
240V, 3ϕ	20	320
480Y/277V, 3ϕ	20	320
480V, 3ϕ	20	552

J. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100 kHz.

K. SPD shall be equipped with the following diagnostics and features:
   1. Visual LED including a minimum one (1) green LED indicator per phase and one red service LED.
   2. Audible alarm with on/off silence function and diagnostic test function.
   3. Minimum one (1) set of NO/NC Form C dry contacts.

4. Surge Counter
5. NEMA 4X Stainless Steel Enclosure Unit shall be suitable for outdoor installation at service entrance equipment

L. Suppressor (TVSS), with External Fuse Status Indicating Lights and Enclosed in a NEMA 4X Stainless Steel Enclosure. Unit shall be suitable for outdoor installation at service entrance equipment or water well pump motors.

1. For 480/277 VAC 3-Phase WYE Systems: Phoenix Contact “COMBOTRAB” Model No. 2800718.

2. For 480 VAC Ungrounded 3-Phase Delta Systems: Phoenix Contact “COMBOTRAB” Model No. 2800722.

3. For 240 VAC 3-Phase High Delta Systems: Phoenix Contact “COMBOTRAB” Model No. 2800721.

4. For 208/120 VAC 3-Phase WYE Systems: Phoenix Contact “COMBOTRAB” Model No. 2800719.

5. For 120/240 VAC Split Single Phase Systems: Phoenix Contact “COMBOTRAB” Model No. 5603417.

6. Others as pre-approved by Engineer.

7. Installers of low-voltage lightning arresters shall be knowledgeable, and if required, certified, in all applicable electrical practices, standards, codes, and wiring techniques as they pertain to installing surge suppressors.

M. Installers shall follow all applicable safety standards.

N. Installers shall follow manufacturer's installation instructions.

O. Installer shall mount SPD devices as close to the equipment as possible to keep phase and ground conductor as short as possible and free of sharp bends in conductors. Phase conductors to be #2 minimum and of equal length. Ground to system ground or to a separately installed ground rod with well for service entrance equipment or to ground rod with well for sub-distribution protected equipment such as a well motor. Installer shall make corrections to installation as directed by Engineer.

PART 3 EXECUTION

3.01 GENERAL

A. Installers of low-voltage lightning arresters shall be knowledgeable, and if required, certified, in all applicable electrical practices, standards, codes and wiring techniques as they pertain to installing surge suppressors.

B. Installers shall follow all applicable safety standards.

C. Installers shall follow manufacturer's installation instructions and recommendations.

D. Installer shall mount SPD devices as close to the equipment as possible to keep phase and ground conductor as short as possible and free of sharp bends in conductors. Phase conductors to be #2 minimum and of equal length. Ground to system ground or to a separately installed ground rod with well for service entrance equipment or to ground rod with well for sub-distribution protected equipment such as a well motor. Installer shall make corrections to installation as directed by Engineer.

E. SPD shall be installed on the load side of the main service disconnect in the service entrance rated switchboard as shown.

F. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.02 WARRANTY

A. The Contractor warrants to the Engineer and Owner that all material and equipment furnished under this contract will be new and of good quality. The Contractor also warrants that all work will be of good quality, free from faults and defects for one (1) year.

B. Manufacturer to provide a minimum ten (10) year product warranty.

END OF SECTION

SECTION 16475
OVERCURRENT PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Overcurrent protective devices (OCPDs) rated 600 V and below and switching devices commonly used with them.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA).

1. NEMA AB1-86 - Molded Case Circuit Breakers and Molded Case Switches.

B. National Fire Protection Association (NFPA):

1. NFPA 70-90 - National Electrical Code (NEC).

C. Underwriters Laboratory (UL):

1. UL 98-87 - Enclosed and Dead Front Switches.

2. UL 486A-80 - Wire Connectors and Soldering Lugs for Use with Copper Conductors. Seventh Edition.

3. UL 489-86 - Molded-Case Circuit Breakers and Circuit-Breaker Enclosures. Seventh Edition.

1.03 DEFINITIONS

A. Overcurrent Protective Device (OCPD): Device operative on excessive current that causes and maintains interruption of power in circuit it protects.

B. Ampere-Squared-Seconds: Expression of available thermal energy resulting from current flow. With regard to current-limiting fuses and circuit breakers, ampere-squared-seconds during fault current interruption represents energy allowed to flow before fuse or breaker interrupts fault current within its current limiting range.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. Components and Installation:

a. NFPA 70 "National Electrical Code (NEC)."
b. Local codes and ordinances.

C. Single-Source Responsibility: Obtain similar OCPDs from single manufacturer.

PART 2 PRODUCTS

2.01 OVERCURRENT PROTECTIVE DEVICES (OCPDs), GENERAL

A. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards, and motor control centers; and also as individually enclosed and mounted single units.

2.02 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers except as indicated:

1. Square D

2. General Electric

3. Eaton/Cutler-Hammer

4. Siemens

5. Or approved equal

B. UL 489 and NEMA AB 1.

C. Construction: Bolt-in type, except breakers in load-center-type panelboards and breakers 225-ampere frame size and larger may be plug-in type if held in place by positive locking device requiring mechanical release for removal.

D. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole.

E. Adjustable Instantaneous Trip Devices: Factory adjusted to low-trip-setting current values.

F. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting in

switchboard or panelboards where indicated.

G. Enclosure for Switchboard or Motor Control Center Mounting: Provide individual mounting where indicated.

H. Enclosure for Independent Mounting: NEMA Type 1 enclosure, as indicated or required to suit environment where located.

I. Combination Circuit Breakers and Ground-Fault Circuit Interrupters: UL 943 arranged for sensing and tripping for ground-fault current in addition to overcurrent and short-circuit current.

1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.

2. Trip Setting for Ground Fault: 4 to 6 milliamperes, listed and labeled as Class A, Type 1 device.

3. Trip Setting for Ground Fault: 30 milliamperes.

J. Current-Limiting Circuit Breakers: Arranged to limit let-through ampere-squared-seconds during fault conditions to value less than ampere-squared-seconds of one-half-cycle wave of prospective symmetrical fault current. Circuit breaker shall use no fusible devices in its operation. Current-limiting characteristic shall be in addition to normal time-delay and instantaneous-trip characteristics and other features as indicated.

K. Circuit Breakers With Solid-State Trip Devices: Provide indicated circuit breakers with solid-state trip devices having following features:

1. Ambient Compensation: Trip device insensitive to temperature changes between minus 20C and plus 55C.

2. Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker, by change of plug-in element without removing breaker from mounting, or by combination of 2 methods.

3. Ground-Fault Tripping: Adjustable for pick-up and time-delay values. Provide for indicated units.

4. Provide clear plastic shield limiting access to rating plug and adjustments on solid state trip circuit breaker. Seal by attaching sealing wire through hole in posts provided. With wire seal installed, circuit breaker rating plug and adjustments shall not be "readily accessible."

2.03 INSULATED-CASE CIRCUIT BREAKERS

A. Manufacturers:

1. Square D
2. General Electric
3. Eaton/Cutler-Hammer
4. Siemens
5. Or approved equal

B. UL 489 and NEMA AB 1.

C. Ratings: Continuous-current, interrupting, and short-time-current ratings, and voltage and frequency ratings as indicated.

D. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with following features:

1. Moving Contacts Closing Speed: Independent of both control and operator.

E. Circuit-Breaker Trip Devices: Solid-state overcurrent trip device system that includes 1 integrally mounted current transformer or sensor per phase, release mechanism, and following features:

1. Functions: Long-time-delay, short-time-delay, and instantaneous-trip functions, which are independent of each other in both action and adjustment.
2. Temperature compensation to assure accuracy and calibration stability from minus 20°C to plus 55°C.
3. Field-adjustable, time-current characteristics.
4. Current Adjustability: Effected by operating controls on front panel or by changing plug-in elements or current transformers or sensors.
5. Three bands for long-time- and short-time-delay functions marked "minimum," "intermediate," and "maximum."
6. Five pickup points, minimum, for long-time- and short-time-trip functions.
7. Six pickup points, minimum, for instantaneous-trip functions.
8. Ground fault protection with at least 3 short-time-delay settings and 37 trip-time-delay bands. Adjustable current pickup.

9. Trip Indication: Labeled lights or mechanical indicators on trip device shall indicate type of fault causing breaker trip. If lights are used, integral power source shall maintain indication for 60 hrs, minimum.

F. Auxiliary Contacts for Remote Indication: Where remote indication of breaker position is indicated, provide spare auxiliary switch in addition to other auxiliary switches required for normal breaker operation. Spare auxiliary switch shall consist of 2 Type "a" and 2 Type "b" stages (contacts), wired to terminal block in breaker housing.

G. Circuit-Breaker Features and Accessories: Include following:

1. Padlocking Provisions: For installing at least 2 padlocks on each breaker to secure its enclosure and prevent movement of draw out mechanism.

2. Operating Handle: Provide 1 for each manually operated breaker. No handle ties are permitted.

3. Electric Close Button: Provide 1 for each electrically operated breaker.

4. Indicating Lights: Contacts for "Breaker Open" and "Breaker Closed," for main and bus tie circuit breakers, and for other indicated breakers.

PART 3 EXECUTION

3.01 CONNECTIONS

A. Check connectors, terminals, bus joints, and mountings for tightness.

B. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.02 GROUNDING

A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

B. Ground in accordance with Section 16452.

3.03 FIELD QUALITY CONTROL

A. Testing:

1. Reports: Prepare certified written reports on tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include complete records of repairs and adjustments made.

2. Labeling: Upon satisfactory completion of tests and related effort, apply label to tested components indicating test results, date, and responsible person.

3. Schedule visual and mechanical inspections and electrical tests with at least 1 week's advance notification.

4. Pretesting: Upon completing installation of system, perform following preparations for tests:

    a. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
    b. Make continuity tests of circuits.
    c. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
    d. Comply with manufacturer's instructions for installation and testing of OCPDs.

5. Visual and mechanical inspection: Include following inspections and related work.

    a. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make final system adjustments.
    b. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
    c. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
    d. Check tightness of electrical connections of OCPDs with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
    e. Clean OCPDs using manufacturer's approved methods and materials.
    f. Verify installation of proper fuse types and ratings in fusible OCPDs.

6. Electrical Tests: Include following items performed in accordance with manufacturer's instructions:

    a. Insulation resistance test of OCPD conducting parts. Insulation resistance less than 100 megohms is not acceptable.
    b. Verify trip unit reset characteristics for insulated-case circuit breakers.
    c. Make adjustments for final settings of adjustable-trip devices.
    d. Activate auxiliary protective devices such as ground fault or undervoltage relays, to verify operation of shunt-trip devices.
    e. Check stored-energy charging motors for proper operation of motor, mechanism, and limit switches.
    f. Check operation of electrically operated OCPDs in accordance with manufacturer's instructions.

g. Check key and other interlock and safety devices for operation and sequence. Make closing attempts on locked-open and opening attempts on locked-closed devices including moveable barriers and shutters.

7. Retest: Correct deficiencies identified by tests and observations and retest. Verify by system tests that specified requirements are met.

3.04 CLEANING

A. Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

APPENDIX A

Geotechnical Report

Enprotec / Hibbs & Todd

August 28, 2020

Mr. Howdy Wayne Lisenbee
Assistant City Manager
Town of Pecos City
110 East 6TH Street
Pecos, Texas 79772

Re: Geotechnical Investigation
City Scada System Improvements
Self-Supporting Towers
Pecos Area

Dear Mr. Lisenbee:

In accordance with your instructions, we have conducted a Geotechnical Investigation for the above referenced project. The conclusions and recommendations of this investigation are to be found in the attached report.

We trust that this will provide the information you have requested. We are also available for the geotechnical and materials testing services during construction as recommended in the Report. If there are any further questions, please do not hesitate to call.

Sincerely,

Enprotec/Hibbs & Todd, Inc.

28 AUG 20

STATE OF TEXAS
GARY SCOTT YUNGBLUT
85640
LICENSED
PROFESSIONAL ENGINEER

G. Scott Yungblut, P.E.
Geotechnical Engineer

Enclosure
20-7469

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RPLS Firm Registration No. 10011900

GEOTECHNICAL INVESTIGATION
FOR THE PROPOSED
CITY SCADA SYSTEM IMPROVEMENTS
SELF-SUPPORTING TOWERS
PECOS AREA

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION
FOR THE
CITY SCADA SYSTEM IMPROVEMENTS
SELF-SUPPORTING TOWERS
PECOS AREA

INTRODUCTION

GENERAL: This investigation was authorized in August 2020 by Mr. Seth A Sorensen, City Manager for the Town of Pecos City, Texas. The purpose of this investigation is to provide foundation design information along with construction recommendations for the SCADA tower foundations located in and around the Town of Pecos City, Texas.

The proposed structures are anticipated to be 100 to 150-foot tall self-supporting towers. The foundation system for the towers should be designed to accommodate download and uplift loadings with adequate safety factors. Maximum horizontal and vertical loads are anticipated to be on the order of 10 to 20 kips.

SCOPE: The scope of the exploration and analysis to be performed by Enprotec / Hibbs & Todd, Inc. (eHT) included a site reconnaissance, the subsurface exploration, field and laboratory testing, and an engineering analysis and evaluation to provide design recommendations for the tower foundations along with construction recommendations for the proposed tower sites. Details and results of the investigation are discussed in the following sections of this report.

LIMITATIONS: The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

DESCRIPTION OF WORK

FIELD INVESTIGATION: Drilling and soil sampling activities were performed at a select locations on August 13, 2020. Five test borings were drilled to depths ranging from 10 to 20 feet below the existing ground surface elevation at the locations shown on Figure 1 in the Appendix. The Well Location Plan was provided by Mr. John W. Gilroy, P.E., Electrical Engineer representing Baird Gilroy & Dixon, Electrical Engineers.

The test borings were drilled utilizing a truck-mounted Failing rotary drilling rig. The test borings were advanced utilizing dry sampling methods and/or air rotary drilling techniques which allow for accurate groundwater observations. Drilling and sampling activities were performed in general accordance with referenced ASTM and/or TxDOT procedures or other accepted methods.

Soil formations were sampled using a 2-inch split barrel sampler (ASTM D 1586). Quantitative estimates of the foundation strata bearing capacity were also obtained from interpretation of the Standard Penetration Test (SPT) results and widely published empirical correlations. The reports of the field tests are reported on the Logs of Borings in the Appendix.

The borings were visually logged in the field, and recovered samples were placed in core boxes for delivery to the laboratory. Shelby tube samples and split barrel samples were placed in polyethylene plastic bags to minimize moisture changes. The samples will be retained for 60 days from the date of this report. The samples will then be discarded unless notified in writing by the client requesting the samples be retained.

The borings were observed for groundwater during and following the completion of the drilling activities. These observations are shown on the Logs of Borings and discussed in a later section of this report. The borings were backfilled with on-site materials upon completion of the field work. Logs of Borings were subsequently prepared, along with a legend titled EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS and GENERAL NOTES. The legend and general notes show typical soil and rock classifications, drilling symbols, weathering descriptions, and soil structure characteristics.

LABORATORY TESTING: Select materials recovered in the boring were tested in the laboratory and classified based on the laboratory test results. Laboratory testing was conducted in general accordance with ASTM procedures and standards. Atterberg Limits (ASTM D 4318) and Minus 200-Mesh Sieve Tests (ASTM D 1140) were performed on the samples in order to classify and establish index properties and grain size characteristics of the soils. A summary of the results of the classification tests are included in the Appendix. The soil classifications are based on the Unified Soil Classification System (USCS).

ENGINEERING ANALYSIS: An engineering analysis was conducted on the information obtained from the field and laboratory investigations and from information provided by Mr. Jordan Hibbs, P.E., Project Engineer representing eHT. If revisions to the plans for the proposed project, or if deviations from the subsurface conditions presented in this report are encountered during construction, we should be notified to determine if changes in our recommendations are required.

SUBSURFACE MATERIALS AND CONDITIONS

SITE GEOLOGY: As shown on the Fort Stockton and Pecos Sheets of the *Geologic Atlas of Texas* the sites are located in an area where Cretaceous Age deposits of the Alluvium, Associated Alluvium and Other Quaternary Deposits Undivided, and Sand and Silt formations are present at or near the surface. The Alluvium consists of flood plain and alluvial deposits of mostly sandy silt. The Other Quaternary Deposits consists mostly of boulders, cobbles, and pebbles of cretaceous limestone and chert.

SITE STRATIGRAPHY: A detailed description of the site stratigraphy is provided on the Logs of Borings in the Appendix.

GROUNDWATER: Groundwater was encountered within Test Boring No. 1 at a depth of 17½ feet during and at completion of drilling activities. Groundwater was not encountered within the other test borings during or at completion of drilling activities. An accurate depiction of the groundwater depth would require leaving the test borings open for an extended period of time due to the moderately impermeable soils. The water table may fluctuate seasonally and during periods of heavy rainfall. Filtered sump pumps placed in the bottom of excavations are expected to be suitable for water removal above the water table.

LABORATORY RESULTS: The results of the Atterberg Limits Testing indicate that the tested soils possess liquid limits (LL) ranging from 28 to 42 with corresponding Plasticity Indices (PI) of 3 to 17. Soil Classification Tests indicate that the soils exhibit a low to moderate expansive potential with a slight to moderate degree of plasticity. The soils are classified as SC and ML materials according to the Unified Soil Classification System (USCS). Refer to the Appendix for the laboratory test results of the materials tested.

FOUNDATION DESIGN RECOMMENDATIONS

TOWER FOUNDATION – GENERAL: Due to the different types of soil encountered in the Pecos area 2 types of tower foundations are included in the report. The wells in the site geology that includes the Other Quaternary Deposit formation will not be able to use a drilled pier foundation due to caving boulders, cobbles, and pebbles. The following table provides the recommended foundation type or types for each of the proposed towers:

Location	Foundation Type
City Yard	Drilled Pier or Shallow Foundation
Blending Tanks	Shallow Foundation
Ward Booster Pump Station	Shallow Foundation
Ward Tank Site	Drilled Pier or Shallow Foundation
South Warsham Wells	
Well 50-25-1	Drilled Pier or Shallow Foundation
Well 50-25-5	Drilled Pier or Shallow Foundation
Well 50-25-6	Drilled Pier or Shallow Foundation
Well 50-25-7	Drilled Pier or Shallow Foundation
Well 50-25-8	Drilled Pier or Shallow Foundation
North Warsham Wells	
Well 10	Shallow Foundation
Well 11	Shallow Foundation
Well 12	Shallow Foundation
Well 16	Shallow Foundation
Well 17	Shallow Foundation
Ward County Wells	
Well 1-B	Drilled Pier or Shallow Foundation

DRILLED PIER FOUNDATION: A deep foundation consisting of straight shaft drilled piers may be considered for a portion of the towers. The clayey silts and/or sands at a depth of about 8 to 10 feet are expected to provide a suitable bearing stratum for the drilled piers.

Design pier depths shown in the construction documents should ensure that the piers reach the depth indicated above. The proper depth must be reached in order to ensure adequate bearing capacity. Piers founded on the referenced materials may be sized assuming a maximum net allowable end bearing pressure of 3.0 kips per square foot (ksf), based on a dead load plus design live load considerations. An allowable skin friction of 0.3 ksf may also be utilized below a depth of 2 feet. An allowable lateral bearing pressure of 0.125 ksf/ft may be used below a depth of 2 feet increasing to 1.0 ksf below a depth of 7 feet. These values include a safety factor of at least 3 against shear failure in the supporting soils.

The piers should have a minimum diameter of 18 inches for good quality construction and inspection. The piers should be reinforced for their full depth to within 6 inches of the bottom of the pier to resist potential tensile forces which may develop due to swelling of the site soils and due to structural loads. It is recommended that each pier be reinforced with a minimum 0.75 percent reinforcing steel (based on the cross-sectional area of the pier shaft). The steel may be considered part of the reinforcement required by axial compressive loads, lateral load considerations, or the minimal reinforcement required by the codes.

Although not anticipated at these sites, temporary casing must be used where necessary to stabilize pier holes if groundwater or caving soils are encountered during construction. Any accumulated water must be removed prior to the placement of concrete. If the pier hole has been cased, sufficient concrete should remain in the casing as the casing is withdrawn to prevent any discontinuities from forming within the concrete section. Additionally, concrete placed in drilled piers should not be placed at slumps less than 6 inches unless it is consolidated full depth with a vibrator or by other means. Concrete placed in piers at a slump less than 5 inches increases the potential for honeycombing.

SHALLOW FOUNDATION: A near surface ground supported shallow foundation system will provide support for the structural loads associated with the proposed towers. Structural loads should be supported by a reinforced mat type foundation which may be designed utilizing a maximum net allowable bearing pressure of 2.0 kips per square foot (ksf) at a minimum depth of 3½ feet, based upon dead load plus design live load considerations. A subgrade modulus of 120 psi/in may be used for foundation design within the existing soils or properly compacted select fill material. The net allowable bearing capacity value provided includes a safety factor of at least 3 against a general shear failure in the supporting soils. The soil profile for seismic design at these sites fall under Site Class D. Any shallow or near ground supported foundation should be designed by a structural engineer experienced in design of shallow foundations.

FOUNDATION CONSTRUCTION RECOMMENDATIONS

SITE CLEARING/STRIPPING: The initial site preparation will require the removal of any moderately organic topsoil present in the proposed tower areas. Removal depths should be verified in the field by a representative of a geotechnical engineer at the time of site grading based upon the subgrade soils and the subgrade stability.

FOUNDATION EXCAVATION: Excavations should be observed by the geotechnical consultant or his representative to make sure that the proper bearing material has been reached in accordance with the recommendations given herein. The excavations should be checked for size and observed to make sure that all loose material has been removed prior to concrete placement. Prompt placement of the concrete following pad preparation is strongly recommended.

SELECT FILL: Select fill should be used in areas where site filling and leveling is necessary. The select fill should consist of non-granular (cohesive) soils free of organics and other deleterious materials and should have a maximum liquid limit of 35, a plasticity index no greater than 20 and have a maximum particle size of 2 inches. The select fill should also meet the USCS classification of SC, GC or CL. The structural fill beneath the foundation pad should be compacted to a minimum 95 percent Standard proctor (ASTM D 698) at not less than 2 percent below optimum moisture content. The majority of the surficial site soils tested meet the select fill criteria.

UTILITIES: Prior to construction all underground utilities should be located and, if present in the construction area, permanently capped and removed at the property line or rerouted around the proposed tower to preserve their function. Special attention should be performed in evaluating the backfill of utilities that will remain which may not be suitable for support of the proposed structure. The soils should be removed and recompacted if found unsuitable. This determination should be made by a representative of the geotechnical engineer during construction.

FOUNDATION CONSTRUCTION CONSIDERATIONS

EXCAVATION SAFETY: All excavations should be in accordance with local and federal (OSHA) regulations and the trench safety plan. If instability problems occur, stability within the excavations should be maintained by flattening or widening slope sidewalls. In addition, the on-site soils are susceptible to erosion and disturbance by flowing water and construction traffic. If these soils are disturbed by construction traffic and excessive moisture, they may become unstable. The site should therefore be graded to prevent water from ponding near the new foundation and running into excavations.

EXCAVATION DIFFICULTIES: Limestone cobbles and boulders were encountered at depths as shallow as 1 to 2 feet below existing grade at some of the test boring locations. Based upon these observations, it is recommended that pre-bid test pits be performed by the prospective project contractor prior to contract bidding so that a determination as to the degree of excavation difficulties throughout the site can be evaluated and the most economical means of excavation determined. Dependent upon the depth of excavation, specialized excavation equipment may be necessary. Furthermore, excavation bank stability problems may be encountered. In this event, shallow excavations may be sloped or widened in the anticipation of bank stability problems, with deeper excavations possibly requiring more elaborate external support means for stability. All excavations should be performed in accordance with OSHA requirements, which will be the responsibility of the project contractor.

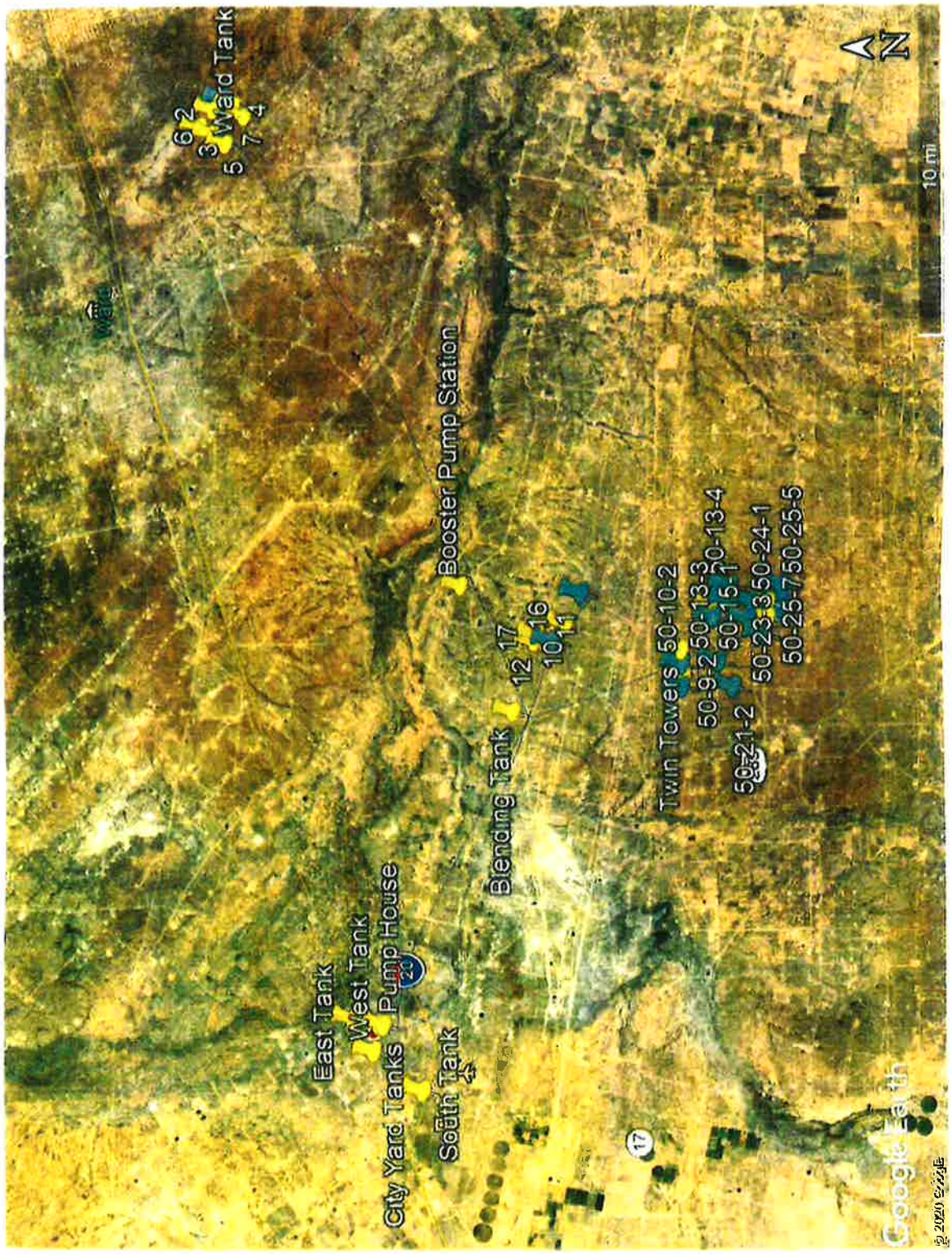
GENERAL: Many problems can be avoided or solved in the field if proper inspection and testing services are provided. A qualified construction materials testing laboratory should be retained to perform testing and inspection services sufficient to verify compliance with our recommendations. It is recommended that the site preparation and foundation construction be monitored by the geotechnical engineer or his representative. The following are recommended minimum sampling and testing frequencies.

EARTHWORK: During the earthwork phase of the project at least one Proctor test, Atterberg limits test, and minus 200 sieve test should be performed per soil type for subgrade, backfill, and fill materials. At least 1 density and moisture content test should be performed for each compacted 6-inch thickness of fill in the tower foundation area.

CONCRETE: At least 1 slump, air content (if required) and temperature test, and at least 1 set of 3 concrete cylinders should be molded for each type of concrete placed in a day. Each set of cylinders should be tested for compressive strength with 1 of the cylinders tested at 7 days and 2 of the cylinders tested at 28 days.

DRILLED PIER INSPECTION: Detailed inspection of pier construction should be performed by a representative of the geotechnical engineer to verify that the piers are vertical and founded in the proper bearing stratum, and to verify that all loose materials have been removed prior to concrete placement.

APPENDIX



WELL LOCATION PLAN

FIGURE 1

CITY SCADA SYSTEM IMPROVEMENTS
SELF-SUPPORTING TOWERS
PECOS AREA

Project No.: 20-7469

Date: August 2020

CITY SCADA SYSTEM IMPROVEMENTS
SELF-SUPPORTING TOWERS
PECOS AREA

SUMMARY OF CLASSIFICATION TESTS

Boring No.	Depth (ft)	Liquid Limit %	Plasticity Index	% Passing #200 Mesh Sieve	Water Content %	USCS	Description
B-1	2-3½'	42	17	94	23.4	SC	Light Brown Clayey Fine Sand
B-1	7-8½'	28	3	99	27.7	ML	Tan Clayey Silt
B-2	2-3½'	32	14	63	7.1	SC	Light Brown Clayey Fine Sand with calcareous nodules

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Firm Registration No. 1151

LOG OF BORING

Project: **CITY SCADA SYSTEM IMPROVEMENTS**

Date: 08/13/2020

Location: **PECAS AREA - CITY YARD**

Type: AIR ROTARY

Boring No.: **B-1**

DEPTH IN FEET	SYMBOL	SAMPLE	MATERIAL DESCRIPTION	N-BLOWS PER FOOT	TEXAS CONE PENETROMETER 1st 6"	TEXAS CONE PENETROMETER 2nd 6"	Qp (tsf)	DEPTH SCALE
		ST	LIGHT BROWN CLAYEY FINE SAND				2.5	
		ST					2.5	
		SS		9				
5		ST	TAN CLAYEY SILT				4.0	
		ST					3.5	
		SS		10				
10			LIGHT BROWN CLAYEY SILT - VERY MOIST AT 13'					
		SS		21				
15			TAN CLAYEY SILT					
		SS		15				
20			TOTAL DEPTH OF BORING 20 FEET					

NOTE

GROUNDWATER WAS PRESENT AT A DEPTH OF ABOUT 17 1/2 FEET DURING AND AT COMPLETION OF DRILLING ACTIVITIES.

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LOG OF BORING

Project: **CITY SCADA SYSTEM IMPROVEMENTS**

Date: 08/13/2020

Location: **PECAS AREA - WELL 50-23-2**

Type: AIR ROTARY

Boring No.: **B-2**

DEPTH IN FEET	SYMBOL	SAMPLE	MATERIAL DESCRIPTION	N-BLOWS PER FOOT	TEXAS CONE PENETROMETER 1st 6"	TEXAS CONE PENETROMETER 2nd 6"	Qp (tsf)	DEPTH SCALE
		ST	LIGHT BROWN CLAYEY FINE SAND				4.5+	
		ST	LIGHT BROWN CLAYEY FINE SAND WITH CALCAREOUS NODULES				4.5+	
		SS		12				
5		ST					4.5+	
		AU	LIGHT BROWN CLAYEY FINE SAND WITH TRACE GRAVEL AND CALCAREOUS NODULES					
		SS		52				
10								
		SS		74/10"				
15								
		SS		50/0"				
20			TOTAL DEPTH OF BORING 20 FEET					

NOTE

NO GROUNDWATER WAS PRESENT DURING OR AT COMPLETION OF DRILLING ACTIVITIES.

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Firm Registration No 1151

LOG OF BORING

Project: **CITY SCADA SYSTEM IMPROVEMENTS**

Date: 08/13/2020

Location: **PECAS AREA - WELL 16**

Type: AIR ROTARY

Boring No.: **B-3**

DEPTH IN FEET	SYMBOL	SAMPLE	MATERIAL DESCRIPTION	N-BLOWS PER FOOT	TEXAS CONE PENETROMETER 1st 6"	TEXAS CONE PENETROMETER 2nd 6"	Qp (tsf)	DEPTH SCALE
		ST					0.5	
		SS		7				
5			TAN CLAYEY FINE SAND WITH MEDIUM GRAVEL TO SMALL COBBLES					
10			TOTAL DEPTH OF BORING 10 FEET DUE TO CAVING LARGE GRAVEL AND COBBLES					

NOTE

NO GROUNDWATER WAS PRESENT DURING OR AT COMPLETION OF DRILLING ACTIVITIES.

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Firm Registration No 1151

LOG OF BORING

Project: **CITY SCADA SYSTEM IMPROVEMENTS**

Date: 08/13/2020

Location: **PECAS AREA - BLENDING TANK**

Type: AIR ROTARY

Boring No.: **B-4**

DEPTH IN FEET	SYMBOL	SAMPLE	MATERIAL DESCRIPTION	N-BLOWS PER FOOT	TEXAS CONE PENETROMETER 1st 6"	TEXAS CONE PENETROMETER 2nd 6"	Qp (tsf)	DEPTH SCALE
		ST					1.5	
		ST	- MEDIUM TO LARGE GRAVEL AND SMALL COBBLES BELOW 3'				1.5	
		SS		7				
5			TAN CLAYEY FINE SAND WITH TRACE GRAVEL					
		ST					1.0	
		AU						
10			TOTAL DEPTH OF BORING 10 FEET DUE TO CAVING GRAVEL AND COBBLES					

NOTE

NO GROUNDWATER WAS PRESENT DURING OR AT COMPLETION OF DRILLING ACTIVITIES.

7469

ENPROTEC/HIBBS & TODD, INC.
ENVIRONMENTAL AND CIVIL ENGINEERING
402 Cedar Street Abilene, Texas 79601
(325) 698-5560 Firm Registration No 1151

LOG OF BORING

Project: **CITY SCADA SYSTEM IMPROVEMENTS** Date: 08/13/2020

Location: **PECAS AREA - WARD TANK** Type: AIR ROTARY Boring No.: **B-5**

DEPTH IN FEET	SYMBOL	SAMPLE	MATERIAL DESCRIPTION	N-BLOWS PER FOOT	TEXAS CONE PENETROMETER 1st 6"	TEXAS CONE PENETROMETER 2nd 6"	Qp (tsf)	DEPTH SCALE
5		SS	LIGHT BROWN CLAYEY FINE SAND WITH INTERBEDDED LIMESTONE COBBLES AND BOULDERS	50/4"				
10		SS		50/3"				
15		SS		50/2"				
20		SS		50/6"				

TOTAL DEPTH OF BORING 20 FEET

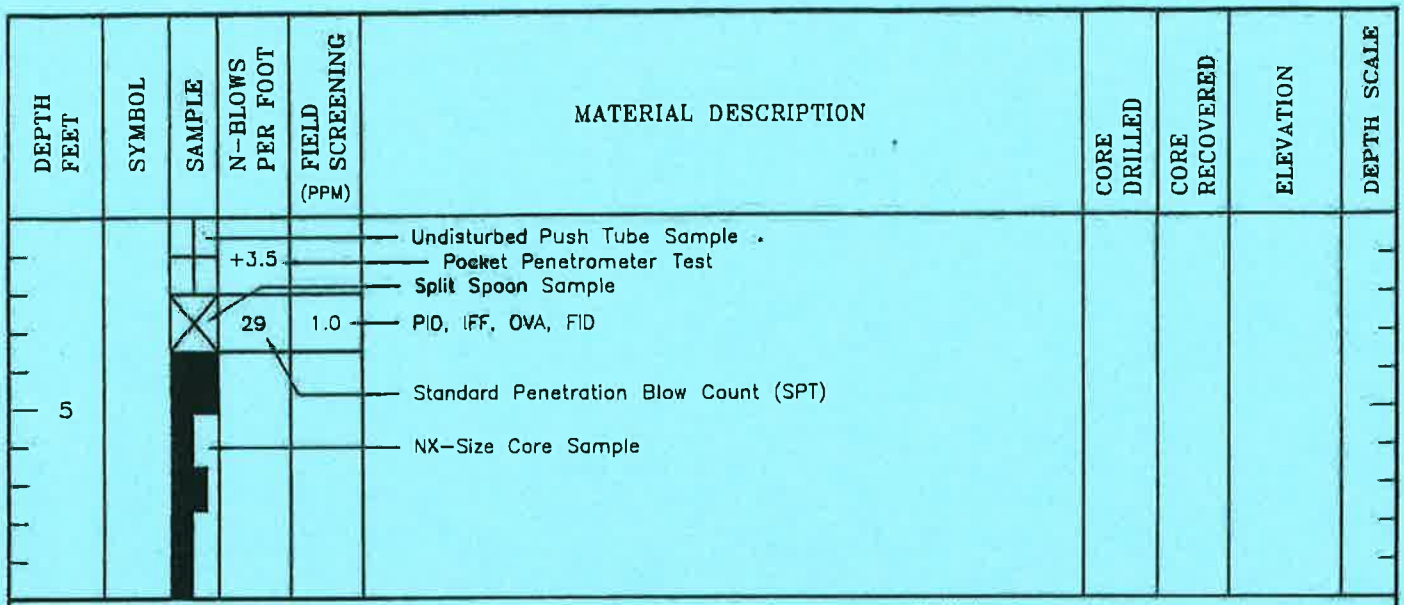
NOTE

NO GROUNDWATER WAS PRESENT DURING OR AT COMPLETION OF DRILLING ACTIVITIES.

7469

ENPROTEC, INC.

EXPLANATION OF SYMBOLS AND TERMS USED ON BORING LOGS



Water Encountered — Water Level Encountered During Drilling

Static Level (date) — Stabilized Water Level

UNIFIED SOIL CLASSIFICATION DESCRIPTION OF SYMBOLS AND DIVISIONS

- Well-Graded Gravels, Gravel Sand Mixtures (GW)
- Poorly-Graded Gravels, Gravel Sand Mixtures (GP)
- Silty Gravel, Gravel Sand-Silt Mixtures (GM)
- Clayey Gravels, Gravel-Sand-Clay Mixtures (GC)
- Well-Graded Sands, Gravelly Sands (SW)
- Poorly-Graded Sands, Gravelly Sands (SP)
- Silty Sands, Poorly-Graded, Sand-Silt Mixtures (SM)
- Clayey Sands, Poorly-Graded, Sand-Clay Mixtures (SC)
- Inorganic Silts and Very Fine Sands, Silty or Clayey Fine Sands (ML)
- Inorganic Clays of Low to Medium Plasticity Gravelly, Sandy or Silty Clays, Lean Clays (CL)
- Organic Silts and Organic Silty Clays of Low Plasticity (OL)
- Inorganic Silts, Micaceous or Diatomaceous Fine Sandy or Silty Soils (MH)
- Inorganic Clays of High Plasticity, Fat Clays (CH)
- Organic Clays of Medium to High Plasticity, Organic Silts (OH)
- Caliche and Other Impervious Layer (HP)

BEDROCK SYMBOLS

- Conglomerate (CGL)
- Sandstone (SS)
- Limestone (LS)
- Shale (Sh)
- Weathered Shale (WS)
- Sandy Shale (SSh)
- Shaley Limestone (Sh LS)
- Dolomite (DOL)

MISCELLANEOUS SYMBOLS

- Asphaltic Concrete (HMAC)
- Cement Grout (CMT)
- Bentonite (BENT)

The LOG of BORING is a representation of the subsurface material at specific boring location and within the depth explored. The transition between strata may be gradual and variations in material types and depths between borings can be expected. Water level observations represent those conditions at the time of exploration and may vary with time and location of site.

SOIL COLOR CLASSIFICATION
Determined by
MUNSELL SOIL COLOR CHARTS
1990 EDITION REVISED

GENERAL NOTES

SAMPLE IDENTIFICATION

Soil Samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D2487 or D 2488)

DRILLING AND SAMPLING SYMBOLS

ST:	Shelby Tube - 3" O.D., except where noted
SS:	Split-Spoon
THD:	THD Cone Penetrometer
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample

SOIL PROPERTY SYMBOLS

N:	Standard "N" penetration: Blows per foot, or fraction thereof, of a 140 pound hammer 30 inches on a split-spoon
Qp:	Calibrated Penetrometer Resistence, TSF
Qu:	Unconfined Compression Strength, TSF
LL:	Liquid Limit, %
PI:	Plasticity Index

SOIL STRENGTH CHARACTERISTICS

NON-COHESIVE (GRANULAR) SOILS

RELATIVE DENSITY	BLOWS PER FOOT(N)
Very Loose	0-4
Loose	5-10
Firm	11-30
Dense	31-50
Very Dense	51 +

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	BLOWS PER FOOT(N)	UNCONFINED COMPRESSIVE STRENGTH (Qu)
Very Soft	0-2	0 - 0.25
Soft	3-4	0.25 - 0.50
Medium Stiff	5-8	0.50 - 1.00
Stiff	9-15	1.00 - 2.00
Very Stiff	16-30	2.00 - 4.00
Hard	31 +	4.00 +

SOIL CHARACTERISTICS

PARTICLE SIZE

Boulders	8 in. +	Coarse Sand	5mm-0.6 mm	Silt	0.074mm-.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074 mm		

DEGREE OF EXPANSIVE POTENTIAL	PI
Low	0-15
Moderate	15-25
High	25 +

DEGREE OF PLASTICITY	PI
None to Slight	0-4
Slight	5-10
Moderate	11-30
High	31 +