



**BUCKSKIN SANITARY DISTRICT  
PARKER, ARIZONA**

**Phase 4 Lift Station No. 1**

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**Contract 107**

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**- Bidding and Contract Documents -**

**May, 2019**



*EXPIRES 3-31-20*

**Energy and Water Solutions, LLC  
4241 E. Hano Street  
Phoenix, Arizona 85044**

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**DIVISION 0**

**BIDDING AND CONTRACT REQUIREMENTS**

## SECTION 00010: INVITATION FOR BIDS

**Buckskin Sanitary District  
Parker, Arizona  
Phase 4 - Contract No. 107**

INVITATION TO BIDDERS

Sealed bids for the construction of the **Phase 4 Contract 107 – Lift Station No. 1** will be received by the **Owner, Buckskin Sanitary District** at their office located at 8832 Riverside Drive, Suite 4, Parker, AZ 85344 until **2:00 P.M.** local time on **November 12, 2019** at which time the Bids received will be publicly opened and read. The Project consists of furnishing of all labor, materials and equipment for the construction of Lift Station No. 1 in its entirety including all work, and all miscellaneous equipment and modifications, shown or specified, necessary to provide a complete and operable system.

**SPECIAL NOTE: The Owner has purchased the majority of material and equipment required to be installed under this contract. (See Appendix 1 of the Specifications.)**

Bids will be received for a single prime Contract. Bids shall be on a lump sum bid basis as indicated in the Bid Form.

The ISSUING OFFICE for the Bidding Documents is: Buckskin Sanitary District, 8832 Riverside Drive, Suite 4, Parker, AZ 85344.

Prospective Bidders may examine the Bidding Documents on Mondays through Thursdays between the hours of **9-12 noon, and 1-5 pm.**, and may obtain copies of the Bidding Documents from the Issuing Office as described below.

The project specifications and other proposal documents and contract documents are now on file at the District office (8832 Riverside Drive, Suite #4, Parker, Arizona 85344), where they may be examined. Contract Documents may be downloaded from the District's web site @ [www.bsdsewer.org](http://www.bsdsewer.org). **Go to Phase 4 – Contract 107.**

Those submitting proposals must be eligible to do the Work under and in accordance with, and must agree to conform to, the laws of the State of Arizona. No preference described in Title 34 of Arizona Revised Statutes applies to the Contract.

Each proposal shall be sealed in an envelope addressed to the District Manager of the Buckskin Sanitary District of La Paz County, Arizona, and bear the following statement on the outside of the envelope: **Proposal to Construct Contract 107, Buckskin Sanitary District of La Paz County, Arizona.**

Each proposal shall be made out in the form set forth in the Contract Documents and all pages of said Contract Documents book must be submitted as part of the proposal and shall be accompanied by a bid bond payable to the Buckskin Sanitary District of La Paz County, Arizona for not less than ten percent (10%) of the amount of the bid. The above-mentioned bond shall be given as a guarantee that the entity submitting the related proposal will enter into the Contract if awarded to such entity, and will be declared forfeited if the entity submitting the related proposals refuses to enter into the Contract after being requested to do so by the District Board of Directors.

All proposals shall be filed with the District Manager at the District Office, 8832 Riverside Drive, Suite #4, Parker, Arizona, 85344 on or before 2:00 p.m. local time, **November 12, 2019**. All proposals will be opened at an open meeting to be held on such date. Thereafter, all proposals will be tabulated by the District Manager who shall report his findings to the Board of Directors. The proposals will be examined and publicly declared at a public meeting of the Board of Directors to be held by the District on **November 19, 2019**, unless a special meeting is held at an earlier date. It is expected that the Board of Directors will award the Contract to the entity submitting the lowest cost, responsive proposal at such Board meeting to be held on or before **November 19, 2019**.

This project will be funded by the United States Department of Agriculture, Rural Utility Services (“RUS”) and will therefore require that the Contractor strictly adhere to the federal requirements governing said work.

The Board of Directors reserve the right to reject any or all proposals and to waive any informalities or irregularities in the proposals.

For information concerning the bid documents, please contact the ENGINEER, Mr. Glenn Panaro, P.E., 4241 E. Hano St., Phoenix, Arizona 85044, phone (602) 309-3824.

For information concerning the financing procedures and the sale of Bonds between the District and RUS, contact Mr. Wayne Posey, District Manager, 8832 Riverside Drive Suite #4, Parker, Arizona 85344, phone (928) 667-7197.

Owner: **Buckskin Sanitary District**  
By: **Wayne Posey**  
Title: **District Manager**  
Date: **October 16, 2019**

**SECTION 00200: INSTRUCTIONS TO BIDDERS**

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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.

#### **ARTICLE 2 – COPIES OF BIDDING DOCUMENTS**

- 2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the advertisement or invitation to bid.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

#### **ARTICLE 3 – QUALIFICATIONS OF BIDDERS**

- 3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid written evidence such as financial data, previous experience, present commitments, and such other data as called for in Contractor's Qualification Statement attached as Document 00451, which must be completed in ink and attached to the Bid.
- 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.
- 3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

#### **ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE**

- 4.01 *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.
- 4.02 *Existing Site Conditions*
- A. Subsurface and Physical Conditions; Hazardous Environmental Conditions
1. The Supplementary Conditions may identify:

- a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
  - b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
  - 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: Information and/or data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.
- C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

#### 4.03 *Site Visit and Testing by Bidders*

- A. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- B. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder 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.
- C. Bidder shall 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.

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

#### 4.04 *Owner's Safety Program*

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

#### 4.05 *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 5 – BIDDER'S REPRESENTATIONS**

#### 5.01 It is the responsibility of each Bidder before submitting a Bid to:

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;
- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;
- E. consider 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 Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;
- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the

- Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
  - H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;
  - I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
  - J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 6 – PRE-BID CONFERENCE (NOT APPLICABLE)**

#### **ARTICLE 7 – INTERPRETATIONS AND ADDENDA**

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.
- 7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding 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, if any) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.
- 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 Documents, 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 Documents 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. Such forfeiture shall 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 seven 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 seven 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 substantially completed and completed and ready for final payment, are set forth in the Agreement.

**ARTICLE 10 – LIQUIDATED DAMAGES**

- 10.01 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 11 – SUBSTITUTE AND “OR-EQUAL” ITEMS**

- 11.01 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.
- 11.02 All prices that Bidder sets forth in its Bid shall 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.
- 11.03 If an award is made, Contractor shall be allowed to submit proposed substitutes and “or-equals” in accordance with the General Conditions.

**ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS**

- 12.01 If required by the bid documents, the apparent Successful Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work:
- A. Pipe Supplier(s)
  - B. Licensed Electrician(s)
  - C. Septic hauling Company

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall 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.

- 12.02 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, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity 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 7.06 of the General Conditions.
- 12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection.
- 12.04 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.06.

### ARTICLE 13 – PREPARATION OF BID

- 13.01 The Bid Form is included with the Bidding Documents.

**NOTE: The BID FORM AND ATTACHMENTS ARE BEING MADE AVAILABLE AS A SEPARATE DOCUMENT TO DOWNLOAD FROM THE BUCKSKIN SANITARY DISTRICT'S WEBSITE AT [www.bsdsewer.org](http://www.bsdsewer.org) TO FACILITATE THE BID PROPOSAL SUBMISSION. THE DISTRICT AND ENGINEER ARE NOT RESPONSIBLE FOR ERRORS OR ANY VARIATIONS CAUSED TO THE CONTRACT DOCUMENTS AS A RESULT OF PRINTING.**

- A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall 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."
- 13.02 A Bid by a corporation shall 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 shall be shown.
- 13.03 A Bid by a partnership shall 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 partnership's address for receiving notices shall be shown.
- 13.04 A Bid by a limited liability company shall 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 firm's address for receiving notices shall be shown.
- 13.05 A Bid by an individual shall show the Bidder's name and address for receiving notices.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
- 13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

#### **ARTICLE 14 – BASIS OF BID**

##### **14.01 *Unit Price***

- A. Bidders shall 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 15 – SUBMITTAL OF BID**

- 15.01 Bidder shall complete the Bid Schedule included in the Bid Form, Section 00410 and submit its Bid in the bound copy of the Contract Documents, along with the Bid security and other documents required to be submitted under the terms of Article 7 of the Bid Form.
- 15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall 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 shall 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 shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to Wayne Posey, District Manager, Buckskin Sanitary District.
- 15.03 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 16 – MODIFICATION AND WITHDRAWAL OF BID**

- 16.01 A 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.

- 16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 16.03 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, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

#### **ARTICLE 17 – OPENING OF BIDS**

- 17.01 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 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 18.01 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 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT**

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. 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, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.
- 19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.
- 19.03 Evaluation of Bids
- A. In evaluating Bids, Owner will consider whether or not 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. 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.
- 19.04 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.



- 19.05 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 20 – BONDS AND INSURANCE**

- 20.01 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 and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

**ARTICLE 21 – SIGNING OF AGREEMENT**

- 21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall 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 shall 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 ten days thereafter, Owner shall deliver one 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 22 – FEDERAL REQUIREMENTS**

- 22.01 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.

**SECTION 00410: BID FORM**

**BUCKSKIN SANITARY DISTRICT  
PHASE 4 - CONTRACT No. 107**

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**ARTICLE 1 – BID RECIPIENT**

1.01 This Bid is submitted to:

**BUCKSKIN SANITARY DISTRICT  
ATTENTION: WAYNE POSEY, DISTRICT MANAGER  
8832 RIVERSIDE DRIVE, SUITE 4  
PARKER, AZ 85344**

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 – BIDDER’S ACKNOWLEDGEMENTS**

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

**ARTICLE 3 – BIDDER’S REPRESENTATIONS**

3.01 In submitting this Bid, Bidder represents that:

- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings
- E. 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 any Site-

- related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
  - G. 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.
  - H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
  - I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
  - J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### **ARTICLE 4 – BIDDER'S CERTIFICATION**

##### 4.01 Bidder certifies that:

- A. 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;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
  - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
  - 2. "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;
  - 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.

**ARTICLE 5 – BASIS OF BID**

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price:

**CONTRACT 107 - BID SCHEDULE**

ITEM No.	ITEM DESCRIPTION	UNIT	QUANTITY	UNIT BID PRICE	TOTAL ESTIMATED BID PRICE
				(\$)	
1	Lift Station No. 1 Complete	LS	1		

**TOTAL ESTIMATED BID PRICE**

\_\_\_\_\_ (words)

\_\_\_\_\_ (US\$)  
(figures)

Bidder acknowledges that the Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for the identified item.

**NOTE: Bidder shall complete the bid schedule (above) and submit the entire Bid Form along with the required attachments under Article 7 of the Bid Form.**

**ARTICLE 6 – TIME OF COMPLETION**

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

**ARTICLE 7 – ATTACHMENTS TO THIS BID**

- 7.01 Bidder agrees that the following documents are submitted with and made a condition of this Bid Proposal.

Section	Title	Attached (x)
00410	Bid Form including a completed Bid Schedule	
00430	Bid Bond	
00451	Bidder's Qualification Statement	
00200	List of Subcontractors and Suppliers (Article 12.01 of ITB)	
<b>Forms</b>		
AD-1048	Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions	
RD Instruction -1940Q (Exhibit A-1)	Restrictions on Lobbying	
RD 400-6	Certification of Non-Segregated Facilities	

**Note: Bidder shall mark (x) under the appropriate attachment**

Bidder’s Qualification Statement must include evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids; and, Contractor’s License No.:   [or] Evidence of Bidder’s ability to obtain a State Contractor’s License and a covenant by Bidder to obtain said license within the time for acceptance of Bids;

**ARTICLE 8 – DEFINED TERMS**

- 8.01 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 9 – BID SUBMITTAL**

BIDDER: *[Indicate correct name of bidding entity]*

By: \_\_\_\_\_  
*[Signature]*

\_\_\_\_\_  
*[Printed name]*

*(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest: \_\_\_\_\_  
*[Signature]*

\_\_\_\_\_  
*[Printed name]*

Title: \_\_\_\_\_

Submittal Date: \_\_\_\_\_

Address for giving notices:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone Number: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Contact Name and e-mail address: \_\_\_\_\_  
\_\_\_\_\_

Bidder's License No.: \_\_\_\_\_  
*(where applicable)*

*NOTE TO USER: Use in those states or other jurisdictions where applicable or required.*



**SECTION 00430 BID BOND**

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*): Buckskin Sanitary District  
Attn: Wayne Posey, District Manager  
8832 Riverside Drive, Suite 4,  
Parker, AZ 85344

BID

Bid Due Date:

Description (*Project Name— Include Location*):

BOND

Bond Number:

Date:

Penal sum

\$

(Words)

(Figures)

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

**BIDDER**

**SURETY**

(Seal)

(Seal)

\_\_\_\_\_  
Bidder's Name and Corporate Seal

\_\_\_\_\_  
Surety's Name and Corporate Seal

By:

\_\_\_\_\_  
Signature

By:

\_\_\_\_\_  
Signature (Attach Power of Attorney)

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Attest:

\_\_\_\_\_  
Signature

Attest:

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

*Note: Addresses are to be used for giving any required notice.*

*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 shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur 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 shall 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 shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall 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 shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall 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 Registered or Certified Mail, return receipt requested, postage pre-paid, and shall 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 shall 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 shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

**SECTION 00451: QUALIFICATIONS STATEMENT**

**THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS**

**1. SUBMITTED BY:**

Official Name of Firm: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

**2. SUBMITTED TO:**

Wayne Posey, District Manager

**3. SUBMITTED FOR:**

\_\_\_\_\_

Owner: Buckskin Sanitary District \_\_\_\_\_

Project Name: Phase 4 – Contract 107

\_\_\_\_\_

\_\_\_\_\_

**TYPE OF WORK:** Construction of Lift Station No. 1 in its entirety including all work and materials necessary to complete the work in accordance with the Contract Documents.

\_\_\_\_\_

\_\_\_\_\_

**4. CONTRACTOR'S CONTACT INFORMATION**

Contact Person: \_\_\_\_\_

Title: \_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

**5. AFFILIATED COMPANIES:**

Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**6. TYPE OF ORGANIZATION:**

SOLE PROPRIETORSHIP

Name of Owner: \_\_\_\_\_

Doing Business As: \_\_\_\_\_

Date of Organization: \_\_\_\_\_

PARTNERSHIP

Date of Organization: \_\_\_\_\_

Type of Partnership: \_\_\_\_\_

Name of General Partner(s): \_\_\_\_\_

\_\_\_\_\_

CORPORATION

State of Organization: \_\_\_\_\_

Date of Organization: \_\_\_\_\_

Executive Officers:

- President: \_\_\_\_\_

- Vice President(s): \_\_\_\_\_

\_\_\_\_\_

- Treasurer: \_\_\_\_\_

- Secretary: \_\_\_\_\_

LIMITED LIABILITY COMPANY

State of Organization: \_\_\_\_\_

Date of Organization: \_\_\_\_\_

Members: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

JOINT VENTURE

Sate of Organization: \_\_\_\_\_

Date of Organization: \_\_\_\_\_

Form of Organization: \_\_\_\_\_

Joint Venture Managing Partner

- Name: \_\_\_\_\_

- Address: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Joint Venture Managing Partner

- Name: \_\_\_\_\_

- Address: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

Joint Venture Managing Partner

- Name: \_\_\_\_\_

- Address: \_\_\_\_\_

**7. LICENSING**

Jurisdiction: \_\_\_\_\_

Type of License: \_\_\_\_\_

License Number: \_\_\_\_\_

Jurisdiction: \_\_\_\_\_

Type of License: \_\_\_\_\_

License Number: \_\_\_\_\_

**8. CERTIFICATIONS**

**CERTIFIED BY:**

Disadvantage Business Enterprise: \_\_\_\_\_

Minority Business Enterprise: \_\_\_\_\_

Woman Owned Enterprise: \_\_\_\_\_

Small Business Enterprise: \_\_\_\_\_

Other ( \_\_\_\_\_ ): \_\_\_\_\_

**9. BONDING INFORMATION**

Bonding Company: \_\_\_\_\_

Address: \_\_\_\_\_

Bonding Agent: \_\_\_\_\_

Address: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Phone: \_\_\_\_\_

Aggregate Bonding Capacity: \_\_\_\_\_

Available Bonding Capacity as of date of this submittal: \_\_\_\_\_

**10. FINANCIAL INFORMATION**

Financial Institution: \_\_\_\_\_

Address: \_\_\_\_\_

Account Manager: \_\_\_\_\_

Phone: \_\_\_\_\_

INCLUDE AS AN ATTACHMENT AN AUDITED BALANCE SHEET FOR EACH OF THE  
LAST 3 YEARS

**11. CONSTRUCTION EXPERIENCE:**

Current Experience:

List on **Schedule A** all uncompleted projects currently under contract (If Joint Venture list each participant's projects separately).

Previous Experience:

List on **Schedule B** all projects completed within the last 5 Years (If Joint Venture list each participant's projects separately).

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

YES  NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

YES  NO

If YES, attach as an Attachment details including Project Owner's contact information.



Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

YES  NO

If YES, attach as an Attachment details including Project Owner's contact information.

**12. SAFETY PROGRAM:**

Name of Contractor's Safety Officer: \_\_\_\_\_

Include the following as attachments:

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) OSHA No. 500- Log & Summary of Occupational Injuries & Illnesses for the past 5 years.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all safety citations or violations under any state all received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide the following for the firm listed in Section V (and for each proposed Subcontractor furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) the following (attach additional sheets as necessary):

Workers' compensation Experience Modification Rate (EMR) for the last 5 years:

YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____

Total Recordable Frequency Rate (TRFR) for the last 5 years:

YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____

YEAR _____	TRFR _____
YEAR _____	TRFR _____
YEAR _____	TRFR _____

Total number of man-hours worked for the last 5 Years:

YEAR _____	TOTAL NUMBER OF MAN-HOURS _____
YEAR _____	TOTAL NUMBER OF MAN-HOURS _____
YEAR _____	TOTAL NUMBER OF MAN-HOURS _____
YEAR _____	TOTAL NUMBER OF MAN-HOURS _____
YEAR _____	TOTAL NUMBER OF MAN-HOURS _____

Provide Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) Days Away From Work, Days of Restricted Work Activity or Job Transfer (DART) incidence rate for the particular industry or type of Work to be performed by Contractor and each of Contractor's proposed Subcontractors and Suppliers) for the last 5 years:

YEAR _____	DART _____
YEAR _____	DART _____
YEAR _____	DART _____
YEAR _____	DART _____
YEAR _____	DART _____

**13. EQUIPMENT:**

MAJOR EQUIPMENT:

List on **Schedule C** all pieces of major equipment available for use on Owner's Project.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: \_\_\_\_\_

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATED: \_\_\_\_\_

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20\_\_

NOTARY PUBLIC - STATE OF \_\_\_\_\_

MY COMMISSION EXPIRES: \_\_\_\_\_

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Schedule C (Major Equipment).
4. Evidence of authority to do business in the state of Arizona; or, a written covenant to obtain such license within the time for accepting of Bids.
5. Contractor's License No.: \_\_\_\_\_; or Evidence of bidder's ability to obtain a State Contractor's License and a written covenant by Bidder to obtain said license within the time for acceptance of Bids.
6. List of Project References
7. Audited balance sheet for each of the last 3 years for firm named in Section 1.
8. Evidence of authority for individuals listed in Section 7 to bind organization to an agreement.
9. Resumes of officers and key individuals (including Safety Officer) of firm named in Section 1.
10. Required safety program submittals listed in Section 12.
11. Additional items as pertinent.

SCHEDULE A

I. CURRENT EXPERIENCE

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

	Name: Address: Telephone:	Name: Company: Telephone:				
--	---------------------------------	---------------------------------	--	--	--	--

SCHEDULE B

II. PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

	Name: Address: Telephone:	Name: Company: Telephone:				
--	---------------------------------	---------------------------------	--	--	--	--

SCHEDULE B

III. PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				





**SECTION 00510: NOTICE OF AWARD**

Date of Issuance:

Owner: Buckskin Sanitary District Contract No.: 107

Engineer: Engineer's Project No.:

Project: Contract Name: Phase 4 – Contract 107

Bidder:

Bidder's Address:

**TO BIDDER:**

You are notified that Owner has accepted your Bid dated [\_\_\_\_\_2018\_\_\_\_\_] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

\_\_\_\_\_  
[describe Work awarded]

The Contract Price of the awarded Contract is: \$ \_\_\_\_\_ [note if subject to unit prices, or cost-plus]

[ ] 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. [revise if multiple copies accompany the Notice of Award]

a set of the 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 the issuance of this Notice of Award:

1. Deliver to Owner [\_\_\_\_\_] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security [e.g., performance and payment bonds] and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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

Owner:

Authorized Signature

By:

Title:

Copy: Engineer

## SECTION 00520: AGREEMENT BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT is by and between Buckskin Sanitary District (“Owner”) and  
\_\_\_\_\_ (“Contractor”).

Owner and Contractor hereby agree as follows:

### ARTICLE 1 – WORK

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

The Work, which is known as Contract 107 – Lift Station No. 1 is located to the north of Parker and south of the Parker Dam. This contract consists of the installation of a new lift station which will tie into an existing force main. The new lift station includes a wet well and pumping equipment, valve vault, emergency generator, and electrical control panel. The existing pump station and septic tanks, located at the site, must be taken out of service and abandoned per ADEQ guidelines. The Contractor shall furnish all materials, labor and equipment for the construction of the work in accordance with the Contract Documents.

Work includes the furnishing of all labor, materials and equipment for the construction of a new lift station , including all miscellaneous equipment and modifications, shown or specified, necessary to provide a complete and operable system.

### ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **PHASE 4 – Contract 107 – Lift Station No. 1**

### ARTICLE 3 – ENGINEER

3.01 The Owner has retained Energy & Water Solutions, LLC (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

### ARTICLE 4 – CONTRACT TIMES

#### 4.01 *Time 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 completed within 150 calendar 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 180 calendar 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 times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. 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 \$ 225.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A 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 \$ 75.00 for each day that expires after such time until the Work is completed and ready for final payment.
  3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

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#### 4.04 *[Deleted]*

### ARTICLE 5 – CONTRACT PRICE

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:
- A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item) as submitted in the Contractor's Bid, attached hereto:
- The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.
- B. 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 account of the Contract Price on the basis of Contractor's Applications for Payment on or before the 1st 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 Work completed (with the balance being retainage); and
    - b. 95 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion of the entire construction to be provided under the Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 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 in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

**ARTICLE 7 – INTEREST**

- 7.01 All amounts not paid when due shall bear interest at the rate of 12 percent per annum.

**ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS**

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
  - A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

- B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
- E. 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 Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.
- F. 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.
- G. 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.
- H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
- I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- J. 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.

## ARTICLE 9 – CONTRACT DOCUMENTS

### 9.01 *Contents*

- A. The Contract Documents consist of the following:
  - 1. This Agreement, Document 00520;
  - 2. Performance bond, Document 00610;
  - 3. Payment bond, Document 00615;
  - 4. Other bonds.

- a. [ ] (pages [ ] to [ ], inclusive).
5. General Conditions, Document 00700;
6. Supplementary Conditions, Document 00800;
7. Specifications as listed in the table of contents of the Project Manual;
8. Drawings - NONE
9. Addenda (numbers [ ] to [ ], inclusive).
10. Exhibits to this Agreement (enumerated as follows):
  - a. Contractor's Bid Form, Document 00410;
  - b. Contractor's Qualification Statement, Document 00451
11. 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, Document 00550
  - b. Work Change Directives.
  - c. Change Orders.
  - d. Field Orders.
- B. The documents listed in Paragraph 9.01.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 9.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

## ARTICLE 10 – MISCELLANEOUS

### 10.01 *Terms*

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

### 10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto 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 Documents.

### 10.03 *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.

### 10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall 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.

### 10.05 *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 10.05:
  - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing 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.

### 10.06 *Other Provisions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, 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 [redacted] (which is the Effective Date of the Contract).

NOTE(S) TO USER:

1. See Article 21 of the Instructions to Bidders and correlate procedures for format and signing of the documents.
2. The Effective Date of the Contract stated above and the dates of any construction performance bond (EJCDC® C-610 or other) and construction payment bond (EJCDC® C-615 or other) should be the same, if possible. In no case should the date of any bonds be earlier than the Effective Date of the Contract.

OWNER:

CONTRACTOR:

\_\_\_\_\_

\_\_\_\_\_

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

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

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Address for giving notices:

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

License No.: \_\_\_\_\_  
*(where applicable)*

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

*NOTE TO USER: Use in those states or other jurisdictions where applicable or required.*



**SECTION 00610: PERFORMANCE BOND**

CONTRACTOR *(name and address):*

SURETY *(name and address of principal place of business):*

OWNER *(name and address):*

**Buckskin Sanitary District  
8832 Riverside Drive, Suite 4  
Parker, Arizona 85344**

**CONSTRUCTION CONTRACT**

Effective Date of the Agreement:

Amount:

Description *(name and location):*

**BOND**

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract):*

Amount:

Modifications to this Bond Form:  None  See Paragraph 16

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

**CONTRACTOR AS PRINCIPAL**

**SURETY**

\_\_\_\_\_  
Contractor's Name and Corporate Seal *(seal)*

\_\_\_\_\_  
Surety's Name and Corporate Seal *(seal)*

By: \_\_\_\_\_  
Signature

By: \_\_\_\_\_  
Signature *(attach power of attorney)*

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Attest: \_\_\_\_\_  
Signature

Attest: \_\_\_\_\_  
Signature

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 shall be 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall 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 shall not be reduced or set off on account of any such unrelated obligations. No right of action shall 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 may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall 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 shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows: To comply with the provisions of A.R.S. §34-222 the following provision is added to and incorporated herein to this bond:

Now, therefore, the condition of this obligation is such, that if the principal faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of the contract during the original term of the contract and any extension of the contract, with or without notice to the surety, and during the life of any guarantee required under the contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the surety being hereby waived, the above obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the extent as if it were copied at length in this Agreement.

The prevailing party in a suit on this bond shall recover as a part of the judgment reasonable attorneys' fees that may be fixed by a judge of the court.



**SECTION 00615: PAYMENT BOND**

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

**Buckskin Sanitary District  
8832 Riverside Drive, Suite 4  
Parker, Arizona 85344**

**CONSTRUCTION CONTRACT**

Effective Date of the Agreement:  
Amount:  
Description *(name and location)*:

**BOND**

Bond Number:  
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:  
Amount:  
Modifications to this Bond Form:  None  See Paragraph 18

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

**CONTRACTOR AS PRINCIPAL**

**SURETY**

\_\_\_\_\_  
Contractor's Name and Corporate Seal

\_\_\_\_\_  
Surety's Name and Corporate Seal

By: \_\_\_\_\_  
Signature

By: \_\_\_\_\_  
Signature *(attach power of attorney)*

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

Attest: \_\_\_\_\_

Attest: \_\_\_\_\_



Signature

Signature

---

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 shall be considered plural where applicable.***

- the Surety (at the address described in Paragraph 13).
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 shall 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 shall 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
  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 shall 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 shall 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 shall 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 shall 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 satisfy 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 shall 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 shall be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall 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 shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall 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:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
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;
4. A brief description of the labor, materials, or equipment furnished;

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;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
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 shall be 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 shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows: To comply with the provisions of A.R.5. §34-222 the following provision is added to and Incorporated herein to this bond:

Now, therefore, the condition of this obligation is such, that if the principal promptly pays all money due to all persons supplying labor or materials to the principal or the principal's subcontractors in the prosecution of the work provided for in the contract, this obligation is void. Otherwise, It remains In full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined In accordance with the provisions, conditions and limitations of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if they were copies at length in this Agreement.

The prevailing party in a suit on this bond shall recover as a part of the judgment reasonable attorneys' fees that may be fixed by a Judge of the court.



**Contractor's Application for Payment No.**

	Application Period:	Application Date:
To (Owner):	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

**Application For Payment  
Change Order Summary**

Approved Change Orders			
Number	Additions	Deductions	
			1. ORIGINAL CONTRACT PRICE..... \$ _____
			2. Net change by Change Orders..... \$ _____
			3. Current Contract Price (Line 1 ± 2)..... \$ _____
			4. TOTAL COMPLETED AND STORED TO DATE (Column F on Progress Estimate)..... \$ _____
			5. RETAINAGE:
			a.     X     _____ Work Completed..... \$ _____
			b.     X     _____ Stored Material..... \$ _____
			c. Total Retainage (Line 5a + Line 5b)..... \$ _____
			6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5c)..... \$ _____
			7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)..... \$ _____
			8. AMOUNT DUE THIS APPLICATION..... \$ _____
			9. BALANCE TO FINISH, PLUS RETAINAGE (Column G on Progress Estimate + Line 5 above)..... \$ _____
TOTALS			
NET CHANGE BY CHANGE ORDERS			

**Contractor's Certification**

The undersigned Contractor certifies that to the best of its knowledge: (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a Bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

---

By: \_\_\_\_\_ Date: \_\_\_\_\_

Payment of: \$ \_\_\_\_\_  
(Line 8 or other - attach explanation of the other amount)

is recommended by: \_\_\_\_\_ (Date) \_\_\_\_\_  
(Engineer)

Payment of: \$ \_\_\_\_\_  
(Line 8 or other - attach explanation of the other amount)

is approved by: \_\_\_\_\_ (Date) \_\_\_\_\_  
(Owner)

Approved by: \_\_\_\_\_ (Date) \_\_\_\_\_  
Funding Agency (if applicable)

**SECTION 00625: CERTIFICATE OF SUBSTANTIAL COMPLETION**

---

Owner:	<b>Buckskin Sanitary District</b>	Contract No.:	107
Contractor:		Contractor's Project No.:	
Engineer:		Engineer's Project No.:	
Project:		Contract Name:	Phase 4 – Contract 107

---

**This [preliminary] [final] Certificate of Substantial Completion applies to:**

- All Work  The following specified portions of the Work:

---

**Date of Substantial Completion**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities:  None  
 As follows

Amendments to Contractor's responsibilities:  None  
 As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

---

EXECUTED BY ENGINEER	RECEIVED:	RECEIVED:
By: _____ (Authorized signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____

## **SECTION 00700: GENERAL CONDITIONS**

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

# **STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT**

Prepared by



Issued and Published Jointly by



These General Conditions have been prepared for use with the Agreement Between Owner and Contractor for Construction Contract (EJCDC® C-520, Stipulated Sum, or C-525, Cost-Plus, 2013 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other.

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## 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 form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting 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, or both; 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, or both; 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; or (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. 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), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree 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 the 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. *Engineer*—The individual or entity named as such in the Agreement.
21. *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.
22. *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. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *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.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *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.
28. *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.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *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.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *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.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *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.
36. *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.
37. *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 furnished by Owner which are designated for the use of Contractor.



38. *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.
39. *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.
40. *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 thereof.
41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, 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.
44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
47. *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.

48. *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 the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. 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:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
    - a. does not conform to the Contract Documents; or
    - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
    - c. 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 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean 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, shall mean 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, shall mean 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. 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 Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), 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 executed 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 specifically 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 *Initial 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 for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall 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.

#### 2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items 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 items, or from those established in applicable transmittal protocols.

### **ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE**

#### **3.01 Intent**

- A. The Contract Documents are complementary; what is required by one 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 or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall 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.

#### **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, shall mean 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, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, 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, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, 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 Documents 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 Documents 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 shall 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 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 thereunder.
- 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 give written notice to Owner and Contractor 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 editions, 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 shall preclude 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 thirtieth 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 sixtieth day after the day of Bid opening or the thirtieth 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 shall 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 shall 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 shall 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 the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the 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. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall 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 utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
  4. acts of war or terrorism.
- D. 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.
- E. Paragraph 8.03 governs 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.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times 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.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.



**ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor 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; 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 7.12, 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 at law; 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 shall 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 known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
  - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
  - 3. Technical Data contained in such reports and drawings.
- 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 upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
  - 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.

#### 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 either:
  - 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; or
  - 2. is of such a nature as to require a change in the Drawings or Specifications; or
  - 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 the necessity of Owner's obtaining 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 above; 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. *Possible Price and Times Adjustments:*
  1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, 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 conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
  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; or
    - 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 as 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, or both, then any such adjustment shall 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, or both, 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.

#### 5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
  1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
  2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
    - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
    - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
    - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
    - d. 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 in the Contract Documents, or was not shown or indicated 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), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; 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 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. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, 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. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
    - 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;
    - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
    - d. 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, or both, then any such adjustment shall 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, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

#### 5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
  2. Technical Data contained in such reports and drawings.
- 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 Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. 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; or
  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, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, 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.

- 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 or 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 shall obligate 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 shall obligate 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 all of Contractor's obligations under the Contract. These bonds shall 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 Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies

Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, 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 shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. 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.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

#### 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.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements 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 and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out



(redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

- E. 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, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- F. If either party does not purchase or maintain all of 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.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect 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 shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

#### 6.03 *Contractor's Insurance*

- A. *Workers' Compensation:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
  - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
  - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
  - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
  - 4. Foreign voluntary worker compensation (if applicable).
- B. *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:
  - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
  - 2. claims for damages insured by reasonably available personal injury liability coverage.
  - 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

- C. *Commercial General Liability—Form and Content:* Contractor’s commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage:
    - a. Such insurance shall 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, to the extent permitted by law, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.
  3. Broad form property damage coverage.
  4. Severability of interest.
  5. Underground, explosion, and collapse coverage.
  6. Personal injury coverage.
  7. 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); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
  8. 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.
- D. *Automobile liability:* Contractor shall purchase and maintain automobile liability insurance against claims 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 shall be written on an occurrence basis.
- E. *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. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor’s pollution liability insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor’s operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds:* The Contractor’s commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

- H. *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 shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.
- I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:
1. include at least the specific coverages provided in this Article.
  2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
  3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
  4. remain in effect at least until final payment (and longer if expressly required in this Article) 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 Documents.
  5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed 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.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

#### 6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. 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.

#### 6.05 *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 full insurable replacement cost thereof (subject to such deductible

amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."
2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
6. extend to cover damage or loss to insured property while in transit.
7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
8. allow for the waiver of the insurer's subrogation rights, as set forth below.
9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
  12. include performance/hot testing and start-up.
  13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change:* All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed 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.
- C. *Deductibles:* The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- 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 notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance:* 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 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

#### 6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers 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. 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 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 Subcontractors, all individuals or entities identified in the Supplementary Conditions as 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. None of the above waivers shall

- extend 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. 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:
1. loss 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 perils whether or not insured by Owner; and
  2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner 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.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
- D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work 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 any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 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 6.05 shall 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, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

## **ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES**

### **7.01 *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. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

### **7.02 *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 at all times maintain good discipline and order at the Site.
- B. 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 shall 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.

### **7.03 *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 shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall 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 shall 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.

### **7.04 *“Or Equals”***

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, 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 material or equipment, or items from other proposed suppliers under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an “or equal” item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
  - a. in the exercise of reasonable judgment Engineer determines that:
    - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
    - 2) it 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) it has a proven record of performance and availability of responsive service; and
    - 4) it is not objectionable to Owner.
  - b. Contractor certifies that, if approved and incorporated into the Work:
    - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
    - 2) it 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 shall result in any change in Contract Price. The Engineer’s denial of an “or-equal” request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

#### 7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment 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 material or equipment under the circumstances described below. To the extent possible such requests shall 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 material or equipment from anyone other than Contractor.
  2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.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 material or equipment that Contractor seeks to furnish or use. The application:
    - a. shall 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 that specified, and
      - 3) be suited to the same use as that 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 that specified, and
      - 2) available engineering, sales, maintenance, repair, and replacement services.
    - d. shall 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 shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

#### 7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity 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 five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. 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, Suppliers, or other individuals or entities 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, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.

- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, 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, Supplier, or other individual or entity, whether initially or as a replacement, shall 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 fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
- J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
- K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
- L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
- N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
- O. Nothing in the Contract Documents:
  - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
  - 2. shall create 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.

#### 7.07 *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 a particular 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 shall be disclosed by Owner 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.

#### 7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. 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

#### 7.09 *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.

#### 7.10 *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. Except where otherwise expressly required by applicable Laws and Regulations, 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 shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

- C. Owner or Contractor may give 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 notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

#### 7.11 *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.

#### 7.12 *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. 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.
- B. 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. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when 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.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

- D. 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.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.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).
- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall 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.

#### 7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

#### 7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of 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 threatened 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 thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

#### 7.16 *Shop Drawings, Samples, and Other Submittals*

- A. *Shop Drawing and Sample Submittal Requirements:*
  - 1. Before submitting a Shop Drawing or Sample, Contractor shall have:
    - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

- b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
  - c. determined and verified 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
  - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
2. Each submittal shall 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 submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
1. *Shop Drawings:*
    - a. Contractor shall submit the number of copies required in the Specifications.
    - b. Data shown on the Shop Drawings will 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.D.
  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.D.
  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. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. 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, conform to the information given in 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 shall 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.
5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 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, shall 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, Sample, or other submittal shall 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.D.4.

E. *Resubmittal Procedures:*

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 submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may



impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

**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 and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, modification, or improper 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.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
  - 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. any inspection, test, or approval by others; or
  - 8. any correction of defective Work by Owner.
- D. 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 shall 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 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 performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury 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 shall 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.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
  - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
  - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

#### 7.19 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

## 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 utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. 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.
- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, 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.

### 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 at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible 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, or both. 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 shall 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. When applicable, any such equitable adjustment in Contract Price shall 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 is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- 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. 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 to 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.
- C. 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 to Contractor.
- D. 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 shall 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 Documents (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 10.08. 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 *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 Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *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.

10.07 *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.

10.08 *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, shall 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 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 10.08 shall also apply to the Resident Project Representative, if any.

#### 10.09 *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 (if any) of which Engineer has been informed.

### **ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

#### 11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
  - 1. *Change Orders:*
    - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
    - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not 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, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
  - 2. *Work Change Directives:* 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 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.
  - 3. *Field Orders:* 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. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.



11.02 *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. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes 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 shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate 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.

11.03 *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.

11.04 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall 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); or
  - 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 11.04.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 11.04.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit shall 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 shall be 15 percent;
    - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five 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 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.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 five 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 shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
- d. no fee shall 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 will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
- f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

#### 11.05 *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 shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

#### 11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.
  - 1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. 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. The supporting data shall 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. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall 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.
  3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *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 that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

#### 11.07 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the 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 11.02, (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 in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

#### 11.08 *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 shall be submitted 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; and
  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.
- 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 shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall 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 shall be incorporated in a Change Order 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. 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 shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall 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. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, 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, shall 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 shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall 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, who 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 shall 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 for services specifically related to the Work.
5. Supplemental costs including 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, and hand tools not owned by the workers, 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.
  - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the 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 property insurance established in accordance with Paragraph 6.05), 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 shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall 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 shall not include any of the following items:
1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, 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. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
  3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  4. 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.
  5. 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*: When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.
- E. *Documentation*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

### 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 on account of any of the foregoing will be valid.

- C. *Contingency Allowance*: Contractor agrees that a 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 on account of Work covered by allowances, and the Contract Price shall 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, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
  - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
  - 2. there is no corresponding adjustment with respect to any other item of Work; and
  - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

### **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 will 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 therewith 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 shall 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 shall 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 shall 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 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 shall 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, or both, 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 shall 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 rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven 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 on account of 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. 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 shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and 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.
2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. 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, or
    - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
    - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
    - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, 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 on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of 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 that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
  - j. liquidated 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;
  - l. there are other items entitling 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 shall 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 shall be treated as an amount due as determined by Paragraph 15.01.C.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 seven 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 shall 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 seven 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 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 6.05 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 7.11), and other documents, Contractor may make application for final payment.
  2. The final Application for Payment shall 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 disputes that Contractor believes are unsettled; 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 Application and Acceptance:*

1. 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 ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall 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. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. 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. *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.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from

Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

- 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 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 terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then 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 other adjacent areas;
  - 2. correct such defective Work;
  - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, 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 therefrom.
- B. If 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 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 correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. 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.
- D. 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.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not 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, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall 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) ten 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) 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 seven 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 shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

#### 16.03 *Owner May Terminate For Convenience*

- A. Upon seven 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 on account of loss of anticipated overhead, profits, or revenue, 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 seven 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, seven 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; and
  - 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising 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; or
  - 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 Documents requires the giving of written notice, it will be deemed to have been validly given if:
  - 1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
  - 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

### **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 shall not constitute a waiver of that provision, nor shall 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 or completion of the Contract or termination 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 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

## **SECTION 00800: SUPPLEMENTARY CONDITIONS**

**These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, EJCDC® C-700 (2013 (REV 1) Edition). All provisions that are not so amended or supplemented remain in full force and effect.**

**The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.**

**The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.**

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### **ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**

#### **SC-1.01** *Defined Terms*

##### **SC 1.01.A.8 Add the following language at the end of last sentence of paragraph 1.01.a.8**

The change order form to be used on this project is **EJCDC C-941**. agency approval is required before change orders are effective.

##### **SC 1.01.A.48 Add the following language at the end of the last sentence of Paragraph 1.01.A.48:**

A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

##### **SC 1.01.A.49 Add the following new Paragraph after Paragraph 1.01.A.48:**

Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered Abnormal Weather Conditions.

##### **SC 1.01.A.50 Add the following new Paragraph after Paragraph 1.01.A.49:**

Agency - The Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices; therefore, the Agency for these documents is USDA Rural Development.

## **ARTICLE 2 – PRELIMINARY MATTERS**

### **SC-2.02 Copies of Documents**

#### **SC-2.02.A. Amend the first sentence of Paragraph 2.02.A. to read as follows:**

Owner shall furnish to Contractor five copies of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

#### **SC 206.B Add the following language to the end of 2.06.B**

Special requirements for electronic data apply to his project. See attached Exhibit entitled “Electronic Communications Protocol Addendum”, Consensus DOCS form 200.2

## **ARTICLE 4 - COMMENCEMENT AND PROGRESS OF THE WORK**

#### **SC 4.01.A Amend the last sentence of Paragraph 4.01.A by striking out the following words:**

In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

#### **SC 4.05.C.2 Amend Paragraph 4.05.C.2 by striking out the following text: “abnormal weather conditions;” and inserting the following text:**

Abnormal Weather Conditions;

#### **SC 4.05.D. Delete Paragraph 4.05.D. in its entirety**

## **ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### **SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.B:**

- C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:
  - 1. Report dated November 19, 2012 prepared by Western Technologies, Inc. entitled “Geotechnical Evaluation-Buckskin Sanitary District Improvements Phase 4 Expansion, Rio Lindo Shores Drive and Marina Village”.
  - 2. Report dated February, 2013 prepared by Logan Simpson Design Inc. entitled “Environmental Report for Buckskin Sanitary District, Phase 4 Wastewater Conveyance Project”.
- D. Contractor may examine copies of reports identified in SC 5.03.C that were not included with the Bidding Documents at District offices located at 8832 Riverside Drive, Suite 4, Parker, Arizona 85344 during regular business hours. These documents are also available on the Buckskin Sanitary District’s website at [www.bsdsewer.org](http://www.bsdsewer.org). These reports and drawings



are not part of the Contract Documents, and are included for reference purposes only, 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 herein.

- E. 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. Contractor is not entitled to rely upon other information and data utilized by Engineer in the preparation of the Drawings and Specifications.
- F. The entire work associated with Contract 107 is to be performed on private property. The Owner does not warrant or make any representation as to the subsurface or physical conditions at the site. It is therefore the sole responsibility of the Contractor to familiarize himself with the work site and assume all risk with regard to subsurface and physical conditions at the site. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by any subsurface or physical condition at the site. 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 a subsurface or physical condition.

**SC-5.05** *Underground Facilities*

**Delete Article SC 5.05 in its entirety and insert the following:**

The entire work associated with Contract 107 is to be performed on private property. The Owner does not warrant or make any representation as to Underground facilities at the site. It is therefore the sole responsibility of the Contractor to familiarize himself with the work site and assume all risk with regard to underground facilities at the site. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by any underground facility at the site. 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 underground facilities.

**SC 5.06** *Hazardous Environmental Conditions*

**Delete Article SC 5.06 (A) and (B) in its entirety and insert the following:**

The entire work associated with Contract 107 is to be performed on private property. There are no drawings or reports included in the Contract Documents or known to Owner that identify Hazardous Environmental Conditions at the site. The presence of sewage and or septage on the site does not constitute a Hazardous Environmental Condition.



2. Contractor’s Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	\$ <u>2,000,000</u>
Products - Completed Operations Aggregate	\$ <u>2,000,000</u>
Personal and Advertising Injury	\$ <u>1,000,000</u>
Each Occurrence (Bodily Injury and Property Damage)	\$ <u>1,000,000</u>

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Bodily Injury:

Each person	\$ _____
Each accident	\$ _____

Property Damage:

Each accident	\$ _____
<i>[or]</i>	
Combined Single Limit of	\$ <u>1,000,000</u>

4. Excess or Umbrella Liability:

Per Occurrence	\$ _____
General Aggregate	\$ _____

5. **Contractor’s Pollution Liability:**

Each Occurrence	\$ _____
General Aggregate	\$ _____

If box is checked, Contractor is not required to provide Contractor’s Pollution Liability insurance under this Contract

6. **Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following:**

**Energy & Water Solutions, LLC**

**7. Contractor’s Professional Liability:**

Each Claim	\$ _____
Annual Aggregate	\$ _____

**SC-6.05** *Property Insurance*

**SC-6.05.** Add the following to the list of requirements in Paragraph 6.05.A, as a numbered item:

- 14. be subject to a deductible amount of no more than [**\$ 1,000**] for direct physical loss in any one occurrence.

**SC-6.05.A.1** Add the following new subparagraph after subparagraph 6.05.A.1:

- a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the following:

La Paz County Office of Community Development, Construction Management Firm

**SC-6.05.A.** Add the following to the list of items in Paragraph 6.05.A, as numbered items:

- 15. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys fees and engineering or other consultants’ fees, if not otherwise covered;

**ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES**

**SC-7.02** *Labor; Working Hours*

**SC-7.02.B.** Add the following new subparagraphs immediately after Paragraph 7.02.B:

- 1. **Regular working hours will be 7 a.m. to 6 p.m**
- 2. **Owner’s legal holidays are New Year’s Day, Martin Luther King Day, President’s Day, Memorial Day, 4<sup>th</sup> of July, Labor Day, Veteran’s Day, Thanksgiving, Day after Thanksgiving, Christmas Eve (1/2 Day), Christmas Day.**
- 3. **La Paz County and District offices are closed every Friday.** The Contractor should take this into consideration when scheduling inspections and any other activity that may require the County and/or Owner’s presence.

**SC-7.02.B.** Amend the first and second sentences of Paragraph 7.02.B to state:

“...all Work at the Site shall be performed during regular working hours, [7 am] through [6 pm]. Contractor may perform Work outside regular working hours or on Saturdays,

Sundays, or legal holidays only with Property Owner’s and District’s consent and notice provided within 24 hours of scheduled work”.

**SC-7.02.C. Add the following new paragraph immediately after Paragraph 7.02.B:**

Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer’s services (including those of the Resident Project Representative, if any), Owner’s representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

**SC-7.02.C. Add the following new subparagraph immediately after Paragraph 7.02.C:**

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as *150% of employee’s direct hourly rate times approved multiplier.*

**SC 7.04.A AMEND THE THIRD SENTENCE OF PARAGRAPH 7.04.A BY STRIKING OUT THE FOLLOWING WORDS:**

Unless the specification or description contains or is followed by words reading that no like, equivalent, or ‘or-equal’ item is permitted.

**SC 7.04.A.1 Amend the last sentence of Paragraph a.3 by striking out “and;” and adding a period at the end of Paragraph a.3.**

**SC 7.04.A.1 Delete paragraph 7.04.A.1.a.4 in its entirety and insert the following in its place:**

[Deleted]

**SC 7.06.A Amend Paragraph 7.06.A by adding the following text to the end of the Paragraph:**

The Contractor shall not award work valued at more than fifty percent of the Contract Price to Subcontractor(s), without prior written approval of the Owner.

**SC 7.06.B Delete paragraph 7.06.B in its entirety and insert the following in its place:**

[Deleted]

**SC 7.06.E Amend the second sentence of Paragraph 7.06.E by striking out “Owner may also require Contractor to retain specific replacements; provided, however, that”.**

**SC 7.08 Permits**

**8 – OTHER WORK AT THE SITE**

**SC-8.02** *Coordination*

**SC-8.02 Delete Paragraph 8.02.A in its entirety.**

**ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION**

**SC-10.03** *Project Representative*

**SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.A:**

- B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.
1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.
  2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.
  3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare and circulate copies of minutes thereof.
  4. 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 proper execution of the Work.
  5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

6. Shop Drawings and Samples:
  - a. Record date of receipt of Samples and Contractor-approved Shop Drawings.
  - b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.
  - c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.
7. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.
8. Review of Work and Rejection of Defective Work:
  - a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
  - b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
9. Inspections, Tests, and System Start-ups:
  - a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.
  - b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.
10. Records:
  - a. Prepare a daily report or keep a diary or log book, recording Contractor's hours on the Site, Subcontractors present at the Site, weather conditions, data relative to questions of Change Orders, Field Orders, Work Change Directives, or changed conditions, Site

visitors, deliveries of equipment or materials, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.

- b. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.
- c. Maintain records for use in preparing Project documentation.

11. Reports:

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.
- b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.

12. Payment Requests: Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

13. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

14. Completion:

- a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.



- b. Participate in Engineer’s final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and prepare a final punch list of items to be completed and deficiencies to be remedied.
  - c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.
- C. The RPR shall 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 Contractor’s work.
  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. Accept Shop Drawing or Sample submittals from anyone other than Contractor.
  8. Authorize Owner to occupy the Project in whole or in part.

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## **ARTICLE 11- AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK**

### **SC 11.07.C Add the following new Paragraph after Paragraph 11.07.B:**

All Contract Change Orders must be concurred in by Agency before they are effective.

**ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK**

**SC-13.01** *Cost of the Work*

**SC 13.01.B.5.c Delete Paragraph 13.01.B.5.c in its entirety and insert the following in its place:**

- c. Construction Equipment and Machinery:
- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
  - 2) Costs for equipment and machinery owned by Contractor will be paid at a rate shown for such equipment in the ***Latest Edition of CALTRANS Equipment Rental Rates***. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs. Costs will include 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 the Equipment directly employed on the changed Work and on STANDBY until such time that any delay in work, for any cause what so ever, shall be paid at the rates determined above in this paragraph. Delay factors for the standby equipment as found in the latest edition of CALTRANS Equipment Rental Rates for the equipment shall be applied to those rates.** The cost of any such equipment or machinery, or parts thereof, shall cease to accrue when the use thereof is no longer necessary for the changed Work. Equipment or machinery with a value of less than \$1,000 will be considered small tools.

**SC 13.02.C Delete Paragraph 13.02.C in its entirety and insert the following in its place:**

[Deleted]

**SC-13.03** *Unit Price Work*

**SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:**

- E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. if 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 20 percent from the estimated quantity of such item indicated in the Agreement; and
2. if there is no corresponding adjustment with respect to any other item of Work; and
  3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

## **ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD**

**SC 15.01.B Amend the second sentence of Paragraph 15.01.B.1 by striking out the following text: “a bill of sale, invoice, or other.”**

**SC 15.01.B.3 Add the following language at the end of paragraph 15.01.B.3:**

No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage, or invest the retainage for the benefit of the Contractor.

**SC 15.01.B.4 Add the following new Paragraph after Paragraph 15.01.B.3:**

The Application for Payment form to be used on this Project is EJCDC C-620. The Agency must approve all Applications for Payment before payment is made.

**SC 15.01.D.1 Delete Paragraph 15.01.D.1 in its entirety and insert the following in its place:**

The Application for Payment with Engineer’s recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

**SC 15.02.A Amend Paragraph 15.02.A by striking out the following text: “no later than seven days after the time of payment by Owner” and insert “no later than the time of payment by Owner.”**

## **ARTICLE 17 – FINAL RESOLUTION OF DISPUTES**

### **SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.**

#### SC-17.02 Arbitration

- A. All matters subject to final resolution under this Article will be decided by arbitration in accordance with the rules of American Arbitration Association, Phoenix Regional Office, subject to the conditions and limitations of this paragraph. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitrator or arbitration provider, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations. The demand for arbitration should include specific reference to Paragraph SC-17.02.D below.
- C. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
  - 1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and
  - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.
- D. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties, in writing, and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.
- E. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

- F. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor.

**SC-17.03 Attorneys' Fees**

**SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.**

SC-17.03 Attorneys' Fees: For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

**ARTICLE 19 – FEDERAL REQUIREMENTS**

**SC 19.01 Agency Not a Party**

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees is a party to this Contract.

**SC 19.02 Contract Approval**

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the following "Certificate of Owner's Attorney" (Exhibit I of RUS Bulletin 1780-26) before Owner submits the executed Contract Documents to Agency for approval.
- B. Concurrence by Agency in the award of the Contract is required before the Contract is effective.

**SC 19.03 Conflict of Interest**

- A. Contractor may not knowingly contract with a supplier or manufacturer if the individual or entity who prepared the plans and specifications has a corporate or financial affiliation with the supplier or manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest in Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

**SC 19.04      Gratuities**

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
  
- B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

**SC 19.05      Small, Minority and Women's Businesses**

- A. Contracting with small and minority business, women's business enterprises, and labor surplus area firms. If Contractor intends to let any subcontracts for a portion of the work, Contractor shall take affirmative steps to assure that small, minority and women's businesses are used when possible as sources of supplies, equipment, construction, and services. Affirmative steps must include:
  - (1) Placing qualified small, minority and women's businesses on solicitation lists;
  - (2) Assuring that small, minority and women's businesses are solicited whenever they are potential sources;
  - (3) Dividing total requirements when economically feasible, into small tasks or quantities to permit maximum participation of small, minority, and women's businesses;
  - (4) Establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women's businesses;
  - (5) Using the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce;

**SC 19.06 Anti-Kickback**

- A. Contractor shall comply with the Copeland Anti-Kickback Act (18 USC 874 and 40 USC 276c) as supplemented by Department of Labor regulations (29 CFR Part 3, “Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States”). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

**SC 19.07 Clean Air Act (42 U.S.C. 7401- 7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended:**

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

**SC 19.08 Equal Employment Opportunity:**

- A. The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”

**SC 19.09 Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)**

A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q, Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

### **SC 19.10 Environmental Requirements**

When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:

- A. Wetlands – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
- B. Floodplains – When disposing of excess, spoil, or other construction materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.
- C. Historic Preservation – Any excavation by Contractor that uncovers an historical or archaeological artifact or human remains shall be immediately reported to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the State Historic Preservation Officer (SHPO).
- D. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily



halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

- E. Mitigation Measures – The following environmental mitigation measures are required on this Project:

**Floodplains**

Construction of the Proposed Action would be required to comply with Section 5.3, Standards for Utilities, of the La Paz County Flood Control District’s *Floodplain Management Ordinance 2010-01*. In addition, the finished grade of each lift station would be constructed at least one foot above the established 100-year flood elevation for the area to ensure protection of the proposed lift stations from flood events. All aboveground equipment at the lift stations would be constructed on concrete slabs above the finished grade.

**Cultural Resources**

It is possible that buried cultural resources could be encountered during ground disturbing activities associated with the Proposed Action. If cultural resources are encountered during project construction, all ground-disturbing activities would cease in the immediate vicinity of the discovery. The District would be required to contact USDA RD/RUS immediately and allow time to properly assess the discovery and determine the appropriate treatment. If the discovery were to occur on BLM land patented to La Paz County, the District should also contact BLM.

**Visual Aesthetics**

The contractor would be required to minimize the amount of vegetation clearing. When necessary, vegetation clearing would be irregular, and straight clearing lines would be avoided by varying the width of the area to be cleared or by leaving selected clumps of vegetation near the edge of the clearing limit. The contractor would avoid damaging vegetation that is to remain in place. In addition, the contractor would be required to restore the areas affected by ground-disturbing activities to conditions deemed acceptable by the District.

**Biological Resources**

1. Fish and Wildlife Resources:

If any Sonoran desert tortoises are encountered during construction, the contractor shall adhere to the AGFD’s *Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects* (Revised October 23, 2007) (Appendix B).

2. Vegetation:

The contractor would be required to minimize the amount of vegetation clearing and avoid damaging vegetation that is to remain in place. In addition, the contractor would be required to restore the areas affected by ground-disturbing activities to conditions deemed acceptable by the District.

### **Endangered Species**

Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.

### **Water Quality**

The District and its contractor would be required to comply with the terms and conditions of Nationwide Permit Number 12 (Utility Line Activities) and the AZPDES permit. Implementation of a SWPPP and associated BMPs would protect water quality by controlling erosion and reducing the potential for sediment transport.

### **Miscellaneous Issues**

#### **1. Air Quality**

La Paz County does not currently have a dust control ordinance. However, the contractor would be required to comply with the *Public Works Standards* for La Paz County, which include specifications for earthwork and the use of water or other dust palliative to control fugitive dust during construction (La Paz County 2012b).

#### **2. Transportation**

In accordance with the *Public Works Standards* for La Paz County, the contractor would be required to implement traffic control measures during construction to minimize impacts to local traffic.

#### **3. Noise**

La Paz County does not have a noise ordinance. The La Paz County Sheriff's Office is responsible for handling community noise complaints. The contractor would be required to limit construction to daylight hours.

Contractor may refer to Environmental Report dated Feb. 2013 prepared by LSD, Inc. on file in the District offices.

### **SC 19.11 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708):**

A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor must comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor must compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are

applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

**SC 19.12 Debarment and Suspension (Executive Orders 12549 and 12689):**

A. A contract award (see 2 CFR 180.220) must not be governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive made to parties listed on the Order 12549.

**SC 19.13 Procurement of recovered materials**

A. The Contractor must comply with 2 CFR Part 200.322, “Procurement of recovered materials.”

Change Order No. \_\_\_\_\_

Date of Issuance: Owner: Buckskin Sanitary District Contractor: Engineer: Project: Phase 4 – Contract 107	Effective Date: Contract No.: 107 Contractor's Project No.: Engineer's Project No.: Contract Name:
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The Contract is modified as follows upon execution of this Change Order:

Description:  
 Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ days
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ days or dates
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ days or dates

RECOMMENDED: By: _____ Engineer (if required) Title: _____ Date: _____	ACCEPTED: By: _____ Owner (Authorized Signature) Title: _____ Date: _____	ACCEPTED: By: _____ Contractor (Authorized Signature) Title: _____ Date: _____
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Approved by Funding Agency (if applicable)

By: \_\_\_\_\_ Date: \_\_\_\_\_  
 Title: \_\_\_\_\_



United States Department of Agriculture

AD-1048

**Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion  
 Lower Tier Covered Transactions**

*The following statement is made in accordance with the Privacy Act of 1974 (5 U.S.C. § 552(a), as amended). This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, and 2 C.F.R. §§ 180.300, 180.355, Participants' responsibilities. The regulations were amended and published on August 31, 2005, in 70 Fed. Reg. 51865-51880. Copies of the regulations may be obtained by contacting the Department of Agriculture agency offering the proposed covered transaction.*

*According to the Paperwork Reduction Act of 1995 an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0505-0027. The time required to complete this information collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The provisions of appropriate criminal and civil fraud privacy, and other statutes may be applicable to the information provided.*

***(Read Instructions On Page Two Before Completing Certification)***

- A. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency;
- B. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

ORGANIZATION NAME

PR/AWARD NUMBER OR PROJECT NAME

NAME(S) AND TITLE(S) OF AUTHORIZED REPRESENTATIVE(S)

SIGNATURE(S)

DATE

*The U.S. Department of Agriculture (USDA) prohibits discrimination in all of its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs). Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Assistant Secretary for Civil Rights, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, S.W., Stop 9410, Washington, DC 20250-9410, or call toll-free at (866) 632-9992 (English) or (800) 877-8339 (TDD) or (866) 377-8642 (English Federal-relay) or (800) 845-6136 (Spanish Federal-relay). USDA is an equal opportunity provider, employer and lender.*

### *Instructions for Certification*

- (1) By signing and submitting this form, the prospective lower tier participant is providing the certification set out on page 1 in accordance with these instructions.
- (2) The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension or debarment.
- (3) The prospective lower tier participant shall provide immediate written notice to the person(s) to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- (4) The terms "covered transaction," "debarred," "suspended," "ineligible," "lower tier covered transaction," "participant," "person," "primary covered transaction," "principal," "proposal," and "voluntarily excluded," as used in this clause, have the meanings set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549, at 2 C.F.R. Parts 180 and 417. You may contact the department or agency to which this proposal is being submitted for assistance in obtaining a copy of those regulations.
- (5) The prospective lower tier participant agrees by submitting this form that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- (6) The prospective lower tier participant further agrees by submitting this form that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.
- (7) A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the System for Award Management (SAM) database.
- (8) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- (9) Except for transactions authorized under paragraph (5) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

COMPLIANCE STATEMENT

This statement relates to a proposed contract with \_\_\_\_\_

\_\_\_\_\_  
(Name of borrower or grantee)

who expects to finance the contract with assistance from either the Rural Housing Service (RHS), Rural Business-Cooperative Service (RBS), or the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

1. I  have,  have not, participated in a previous contract or subcontract subject to Executive Order 11246 (regarding equal employment opportunity) or a preceding similar Executive Order.
2. If I have participated in such a contract or subcontract, I  have,  have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.  
 If the proposed contract is for \$50,000 or more: or  If the proposed nonconstruction contract is for \$50,000 or more and I have 50 or more employees, I also represent that:
3. I  have,  have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
4. If I have participated in such a contract or subcontract,  I have,  have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods):

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According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays the valid OMB control number. The valid OMB control number for this information collection is 0575-0018. The time required to complete this information collection is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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**NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR  
CERTIFICATIONS OF NON-SEGREGATED FACILITIES**

A certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, may 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$ 10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

DATE \_\_\_\_\_

\_\_\_\_\_  
*(Signature of Bidder or Prospective Contractor)*

\_\_\_\_\_  
*Address (including Zip Code)*



CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including contracts, subcontracts, and subgrants under grants and loans) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

\_\_\_\_\_  
(name)

\_\_\_\_\_  
(date)

\_\_\_\_\_  
(title)

oOo

**DIVISION 1**

**GENERAL REQUIREMENTS**

## **SECTION 01010: SUMMARY OF WORK**

### **PART 1 - GENERAL**

#### **1.1 LOCATION AND DESCRIPTION OF WORK**

A. The Work, which is known as Contract 107 – Lift Station No. 1, is located to the north of Parker and south of the Parker Dam in the Rio Lindo development. This contract consists of the installation of a new lift station which will tie into an existing force main. The new lift station includes a wet well and pumping equipment, valve vault, emergency generator, and electrical control panel. The existing pump station and septic tanks, located at the site, must be taken out of service and abandoned per ADEQ guidelines. The Contractor shall furnish all materials, labor and equipment for the construction of the work in accordance with the Contract Documents.

B. The Contract Documents include the following:

1. Bid Documents (Division 0) Specifications.
2. Divisions 1 through 16 Specifications
3. Drawings.

#### **1.2 CONTRACT**

A. The Work shall be constructed under one prime contract.

#### **1.3 WORK BY OWNER**

A. OWNER will perform the following work:

- I. Operation of the existing Buckskin WWTP and maintenance of sewerage treatment facilities.

#### **1.4 SEQUENCE AND PROGRESS OF WORK**

- A. CONTRACTOR shall submit a Construction Schedule covering the entire Work in accordance with Section 01300, Progress Schedule.
- B. CONTRACTOR'S Construction Schedule may use a different sequence from that specified, if techniques and methods known to CONTRACTOR will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of workmanship. The ENGINEER'S determination on the acceptability of any alternative sequence from that specified shall be final.
- C. CONTRACTOR shall make provisions in its sequence and progress of Work to account for longer manufacturing and delivery lead times for the motors or controls, and any equipment requiring long lead times under this Project.

#### **1.5 CONTRACTOR'S USE OF PREMISES**

A. CONTRACTOR shall coordinate use of the premises, for their storage and the operations of their workmen, with OWNER, ENGINEER and utility service companies.

- B. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to CONTRACTOR. CONTRACTOR must operate entirely within the space allowed to him.
- C. CONTRACTOR shall be solely responsible for obtaining and paying all costs in connection with any additional work area, storage sites, access to the Site or temporary right-of-way which may be required for proper completion of the Work.
- D. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the Site will be entirely that of CONTRACTOR and that no claim shall be made against the OWNER or their authorized representatives by reason of any act. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown, or as described in these Specifications, unless the ENGINEER has agreed to the location contemplated by CONTRACTOR to be used for storage. All stored materials shall be labeled according to the appropriate contractor or subcontractor with the manufacturer's label as well.

#### **1.6 EASEMENTS AND RIGHTS-OF-WAY**

- A. Easements and rights-of-way determined by the OWNER to be required to perform the Work will be provided by OWNER. Confine construction operations within the limits indicated on the Drawings. Use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic. Do not enter any private property outside the designated construction easement boundaries without written permission from the ENGINEER and the owner of the property. Any private property or rights-of-way owned by other than the OWNER, which CONTRACTOR wishes to utilize during the performance of the Work, shall be provided by CONTRACTOR.

#### **1.7 ELECTRIC SERVICE**

- A. A new meter will be part of the new panel, which has already been purchased by the District.
- B. There is a j-box located in the driveway of 6246 Rio Lindo Shores Dr. The Contractor will utilize the existing conduit to pull a new service line from the j-box to the new panel at the site. This will be an underground service that will need to be installed within the easement for access to this property.
- C. The existing transformer is adequate for the lift station.

**Note: APS requires a 24" separation between the existing electric service line and the new water line.**

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

## **SECTION 01014: WORK SEQUENCE –LIFT STATION NO. 1 CONTINUITY OF PLANT OPERATIONS**

1. General. The Contractor is advised that the existing pumping system and effluent disposal field located at the Rio Lindo development is currently and continuously receiving and pumping wastewater, and that this function shall not be interrupted except as specified herein. It is essential, therefore, that the Contractor coordinate the work with the Owner associated with Lift Station #1 to avoid, whenever possible, any interference with normal operations. Contractor shall maintain continuous electric service to all areas.
2. Contractor shall determine what work sequence is required and include this with the initial construction schedule.
3. Contractor shall provide labor, materials, and supervision to temporarily bypass flow around the Contractor's work with the specific needs of the construction method being utilized. The Contractor will be allowed to tie into the existing force main to convey wastewater to the Buckskin WWTP as an alternative to pumping wastewater to the existing disposal field.
  - a. Contractor shall submit drawings and complete design data showing methods and equipment proposed to utilize in sewer bypassing for approval by the Engineer. The submittal shall include the following information:
    - i. Drawings indicating the scheme and location of temporary sewer plugs and bypass discharge lines. The drawings shall also show the method and location for discharging the bypass lines.
    - ii. Capacities of pumps and standby equipment. The minimum pump capacity is 130 gpm.
    - iii. Design calculations proving adequacy of the system and selected equipment.
    - iv. Standby power source.
  - b. The bypassed flow shall be operated and monitored on a continuous basis. The bypassing system shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written permission from the Engineer.
  - c. The Contractor is responsible for immediate and proper cleanup should any spill occur, regardless of the amount.
4. Bypassing. Bypassing of untreated or partially treated wastewater to surface waters or drainage courses will not be permitted during construction. All responsibility for unauthorized bypass caused by the actions of the Contractor, his employees, or subcontractors shall be borne in full by the Contractor, including any and all legal fees and other expenses to the Owner resulting directly or indirectly from said bypass.
5. Outage Plan. Because of these restrictive requirements, the Contractor shall submit a detailed plan and time schedule for any operation which is necessary to remove the old pump station from service and connect to the new facilities. The detailed plan shall describe the Contractor's method for preventing spillage, the length of time required to complete

- said operation, the necessary plant and equipment which the Contractor shall provide in order to prevent spillage.
6. No systems or individual equipment items shall be isolated, dewatered, decommissioned, de-energized, or de-pressurized without prior written approval from the Owner. Application for said approval shall be made at least one week in advance of the planned operation. Similarly, no item of equipment installed or modified during the course of this contract shall be started, tested, or operated without the approval of the Owner.
  7. Interruption of any power, or pneumatic or electronic signal or control system is prohibited without prior written approval of the Engineer. The Contractor shall provide temporary power supplies and alternate signal control and transmission systems whenever required to maintain operations, protect equipment or maintain existing monitoring and alarm systems.
  8. Tie-ins to the WWTP shall be coordinated with the OWNER and shall be scheduled as to minimize the disruption of services:
  9. Contractor shall submit a Work Plan on the manner he proposes to construct and coordinate activities associated with Lift Station #1. The work plan shall include the methods to be used in maintaining the bypass pumping system to avoid interrupting service while constructing Lift Station #1 on the same sight. The Contractor shall not initiate work at Lift Station #1 until the Work Plan is approved by the Engineer.
  10. Contractor shall take all precautions in maintaining the structural integrity of the concrete tanks during construction activities and dewatering operations. Modifications to the existing facilities shall be undertaken in accordance with Section 02070 of the specifications.

END OF SECTION

## **SECTION 01025: MEASUREMENT AND PAYMENT**

### **1. SCOPE OF WORK**

Work Included:

1. Scope
2. Total Contract Price
3. Lump Sum Items
4. Unit Price Items
5. Measurement and Basis of Payment
6. Work Included in Overall Contract Price
7. Limits of Payment for Unit Price Items

### **2. TOTAL CONTRACT PRICE**

The Total Contract Price shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plans, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form, including mobilization/demobilization, shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

### **3. LUMP SUM ITEMS**

Each lump sum price submitted in the Bid Proposal shall constitute full compensation for all work shown on the Drawings and required by the Specifications and any other portion of the Contract Documents. All costs in connection with the Work including furnishing of all materials, equipment, supplies and appurtenances, providing all construction plant, equipment, and tools; and performing of all necessary labor to fully complete the Work, shall be included in the lump sum prices named in the Bid Proposal. No Item of Work that is required by the Contract will be paid for outside of or in addition to the prices submitted in the Bid Proposal. All Work of an incidental nature or as may be necessary for the complete and fully functional use of Lump Sum Items in accordance with the Plans and Specifications not specifically set forth in the Bid Proposal for Lump Sum Prices as a pay Item shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the prices named in the Bid Proposal for Lump Sum Prices.

### **4. UNIT PRICE ITEMS**

All costs in connection with the Work including furnishing of all materials, equipment, supplies and appurtenances, providing all necessary labor to fully complete the Work, shall be included in the unit prices specified in the Bid Proposal. No Item of work that is required by the Contract will be paid for outside of or in addition to the prices submitted in the Bid Proposal as a pay Item and shall be considered a subsidiary obligation of the Contractor and all costs in connection therewith shall be included in the unit prices named in the Bid Proposal.

All estimated quantities stipulated in the Bid Schedule or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the bids submitted for the Work. The actual amounts of work done and materials

furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefor.

## **5. MEASUREMENT AND BASIS OF PAYMENT**

The method of measurement and basis of payment for specific Items listed in the Bid Proposal shall be as stipulated in the following subparagraphs.

### **Bid Item 1 – Lift Station No. 1**

#### **Method of Measurement**

For the lump sum price bid for Item 1, the Contractor shall furnish all materials and labor, tools, plant, and equipment required to construct Lift Station No. 1 complete in every detail with all appurtenances, ready for operation, as required by the Contract Documents and required to complete the work.

The work shall include but not limited to excavation, dewatering, backfill, bedding, and compaction for all piping and structures including the pump station building, precast wet well, inlet structure, and chemical injection manhole; mobilization, submersible pumps, guide rails, piping, fittings, painting, lifting chain, hoist and gantry system, vent, access hatches, level sensing probe, connections to electric service; wiring, cable, conduit, service panel, control panel, emergency generator, automatic transfer switch, valve vault, valving, transmitter and recorders, pressure gauges, odor control facilities, water service line and valves, backflow preventer, water meter, hose bibb, yard hydrant; chemical storage tank, vent, and fill line; chemical feed pumps, lines, and valving; containment pipe, handrails, safety equipment; frames and covers, pump station block walls and screening appurtenances, lighting; grading, crushed stone, PVC sewer pipe, sanitary manholes, connections to new manholes, force main, precast inlet structure, concrete, access driveway, pavement replacement, blind flange, system testing, soil erosion and sediment controls, topsoil, seeding, and mulch; fencing and gate, site lighting, plantings, and all incidentals and appurtenances necessary for a complete and fully operational station all as shown on the Drawings as specified herein.

**The lump sum price bid for Lift Station No. 1 shall include the cost of installation of water lines and water service per Brooke Utilities standards, and all work involved with construction of the access roads shown on the Drawings and as specified herein.**

#### **Basis of Payment**

Payment for these items shall be at the Lump Sum price included in the bid.

**Note: For the lump sum price bid for Item 1, Lift Station No. 1, the Contractor shall include in his bid all costs associated with maintaining a bypass pumping system to allow for uninterrupted service while constructing Lift Station No. 1 on the same sight. The cost of dismantling the existing pump station and abandoning the septic tanks in accordance with ADEQ requirements shall be the responsibility of the Contractor and included in the lump sum price.**



Any incidental material needed to complete the work in accordance with the contract documents not specifically set forth as a pay item in the Bid Form, shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the bid price.

## **6. WORK INCLUDED IN OVERALL CONTRACT PRICE**

The cost of any work not specifically called for or set forth in the Bid Proposal as part of Lump Sum or Unit Price Items, but which is considered necessary for the proper execution of the Work, shall be considered as an obligational requirement of the Contractor to furnish such labor, equipment, materials and appurtenances as part of the Total Contract Price for the complete construction of the Work in accordance with the Contract Documents, and no separate payment will be made. Such work shall include, but is not limited to: construction surveys; removal and proper disposal of unsuitable materials; demolition; providing operation and maintenance manuals; project documentation by videotape and photos; temporary facilities; traffic control; testing; materials and equipment for required testing; conforming to all requirements set forth in the project permits; startup services of factory trained service engineers; all other general requirements and industry standards; and all work shown on the Contract Drawings and required by the Specifications.

The total lump sum price for Bid Item 1, shall constitute full compensation for all work to be performed as required by the Contract Documents.

## **7. LIMITS OF PAYMENT FOR UNIT PRICE ITEMS**

Pay limits and method of measurement for unit price items shall be in accordance with Subsection 4 of this Section and at the dimensions shown on applicable details. Any materials such as concrete, stone, or pavement used beyond the limits and detail dimensions shown on the Drawings shall not be paid for in addition to the unit price named in the Bid Proposal. Payment of additional materials as stipulated in the Bid Proposal shall only be made as may be authorized by the Engineer.

## SECTION 01049: GEOTECHNICAL DATA

### 1. DESCRIPTION

- A. A geotechnical investigation was performed at Lift Station #1.
- B. The results of the geotechnical investigation are contained in the document as **noted in Section 00800, article SC 5.03 of the specifications.**
- C. A copy of this report is on file and can be observed at the District offices, or can be downloaded from the Districts website.
- D. This report was obtained only for the Owner's use in design. This report and data have been made available to prospective Bidders/Contractors solely to assist them in familiarizing themselves with the site and the surface and subsurface conditions pertaining thereto. The Owner and its Engineer make no representations with respect to nor does the Owner or its Engineer guarantee or warrant the accuracy of the data contained in said Report or that said Report and data therein shall and does not relieve any prospective Bidder/Contractor from his/her obligation to independently familiarize himself/herself with all site conditions, surface and subsurface, which might affect the work in any way.
- E. Such data is offered in good faith solely for the purpose of placing the Contractor in receipt of available information, and in no event is to be considered a part of the Contract Documents. The boring log and other subsurface information will not be interpreted by the Owner or the Engineer. The Contractor must interpret such data according to his own judgment and acknowledge that he is not relying upon the same as accurately describing subsurface conditions which may be found to exist. The Contractor shall make additional investigations of his own to inform himself as to surface and subsurface water conditions, rock and other material which may be encountered, prior to submitting a bid. The Contractor further acknowledges that he assumes all risk contingent upon the nature of the subsurface conditions to be actually encountered by him in performing the Work covered by the Contract.

### 2. SITE INVESTIGATION

The Contractor acknowledges that he has satisfied himself as to the nature and location of the Work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, groundwater table or similar physical conditions at the site, the conformation and condition of the ground, the character, quality and quantity of surface and subsurface materials to be encountered, the character of equipment and facilities needed prior to and during the prosecution of the work and all other matters which can in any way affect the Work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself/herself with all the available information concerning these conditions, and any other circumstance or condition affecting the Work, shall not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the Work.

**Note: The Contractor shall take all precautions necessary to determine the methods, means and character of equipment and facilities needed prior to the prosecution of work and sequencing of construction related to Lift Station #1.**

- END OF SECTION -

## **SECTION 01050: GRADES, LINES AND LEVELS**

### **1. REQUIREMENTS**

- A. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as directed by the Engineer. Property lines and existing benchmarks are shown on the Drawings. All other base lines and benchmarks for performance of the Contract work must be established by the Contractor. The Contractor shall provide such materials as templates, stakes, ranges, spikes, nails and boards, and give such assistance as may be required. Elevation of existing ground, structures and appurtenances are believed to be reasonably correct but are not guaranteed to be absolute and, therefore, the Contractor shall verify all information. Any error or apparent discrepancy in the data shown or omissions of data required for accurately accomplishing a stake-out survey shall be referred immediately, in writing, to the Engineer for interpretation or correction prior to proceeding with the Work. The Contractor and his subcontractors shall rely on their own measurements for the performance of their Work and shall verify all dimensions necessary for the proper construction of the Work called for by the Drawings and Specifications.
- B. All survey work for construction control purposes shall be made by the Contractor at his expense. The Contractor shall employ an Arizona Licensed Surveyor or Professional Engineer as Chief of Party, competently qualified men, all necessary instruments, stakes and other material to perform the work. The Licensed Engineer or Land Surveyor shall make all necessary computations to establish the exact position of all the work from the control points as may be shown on the Drawings or furnished by the Engineer.
- C. The Contractor shall establish all base lines for the location of the principal component parts of the Work together with a suitable number of bench marks and batter boards adjacent to the work, and shall preserve such controls throughout the duration of the Contract. Based upon the information provided by the Drawings, the Contractor shall develop and make all detail surveys necessary for construction, including slope stakes, batter boards, stakes for all working points, lines and elevations.
- D. The Contractor shall have the responsibility to carefully preserve all bench marks, reference points and stakes, and in the case of destruction thereof by the Contractor or resulting from his negligence, the Contractor shall be charged with the expense and damage resulting therefrom and shall be responsible for any mistakes that may be caused by the unnecessary loss or disturbance of such bench marks, reference points and stakes. The Contractor shall protect all private survey points he may encounter during construction.
- E. Existing or new control points, property markers and monuments that are destroyed during the course of construction shall be reestablished by the Contractor at his expense, and all reference ties recorded therefor shall be furnished to the Engineer. All computations necessary to establish the exact position of the work shall be made and preserved by the Contractor.
- F. The Engineer may check all or any portion of the work and the Contractor shall afford all necessary assistance to the Engineer in carrying out such checks. Any necessary corrections to the work shall be immediately made by the Contractor. Such checking by the Engineer shall not relieve the Contractor of any responsibilities for the accuracy or completeness of his work.

- G. No direct payment will be made for the cost to the Contractor of any of the work or delay occasioned by Engineer's instruction as to lines and grades, compensation therefor being considered as having been included in the Contract Price.
  
- H. All sewer grades and elevations shown are considered as the minimum obtainable given the existing topography of the main sewer, collector sewers and other areas to be sewered in the future. It is possible that benchmarks and other control points have been disturbed since design. The contractor shall therefore perform a pre construction survey of all benchmarks and project control points verifying the information shown in the contract documents to determine and verify the accuracy of one to another and each to the other. The contractor shall notify the engineer immediately in the event of a discrepancy. A copy of this survey shall be submitted to the engineer, under seal of an Arizona registered Land Surveyor prior to start of any construction.

No additional or separate compensation will be made for this work

## **SECTION 01200: PROJECT MEETINGS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
  - 1. Qualifications of Meeting Participants.
  - 2. Preconstruction Conference Progress Meetings.
  - 3. Pre-installation Meetings.
  - 4. Post Construction Meeting.

#### **1.02 QUALIFICATIONS OF MEETING PARTICIPANTS**

- A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

#### **1.03 PRECONSTRUCTION CONFERENCE**

- A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, ENGINEER will arrange a preconstruction conference in a convenient place for most persons invited, in accordance with the General Conditions.
- B. Attending Preconstruction Conference: CONTRACTOR's Superintendent, OWNER, ENGINEER, representatives of utilities, major subcontractors and others involved in performance of the Work, and others necessary to agenda.
- C. ENGINEER will preside at conference.
- D. Purpose of Conference: To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.
- E. Agenda Will Include:
  - 1. Adequacy of distribution of Contract Documents.
  - 2. Distribution and discussion of list of major subcontractors and suppliers.
  - 3. Proposed progress schedules and critical construction sequencing.
  - 4. Lift Station No. 1 work plan
  - 5. Major equipment deliveries and priorities.
  - 6. Project coordination.
  - 7. Designation of responsible personnel.
  - 8. Procedures and Processing of:
    - a. Field decisions.
    - b. Proposal requests.
    - c. Submittals, including detailed list of all shop drawings, product data and samples.
    - d. Change Orders.

- e. Applications for Payment.
  - f. Record Documents.
  - 9. Use of Premises:
    - a. Office, construction, and storage areas.
    - b. OWNER's requirements.
  - 10. Construction facilities, controls, and construction aids.
  - 11. Shoring requirements and submittal of Contractor's geotechnical report, if required.
  - 12. Temporary utilities.
  - 13. Safety and first aid procedures.
  - 14. Security procedures.
  - 15. Housekeeping procedures.
- F. ENGINEER will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

#### **1.04 PROGRESS MEETINGS**

- A. Conduct progress meetings at least once every two weeks in CONTRACTOR's field office, ENGINEER's field office or other mutually agreed upon place.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Require attendance of CONTRACTOR's superintendent and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
- D. Invite OWNER, ENGINEER, Utility Companies when the Work affects their interests, and others necessary to agenda.
- E. Complete and bring Application for Payment and Progress Schedule to progress meeting.
- F. Prepare and distribute agenda.
- G. Preside at meetings.
- H. Purpose of Progress Meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
- I. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
- J. Verify:
  - 1. Actual start and finish dates of completed activities since last progress meeting.
  - 2. Durations and progress of activities not completed.
  - 3. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.
  - 4. Percentage completion of items on Application for Payment.

- 5. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.
- K. Discuss potential problems which may impede scheduled progress and corrective measures.
- L. ENGINEER will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

**1.05 POST CONSTRUCTION MEETING**

- A. Meet with and inspect the Work following the date of Substantial Completion with OWNER and ENGINEER.
- B. Arrange meeting at least 7 days before meeting.
- C. Meet in OWNER's office or other mutually agreed upon place.
- D. Inspect the Work and draft list of items to be completed or corrected.
- E. Review service and maintenance contracts, and take appropriate corrective action when necessary.
- F. Complete or correct defective work and extend correction period accordingly.
- G. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.



## **SECTION 01250: SCHEDULE OF VALUES**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Requirements for preparation, format, and submittal of Schedule of Values.

#### **1.02 PREPARATION**

- A. Prepare Schedule of Values identifying costs of Major Items of Work and other costs necessary to substantiate the complete value of work.
- B. Divide the Work into the following Major Items of Work:
  - 1. Lift Station #'s 1 to include as a minimum:
    - a. Concrete wet well
    - b. Pumps and Discharge Piping
    - c. Site Piping Including Drainage, Sewer, and Water
    - d. Electrical system including but not limited to electrical panels, switchboards, motor control centers, and other electrical distribution equipment.
    - e. Generator and Switchgear
    - f. Control Systems and Programming
    - g. Sitework Including Grading and Paving
    - h. Site wall and access gate
    - i. Valve Vault Construction
    - j. All other appurtenances
  - 2. Gravity sewer including manholes, and specialty areas.
  - 3. Force mains including air release valves, if applicable.
  - 4. Start-Up, Testing, and Demobilization.
- C. Assign prices to Major Items of Work which aggregate the Contract Price. Base prices on costs associated with scheduled activities based on the Project Schedule for each Major Item of Work.

**Notes: (1) Demolition of Existing Septic System at Rio Lindo to be included under Lift Station #1 breakdown.**

**(2) A material list of equipment items previously purchased and being supplied by the District for Lift Station No. 1 is included in Appendix I to the contract documents.**

#### **1.03 SUBMITTALS**

- A. Submit preliminary schedule of values within 10 days of the notice to proceed.

- B. Submit corrected schedule of values within 30 days of the notice to proceed but no later than 10 days prior to anticipated submittal of first Application for Payment, in accordance with Document 00700, General Conditions, Paragraph 2.05.
- C. Upon request, support prices with data which will substantiate their correctness.

If activities are added or removed from the Progress Schedule, the Contractor shall revise and resubmit the Schedule of Values for approval by the Engineer.

**PART 2 - PRODUCTS**

Not Used.

**PART - EXECUTION**

Not Used.

## **SECTION 01300: PROGRESS SCHEDULES AND REPORTS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. This section includes: Preparation, submittal, and maintenance of construction schedule, progress schedule and reports.

#### **1.02 RESPONSIBLE PERSON**

- A. Designate, in writing and within 5 calendar days after Notice of Award, person responsible for preparation, maintenance, updating and revision of all schedules.

#### **1.03 SCHEDULING FORMAT AND SOFTWARE**

- A. Schedule Format: Prepare the schedule using a simple chart to appropriately indicate the percentage of Work completed at any time. The chart shall be in a form approved by the Engineer, and include items corresponding to the items contained in the Schedule of Values with additional detail as necessary to accurately track progress of the Work to the satisfaction of the Engineer.

#### **1.04 PREPARATION AND SUBMITTAL OF PRELIMINARY and FINAL CONSTRUCTION SCHEDULES**

- A. Within ten (10) days after issuance of the Notice to Proceed, submit to the Engineer five (5) copies of a practicable and feasible construction schedule showing the order in which the Work is to be carried on, the dates on which salient features will start and the contemplated dates for completing such work.
- B. CONTRACTOR's bid covers all costs associated with the execution of the Work in accordance with the Construction Schedule.
- C. ENGINEER and CONTRACTOR shall meet within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. CONTRACTOR shall submit revised preliminary schedule within 5 calendar days after meeting.
- D. Failure of CONTRACTOR to include required schedule constraints, sequences or milestones in schedule shall not relieve CONTRACTOR of obligation to conform to requirements of Contract. Acceptance of schedule shall not waive Contract requirements. In event of conflict between accepted schedule and Contract requirements, terms of Contract shall govern at all times, unless requirements are waived in writing by the OWNER.
- E. Revise the Construction Progress Schedule as required by the Engineer until finally approved by him, and after such approval, adhere to such schedule unless, upon written order of the Engineer, it is changed.

#### **1.05 UPDATING THE SCHEDULE**

- A. At the end of each month, if necessary, update the Construction Progress Schedule by entering the actual progress of the Work on the schedule. The updated Construction Progress Schedule must be submitted with or prior to the application for payment. Deliver three (3)

copies of the updated Construction Progress Schedule to the Engineer immediately after its completion.

- B. If the monthly update of the Construction Progress Schedule indicates variations in the schedule as previously approved, submit a revised Construction Progress Schedule to the Engineer for approval in accordance with requirements specified previously.

#### **1.07 WEEKLY SCHEDULE**

- A. Submit to ENGINEER, on the last working day of every week, a progress schedule showing the activities completed during the previous week and the CONTRACTOR's schedule of activities for the following week.
- B. The activity designations used in the Weekly Schedule shall be consistent with those used in the approved Construction Schedule and the monthly Schedule Updates.
- C. The format of the Weekly Schedule shall be as agreed upon between the CONTRACTOR and the ENGINEER.

#### **1.08 FINAL SCHEDULE SUBMITTAL**

- A. As a condition precedent to the release of retainage, the final Schedule Update shall be identified by the CONTRACTOR as the As-Built Schedule.
- B. The As-Built Schedule shall reflect the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.
- C. The As-Built Schedule shall be signed and certified by the CONTRACTOR's Project Manager and scheduler as being an accurate record of the way in which the project was actually constructed.

#### **PART 2 PRODUCTS**

Not Used.

#### **PART 3 EXECUTION**

Not Used.

## **SECTION 01310: SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Requirements and procedures for submitting Shop Drawings, Material Submittals, Product Data, Samples, other submittals relating to products, and as specified in individual sections.

#### **1.02 DEFINITIONS**

- A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.
- B. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.
- C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.
- D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

#### **1.03 PROCEDURES**

- A. The Contractor is required to submit details of all materials and equipment, even though a particular item is the one specified.
- B. The Contractor shall prepare and submit to the Engineer for his review a tabulation of all principal items of equipment and material to be purchased under the Contract, with appropriate spaces to insert the following listed information:
  - 1. Date on which shop drawings are requested from Manufacturer;
  - 2. Date on which shop drawings are received from Manufacturer;
  - 3. Date on which shop drawings are submitted to Engineer;
  - 4. Date on which shop drawings are returned by Engineer for revision;
  - 5. Date on which shop drawings are revised by Manufacturer;
  - 6. Date on which shop drawings are resubmitted to Engineer;
  - 7. Date on which shop drawings are returned by Engineer marked "Approved" or "Approved as Noted";

8. Date on which reviewed shop drawings are transmitted to Manufacturer;
  9. Final revised date of Manufacturer's scheduled delivery; and
  10. Date on which delivery is actually made.
- C. A black-on-white print of this tabulation shall be brought up to date bi-weekly and submitted to the Engineer. This data shall also be used in updating the construction program. This submission shall also be prerequisite to any partial estimate.
  - D. The Contractor, on approval from the Engineer, may submit Manufacturer's literature as a substitute for, or supplement to, the shop drawings. The minimum size for any submission shall be 8½ in. by 11 in. and the maximum size shall not exceed 24 in. by 36 in. All shop drawings and printed matter submitted shall clearly indicate the Section of the Contract Documents to which they correspond.
  - E. Shop drawings or printed matter shall give all dimensions and sizes to enable the Engineer to pass on the suitability of the material or layout for the purpose intended. The shop drawings shall, where needed for clarity, include outline and sectional views, and detailed working dimensions and designations of the kind of materials and the kinds of machine work and finishes required. Shop drawings for submission shall be coordinated by the Contractor with shop drawings previously submitted, with shop drawings being prepared, and with the design and function of any equipment or structure.
  - F. If the shop drawings show variances from the requirements of the Contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment, otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though such shop drawings have been approved by the Engineer.
  - G. Material shall not be purchased or fabricated for equipment or structure until the Engineer has reviewed the shop drawings, which shall represent all materials and work involved in the construction. No materials or equipment for which a submittal of a shop drawing is required shall be delivered to the site unless they are in conformance with the shop drawings which have been "Approved".
  - H. Work shall not be done upon any part of a structure, the design or construction of which is dependent upon the design of equipment or other features, for which approval is required, until such approval has been received from the Engineer.
  - I. Five (5) copies of Shop Drawings, Product Data and Manufacture's Instructions, and printed matter shall be submitted to the Engineer for review. By submitting the working drawing, the Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, catalog numbers and similar data, or will do so, and that he has checked and coordinated each working drawing with the requirements of the Work and of the Contract Documents.

Samples: Submit 2 samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.

- J. The Contractor shall review all drawings or literature submitted to him by Subcontractors and Manufacturers for correctness and adequacy of data prior to submitting such working drawings and literature to the Engineer for approval.
- K. The Contractor shall be responsible for the prompt submission of all shop drawings, so that there shall be no delay to the work due to the absence of such drawings.

#### **1.04 MANUFACTURER'S INSTRUCTIONS**

- A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.
- B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

#### **1.05 ENGINEER'S REVIEW**

- A. ENGINEER's review of submittals shall not release CONTRACTOR from CONTRACTOR's responsibility for performance of requirements of Contract Documents. Neither shall ENGINEER's review release CONTRACTOR from fulfilling purpose of installation nor from CONTRACTOR's liability to replace defective work.
- B. Contractor shall not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how CONTRACTOR intends to conform with the design concept.
- C. The Engineer will review the shop drawings, but only for conformance with the design concept of the Project and with the information given in the Contract Documents.
- D. Three (3) copies of the shop drawings or printed matter will be retained by the Engineer. The remaining copies will be returned to the Contractor, marked in one of the following ways, all subject to Contract requirements:

**IN THE EVENT OF A CONFLICT BETWEEN THE CONTRACT PLANS AND SPECIFICATIONS WITH THE MAG STANDARD SPECIFICATIONS OR MAG STANDARD DETAILS, THE CONTRACT PLANS AND SPECIFICATIONS SHALL GOVERN FOR RESOLUTION OF THE CONFLICT.**

Submittals (Shop Drawings) shall be numbered sequentially from 1 – n with subsequent submittals of the same item numbered with the original submittal number followed by A for the first resubmittal and B for the second resubmittal etc.

All submittals shall be clearly marked as to the specific item being submitted. Items contained in the submittal that are not applicable to the Work in this contract shall be clearly marked out by boxing around the inapplicable item and crossing out the item from corner to corner. Submittals not marked in this manner will be returned without review.

The contractor shall keep a current shop drawing log and shall furnish a copy of such log to the engineer at each periodic construction progress meeting.

Submittals received by the Engineer from the contractor for review marked Urgent or Priority or other similar designation by the Contractor due to the Contractor's failure to submit the item without adequate construction schedule lead time will be reviewed by the Engineer within a reasonable time. Under no circumstance, for any reason what so ever, will the Contractor be entitled to compensation for any delay of any nature what so ever occurring as a result of an Urgent or Priority type request for submittal review.

Submittals shall be identified by Specification Section AND the MAG STD Detail number where a MAG STD Detail applies.

All Submittals shall be prepared and submitted in compliance with Specification Section 01310, Submittal Procedures.

The status of the submittal will be marked as:

“Record Copy” – for use on submittals that do not require review. These are items that are the sole responsibility of the contractor. For Example the Contractor's Safety Plan, Trench and Excavation Plans and calculations etc.

“No Exceptions Noted” - the item was reviewed and appeared to conform to the requirements of the contract. This shall not be construed in any way as relieving the Contractor from his responsibility for errors or omissions in the working drawings or from any of his other responsibilities under the terms of the Contract, but shall be interpreted only to mean that an examination of the exhibits has been made, that no variation from the Contract requirements has been discovered and that no criticism is offered.

“Exceptions Noted” - minor discrepancies are noted for the Contractors attention. Resubmittal IS NOT required. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product, and a set of corrected drawings submitted in accordance with 1.05 (E) below.

“Revise and Resubmit” - comments address items or salient portions of items that do not appear to conform to the contract documents (RESUBMITTAL IS REQUIRED).

“Rejected” - submittal item does not conform to the salient requirements of the contract documents and may not be incorporated into the work. Resubmittal is required.

**“Review does not relieve the contractor from compliance with the requirements of the Contract Documents”**

- E. After shop drawings have been returned “No Exceptions Noted” or “Exceptions Noted” and just prior to the end of the Contract Work, the Contractor shall furnish the Engineer with three prints and one reproducible copy of each approved drawing, with all approved field changes shown. The Contractor shall also furnish three copies of approved Manufacturer's printed literature. Only drawings which have been checked and corrected shall be submitted. The Contractor shall review all drawings or literature submitted to him by Subcontractors and Manufacturer's for correctness and adequacy of data prior to submitting such drawings and literature to the Engineer for approval.
- F. Any approval by the Engineer of such, or parts of such, shop drawings, manufacturer's literature, or other data relative to the work or material to be furnished for the Contract shall not be



construed in any way as relieving the Contractor from his full responsibilities under the terms of the Contract, but shall be interpreted only to mean that an examination of the exhibits has been made, that no variation from the Contract requirements has been discovered and that no criticism is offered. Approval of a separate item shall not indicate approval of an assembly in which the item functions.

- G. ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.
- H. Costs incurred by OWNER as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to OWNER will be made by deducting such costs from CONTRACTOR's subsequent partial payments.

#### **1.06 SAMPLES**

- A. Contractor shall furnish for review all samples as required by the Contract Documents or requested by the Engineer.
- B. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show the nature of the material, trade name of manufacturer and location of the work where the material represented by the sample will be used.
- C. Samples shall be checked by the Contractor for conformance to the Contract Documents before being submitted to the Engineer and shall bear the Contractor's stamp of approval certifying that they have been so checked. Transportation charges on samples submitted to the Engineer shall be prepaid by the Contractor.
- D. Engineer's review will be for compliance with the Contract Documents and his comments will be transmitted to the Contractor with reasonable promptness.
- E. Accepted samples will establish the standards by which the complete work will be judged.

#### **1.07 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES**

- A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.
- B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

#### **1.08 SUBMITTALS FOR INFORMATION OR RECORD ONLY**

- A. Submit 4 copies of each. None will be returned.
- B. Mill Test Reports:
  - 1. Submit 4 certified copies of factory and mill test reports for record only. No copies will be returned.
  - 2. Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.

3. Pay for mill and factory tests.

C. Reinforcing Steel:

1. Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.
2. Note deviations and variations as specified for Shop Drawings.

**1.09 MATERIAL SUBMITTALS**

A. Submittals shall be prepared and submitted to the Engineer for review for the following items. The contractor shall, in addition to these items, submit on all salient items to be incorporated into construction whether or not listed herein.

1. PVC SDR 35 Sewer Pipe

A. Materials

- 4 inch Diameter – Service Connection – MAG Spec Section 745
- 6 inch Diameter – Service Connection – MAG Spec Section 745
- 6 inch Diameter – MAG Spec Section 745
- 8 inch Diameter – MAG Spec Section 745
- 10 inch Diameter – Mag Spec section 745
- Sewer Wyes and Tees – MAG STD Detail 440-1
- Elder Valve and Box – Specification Section 15100 Section 2.6.B
- 4, 6 and 8 inch Diameter Sewer Cleanouts – MAG STD Detail 441
- 2, 6, 8, 10 inch Diameter Sewer Plugs – MAG Spec Section 427 (sewer line and typical stub out and force main)
- Installation lubricant – MAG Spec Section 745
- Electronic Marker– MAG STD Detail 440-1
- Underground Warning Tape – Specification Section 15265.2.5 and MAG STD Spec 616.4.1

B. Manufacturers Written installation Instructions for all materials

2. Force Main (PVC Pressure Piping) –

A. Materials

- 2, 4 and 6 inch Diameter - Specification Section 15265.2.2.B
- Ductile Iron fittings – Specification Section 15251
- Pipe Connecting and Restraint Devices Specification section 15200
- Tracer Wire – Specification Section 15265.2.6

B. Manufacturers written Installation Instructions

C. As Constructed Submittal (Shop Drawing) Documentation – Specification Section 01310.1.05.E.

3. Ductile Iron Pipe and Fittings –

A. Materials and Manufacturing Details

- 4 inch Diameter Epoxy Lined Ductile Iron Pipe – Spec Section 15251
  - Ductile Iron Pipe Linings and Coatings – Specification Section 15251.2.3
  - Ductile Iron fittings – Specification Section 15251
- B. Manufactures written installation instructions for all materials
- C. As Constructed Submittal (Shop Drawing) Documentation – Specification Section 01310.1.05.E.
4. Precast Concrete Manholes and Polymer Manholes
- A. Materials and Manufacturing Details
- 4 ft. Diameter including cones and grade rings – MAG STD Detail 420-1, 420-2, 423-1, 424-1 for WT (water tight)
  - 5 ft. Diameter including cones and grade rings – MAG STD Detail 420-1, 420-2, 423-2, 423-2 for WT (water tight)
  - Pre – Cast Manhole Bases MAG STD Detail 420-2
  - Interior Coating of Manhole – Spec Section 09930
  - Manhole Section sealant – MAG STD Detail 420-1
  - Manhole Lids and frames – MAG STD Detail 423-1
  - Drop Sewer Connection – MAG STD Detail 426 Type A
  - Drop Sewer Connection – MAG STD Detail 426 Type B
- B. Manufactures written installation instructions for all materials
- C. As Constructed Submittal (Shop Drawing) Documentation – Specification Section 01310.1.05.E.
5. Air Release assembly and Man Hole
- A. Materials and Manufacturing Details
- Combination Air/Vacuum Valve - Specification Section 15100.2.6.A, Plan Sht. 45 Detail “Sewer Air Release Valve”.
- B. Manufactures written installation instructions for all materials
- C. As Constructed Submittal (Shop Drawing) Documentation – Specification Section 01310.1.05.E.
6. A. Trench Backfill
- Tests reports on all
7. Asphalt Concrete
- A. Materials and Manufacturing Details
- Specification 02350.1.4
    - Support and Protection systems Design
    - Test Reports on samples of all backfill and fill materials
    - Laboratory compaction tests (Proctors)
- B. Not Used

- C. As Constructed Documentation – Section 2350.1.3.B.f and as Constructed Submittal (Shop Drawing) Documentation – Specification Section 01310.1.05.E.
8. Connect Force Main to Manhole
- A. Materials
    - Plan Sheet 45 and MAG STD DET 420-1 including “A Lok, C-Cel or equal and stainless steel pipe supports and anchors.
  - B. Manufacturer’s written instructions for pipe support anchors
  - C. As Constructed Documentation – (Shop Drawing) Documentation – Specification Section 01310.1.05.E.
9. Lift Station No. 1: All components and items proposed for use in construction as required, indicated, shown or called out in the Contract Documents. The Contractor is reminded that the price Bid includes all components required for a complete and operational system whether or not specifically indicated, shown or called out. All such items shall be submitted for review as well.

A schedule of values identifying the values of the major components shall be submitted for use in determining the value of the WORK for purposes of progress payments.

**PART 2 - PRODUCTS**

Not Used.

**PART 3 - EXECUTION**

Not Used.

## **SECTION 01330: CONSTRUCTION PHOTOGRAPHS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. CONTRACTOR shall retain a professional photographer or an acceptable person, as determined by the ENGINEER, to perform the services specified below. All photographs need to be provided in a digital format and viewable at the construction Site. Otherwise, they will not be allowed off-site.
- B. Obtain ENGINEER'S approval of the photographer selected prior to taking first photographs. Submit qualifications and experience record of photographer to ENGINEER.

#### **1.2 PHOTOGRAPHS**

- A. The maximum number of color digital photographs required will be 250.
- B. Take a minimum of 25 color digital photographs of the completed or substantially completed Work at Project Completion. These photographs shall be submitted with the Final Application for Payment. These photographs are not part of the photographs required under Paragraph 1.2.A., above.
- C. Color digital photographs shall be taken approximately once each month.
- D. ENGINEER will approve the views to be taken and select the time at which they will be taken. Views will vary depending on the Progress Schedule.
- E. A minimum of 30 color digital photographs will be taken each time the photographer is at the site. The Contractor will take additional photographs if the ENGINEER determines that there is a specific need to do so.

#### **1.3 PRINTS FORMAT**

- A. Provide high quality digital photographs on CDs. The file format shall be JPEG file interchange format (.jpg) and tag image file format (.tiff). The digital photographs shall be provided for all photographs taken for the Project.
- B. Provide interior and exterior photographs of each buried structure prior to burial.
- C. Provide a minimum of four internal views and four external views of each structure. One view shall be provided of each wall, detail, floor and top of structure.
- D. Place the following information on the back of each print and on front for digital photographs:
  - 1. Date photograph was taken.
  - 2. Title of Project.
  - 3. Description of view shown in photograph.
  - 4. North Arrow reference.

#### **1.4 PRE-CONSTRUCTION PHOTOGRAPHS**

A. General:

1. It is the CONTRACTOR'S responsibility to take a sufficient number Pre-construction photographs, so as to resolve any disputes which may arise regarding the considerations prior to and subsequent to construction.
2. If a dispute arises where no Pre-construction photographs were taken, the disputed area shall be restored to the extent directed by the ENGINEER and to the complete satisfaction of the ENGINEER.
3. Furnish one set of color prints of the Pre-construction photographs to the ENGINEER, and make others available for review in settling any disputes. In the event additional prints are required, CONTRACTOR will be reimbursed at the normal reproduction cost for each additional print.
4. Pre-construction photographs taken by CONTRACTOR will not be considered as part of the required number of construction photographs required in Article 1.2, above.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

## **SECTION 01400: CONTRACTOR QUALITY CONTROL**

### **1. SCOPE**

- A. Work Included:
  - 1. Scope
  - 2. Quality Control Plan
  - 3. Submittals
  - 4. Control
  - 5. Tests
  - 6. Completion Inspection
  - 7. Documentation
  - 8. Notification of Noncompliance

### **2. QUALITY CONTROL PLAN**

- A. General: The Contractor shall assign a Contractor Quality Control Agent (CQCA) within ten (10) calendar days after Notice to Proceed. The CQCA shall identify procedures, instructions, and forms to be used.
- B. The CQCA shall provide as a minimum, the following:
  - 1. A description of the quality control protocols, including a chart showing lines of authority and reporting to the Project Manager or someone higher in the Contractor's organization.
  - 2. The name, duties, responsibilities and authorities of each person reporting to the CQCA.
  - 3. Procedures for scheduling and managing submittals, including those of Subcontractors, offsite Fabricators, Suppliers and Purchasing Agents.
  - 4. Control testing protocols for specific testing (Testing laboratories must be approved by the Engineer).
  - 5. Reporting protocols including reporting formats.
- C. Acceptance of Protocols: Acceptance of the Protocols by the Engineer is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction.

- D. Notification of Changes: After acceptance of the Protocols, the Contractor's CQCA shall notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

### **3. SUBMITTALS**

Submittals shall be as specified in Section 01310. The CQCA shall be responsible for certifying that all submittals are in compliance with the Contract requirements.

### **4. CONTROL**

- A. Contractor Quality Control is the means by which the Contractor assures himself that his/her construction complies with the requirements of the Contract Drawings and Specifications. The controls shall be adequate to cover all construction operations, including both onsite and offsite operations and will be keyed to the proposed construction sequence. The controls shall include at least three (3) phases of inspection for all definitive features of work as follows:

Preparatory Inspection: This shall be performed prior to beginning any definable feature of work. It shall include a review of contract requirements; a check to assure that all materials and/or equipment have been tested, submitted and approved; a check to assure that provisions have been made to provide required control testing; examination of the work area to ascertain that all preliminary work has been completed and a physical examination of materials, equipment and sample work to assure that they conform to approved shop drawings or submittal data and that all materials and/or equipment are on hand.

Initial Inspection: This shall be performed as soon as a representative portion of the particular feature of work has been accomplished and shall include examination of the quality of workmanship and a review of tests for compliance with Contract requirements, non-usage of defective or damaged materials, omissions, and dimensional requirements.

Follow-up Inspection: These shall be performed daily to assure continuing compliance with Contract requirements, including control tests, until completion of the particular feature of work. Such inspection shall be made a matter of record in the CQCA documentation as required below. Final follow-up inspections shall be conducted and deficiencies corrected prior to the addition of new features of work.

### **5. TESTS**

Test Procedures: The Contractor shall perform tests specified or required to verify that control measures are adequate to provide results which conform to Contract requirements. A list of tests which the Contractor understands he/she is to perform shall be furnished as a part of this requirement to the Engineer. The list shall give the test name, Specification paragraph containing the test requirements and the personnel and Laboratory responsible for each type of test. The Contractor shall perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with Contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.



3. Verify that test instrument calibration has been checked against certified standards.
4. Verify that recording forms, including all of the test documentation requirements, have been prepared.

**6. COMPLETION INSPECTION**

At the completion of all work or any increment thereof, the CQCA shall conduct a completion inspection of the work and develop a “punch list” of items which do not conform to the approved Drawings and Specifications. Such a list shall include the estimated date by which the deficiencies will be corrected. The CQCA shall make a second completion inspection to ascertain that all deficiencies have been corrected and so notify the Engineer. The completion inspection and any deficiency corrections required by this paragraph will be accomplished within the time stated for completion of the Work.

**7. DOCUMENTATION**

- A. The Contractor shall maintain current records of quality control operations, activities and tests performed including the work of Suppliers and Subcontractors. These records shall be on an acceptable form and indicate a description of deficiencies noted along with the corrective actions taken on current and previous deficiencies. In addition, these records shall include factual evidence that required activities or tests have been performed, including but not limited to the following:
  1. Type and number of control activities or tests involved.
  2. Results of control activities or tests.
  3. Nature of defects, causes for rejection, etc.
  4. Proposed remedial action.
  5. Corrective actions taken.
- B. These records shall cover both conforming and defective or deficient features and shall include a statement that supplies and materials incorporated in the Work comply with the requirements of the Contract. Legible copies of these records shall be furnished to the Engineer on Tuesday following the previous week’s work.

**8. NOTIFICATION OF NONCOMPLIANCE**

The Engineer will notify the Contractor of any noncompliance with the foregoing requirements. The Contractor shall, after receipt of such notice, immediately take corrective action. Such notice, when delivered to the Contractor or his/her representative at the site of the work, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Owner may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to any such Stop Orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor.

**SAMPLE**

**QUALITY CONTROL DAILY REPORT**

REPORT NO. \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_ DATE \_\_\_\_\_

LOCATION OF WORK: \_\_\_\_\_

DESCRIPTION: \_\_\_\_\_

1. List Specific Inspection Performed and Results of these Inspections.

(Include Corrective Actions): \_\_\_\_\_

2. List Type and Location of Tests Performed and Results of these Test:

\_\_\_\_\_

3. Verbal Instructions Received from Owner or Engineer on Construction Deficiencies or Re-testing Required: \_\_\_\_\_

4. Remarks: \_\_\_\_\_

5. CERTIFICATION: I certify that the above Report is complete and correct and that I, or my authorized representative, have inspected the work performed by the Contractor and Subcontractor(s) and have determined that all materials, equipment and workmanship are in strict compliance with the Drawings and Specifications except as may be noted above.

\_\_\_\_\_  
Contractor's Quality Control Agent (CQCA)

- END OF SECTION -

## **SECTION 01420: WORK WITHIN PRIVATE PROPERTY**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. All work will essentially be conducted on private property. The contractor shall take all precautions to protect the surrounding properties impacted by the work associated with Contract 107.

#### **1.02 REFERENCES**

- A. Sponsored and Distributed by the Maricopa Association of Governments - Arizona, Latest Edition, with updates.
  - 1. MAG - Uniform Standard Specifications for Public Works Construction.
- B. La Paz County
  - 1. Standard Specifications.

#### **1.03 DEFINITIONS**

- A. Utility: For purpose of this Section, utility means any public or private service, such as electric light and power systems; gas distribution systems; telephone, telegraph, cable television and other communication services; water distribution; storm drain and sanitary sewer services; police and fire communication systems; street lighting and traffic signs and signals; parking meters; and steam distribution systems.
- B. For Trenching:
  - 1. Open Trench:
    - a. General: Includes excavation, pipe laying, backfilling, and pavement replacement.
  - 2. Any excavated areas shall be considered as "open trench" until all pavement replacement has been made, or until all trenches outside of pavement replacement areas have been backfilled and compacted in accordance with these Contract Documents.

#### **1.04 DESIGN REQUIREMENTS**

- A. General: Completely backfill trenches and install temporary or permanent pavement as soon as possible after pipe laying.
- B. Site Conditions:
  - 1. Use substantial steel plates with adequate trench bracing to bridge across trenches at street and alley crossings, commercial driveways, and residential driveways where trench backfill and temporary patch have not been completed during regular working hours.
  - 2. Provide safe and convenient passage for pedestrians.
  - 3. Maintain access to fire stations, fire hydrant, and hospitals at all times.
  - 4. Provide traffic control devices, barricades, and signage as required by the regulating agency.

**1.05 SUBMITTALS**

- A. Traffic Control Plan: Not required for this contract.

**1.06 PERMITS**

- A. A permit to decommission the septic tank and install the sewer connection will be obtained by the Owner from the County of La Paz.

**PART 2 PRODUCTS**

Not Used.

**PART 3 EXECUTION**

Not Used.

END OF SECTION

## **SECTION 01530: PROTECTION OF MATERIALS AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. CONTRACTOR shall make all arrangements for transportation, delivery, storage and handling of equipment and materials required for prosecution and completion of the Work.
- B. Shipments of materials to CONTRACTOR or subcontractors shall be delivered to the Site only during regular working hours. Shipments shall be addressed and consigned to the proper party giving name of Project, street number and city. Shipments shall not be delivered to OWNER, except where otherwise directed.
- C. If it is necessary to move stored materials and equipment during construction, CONTRACTOR shall move materials and equipment without any additional compensation.

#### **1.2 PREPARATION FOR SHIPMENT**

- A. When practical, factory assemble products. Matchmark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with a strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, OWNER'S contract name and number, CONTRACTOR, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.
- C. Protect products from exposure to the elements and keep thoroughly dry and dust free at all times. Protect painted surfaces against impact, abrasion, discoloration, or other damage. Grease or oil all bearings and similar items.
- D. Advance Notice to ENGINEER of Shipments: Upon receipt of manufacturer's advance notice of shipment, provide ENGINEER seven-day advance notice of anticipated date and place of arrival of the following:
  - 1. Electrical switchgear.
  - 2. Control panels.
- E. Do not have products shipped until:
  - 1. Related Shop Drawings have been approved by ENGINEER.
  - 2. Related factory test results, required in the individual Specification Sections, have been reviewed and accepted by ENGINEER.
  - 3. Required storage facilities have been provided.

#### **1.3 DELIVERY**

- A. Arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.

- B. Coordinate deliveries to avoid conflict with Work and conditions on Site and to accommodate the following:
  - 1. Work of other contractors, or OWNER.
  - 2. Limitations of storage space.
  - 3. Availability of equipment and personnel for handling products.
  - 4. OWNER'S use of premises.
- C. Do not have products delivered to Project Site until related Shop Drawings have been approved by the ENGINEER.
- D. Do not have products delivered to Project Site until required storage facilities have been provided.
- E. Have products delivered to Site in manufacturer's original, unopened, labeled containers. Keep ENGINEER informed of delivery of all equipment to be incorporated in the Work.
- F. Partial deliveries of component parts of equipment shall be clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- G. Immediately on delivery, inspect shipment to assure:
  - 1. Product complies with requirements of Contract Documents and reviewed submittal.
  - 2. Quantities are correct.
  - 3. Containers and packages are intact, and labels are legible.
  - 4. Products are properly protected and undamaged.
  - 5. Verify that the accelerometer recordings were made during shipment.
- H. Promptly remove damaged products from the Project Site and expedite delivery of new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

#### **1.4 PRODUCT HANDLING**

- A. Provide equipment and personnel necessary to handle products, including those provided by OWNER, by methods to prevent soiling or damage to products or packaging.
- B. Provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. Handle products by methods to prevent bending or over stressing.
- D. Lift heavy components only at designated lifting points.
- E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

## **1.5 STORAGE**

**A. Contractor shall provide for storage of materials and equipment in accordance with Article 5.01 of the General Conditions.**

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

## **SECTION 01610: REGULATORY REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes: Description of applicable codes, ordinances, and regulations.

#### **1.02 CODES AND ORDINANCES**

- A. Applicable Codes: Compliance with all laws, ordinances, and regulations of authorities having jurisdiction is an integral requirement of the Contract Documents, whether each code is mentioned or not in the Contract documents.
- B. Compliance: Comply with all applicable codes, ordinances and regulations in effect at the time of bid opening, including but not necessarily limited to the following:
  - 1. 2006 International Building Code.
  - 2. 2005 National Electrical Code.
  - 3. 2006 International Plumbing Code.
  - 4. National Fire Protection Association 820.
  - 5. Utility Company requirements.
  - 6. State and Federal Safety and Health Laws.
  - 7. National Electrical Safety Code (NESC).
  - 8. Amendments to Codes, if any.
  - 9. Clean Water Act compliance for storm water and potable water discharges.
  - 10. NSF International Standards 60 and 61.
- C. Detailed Requirements: Be familiar with and verify detailed requirements of applicable codes to verify that items and their installation provided under Work of this Contract meet or exceed legal requirements.
  - 1. Discrepancies: If discrepancies occur between the Contract Documents, local codes, local utility requirements, etc., most stringent requirements shall apply.

#### **2. PRODUCTS (NOT USED)**

#### **3. EXECUTION (NOT USED)**



## **SECTION 01700: PROJECT CLOSEOUT**

### **1. SCOPE**

Work Included:

1. Scope
2. Cleaning-Up
3. Responsibility of Contractor for Backfill Settlement
4. Accessory Items
5. Guarantee, Bond and Affidavits
6. Operation and Maintenance Data
7. Final Inspection
8. Final Payment

### **2. CLEANING-UP**

At the completion of work and immediately prior to final inspection, clean-up of the entire Project will be accomplished according to the following provisions.

1. The Contractor shall perform thorough cleaning, sweeping, washing and polishing of all work and equipment provided under the Contract, including finishes. The clean-up work of the Contractor shall leave the structure and site in a complete and finished condition to the satisfaction of the Owner.
2. All Subcontractors shall similarly perform at the time of the Contractor's clean-up, an equivalent thorough cleaning of all work and equipment provided under their subcontracts.
3. Should the Contractor or Subcontractor not remove rubbish, etc., or clean the building and site as specified above prior to Application for Final Payment, the Owner reserves the right to have the work done at the Contractor's expense. Should any Subcontractor fail to perform the cleaning of work and equipment provided under their Contract, the Contractor shall perform such cleaning work at Contractor's expense.

### **3. RESPONSIBILITY OF CONTRACTOR FOR BACKFILL SETTLEMENT**

- A. The Contractor shall be responsible financially, and otherwise, for: (a) all settlement of trench and other backfill which may occur until the expiration of one (1) year after the date of final acceptance for the entire Contract under which the backfilling work was performed, (b) the refilling and repair of all backfill settlement and the repair or replacement to the original or a better condition of all pavement, top surfacing, driveways, walks, surface structures, utilities and drainage facilities which have been removed or destroyed in connection with backfill replacement operations and (c) all damage claims or court actions against the Owner for any damage directly or indirectly caused by backfill settlement.
- B. The Contractor shall make, or cause to be made, all necessary backfill replacements, and repairs or replacements appurtenant thereto, within thirty (30) days after notification by the Owner.

#### **4. ACCESSORY ITEMS**

The Contractor and all Subcontractors furnishing and/or installing equipment on this Project shall provide to the Owner, upon acceptance of the equipment, all special accessories required to place each item of equipment in full operation. These special accessory items include adequate oil and grease as required for the first lubrication of the equipment and/or light bulbs, fuses, filters and other expendable items as required for initial start-up and operation of all equipment.

#### **5. GUARANTEES, BONDS AND AFFIDAVITS**

The Contract shall not be finalized until all Guarantees, Bonds, and Affidavits required by the Contract Documents or as hereinafter specified, are satisfactorily filed with the Owner. The Contractor shall obtain suitable releases from the owner's of all lands which the Contractor has used for storage, yards and any other purpose in conjunction with this project.

#### **6. OPERATION AND MAINTENANCE DATA**

The Contract shall not be finalized until all operation and maintenance data as specified in Section 01730 are on file with the Owner.

#### **7. FINAL INSPECTION**

- A. Upon written notice from the Contractor, that the Contract is complete, the Owner and Engineer will make a semi-final inspection with the Contractor. Upon completion of this semi-final inspection, the Engineer will notify the Contractor in writing, of any particulars that this inspection reveals that the Work is defective or incomplete.
- B. Upon receiving the written notice from the Engineer, the Contractor shall immediately undertake the work required to remedy such defects and complete the Project to the satisfaction of the Engineer.
- C. When the Contractor has corrected or completed the items as listed in the Engineer's written notice, he shall inform the Engineer in writing, that the required work has been completed. Upon the receipt of this further notice, the Engineer and Contractor, shall make a final inspection of the Project. The final inspection of the Project will be made by the Owner, Engineer and all regulatory agencies involved in the Project. Following this inspection, the Engineer shall prepare a final "punch list" for the Project. Upon completion of the punch list items by the Contractor and acceptance of the Project by regulatory agencies and the Owner, a final payment will be made to the Contractor.
- D. Should the Engineer find all work satisfactory at the time of this inspection, the Contractor will be allowed to make application for final payment in accordance with the provisions of the General Conditions. Should the Engineer still be dissatisfied with the Work, the Engineer will again inform the Contractor of the deficiencies and will deny the Contractor's request for final payment until such time as the Contractor has satisfactorily completed the required work.

#### **8. FINAL PAYMENT**

The final application for Payment shall be made in accordance with the provisions set forth in the General Conditions.

## SECTION 01740: RECORD DOCUMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. CONTRACTOR shall maintain and provide the ENGINEER with Record Documents as specified below, except where otherwise specified or modified in Division 2, Site Construction, through Division 16, Electrical.
- B. Maintenance of Documents:
  - 1. Maintain in CONTRACTOR'S field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, Photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR'S Work.
  - 2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by ENGINEER.
  - 3. Make documents available at all times for inspection by ENGINEER and OWNER.
  - 4. Record Documents shall not be used for any other purpose and shall not be removed from CONTRACTOR'S office without ENGINEER'S approval.
- C. Marking System: Changes, revisions, additions and deletions, to the record set of Documents shall be marked in Red.
- D. Recording:
  - 1. Label the Cover Sheet, Index and each supplemental sheets of each document "PROJECT RECORD" in 2-inch high printed letters.
  - 2. Keep Record Documents current. CONTRACTOR'S refusal, failure or neglect to maintain current Record Documents shall constitute sufficient basis for the ENGINEER to recommend the withholding of some or all of any payment due.
  - 3. Do not permanently conceal any Work until required information has been recorded.
  - 4. Drawings: Legibly mark to record actual construction including:
    - a. Depths of various elements of foundation in relation to datum.
    - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
    - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
    - d. Field changes of dimensions and details.
    - e. Changes made by Change Order or Field Order.
    - f. Details not on original Drawings.
  - 5. Specifications and Addenda: Legibly mark up each Section to record:

- a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
  - b. Changes made by Change Order or Field Order.
  - c. Other matters not originally specified.
- E. Record Drawings:
1. Record Drawings shall be prepared for all the Work included in the Contract. On a weekly basis, CONTRACTOR shall furnish to the ENGINEER a full size annotated copy of the Record Drawings that include changes from the previous week's Record Drawing submittal. Annotations shall include redlined "clouds" of only those changes from the previous week's submittal. The redlined Drawings shall show the actual in-place installation of the items installed under this Contract. The redlined Drawings shall show the Work in plan and sections as required for clarity with reference dimensions and elevations for complete Record Drawings.
  2. CONTRACTOR shall develop and furnish to the ENGINEER, redlined Electrical Drawings showing one line diagrams with all conduit and wire sizes shown of the distribution systems and the actual in-place grounding system, lighting arrangement, motor control centers, corrected wiring diagrams, equipment and conduit and cable plans.
    - a. The Drawings may be used as a starting point in developing these Electrical redlined drawings. Subcontractor and manufacturer drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary cross references between drawings. The drawing package shall include interconnection and termination details to equipment furnished under this Contract.
    - b. All drawings must be maintained and filed on-site for monthly review by the ENGINEER. This shall include the following composite drawings for the system being furnished:
  3. Schematic (Elementary) Diagrams: This shall include, but not be limited to, complete schematics including items furnished by others for the following:
  4. Motor Control Circuits for Starters furnished under this Contract.
  5. HVAC Control Panels furnished under this Contract.
  6. Wiring (Connection) Diagrams: These shall be included for all pre-wired equipment furnished under this Contract.
  7. Interconnection Diagrams: these shall include all interconnections to be furnished under this Contract.
  8. Conduit and Cable Schedules: These shall include all conduit and cable furnished under this Contract.
    - a. Dimension of Outline Drawings: These shall include all equipment furnished under this Contract.
    - b. Power and Lighting Layout Drawings: These shall include all conduits and wiring furnished under this Contract.
  9. In addition to the redlined Record Drawings, CONTRACTOR shall prepare and submit CADD files, AutoCADD 2000i, for all supplemental drawings used to complete the Record Drawings.

10. ENGINEER shall post revisions electronically based on the information provided by CONTRACTOR.

F. Submittals:

1. Acceptance of CONTRACTOR'S monthly application for payment shall be dependent on the ENGINEER'S acceptance and agreement that CONTRACTOR'S Record Documents and weekly submittals are complete, thorough and acceptable in showing all Work up through and including such work as CONTRACTOR is claiming for completion and payment on CONTRACTOR'S application for payment. Any items which do not appear on the Record Documents in complete and acceptable form shall not be paid for in CONTRACTOR'S monthly payment.
2. Examination by the ENGINEER of CONTRACTOR'S Record Documents will be made on a weekly basis to determine completion for consideration of monthly pay application. CONTRACTOR shall, however, make available all Record Documents at all times to the ENGINEER for examination.
3. Prior to Completion of the Work, deliver final Record Documents to ENGINEER. Substantial completion will not be made until satisfactory final Record Documents are received by ENGINEER.
4. Accompany final and weekly submittals with transmittal letter containing:
  - a. Date.
  - b. Project title and number.
  - c. CONTRACTOR'S name and address.
  - d. Title and number of each Record Document.
  - e. Certification that each document as submitted is complete and accurate.
  - f. Signature of CONTRACTOR, or their authorized representative.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION (NOT USED)**

**DIVISION 2**

**SITE WORK**

## **SECTION 02050: ENVIRONMENTAL PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 SCOPE**

This section details the work necessary to provide and maintain environmental protection. Referenced standards and recommended practices referred to herein shall be the latest edition of any such document. No separate payment for Environmental Protection will be made.

#### **1.2 GENERAL REQUIREMENTS**

Provide and maintain environmental protection during the life of the work as defined herein and in accordance with all applicable permits. Provide protection measures to correct conditions that develop during the construction of permanent environmental protection features or to control pollution that develops during normal construction practices but are not associated with permanent control features incorporated in the project. Comply with all federal, state, and local regulations pertaining to water, air, solid waste, hazardous waste, asbestos, lead-based paint, oily substances, and noise pollution.

#### **1.3 SUBMITTALS**

- A. Prior to the commencement of the work, contact the applicable environmental agencies as required, and meet with the Engineer to discuss the proposed environmental protection plan. Develop details of the environmental protection plan, including reports and corrective measures to be taken should the Contractor fail to provide adequate protection in an adequate and timely manner.
- B. Within 14 days of the meeting, submit for approval a written environmental protection plan that addresses the items referenced in paragraphs 3.1 thru 3.6 of this section.

#### **1.4 DEFINITIONS OF CONTAMINANTS**

- A. Asbestos and Asbestos Material: Asbestos means actinolite, amphibole, amosite, anthophyllite, chrysotile, crocidolite, and tremolite. Asbestos material means asbestos or any material containing asbestos (such as asbestos waste, scrap, debris bags, containers, equipment, and asbestos-contaminated clothing consigned for disposal).
- B. Debris: Includes both combustible and noncombustible wastes, such as ashes, waste materials that result from construction or maintenance and repair work, leaves, and tree trimmings.
- C. Hazardous Material: As defined in United States (U.S.) (DOT) 49 Code of Federal Regulations (CFR) 171 and listed in U.S. DOT 49 CFR 172.
- D. Hazardous Substance: As defined in Public Law 96-510 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).
- E. Hazardous Waste: As defined in EPA 40 CFR 261 and/or appropriate state regulations.
- F. Oily Substance: Includes petroleum products and bituminous materials.

- G. Rubbish: A variety of combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
- H. Sanitary Wastes:
  - a. Sewage - That which is considered domestic sanitary sewage.
  - b. Garbage - Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.
- I. Sediment: Soil and other debris that has been eroded and transported by runoff water.
- J. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 PROTECTION OF NATURAL RESOURCES**

- A. Preserve all natural resources, within the project boundaries and outside the limits of permanent work performed, in their existing condition or restore same to equivalent or improved condition upon completion of the work. Confine construction activities to areas defined by the work schedule, drawings, and specifications.
- B. Except in areas indicated to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs. Do not fasten or attach any ropes, cables, or guys to existing trees unless specifically authorized by the Engineer. Where such special emergency use is permitted, repair any damage resulting from such use.
- C. Provide procedures in the environmental protection plan for protecting existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove and dispose of rocks displaced by clearing.
- D. Restore or replace all trees or other landscape features scarred or damaged by the Contractor's equipment or operations to their original condition at the Contractor's expense. Obtain Engineer's approval prior to initiation of repair and/or restoration and upon completion.
- E. Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess or waste materials, and all other vestiges of construction. Grade temporary roads, parking areas, and similar temporary use areas in conformance with surrounding areas. Provide topsoil and seed with nutrients as necessary to establish a stand of grass.
- F. Execute this contract in such a manner as to minimize adverse environmental impacts to a level acceptable to the applicable environmental agencies and the Owner.
- G. Prevent oily and/or other hazardous substances from entering the ground, drainage areas, or bodies of water. EPA 40 CFR 112 details the requirements for the prevention of oil spills.



- H. Perform all work and take such steps required to prevent any interference or disturbance to fish and wildlife. Do not alter water flows or otherwise significantly disturb native habitat adjacent to the project area.
- I. Preserve and report immediately to the Owner all items having any apparent historical or archaeological interest discovered during the course of construction activities.

### **3.2 EROSION AND SEDIMENT CONTROL MEASURES**

- A. Do not burn-off ground cover without prior written approval from the Owner and without obtaining all required permits.
- B. Immediately provide specified finish for all earthwork brought to final grade. Immediately protect side and back slopes upon completion of rough grading. Minimize the duration of exposure to unprotected soils.
- C. Utilize diversion ditches, benches, and berms to retard and divert runoff to protect erodible soils.
- D. Utilize temporary vegetation, mulching, netting, and/or hydroseeding to provide effective erosion control.
- E. CONTRACTOR shall take whatever means necessary to protect stream embankments during construction and prevent any soils or construction material or debris from entering the Colorado River.

### **3.3 CONTROL AND DISPOSAL OF SOLID, HAZARDOUS, AND SANITARY WASTES**

- A. Pick up and place all waste in containers provided by the Contractor and empty same on a regular schedule.
- B. Dispose of waste in compliance with federal, state, and local requirements. Display a copy of state and/or local permit or license which reflects approval and compliance with solid waste disposal regulations. Dispose of all waste off site at a permitted disposal facility. Provide the Owner with the permit or license and the location of the disposal area.
- C. Provide a connection to municipal, district, or station sanitary sewerage systems. Where such systems are not available, provide chemical toilets or other comparably effective units. Provide provisions for pest control and elimination of odors.
- D. Handle, store, manifest, and dispose of hazardous waste in accordance with federal, state, and local regulations.

### **3.4 DUST CONTROL**

Minimize generating dust at all times, including nonworking hours, weekends, and holidays. Utilize water on site, haul roads, and other areas, to control dust.

### **3.5 NOISE**

Maximize use of "low-noise-emission products" as certified by the EPA, when available. Do not use explosives or other blasting techniques.

### **3.6 LEAD ABATEMENT**

Certain components of the treatment plant facilities may contain lead-based paint. Properly dispose of all plant components planned for removal in accordance with all state and federal laws. Do not cut, torch, weld, sandblast, or otherwise perform operations that may release lead to the environment.

## **SECTION 02070: MODIFICATIONS TO EXISTING PUMPING STATION -DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 THE REQUIREMENTS**

- A. The Contractor shall furnish all labor, equipment, and materials required for the partial or complete demolition, removal, and disposal of all concrete, piping, equipment, metals, masonry, lumber, pavement, structures, tankage and other associated debris and rubbish in connection with the dismantling of the existing pumping station and septic tank facilities at **Lift Station No.1** in the area known as Rio Lindo, as specified herein or as may be shown on the Contract Drawings.
- B. No separate payment for demolition will be made. Payment for work shall be included in the Lump Sum Price for Lift Station No. 1.
- C. The existing septic tanks, holding tank and pumping station are in operation. The contractor shall be responsible, at no additional cost, to clean out the existing tanks and pump station and to dispose of all contents in strict accordance to ADEQ requirements prior to decommissioning any of the existing facilities.

#### **1.2 GENERAL**

- A. All demolition or removal work shall comply with the provisions of the latest Federal and State codes, and with all other applicable laws, ordinances, rules and regulations of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.
- B. The demolition work shall be performed by competent workmen experienced in this kind of work and shall be performed with due regard to the safety of the public, the structure(s), and the workmen.
- C. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the site. Remove rubbish and debris; do not allow accumulations. Store materials that cannot be removed daily only in areas approved by the Owner.

#### **1.3 DUST, VIBRATION, AND NOISE CONTROL**

- A. All work shall be executed in a careful and orderly manner with the least possible noise, dust, or disturbance to the adjacent and area residencies.
- B. The existing pumping station is an operational lift station. The operation of this existing lift station must not be interrupted during construction unless and until an approved bypass piping plan is in place and fully operational. Unobstructed and continuous access to the existing or approved bypass lift station must be provided to Buckskin Sanitary District personnel 24 hours per day and 7 days per week.
- C. Take appropriate action to check the spread of fugitive dust and to avoid the creation of a nuisance in the surrounding areas.

- D. The use of other than hand tools for demolition is prohibited to avoid unnecessary noise and vibration. All motor operated equipment shall be equipped with not less than manufacturer's fully functional muffling devices. If required due to excessive noise, the contractor shall furnish, at no additional cost, noise abatement devices or methods to provide a satisfactory noise level at the property lines of adjacent properties.

#### 1.4 UTILITY DISCONNECTIONS

- A. Prior to commencing demolition, the Contractor shall be responsible for disconnection and termination of all water, sewer, gas, electric, telephone, or other utilities as may be connected to the structure or facility (or portion thereof) sited for demolition EXCEPT for those utilities and services required to keep the existing Lift Station operational. Such disconnection or termination shall be done in conformance with the requirements of the municipality or utility company owning or controlling them and applicable Code requirements.
- B. Where only a portion of the structure or facility is to be demolished, demolition work shall be done so as not to interrupt the services of the remaining portion. Where it is necessary to reconnect utilities to the undemolished portion, such reconnection shall be made permanent in accordance with applicable Codes, local requirements, and to the satisfaction of the servicing utility.
- C. Prior to undertaking demolition, the Contractor shall notify the utility or municipality of such disconnections, terminations, or reconnections. The Contractor shall comply with all standard work practices and requirements for work performed under their supervision. Should special allowances be required for scheduling, the Contractor shall coordinate his activities so as not to conflict with normal operating utility service.

#### 1.5 PROTECTION AND SAFETY

- A. During demolition and alteration operations, and until final acceptance of the work under this Contract, the Contractor shall protect and be responsible for all work performed in the existing building facilities, adjacent residences and areas, structures, equipment and improvements within the areas of operation under this Contract. **Due to the limited work area of Lift Station No. 1, sheeting and shoring may be required. See Section 02151 – Sheeting and Shoring.**
- B. Protect existing structures, utilities, equipment, and work that is to remain in place, that is to be reused, or that is to remain the property of the Owner with temporary covers, shoring, bracing, and supports as required. Repair items damaged during performance of the work or replace with new. Do not overload structural elements. Provide new supports or reinforcement for existing construction weakened by demolition or removal work.
- C. The Contractor shall take all necessary precautions in placing equipment over existing tanks. The design of support and protections systems shall be the responsibility of the CONTRACTOR, performed by a Registered Professional Engineer licensed in the State of Arizona, and shall conform to OSHA requirements. The Owner assumes no responsibility nor does it make any claim as to the structural integrity of the existing tanks.
- D. Protect all materials and equipment from the weather at all times. Have materials and workmen ready to provide adequate and approved temporary covering of exposed areas. Temporary coverings shall be attended, as necessary, to insure effectiveness and to prevent displacement.

- E. Provide all necessary temporary closures, guard rails, barricades, warning signs and lights to adequately protect all workmen, other persons and the public from injury.
- F. Protect interior areas adjacent to the areas of work and along the route of travel for disposition of debris.
- G. Protect all services and utilities. Where removal of existing utilities is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services for connections for electrical and mechanical utilities.
- H. All security, fire and alarm protection systems shall be continuously maintained in good condition and shall be removed when directed by the Engineer.
- I. All protection shall comply with the requirements of all authorities and agencies having jurisdiction.
- J. Suitable barriers shall be erected and maintained around all operations and all ground openings or excavations, as long as such operations, openings, or excavations constitute a hazard or dangerous condition.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Carefully examine the drawings for the amount of demolition work to be done under the Contract. Take great care in demolition to protect adjoining work during performance of the demolition work.
- B. Provide additional miscellaneous removals as necessary to properly complete all demolition removal and alteration work. Materials that are to remain the property of the Owner are indicated on the Drawings.
- C. Provide all necessary temporary bracing as required for safe demolition.
- D. Contractor shall be responsible for all private party claims resulting from damages caused by the contractor's activities. In the event of any such claim, the OWNER shall be furnished a copy of the claim and a written statement by the contractor as to the corrective action to be taken. The contractor shall furnish written proof that the claim has been resolved and a release of liability specifically to OWNER.

### **3.2 DISPOSITION OF MATERIALS**

- A. Title to all materials and equipment to be removed, except as specified otherwise, is vested in the Contractor upon receipt of Notice to Proceed. The Owner will not be responsible for the condition, loss of, or damage to such property after Notice to Proceed. This does not apply to equipment or materials that are required to remain fully operational until replaced; the existing Lift Station 1, all existing sewer lines and all existing force mains for example. The Owner will retain title to, operation of and maintenance of these facilities until such time that they are replaced or refurbished under this contract.

- B. Salvaged materials and equipment that are indicated or specified to remain the property of the Owner shall be carefully removed by the Contractor. Deliver and store them on site where directed by the Owner. Remove items in a manner that will prevent damage.

### **3.3 BACKFILLING AND GRADING**

- A. Backfill, backfill materials, compaction, and grading as required for site restoration resulting from demolition work shall be done in accordance with appropriate sections of Division 2 – Site Work.

### **3.4 CLEANUP**

- A. Remove materials, debris, tools, equipment, temporary protection, etc. from site upon completion of work.
- B. Remove and transport equipment, debris and rubbish in a manner that will prevent spillage on streets or adjacent areas. Clean up spillage from streets and adjacent areas.
- C. Clean all items of work. Examine all work and repair all damages. In the event damage is irreparable, remove and replace such items without additional cost to the Owner. Do all required "touch-up" to marred or abraded surfaces. Leave all work that is to remain in perfect condition.
- D. The Contractor shall comply with Federal, State and local hauling and disposal regulations.

## **SECTION 02110: SITE CLEARING**

### **PART 1 - GENERAL**

- A. This specification defines the requirements for site clearing, grubbing, stripping, and protection of trees, shrubs, vegetation, top soil, and manmade improvements. Provide all equipment, labor, and materials as necessary to prepare the site for the project construction. The Contract Drawings illustrate the location, orientation, and elevations of proposed equipment, the existing and proposed grading, and defines the limits of construction.
- B. No separate payment for Site Clearing will be made.

#### **1.1 QUALITY ASSURANCE**

- A. Prior to commencing any site work, verify the accuracy of all survey data and the existing conditions as indicated on the drawings and in these specifications.
- B. Immediately notify Engineer of any inaccuracies, errors, or omissions in the survey data or contract drawings.
- C. Provide backfill elevations for restoration of cleared and grubbed areas to  $\pm 0.1$  foot of the required grade.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 PROTECTION**

- A. EXISTING IMPROVEMENTS. Provide damage protection for the Owner's property, all adjoining properties, all structures, buildings, and utilities (located underground, at /or above grade) that are outside the limits of construction. Restore/repair any and all damage resulting from the work, regardless of its location, to its original condition to the full satisfaction of the property owner.
- B. EXISTING TREES AND VEGETATION. Protect existing trees and vegetation as indicated by the Owner and/or the Contract Documents to remain.
  - a. Protected from unnecessary cutting, breaking, or skinning of roots; bruising or skinning of bark; smothering by piles of excavated or stockpiled dirt, supplies, material, or debris located within the drip line of trees or otherwise adjacent or upon vegetation; excess vehicular or foot traffic; or parking of vehicles upon vegetation or within the drip lines of trees.
  - b. Replace in kind, damaged or inadvertently removed items (those not strictly required by the work) or better, to the full satisfaction of the Owner.

#### **3.2 CLEARING AND GRUBBING**

- A. Remove and dispose all surface and subsurface vegetation and all trash and debris necessary to permit construction of the work.
- B. Clear site of trees, shrubs, brush, logs, and rubbish except those items indicated to be left standing.

- C. Completely remove stumps, roots, and other debris protruding through the ground surface to a minimum depth of 18 inches below subgrade elevation. Use only hand methods when grubbing inside the drip line of remaining trees.
- D. Fill depressions with Satisfactory Soil and place horizontal layers not more than 6 inches in loose depth, and compact to the adjacent soil's density.

### **3.3 STRIPPING**

- A. As required, strip top soil and subsoil to a minimum depth of 6 inches. Additional soil may be stripped at the direction of the Engineer if provided for in the contract, or required as elsewhere in these specifications.

### **3.4 WASTE MATERIALS**

- A. Dispose of all unsatisfactory soils, waste material, and refuse resulting from clearing and grubbing operations at an off site landfill or other appropriate site as approved by the Engineer. Provide proper documentation of disposal upon request.

### **3.5 SILTATION AND EROSION**

- A. Provide suitable erosion and siltation prevention devices and methods to minimize wind and/or water causing siltation and erosion resulting from project construction activities.
- B. Comply with all rules and regulations of those agencies with jurisdiction which address siltation and/or erosion (including but not limited to) County, Arizona Department of Environmental Quality (ADEQ), and the United States Environmental Protection Agency - Region IX (EPA).

### **3.6 CLEANUP AND RESTORATION**

- A. Immediately clean and regrade completed backfill areas. Refill, compact, and smooth, to indicated elevation, any settled trench surface. Correct, as directed by the Engineer, any settlement occurring after paving or other surfacing operation. Restore all disturbed areas to existing conditions or better.



## **SECTION 02151: SHEETING AND SHORING**

### **PART 1 - GENERAL**

#### **1.1 THE REQUIREMENTS**

- A. The Contractor shall furnish all labor, equipment, and materials required to carry out all sheeting and shoring required by this Project for whatever purpose.
- B. All excavation, trenching and related sheeting and bracing, shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P), State requirements, and Section 601 of MAG. Where conflict between OSHA, State and MAG requirements exists, the more stringent requirements shall apply.
- C. No separate payment for Sheeting and Shoring will be made.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 SHEETING AND SHORING**

- A. Where necessary for protection of workmen or to avoid undermining or otherwise damaging structures or property, trenches shall be properly and substantially sheeted with bracing or shoring designed and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining its shape and position under all circumstances. Where bracing, sheeting or shoring is necessary, the trench shall be of additional width to accommodate these items. There will be no separate bid item for sheeting and shoring. The cost of work, materials, and excavation for all necessary timber, wood or steel sheeting, and bracing shall be included in the Base Bid.
- B. Where trench sheeting is left in place, such sheeting shall not be braced against pipe or appurtenances, but shall be supported in a manner which will preclude the application of concentrated loads or horizontal thrusts on pipe or appurtenances. Cross braces installed above the pipe for the purpose of supporting sheeting in the bottom of the trench may be removed after the pipe embedment has been completed. Sheeting and bracing ordered left in place will be removed for a distance of three (3) feet below the established grade or the existing surface, whichever is lower, or as may be indicated on the Contract Drawings.
- C. Steel trench boxes may be used in lieu of sheeting and shoring at the Contractor's option, unless prohibited by the Engineer. The use of steel trench boxes, their type and fabrication, will be subject to applicable State and Federal Codes and Standards. In using trench boxes, the trench sides will be maintained in placing and removing the box to avoid excessive trench widths. All embedment and backfill to twenty-four (24") inches above the pipe shall be properly tamped and compacted in place and maintained in position when boxes are moved, or removed, to avoid disturbing alignment or grade of the pipe. All embedment, backfill, and compaction work and materials in connection with use of trench boxes shall be included under the bid item for the gravity sewer or force main and appurtenances, and no separate payment will be made.

- D. Where sheeting and bracing is required to support the sides of excavations for special types of construction, the Contractor shall, at his expense, engage a Professional Engineer, currently registered in the State of Arizona, to design the sheeting and bracing. Such design, properly signed and sealed, shall be maintained and filed in accordance with the General Conditions. The sheeting and bracing installed shall be in conformity with such design, and certification of this requirement shall be provided by the Professional Engineer.

## **SECTION 02222: TRENCH PROTECTION**

### **PART 1 - GENERAL**

#### **1.1 THE REQUIREMENTS**

- A. The Contractor shall furnish all labor, materials, and equipment required for the protection of open trenches.
- B. Protection is to include Jersey Barriers, barricades, barrels, cones or other approved devices most appropriate for the particular site(s), traffic conditions, and potential danger.
- C. No separate payment for trench protection will be made.

#### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

- A. Other work related to the work of this Section is specified elsewhere in these Specifications.
  - a. Such work includes excavation, pipe layout and placement, backfilling, paving, guide rail installation and pavement marking. Other work may also be related to this Section.

#### **1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS**

- A. Without limiting or overriding the specific requirements of this Section, the Work is to conform to applicable sections of the following Specifications, Codes and Standards:
  - a. Applicable Standards of the American Association of State Highway and Transportation Officials, AASHTO.
  - b. Applicable Standards of the Occupational Safety and Health Act, OSHA
  - c. Applicable Standards of the Manual of Uniform Traffic Control Devices, Part VI

#### **1.4 SUBMITTALS**

- A. The Contractor shall submit a Plan which indicates the intended layout and types of trench protective devices to be employed, on all pavements where vehicular or pedestrian traffic can occur within ten (10') feet of any trench edge, for the Engineer's review and comments.
- B. This submittal will be reviewed for the Contractor's benefit but will not receive an approval since the placement, maintenance and responsibility for trench safety lies with the Contractor.

### **PART 2 - PRODUCTS**

#### **2.1 PRODUCTS**

- A. The Contractor shall furnish, install, maintain, and remove or relocate as required for the ongoing protection of trenches, all such devices as would be considered customary and usual for their intended purpose.
- B. Products for trench safety may be owned and/or rented by the Contractor.

- C. All products, owned or rented, shall be in first class condition throughout the period of their use. Any products not meeting such criteria shall be immediately replaced by the Contractor at the Engineer's request.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Jersey Barriers, where used, shall be mechanically joined together using quick-connection devices which cause the concrete barriers to act as a single unit but can be quickly assembled and disassembled. All barriers shall be equipped with reflective devices at intervals not exceeding six (6') feet.
- B. All other devices including portable metal barricades (horses), barrels, cones and the like shall be weighted against overturning due to wind or the forces from fast-moving vehicles. Such devices shall be marked with reflective tape and/or fitted, as appropriate, with battery- operated amber flashing lights.

## **SECTION 02240: DEWATERING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Installation and maintenance of dewatering systems. Disposal of water entering excavation or other parts of the work.
- B. The Contractor may refer to the Geotechnical Data on file in the District offices, or on the District's website. The results of the geotechnical investigation are contained in the document prepared by Western Technologies Inc.
- C. No separate payment for Dewatering will be made. The Contractor shall include all work associated with the cost of conducting dewatering activities in his bid.
- D. Static groundwater levels at the time of construction may vary due to the Colorado River and may be different from those levels recorded at the time the Geotechnical Evaluation was conducted. The Contractor shall assume all responsibility and take all precautions when submitting his bid in recognition of this potential situation.

#### **1.2 SUBMITTALS**

- A. Dewatering Plan: Proposed dewatering plan including arrangement, location, and depths of system components, type, and sizes of filters, and required permits. The Dewatering Plan must be prepared in accordance with County and State requirements.

#### **1.3 QUALITY ASSURANCE**

- A. Regulatory Requirements:
  - a. The Contractor is responsible for meeting all Federal, State, and local laws, rules and regulations regarding the treatment and disposal of water from dewatering operations at the construction site.
  - b. Assume responsibility for obtaining water discharge permits, if required.

#### **1.4 PROJECT CONDITIONS**

- A. Environmental Requirements:
  - a. Keep excavations reasonably free from water. The static water level shall be drawn down a minimum of 2 feet below the bottom of excavations.
  - b. Dewatering shall be performed by methods that will ensure a dry excavation and preservation of the final lines and grades of the bottoms of excavations. Dewatering methods may include well points, sump points, suitable rock or gravel placed as pipe bedding for drainage and pumping, temporary pipelines, or other means, all subject to the approval of the Engineer. The cost of all dewatering activities shall be borne by the Contractor.

- c. Do not place concrete or masonry footings, foundations, or floors in water, nor allow water to rise over them until concrete or mortar has set at least 24 hours.
- d. Maintain operation of the dewatering system until the complete structure including walls, slabs, beams, struts, and all other structural elements has attained specified strength, and backfill has been completed to 3 feet above the normal static groundwater level.
- e. Provide standby power to ensure continuous dewatering in case of power failure.
- f. Prior to release of groundwater to its static level, all pressure relief devices shall be fully operational.
- g. Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted fill and to prevent flotation or movement of structures or pipelines.
- h. Sewer systems shall not be used as drains for dewatering trenches or excavations, nor for disposal of collected or accumulated groundwater, without the approval of the agency of jurisdiction.

## **1.5 SEQUENCING AND SCHEDULING**

- A. Within Limits of Structure Foundation: Secure written permission from the ENGINEER before locating wells, well points, or drain lines for purposes of dewatering.
- B. The Contractor shall provide and maintain at all times during construction ample means and devices to promptly remove and dispose of all water from any source entering excavations or other parts of the work.
- C. Locate dewatering facilities where they will not interfere with utilities and construction work to be performed by others.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Provide and Maintain During Construction: Ample means, size, and devices with which to promptly and continuously remove and properly dispose of water entering excavation or other parts of the work, whether water be surface water or underground water, regardless of source.
- B. Intercept and divert precipitation and surface water away from excavations through the use of dikes, curb walls, ditches, pipes, sumps, or other means.
- C. Disposing of Water:
  - a. Dispose of water from the work in suitable manner without damage to adjacent property. Methods used shall not cause settlement or damage to adjacent property.
  - b. Do not drain water into work built or under construction.

- c. Dispose of water in such manner as not to be menace to public health.
    - d. Do not dispose of water into adjacent wash.
- D. Wells, Well Points, and Drain Lines for Dewatering:
  - a. Locate after receipt of ENGINEER's written permission.
  - b. Remove dewatering controls when no longer needed.

## **SECTION 02250: EARTHWORK**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - a. Preparing subgrades for slabs-on-grade and walks.
  - b. Excavating and backfilling for buildings and structures.
  - c. Drainage course for slabs-on-grade.
  - d. Subbase course for concrete walks.
- B. All Work shall conform to the requirements of the most current publication of MAG Specifications.
- C. No separate payment for Earthwork will be made. The Contractor shall include all work associated with the cost of earthwork activities in his bid.

#### **1.2 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
- B. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
- C. Final Backfill: Backfill placed over initial backfill to fill a trench.
- D. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- E. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- F. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- G. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- H. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
- I. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
- J. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- K. Fill: Soil materials used to raise existing grades.



- L. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- M. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- O. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

### **1.3 PROJECT CONDITIONS**

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.

## **PART 2 - PRODUCTS**

### **2.1 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, GC, SC and SM, or a combination of these groups; free of rock or gravel larger than [2 inches] in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups. Unsatisfactory soils also include satisfactory moisture sensitive soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 3-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 3-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. Bedding shall conform to Section 601.4 of MAG Specifications.

- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. All products shall conform with Section 601 of MAG Specifications.

### **PART 3 - EXECUTION**

All work shall be performed in accordance with MAG Specifications.

#### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations.

#### **3.2 EXCAVATION**

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
- B. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

#### **3.3 EXCAVATION FOR STRUCTURES**

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

#### **3.4 EXCAVATION FOR WALKS AND PAVEMENTS**

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### **3.5 SUBGRADE INSPECTION**

- A. Proof-roll subgrade below the building and equipment slabs with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

### **3.6 UNAUTHORIZED EXCAVATION**

- A. Work covered under this sections shall conform to the requirements of Section 604 of MAG Specifications.
- B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation.
- C. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### **3.7 STORAGE OF SOIL MATERIALS**

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- B. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### **3.8 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
- C. Under grass and planted areas, use satisfactory soil material.
- D. Under walks and pavements, use satisfactory soil material.
- E. Under steps and ramps, use engineered fill.
- F. Under building slabs, use engineered fill.
- G. Under footings and foundations, use engineered fill.

### **3.9 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content for moisture sensitive soils.
- B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

- C. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### **3.10 COMPACTION OF SOIL BACKFILLS AND FILLS (SEE SECTION 02400 FOR TRENCH BACKFILLING)**

- A. Place backfill and fill soil materials in conformance with the requirements of Section 601 of MAG specifications, but in no case shall the depth exceed 12 inches in any succeeding lift.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
- D. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - a. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - b. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.

### **3.11 GRADING**

- A. Grading shall conform to the requirements of Section 02310 - Grading.

### **3.12 SUBBASE AND BASE COURSES**

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
  - a. Shape subbase and base course to required crown elevations and cross-slope grades.
  - b. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 100 percent of maximum dry unit weight according to ASTM D 698.

### **3.13 DRAINAGE COURSE**

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - a. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - b. The Contractor may in lieu of these requirements submit a work plan stating the installation procedure for the Engineer's review and approval.

### **3.14 FIELD QUALITY CONTROL**

- A. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil fill lift will be performed to verify density compliance. Subsequent verification and approval of other footing subgrades may be based on a visual footing inspections when approved by the Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 6938.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### **3.15 PROTECTION**

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
- D. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### **3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS**

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property or on site at the Owner's direction.

## **SECTION 02310: GRADING**

### **PART 1 - GENERAL**

- A. This Section includes requirements related to: Earth and borrow excavation, stripping, site preparation, field quality control, and finish grading and protection.
- B. No separate payment for Grading will be made.

### **PART 2 - EXECUTION**

#### **2.1 EARTH EXCAVATION**

- A. Grading shall consist of excavation, removal and satisfactory disposal of excess excavated materials taken from within Project area, construction of embankments, subgrades, ditches, and incidental work; and removal and satisfactory disposal of unstable and unsuitable materials and their replacement with satisfactory materials where needed.
- B. Remove unstable material encountered and replace with suitable material.
- C. Dispose of all unsatisfactory soils, waste material, and refuse at an off-site landfill or other appropriate site as approved by the Engineer. Provide proper documentation of disposal upon request.

**2.2 STRIPPING** - Prior to grading and/or borrow excavation, strip topsoil, in accordance with Section 02110 – Site Clearing.

#### **2.3 BORROW EXCAVATION**

- A. Borrow excavation shall consist of excavating, transporting, and placing of earth materials obtained from locations furnished by CONTRACTOR necessary for construction of subgrades and other parts of work.
- B. CONTRACTOR shall furnish and pay for borrow sites, or other sources of borrow, and obtain from property owners necessary agreements for removal of excavated material. Borrow material shall have a Standard Dry Density of not less than 95 lb/cu. ft. when tested in accordance with AASHTO T99 and shall not possess an organic content greater than 10% when tested in accordance with AASHTO T194.

#### **2.2 SITE PREPARATION**

- A. Prepare the ground surface in fill areas and cut areas to grade by scarifying, moisture conditioning and compacting the exposed surface soil to a depth of 10 inches.
- B. Moisture condition and place all fill and backfill material required to achieve specified grades. Fill materials should be moisture conditioned, placed and compacted in horizontal lifts of thicknesses compatible with the compaction equipment being used.

## **2.3 FIELD QUALITY CONTROL**

- A. Moisture-density laboratory tests: Minimum of one test on each type of soil to be used in embankment construction; conform to ASTM D698. Perform tests prior to placement of embankment materials.
- B. In-place density tests for embankments: Perform tests on structures and paved roads during course of work on subgrade for each successive 8" layer conforming to ASTM D1556 or ASTM D6938.

## **2.4 FINISH GRADING**

- A. Finish fill, excavated areas, and other disturbed areas to uniform grade and section normally obtainable with blade grader.
- B. Allowable template tolerances: +0.10'.
- C. Finish grade to neat appearance and to provide positive drainage.
- D. Crushed rock shall be in accordance with MAG Specification Section 716.2 and Table 716-2 (3/8" crushed rock, no rejects).

## **2.5 PROTECTION**

- A. Water shall be used as controlling agent to prevent operations from polluting air with dust.
- B. Regulations as set forth by OSHA and appropriate state agencies, shall govern.

## **SECTION 02350: EXCAVATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This section includes requirements related to the following items: structural backfill and fill, granular fill, crushed rock fill, borrow material, support and protection systems, earth excavation, backfill and fill, rock excavation, and disposal of material. The Contractor shall also adhere to the requirements of Section 206 of the most current publication of MAG Specifications.
- B. No separate payment for Excavation will be made. The Contractor shall include all work associated with the cost of excavation activities in his bid.

#### **1.2 RELATED SECTIONS**

- A. The following Section shall also apply : Section 02400 – Trenching, Backfilling and Compacting.
- B. In the preparation of Drawings and Specifications, ENGINEER or ENGINEER'S Consultants have relied upon the reports of explorations and tests of subsurface conditions at the site of the work noted in Section 01049. The results of the geotechnical investigations are contained in the documents prepared by Western Technologies Inc. noted in Section 01049.

#### **1.3 QUALITY ASSURANCE**

- A. The CONTRACTOR shall retain the services of an independent qualified professional soils consultant and testing laboratory.
- B. Responsibilities of soils consultant shall include:
  - a. Sampling, testing, and approval of backfill and fill materials prior to and during placement.
  - b. Sampling and testing to determine moisture-density and maximum density characteristics of materials in accordance with ASTM D698.
  - c. Observation of placement, selection of test locations, and testing of material during placement to determine that uniformity of compaction and specified compaction requirements are met. Determine in-place densities in accordance with ASTM D6938, as applicable. Conduct one test for every 500 sq. ft. of backfill material placed but a minimum of one test per section or structure, whichever is greater.
  - d. Inspection and approval of soil at bottom of excavations under foundations, considering settlement and load-bearing characteristics of soil and design bearing capacity.
  - e. Providing reports to ENGINEER giving information on materials and testing performed.
  - f. Binding all reports and recommendations in one (1) report at end of Project and giving two (2) copies to ENGINEER and one (1) copy to OWNER.



## 1.4 SUBMITTALS

- A. Support and protection system designs.
- B. Test reports on samples of all backfill and fill materials.
- C. Laboratory compaction test reports establishing moisture-density relationships and maximum densities for all proposed backfill, fill and borrow materials.

## 1.5 UNDERGROUND OBSTRUCTIONS

- A. Known underground piping, foundations, and other obstructions in the vicinity of new construction are shown on the Drawings. Locations shown were based upon best known information supplied by others. CONTRACTOR shall contact Bluestake a minimum of ten (10) working days prior to beginning construction. CONTRACTOR is responsible for field locating all utilities prior to installation of proposed facilities. The cost of locating all utilities shall be included in his bid.
- B. Protect underground facilities encountered during excavation until it is determined whether they are active or inactive. Repair, without compensation, existing active facilities damaged during operations.
- C. Notify ENGINEER of unexpected subsurface conditions and discontinue work in area until ENGINEER provides directive and notification to resume work.

## 1.6 DEFINITIONS

- A. Support system (per OSHA): Structure such as underpinning, bracing, or shoring, which provides support to adjacent structure, underground installation, or sides of an excavation.
- B. Protective system (per OSHA): Method of protecting employees from cave-ins, from materials that could fall or roll from an excavation face or into an excavation, or from collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, and other systems that provide necessary protection.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Clayey native soils (with Unified Soil Classification of CL or SC) are considered suitable for use in general grading fills but should not be used in the top foot of pad fill (in the case of slabs-on-grade for surface structures) or as wall backfill. The top foot should be completed with an approved low or nonexpansive soil, either selectively used on-site soils or import.
- B. Exclude debris, stones larger than 3", rocks, roots, expansive material and other deleterious materials.

### 2.2 STRUCTURAL BACKFILL AND FILL

- A. Type: Excavated or imported material conforming to recommendations set forth in the Geotechnical Reports prepared by Western Technologies Inc.

- B. Use:
  - a. Backfill behind wet wells, manholes and walls of vaults.
  - b. All other backfill and fill except where specified.

### **2.3 GRANULAR FILL**

- A. Type: Clean, medium or coarse sand conforming to ASTM D2487 (Unified Soil Classification System) classification SW.
- B. Material: Free of earth, clay or other foreign substances.
- C. Use: Fill all depressions, resulting from compaction excavation of unsuitable bearing material under interior slabs-on-grade.

### **2.4 CRUSHED ROCK FILL**

- A. Type: Well graded sand and gravel.
- B. Size and grading: Material shall be well graded sand and gravel base course meeting Maricopa Association of Government's "Specification for Aggregate Base Course Materials".
- C. Material: Free of earth, clay, or other foreign substances.
- D. Use: Place a minimum of 8" layer of crushed rock fill under concrete slabs on grade unless otherwise shown on the Contract Drawings.

### **2.5 BORROW MATERIAL**

- A. Obtain borrow material from off-site source, if volume of suitable excavation material is inadequate.
- B. Borrow materials shall conform to material specifications for intended use.
- C. See Section 2310, paragraph 2.3 for Borrow Excavation requirements.

### **2.6 SUPPORT AND PROTECTION SYSTEMS**

- A. Provide support and protection system where shown and where required to protect public, workers, and existing and new utilities, property and structures.
- B. Design of support and protection systems shall be responsibility of CONTRACTOR, performed by a Registered Professional Engineer in the State of Arizona, and shall conform to OSHA requirements.
- C. Design of system shall include:
  - a. Loading effects from:
    - i. Soil.

- ii. Ground water.
  - iii. Surcharge loading (construction and public traffic on adjacent roadways).
  - iv. Existing structures dead load and live load.
- b. Consideration of effects on existing structures including vibration and settlement. Installation and removal of support systems shall not cause damage to existing facilities.

### **PART 3 - EXECUTION**

#### **3.1 EARTH EXCAVATION**

- A. Excavate as shown and required for construction work. Extend excavation sufficient distance from walls and footings to allow for placement and removal of forms.
- B. Use special care when excavating under and around existing facilities. Support existing facilities and earth under facilities to prevent settlement resulting from construction operations.
- C. Soils Report indicates that rock excavation techniques may be required. All excavation and construction techniques shall conform to OSHA regulations, and additional regulations, as required.
- D. Excavation for soil supported foundations of Sewer Manholes, and Lift Station/Wetwell:
  - a. Excavate to elevations shown or specified. Soils consultant shall inspect and approve soil at foundation levels shown.
  - b. If soils consultant determines that bearing capacity of soil is unsuitable at foundation levels shown:
    - i. Notify ENGINEER of subsurface conditions and discontinue Work in area until ENGINEER provides directive and notification to resume Work.
  - c. Fill with concrete, at no expense to OWNER, unauthorized excavations carried below bottoms of foundation levels shown.
  - d. Trim excavations by hand to remove material disturbed by machine excavation; produce neat, plane surface at elevation of bottom of footing.
- E. Excavation for soil supported foundations of Electrical Enclosure, Equipment Pads and Standby Generator Pad:
  - a. Excavate to a depth at least 2'-0" below the proposed bottom of footing elevation or 2'-0" below existing grade, whichever would result in a deeper excavation. Soils consultant shall inspect and approve soil at excavation foundation level.
  - b. If soils consultant determines that bearing capacity of soil is unsuitable at foundation levels shown:

- i. Notify ENGINEER of subsurface conditions and discontinue Work in area until ENGINEER provides directive and notification to resume Work.
- c. Fill with concrete, at no expense to OWNER, unauthorized excavation carried below bottom of excavation levels indicated above.
- d. Trim excavations by hand to remove material disturbed by machine excavation.
- e. Excavation shall extend 3'-0" beyond the edges of footings.
- f. Scarify the exposed grade to a depth of 8" and compact as specified below for backfill.

### **3.2 BACKFILL AND FILL**

- A. Backfilling around structures:
  - a. Backfill only after concrete has attained 85% of specified 28-day compressive strength.
  - b. Prevent displacement of construction during backfilling operations; backfill opposite sides of walls simultaneously.
  - c. Do not backfill behind wet wells and walls of vaults until top slab is in place and concrete has attained 85% of specified 28-day compressive strength, unless noted otherwise on drawings.
- B. Backfill and fill to elevations or grades shown and required for drainage. Maintain surface and slopes for drainage during operations. Refer to Geotechnical Report prepared by Western Technologies Inc. for requirements on grading fill and structural backfill.
- C. Placement:
  - a. Maintain surfaces free of water, debris, and excessively wet, and other deleterious materials.
  - b. Place backfill and fill materials in successive horizontal layers not more than 8" in loose depth.
  - c. Place materials at proper moisture content for obtaining densities as specified. Generally maintain within -2% to +2% of optimum.
  - d. Material too dry or too wet to compact properly: Moisten or aerate to extent necessary to produce desired results.
- D. Compaction:
  - a. Mechanically compact backfill and fill within structure and structure subgrade outlines, beneath and within 10' of sidewalks, streets, drives, and parking areas to at least 95% of maximum density as determined by ASTM D6938.
  - b. Perform sampling and testing in each layer of backfill and fill placed to confirm adequacy of compaction. This does not apply to sampling and testing of trench excavation for

force mains and gravity sewers. See Section 02400 – Trenching, Backfilling and Compacting.

- c. Do not use pneumatic tiered rollers, sheep foot type heavy mechanical tamping rollers or heavy vibratory compactors within 6' of structure, walls, pipes, or other construction which might be damaged by compaction equipment.
- d. If tests indicate inadequate compaction, remove, replace and recompact material until compliance with these specifications is achieved.
- e. Support all pipes and structures in the backfill zone on the facility wall or undisturbed soils, until post-compaction settlement has been achieved.

### 3.3 SHEETING AND SHORING

- A. Sheeting and Shoring shall conform to the requirements of Section 02151 – Sheeting and Shoring.

### 3.4 ROCK EXCAVATION

#### A. General:

- a. All excavation will be unclassified. **It is the Contractor's responsibility to determine the location of all rock within the limits of this project. Contractor shall include the cost of all rock excavation in his unit price and lump sum bids in accordance with the bid schedule. No separate measurement or payment will be made for rock excavation.**
- b. On rock surfaces to receive concrete footings, the rock shall be worked down to a satisfactory bed or sidewall. Only drilling, picking, barring, wedging, or similar methods that will leave the foundation rock in an entirely solid and unshattered condition shall be used on rock surfaces to receive concrete. Level surfaces shall be roughened, and sloped surfaces shall be cut as directed into rough steps or benches to provide a satisfactory bond with concrete. Shales shall be protected from flaking or other erosion resulting from ponding or flow of water.

#### B...Trench Excavation

- a. Trench excavation of rock shall be made in accordance with Section 601.2.5 of MAG Specifications.

#### C...Execution includes:

- a. Strip and stockpile topsoil for use in surface restoration.
- b. Keep trench width below top of pipe as narrow as practicable; provide adequate width for proper pipe jointing operations and for placing and compacting backfill in accordance with Table 601-1 of MAG Specifications.
- c. Slope walls of trench or provide trench shoring as required to comply with OSHA and safety requirements. Maintain walls of excavation vertical below top of pipe; use trench box or shield as required.

- d. Excavate to provide required depth of pipe bedding and for appurtenance foundations. Trench bottom shall be suitable for placement of pipe bedding material.
- e. Trench bottoms carried below required grade: Backfill with ABC material to proper elevation at no additional expense to OWNER.
- f. Blasting of the soil/weathered rock matrix will not be allowed.

### **3.5 DISPOSAL OF MATERIAL**

- A. Dispose of excess and unsuitable excavated material off-site in disposal area obtained by CONTRACTOR.
- B. Dispose of debris, large stones, rocks, roots, and organic materials off-site in disposal area obtained by CONTRACTOR.

## SECTION 02400: TRENCHING, BACKFILLING AND COMPACTING

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. This section includes materials, testing and installation for trench excavation, pipe embedment, backfill, and compaction of piping.
- B. No separate payment for trench excavation, backfilling, compacting, or pipe embedment will be made unless specifically set forth on the Bid Proposal Form.

#### 1.2 GENERAL

- A. The Work shall include the necessary excavation and trenching as required; the handling, storage, transportation and disposal of all excavated material; preparation of subgrades; pumping and dewatering as necessary or required; preservation of natural features; backfilling; surfacing and grading and other appurtenant work for construction in conformance with the plans.
- B. The Contractor shall notify corporations, companies, individuals or authorities owning utility conduits, wires or pipes running in right-of-ways, easements, or on properties which are expected to be encountered during excavating operations. If required for construction and authorized in writing by such utility owner and Engineer, the Contractor shall cap or remove the utility and reinstall the service providing proper clearance and protection, in accordance with the utility owner's instructions and its satisfaction. The Contractor shall otherwise protect, support and maintain all conduit, drains, sewers, pipes and wires that are to remain and are not in direct conflict or interference with new construction.
- C. The Contractor shall satisfy himself as to the nature of the materials to be excavated and amount of dewatering required. The Contractor shall include in his bid all costs in connection with excavation, including rock excavation, dewatering and difficulties to be encountered, and shall assume full risk in these matters.
- D. Excavation work shall be performed in a safe and proper manner, with suitable precautions being taken against hazards of every kind. Excavations shall provide adequate working space and clearances of the work to be performed.
- E. Excavations shall provide adequate clearance for installation and removal of concrete forms where occurring. In no case shall excavation faces be undercut for extended footings.
- F. When operating on pavements or walks, all equipment shall be rubber tired, except for excavation equipment. Excavating equipment in such cases, shall not have grousers, cleats or lugs on the tracks. The Contractor shall take all reasonable precautions to protect any existing pavement and walks.
- G. **No separate measurement or payment will be made for trench rock excavation for sewers and other pipelines, nor for any other appurtenant facilities such as manholes, inlets, outlets, headwalls, collars, saddles, piers, and pipe protection or encasement. Payment for all such excavation shall be included in the unit prices bid per linear foot of the various sizes of pipe laid for the respective trench depths as provided for in the Bid Schedule for this contract.**

### 1.3 SUBMITTALS

- A. Test reports on samples of all backfill and fill materials.
- B. Laboratory compaction test reports establishing moisture-density relationships and maximum densities for all proposed backfill, fill and borrow materials.

## PART 2 - PRODUCTS

### 2.1 PIPE EMBEDMENT

- A. Bedding and Initial Backfill Material:
  - a. Bedding and Initial Backfill Material (12 inches above top of pipe) shall be per details indicated on the Drawings and in accordance with Section 601.4.1- 4.4 of the most current publication of MAG Specifications.

### 2.2 TRENCH BACKFILL

- A. Final Backfill Material:
  - a. Final Backfill material (material above the Initial Backfill) shall be per details indicated on the Drawings and in accordance with the following gradation for imported fill:

<u>Gradation (ASTM C 136)</u>	<u>Percent finer by weight</u>
6"	100
4"	85-100
¾"	70-100
No. 4 Sieve	50-100
No. 200 Sieve	40 (max)
Maximum expansive potential (%)	1.5
Maximum soluble sulfates (%)	0.10

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Excavation work shall be performed in a safe and proper manner, with suitable precautions being taken against hazards of every kind. Excavations shall provide adequate working space and clearances for the work to be performed therein.
- B. Excavations shall be to the elevations and dimensions indicated for footings, foundations, piping, paving, drives, walls and other work shown, plus sufficient space to permit erection and removal of forms, shoring, damp-proofing and inspection of all work.
  - a. Subgrade soils shall be firm and free from mud and muck. Subgrade surfaces shall be clean and free of loose material of any kind before concrete is placed on the subgrade.



### 3.2 STABILIZATION

- A. When unsuitable soil materials are encountered, the unsuitable material shall be removed to the depth determined necessary in the field by the Contractor's Soils Technician, and approved by the Engineer. The sub-grade shall be restored with compacted Imported Granular Material or crushed rock as approved by the Engineer. Place the appropriate bedding or base material on this restored foundation.

- 1.2 When rock encroachment is encountered, the rock shall be removed to a point below the intended trench or excavation sub-grade in accordance with Section 601.2.5 of MAG Specifications and acceptable to the Engineer. The sub-grade shall be restored with compacted Imported Granular Material as approved by the Engineer. Place the appropriate bedding or base material on this restored foundation.

- A. When excessively wet, soft, spongy, or similarly unstable material is encountered at the surface upon which the bedding or base material is to be placed, the unsuitable material shall be removed to the depth determined necessary in the field to the satisfaction of the Engineer. Restore the trench with crushed rock enclosed in filter fabric as directed by the Engineer. Larger size rocks, up to 3", with appropriate gradation, may be used if recommended by the Soils Technician and approved by the Engineer. Place the appropriate bedding or base material on this restored foundation.

### 3.3 SOIL AND MATERIAL TESTING

- A. The Contractor shall engage the services of an independent, qualified testing firm to perform laboratory and field tests to monitor soil conditions during earthwork, trenching, bedding, backfill and compaction operations. Sampling and testing procedures shall be performed in accordance with the Reference Standards addressed herein.
- B. The Contractor's Soil Technician shall be present at the site during all backfill and compaction operations. Failure to have the soils technician present will subject such operations to rejection.
- C. Tests required:
  - a. Moisture-density tests: ASTM D698; minimum of one determination of optimum moisture for each type of soil incorporated into work.
  - b. In-place density tests: ASTM D6938.
    - i. Perform tests in areas of backfill and where compaction requirements are specified.
    - ii. Provide equipment necessary and perform field density tests during course of work.
    - iii. Perform tests for fill or backfill at following interval: One test per 250 feet random depths above the pipe zone and one test per 250 feet in the pipe zone.
  - c. Sieve analysis: ASTM C136; minimum of one test on each source of each material of specified gradation unless otherwise specified or provide certified copy of test report

from material supplier. If the Contractor is producing material from a local borrow area, daily sieve analysis will be required.

- D. If tests indicate inadequate placement or compaction, CONTRACTOR shall correct inadequacies and perform additional tests in same area at no additional cost to OWNER.
- E. A report of all soils tests performed shall be stamped and signed by the Contractor's soils firm and shall be submitted by the Contractor prior to the filing of the Notice of Completion by the District. The report shall document the sampling and testing of materials, the location and results of all tests performed, and shall certify that materials and work are in compliance with this specification.

### **3.4 TRENCH EXCAVATION**

- A. Excavate the trench to the lines and grades shown on the drawings with allowance for 6" of pipe bedding material. The trench section shall be as shown on the Drawings and in accordance with Section 601 of MAG Specifications.
- B. The maximum length of open trench shall be as prescribed under Section 01410 – Work in Right of Way unless otherwise approved by the Engineer. The distance is the collective length at any location, including open excavation and pipe laying, which has not been backfilled to the elevation of the surrounding grade.
- C. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions.
- D. Place the specified thickness of bedding material over the full width of the trench. Grade the top of the pipe base ahead of the pipe laying to provide a firm, uniform support along the full length of pipe.
- E. Keep trench width below top of pipe as narrow as practicable; provide adequate width for proper pipe jointing operations and for placing and compacting backfill. See MAG Section 601 for maximum trench width.
- F. Slope walls of trench or provide trench shoring as required to comply with OSHA and safety requirements; cuts deeper than 12 feet and/or shoring shall be designed by a professional civil engineer and submitted to the ENGINEER for approval; maintain walls of excavation vertical in pipe zone. Use trench box or shield as required.
- G. Excavate to full depth by machine. Trench bottom shall be suitable for hand working of finely divided, loose, excavated material or for placement of pipe bedding material.
- H. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. No part of any bell or coupling shall be in contact with the trench bottom, or trench walls when the pipe is jointed.
- I. The Contractor shall conform to the requirements of Article 3.02 of this Section if soft, spongy, or otherwise unstable material is encountered which may not provide suitable foundation for pipe. Removal and replacement of questionable material will be authorized only if dewatering methods are unsuccessful in stabilizing trench bottom.

### **3.5 EROSION CONTROL**

- A. See Section 02110 - Site Clearing.

### **3.6 SHEETING, SHORING AND BRACING**

- A. See Section 02151 – Sheeting and Shoring

### **3.7 PIPE BEDDING**

- A. Bedding and trench bottom:
  - a. Pipe bedding: As required on the Drawings and in accordance with Section 601 of MAG Specifications.
  - b. Provide bell holes at each pipe joint; allow access completely around circumference of pipe for proper jointing operations.
  - c. Place in layers not to exceed 10" and compact by hand held tamping device.
  - d. Force bedding under edge of pipe by slicing with shovel.

### **3.8 TRENCH BACKFILL AND COMPACTING:**

- A. General:
  - a. All trench backfill above pipe embedment shall conform to the details as may be shown on the Contract Drawings, as specified herein, or as may be conditioned by the project Permits. The trench surface shall be restored to the same line, grade, and condition which existed prior to construction.
  - b. Material obtained from trench excavation may be used for trench backfill above the pipe embedment. If, however, in the opinion of the Engineer, the excavated material is not deemed suitable for backfilling, the unsuitable material shall be removed from the site and replaced with an approved soil aggregate for backfill. The imported soil aggregate shall meet or exceed the fill material specified for imported select fill material.
- B. Road Right-of-Ways:
  - a. The Work in, on, or along a road right-of-way shall be governed by the Governing Agency issuing the Permit for the Work performed within such right-of-ways.
- C. Backfill Compaction:
  - a. Unless otherwise conditioned by Permit, trench backfill shall be compacted to at least ninety-five (95%) percent in all areas of its maximum Standard Proctor density per ASTM Test Method D-698. Backfill shall not be placed in lifts exceeding ten (10") inches, loose measurement, in thickness.

## **SECTION 02500: PAVING AND SURFACING**

### **PART 1 - GENERAL**

#### **1.1 THE REQUIREMENTS**

- A. This Section of the Specifications covers the restoration, repair and replacement of existing paved surfaces, and the installation of new paved surfaces, whether used for State, Municipal or County Roads, and for sidewalks and related items necessary to complete Work shown on Contract Drawings or specified herein.
- B. Where applicable, the Contractor shall maintain backfilled trenches in a safe condition until permanently repaired.
- C. Payment for "Paving and Surfacing" will be made in accordance with Section 01025 Measurement and Payment.
- D. Pavement and surfacing replacement shall be done in accordance with MAG Section 336.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 TRENCH BACKFILL**

- A. Trench backfill shall be in accordance with Section 02400, the Contract Drawings, and as conditioned by the project permits. In all cases, the most stringent requirement shall govern.

#### **3.2 SUBGRADE**

- A. The subgrade shall be thoroughly compacted using a ten (10) ton roller or similar equipment.
- B. The subgrade shall be accurately shaped in conformance to the required lines and grades indicated on the Contract Drawings, and shall be crowned to conform to the surface of the finished construction elevation which permits placing of compacted material as specified. All hollows and depressions, which develop in the subgrade under rolling, shall be filled with acceptable material and rolled until compacted to the required line and grade.

#### **3.3 SUBBASE PREPARATION**

- A. The subbase shall meet the requirements Section 336 of MAG.
- B. The subbase course material shall be placed and compacted by rolling. The subbase course material, as spread, shall be well-graded with no pockets or segregation of large or fine particles. All holes or depressions, resulting from rolling, shall be filled with the material being used and the surface re-rolled until it conforms to the lines and grades called for, with a uniform surface free from humps or pockets. Compaction shall be continued until the material does not weave under the roller.

### **3.4 TEMPORARY PAVEMENT**

- A. At the end of each day's work, the Contractor shall temporarily repair any pavement removed or damaged as a result of the work and prepare the trench for temporary pavement. Such temporary pavement shall only apply to utility excavations crossing access routes during the construction period. Preparation will include removal of any loose pavement and cutting the pavement edges to straight lines. Temporary pavement will consist of stabilized base material as detailed on the Contract Drawings. No separate payment will be made for temporary pavement removal and disposal for permanent pavement replacement.

### **3.5 BITUMINOUS STABILIZED BASE COURSE**

- A. The bituminous-stabilized base course shall be as detailed on the Contract Drawings, but not less than the thickness indicated after compaction in all paved areas.
- B. The material, as spread, shall be well-graded with no pockets or segregation of large or fine particles. All holes or depressions, resulting from rolling, shall be filled with the material being used and the surface re-rolled until it conforms to the lines and grades called for on the Contract Drawings, with a uniform surface free from humps or pockets. Compaction shall be continued until the material does not weave under the roller.

### **3.6 SURFACE COURSE**

- A. The existing surface material shall be saw cut and removed to a width as indicated on the Contract Drawings. This cut edge shall be wider than the existing base course and trench width and saw cut a minimum of two (2") inches.
- B. The surface of the bituminous-stabilized base course shall be swept to remove loose dust without disturbing the natural bond in the surface. It shall be free of all foreign and loose material, dry, and free of water and ice.
- C. The surface course shall be uniformly distributed and compacted by rolling to a thickness of not less than that shown on the Contract Drawings after compaction. The surface course shall be a hot-mixed bituminous concrete paving mixture conforming to the requirements of Sections 331 and 336 of MAG.
- D. The edges of existing bituminous pavements, along which new pavement is to be constructed, shall be coated with an accepted liquid-bituminous material. This material shall be placed immediately prior to placing the new surface course to ensure a complete bond between the existing and new pavements.

### **3.7 SIDEWALKS, DRIVEWAYS, CURBS AND GUTTERS**

- A. Replacement sidewalks, curbs and gutters shall be installed consistent with those which may exist in the work area(s).

### **3.8 BITUMINOUS SURFACE AND PATCHING**

- A. The Contractor shall use bituminous concrete wearing course material for surfacing and patching where approved by the Owner or regulating authority. The prepared area shall be prime coated before the bituminous concrete is placed and compacted.

### **3.9 ROADWAY MARKINGS**

- A. New pavement paint markings shall be as specified in Section 02762 of the Specifications.

## **SECTION 02722: GRAVITY SEWER CONSTRUCTION**

### **PART 1 - SCOPE**

- A. Installation of gravity sewer pipes in open-cut trenches and related items necessary to complete work shown or specified are a part of the Contract.
- B. Trenches for sewer construction are specified under Section 02400
- C. Installation of sewer pipe shall be in open-cut trenches for all sewers except sewers specified under Tunneling, Boring or Jacking.
- D. All work shall conform to Section 615 of MAG specifications.
- E. Work Included:
  - a. Scope
  - b. General
  - c. Cooperation by Contractor
  - d. Materials - Sewer Pipe
  - e. Inspection and Rejection of Pipe and Materials
  - f. Handling Pipe
  - g. Notice to Engineer
  - h. Pipe Encasement
  - i. Laying Pipe
  - j. Minimum Grades
  - k. Jointing
  - l. Manholes and Other Structures
  - m. Temporary Sewer Connections
  - n. Connections to Existing Sewers
  - o. Sewer Tests
  - p. Delivery, Storage and Handling

### **PART 2 - GENERAL**

- A. The Contractor shall furnish all materials, perform all excavation and backfill, make all necessary joints and connections, construct all appurtenances, install all temporary lines and dispose of all surplus excavation and discarded pipe material and perform all work as may be necessary to complete the sewer installation as set forth in these Specifications and as shown on the Drawings.
- B. The Contractor shall notify all authorities owning conduit, sewer pipe, wires, or pipes located within proximity of the proposed or encountered during excavating operations. The Contractor shall protect, support and maintain all conduits, drains, sewers, pipes, and wires that are to remain in place.
- C. The Contractor shall refer to special notes on the Drawings and shall so arrange and conduct the Work as to conform to the requirements thereon. Such notes shall be an integral and binding part of the Specifications.

## **2.1 COOPERATION BY CONTRACTOR**

- A. The Contractor shall arrange and perform his work so as to cause the least amount of interference to residences and businesses.

## **2.2 MATERIALS – GRAVITY SEWER PIPE**

- A. PVC Gravity Sewer Pipe shall be of the size and type shown on the Drawings. PVC Sewer Pipe shall conform to ASTM Designation D-3034-(SDR-35). Factory attachment of couplings and saddle fittings and field jointing of pipe sections and fittings shall be accomplished by O-ring rubber gaskets (ASTM Designation F-744).
- B. Sanitary sewer pipe shall be polyvinyl chloride (referred to as PVC) pipe with integral wall bell and spigot joints for conveyance of domestic sewage. Pipe material shall conform to ASTM D-1784, cell classification 12454-B, 1254-C, or 13364-B, with minimum tensile modulus of 500,000 psi. Joints shall conform to ASTM D-3212, each with integral bell joint consisting of a formed bell complete with single rubber gasket. Pipe stiffness shall conform to ASTM D-4214 at five (5%) percent deflection for forty-six (46) psi, and conform to drop impact test per ASTM D-2444.
- C. Ductile Iron Gravity Sewer Pipe (DIP) shall be of the size and type shown on the Drawings. DIP for gravity sewers shall be push-on joint conforming to ASTM A746. Ductile iron pipe and fittings shall be as specified in ASTM A 746 for thickness Class 52.
- D. All branches, bends, and accessories shall be as manufactured by the approved pipe supplier and have bell and spigot configuration compatible with that of the sanitary sewer pipe. All necessary lubricants for pipe and fitting installation shall be furnished and applied in accordance with the manufacturer's recommendation.

## **2.3 INSPECTION AND REJECTION OF PIPE AND MATERIALS**

- A. The quality of all materials, the process of manufacturer, and the finished pipe shall be subject to inspection and approval by the Engineer. Such inspection may be made at the place of manufacture or on the work site after delivery or at both places, and the pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements even though sample pipes may have been accepted as satisfactory at the place of manufacture.
- B. Previous to being lowered into the trench, each pipe shall be carefully inspected and those not meeting the Specification shall be rejected and at once removed from the Work. Pipes having any defects not sufficient, in the judgment of the Engineer, to warrant their rejection, shall be so laid as to bring these defects to the upper half of the sewer.
- C. The Owner shall also have the right to take samples of concrete after it has been mixed, or as it be being placed in the forms or molds, and to make such inspection and tests thereof as he may wish.

## **2.4 HANDLING PIPE**

- A. Each pipe section shall be handled into its position in the trench only in such manner and by such means as the Engineer approves as satisfactory. The Contractor shall furnish slings, straps, and other approved devices to permit satisfactory support of all parts of the pipe when it is lifted.



## 2.5 NOTICE TO ENGINEER

- A. The Engineer shall be notified when the pipes are to be laid in the trench, and none shall be covered until they have been inspected and approved by the Engineer. At least twenty-five (25) feet of pipe shall, under ordinary circumstances, be laid before covering begins.
- B. If any pipe or section thereof is covered by the Contractor without being inspected and approved by the Engineer, the Contractor shall expose the pipe for inspection and recover in accordance with the specifications at his own expense.

## 2.6 PIPE ENCASEMENT

- A. Concrete Pipe Encasement
  - a. Concrete pipe encasements shall be installed where indicated on the Drawings or where field conditions warrant their use as directed by the Engineer. Such field conditions shall include but not be limited to stream crossings, utility crossings, proximity to other structures three (3) feet or less from the pipe, or at such other locations as may be directed by the Engineer.
  - b. Encasements shall consist of concrete cradles (under pipe), concrete arches (over pipe), full concrete encasement (full pipe), and utility crossings. Construction and placement of concrete encasements shall include all necessary excavation, reinforcement, forms, and other labor, equipment, and materials to construct a complete structurally sound, thoroughly embedded, and firm encasement.
  - c. Concrete used for encasements shall have a minimum compressive 28-day strength of 3,000 psi, and reinforcement in accordance with Division 3 of the Specifications. Payment will be made on the basis of cubic yards of concrete at the dimensions and limits shown on the details and no additional payment will be made for materials used in excess thereof.

## 2.7 LAYING PIPE

- A. All pipe shall be reinspected for soundness and damage due to handling immediately before being lowered into the trench. Any pipe found to be unsound or damaged will be rejected, and shall be removed immediately from the site of the Work.
- B. All pipe shall be laid accurately to the required line and grade, and in such manner as to form a close, concentric joint with the adjoining pipe and to bring the invert of each section to the required grade. All pipe shall be laid in a straight line between manholes. No curved sewers will be permitted. Bell holes shall be dug in advance of the pipe laying. The supporting of pipe on blocks will not be permitted.
- C. Branches, fittings and specials shall be provided and laid as indicated on the Drawings, or as directed by the Engineer. All open ends of pipes and branches shall be sealed with stoppers or bulkhead finely held in place in a manner acceptable to the Engineer. No special payments will be made for stoppers or bulkheads. At the end of each day's work the open ends of all pipes shall be satisfactorily protected against the entrance of animals, earth or other materials.

## 2.8 MINIMUM GRADES (SPECIAL NOTE)

- A. The slope of most gravity sewer lines is the minimum allowable and must be maintained. The Contractor, upon completion of pipe line laying from manhole to manhole, shall check the grade of pipe for proper slope before proceeding to the next manhole. Failure of the Contractor to verify and correct deviations from established grade, may require removal and replacement of several strings of pipe to correct less than minimum grade conditions detected at time of final inspection.

## 2.9 JOINTING

- A. Practically water-tight work is required, and the Contractor shall construct the sewers with a "premium joint" so that the sewer installation will meet the requirements of paragraph 2.13 "Sewer Tests".
- B. The ends of the pipe shall be satisfactorily cleaned just before laying, and the joint shall be made in a satisfactory manner in accordance with the recommendations of the manufacturer of the particular type of joint. All joint work shall be done by experienced workmen.
- C. Before any joints are actually made in the trench, the Contractor shall demonstrate to the Engineer, by making a sample joint, that the methods employed will secure a joint that will meet the requirements of the specifications for "Sewer Test".

## 2.10 MANHOLES AND OTHER STRUCTURES

- A. Construct all manholes, and other structures at the locations shown on Drawings and in accordance with Section 03410 – Precast Polymer and Concrete Structures. Sewer pipes entering the structure shall be properly and adequately sealed to prevent leakage.
  - a. Manholes shall be constructed per MAG Standard Specification Sections 505 and 625, and Standard Details.
  - b. Manhole Sealed Lids per MAG Standard Detail 423.
  - c. Manhole Testing shall be conducted in accordance with City of Phoenix Supplement to MAG, Section 625.3.3 Sanitary Sewer Manhole Testing.
- B. Polymer manholes shall be designed and fabricated in accordance with Section 10020 of the specifications and must be constructed in conformance with MAG Standard Specification Section 625.

## 2.11 TEMPORARY SEWER CONNECTIONS

- A. Where special junction chambers are to be constructed or where existing sewers carrying sanitary sewage are encountered; the Contractor shall provide and maintain temporary connections to prevent a nuisance.
- B. All such temporary connections, pumping and diversion shall be included in the unit price bid for sewer pipe.

**2.12 CONNECTIONS TO EXISTING SEWERS**

- A. As shown on the Drawings or as directed by the Engineer, the Contractor shall connect the new sewer to existing facilities and existing sewers to new facilities where designated.
- B. The Contractor will be required to make provisions for handling sewage flow while connections are being made. The Contractor shall submit in writing an operational schedule showing the exact procedure to be followed for major connections. The Contractor shall receive approval of the procedures from the Engineer prior to the commencement of the Work.

**2.13 SEWER TESTS**

A. General

- a. The Contractor shall furnish all equipment and labor necessary to conduct testing as specified herein.
- b. Tests for water-tightness and deflection of sewers shall be made in the presence of and in the manner approved by the Engineer.
- c. Where the section tested indicates a loss in excess of the allowable amount, the Contractor shall correct the work so that the retest is within the allowable limit.

B. Gravity Sewer Testing

Gravity sewer testing shall be conducted in accordance with ASTM F1417 using the following table:

Pipe Diameter (in)	Minimum Specified Time Required for a 0.5 psig Pressure drop for Size and Length of Pipe Indicated										
	Minimum Time, min:s	Length for Minimum Time, ft	Time for Longer Lengths, s	Specification Time for Length (L) Shown, min:s							
				100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
6	2:50	398	0.427	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16

Refer to ASTM F 1417 for Testing Details

Gravity sewer testing by means of exfiltration should only be considered when low pressure air testing cannot be used and only with the approval of the Engineer. See Section 15265, Part 3.2 for additional testing requirements.

C. Gravity Sewer Deflection Testing

The Contractor shall also furnish all equipment and personnel to conduct deflection testing of PVC sewer pipe installed in accordance with MAG specifications 611.3. The Deflection testing shall not be conducted earlier than seven (7) days after placement

and compaction of the backfill. The Contractor shall conduct all deflection testing in the presence of the Engineer. Should any pipe section exceed the maximum deflection specified, the Contractor shall undertake any remedial action as required to reduce the deflection to within that limit.

D. Gravity Sewer Video Test

Contractor shall conduct a closed circuit TV inspection of all gravity lines 8-inch and greater in accordance with Section 15265, Part 3.2 (A) of the specifications.

## 2.14 DELIVERY, STORAGE AND HANDLING

A. Delivery:

- a. Arrange delivery of products in accordance with construction schedules and to allow inspection prior to installation.
- b. Coordinate deliveries to avoid conflict with conditions at Site.
- c. Deliver products in undamaged condition in original containers or packaging, with identifying labels intact and legible.
- d. Clearly mark identity of partial deliveries of component parts to facilitate assembly.

B. Storage:

- a. Store products immediately on delivery and protect until installed. Store in accordance with manufacturer's instructions, with seals and labels intact and legible.
- b. Provide platforms, blocking or skids, or coverings required to protect products from deterioration or damage.
- c. Arrange storage in manner to provide easy access for inspection.
- d. Maintain storage conditions and cover PVC pipe as necessary to prevent deterioration from UV light or damage.
- e. Protect products after installation to prevent damage from subsequent operations. Remove when no longer needed.

C. Handling:

- a. Provide equipment and personnel necessary to handle products by methods to prevent damage to products or packaging. Handle products by methods to prevent bending or overstressing.

**DIVISION 3**

**CONCRETE WORK**

## **SECTION 03000: CONCRETE WORK**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Cast-in-place concrete including form work, reinforcing steel and miscellaneous materials for sidewalks, manholes, wet wells, equipment concrete pads and footings for walls. The work shall consist of furnishing all labor and material for constructing the concrete work at the locations and in conformance with the details on the Project Plans, this section and as directed by the Engineer. All work under this section shall also conform to Section 505 Concrete Structures and Section 725 Portland and Cement Concrete of the Uniform Standard Specifications and details for Public Works Construction- 2012 Edition, except as noted herein and on the Project Plans.

#### **1.2 SUBMITTALS**

- A. Shop Drawings on reinforcing steel will include: bar placement drawings, bar lists and bending details, certified mill test analyses, tensile and bend test results, bar tags, and welder qualification certificate in accordance with ASTM D12.1-75.
- B. Tests, or certificates of compliance with standards specified in this Section prior to commencing concrete placement for:
  - a. Cement: From each pallet from which cement will be used.
  - b. Aggregates: For each size aggregate from each source of aggregate, for grading, deleterious substances and soundness.
- C. List of admixtures, joint fillers, sealers, curing compounds, and manufactured materials proposed identifying manufacturer and type. Provide data on specific items when requested by OWNER.
- D. Testing laboratory reports required prior to commencing concrete placement for each class of concrete and each size aggregate:
- E. Proposed concrete design mix.
- F. Testing laboratory reports for tests on concrete cylinders taken in field.
- G. Copy of manufacturer's literature (MSDS sheets and ASTM D471 test results) for chemical resistant water stops.

#### **1.3 QUALITY ASSURANCE**

- A. CONTRACTOR shall retain services of qualified independent testing laboratory.
- B. Responsibility of testing laboratory will include:
  - a. Obtaining, making samples and trial batches and performing laboratory and field testing specified.

- b. Provide reports to ENGINEER giving information on materials, design mixes and testing performed.
  - c. Reports shall indicate whether or not materials meet specifications.
- C. Perform Work in accordance with ACI 117, 301, and 347.

#### **1.4 STORAGE OF MATERIALS**

- A. Cement: Keep clean, dry, and free from weather damage.
- B. Aggregates: Stockpile each gradation separately on clean, noncontaminating surface.

#### **1.5 TESTS**

- A. Concrete strength tests:
  - a. Comply with ASTM C39 for testing and ASTM C31 or C192 for preparation of cylinders.
  - b. Trial batches for mix designs:
    - i. Test three (3) specimens at seven (7) days and three (3) at twenty-eight (28) days for each of three (3) points used to define curves showing relationship between water-cement ratio and compressive strength for each mix design.
    - ii. Certified copies of test results for mix designs performed within the preceding six (6) month period, for same aggregates and cement for mix producing strengths equal to required average compressive strengths and from an established central plant, may be submitted for review instead of conducting new trial batch tests.
    - iii. If tests from previous work are not acceptable, prepare trial batch tests as specified.
  - c. Field tests: Sample in accordance with ASTM C172; make and test three (3) cylinders from each sample on basis of not less than:
    - i. One (1) sample from each day's placement for each class of concrete.
    - ii. One (1) sample per truck.
  - d. Cylinders shall be laboratory cured. Test one (1) laboratory cured cylinder at seven (7) days and other two (2) at twenty-eight (28) days for average strength.
  - e. If tests indicate deficient strength as defined by ACI 318, immediately adjust mix to increase average of subsequent test results.
- B. Slump tests:
  - a. Test each batch as delivered; comply with ASTM C172 and C143.

- b. If slump exceeds Specifications, promptly remove batch from Work and dispose of off-site at location selected by CONTRACTOR. Under no circumstances is water to be added to batch after slump test, except in strict accordance with ASTM C94 requirements.
- C. Air content tests:
  - a. Sample on basis specified above for field strength tests.
  - b. Obtain samples from concrete after it has been placed and consolidated.
  - c. Determine air content by pressure method; comply with ASTM C231.
  - d. If air content does not meet Specifications, remove deficient concrete from Work.

## **PART 2 - PRODUCTS**

### **2.1 CEMENT**

- A. Only for wet wells and manholes use Portland cement: ASTM C150, Type V.
- B. For all other concrete work, the Contractor shall conform with Section 505 of MAG Specifications, 2012 Edition, except as noted herein and on the Project Plans.
- C. Use only one (1) brand of cement.

### **2.2 AGGREGATE**

- A. Regular aggregate: Strong, durable, well-graded material conforming to ASTM C33 requirements for grading, deleterious substances and soundness.
- B. Aggregates not conforming exactly to above specifications may be used provided special tests or actual service establish that such aggregates will produce concrete of quality specified.
- C. 1-1/2" to No. 4 coarse aggregate: Use for all concrete unless specified otherwise.

### **2.3 WATER**

- A. Clean, fresh, free from injurious amounts of oil, alkali, acid, salts, organic materials, or other substances that may be deleterious to concrete or steel.

### **2.4 ADMIXTURES**

- A. Water-reducing and set-controlling admixture, ASTM C494, Type A, D, or E as required. Use for all concrete.
- B. Air entraining agent, ASTM C260. Use in accordance with manufacturer's recommendations. Use for all concrete.

### **2.5 REINFORCING**

- A. Bars: ASTM A615, Grade 60 deformed bars.



- B. Bend bars cold to conform to required details.

## 2.6 FORMS

- A. Acceptable materials:
  - a. Douglas fir, exterior type, concrete form plywood, 5/8" thick minimum.
  - b. Removable metal forms with surfaces equal to Douglas fir, exterior type, concrete form plywood.
  - c. Cylindrical reinforced fiberglass forms.
- B. Form ties: Type leaving no metal within 1" of finished surface after removal of forms.
- C. Form coating:
  - a. Wood forms: Nonstaining mineral oil or commercially produced form-release agent that will not bond with, stain, or adversely affect concrete surfaces and curing, and will not impair bond or adhesion of subsequent treatment of concrete surfaces.
  - b. Acceptable material: "Nox-Crete Form Coating" as manufactured by Nox-Crete Chemicals, or equal.
  - c. Metal forms: Treat surfaces as recommended by manufacturer before placing reinforcing.
  - d. Fiber tube forms and form liners: Treat surfaces as specified for wood forms or as recommended by manufacturer.

## 2.7 EXPANSION JOINT MATERIALS

- A. Joint filler: Preformed nonextruding and resilient nonbituminous type, ASTM D1752, Type 1; use for all expansion joints.
- B. Joint sealer:
  - a. "Sonolastic" or "Vinylastic" two-component polysulfide base by Sonneborn Division of Rexnord Chemical Products, Inc.
  - b. Provide primer as recommended by manufacturer.
  - c. Use for all expansion joints.

## 2.8 WATER STOPS

- A. Chemical resistant - Thermoplastic Elastomeric Rubber (TPE-Rubber):
  - a. Type: Earth Shield Part No. JP 636 as manufactured by J.P. Specialties, Inc., or Envirostop Part No. 619 as manufactured by Westec, or equal.

## 2.9 CURING MATERIALS

- A. Liquid membrane-forming compound:
  - a. ASTM C309, Type 1 with fugitive dye, except Type 2 with white pigment for surfaces exposed to direct rays of sun.
  - b. Do not use compounds containing wax, oil, resin, varnish, or other bases that will prevent bonding of finishes such as floor coverings, tile, separate wearing course, additional concrete, paint, and similar applied finishes.
  - c. Use for curing at CONTRACTOR'S option except where specifically excluded.
- B. Plastic film:
  - a. Polyethylene plastic film, white, nonstaining, conforming to ASTM D2103.
  - b. Minimum 4-mil thickness.
  - c. Use for curing at CONTRACTOR'S option except where specifically excluded.
- C. Absorptive mat:
  - a. Cotton fabric, burlap fabric, or burlap-polyethylene material woven or bonded to prevent separation.
  - b. Material shall be clean and non detrimental to concrete or finish.
  - c. Use for curing at CONTRACTOR'S option except where specifically excluded.

## 2.10 GROUT (NOT FOR MASONRY)

- A. Regular grout:
  - a. One (1) part Portland cement to three (3) parts fine aggregate with sufficient water to maintain adequate workability.
  - b. Minimum strength: 4,000 psi at twenty-eight (28) days.
- B. Nonshrink grout:
  - a. Acceptable products:
    - i. "Five Star Grout" by U.S. Grout Corporation.
    - ii. "Masterflow 713 Grout" by Master Builders.
    - iii. "V-I Grout" by W. R. Meadows, Inc.
  - b. Nonmetallic, non-gas forming, and free of chloride, gypsum or corrosive-type materials.
  - c. Minimum strength: 5,000 psi at twenty-eight (28) days.

- d. Use under base plates and equipment.

**2.11 CONCRETE DESIGN AND USE**

- A. Compressive Strength requirements:

Class	Required Compressive Strength, f'c	Minimum Cementitious Materials Content (lbs. per cubic yard)
AA	4,000 psi	600
A	3,000 psi	520

- B. Average compressive strengths: Produce concrete of average strengths noted above unless test results substantiate a lower permissible average strength based on standard deviation criteria set forth in ACI 318.

- C. Maximum water-cement ratio: 0.50 by weight.

- D. Air entrainment: Concrete shall contain entrained air within following limits.

Nominal Maximum Size of Coarse Aggregate, In.	Total Air-Content, Percent By Volume
3/8"	6 to 10
3/4"	4 to 8
1"	3.5 to 6.5
1-1/2"	3 to 6

- E. Workability:

- a. Proportions of concrete shall produce a mixture, suited to placement methods, which will work readily into corners and angles of forms and around reinforcement and embedded items. Segregation of materials or free water will not be permitted.
- b. Slump of concrete: Use minimum practical; vary between 2" to 5" to suit placement conditions; in no case is slump to be increased by addition of water in excess of design mix quantity.

- F. Concrete use: Class A or AA as specified in the plans.

**2.12 READY-MIX CONCRETE**

- A. Provide concrete from an established, approved ready-mix" plant.
- B. Equipment and methods: Conform to ASTM C94, Alternate No. 2.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Construct forms strong, straight, adequately braced and securely fastened.
- B. Remove laitance from previously placed or existing concrete; thoroughly clean surface.
- C. Apply form coating on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

### **3.2 PLACING CONCRETE**

- A. Clean transporting equipment, reinforcing, and embedded items before placing concrete. Remove water and debris from places to be occupied by concrete.
- B. Place no concrete until forms, reinforcing, and embedded items have been verified as adequately supported and accurately placed. Place no concrete over water-covered, muddy, or frozen soil.
- C. Saturate subgrade surface with water immediately prior to placing concrete.
- D. Immediately remove concrete where water, soils, or other deleterious substances are permitted to mix with concrete, form or embedded item movement occurs, or inadequate consolidation is obtained.
- E. Hot weather concreting:
  - a. All hot weather concreting shall comply with ACI 305-77 and these specifications. The Contractor shall take precautions to prevent cracking or crazing of concrete and shall organize his program to arrange pouring of concrete during the early morning or late evening whenever daily temperature exceeds 100 degrees Fahrenheit. The temperature of the concrete to be placed shall not exceed 90 degrees Fahrenheit. The fresh concrete shall be shaded and protected with a light hessian screen within one hour of finishing. The water to be used for mixing shall be kept cool by methods described in ACI 305-77 and approved by the Engineer. The Contractor may, if he so desires, use retarders and admixtures in the concrete after obtaining written permission from the Engineer. The admixtures used shall be in accordance with ACI and Section 03000.
  - b. The Contractor shall provide a thermometer suitable for measuring temperature of wet concrete and a maximum and minimum thermometer shall be hung in a position indicated by the Engineer.
  - c. All freshly placed concrete shall be kept moist on exposed surfaces for 7 days after placing by means approved by the Engineer. Concrete surfaces may be sprayed with a membrane curing compound of approved manufacture immediately after stripping the formwork if approved by the Engineer.
- F. Employ best industry practices to prevent segregation during placing. Do not drop concrete more than 5'. Place in layers approximately 18" deep.

- G. Place concrete continuously in each section until completed. Permit not more than thirty (30) minutes between depositing adjacent layers of concrete within each section, unless an acceptable set retarder is used in concrete mix.
- H. Thoroughly compact, puddle, and vibrate concrete into corners and around reinforcing and embedded items. Use internal vibration where size of section permits.
- I. Maintain concrete temperature between 50°F and 90°F while placing except as specified for hot and cold weather concreting.
- J. Place sections of concrete in sequence which eliminates shrinkage effects to greatest extent practicable.
- K. Protect concrete from injury due to sun, cold weather, running water, construction operations, and other causes until properly cured.

### **3.3 REINFORCEMENT PLACEMENT**

- A. Remove scale, loose flaky rust, dirt, grease, curing compound, and other coatings which would impair bond.
- B. Install slab reinforcing bars in correct position by use of preformed bolsters and spacers, except concrete blocks may be used to position bars in concrete placed on grade.
- C. Space bars properly and tie securely in position before placing concrete. Tack welding to keep reinforcing in place is not permitted.

### **3.4 CONSTRUCTION JOINTS**

- A. Install only where shown or where specifically permitted.
- B. Provide keyway 1-1/2" deep covering approximately 1/3 area of construction joint, unless shown otherwise.
- C. Location where not shown:
  - a. CONTRACTOR shall locate joints using the following guide for OWNER'S review.
  - b. Near center of self-supported slabs, beams, and girders unless beam intersects girder at this point, in which case joints in girders shall be offset a distance equal to twice beam width.
  - c. Underside of deepest beam at walls and piers.
  - d. At other places least likely to impair strength and appearance.
  - e. Provide additional shear reinforcement where requested by ENGINEER.
  - f. Maximum pour unit shall be less than 50' in any dimension unless specified otherwise.

- D. A delay of at least two (2) hours or until concrete is no longer plastic, shall occur after placing concrete for columns or walls before placing concrete for slabs, beams, or girders supported thereon.
- E. Slabs-on-grade: Place concrete in continuous side-by-side strips. Sawcut control joints as soon as possible after concrete hardens.

### **3.5 EXPANSION JOINTS**

- A. Formed joints: Make exposed edge of concrete slightly rounded with edger at joints to contain joint sealer.
- B. Install materials in accordance with manufacturers' instructions. Set preformed material securely in place before placing concrete.
- C. Install joint filler to within joint width (1/2" minimum) of exposed surface. Fill remainder of joint with joint sealer.

### **3.6 EMBEDDED ITEMS**

- A. Install items required under this contract to be embedded in concrete. Install items required by others for embedding in concrete, if so instructed before placing concrete.
- B. Fasten embedded items securely in proper position before placing concrete.
- C. Conduit or pipe embedded in slabs or walls:
  - a. Locate in center of slab or wall and space not closer than three (3) diameters on center; locate to avoid impairing strength of concrete.
  - b. Coordinate placing of reinforcing with conduit or pipe location. Do not cut reinforcing to clear conduit or pipe.
- D. Aluminum pipe shall not be embedded in concrete. Where aluminum projects into or rests against surface of concrete, coat surfaces of aluminum to prevent direct contact with concrete.

### **3.7 GROUTING**

- A. Roughen concrete surfaces by light chipping to remove laitance to approximately 1/4". Do not expose reinforcing steel.
- B. Remove materials which might interfere with bond; prepare surfaces in strict conformance to manufacturer's instructions.
- C. Mix, place, and cure grout in strict accordance to manufacturer's instructions.
- D. Remove shims and leveling bolts after grout is placed. Fill shim voids with grout.
- E. Provide samples and submit cylinder laboratory test results showing compliance with strength specified. Remove and replace grout not having strength test results equal to or greater than minimum specified.

### 3.8 FINISHING

#### A. Flatwork:

- a. Tamp concrete to force coarse aggregate down from surface.
- b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
- c. Dusting of surface with dry cement or sand during finishing operations is not permitted.
- d. Finish surfaces within following tolerances in accordance with ACI 117:
  - i. Slabs: Class BX.
  - ii. Top surfaces of structures other than slabs: In accordance with ACI 117.
- e. Trowel finish:
  - i. Float surface to true, even plane.
  - ii. Steel trowel to smooth, uniform finish, free of defects; steel trowel second time to final burnish finish; use edger on exposed edges.
  - iii. Use on interior floor slabs.
- f. Float finish:
  - i. Float surface to true, even plane.
  - ii. Float second time to uniform finish with wood or cork float; use edger on exposed edges.
  - iii. Use on exposed tops of walls and piers.
- g. Broomed or belted finish:
  - i. Float surface to true, even plane.
  - ii. Steel trowel to smooth, uniform surface.
  - iii. Broom with fiber brush or drag burlap belt across surface in direction transverse to traffic flow.
  - iv. Use on exterior slabs.

#### B. Formed surfaces:

- a. Remove fins, projections, and loose material.
- b. Clean surfaces of form oil.
- c. Patch honeycomb, aggregate pockets, voids, and holes as follows:
  - i. Chip out until sound concrete is exposed to minimum depth of 1".
  - ii. Prepare patching mortar with approximately two (2) parts normal portland cement, one (1) part white cement, nine (9) parts fine aggregate; vary proportions of cement as necessary to match color of adjacent concrete.
  - iii. Saturate surfaces with water and fill cavities with patching mortar.
- d. Fill holes left by form ties with patching mortar.
- e. Cure patches as specified for concrete.

### **3.9 FORM REMOVAL**

- A. Minimum time before removal after placing concrete, unless permitted otherwise:
  - a. Footings: Twenty-four (24) hours.
  - b. Walls, piers, and columns: Forty-eight (48) hours twenty-four (24) hours for metal-lined forms).
  - c. Self-supported beams and slabs: Fourteen (14) days.
  - d. Time specified above represents cumulative time during which temperature of concrete is maintained above 50°F.
- B. Reduce removal time by half for high-early-strength cement concrete.
- C. In any event, do not remove supporting forms and shoring until concrete has acquired sufficient strength to safely support own weight plus construction loads.
- D. Take care when removing forms that concrete is not marred or gouged and that corners are true, sharp and unbroken.

### **3.10 CURING**

- A. Cure all concrete; begin curing as soon as possible after placement of concrete.
- B. Method of concrete curing optional.
- C. Plastic film curing:
  - a. Dampen surface of concrete and lay plastic film with minimum 6" side laps; tape side laps.
  - b. Hold film in place with lumber or use similar provisions to prevent exposure of concrete for seven (7) days after placing.
- D. Water curing:
  - a. Keep concrete continuously wet for seven (7) days after placing.
  - b. Use on concrete surfaces not receiving compound or plastic film curing.
  - c. Clean, nonstaining absorptive mat may be used with water curing.
- E. Method must be submitted to ENGINEER for approval.

### **3.11 MISCELLANEOUS CONCRETE ITEMS**

- A. Equipment bases and foundations. Provide as indicated on the drawings, or as required for such equipment as actually furnished, if different from arrangement shown on the drawings. Anchor bolts shall be set with template, in compliance with manufacturer's certified equipment diagrams or templates. Isolation joints at base shall be provided where indicated or required.
- B. Openings for work of other trades left in concrete structures or slabs shall be filled, unless otherwise directed by the Engineer, after such other work is in place and approved. Filling concrete shall be mixed, placed, and cured as specified for the concrete of the structure.



## **SECTION 03410: PRECAST POLYMER AND CONCRETE STRUCTURES**

### **PART 1 - GENERAL**

#### **1.1 SCOPE OF WORK**

- A. Furnish all materials, labor, and equipment and construct manholes, wet wells, valve pits, and accessory items, consisting of precast sections as shown on the Drawings and as specified herein.
- B. The forms, dimensions, concrete, and construction methods shall be approved by the ENGINEER in advance of construction.
- C. These specifications are intended to give a general description of what is required, and do not cover all of the structural design details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, shop testing, delivery, and complete installation of all precast structures whether specifically mentioned in these specifications or not.
- D. The supplier of the precast manholes, wet wells, valve pits, meter pits, and accessory items shall coordinate his work with that of the CONTRACTOR to the end that the unit will be delivered and installed in the excavation provided by the CONTRACTOR, in accordance with the CONTRACTOR'S construction schedule.
- E. Coordinate the precast structures fabrication with the equipment supplied to achieve the proper structural top slab openings, spacings, and related dimensions for the selected equipment frames and covers.
- F. No separate payment for wet wells and valve vaults will be made. Payment for wet wells and valve vaults will be included in the Lump Sum Bid Item for the respective lift station. Payments for Manholes will be made in accordance with the items described in the Bid Proposal.

#### **1.2 SUBMITTALS**

- A. Submit to the ENGINEER, as provided in the General Conditions, shop drawings showing details of construction, reinforcing and joints.
  - a. Shop Drawings
    - i. Content
    - ii. Dimensions and finishes
    - iii. Estimated camber
    - iv. Reinforcing and connection details
    - v. Anchors
    - vi. Lifting and erection inserts
    - vii. Other items cast into members
- B. Show location of unit by same identification mark placed on member.
  - a. Include design calculations including buoyancy calculations for each wet well. Wet well designs shall be signed and sealed by a Professional Engineer licensed in the State of Arizona. Submit manufacturer's catalog data on precast items. Provide details and dimensions of each unit including reinforcement, the thickness of polymer concrete sections, and locations of the hatch, ladder, sump, and other required items.

- i. Manufacturer's Literature: Manufacturer's recommended installation instructions.
  - ii. Manufacturer's certificates of material conformance with specifications.
  - iii. Test Reports: Reports of tests on concrete.
  - iv. Testing
- C. Manholes and Valve Vaults: Four (4) concrete test cylinders shall be taken for every 50 cubic yards (cu. yds) for each type of precast structure.
- D. Lift Stations: Four (4) concrete test cylinders shall be taken for each lift station wet well. Four (4) concrete test cylinders shall be taken for each lift station's top and bottom slabs.
- E. Certification: The supplier shall provide the certified results of testing (7 day, 28 day) for the test cylinders stated herein. Random test cylinders may be taken at any time by the ENGINEER at the OWNER'S expense.
- F. Facility Quality Control should be maintained by adhering to ISO 9001 for manufacturing. All fabricators will be ISO 9001 Certified. All fabrication of wet wells and polymer manholes will take place in an all polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility. Fabricator is also to provide references of 5 previous projects in the last 5 years performed with both owner and contractor for reference and review by owner.

### **1.3 DESIGN REQUIREMENTS**

- A. Minimum design adequacy of base and top slab reinforcement for manholes, wet wells and valve vaults is for AASHTO H-20 truck loading.

### **1.4 INSPECTION**

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the ENGINEER, or other representatives of the OWNER. Such inspection may be made at the place of manufacturer, or at the site after delivery, or at both places, and the sections shall be subject to rejection at any time on account of failure to meet any of the Specification requirements; even though sample sections may have been accepted as satisfactory at the place of manufacture. Sections rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed, shall be repaired, if permitted and accepted by ENGINEER, or removed and replaced, entirely at the CONTRACTOR'S expense.
- B. At the time of inspection, the sections will be carefully examined for compliance with ASTM C478 designation and these Specifications, and with the approved manufacturer's drawings. All sections shall be inspected for general appearance dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections may be repaired, subject to the approval of the ENGINEER, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at the end of 7 days and 5,000 psi at the end of 28 days, Epoxy mortar may be utilized for repairs subject to the approval of the ENGINEER.

## **PART 2 - PRODUCTS**

### **2.1 PRECAST POLYMER CONCRETE WET WELLS AND CONCRETE VALVE VAULTS**

- A. Precast submersible pump station wet wells shall consist of precast base, precast wet well sections, and top cover slab. Precast valve vaults shall consist of precast base, sidewalls and top slab. For wet wells and valve vaults, provide an integrally cast concrete base slab with minimum slab thickness as shown on the drawings. Concrete shall be air entrained at the time of delivery and shall have a minimum compressive strength of 4,500 psi at the end of 28 days. The minimum concrete clear cover shall be 2 inches due to the severe soil conditions.
- B. Joints between precast concrete sections shall be set by plastic shims and fitted with non-metallic non-shrink grout as shown on the drawings.
- C. No direct opening between vault and wet well shall exist. A 2-inch PVC floor drain with P-trap from the vault to the wet well shall be required, as shown on the Drawings.
- D. The top slab sections shall be fitted with water tight hatches. The frames and covers will be sized for the openings shown on the drawings.
- E. The various precast sections should have the inside dimensions and minimum thickness of concrete as indicated on the drawings. All precast and cast-in-place concrete members shall conform to the Building Code Requirements for Structural Concrete ACI 318 and commentary.
- F. A vent pipe shall be furnished and installed as shown on the drawings.
- G. Fillets shall be provided and installed in the wet wells as shown on the drawings.
- H. Precast structures shall be constructed to the dimensions as shown on the drawings and as specified in these Specifications.
- I. Type V cement shall be used except as otherwise approved.
- J. The date of manufacture and the name or trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- K. Sections shall be cured by an approved method and shall not be shipped until the minimum 7-day compressive strength has been attained.
- L. Each pre-cast section manufactured in accordance with the drawings shall be clearly marked to indicate the intended pump station installation location. The CONTRACTOR shall be responsible for the installation of the correct pre-cast sections in their designated pump station locations.
- M. Unless shown otherwise on the drawings, the minimum interior dimensions for valve vaults shall be 8-foot by 6-foot with a minimum wall thickness of 6 inches.
- N. Wet wells and valve vaults shall be of the type shown on Drawings and as specified herein. Wet wells shall be as manufactured by Geneva Polymer Products, or approved equal; and, valve vaults shall be as manufactured by Jensen Precast, or approved equal. Alternate manufacturer, Hanson provided said manufacturer meets the specifications.

## 2.2 PRECAST POLYMER CONCRETE SECTIONS FOR CIRCULAR WET WELLS

- A. Polymer Concrete Wet wells shall meet and exceed the requirements of ASTM C478, Specification for Precast Reinforced Concrete Manhole Sections, with the exclusion of Section 10(a), except as modified herein. Polymer concrete shall adhere to the mix designed found in ASTM D6783. Polymer concrete shall meet the minimum requirement for 10000 psi compression strength breaks and 2000 psi break in flexural strength. Minimum wall thickness shall be 6 inches unless otherwise shown on the drawings. The required minimum strength of concrete shall be confirmed by making and testing three standard cylinders at seven days. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Submit shop drawings, consisting of manufacturers' standard details of various sections for approval prior to placing order for wet wells. Drawings of individual wet wells showing invert elevations, pipe sizes and similar details will not be required.
- B. Joints. Form joint contact surfaces with machined castings. Surfaces shall be exactly parallel with nominal 1/16 inch clearing and the tongue equipped with a proper recess for the installation of a mastic connection "RAM-NEK", or approved equal, or butyl mastic sealing compound conforming to Federal Specification SSS-00210 (GSA-FSS), Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints may be used in lieu of O-ring rubber gaskets.

## 2.3 PIPE CONNECTIONS AT STRUCTURES

- A. Where pipes are to extend into or through structures from the exterior, flexible connections (mechanical or push-on type joints) shall be provided at the exterior wall face.
- B. For pipes passing through structural walls, wall pipes with water stops shall be installed where the location is below the surface of the ground or at any point where fluid levels will exceed that elevation. Neoprene sleeves with watertight caulking and 316 Series SS stainless steel clamps will be suitable at other locations.
- C. Contractor shall conform to the requirements of Section 15200 – Pipe Connecting and Restraint Devices.

## 2.4 PROTECTIVE COATINGS AND DAMP- PROOFING FOR CONCRETE

- A. Exterior of Precast Concrete Structures – Factory apply exterior surfaces of valve vaults, and concrete manholes with Carboline "Bitumastic 300M", or approved equal to a thickness of 30 mils in accordance with the manufacturers instructions and approved by the Engineer. Field apply coating to exterior surfaces along all patched riser joints.
- B. Interior of Concrete Manholes – All interior surfaces of concrete manholes shall be coated with Carboline Plasite -4500 S Epoxy, or approved equal to a thickness of 60 mils in accordance with the manufacturers instructions and approved by the Engineer. Note: Polymer manholes do not require coating.
- C. Interior of Valve Vaults - All interior surfaces of valve vaults shall be coated with Carboline "Bitumastic 300M", or approved equal to a thickness of 30 mils in accordance with the manufacturers instructions and approved by the Engineer.

- D. Coating Interior of Manholes with Insecticide – Coat (paint) the interior of all manholes (including polymer manholes) in accordance with the manufacturer's instructions with INSECTA, or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. A minimum of an 18-inch layer of Engineered Fill shall be placed as a foundation for the wet well base slabs in accordance with the Drawings.

#### **3.2 MANHOLE CONSTRUCTION**

- A. General: Place pre-cast base as applicable. Inverts and floors preformed in the factory prior to shipment
- B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.
- C. Seal all pipe penetrations in manhole. Form pipe openings smooth and well shaped. After installation, seal cracks with non shrink grout. After grout cures, wire brush smooth and apply two coats emulsified fibered asphalt compound to minimum wet thickness of 1/8 inch to ensure complete seal.
- D. Set and adjust frame and cover final 6 inches (minimum) to 18 inches (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.
- E. Manholes shall be constructed per MAG Standard Specification Sections 505 and 625, and Standard Details. Manhole Sealed Lids per MAG Standard Detail 423.

#### **3.3 VALVE VAULT CONSTRUCTION**

- A. The vault base section shall be placed on a eight-inch thick minimum base of compacted crushed rock over undisturbed soils, and shall be graded level to the elevation shown on the Drawings.
- B. The concrete vault base section and successive precast sections will receive a joint sealing compound prior to setting the precast sections in place. The joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint, which will remain impermeable throughout the design life of the structure. Following placement of the precast sections, the joints shall be mortared and tooled to a smooth finish, free of voids.
- C. Assemble the precast sections to the elevation required by the Drawings.
- D. Secure the vault access door in accordance with the manufacturer's recommendations. Access doors shall be built up so that the hatch is installed as required. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments.
- E. Adjustable-linked rubber seal devices providing seals around pipe penetrations through precast concrete vaults shall be assembled and installed in accordance with the manufacturer's recommendations.

- F. Non-shrink grout providing seals around pipe penetrations through precast concrete vaults instead of, or in addition to, adjustable-linked rubber seal devices shall be installed in accordance with Section 03000.
- G. Where vaults are to be given a protective coating, they shall be free of seepage and surface moisture.
- H. After the vault and all appurtenances are in place and are approved by the Engineer, backfill shall be placed to the original grade or to the limits shown on the approved plans. 1.00 cu ft of crushed rock shall be placed adjacent to the hatch gutter drain outlet.
- I. Install ladders using Type 316 stainless steel anchors secured in place using an epoxy adhesive in accordance with Section 03000. Extendable handrails shall be mounted to the outside portion of the ladder railing.

### **3.4 WET WELL CONSTRUCTION**

- A. The CONTRACTOR shall be responsible for control of ground water to provide firm, dry subgrade for the structure, shall prevent water rising on or joint sections within 24 hours after placing, and shall guard against flotation or other damage resulting from ground water or flooding.
- B. A minimum of a 18 inch layer of Engineered Fill shall be placed as a foundation for the wet well base slabs per the Drawings.
- C. Construct Precast bases made of polymer concrete. Make invert slope toward pumps as shown on plans. Pour base slab integral with bottom barrel section.
- D. Build each wet well to dimensions shown on plans.
- E. For all horizontal mating surfaces between concrete to concrete and concrete to metal, install resilient O-ring type gaskets, or butyl mastic connection and external joint wrap.
- F. Seal all pipe penetrations in wet well. Form pipe openings smooth and well shaped. After installation, seal cracks with non shrink grout. After grout cures, wire brush smooth and apply two coats emulsified fibered asphalt compound to minimum wet thickness of 1/8 inch to ensure complete seal.
- G. Place Double Leaf Hatch at surface per dimensions shown on plans. Place frame integral with polymer concrete roof. See manufacturer's recommendation for construction methods.
- H. Backfill material around the wet well and above the pipe bedding shall be selected material as specified in Section 02350.
- I. Precast bases, conforming to all requirements of ASTM C478 and above listed requirements for precast polymer concrete sections, may be used. The base shall be set in place on a thoroughly compacted crushed stone sub-base and adjusted in grade for the correct structure elevation.
- J. The station shall not be set into the excavation until the installation procedure and excavation have been approved by the ENGINEER. The Contractor shall conform to the backfill and compaction recommendations in the Geotechnical Report (Appendix A) and in accordance with Sections 02250: Earthwork and 02350: Excavation of these specifications.

- K. Precast concrete structure sections shall be set so as to be vertical and with sections in true alignment with a 2 inch maximum tolerance to be allowed. The outside and inside joint shall be filled with a non-shrink polymer grout and finished flush with the adjoining surfaces. Allow joints to set for 24 hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If leaks appear in the structures, the inside joints shall be caulked with lead wool to the satisfaction of the ENGINEER. Install the precast sections in a manner that will result in a watertight joint.
- L. Holes in the concrete sections required for handling or other purposes shall be plugged with a non-shrinking polymer grout or by grout in combination with concrete plugs.
- M Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done by core drilling prior to setting them in place to prevent any subsequent jarring which may loosen the mortar joints.

END OF SECTION 03410

**DIVISION 7**

**THERMAL AND MOISTURE PROTECTION**





**DIVISION 9**

**FINISHES**



## **SECTION 09910: PAINTING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - a. Field applied paints and coatings for normal exposures
  - b. Painting Accessories.
  
- B. Contractor shall refer to Section 3.7 – 3.9 for the appropriate system of the item painted. Only Painting Systems AA and EE are applicable for exterior piping and valves, nonsubmerged and submerged, unless otherwise shown on the drawings.

#### **1.2 DEFINITIONS**

- A. Paints: Manufacturer's best ready-mixed coatings, except when field catalyzed, with fully ground pigments having soft paste consistency and capable of being readily and uniformly dispersed to complete homogeneous mixture, having good flowing and brushing properties, and capable of drying or curing free of streaks or sags.
  
- B. Volatile Organic Compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon.

#### **1.3 RELATED SECTIONS**

- A. Division 15 - Mechanical
  
- B. Division 16 – Electrical

#### **1.4 SUBMITTALS**

- A. General: Submit in accordance with Section 01310.
  
- B. Shop Drawings: Include schedule of where and for what use coating materials are proposed in accordance with requirements for Product Data.
  
- C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips.
  
- D. Samples: Include 8 inch square draw-downs or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.
  
- E. Manufacturer's Instructions: Submit in accordance with requirements for Product Data include:
  - a. Special requirements for transportation and storage.
  - b. Mixing instructions.
  - c. Shelf Life.
  - d. Pot life of material.

- e. Precautions for applications free of defects.
- f. Surface preparation.
- g. Method of application.
- h. Recommended number of coats.
- i. Recommended thickness of each coat.
- j. Recommended total thickness.
- k. Drying time of each coat, including prime coat.
- l. Required prime coat.
- m. Compatible and non-compatible prime coats.
- n. Recommended thinners, when recommended.
- o. Limits of ambient conditions during and after application.
- p. Time allowed between coats.
- q. Required protection from sun, wind and other conditions.
- r. Touch-up requirements and limitations.

## **1.5 QUALITY ASSURANCE**

- A. Products: First line or best grade.
- B. Materials for Each Paint System: By single manufacturer.
- C. Applicator Qualifications: Applicator of products similar to specified products with minimum 3 years experience.
- D. Regulatory Requirements: Comply with by using paints that do not exceed governing agency's VOC limits or do not contain lead.
- E. Field Samples: Paint one complete surface of each color scheme to show colors, finish texture, materials and workmanship. Obtain approval before painting other surfaces.

## **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products in accordance with Section 01530
- B. Remove unspecified and unapproved paints from Project site immediately.
- C. Deliver containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
- D. Store coatings in well ventilated facility that provides protection form the sun weather, and fire hazards. Maintain ambient storage temperature between 45 and
- E. 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.
- F. Take precautions to prevent fire and spontaneous combustion.

## 1.7 ENVIRONMENTAL CONDITIONS

- A. Surface Moisture Contents: Do not paint surfaces that exceed manufacturer specified moisture contents, or when not specified by the manufacturer, the following moisture contents:
  - a. Plaster and Gypsum Wallboard: 12 percent.
  - b. Masonry, Concrete and Concrete Block: 12 percent.
  - c. Interior Located Wood: 15 percent.
  - d. Concrete Floors: 7 percent.
- B. Do Not Paint or Coat:
  - a. Under dusty conditions.
  - b. When light on surfaces measures less than 15 foot-candles.
  - c. When ambient or surface temperature is less than 50 degrees Fahrenheit or unless manufacturer allow a lower temperature.
  - d. When relative humidity is higher than 85 percent.
  - e. When surface temperature is less than 5 degrees Fahrenheit above dew point.
  - f. When surface temperature exceeds the manufacturer's recommendation.
  - g. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
  - h. Apply clear finishes at minimum 65 degrees Fahrenheit.
- C. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 50 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes.

## 1.8 PROTECTION

- A. Protect adjacent surfaces from paint and damage. Repair damage resulting from inadequate or unsuitable protection.
- B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.
- C. Place cotton waste, cloths, and material that may constitute fire hazard in closed metal containers and remove daily from site.
- D. Remove electrical plates, surface hardware, fittings and fastenings, prior to painting operations. Carefully store, clean and replace on completion of painting in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

## 1.9 EXTRA MATERIALS

- A. Extra Materials: Deliver in accordance with Section 01700. Include minimum 1 gallon of each type and color of coating applied.

- a. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
- b. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type and color.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Paints: One of the following or approved equal:
  - a. Carboline: Carboline, St. Louis, MO.
  - b. Devoe: Devoe Coatings, Louisville, KY.
  - c. Dunn Edwards: Dunn Edwards Paints, Los Angeles, CA.
  - d. Frazee: Frazee/Deer-O Paints, City of Commerce, CA.
  - e. Fuller: Fuller O'Brien Paints, San Francisco, CA.
  - f. Pittsburgh: Pittsburgh Paints.
  - g. Benjamin Moore Paints.
  - h. S-W: Sherwin-Williams Co., Cleveland, OH.
  - i. Sinclair: Sinclair Paints.
  - j. Tnemec: Tnemec Co., Kansas City, MO.

### **2.2 PRETREATMENT, PRIMERS, PRIMER-SEALERS, AND WOOD STAIN**

- A. Aluminum Primer: One of following or approved equal:
  - a. Carboline: 1037 WP.
  - b. S/W: B50Y1, Zinc Chromate Primer for alkyd systems. None required for latex systems.
- B. Concrete Masonry Filler/primer: One of following or approved equal:
  - a. S/W: B42W25, Block Filler Interior/Exterior.
  - b. Tnemec: 130-6601, Envirofill.
- C. Concrete, Porous, Filler/primer: One of following or approved equal:
  - a. S/W: B42W25, Block Filler Interior/Exterior.
  - b. Tnemec: 130-6601, Envirofill.
- D. Concrete, Smooth, Filler/primer: One of following or approved equal:
  - a. S/W: B61W2, Epoxy Ester Masonry Filler/Sealer.
  - b. Tnemec: W55 WB, Tneme-Crete.
- E. Ferrous Metal Primer: One of following or approved equal:
  - a. S/W: B50WZ1, Kem Kromik Universal Metal Primer.
  - b. Tnemec: Series 135 Chembuild.
- F. Galvanized Metal Surface Pretreatment Materials: One of following or approved equal:
  - a. Amercoat: 59.
  - b. S/W: P60G2, Wash Primer.
  - c. Tnemec: 32-1210, Tneme-Grip.

- G. Galvanized Metal Surface Primer: One of following or approved equal:
  - a. S/W: B66W1 for alkyd. None for latex systems.
  - b. Tnemec: Series 135 Chembuild.
- H. Plaster Sealer: One of following or approved equal:
  - a. S/W: Promar 200 Primer.
  - b. Tnemec: 51-792, PVA Sealer.
- I. Plywood, Latex Finishes: One of following or approved equal:
  - a. S/W: B42W41, A100 Latex Primer.
  - b. Tnemec: Series 151, Elasto-Grip.
- J. Wood Primer for Opaque Finish Paint, Interior Exposure: One of following or approved equal:
  - a. S/W: B49WZ2, Wall and Wood Primer.
- K. Wood Primer for Opaque Finish Paint, Exterior Exposure: One of following or approved equal:
  - a. S/W: Y24W20, A-100 Primer.
- L. Wood Stain: One of following or approved equal:
  - a. S/W: A40, Oil Stain.

### **2.3 PAINTS, INTERIOR EXPOSURE**

- A. Latex, Flat: One of following or approved equal:
  - a. S/W: Promar 200, Latex Flat Wall Paint.
  - b. Tnemec: Series 6, Tneme Cryl.
- B. Latex, Semi-gloss: One of following or approved equal:
  - a. S/W: Promar 200, Latex Semi-Gloss Wall Paint.
  - b. Tnemec: Series 7, Tneme Cryl.
- C. Alkyd, Gloss: One of following or approved equal:
  - a. S/W: B54Z, Industrial Enamel, VOC Complying.
- D. Acrylic, Semi-gloss: One of following or approved equal:
  - a. S/W: B31W200, ProMar 200 Interior Latex, Semi Gloss Enamel.
- E. Urethane Varnish, Clear: One of following or approved equal:
  - a. Flecto: Varathane Exterior Liquid Plastic.
  - b. S/W: A67V4, Exterior Varnish.
- F. Oil: One of the following or approved equal:
  - a. Watco Danish Oil.

### **2.4 PAINTS, EXTERIOR EXPOSURE**

- A. Latex, Flat: One of following or approved equal:
  - a. S/W: A-100, Flat Exterior Latex.
  - b. Tnemec: W55 WB, Tneme-Crete.
- B. Alkyd, Gloss: One of following or approved equal:



- a. S/W: B54Z, Industrial Enamel, VOC Complying.
- C. Acrylic Latex, Semi-gloss: One of following or approved equal:
  - a. S/W: A100, Latex House and Trim Paint.
- D. Urethane Varnish, Clear: One of following or approved equal:
  - a. Flecto: Varathane Exterior Liquid Plastic.
  - b. S/W: A67V4, Exterior Varnish.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Thoroughly examine surfaces scheduled to be painted before starting work.
- B. Start painting when unsatisfactory conditions have been corrected.

#### **3.2 SURFACE PREPARATION**

- A. Prepare surfaces in accordance with paint manufacturer's instructions or when none, the following:
  - a. Aluminum: Remove surface contamination by steam, high pressure water or degreasers. Abrade surface by abrasive blasting, power tool cleaning or hand tool cleaning. Apply etching primer.
  - b. Reinforced Concrete Panels: Remove dirt, powdery residue and foreign matter. Paint immediately; both sides when applicable.
  - c. Canvas and Cotton Insulation Coverings: Remove dirt, grease and oil.
  - d. Concrete Floors: Remove contamination, abrasive blast or acid etch and rinse with clear water. Ensure required acid-alkali balance is achieved. Allow to dry thoroughly.
  - e. Copper for Paint Finish: Remove contamination by steam, high pressure water or degreasers. Abrade surface by abrasive blasting, power tool cleaning or hand tool cleaning. Apply vinyl etch primer.
  - f. Copper for Oxidized Finish: Remove contamination. Apply oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for correct effect. Once attained rinse surfaces well with clear water and allow to dry.
  - g. Gypsum Wallboard: Remove contamination and prime to show defects. Repair and prime defects.
  - h. Galvanized Surfaces: Remove surface contamination and oils and wash with degreasers. Apply coat of etching type primer.
  - i. Zinc Coated Surfaces: Remove surface contamination and oils and prepare for priming in accordance with metal manufacturer's recommendations.
  - j. Concrete and Concrete Masonry: Remove dirt, loose mortar, scale, powder and other foreign matter. Remove oil and grease with solution of tri-sodium phosphate. Remove stains caused by weathering of corroding metals with solution of sodium metasilicate. Rinse well and allow to thoroughly dry. Spot prime exposed metal with alkyd primer.
  - k. Plaster: Fill hairline cracks, small holes and imperfections with patching plaster. Smooth off to match adjacent surfaces. Wash and neutralize high alkali surfaces where they occur.

- l. Unprimed Steel and Iron: Remove grease, rust, scale, dirt and dust by wire brushing, sandblasting or other necessary method.
- m. Shop Primed Steel: Sand and scrape to remove loose primer and rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces. Prime bare steel surfaces.
- n. Wood and Millwork: Sandpaper to smooth even surface. Wipe off dust and grit prior to priming. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats.
- o. Exterior Wood Siding: Remove dust, grit and foreign matter. Seal knots, pitch streak and sappy sections. Fill nail holes with exterior caulking compound after prime coat has been applied.
- p. Mildew: Remove by scrubbing with solution of tri-sodium phosphate and chlorine bleach. Rinse with clean water and allow surface to dry completely.
- q. Glue Laminated Woods: Remove grease and dirt. Wash down surfaces with degreasers.

### **3.3 APPLICATION**

- A. Apply each coat at proper consistency.
- B. Tint each coat of paint slightly darker than preceding coat.
- C. Sand lightly between coats to achieve required finish.
- D. Do not apply finishes on surfaces that are not sufficiently dry.
- E. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.
- F. Where clear finishes are required ensure tint fillers match wood. Work fillers well into grain before set. Wipe excess from surface.
- G. Backprime exterior woodwork, which is to receive paint finish, with exterior primer paint.
- H. Backprime interior woodwork, which is to receive paint or enamel finish, with enamel undercoat paint.
- I. Backprime interior and exterior woodwork, which is to receive stain or varnish finish, with gloss varnish reduced 25 percent with mineral spirits.
- J. Prime top and bottom edges of wood and metal doors with enamel undercoat when they are to be painted.
- K. Prime top and bottom edges of wood doors with gloss varnish when they are to receive stain or clear finish.

### **3.4 MECHANICAL AND ELECTRICAL EQUIPMENT**

- A. Identify equipment, ducting, piping, and conduit in accordance with Related Sections.

- B. Remove grilles, covers and access panels for mechanical and electrical system from location and paint separately.
- C. Finish paint primed equipment with color selected by the ENGINEER.
- D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars and supports, except where items are plated or covered with prefinished coating.
- E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.
- F. Paint interior surfaces of air ducts, convactor and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.
- G. Paint dampers exposed immediately behind louvers, grilles, convactor and baseboard cabinets to match face panels.
- H. Paint exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.
- I. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
- J. Color code equipment, piping, conduit and exposed ductwork and apply color banding and identification, such as flow arrows, naming and numbering, in accordance with DIVISIONS 15 and 16.

### **3.5 SURFACES NOT REQUIRING FINISHING**

- A. Stainless Steel, Brass, Bronze, Copper, Monel, Chromium, Anodized Aluminum: Specially finished articles such as porcelain enamel, plastic coated fabrics, and baked enamel.
- B. Finished products such as ceramic tile, windows, glass, brick, resilient flooring, acoustical tiles, board and metal tees; other architectural features, such as finish hardware, furnished in aluminum, bronze or plated ferrous metal, prefinished panels, or other items that are installed prefinished.
- C. Items completely finished at factory, such as preformed metal roof and wall panels, aluminum frames, toilet compartments, sound control panels, acoustical tiles, shower compartments, folding partition, flagpole.

### **3.6 CLEANING**

- A. As work proceeds and upon completion, promptly remove paint where spilled, splashed, or spattered.
- B. During progress of work, keep premises free from unnecessary accumulation of tools, equipment, surplus materials and debris.
- C. Upon completion of work, leave premises neat and clean.

### 3.7 PAINT SYSTEMS SCHEDULE

- A. System A: Metals, exterior. One of the following or approved equal.
  - 1. Primer on ferrous metals: AKem Kromiks - Universal metal primer B50 Series.
  - 2. Primer, on galvanized metal and aluminum: AGalvite HS, B50WZ30.
  - 3. Primer shop-primed surfaces: Compatible zinc-rich primer as furnished for materials requiring touch-up.
  - 4. Finish coats: 2 coats AMetalatex - semi-gloss coating B42 Series.
  
- B. System B: Metals, exterior.
  - 1. Primer: AKem Kromika - Universal Metal Primer B50 Series.
  - 2. Finish coat: ASteel-Master= 9500 silicone alkyd (VOC) B56 Series.
  
- C. System C: Concrete and concrete masonry, exterior.
  - 1. Finish coats: 2 coats AMetalatexs semi-gloss coating B42 Series.
  
- D. System F: Wood, exterior, surfaces to be painted.
  - 1. Primer: 1 coat AWeather Perfect- exterior alkyd undercoater Y24W538.
  - 2. Finish coats: 2 coats AMetalatex= semi-gloss coating B42 Series.
  
- E. System H: Parking lot striping.
  - 1. 1 coat ASetFast= fast dry latex traffic marking paint; TM226, white. TM225, yellow.
  
- F. System M: Drywall and plaster surfaces, interior.
  - 1. Primer, drywall: 1 coat APrep-Rite 200= latex wall primer B28W200.
  - 2. Finish coats: 2 coats APro-Mar 400= latex A Eg-Shell enamel B20W400.
  
- G. System S: Metals, interior.
  - 1. Primer and touch-up on shop-primed surfaces, on ferrous metals: AKem Kromik-Universal Metal Primer (low VOC) B50Z Series.
  - 2. Primer, on galvanized metal and aluminum: Galvite HS; B50WZ30.
  - 3. Primer shop-primed surfaces: Compatible zinc-rich primer as furnished for materials requiring touch-up.
  - 4. Finish coats: 2 coats APro-Mar 400= interior latex AEg-Shell; B20W400.
  
- H. System T: Metals, interior.
  - 1. Primer: 1 coat AKem Bond HS= primer (low VOC) B502 Series.
  - 2. Primer shop-primed surfaces: Compatible zinc-rich primer as furnished for materials requiring touch-up.
  - 3. Finish coat: 1 coat ATile-Clads high-solids epoxy B62Z100 Series.
  
- I. System V: Concrete and concrete masonry, interior.

1. Filler: "Prep Rite Block Filler" B25W25.
2. Primer (concrete only): 1 coat "Prep Rite 400" B28W400.
3. Finish coats: 2 coats AMetalatex- semi-gloss coating B42 series.

J. System W: Concrete and concrete masonry, interior, epoxy finish.

1. Filler: 1 coat "Prep Rite Block Filler" B25W25.
2. Finish coats: 1 coat 2 coats "Water-Based Catalyzed Epoxy" B70-200.
3. Finish coat (concrete only): 1 coat "Water-Based Catalyzed Epoxy" B70-200.

K. System AA:

1. Surface preparation: Commercial blast cleaning.
2. First coat: "65-1255 Poxiprime" epoxy-polyamide primer, 3.0 mdft.
3. Second coat: "74 Endura-Shield", high-build acrylic polyurethane enamel, 3.0 mdft.
4. Use: Exterior steel surfaces, non-immersion.

L. System CC:

1. Surface preparation: Commercial blast cleaning.
2. First coat: "65-1255 Poxiprime" epoxy-polyamide primer, 3.0 mdft.
3. Second coat: "66 High-Build Epoxoline", epoxy-polyamide coating, 5.0 mdft.
4. Use: Interior steel surfaces, non-immersion (severe exposure).

M. SYSTEM EE:

1. Surface preparation: Near-white blast cleaning.
2. First coat: "69 High-Build Epoxoline - II," polyamidoamine epoxy, 6.0 mdft.
3. Second coat: "69 High-Build Epoxoline - II," polyamidoamine epoxy, 6.0 mdft.
4. Use: Immersion or non-immersion steel.

### 3.8 COLOR SCHEDULE

A. Colors will be determined by Owner at commencement of project.

Color	Description

### 3.9 PAINT SCHEDULE

A. Colors will be selected after award of contract from manufacturer's standard colors.

Item Description	System	Color
<b>Exterior</b>		
Structural and miscellaneous steel	A	
Hollow metal doors and frames	A	

Galvanized and aluminum	A	
Metal surfaces (mild industrial environment)	B	
Concrete and masonry	C	
Concrete masonry (opaque stain)	D	
Precast concrete (semi-transparent stain)	E	
Parking lot striping	H	
Rooftop mechanical equipment, i.e. air handling units, roof exhausters, smoke vents		
Steel guard posts	A	
Steel handrails and guardrails	A	
Fire hydrants		
Post indicator valves		
Steel lintels	A	
Cement fiberboard	A	
Sluice gates and accessories (submerged)	EE	
Gate and valve operators	AA	
Ferrous piping and valves (nonsubmerged)	AA	
Ferrous piping and valves (submerged)	EE	
Miscellaneous nonsubmerged ferrous metals (unless otherwise specified)	AA	
Miscellaneous submerged ferrous metals (unless otherwise specified)	EE	
<b>Interior</b>		
Drywall and plaster	M	
Drywall and plaster (epoxy coating)	N	
Structural and miscellaneous steel	S	
Structural and miscellaneous steel (ceilings)	U	
Hollow metal doors and frames	S	
Galvanized and aluminum	S	
Metal surfaces (epoxy coating)	T	
Concrete and masonry	V	
Concrete and masonry (epoxy coating)	W	
Concrete floor	X	
Piping, galvanized		
Piping, nongalvanized		
Piping, insulated		
Piping, canvas jacketed		
Pumps and motors (nonsubmerged)	CC	
Pumps and motors (submerged)	EE	
Grates	EE	
Gate operators	CC	
Ferrous piping and valves (nonsubmerged)	CC	
Ferrous piping and valves (submerged)	EE	
Miscellaneous nonsubmerged ferrous metals (unless otherwise specified)	CC	
Miscellaneous submerged ferrous metals (unless otherwise specified)	EE	
PVC chlorine pipes and valves		

## SECTION 09930: PROTECTIVE COATING FOR CONCRETE

### PART 1 - GENERAL

#### 1.1 DESCRIPTION

- A. Scope:
- a. The Work shall include the furnishing and installation of an interior protective lining /coating corrosion protection system including all necessary materials, equipment and tools as required for a complete installation in accordance with the manufacturers recommendations. The completed system shall provide a waterproof, corrosion protection system to prevent any deterioration of concrete surfaces from hydrogen sulfide and other corrosive gases/acids produced by wastewater and to prevent infiltration. To ensure total unit responsibility, all materials and installation thereof shall be furnished by, and coordinated with, one supplier/manufacturer.
  - b. Where not otherwise shown, extent of the protective coating shall be located 1) interior walls of wet well structures and manholes to be protected, and 2) interior surface of lids and top decks of structures and manholes to be protected.
  - c. Types of protective coating for concrete Work required include, but are not necessarily limited to, the following:
    - i. Trowelable, fast setting, high-early strength underlayment.
    - ii. Epoxy formulation filler compound
    - iii. Corrosion-resistant, spray-applied, polymer, monolithic protective lining.
    - iv. Miscellaneous materials.
- B. Coordination:
- a. Coordinate abrasive blasting of substrates to avoid later difficulty or delay in performing the Work of this Section.
  - b. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to application of the protective coating.
  - c. Coordinate the setting of wall and floor penetrations, and installation of piping and equipment or other items interfacing with the recommended execution procedures of the protective coating manufacturer.
  - d. Remove all chemicals, films, lattice, compounds and other materials from substrates to receive the Work of this Section, as may be required by the protective coating manufacturer at no additional expense to OWNER.
  - e. All substrate surface preparation and coating application to be completed by manufacturer's approved Applicator.
- C. Related Sections:
- a. Section 03410, Precast Concrete Structures
  - b. Section 09910, Painting.

#### 1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
- a. Engage a single surface preparation and coating installation applicator specialist (Applicator) with specific experience in the application of the type of protective coating specified, and

- who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER for approval.
- b. All Applicators shall be certified or licensed by the protective coating materials manufacturer.
- B. Performance Criteria: The surfaces to receive the protective coating shall be capable of withstanding, under constant exposure, raw wastewater including attack from hydrogen sulfide and organic acids generated by microbial sources, with no adverse effects. Products capable of only intermittent exposure resistance are not acceptable.
  - C. Source Quality Control: Provide each component of protective coating produced by a single manufacturer, including recommended underlayment, fillers, base coat and top coat materials.
  - D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
    - a. As defined with Part 2 – Products
  - E. Statement of Application: Upon completion of the Work under this Section, submit a statement to ENGINEER, signed by CONTRACTOR and the protective coating Applicator stating that the installed protective coating complies with the requirements of the Specifications, and that the installation and materials comply with the manufacturer's printed recommendations related to the condition of installation and use.
  - F. Protective Coatings system specified are as manufactured by Sauereisen, Pittsburgh, PA (412)963-0303. Request for material substitutions shall be in accordance with requirements of the General Conditions and General Requirements, including Section 01310, Submittals.

### 1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
  - a. 12-inch by 12-inch samples of protective coating on ¼-inch board showing the installed coating system to be expected in the finished Work. Show full thickness of system with all components in place. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
  - a. Copies of manufacturer's technical data and installation instructions for protective coating system required.
  - b. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:
    - i. Product name and number.
    - ii. Name, address and telephone number of manufacturer and local distributor.
    - iii. Detailed procedures for routine maintenance and cleaning.
    - iv. Detailed procedures for repairs.
  - c. Test Reports: Copies of test data from an independent testing laboratory for all the physical properties listed herein.
- C. Certificates: Submit manufacturer's certifications that materials have been approved for the installation conditions shown on the Drawings and as specified herein. Submit manufacturer's Materials Warranty certificate.



## 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
  - a. Deliver material in manufacturer's original unopened and undamaged packages.
  - b. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
  - c. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Storage of Materials
  - a. Store in original packaging under protective cover and protect from damage.
  - b. Stack containers in accordance with manufacturer's recommendations.
- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

## 1.5 JOB CONDITIONS

- A. Environmental Requirements: Maintain substrate temperature and room temperature before, during and after installation above 60°F and rising in accordance with protective coating material manufacturer's instructions. Provide adequate ventilation during application and curing periods. Coating shall not be applied when ambient air temperature is within 10°F of the dew point and falling.

## 1.6 WARRANTY

- A. Protective Coating manufacturer shall warranty its products as free from material defects for a minimum period of one (1) year. Provide associated Warranty Certificate.
- B. CONTRACTOR shall warranty the installed protective coating system as free from material and workmanship defects for a minimum period of one (1) year.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. The protective coating system shall be a three-components protective coating system, including:
  - a. Trowable grade underlayment when needed and recommended by the Applicator to provide proper substrate for application for the epoxy lining.
  - b. Epoxy filler when needed and recommended by the Applicator to fill small voids and provide a properly prepared surface for the epoxy lining.
  - c. Epoxy lining to provide a abrasion resistance and chemical resistant protective coating against physical and chemical attack phenomena typically associated with municipal wastewater service conditions.
  - d. CONTRACTOR shall provide all accessory components such as sealants, hardeners or other compounds as recommended by the manufacturer for maximum protective coating adherence to substrate, and long-term service performance.
- A. Trowable Underlayment:

a. Properties Sauereisen No. F-120 Trowel Grade

**Application time**

Working time at 70°F	30 minutes
Initial set at 70°F	3 hours

<b><u>Color</u></b>	<b><u>Tan</u></b>
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**Compressive Strength**

@ 24 hours	3500 psi
@ 5 hours	2500 psi
@ 28 days	6,000psi
Density	137 pcf
Mix ratio (powder to water, by weight)	9:1

**Abrasion Resistance (ASTM C-704)**

Volume Loss, cm <sup>3</sup>	5.14 cm <sup>3</sup>
Volume Loss, %	0.65%
Freeze-thaw Durability Factor (ASTM C666-A)	87.2

- A. Underlayment shall be a fast-setting, high early strength, Portland-based resurfacing material. Underlayment shall be trowelable formulation, except where Applicator recommends alternate use of castable or gunite formulations for intended service application.
- B. Filler Compound:

a. Properties Sauereisen Filler Compound No.209

<b><u>Color</u></b>	<b><u>Off White</u></b>
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Compressive Strength	10,000 psi
Density (ASTM C-905)	87.2 pcf
Flexural Strength (ASTM C-580)	4000 psi
Modulus of Elasticity (ASTM C-580)	5.2 x 10 <sup>4</sup> psi
Tensile Strength (ASTM C-307)	2200 psi

**Bond Strength to Concrete (ASTM D-4541)** **Concrete Failure**

Moisture Absorption (ASTM C-413)	<0.25%
Shrinkage (ASTM C-531)	<0.2%
Working Time	15 min @ 70°F
Topcoat	3 hours @ 70°F

- b. Filler Compound shall be an epoxy formulation specifically designed to fill voids, irregularities and air pockets in concrete surfaces. The filler compound shall provide a smooth surface for the application of epoxy monolithic protective coatings. Filler compound shall be confirmed by the manufacturer as compatible with any undelayment materials and with the protective coating.
- C. Epoxy Lining Protective Coating:

a. Properties Sauereisen SewerGard No. 210S

**Application time**

Working time - 70°F (ASTM C-308 modified)	30 minutes
Initial set time - 70°F (ASTM C-308 modified)	17 hours
Bond strength (ASTM C-4541)	Concrete Failure

(to dry or damp concrete)	
Compressive strength (ASTM C-579)	6800 psi
Flexural strength (ASTM C-580)	4600 psi
Modulus of elasticity (ASTM C-580)	3.3 x 10 <sup>5</sup> psi
Tensile strength (ASTM C-307)	2500 psi
Coefficient of thermal expansion	38.0 x 10 <sup>-6</sup> in/in/°F
Abrasion Resistance (ASTM D-4060)	49mg <sub>(avg)</sub>
Density (ASTM C-905)	77 pcf
Maximum Service Temperature	150°F
Moisture Absorption (ASTM C-413)	≤0.2%
Shrinkage (ASTM C-531)	≤0.11%
Elongation	1.27%
Tensile Modules	42,000 psi
Fracture Toughness	100 in-lb/cu.in.
Minimum Applied Thickness (Dry Film)	60 mils

- b. Epoxy lining shall be a fiber-filled, spray-applied polymer protective coating material specifically designed to protect concrete and steel surfaces of manholes and structures subjected to municipal wastewater service conditions, including associated abrasive physical attack and chemical attack mechanisms related to hydrogen sulfide and organic acids generated by microbial sources.

- D. Product and Manufacturer: Provide one of the following:
  - a. Sauereisen, Pittsburgh, PA (412)963-0303.
  - b. Or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. CONTRACTOR and his Applicator shall examine the areas and conditions under which protective coating Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Commencement of the Work of this Section shall indicate that the substrate and other conditions of installation are acceptable to the CONTRACTOR and his Applicator, and will produce a finished product meeting the requirements of the Specifications. All defects resulting from such accepted conditions shall be corrected by CONTRACTOR at his own expense.
- C. Stopping Active Leaks: After surface cleaning, any visible leaks shall be reported to the ENGINEER. Any minor leaks not requiring other repairs by the ENGINEER must be sealed using Sauereisen InstaPlug No. F-180, No. F-370 Chemical Grout, No.F-190 H2OPRUF, or approved equal prior to proceeding with protective coatings system installation.

#### **3.2 PREPARATION**

- A. Concrete surfaces to receive protective coating shall be cast with rough form finish. Surfaces shall not be rubbed, troweled or otherwise finished in any manner that will obscure or cover the firm substrate surface. All subsequent surface washing, abrasive blasting, grinding, patching, filling and preparation shall be completed by the Applicator in accordance with the protective coating manufacturer's recommendations.

- B. The protective lining / coating corrosion protection shall cover all concrete surfaces within the wet well or manhole including the adjustment ring area. Coatings and lining surfaces shall be holiday free and all defects shall be repaired in accordance with the manufacturer's recommendations prior to the next coat being applied. In addition, all exposed concrete of the entire interior surface of precast structure including but not limited to benching, pipe penetrations, walls, bottom of top slab, chimney, etc. Flow channel inverts are not necessary to coat.
- C. Corrosion protection system shall interface with adjoining construction materials/components throughout the precast structure to effectively seal and protect substrates from attack by corrosive elements and to ensure the effective elimination of infiltration into the sewer system. Extend coating and liner and seal onto wet well hatch frame, around pipe openings and other protrusions to prevent contact of wet well surface with corrosive sewer gases.
- D. Allow concrete to cure for 28 days before protective coating systems is installed, unless otherwise recommended by the Applicator or systems manufacturer.
- E. Substrate: Concrete surfaces to be coated shall be free of curing compounds and form release agents, laitance and foreign particles that may inhibit bonding. Prior to start of protective coating systems application, broom clean, vacuum, hydroblast or abrasive blast surfaces to be covered as required, and inspect the substrate. Start of application operations shall indicate acceptance of substrate conditions and full responsibility for the completed Work. Surface preparation procedures shall be in accordance with ICRI (International Concrete Repair Institute) Guideline No. 03732, or comparably approved method. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling an ICRI CSP #4-6 comparators.
- F. Level or grind concrete substrates to manufacturer's recommended tolerances and to produce a smooth, uniform installation, including removal of all sharp edges, ridges or depressions.
- G. New Concrete Application – New concrete voids and depressions shall be filled with underlayment material, re-establishing plan finished grades and surface profiles.
  - a. Moisture Testing
    - i. Floors - New concrete should be installed over a moisture barrier to eliminate moisture transmission through the concrete floor. Prior to the application of materials, the moisture content must be determined using a suitable Moisture Detection System per ASTM F-1869 - "Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride." One such manufacturer is Sealflex Industries, 2925 College Ave. #B4, Costa Mesa, CA (714-708-0850). An average value exceeding 3.0 lbs/1000 ft<sup>2</sup>/24-hr period is unacceptable and will require additional cure time, the application of a surface penetrating vapor barrier or other corrective measures. Re-test after taking corrective measure to ensure an average value below 3.0 lbs.
    - ii. Moisture Testing for walls and overheads - Test new concrete pours for moisture after completing surface preparation. Utilize ASTM D-4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method." Any indication of moisture will require additional cure time, the application of a surface penetrating vapor barrier or other corrective measures. Re-test after taking corrective measure to ensure the absence of moisture.
- H. Existing Concrete Application - Existing concrete structures to receive protective coating system must be capable of withstanding imposed loads. All oil, grease and chemical contaminants must be removed from the surface of concrete by chemical cleaning. Surfaces must be firm, free of standing water, laitance, form release agents, and be structurally sound as determined by architect/engineer.

Suitable surface preparation methods include Shotblasting, Abrasive Blasting, or Water Jetting. Surface preparation procedures shall be in accordance with ICRI Guideline No. 03732. Surface preparation requirement is to expose aggregate and obtain a uniform surface texture resembling an ICRI CSP # 4-6 comparators.

- I. Brick Structures Application - All oil, grease and chemical contaminants must be removed from the brick by chemical cleaning. Hydroblast or abrasive blast to provide anchor profile on brickwork and to remove all existing paints, protective coatings, foreign particles, chemically attacked or unsound mortar. Loose brickwork and voids in the mortar joints should be re-pointed with Sauereisen Underlayment No. F-120 or F-121. All active hydrostatic leaks must be stopped prior to No. 210T application.
- J. Metal Application - Remove all visible oils and grease per SSPC-SP1, section 2.1 Remove contaminants from surface as per SSPC-SP1 section 3.2. Using CHLOR\*RID INTERNATIONAL "CHLOR\*TEST" test kits, or approved equivalent method, determine level of chlorides on the metal surfaces. Level of acceptable chlorides shall be no more than  $3\mu\text{g}/\text{cm}^2$  for immersion and no more than  $5\mu\text{g}/\text{cm}^2$  for atmospheric conditions. Surfaces with unacceptable levels must be washed with CHOR\*RID, or approve equal, as per manufacturer's recommendations and then re-tested.

Using SSPC-VIS 1 as a guide, abrasive blast to a NACE 1/ SSPC-SP5 White Metal Blast for immersion and a NACE 2/SSPC-SP10 for other service conditions. An anchor profile range of 2.5-3.0 mil is preferable. All welds must be continuous, free of flux and have a smooth rounded radius without any sharp edges or be ground flat and free of flux, fins and spatter.

### 3.3 APPLICATION

- A. Protective coating systems shall be installed when ambient air and surface temperature is between 65 and 80oF. Store material within the 65o to 80oF range for 48 hours prior to use. Application temperatures outside of this range will require written instruction from the manufacturer and approval of the ENGINEER.
- B. Application in direct sunlight and/or with rising surface temperatures is not allowed, as this may result in blistering of the materials due to expansion of entrapped air or moisture in the concrete. In such cases, it will be necessary to postpone the application until later in the day when the temperature of the substrate is falling. Concrete surfaces that have been in direct sunlight must be shaded for at least 24 hours prior to application and remain shaded until the initial set has taken place.
- C. Underlayment Application – Underlayment shall used for surface leveling, filling voids, large bugholes, and for general concrete patching.
  - a. Mixing - The Underlayment No. F-120 Powder is mixed with potable water. The mixing ratio is 9.0 parts No. F-120 Powder to 1 part potable water, by weight. Consult Sauereisen for mix ratio and procedures on the No. F-120 Castable and Gunitite.
  - b. Pour the entire amount of potable water into the mixing container and add the powder slowly, mixing continuously to reduce the potential for entrapped air. Mix slowly and thoroughly for a minimum of 5 minutes until a uniform consistency is achieved. Addition of more water will decrease the physical properties that are desired.
  - c. Installation - Prepared concrete substrates must be dampened prior to applying underlayment. Surfaces must not be wet, or have flowing water present during application. Using a trowel, apply the underlayment to a maximum 1/2" thickness. Use a water-dampened mason's brush to provide an anchor profile to the surface of the underlayment.

- d. Coverage - The following coverage rates do not take into consideration material losses, wastage during application, or normal density variations:

**COVERAGE CHART - NO.F-120 TROWELABLE**

THICKNESS	AMOUNT REQUIRED/SQ. FT.
1"	11.25 lbs.

- e. Curing – Underlayment shall be properly cured by means of fog spray or wet burlap. Application of a chemical-resistant lining may proceed after 5 hours at a temperature of 70oF. Manufacturer shall submit written recommendation if special conditions exist requiring other curing methods.
- D. Epoxy Filler Compound Application - Epoxy filler shall be used for filling small bug holes, static cracks and joints, and for general concrete patching, and to provide a smooth surface for epoxy lining application.
- a. Mixing - Add contents of Hardener to Liquid and mix with a slow speed paddle or "Jiffy" mixer for 1 minute until thoroughly blended. Add the Powder gradually while mixing with same slow speed mixer to obtain a uniform consistency. Mix only complete batches. Material which has begun to set must be discarded. Do not try to retemper the material.
  - b. Installation - To maximize working time, spread mixed filler onto a plasterer's hawk upon completion of the mixing. Apply filler to concrete with a smooth plasterer's rubber float. After application excess material must be removed by using the edge of the float or squeegee. Cure in accordance with the manufacturer's recommendations before applying additional coatings.
  - c. Curing - Working time shall be maintained within fifteen (15) minutes at 70oF, and in accordance with manufacturer's recommendations for working temperatures above or below 70oF Epoxy filler may be top coated after three (3) hours at a temperature of 70 oF.
- E. Epoxy Lining Protective Coating – Epoxy lining protective coating shall be spray applied on the prepared surface.
- a. Epoxy lining is a two-component product, packaged in premeasured, containers consisting of Liquid and Hardener.
  - b. Remix contents of Liquid component for a minimum of 2 minutes with a "Jiffy" type mixer.
  - c. Remix contents of the Hardener by shaking then add to Liquid and mix for a minimum of 3 minutes until thoroughly blended.
  - d. Mix only complete batches. Material which has begun to set must be discarded. Do not try to retemper the material.
  - e. Installation – Epoxy lining shall be applied by spray method to a minimum thickness of 60 mils at an approximate coverage of 90.5ft<sup>2</sup> per unit at 60-mil thickness. Application equipment shall be approved by the Applicator, in accordance with the protective coating manufacturer's recommendations.
  - f. Curing – Allow a minimum of 8 hours prior to any top coating at a temperature of 70oF, and in accordance with manufacturer's recommendations for application temperatures above or below 70oF.

- F. Expansion and construction joints shall be formed as recommended by the protective coating manufacturer.
- G. High Voltage Spark Testing. Installed epoxy lining protective coating shall be tested for pinholes after a minimum 24-hour cure at a temperature of 70°F. Pinhole testing shall be accomplished using a Tinker Razor Holiday Detector, San Gabriel, CA, Model AP/W, or an approved equal device. Test voltage of 100 volts/mil of coating thickness shall be applied. All pinholes shall be marked and repaired using manufacturer's approved Patch Kit, or other approved method.

### **3.4 ADJUSTMENT AND CLEANING**

- A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.
- B. Clean all surfaces not designated to receive protective coating. Restore all other work in a manner acceptable to ENGINEER.
- C. All finished protective coating shall be protected from damage until Final Acceptance of the Work. Protective coating damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.
- D. Clean all protective coating as recommended by the manufacturer to provide finished Work acceptable to OWNER, just prior to Final Acceptance.

**DIVISION 11**

**EQUIPMENT**





## **SECTION 11380: DRY AIR SCRUBBERS**

### **PART 1 - GENERAL**

#### **1.1 SCOPE OF WORK**

- A. The Contractor shall furnish and install, as shown on the drawings, a complete skid-mounted Dry Air Scrubbing System for the effective control of atmospheric hydrogen sulfide (H<sub>2</sub>S) and other sewage-based odors from an induced draft air stream at each of the locations shown on the drawings. The draft-inducing fan shall have variable air flow control, and shall draw in air from the enclosed space being scrubbed through converting, oxidizing and polishing sections to provide intimate contact with treatment media's.

#### **1.2 RELATED WORK**

- A. Mechanical piping is included in Part 3: 3.01 B.1.
- B. Concrete work is included in Part 3: 3.01 A.1.
- C. Electrical work is included in Part 3: 3.01 A.2.

#### **1.3 SUBMITTALS**

- A. The Contractor shall provide the following submittals in order to establish compliance with this section:
  - a. Manufacturer's Technical Data, including drawings.
  - b. Individual Model Specification Sheet detailing exterior and interior dimensions, chamber sizes, material types and thickness, weight, packaging, storage and use conditions.
  - c. Fan specifications.
  - d. Installation and start-up instructions.
  - e. Return instructions.

#### **1.4 SYSTEM DESCRIPTION**

- A. The system shall remove H<sub>2</sub>S and other malodorous compounds from the air stream via dry air converter, oxidation and polishing chemistry. H<sub>2</sub>S conversion and oxidation shall be accomplished via molecular contact with demand dependent media's. H<sub>2</sub>S converter media; forms water-soluble and non-volatile poly sulfides. Chlorine dioxide releasing media; oxidizing H<sub>2</sub>S molecules to inorganic sulfate. Other malodorous gases shall be treated by Countervailant™ polishing chemistry. This chemistry shall include polymeric adsorption, esterification, and neutralization properties or carbon.
- B. The unit shall draw contaminated air from the enclosed space being scrubbed into a mixing chamber and through an air diffuser which precedes the converter media chamber, then through the oxidizing chamber, which precedes the final polishing chamber; through the polishing and exhausting to atmosphere. Greater than 99.5 percent of H<sub>2</sub>S shall be removed by the scrubber.

#### **1.5 QUALITY ASSURANCE**

- A. All of the equipment specified under this section shall be furnished by manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished.

The equipment shall be designed, constructed and installed in accordance with the best practices and methods.

- B. The Converting/Oxidizing Dry Air Scrubbers specified under Section 2.3 herein shall be a PEACEMAKER™ Model manufactured by Syneco Systems, Inc., or approved equal.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. This section calls attention to certain features, but does not purport to cover all details of construction of the equipment. Furnish and install the equipment complete in all details and ready for operation.
- B. All system appurtenances, which include the plumbing connection from the vessel’s foul-air intake to the malodor source, discharge ducting from exhaust to atmosphere (if required), the electrical connection from the power source to the fan switch box and a stable base on which to place mounting skid, shall be provided by installer as shown on the drawings. All components of the scrubber system shall be compatible with, but not limited to the following compounds: hydrogen sulfide, chlorine dioxide, acids.
- C. The dry air scrubber shall be designed to operate for a period of one year without chemical additions or the need to exchange or service the media. Disposal of expended media shall be accomplished by the manufacturer at no additional cost to end-user. The design parameters shall meet the following field conditions:

**FIELD CONDITIONS**

Parameter	Unit	LS#1
1) Enclosed space to be scrubbed	CU-FT	395
2) CFM required	CFM	10
3) Air turnovers required	x/HR	1
4) Average H <sub>2</sub> S load	PPM	25
5) Average daily flow – dry weather	MGD	0.024
6) Average daily flow – wet weather	MGD	0.026
7) Peak hourly flow	MGD	0.074
8) Pump rate capacity of all pumps combined	GPM	160
9) Variable speed drive pumps		Yes
10) Percent pumped	%	100
11) Percent gravity	%	100%
12) Gravity line enters wet well below liquid level		Yes

**2.2 PHYSICAL AND ELECTRICAL COMPONENTS**

- A. Vessel
  - a. Scrubber vessels shall be constructed of rotationally molded High-Density Polyethylene (HDPE). No other material shall be acceptable. The polyethylene shall be of virgin

material, containing no fillers. Pigments and ultraviolet stabilizers shall be compounded at the time of resin manufacture. The rotational molding process shall be in accordance with ASTM D 1988-91, Type 1 only.

- b. Minimum mechanical properties of the HDPE shall be as follows:

PROPERTY	Units	Value
Melt Index 190°/2160 g	g/10 min.	5.5
Density	g/cc	0.934
Tensile @ yield 2"/min.	p.s.i.	2.100
Ultimate Elongation	%	440
Environmental Stress Crack	F50 (100% Igepal)	>1,000
Resistance Hours	F50 (100# Igepal)	>400
Flexural Modulus	p.s.i.	72,000
Heat Distortion Temp. °C	66 p.s.i.	49
ARM Impact @ -40°C	ft/lbs	38

A. Mounting Skid

- a. Scrubber mounting skid shall be constructed of rotationally molded Linear Low-Density Polyethylene (LLDPE). The polyethylene shall be non-expanded, virgin material, containing no fillers. Pigments and ultraviolet stabilizers shall be compounded at the time of resin manufacture. Skid shall contain material and reinforcement appropriate for the weight of the vessel placed upon it.

B. Fan and Air Flow Control

- a. Fan and air flow control shall be appropriate for conditions of use and sized to provide necessary CFM to maintain a negative pressure in the enclosed space from which contaminated air is being drawn. All fans shall be inspected for balance, welding dimensions, bearings, base connector points, overall workmanship. Fans shall conform to Underwriters Laboratories and appropriate ISO standards and applicable state and local electrical codes.

**2.3 MANUFACTURER**

- A. Furnish and install one (1) Converting/Oxidizing Dry Air Scrubber of the following types for the intended purposes in the locations listed:
- a. Lift Station No. 1 (1 each) PEACEMAKER Model 2 x 2
- B. The Converting/Oxidizing Dry Air Scrubbers specified herein shall be manufactured by Syneco Systems, Inc., or approved equal, and each system shall be equipped with a \_AO-70 Model fan.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General

- a. Install Air Scrubber in strict conformance with the Manufacturer’s recommendations, these Contract Documents, and conditions attendant to both field conditions and approved Shop Drawings. In the event of conflicts, the Owner’s Engineer shall be the final decision maker as to their resolution.

- B. Site and Utilities
  - a. The Contractor shall provide a base of concrete, crushed rock or other suitable material to safely support the skid upon which the scrubber is mounted, as shown on the drawings. Proximity to the enclosed space being scrubbed shall be as near as is practicable, and the area shall be accessible by hand truck, forklift or boom truck.
  - b. The Contractor shall provide an electrical service, as shown on the drawings.
- C. Connection
  - a. The Contractor shall provide a PVC plumbing connection from the vessel's four-air intake to the head space of the enclosed space being scrubbed (and discharge ducting from exhaust to atmosphere, if scrubber is in an enclosed building) and the electrical connections from the electrical service to the fan switch box, as shown on the drawings.

### **3.2 TESTING**

- A. All components of the scrubber system shall be provided by a single manufacturer who shall have sole-source responsibility for the system. Manufacturer's facilities shall be open for inspection at any time during the construction and testing of the system. Testing shall include at a minimum:
  - a. Visual inspection for any defects that would impair the serviceability of the vessel.
  - b. Oxidizing and polishing capacities of media,
  - c. Complete assembly start-up and trial run of equipment.

### **3.3 OPERATION AND MAINTENANCE MANUALS**

- A. Provide not less than six (6) comprehensive Operations and Maintenance Manuals for equipment provided under this Section of the Specifications.

### **3.4 WARRANTY**

- A. The Manufacturer and Contractor shall warrant the Air Scrubber being supplied to the Owner against all defects in workmanship and materials for a period of sixteen (16) months from date of start-up. All other package components shall be warranted for a period of twelve (12) months from date of start-up.
- B. The Manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed. The Contractor shall be responsible for proper storage of the equipment so as to remain in "as shipped" condition. If the equipment remains in storage at the job site for longer than six (6) months before installation, the Contractor shall provide factory service personnel for a complete inspection of the equipment. Any work necessary to restore the equipment to "as shipped" condition shall be the responsibility of the Contractor.

## **SECTION 11400: PUMPS**

### **PART 1 - GENERAL**

#### **1.1 REQUIREMENTS**

- A. The Contractor shall provide all labor, materials and construction equipment, and purchase, deliver, off-load, install and test the pumps, motors, control system and all equipment required for a complete pumping system to be furnished under this Section of the Specifications. Pumps shall be installed in locations shown on the Contract Drawings and to the criteria set forth in these Specifications.
- B. Work of this Section shall also include:
  - a. Division 1: General Conditions
  - b. Division 3: Concrete
  - c. Division 11: Equipment
  - d. Division 16: Electrical

#### **1.2 GENERAL INFORMATION AND DESCRIPTION**

- A. These Specifications are intended to give a general description of what is required, but does not cover details which may vary in accordance with the requirements of the actual equipment furnished.
- B. Submersible pumps and components: Submersible pump, motor driver, electrical cable, lifting eyes, lifting cable or chain and guide rails, guide rail supports, self aligning discharge connection, and other items specified in the Pump Schedule as required for complete operational units.

#### **1.3 TOOLS, SUPPLIES, AND SPARE PARTS**

- A. Special tools: Deliver 1 set for every furnished pump type and size needed to assemble and disassemble pump system. Spare parts: Provide 1 of the following for each size or type of pump; deliver as specified in Section 01760.
  - (1) Upper bearing set.
  - (2) Lower bearing set.
  - (3) Upper and lower mechanical seal set.
  - (4) Wear ring set (rotating and stationary).
  - (5) O-rings.
  - (6) Power cable entry seal set.
- B. Air Powered Mixer  
Each lift station shall be furnished with an air-powered mixer system complete with mixer, air unit and accessories capable of being suspended or placed at the bottom of each wet well. The mixer system shall be a Grid Bee AP500 manufactured by Medora Corporation, or approved equal.

## 1.4 SUBMITTALS

- A. Shop Drawings showing arrangement, dimensions, and materials.
- B. Characteristic performance curves for pumps at four speeds including full speed, showing total dynamic head, efficiency, and brake horsepower plotted against capacity in gpm for conditions of head and capacity with required impeller.
- C. Certified shop test curves.
- D. Certification that the pump manufacturer is bearing coordination responsibility for the pump(s) and motor(s) for their specific application to avoid overheating and harmonic vibrations caused by rotational speed and carrier-frequency-induced rotational "cogging".
- E. Certified statement signed by a registered professional ENGINEER that the bearing lives meet or exceed the specified requirements.
- F. Pumps and motors shall be provided for approval in one submittal package.
- G. Certification that the wet well configuration meets or exceeds pump manufacturer requirements for both normal pumping operations and wet well cleaning operations when the wet well operating level is reduced.
- H. O&M Manuals as specified in Section 01730.
  - a. Submit copy of this Section with addenda and referenced sections with addenda, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations and clarifications from specified requirements.
    - i. If deviations and clarifications from Specifications are indicated and requested by CONTRACTOR, provide detailed written justification for each deviation and clarification.
    - ii. Failure to include copy of marked-up specification sections and or detailed justifications for requested deviation or clarification will result in rejection of submittal with no further review and consideration.

## 1.5 START-UP SERVICES

- A. Provide factory authorized service representative to perform functions described in Specification Section 01400.
- B. The equipment manufacturer shall furnish the services of a qualified factory trained field service engineer for an 8-hour working day(s) at the site to inspect the installation, and instruct the owner's personnel on the operation and maintenance of the pumping units. After the pumps have been completely installed and wired, the Contractor shall have the manufacturer perform the following:
  - 1. Megger stator and power cables.
  - 2. Check seal lubrication
  - 3. Check for proper rotation

4. Check power supply voltage
5. Measure motor operating load and no load current
6. Check level control operation and sequence

During the initial inspection, the manufacturer's service representative shall review recommended operation and maintenance procedures with the owner's personnel.

## 1.6 TESTING REQUIREMENTS

- A. Hydraulic performance shop test:
  - a. Submersible pumps shall be factory-tested at pump manufacturer's plant. Tests shall be in accordance with Test Code of Hydraulic Institute Standards to determine head vs. capacity and kilowatt draw required.
  - b. Test curves shall cover full range of operation from shutoff to maximum capacity, and have capacity plotted as abscissas and operating head, input KW, brake horsepower, and overall efficiency plotted as ordinates.
  - c. Witness tests shall be available at the factory upon request.
- B. Test tolerances:
  - a. Pumps shall be within 1 or the other of the following tolerance:
    - i. At rated head: +10% of rated capacity.
    - ii. At rated capacity: +5% of rated head.
  - b. No minus tolerance or margin shall be allowed with respect to capacity or total head at any specified condition. (HI Level A testing)
  - c. Pump manufacturer shall provide shop space, tools, equipment, instruments, personnel, and all else required for satisfactory completion of tests. Payment for tests shall be included in Contract amount.
  - d. Test curves shall be submitted and reviewed prior to pumps being released for shipment.
- C. Pump tests:
  - a. Pump manufacturer shall perform following inspections and tests on pumps prior to shipment.
    - i. Inspect for conformance to Contract Documents with respect to correct model number, impeller, motor rating, and electrical connections.
    - ii. Test motor and seal housing chambers for moisture content or insulation defects.
    - iii. Prior to submergence, allow pump to run dry to establish correct rotation and mechanical integrity.
    - iv. Discharge piping attached to pump shall operate submerged under a minimum of 6' of water for a minimum of 30 minutes.
    - v. After operational test, motor and cable shall be tested again for moisture content or insulation defects.
  - b. Pumps failing inspection or tests shall be repaired or replaced at no cost to OWNER.



- c. Pumps shall be rejected if the above requirements are not satisfied.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

- A. Furnish and install pumps of the following types for the intended purposes in the locations listed:
  - a. Lift Station No. 1 (2 each)            Model NP – 3102
- B. Pumps shall be as furnished by the following manufacturer:

Xylem FLYGT, N series , or approved equal.
- C. Pump, mechanical seals and motor shall be from the same manufacturer.

### **2.2 PUMP DESIGN CRITERIA AND SYSTEM REQUIREMENTS**

#### **A. Design Criteria**

##### **a. Lift Station No. 1**

Furnish and install two (2) submersible non-clog wastewater pump(s). Each pump shall be equipped with a 6.5 HP (minimum) submersible electric motor connected for operation on 230 volts, 1 phase, 60 hertz, 3 wire service, with 50 feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA standards and have P-MSHA Approval.

Provide FLYGT model NP 3102 (Explosion-Proof) with Hard-Iron, or approved equal.

Each of the above noted pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two guide bars extending from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet-well. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. **Sealing of the discharge interface with a diaphragm, O-ring or profile gasket will not be acceptable.** No portion of the pump shall bear directly on the sump floor. Each pump shall be fitted with 20 feet of FLYGT Grip-Eye Lifting System, or approved equal; coordinated and field cut to length by the installing contractor. The working load of the lifting system shall be 50% greater than the pump unit weight.

#### **B. Pump Construction**

##### **a. Materials**

- i. General: When materials are referenced in this Section or on the pump schedule, the compositions shall be the UNS Alloys, Types, or Grades unless specified or scheduled otherwise.

- ii. Cast iron: ASTM A 48, Class 35 B minimum.
- iii. Nickel cast iron: ASTM A 48, Class 35 minimum with 3 percent nickel added.
- iv. Steel: ASTM A 108, Grade or UNS Alloy as specified or scheduled.
- v. Stainless steel: ASTM A 276 or ASTM A 582, Type or UNS Alloy as specified or scheduled.
- vi. Bronze: ASTM B 505 or ASTM B 584, UNS Alloy C83600.
- vii. Zincless bronze: ASTM B 505 or ASTM B 584, Leaded Tin Bronze, UNS Alloy C92700.
- viii. Aluminum bronze: ASTM B 148, ASTM B 505 or ASTM B 584, UNS Alloy C95200.
- ix. Fasteners: Stainless steel, ASTM F 593 or ASTM F 594, type or grade as specified.

**b. Pump Casings**

- i. Type: 2 piece; pump and motor casing bolted together; machined seal faces with Nitrile or Buna N rubber O-ring seal; Type 316 stainless steel bolting.
- ii. Material: As scheduled.
- iii. Construction: Of sufficient strength, weight, and thickness to provide accurate alignment and watertightness.
- iv. Design working pressure: Minimum 1.10 times maximum shutoff total dynamic head with maximum installable impeller diameter at maximum operating speed plus maximum suction static head; suitable for submergence in up to 65 feet of water.
- v. Discharge interface:
  - 1. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal-to-metal watertight contact.
  - 2. Self-aligning without bolting or having to enter the wet well.

**c. Bearings**

- i. The Pump shaft shall rotate on a minimum of 2 permanently sealed, grease lubricated bearings:
  - 1. Upper bearing for radial forces.
  - 2. Lower bearing for combined axial and radial forces.
- ii. Bearing type: Anti-friction meeting ABMA standards.
- iii. Bearing lubrication system shall be sized sufficiently to safely absorb heat energy normally generated in bearing under maximum ambient temperature of

60 degrees Celsius when pump scheduled for dry running. Bearing life: Minimum L<sub>10</sub> life of 100,000 hours at rated design point or 24,000 hours in accordance with ABMA 9 or 11 at bearing design load imposed by pump shutoff with maximum sized impeller at rated speed, whichever provides longest bearing life in intended service.

**d. Mechanical Seals**

- A. Provide dual tandem mechanical seal system made from the same OEM as the manufacture of the submersible pump.
1. Shaft sealing system shall be capable of withstanding volute pressure up to 1.5 times pump shutoff head.
  2. No seal damages shall result from operating the pumping unit in its liquid environment, or from running pump dry.

B. Upper seal:

1. Tungsten-carbide rotating seal and tungsten-carbide stationary seal.
2. Submerged in oil chamber located below the stator housing.

C. Lower seal:

1. Tungsten-carbide rotating seal and tungsten-carbide stationary seal.

D. Springs and other hardware: Stainless steel, 300 or 400 series.

E. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and to provide lubricant expansion capacity. The drain and inspection plug, with positive anti-leak seal shall be easily accessible from the outside. The seal system shall not rely upon the pumped media for lubrication. **The motor shall be able to operate dry without damage while pumping under load.**

F. Seal lubricant shall be FDA Approved, nontoxic.

**e. Pump Shaft**

- i. Pump and motor shaft shall be the same unit. The pump shaft is an extension of the motor shaft. Couplings shall not be acceptable. The pump shaft shall be stainless steel – ASTM A479 S43100-T.
- ii. Strength: Able to withstand minimum 1.5 times maximum operating torque and other loads.
- iii. Deflection: Maximum 0.002 inches under operating conditions.
- iv. Shaft sleeve: ASTM A 743, Grade CA40 or AISI Type 420 stainless steel with minimum Brinell Hardness of 450 when tested in accordance with ASTM E 10;

renewable, key locked in stuffing box, gland area, and bearings; able to protect shaft from pumped liquid and wear.

**f. Impeller**

- i. The impeller shall be of ASTM A-532, Alloy III A 25% chrome cast iron dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design.
- ii. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the gray iron impeller shall be hardened to Rc 45 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater.
- iii. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw.
- iv. The impellers shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

**g. Volute/Suction Cover**

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of ASTM A-532 Alloy III A 25% chrome cast iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

**i. Mix-Flush System**

One pump for the lift station shall be equipped with a flush valve that will automatically flush the sump during initial operation of the pump. The system shall be Flygt 4901 Flush Valve, or approved equal. The valve is to be mounted directly on one pump volute to direct part of the pumped discharge to flush solids into suspension at the start of each pumping cycle. The valve shall be positioned on the pump volute to provide a non-clogging flow operation and oriented so as not to interfere with pump removal or installation. The valve shall open at the beginning of each pumping cycle and close under full pump discharge pressure after a pre-selected time. No external power source shall be allowed for operation of the valves. A means of adjustment shall be provided to achieve a 30-second flushing period for different head and flow conditions.

### C. MOTORS AND POWER CABLES

- i. **Motors:** Features as specified and as scheduled:
  1. Provide motors that are rated suitable for continuous operation in 40 degrees Celsius ambient temperature at project site altitude.
  2. Horsepower:
    - a. As scheduled in Part 2 of this section.
      - i. Listed motor horsepower is the minimum to be supplied. Increase motor horsepower if required to prevent motor overload while operating at any point on the supplied pump operating head-flow curve, including runout. However, variable frequency drives, generator, and other electrical equipment are sized for scheduled motor horsepower.
      - ii. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.
  3. Revolutions per minute: Per Part 2.
  4. Enclosure: Per Part 2.
  5. Electrical characteristics: Per Part 2.
- ii. **Motor Construction**
  1. Squirrel cage induction motor, shell design.
  2. If explosion proof motor is scheduled, provide motor that is UL or FM listed for NEC Class 1, Division 1, Groups C and D service, whether submerged or unsubmerged.
  3. NEMA design type: B.
  4. Motor insulation, either one:
    - a. Class H, moisture resistant, rated for 185 degrees Celsius.
  5. The motor shall be designed for continuous duty handling pumped media of 40 degrees Celsius and capable of a minimum of 30 evenly spaced starts per hour.
  6. The motor shall be capable of continuous operation under load with the motor submerged, partially submerged, or exposed, without derating the motor
  7. Motor cooling system:
    - a. Design to provide adequate cooling:
      - i. At the minimum operating speed with a variable frequency drive.
      - ii. With motor submerged.
      - iii. With motor dry.
    - b. A motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation.
      - i. Material: Stainless Steel.
      - ii. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket.
      - iii. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow. .

- c. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104 degrees Fahrenheit (40 degrees Celsius).
      - d. Spray systems, air moving equipment or other secondary cooling systems are not acceptable.
    8. Motor sealing: Design motor case and seals to withstand 65 feet of submergence.
    9. When variable frequency drive is scheduled, motor shall be capable of continuous inverter duty over the speed range specified.
  - iii. **Power cables:**
    1. Submersible to same water depth as motor casing.
    2. Type SPC with Hypalon/Buna N jacket.
    3. Insulation rated for 90 degrees Celsius.
    4. Non-wicking fillers.
    5. Length: Sufficient to connect to surface junction box (without the need of splices) as indicated on the Drawings or 30 feet, whichever is greater.
    6. Sized to conform to NEC, ICEA, and CSA specifications.
    7. Provide stainless steel cable and stainless steel wire braid sleeve to support power cable from underside of wet well roof slab or access frame.
    8. This cable is required for use with Flygt SmartRun™ intelligent controls.
  - iv. **Cable entry seal and junction chamber:**
    1. Cable entry seal design shall not require specific torque requirements to insure a watertight and submersible seal.
    2. Cable entry seal shall consist of dual cylindrical elastomer grommets, flanked by stainless steel washers.
    3. The cable entry seal shall provide strain relief for the cable.
    4. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
  - v. **Control/protection module:**
    - 1) Each pump shall be supplied with its own self-contained control/protection module to provide for the direct connection to all internal pump monitoring devices, including:
      - a. Thermal protection: Provide automatic reset motor stator temperature detectors, 1 switch in each phase winding. If any detector is activated, the sensor shall activate an alarm and shut down the motor. The thermal detectors shall activate when the stator temperature exceeds 125 degrees Celsius.
      - b. Moisture detection: one of the following:

- i. Provide a small float to detect the presence of water in the stator chamber.
- c. The module shall signal an alarm condition if any of the internal monitoring devices is activated.

## 2.3 SYSTEM REQUIREMENTS

### A. General

- a. CONTRACTOR shall verify lift station conditions and verify pump compatibility prior to shop drawing submittal and fabrication of equipment.
- b. Pumps, motors and mechanical seals shall be product of single manufacturer.
- c. Pumping units shall consist of submersible pumps and motors, guide rails, lifting chains, discharge elbow and mounting plate, anchor bolts, access frame and cover, electric cables, control system and accessories for a complete, operable system.
- d. Pumps shall be suitable for pumping raw wastewater with solids concentrations of up to 3% by weight and shall be capable of passing stringy, fibrous material without clogging.
- e. Pumps shall be suitable for continuous operation at flow conditions stated herein without excessive noise, vibration, heating, cavitation, or damage to pump.
- f. Size pumps to allow increase in rated pump head by as much as 10% by replacement of impellers.
- g. Fit each pump with centered stainless steel type 316 lifting chain of adequate strength to raise and lower pumping unit.
- h. Discharge connections shall be permanently installed in wet well with discharge piping. Pump shall automatically connect to discharge connection elbow when lowered into place and shall disengage easily and automatically without removal of fasteners or piping when pump is raised.
- i. Attach sliding guide bracket to pump units which will slide between a minimum of 2 guide rails to properly position pump discharge on discharge connection elbow.
- j. Pump, appurtenances, and cable shall be capable of continuous submergence underwater to depth of 65' without loss of watertight integrity.
- k. Design pump motors to operate continuously at design conditions with 50% of motor unsubmerged without overheating.
- l. Design pumps, motor and appurtenances for a Class 1, Division 1 environment.

### B. Guide Rails and Lifting Devices

There shall be no need for personnel to enter the wetwell to remove or reinstall the pump(s). In a wet pit installation, the discharge base & elbow assembly shall be permanently installed in the wetwell and connected to the discharge piping.

- i. General: Provide guide rails and lifting devices suitable for wet pit installation as indicated on the Drawings.

- ii. Materials:
  - 1. Wet pit: Type 304 stainless steel guide rails, lifting cable or chain and wall supports; Type 316 stainless steel anchor bolts and fasteners.
- iii. Wet pit guide rails:
  - 1. Type: Dual pipe able to accurately guide the pump to mate with the discharge elbow.
  - 2. Intermediate supports: Provide at 20-foot maximum intervals; less as required to provide specified support.
- iv. Lifting device:
  - 1. Type: Cable attached to lifting eye on the pump casing.
  - 2. Length: Able to lower pump from top of wet well to operating position as indicated on the Drawings
  - 3. Retainer: Provide Type 316 stainless steel locking hook or clasp at top of wet well to securely retain the upper end of the lifting chain or cable during pump operation.
  - 4. Lifting device shall be sized for combined weight of pump and motor.

### C. Painting

#### A. Shop Painting:

- 1. Sandblast submerged ferrous surfaces to SSPC SP 10 finish and give one shop coat of Tnemec “413 Hi-Build Tneme-Tar”, or approved equal coal tare epoxy, 8 mdft.
- 2. Machine finished surfaces shall be coated with suitable corrosion preventative compound.

#### B. Field Painting: In accordance with Section 09910

## PART 3 - EXECUTION

### 3.1 TESTING

- A. One (1) pump of each type and rating shall be factory tested, and certified test curves indicating compliance with the design point(s) for flow, head, efficiency, and brake horsepower shall be provided to the Engineer prior to delivery of the equipment.
- B. Pumps shall be tested in accordance with Hydraulic Institute (HI) standards using calibrated shop drivers and instrumentation. All instrumentation shall have been calibrated within the time frame specified, to the standards and tolerances set forth by the HI.
- C. A minimum of five (5) test points, not including shut-off, shall be used to develop any pump speed curve.

### 3.2 INSTALLATION

- A. Install pumping equipment in strict conformance with the manufacturer’s recommendations, these Contract Documents and conditions attendant to both field conditions and approved shop drawings. In the event of conflicts, the Owner’s Engineer shall be the final decision- maker as to their resolution.



- B. The services of the manufacturer's technical representative, (factory trained Engineer) who is intimately familiar with all aspects of installation, start-up, training, operation, and maintenance shall be provided as part of this Section. Services shall be on-site for each lift station for a period of time as set forth below:

Submersible Centrifugal: Installation - 4 hours; Training -2 hours

- C. Services shall be on-site for a period of six (6) hours minimum for one (1) day for each lift station. Where two (2) days time is indicated, they shall be non-consecutive days unless the Engineer agrees, in writing, to the contrary. Different pumps, provided by the same Manufacturer, can total their time, however, to alter the non-consecutive day requirement, they can make installation calls only if their equipment is in the process of being installed at the same time by the Contractor.

**DIVISION 13**

**SPECIAL CONSTRUCTION**



## **SECTION 13321: MONITORING AND CONTROL SYSTEM GENERAL REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SCOPE OF WORK**

- A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate and place in operation a complete Monitoring and Control System (MCS). MCS shall be type as specified in this Section, related Sections, and as shown on the Drawings
- B. The MCS shall be designed to monitor, store, display and log process and equipment operating information and alarms and to perform various process control functions and generate various reports. The unit processes which the MCS shall monitor and control are shown on the Drawings and described herein.
- C. Process and Instrumentation Diagrams (P&ID's) and Specifications of this Section and the other 13300's Sections illustrate and describe the overall MCS functional and operational requirements.
- D. OWNER shall configure all distributed control system software for the supplied MCS. However, CONTRACTOR shall be responsible for hardware configuration, loop testing of signals, and communications testing for new and modified existing control equipment through the Distributed Control System under OWNER supervision.
- E. Related Sections:
  - 1. Section 13323, Check-out, Start-Up and Field Testing.
  - 2. Section 13329, Primary Sensors and Field Instruments.
  - 3. Section 13330, Panels and Enclosures.
  - 4. Section 13331, Panel Instruments and Devices.

#### **1.2 QUALITY ASSURANCE**

- A. General:
  - a. The MCS shall be furnished by a single supplier who shall assume responsibility for providing a complete and integrated system.
  - b. All equipment, components and materials required shall be furnished by the single supplier who shall assume the responsibility for adequacy and performance of all items.
  - c. The system components which are not manufactured by the supplier shall be clearly identified.
  - d. Supplier company's quality assurance plan shall be provided, and for components which are not manufactured by the supplier, the component manufacturer's quality assurance plan shall be provided. The quality assurance 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. Said quality assurance plans should be in accordance with M.I.L.-105D.

- B. Supplier's Qualifications:
- a. Shall be a financially sound firm having at least five (5) years continuous experience in designing, implementing, supplying and supporting instrumentation and control systems which are comparable to the MCS in terms of hardware, software, cost and complexity.
  - b. Shall have manufactured and supported standard lines of digital processing and control equipment and application software continuously for the last five (5) years.
  - c. Shall have in existence at the time of bid advertisement, an experienced engineering and technical staff capable of designing, implementing, supplying and supporting the MCS and handling the MCS submittal and training requirements.
  - d. Shall provide system hardware components of fully developed, field proven standardized designs and therefore shall furnish a system which is not a highly unique, custom one-of-a-kind system.
  - e. Shall have a minimum of two (2) years experience in hardware application and programming of distributed microprocessor based controllers and data highway systems.
  - f. Shall provide standard course offerings in general process control applications and in operation, and maintenance of the control system and equipment at a facility specifically utilized for training purposes. The facility shall have been in operation continuously for the last two (2) years.
  - g. Shall have a thorough working knowledge of wastewater treatment processes and control philosophy in accordance with standard practices of the wastewater treatment industry.
  - h. Shall have a system of traceability of the manufactured- units and purchased components through production, assembly and testing.
  - i. Shall have a system of "Bum-In" for all components and available supportive documentation.
  - j. Shall have a demonstrated record of prompt response to field failures.
  - k. Shall have a documented program of failure analysis.
  - l. Shall have a warranty covering parts and labor and in the case of microprocessor-based equipment and its appurtenances, a guaranteed availability clause.
  - m. Shall have proof of compliance with relevant NEC, OSHA, NJIL, NRC, ISA, SAMA, NFPA, UL and API standards and all relevant state and local codes.
  - n. Shall have a record of prompt shipments in accordance with contract obligations required for previous projects.
- C. Technical Proposal Requirements: The apparent low, responsive, responsible Bidder shall submit to OWNER a copy of a Technical Proposal from the supplier which has been selected to provide the MCS. The proposal shall be complete and contain all information as specified below.
- a. Financial Statement: Include the value of distributed microprocessor based control systems delivered during the last two fiscal years. Also include the value of other process instrumentation and controls shipped during the period.
  - b. Experience:
    - i. Provide evidence of compliance with the specific experience requirements listed in Paragraph 1.2.B. above in the form of an experience certification signed by an officer of the company.
    - ii. Describe at least three (3) completed municipal projects utilizing instrumentation and control equipment identical to or similar to (indicate which) that specified. Indicate OWNER, value, completion date, names and phone numbers of OWNER'S representatives familiar with each project. Letters of recommendation may be submitted.

- iii. Furnish list of last ten (10) projects completed.
  - c. Personnel: Provide a listing of those personnel expected to be assigned to the project. List is to include project manager, project engineer, field representative, local service representative, and sales representative. Indicate addresses of personnel not based at supplier's main office. Provide documentation including resumes of personnel experienced in water treatment applications.
  - d. Exceptions: List all exceptions and deviations from the requirements of the Specifications. Reference section number, article, and paragraph of proposed variance and provide an explanation of why the proposed substitution meets (or exceeds) the functional or equipment requirements specified.
  - e. Shipment Records: Provide evidence of timely delivery of equipment on past projects.
  - f. Instrumentation and Panel Mounted Devices: Provide descriptive literature and catalog cuts for each type of sensor, transmitter, indicator, and other such devices required by the project.
  - g. Training: Provide information and literature as to the organization proposed and the factory facilities to be utilized for the training specified. Indicate the qualifications of the factory training staff.
  - h. Availability Demonstration: Indicate how the Availability Demonstration will be accomplished.
  - i. Maintenance: Provide the following information:
    - i. Location of service facility along with minimum and maximum response time.
    - ii. Location of parts facility with delivery time and method.
- D. Operating Experience:
- a. The treatment facilities outlined in the Contract Documents included herein have been designed to meet stringent quality standards. OWNER has selected and designed a plant monitoring and control system to provide effective monitoring and control for the treatment facilities required to meet these stringent quality criteria limitations. The criteria for selection of this system includes, but is not limited to, the following:
    - i. The use of standard, "non-custom" equipment and application software.
    - ii. The ability of OWNER'S personnel to make modifications and adjustments in the field to react to actual field conditions.
    - iii. The ability of OWNER to obtain training of OWNER'S personnel in well established equipment manufacturer training program.
    - iv. The availability of factory service and a well stocked spare parts inventory which could be drawn upon by OWNER in emergency situations.
- E. Supplier's Responsibility:
- a. CONTRACTOR shall retain the plant monitoring and control system supplier to assume the responsibilities specified below. However, execution of these specified duties by the system supplier shall not relieve CONTRACTOR of the ultimate responsibility for the plant monitoring and control system.
    - i. Design and implementation of the plant monitoring and control system and all subsystems in accordance with the Contract Documents and all referenced standards and codes.
    - ii. Preparation, assembly and correction of all plant monitoring and control system submittal in accordance with the Contract Documents.
    - iii. Proper interfacing of the plant monitoring and control system hardware, field devices and panels including required interfacing with package control systems furnished by other equipment suppliers and with the plant electrical system.

- iv. Supervision of the installation of plant monitoring and control system, instruments, panels, consoles, cabinets, wiring and other components required.
- v. Calibration, testing and start-up of the plant monitoring and control system.
- vi. Training of OWNER'S personnel in operation and maintenance of the monitoring and control system.
- vii. Handling of all warranty obligations for the control system components.
- a. Reference Standards: The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in this Specification and the Contract Drawings:
  - i. I.S.A., Instrument Society of America.
  - ii. A.P.I., American Petroleum Institute.
  - viii. U.L., Underwriters' Laboratories, Inc.
  - ix. A.W.W.A., American Water Works Association.
  - x. N.R.C., Nuclear Regulatory Commission.
  - xi. N.E.M.A., National Electrical Manufacturers Association.
  - xii. O.S.H.A., Occupational Safety and Health Administration.
  - xiii. A.N.S.I., American National Standards Institute.
  - xiv. M.I.L., Military Standards.
  - xv. N.F.P.A., National Fire Protection Association.
  - xvi. S.A.M.A., Scientific Apparatus Manufacturers Association.
  - xvii. I.E.E.E., Institute of Electrical and Electronic Engineers.
  - xviii. N.E.C., National Electrical Code.
  - xix. F.M., Factory Mutual.

### **1.3 COORDINATION AND PROGRESS MEETINGS**

- A. CONTRACTOR shall be responsible for the scheduling and coordinating the system installation with regard to all other Work on the site and in accordance with the provisions of the General Conditions. Said coordination shall be documented on the project schedule.
- B. Routine progress and coordination meetings will be scheduled by OWNER. CONTRACTOR and a representative of the system supplier shall be required to attend a minimum of two (2) meetings.
- C. The purpose of the meetings shall be to review the progress of the Work involving the Plant Monitoring and Control System and provide coordination for installation of the equipment to ensure construction schedules are met.
- D. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit CONTRACTOR and system supplier to agreed procedures and schedules.

### **1.4 SYSTEM SUPPLIER PROJECT PERSONNEL**

- A. CONTRACTOR shall require the system supplier to provide the following project personnel:
  - a. Project Manager:
    - i. The system supplier shall appoint a project manager who shall coordinate and schedule all Work and assure that project schedule is met.

- ii. The project manager shall act as the liaison with CONTRACTOR for the installation of the monitoring and control system equipment and shall assist in all matters required for proper coordination and interfacing of the equipment and processes.
  - b. On-Site Project Engineer:
    - i. System supplier to appoint a full-time, on-site project engineer to remain during the period from the system supplier's control panel installation through Final Completion of the Work.
    - ii. Project engineer to ensure control system installation remains on schedule and to communicate to the Project Manager where potential problems may arise.
    - iii. Project engineer to assist field engineer with loop testing and to ensure existing processes are not interrupted during testing.
  - c. Field Engineer:
    - i. The system supplier shall appoint a field engineer with responsibilities as follows:
- B. Provide advice and technical consultation relative to installation techniques and procedures for equipment furnished.
- C. Installed system checkout, calibration, adjustment and start-up including tuning of every control loop.
- D. Maintenance services during availability demonstration.
- E. Involvement in the on-site system training of plant personnel.
- F. Resolving of control problems encountered during initial start-up and testing of all plant monitoring and control equipment.
- G. The field engineer shall have a minimum of five (5) years experience in systems engineering and start-up and shall have a thorough working knowledge of both the hardware and software supplied for the plant monitoring and control system.

## 1.5 SUBMITTAL

- A. Shop Drawings:
  - a. General:
    - i. Shop Drawing submittal are to be in accordance with the requirements of the Contract Documents.
    - ii. Shop Drawing preparation shall not commence until after the pre-submittal conference specified below.
    - iii. Manufacture of the plant monitoring and control system shall not commence until related submittal have been approved by OWNER.
    - iv. Shop Drawings shall be submitted in complete packages grouped to permit review of related items as generally outlined in Paragraph 1.5.A.3, Submittal Requirements.
    - v. Review of Shop Drawings will be for conformance with Contract Documents and with regard to functions specified to be provided.
- B. Pre-Submittal Conference:



- C. CONTRACTOR shall arrange and conduct a Pre-Submittal Conference on the control system within 45 days of notification of preliminary acceptance of the proposed MCS and supplier by OWNER.
- D. Pre-Submittal Conference shall be attended by representatives of CONTRACTOR, OWNER, the plant monitoring and control system supplier. CONTRACTOR shall allot three (3) full consecutive working days for the conference and that time shall be included in the price of this Contract.
- E. Purpose of the Pre-Submittal Conference shall be to review informally and approve the manner in which the control system supplier intends to respond to the Contract requirements before any submittal are prepared.
- F. CONTRACTOR shall prepare the items listed below for presentation at the Pre-Submittal Conference. The information shall be submitted to OWNER three (3) weeks prior to the date of the conference.
- G. List of equipment and materials required for the control system and the brand and model which CONTRACTOR proposes to use for each item.
- H. List of proposed exceptions to the Contract Documents along with a brief explanation of each. Approval shall be subject to a formal submittal.
- I. Sample of each type of submittal specified herein. These may be submittal prepared for other projects.
- J. A flow chart showing the steps to be taken in preparing and coordinating each control system submittal to OWNER, and a list of proposed submittal.
- K. Bar chart type schedule for all plant monitoring and control system related activities from the Pre-Submittal Conference through start-up and training. Particular emphasis shall be given to dates relative to submittal, design, fabrication, programming, factory testing, deliveries, installation and field testing. The schedule shall be subdivided to show activities relative to each major item or group of items when everything in a given group is on the same schedule.
- L. General outline of the type of tests to be performed to verify that all sensors/transducers, instruments and digital processing equipment are functioning properly.
- M. Submittal Requirements:
  - a. Product information for all sensors/transducers and field instruments. Include the following:
  - b. Manufacturer's product name and complete model number.
  - c. Instrument tag number from Contract Documents.
  - d. Manufacturer's data sheets and catalog literature. Provide data sheets as shown in ISA-S20-1981. For instruments not included in S20, submit data sheets using a similar format.
  - e. Description of construction features.
  - f. Performance and operation data.
  - g. Installation and mounting details, instructions and recommendations.
  - h. Service requirements.
  - i. Dimensions.
  - j. List of recommended spare parts.

- N. Panels, Consoles and Cabinets Information:
- a. Layout Drawings include the following:
    - i. Front, rear, end and plan views to scale.
    - ii. Dimensional information.
  - b. Tag number and functional name of components mounted -in and on panel, console or cabinet.
  - c. Product information on all panel components.
  - d. Nameplate location and legend including text, letter size and colors to be used.
  - e. Location of anchoring connections and holes.
  - f. Location of external wiring and/or piping connections.
  - g. Mounting and installation details.
  - h. Proposed layouts and sizes of graphic display panels.
- O. Wiring and/or piping diagrams include the following:
- a. Name of panel, console or cabinet.
  - b. Wiring sizes and types.
  - c. Piping sizes and types.
  - d. Terminal strip numbers.
  - e. Color coding.
  - f. Functional name and manufacturer's designation for components to which wiring and piping are connected.
  - g. Electrical control schematics in accordance with NFPA 79 standards.
  - h. Plan showing equipment layout in each area.
- P. Field wiring and piping diagrams, include the following:
- a. Wiring and piping sizes and types.
  - b. Terminal strip numbers.
  - c. Color coding.
  - d. Conduits in which wiring is to be located.
  - e. Location, functional name and manufacturer's designation of items to which wiring and/or piping are connected.
  - f. Point-to-point wiring diagrams.
- Q. Instrument loop diagrams for all analog display, control and I/O loops prepared using ISA standard symbols in accordance with ISA standard S5.4, include the following:
- a. Instrument tag numbers from Contract Documents.
  - b. Functional name of each item.
  - c. Manufacturer's model, product, or catalog number for each item.
  - d. Location of each item.
- R. Distributed Control System I/O Loop Wiring Diagrams: Prepare drawings on a module-by-module basis and include the following information:
- a. Rack numbers, slot number, module type and module terminal point numbers. Also include location and identification of all intermediate panel and/or field terminal block and strip numbers to which I/O wiring and power supply wiring is connected. Identify all power supply circuit numbers and ratings.
  - b. Wiring sizes, types, wire numbers and color coding.

- c. Designation of conduits in which field I/O wiring is to be run.
  - d. Location, functional name, tag numbers and manufacturer model numbers of panel and field devices and instruments to which I/O wiring is connected. For discrete I/O devices use NFPA 79 electrical symbols tagged with designation shown on P&I drawings.
  - e. Programmable Logic Controller Communication Registers: Listing of all contiguous register locations used in serial communications to the Distributed Control System.
- S. Control System Operation and Maintenance Manuals:
- a. Furnish O&M manuals for the Plant Monitoring and Control System in accordance with the Contract Specifications, and the supplemental requirements below:
    - i. The O&M manuals shall include the following:
      - 1. Name, address and telephone number of the control system supplier's local service representative.
      - 2. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
      - 3. Copy of all approved submittal information and system shop drawings as specified herein with corrections made to reflect actual system as tested and delivered to the site for installation. Half-size black line reproductions shall be provided for all shop drawings larger than 11 by 17 inches.
    - ii. Manufacturer's original copies of hardware, software, installation, assembly and operations manuals for control system components and peripheral devices. Manuals shall include the following information:
      - 1. General descriptive information covering the basic features of the equipment.
      - 2. Physical description covering layout and installation requirements and all environmental constraints.
  - b. Functional and operational descriptions covering the procedures for start-up, shutdown, and calibration of control system equipment and explaining how the various control functions are performed.
  - c. Principles of operation explaining the logic of operation; provide information covering operation to a component level.
  - d. Maintenance procedures covering checkout, troubleshooting, and servicing; checkout procedures shall provide the means to verify the satisfactory operation of equipment, troubleshooting procedures shall serve as a guide in determining faulty components and servicing procedure shall cover requirements and recommended time schedule for calibration, cleaning, lubrication and other housekeeping and preventive maintenance procedures.
  - e. Wiring, schematic and logic diagrams.
  - f. Safety considerations relating to operation and maintenance procedures.
- T. Record Drawings and Documentation:
- a. CONTRACTOR and system supplier shall revise all system Shop Drawings, submittal and software documentation to reflect as-built conditions in accordance with the requirements of the Contract Documents and the supplemental requirements below.
  - b. Six (6) copies of all revised Shop Drawings and documentation shall be submitted to the OWNER to replace out-dated drawings and documentation contained in the System

O&M Manuals. Half-size black line sets shall be provided for all drawings larger than 11-inches by 17-inches. Specific instructions for out-dated drawing removal and replacement shall be provided with the Record Drawing submittal.

- c. Half-size black line prints of wiring diagrams applicable to each control panel shall be placed inside a clear plastic envelope and stored in a suitable print pocket or container inside each control panel.
- U. Reports:
- a. Two (2) copies of the following reports shall be submitted to OWNER:
  - b. Factory Test Reports if specified in Section 13322, Factory Testing.
- V. Installation Inspection, Field Calibration, and Field Testing Reports as specified in Section 13323, Check-out, Start-up and Field Testing.

## **1.6 EQUIPMENT DELIVERY, HANDLING AND STORAGE**

- A. CONTRACTOR shall make all arrangements for transportation, delivery and storage of the equipment and materials in accordance with the requirements of the Contract Documents, requirements of the system supplier, and requirements of equipment manufacturers.
- B. Plant monitoring and control system equipment shall be packaged at the factory prior to shipment to protect each item from damage during shipment and storage. Containers shall be protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment. Keep OWNER informed of equipment delivery.
- C. All equipment shall be handled and stored in accordance with manufacturer's instructions and relevant organization standards. Equipment shall be protected from weather, moisture and other conditions which could cause damage. Items which require a controlled environment for storage such as panels and microprocessor units shall be stored in a climate controlled warehouse or facility. System supplier shall notify CONTRACTOR in writing with copies to OWNER of the storage requirements and recommendations for the equipment prior to shipment.

## **1.7 GENERAL DESIGN REQUIREMENTS**

- A. Power Supplies:
  - a. All electrically powered equipment and devices shall be suitable for operation on 115 volt  $\pm$  10 percent, 60 Hz  $\pm$  2 Hz power. If a different voltage or closer regulation is required, a suitable regulator or transformer shall be provided.
  - b. Appropriate power supplies shall be furnished by CONTRACTOR for all two wire transmitters, loops for monitoring discrete inputs and all necessary outputs. Power supplies shall be mounted in enclosures and installed in the appropriate Room or field panel.
  - c. Design all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.
  - d. A power on-off switch or an air circuit breaker shall be furnished for each item requiring electrical power.
  - e. Provide isolation transformers, line voltage regulators and power distribution panels for the distributed digital portions of the plant monitoring and control system to eliminate electrical noise and/or transients entering on the primary power line.

B. Signal Requirements:

- a. The control system shall be designed to use 4 to 20 MADC analog signals, unless otherwise specified.
- b. Signal converters and repeaters shall be provided where required and in addition analog inputs to the distributed control system shall be through appropriate repeaters to provide signal isolation where series looped with other devices and to allow the loop to maintain integrity even if the distributed control system is out of service. Power supplies shall be sized adequately for signal converter and repeater loads.
- c. Signals shall be isolated from ground.
- d. Signals shall not have a transient dc voltage exceeding 300 volts over one millisecond nor a dc component over 300 volts.
- e. The system and associated input/output wiring will be used in a plant environment where there can be high energy ac fields, dc control pulses, and varying ground potentials between the sensors/transducers or input contact locations and the system components. The system design shall be adequate to provide proper protection against interference from all such possible situations.

C. Miscellaneous:

- a. All instrumentation and plant monitoring and control system components shall be heavy duty types, designed for continuous service in a municipal treatment plant environment. The system is to contain products of a single manufacturer, when possible, and to consist of equipment models currently in production. All equipment provided is to be of modular construction and to be capable of field expansion through the installation of plug-in circuit cards and additional cabinets as necessary. Design all logic and control loops to fail safe.
- b. All instrumentation and plant monitoring and control system components shall be designed to return automatically to accurate measurement within 15 seconds upon restoration of power after a power failure or when transferred to standby power supply.
- c. Surge protection shall be provided for all instruments and all other control system components damaged by electrical surges.
- d. All field-mounted instruments and system components shall be designed for installation in humid and corrosive service conditions. All field mounted instrument enclosures, junction boxes and appurtenances shall conform to NEMA 4X requirements unless otherwise specified.
- e. All relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are not an acceptable alternate.
- f. All panel mounted instruments, switches, and other devices shall be selected and arranged to present a pleasing coordinated appearance. All front of panel mounted devices shall be of the same manufacturer and model line.
- g. All components finished, including field and rear of panel instruments, shall be tagged with the item number and nomenclature indicated on the Contract Documents and/or approved Shop Drawings.
- h. Ranges and scales specified herein shall be coordinated to suit equipment actually furnished.
- i. Field-mounted devices shall be treated with an anti-fungus spray.
- j. Field-mounted devices shall be protected from exposure to freezing temperatures and shaded from direct sunlight.

D. Environmental Conditions:

- a. The control system shall be designed and constructed for continuous operation under the following temperature and humidity conditions:
  - i. Control Rooms:
    - 1. Ambient Temperature: 60 degrees F to 80 degrees F normal range; 40 degrees F to 115 degrees F maximum extremes.
    - 2. Relative Humidity: 80 percent, normal; 95 percent maximum.
- E. Indoor locations for digital processing equipment hardware, control panels and instruments:
  - a. Ambient Temperature: 40 degrees F to 120 degrees F.
  - b. Relative Humidity: 98 percent maximum.
- F. Outdoor locations for instruments:
  - a. Ambient Temperature: -10 degrees F to +120 degrees F.
  - b. Relative Humidity: 100 percent maximum.
- G. System Designs:
  - a. Range, scale and setpoint values specified in other Division 13 sections are for initial setting and configuration. Modifications to these values may be required based on actual equipment finished and as necessary to implement proper and stable process actions which are determined as systems are placed in operation. These modifications shall be done at no additional cost to OWNER.
  - b. For any items where ranges, scales and setpoints may not have been specified, CONTRACTOR shall submit a recommendation to OWNER for review.

**PART 2 - PART 2 - PRODUCTS (NOT USED)**

**PART 3 - PART 3 - EXECUTION (NOT USED)**

## **SECTION 13329: MONITORING AND CONTROL SYSTEM PRIMARY SENSORS AND FIELD INSTRUMENTS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Scope:
  - a. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation all primary sensors and field instruments furnished under this Section.
  - b. CONTRACTOR shall be responsible for installing in-line flow elements (magmeter flow tubes, insert flow tubes, propeller flow meters) and for providing taps in the process piping systems for installation of other flow, pressure and temperature sensing instrumentation.
  - c. Drawings and Specifications illustrate and specify functional and general construction requirements of the sensors and field instruments and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. CONTRACTOR shall provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.
- B. Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.
- C. Related Sections:
  - a. Section 13321, General Requirements.

#### **1.2 QUALITY ASSURANCE**

- A. Comply with the requirements of Section 13321, General Requirements.
- B. Acceptable Manufacturers:
  - a. Furnish primary sensors and field instruments by the named manufacturers or equal equipment by other manufacturers.
  - b. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
  - c. Obtain all sensors and field instruments of a given type from the same manufacturer.
  - d. The primary sensors and field devices shall be interchangeable with similar function existing primary sensors and field devices to minimize spare parts inventory.
- C. Manufacturer's Responsibilities and Services:
  - a. Design and manufacture the primary sensors and field instruments in accordance with the applicable general design requirements specified in Section 13321, General Requirements, and the detailed specifications herein.

#### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with the requirements specified in Section 13321, General Requirements.

- B. Primary sensors and field instruments shall not be delivered to the site until all product information and system Shop Drawings for the sensors and instruments have been approved.

**1.4 SUBMITTAL**

- A. Comply with the requirements specified in Section 13321, General Requirements.

**1.5 CHEMICAL SERVICE**

- A. Where a primary element is designated for chemical service, all wetted components and appurtenances for that primary element shall be resistant to corrosion by that chemical. Chemicals referred to commonly as "caustic", "chlorine gas/solution", shall mean the following:
  - a. "CAUSTIC": Sodium hydroxide (NaOH), 50 percent solution, Specific Gravity = 1.53.
  - b. "CHLORINE GAS/SOLUTION": Chlorine Gas/Solution (Cl<sub>2</sub>).

**1.6 MATERIALS OF CONSTRUCTION FOR WETTABLE PARTS**

- A. Provide the following materials of construction for primary sensors and field instrument (wetted) parts that come in contact with the following list of process fluids:

PROCESS FLUID	ELASTOMER	METAL	PLASTIC	OTHER
Air	Neoprene	Type 316 SS	Teflon	--
Potable Water	Neoprene	Type 316 SS	Teflon	Ceramic
Sodium Hydroxide	EPDM	Hastelloy C Titanium	Teflon PVC/CPVC	--
Chlorine Solution, Sample water	Viton	Monel Titanium	Teflon PVC/CPVC	Ceramic

**1.7 IDENTIFICATION TAGS**

- A. All sensors and field instruments shall have an identification tag meeting the following requirements:
  - a. Tag numbers for sensors and field instruments shall be as listed on the Drawings as the equipment number (a seven digit number).
  - b. The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
  - c. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circllet of 1/16-inch diameter stainless steel wire rope.
  - d. All sensors and field instruments mounted on or within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel.

**PART 2 - PRODUCTS**

**2.1 LEVEL SWITCH - FLOAT TYPE**

- A. Type: Direct acting, pear shaped, eccentric weighted displacement type, liquid level sensor.



- B. Construction Features:
  - a. Float Body: Hollow hermetically sealed, rigidly molded of plastic containing mercury switch and eccentric metal weight. Select plastic material from the table in Paragraph 1.6 based on process fluid in contact with float.
  - b. Mercury Switch: Hermetically sealed SPDT switch rated 8 amps ac/5 amps dc, cushioned and mounted along main axis at about 65 degree inclination.
  - c. Weight: Weight to cause sensor to hang straight down from cable when not immersed and only allow float to pivot when immersed in liquid.
  - d. Electrical Cable:
    - i. Heavy duty, three conductor, flexible and submersible cable, sheathed in PVC and connected to float and switch with watertight seal.
    - ii. Length finished to be sufficient to extend to junction box.
- C. Product and Manufacturer: Provide the following:
  - a. Model ENH- 10, as manufactured by Flygt.
  - b. Or approved equal.

## 2.2 PRESSURE TRANSDUCERS

- A. Type: Strain gage pressure transducer, flush mount, for pressure ranges of 0-15 psig and greater.
- B. Performance Specifications:
  - a. Accuracy (includes combined effects of non-linearity, hysteresis and repeatability):  $\pm 0.5$  percent of calibrated span.
  - b. Operating Temperature Range: 35 degrees F to +200 degrees F.
  - c. Compensated Temperature Range: 30 degrees F to 200 degrees F.
  - d. Thermal Effect on Zero: Less than  $\pm 1$  percent within any 100 degrees F range within the compensated temperature range.
  - e. Thermal Effect on Span: Less than  $\pm 1$  percent within any 100 degrees F range within the compensated temperature range.
- C. Construction Features:
  - a. Case: 316 Stainless Steel Flush Mount Transducer with Pressure Port Adaptor for sludge or sewage pressure measurements.
  - b. Pressure Port Adaptor: 1 -inch NPT male 0.94-inch Insert Depth, 1-3/8-inch Hex Head and O-Ring Seal.
  - c. Overload: Two time rated range without damage, five times rated range without bursting.
  - d. Shock Resistance: 50 g's peak (11 milliseconds).
  - e. Vibration Resistance: Meets NIIL STD 81 O-C, Figure 514-5, Curve AP, Time Schedule 11 Random Vibration Test.
  - f. Weight: 2 ounces less cable and adapter.
  - g. Pressure Diaphragm: 0.749-inches maximum.
- D. Electrical:
  - a. Span:  $100 \pm 1.0$  mVDC at rated excitation voltage at 77 degrees F.
  - b. Zero Balance:  $\pm 5.0$  mVDC at 77 degrees F.
  - c. Bridge Resistance: Input  $150 \pm 50$  Ohms, Output  $115 \pm 25$  Ohms.
  - d. Insulation Resistance: Greater than 1000 MOhms at 50 VDC maximum.
  - e. Electrical Connection: Provide 4 conductor shielded cable of sufficient length to connect to process indicator.

- E. Product and Manufacturer: Provide the following:
  - a. Model PTX 1830 Pressure Transducer, as manufactured by Druck Incorporated, or approved equal.

### **2.3 BEACON**

- A. General: Strobe light providing wan-ling in an area where a potential hazard may occur.
- B. Service: Outdoors.
- C. Required Features:
  - a. Power Required: 120 VAC, 60 Hz.
  - b. Strobe Light: Minimum 250 candlepower; 360 degree pafitem.
  - c. Flashing Mechanism: 72-80 Rashes per minute.
  - d. Dome Material of Construction: Polycarbonate.
  - e. Color: As shown on the Drawings.
  - f. Base Materials of Construction: Aluminum (NEMA 4X rated).
  - g. Mounting: As shown on the Drawings. Provide appropriate brackets and appurtenances for installation.
- D. Product and Manufacturer: Provide the following:
  - a. Federal Signal.
  - b. Edwards.
  - c. Or approved equal.

### **2.4 TEMPERATURE SENSOR AND TRANSMITTER - RTD TYPE**

- A. Sensor Requirements:
  - a. Accuracy:  $\pm 0.05$  percent of actual temperature, whichever is greater from 32 degrees F to 120 degrees F.
  - b. Stability: +0.1 of reading from initial calibration in one year.
  - c. Resistance: 100 ohms at 320F.
  - d. Resistance Change: 0.22 ohms per degrees or 0.03 percent of ohm reading per 10 degrees C change from 20 degrees C.
  - e. Sensor Assembly:
    - i. Platinum RID type sensor assembly consisting of the following components:
      1. Three lead wire type RTD with primary resistance wire wound in a coil.
      2. No. 22 AWG minimum insulated leads and resistance wire enclosed in small diameter seamless, closed end sheath.
      3. Sheath surrounded by a thermowell designed for threaded, Ranged or welded process mounting as required.
      4. Element, sheath and thermowell joined to an industrial, heavy-duty, waterproof type head using extension fittings, compression springs and pressure plate to maintain RTD tip contact with end of thermowell. Sheath, thermowell and extension fittings shall be Type 316 stainless steel, unless otherwise noted.
    - ii. Insertion Length: Coordinate lengths with process piping and installation requirements.
    - iii. Three lead extension wire between connection head and transmitter of either shielded, armored or waterproof type as recommended by the manufacturer.

- iv. RTD assembly shall be of the spring-loaded design. NEMA 4X connection head shall be finished with threaded cover and O-ring gasket.

B. Transmitter Requirements:

- a. Accuracy:  $\pm 0.2$  percent of calibrated span, including repeatability, hysteresis, linearity and adjustment resolution. (Not including sensor error).
- b. Output: 4-20 MADC linear with temperature. Digital process variable signal superimposed on 4-20 MADC signal without compromising loop integrity.
- c. Ambient Temperature Limits: 32 to 120 degrees F.
- d. Ambient Temperature Effect: Not more than  $\pm 0.03$  percent of reading. Change in calibrated span for a 50 degrees F change in ambient temperature within operative limits.
- e. Power Supply Effect: Maximum of  $\pm 0.005$  percent of span per one-volt change in power supply.
- f. Solid-state electronics.
- g. Input/output isolation.
- h. Factory calibrated for the operating temperature ranges required.
- i. Field adjustable span and zero settings.
- j. Built-in EMI and RFI protection.
- k. Electronics housing designed and constructed to meet NEMA 4X requirements and equipped with brackets suitable for pipe stand mounting remote from the RTD Sensor assembly.
- l. Barrier terminal strip wiring connections.
- m. 3/4-inch internal NPT conduit connections.
- n. Designed to operate from remote power supply at 12 to 45 VDC.

C. Accessories: A HART communicator or similar to allow reconfiguration in the field.

- a. Provide a local loop powered 0 to 100 percent analog or 3-1/2 digit LCD indicator mounted either in the transmitter enclosure and visible through an inspection window, or mounted in a separate enclosure installed near the transmitter. Display indication shall be calibrated in engineering units. Remote indicator shall have an accuracy of  $\pm 0.5$  percent of span and shall be furnished with an auxiliary stainless steel tag to indicate calibrated range in degrees Fahrenheit units.
- b. A HART communicator or similar to allow reconfiguration in the field. Provide one communicator for every 10 units specified in Section 13661, Component Schedule.
- c. Transient Protection to prevent damage to the transmitter induced on the loop wiring by lightning, welding, heavy electrical equipment or switch gears.

D. Product and Manufacturer: Provide one of the following:

- a. Sensors:
  - i. Rosemount, Incorporated.
  - ii. Honeywell.
  - iii. Yokogawa.
  - iv. Or approved equal.
- b. Transmitters:
  - i. Series 3144, as manufactured by Rosemount, Incorporated.
  - ii. Series STT 3000, as manufactured by Honeywell.
  - iii. Series YTA, as manufactured by Yokogawa.
  - iv. Or approved equal.

## 2.5 THERMOMETER

- A. Type: Bimetal.
- B. System Performance Requirements:
  - a. Accuracy: ASME B40.3 Grade A 1 percent.
  - b. Thermowell: Type 316 Stainless Steel.
  - c. Case: All-Welded Stainless Steel.
  - d. Silicone liquid filled.
- C. Product and Manufacturer: Provide the following:
  - a. Ashcroft series EL.
  - b. Or approved equal.

## 2.6 TEMPERATURE SWITCH

- A. Type: Filled thermal element and pressure switch, close coupled.
- B. System Performance Requirements:
  - a. Temperature Element: SAMA Class II Vapor Pressure type.
  - b. Type 316 Stainless Steel.
  - c. Thermowell: Type 316 Stainless Steel
  - d. Dimension U determined by process location.
  - e. Switch
    - i. Calibrated Scale
    - ii. Rating: SPDT 10 A at 120 VAC
    - iii. Deadband: Fixed.
    - iv. Switch Housing Rating: NENIA 4X.
- C. Product and Manufacturer: Provide one of the following:
  - a. Ashcroft P-Series.
  - b. United Electric.
  - c. Or approved equal.

## 2.7 SPARE PARTS AND TEST EQUIPMENT

- A. CONTRACTOR shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Specification Section.
- B. Spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- C. The following shall constitute the minimum spare parts:
  - a. A one (1) year supply of all expendable materials.
  - b. One dozen of each type and size of fuse used in instruments.
  - c. No less than one (1) spare shall be provided for the below listed devices. The total for the required spares shall be based on Section 13661, Component Schedule.

<b>Primary Sensors and Field Instrument Description</b>	<b>Specification Reference (Section 13329)</b>	<b>Required Spares</b>
Level Switch	2.1	10% of total specified
RTD Sensor	2.4	10% for each range specified

- d. Spare pressure gages and pressure switches shall be provided with diaphragm seals, filled and ready for use.
- D. The following shall constitute the minimum test and calibration equipment:
  - a. All special tooling required to insert, extract and connect any internal or external connector, including edge connectors.
  - b. All special calibration equipment required for system calibration.
- E. All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.
- F. The Primary Sensor and Field Instrument Supplier(s) shall submit a separate quotation for a recommended list of spare parts and test equipment. Each item recommended shall be listed and priced separately.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. CONTRACTOR shall require the system supplier to furnish the services of qualified factory-trained servicemen to assist in the installation of the instrumentation and control system equipment.
- B. Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents. Transmitters and instruments which require access for periodic calibration or maintenance shall be mounted so they are accessible while standing on the floor.
- C. All items shall be mounted and anchored using stainless steel hardware unless otherwise noted.
- D. All field instruments shall be rigidly secured to walls, stands or brackets as required by the manufacturer and as shown.
- E. Conform to all applicable provisions of the NEMA standards, NEC and local, State and Federal codes when installing the equipment and interconnecting wiring.

#### **3.2 START-UP, CALIBRATION, AND TESTING AND TRAINING**

- A. Comply with the requirements of Section 13321, General Requirements.

## **SECTION 13330: MONITORING AND CONTROL SYSTEM PANELS AND ENCLOSURES**

### **GENERAL**

#### **PART 1 - DESCRIPTION**

- A. Scope:
  - a. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and place into satisfactory operation control panels and enclosures.
- B. Related Sections:
  - a. Section 13321, General Requirements.
  - b. Section 13331, Panel Instruments and Devices.
  - c. Division 16, Electrical.

#### **1.1 QUALITY ASSURANCE**

- A. Standards, Codes and Regulations:
  - a. Construction of panels and the installation and interconnection of all equipment and devices mounted within shall comply with applicable provisions of the following standards, codes and regulations:
    - 1. National Fire Protection 79, Electrical Standard for Industrial Machinery (NFPA 79).
    - 2. National Electrical Code (NEC).
    - 3. National Electrical Manufacturer's Association Standards (NEMA).
    - 4. American Society for Testing and Materials (ASTM).
    - 5. Operational Safety and Health Administration (OSHA) Regulations.
  - b. State and Local code requirements.
    - 1. Where any conflict arises between codes or standards, the more stringent requirement shall apply.
  - c. All electrical materials and equipment shall be new and shall bear the label of the Underwriters' Laboratory (UL), Inc., Factory Mutual (FM) or equivalent where standards have been established and label service regularly applies.
- B. General Design Requirements:
  - a. Comply with the requirements of Section 13321, General Requirements.
- C. Factory Assembly and Testing:
  - a. Comply with the requirements of Section 13322, Factory Training.

#### **1.2 SUBMITTAL**

- A. Comply with the requirements of Section 13321, General Requirement.

#### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with the requirements of Section 13321, General Requirements.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL CONSTRUCTION REQUIREMENTS**

- A. Provide all electrical and/or pneumatic components and devices, support hardware, fasteners, interconnecting wiring and/or piping required to make the control panels and enclosures complete and operational.
- B. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.
- C. Components for installation on panel exterior shall be located generally as shown. Layouts shall be submitted for approval in accordance with Section 13321, General Requirements.
- D. Where permitted by location and layout as shown, panels and enclosures shall have full height rear access doors. Where rear doors are not possible, panels shall have full or half height front access doors.
- E. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.
- F. Provide sub-panels for installation of all relays and other internally mounted components.
- G. All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.
- H. Provide copper grounding studs for all panel equipment.
- I. Provide the following convenience accessories inside of each control panel:
  - a. One 120 VAC, 20A duplex, grounding type receptacle.
  - b. One 120 VAC fluorescent light fixture with 40 watt lamp and protective plastic shield.
  - c. One 120 VAC, 20A, snap switch, to turn on the light, mounted in an outlet box with a cover and located so that it is easily accessible from access door.
  - d. Service light with switch and duplex receptacle shall have its own circuit breaker and separate power feed.
- J. The bottom 12-inches of free standing panels shall be free of all devices, including terminal strips, to provide ease of installation and testing.
- K. No device shall be mounted less than 36-inches above the operating floor level, unless otherwise specified.

### **2.2 IDENTIFICATION**

- A. Provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:
  - a. Nameplates shall be of 3/32-inch thick laminated phenolic type with black matte finish surface and white letter engraving.
  - b. Panel identification nameplates to have 1/2-inch high letter engravings.
  - c. Panel mounted component identification (e.g., control devices, indicating lights, selector switches, etc.) nameplates to have 1/4-inch high letter engravings.

- d. Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.
  - e. Nameplate engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.
- B. Tag all internally mounted components in accordance with the following requirements:
- a. Tag numbers shall be as shown.
  - b. The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
  - c. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circllet of 1/16-inch diameter stainless steel wire rope.
  - d. Identification tag shall be installed so that the numbers are easily visible to service personnel.
  - e. Front of panel mounted instruments shall have the tag attached to rear of device.
- C. Tag all electrical components and devices mounted within control panels and enclosures with embossed plastic tape labels.
- D. Tag all pneumatic lines with plastic tags. Paper tags are not acceptable.
- E. Numerically code terminals on terminal strips using a Brady LS2000 Labeling System, or approved equal.
- F. Color code and/or numerically code wiring as required by applicable standards. Wires shall be identified at each end with permanent number codes using a Brady LS2000 Labeling System, or approved equal.
- G. CONTRACTOR shall provide OWNER with a Labeling System of same manufacture used in Paragraph 2.2.E and Paragraph 2.2.F above. In addition, materials shall be provided for preparing 100 wire markers and 100 terminal blocks.

## **2.3 PANELS AND ENCLOSURES**

- A. General:
- a. Panels and enclosures shall meet the NEMA requirements for the type specified.
  - b. Sizes shown are estimates. CONTRACTOR shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, tubing and other components installed within.
- B. Construction Features:
- a. Control panels located inside control or electrical room areas shall be NEMA 12 rated.
    - i. Fabricate enclosures using minimum 14 gage steel for wall or frame mounted enclosures and minimum 12 gage for free standing enclosures. Steel shall be free of pitting and surface blemishes.
  - b. Continuously weld all exterior seams and grind smooth. Also, surface grind complete removal of corrosion, burrs, sharp edges and mill scale.
  - c. Reinforce sheet steel with steel angles where necessary to adequately support equipment and ensure rigidity and to preclude resonant vibrations.



- d. Panel shall be flat within 1/16-inch over a 24-inch by 24-inch area, or flat within 1/8-inch for a larger surface. Flatness shall be checked by using a 72-inch long straight edge. Out-of-flatness shall be gradual, in one direction only, and shall not consist of obvious depressions or a series of wavy sections.
- e. Use pan type construction for doors. Door widths shall not exceed 36 inches.
- f. Mount doors with UL length heavy duty piano hinge with stainless steel hinge pins.
- g. Provide oil resistant gasket completely around each door or opening.
- h. Provide handle-operated, oil-tight, key-lockable three point stainless steel latching system with rollers on latch-rods for easy door closing.
- i. Use stainless steel fasteners throughout.
- j. Provide interior mounting panels and shelves constructed of minimum 12 gage steel with a white enamel finish.
- k. Provide steel print pocket with white enamel finish.
- l. Provide enclosure mounting supports as required for floor, frame, or wall mounting.
- m. Provide all holes and cutouts for installation of conduit and equipment. Cable and piping to enter the enclosure through the bottom unless otherwise noted. All conduit and piping openings and all conduits shall be sealed watertight.
- n. Completely clean all interior and exterior surfaces so they are free of corrosive residue, oil, grease and dirt. Zinc phosphatize for corrosion protection.
- o. One coat of primer shall be applied to all interior and exterior surfaces immediately. Exterior surfaces shall then be given sufficient coats of primer surfacer, applied with sanding and cleaning between coats, until a Grade 1 finish can be produced on the finish coat.
- p. All interior surfaces shall be painted with two coats of semi-gloss white enamel.
- q. All exterior surfaces shall be painted with a minimum of three finish coats of enamel to ultimately produce a Grade 1 finish (super smooth; completely free of imperfections). Color to be selected from color charts furnished by CONTRACTOR. Provide one extra quart of touch-up paint for each exterior finish color.
- r. Primer and finish paint shall be compatible and shall be Sherwin-Williams "Polane T Polyurethane Enamel", or approved equal.
- s. Provide one extra quart of touch-up paint for each exterior finish color.
  - i. Control panels located in field shall be NEMA 4X rated. Panels shall be either metallic or non-metallic, as shown on the Drawings.
    1. Non-metallic Panels:
    2. Panels shall be constructed of fiberglass mat-reinforced polyester resin, with a minimum thickness of 3/16-inch for all surfaces except those areas requiring reinforcement.
    3. Panels shall be precision molded to form a one-pieced unit with all comers rounded.
    4. Exterior surfaces shall be gel-coated to provide a corrosion-resistant, maintenance-free satin finish which shall never require painting.
    5. Color pigments shall be molded into the resin.
    6. Color to be selected from color charts furnished by CONTRACTOR.
    7. Panels shall have "half height" front access doors wherever rear access is not feasible; no devices to be mounted on doors.
    8. Provide a clear plastic, gasketed, hinged door to encompass all non-NEMA 4 front of panel instruments.
    9. All hardware, including hinge and means of locking shall be corrosion resistant.

10. Provide 5/16-inch diameter copper ground studs which will be the ground connection points for all panel equipment.
11. Floor Pad: Refer to Part 3 of this Specification Section.
- ii. Metallic Panels:
  1. Panels shall be Type 316 stainless steel construction with a minimum thickness of 12 gage for all surfaces (except those areas requiring reinforcement) having a smooth brushed finish.
  2. Stainless steel fast-operating clamp assemblies on three sides of each door.
  3. Rolled lip around three sides of door and along top of enclosure opening.
  4. Hasp and staple for padlocking.
  5. Provide a clear plastic, gasketed lockable hinged door to encompass all non-NEMA 4 front of panel instruments.
  6. Provide 3-inch high channel base assembly, with solid bottom, drilled to mate the panel to its floor pad for free-standing panel.
  7. Floor Pad: Refer to Part 3 of this Specification Section.
- t. Where the application applies and with the approval of OWNER, wall mounted enclosures may be provided. The enclosure shall comply with Paragraph 2.3.B.1 and Paragraph 2.3.B.2, except for the following:
  - i. Doors shall be fall height.
  - ii. No extra holes or knockouts shall be provided. No light or convenience outlet need be provided.

C. Electrical Systems:

- a. Control of Environment:
  - i. Outdoor Panels:
    1. Provide automatically controlled closed loop ventilation fans or closed loop air conditioners with filtered air louvers if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the enclosure. Housing shall be constructed of corrosion resistant materials.
    2. Provide calculations for cooling and heating load requirements.
    3. Provide thermostats to automatically control heating and cooling requirements without need of manual operation of a heating/cooling transfer switch.
    4. Heating and cooling elements including external shall be Heresite coated, or approved equal.
  - ii. Indoor Panels:
    1. Provide adequately sized, automatically controlled 120 VAC strip heaters to maintain temperature 10 degrees F above ambient for condensation prevention inside panels.
    2. Provide automatically controlled closed loop ventilation fans or closed loop air conditioners with filtered air louvers if required to maintain temperature inside each enclosure below the maximum operating temperature rating of the components inside the enclosure.
    3. Provide calculations for cooling and heating load requirements.
    4. Provide thermostats to automatically control heating and cooling requirements without need of manual operation of a heating/cooling transfer switch.

5. Heating and coiling elements including external shall be Heresite coated, or approved equal.
- b. Power Source and Internal Power Distribution:
- c. General: Control panel power supply source, type, voltage, number of circuits and circuit ratings shall be as shown.
- d. Panels shall be provided with an internal 120 VAC power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components. Distribution panel shall contain two spare breakers minimum.
- e. Electrical Systems:
  - i. Internal wiring shall be Type THHN stranded copper wire with thermoplastic insulation rated for 600 V at 85 degrees C for single conductors, color coded and labeled with wire identification.
  - ii. For DC panel signal wiring, use No. 16 minimum AWG shielded. For DC field signal wiring, terminal strips shall be capable of handling No. 12 wiring (minimum).
  - iii. For AC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 14 minimum AWG. For wiring carrying more than 15 amps, use sizes required by NEC and JIC standards.
  - iv. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6-inches.
  - v. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1 -inch. Troughs shall have 40 percent spare capacity.
  - vi. Install wire troughs along horizontal or vertical routes to present a neat appearance. Angled runs are not acceptable.
  - vii. Adequately support and restrain all wiring runs to prevent sagging or other movement.
  - viii. Terminate all field wiring using forked, insulated, crimp-on connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips with screwed connections and permanently affixed numeric identifiers beside each connection. Identifiers to be self-stick plastic tape strips with permanent type, machine printed numbers.
  - ix. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.
  - x. All alarms generated external to the panel, spare alarm, and repeat contacts shall be wired out to terminal blocks.
  - xi. For internal component to component wiring only, compression type terminal blocks are acceptable.
  - xii. Provide spare terminals equal in number to 20 percent of the terminals used for each type of wiring (e.g., DC signal and AC power).
  - xiii. Provide a separate terminal for grounding each shielded cable.
  - xiv. Use separate 5/16-inch diameter copper grounding "studs for instrument signal cable shields and AC power.
  - xv. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
  - xvi. When DC power and/or low voltage AC power is required, provide and install the necessary power supplies and transformers in the panel.
  - xvii. Provide circuit breakers to protect each circuit, with no more than six instruments on a single circuit. Provide lockable circuit breakers for metering pump circuits.

- xviii. Provide complete wiring diagram showing "as-built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install equipment in conformance with NEC.
- B. Unless otherwise noted, install indoor free standing NEMA 4X panels on 6-inch concrete pad. Lay grout after panel sills have been securely fastened down. Extend pad 4-inches beyond outside dimensions of base, all sides.
- C. Unless otherwise noted, install outdoor non-free standing NEMA 4X panels on a reinforced concrete pedestal:
  - a. Minimum Thickness: 8-inches with No. 4 steel reinforcing bars at 12-inches on centers, each way.
  - b. Minimum Size: 12-inches larger than outer dimensions of base, all sides.
  - c. Provide excavation and backfill work in conformance with Section 02220, Excavation and Backfill.
  - d. Provide concrete work in conformance with Section 03300, Cast-In-Place Concrete.
- D. Install anchor bolts and anchor in accordance with Section 05051, Anchor Bolts, Expansion Anchors, Toggle Bolts and Concrete Inserts.
- E. Install and interconnect all equipment, devices, electrical hardware, instrumentation and controls and process controller components into and out of and among the enclosures as shown on the Drawings.

#### **3.2 TESTING AND ADJUSTMENTS**

- A. Perform system testing and make any adjustments necessary in accordance with this Section and Section 13321, General Requirements.
- B. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

## **SECTION 13331: MONITORING AND CONTROL SYSTEM PANEL INSTRUMENTS AND DEVICES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Scope:
  - a. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation panel instruments and devices.
  - b. Drawings and Specifications illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, piping and accessories required for a completely integrated system. CONTRACTOR shall provide all piping, wiring, accessories and labor required for a complete, workable and integrated system.
- B. Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

#### **1.2 QUALITY ASSURANCE**

- A. Comply with the requirements of Section 13321, General Requirements.
- B. Acceptable Manufacturers:
  - a. Furnish instruments and devices by the named manufacturers or approved equal equipment by other manufacturers.
  - b. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
  - c. Obtain all instruments or devices of a given type from the same manufacturer.
- C. Manufacturers' Responsibilities and Services:
  - a. Design and manufacture the instruments and devices in accordance with the applicable general design requirements specified in Section 13321, General Requirements, and the detailed specifications herein.

#### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Comply with the requirements specified in Section 13321, General Requirements.
- B. Instruments and devices shall not be assembled in the panels until all product information and system shop drawings for respective components have been approved.

#### **1.4 IDENTIFICATION TAGS**

- A. All panel instruments and devices shall have an identification tag meeting the following requirements:
  - a. Identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.

- b. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circle of 1/16-inch-diameter stainless steel wire rope.
- c. All instruments and devices mounted within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.
- d. Front of panel mounted components shall have nameplates which comply with the requirements specified in Section 13330, Panels and Enclosures.

## **PART 2 - PRODUCTS**

### **2.1 PROCESS INDICATOR**

- A. Indicator shall be a seven-segment, vacuum-fluorescent display, capable of five-digit readout, programmable to four decimal places, with a seven-segment alarm, status, and negative signal indicator.
- B. Required Design and Construction Features:
  - a. Front panel vacuum-fluorescent type display.
  - b. 4-20 MADC optically isolated retransmission output.
  - c. Alarm Relays: Normally energized Form C contacts where required.
  - d. Inputs:
    - i. Thermocouple (B, C, D, G2, J, K, L, N/N, PL2, R, S and T).
    - ii. RTD (100 Ohm Pt ANSI or DIN 120 Ni, 100 Ni, 10Cu).
    - iii. DC Volts: 20 percent to 100 percent of spans from 20 mV to 5 VDC.
    - iv. AC Volts: 0 percent to 100 percent of spans from 1-600 VAC
    - v. Strain Gauge: Transducer supply configures to provide 5, 7.5, 10 or 20 VDC power.
    - vi. Sample Rate: 3 per second.
  - e. Ratings:
    - i. Accuracy: 0.1 percent of full scale.
    - ii. Conformity: 0.2 degrees C for thermocouples; 0.1 degrees C for RTD.
- C. Normal Mode Rejection: 55 dB at 60 Hz.
  - a. Common Mode Rejection: 120 dB at 60 Hz.
- D. Supply transmitter power supply for all strain gauge applications.
- E. Product and Manufacturer: Provide one of the following:
  - a. Model 750, as manufactured by Chessell Corporation.
  - b. Or approved equal.

### **2.2 ANNUNCIATOR SYSTEMS**

- A. Performance Requirements:
  - a. Activate flashing light in module and sound alarm horn(s).
  - b. Change flashing light to steady light and silence horn(s) by depressing acknowledge pushbutton.
  - c. Automatically turn off steady light when alarm condition is corrected.

B. Required Features:

- a. Flush panel mounted; NENIA rating to match that of panel in which it is mounted.
  - b. Solid state integral or remote logic.
  - c. Plug-in lamp modules including alarm logic circuit boards and filter module if required.
  - d. Isolated auxiliary contacts for each alarm point.
  - e. Front accessible selectors for:
    - i. N.O./N.C. dry field contacts.
    - ii. Lock-in/non-lock-in alarms.
  - f. Yellow lamp test and acknowledge pushbuttons as shown on the Drawings as either integral or external to the annunciator.
  - g. Horn with adjustable volume control if shown on the Drawing. Mounted within panel if located in control room.
  - h. Alarm sequence to be ISA sequence 'A'.
  - i. Single alarm point per window with 2 lamps per point.
  - j. Total number of alarm points shall include 20 percent as spares for each system. Future equipment alarms shall not be considered as spares.
  - k. Spare points shall be provided complete with logic.
  - l. Windows shall be nominal 3-inch by 3-inch and engraved for all active points as per Alarm Schedule. Spare point windows shall not be engraved.
  - m. Character size shall be largest available to allow all information to be shown on window face.
  - n. Units shall be powered by 120 VAC, 60 Hz and be provided with individual replaceable non-resettable line fuses sized to protect the system.
  - o. Annunciators shall be provided with internal 24 VDC power supply.
  - p. On panels with fall front access doors where the weight of the annunciator becomes a consideration, remote logic type shall be provided.
  - q. Common trouble alarm output from annunciator, where any one point in the system going into alarm shall energize a system relay.
- C. Product and Manufacturer: Provide one of the following:
- a. Ronan Engineering Company.
  - b. Or approved equal.

## 2.3 POWER SUPPLIES

- A. General: Single unit and multiple unit power supplies, located in control room panels, remote terminal units and field panels as required.
- B. Single Unit Required Features:
- a. Solid state circuitry.
  - b. Surface mounting.
  - c. Input Power: 117Vac  $\pm$ 10 percent, 60 Hz.
  - d. Output Power: 24 VDC or as required.
  - e. Line/Load Regulation:  $\pm$ 0.005 percent.
  - f. Ripple: 0.25 mv RMS.
  - g. Overload Protection: Internal preset.
  - h. Include mounting brackets, fuse, and mating connector for AC power plug.
- C. Multiple Unit Required Features:
- a. Solid state circuitry.
  - b. Standard 19-inch RETMA (EIA) rail mounting.

- c. Input Power: 120 VAC  $\pm$ 10 percent, 60 Hz.
  - d. Output Power: 24 VDC or as required.
  - e. Include over-voltage protection, output current limiting protection, power supply failure alarm contacts, provisions for paralleling power supplies and front panel mounted indicating fuses, test jacks and adjustments.
  - f. If the power supplies are connected in parallel, provide isolation diodes in series with the positive lead of each of the parallel connected power supplies.
  - g. Connections:
    - i. Twist-lock ac power connector.
  - h. DC power terminal strip.
- D. Product and Manufacturer: Provide one of the following:
- a. Acopian Corporation.
  - b. Or approved equal.

## 2.4 CURRENT ISOLATOR

- A. General: The isolating unit shall be a two wire, loop powered device. It shall accept a 4-20 MADC input signal and deliver a 4-20 MADC output.
- B. Required Features:
- a. Repeatability:  $\pm$ 1 percent of span.
  - b. Ambient Temperature Range: -25 degrees F to +185 degrees F.
  - c. Linearity:  $\pm$ 0.1 percent of full scale.
  - d. Provide one spare isolator.
- C. Product and Manufacturer: Provide one of the following:
- a. Rochester Instrument Systems.
  - b. Or approved equal.

## 2.5 CONTROL RELAYS

- A. Type: General purpose, plug-in type rated for continuous duty.
- B. Construction Features:
- a. Coil Voltages: 24 VDC and 120 VAC as required.
  - b. Contacts:
    - i. Silver cadmium oxide rated not less than 5 amperes resistive at 120 VAC or 28 VDC continuous.
    - ii. For switching low energy circuits (less than 200 made) fine silver, gold flashed contacts rated not less than 3 amperes resistive at 120 VAC or 28 VDC continuous shall be provided.
  - c. Relays to have clear plastic dust cover.
  - d. Relays to be UL recognized.
- C. Product and Manufacturer: Provide one of the following:
- a. Type R and/or Type K, as manufactured by Square D Company.
  - b. Or approved equal.



## 2.6 TIME DELAY RELAYS

- A. Type: Dial adjustable, plug-in type time delay relay providing delay-on-make, delay on-break or interval operation.
- B. Construction Features:
  - a. MOS digital circuit with transformer coupled power.
  - b. Switch selectable ranges as follows:
    - i. 1 second.
    - ii. 10 seconds.
    - iii. 1 minute.
    - iv. 10 minutes.
    - v. 1 hour.
    - vi. 10 hours.
  - c. Minimum Setting: 3 percent of range, except 50 ms for 1 second range.
  - d. Contacts:
    - i. Type: DPDT.
    - ii. Rating: 7 amps resistive at 120 VAC, 7 amps at 24 VDC.
  - e. Housing: Plug-in design with dust and moisture resistant molded plastic case.
  - f. Power Input: 120 VAC and 24 VDC as required.
  - g. Relays shall be UL recognized.
- C. Product and Manufacturer: Provide one of the following:
  - a. Series 328, as manufactured by Automatic Timing and Controls Company.
  - b. Or approved equal.

## 2.7 CURRENT ALARM RELAYS

- A. Type: Direct current, electronic setpoint control relay which accepts 4-20 MADC input signal and provides dry circuit contact output based on trip point setting.
- B. Performance Requirements:
  - a. Repeatability: Trip point repeats within  $\pm 0.1$  percent of span.
  - b. Trip Adjustment: 0 to 100 percent of span.
  - c. Adjustable Deadband: 1 to 20 percent of span.
- C. Construction Features:
  - a. Trip Adjustment: Multiturn front panel adjustment.
  - b. Contacts: DPDT relays, rated 5 amps at 117 VAC or 24 VDC non- inductive.
  - c. Enclosure: Standard housing designed for internal panel mounting.
  - d. Power Supply: 120 VAC, 60 Hz.
- D. Product and Manufacturer: Provide one of the following:
  - a. Rochester Instrument Systems.
  - b. Or approved equal.

## 2.8 SELECTOR SWITCHES, PUSHBUTTONS AND INDICATING LIGHTS

- A. General:
  - a. Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type.

- b. Type:
    - i. Heavy duty, oiltight.
  - c. Provide legend plate for indication of switch, pushbutton or light function (e.g., Open-Closed, Hand-Off-Auto).
  - d. Mounting: Flush mounted on control panel front, unless otherwise noted.
  - e. NEMA rated to match panel in which mounted.
- B. Selector Switches:
- a. Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.
- C. Contacts:
- a. Provide number and arrangement of contacts as required to perform intended functions specified but not less than one single pole, double throw contact.
  - b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
  - c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts but not less than 10 amperes resistive at 120 volts AC or DC continuous.
  - d. Switch Operator: Standard black knob.
- D. Pushbuttons (Standard or Illuminated):
- a. Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.
  - b. Contacts: Comply with the requirements specified for selector switches.
- E. Indicating Lights:
- a. Type: Compact, integral transformer type.
  - b. Lamps: 6 volt, long life (20,000 hours minimum).
  - c. Where shown on the Drawings, common, push to test circuitry shall be provided to simultaneously test all indicating lights on the panel using a single pushbutton.
- F. Button and Lens Colors:
- a. Red for indication of open, on, running.
  - b. Green for indication of closed, off (ready), stopped.
  - c. Amber for indication of equipment malfunction, process trouble and alarms (e.g., high level, low level, etc.).
  - d. Blue for indication of equipment under local control.
  - e. White for indication of electric power available.
- G. Rotary Cam Switches:
- a. Provide rotary cam switches with number of positions and poles as required to perform the required signal switching function specified and shown.
  - b. Contacts:
    - i. Gold-flashed contacts housed in mechanical contact blocks with number and arrangement of contacts as required to perform intended functions.
    - ii. Contact Rating: Compatible with AC or DC throughput current of signals and devices simultaneously operated by the switch contacts but not less than 20 amperes at 600 VAC or 250 VDC continuous.
  - c. Switch Operator: Standard black knob.

- H. Product and Manufacturer: Provide one of the following:
  - a. Square D.
  - b. Or approved equal.

## 2.9 ELAPSED TIME METER

- A. General: The unit shall be a self-powered, non-reset, solid-state counter which provides silent, accurate and noise immune operation.
- B. Required Features:
  - a. Power: No external power; 5 year minimum battery life.
  - b. Display:
    - i. Type: Liquid crystal.
    - ii. Digits: Six.
    - iii. Figure Size: 1/2-inch approximately.
    - iv. Display Life: 50,000 hours minimum.
    - v. Provide indication of sufficient battery power.
  - c. Input: 120 VAC.
  - d. Mounting: Provide accessories for panel mounting.
  - e. Nameplate below the LCD display shall read "HOLTRS" and shall carry the equipment name as shown.
- C. Product and Manufacturer: Provide one of the following:
  - a. Durant.
  - b. Or approved equal.

## 2.10 SURGE PROTECTION DEVICE

- A. General: Lightning and surge protection shall be provided for instrument and main power protection.
- B. Required Features:
  - a. Amp Rating: 10 kA for instruments; 20 kA for main power.
  - b. Voltage Rating: Compatible with working voltage of protected device.
  - c. Reaction Time: nanosecond range.
  - d. Mounting: DIN rail.
  - e. Enclosure Rating: Intrinsically safe when noted.
- C. Product and Manufacturer: Provide one of the following:
  - a. Telematic.
  - b. Or approved equal.

## 2.11 ELECTRONIC TOTALIZER AND INTEGRATOR

- A. General:
  - a. Electronic integrator shall be a solid state device to totalize a linear flow signal with respect to time. The integrated output shall be indicated on a front counter, calibrated to read directly in units of flow and shall be mounted on the panel face.

- B. Required Features:
  - a. Instrument shall be modular plug-in design. A variable dropout adjustment shall be provided to prevent erroneous counting at low flow rates. The instrument shall accept an input signal of 4-20 MADC. Power requirements shall be 120 VAC  $\pm$ 10 percent, 60 Hz. Accuracy shall be 0.5 percent of rate between 10 and 100 percent of full scale.
  - b. Unit shall be provided with a slide-out chassis and shall be suitable for flush panel mounting. Unit shall use a 3-inch by 6-inch cutout and shall match in appearance other panel mounted instruments.
  - c. Integrator output shall be displayed on an integrally mounted eight-digit nonreset electronic counter with battery backed display to prevent loss of display in the event of power outages. Display shall be LCD.
- C. Product and Manufacturer: Provide one of the following:
  - a. Foxboro.
  - b. Or approved equal.

## 2.12 POTENTIOMETER

- A. Type: Industrial potentiometer operator, direct acting, 3/4 to full turn; and standard 3-wire potentiometer.
- B. Required Features:
  - a. NEMA rated to match panel in which mounted.
  - b. Resistance Range: 0 - 10,000 Ohms.
  - c. Resistance Element: Wirewound or conductive plastic.
  - d. Power Rating: 2 Watts.
  - e. Mounting: Flush mounted on control panel front, unless otherwise noted.
  - f. Provide legend plate for indication of position (0 to 100 percent).
- C. Product and Manufacturer: Provide potentiometer of one of the following:
  - a. Square D.
  - b. General Electric.
  - c. Allen-Bradley Co.
  - d. Or approved equal.

## 2.13 SPARE PARTS AND TEST EQUIPMENT

- A. CONTRACTOR shall furnish and deliver the spare parts and test equipment as outlined below, all of which shall be identical and interchangeable with similar parts furnished under this Specification.
- B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- C. The following shall constitute the minimum spare parts:
  - a. Five (5) of each type of input-output relay for each 40 or less furnished for this CONTRACT.
  - b. One (1) replacement power supply for each type and size furnished for this CONTRACT.
  - c. A one (1) year supply of all expendable materials.
  - d. One per ten (two, if fewer than twenty) of each type of panel mounted instrument including lights, pushbuttons and PLC equipment.

- e. One dozen of each type and size of fuse used in panels.
- D. The following shall constitute the minimum test and calibration equipment:
  - a. All tooling required to insert, extract and connect any internal or external connector, including edge connectors.
  - b. All special calibration equipment required for system calibration.
- E. All spare parts shall have been operated and tested in the factory as part of factory testing prior to shipment of the control system.
- F. For process sensors and all other analog instruments, the supplier shall submit a separate quotation for a recommended list of spare-parts and test equipment. Each item recommended shall be listed and priced separately. The spare parts quotation shall contain a statement that the prices quoted are firm for a period of one year (with escalators for the next 2) subsequent to the OWNERS acceptance of the equipment, and that the supplier understands that the OWNER reserves the right to purchase none, any, or all of the parts quoted. The supplier is required to show that a stock of spare-parts and test equipment is obtainable within a 48 hour period.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents.
- B. All items shall be mounted and anchored in compliance with Section 13330, Panels and Enclosures.

#### **3.2 START-UP, CALIBRATION, TESTING AND TRAINING**

- A. Comply with the requirements of Section 13321, General Requirements.

## **I. SECTION 13350: AUTOMATIC TELEPHONE DIALER (SUPERCEDED)**

**NOTE TO CONTRACTOR: The autodialer is now cellular based; the Omnisite Crystal Ball replaces the Raco Verbatim. The cellular SCADA control schematics are updated accordingly on sheets E5.0 and E5.2**

### **A. GENERAL**

#### **1. DESCRIPTION**

- A. Requirements of Conditions of the Contract, Division 1, and Section 13300 form a part of this Section. This Section specifies the instruments and equipment to perform the required functions in conjunction with information and equipment specified in other Sections of Division 11.
- B. Unit Responsibility. It shall be the responsibility of ICM Subcontractor as described in Section 13300 of this Division to insure that the instruments and equipment furnished under this Section are compatible with the equipment furnished under Sections of this Division, and other Divisions of these Specifications, and that the signal transmission methods are compatible.
- C. Case colors shall be compatible with panel colors and subject to final approval by the Owner. Normally, compatible standard colors of the manufacturer shall be acceptable.

#### **2. SUBMITTALS**

- A. General. Comply with the general requirements and procedures described in Section 13321 to submittals, including preparation, transmittals, and guarantees, and to the additional requirements specified herein.
- B. Shop Drawings. Submit shop drawings and data sheets describing the following information:
  - a. Manufacturer's equipment specifications.
  - b. Dimensions of furnished unit and mounting details.
  - c. Materials of construction for enclosure.
  - d. Wiring schematics.
  - e. Listing of available optional features and accessories.
- C. Instruction Manual. Submit written installation and troubleshooting instructions. Also, provide written description of operational capability and procedures for programming message and telephone number features.

#### **3. QUALITY ASSURANCE**

- A. Manufacturer. In addition to requirements of Section 13300, instrumentation and control equipment furnished shall be manufactured by a firm regularly and currently

engaged in the design and manufacture of similar equipment. All equipment furnished shall be new and of the most recent design.

## **B. PRODUCTS**

### **1. AUTOMATIC TELEPHONE DIALER**

- A. General Description. The telephone dialer system shall monitor operations in an unmanned facility, where in the event of an alarm condition indicated by remote contact operations, the dialer system shall automatically initiate contact with preset telephone numbers to advise of alarm condition. The telephone dialer system shall communicate in an electronic synthesized voice, using vocabulary identifying the site and describing the alarm selected by the user from a list of words permanently stored in the unit. At least four (4) messages shall be programmable.
- B. Capacity for Monitoring. The dialer system shall be capable of receiving input contact operations from up to four (4) independent sources. Contact operation shall be either NC or NO, and be jumper or switch selectable. The dialer system shall be capable of reporting in a single telephone call the existence of one or a multiple number of alarm conditions.
- C. Capacity for Dialing. The dialer system shall be capable of dialing up to four (4) telephone numbers. The dialer system shall have the capacity to use up to sixteen (16) digits to define the telephone number.

For example, the dialer system shall be capable of dialing one or more numbers to connect itself to an “outside” line, followed by “1,” if required, plus area code in three (3) digits, if required, and finally, a standard seven-digit telephone number.

- D. Telephone Line Requirements. The dialer system shall use standard telephone lines. Systems which require dedicated telephone lines or other specialized telemetering methods are not acceptable.
  - a. Installation of the dialer system shall be readily achieved by plugging the dialer directly into a modular jack supplied as a part of a normal telephone line installation.
  - b. It is desirable, but not essential, that the dialer system be compatible with a telephone installation which will permit inclusion of a standard telephone handset at the monitoring station. Such an arrangement shall permit personnel to make outgoing telephone calls without interference with the dialer system installation.
  - c. The dialer system shall include the telephone line coupler required by the Federal Communications Commission. Preference will be given to those dialer systems which contain the coupler as an integrated portion of the dialer itself.
- E. Programming. The dialer system shall be equipped with a keyboard to enter telephone numbers to be dialed, and the sequence in which the dialing procedure shall be

executed. Subsequent alterations to the telephone numbers, or the sequence in which they are called, shall be entered by the same keyboard.

Messages shall be similarly programmed by entering 2 digit numbers for the selected words from a list of 100 words.

The dialer system shall incorporate a play-back feature which permits the person establishing the program of telephone numbers to confirm that the data stored in the dialer system's program is correct. This confirmation shall be achieved by the ability of the dialer system to annunciate, through an audio speaker located on the front panel of the system, the complete series of telephone numbers and their calling sequence. Controls located on the keyboard shall make this confirmation procedure available at any time. Other controls located on the keyboard shall be available to initiate a test run of the dialer system's complete alarm advisory operation, including optionally, the actual telephone dialing process.

- F. Operation. The dialer system shall proceed to deliver its alarm message a minimum of sixteen (16) times, pausing at the completion of each message to permit the receiving person to acknowledge by pressing a tone button on the touch-tone-type phone.

If acknowledgement is not received on the first telephone call because the telephone receiving the call did not answer, or the receiving party did not acknowledge, the dialer system shall terminate the first call by hanging up. The system shall wait approximately sixty (60) seconds before proceeding to the next telephone number in its programmed sequence. This shall continue until receipt of the alarm message is obtained.

- a. If the alarm condition is not corrected within a preset period, up to one (1) hour, the dialer system shall reinitiate its alarm advisory, commencing with a call to the first priority telephone number. The dialer shall repeat the cycle, continuing indefinitely until the alarm problem is eliminated, or the dialer system is turned off manually at the site.
    - i. The format of the alarm message to be delivered by the dialer system shall contain sufficient vocabulary to identify the location of the dialer system and the nature of the alarm.
- G. Optional Acknowledgement Generator. Where the receiving telephone uses a rotary dialing mechanism, the supplier of the subject dialer system shall make available at optional extra cost, a battery-powered hand-held tone generator. The output audible tone signal from this device shall provide the signaling acknowledgement when it is directed into the telephone handset mouthpiece.
- H. Electrical Power Requirements. The dialer system shall operate from standard electric power utilities furnishing 120 Vac, 60 Hz, single phase service. The dialer system shall be furnished with an integrally-mounted rechargeable dc battery power supply which shall automatically serve the system in event of failure of commercial power for a period of not less than twenty-four (24) hours continuously. Restoration of the ac power source shall restore the battery to full capacity through use of a float-charging circuit included



in the system. the dialer shall automatically initiate the calling sequence on ac power failure.

- I. Construction. The housing for the dialer system shall be UL-listed, heavy gauge steel, fiberglass or aluminum. Access to controls shall require opening of a hinged door. Connections for alarm-signaling inputs, electrical power and telephone, shall be located on the lower side of the housing and shall accommodate standard electrical conduit fittings in three (3) separate ports.
- J. Temperature Compatibility. The dialer system shall be tested and guaranteed for performance in ambient temperatures ranging between 0 to 120 degrees F.
- K. Manufacturer. The dialer system shall be a RACO Verbatim VSS-4C, or approved equal.

**C. EXECUTION**

**1. INSTALLATION**

- A. Installation, testing, validation and start-up shall be as specified in Section 13300.

**DIVISION 15**

**MECHANICAL**



## **SECTION 15061: PIPE SUPPORTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Supports for pipe, fittings, valves, and appurtenances.

#### **1.2 REFERENCES**

- A. American National Standard Institute or Manufacturer's Standardization Society (ANSI/MSS):
  - a. SP-58 - Standard for Pipe Hangers and Supports - Materials, Design, and Manufacturer.
  - b. SP-69 - Standard for Pipe Hangers and Supports - Selection and Application.

#### **1.3 SUBMITTALS**

- A. Shop Drawings: Include schedule, indicating where supports will be installed, and drawings of pipe support system components.
- B. Calculations and other information to substantiate supports meeting minimum design strength requirements shall be signed and stamped by a civil or structural Professional Engineer licensed to practice in the State of Arizona.

### **PART 2 - PRODUCTS**

#### **2.1 PIPE SUPPORTS**

- A. Concrete Inserts for Pipes under 30 Inch Diameter: ANSI/MSS SP-69 Type 18.
- B. Minimum 1,140 pounds capacity with 5/8 inch diameter rod.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 282.
    - ii. Carpenter and Paterson, Figure CP-109.
- C. Concrete Inserts for Pipe 30 Inch Diameter and Larger: Hot-dip galvanized steel body with 3/4 inch diameter National Coarse zinc plated square nut, anchor insert to steel concrete reinforcement.
  - a. Manufacturers: The following or approved equal:
    - i. Connection Specialties, Inc., Model 6MD350.
- D. Hanger Rods: Sized to match suspended pipe hanger.
  - a. Manufacturers: One of following or approved equal:
    - i. Anvil, Figure 140.
    - ii. Bergen-Paterson, Part 5000.
    - iii. B-Line Systems, Inc., Figure B3205.
- E. Hanger Rods, Continuously Threaded: Sized to match suspended pipe hanger.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 146.
    - ii. Bergen-Paterson, Part BP-5006.

- F. Eye Bolts: Welded and rated equal to full load capacity of rod.
- G. Welded Eyebolt Rod:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 278.
    - ii. Bergen-Paterson, Part 5004.
    - iii. B-Line Systems, Inc., Figure B3210.
- H. Adjustable Ring Hangers: ANSI/MSS SP 69 Type 7.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil.
    - ii. B-Line Systems, Inc., Figure B3172.
- I. Adjustable Clevis Hangers: ANSI/MSS PS 69, Type 1.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 260.
    - ii. Bergen-Paterson, Part 6750.
    - iii. B-Line systems, Inc., Figure B3100 or B3105.
- J. Adjustable Clevis Hangers for Insulated Pipe: Oversize.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 300.
    - ii. Bergen-Paterson, Part 6754.
    - iii. B-Line Systems, Inc. Figure B3108.
- K. Single Rod Hangers for Steam Pipe: ANSI/MSS SP 69 Type 43; malleable iron or steel yoke and roller hangers; swivel to allow rotation of yoke on rod.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 181.
    - ii. B-Line Systems, Inc., Figure B3110.
- L. Double Rod Hangers for Steam Pipe: ANSI/MSS SP 69 Type 41:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 171.
    - ii. B-Line Systems, Inc., Figure B3114.
- M. Brackets: ANSI/MSS SP-69 Type 32 with back plate; rated for 1,500 pounds.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 195.
    - ii. B-Line Systems, Inc., Figure B3066.
- N. Standard U-bolt: ANSI/MSS SP-69 Type 24.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 137.
    - ii. Bergen-Paterson, Part 6510.
    - iii. B-Line Systems, Inc., Figure B3188.
- O. Riser Clamps: ANSI/MSS SP-69 Type 8.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 261.
    - ii. Bergen-Paterson, Part 6302.

- iii. B-Line Systems, Inc., Figure B3373.
- P. Pipe Clamps: ANSI/MSS SP 69 Type 4.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 212.
    - ii. Bergen-Paterson, Part 6100.
    - iii. B-Line Systems, Inc., Figure B3140.
- Q. Adjustable Offset Pipe Clamp:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 100.
    - ii. B-Line Systems, Inc., Figure B3149.
- R. Offset Pipe Clamp:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 103.
    - ii. B-Line Systems, Inc., Figure B3148.
- S. Floor Stand or Stanchion Saddles: ANSI/MSS SP-69 Type 37. Provided with U-bolt hold down yokes.
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 259.
    - ii. Bergen-Paterson, Part 6652.
    - iii. B-Line Systems, Inc., Figure B3090.
- T. Spring Supports:
  - a. Manufacturers: One of the following or approved equal:
    - i. Bergen-Paterson, Part 3200. b. Anvil, Figure B-268.
- U. One Hole Pipe Clamps:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 126.
    - ii. Carpenter and Paterson, Figure 237.
- V. Welded Beam Attachment:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 66.
    - ii. Bergen-Paterson, Part 1047.
    - iii. B-Line Systems, Inc., Figure B3083.
- W. Heavy Pipe Clamp:
  - a. Manufacturers: One of the following or approved equal:
    - i. Anvil, Figure 216.
    - ii. Bergen-Paterson, Part 6101.

## 2.2 MATERIALS

- A. Pipe Supports:
  - a. Stainless Steel (Type 304 or 316): Use in all submerged locations, above water level but below top of wall inside water bearing structures and where specifically indicated on the Drawings.

- b. Hot-dip Galvanized Steel: Use in areas other than above and where specifically indicated on the Drawings. Hot-dip galvanize pipe support after fabrication.
  - c. Plastic, Aluminum, FRP and Other Miscellaneous Materials: Use where specifically indicated on the Drawings.
- B. Fasteners:
- a. As specified in ASTM.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Properly support, suspend or anchor exposed pipe, fittings, valves, and appurtenances to prevent sagging, overstressing, or movement of piping; and to prevent thrusts or loads on or against connected pumps, blowers, and other equipment.
- B. Carefully determine locations of inserts. Anchor to formwork prior to placing concrete.
- C. Use flush shells only where indicated on the Drawings.
- D. Do not use anchors relying on deformation of lead alloy.
- E. Do not use stud type powder actuated fasteners for securing metallic conduit or steel pipe larger than 1 inch to concrete, masonry, or wood.
- F. Suspend pipe hangers from hanger rods. Secured with double nuts.
- G. Install continuously threaded hanger rods only where indicated on the Drawings.
- H. Use adjustable ring hangers; or adjustable clevis hangers, for 6 inch and smaller diameter pipe.
- I. Use adjustable clevis hangers for pipe larger than 6 inches in diameter.
- J. Secure pipes with galvanized double nutted U-bolts or suspend pipes from hanger rods and hangers.
  - a. Support Spacing:
  - b. Support 2 inch and smaller piping on horizontal and vertical runs at maximum 5 feet on center, unless otherwise specified.
  - c. Support larger than 2 inch piping on horizontal and vertical runs at maximum 10 feet on center, unless otherwise specified.
  - d. Support exposed polyvinyl chloride and other plastic pipes at maximum 5 feet on center, regardless of size.
  - e. Support tubing, copper pipe and tubing, fiber-reinforced plastic pipe or duct, and rubber hose and tubing at intervals close enough to prevent sagging greater than 1/4 inch between supports.
- K. Install Supports at:
  - a. Horizontal bends.
  - b. Both sides of flexible pipe connections.
  - c. Base of risers.
  - d. Floor penetrations.

- e. Connections to pumps, blowers and other equipment.
  - f. Valves and appurtenances.
- L. Securely anchor plastic pipe, valves, and headers to prevent movement during operation of valves.
  - M. Anchor plastic pipe between expansion loops and direction changes to prevent axial movement through anchors.
  - N. Provide ductile iron elbows or tees supported from floors with base fittings where indicated on the Drawings.
  - O. Support base fittings with metal supports or when indicated on the Drawings, concrete piers.
  - P. Size hanger rods, supports, clamps, anchors, brackets, and guides in accordance with ANSI/MSS SP 58 and SP 69.
  - Q. Do not use chains, plumbers' straps, wire, or similar devices for permanently suspending, supporting, or restraining pipes.
  - R. Support plumbing drainage and vents in accordance with Uniform Plumbing Code.
  - S. Supports, Clamps, Brackets, and Portions of Support System Bearing against Copper Pipe: Copper plated, copper throughout, or isolated with neoprene or polyvinyl chloride tape.
  - T. Where pipe is insulated, install over-sized supports and hangers.
  - U. Install insulation shield in accordance with ANSI/MSS SP 69, Type 40. Shield shall be galvanized steel unless specified elsewhere.
  - V. Install riser clamps at floor penetrations and where indicated on the Drawings.
  - W. Paint or Coat support system components as specified in Section 09910.



## **SECTION 15100: VALVES**

### **PART 1 - GENERAL**

#### **1.1 REQUIREMENTS**

- A. Under this Section, the Contractor shall provide all labor, equipment and materials necessary to furnish, install and test all valves required to complete both interior and exterior piping systems as shown on the Contract Drawings and specified herein. All valves for the same use and function shall be supplied by the same manufacturer.
- B. The following valves and appurtenances are included in this Section:
  - a. Large valves (3" and larger)
    - i. Gate valves
    - ii. Check valves
    - c. Plug valves
  - b. Small valves (2 ½" and smaller)
    - i. Ball valves
    - ii. Corporation stops (valves)
    - iii. Curb stops (valves)
  - c. Specialty valves
    - i. Combination air valves
    - ii. Tapping Sleeves and Valves
- C. Valve appurtenances
- D. Valve stems, extensions, guides and stands
- E. Valve boxes and covers

#### **1.2 QUALITY ASSURANCE**

- A. Standards:
  - a. Comply with standards specified herein.
  - b. Comply with AWWA, ANS, ASTM, National Electric Code and all other applicable Federal, State and Municipal codes including revisions to the date of Contract.
  - c. In all cases where a device or part of the equipment is referred to in this Section in the singular (such as "valve"), it is intended that such references shall apply to as many such devices as are required to complete the installation.
- B. Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Engineer.

#### **1.3 SUBMITTALS**

- A. Submittals shall be in accordance with Section 01310.
- B. Product Data:
  - a. Manufacturer's specifications and other data required to demonstrate compliance with the specific requirements.
  - b. Such submittals shall include satisfactory evidence that the materials have been manufactured and tested in conformance with the specifications.

- c. A completed materials of construction or parts list showing all items and their dimensions, materials and parts number to be furnished for materials installed under this Section.
- C. As a condition of acceptance, deliver to the Engineer complete O&M Manuals in accordance with the provisions of Section 01730.

#### **1.4 WARRANTEES**

- A. All products provided under this Section of the Specifications shall be warranted for a period of not less than twelve (12) months from the start of continuing beneficial use or eighteen (18) months following receipt of delivery, whichever is longer.

#### **1.5 PRODUCT HANDLING**

- A. Use all means necessary to protect materials of this Section before, during and after installation and to protect installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary, to the approval of the Engineer, and at no additional cost to the Owner.
- C. Cast markings shall appear on each valve, identifying the following:
  - a. Manufacturer's name or mark
  - b. Size of valve (pipe size)
  - c. Working pressure
  - d. Year valve manufactured
  - e. Flow direction arrow

#### **1.6 SPARE PARTS AND TOOLS**

- A. The Contractor shall comply with the provisions of Sections 01760. One (1) set of operating tools per ten (10) valve units shall be supplied with each type valve specified herein, unless indicated to the contrary elsewhere in the Specifications.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Where used, the names of manufacturers and specific catalog numbers are given only as an indication of the quality of the materials, type of operation and/or function and workmanship expected. Equal products by other manufacturers will be reviewed for acceptability, by the Engineer, in accordance with the General Conditions.
- B. Unless otherwise specified, all metallic valves exposed to view shall receive one shop primer coat and field finish painting in accordance with the requirements of Section 09910. Buried valves are to receive two bituminous seal coats before shipping.
- C. Unless specified otherwise in the specific valve Sections, all valve end connections shall match the piping they are to be installed with, or be as indicated by the Engineer at the time of shop drawing approval.

- D. Valves shall be type shown on Drawings and as specified herein. The contractor shall use valves of only one (1) manufacturer for each type of valve. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.
- E. Provide special tools required for repacking and disassembling valves provided.
- F. Pressure class, body material, bonnet-type, and trim material: As shown in standards and as specified. Unless specified elsewhere, valves shall be designed for a working pressure of not less than 150 psig and 250\* psig (\*Pump Discharge Piping shall be tested at 225 psig).
- G. Valves shall open by turning operator in a counter clockwise direction. Exposed valves shall be outside screw and yoke (OS&Y) type.

## 2.2 GATE VALVE CONNECTIONS

- A. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves.
- B. Threaded for pipe sizes 2" and smaller.
- C. Flanged for exposed pipe sizes 2-1/2" and larger.
- D. Mechanical joint for buried pipe 3" and larger.
- E. Solder or screw to solder adapters for copper tubing
  - a. Gate Valves: 3 inches in size and larger :
    - i. Resilient wedge type in compliance with AWWA C509.
    - ii. Flange, iron body and bonnet rated for 200 pound working pressure.
  - b. Provide O-ring seal between valve body and bonnet.
    - iii. Ductile or cast iron wedge encapsulated in nitrile rubber and capable of sealing in either flow direction.
    - iv. Bronze stem with double or triple O-ring or braided packing stem seals.
    - v. Rising stem configuration with handwheel diameter sized to allow opening of valve with no more than a 40 pound pull.
    - vi. Coat interior and exterior surfaces of valve body and bonnet with fusion bonded epoxy in accordance with AWWA C550.
    - vii. Gate valves, three (3") inches and larger shall be as manufactured Corporation-provided said manufacturer meets the Specifications.
    - viii. Gate valve ends shall be compatible with the piping system application indicated on the Contract Drawings, per industry standard practice, and as approved by the Engineer. Flange ends shall conform to ANSI/AWWA B16.1, Class 125. Mechanical joint ends shall conform to ANSI/AWWA C111.
    - ix. Unless otherwise shown, buried valves for ductile iron piping shall be mechanical joint end. Valves not buried shall be flanged end. Valves for non-buried piping other than ductile iron shall be flanged or threaded end.

### **2.3 CHECK VALVE (RUBBER FLAPPER TYPE):**

- A. Check valves for liquid service three (3") inches and larger shall be of the full body, flanged type (wafer not acceptable) with only one moving part, the valve disc. Valves shall be as manufactured by G-A Industries, or approved equal, Figure No. 200. Alternate manufacturer, APCO provided said manufacturer meets the specifications.
- B. The valve body shall have a flow area equal to the nominal pipe diameter at all points throughout the valve. The valve seat shall be on a 45° angle and have a disc that strokes 35° angle to minimize disc slam potential. The access cover shall be large enough in size to permit disc replacement without removing the valve from the line.
- C. The disc shall be precision molded of Buna-N per ASTM D2000, be of one-piece construction, and have an integral O-ring type sealing surface for low pressure shut-off. The disc shall also have steel or ductile iron reinforcement where the disc is contained between the cover and the body, and in the seat area. The flex area of the disc shall be heavily reinforced with fabric for strength and long life.
- D. The body and cover shall be ASTM A-536 Grade 65-45-12 ductile iron.
- E. The interior of the valve is fully coated with a liquid thermosetting epoxy suitable for use in potable water service. The exterior is provided with, as standard, a universal primer enamel suitable for top coating by the contractor in the field.
- F. The check valve shall absolutely prevent the return of liquid back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must operate without hammer or shock.

### **2.4 PLUG VALVES:**

- A. Plug valves three (3") inches and larger shall be non-lubricated, eccentric plug valves furnished with end connections as shown on the Contract Drawings. Eccentric plug valves shall be manufactured by DeZurik, or approved equal, and be rated for maximum pressure of 175 psi. Alternate manufacturer -Henry Pratt Co.- provided said manufacturer meets the Specifications.
- B. Valve bodies shall be constructed of heavy cast iron body and furnished with a welded overlay seat of not less than 90% pure nickel for corrosion protection.
- C. Valves shall be furnished with replaceable, sleeve-type stainless steel bearings.
- D. Plugs shall be constructed of cast iron and be capable of withstanding the full pressure rating of the valve. Plugs shall be resilient-faced with neoprene suitable for use with the liquid and/or solids they come in contact with.
- E. Valve shaft seals shall be of the multiple V-ring type and be externally adjustable, repackable without removing the bonnet or actuator from the valve, and repackable under pressure.
- F. Unless otherwise shown on the Contract Drawings or specified, the Contractor shall provide plug valves with a standard operating nut. Other operating mechanisms may include a handwheel,

chain operator, operating stand, locking or non-locking operating nut, lever, or electric actuator with manual hand wheel operator. All operating mechanisms must be manufactured or guaranteed as furnished by the valve Manufacturer to be operator-compatible with the valve for which furnished. Not less than one (1) six (6) hour on-site period shall be included for the purpose of adjusting motorized plug valves by a Manufacturer's field-service Engineer.

## 2.5 SMALL VALVES (2 ½" AND SMALLER)

- A. Ball Valves:
  - a. Plastic
    - i. Ball valves shall be Type 1 PVC double end entry, self lubricated, corrosion resistant and furnished with end connections suitable for the application, or as shown on the Contract Drawings. Ball valves shall be manufactured by Spears Manufacturing Company, or approved equal. Valves shall be complete with replaceable EPDM O-rings and PTE seats.
    - ii. Valves shall be designed to handle a minimum pressure of 150 psi.
  - b. Metallic
    - i. Metallic ball valves shall be full port, brass body valves, McMaster Carr, or approved equal model number 47865K. Alternate manufacturer -Watts- provided said manufacturer meets the Specifications.
    - ii. The ball shall be chrome-plated brass and the seats fabricated from PTFE.
    - iii. The actuator shall be a carbon steel lever handle with a PVC grip.
    - iv. The minimum working pressure shall be 150 psi.
- B. End connections shall be threaded, female by female.
- C. Corporation Stops (valves):
  - a. Corporation stops shall be ball-type valves with a stainless steel reinforced seat seal having a maximum working pressure of 300 psi. Corporation stops shall be ball corporation valves as manufactured by Mueller Co., or approved equal, Type 300. The valve body shall be constructed of brass in accordance with ASTM B-62.
  - b. Inlet end shall be tapered inlet type. Outlet end shall be suitable for connection to designated pipe material and be as directed by the Engineer.
- D. Curb Stops (valves):
  - a. Curb stops shall be ball type curb valves with stainless steel reinforced seat seals having a maximum working pressure of 300 psi. Curb stops shall be ball curb valves as manufactured by Mueller Co., or approved equal, Type 300. Alternate manufacturer - Ford Meter Box- provided said manufacturer meets the Specifications.
  - b. The valve body shall be constructed of brass in accordance with ASTM B-62.
    - i. Inlet and outlet ends shall be suitable for connection to designated pipe material and/or be as directed by the Engineer.
    - ii. Unless otherwise specified, curb stops shall be furnished with three piece cast iron valve boxes and covers which includes brass pentagon plugs and be as manufactured by Mueller Co., or approved equal. Contractor to provide two (2) pentagon key wrenches for operation. Alternate manufacturer -Ford Meter Box- provided said manufacturer meets the Specifications.

## 2.6 SPECIALTY VALVES

- A. Combination Air/Vacuum Valves:
- a. Combination air valves shall be designed to exhaust large amounts of air during filling, release small amounts of accumulated air during operation and open upon impending vacuum to admit large amounts of air while draining. The combination air valve shall be as manufactured by GA Industries, Inc., or approved equal, Figure Number 942F, 2" inlet and 1" outlet. Alternate manufacturer -Val-Matic- provided said manufacturer meets the Specifications.
  - b. The valve shall be float operated, and both the air and vacuum, and air release functions shall be housed in a single body. Body and cover shall be of cast iron conforming to ASTM A126, Class B. All leverage mechanism parts and the spherical float shall be stainless steel. The large and small orifice seats shall be Buna-N and be removable.
  - c. The valve shall be provided with a flushing attachment, complete with bronze shut-off valves, quick-connect couplings and reinforced rubber hose. Inlet and outlet connections shall be threaded.
- B. Elder Valve: **(Not included in Contract)**
- i. Type: Elder Valve.
  - ii. Location: As shown on plans. Final location to be determined in field based upon utility locations and property information. Valves shall be set approximately one (1) foot from right-of-way line.
  - iii. Size: To match size of service.
  - iv. Manufacturer: Elder Valve, Inc., or approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The installation procedures for valves shall be the same as for joining pipes with the same end connections.
- B. The excavation, backfilling and compaction of all buried valves shall be in accordance with the requirements of Section 02400 of these specifications.
- C. Large valves, four (4") inches and larger, installed on interior piping, shall be supported on both sides whether or not indicated on the Contract Drawings.
- D. Large and small diameter interior valves shall be set as shown on the Contract Drawings, or as directed by the Engineer. In the event that wheel operation clearances, interferences with other piping, equipment, or walls occurs, or for other unanticipated reasons causes, a resetting of the wheel operating position, instructions for repositioning shall be given by the Engineer.
- E. The insides of all valves shall be cleaned to remove slag, dirt and other sediment, as well as other foreign materials, before being installed. During installation, sufficient care shall be exercised to prevent foreign matter from entering the valves.
- F. Proper and suitable tools and appliances for the safe and convenient handling and laying of all valves shall be used. Care shall be taken to prevent the valve coating from being damaged, particularly on the inside of the valves, and any damage shall be remedied as directed. No valve shall be installed which is known to be defective. If any defective valve is discovered after having

been installed, it shall be removed and replaced with a sound valve, in a satisfactory manner, by the Contractor, at his own expense.

- G. All buried valves shall be set vertically along their operating stem and to the proper grade.
- H. Valve operating stems shall be centered within the valve box inside diameter. If the operating wrench is unable to be seated on the operating nut while within the valve box, the valve box shall be properly repositioned until the wrench operation is satisfactory. Open ends of buried valves shall be kept plugged with a bulkhead during construction. Open ends of exposed valves shall be covered to prevent foreign materials from entering.

### **3.2 FIELD TESTING**

- A. Valves shall be field tested as an integral part of the pipeline to which they are connected.

## **SECTION 15200: PIPE CONNECTING AND RESTRAINT DEVICES**

### **PART 1 - GENERAL**

#### **1.1 REQUIREMENTS**

- A. Under this Section, the Contractor shall provide all labor, equipment, and materials necessary to install all special and separate pipe connections and restraint devices required to join and/or resist internal pipe forces. Concrete thrust blocks shall not be included under this Section. Wall pipe penetrations and closures shall be included under this Section.
- B. All external and separate connection and/or restraint systems shall be protected by coating systems which will not impede their movement or flexibility, but ensure long-term resistance to corrosion or rust attack.

#### **1.2 QUALITY ASSURANCE**

- A. Products used in the work of this Section shall be produced by Manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Engineer.

#### **1.3 SUBMITTALS**

- A. Submit shop drawings in accordance with Section 01310.
- B. B. Product Data:
  - a. Manufacturer's specification and other data required to demonstrate compliance with the specific requirements.
  - b. A completed material list showing all items to be furnished and installed under this Section.
  - c. Complete shop drawings of all work of this Section showing dimensions and locations of all items including supporting structures and clearance requirements.
  - d. Submit calculations indicating that all devices intended to be employed in the work covered by this Section will be at least as effective in resisting internal pipe pressures, including surges, as the pipes they connect or provide restraint for. Calculations shall be sealed by a currently licensed Arizona Professional Engineer.

#### **1.4 PRODUCT HANDLING**

- A. Use all means necessary to protect materials of this Section before, during and after installation and to protect installed work and materials of all other trades.
- B. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. The design is based on the use of products manufactured by a variety of Manufacturers including but not limited to Dresser Industries, Inc.; Brico Industries, Inc.; EBBA Iron; Link-Seal,



A-LOK, or approved equal. Manufacturers making products of a similar type for the purposes intended by this Section of the Specifications shall be considered.

- B. The Contractor shall prepare a schedule for the Engineer's review which indicates the types, styles, locations, sizes, and pressure ratings of the various couplings and restraint devices, and for the wall pipe closure components intended for use in the work. The Engineer will review the schedule for overall content and compliance with the design intent.

## **2.2 UNIONS**

- A. Provide for pipe assembly and to allow removal of connecting equipment.
- B. Use: Pipe 2" and smaller; for larger piping use flanges or flexible couplings as specified or shown.

## **2.3 FLEXIBLE COUPLINGS**

- A. Construction: Steel middle ring, without pipe stop, two (2) steel followers, two (2) rubber compound wedge section gaskets suitable for maximum temperature of 240°F, and required number of track-head steel bolts to properly compress gaskets.
- B. Flexible Coupling Restraint System:
  - a. Flexible capacity restraint system shall conform to details shown on the Drawings.
  - b. Super Star Tiebolts and Super Star Tierods, ASTM A242, Type 2. Super Star Tiebolts shall be heat-treated to manufacturer's specifications.
  - c. Steel Nuts: Super Star Tienuts, ASTM A563 Grade C3.

## **2.4 FLANGED COUPLING ADAPTORS**

- A. Construction: Cast iron construction with rubber follower gasket suitable for a maximum pressure of 250 psi. Steel trackhead bolts shall be provided as recommended by the manufacturer. Adaptor shall meet ASTM A-126 Class B, cast iron. Flanges shall mate with adjacent pipe.
- B. Adaptors shall be provided with high strength counter-sunk threaded lock pins to restrain joint thrust and pipe separation.
- C. Manufacturer: Dresser style 127 or equal.

## **2.5 CONNECTIONS TO FORCE MAINS AND TAPPED SADDLES**

- A. Connections to force mains shall be made with a proper fitting specifically manufactured for such use and approved by the Engineer. 2-inch PVC force main shall use 2-inch Schedule 80 Wye fitting for connection to force main. 6-inch PVC force main shall use 3-inch Schedule 80 with 3" x 2" SCH 80 flush bushing.
- B. Fittings for C900 pipe shall be one piece injection molded or fabricated from a PVC compound meeting ASTM D1784. Fittings shall be Class 100/150/200 and conform to the requirements of DR 25/18/14. Solvent weld or gasket-end fittings may be used. Solvent weld bells shall be compatible with C900 pipe. Gasket bells shall conform to ASTM D3139 with Gaskets conforming to F477. Gaskets shall be locked-in style.

- C. Manufacturer: Specified Fittings, or approved equal.
- D. All connections to force mains shall be installed with a 2-inch or 1 ¼-inch outlet by Signa Mechanical, or approved equal, and a PVC Ball Valve with concrete meter box at property line as shown on the drawings
- E. Tapped saddles will only be allowed if authorized by the Engineer. If authorized, tapped saddles shall be used in the following manner:
  - 1. For 6-inch PVC force main pipe: Use 6-inch polypropylene saddle with 2-inch and 1 ¼-inch outlets by Signa Mechanical, or approved equal.
  - 2. For 2-inch PVC force main: Use 2-inch polypropylene saddle with 1 ¼ inch outlet by Signa Mechanical, or approved equal.

## 2.6 PIPES THROUGH WALLS AND SLABS

- A. Cast or ductile iron wall pipes:
  - a. Provide with intermediate flange.
  - b. Material, thickness, and ends shall match connecting piping.
  - c. Provide tapped holes where wall pipes are flush with concrete.
  - d. Use where shown for pipes passing through floors or walls.
- B. Wall sleeves:
  - a. Use where shown for pipes passing through floors, walls, or roof slabs.
  - b. Materials: Type 316 stainless steel with intermediate flange on piping 3" and larger unless shown otherwise on the Drawings; type 316 stainless steel pipe with anchor ring or lugs on piping smaller than 3".
  - c. Sleeve length: Extend 2" above floors, flush with other surfaces unless shown otherwise on the Drawings.
  - d. Clearance: As recommended by seal manufacturer.
- C. Seal: Mechanical, link-type, modular, field assembled, insulating, positive- sealing with type 316 stainless hardware; "Link-Seal" by PSI-Thunderline Corp., or A-LOK X-CEL compression connector by A-LOK Products, Inc., or approved equal.

## 2.7 MISCELLANEOUS

- A. BACKFLOW PREVENTORS
  - a. Provide and install backflow prevention devices at Lift Station No.'s 1, 2, and 3 where shown on Drawings per detail cited.
  - b. The backflow prevention devices shall be manufactured by WATTS Regulator, or approved equal.
  - c. Backflow prevention devices shall be installed per the requirements of Brooke Utilities, Inc. in accordance with their Reduced Pressure Backflow Assembly detail.
- B. RESTRAINED JOINTS
  - a. All buried pipe within the Lift Station sites shall be with restrained joints and where shown on the Drawings.
  - b. Pipe restraints shall be JM Eagle, U.S. Pipe TR FLEX, EBAA Iron Mega Lugs, or approved equal.

- c. The following restraint devices are available for use under this Section.
  - i. EBBA Iron Sales, Inc., or approved equal, “Meg-A-Lug” shall consist of a mechanical joint restraint incorporated in the follower gland design and include a restraining mechanism which imparts a multiple wedge action against the exterior pipe wall, increasing resistance as interval pipe pressure increases. The gland shall be of ductile iron. Gland dimensions shall conform to ANSI/AWWA Standards. Twist-off nuts shall insure proper activation of the restraining devices. Alternate manufacture -US Pipe- provided said manufacturer meets the Specifications.
  - ii. EBBA-Iron Sales, Inc., or approved equal, “MegaFlange” Series 2100, similar to a. above, except for pipe flange applications. Alternate manufacture -US Pipe- provided said manufacturer meets the Specifications.
  - iii. Eagle Loc 900 Internal Joint Restraint System, or approved equal.
- d. External joint restraint components shall consist of amply-sized minimum A36 steel rods with threaded ends, all-thread rods, properly bent and configured tie bolts, nuts, retainer clamps, non-slip washers, rod couplings, hairpins for elbow lugs, and such other pieces as may be needed to effectively stabilize piping systems against hydrostatic forces likely to be experienced in pressure piping.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All components are to be installed in complete conformance with the Manufacturer’s recommendations, approved shop drawings and the accepted schedule.
- B. All external components shall be fully double-coated and protected after installation with particular care given to threaded components.
- C. The Engineer shall have the final authority with respect to the proper and acceptable use and installation of pipe connections, restraint systems, and wall sealing systems.

## **SECTION 15251: DUCTILE IRON PIPE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Ductile iron piping, joints, fittings, gaskets, and pipe lining and coating.
- B. Only Ductile iron piping shall be used for the force main piping within lift station sites unless otherwise indicated on the drawings.

#### **1.2 REFERENCES**

- A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
- B. American Society for Testing and Materials (ASTM).
- C. American Water Works Association (AWWA)

#### **1.3 SUBMITTALS**

- A. Shop Drawings:
  - a. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, connections to structures and thrust restraint system layouts.
  - b. Thrust Restraint Systems: Layouts and supporting calculations for restrained joint thrust restraint systems.
- B. Pipe Design Calculations: Calculations for required wall thickness in accordance with AWWA C 150 and ASTM A 746.
- C. Product Data: Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, pipe linings, and coatings.
- D. Test Reports:
  - a. Manufacturer's test reports for polyethylene lining certifying successful performance of the wet sponge spark tests.
  - b. Manufacturer's test results for glass lined pipe certifying compliance with specified material requirements for glass lining.
- E. Certificates: Submit certified documentation of holiday detection testing results with all glass lined pipe shipments. This documentation shall identify each piece by mark designation and show the actual test results during the final inspection by the manufacturer prior to shipment. Acceptance criteria shall be as specified under Field Quality Control.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Block piping material for shipment, prevent damage to castings and linings.

- B. Carefully handle piping material during loading, unloading, and installation. Do not drop piping material from cars or trucks. Lower piping material by mechanical means. Do not drop or pound pipe to fit grade.
- C. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C 104. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.
- D. Protect gaskets and polyethylene encasement from long term exposure to sunlight.
- E. Store fittings and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

## 1.5 QUALITY ASSURANCE

- A. Qualifications of Lining Manufacturers: For piping specified to receive glass lining or polyethylene lining use only a manufacturer having a minimum of 5 years experience supplying this type of product to the wastewater and water treatment industry.
- B. Regulatory Requirements: Install work of this Section in accordance with local, state, and federal regulations.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Ductile Iron Piping:
  - a. Type, Typical: AWWA C 150 and AWWA C 151 with minimum pressure class wall thickness that meets project pressure and structural requirements, unless otherwise specified or indicated on the Drawings.
  - b. Type with Screw-on Flanges: AWWA C 115 with minimum special thickness Class 52 wall thickness that meets project pressure and structural requirements, unless otherwise specified or indicated on the Drawings.
  - c. Laying Condition: Type 3 as defined by AWWA C 150.
  - d. The minimum wall thickness shall be as specified in ASTM for Thickness Class 52.
- B. Joints:
  - a. All buried DIP within the **lift station sites** shall have restrained joints for the force mains unless indicated otherwise on the plans. The Contractor shall assume responsibility for the restrained joint thrust restraint system design. Restrained Push-on Joints are an acceptable means of restraint.
  - b. Ductile iron pipe for force main shall be mechanical joint or push-on joint conforming to ASTM A746, unless otherwise noted on the plans.
  - c. Ductile Iron Gravity Sewer Pipe shall be installed using a restrained push-on joint system.
  - d. Flanged Joints: Flanges, Screw-on: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ANSI B 16.1.
    - i. Bolts and Nuts: As specified in ANSI/ASME B 16.1 except when connecting flanges underground, in concrete pipe valve boxes, or underwater, use Type 304 or Type

316 stainless steel. Cut and finish bolts to project a maximum of 1/4 inch beyond nut when joints are assembled.

1. Gaskets: Suitable for pressures equal to and less than 200 pounds per square inch gauge, temperatures equal to and less than 250 degrees Fahrenheit.
- e. Mechanical Joints: In accordance with AWWA C 111/ANSI A 21.11.
  - f. Restrained Mechanical Joints:
    - i. Design: Integral retainer weldment type or lugged type joint with Type 304 stainless steel rods and nuts.
    - ii. Manufacturers: One of the following or approved equal:
      1. EBAA Iron Inc.
      2. Pacific States Cast Iron Pipe Company, Lock Mechanical Joint.
    - iii. Push-on Rubber Gasket Joints: AWWA C 111/ANSI A 21.11.
  - g. Restrained Push-on Joints:
    - i. Manufacturers: One of the following or approved equal:
      1. United States Pipe and Foundry Company, TR Flex.
      2. Pacific States Cast Iron Pipe Company, Perma Lock.
      3. American Cast Iron Pipe Company, Flex Ring or Lok-Ring.
    - ii. Design: Suitable for the following working pressures:
      1. For 4- Through 24-inch Pipe: 350 pounds per square inch gauge.
      2. For 30- Through 54-inch Pipe: 250 pounds per square inch gauge.

## 2.2 FITTINGS

- A. Fittings: Ductile iron conforming with AWWA C 110/ANSI A 21.10 or AWWA C 153/ANSI A 21.53.
- B. Joint Type: Same as that of the associated piping as specified herein.
- C. Plain end-to-flanged joint connectors using set screws are not acceptable.

## 2.3 PIPE LININGS AND COATINGS

- A. Coating:
  - a. Exposed: High-solids epoxy primer, ACIPCO Coating System No. 2, or approved equal per Section 09900
- B. Lining (wastewater): Provide linings to a minimum thickness as indicated below.
  - a. Ceramic epoxy, "Protecto 401": 40 mils (nominal thickness), 35 mils (minimum thickness).
  - b. At ends of pipe and fittings, taper linings and prepare joints in accordance with manufacturer's recommendations.
- C. For ceramic epoxy linings, holiday test each section of pipe and each fitting:
  - a. Test barrel area of pipe using a voltage of 2,000 volts for polyurethane and 2,500 volts for "Protecto 401", and a dry conductive probe.
  - b. Holiday testing to conform to ASTM G62-87 and NACE standards RP027-74 and RP 0188-90.

- c. Holiday testing shall be with a minimum 10,000 volt charge.

## **2.4 POLYETHYLENE ENCASEMENT**

- a. All ductile iron pipes, valves, and fittings shall be protected from corrosion in accordance with Section 610.6 of MAG Specifications, and as noted herein. Polyethylene Encasement: Linear, low-density with 8-mil thickness or high- density, cross-laminated with 4-mil thickness, tube-type polyethylene film; AWWA C105.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General:
  - a. Install ductile iron piping in accordance with AWWA C 600.
  - b. Lay mechanical joint or bell and spigot pipe with 1/8 inch space between the spigot and shoulder of the pockets.
- B. Polyethylene Encasement:
  - a. Wrap ductile iron pipe to be buried with polyethylene encasement in accordance with Section 6.10.6.3 of MAG Specifications.
  - b. Repair tears and make joints with two layers of plastic tape.

### **3.2 FIELD QUALITY CONTROL**

- A. Test ductile iron piping in accordance with MAG Standard Specifications Section 610.15
  - a. Do not test sections longer than 1/2 mile in total pipe length.
- B. Verify that interior surfaces of lined pipe and fittings have continuous coverage.
- C. Discard lined piping and fittings found to have pinholes, crazing, or fish scales which expose the metal substrate.

## **SECTION 15265: PLASTIC PIPING AND TUBING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Plastic pipe, tubing, and fittings.

#### **1.2 REQUIREMENTS**

- A. Under this Section, the Contractor shall provide all labor, equipment and materials necessary to furnish and install all piping, fittings, and accessories required for the completion of mechanical piping work as shown on the Contract Drawings or specified, including wall sleeves in all types of walls. The furnishing and installation of all pipe hangers, supports, braces, insulation, anchor bolts, concrete or other masonry type inserts and hardware required for the correct installation of all piping maybe covered more specifically in other Sections of these Specifications.
- B. Miscellaneous pipe connections supplied with equipment furnished under other Sections shall comply with the requirements of this Section.

#### **1.3 ABBREVIATIONS**

- A. ABS: Acrylonitrile-Butadiene-Styrene. B. CPVC: Chlorinated Polyvinyl Chloride.
- B. DR: Dimension Ratio.
- C. DWV: Drain, Waste, and Vent.
- D. ID: Inside Diameter of piping or tubing.
- E. NPS: Nominal pipe size followed by the size designation.
- F. NS: Nominal size of piping or tubing.
- G. PE: Polyethylene.
- H. PP: Polypropylene.
- I. PVC: Polyvinyl Chloride.
- J. SDR: Standard Dimension Ratio; the Outside Diameter divided by the pipe wall thickness.

#### **1.4 SUBMITTALS**

- A. Product Data: Describe materials, pipe, fittings, gaskets and solvent cement.
- B. Manufacturer's Published Installation Instructions.
- C. Certificates:



- a. Submit manufacturer's certificate attesting that plastic pipe, tubing, and fitting types meet specified requirements.
  - i. PVC gravity sewer piping: Requirements of ASTM D 3034
- D. ASTM F 679, as applicable.
  - a. Manufacturer's certification of date of manufacture of plastic pipe and tubing for each lot delivered.
  - b. Copies of solvent cement manufacturer's report and certification in accordance with ASTM D 2564 for PVC piping, and ASTM F 493 for CPVC piping.

## 1.5 QUALITY ASSURANCE

- A. Plastic Pipe in Potable Water Applications: Provide pipe and tubing bearing NSF seal.
- B. Mark plastic pipe with nominal size, type, class, schedule or pressure rating, manufacturer and all markings required by applicable ASTM and AWWA standards.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping materials from sunlight, scoring and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees F.
- C. Store and handle pipe and fittings as recommended by manufacturer in published instructions.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Extruding and Molding Material: Virgin material containing no scrap, regrind, or rework material except where permitted in the referenced standards.
- B. Fittings: Same material as the pipe and of equal or greater pressure rating, except that fittings used in drain, waste and vent piping systems need not be pressure rated.
- C. Unions 2 1/2 Inches and Smaller: Socket end screwed unions. Make unions 3 inches and larger of socket flanges with 1/8 inch full face soft EPDM gasket.

### 2.2 PVC PLASTIC PIPE

- A. Gravity Sewer System
  - a. PVC pipe and fittings shall be SDR-35 polyvinyl chloride pipe, with a pipe stiffness value of 46 psi when tested in accordance with ASTM D-2412, Standard Test Method for Determination of External Loading of Plastic Pipe by Parallel Plate Loading.
  - b. Nominal sizes 4", 6", 8", 10", 12" and 15" are manufactured to meet requirements of ASTM D-3034, Standard Specification for Type PSM PVC Sewer Pipe. Nominal sizes 18", 21", 24", 27" and 30" comply with ASTM F-679, Standard Specification for PVC Large Diameter Plastic Gravity Sewer Pipe.

- c. Pipe shall be manufactured from PVC compound meeting the requirements of Cell Class 12454-B as defined by ASTM D-1784, Standard Specification for Rigid PVC Compounds. These materials are classified as type T-1 in ASTM F-679.
  - d. The pipe shall utilize a “locked in” integral gasket joint design meeting the requirements of ASTM D-3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals. The gaskets are to be reinforced with a steel band and conform to the requirements of ASTM F-477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipes.
  - e. Pipe markings and quality assurance testing is as specified in ASTM D-3034 and ASTM F-679.
- B. Force Main
- a. The 4-inch and 6-inch force main piping shall be PVC Pipe, Class Type: AWWA C 900, Pressure Class 150, DR 18.
    - i. Fittings: Cast or ductile iron fittings as specified under Section 15251, sized for the dimensions of the pipe being used. All fittings shall meet the same constant working pressure rating as the pipe.
  - b. Joint Design: PVC force main pipe shall be furnished with an elastomeric gasket at each joint and an integral thickened bell as part of each joint. Pipe and pipe fitting must be assembled with a non-toxic lubricant. Provisions must be made at each joint for expansion and contraction. Refer to ASTM F477, D3139 and D3212.
  - c. Fittings for PVC force main piping shall be ductile iron, and shall conform to AWWA C153, unless otherwise specified. See Section 15200 for connections to force mains using wye branch PVC fittings.
  - d. The 2-inch force main piping shall be Schedule 80 PVC, Type I Grade I, manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances.

## 2.3 POLYETHYLENE PIPING FOR DRAIN, WASTE, AND VENT PIPING SYSTEMS

- A. General:
- a. Pipe and Fittings: High density polyethylene.
  - b. Dimensions of Pipe and Fittings: Based on controlled outside diameter in accordance with ASTM F 714.
    - i. SDR: Maximum of 11.
- B. Manufacturers: One of the following or approved equal:
- a. DuPont, Sclairpipe.
  - b. Polaris, Duratuff; or equal.
- C. Pipe, Fittings, and Adapters: Furnished by the same manufacturer, and compatible with components in the same system and with components of other systems to which connected.
- D. Materials:
- a. Polyethylene: In accordance with ASTM D 1248, Type III, Class C, Category 5, Grade P34; listed by the Plastic Pipe Institute under the designation PE 3408; and have a minimum cell classification, in accordance with ASTM D 3350, of 345434C.

- b. Pipe and Fittings: Manufactured from material with the same cell classification.

## **2.4 SOURCE QUALITY CONTROL**

- A. PVC Piping, Schedule Type:
  - a. Mark pipe and fittings in accordance with ASTM D 1785.
- B. PVC Piping, Class Type:
  - a. Test pipe to withstand, without failure, 600 pounds per square inch, gauge, hydrostatic pressure for a minimum of 5 seconds.
  - b. Test integral bell with the pipe.
- C. PVC Gravity Sewer Piping:
  - a. Mark pipe and fittings in accordance with ASTM D 3034. Also mark the production control code on pipe and fittings.

## **2.5 UNDERGROUND WARNING TAPE**

- A. The Contractor shall furnish and install a detectable identifying tape in all trenches where non-metallic pipe is used in accordance with MAG specification 616.4.1.
- B. The identifying tape shall be made of polyethylene tape bonded to a metalized foil and shall be highly resistant to alkaloids, acids or other destructive chemical components likely to be encountered in soils. The tape shall be six (6) inches wide shall be brightly colored to contrast with soil and bear an imprint identifying the type of line buried below. The tape shall be placed approximately eighteen (18) inches below the finished grade.

## **2.6 TRACER WIRE ON FORCE MAINS**

- A. On all force mains there shall be installed a trace wire which shall be a single insulated No. 12 copper wire, THNN or THWN, gasoline and oil resistant. The insulated wire shall be furnished in rolls not less than 500 feet. Where splices are required, splices shall be made with 3M splice kits, and no other splicing will be allowed unless approved by the Engineer.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. General:
  - a. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping, as applicable to the particular type of piping.
  - b. Provide molded transition fittings for transitions from plastic to metal or
- B. IPS pipe. Do not thread plastic pipe.
  - a. Locate unions where indicated on the Drawings, and elsewhere where required for adequate access and assembly of the piping system.
  - b. Provide serrated nipples for transition from plastic pipe to rubber hose.
- C. Installation of PVC Piping, Schedule Type:
  - a. Solvent weld joints in accordance with ASTM D 2855.

- i. For PVC pipe in sodium hypochlorite service use IPS Corp. Type 724 cement in accordance with manufacturer's instructions.
  - b. Install piping in accordance with manufacturer's published instructions.
- D. Installation of PVC Piping, Class Type:
  - a. Install piping in accordance with the Appendix of AWWA C 900 complemented with manufacturer's published instructions.
- E. Installation of PVC Gravity Sewer Piping.
  - a. Install piping in accordance with manufacturer's published instructions, as modified and complemented herein; MAG Standard Specifications and the approved plans and specifications.
  - b. Install pipe and fittings not later than 4 months after their manufacture.
  - c. Provide for contraction and expansion at joints with a gasket ring.
  - d. Provide plugs or caps for stubs and branch pipes left unconnected to laterals.
  - e. Lubricate and assemble joints in accordance with the pipe manufacturer's published instructions.
  - f. Make connections to manholes with a manhole gasket that prevents infiltration and exfiltration through the penetrations.
    - i. Provide opening for connection large enough to allow subsequent grouting around the manhole gasket.
  - g. Grout around the manhole gasket and seal the opening.

### 3.2 FIELD QUALITY CONTROL

- A. Leakage Test for PVC Piping, Class Type:
  - a. Gravity sewers, sanitary:
  - b. Testing shall be performed in accordance with Section 02722 Part 2.13(B) of the specifications and in general conformance with MAG Standard Specification Section 611.3 and City of Phoenix supplements.
  - c. In addition, sewer lines 8" and larger, shall be closed circuit T.V. inspected in accordance with the following procedures.
    - i. Closed Circuit T.V. Inspection: After backfilling has been completed and prior to acceptance, sanitary sewer lines shall be closed circuit T.V. inspected. The CONTRACTOR shall notify the ENGINEER at least forty-eight (48) hours prior to completion of the backfilling and scheduling the inspection.
    - ii. T.V. inspection shall be pursuant to MAG specifications and City of Phoenix supplements.
    - iii. CONTRACTOR shall replace any broken, cracked, or otherwise defective pipe or offset joints at no cost to OWNER.
      - 1. The CONTRACTOR shall pay for the initial T.V. inspection. Any additional inspections required, due to failure of the initial inspection, shall be paid for by the CONTRACTOR.
- B. Force Mains
  - a. Pressure testing and leakage tests of force mains shall be conducted in accordance with MAG Standard Section 611.1 and the City of Phoenix Supplements.

**DIVISION 16**

**ELECTRICAL**



## **SECTION 16010: GENERAL ELECTRICAL REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This Section summarizes the general requirements for electrical work, and forms a part of all other Sections of Division 16 unless otherwise specified.
- B. Work Included In Division 16. Electrical work as indicated, specified, and required.

#### **1.2 QUALITY ASSURANCE**

- A. Qualifications of Manufacturers. Furnish manufacturer's electrical equipment of the types and sizes specified which has successfully operated for not less than the past two years except where specific types are named by manufacturer and catalog number or designation under other Sections of Division 16.
- B. Factory Tests are required for all electrical equipment and assemblies. Perform factory tests in accordance with the codes and standards specified as applicable to the equipment. Items to be factory tested shall include:
  - a. Panelboards.
  - b. Induction Motors.
  - c. Switchboards.
  - d. Transformers.
  - e. Lighting Equipment.
  - f. Communications Equipment.
  - g. Motor Control Centers.
- C. Factory Inspection. OWNER or his representative may inspect fabricated electrical equipment at the factory. Notify OWNER in sufficient time so that factory inspection can be arranged. Factory inspection will be made after manufacturer has performed satisfactory checks, adjustments, tests, and operations. Approval of equipment at the factory only allows the manufacturer to ship the equipment to the site, and does not constitute final acceptance.
- D. Codes and Standards. Provide electrical equipment and materials, including installation, conforming to the following codes and standards, as applicable. The equipment and materials shall bear labels to indicate manufacturing conformance to the specified standards or equal. Where two codes or standards are at variance, conform to the more restrictive requirement:
  - a. National Electrical Code.
  - b. National Electrical Safety Code.
  - c. County and City Electrical Codes.
  - d. Owner's Electrical Standards.
  - e. American National Standards Institute.
  - f. American Society for Testing Materials.
  - g. Certified Ballast Manufacturers.
  - h. Illuminating Engineering Society.
  - i. Institute of Electrical and Electronic Engineers.
  - j. Insulated Cable Engineers Association.
  - k. National Electrical Manufacturers Association.
  - l. National Fire Protection Association.

- m. Occupational Safety and Health Act.
- n. Public Utilities Service Requirements.
- o. Underwriters' Laboratories, Inc.
- p. National Electrical Installation Standards

### 1.3 SUBMITTALS

- A. Shop Drawings.
  - a. Submit, for the OWNER'S approval, shop drawings to the extent required in this Section, and other Sections of Division 16. Submit shop drawings for the following:
    - i. Section 16100, Basic Electrical Materials and Methods.
    - ii. Section 16200, Power Generation.
    - iii. Section 16400, Service and Distribution.
  - b. Complete equipment description, operation and installation data shall be submitted with the shop drawings. Shop drawings shall include the following:
  - c. Dimensions and weights of equipment.
  - d. Nameplate data including the nameplate material, heights of letters and inscriptions.
  - e. Details showing enlarged views of small parts when required. Arrangements of equipment and nameplates.
  - f. Plans showing the equipment assembly, space requirements, clearances and locations for conduits and anchor bolts.
  - g. Elevations showing the vertical components, positions and arrangements of the equipment.
- B. Coordination. Properly coordinated automatically operated circuit breakers shall be provided in the equipment. The circuit breakers shown on the drawings shall be coordinated for adequate continuous current and interrupting capacity to assure proper circuit breaker operation under normal and fault conditions in the system. Time-Current curves for the circuit breakers shall be submitted with the equipment shop drawings for the Owner's approval. Refer to Section 16100, paragraph 2.14D for additional requirements.
- C. Record Drawings. Prepare and submit for all work included in Division 16. Refer to General Conditions for uncovering of uninspected and unrecorded work.
- D. Materials List. Submit material lists for the OWNER'S review prior to purchase. The material lists shall include all products described in Division 16, including the equipment that shall have shop drawings. Within 30 days after receiving the submittal approval, provide the Owner with evidence that all equipment and materials required to complete the installations have been purchased. List only those products named in the Contract Documents or substitutions approved.
- E. Technical Data. Submit descriptive and instruction manuals to the extent required under this Section and other Sections of Division 16.
- F. Manufacturers' Certified Reports. Submit a notarized written report from the equipment manufacturer, or his authorized representative with respect to his equipment certifying that (1) the equipment has been properly installed, wired, and connected under his supervision, (2) the equipment is in accurate alignment, (3) he was present when the equipment was placed in operation, (4) he has checked, inspected, and adjusted the equipment as necessary, (5) the equipment has been operated under full load conditions and operated satisfactorily, and (6) the equipment is fully covered under the terms of the guarantee.



- G. Demonstration and Final Operation Test Plans and Results. Submit a written plan for demonstrating that each item of equipment provided under Division 16 meets the specified operational requirements. Submit a written plan for procedures to be used in final operation testing of entire systems including a description of each system, test methods and materials, testing instruments and recorders, and a list of the equipment involved with the functional parameters to be recorded on each item. Submit three copies of test results and records for all final operation tests.
- H. Accessory and Maintenance Materials. Furnish items as specified herein and in other Sections of Division 16. Deliver to OWNER as directed with an itemized list in a letter of transmittal accompanying each shipment.
  - a. Special Tools and Accessories. Furnish special tools, instruments, and accessories for maintaining equipment requiring periodic repair and adjustment. Also, furnish special lifting and handling devices for equipment requiring such devices.
  - b. Maintenance, Materials and Spare Parts. Deliver in manufacturer's original containers labeled to completely describe contents and equipment for which it is furnished.

#### **1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Delivery. Deliver electrical materials and equipment in manufacturers' original cartons or containers with seals intact, as applicable. Unless otherwise specified, deliver conductors in sealed cartons or on sealed reels, ends of reeled conductors factory sealed. Deliver large multi-component assemblies in sections that facilitate field handling and installation.
- B. Storage. Unless designed for outdoor exposure, store electrical materials off the ground and under cover. Prevent corrosion, contamination, or deterioration.
- C. Handling. Handle materials and equipment in accordance with manufacturers' recommendations. Lift large or heavy items only at the points designated by the manufacturer. Use padded slings and hooks for lifting as necessary to prevent damage.

#### **1.5 JOB CONDITIONS**

- A. Electrical Drawings are diagrammatic and indicate the general layout of the complete work. Locations of equipment, inserts, anchors, motors, panels, pull boxes, manholes, conduits, stub-ups, fittings, lighting fixtures, power and convenience outlets, exterior lighting units, and ground wells are approximate. Conform to Drawings as closely as possible. Exercise care to secure approved headroom and clearances, and to overcome structural interference. Verify scaled dimensions, field dimensions, and conditions at the place of work.
- B. Changes. Submit written details and reasons for proposed deviations from Drawings and Specifications, and do not deviate therefrom unless authorized by Field Order or Change Order. If approved changes requested by CONTRACTOR require alteration of structures or related work, make the alterations at no additional cost to OWNER.
- C. Protection. Protect electrical materials and equipment until final acceptance. Protect factory painted surfaces from impact, abrasion, discoloration, and other damage. Keep electrical equipment, materials, and insulation dry at all times. Maintain heaters in equipment connected and operating until equipment is placed in operation. If partial dismantling of equipment is required for installation, box or wrap the removed parts until reinstalled. Repair or replace damaged work as directed, at no additional cost to Owner.

- D. Coordinate electrical work with all trades, code authorities, public utilities, and OWNER. Where two or more trades interface in an area, verify that no electrical work is omitted.

#### **1.6 RELATED ELECTRICAL WORK**

- A. Review entire Contract Documents and provide electrical work required for all trades unless excluded from Division 16 or specified elsewhere.

#### **1.7 PUBLIC UTILITIES**

- A. Obtain service requirements from public utilities for required power, telephone, and telemetering. Provide electrical work for power, telephone, and telemetering as indicated or specified, and according to power and telephone companies service requirements. Pay the service charges of power and telephone companies, including costs for conduits, cables, boxes, trenching, backfilling, and grounding.

#### **1.8 POWER SUPPLY**

- A. The power supply shall be alternating current, 60 hertz and at the voltage indicated on the Drawings.

#### **1.9 PERMITS**

- A. Obtain and pay for permits, licenses, and inspections required for electrical construction work by public agencies having jurisdiction, except as otherwise specified.

#### **1.10 OUTAGES**

- A. Keep power shutdown periods to the minimum time feasible, and only for such times and durations as may be approved. Submit written request for outage approval at least 5 working days in advance of need, stating date, time, and probable duration. Bear all overtime costs for outages required to be performed during non-working hours.

#### **1.11 TEMPORARY POWER**

- A. Make necessary arrangements with power company, and provide equipment, materials, and wiring in accordance with applicable codes and regulations. Upon completion of work, remove temporary power equipment, materials, and wiring as approved.

#### **1.12 AREA CLASSIFICATIONS**

- A. Installation areas for electrical equipment, materials, and wiring are classified as "Non-Hazardous" unless otherwise indicated or specified.

#### **1.13 GUARANTEE AND WARRANTIES**

- A. Guarantee all work of Division 16 in accordance with the General Conditions. With respect to equipment, condition guarantee to cover (1) faulty or inadequate design; (2) improper assembly or erection; (3) defective workmanship or materials; and (4) incorrect or inadequate operation, or other failure. For equipment bearing a manufacturer's warranty in excess of 1 year, & furnish a copy of the warranty to the Owner named as beneficiary.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

- A. Provide new materials and equipment as required to complete all indicated and specified electrical work, including incidental items inferable from the Contract Documents that are necessary to complete the work. Provide materials and equipment of latest design, standard products of established manufacturers. For uniformity, only one manufacturer is acceptable for each type of product. Manufacture individual parts to standard sizes and gages so that repair parts can be installed in the field. Make like parts of duplicate units interchangeable. Do not place equipment in service at any time prior to delivery except as required for factory or shop tests.
- B. Prohibited Materials. Aluminum conduits, fittings, supports, and conductors are not acceptable.
- C. Damaged Products. Notify OWNER in writing if any equipment or material is damaged. Do not repair damaged products without prior written approval.
- D. Outdoor Equipment. Outdoor electrical equipment shall be weatherproof, NEMA 3R gasketed, unless otherwise indicated. All hardware in outdoor locations shall be stainless steel.
- E. Factory Finishes. Unless otherwise specified in other Division 16 sections, the sheet metal surfaces of equipment enclosures shall be phosphatized and coated with a rust resisting primer. Over the primer, apply a corrosion resistant baked enamel finish on the interior and exterior metal surfaces. The color shall be specified by owner. Hardware shall have a corrosion resistant finish. Cast iron outlet bodies, boxes, covers and fittings shall be finished with cadmium zinc electroplate covered with aluminum cellulose lacquer. In indicated corrosive areas, all surfaces of rigid steel conduit, cast metal boxes, cast metal outlet bodies, covers, fittings, supports and clamps shall have a polyvinyl chloride coating bonded to the outer surface, and the hardware shall be stainless steel. Sheet metal enclosures and lighting fixtures, in corrosive areas, shall have an outer coating of corrosion resistant epoxy.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Install electrical work in accordance with the codes and standards specified, except where more stringent requirements are indicated or specified. Verify that materials and equipment properly fit the installation space with clearances conforming to the codes and standards specified except where greater clearance is indicated. Perform work as required to correct improper installations, at no additional cost to OWNER.

### **3.2 ELECTRICAL SUPERVISION**

- A. In addition to supervision required under the General Conditions, assign a competent representative to supervise the electrical construction work from beginning to completion and final acceptance.

### **3.3 INSPECTION**

- A. Inspect each item of material and equipment for damage, defects, completeness, and correct operation before installing. Inspect previously installed related work and verify that it is ready for installation of electrical work.

### **3.4 PREPARATION**

- A. Prior to installing electrical work, ensure that installation areas are clean. Maintain the areas in a broom-clean condition during installation operations. Clean, condition, and service equipment in accordance with the manufacturer's instructions, approved submittals, and other requirements indicated or specified.

### **3.5 WORKMANSHIP**

- A. Employ skilled craftsmen experienced in installation of the types of electrical materials and equipment specified. Use specialized installation tools and equipment as applicable. Produce acceptable installations free of defects.

### **3.6 FIELD QUALITY CONTROL**

- A. Manufactures' Supervision and Field Installation Check. Where specified, electrical equipment manufacturer shall furnish the services of an authorized representative especially trained and experienced in the installation of his equipment to (1) supervise the equipment installation in accordance with the approved submittals and manufacturer's instructions, (2) be present when the equipment is first put into operation, (3) inspect, check, adjust as necessary, and approve the installation, (4) repeat the inspection, checking, and adjusting until all trouble or defects are corrected and the equipment installation and operation are acceptable, and (5) prepare and submit the specified Manufacturers' Certified Report. Include all costs for representatives services in the Contract Price.
- B. Operational Demonstrations. Demonstrate that performance of installed electrical materials and equipment complies with requirements specified in Division 16. Operate equipment through entire no-load to full-load range for not less than 24 hours unless a longer period is specified elsewhere. Immediately correct defects and malfunctions with approved methods and materials in each case, and repeat the demonstration. Conform to the approved demonstration plan.
- C. Final Operation Tests. Test all electrical systems for not less than 168 hours, with no interruptions except for normal maintenance or corrective work. Conform to the approved test plan. Coordinate with final operation tests required under Division 15.
  - a. Testing Materials. Furnish labor, instruments, recorders, gages, materials, and power for tests as required.
  - b. Testing Methods. Operate systems continuously 24 hours a day under constant inspection of trained operators. Cause variable speed equipment to cycle through the applicable speed range at a steady rate of change. Induce simulated alarm and distressed operating conditions, and test controls and protective devices for correct operation in adjusting system functions or causing system shutdown. Perform other final operation tests as may be required under other Sections of Division 16.

3. Defects. Immediately correct all defects and malfunctions disclosed by tests. Use new parts and materials as required and approved. Add the interruption time for corrective work to the specified total test period.

4. Test Records. Furnish approved instruments, gages, chart recorders, and other devices as required. Continuously record all function and operation parameters during entire test period. Submit data to Owner.

### 3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Where specified under other Sections of Division 16, conduct an instruction program for up to five persons designated by OWNER. Furnish the services of qualified instructors from the applicable equipment manufacturers. Include instruction covering basic operation theory, routine maintenance and repair, and "hands on" operation of equipment. Base duration of the program on the complexity of equipment involved, and obtain OWNER'S approval of instruction adequacy before terminating the program. Schedule instruction in consultation with OWNER.

### 3.8 CONSOLIDATION OF TESTING AND INSTRUCTION REQUIREMENTS

A. Demonstration testing, final operation testing, and instructing OWNER'S personnel may be performed simultaneously, subject to prior approval of the extent of consolidation in each case.

++ END OF SECTION ++

## **SECTION 16100: BASIC ELECTRICAL MATERIALS AND METHODS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. This Section outlines the wiring requirements for the electrical work and forms a part of all other Sections of Division 16 unless otherwise specified.
- B. Related Work Specified Elsewhere.
  - a. Service and Distribution, Section 16400.

#### **1.2 SUBMITTALS**

- A. Submit for the Owner's approval material lists, shop drawings, factory test reports and technical data to the extent required in this Section and Section 16010.

#### **1.3 WIRING**

- A. Wiring for furnished equipment shall include the following:
- B. Wiring for Furnished Equipment. The wiring from electrical panels, control panels and motor control centers to the furnished equipment shall include all the required materials and installations to complete the wiring as shown on the Drawings, specified and required.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Provide basic materials and all wiring installations as indicated, specified and required.

#### **2.2 METAL CONDUITS**

- A. Conduits shall be steel, hot-dipped galvanized and equipped with couplings and thread protector caps. The surfaces and threads shall be corrosion-resistant coated. Conduits shall be in ten foot lengths and manufactured by Jones & Laughlin Steel Co., Allied Tube & Conduit Co., Triangle PWC, Republic, Youngstown, or approved equal. Conduits shall be a minimum size of 3/4 inch. Supports shall be provided for all conduits.
- B. Rigid Steel Conduit shall be provided for all exposed exterior installation unless otherwise indicated and/or specified.
- C. Electrical Metallic Tubing may be substituted for rigid steel conduit on the interior of the control building unless otherwise indicated and/or specified.

#### **2.3 NONMETALLIC CONDUITS**

- A. Nonmetallic conduits shall be Schedule 40 polyvinyl chloride as manufactured by Triangle Conduit & Cable, Carlon, or approved equal. All the conduit shall be of one type, and low temperature, corrosion, and moisture resistant.

- B. Nonmetallic Conduit may be installed for underground conduit runs which are outside of the buildings and structures and run between buildings and structures. Rigid steel bends and risers shall be used with nonmetallic conduit wherever conduit rises above grade. Each nonmetallic conduit shall contain a code sized grounding conductor.

## **2.4 FLEXIBLE CONDUIT**

- A. Liquid-tight flexible metal conduit shall be provided for short connections to equipment as shown on the drawings and as required which withstand temperatures from -50°F to +220°F.
- B. Liquid-tight Conduit shall have an interlocked flexible galvanized steel core with a permanently bonded exterior gray polyvinyl chloride jacket.
- C. Conduits, 1-1/4 inch and smaller shall have an internal copper bonding conductor wound spirally in the space between each convolution for the equipment ground provided by the manufacturer.
- D. Separate Ground Conductor shall be provided by the Contractor in liquid-tight flexible conduits that do not have the internal copper bonding conductors included by the manufacturer.
- E. Manufacturers for liquid-tight flexible conduit shall be Anaconda, Electri-Flex, Universal or Approved equal.

## **2.5 CAST METAL BOXES AND FITTINGS**

- A. Provide conduit outlet bodies, boxes, fittings, gaskets and covers for lighting outlets, lighting switches, receptacles, control stations, alarm, switch and thermostat outlets, etc. in exposed conduit installations as indicated and required. Cast boxes and fittings shall be finished as specified in Section 16010. The outlet bodies, boxes, fittings and covers shall be cast iron alloy with threaded hubs, and of sufficient size to provide free space for all conductors that shall be enclosed. The materials shall be manufactured by Crouse-Hinds, Appleton, Pyle-National Efcor, or approved equal.
- B. Covers and Gaskets shall be provided for all conduit outlet bodies, boxes and fittings. The covers shall be cast iron alloy and equipped with neoprene gaskets.
- C. PVC Coated Fittings shall have the same polyvinyl chloride coating that is on the conduit to which they shall be connected. The PVC coating shall be bonded to the surfaces of cast outlet bodies, boxes, fittings and supports by Occidental Coating, Kor-Kap, Robroy, Youngstown, or approved equal.
- D. Plastic Fittings shall be solvent weld type, and shall match the conduit to which they shall be connected.
- E. Expansion/Deflection Fittings shall be provided as indicated, specified and required. The fittings shall permit movement between two conduits without damage to the conduits and conductors. The expansion/deflection fittings consist of cast metal conduit hubs securely attached to a flexible outer neoprene jacket. A flexible copper grounding strap shall be provided inside the fitting and connected to the two hubs. The linear expansion or contraction shall be a movement up to 3/4 inch. The linear misalignment shall be a movement up to 3/4 inch. The angular

misalignment shall be a movement up to 30 degrees. The expansion/deflection fittings shall provide flexible and watertight conduit joints.

- F. Thread Lubricant shall be provided for all metal conduit threads. The lubricant shall inhibit corrosion and maintain grounding continuity, and shall be Crouse-Hinds STL, Thomas and Betts "Koper-Shield" or approved equal.
- G. Couplings and Elbows shall be of the same type as the conduit to which they shall be connected, except where rigid steel bends and risers are connected to nonmetallic conduits where conduits rise above grade. For metallic conduits, the couplings and elbows shall be steel, hot dipped galvanized, threaded and one-piece. For plastic conduits, couplings and elbows shall have plain ends for tight weld fits, which form watertight joints.

## **2.6 STEEL BOXES AND FITTINGS**

- A. Provide the steel boxes and fittings as indicated and required.
- B. Pull Boxes shall be of sufficient size to accommodate the connected conduits and enclosed conductors. Boxes 24 inches square and smaller shall have gasketed screw type covers. Larger boxes shall have bi-parting gasketed hinged doors with latch mechanisms, handles and cylinder locks complete. Provide two keys for each lock. Pull boxes shall be painted as specified in Section 16010. The pull boxes shall be Hoffman, Boss, Circle A-W, or approved equal.

## **2.7 WATER SEAL FITTINGS**

- A. Provide the malleable iron water seal fittings connected to rigid steel conduits as indicated, specified and required.
- B. Sealing Bushings shall be provided on the ends of exterior underground conduits that terminate at indoor equipment. The bushing shall consist of a thick neoprene sealing ring secured between two metal plates by socket head screws. When the conduit sealing bushing is in place and the screws are tightened, the neoprene shall become compressed between the metal plates and be forced against the conduit inside wall and also against the conductor insulation to form a watertight seal inside the conduit.
- C. Wall and Floor Seals shall be provided to completely seal the areas around the conduits that pass through concrete walls and floors. Seals shall have a neoprene grommet between two pressure rings, which provides a watertight seal on the outer surface of the entering conduits.

## **2.8 CONDUIT FITTINGS**

- A. Provide all the hot-dip galvanized steel and iron conduit fittings required to complete the wiring installations.
- B. Liquid-tight Conduit Fittings shall be Types LT, ST, CT as manufactured by Crouse-Hinds, Appleton, Pyle-National or approved equal.
- C. Union shall be provided, as required, for conduit connections to threaded outlet bodies, boxes, and equipment, for connecting two steel conduits together. Unions shall be type UNY or UNF. Running threads are not acceptable. Union shall be Appleton, Crouse-Hinds, Pyle-National or approved equal.



- D. Bushing Reducers shall be provided in conduit fitting hubs for connections to smaller conduits. Reducers shall be Appleton, Thomas and Betts, Efcor or approved equal.
- E. Conduit Enlargers shall be provided for connecting two conduits of different sizes together. The enlargers shall be Appleton, Thomas and Betts, Efcor or approved equal.
- F. Locknuts shall be provided on the threads of conduits that enter through close fitting openings in enclosures. Locknuts shall have notches all around for tightening with a screwdriver. Locknuts shall be Appleton, O-Z, Thomas and Betts or approved equal.
- G. Metallic Insulated Bushings with ground terminals shall be provided on the ends of threaded steel conduits and nipples that terminate through openings in sheet steel enclosures. The malleable iron grounding bushings shall have smooth and well rounded surfaces to protect the conductor insulation. The conduit threads shall be deep, clean and easily attached to the conduits. The bushings shall be O-Z, Efcor, Thomas and Betts or approved equal.
- H. Plugs shall be the recessed type and installed in all unused conduit fitting hubs and couplings. Plugs shall be Appleton, Crouse-Hinds or approved equal.
- I. Interchangeable Hubs shall be provided for rigid steel conduit connections to sheet steel enclosures. The interchangeable hub shall have an insulated throat, sealing ring and vibration-proof nut. Machined serrations on hub and nut shall bite into the metal enclosure assuring an equipment ground. The hubs shall be Myers "Scru-Tite," "Efcor" "Space-Saver", or approved equal.

## **2.9 CONDUCTORS AND CABLES**

- A. Conductors and cables shall be new, single conductor, copper, not smaller than #12 AWG (except fixture wire or control power conductors) unless otherwise indicated, and as shown on the Drawings. No running splices will be allowed for new conductor installations. Where modifications to existing conductor runs, and conductors are unable to be replaced, an acceptable means of splicing would be to use STA-KIN butt splice or equatl, with heat shrinkable insulating cover (T&B cat #H5 or equal). Use calibrated T&B #WT1455 ratchet tool for compression of terminal at all STA-KON terminals and connectors.
- B. Aerial Cables shall be three individual conductors (600 volt, 5 KV, 15 KV), stranded and cabled together to a steel messenger. The cables shall be Simplex SSA7400, SSA7500, SSA7600; Anaconda API0786, API7506, API7516 or approved equal.
- C. Steel Interlocked Armor cables shall be provided for power circuits to the motors as shown on the Drawings. The cables shall be 600 volts, three conductor, rated 90 degrees centigrade and stranded copper. The conductors shall be individually polyethylene insulated, grouped together with fillers and ground wires, and covered with binding tape. The cable shall be enclosed in an interlocked aluminum or galvanized steel armor that shall be protected with a polyvinylchloride outer jacket. The interlocked armor cables shall be approved for submersible pump power wiring installations. The power cables shall be manufactured by General Electric, Okonite, Cyprus or approved equal. The power cables shall be securely attached to steel messenger cables with stainless steel binding tape as shown on the Drawings unless otherwise indicated.

- D. Conductors 250MCM and Larger shall be stranded, 600 volts, ethylene propylene rubber insulation, Type RHW. Conductors shall be manufactured by Rome, American Insulated Wire Co., Cablec Co., or approved equal.
- E. Conductors smaller than 250MCM shall be stranded , 600 volt and Type XHHW-2. Conductors shall be manufactured by Rome, American Insulated Wire Co., Cablec Co., or approved equal.
- F. Ground and Neutral Conductors shall be provided for the required ground and neutral wiring.
  - a. The insulated ground and neutral conductors shall be the same type as the phase conductors.
  - b. Bare ground conductors shall be copper, soft drawn, annealed, concentric lay, stranded conforming to ASTM Specifications B3 and B8.
- G. Fixture Wires shall be rated 90<sup>0</sup> centigrade, #16 AWG stranded, thermoplastic insulated with an outer jacket. The wire shall be Type TFFN and manufactured by Brand-Rex, Carol Cable, or approved equal.
- H. Control power conductors shall be type XHHW stranded #14 gauge with manufacturer sequential number identification on exterior of insulation jacket.
- I. Instrumentation Signal Cables shall be Type TC single twisted pair or multi twisted pairs of stranded, copper cables with 600 volt, 15 mil polyvinyl chloride insulation over each conductor, overall aluminum-mylar tape shield, overall tinned copper drain wire and 45 mil minimum polyvinyl chloride jacket overall, 90E centigrade (dry/75 centigrade wet rating. Twisted pair cables that are required to be shielded, shall have aluminum-mylar tape shields and tinned copper drain wires over individual twisted pairs of cable. Single twisted pair cables shall be #16 AWG minimum. Cables shall be manufactured by Belden, Okonite, or approved equal.
- J. Wire Lubricant shall be provided to ease the pulling of cables and conductors in conduits. The lubricant shall be Aqua Gel, Polywater or approved equal. "Yellow 77" is not acceptable.

## **2.10 WIRE CONNECTORS**

- A. Connectors shall be provided for splices and terminal connections of all copper conductors and cables. The connector shall fit the conductor to which it shall be connected, and the assembly shall have joint contact surfaces not less than 50 percent.
- B. High voltage conductors (480V) shall be terminated in junction boxes using appropriately sized Weidmuller terminal blocks, color coded (green = grounding conductors, white or gray = neutral/grounded conductors, black red or blue for medium voltage (120V-240V) and brown, orange and yellow for high voltage conductors (480V).
- C. Compression Connectors for No. 8 AWG and larger shall be copper lugs for terminal connections, and two-way copper sleeves and taps for splice connections. A crimping tool shall be provided to make tight and neat compression connections. The connectors and crimping tool shall be Anderson-Square D, Thomas and Betts, Buchanan or approved equal.
- D. Tapered Spring Connectors shall have live springs attached to inner steel housings and enclosed with plastic insulators. Connectors shall be provided for No. 10 AWG conductors and smaller, and shall be Buchanan Type B2, Scotchlok Type B, Thomas and Betts Type PT or approved equal.

- E. Ground Clamps shall be provided for cable connections to ground rods and metal pipes as shown on the Drawings. Clamps shall be copper alloy, heavy duty, corrosion resistant and consist of U-bolts and saddles with bolted cable connections. The ground clamps shall be O-Z, Thomas and Betts Burndy or approved equal.
- F. Electrical Tape shall be plastic, 0.007 inches thick, and resistant to abrasion, alkalies, acids, corrosion, moisture, low and high temperatures. The tape shall be Scotch No. 33 Plus, Plymouth Premium Black No. 4453 or approved equal.
- G. Wire Markers shall be provided to identify each conductor at equipment terminals, and in intermediate junction boxes, pull boxes, handholes and manholes. At motor control centers and control panels, identify each motor or other electrical device circuit conductor with the motor or device number shown on the drawings and with the terminal number of the motor control center or control panel to which the conductor is connected. At motor and device terminals, at control stations, and in junction boxes, pull boxes, handholes and manholes, identify each motor or device circuit conductor with the terminal number of the motor control center or control panel to which the conductor is connected. In addition to identifying each conductor with the terminal number, in junction boxes, pull boxes, handholes and manholes, identify each group of conductors forming a motor or device circuit with the motor or device number shown on the drawings. At panelboards, junction boxes, pull boxes, handholes and manholes, identify each panelboard circuit conductor with the panelboard number and circuit number. The individual conductor wire markers shall be adhesive and manufactured by Thomas and Betts, Brady, Scotch 3M or approved equal. The wire marker to identify groups of conductors shall be nylon cable tie markers as manufactured by Brady, Seaton, Thomas and Betts, Panduit or approved equal. The marker pads on the cable tie markers shall be large enough to show the motor or device numbers. The motor or device numbers on the cable tie markers shall be 3/16 inch high minimum and shall be applied to the marker pads using marking pens for the purpose which shall be provided by the manufacturer of the cable tie markers. When a device is not numbered on the drawings, use a short descriptive title or assign numbers and provide the Owner with a list of the devices and assigned numbers. Electrical devices include items such as solenoid valves, vibrators, horns, heaters, analyzers, computers, instruments, etc.

## **2.11 PANELBOARDS**

- A. Panelboards shall be factory assembled, metal enclosed, dead front and equipped with bus, time switches, contactors, terminals and thermal-magnetic molded case circuit breakers as shown on the drawings.
- B. Circuit Breakers shall be molded case, quick-make, quick-break, single and multipole, and bolted type. Each circuit breaker shall have clear indications for "ON," "OFF", and "TRIP" positions. The minimum interrupting capacity shall be 10,000 symmetrical amperes at 240 volts. As indicated, provide devices to lock the branch circuit breaker in the "ON" and "OFF" positions. Ground fault protection, 5 milliamperere sensitivity, shall be provided for the indicated 120 volt branch circuits, which shall be an integral part of the regular branch breaker. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than the regular single pole circuit breaker.
- C. Copper Bus shall be provided for panelboards. Bus shall be provided for the complete length of the panelboard branch circuit area including circuits indicated as spaces. Bus bars shall be drilled and tapped for the indicated spaces for installation of future circuit breakers.

- D. Single Phase Panelboards, three wire, shall be bussed so that any two adjacent single-pole breakers shall be connected to opposite polarities. A single handle two-pole circuit breaker can be installed in any location, and in place of two adjacent single pole breakers.
- E. Terminals and connectors shall be provided for the feeder, neutral and branch conductors shown on the Drawings.
- F. Circuit Numbers shall start at the top of the panelboard. Odd numbers shall be assigned in sequence on the left side, and even numbers shall be in sequence on the right side of the panelboard.
- G. The Cabinet shall enclose the bus and breaker assembly, and shall be steel fabricated and coated with corrosion-resistant finish as specified in Section 16010. The front of the panelboard shall include a trim, hinged door, flush cylinder lock with catch. The lock shall be furnished with two keys, and all locks shall be keyed alike. Fronts shall not be removable when the door is in the locked position.
- H. Time Switches shall be provided as indicated and specified in Section 16900.
- I. Contactors shall be provided as indicated and specified in this Section.
- J. Metal Circuit Directory frame and card with clear plastic covering shall be provided on the inside of the door. The directory card shall provide a space at least 1/4-inch high and 3 inches long for each branch circuit. The card shall be completely typed to identify each connected and spare circuit.

## **2.12 MOTORS AND CONTROLS**

- A. Motor Wiring shall be provided as shown on the Drawings. Include the wiring interconnections between the motors, motor starters, control panels and controls as required.
- B. Control Power shall be 120 volts, single phase and 60 hertz unless otherwise indicated. A separate control transformer shall be provided for each motor magnetic starter, contactor and grouped relays as indicated.
- C. Contactors shall be provided for circuits as shown on the Drawings, specified and required. The contactor shall be electrically held unless otherwise indicated, 600 volt, 60 hertz, industrial duty, and connected to 120 volts AC circuit with remote control device. The drawings shall indicate the number of poles and ampere ratings for the contactors and the locations, which shall be mounted inside motor control centers, panelboards or separate metal enclosures as indicated. Enclosures shall be finished as specified in Section 16010. The silver alloy power contacts shall be load break within the rating of the contactor without assistance from additional arcing contacts. The magnetic coil shall be continuous duty, encapsulated and easily removable. The magnet shall provide rapid action on pickup or dropout and satisfactory operation without hum. The 120 volt circuit shall be provided by an individual control power transformer for each contactor. The contactors shall be Square D Class 8903, Cutler-Hammer Type C30, Allen-Bradley Bulletin 702 or approved equal.
- D. Relays shall be provided as specified in Section 13331 and as shown on the Drawings.
- E. Manual Starters shall be provided as specified in Overcurrent Protection Paragraph.

## 2.13 OVERCURRENT PROTECTION

- A. Circuit breakers, fuses, relays and other protective devices that protect the conductors and equipment against overload currents and short circuit currents shall be provided as indicated, specified and required. The circuit breakers shall be coordinated as specified in this Section and Section 16010.
- B. Circuit Breakers shall be molded case type unless otherwise indicated. Breakers shall be quick-make and quick-break on manual or automatic operation. The drawings shall indicate the number of poles and ampere trip ratings. The handle mechanism shall be trip-free which prevents holding the contacts against overload or short circuit conditions.
  - a. The thermal device shall provide time-delay tripping on overloads, and the magnetic device shall provide instantaneous tripping on short circuits. The instantaneous magnetic trip shall be adjustable and accessible from the front of the circuit breaker on frame sizes above 100 amperes. Non-automatic breakers shall have no tripping devices, and shall be used for manual switching of circuits. Molded case thermal-magnetic circuit breakers shall have at least the following interrupting capacities in symmetrical amperes at 480 volts unless otherwise indicated.
    - i. 100 Ampere Frame - 22,000.
    - ii. 225 Ampere Frame - 22,000.
  - b. Solid state circuit breakers shall be equipped with programmers, integral current sensors, logic and trip circuitry, sensor-powered shunt trips and integral ground fault protection. The programmer shall include silicon transistors, silicon diodes, silicon controlled rectifiers and printed circuitboards to assure the circuit breaker's reliability and stability. Each printed circuit board shall be given a protective epoxy coating to prevent moisture absorption, fungus growth and signal leakage. Gold plated surfaces shall be provided on all electrical connectors and adjustment taps. Sensing power and signals shall be derived from three current transformers inside the circuit breaker, which shall supply power to the solid state programmer. The trip shall utilize logic circuitry contained in the programmer. The ampere setting shall be a tap adjustment which selects the continuous current setting of the breaker. These tap adjustments shall be made with knobs on the front of the programmers. Regulated d-c power shall be provided by the full wave rectifiers and filters in the power supply. There shall be individual signals from the programmer which shall trip the breaker on overloads, short circuits, ground faults and high temperatures. The interrupting capacity for the solid state circuit breaker shall be 100,000 symmetrical amperes at 480 volts. It shall be possible to lock the operator handle in the "off" position with a padlock.
  - c. Molded plastic housings that contain standard molded case circuit breakers and current limiters connected to the load side of the breakers shall be provided as indicated. The circuit breaker shall be ambient temperature compensated, and shall be provided with thermal overload protection. The integrally fused circuit breaker shall be capable of interrupting short circuit currents up to 100,000 symmetrical amperes at 480 volts. The time current limiting characteristics of the fuses shall be coordinated with the time current tripping characteristics of the circuit breaker. The fuse limiters shall be individually interlocked with the breaker element tripping mechanism so that no fuse can be inserted or removed until the circuit breaker is in the "off" position. An interlock shall be provided so the circuit breaker cannot be closed if a fuse limiter is either missing or has blown. Fuse limiters shall be individually removable from the molded case housing. It shall be possible to lock the operator handle in the "off" position with a padlock.

- d. Motor circuit protectors shall be provided as shown on the drawings. They shall be molded case magnetic-trip-only circuit breakers. Each pole shall provide instantaneous protection by means of a single adjustable magnetic element that trips all currents equal or above the trip setting. The single adjustment screw shall adjust all poles simultaneously. Tripping shall be clearly indicated by the handle automatically assuring a position midway between the manual "OFF" and "ON" positions. All poles shall be constructed to open, close and trip simultaneously. The contacts shall be of non-welding silver alloy. It shall be possible to lock the operator handle in the "OFF" position with a padlock.
  - e. As indicated, motor circuit protectors shall be provided with current limiters having an interrupting capacity of 100,000 amperes. The MCP and limiter shall be fully coordinated so the motor circuit protector shall open all three poles if the limiter operated. The current limiters shall be so constructed that they can only be replaced by an identical or similar limiter having the same interrupting capacity. It shall be possible to lock the motor circuit protector handle in the "OFF" position with a Padlock.
  - f. The circuit breakers shall be mounted inside low voltage switchgears, motor control centers, switchboards or separate metal enclosures as indicated. Breakers shall be equipped with indications for the "trip", "on", and "off" positions, and connectors that fit the conductors shown on the drawings. Submittal shall include complete descriptive data, technical data and manufacturers Certified Test Reports for circuit breakers 600 amperes and larger. The molded case circuit breakers shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal.
- C. Fused Switches shall be provided in metal enclosures that are suitable for locations shown on the Drawings. Each switch shall be industrial type, heavy duty, horsepower rated, quick-make, quick-break and equipped with fuses, cover-handle interlock, "ON-OFF" indications and feature to lock the operating handle in the "OFF" position. The drawings shall indicate the volts, amperes and number of poles. The switches shall include connectors that shall fit the conductors shown on the drawings. The fuses shall be Fusetron or Low-peak dual-element type and capable to interrupt 200,000 amperes. Ratings for volts and amperes shall be shown on the drawings. The enclosure shall be finished as specified in Section 16010. On the front of the enclosure, attach a plastic nameplate that identifies the load. The fused switches shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal.
- D. Overload Relays shall be provided in each phase of all circuit breakers and magnetic starters to properly protect the conductors and equipment that shall be connected on the circuits. Provide one spare overload relay for each overload relay provided.
- E. Overcurrent Protection Device Coordination. All overcurrent protection devices on this project shall be coordinated so that they will perform as follows:
- a. When two or more overcurrent protective devices in series with each other experience current flow greater than their rated current, the device with the lowest rated current shall trip and/or open the circuit first and thereby prevent the higher rated devices from operating.
  - b. The Supplier of the circuit breakers shall prepare a coordination study to verify the above stated performance requirements. The study shall be documented by the Supplier and the documents shall include but not be limited to the following:
    - i. Manufacturer's overcurrent device operating curve printed on transparent paper for each overcurrent device. In the case of fuses, both minimum melt and maximum clearing time curves shall be included.

- ii. One reproducible copy of all project single line diagrams so marked to show which operating curve applies to each overcurrent device on the diagram (the operating curves shall also be correspondingly marked).
- iii. A tabulation of the required settings of all of the adjustable overcurrent devices so that the performance requirements is met. This documented coordination study shall be submitted for review before the overcurrent devices are supplied for the project. Circuit breakers which have ground fault protection features are specifically required to meet this performance requirement.

## **2.14 WIRING DEVICES**

- A. Receptacles and switches shall be specification grade, heavy duty and provided in galvanized steel and cast metal boxes with covers as identified and located on the drawings. Unless otherwise indicated, the device phenolic color shall be ivory for all flush duplex receptacles and local switches, and their coverplates. Unless otherwise indicated the device phenolic color shall be brown for all duplex receptacles and local switches which are installed in surface mounted boxes. Galvanized steel boxes shall be installed in the walls for flush devices. All surface device outlets shall have cast iron boxes.
- B. Convenience Receptacles, for exterior installations, shall be single, grounding type, polarized, NEMA 5-15R, rated 20 amperes and 125 volts AC, and shall have side screw terminals for copper wire unless otherwise indicated equipped with ground fault capabilities. The metal coverplate shall attach to the box with corrosion resistant screws. The plug opening in the coverplate shall have a ethylene propylene rubber gasket. Attached to the coverplate shall be a stainless steel hinge-spring metal cover. The receptacles shall be ivory and manufactured by Hubbell, Slater, P&S, Arrow Hart, General Electric or approved equal. The convenience outlet shall be weatherproof with the hinged cover closed. Also, the outlet shall be weatherproof with the hinged cover open and a cord plug attached to the receptacle. The coverplate shall be manufactured by Crouse-Hinds, Appleton, Intermatic or approved equal.
- C. 240 Volt Receptacles shall be single, grounding and locking type, NEMA L6-30R, polarized, rated 30 amperes and 250 volts AC, 3-wire and equipped with screw terminals for copper wire. The receptacles shall be manufactured by Hubbell, Slater, P&S, Arrow Hart, General Electric or approved equal. For each power outlet, provide a plug cap, NEMA L6 30P, Hubbell, Arrow, Bryant or approved equal.
- D. Welding Outlets shall be 3-pole, 4-wire, 3-phase, grounding and locking type, rated 60 amperes and 600 volts. The welding outlet shall include #26420 receptacle, housing and cover, #26401 cast metal box, #26404 cast metal box adapter and #26419 plug cap with adjustable cord grip. The welding outlets shall be suitable for indoor and outdoor installations, and shall be manufactured by Hubbell, Slater, P&S, Arrow Hart, General Electric or approved equal.
- E. Local and Weatherproof Switches shall be toggle type, rated 20 amperes and 120-277 volts AC, and equipped with side screw terminals for copper wire. Single pole switches shall be #1221, #1991, #4901 brown and ivory. Three way switches shall be #1223, #1993, #4903 brown and ivory. The switches shall be manufactured by Hubbell, Slater, P&S, Arrow Hart, General Electric or approved equal.

## **2.15 DISCONNECT SWITCHES**

- A. Provide the non-fusible disconnect switches, as indicated, specified and required.

- B. Switches shall be steel enclosed, heavy duty, NEMA 1 and NEMA 3R as required, 2-pole and 3-pole, 250 volt and 600 volt, ampere rating as indicated, and finished as specified in Section 16010. On the front of the enclosure, attach a plastic nameplate that identifies the load. Disconnect switches shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal.
- C. Mechanisms shall have quick-make and quick-break operating handles and provisions for padlocking in the "OFF" position. The switch shall have an interlock to prevent unauthorized opening of the hinged cover when the switch is in the "ON" position, and an interlock to prevent closing the switch mechanism with the hinged cover open.
- D. Copper Lugs shall be included for the copper wire connections. The lug shall fit the conductor which shall be connected to the lug.

## **2.16 SUPPORTS**

- A. Provide the galvanized and PVC coated metal channels, fittings, stanchions, clamps, hangers, and required hardware to support all conduit and equipment as required.
- B. Channels shall be steel and cold rolled. One side of the channel shall have a continuous slot. On both sides of the slot, the edges turn inward and forms a guide for the spring nuts. The fittings shall be fabricated from steel and attached to the channel with bolts and spring nuts. The channel, fittings and hardware shall be hot-dipped galvanized and manufactured by Unistrut, GTE Products Co., Ideal Industries, Joslyn Mfg & Supply Co., or approved equal.
- C. One-Hole Clamps shall be malleable iron, galvanized for steel conduits and equipped with clamp-backs. The clamps shall be Efcor, Thomas and Betts, Appleton or approved equal.
- D. Beam Clamps shall be malleable iron, galvanized, right angle and parallel types. The clamps shall be manufactured by Efcor, Thomas and Betts, Appleton or approved equal.
- E. Spacers shall be plastic and provided to support underground conduits for concrete encasements. The spacers shall be Carlon, Johns-Manville, Underground Products or approved equal.
- F. Steel Anchors shall be sleeve and stud types for securing equipment to concrete foundations, floors and walls. The anchors shall be Phillips "Red Head", Diamond or approved equal. Concrete foundation to include 4" housekeeping pad.
- G. Toggle Bolts shall be steel, spring wing type for securing equipment to hollow walls and ceilings. Toggle bolts shall be Phillips "Red-Head", Diamond or approved equal.
- H. Conduit Hangers shall be heavy gauge formed steel, galvanized and equipped with carriage bolts, 1/4-inch rods and nuts. The hangers shall be Efcor, Appleton, Ideal Industries, Joslyn Mfg & Supply Co. or approved equal.
- I. U-Bolts shall be heavy gauge steel, galvanized and equipped with two hexagon steel nuts. The U-bolts shall be Efcor, Kindorf or approved equal.
- J. Hardware shall be provided to securely attach all equipment and materials.



## **2.17 NAMEPLATES**

- A. Nameplates shall be provided as indicated to identify equipment, and the positions and circuits within the equipment. Also, individually enclosed equipment shall be provided nameplates as indicated.
- B. The Nameplates shall be laminated black plastic with 1/4 inch high white letters, NEMA ES-1, 3-ply, 1/16-inch thick, beveled and satin finished. Nameplate inscriptions shall include the identifications for the equipment and loads and shall identify the controls on control equipment as shown on the Drawings.
- C. Plastic Nameplates shall be provided for switchgears, motor controllers, substations, service equipment, switchboards, motor control centers, panelboards, and individually enclosed circuit breakers, disconnect switches, magnetic starters, relays, manual starters and control stations unless otherwise indicated. Provide lighting switch nameplates as indicated on the Drawings.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Provide the wiring installations and equipment installations, including connections and interconnections as indicated, specified and required. Assure proper fits for all equipment and materials in the spaces shown on the Drawings.
- B. Excavations and Backfills. Earthwork shall be performed for equipment foundations, supports and underground conduits as indicated and as specified.
- C. Concrete shall be provided for electrical equipment foundations, support foundations and conduit encasements as indicated and as specified. Concrete foundation to include 4" housekeeping pad.

### **3.2 RACEWAYS**

- A. Provide all the cable tray and conduit installations, including the outlet bodies, boxes, gaskets, covers, fittings and supports to complete the raceway systems as shown on drawings and as required. Install ground conductors in all non-metallic conduits.
- B. Exposed Installations. The installations shall be completed with hot-dipped galvanized cable trays, rigid steel conduits and intermediate steel conduits with wrench tight connections. In hazardous areas, only rigid steel hot-dipped galvanized conduits shall be installed. In corrosive areas, PVC coated galvanized rigid steel conduits shall be installed. Maintain a minimum clearance of 12 inches for conduits that shall be installed near hot pipes or surfaces (150EF or higher). Exposed conduits shall be installed parallel or perpendicular to buildings and structures.
- C. Flexible Conduits. Flexible conduits shall be liquid-tight with fittings for short tight connections (30 inches maximum) to equipment, except in Class 1, Division 1 areas. A separate ground conductor shall be installed in flexible conduit that does not have the internal copper bonding conductor included by the manufacturer.
- D. Flexible Couplings. The couplings shall be explosion-proof with fittings for short, flexible, tight connections to equipment in Class 1, Division 1 hazardous areas.

- E. Threads. All steel conduit threads shall be coated with a corrosion resisting lubricant, and the connections shall be made watertight. The lubricant shall maintain the grounding continuity.
- F. Locknuts and Bushings. Locknuts and bushings shall be installed on the threads of steel conduits that enter through close-fit openings in enclosures.
- G. Sealing Bushings. The bushings shall be installed on the ends of exterior conduits that terminate at indoor equipment. The bushing shall provide a water-tight seal inside the conduit.
- H. Seal Fittings. Seal fittings shall be connected to rigid steel conduits in hazardous areas to prevent gases and flames to pass from one area to another through the conduit system. Also, sealing fittings shall be installed to completely water seal inside conduits and the areas around steel conduits that pass through concrete floors and outside walls.
- I. Expansion/Deflection Fittings. Expansion/Deflection fittings shall be connected to steel conduits as indicated and required.
- J. Penetrations. Penetrations through concrete for sleeves and conduits shall be approved by the Owner. Submit the sizes, locations and methods for all penetrations.
- K. Stub-ups. All steel conduit stub-ups shall be painted per requirements in Pertinent Sections. Conduits shall be painted a minimum of 4 inches above and below concrete slabs. Finish shall be applied before concrete is poured. Identify spare stub-ups under control panels, motor control centers and switchboards with tags as to the location of the termination of the conduit at the other end.
- L. Terminations. Conduits entering equipment, including control panels, motor control centers, switchboards, etc. shall enter in the same vertical section in which the circuit will terminate. Tag conduits at each end for identification.
- M. Tool Marks. Conduits and fittings that have tool marks shall be smoothed and finished with paint that matches the original finish.
- N. Conduit Through Roof. Provide a watertight seal around the conduit on the roof Coordinate the work with the roofing contractor.
- O. Furnished Equipment. Provide conduit installations as shown on the Drawings, and specified in other Sections of the Specifications for furnished equipment.
- P. Alterations. Alterations to existing installations shall be completed as indicated and specified.

### **3.3 BOXES AND FITTINGS**

- A. Outlet bodies, boxes, gaskets, covers, fittings and supports shall be installed as indicated, specified and required.
- B. Cast Iron. Cast iron outlet bodies, boxes, gasketed covers and fittings shall be connected to exposed galvanized rigid steel conduits.
- C. Sheet Steel. Sheet steel boxes shall be provided with close-fit holes for steel conduit connections. Weatherproof boxes shall be provided with interchangeable conduit hubs for steel conduit connections as indicated.

- D. Interchangeable Hubs. The hubs shall be installed in steel enclosures for rigid steel conduit connections. Cut a close fitting hole in the sheet steel enclosure and place the interchangeable hub in the opening. Connect the hub on the conduit and make a tight connection to the enclosure.
- E. The purpose of all circuits shall be legibly identified at the panel, receptacles, junction boxes and equipment in a permanent manner (i.e. Etched Plates, Conductor Tag, Permanent Marker, Etc.). The labeling shall include panel circuit number, "To" and "From" identification and marked "Spare" where applicable.

### **3.4 CONDUCTORS AND CABLES**

- A. Install all the conductors and cables for the wiring as indicated, specified and required.
- B. Conductors. Conductors shall be completely installed and connected. Apply wire lubricant to ease the pulling of conductors in conduits. Recommended pulling tensions shall not be exceeded. Splice and terminal connections shall be made tight with spring and compression connectors. The connectors shall be crimped with a tool that provides uniform and tight connections. Connectors shall be sized as outlined in paragraph on Wire Connectors in this Section. Include all the required wiring interconnections. When routing conductors, and cables through precast concrete pull boxes and manholes, the longest (not shortest) route from entrance to exit shall be used.
- C. Insulate. All connections shall be insulated as required with tight wraps of plastic tape. Apply insulation putty to fill irregularities and voids in splices. High and medium voltage cable splices shall be completed as instructed by the cable manufacturer.
- D. Furnished Equipment. Provide wiring installations as shown on the Drawings, and specified in other Sections of the Specifications for furnished equipment.
- E. The purpose of all circuits shall be legibly identified at the panel, receptacles, junction boxes and equipment in a permanent manner (i.e. Etched Plates, Conductor Tag, Permanent Marker, Etc.). The labeling shall include panel circuit number, "To" and "From" identification and marked "Spare" where applicable.

### **3.5 PANELBOARDS**

- A. Install and completely connect all the factory assembled panelboards as shown on the Drawings.
- B. Elevation. The elevation to the top of the panelboard shall be six feet above grade unless otherwise indicated.
- C. Clearance Space. Provide at least 1/2-inch clearance between the back of the panelboard cabinet and the RTU Cabinet.
- D. Anchor Bolts. Securely attach the panelboard to the wall with anchor bolts.
- E. Locking Devices. Attach locking devices on the handles of branch circuit breakers for the "ON" position as shown on the Drawings.
- F. Circuit Director Card. Completely type the card to identify each connected and spare circuit.

- G. Tight Connections. Provide tight connections for feeder and branch circuit wiring.

### **3.6 MOTORS AND CONTROLS**

- A. Install all the wiring and control equipment as indicated, specified and required.
- B. Motors. Motors shall be provided with the driven mechanical equipment.
- C. Wiring. The wiring installations shall be complete. Include all the required wiring interconnections between the motor magnetic starters, and between the starters and the instrument control panels. Provide motor frame conduit connection boxes as required. Be certain that all wiring connections provide the proper motor rotation.
- D. Magnetic Starters. The magnetic starters shall be provided in the motor control centers unless otherwise indicated.

### **3.7 OVERCURRENT PROTECTION**

- A. Install all the overcurrent protective equipment as indicated, specified and required.
- B. Metal Enclosures. The enclosures for individual equipment shall be constructed to satisfy the condition in the location where they shall be installed.
- C. Overload Relays. Overload relays shall be provided in the control equipment for three phase and single phase circuits as required. Check the full load amperes for each motor and the overload relay rating. Replace the relays that shall not satisfactorily protect the connected motors.
- D. Trip Settings. Circuit breakers shall assure the required circuit protection with the indicated trip settings.
- E. Fuses. Provide fuses that have the current and voltage ratings to protect the circuits shown on the Drawings.

### **3.8 WIRING DEVICES**

- A. Install the required local switches, convenience outlets and clock outlets complete, including the supports and wiring.

### **3.9 DISCONNECT SWITCHES**

- A. Provide the complete installations for fused disconnect switches and non-fused disconnect switches where shown on the Drawings and as required.
- B. Mounting Height. Switches shall be installed 5 feet from grade or floor to the top of the enclosure unless otherwise indicated.
- C. Connections. The steel enclosures shall be connected complete with steel conduits terminating into interchangeable hubs attached to the enclosures. Wire connectors shall be provided for connecting the copper conductors.

### **3.10 SUPPORTS**

- A. Install the required structural channels, brackets, stanchions, U-bolts, clamps, anchors, hangers, fittings and other hardware to securely attach and support all the equipment and conduits.
- B. Painting. Brackets, stanchions and other unfinished steel supports shall be painted per requirements of "Painting and Protective Coatings" Section of the Specifications.

### **3.11 NAMEPLATES**

- A. Nameplates shall be positioned and lined-up to provide a neat appearance. They shall be attached to the cleaned metal surfaces of enclosures as directed by the OWNER.
- B. Nameplates. Nameplates shall be installed on primary interrupters, switchgears, substations, switchboards, service equipment, motor controllers, motor control centers, panelboards, and individually enclosed circuit breakers, disconnect switches, magnetic starters, manual starters, relays and control stations unless otherwise indicated. Install lighting switch nameplates as indicated on the Drawings.

### **3.12 CHECKING, ADJUSTING AND TESTING**

- A. Provide the required labor and equipment, and all checking, adjusting and testing operations on the electrical installations.
- B. Check All wire terminals shall be checked to assure tight connections.
- C. Adjust. Adjust repeat cycle timers, interval timers and time delay relays and other devices so the controls shall operate in the indicated sequence.
- D. Wiring Tests. The tests shall be performed to detect wrong connections, short circuits, continuity and grounds. Insulation tests shall be made with a hand crank test instrument on all cables and conductors. NOTE: WARNING. Do not make insulation tests on any conductors either signal or power, that are connected to semi-conductor type equipment. Remove the conductors from the equipment before insulation testing; severe damage may result from meggar-type instruments. Power feeders and branch conductors shall be tested phase to phase, and phase to ground. Phase to ground tests on shielded cable shall mean "conductor to shield". After insulation resistance tests have been performed, high voltage and medium voltage shielded cables shall be "hi-Pot" tested in accordance with the current ICEA Standards and the manufacturer's recommendation. Voltage shall be applied and removed in a slow, even manner, and the conductors shall be grounded for at least one minute after the voltage is removed to insure that no charge remains. Test voltage and application time for the various cables and conductors shall be submitted to the Owner. Correct any defects in the wiring systems.
- E. Equipment Tests.
  - a. Perform equipment tests as indicated and directed by the manufacturer. Refer to Section 16010 for Manufacturers' Certified Reports on primary interrupters, substations, switchgears, service equipment and motor control centers.
- F. Test Data. Test data for equipment, shielded cables and supply voltage shall be submitted to the Owner.

- G. Supply Voltage. Test the supply voltage while the normal plant loads are operating. If the voltage is not within normal limits (plus or minus one percent), notify the power company and request a voltage correction.
  
- H. Operation Tests. Perform operation tests and observe that all loads operate satisfactorily. Refer to Section 16010 for Demonstration and Final Operation Test Plans and Results.

## **SECTION 16120: SURGE PROTECTION DEVICE**

### **PART 1 - GENERAL**

#### **1.1 APPLICABLE STANDARDS AND TESTING:**

- A. Underwriters Laboratories 1449 - (UL 1449 2nd edition for Transient Voltage Surge Suppressors)
- B. Underwriters Laboratories 1283 - (UL 1283 listed as an electromagnetic interference filter that provides noise attenuation)
- C. Underwriters Laboratories 67 - (UL 67 listing for internal panelboard SPD)
- D. Canadian Standards Association (CSA)
- E. National Electrical Code 2002 - (NEC Article 285 SPD Installation practice/NEC Article 250.56 Grounding)
- F. NFPA-78 and CSA - (National Fire Protection Association and Canadian Standards Associations)
- G. ISO 9001:2000 - Quality standard
- H. Military Standards (MIL-STD 220A)
- I. IEEE C62.41.1 and C62.41.2 - 2002 - (System shall be designed to meet American National Standards Institute/Institute of Electrical and Electronic Engineering Inc. C62.41)
- J. IEEE C62.45 2002. - (System shall be tested to meet the C62.45)
- K. Category A & B - (0.5  $\mu$ SEC x 100 kHz Ring Wave)
- L. Category B3 Biwave - (8 x 20  $\mu$ SEC at 3,000 Amperes and 1.2 x 50  $\mu$ SEC at 6,000 Volts)
- M. Category C3 Biwave - (8 x 20  $\mu$ SEC at 10,000 Amperes and 1.2 x 50  $\mu$ SEC at 20,000 Volts)
- N. The fusing elements must be capable of allowing the suppressor's rated single impulse current to pass through the suppressor at least one time without failure. The system shall be tested to 1,000 sequential ANSI/IEEE C62.41.1 and C62.41.2 Category C3 combination wave transients. The Category C3 combination wave is defined as a 1.2 x 50 microsecond wave at 20,000 volt open circuit voltage waveform and 8 x 20 microsecond wave at 10,000 ampere short circuit current waveform. In addition, the system components shall be tested repetitively 1,000 times testing based on an IEEE C62.33 (MOV test) and C62.35 (SAD test) without failure or degradation exceeding  $\pm 10\%$ .
- O. CBEMA (ITIC) and IEC - (Computer Business Equipment Manufacturers Association or Information Technology Industry Council and International Electrotechnical Commission define clamping voltage tolerance guidelines for sensitive equipment)

#### **1.2 SUBMITTALS**

- A. Must have fifteen day prior approval to bid on project. Request for submittal must be in writing with the following up items.

- B. Drawings: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.
- C. Equipment Manual: The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external overcurrent device to maintain the system's UL 1449 listing.
- D. National Electrical Code (NEC) 285 - Installation requirements for SPD.
  - a. Section 285.2, SPD must limit transient voltage by diverting or limiting surge current; it also should prevent continued flow of follow current while remaining capable of repeating these functions. SPD that utilize fuses must have repetitive surge capability that can survive its surge rating and meet UL 1449.
  - b. Section 285.6, SPD shall be marked with a short circuit current rating and shall not be installed at a point on the system (ex. service, distribution or branch panels) where the available fault current (AIC rating) is in excess of that rating.
  - c. UL 1449 stipulation for fused SPD - The manufacturer's authorized representative is required to submit the following:
    - i. Certify that the SPD system is UL 1449 listed (UL Card).
- E. Indicate the type of internal or external fusing that is incorporated in the SPD system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.
  - a. CBEMA (ITIC) & IEC - SVRs must meet voltage tolerance guidelines
  - b. SVR clamp levels for wye and single phase (L-N, L-G and N-G):
  - c. 400-600V for 120V systems, 800-1200V for 277V systems and 1200-1500V for 347V systems
  - d. SVR clamp levels for delta circuits (L-L and L-G):
    - i. 1000-1200V for 240V systems, 1500-1800V for 480V systems and 1800-2000V for 600V systems

## **PART 2 - PRODUCTS**

### **2.1 SERVICE ENTRANCE/SWITCHBOARD/SWITCHGEAR:**

- A. Acceptable Manufacturers:
  - a. Current Technology
  - b. Surge Suppression Inc.
  - c. Liebert
  - d. LEA International Inc.
  - e. Eaton Cutler Hammer
  - f. Square D Schneider
  - g. Phoenix Contact
  - h. General Electric
  - i. OR approved equal
- B. Equipment shall be a multi-stage parallel protector rated for 277/480VAC, 3 PHASE, 4 WIRE, plus ground. The equipment's minimum surge current capacity shall be 400 kA per phase (L-N plus L-G) and 200 kA per mode (L-N, L-G, L-L and N-G).



- C. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
- D. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
- E. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. Redundant status indicators shall be mounted on the front of the door that monitors the system protection circuitry.
- F. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.
- G. Each protection module shall have a capacitive filtering system connected in each Line to Neutral (L→N)(Wye) mode or Line to Line (L→L)(Delta) mode to provide EMI/RFI noise attenuation (UL 1283).
- H. Protection modes: The SPD shall provide Line to Neutral (L→N)(Wye), Line to Ground (L→G)(Wye or Delta), Line to Line (L→L)(Delta) and Neutral to Ground (N→G)(Wye) protection.
- I. Service Conditions: Rate surge protective device for continuous operation under the following conditions, unless otherwise indicated:
  - a. MCOV: Maximum Continuous Operating Voltage of 125% or greater.
  - b. Operating Temperature: 30 to 120 degrees F.
  - c. Humidity: 0 to 85 percent, noncondensing.
  - d. Altitude: Less than 20,000 feet above sea level.

## 2.2 BRANCH PANEL PROTECTION

- A. Acceptable Manufacturers:
  - a. Current Technology
  - b. LEA International Inc.
  - c. Liebert
  - d. Phoenix Contact
  - e. General Electric
  - f. OR approved equal
- B. Device shall meet all specification requirements in section 2.1 except as follows:
- C. Equipment shall be a multi-stage parallel protector rated for 277/480VAC, 3 PHASE, 4 WIRE, plus ground. The equipment's minimum surge current capacity shall be 400 kA per phase (L-N plus L-G) and 200 kA per mode (L-N, L-G, L-L and N-G).
- D. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. The specified service entrance/switchboard/switchgear system shall be installed with the shortest lead length possible not to exceed five (5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends. Utilize a 3 pole 15 amp breaker for connection means.
- B. The specified branch panelboard system shall be installed with the shortest lead length possible not to exceed a foot and half (1.5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends.

#### **3.2 WARRANTY AND QUALITY ASSURANCE**

- A. Manufacturer shall provide a product warranty for a period of not less than five (5) years from date of installation. Warranty shall cover unlimited replacement of SPD modules during the warranty period. Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of SPD for not less than twenty (25) years. Utilize a 3 pole 15 amp breaker for connection means.

#### **3.3 ACCEPTANCE**

- A. Manufacturer's representative shall visit site, verify installation, and submit to Contracting Officer a letter stating that equipment and installation meets intent of Contract Documents and manufacturer's warranties and that guarantees are in effect.

## **SECTION 16200: POWER GENERATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Requirements specified in the General Provisions and Section 16010 and Section 16100 form a part of this Section. This Section outlines the electrical work for power generation equipment.
- B. Work Included in This Section. Principal items are:
  - a. Engine-driven electric generator with engine mounted radiator, fan, fuel day tank, exhaust system, fuel transfer pump and all required items of auxiliary electrical equipment.

#### **1.2 QUALITY ASSURANCE**

- A. Requirements.
  - a. The manufacturer of the electric generating unit shall be the actual manufacturer of either the generator or the prime mover and shall have demonstrated experience in producing electric generating units of similar size. The manufacturer shall not be just an assembler of components.
  - b. The manufacturer shall own and operate a permanent test facility where the required factory tests shall be performed.
  - c. The electric generating set shall be a standard product of the manufacturer. A one of a kind fabrication is not acceptable.
  - d. The set including all components, shall be new, fabricated, assembled complete, tested and shipped by the manufacturer so there is one source of supply and responsibility.
  - e. Provide all components that are required to satisfactorily complete the - generating system even if not described in this Section.
  - f. All the equipment and materials, including their fabrication, assembly, testing and installation shall conform to the applicable codes and standards that are listed in Section 16010 "General Electrical Requirements."
  - g. The installation shall also comply with applicable requirements of National Fire Protection Association No. 37, Stationary Combustion Engines and Gas Turbines and No. 110, Standby and Standby Power Systems.
- B. The electric generating unit shall be manufactured by Cummins, Onan, Caterpillar, Detroit Diesel, Kohler, Generac, or equal.

#### **1.3 SUBMITTALS**

- A. Submit for the Owner's approval material lists, shop drawings, test reports, manufacturers' certified reports and technical data to the extent required in this Section and Section 16010.
- B. Shop Drawings: In addition to the information required to be included in the shop drawings as specified in Section 16010, shop drawings shall include the following:
  - a. Details for anchor bolts, method of anchoring, vibration isolator mountings, muffler, and exhaust pipe installations, connections for fuel, connections for power and control wiring, plans, elevations, equipment arrangements, diagrams, dimensions, weights, locations for conduits and nameplate inscriptions.
  - b. Detailed factory brochures of the complete standby generating plant.

- C. Certified Reports.
  - a. The performance of the generating set shall be certified by an independent testing laboratory as to the set's full power rating, stability, voltage regulation and frequency regulation, all in conformance with NFPA 110.
- D. Prototype model test reports, production model test reports and field test reports shall be provided to the extent required in this Section.
- E. Instruction Manuals. Obtain data from the electric generating plant manufacturer and submit instruction manuals that outlines the complete description, installations and operations of each unit.
  - a. Contents. Each manual shall have an index listing the contents. Information in the manuals shall include not less than (a) general, introduction and overall equipment description, purpose, functions, and operation, (b) specifications, (c) installation instruction, procedures, sequences, and precautions, including tolerances for level, horizontal, and vertical alignment, (d) grouting requirements including grout spaces and materials, (e) list showing lubricants, approximate quantities needed per year, and recommended lubrication intervals, (f) startup and beginning operation procedures, (g) operational procedures, (h) shut down procedures, (i) short and long term inactivation procedures, (i) maintenance, calibration, and repair instruction, (k) parts lists and spare parts recommendations, (l) prices of spare parts and maintenance materials, (m) lists of all special tools, instruments, accessories, and special lifting and handling devices required for periodic maintenance, repair, adjustment, and calibration, and (n) other information as may be specified or required for approval.
  - b. Format and Binding. Drawings and pictorials shall be used to illustrate the text as necessary to fully present the information. Where the information covers a family of similar items, the inapplicable information shall be struck out or the applicable portions identified by heavily weighted arrows, boxes, or circles. Each manual shall be bound in sturdy covers labeled to indicate the equipment to which it applies. Manuals less than one inch thick shall be bound in standard three-ring binders; others shall have sturdy covers secured with removable fasteners and, when more than two inches thick, shall be bound in locking-bar post binders with rigid covers.
  - c. Manual Submittals. Submittals shall include two copies of each manual, one of which will be marked to show the required corrections or approval and returned. When approved, deliver four copies of each approved manual to the OWNER.
- F. Equipment Data. For equipment under this Section not covered by the above instruction manuals, submit complete technical and catalog data giving specific information on performance and operating curves and data, ratings, capacities, characteristics, efficiencies, and other data to fully illustrate and describe the items as may be specified or required for the OWNER'S approval. Include the name, address and phone number of the local service organization for the electric generating equipment.
- G. Tools and Accessories. Furnish and deliver all special tools, instruments, accessories, and special lifting and handling devices shown in the approved instruction manuals. Unless otherwise specified or directed by the OWNER, the items shall be delivered to the OWNER, with a written transmittal accompanying each shipment, in the manufacturers' original containers labeled to describe the contents and the equipment for which it is furnished. Deliver a copy of each transmittal to the OWNER for record purposes.

#### **1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING.**

- A. The electric generating plant shall be delivered to the site as a complete factory-assembled unit including structural base, with factory-applied weather protection. Units shall be stored under cover or shall be fully protected until installed.

#### **1.5 JOB CONDITIONS.**

- A. The exact space requirements for all required equipment shall be determined by the approved equipment for the project. The drawings indicate the major components that shall be included in the electric generating systems. Should there be a need to deviate from the drawings and specifications, all proposed changes shall be detailed in writing and submitted to the OWNER for approval.

### **PART 2 - PRODUCTS**

#### **2.1 ELECTRIC GENERATING SET (STANDBY GENERATOR).**

- A. The outdoor electric generating set shall provide standby power as indicated and specified. Outdoor equipment shall be raintight NEMA 3R. The electric generating set shall be rated as indicated and specified and shall be designed to start automatically on normal power failure and continuously supply standby power to all the indicated loads for the duration of the power outage.
  - a. Ratings.
  - b. Capacity: The electric generating set shall have continuous standby kilowatt and kilovolt-ampere ratings at 0.80 power factor as indicated. The electric generating set shall be able to accept it's full rated load in one step with a maximum 20 percent voltage dip.
  - c. Electrical Characteristics: The electric generating set shall provide standby power at 277/480 volts, three phase and 60 hertz as shown on the drawings.
  - d. Ratings. The rating of the engine shall be based upon a satisfactory operation at an elevation to 2000 feet above sea level, an atmospheric temperature of 110 degrees Fahrenheit and a barometric pressure of 29.25 inches of mercury.
- B. Engines. The engine shall be standby duty, four cycle, water cooled with mounted radiator, fan and pump, and shall be equipped with all the required components to provide satisfactory operation. The engine shall be fueled with #2 diesel fuel and shall have a water separator type fuel filter, oil filter, oil cooler, oil pump, water pump and air filter. Engine shall have rigid supports and heavy structural base. The genset shall be mounted on a sub base fuel tank.
  - a. Engine Controls. The engine driven electric generating set shall contain a complete engine start-stop control which automatically starts the engine on closing contact and stops the engine on opening contact. Once started, the engine shall remain in operation for a minimum, adjustable period of from 5 to 90 minutes if the engine control selector switch is in the test position or for an adjustable period determined by the automatic transfer switch if the engine control selector switch is in the automatic position. The control shall include a cycle cranking function. The cranking cycle, nonadjustable, shall consist of an automatic crank period of approximately 15 seconds duration followed by a rest period of approximately 15 seconds duration. Cranking shall cease upon engine starting and running. Two means of cranking termination shall be provided, one as a backup to the other. Failure to start after three cranking attempts (75 seconds) shall

shut down and lockout the engine, and visually indicate an overcrank shutdown on the panel. The engine control shall also include a four position selector switch (TEST-OFF-MANUAL-AUTOMATIC) complete with wiring. Low coolant temperature alarm, low oil pressure alarm, high coolant temperature alarm, low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, overspeed shutdown and overcrank shutdown shall be provided with local signal lights, an audible alarm and type C dry contacts wired to terminals for remote alarm wiring. A switch shall be provided to silence the audible alarm until the alarm condition has been corrected. After the alarm condition has been corrected, the audible alarm shall sound until the switch is moved to the normal position.

- b. Engine Instruments. The engine generator control panel shall contain a lubricating oil pressure gauge, engine temperature gauge, and battery charge rate ammeter.
  - c. Engine Fuel System. The engine shall be provided with a fuel system integral with the engine. The fuel system on the engine shall have the required heaters, pipes, valves, fittings, filters, pump and provision for external fuel pipe connection.
  - d. Engine Lubrication System. The engine shall be provided with a complete pressure lubrication system. The lubricating system integral with the engine shall be complete with all required pipes, valves, heaters, fittings, pump, pressure gauge, filters and other necessary components to complete the system.
  - e. Governor. The engine-generator set shall be equipped with an engine speed, an electronic governor, consisting of a magnetic pickup speed sensor, adjustable electronic control, and an actuator mounted with the fuel pump, shall provide automatic isochronous generator set frequency control, which shall conform to ASME Specification No. 606 "Speed Governing of Internal Combustion Engine-Generator Units." Provide the overspeed shutdown wiring and signal light in the control panel.
  - f. Cooling System. An engine mounted radiator with pusher type fan shall be provided for the cooling system. The pump shall have ample capacity to circulate the required flow of engine jacket water through the radiator to remove the heat rejected from the engine to the jacket water and to maintain the water temperatures as recommended by the manufacturer.
  - g. Antifreeze. The engine cooling system shall contain a proper solution of ethylene glycol for freeze protection to plus 10EF.
  - h. Jacket Water Heater. A set mounted thermal circulation type water heater incorporating a thermostat and switch shall be provided to maintain engine jacket water to 90 degrees Fahrenheit in an ambient temperature of plus 30EF. The heater shall be single phase, 120 volts, 60 hertz.
  - i. Battery Charging Alternator. The engine shall be provided with a 45 ampere battery charging D.C. alternator with a transistorized voltage regulator.
- C. Generator. The generator shall be brushless, revolving field type, 277/480 volts, three phase, 60 hertz with a permanent magnet rotating type exciter and solid state voltage regulator with isochronous operation providing immunity to SCR tracking. The rotor shall be directly connected to the engine through a semiflexible driving flange to insure permanent alignment. The insulation shall be Class F as defined in NEMA MG1-1.65. The stator winding shall be arranged for "12 lead reconnectable" connection with both line and neutral leads of each 3-phase winding brought out into the terminal box on the generator frame. The generator shall be mounted on a common base with the engine, and shall be equipped with the required supports and hardware.
- D. Performance. The frequency regulation shall not exceed + 0.25% of its mean value for constant loads from no load to full load. Frequently regulation under varying loads shall be isochronous.

Voltage regulation shall not exceed + 2% of its mean value for varying loads and + 1% of its mean value for constant loads from no load to full load. The transient voltage dip shall be less than 20 percent of rated voltage when full nameplate rated load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 2 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant within plus or minus one percent of the rated voltage. A rheostat shall provide a minimum of plus or minus 5 percent voltage adjustment from the rated voltage. Temperature rise shall be within the NEMA MGI-22.40 standard.

- E. Generator Control Panel. The control panel shall be totally metal enclosed, assembled, wired, tested and shock mounted on the engine-driven electric generating plant by the manufacturer. The panel shall contain the main circuit breaker, frequency meter, running time meter, voltage adjusting rheostat, AC voltmeter (dual range, indicating all voltages), voltmeter phase selector switch, AC ammeter (dual range, indicating current each phase), ammeter phase selector switch, engine controls and instruments, pushbuttons, switches, relays, wiring, terminals, indicating lights and other required components.
- F. Circuit Breaker. The main standby power circuit breaker shall be enclosed, molded case, thermal-magnetic, manual, quick-make, quickbreak, 600 volt, three pole, having the current trip rating as shown on the Drawings and as specified in Section 16100.
- G. Meters. The meters shall be indicating type, flush panel mounted, approximately 2-1/2 inches square or round, self-contained, and back connected. The scales shall have white backgrounds with black numerals. Pointers shall be black, and shall have a zero adjustment device.
- H. Meter Switches. Phase selector switches shall be panel type, heavy duty, non-illuminated with four positions (off-A-B-C). The switch shall be equipped with a standard black knob. Ammeter switch shall have intermediate positions such that current transformer circuits are never open circuited.
- I. Indicating Lights. Indicating lights shall be the same voltage as the starting battery and shall be provided complete with color caps. The lamps shall be removable without entering the generating panel.
- J. Wiring. The panel wiring shall be complete to all equipment and terminal blocks. Alarm contacts shall be wired to terminals for connections to remote wiring. Wire shall be copper, single conductor, 600 volt, 90 degrees centigrade minimum. Provide the neutral and equipment grounding as indicated, specified and required. All wiring for the engine, generator and accessories shall be enclosed in conduit in conformance with Section 16100.
- K. Nameplates. Provide all the required nameplates as specified in Section 16100. The nameplates shall have inscriptions that identify the equipment and all its positions.
- L. Contacts. Provide the quantity of generator status contacts indicated on the Drawings and in other Sections of the specifications.
- M. Heater. A 120 volt, single phase, 60 hertz heater with thermostat shall be provided within the Control Panel to eliminate condensation.
- N. Generator Set Mountings. Provide the equipment concrete foundations per manufacturers requirements. The electric generating set shall be equipped with vibration isolators and shall be

capable of withstanding earthquake forces of seismic zone 4 per UBC. Manufactureres shall provide IBC certification to show that the genset shall operate during and after a zone 4 seismic event. Generator shall be mounted on a welded structural steel base, with cross-framing for additional stiffening. The entire welded steel base shall be mounted on concrete base with standard mounting methods currently used by generator manufacturers.

O. Battery.

- a. The electric generating set shall be provided with a heavy duty, high rate of discharge, lead acid starting battery.
- b. The battery shall have sufficient capacity for a minimum of five 15 second crank periods each separated by a 15 second rest period, without recharging. Battery shall be minimum 200 AMP hour size. Confirm that these requirements are suitable for the engine supplied.
- c. The minimum ambient temperature expected at the electric generating set location is 30EF. The maximum ambient temperature is 110EF.
- d. Provide battery rack mounted on the unit and located above floor. Provide fiberglass enclosure for battery and rack.
- e. The battery voltage shall be compatible with that of the starting system.
- f. Provide all required interconnection cables, conduits, etc. to result in a complete and operating system.
- g. Battery shall be guaranteed for a minimum of five years.
- a. Provide detailed calculations showing derivation of battery size and type.

P. Battery Charger.

- b. The battery charger shall be of the SCR full wave rectification design. The charger shall be dual rate output allowing for automatic initiation of high rate charging on battery demand. An A.C. outage shall not be the sole criteria for initiation of high rate charging, nor shall this charging be performed for a preset period of time. High rate charging shall be proportionate to battery demand only, and shall be controlled by solid state circuits monitoring battery demand.
- c. The charger shall be capable of full output from -10EC to +45EC, and shall be operated in this application at ambient conditions of 40EC and altitude of 385 ft. MSL.
- d. The charger input shall be single phase 120 volts 60 HZ AC. Output current/voltage shall be sufficient to recharge the battery in order to perform a repeat of the duty cycle in 12 hours. In addition, the charger shall supply continuously all required secondary loads.
- e. Output voltage regulation shall be + 1/2% when connected to the battery with input variations of + 10% voltage and + 5% frequency from zero to full rated output.
- f. Charger enclosure shall be NEMA 12 for indoor applications.
- g. Provide detailed calculation showing derivation of battery charger size.

Q. Standby Generator Exhaust System.

- a. General. The exhaust system shall be complete and shall include a 6-inch long solid flanged piping, muffler, piping to the outside of the enclosure, high temperature insulation with aluminum jacket, and supports. The exhaust system shall be provided with a means to prevent rain from entering the exhaust outlet. The exhaust silencer shall be mounted inside of the enclosure, and allow the generator set package to meet specified sound level requirements. Exhaust piping and muffler shall be mounted so that their weight is not supported by the engine, and shall allow pipe to adjust for expansion and contraction. The exhaust system shall comply with NFPA 37 and 211. Exhaust piping shall be black, seamless steel, standard weight, conforming to ASTM A120, with flanged ends, high temperature gaskets and/or welded joints as specified in related Section.



Elbows shall be sweep type with a radius at least three times the pipe diameter. A wye or tee type condensation trap with drain plug or cock shall be provided between the engine and exhaust muffler. The entire exhaust piping except the flexible connector shall be insulated per paragraph 2.01.I.4 of this pipe section mounted directly on the generator manifold flange, condensate trap with drain plug or cock.

- b. Flexible Section. The flexible exhaust section shall consist of flanged, convoluted, 321 stainless steel seamless coupling at least 12 inch long, without joints or packing. The section shall be capable of absorbing vibration from the engine and compensating for the expansion and contraction caused by thermal expansion of exhaust gases.
- c. Exhaust Muffler. The exhaust muffler shall be critical type. The muffler shall be suitable for service at temperature 1150EF with low resistance limited to 4 in. W.G. The muffler shall have 125# ASA flanges, all welded construction, 1/4" drain connection with cock. The muffler shall be protected by a single coat of shop primer and 4 inches thick thermal insulation per Para. 2.01.I.4.
- d. Thermal Insulation. The exhaust piping and muffler shall be insulated to maintain surface temperature below 140EF. The insulation shall be molded, high temperature pipe insulation composed of hydrous calcium silicate suitable for operating temperatures up to 1200EF. Insulation shall have continuous aluminum alloy 3003-H14 per ASTM B209 jacketing of minimum thickness .025 in. fabricated to exact dimensions. Insulation shall be Thermo-12 as manufactured by Manville, Kayto by Owen-Corning or approved equal.

R. Fuel System.

- a. The genset shall be mounted on a sub base fuel tank. The tank shall be reinforced to support the weight of the entire genset and enclosure. The tank shall be sized to provide 8 hours supply of fuel for the engine. The tank shall be provided with manual fill cap, float switches, low fuel level alarm light, type C dry contacts wired to terminals for remote low fuel alarm, fuel gauge, petcock drain valve, fuel strainer, all necessary pipe connections and flexible fuel connections to the engine.
- b. Accessories. Furnish all accessories including hardware that shall be needed for the complete installation and proper operation of the electric generating plant.
- c. Heater. A 120 volt, single phase, 60 hertz space heater with thermostat shall be provided within the electric generating set housing to eliminate condensation.
- d. Automatic Transfer Switch. Provide complete factory assembled transfer equipment with electronic controls designed for surge voltage isolation, and including voltage sensors on all phases of both sources, linear operator, permanently attached manual handles, positive mechanical and electrical interlocking, and mechanically held contacts.
  - a. Transfer Switch Ratings. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosures, and accessories.
  - b. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved. Transfer switches used for fire pump applications shall be specifically listed for that service, per NFPA20.
  - c. Main contacts shall be rated for 600 Volts AC minimum.
  - d. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure, in ambient temperatures of -40 to +50 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
  - e. Transfer switch equipment shall have a withstand and closing rating (WCR) in RMS symmetrical amperes greater than the available fault currents shown on the drawings. The transfer switch and it's upstream protection shall be coordinated. The transfer

switch shall be third-party listed and labeled for use with the specific protective device(s) installed in the application.

- f. Construction:
  - i. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in both positions.
  - ii. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms suitable for safe manual operation under load. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.
  - iii. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent interphase flashover. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
  - iv. Transfer switches designated on the drawings as 4-poles shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Equipment using add-on accessory overlapping contacts are not acceptable.
  - v. Transfer switches which are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs, sized to carry 100% of the current designated on the switch rating.
  - vi. Enclosures shall be UL listed. The enclosure shall provide NEC wire bend space. The cabinet door shall be key-locking. Controls on cabinet door shall be key-operated.
  - vii. Transfer switches shall be mounted in enclosures as designated on the drawings. Separate enclosures shall be the NEMA type specified. The cabinet shall provide required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.
- g. Automatic Controls:
  - i. Transfer switches that are designated on the drawing as automatic shall be provided with a fully automatic control system, and provisions for manual operation as described in this section.
  - ii. Control shall be solid-state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs
  - iii. Solid-state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and drop-out settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual supply voltage to nominal system voltage.
  - iv. Provide Phase Sequence Monitor and Balance module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.

- v. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.
  - vi. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
  - vii. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.
  - viii. Power for transfer operation shall be from the source to which the load is being transferred.
  - ix. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time, as follows:
    - 1. Source 1 OK
    - 2. Start Gen Set
    - 3. Source 2 OK
    - 4. Transfer Timing
    - 5. Transfer Complete
    - 6. Retransfer Timing
    - 7. Retransfer Complete
    - 8. Timing for Stop
  - x. Transfer switches shall be equipped with field adjustable controls to allow the operator to control the transfer switch operating time during switching in both directions. The controls shall control the time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The transfer switch operating speed control feature shall have an adjustable range of 0 to 7.5 seconds. Phase angle monitor is not acceptable substitute for this feature.
  - xi. Front Panel Devices:
    - 1. Provide devices mounted on cabinet front consisting of:
      - a. A key-operated selector switch to provide the following positions and functions:
        - i. Test - Simulates normal power loss to control for testing of generator set. Controls shall provide for a test with or without load transfer.
        - ii. Normal - Normal operating position.
        - iii. Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
        - iv. Transfer switch position and source available lamps.
- h. Non-automatic Controls:
- i. Transfer switches designated on the drawings as Non-Automatic shall be provided with a non-automatic control. The control shall operate the transfer switch position either by a remote contact opening or closing, or by a front panel mounted selector switch. The selector switch shall be a three-position switch. In the center Auto position the transfer switch shall transfer and retransfer in response to input signals as shown. The key shall be removable with the selector switch in the Auto position only. Turning the selector switch to the Emergency position shall transfer load to an energized emergency power

- source. Turning the selector switch to the Normal position shall transfer load to an energized normal power source.
- ii. Front Panel Devices:
    - 1. Provide devices mounted on the cabinet front consisting of:
    - 2. A key-operated switch with standby and normal positions to manually switch between the standby and normal source.
  - iii. Transfer switch position and source available lamps.
  - iv. Accessory Items
  - v. Transfer switches shall be equipped with accessories as follows:
  - vi. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period.
- S. Finish. Metal surfaces shall be finished as specified in Section 16010. All exposed connections shall be sprayed with CRC coating.
- T. Outdoor Weatherproof Enclosure. A weatherproof enclosure, designed to allow full load operation of the engine generator system and all of its accessories shall be sized for the exact unit being installed.
- a. General. The enclosure shall be of the welded and bolted design, with all fabricated steel parts conforming to ASTM 569, specification C-1018, and all structural steel conforming to ASTM A36. No external fasteners requiring gasketing, or allowing corrosion to form will be allowed. All parts are to be individually prepped and primed prior to assembly.
  - b. Roof. The roof shall be of the tapered design for moisture runoff, with 12 gauge steel roof members and 16 gauge steel roof panels. Lifting eyes shall be supplied. The exhaust outlet(s) shall be supplied with a 3/16" steel ring, 1" above the roofline to prevent moisture from entering the enclosure.
  - c. Walls. The walls shall be a minimum of 1/2" deep, of the fabricated design, and of 14 gauge steel.
  - d. Base. The base of the enclosure shall be designed for a drop-over installation, and shall include a means for fastening to the concrete slab. The drop-over style shall have a structural steel channel perimeter.
  - e. Louvers. The air openings shall include fixed louvers sized to allow proper airflow. The frames shall be manufactured of 14 gauge steel, the blades of 14 gauge steel, and the fronts shall be covered with 13 gauge expanded steel screen.
  - f. Doors. Adequate doors shall be installed for sufficient access to the generator set and all accessories. As standard, doors shall include stainless steel hinges with brass pins, rainrail moldings above all door openings, recessed, keyed, chrome plated handles with positive rod locking assemblies, and fully weatherstripped. Doors shall be removable.
  - g. Paint. All seams shall be caulked with body sealer. Enclosure shall be metal prepped, primed with two coats of Dupont self-etching primer, and finished with two coats of Dupont Centari with hardener.
  - h. Exhaust Silencer Mounting. The engine generator set supplier shall ship the silencer and flex to the enclosure manufacturer for mounting.
  - i. Insulation. The walls, roof, and doors shall be lined with 1/2" of fiberglass insulation, complete with 26 gauge galvanized liner installed with pop rivet construction. When additional sound attenuation is needed, perforated liner can be used. For a higher level yet, #6 density mineral wool shall be substituted for the fiberglass.

- j. Sound Attenuation. Air discharge hoods and intake louver sound baffles shall be installed on all air openings. The enclosure shall have sound attenuation to obtain a maximum 72dBA level at 7 meters.
- k. Equipment Installation. The enclosure manufacturer shall install and wire the generator set and all related transfer equipment, distribution equipment, and all ancillary systems for the proper operation of the total system, prior to shipment to the jobsite for final installation. Included, shall be a 100 amp circuit breaker panel, with breakers for lights, outlets, louver motors, engine water jacket heater, battery charger, and enclosure heater, if needed.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION.**

- A. Provide concrete foundation. Install the electric generating set in accordance with the approved submittals. All fuel, coolant and exhaust piping and electrical conduit shall have flexible connections so that vibration is not transmitted along these lines. Install all required wiring for the components, including interconnections, for the electric generating set.

#### **3.2 FACTORY TESTS.**

- A. Factory tests shall include testing of both prototype model and production model of proposed unit. Submit three (3) copies of the certified test reports in typed form to the OWNER. Do not ship the unit prior to approval by the Owner. Notify the OWNER or his representative who shall have the right to witness the production model tests.
- B. Prototype Model Test: Prime mover, generator, all necessary controls and alarms shall be tested as a complete system. In addition to the manufacturer's standard tests, a load test shall be performed at 100% full specified full load capacity, at 0.80 power factor lagging for a minimum duration of 2 hours. Three (3) copies of a certificate certifying that this prototype testing has been accomplished, and that the set passed all tests, shall be submitted along with submittal data for approval.
- C. Production Model Test: Prime mover, generator, all necessary controls and alarms shall be tested as a complete system. In addition to the manufacturer's standard tests, a load test shall be performed at 100% of specified full load capacity, at 0.80 power factor lagging for a minimum duration of 2 hours. Tests shall be performed to confirm that the engine-generator can accept it's full rated load in one step with a maximum 20 percent voltage dip. Tests shall also be performed to show that all controls, alarms and indication circuits perform as required. Test reports shall be signed and verified by a test service, acceptable to the OWNER, and three (3) copies shall be submitted to the OWNER for approval prior to shipment to the Site.

#### **3.3 FIELD TESTING.**

- A. Check all the equipment and ensure that all installations are correct and complete. The completed installations shall be field checked and tested. The field test shall include all tests performed in the production model test plus an operational test that simulates at a normal power failure and demonstrates that the standby generator set can start and run all standby loads. This test shall run for an 8 hour duration with a portable load cell equal to full load. Top off fuel after test completion. Test results shall show the maximum voltage dip that occurs during the standby starting sequence. Three (3) copies of the certified field test report in typed

form shall be submitted to the OWNER. Arrange for the OWNER and equipment manufacturer to supervise the checking, adjusting, testing, and operating procedures.

### **3.4 START-UP**

- A. Arrange for the manufacturer to provide the services of a field engineer at the job site at the time of start-up to check the complete installation. The field engineer shall be a full-time employee of the manufacturer, factory trained and whose primary duty is to provide field service for standby power systems.

### **3.5 INSTRUCTION OF OWNER'S PERSONNEL**

- A. Conduct an instruction program at the job site for up to five persons designated by OWNER. Furnish the services of a qualified instructor from the manufacturer of the standby generator. Include instruction covering basic operation theory, routine maintenance and repair, and "hands on" operation of equipment. Base duration of the program on the complexity of equipment involved, and obtain OWNER'S approval of instruction adequacy before terminating the program. Schedule instruction in consultation with OWNER.

## **SECTION 16400: SERVICE AND DISTRIBUTION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Requirements specified in Section 16010 and Section 16100 form a part of this Section. This Section outlines the electrical work for underground or overhead power service, power distribution and grounding.
- B. Power Service. The underground or overhead service shall be complete and as shown on the Drawings. The service installation shall conform with the power company service requirements.
- C. Distribution. The power distribution system shall include equipment installations and underground or overhead wiring installations as shown on the Drawings.
- D. Grounding. System, structural and equipment grounding installations shall be complete, as indicated, specified and required.
- E. Equipment Grounding includes that all non-current carrying metal parts of electrical equipment and wiring systems shall be effectively grounded.
- F. Structural Grounding includes ground conductor connections to structural steel as shown on the Drawing.
- G. System Grounding includes a solid or resistance ground connection to the neutral point of a system, transformer and rotating machine as indicated, specified and required.

#### **1.2 SUBMITTALS**

- A. Submit for the Owner's approval material lists, shop drawings, factory test reports, and technical data to the extent required in Section 16010.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Provide all the equipment and materials, and complete all of the power service, power distribution and grounding installations as indicated, specified and required. Sizes of equipment shown on the Drawings and space allowed for the equipment are based on equipment manufactured by only one of the listed acceptable manufacturers. The manufacturers and models listed in this Section of the Specifications are acceptable providing they conform to the Specifications and that the equipment and materials provided fit properly in the available space. Refer to Section 16100 for conduits, conductors, circuit breakers and nameplates.

#### **2.2 HANDHOLES AND PULL BOXES**

- A. Precast concrete handholes and pull boxes shall be provided as shown on the Drawings, and shall be manufactured by Appleton Electric Co., Crouse-Hinds, Killark, Raco, Hoffman Engineering Co., Hammond Manufacturing, Weigman, B-Line Circle AW, Adalet or approved equal. Handholes and pull boxes shall be complete.

- B. Covers shall be steel or concrete as indicated.
- C. Knockouts in the walls shall permit underground conduit connections. Bottom shall be provided with a sump opening.
- D. Accessories shall include angle iron, inserts, bolts, pull eyes and all other required hardware.

### **2.3 SERVICE EQUIPMENT**

- A. Provide the metal enclosed, service equipment as shown on the Drawings, specified and in accordance with the power company service requirements. The low voltage equipment shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal. Service equipment shall be part of the motor control center assembly as shown on the Drawings.
- B. Metering Section shall be full height, free standing and equipped with meter sockets, copper busses, main circuit breaker and ground fault protection as indicated. The meter sockets shall be provided for the power company self contained meter or meters that shall be connected to instrument transformers as required.
- C. Pull Section shall be totally metal enclosed, full height, free standing and equipped with copper busses and connectors for the underground service conductors.
- D. Main Fused Disconnect shall be included in the service equipment as shown on the Drawings, and specified in Section 16100. Provide a shunt trip as indicated.
- E. Nameplates shall be provided for the service equipment. Refer to Section 16100 for nameplates.
- F. Double Hasp shall be attached on a gasketed hinged door of outdoor equipment for two padlocks.
- G. Finish indoor and outdoor equipment as specified in Section 16010.

### **2.4 GROUNDING**

- A. Provide all equipment and materials required to complete all the grounding installations as indicated and specified.
- B. Ground Rods shall be sectional copper-clad or hot-dipped galvanized high strength steel conforming to UL 467, 3/4 inch diameter, 10 feet long and with pointed ends and chamfered tops. The sectional ground rods shall be equipped with bronze or hot dipped galvanized couplings and driving bolts, and shall be driven to the depths needed to obtain the desired resistance. The ground rods shall be Copperweld, Hubbard, Chance or approved equal.
- C. Ground Rod Clamps shall be cast copper alloy, and shall tightly grip the rod and cable. The high strength silicon bronze U-bolts, nuts and lock washers shall make positive corrosion resistant ground connections. The clamps shall be manufactured by O-Z Gedney Co., Thomas & Betts, Burndy, Cadweld or approved equal.
- D. Ground Connectors shall be cast copper alloy interlocking clamps equipped with silicon bronze bolts, nuts and lock washers or interlocking lugs with allen head set screws and one-hole tongues. Ground connectors shall be corrosion resistant and provided for cable to flat surface



connections on equipment and structural steel. The connectors shall be manufactured by O-Z Gedney Co., Thomas & Betts, Burndy, Cadweld or approved equal.

- E. Direct Buried Ground Connections shall be the compression method or the exothermic method as indicated and supplied by Thomas & Betts, Cadweld, Burndy or equal. Underground grid connectors shall be crimped to the cables for splices by compression with hydraulic die sets, which form uniform and smooth connections. Exothermic welding method produces a super heated flow of molten copper by burning powder in the crucible-mold. The connections shall be manufactured by O-Z Gedney Co., Thomas & Betts, Burndy, Cadweld or approved equal.
- F. Ground Conductors shall be provided as shown on the Drawings and specified in Section 16100.
- G. Lightning & Surge Arrestors shall be distribution type and consist of avalanche diodes, arrays of fused non-linear voltage dependant metal oxide varistors (MOV's), insulated, coated valve blocks of chemically and electrically stable refractory material and shall be mounted in a separate container and equipped with terminals, resistance gaps, compression rings, diaphragms, sealed isolators and mounting brackets. The valve block material shall be capable of carrying a high surge current with a resulting low discharge voltage. Lightning arresters shall be manufactured by Libert, Advance Protection Technologies, or approved equal. Arrestors shall be mounted in a separate enclosure outside MCC and the arrestor enclosure shall be NEMA 3R rated.
- H. Lightning Protection equipment and materials shall be manufactured by Thompson Lightning Protection, Inc., Independent Protection Company, or approved equal.
  - a. Lightning Air Terminals shall be solid copper bronze, nickel plated and 16 inches in height unless otherwise indicated. The bottom end of the terminal shall have 5/8 inch inside threads.
  - b. Air Terminal Brackets shall be solid copper bronze, unless otherwise indicated, and equipped with flat bases having anchor holes, cable clamps and short stud bolts with 5/8 inch threads. Air terminal shall be attached to the 5/8 inch stud bolt on the bracket. The bracket shall be securely attached to structural steel with bolts, nuts and washers, and concrete with anchors.
  - c. Lightning Conductors shall be copper, stranded rope lay, 28 strands, No. 4/0 AWG and 5/8 inch diameter unless otherwise indicated. Down conductors shall be protected as shown on the drawings.
  - d. Lightning Conductor Connectors shall be provided for conductor splice connections and conductor terminal connections. The connectors shall be heavy duty, cast metal and shall have hex-head screws in the bodies and holes in the tongues for bolts.
  - e. Lightning Conductor Clamps shall be provided to securely attach the conductors to the structure. The clamps shall be heavy duty, cast metal interlocking and sized for the lightning conductors.
- I. Ground Fault Protection shall be provided as indicated, specified and required. The system shall provide low-level ground fault protection, and shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal. The ground fault protection system shall be complete and consist of an adjustable relay, monitor panel, current sensor and a disconnect device that actuates a shunt trip on the circuit breaker. The ground fault relay shall be solid state with an adjustable pickup setting. The sensor shall be a specially constructed current transformer, which encompasses the phase and neutral conductors. A monitor panel shall include visual indication when the circuit interrupter has opened on a ground fault, and a push-to-test button. The circuit disconnecting device shall be actuated when

the current output of the sensor exceeds the pickup setting of the static relay, which trips the shunt mechanism on the circuit breaker.

## **2.5 TRANSFORMERS**

- A. Provide the power, pad-mounted, dry-type and distribution transformers as indicated, specified and required. After fabrication, the surfaces shall be finished as specified in Section 16010. The equipment shall be secured with hardware to brackets, supports, and inside equipment.
- B. Dry Type Transformers shall be provided for meters, control power, lighting, convenience and power outlets as shown on the drawings, specified and required. The transformers shall be self-cooled, two winding, three phase and single phase, 60 hertz, KVA and voltage ratings as indicated, and designed for indoor and outdoor installations at altitudes of 3,300 feet or less. Totally enclosed, non-ventilated transformers shall be provided for outdoor installations. Core laminations shall be grain oriented silicon steel, annealed, free of burrs and tightly clamped to provide quiet operation. Maximum flux densities shall be substantially below the saturation level. Transformers rated 2 KVA and smaller shall have NEMA Class B insulating materials which withstand a maximum winding temperature of 150 degrees Centigrade. Transformers rated 3 KVA through 25 KVA shall have NEMA Class F insulating materials which withstand a maximum winding temperature of 185 degrees Centigrade. Transformers rated 30 KVA and larger shall have NEMA Class H insulating materials which withstand a maximum winding temperature of 220 degrees centigrade. The transformer coils shall be wound with high temperature epoxy film insulated wire. Coils shall be vacuum impregnated with silicone varnish and cured at a minimum temperature of 350 degrees Fahrenheit to reduce hotspots and seal out moisture. Hybrid silicone varnish shall not be accepted. The coils shall be protected with an outer layer of glass tape or similar quality insulation. The core and coil assembly shall be isolated from the enclosure with neoprene pads. Single phase transformers 15 through 25 KVA shall be equipped with two 5 percent full capacity taps below normal rated primary voltage. Sound levels shall be guaranteed by the manufacturer and substantiated by certified tests for each transformer. The sound levels shall not exceed the following: 0-9 KVA, 38 decibels; 10-45 KVA, 42 decibels. Pressure connectors shall be included for the copper conductors shown on the drawings, which shall be accessible in a front wiring compartment. Enclosures shall be fabricated from at least #14 formed steel with uniform surfaces, except the base shall be #11 gauge minimum. Metal surfaces shall be finished as specified in Section 16010. A diagrammatic metal plate shall show the complete diagram, internal connections, identified terminals and voltages. The dry-type transformers shall be manufactured by Square D, Allen Bradley, Cutler Hammer, Siemens, General Electric, or approved equal.

## **2.6 PANELBOARDS**

- A. Provide the panelboards as shown on the Drawings and specified in Section 16100.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Provide all the equipment installations and wiring installations including connections and interconnections for the power service and distribution as indicated, specified and required. Assure proper fits for all equipment and materials in the spaces shown on the Drawings.

- B. Earthwork, Concrete and Painting. The required work for excavations, backfills, concrete and painting shall be provided for the electrical installations.
  - a. Earthwork shall be performed for handholes, pull boxes, underground conduits, poles, guys, grounding, equipment foundations and supports as indicated and specified.
  - b. Concrete shall be provided for electrical equipment foundations and supports, and conduit encasements as indicated and specified in Division 3.
  - c. Painting shall be provided for all installations having unfinished surfaces as specified in. Field damaged factory finishes on equipment shall be touched-up with paint that is equal in quality and color to the original factory finish.
  
- C. Handholes and Pull Boxes. Precast concrete handholes and pull boxes shall be installed in excavations as shown on the Drawings and as required.
  - a. Accessories shall be installed, which include pull eyes and required hardware.
  - b. Covers shall be installed on all handholes and pull boxes.
  - c. The purpose of all circuits shall be legibly identified at the panel, receptacles, junction boxes and equipment in a permanent manner (i.e. Etched Plates, Conductor Tag, Permanent Marker, Etc.). The labeling shall include panel circuit number, "To" and "From" identification and marked "Spare" where applicable.
  
- D. Service Equipment. Install the metal enclosed service equipment and wiring as indicated, specified and required.
  - a. Equipment shall be installed level and securely attached to the concrete foundation with anchor bolts. The sections shall be joined together with bolts, washers and nuts to form a unit assembly.
  - b. Wiring installations shall be complete and in accordance with the power company service requirements.
  - c. Nameplates shall be laminated plastic and attached to clean surfaces of the metal enclosures with an adhesive or equal.
  
- E. Grounding. Install all the equipment, materials and wiring to complete the equipment, structural, lightning and system grounding installations as shown on the Drawings, specified and required.
  - a. Ground Rods, sectional, shall be long enough and driven to reach the permanent moisture level of the soil. The resistance of the driven electrode shall not exceed 15 ohms, and additional sections shall be installed to obtain the required lower resistance. The hand or power driving methods shall produce a force in line with the main axis of the ground rod, and the blow shall drive the rod straight to the required depth in the earth.
  - b. Clamps and Connectors shall be connected tight to ground conductors and securely attached to equipment, structural steel, conduits and ground rods with set screws, bolts and nuts.
  - c. Grounding Bushings shall be installed tight on the ends of metal conduit, and ground jumpers shall be securely attached to the bushings and equipment enclosure or ground bus.
  - d. Exothermic Welding Connections shall be provided as indicated. Install the uninsulated portions of copper conductors into a mold and fire the powder in the crucible, which produces a super heated flow of molten copper in the mold. Insulate the welded connection with vinyl plastic electrical tape to a thickness equal to the conductor insulation.
  - e. Compression Method ground grid connectors shall be provided unless otherwise indicated. Attach the connector to cleaned copper conductors. Place the connector with

- conductor into a matched hydraulic head die. Compress the connector around the conductor with the hydraulic die, which forms a uniform, tight and smooth connection. Position a plastic tubing over the connector and cautiously apply a torch. The heat shall shrink the tubing into a tight fitting insulation on the connection.
- f. Ground Conductors shall be installed in conduits, in trenches, in manholes and on poles as shown on the drawings. When installing the copper conductor in a trench, allow 5 percent additional length for slack, to the conductor length before backfilling the trench.
  - g. Lightning Arrestors shall be equipped with support hardware and installed on poles and on concrete foundations.
  - h. Lightning Air Terminals shall be attached to the threaded stud bolts on the air terminal brackets.
  - i. Air Terminal Brackets shall be securely attached to structural steel with bolts, nuts and washers, and attached to concrete with anchor bolts.
  - j. Lightning Conductors shall be installed as indicated and required, and connected to the air terminal brackets and ground rods.
  - k. Connectors and Clamps shall be installed for conductor connections and supports as required.
  - l. Ground Fault equipment and wiring installations shall be completed as indicated, specified and required.
- F. Primary Interrupters. Install the metal enclosed interrupters as shown on the Drawings.
- a. Equipment shall be installed level and securely attached to supports with the required hardware.
  - b. Wiring installations shall be complete including all connections. The cableheads shall be filled with insulating compound after the cables have been connected to the terminals.
  - c. Nameplates shall be laminated plastic, and attached to clean surfaces of the metal enclosures with an adhesive or equal.
- G. Transformers. Install the power, pad-mounted, dry-type and overhead distribution transformers as indicated, specified and required.
- a. Equipment shall be installed level and securely attached to concrete foundations, floors, walls and poles with the required hardware.
  - b. Wiring installations shall be complete as shown on the Drawings.
- H. Panelboards and Switchboards. Install the metal enclosed panelboards and distribution switchboards as indicated, specified and required.
- a. Equipment shall be installed level and securely attached to the concrete foundations, floors and walls with anchor bolts.
  - b. Wiring installations shall be complete, including all connections.
  - c. Nameplates shall be laminated plastic, and attached to clean surfaces of the metal enclosures with an adhesive.
- I. Checking, Adjusting and Testing. Provide all checking, adjusting and testing operations on equipment and complete installations as specified in Section 16100.

## **SECTION 16482: ADJUSTABLE FREQUENCY DRIVE EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. The CONTRACTOR shall furnish all labor, materials, equipment, appurtenances, and incidentals required to install, test, and operate the adjustable frequency drive (AFD) systems specified herein, complete with all auxiliary items and accessories necessary to meet the highest standards for the type of service. Also included shall be provisions for instruction of the regular operating personnel in the operation and maintenance of all systems and equipment. This Section outlines the work for adjustable speed equipment, and forms a part of all applicable sections.
1. Work Included in This Section.
    - a. Adjustable Frequency Drives (AFDs) for horsepower(as shown on the drawings) Motor Drive Pumps. The AFDs will vary the speed of the pumps.
    - b. Harmonic Filter
    - c. Motor Protection Devices
    - d. Speed Controls & Indicators as shown on the drawings
  2. Supplier. The AFD supplier shall provide and have complete system responsibility for the adjustable frequency drives and harmonic filters. The AFD supplier must confirm that his equipment is completely compatible with the pump motors and with the electrical power system at each location.
  3. Verification. Verify that the motor and adjustable speed equipment output speed, horsepower, and torque range agree with the driven pump requirements as determined and required by the pump supplier. Provide letter confirming these facts.
  4. Related Work Included in other Sections:
    - a. Division 16 Electrical
  5. Guarantee. Guarantee all work and equipment in accordance with Section 16010, and General Conditions.
  6. Motors. Motors shall be provided as specified in the section specifying the driven equipment and in Section 11400.
  7. Wiring. Wiring for adjustable speed equipment shall be provided as shown on the Drawings and specified in Section 16100.
  8. Codes and Standards. Provide the equipment and materials, including installation, conforming to the codes and standards that are listed in Section 16010 as well IEEE 519.
  9. Start-up Services.
    - a. Contractor shall perform commissioning services for AFD equipment.

#### **1.2 SUBMITTALS**

- A. Submit complete material lists, shop drawings, and technical data for Owner's approval to the extent required in the Section and Section 16010.
1. Material Lists. The material lists shall be complete and include all projects in the Section, including the equipment that shall have shop drawings. The list shall include only one manufacturer for each type of product.

2. Shop drawings. The shop drawings shall be complete for the adjustable speed equipment as well as all other equipment furnished per this specification and shall include as a minimum the following items:
  - a. Plans shall show the floor space requirements, clearances, conduit, and anchor bolt locations.
  - b. Elevations shall show the arrangement of all components. Positions on the front panel shall be identified with nameplates. Refer to Section 16100 for nameplates.
  - c. Details shall show the required enlarged view of small parts.
  - d. Diagrams shall show the equipment, equipment locations, wiring circuit schematics, voltage, wire numbers, and identified terminals. Include logic ladder diagrams for the programmable controllers and at least one copy of the programming manual.
  - e. Dimensions for the equipment shall be shown on the Drawings.
  - f. Weights for the equipment shall be shown on the Drawings.
  - g. Nameplates Data shall include the nameplate material, height of letters, number of lines, inscriptions, and dimensions.
  - h. Settings of all protective devices and relays plus settings of all adjustable equipment parameters shall be provided as a typed list.
3. Technical Data. Complete equipment description including detailed draft theory of operation and operation data shall be submitted to the Owner with shop drawings. The final version shall be included in the Operation and Maintenance Manuals.
4. Parts List. A complete list of parts with prices that would be necessary to maintain and service the equipment shall be submitted to the Owner with the shop drawings. Manufacturer shall identify and furnish those spare parts required for one year of operation as part of this contract. (See Section 2.02, E.10.)
5. Factory Test Reports. Submit certified test reports.
6. Installation and Operation Reports. Copies of the Manufacturer's Certified Reports for the equipment installations and operations shall be submitted to the Owner.
7. Installation, Operations, and Maintenance Manuals. Submit four (4) copies of complete installation, operation, and maintenance manuals.
  - a. Required operation and maintenance data includes, but is not limited to the following:
    - 1) Complete, detailed written operating instructions for each project or piece of equipment including: equipment function; operating characteristic; regulation and control; and shutdown. Manuals must be specific. General Manuals will not be accepted.
    - 2) Complete, detailed written preventative maintenance instruction.
    - 3) A complete inventory of all parts and components.
    - 4) Recommended spare parts lists and local sources of supply for parts. (See Section E Paragraph 10)
    - 5) Written explanations of all safety considerations relating to operation and maintenance procedures.
    - 6) Name, address and phone number of manufacturer, manufacturer's local service representative, or installer.
    - 7) A written explanation with illustrations for each preventative maintenance task.
    - 8) Trouble shooting instructions.

B. Line Disturbance Limitations. Power line disturbances at all of the pump stations shall be

limited as follows per IEEE Standard No. 519 (revised edition per 1989 draft.)

### **1.3 OPERATING INSTRUCTIONS.**

- A. A trained representative who has complete knowledge of proper operation and maintenance of the equipment furnished under this and related sections, shall instruct representatives of the Owner on the proper operating and maintenance of the equipment. This instruction may be done at the same time as the start-up required under Section 1.01-1-1, provided the start-up is successful and the operating and maintenance instructions have been furnished to and approved by the OWNER.
- B. Notify owner of schedule for the O & M training.

### **1.4 QUALIFICATIONS.**

- A. The manufacturers of AFD equipment and of harmonic filters shall provide equipment which is reliable, and designed and manufactured to assure compatibility of all components in both function and appearance.
- B. AFDs and all specified equipment shall be built in strict accordance with the overall sizing and component layouts as detailed on the drawings, and no deviations will be allowed without prior approval of the OWNER.
- C. The AFD equipment and filters shall be installed as shown on the Drawings in the existing limited spaces available. Contractor and manufacturer shall verify that all equipment will fit into the space allocated for each as shown on the Drawings.
- D. All of the AFD furnished under this Section shall be the product of a single manufacturer. All harmonic filters shall be the products of a single manufacturer.
- E. All AFD equipment plus filters shall be fully tested as a system with actual job motors at the point of installation.

## **PART 2 – PRODUCTS**

### **2.1 ADJUSTABLE FREQUENCY DRIVE EQUIPMENT**

- A. REQUIREMENTS
  - 1. Furnish and install AFD designed for waste water transport pumping. Each pump shall be equipped with a Pump drive SRC 311 unit sized to match, to submersible electric motor connected for operation on 230-480 volts, 3-phase, 50/60 hertz, horsepower (as shown on the drawings) with submersible screened cable for variable speed [length shall be sufficient to connect to surface junction box (without the need of splices) as indicated on the Drawings or 30 feet, whichever is greater]. The power cable shall be sized according to IEC and also include at least two leads to convey pump monitoring device signals.
  - 2. The drive, motor and pump shall be matched for optimal performance.

B. PUMP DRIVE PRODUCT DESCRIPTION

1. The Pump drive shall be equipped with dedicated application functionality and integrated frequency drive functionality for the application waste water pumping.
2. The pump drive shall be an integrated component in the system solution for sewage pumping consisting of pressure sensor “inverse level control” and high level switch, which control the waste water pumping system in a reliable and energy efficient way. One Pump drive per pump should be used to allow full redundancy and alternation.
3. The application software shall be programmed with all parameters and settings pre configured for an efficient operation with Flygt N-pumps.

C. PUMP DRIVE SYSTEM

1. A pump drive shall be provided for each pump in the system, sized for the appropriate voltage and power. The pump drive shall be provided by the pump manufacturer and designed for wastewater pumping and with functionality pre-programmed for the specific pump model used. The pump drive shall provide all level control functionality, hand/auto operation, pump alternation, pump over temperature monitoring, seal leakage monitoring, pump self-cleaning, sump cleaning and pipe cleaning algorithms. The pump drive shall also include capability to monitor station inflow, pump speed and energy consumption in order to automatically operate the pump station at optimal energy efficiency.

D. PUMP DRIVE CONSTRUCTION

1. The pump drive shall be freestanding for wall mounting or cabinet installation construction, for 230-480V 50/60HZ 3Phase supply. It holds an IP55 and IP66 isolation class.

E. PUMP DRIVE COOLING SYSTEM

1. The pump drive shall have an air ventilated system, with or without fan driven ventilation having a maximum ambient temperature of up to 40°C (104°F) without derating.
2. Max altitude without derating is 1000m

F. COMMUNICATION

1. The pump drive shall include provision for external communication to higher-level system. Communication shall be via 2-wire RS-485 connection to the pump drive. Communication shall be available as MODBUS RTU.
2. Serial communication capabilities shall include, but not be limited to set Start- and stop level, Pump clean interval, speed and ramp times as well as PID control parameters.
3. The communication telegram shall include process variable feedback like Sump



level, power (kW), Output speed/frequency, current (A), % torque, relay outputs, digital inputs and drive status and fault information.

G. POWER AND MONITORING CABLE

1. The power cable shall be sized to the IEC standards and shall be of sufficient length to reach the junction box without the need of any splices. The motor cable shall be a screened cable and sized and installed according to IEC requirement.

H. USER INTERFACE/MENUS

1. The pump drive shall incorporate an (OLED) LCD screen to display drive operating status, alarms, liquid level and parameters.

The pump drive shall include 7 pushbuttons with the following functions: Pump Start, Pump Stop, Hand (Manual) Operation, Auto Operation, Menu Access, Increase Value, and Decrease Value.

Pump Start Level, Operating Parameter Adjustment and Alarm History shall be accessed via menu structure. Menu shall have 4 levels of security, limiting access to qualified personnel only.

The LCD screen shall display status information in 4 modes: Off, Active Auto and Active Manual. The information shown shall be as follows:

OFF: Firmware Version, Status ("OFF")

STANDBY: Status and Name, Pump Running Hours, Operating Mode, Sump Level

ACTIVE AUTO: Status and Name, Pump Running Hours, Operating Mode, Motor

Freq. Power, Sump Level

ACTIVE MANUAL: Status and Name, Pump Running Hours, Operating Mode, Motor Freq., Power, Sump Level

I. PUMP DRIVE OPERATIONAL FUNCTIONALITY

1. High/Low Level Sump Control:

The pump drive shall provide automatic level control via means of a submersible pressure transducer (4-20mADC). User-programmable Start Level shall indicate the point at which the pump will start. Upon activation the pump shall run at maximum speed for a pre-determined period, then ramp down to the energy efficient Optimal speed, calculated by the pump drive. When the water level reaches the Stop Level, the pump shall stop. The Optimal Speed shall either be calculated by the pump drive or manually entered by the user.

In case of high inflow, the pump drive shall increase pump speed until the water level begins to decrease. When the water level reaches the Stop Level, the pump shall stop.

In case of very high inflow, in a duplex installation, when a single pump is unable to overcome the inflow conditions even at maximum speed, additional pumps shall be activated and run at maximum speed until the Stop Level is reached. If water levels continue to rise, a High Level Alarm shall be activated.

The pump drive shall incorporate a Minimum Speed function that prevents the pump from operating at speeds too low to move water based on the pump curve.

2. **Run Time Averaging (Duplex Application Only):**  
In cases of duplex pumps/drives, the pump drive shall provide capability to balance run times for even wear. This shall be an internal function of the drive and not require external devices, such as an Alternating Relay. The function shall operate by determining a “random” start level based on the Start Level setting. Each drive shall determine its own random start level independent of each other. New random start levels will be determined every 24 hours. The pump with the lowest random start level shall be first to start on any given pump cycle. The second pump shall remain in Standby capacity in case the lead pump shall not be able to lower the water level as described in the section above. By recalculating the random start levels every 24 hours, balanced run times are accomplished.
3. **Pump Cleaning Function:**  
The Pump drive shall incorporate a “self-cleaning” function to remove debris from the impeller. The cleaning shall be triggered by three circumstances:
  - a. **Soft Clogging:** When motor current equals 20% or greater above rated motor current, in the drive, for a period of 7 seconds
  - b. **Hard Clogging:** When motor current equals 80% or greater above rated current for a period of 0.01 seconds
  - c. **Schedule Cleaning:** The pump drive is pre-programmed to perform cleaning regularly.
  - d. The cleaning function shall consist of forced stopping, reversal and forward runs timed to allow for debris to fall from the impeller. After cleaning cycle is complete, drive shall resume to automatic operation
4. **Sump Cleaning Function:**  
The pump drive shall incorporate a sump cleaning function to ensure surface solids and grease is regularly removed from the sump. The sump cleaning function shall perform regularly when enabled by the operator. Sump cleaning shall consist of the following functions
  - a. Sump cleaning is triggered when internal timer expires and during a normal pump down cycle
  - b. Pump is automatically ramped to maximum speed
  - c. Pump runs at maximum speed for designated time or until the pump are snoring."
  - d. When Sump Cleaning is over, the pump is shut off and resumes normal operation.
5. **Pipe Cleaning Function:**  
The pump drive shall incorporate a pipe cleaning function to avoid discharge pipe sedimentation and clogging due to reduced pump speed. This shall be an automatic feature that initiates with every pump cycle. Upon reaching Pump Start Level, the drive shall operate the pump at 100% speed for a determined time before ramping down to the most energy efficient speed for the duration of the cycle.
6. **Energy efficient speed finder:**  
The pump drive shall provide a function that automatically calculates the most energy efficient speed for the pump based on station inflow characteristics. An

algorithm calculates the optimal speed whereby the most water is pumped using the least amount of energy, the optimal speed is constantly adjusted to account for changes inflow without requiring operator adjustment, multiple setpoints, etc. The energy efficient function prevents the drive from running off of the system curve for the pump. This will ensure maximum hydraulic efficiency as well as electrical efficiency is maintained.

7. Alarms & Monitoring

The pump drive shall provide alarms and monitoring for the drive, pump and sump. Alarms shall be presented on the LCD display, via a Summary Alarm relay and via Modbus registers. All alarms, when occurring, shall remain active until reset. Alarms shall have a built-in 4 second delay to prevent nuisance tripping. Alarms shall be as follows:

- a. Pump Monitoring:
  - 1) Pump Over Temperature (thermal contacts in motor stator)
  - 2) Pump Seal Leak (Flygt FLS leakage sensor)
- b. Sump Monitoring:
  - 1) High Sump Level (via level float switch or submersible transducer)
  - 2) Submersible transducer Sensor Error (Submersible transducer is not connected, reports faulty values or the wrong start level is used)
- c. Pump drive Monitoring (includes, but not limited to):
  - 1) Drive Overcurrent
  - 2) Drive Overload Trip
  - 3) Drive Overvoltage
  - 4) Drive Undervoltage
  - 5) Drive Overtemperature (internal)
  - 6) Drive Overtemperature (ambient)
  - 7) Drive Undertemperature (ambient)
  - 8) Input Phase Loss
  - 9) Drive Output Max Torque Exceeded

**2.2 HARMONIC FILTER**

A. Shunt filter assemblies shall be provided for all motors 20 horse power and above. They shall include the characteristics and properties described herein to remove the fifth and seventh order harmonics from the 480 volt, 3 phase, 60 Hz power systems at the Pump Station. This filter may be included and enclosed within the AFD enclosure.

1. Characteristics.

a. General Requirements.

- 1) 60 Hz system
- 2) 480 Volts nominal
- 3) 30 KV BIL
- 4) 55 degree Celsius ambient temperature (maximum)
- 5) Filters shall remove fifth and seventh order harmonics

- B. Capacitors shall be of welded construction, hermetically sealed, non PCB type, and designed for automatic switching.
- C. Reactors shall be air cooled and suitable for the application.
- D. Configuration. Each filter shall be connected as follows:
  - 1. A separate filter section shall be provided for each order of harmonics removed (one section for a fifth order and one section for a seventh order harmonics filter, etc.).
  - 2. Capacitors shall be connected in a delta configuration bank with fuse protecting each phase.
  - 3. Reactors shall be connected in the lines running to the capacitor banks.

Harmonic Filters shall be supplied by TCI, Mirus, Powersmiths, or approved equal.

**PART 3 – (NOT USED)**

++END OF SECTION++

## **SECTION 16500: LIGHTING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Requirements specified in Conditions of the Contract, Division 1, Section 16010 and Section 16100 form a part of this Section. This Section outlines the electrical work for lighting equipment installations and wiring.
  - a. Related Work Not Included in this Section.
    - i. Electrical Controls, Section 16900.

#### **1.2 SUBMITTALS**

- A. Submit for the Owner's approval material lists, shop drawings, factory test reports and technical data to the extent required in this Section and Section 16010.
  - a. Shop Drawings. In addition to the information required to be included in the shop drawings as specified in Section 16010, shop drawings shall include the following:
    - i. Manufacturer's catalog data sheets and/or drawings for all lighting equipment. Catalog data and/or drawings shall clearly identify the equipment assembly, and locations for conduits.
    - ii. Elevations showing the complete lighting fixture and the method of attaching the diffuser to the housing.
    - iii. Types of lamps and ballasts for each lighting fixture. Ballast data shall include required starting and operating current.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Provide all the lighting fixtures, wall brackets, lamps, and other fixtures and materials, including proper space, and complete the interior and exterior lighting installations as shown on the drawings, specified and required. All outdoor equipment shall be weatherproof and gasketed. The equipment shall have the manufacturer's corrosion resistant finish as indicated. The lighting equipment shall be completely fabricated, assembled, checked and tested at the factory. Lighting equipment types shall be shown on the Drawings.
  - a. Interior Lighting Fixtures. Fluorescent equipment shall be surface and mounted type mounted in motor Control Center and RTU Cabinets. The lighting fixtures shall be complete and include all the required components, lamps, wiring and supports.
    - i. Fluorescent Fixtures shall be fabricated from heavy gauge formed sheet steel. Metal parts shall be joined together to form rigid housings with wireway covers and frames.
  - b. Fluorescent Ballasts. Ballasts for fluorescent fixtures shall be Class P. The ballasts shall be equipped with thermally actuated automatic reclosing protective devices. The overheat protective device shall be sensitive to current and winding temperatures, and shall prevent ballast case temperatures from exceeding 110 degrees centigrade. The ballasts shall be rapid start, 430 MA, high power factor, 60 hertz and the circuit voltage as shown on the drawings. In indicated cold areas (below 550F, the fluorescent fixtures shall be equipped with cold weather ballasts and lamps. The ballasts shall be energy saving type.

- c. Controls. Time switches, contactors and photoelectric controls shall be provided as indicated and specified in Section 16100.
- d. Wiring Devices and Materials. Convenience outlets, power outlets, switch outlets and wiring materials shall include the required boxes, receptacles, switches, plates, fittings and hardware as shown on the Drawings and specified in Section 16100.
- e. Transformers and Grounding. Lighting transformers and grounding shall be provided as shown on the drawings and specified in Section 16400.
- f. Branch Circuits. Wiring for the panelboard branch circuits shall be provided as shown on the Drawings and specified in Section 16100. The wiring, outlets and supports shall be complete.
- g. Lamps. Lamps shall be provided for the lighting fixtures, floodlights, streetlight and other lighting units as shown on the Drawings. The lamps shall be General Electric, Sylvania, Phillips, or approved equal.
  - i. Fluorescent Lamps shall be rapid start, 48 inch, 34 watt, 460 MA, medium bi-pin, lite white and Type T-12. The lamp life shall be approximately 18,000 hours, and the light output shall be approximately 2925 lumens.
  - ii. Controls (contactors, photoelectric units and time switches) shall be provided as shown on the Drawings and specified in Sections 16100.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. Provide all the equipment installations and wiring installations, including connections as indicated, specified, and required. Assure proper fits for all equipment and materials in the spaces shown on the Drawings.
  - a. Lighting Fixtures. Install all the exterior lighting fixtures as shown on the Drawings.
    - i. Ballasts shall be provided for high pressure sodium, fluorescent and metal halide fixtures
    - ii. Lamps shall be installed in the lighting fixtures as shown on the Drawings.
  - b. Wiring. Provide complete wiring installations for the interior and exterior lighting units, switches, convenience outlets, automatic controls and grounding as indicated and required.
  - c. Automatic Control. Install the photoelectric controls, time switches and contactors as shown on the Drawings, and as required.
    - i. Adjust all the automatic controls so they operate satisfactorily.

## APPENDICES

The documents provided in the appendices below are not part of the Contract Documents. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained or indicated in the appendices.

### **1. Lift Station No. 1 – Material List**

Item 1 includes a complete list of the equipment, parts and material previously purchased by the Owner and being held in storage for incorporation into the project. This information is being presented for the Contractor's use in examining the project and preparing his bid.

### **2. As-Built Drawing of Sheet 27 of the Phase 4 Project**

Item 2 includes a copy of the as-built drawing of Sheet 27 showing the location of the connection of the two 4-inch force mains to be accomplished by the Contractor under Contract 107. Construction Note 19 on sheet 27 describes the type of connection to be made.

#### **Note:**

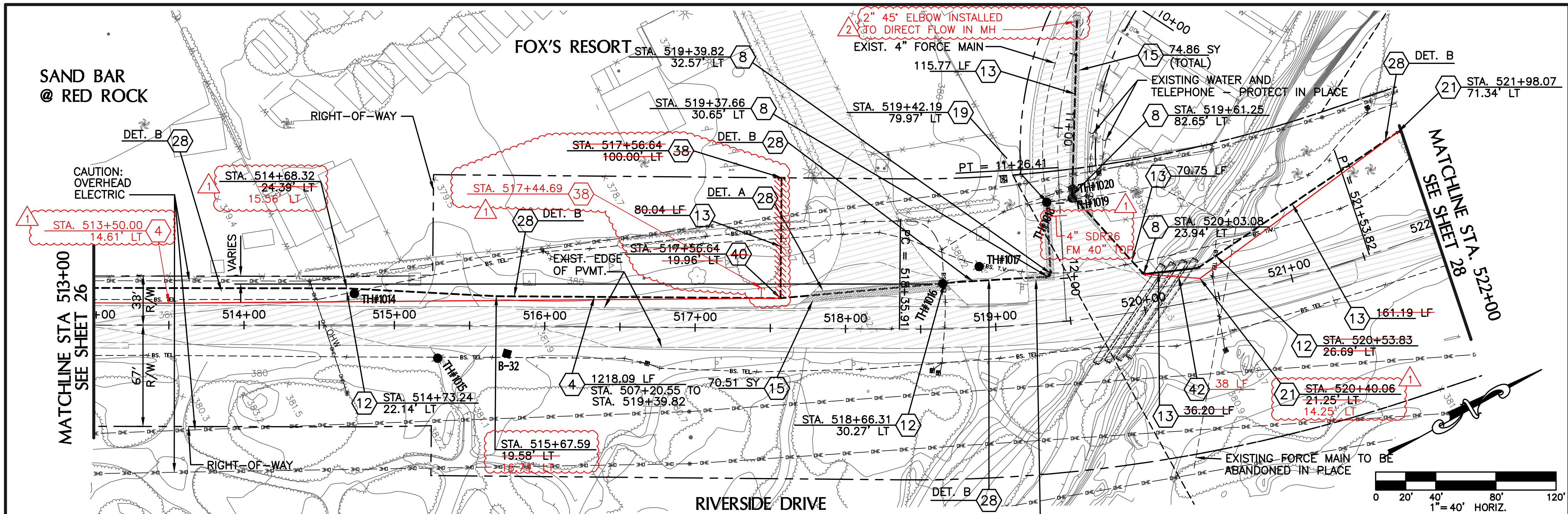
- 1. A copy of the report dated November 19, 2012 prepared by Western Technologies, Inc. entitled "Geotechnical Evaluation-Buckskin Sanitary District Improvements Phase 4 Expansion, Rio Lindo Shores Drive and Marina Village", and a copy of the report dated February, 2013 prepared by Logan Simpson Design Inc. entitled "Environmental Report for Buckskin Sanitary District, Phase 4 Wastewater Conveyance Project" of the Phase 4 Wastewater Conveyance System will be available at the District offices for examination. These documents are also available on the Buckskin Sanitary District's website at [www.bsdsewer.org](http://www.bsdsewer.org).**

**APPENDIX I - CONTRACT 107**

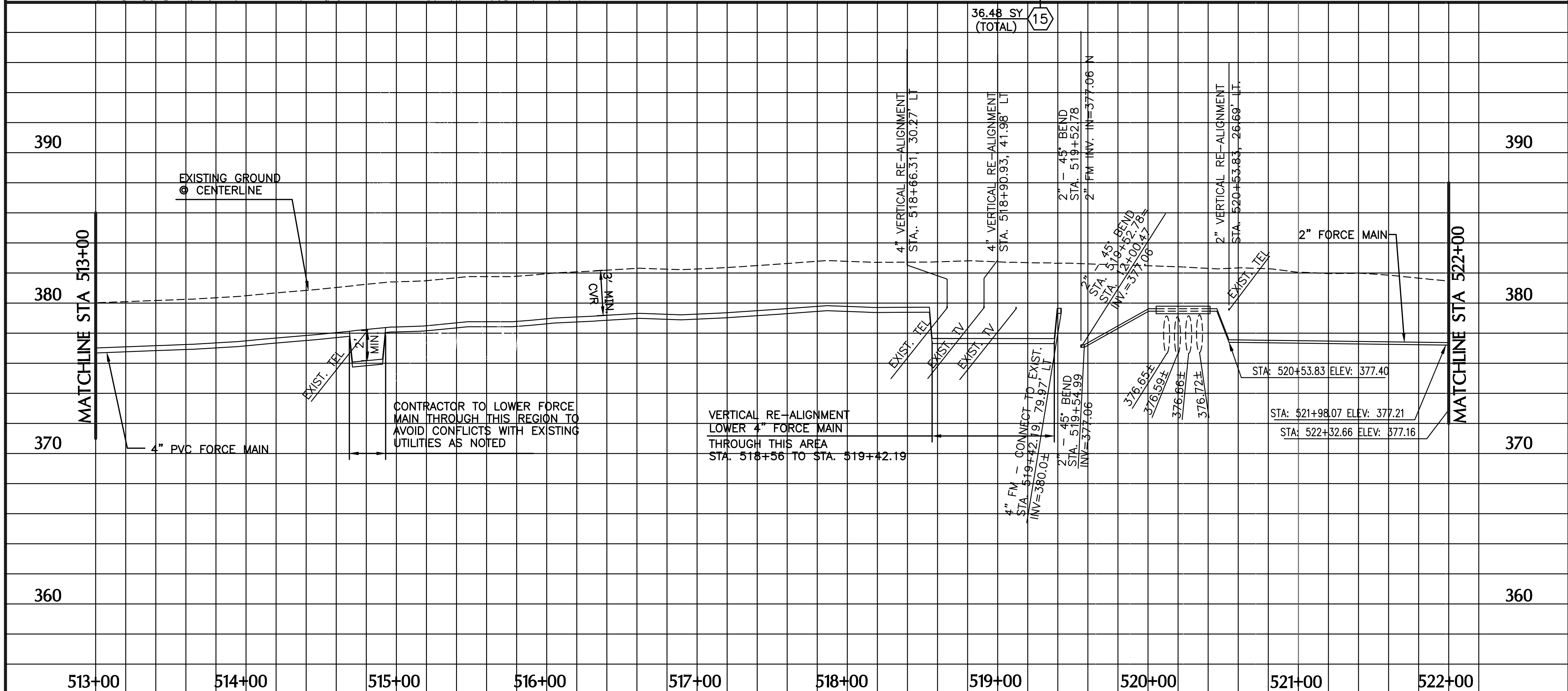
<b>BSD</b>		<b>PHASE 4</b>	<b>LS #1</b>	<b>MATERIALS ON SITE</b>
<b>VENDOR</b>	<b>PARTS/EQUIPMENT DESCRIPTION</b>			<b>QTY</b>
JCH	FLYGHT PUMPS			2
	Wet Well			1
	Flyght Mixer			1
	Basic Repair Kit			3
	Pump Shoes			2
	Pump Control Panel			1
	Float Bracket			1
	Floats			4
	Gridbee			1
	Davit Crane Socket			1
	Transducer			1
	SS Guide Rails			4
DME	DG200NK Neutral Kit			1
	Panel A			1
	Lights			2
	Eaton Breaker CCVH2200 120/240			1
	Surge Protection Device			1
	200 AMP Meter Socket Enclosure			1
	J Box SS 12 x 12			1
FW/FL	DI Spools 4" x 20' Fig x Pe			2
	DI Spools 4" x 14' Fig x Pe			2
	DI Spools 4" x 7' Fig x Pe			2
	DI Spools 4" x 5' Fig x Pe			6
	Gate Valve 4" Fig x Fig			2
	DI Reducer 4" x 3"			2
	Plug Valve 4" Fig x Fig			1
	Check Valve 4" Fig x Fig			2
	Full Gasket Rubber 4"			6
	BN Kit 4"			13
	DI Fitting 4" 90 Bend			3
	Camlock Fig x Male			1
	Camlock Cap			1
OP	Manhole			1
	Valve Vault			1
	Vault Drain			1
LFT	Generator			1
	ATS			1
SYN	Odor Control Unit 2x2			1

<b>KEY:</b>	
<b>JCH</b>	<b>James Cooke &amp; Hobson, Inc.</b>
<b>DME</b>	<b>Dutch Masters Electric</b>
<b>FW/FL</b>	<b>Frontline Water/Frontline</b>
<b>OP</b>	<b>Olsen Precast</b>
<b>LFT</b>	<b>Loftin</b>
<b>SYN</b>	<b>Syneco Systems</b>





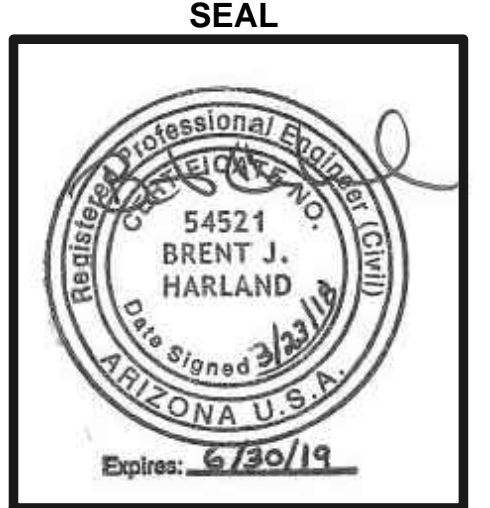
- ### SEWER CONSTRUCTION NOTES
- 4 INSTALL 4" PVC FORCE MAIN
  - 8 INSTALL 45° BEND W/ JT. RESTRAINT
  - 12 VERT. RE-ALIGNMENT PER MAG STD. DET. 370 AS REQ'D. CONTRACTOR TO FIELD VERIFY HORIZ. AND VERT. LOCATION PRIOR TO CONST.
  - 13 INSTALL 2" FORCE MAIN
  - 15 SAWCUT, REMOVE & REPLACE ASPHALT PVMT. PER DTL. ON SHEET 44, T-TOP (INCLUDES STUBS AND TAPS WHERE APPLICABLE).
  - 19 CONTRACTOR TO FIELD VERIFY EXISTING HORIZ. AND VERT. LOCATION OF EXISTING 4" FORCE MAIN. CONTRACTOR TO CUT EXISTING FORCE MAIN AND TIE PROPOSED 4" FORCE MAIN INTO EXISTING FORCE MAIN USING MEGA-COUPLING SERIES 3300 BY EBAA IRON, INC OR APPROVED EQUAL.
  - 21 INSTALL 2" - 22.5" BEND
  - 22 ONCE EXISTING FORCE MAIN IS ABANDONED. CONTRACTOR SHALL UTILIZE EXISTING FORCE MAIN UNDER WASH AS A CARRIER PIPE FOR PROPOSED 2" FORCE MAIN.
  - 28 TRENCH PER DTL. ON SHEET 44.
  - 38 CONTRACTOR SHALL INSTALL A CURB BOX CONTAINING A PVC BALL VALVE IN ACCORDANCE WITH SPECIFICATION SECTION 15100, PART 2.5
  - 40 2-INCH CONNECTION TO FORCE MAIN SHALL BE INSTALLED IN ACCORDANCE WITH SPECIFICATION SECTION 15200, PART 2.5.
  - 42 INSTALL 6" D.I.P. CARRIER PIPE



### RECORD DRAWINGS

THIS DRAWING HAS BEEN REVISED TO SHOW THOSE CHANGES DURING THE CONSTRUCTION PROCESS REPORTED BY THE CONTRACTOR TO SLATER HANIFAN GROUP, INC., AS OBSERVED BY SHG AND INCLUDES SURVEY CONFIRMATION PROVIDED BY J.C. ELLIS SURVEY AS NOTED. ALL CHANGES CONSIDERED TO BE MATERIAL ARE SHOWN ON THESE RECORD DRAWINGS.

DATE: 3/14/2018 BY: BRENT J. HARLAND, PE



- 1 (CNB)REVISED FORCE MAIN LOCATION
  - 2 (SHG)ADD 45° ELBOW IN MH TO DIRECT FORCEMAIN DISCHARGE INTO MH CHANNEL
- NOTE:  
CONTRACTOR SHALL USE EXTREME CAUTION WHEN IDENTIFYING, UNCOVERING AND HANDLING ALL UTILITIES.

### APPROX FORCEMAIN QUANTITY

APPROXIMATELY 4,220 LF 4" FORCE MAIN LENGTH BASED ON CONTRACTOR REDLINES & SHG OBSERVATIONS

REVISIONS	BY	DATE