

Helm Street Tank Replacement



**Bedford
Regional
Water Authority**

PROJECT MANUAL



NOVEMBER 2023



Whitman, Requardt & Associates, LLP
Engineers · Architects · Environmental Planners Est. 1915



PROJECT MANUAL

FOR

HELM STREET TANK REPLACEMENT

Bid Date: December 19th, 2023

Prepared For:

Bedford Regional Water Authority
1723 Falling Creek Road
Bedford, Virginia 24523
(540) 586-7679

Prepared By:

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1700 Kraft Dr., Suite 1200
Blacksburg, VA 24060
WRA WO 46626.003

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Bedford Regional Water Authority Master Specifications, Latest Edition,
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<https://www.brwa.com/your-water/building-developing/developer-services/>

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ADVERTISEMENT FOR BIDS

Bedford Regional Water Authority
1723 Falling Creek Road Bedford VA, 24523
Helm Street Tank Replacement Project

General Notice

Bedford Regional Water Authority (BRWA) (Owner) is requesting Bids for the construction of the following Project:

Helm Street Tank Replacement
BRWA JOB #2021-111

Bids for the construction of the Project will be received at the Bedford Regional Water Authority Office, located at 1723 Falling Creek Road, Bedford Virginia 24523, until Tuesday, December 19, 2023 at 2:00 PM local time. At that time the Bids received will be publicly opened and read.

The Project includes the following Work:

The project consists of the demolition of the existing round concrete tank with steel roof and construction of a new 1 million gallon welded steel potable water storage tank and related site, electrical, and instrumentation improvements at the end of Helm Street in the Town of Bedford.

Obtaining the Bidding Documents

The Issuing Office for the Bidding Documents is:

Bedford Regional Water Authority

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

<https://www.brwa.com/your-water/building-developing/bidding/>

Bidding Documents may be downloaded from the designated website.

BRWA Master Specifications may be downloaded from the following website under "Developer Resources":

<https://www.brwa.com/your-water/building-developing/developer-services/>

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

Pre-bid Conference, Clarifications and Addenda

A pre-bid conference for the Project will be held on Wednesday, November 29, 2023, at 2:00PM at the Tank Site located at 900 Helm Street, Bedford VA, 24523. Attendance at the pre-bid conference is encouraged but not required. The deadline for questions and clarifications on the contract documents must be made in writing by 5:00 PM on Friday, December 1, 2023. Only clarifications by formal written addenda will be binding. All communications regarding clarifications and other matters related to this project shall be addressed to the Owner, Attn: Whitney Quarles, P.E. Engineering Manager, 1723 Falling Creek Road, Bedford, VA 24523, email: w.quarles@brwa.com.

Instructions to Bidders

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

Nondiscrimination and Drug-Free Workplace

The successful bidder must comply with the Presidents Executive Order #11246, prohibiting discrimination in employment regarding race, creed, sex, or national origin; Executive Orders #12138 and 11625 regarding utilization of MBE/WBE subcontractors in the performance of this contract; provide certification that they do not or will not maintain or provide for their employees facilities that are segregated on the basis of race, color, creed, or national origin; and comply with the provisions of Civil Rights Act of 1964. The successful bidder and contractors performing work under this advertisement must meet the requirements of the Code of Virginia, Title 2.2, Chapter 43, Paragraph 2.2-4311, Employment Discrimination Prohibitions, and Paragraph 2.24312, Drug-free Workplace.

This Advertisement is issued by:

Owner: Bedford Regional Water Authority
By: Rhonda B. English
Title: Deputy Director
Date: November 5, 2023

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

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

A. *Issuing Office*—The office from which the Bidding Documents are to be issued.

ARTICLE 2—BIDDING DOCUMENTS

- 2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.
- 2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders may receive Addenda issued by Owner. It is the Contractor's responsibility to check the Owner's website for any issued addenda prior to bidding.
- 2.04 *Electronic Documents*
- A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.
1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.
- B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences

arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.

ARTICLE 3—QUALIFICATIONS OF BIDDERS

- 3.01 Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:
- A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.
 - B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.
 - C. Bidder's state or other contractor license number, if applicable.
 - D. Subcontractor and Supplier qualification information.
 - E. Other required information regarding qualifications.
- 3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE

- 4.01 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.
- 4.02 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

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

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

5.02 *Existing Site Conditions*

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

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:
 - a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.
 - b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.
 - c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
 - d. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

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

5.03 *Other Site-related Documents*

- A. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

- A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.
- B. A pre-bid conference will be held on site at the tank site.
- C. Bidders visiting the Site are required to arrange their own transportation to the Site.
- D. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: Rhonda English,

r.english@brwa.com. Bidder must conduct the required Site visit during normal working hours.

- E. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- F. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.
- G. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
- H. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

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

5.06 *Other Work at the Site*

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

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

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

- A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.
- B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

- 7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.
- 7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Owner in writing at the following email address: r.english@brwa.com
- 7.03 Interpretations or clarifications considered necessary by Owner in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.
- 7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.
- 9.02 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.

EJCDC® C-200, Instructions to Bidders for Construction Contract.

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ARTICLE 10—SUBSTITUTE AND “OR EQUAL” ITEMS

- 10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those “or-equal” or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an “or-equal” or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner.
- 10.02 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder's sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:
- A. Demolition
 - B. Site Grading
 - C. Site Piping
 - D. Tank Mixing System
 - E. Electrical
 - F. Instrumentation and Controls
 - G. Cathodic Protection
 - H. Lightning Protection System
- 11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder's Bid price will be increased (or decreased) by

the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

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

ARTICLE 12—PREPARATION OF BID

- 12.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
 - B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
- 12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.
- 12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.
- 12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.
- 12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.
- 12.06 A Bid by an individual must show the Bidder’s name and official address.
- 12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.
- 12.08 All names must be printed in ink below the signatures.

- 12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.
- 12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.
- 12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.
- 12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

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

ARTICLE 14—SUBMITTAL OF BID

- 14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.
- 14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.
- 14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

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

- 15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 14.01 and submit a new Bid prior to the date and time for the opening of Bids.

ARTICLE 16—OPENING OF BIDS

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

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.
- 18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.
- 18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.
- 18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.
- 18.05 *Evaluation of Bids*
- A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
 - B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.
- 18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.
- 18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

- 19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.
- 19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

- 20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver 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.

BID FORM FOR CONSTRUCTION CONTRACT

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

ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

Bedford Regional Water Authority
1723 Falling Creek Road
Bedford, VA 25423
Attn: Rhonda B. English, P.E., Deputy Director

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

ARTICLE 2—ATTACHMENTS TO THIS BID

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

- A. Required Bid security;
- B. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;
- C. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;
- D. Required Bidder Qualification Statement with supporting data

ARTICLE 3—BASIS OF BID—LUMP SUM BID

3.01 *Lump Sum Bids*

- A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s):

1. Lump Sum Price (Single Lump Sum)

Helm Street Tank Replacement	\$
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ARTICLE 4—TIME OF COMPLETION

4.01 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.

EJCDC® C-410, Bid Form for Construction Contract.

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

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

5.01 *Bid Acceptance Period*

- A. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

5.02 *Instructions to Bidders*

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

5.03 *Receipt of Addenda*

- A. Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Addendum Date

ARTICLE 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS

6.01 *Bidder's Representations*

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

Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
 - a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
 - b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
 - c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.

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

BIDDER hereby submits this Bid as set forth above:

Bidder:

(typed or printed name of organization)

By:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

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

Attest:

(individual's signature)

Name:

(typed or printed)

Title:

(typed or printed)

Date:

(typed or printed)

Address for giving notices:

Bidder's Contact:

Name:

(typed or printed)

Title:

(typed or printed)

Phone:

Email:

Address:

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

BID BOND (PENAL SUM FORM)

Bidder Name: Address (<i>principal place of business</i>):	Surety Name: Address (<i>principal place of business</i>):
Owner Name: Bedford Regional Water Authority Address (<i>principal place of business</i>): 1723 Falling Creek Road Bedford, VA 24523	Bid Project (<i>name and location</i>): Helm Street Tank Replacement Town of Bedford, Va Bid Due Date:
Bond Penal Sum: Date of Bond:	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder	Surety
_____ (<i>Full formal name of Bidder</i>)	_____ (<i>Full formal name of Surety</i>) (<i>corporate seal</i>)
By: _____ (<i>Signature</i>)	By: _____ (<i>Signature</i>) (<i>Attach Power of Attorney</i>)
Name: _____ (<i>Printed or typed</i>)	Name: _____ (<i>Printed or typed</i>)
Title: _____	Title: _____
Attest: _____ (<i>Signature</i>)	Attest: _____ (<i>Signature</i>)
Name: _____ (<i>Printed or typed</i>)	Name: _____ (<i>Printed or typed</i>)
Title: _____	Title: _____
Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.	

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

BIDDER'S QUALIFICATION STATEMENT

ARTICLE 1—GENERAL INFORMATION

1.01 Provide contact information for the Business:

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

1.02 Provide information on the Business's organizational structure:

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

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

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

EJCDC® C-451, Qualifications Statement.

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

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

ARTICLE 2—LICENSING

2.01 Provide information regarding licensure for Business:

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

ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

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

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

ARTICLE 4—SURETY INFORMATION

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

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

ARTICLE 5—INSURANCE

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

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

ARTICLE 6—CONSTRUCTION EXPERIENCE

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

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

- 6.02 Provide information regarding the Business's previous contracting experience.

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

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

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

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

ARTICLE 7—REQUIRED ATTACHMENTS

- 7.01 Provide the following information with the Statement of Qualifications:

- A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.
- B. Diverse Business Certifications if required by Paragraph 3.01.
- C. Certification of Business's safety performance if required by Paragraph 4.02.
- D. Financial statements as required by Paragraph 5.01.
- E. Attachments providing additional information as required by Paragraph 6.02.

- F. Schedule A (Current Projects) as required by Paragraph 6.03.
- G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 6.04.
- H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 6.05.
- I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

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

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address: _____

Phone: _____
Email: _____

Schedule A—Current Projects

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

Schedule B—Previous Experience with Similar Projects

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

Schedule B—Previous Experience with Similar Projects

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

Schedule C—Key Individuals

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

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

NOTICE OF AWARD

Date of Issuance:

Owner: Bedford Regional Water Authority Owner's Project No.: 2021-111
Engineer: Whitman, Requardt and Assoc., LLP Engineer's Project No.: 46626-003
Project: Helm Street Tank Replacement
Contract Name: Helm Street Tank Replacement
Bidder:
Bidder's Address:

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

The Helm Street Tank Replacement Project

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

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

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

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

1. Deliver to Owner 3 counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.

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

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

Owner: Bedford Regional Water Authority

By (signature): _____

Name (printed): _____

Title: _____

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

This Agreement is by and between Bedford Regional Water Authority ("Owner") and
_____("Contractor").

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

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

- 1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: The project consists of the demolition of the existing round concrete tank with steel roof and construction of a new 1 million gallon welded steel potable water storage tank and related site, electrical, and instrumentation improvements at the end of Helm Street in the Town of Bedford.

ARTICLE 2—THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Helm Street Tank Replacement

ARTICLE 3—ENGINEER

- 3.01 The Project has been designed by Whitman, Requardt, and Associates LLP, hereinafter called Engineer, is to assume all duties and responsibilities and has the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Project in accordance with the Contract Documents. See Supplementary Conditions, Paragraph SC-10.01 Owner's Representative.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 *Contract Times: Days*

- A. The Work will be substantially complete within 390 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 420 days after the date when the Contract Times commence

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. *Substantial Completion*: Contractor shall pay Owner \$500 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
 2. *Completion of Remaining Work*: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$250 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 Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.

4.04 *Special Damages*

- A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.
- C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, a lump sum of \$_____.

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the 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 the value of the Work completed (with the balance being retainage).

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

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 98 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions.

6.03 *Final Payment*

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

6.04 *Consent of Surety*

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

6.05 *Interest*

- A. All amounts not paid when due will bear interest at the maximum rate allowed by law at the place of the Project.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

- A. The Contract Documents consist of all of the following:
 - 1. This Agreement.
 - 2. Bonds:
 - a. Performance bond (together with power of attorney).
 - b. Payment bond (together with power of attorney).
 - 3. General Conditions.
 - 4. Supplementary Conditions.
 - 5. Specifications as listed in the table of contents of the project manual.
 - 6. Drawings (not attached but incorporated by reference) consisting of 31 sheets with each sheet bearing the following general title: Helm Street Tank Replacement.
 - 8. Addenda (numbers ___ to ___, inclusive).
 - 9. Exhibits to this Agreement (enumerated as follows):
 - a.
 - 10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - e. Warranty Bond, if any.
- B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 7.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
 4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
 5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
 6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
 7. 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.
 8. 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.
 9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:
 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

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

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

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

Owner:

Bedford Regional Water Authority

(typed or printed name of organization)

By:

(individual's signature)

Date:

(date signed)

Name:

(typed or printed)

Title:

(typed or printed)

Attest:

(individual's signature)

Title:

(typed or printed)

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Address:

Phone:

Email:

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

Contractor:

(typed or printed name of organization)

By:

(individual's signature)

Date:

(date signed)

Name:

(typed or printed)

Title:

(typed or printed)

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

Attest:

(individual's signature)

Title:

(typed or printed)

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Address:

Phone:

Email:

License No.:

(where applicable)

State:

NOTICE TO PROCEED

Owner: Bedford Regional Water Authority Owner's Project No.: 2021-111
Engineer: Whitman, Requardt and Assoc. LLP Engineer's Project No.: 46626-003
Contractor: _____ Contractor's Project No.: _____
Project: Helm Street Tank Replacement
Contract Name: _____
Effective Date of Contract: _____

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

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

In accordance with the Agreement:

The date by which Substantial Completion must be achieved is _____,
and the date by which readiness for final payment must be achieved is _____.

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

[Note any access limitations, security procedures, or other restrictions]

Owner: Bedford Regional Water Authority
By (signature): _____
Name (printed): _____
Title: _____
Date Issued: _____
Copy: Engineer

PERFORMANCE BOND

Contractor Name: Address <i>(principal place of business)</i> :	Surety Name: Address <i>(principal place of business)</i> :
Owner Name: Bedford Regional Water Authority Mailing address <i>(principal place of business)</i> : 1723 Falling Creek Road Bedford, Virginia 24523	Contract Description <i>(name and location)</i> : Helm Street Tank Replacement Town of Bedford, Virginia Contract Price: Effective Date of Contract:
Bond Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: ☐ None ☐ See Paragraph 16	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
 - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
- 6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
- 7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
- 8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
- 9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
- 10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
- 11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
- 12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
- 13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

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

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
 - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
 - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
 - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows:

PAYMENT BOND

Contractor Name: Address (<i>principal place of business</i>):	Surety Name: Address (<i>principal place of business</i>):
Owner Name: Bedford Regional Water Authority Mailing address (<i>principal place of business</i>): 1723 Falling Creek Road Bedford, Virginia 24523	Contract Description (<i>name and location</i>): Helm Street Tank Replacement Town of Bedford, Virginia Contract Price: Effective Date of Contract:
Bond Bond Amount: Date of Bond: (<i>Date of Bond cannot be earlier than Effective Date of Contract</i>) Modifications to this Bond form: ☐ None ☐ See Paragraph 18	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
By: _____ (<i>Full formal name of Contractor</i>) By: _____ (<i>Signature</i>) Name: _____ (<i>Printed or typed</i>) Title: _____ Attest: _____ (<i>Signature</i>) Name: _____ (<i>Printed or typed</i>) Title: _____	By: _____ (<i>Full formal name of Surety</i>) (<i>corporate seal</i>) By: _____ (<i>Signature</i>)(<i>Attach Power of Attorney</i>) Name: _____ (<i>Printed or typed</i>) Title: _____ Attest: _____ (<i>Signature</i>) Name: _____ (<i>Printed or typed</i>) Title: _____
Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
 - 5.1. Claimants who do not have a direct contract with the Contractor
 - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2. Pay or arrange for payment of any undisputed amounts.
 - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety

shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. Definitions

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

16.1.1. The name of the Claimant;

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

- 16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
- 16.1.4. A brief description of the labor, materials, or equipment furnished;
- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
- 16.1.7. The total amount of previous payments received by the Claimant; and
- 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
- 17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
- 18. Modifications to this Bond are as follows:

Contractor's Application for Payment

Owner: <u>Bedford Regional Water Authority</u> Engineer: <u>Whitman, Requardt and Assoc. LLP</u> Contractor: _____ Project: <u>Helm Street Tank Replacement</u> Contract: _____	Owner's Project No.: <u>2021-111</u> Engineer's Project No.: <u>46626-003</u> Contractor's Project No.: _____
Application No.: _____ Application Date: _____ Application Period: From _____ to _____	

1. Original Contract Price	\$	-
2. Net change by Change Orders	\$	-
3. Current Contract Price (Line 1 + Line 2)	\$	-
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	\$	-
5. Retainage		
a. _____ X \$ - Work Completed	\$	-
b. _____ X \$ - Stored Materials	\$	-
c. Total Retainage (Line 5.a + Line 5.b)	\$	-
6. Amount eligible to date (Line 4 - Line 5.c)	\$	-
7. Less previous payments (Line 6 from prior application)		
8. Amount due this application	\$	-
9. Balance to finish, including retainage (Line 3 - Line 4)	\$	-

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(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 the Work covered by prior Applications for Payment;

(2) Title to 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 the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ Date: _____

Recommended by Engineer By: _____ Title: _____ Date: _____ Approved by Funding Agency By: _____ Title: _____ Date: _____	Approved by Owner By: _____ Title: _____ Date: _____ By: _____ Title: _____ Date: _____
---	--

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Bedford Regional Water Authority Owner's Project No.: 2021-111
Engineer: Whitman, Requardt and Assoc. LLP Engineer's Project No.: 46626-003
Contractor: Contractor's Project No.:
Project: Helm Street Tank Replacement
Contract Name:

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 Documents.

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.

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 must be as provided in the Contract, except as amended as follows:

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:

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 Documents.

Engineer

By (signature): _____
Name (printed): _____
Title: _____

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract

- Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.
- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions,

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

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.
36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part

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

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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

1.02 *Terminology*

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day*: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective*: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
1. does not conform to the Contract Documents;
 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words “furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.
- F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

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

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and
 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 - 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 - 2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

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

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in

resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

- a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
- b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
- C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption,

- and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. Abnormal weather conditions;
 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
 4. Acts of war or terrorism.
- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment;
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

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

- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

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

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

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

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b)

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

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
 - 2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
 - 3. Technical Data contained in such reports and drawings.
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. *Reliance by Contractor on Technical Data:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
 2. is of such a nature as to require a change in the Drawings or Specifications;
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

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

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

- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
 - 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
 - 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
 - 3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 - 4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

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

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;
 3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review*: Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
 4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

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

- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
 4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
 2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely

- obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to

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indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

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

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.
- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party’s full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party’s obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner’s option, may purchase and maintain Owner’s own liability insurance. Owner’s liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner’s liability policies for any of Contractor’s obligations to the Owner, Engineer, or third parties.

- H. Contractor shall require:
1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.
- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 Contractor's Insurance

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);
 4. not seek contribution from insurance maintained by the additional insured; and
 5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

- C. *Property Insurance for Substantially Complete Facilities:* Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner:* If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance:* If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
 - 1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 - 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to

Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

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

7.02 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.
- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

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

- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 “Or Equals”

- A. *Contractor’s Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or “or equal” item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an “or equal” item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
 - b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor’s Expense:* Contractor shall provide all data in support of any proposed “or equal” item at Contractor’s expense.
- C. *Engineer’s Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each “or-equal” request. Engineer may require Contractor to furnish additional data about the proposed “or-equal” item. Engineer will be the sole judge of acceptability. No “or-equal” item will be ordered, furnished, installed, or utilized until Engineer’s review is complete

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and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 Substitutes

- A. *Contractor's Request; Governing Criteria:* Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
 - 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 - 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 - 3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design;
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

- 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 Concerning Subcontractors and Suppliers

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

- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.
- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

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

7.08 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

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

7.10 *Taxes*

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

7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

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

7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 - 1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.
3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

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

1. *Shop Drawings*

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

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

2. *Samples*

- a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.
3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

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

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.
5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.
- D. *Resubmittal Procedures for Shop Drawings and Samples*
1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
 2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
 3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.
- E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*
1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
 - d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. *Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.*

7.17 *Contractor's General Warranty and Guarantee*

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

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- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 - 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
 - 1. Observations by Engineer;
 - 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
 - 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 - 4. Use or occupancy of the Work or any part thereof by Owner;
 - 5. Any review and approval of a Shop Drawing or Sample submittal;
 - 6. The issuance of a notice of acceptability by Engineer;
 - 7. The end of the correction period established in Paragraph 15.08;
 - 8. Any inspection, test, or approval by others; or
 - 9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 Indemnification

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses,

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- damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.
- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.
- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay,

disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
 - 1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is

proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.
- E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

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10.07 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.
- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 - 2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 - 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 - 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.
- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract

Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 - 1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 - 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 - 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
1. A mutually acceptable fixed fee; or
 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

- C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 Notification to Surety

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 Claims

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 - 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 - 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 - 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 - 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

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D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the

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locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not

be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, 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. The cost of purchasing, renting, or furnishing small tools and hand tools.
3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
6. Expenses incurred in preparing and advancing Claims.
7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish

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and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

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E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
3. by manufacturers of equipment furnished under the Contract Documents;
4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this

right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 Progress Payments

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
 - 2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's

request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. Review of Applications

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. Payment Becomes Due

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. Reductions in Payment by Owner

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

- b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. The Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. The Contract Price has been reduced by Change Orders;
 - i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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- submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
 - C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
 - D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
 - E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
 - F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

- d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Final Application and Recommendation of Payment:* If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);
 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs,

losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due,

Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this article:
1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
 2. agree with the other party to submit the dispute to another dispute resolution process; or
 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

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

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement C-700, Standard General Conditions of the Construction Contract. The General Conditions remain in full force and effect except as amended.

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—for example, "Paragraph SC-4.05."

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

- B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- C. *Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01 Amend the third sentence of paragraph to read as follows:

- A. In no event will the Contract Times commence to run later than the 90th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.A.3:

- 4. Reports and Drawings Known to Owner, Helm Street Tank Site, Bedford, VA is available on the Owner's website at the following location: <https://www.brwa.com/your-water/building-developing/bidding/>

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

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

Report Title	Date of Report	Technical Data
Geotechnical Engineering Report for Helm Street Tank Replacement	September 2022	Geotechnical Borings

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

Report Title	Date of Report	Technical Data
Drawing – Waterworks Improvements for the City of Bedford; Structural, Cover Details for Existing 148'-0" Dia. Reservoir	Jan. 15, 1970	None

5.06 Hazardous Environmental Conditions

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

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

Report Title	Date of Report	Technical Data
Lead Paint Chip Analysis Report by EHS Laboratories	4/27/2022	Laboratory Results
Concrete Tank Wall Samples Analysis Report by Pace Analytical	June 01, 2023	Sample Analyte Count

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely: No Such Drawings.

6.01 Performance, Payment, and Other Bonds

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. *Required Performance Bond Form:* The performance bond that Contractor furnishes shall be in the form of EJCDC® C-610, Performance Bond (2010, 2013, or 2018 edition).
2. *Required Payment Bond Form:* The payment bond that Contractor furnishes shall be in the form of EJCDC® C-615, Payment Bond (2010, 2013, or 2018 edition).

6.03 Contractor's Insurance and Bonds

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: Whitman, Requardt and Associates, LLP

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

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Employer's Liability	\$1,000,000

- E. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- F. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.

6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
 7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- G. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.
 3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
 4. Any exclusion of coverage relating to earth subsidence or movement.
 5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
 6. Any limitation or exclusion based on the nature of Contractor's work.
 7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

H. *Commercial General Liability—Minimum Policy Limits*

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

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

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	\$1,000,000
Each Accident	\$1,000,000
Property Damage	
Each Accident	\$1,000,000
[or]	
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	\$1,000,000

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

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	\$5,000,000
General Aggregate	\$5,000,000

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

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	\$1,000,000
General Aggregate	\$2,000,000

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

retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

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

6.04 Builder's Risk and Other Property Insurance

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. Builder's Risk Requirements: The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).
 - a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. 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 will be provided through other insurance policies acceptable to Owner and Contractor.
2. 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.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
4. 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).

5. extend to cover damage or loss to insured property while in transit.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:
 - a. Bedford County Public Schools
310 South Bridge Street
Bedford, VA 24523
Phone: 540-586-1045
Fax: 540-586-7703
Email: bcps@bedford.k12.va.us

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

- G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

- H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

7.03 Labor; Working Hours

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be 8:00AM to 5:00PM.

2. Owner's legal holidays (2024) are:
 - January 1st - New Year's Day
 - January 15th - Martin Luther King, Jr. Day
 - February 19th - George Washington Day
 - May 27th - Memorial Day
 - June 19th - Juneteenth
 - July 4th - Independence Day
 - September 2nd - Labor Day
 - October 14th - Columbus Day
 - November 5th - Election Day
 - November 11th - Veterans Day
 - November 27th - Close at Noon
 - November 28th - Thanksgiving
 - November 29th - Day after Thanksgiving
 - December 24th - Christmas Eve (Observed)
 - December 25th - Christmas

7.10 Taxes

SC-7.10 Add a new paragraph immediately after Paragraph 7.10.A:

- A. Owner is exempt from payment of sales and compensating use taxes of the Commonwealth of Virginia and of cities and counties thereof on all materials to be incorporated into the Work.
 1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
 2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

7.13 Safety and Protection

SC-7.13 Add a new paragraph immediately after Paragraph 7.13.J:

- K. Contractor shall comply with all Occupational Safety Health Administration (OSHA) Laws and Regulations until such time as all the Work is completed.

9.13 Owner's Site Representative

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

9.13 Owner's Site Representative

- A. Owner will furnish an "Owner's Site Representative" (OSR) to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner's Site Representative is not Engineer's consultant, agent, or employee. Owner's Site Representative will be inspection staff of the Owner. The authority and responsibilities of Owner's Site Representative follow:

- B. The Owner's Site Representative's (OSR) dealings in matters pertaining to the Work in general will be with Owner and Contractor. OSR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The OSR will:
1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
 2. *Safety Compliance:* Comply with Site safety programs, as they apply to OSR, and if required to do so by such safety programs, receive safety training specifically related to OSR's own personal safety while at the Site.
 3. *Liaison*
 - a. Serve as Owner's and Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 4. *Review of Work; Defective Work*
 - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
 5. *Inspections and Tests*
 - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
 6. *Payment Requests:* Review Applications for Payment with Contractor.
 7. *Completion*
 - a. Participate in Owner and Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.

- d. Observe whether items on the final punch list have been completed or corrected.
- C. The OSR will not:
 - 1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 - 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 - 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 - 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
 - 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
 - 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Owner.
 - 7. Authorize Owner to occupy the Project in whole or in part.

10.01 *Owner's Representative*

SC-10.01 Delete Paragraph 10.01.A in its entirety and insert the following in its place:

- A. On this Project, by agreement with the Owner, Engineer will be Owner's representative on an as requested by the Owner basis during the construction period. Owner will perform all duties and responsibilities of the Engineer unless requested of the Engineer. 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*

SC-10.02 Amend the first sentence of paragraph to read as follows:

- A. On this Project, by agreement with the Owner, Engineer will make visits to the Site at intervals appropriate to the various stages of construction and as requested by the Owner 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.

10.03 *Resident Project Representative*

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

- 1. On this Project, by agreement with the Owner, the Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

15.01 Progress Payments

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

D. *Payment Becomes Due*

1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner setoffs) will become due, and when due will be paid by Owner to Contractor.

END OF SECTION

WORK CHANGE DIRECTIVE NO.: _____

Owner: Bedford Regional Water Authority Owner's Project No.: 2021-111
Engineer: Whitman, Requardt and Assoc. LLP Engineer's Project No.: 46626-003
Contractor: Contractor's Project No.:
Project: Helm Street Tank Replacement
Contract Name:
Date Issued: Effective Date of Work Change Directive:

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments:

Purpose for the Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

☐ Non-agreement on pricing of proposed change. ☐ Necessity to proceed for schedule or other reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price: \$ _____ [increase] [decrease] [not yet estimated].

Contract Time: _____ days [increase] [decrease] [not yet estimated].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

Recommended by Engineer

Authorized by Owner

By:

Title:

Date:

CHANGE ORDER NO.: _____

Owner: Bedford Regional Water Authority Owner's Project No.: 2021-111
Engineer: Whitman, Requardt and Assoc. LLP Engineer's Project No.: 46626-003
Contractor: Contractor's Project No.:
Project: Helm Street Tank Replacement
Contract Name:
Date Issued: Effective Date of Change Order:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments:

Change in Contract Price	Change in Contract Times
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. [Number of previous Change Order]: \$ _____	[Increase] [Decrease] from previously approved Change Orders No.1 to No. [Number of previous Change Order]: Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] this Change Order: \$ _____	[Increase] [Decrease] this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)

Authorized by Owner

By: _____

Title: _____

Date: _____

Authorized by Owner Approved by Funding Agency (if applicable)

By: _____

Title: _____

Date: _____

FIELD ORDER NO.: _____

Owner:	Bedford Regional Water Authority	Owner's Project No.:	2021-111
Engineer:	Whitman, Requardt and Assoc., LLP	Engineer's Project No.:	46626-003
Contractor:		Contractor's Project No.:	
Project:	Helm Street Tank Replacement		
Contract Name:			
Date Issued:		Effective Date of Field Order:	

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

Specification Section(s):

Drawing(s) / Details (s):

Description:

Attachments:

Issued by Engineer

By: _____

Title: _____

Date: _____

SECTION ARPA-1

ARPA CONTRACT REQUIREMENTS

PART 1 - GENERAL

1.01 MINORITY BUSINESS ENTERPRISE/WOMEN'S BUSINESS ENTERPRISE/LABOR SURPLUS REQUIREMENTS.

- A. The contractor agrees to take affirmative steps in letting any subcontracts for the project described in the RFP to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible, including the following:
1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
 2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
 3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
 4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; and
 5. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

1.02 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

- A. Overtime Requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- B. Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract

for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$29 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

- C. Withholding for unpaid wages and liquidated damages. The contractor shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- D. Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (3) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section. As used in this section, the terms laborers and mechanics include watchmen and guards.

1.03 DOMESTIC PREFERENCE

- A. The contractor agrees to provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products) in selecting subcontractors, materialmen, and vendors to provide work or products furnished under the contract.
- B. "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- C. "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

1.04 RECOVERED MATERIALS REQUIREMENT

- A. In accordance with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, the contractor shall procure items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition. The contractor shall procure items designated in the EPA guidelines that contain the highest percentage of recovered materials practicable unless the successful Bidder determines that such items: (1) are not reasonably available in a reasonable period of time; (2) fail to meet reasonable performance standards, which shall be determined on the basis of the guidelines of the National Institute of Standards and Technology, if applicable; or (3) are only available at an unreasonable price.
- B. These requirements shall apply to items purchased where: (1) the contractor purchases in excess of \$10,000 of the item; or (2) during the preceding Federal fiscal year, the contractor: (i) purchased any amount of the items for use under a contract that was funded with federal appropriations and was with a federal agency, state agency, or agency of a political subdivision of a state; and (ii) purchased a total of in excess of \$10,000 of the item both under and outside that contract.

1.05 NONSEGREGATED FACILITIES

- A. The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

1.06 BYRD ANTI-LOBBYING CERTIFICATION

- A. By entering a contract with the Authority, the contractor certifies, to the best of its knowledge and belief, that:
 - 1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the contractor, to any person for influencing or attempting to influence an officer or employee of an 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, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

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, loan, or cooperative agreement, the contractor shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
3. The contractor shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) 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.

1.07 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

- A. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this section, are defined in 2 CFR Parts 180 and 1200. "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "Lower Tier Participant" refers to any participant who has entered into a covered transaction with the contractor or other Lower Tier Participants (such as subcontractors and suppliers).
- B. By entering a contract with the Authority, the contractor certifies to the best of its knowledge and belief, that it and its principals:
 1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;
 2. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery,

- falsification or destruction of records, making false statements, or receiving stolen property;
3. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (2)(b) of this certification; and
 4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- C. The certification in this section is a material representation of fact upon which reliance was placed when the Authority determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available, the Authority may terminate the contract for default.
- D. The contractor shall provide immediate written notice to the Authority if the contractor learns at any time that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- E. The contractor agrees that 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 Authority.
- F. The contractor further agrees that it will include the certification in paragraph (2), without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.
- G. 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 is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.
- H. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

- I. Except for transactions authorized under paragraph (5), 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, the Authority may terminate the contract for cause or default.

1.08 COMPLIANCE WITH THE CARGO PREFERENCE ACT

- A. The following provisions are only applicable when materials or equipment are acquired for the project described in the RFP and have been transported by ocean vessel. They do not apply when materials or equipment used for the project are obtained from the existing inventories of suppliers and contractors.
 1. The contractor agrees to utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.
 2. The contractor agrees to furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States, a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (1) of this section to both the Contracting Officer (through the prime contractor in the case of subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.
 3. The contractor agrees to insert the substance of the provisions of this clause in all subcontracts issued pursuant to the contract.

1.09 COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

- A. The contractor agrees 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 Authority and the Regional Office of the Environmental Protection Agency (EPA).

1.10 FALSE OR FRAUDULENT STATEMENTS OR CLAIMS

- A. The contractor acknowledges that the provisions of the Program Fraud Civil Remedies Act of 1986, as amended, 31 U.S.C. § 3801, et seq., applies to its actions pertaining to the contract. The contractor certifies or affirms the truthfulness and accuracy of any

statement it has made, it makes, it may make, or causes to be made, pertaining to the contract.

1.11 EXAMINATION AND RETENTION OF RECORDS

- A. The Authority and any of its duly authorized representatives shall, until three years after final payment under the contract, have access to and the right to examine any of the contractor's directly pertinent books, documents, papers, or other records involving transactions related to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

1.12 CLAIMS, ADMINISTRATIVE ISSUES, AND APPEALS

- A. The Authority will be solely responsible for the settlement of all contractual and administrative issues arising from the contract, including source evaluation, protests, disputes, and claims in accordance with good administrative practice and sound business judgment. All contractual and administrative claims shall be adjudicated using the following procedures:

1. Claims Process.

- a. The contractor shall give the Authority written notice of the intention to file a contractual claim at the time of the event or the beginning of the work upon which the claim is based.
- b. Contractual claims must be submitted in writing to the Authority no later than 60 days after final payment.
- c. The Authority or an authorized designee shall make a written decision addressing the claim within 90 days of submission.

2. Administrative Appeal.

- a. The contractor may appeal the decision rendered above in Subsection (1)(c) by filing a Letter of Appeal with the Authority within 10 days of the date of the decision being challenged. No appeal will be allowed if the Letter of Appeal is untimely.
- b. The Letter of Appeal shall specify the basis for the appeal, the relief sought, and whether a hearing is requested.
- c. If a hearing is not expressly requested, the Authority shall render a written decision within 10 days of receiving the Letter of Appeal.

- d. If a hearing is requested, it shall be held within 30 days of receipt of the Letter of Appeal. The hearing will be conducted by a disinterested arbiter appointed by the Authority. The arbiter should be an attorney-at-law. Each party will have the opportunity to present pertinent information during the hearing. The hearing shall be an informal administrative proceeding, rather than a judicial-like trial, but it is nevertheless the appellant's burden to produce evidence sufficient to show that prior decision was erroneous. The hearing shall be recorded and transcribed. A final decision with findings of fact will be issued within 21 days of the hearing.
3. Judicial Review. The process set out in Subsections (1) and (2) is a mandatory pre-requisite to filing any judicial action against the Authority. After the completion of such process, however, such a judicial action may be filed within 21 days of the issuance of the arbiter's decision and not afterward. Such arbiter's decision shall be presumed correct and shall not be set aside unless (i) it reflects a material legal error, or (ii) it is factually unsupported by the record of the arbiter's hearing. The arbiter is entitled to assess the credibility of all witnesses and such assessments shall not be attacked judicially.

1.13 TERMINATION FOR CAUSE AND FOR CONVENIENCE

- A. Termination for Cause. The Authority will provide the contractor with written notice of any breach of the contract along with a request that the contractor cure the breach within 14 days of the date of the notice. In the event a breach remains uncured after the 14-day period, the Authority may terminate the contract for cause by written order issued seven days after the expiration of the cure period. In the event the contract is terminated for cause, the Authority may take any or all of the following actions:
 1. Require the contractor to deliver any work described in the notice of termination;
 2. Take over the work and prosecute the same to completion by contract or otherwise with the contractor being liable for any additional cost incurred by the Authority; and c. Withhold any payments to the contractor, for the purpose of set-off or partial payment, as the case may be, of amounts owed to the Authority by the contractor.
- B. Termination for Convenience. The Authority may, at any time, terminate the contract for its convenience and without cause by sending written notice to the contractor at least 10 days prior to termination without prejudice to any other available remedies. If the contract is terminated under this subsection, the contractor shall be paid for the following:

1. All completed work furnished to the satisfaction of the Authority prior to the date of termination.
2. With respect to unfinished or incomplete work, all expenses from furnishing services, labor, materials, and equipment for such work prior to the date of termination.
3. A fair and reasonable amount for overhead and profit attributable to the items described above in Subsections (a) and (b).

1.14 COMPLIANCE WITH OTHER APPLICABLE FEDERAL LAWS AND REGULATIONS

- A. The contractor agrees to comply with all applicable requirements of (1) Title VI of the Civil Rights Act of 1964 (Title VI), 42 U.S.C. § 2001d-1, et seq., and the implementing regulations at 31 C.F.R. Part 22; (2) Section 504 of the Rehabilitation Act of 1973, 29 U.S.C. § 794; (3) the Age Discrimination Act of 1975, 42 U.S.C. § 6101, et seq., and the implementing regulations at 31 C.F.R. Part 23; and (4) 2 C.F.R. Part 200, the OMB Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Related documents: Conditions of the Contract, this section and other sections of Division 0 – General Requirements, apply to the entire work of the contract.

1.02 LOCATION AND WORK COVERED BY THE CONTRACT DOCUMENTS

- A. The Work is located at 900-902 Helm Street, Bedford Virginia, 24523.
- B. Work under this Contract includes, but is not limited to, constructing the Work described below and all related appurtenances. The Work shall be as follows:
1. Demolition of the existing round concrete storage tank, painted steel roof, and appurtenances.
 2. Construction of a 1 million gallon, welded steel, ground water storage tank.
- B. Work consists of providing labor, materials, equipment, services and administration required in conjunction with or properly incidental to construction of the project. All work shall be performed in accordance with Federal, State and Local regulations and OSHA requirements.
- C. Consideration will not be given for misunderstanding the amount of work to be performed. Work includes all items and conditions specified, indicated in the Specifications or required by nature of the building or site. Any questions on the Scope of Work should be submitted to the Engineer, in writing, for resolution.
- D. The Contractor shall submit a health and safety plan outlining fall protection and confined space measures etc. to be taken at the site.
1. The health and safety plan shall include but not be limited to safety procedures including confined space entry, fall protection, etc., employee certifications, MSDS sheets, emergency contact numbers, required permits, etc. Health and safety plan and procedures shall address all local, state, federal and OSHA requirements in triplicate. The safety plan shall be submitted at the Pre-Construction Meeting for County and Engineer review. The Contractor shall submit a health and safety plan that shall include but not be limited to safety procedures including confined space entry, fall protection, etc., employee certifications, MSDS sheets, emergency

contact numbers, required permits, etc. Health and safety plan and procedures shall address all local, state, federal and OSHA requirements in triplicate. The safety plan shall be submitted at the Pre-Construction Meeting for County and Engineer review.

1.03 CONTRACTOR'S USE OF SITE

- A. Contractor's use of the Site shall be confined to the areas shown on the drawings.
- B. Move stored products that interfere with operations of Owner, other contractors, and others performing work for Owner.

1.04 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

- A. Notify owners of adjacent property and utilities when prosecution of the Work may affect their property, facilities, or use of property.
- B. When it is necessary to temporarily obstruct access to property, or when utility service connection will be interrupted, provide notices sufficiently in advance to enable affected persons to provide for their needs. Conform notices to Laws and Regulations and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01106

CONSTRUCTION SCHEDULING, COORDINATION AND SEQUENCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. Construction work under this contract shall have the least amount of interferences with the operations of existing facilities. Existing facilities must be maintained in continuous operation at all times during the course of the work under this contract.
- B. Operation of all gates, valves, pumps, equipment and appurtenances required to perform the work shall be done by the Owner. The Owner, or their designated agent, shall be informed in writing at least 48 hours, or longer where specified, in advance of the need to operate gates, valves, pumps equipment, appurtenances or other actions which could affect system operations.
- C. To achieve reliable, continuous operation, new equipment and facilities shall be tested and in operating condition to the greatest extent possible before final tie-ins are made which connect new equipment and facilities to the existing system.
- D. The Contractor shall submit to the Engineer, drawings showing details of all temporary connections or facilities as required.
- E. No extra payment shall be made for any labor, materials, tools, equipment or temporary facilities required during the construction of facilities, including the required installation and removal of the preassembled flushing mechanism for water line tie-ins and disinfection procedures. All costs therefore shall be considered to have been included in the price bid of the Proposal.
- F. The Contractor shall install a construction entrance from wherever construction vehicles enter or exit the site.

1.02 SEQUENCE OF CONSTRUCTION

- A. A plan for the sequence of construction and delivery dates is necessary to keep shutdowns to a minimum and construction proceeding unimpeded. The Contractor shall develop a sequence of construction and submit it to the Owner and Engineer for review and approval. The Sequence of Construction shall be in bar chart format and shall identify the logical sequence of events for this project. It shall include all procurement activities such as shop drawing submittal and review times, construction activities/events, defined by specific start and finish dates of the activities. The Sequence of Construction shall be such that all work under this contract shall be completed within the construction time stated

in these specifications. Contractor shall supply the Owner with a sequence of construction within ten (10) days after Notice to Proceed has been issued.

1.03 FACILITY SHUTDOWNS

- A. Shutdowns impacting the Owner's water system shall be coordinated with the Owner a minimum of ten (10) days prior to work being initiated.
- C. Scheduled shut downs shall be mutually agreed upon by the Owner and the Contractor, with the Engineer's approval.
- D. Contractor shall notify the Owner at least 10 days prior to shutdown in order for Owner to notify each resident, business and/or facility to be affected by the shutdown. Notification shall include the date of the shutdown and the expected duration of the shutdown. Notification shall be mailed or delivered at least seven (7) days prior to the shutdown.
- E. In order to keep each shutdown period to a minimum, the Contractor shall, prior to each shutdown, expedite completion of the work to the fullest extent. The Contractor shall have completed all necessary preparatory work including testing and shall have adequate personnel available to keep each shutdown period to a minimum. All equipment and materials required to complete the work during a shutdown period shall be on the job site before the shutdown is commenced.
- F. Prior to a shutdown, the Contractor shall submit to the Engineer and Owner in writing, detailed descriptions and schedules of the proposed construction procedures during the shutdown period. Information submitted to the Engineer shall include a complete inventory of materials and equipment needed to perform the work. No shutdown of a facility or operation will be permitted until the Engineer has reviewed and approved, in writing, the proposed construction plans and procedures.
- G. If, during any temporary shutdown periods, the work performed is not satisfactory, as planned, or not completed within the maximum time allocated, the Owner may order the Contractor to place the facility back in service and reschedule the work, or he may order the work required to place the facility or operation back in service to be performed with other forces at the Contractor's expense.
- H. During scheduled shut downs the Contractor shall be responsible for all damages and costs thereof due to negligence.

1.04 COORDINATION

A. Contractor, Subcontractors and Owner Personnel

1. The Contractor is responsible for the proper coordination of his work and his subcontractor's work, to assure timely completion of the work and to assure that the Owner is made aware in advance of proposed construction activities.
2. There will be no basis for claim for extra compensation or contract time extension due to delay caused by the Contractor's failure to give proper notice for requested shutdowns or to advise the Owner of proposed construction activities that in the judgement of the Owner will interfere with operation of the distribution system.
3. Should an emergency condition arise, the Owner has the authority to require the Contractor and his subcontractors to suspend their operations temporarily until conditions return to normal, without claim for extra cost or contract time extension by the Contractor and his subcontractors.

B. Subcontractors

1. Where the work of any subcontractor will be installed in close proximity to work of other subcontractors, or where there is evidence that the work of any subcontractor will interfere with the work of other subcontractors, the Contractor shall work out space allocations to make a satisfactory adjustment. If so ordered by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale, not less than 1/4 inch equals 1 foot, clearly showing how work is to be installed in relation to the work of others. If the Contractor permits any work to be installed before coordinating with the various subcontractors; or so as to cause interference with work of other subcontractors, he shall make necessary changes in the work to correct the condition without extra cost to the Owner.
2. The Contractor shall arrange that each subcontractor determines the location, size and arrangement of all chases and openings and shall establish clearances in concealed spaces required for the proper installation of its work and shall see that such are provided.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01130

MEASUREMENT AND PAYMENT

PART 1- GENERAL

1.01 GENERAL

- A. The Contractor shall receive and accept the compensation provided in the Proposal and the Contract as full payment for furnishing all materials, labor, tools and equipment, for performing all operations necessary to complete the Work under the Contract, and also in full payment for all loss or damages arising from the nature of the Work, or from any discrepancy between the actual quantities of work and quantities herein estimated by the Engineer, or from the action of the elements or from any unforeseen difficulties which may be encountered during the execution of the Work until the final acceptance by the Owner.
- B. The prices stated in the Proposal include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as specified herein. The basis of payment for an item at the unit prices in the Proposal shall be in accordance with the description of that item in this Section.
- C. The Contractor's attention is called to the fact that the quotations for the various items of work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of work has not been defined by a Bid Form payment item, he shall include the cost for that work in some other applicable bid item, so that his proposal for the project reflects his total price for completing the work in its entirety.
- D. Alterations
 - 1. The Owner reserves the right to change the scope, alignment, grade, form, length, dimensions or materials of the work under the Contract, whenever any conditions or obstructions are met that render such changes desirable or necessary. All such alterations shall be paid for under the total lump sum bid or at a unit price bid for these items of work, except as follows:
 - a. In case such alterations made the work less expensive to the Contractor, a proper deduction shall be made from the contract prices and the Contractor shall have no claim on this account for damages or for anticipated profits on the work that may be dispensed with.

- b. In case such alterations make the work more expensive, a proper addition shall be made to contract prices. Any such additions or subtractions shall be proposed by the Contractors and then reviewed by the Engineer and approved by the Owner.
- c. Unit prices in the Proposal shall be good for the duration of the Contract.
- d. In case the quantity of work in individual unit price items of work increases or decreases greater than 25 percent of the bid quantity, unit prices may be renegotiated.

E. Owner May Increase or Decrease Quantities

- 1. The Owner reserves the right to increase or decrease the quantity of material to be furnished or work to be done under the Contract whenever deemed advisable or necessary, and such increase or decrease shall in no way violate the Contract.
- 2. For the unit price items included in the Bid, the Contractor will be paid for the actual quantity of the authorized work done or material furnished under each item of the Proposal, at the unit price bid for such item. In case the quantity of any item is increased, the Contractor shall not be entitled to compensation over and above the unit price bid for such item. In case the quantity of any item is decreased, the Contractor shall have no claim for damages on account of loss of anticipated profits because of such decrease.
- 3. Bids will be considered irregular and may be rejected if the unit prices contained in the Bid are obviously unbalanced so they are substantially in excess of the cost analysis values determined by the Engineer.

1.02 MEASUREMENT

- A. The quantities for payment under this Contract shall be determined by actual measurement of the completed items, in place, ready for service and accepted by the Owner, in accordance with the General Conditions. A representative of the Contractor shall witness all field measurements.

1.03 PAYMENT

- A. Payments during the course of the work for lump sum items will be made on the basis of percentage completion of the work items listed in the schedule of values for each lump sum item. The Schedule of Values shall be prepared by the Contractor and submitted to the Engineer within 10 days of the execution of the Contract and shall serve as a breakdown of the lump sum bid for the purpose of arriving at a basis for the monthly estimate. The schedule shall be broken down into schedule of values categories and each category shall be further broken into each applicable specification section. The total of the Schedule of Values unit prices shall add up to 100% of the Total Project Cost Bid.

1.04 SCHEDULE OF VALUES

Item 1: 1.0 Million Gallon Welded Steel Ground Water Storage Tank

1. Payment for furnishing and installing the 1.0 Million Gallon Welded Steel Ground Water Storage Tank, complete and in-place is for all work required to construct and test the tank in accordance with the Contract Documents and shall be made at the lump sum price bid.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing and installing tank and appurtenances including, handrail and traction surface, roof vent, roof anchors, manways, access hatch, overflow structure, ladders, level indicator, safety climb device, cable support brackets, welded roof penetrations, pipe supports, floor penetrations and associated piping, painting, testing, chlorination and de-chlorination.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 2: Tank Foundation

1. Payment for design, furnishing and installing the Tank Foundation, complete and in-place is for all civil work and structural work required to design and construct the tank foundation in accordance with the Contract Documents and shall be made at the lump sum price bid.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing and installing tank foundation.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 3: Demolition

1. Payment for demolition, complete and in-place is for all work required to demolish the tank and appurtenances as indicated on the Contract Documents and shall be made at the lump sum price bid.
2. The lump sum bid shall include all labor, materials, tools, equipment and services to demolish the existing round tank including concrete walls, foundation, and floor down to adequate subgrade; painted steel roof and support structure, buried piping as indicated, and all related appurtenances. Demolition shall include existing concrete vaults, water main abandonment/removal, tank drain line abandonment/removal, water main bulkhead anchor installation, water main plugs/caps, lead abatement as required, disposal or rubblization of tank concrete, testing as required, containment, cleanup, existing fence removal/disposal, yard hydrant removal, temporary site restoration, and hauling materials off-site for disposal in accordance with all applicable requirements.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 4: Site Grading, Access Road, and Improvements

1. Payment for site grading, access road, and improvements, complete and in-place, is for all civil work required for site grading, tank access road, and improvements construction in accordance with the Contract Documents.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for site grading, access road installation including grading, excavation and fill, installation of rubblized concrete or crushed stone, borrow material and hauling, compaction, bollards, permanent fencing, temporary site security/fencing, and erosion and sediment control.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 5: Site Piping (Drainage, Water Mains and Related Structures)

1. Payment for furnishing and installing the Site Piping, complete and in-place is for all civil work required to install the site piping in accordance with the Contract Documents.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing and installing site piping including water mains and appurtenances,

valves, sleeves, tank drain line and appurtenances, site drainage piping, tracer wire, electronic markers, tracer wire box, drainage structures, drainage end wall, rip rap, vault drain lines and appurtenances, fittings, concrete anchors, yard hydrant, service line, meter box, chlorination, testing, tie-ins, bedding, backfill and compaction.

3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 6: Altitude Valve and Meter Vault

1. Payment for furnishing and installing the altitude valve and meter vault, complete and in-place is for all civil work required in accordance with the Contract Documents.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing and installing altitude valve vault including internal piping, fittings and appurtenances, hatch, ladder, drain, excavation, bedding, and backfill, and connections to site piping. Altitude valve and meter shall not be provided.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 7: Double Check Valve and Vault

1. Payment for furnishing and installing the double check valve and vault, complete and in-place is for all civil work required in accordance with the Contract Documents.
2. The lump sum bid shall include all labor, materials, tools, equipment, and services for furnishing and installing double check valve vault including internal piping, fittings and appurtenances, double check valve, hatch, ladder, drain, excavation, bedding and backfill, and connections to site piping.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 8: Tank Mixing System

1. Payment for furnishing, installing, starting up, and testing the tank mixing system, complete and in-place is for all work required to install the mixing system in accordance with the Contract Documents.

2. The lump sum bid shall include all labor, materials, tools, equipment, and services for furnishing, installing, and testing the mixing system including tank mixer, control panel, and appurtenances.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 9: Electrical

1. Payment for furnishing and installing the tank electrical, complete and in-place is for work required install in accordance with the Contract Documents.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing, installing, and testing all tank electrical systems, conduit, junction boxes, wiring, control panel, load center, pull boxes, excavation, bedding, backfill, and compaction.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 10: Instrumentation and Controls

1. Payment for instrumentation and controls, complete and in-place is for all instrumentation work required in accordance with the Contract Documents and shall be made at the lump sum price bid.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing, installing, and testing all instrumentation and controls, RTU Panel, chlorine analyzer, hotbox and concrete pad, heat tape, sampling line for chlorine analyzer, drain pipe for chlorine analyzer, pressure transducer, pressure transducer enclosure, and switches.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 11: Tank Cathodic Protection System

1. Payment for Tank Cathodic Protection System, complete and in-place is for all work required in accordance with the Contract Documents and shall be made at the lump sum price bid.

2. The lump sum price bid shall include all labor, materials, tools, equipment, and services for furnishing, installing, and testing a complete the tank cathodic protection system and control panel.
3. No measurement will be made. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

Item 12: Lightning Protection System

1. Payment for furnishing and installing the lightning protection system, complete and in-place is for all work required in accordance with the Contract Documents and shall be made at the lump sum price bid.
2. The lump sum bid shall include all labor, materials, tools, equipment and services for furnishing, installing, and testing a complete tank lightning protection system.
3. No measurement will be made for this bid item. Partial payments shall be made for the work completed in accordance with the General Conditions and Contract.

1.05 COORDINATION

- A. All connections to other work shall be coordinated with the Owner and the Contractor responsible for the other work.
- B. The Contractor shall not impede the progress of work by other Contractors without notifying and coordinating with that Contractor.

PART 2 – PRODUCTS (Not used)

PART 3 – EXECUTION (Not used)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The BRWA and Engineer will schedule and administer a preconstruction meeting, periodic progress meetings, and specially called meetings throughout the progress of the work.
 - 1. Prepare agenda for meetings
 - 2. Make physical arrangements for meetings
 - 3. Preside at meetings
- B. Representatives of the Contractor, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

- A. A preconstruction meeting will be scheduled before the Contractor starts Work at the site.
- B. Location: A site designated by the Owner.
- C. Attendance:
 - 1. Owner's representative
 - 2. Engineer and his professional consultants
 - 3. Contractor's project manager and superintendent
 - 4. Major subcontractors
 - 5. Utilities representative
 - 6. Others as appropriate

- D. Purpose: To establish procedures for handling shop drawings, submittals, field decisions, requests for information or clarification, change orders, partial payment applications, and other items pertinent to the construction.
- E. A checklist for the preconstruction meeting is included in the Appendix.

1.03 PROGRESS MEETINGS

- A. Regular periodic meetings will be held every 30 days or less. The first meeting will be scheduled 30 days after the Preconstruction Meeting or 30 days or less after the date of Notice to Proceed.
- B. Additional meetings will be scheduled as required by progress of the work.
- C. Location of the meetings: A site designated by the Owner.
- D. Attendance:
 - 1. Engineer and his professional consultants as needed.
 - 2. Contractor and his Subcontractors (as appropriate to the agenda).
 - 3. Owner's representative.
 - 4. Others as appropriate.
- E. Suggested Agenda:
 - 1. Review and approval of minutes of previous meeting.
 - 2. Review of work progress since previous meeting.
 - 3. Field observations, problems, conflicts.
 - 4. Problems which impede Construction Schedule.
 - 5. Review of off-site fabrication, delivery schedules.
 - 6. Corrective measures and procedures to regain projected schedule.
 - 7. Revisions to Construction Schedule.
 - 8. Progress schedule during succeeding work period.

-
9. Coordination of schedules.
 10. Review submittal schedules; expedite as required.
 11. Maintenance of quality standards.
 12. Pending changes and substitutions.
 13. Review proposed changes for:
 - a. Effect on Construction Schedule and on completion date.
 - b. Effect on other contracts of the Project.
- F. The Contractor is to attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the work, etc.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION (Not used)

END OF SECTION

SECTION 01315

CPM SCHEDULES AND REPORTS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- A. The Work under this Contract shall be planned, scheduled, executed, reported and accomplished using the Critical Path Method (hereinafter referred to as CPM), in calendar days, unless otherwise specifically provided in the Contract Documents.
- B. The primary objectives of the CPM scheduling requirements are:
 - 1. To ensure adequate planning and execution of the Work by Contractor;
 - 2. To assist Owner in evaluating progress of the Work;
 - 3. To provide for optimum coordination by the Contractor of his trades, Subcontracts and Suppliers, and of his work with the work or services provided by separate contractors;
 - 4. To permit the timely prediction or detection of events or occurrences which may affect the timely prosecution of the Work; and
 - 5. To provide a mechanism or tool for use by the Owner and Contractor in determining and monitoring any actions of the Contractor which may be required in order to comply with requirements of the Contract Documents relating to the completion of the various portions of the Work by the Milestone Dates specified in the Contract Documents.
- C. Contractor is responsible for determining the sequence of activities, the time estimates of the detailed construction activities and the means, methods, techniques and procedures to be employed. The Construction Schedule shall represent the Contractor's best judgment of how he will prosecute the Work in compliance with the Contract requirements. Contractor shall ensure that the Construction Schedule is current and accurate and is properly and timely monitored, updated and revised as Project conditions and the Contract Documents may require.
- D. Contractor shall consult with his principal Subcontractors and Suppliers relating to the preparation of his construction plan and Construction Schedule. Principal Subcontractors shall receive copies of those portions of Contractor's Construction Schedule which relates to their work and shall be continually advised of any updates or revisions to the Construction Schedule as the Work progresses. When Contractor submits his

- Construction Schedule or makes any proposed updates or revisions to such Schedule, it will be assumed by Owner that Contractor has consulted with and has concurrence of his principal Subcontractors and Suppliers. Contractor shall be solely responsible for ensuring that all Subcontractors and Suppliers comply with the requirements of the Construction Schedule for their portions of the Work.
- E. Contractor will provide the basic data relating to activities, durations and sequences as part of the Construction Schedule. This data shall reflect the Contractor's actual construction plan for the Project and shall fully comply with all requirements of the Contract Documents.
- F. When there are separate contractors working concurrently on the Project whose work must interface or be coordinated with the Work of Contractor, Contractor shall coordinate his activities of the separate contractors and shall, prior to the submission of his Construction Schedule, obtain written approval of his Construction Schedule by the separate contractors. If Contractor is unable to obtain such written approval by the separate contractors after his best efforts to do so, or if a conflict occurs that cannot be resolved by mutual agreement between Contractor and any separate contractor, the Owner shall make a determination of the schedule which will be binding upon Contractor and the separate contractors.
- G. It is understood and agreed that the Construction Schedule is to represent Contractor's best plan and estimate for the work; however, Contractor acknowledges that the Construction Schedule may have to be revised from time-to-time as progress proceeds. Contractor further acknowledges and agrees that the Owner does not guarantee that:
1. Contractor can start work activities on the "early start" or "late start" dates or complete work activities on the "early finish" or "late finish" dates shown in the schedule, or as same may be updated or revised;
 2. Contractor can proceed at all times in the sequence established by the utilization of only the resources and manpower he initially plans for the performance of the Work;
 3. Contractor's Construction Schedule will not have to be modified in order to obtain the agreement of any separate contractors to the schedule; or
 4. Contractor's Construction Schedule will not have to be modified or changed by direction of the Construction Manager. Any changes, modifications or adjustments made by the Contractor to the Construction Schedule shall be in full compliance with all requirements of the Contract Documents.
- H. The Contractor acknowledges and agrees that his Construction Schedule must be flexible in order to accommodate and allow for his coordination with the operations of the Owner

and the work of separate contractors relating to the Project. The Owner will review the Contractor's Construction Schedule for compatibility with Owner operations and the work of separate contractors. Contractor agrees to hold meetings with the Owner and separate contractors to resolve any conflicts between Contractor's Construction Schedule and the operations of the Owner or work of separate contractors. Contractor agrees to fully cooperate with Owner and separate contractors to resolve such conflicts and to revise his Construction Schedule as reasonably required.

- I. In order to maintain the orderly progress of the work performed on the Project, the Owner shall have the right to determine, in his sole discretion, the priority between the Work performed by Contractor and the work of any separate contractors or Owner's operations; this decision shall be final and binding upon Contractor and shall not be a cause for extra compensation or an extension of time, except where an extension of time is granted because of a delay for which Contractor is otherwise entitled to an extension under the Contract Documents.
- J. If Contractor's Construction Schedule indicates that Owner or a separate contractor is to complete an activity or perform certain preceding work by a particular date, or within a certain duration, Owner, or any separate contractor shall not be bound to said date or duration unless Owner expressly and specifically agrees in writing to same. The review and approval or acceptance by Owner of the Construction Schedule or any other schedule or plan of construction of Contractor, does not constitute an agreement by Owner of any start or finish date in the schedule or specific durations or sequences for activities of the Owner or any separate contractor; provided, however, that nothing herein shall be construed as modifying or changing, or excusing the performance of Contractor of required portions of the Work by the Milestone Dates as set forth in the Contract Documents.
- K. The Milestone Dates set forth in the Contract Documents represent only the major items of Work and may include interface dates with the operations of the Owner, the work of separate contractors or others. Milestone Dates are Contract requirements and are of the essence to this Contract and to the coordination of the Work by Contractor. Milestone Dates represent the latest allowable start or completion time for those portions of the Work to which each Milestone Dates relates. The Milestone Dates are not intended to be a complete listing of all Work under this Contract or of all interfaces with work performed by other separate contractors, the Owner or others. Contractor shall determine the time requirements for all such interfaces and shall be responsible for planning, scheduling and coordinating the work in order to complete in accordance with those requirements.
- L. Approval or acceptance by the Owner of the Contractor's Construction Schedule, or any revisions or updates thereto, is advisory only and shall not relieve the Contractor of the responsibility for accomplishing each portion of the Work within each and every applicable Specific Date. Omissions and errors in the approved or accepted Construction

Schedule, or any revisions or updates shall not excuse performance which is not in compliance with the Contract.

- M. Should Contractor intend or plan to complete the Work, or any portion thereof, earlier than any applicable Specific Date or Contract Time, Contractor shall give timely and reasonable notice of this fact to the Owner.
- N. Unless otherwise specifically provided in the Contract Documents, Contractor acknowledges that Owner has contemplated in planning and initial scheduling of the projects, that the work will be performed on a 5-day work week basis, utilizing a single 8-hour shift per day.

1.02 CONSTRUCTION SCHEDULE

- A. The Construction Schedule shall represent the Contractor's best judgement and intended plan for completion of the Work in compliance with Milestone Dates in the Contract Documents and the Contract Time. The Construction Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, and interface dates with utility owners, the Owner's operations and others. The Construction Schedule shall anticipate all necessary manpower and resources to accomplish the activities within the durations set forth in the Construction Schedule.
- B. Owner shall have the right to require the Contractor to modify any Contractor data or any portion of the Contractor's Construction Schedule, Schedule of Values or Recovery Schedule, as herein required, with Contractor bearing the expense thereof, which the Engineer reasonably determines to be:
 - 1. Impracticable;
 - 2. Based upon erroneous calculations or estimates;
 - 3. Unreasonable;
 - 4. Required in order to ensure coordination by Contractor of the work of his Subcontractors and with the work or services being provided by any separate contractors;
 - 5. Necessary to avoid undue interference with the Owner's operations or those of any utility owners or adjoining property owners;
 - 6. Necessary to ensure completion of the Work by the Milestone Dates set forth in the Contract Documents or
 - 7. Not in accordance with the Contractor's actual operations.

- C. At the Engineers request, Contractor shall supply to the Engineer an electronic copy of CPM schedule for review.

1.03 SCHEDULE OF VALUES

- A. Within ten (10) days after completion of the Construction Schedule, the Contractor shall submit to the Owner a Schedule of Values for review, allocating a dollar value for the activities on the Construction Schedule. The dollar value for the activity shall be the cost of the work of the activity including labor, materials, and pro rata contribution of General Conditions requirements, overhead and profit. The sum of all activity costs shall equal the total Contract Sum. The Contractor shall revise the Schedule of Values as necessary to gain the approval of the Owner.
- B. The activity cost for the Schedule of Values shall be coded with a cost code corresponding to the trade, Subcontractor or Supplier performing the work so that subtotals for each division of the Work can be prepared.
- C. The Schedule of Values shall, in the best judgment of the Contractor, represent a fair, reasonable and equitable dollar (cost) allocation for each activity on the Construction Schedule.

1.04 CONSTRUCTION SCHEDULE CONTENT

- A. The Construction Schedule shall consist of a time-scaled, detailed network graphic representation of all activities which are part of the Contractor's construction plan and an accompanying computerized mathematical analysis of these activities. The graphic network shall include, but not be limited to, the following information:
 - 1. Project Name;
 - 2. Activities of completed work ready for use by next trade, Owner, etc;
 - 3. Activities relating to different areas of responsibility, such as subcontracted work which is distinctly separate from that being done by the Contractor directly;
 - 4. Different categories of work as distinguished by craft or crew requirements;
 - 5. Different categories of work as distinguished by equipment requirements;
 - 6. Different categories of work as distinguished by materials;
 - 7. Distinct and identifiable subdivisions of work such as structural slabs, beams, columns;

8. Location of work within the Project that necessitates different times or crews to perform;
 9. Outage schedules for existing utility services that will be interrupted during the performance of the Work;
 10. Acquisition and installation of equipment and materials, supplies and/or installed by Owner or separate contractors;
 11. Material to be stored on site; and
 12. Milestone Dates.
- B. For all major equipment and materials to be fabricated or supplied for the Project, the Construction Schedule shall show a sequence of activities including:
1. Preparation of Shop Drawings and sample submissions;
 2. A reasonable time for review of Shop Drawings and samples or such times as specified in the Contract Documents;
 3. Shop fabrication, delivery, and storage;
 4. Erection or installation; and
 5. Testing of equipment and materials.
- C. The Construction Schedule shall include late completion dates for the Work that are not later than the required Milestone Dates. The time-scaled graphic network shall be drawn based upon the early start dates of activities shown on the graphic.
- D. All activity durations shall be given in calendar days.

1.05 UPDATING OF CONSTRUCTION SCHEDULE/PROGRESS REPORTS

- A. On or about the dates specified, Contractor shall arrange for his project manager and Superintendent to meet at the Project Site with the Owner to review Contractor's report of actual progress prepared by Contractor. Said report shall set forth up-to-date and accurate progress data, shall be based upon Contractor's best judgement and shall be prepared by Contractor in consultation with all principal Subcontractors and Suppliers.
- B. The progress report of Contractor shall show the activities or portions of activities, completed during the reporting period, the actual start and finish dates for these

activities, remaining durations and/or estimated completion dates for activities currently in progress.

- C. Contractor shall submit a narrative report with the updated progress analysis which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors and their impact, explanations of corrective actions taken or planned, any newly planned activities or changes in sequence, and proposed logic for a Recovery Schedule, if required, as further described herein. The report shall also include:
1. A narrative describing actual work accomplished during the reporting period;
 2. A list of major construction equipment used on the Work during the reporting period and any construction equipment idle during the reporting period;
 3. The total number of men by craft actually engaged in the Work during the reporting period, with such total stated separately as to office, supervisory, and field personnel;
 4. A manpower and equipment forecast for the succeeding thirty (30) days, stating the total number of men by craft, and separately stating such total as to office, supervisory and field personnel;
 5. A list of Contractor-supplied materials and equipment, indicating current availability and anticipated jobsite delivery dates;
 6. Changes or additions to Contractor's supervisory personnel since the preceding progress report.
- D. The Contractor shall provide initial computer reports and monthly reports thereafter, in accordance with the following:
1. Schedule Reports: Initial and subsequent Schedule Reports will contain the following minimum information for each activity:
 - a. Activity number, description and estimated duration in days;
 - b. Early and late finish dates;
 - c. Percentage of each activity complete as of each report;
 - d. Remaining float/days behind schedule;

- e. Responsibility for activity. Actual start and finish dates shall be indicated for each activity, as appropriated. Dummies and completed activities will be omitted from remaining Float and Late Start Sorts.
- 2. Cost Reports: Initial and subsequent Cost Reports will include the following information on each activity, sorted by trade activity:
 - a. Activity number and description;
 - b. Percentage of value of Work in place against total value;
 - c. Total cost of each activity;
 - d. Value of Work in place since last report;
 - e. Value of Work in place to date;
 - f. Value of uncompleted Work.
- 3. As part of the updating process, the Contractor will calculate, the value of work done for each activity based on percentage complete for each activity less the amount previously paid for past percentages completed. Summation of all values of each activity less the appropriate percent of retainage shall be the amount payable to the Contractor, provided that Contractor has complied with all requirements of the Contract Documents.
- E. Contractor shall be solely responsible for expediting the delivery of all materials and equipment to be furnished by him so that the progress of construction shall be maintained according to the currently approved Construction Schedule for the Work. Contractor shall notify the Owner in writing, and in a timely and reasonable manner, whenever Contractor determines or anticipates that the delivery date of any material or equipment to be furnished by Contractor will be later than the delivery date indicated by the Construction Schedule or required consistent with the completion requirements of this Contract, subject to updates as herein provided.
- F. Contractor shall ensure that the critical path runs through on-site activities and that off-site activities do not control the critical path of the Construction Schedule.

1.06 RECOVERY SCHEDULE

- A. Should the updated Construction Schedule show at any time that the Contractor is fourteen (14) or more days behind schedule for any Specific Date, the Contractor shall prepare a Recovery Schedule explaining and displaying how Contractor intends to reschedule his Work in order to regain compliance with the Construction Schedule.

- B. If the Contractor believes that all of the time can be recovered during the subsequent pay period the Contractor will be permitted to prepare a Recovery Schedule as set forth below. However, if the Contractor believes it will take more than thirty (30) days to recover all of the lost time, he shall prepare and submit a revision to the Construction Schedule.
1. The Contractor shall prepare and submit to the Construction Manager a one-month maximum duration Recovery Schedule, incorporating best available information from Subcontractors and others which will permit return to Construction Schedule at the earliest possible time. The Contractor shall prepare a Recovery Schedule to same level of detail as the Construction Schedule for a maximum duration of one month. This Recovery Schedule shall be prepared in coordination with other separate contractors on the Project;
 2. Within two (2) days after submission of Recovery Schedule, the Contractor shall participate in a conference with the Owner to review and evaluate the Recovery Schedule. Within two (2) days of conference, the Contractor shall submit the revisions necessitated by the review for review and approval. The Contractor shall use the approved Recovery Schedule as his plan for returning to the Construction Schedule.
 3. Contractor shall confer continuously with the Owner to assess the effectiveness of the Recovery Schedule. As a result of this conference:
 - a. If the Contractor is still behind schedule, the Contractor shall prepare a Schedule Revision and comply with all of the requirements of a Schedule Revision as stated herein and the other requirements of the Contract Documents; provided, however, that nothing herein shall limit in any way the rights and remedies of the Owner and as provided elsewhere in the Contract Documents.
 - b. If the Contractor has successfully complied with provisions of the Recovery Schedule, the Contractor shall return to the use of the approved Construction Schedule.

1.07 SCHEDULE REVISIONS

- A. Should Contractor desire to or otherwise be required under the Contract Documents to make modification or changes in his method of operation, his sequence of Work or the durations of the activities in his Construction Schedule, he shall do so in accordance with the requirements of the Contract Documents. Revisions to the approved Construction Schedule must be approved in writing by the Owner.

1.08 FLOAT TIME

- A. Float or slack time associated with one chain of activities is defined as amount of time between earliest start date and latest start date or between earliest finish date and latest finish date for such activities, as calculated as part of the Construction Schedule. Float or slack time shown on the Construction Schedule is not for exclusive use or benefit of either the Owner or the Contractor. Contractor specifically agrees that float time may be used by the Owner in conjunction with their review activities or to resolve for any modification of the Milestone Dates or an extension of the Contract Time, or a claim for additional compensation as a result of any Project problem, Change Order or delay which only results in the loss of available positive float on the Construction Schedule.
- B. Float time shown on the Construction Schedule shall not be used arbitrarily by Contractor in a manner which unnecessarily delays separate contractors from proceeding with their work or in a way which is detrimental to the interests of the Owner.

1.09 CPM PERSONNEL

- A. Contractor shall maintain a competent staff of sufficient size who are knowledgeable in the use, application and implementation of CPM as required by the Contract Documents. It shall be the responsibility of the Contractor to prepare input information for the Construction Schedule, monitor progress, provide input for updating and revising logic diagrams when necessary and otherwise assist the Contractor in fulfilling his obligations hereunder.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall have construction record photographs taken prior to start of the Work and periodically during the course of the Work.

1.02 PHOTOGRAPHY REQUIRED

- A. Photographs taken in conformance with this Section shall be furnished to the Engineer with each Application for Payment.
- B. Photographs shall be taken at each of the major stages of construction listed below.
 - 1. Site before any contract work begins.
 - 2. Completion of site clearing for each structure.
 - 3. Completion of excavations of each structure.
 - 4. Completion of foundations of each structure.
 - 5. Completion of framing of each structure.
 - 6. Completion of enclosure of each structure.
 - 7. Completion of pipe laying prior to backfilling.
 - 8. Completion of site restoration and landscaping.
 - 9. Installation of equipment and facilities as directed by Engineer.
- C. Views and Quantities Required:
 - 1. Two (2) views of each item listed in Article 1.02(B) above.
 - 2. Five (5) views of overall project site monthly, as directed by the Engineer.
 - 3. Provide electronic images of each view.

1.03 COSTS OF PHOTOGRAPHY

A. The Contractor shall pay costs for specified photography.

1. Parties requiring additional photography or prints will pay photographer directly.

1.04 DIGITAL PHOTOGRAPHY

A. The photographs shall be taken digitally. The minimum digital resolution shall be 5.0 mega-pixels. The Contractor shall provide to the Owner a memory card or link for digital download.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 TECHNIQUE

A. Factual Presentation.

B. Correct exposure and focus.

1. High resolution and sharpness
2. Maximum depth-of-field
3. Minimum distortion

3.02 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate condition of construction and state of progress.

1. At successive periods of photography, take at least one photograph from the same overall view as previously.
2. Consult with the Engineer at each period of photography for instructions concerning views required.

3.03 DELIVERY OF PRINTS

A. Deliver digital photographs to the Engineer to accompany each Application for Payment.

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 CODES, RULES, PERMITS AND FEES

A. General:

1. The Contractor shall comply with all Federal, State, and Local laws and regulations as well as the requirements of all permits obtained by the Owner or the Contractor.
2. The Contractor shall give all necessary notices, obtain all permits (except as otherwise noted herein) and pay all governmental taxes, fees, and other costs in connection with the work, file all necessary plans, prepare all documents and obtain all necessary approvals of all government departments having jurisdiction, obtain all required Certificates of Inspection and Approval for the work and deliver same to the Engineer, except as otherwise noted herein.

B. Included Items:

1. The Contractor shall include in his work, all labor, materials, services, apparatus, and drawings required to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on the Drawings or specified.

C. Compliance:

1. The Contractor shall arrange for inspection and approval by the appropriate permitting authority and shall pay all costs of these services. The Contractor shall also coordinate inspections with any third-party consultants as used by the Owner.

1.02 MATERIALS AND WORKMANSHIP

- A. All materials and equipment required for the work shall be new, unless otherwise specified, and of the best quality and especially adapted to the services required.
- B. The Contractor shall furnish a superintendent who shall be constantly in charge of the installation of the work, together with all skilled workmen and labor required to unload, transfer, erect, connect up, adjust, start, operate, and test each system.
- C. The Contractor shall locate and install all equipment which must be serviced, operated,

or maintained in fully accessible positions. Such equipment shall include, but not be limited to, valves, unions, cleanouts, drain points, pressure gages, and controls. Minor deviations from the Drawings may be made to allow for better accessibility, but changes of significant magnitude or changes involving extra cost shall not be made without approval of the Engineer.

1.03 STANDARDS

- A. Any reference to standards in the Contract Documents shall always imply the latest issue in effect including all amendments and errata at the time bids are taken, of said standards unless otherwise stated.
- B. Abbreviations for various organizations which may be used in these Specifications are as follows:

<u>Abbreviation</u>	<u>Organization</u>
AA	- Aluminum Association
AASHTO	- American Association of State Highway and Transportation Officials
ACI	- American Concrete Institute
ACS	- American Chemical Society
AFBMA	- Anti-Friction Bearing Manufacturers Association
AGA	- American Gas Association
AGMA	- American Gear Manufacturers Association
AHDGA	- American Hot Dip Galvanizers Association
AICHE	- American Institute of Chemical Engineers
AISC	- American Institute of Steel Construction
AASHO	- The American Association of State Highway Officials
ABPA	- Acoustical and Board Products Association
AI	- The Asphalt Institute
AIEE	- American Institute of Electrical Engineers (Now IEEE)
AIMA	- Acoustical and Insulating Materials Association
ISI	- American Iron and Steel Institute
AMCA	- Air Moving and Conditioning Association
ANSI	- American National Standards Institute
API	- American Petroleum Institute
APWA	- American Public Works Association
AREA	- American Railway Engineering Association
ASA	- American Standards Association (Now ANSI)
ASCE	- American Society of Civil Engineering
ASHRAE	- American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	- American Society of Mechanical Engineers
ASSCBC	- American Standard Safety Code for Building Construction

<u>Abbreviation</u>		<u>Organization</u>
ASTM	-	American Society of Testing and Materials
AWPA	-	American Wood Preservers Association
AWPB	-	American Wood Preservers Bureau
AWS	-	American Welding Society
AWWA	-	American Water Works Association
BIA	-	Brick Institute of America
CBRA	-	Copper and Brass Research Association
C&P	-	Chesapeake and Potomac Telephone Company
CIPRA	-	Cast Iron Pipe Research Association
CRSI	-	Concrete Reinforcing Steel Institute
CS	-	Commercial Standard (U.S. Department of Commerce)
VDOT Spec	-	Road and Bridge Specifications Virginia Department of Transportation, 1997
E/A	-	Engineer and/or Architect
EEI	-	Edison Electric Institute
EPA	-	U.S. Environmental Protection Agency
FM	-	Factory Mutual
FTI	-	Facing Tile Institute
FS	-	Federal Specifications
GPM	-	Gallons Per Minute
HP	-	Horsepower
IEEE	-	Institute of Electrical and Electronic Engineers
ID	-	Inside Diameter
IPCEA	-	Insulated Power Cable Engineers Association
MBE	-	Minority Business Enterprise
MBMA	-	Metal Building Manufacturers Association
MSS	-	Manufacturers Standardization Society of the Valve and Fittings Industry
NAAMM	-	National Association of Architectural Metal Manufacturers
NBFU	-	National Bureau of Fire Underwriters
NBS	-	National Bureau of Standards
NCPI	-	National Clay Pipe Institute
NCMA	-	National Concrete Masonry Association
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NPT	-	National Pipe Threads
NSF	-	National Science Foundation
OD	-	Outside Diameter
OFCCP	-	Office of Federal Contracts Compliance Programs
OSHA	-	U. S. Department of Labor, Occupational Safety and Health Administration

<u>Abbreviation</u>		<u>Organization</u>
PCA	-	Portland Cement Association
PCI	-	Prestressed Concrete Institute
PS	-	United States Products Standards
PSIG	-	Pounds Per Square Inch Gauge
RPM	-	Revolutions Per Minutes
SAE	-	Society of Automotive Engineers
SCPI	-	Structural Clay Products Institute
SDI	-	Steel Decks Institute
SJI	-	Steel Joists Institute
SPIB	-	Southern Pine Inspection Board
SMACNA	-	Sheet Metal and Air Conditioning National Association
SMSA	-	Standard Metropolitan Statistical Area
SSPC	-	Steel Structures Painting Council
STA	-	Station (100 feet)
TDH	-	Total Dynamic Head
TEMA	-	Tubular Exchanger Manufacturers Association
UL	-	Underwriter's Laboratories
USASI or	-	United States of America Standards Institute
USAS	-	(Now ANSI)
USGS	-	United States Geological Survey
USC&GS	-	United States Coast and Geodetic Survey

1.04 VERIFICATION OF DIMENSIONS

- A. The Contractor shall be responsible for field verification of all dimensions of existing facilities and other items that are shown on the Contract Drawings.

1.05 TESTS OF MATERIALS AND EQUIPMENT

- A. All material shall be subject to inspection, testing and approval of the Engineer before being incorporated in the work. Any work in which such materials are used without prior testing and approval shall be considered defective and unauthorized and will not be paid for. The Contractor shall perform such tests as required by the specifications in a timely fashion taking into account when the items will be incorporated in the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01510

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish, install and maintain temporary utilities required for construction and remove those temporary utilities upon completion of Work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with National Electric Code.
- B. Comply with Federal, State, and local codes and regulations and with utility company requirements.
- C. Comply with Bedford County and State Health Department Regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

- A. The Contractor will be responsible for all temporary power. The Contractor will reimburse the BRWA for all costs for service and for power used during construction, testing and trial operation prior to issuance of Substantial Completion of the Work by the Owner as stipulated by the Engineer.
- B. Install circuit and branch wiring, with area distribution boxes located so that power and lighting are available throughout the construction by the use of construction-type power cords.
- C. Provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by applicable codes, OSHA Standards, and safety regulations.

2.03 TEMPORARY HEAT AND VENTILATION

- A. Provide temporary heat and ventilation as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for the installation of materials, and to protect materials and finishes from damage due to temperature or humidity.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- C. Portable heaters shall be standard approved units complete with controls.
- D. Pay all costs of installation, maintenance, operation and removal, and for fuel consumed.

2.04 TEMPORARY TELEPHONE SERVICE

- A. Not provided by the BRWA.

2.05 TEMPORARY WATER

- A. The Contractor shall make all necessary arrangements for securing water for construction purposes at his own cost and expense. No separate payment, other than that included in contract lump sum unit prices will be allowed for water so used.
- B. The Contractor may obtain water for any purpose through a portable meter connected to the potable water distribution system. The Contractor shall obtain and pay for the portable meter and water used.
- C. The Contractor will reimburse the BRWA for all costs for water usage during construction, testing, and trial operation prior to issuance of Substantial Completion of the Work by the Owner as stipulated by the Engineer.

2.06 TEMPORARY SANITARY FACILITIES

- A. Approved sanitary convenience for the use of laborers and others employed on the work, properly secluded from public observation shall be constructed and maintained by the Contractor, in such manner and at such points shall be approved or directed and their use shall be strictly enforced. The collections in the same shall be disinfected and/or removed when and as required.
- B. The Contractor shall provide and maintain, in a neat and sanitary condition, such accommodations for the use of his employees, as may be necessary to comply with the

requirements and regulations of the Department of Health or of other bodies or tribunals having jurisdiction thereof. He shall commit no public nuisance.

2.07 TEMPORARY PUMPING AND SITE DRAINAGE

- A. Keep the site free from water at all times to permit continuous access and to prevent damage to the work.

2.08 SECURITY

- A. Full time watchmen are not required as a part of the Contract, but the Contractor shall provide inspection of work area daily and shall take whatever measures as necessary to protect the safety of the public, workmen, and materials, and provide for the security of the site, both day and night.
- B. Contractor may install security fencing to secure site if he chooses, at no additional cost to the Owner.

2.09 DUST AND MUD CONTROL

- A. Take all necessary precautions to control dust and mud associated with the Work of this Contract, as required by the Virginia Erosion and Sediment Control Manual and subject to the review of the Engineer. In dry weather, spray dusty areas daily with water or provide other approved means in order to control dust. Take necessary steps to prevent the tracking of mud onto parking areas, adjacent streets and highways.

PART 3 - EXECUTION

3.01 GENERAL

- A. Comply with the applicable requirements specified in Division 15 -Mechanical, and in Division 16 - Electrical.
- B. Maintain and operate systems to assure continuous service.
- C. Modify and extend systems as work progress requires.

3.02 REMOVAL

- A. Completely remove temporary materials and equipment when their use is no longer required.
- B. Clean and repair damage caused by temporary installations or use of temporary facilities.

- C. Restore permanent facilities used for temporary services to specified condition.

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1.01 DEFINITIONS

A. Products:

New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock and may also include existing materials or components required for reuse.

Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change the meaning of such other terms used in the Contract Documents as those terms are self-explanatory and have well recognized meanings in the construction industry.

Items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 ENVIRONMENTAL REQUIREMENTS

- A. Provide systems, equipment, and components, including supports and anchorages, except for the tank design, in accordance with the provisions of the latest edition of National Building Code (BOCA).

1.03 SUBMITTALS

A. Administrative Submittals:

List of all proposed substitute or "or-equal" items/methods.

1. Schedule of factory tests required by Contract Documents. Identify tests for which Engineer's presence has been specified.

B. Quality Control Submittals:

1. Factory Tests: As specified in the individual Specifications.

- a. Procedures: Preliminary outlines.

- 1) Final Accepted Procedures: Prior to start of factory testing.

- b. Test Documentation: Results of successful testing, including certification of procedures and results.

1.04 PREPARATION FOR SHIPMENT

- A. When practical, factory assemble products. Match mark 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, name of Project and Contractor, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.
- C. Spare Parts, Special Tools, Test Equipment, Expendables, and Maintenance Materials:
 - 1. Furnish as required by the Specifications prior to (i) starting functional testing as set forth in Section 01650, FACILITY STARTUP, or (ii) operation of the equipment by the Owner, or (iii) 75 percent Project completion, whichever occurs first.
 - 2. Properly package to avoid damage, in original cartons insofar as possible. Replace parts damaged or otherwise inoperable.
 - 3. Firmly fix to, and prominently display on, each package.
 - a. Minimum 3-inch by 6-inch manila shipping tag with the following information printed clearly:
 - 1) Manufacturer's part description and number.
 - 2) Applicable equipment description.
 - 3) Quantity of parts in package.
 - 4) Equipment manufacturer.
 - 5) Applicable Specification section.
 - 6) Name of Contractor.
 - 7) Project name.
 - 4. Deliver materials to site.

- D. Protect equipment 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.
- E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.05 DELIVERY AND INSPECTION

- A. Deliver products in accordance with the accepted current progress schedule and coordinate to avoid conflict with Work and conditions at the site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.
- B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label date of manufacture and shelf life, where applicable. Include UL labels on products so specified.
- C. Unload products in accordance with manufacturer's instructions for unloading, or as specified. Record the receipt of products at the site. Inspect for completeness and evidence of damage during shipment.
- D. Remove damaged products from the site and expedite delivery of identical new undamaged products and remedy incomplete or lost products to provide that specified, so as not to delay the progress of the Work.

1.06 HANDLING, STORAGE, AND PROTECTION

- A. Handle products in accordance with the manufacturer's written instructions, and in a manner to prevent damage. Store products, upon delivery, in accordance with manufacturer's instructions, with labels intact and legible, in approved storage yards or sheds. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.
- B. The Contractor shall store and protect products in accordance with the manufacturer's recommendations, and the requirements specified herein.
- C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered but not installed in the Work.
- D. All equipment and materials provided and work performed under this Contract shall be protected from damage before and after installation. The Contractor shall be responsible for work, equipment and materials until finally accepted by the Owner.

- E. During construction, the open ends of work shall be effectively closed with temporary caps or plugs to prevent the entry of foreign material.
- F. Store electrical, instrumentation, and control products, and equipment with bearings in weathertight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulation against moisture, water, and dust damage. Connect and operate continuously all space heaters furnished in electrical equipment.
- G. Store fabricated products aboveground, on blocking or skids, and prevent soiling or staining. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
- H. Where permanent equipment called for under this Contract is installed before the erection of adequate protective structures, the Contractor without additional compensation therefore, shall provide approved effective and durable covers for fully protecting such equipment against damage from the elements or from any other cause.
- I. Store finished products that are ready for installation in dry and well ventilated areas. Do not subject to extreme changes in temperature or humidity.
- J. All existing and new structures, machinery, equipment, piping electric conduit, wiring, and accessories and appurtenances shall be adequately supported and safeguarded against all damage or injury during performance of work under this Contract. The Contractor shall be responsible for all damage or injury resulting from his operations and shall repair such damage immediately and to the satisfaction of the Engineer.
- K. Hazardous Materials: Prevent contamination of personnel, buildings, and the site. Meet the requirements of the product specifications, codes, and manufacturer's instructions.
- L. The Contractor shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into the work shall be placed so as not to injure any part of the work or existing facilities, and so that free access can be achieved at all times to all parts of the work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience.
- M. Areas available on the job site for storage of materials and equipment shall be as shown, specified or designated and approved by the Engineer. All materials and equipment must be consigned to the Contractor directly. No delivery of materials and equipment will be accepted by the Owner, and all expenses incurred by the Owner in handling materials or equipment which have been consigned or directed to the Owner, will be charged to the Contractor.

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- N. Materials and equipment which are to become the property of the Owner shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the work, including proper protection against damage by freezing and moisture. They shall be placed in inside storage areas, unless otherwise shown, specified or approved by the Engineer. Materials and equipment whether installed or being stored prior to installation shall be protected in full accordance with the manufacturer's recommendations for safeguarding the items. Upon delivery of equipment the Contractor shall furnish the Engineer a copy of the manufacturer's recommendations for the proper storage and protection of the equipment.
- O. Lawns, grass plots or private property shall not be used for storage purposes without written permission of the property Owner and approval of the Engineer.
- P. The Contractor shall be responsible for maintaining, exercising, lubricating and servicing all stored equipment and materials.
- Q. Contractor shall be fully responsible for loss of or damage to stored materials.
- R. Uncovered Storage:
1. The following types of materials may be stored out-of-doors without cover:
 - a. Masonry units
 - b. Reinforcing steel
 - c. Structural steel
 - d. Piping
 - e. Precast concrete items
 - f. Castings
 - g. Hand railing
 2. Store the above materials on wood blocking so there is no contact with the ground.
- S. Covered Storage:
1. The following type of material may be stored out-of-doors if covered with material impervious to water:
 - a. Rough Lumber

2. Covers shall be tied down with rope, and sloped to prevent accumulation of water on covers.
 3. The above materials shall be stored on wood blocking.
- T. Fully Protected Storage:
1. The Contractor shall store all products not named above in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.
 2. Heated storage space shall be provided for materials which would be damaged by freezing.
 3. Mechanical and electrical equipment shall be protected from being contaminated by dust, dirt and moisture.
 4. Humidity shall be maintained at levels recommended by manufacturers for electrical and electronic equipment.
 5. Equipment with built-in space heaters shall be connected to a power source and kept in operation.
- U. The Contractor shall replace, at no additional cost to the Owner, any material or equipment that is stolen. This includes any material or equipment that has been billed to the Owner. The Contractor shall be responsible for any material or equipment unless that material or equipment has been accepted and stored by the Owner.
- 1.07 "OR-EQUAL" PRODUCTS
- A. See the General Conditions for contract requirements regarding the allowances of "or equal" products.
- B. Listing of proposed substitute or "or-equal" items or methods.
1. With consideration of the additional evaluation time necessary for Engineer's review of such items, indicate for each item the review status (either substitute or "or-equal") and estimated submission date.
 2. Contractor, in indicating the review status of the proposed item, acknowledges that the time shown for Engineer's review on the current accepted schedule is sufficient only to allow Engineer to accomplish review for the status indicated and not sufficient to perform both a review for "or-equal" status and a subsequent review for substitute status on the same product.

3. Engineer may return unreviewed those submissions (i) not shown on the current accepted schedule, (ii) for which the review status differs from that indicated on the accepted list unless previously approved in writing by Engineer, (iii) which are incomplete, or (iv) which are uncertified, in which case Contractor shall provide the specified product.
- C. Submit proposed substitute or “or-equal” item/method, to include all supporting data to allow Engineer’s review. Complete, sign, and transmit with each proposed substitute or “or-equal” item/method submission.
- D. Disposition of “Or-Equal” Item: In accordance with BRWA Master Specification Section 01 33 00, Submittals, or in accordance with following paragraph.
- E. Disposition of Substitute Item/Method:
 1. Accepted: Engineer will evidence such acceptance by recommendation of a Change Order for Contractor and Owner execution. Such Change Order will accompany Engineer’s evaluation and acceptance of Contractor’s proposed substitute.
 2. Rejected: Submittal returned to Contractor with a commentary by Engineer.

1.08 EQUIPMENT, MATERIALS AND SERVICES TO BE FURNISHED BY THE OWNER

- A. Certain equipment, materials and services may be furnished by the Owner for installation and/or utilization by the Contractor if indicated on the Drawings or in these Specifications. The Contractor is to be responsible for unloading the equipment and materials furnished by the Owner and for installation of same as described hereinafter.
- B. The Owner and Contractor shall inspect equipment and materials prior to unloading to ascertain that no damage has occurred in shipment. The Contractor shall then assume responsibility for unloading, storing and installation of the materials and equipment and any damage to the materials or equipment during these operations shall be properly repaired at the Contractor’s expense.

1.09 ADDITIONAL MATERIAL AND/OR EQUIPMENT

- A. Because of the small scale of the Drawings, all offsets, valves, fittings and accessories that may be required may not be shown. The Contractor shall carefully investigate the structural and finish conditions affecting his work and shall arrange his work accordingly, furnishing such fittings, valves, transitions, pull or junction boxes, and accessories as may be required to meet such conditions, at no additional cost to the Owner.

1.10 SINGULAR NUMBER

- A. Where material, a device, or part of the equipment is referred to in the singular number, it is intended that such reference shall apply to as many items of material, devices or parts of the equipment as are required to complete the installation.

1.11 EQUIPMENT UNIFORMITY

- A. All pumps, blowers, valves and other multiple-unit equipment shall be, to the greatest extent possible within its category, the product of a single manufacturer.

1.12 SPARE PARTS, SPECIAL TOOLS AND LUBRICANTS

- A. Spare parts, special tools and lubricants shall be provided as specified in the various section of the Specifications. Lists of spare parts furnished and tools shall be included in the Operation and Maintenance Manuals.
- B. Special tools required for the normal maintenance of each piece of equipment shall be provided and shall be identified with the tool number corresponding to the number in the Operation and Maintenance Manuals. Special tools are those not normally available in an industrial hardware or mill supply house.
- C. The Contractor shall provide the Engineer a consolidated list of all spare parts, special tools and lubricants furnished.
- D. The Contractor shall deliver spare parts, special tools and lubricants to the site for inventory by the Engineer and shall place them in storage areas designated by the Engineer and Owner. The manufacturer shall prepare all items for storage including necessary packaging and shall clearly label the unit for which the items are intended, using the equipment nomenclature employed in the Contract. The manufacturer shall provide any special instructions in writing necessary for the proper care of spare parts in storage.
- E. Should the spare parts, special tools and lubricants be stored at the site in a temporary location, the Contractor shall provide the necessary labor and equipment to remove and relocate the items into permanent structures at the site when directed by the Engineer.

1.13 NAMEPLATES

- A. All component parts of each item of mechanical equipment or device shall bear the manufacturer's corrosion-proof nameplate, giving name of manufacturer, description, size, type, serial number, model number, electrical characteristics, and other data to facilitate maintenance or replacement. The nameplate of a subcontractor or distributor will not be acceptable. In addition to the manufacturer's nameplate, all mechanical and electrical equipment, including such equipment as air ventilating units, heating units, fans, pumps, compressors and tanks, electrical panelboards and motor control centers,

shall be permanently identified by name/or number corresponding to the Drawings. Motors shall be identified by the same name and/or number as the driven unit. Nameplates shall be of plastic or engraved laminated phenolic with characters at least 1/4 inch high.

1.14 TESTS AND INSPECTIONS

- A. Notice of Defects: Prompt notice of all defective Work of which Owner or Engineer have actual knowledge will be given to Contractor. Defective Work may be rejected, corrected or accepted.
- B. Rejecting Defective Work: Engineer will have authority to disapprove or reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed or completed.
- C. Access to Work: Owner, Engineer, other representatives and personnel of Owner, independent testing laboratories and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's site safety procedures and programs so that they may comply therewith as applicable.
- D. Tests and Inspections:
 - 1. Contractor is responsible for the initial and subsequent inspections of Contractor's Work to ensure that the Work conforms with the Contract Documents. Contractor shall give Engineer timely notice of readiness of the Work for all non-Contractor required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
 - 2. Owner shall employ and pay for the services of an independent testing laboratory to perform all non-Contractor inspections, tests, or approvals required by the Contract Documents, except for inspections, tests or approvals covered by paragraph 3 below. The Owner shall employ the services of an independent firm to perform all Special Inspections identified in Section 01453 – Special Inspections.
 - 3. 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. Contractor shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

4. 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, it must, if requested by Engineer, be uncovered for observation.
5. Uncovering Work shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

E. Uncovering Work:

1. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
2. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, 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, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, Contractor shall pay all claims, costs, losses and damages caused by, arising out of or resulting from 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 Owner may be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefor. If, however, such 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 Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefor.

- F. Owner May Stop the Work: If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, 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 or any surety or other party.

- G. Correction or Removal of Defective Work: If required by Engineer, Contractor shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

PART 2 – PRODUCTS

2.01 GENERAL

- A. Provide manufacturer's standard materials suitable for service conditions unless otherwise specified in the individual Specifications.
- B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.
- C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, and manufacturer's services and implement same or similar process instrumentation and control functions in same or similar manner.
- D. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
- E. Provide interchangeable components of the same manufacturer, for similar components, unless otherwise specified.
- F. Equipment, Components, Systems, Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.
- G. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.
- H. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

- I. Provide materials and equipment listed by UL wherever standards have been established by that agency.
- J. Equipment Finish:
 - 1. Provide manufacturer's standard finish and color, except where specific finish and color is indicated.
 - 2. If manufacturer has no standard color, provide equipment with ANSI No. 61, light gray color.
- K. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, hand wheels, chain operators, special tools, and other spare parts as required for maintenance.
- L. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

2.02 FABRICATION AND MANUFACTURE

A. General:

Manufacture parts to U.S.A. standard sizes and gauges.

- 1. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
- 2. Design structural members for anticipated shock and vibratory loads.
- 3. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
- 4. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

- 1. Require no more than weekly attention during continuous operation.
- 2. Convenient and accessible. Oil drains with bronze or stainless steel valves and fill plugs easily accessible from the normal operating area or platform. Locate drains

to allow convenient collection of oil during oil changes without removing equipment from its installed position.

3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

- A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.
- B. Calibration Instruments: Bear the seal of a reputable laboratory certifying that instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).
- C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.02 INSTALLATION

- A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.
- B. No shimming between machined surfaces is allowed.
- C. Install Work in accordance with NECA Standard of Installation, unless otherwise specified.
- D. Repaint painted surfaces that are damaged prior to equipment acceptance.
- E. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions and as may be specified. Retain a copy of manufacturers' instruction at site, available for review at all times.

- F. For material and equipment specifically indicated or specified to be reused in the Work:
 - 1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
 - 2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.03 FIELD FINISHING

- A. In accordance with Section 09960, High Performance Coatings.

3.04 ADJUSTMENT AND CLEANING

- A. Perform required adjustments, tests, operation checks, and other startup activities for all material provided on this project.

3.05 LUBRICANTS

- A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

END OF SECTION

SECTION 01640
MANUFACTURER'S SERVICES

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Reference Section 01650 – Facility Start-Up.
- B. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

- A. Training Plan: Submit within 120 days after Notice to Proceed. The Training Plan shall include both equipment and software (telemetry and SCADA).
- B. Training Schedule: Submit not less than 60 days prior to start of equipment installation and revise as necessary for acceptance.
- C. Training Sessions: Training sessions shall be scheduled such that all training is complete prior to start-up of the facility. Training sessions should be completed at least 14 days prior to final start-up. Final payment shall not be made until all training is complete.
- D. Training Materials:
 - 1. Submit written outlines of proposed training sessions not less than 60 days prior to scheduled training.
 - 2. Furnish complete training materials, to include operation and maintenance data as required in this section to be retained by each trainee.
- E. Quality Control Submittals: When specified in the individual Specifications, submit:
 - 1. Qualifications of Manufacturer's Representative performing specified services.
 - 2. Manufacturer's Certificate of Proper Installation: On form appended to this section.
 - 3. Coordinate with BRWA Master Specification Section 01 33 00 – Submittals

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system. Additional qualifications may be specified elsewhere.
- B. Representative subject to acceptance by Engineer. No substitute representatives will be allowed unless prior written approval by Engineer has been given.

1.04 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

- A. Where manufacturers' services are specified, furnish manufacturer's qualified representative. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, additional time required to perform the specified services shall be considered incidental work.
- B. Schedule manufacturer's services to avoid conflicting with other onsite testing or other manufacturer's onsite services.
- C. Determine that all conditions necessary to allow successful testing have been met before scheduling services.
- D. Only those days of service approved by Engineer will be credited to fulfill the specified minimum services.
- E. If specified, manufacturer's onsite services shall include as a minimum:
 - 1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
 - 2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish written approval of installation.
 - 3. Revisiting the site as required to correct problems and until installation and operation are acceptable to Engineer.
 - 4. Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.
 - 5. Assistance during functional and performance testing and startup demonstration, and until product acceptance by the Owner.

6. Training of Owner's personnel in the operation and maintenance of respective product as required.
7. Completion of Manufacturer's Certificate of Proper Installation (form enclosed at end of this section) with applicable certificates for proper installation and initial, interim, and final test or service.
8. Maintenance requirements for all supplied equipment shall be provided by the Contractor per the manufacturer's recommendations until equipment is accepted by the Owner.
9. Additional requirements may be specified elsewhere.

1.05 TRAINING REQUIREMENTS

- A. The Contractor shall provide Owner personnel with training on the following:

1. Controls
2. SCADA
3. Other Equipment as Determined by the Owner

1.06 TRAINING SCHEDULE

- A. List specified equipment and systems with respective manufacturers that require training services of manufacturers' representatives and show:
1. Estimated dates for installation completion.
 2. Estimated training dates to allow for multiple sessions when several shifts are involved.
- B. Adjust training schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
- C. Coordinate with Section 01315 – CPM Schedules and Reports and Section 01650 - Facility Start-Up.

1.07 TRAINING PLAN

- A. Training Plan: Submit for each proposed course:
1. Title and objectives.

2. Training schedule.
3. Prerequisite training and experience of attendees.
4. Recommended attendees.
5. Course description and outline of course content.
6. Duration.
7. Format (e.g., lecture, self-study, demonstration, hands-on).
8. Instruction materials and equipment requirements.
9. Schedule of training courses including dates, durations, and locations of each class.
10. Detailed course schedule for each day showing time allocated to each topic.
11. Resumes of instructors providing the training.

1.08 TRAINING OWNER'S PERSONNEL

- A. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information.
- B. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, and component) and as may be required in applicable Specifications.
- C. Manufacturer's Representative: Familiar with plant operation and maintenance requirements as well as with specified equipment.
- D. Pre-Startup Training:
 1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives, and with submission of operation and maintenance manuals.
 2. Complete at least 14 days prior to actual startup.
- E. Post-Startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

1.09 SUPPLEMENTS

- A. The supplements listed below, following "END OF SECTION," are part of this Specification.
- B. Forms: Manufacturer's Certificate of Proper Installation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

Owner _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- ☐ Installed in accordance with Manufacturer's recommendations.
- ☐ Inspected, checked, and adjusted.
- ☐ Serviced with proper initial lubricants.
- ☐ Electrical and mechanical connections meet quality and safety standards.
- ☐ All applicable safety equipment has been properly installed.
- ☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Comments: _____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment and (iii) authorized to make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20

Manufacturer: _____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01650

FACILITY START-UP

PART 1 - GENERAL

1.01 DEFINITIONS

- A. Reference Section 01640 – Manufacturer’s Services.
- B. Functional Test: A test or tests in the presence of the Engineer to demonstrate that the installed equipment or systems meets manufacturer’s installation and adjustment requirements and other requirements specified including, but not limited to: noise, vibration, alignment, proper electrical and mechanical connections, thrust restraint, and initial servicing.
- C. Performance Test: A test performed in the presence of the Engineer and after any required functional test specified, to demonstrate and confirm that the equipment and/or systems meet the specified performance requirements.
- D. Start-Up Test Period: A period of time as defined here-in where the facility has been successfully started up, is fully functional and is in continuous operation.
- E. System: The overall process, or a portion thereof, that performs a specific function. A system may consist of two or more subsystems as well as two or more types of equipment.
- F. Substantial Completion: The stage in the progress of the Work where the Work, is sufficiently complete, in accordance with the Contract Documents, and the Owner can occupy or utilize the Work for its intended use.

1.02 SUBMITTALS

- A. Administrative Submittals:
 - 1. Plan functional and performance test schedules for equipment, units, and systems at least 14 days prior to start of related testing. Include test plan, procedures, and log format.
- B. Schedule and plan facility start-up activities at least 30 days prior to commencement. Submit separate start-up plans for multiple systems if present.
- C. Quality Control Submittals:
 - 1. Manufacturer’s Certificate of Proper Installation as required.

2. Test Reports: Functional and performance testing, in format acceptable to Engineer and certification of functional and performance test for each piece of equipment or system specified.
3. Certifications of Calibration: Testing equipment.

1.03 CONTRACTOR FACILITY STARTUP RESPONSIBILITIES

A. General:

1. Perform Work for tests specified.
2. Demonstrate proper installation, adjustment, function, performance, and operation of equipment, systems, control devices, and required interfaces individually and in conjunction with process instrumentation and control system.
3. Demonstrate the essential features of all systems as they apply to the Work.
4. Each system shall be demonstrated only after satisfactory completion of testing.
5. Provide water, power, chemicals, and other items as required for testing, unless otherwise indicated.

1.04 OWNER/ENGINEER FACILITY STARTUP RESPONSIBILITIES

A. General:

1. Review Contractor's test plan and schedule.
2. Witness each functional or performance test.
3. Coordinate other plant operations, if necessary, to facilitate Contractor's tests.

B. Startup Test Period:

1. Witness operation of units and devices, with support of Contractor.
2. Provide sampling, labor, and materials as required and provide laboratory analyses.

1.05 OPERATIONAL ACCEPTANCE TESTS

- ##### A.
- The Contractor shall make a request in writing to the Engineer at least ten days in advance of starting an operational acceptance test of the major mechanical and electrical equipment. Such tests shall be conducted with qualified representatives of the equipment manufacturer present. All pertinent operation and maintenance manuals must be in receipt of the Engineer prior to any operational acceptance tests.

1.06 DEMONSTRATION

A. Date-Time

1. A demonstration shall be held upon completion of all systems at a date and time to be agreed upon in writing by the Owner or his representative.

B. Attending Parties

1. The demonstration shall be held by the Contractor in the presence of the Owner and the Engineer, and the manufacturer's representative (if applicable).

C. Certificate of Completed Demonstration

1. Submit five (5) copies of Certificate of Completed Demonstration memo signed by the Contractor, Subcontractor and Owner and insert one copy in each Operation and Maintenance Manual.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. General:

1. Complete Work associated with the unit and related processes before testing, including related manufacturer's representative services.
2. Prior to system start-up, successfully complete all testing required of the individual components of the work.
3. Furnish qualified manufacturer's representatives when required to assist in testing.
4. Utilize the Manufacturer's Certificate of Proper Installation Form from Section 01640 – Manufacturer's Services, supplemented as necessary, to document functional and performance procedures, results, problems, and conclusions.
5. Schedule and attend pretest (functional and performance) meetings related to test schedule, plan of test, materials, chemicals, and liquids required, facilities' operations interface, Engineer and Owner involvement.
6. Designate and furnish one or more persons to be responsible for coordinating and expediting Contractor's facility startup duties. The person or persons shall be

present during facility startup meetings and shall be available at all times during the facility startup period.

7. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required to conduct testing.

B. Cleaning and Checking: Prior to starting functional testing:

1. Calibrate testing equipment for accurate results.
2. Inspect and clean equipment, devices, connected piping, and structures so they are free of foreign material.
3. Lubricate equipment in accordance with manufacturer's instructions.
4. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.
5. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
6. Check power supply to electric-powered equipment for correct voltage.
7. Adjust clearances and torques.
8. Test piping for leaks.
9. Demonstrate to the Engineer that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their controls as designated.
10. Obtain completion of applicable portions of Manufacturer's Certificate of Proper Installation in accordance with Section 01640 – Manufacturer's Services.

C. Ready-to-test determination will be by Engineer based at least on the following:

1. Notification by Contractor of equipment and system readiness for testing.
2. Acceptable testing plan.
3. Acceptable Operation and Maintenance Manuals.
4. Receipt of Manufacturer's Certificate of Proper Installation, if specified.
5. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.

6. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment, and satisfactory fulfillment of other specified manufacturers' responsibilities.
7. Equipment and electrical tagging complete.
8. All spare parts and special tools delivered to Owner.

3.02 FUNCTIONAL TESTING—GENERAL

- A. Begin testing at a time mutually agreed upon by the Owner, Engineer, and Contractor. Coordinate start up activities with the Owner's operating personnel and with the Engineer prior to commencing system start-up.
- B. Engineer will be present during test. Notify in writing Owner, Engineer, and manufacturer's representative(s) at least 10 days prior to scheduled date of functional tests.
- C. Separate items of equipment demonstrated to function properly during subsystem testing may require no further functional test if documentation of subsystem testing is acceptable to Engineer.
- D. Conduct functional tests as specified for each equipment item or system or subsystem.
- E. Demonstrate all operational features and instrumentation and control functions.
- F. If, in Engineer's opinion, functional test results do not meet requirements specified, the systems will be considered as nonconforming.
- G. Performance testing shall not commence until the equipment or system meets the specified functional tests.

3.03 PERFORMANCE TEST—GENERAL

- A. Begin testing at a time mutually agreed upon by the Owner, Engineer, and Contractor.
- B. Engineer will be present during test. Notify in writing Owner, Engineer, and manufacturer's representative(s) at least 14 days prior to scheduled date of functional tests.
- C. Conduct performance tests as specified for each equipment item or system or subsystem.
- D. Unless otherwise indicated, furnish all labor, materials, and supplies for conducting the test and taking all samples and performance measurements.

- E. Prepare performance test report summarizing test method. Include test logs, pertinent calculations, and Contractor's written certification that the equipment or system performs as specified.

3.04 START-UP TEST PERIOD

A. General:

1. Attend planning meetings and arrange for attendance by key major equipment manufacturer representatives as required by the Contract Documents.
2. Designate one or more persons on the Contractor's staff, other than the field superintendent, to be responsible for coordinating and expediting Contractor's facility startup duties.
3. When facility start-up has commenced, schedule remaining Work so as not to interfere with or delay the completion of facility startup.
4. Support facility start-up activities with adequate staff to prevent delays. Such staff shall include, but not be limited to, major equipment and system manufacturer's representatives, electricians, instrumentation and control personnel, millwrights, pipe fitters, and plumbers.
5. Furnish and coordinate specified manufacturer's facility start-up services.
6. After the facility is operating, complete the testing of those items of equipment, systems, and subsystems which could not or were not successfully tested prior to the start-up test period.

B. Start-Up Testing:

1. Start-up of the entire facility, or any portion thereof, requires the coordinated operation of the facilities by the Contractor, subcontractors, Owner's operating personnel, and manufacturer's representatives.
2. Startup test period shall occur after all required functional tests have been completed and those performance tests deemed necessary for the safe operation of the entire facility have been completed.
3. Start-Up of the entire facility, or any portion thereof, shall be considered complete when, in the opinion of the Owner and Engineer, the facility, or designated portion thereof, has operated in the manner intended for 14 continuous days without Significant Interruption. This includes all controls and SCADA. This period is in addition to any training, functional, or performance test periods specified elsewhere.

4. Significant Interruption shall be defined as any of the following events:
 - a. Failure of the Contractor to maintain qualified Start-Up personnel on-site as scheduled.
 - b. Failure of the facilities to meet specified performance for more than 2 consecutive hours.
 - c. Failure of any critical equipment, system, or subsystem that is not satisfactorily corrected within 2 hours after failure.
 - d. Failure of any non-critical equipment, system, or subsystem that is not satisfactorily corrected within 4 hours after failure.
 - e. A major unforeseen event as determined by the Owner or Engineer.
 5. A Significant Interruption will require the Start-Up Testing, then in progress, to be stopped and restarted after corrections are made.
- C. Start-Up Test Reports: As applicable to the equipment furnished, certify in writing that:
1. Hydraulic structures, piping systems, and valves have been successfully tested.
 2. Equipment systems and subsystems have been checked for proper installation, started, and successfully tested to indicate that they are operational.
 3. Systems and subsystems are capable of performing their intended functions, including fully automatic.
 4. Facilities are ready for intended operation.

3.05 SUBSTANTIAL COMPLETION

- A. The Contractor shall maintain all equipment placed into operation for beneficial use of the Owner until completion of the entire project.
- B. The Contractor be responsible for all power costs during construction, testing and trial operation prior to issuance of Substantial Completion of the Work by the Owner as stipulated by the Engineer.

END OF SECTION

CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

Note to Contractor: Do not submit this form at the time Operation and Maintenance Manual is submitted. Submit five copies of all information listed below for checking at least one week before scheduled completion of Work. After information has been approved and inserted in each brochure, give the Owner a demonstration of completed mechanical systems and have him sign five copies of this form. Provide one signed copy for each brochure. After this has been done, a written request for a final inspection of the system shall be made.

RE:

(Name of Project)

(Division Number and Name)

This memo is for the information of all concerned that the Owner has been given a Demonstration of Completed System on the work covered under this Division. This demonstration consisted of the system operation, a tour on which all major items of equipment were pointed out, and the following items were given to the Owner:

- (a) Owner's copy of Operation and Maintenance Manual containing approved submittals on all items, including the following: (To be inserted in the Operation and Maintenance Manual after the correct tab).
 - (1) Maintenance Information published by manufacturer on equipment items.
 - (2) Printed Warranties by manufacturers on equipment items.
 - (3) Performance verification information as recorded by the Contractor.
 - (4) Manufacturer's Certificate.
 - (5) Written operating instructions on any specialized items.
 - (6) Explanation of guarantees and warranties on the system.
 - (7) Approved shop drawings.
- (b) Prints showing actual "As-Built" conditions.
- (c) A demonstration of the System in Operation and of the maintenance procedures which will be required.

(Name of General Contractor)

By:

(Authorized Signature, Title & Date)

(Name of Subcontractor)

By:

(Authorized Signature, Title & Date)

Operations and Maintenance Manual, Instruction Prints, Demonstration and Instruction in
Operation Received:

(Name of Owner)

By:

(Authorized Signature, Title & Date)

cc: Owner, Engineer, Contractor, Subcontractor, and General Contractor

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. CONTRACTOR shall maintain at the site one record copy of:

1. Drawings.
2. Project Manual.
3. Addenda.
4. Change orders and other modifications to Contract.
5. Field orders, written instructions, or clarifications.
6. Approved submittals.
7. Field test records.
8. Construction photographs.
9. Associated permits.
10. Certificates of inspection and approvals.
11. Building Permits

1.02 SUBMITTALS

A. Operation and Maintenance Manuals for Equipment and Products

1. The Contractor shall furnish Operation and Maintenance Manuals for all products and equipment provided under this Contract. See BRWA Master Specification Section 01 33 00 – Submittal Procedures for requirements.

B. At Substantial Completion:

1. Deliver one marked up set of record documents to Engineer. The record documents shall consist of: "Red Line" record drawings and "Red Line" specifications.

C. Accompany submittals with transmittal letter containing following.

1. Date.
2. Project title and number.
3. CONTRACTOR'S name and address.
4. Title of record document.
5. Signature of CONTRACTOR or authorized representative.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples on-site apart from documents used for construction.
1. Provide files and racks for storage of documents.
 2. Provide secure storage space for storage of samples.
- B. Maintain documents in clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- C. Make documents and samples available for inspection by Engineer or Owner.
- D. Failure to properly maintain record documents may be reason to delay a portion of progress payments until records comply with Contract Documents.

3.02 RECORD DOCUMENTS

- A. Label each document "PROJECT RECORD" in neat, large printed letters.
- B. Maintain a record set of "Red Line" Record Drawings and Specifications legibly annotated to show all changes made during construction.

1. Graphically depict changes by modifying or adding to plans, details, sections, elevations, or schedules.
 2. Make changes on each sheet affected by changes.
- C. Record information concurrently with construction progress.
1. Do not conceal Work until required information is recorded.
 2. Record changes made by Written Amendment, Field Order, Change Order or Work Directive Change.
- D. Information to be recorded on Record Drawings:
1. Depths of various elements of foundation in relation to finish first floor datum.
 2. Record top of pipe and finished ground surface elevations at least every 50 feet along the center line of installed pipelines.
 3. Record horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 4. Record location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 5. Record field changes.
 6. Provide details not on original Drawings.
 7. Record location and identification of exposed interior piping, including those shown schematically on Drawings.
 8. Record size of equipment and location including connections.
 9. Record the coordinates of all fittings and valves installed. Coordinates shall be tied to the Virginia State Grid System.
- E. Specifications:
1. Mark Specification sections: to show substantial variations in actual Work performed in comparison with test of Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

2. Note related record drawing information and Product Data.

F. Electrical and Instrumentation:

1. Record location and identification of exposed interior conduit, including those shown schematically on Drawings.
2. Record size of panels and locations.
3. Record field changes.
4. Provide hard color copies of final graphic display screens that have been modified to include the new site(s) or structure(s).
5. Provide copies of final revised program for the central monitoring/control station HMI (Human Machine Interface) computer that is used for graphic display and operator interface. Include complete, detailed documentation for all modifications made to the existing factory program. Provide (2) electronic copies of the program on individual electronic media, and one printed copy of documentation. Provide one printed copy of the program at the request of the Owner.
6. Provide copies of final revised SCADA program used for polling and interfacing with remote sites. Include complete, detailed documentation for all modifications made to existing program. Provide (2) electronic copies of the program on individual electronic media, and one printed copy of documentation. Provide one printed copy of the program at the request of the Owner.
7. Provide copies of the system integration drawings in the O&M Manuals. Also provide a disc or transfer electronically the AutoCAD .dwg files of the system integration drawings.

G. Indication of Changes:

1. All changes shall be annotated in the color red.
2. Annotations to delete or remove items shall be identified in the color blue.
3. Comments to the work or instructions to the work and not to be translated to the final shall be annotated in the color green.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work included in this section includes compiling specified warranties and bonds, reviewing submittals to verify compliance with the Contract Documents, submitting warranties and bonds to the Engineer for review and transferring said warranties and bonds to the Owner as required in the General Conditions and as specified herein.

1.02 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors in an appropriate sized three ring binders.
- B. Provide two (2) signed original copies of each document.
- C. Provide a Table of Contents, neatly typed and in proper sequence listing contents of binder. Provide complete information for each document including:
 - 1. Product or work Item covered.
 - 2. Name of Firm that supplied or manufactured product, with name of principal, address and telephone number.
 - 3. Scope.
 - 4. Date of beginning of warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond or service and maintenance contract.
 - 6. Ending date of warranty, bond or service and maintenance contract.
 - 7. Provide information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect validity of warranty or bond.
 - 8. Contractor and Subcontractors name, street address and telephone number of responsible principal.

1.03 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8 ½ inches x 11 inches, punched for standard three ring binder.
 - 2. Fold larger size sheets to proper size and provide clear plastic sleeves for insertion into binder
 - 3. Cover: Identify each binder with a typed or printed title "WARRANTIES AND BONDS". Include on cover the title of the project, name of Owner and name of Contractor.
- C. Binders shall be commercial grade, three ring binders with durable and cleanable plastic covers. The maximum binder width shall be 2 inches.

1.04 WARRANTY SUBMITAL REQUIREMENTS

- A. For all major pieces of equipment, except those listed below, submit a warranty from the equipment manufacturer. The manufacturer's warranty period shall be concurrent with the Contractor's for one (1) year, unless otherwise specified, commencing at the time of Final Completion.
- B. Contractor shall be responsible for obtaining certificates for equipment warranties for all equipment specified under any division that lists for more than \$1000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not classified as "major" in the Contractor's one year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a one year warranty commencing at the time of Final Completion, the Contractor shall obtain for the manufacturer a two (2) year warranty commencing at the time of delivery to the job site. The two year warranty from the manufacturer shall not relieve the Contractor of the one year warranty starting at the time of substantial completion as described in the general and supplementary conditions of the contract documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 02200

DEMOLITION OF CONCRETE TANK WITH STEEL ROOF

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section covers the demolition of the existing Helm Street Ground Water Storage Tank (Round Tank), and associated site improvements.
- B. The Contractor shall provide all labor, materials, equipment, and incidentals specified or required for demolition, removal, and disposal work.

1.2 DEFINITIONS

- A. Reclaimed/Recycled Concrete (RC): Rubbilized or crushed concrete no larger than 6 inches in diameter not containing reinforcing steel or other debris.
- B. Lead Based Paint: is paint containing lead with 600 parts per million (ppm) (0.06% lead by weight) or greater concentration. The existing paint on the tank has been laboratory tested and results are summarized below. See Reports and Drawings Known to Owner, Helm Street Tank Site, Bedford VA, for full laboratory reports.

Collection Location	% Pb by Wt.
Tank Roof 1 Exterior	1.8
Tank Roof 2 Exterior	1.5
Tank Roof 1 Interior	<0.0049
Tank Roof 2 Interior	0.13
Tank Concrete Coating 1	0.0092
Tank Concrete Coating 2	0.030
Helm-1 (Tank Wall Composite Sample)	ND
Helm-2 (Tank Wall Composite Sample)	ND

- C. Hazardous Waste: is spent abrasive with lead based paint debris if, after testing by Toxicity Characteristic Leaching Procedure (TCLP), the leachate from the debris contains any of the elements or metals following in concentrations equal to or greater than those listed:

1.	Barium	100 ppm
2.	Cadmium	1 ppm
3.	Chromium	5 ppm
4.	Lead	5 ppm
5.	Mercury	0.2 ppm

6. Other metals that can cause a paint to be classified as hazardous are defined in 40 CFR 261 and shall be taken into consideration.
- D. Generator: For the purpose of hazardous waste generation, the term "Generator" shall refer to both the Owner of a structure and to the Abatement Contractor.
- E. Non-hazardous Waste Stabilization: These are materials designed, produced and tested to minimize leachable lead levels in spent abrasive residues produced in the removal of lead based paints by using chemical stabilization and fixation. The chemical stabilization and fixation thereby render the spent residue non-hazardous per TCLP testing.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. All recycled or rehandled concrete material furnished or supplied for use on the project shall be tested and certified to be in conformance with all applicable environmental and EPA requirements. The required testing will include, but not be limited to, the EPA Toxicity Characteristic Leaching Procedure (TCLP) or its successor. The evaluation and interpretation of the test data will be made by the Engineer and be based upon the project environment. Testing and certification shall be at no additional cost to the Owner. This does not preclude the normal materials process, and the recycled material shall conform to all applicable specifications. For any EPA regulation governing the use of that material, certified testing results and material safety data sheets shall accompany the source of supply letter and sample for approval.

1.4 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 1 specification sections apply to this Section.
- B. Regulations and Reference Standards
 1. Code of Federal Regulations (CFR)
 - a. 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response
 - b. 29 CFR Part 1910.134 – Respiratory Protection
 - c. 29 CFR Part 1910.146 – Confined Space Entry Program
 - d. 29 CFR Part 1910.1025 – Lead
 - e. 29 CFR Part 1910.1200 – Hazard Communication
 - f. 29 CFR Part 1926.55 – Gases, Vapors, Fumes, Dusts and Mists
 - g. 29 CFR Part 1926.57 – Ventilation
 - h. 29 CFR Part 1926.62 – Lead (Construction Industry Standard)
 - i. 40 CFR Part 260 – Hazardous Waste Management Systems: General
 - j. 40 CFR Part 261 – Identification and Listing of Hazardous Waste
 - k. 40 CFR Part 262 – Generators of Hazardous Waste

- l. 40 CFR Part 263 – Transporters of Hazardous Waste
 - m. 40 CFR Part 264 – Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
 - n. 40 CFR Part 265 – Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
 - o. 49 CFR Part 170-178 – Department of Transportation Regulations
 - p. 40 CFR Part 268 – Land Disposal Restrictions
- 2. Steel Structures Painting Council (SSPC)
 - a. SSPC-Guide 6 – Guide for Containing Debris Generated During Paint Removal Operations
 - b. SSPC-Guide 7 – Guide for the Disposal of Lead-Contaminated Surface Preparation Debris
- 3. Standards: Comply with ANSI A10.6 and NFPA 241.
- 4. National Fire Protection Association (NSPA)
 - a. NFPA 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations

1.5 SUBMITTALS

- A. General: Shall be in accordance with BRWA Master Specifications Section 01 33 00 – Submittal Procedures.
- B. The Contractor shall submit a demolition plan and sequence of construction at least three weeks prior to the scheduled start of demolition activity. The schedule shall be updated weekly during demolition. The plan shall indicate the final disposal location of the tank concrete, tank steel, pipe, and appurtenances.
- C. Submit qualification of Contractor and individuals performing the demolition work.
- D. All documentation and submittals required for the demolition of lead-based paint coated materials.
- E. An Air Monitoring Program including the number, location and frequency of sampling.
- F. A Soil Sample Plan to verify levels at the completion of demolition activity and that all debris has been removed from the site of the work. The plan will document pre and post-job sample locations, methods of testing, and the qualifications of the independent laboratory that will perform the soil analyses. In addition, the Owner, Engineer or Owner's Representative must be present during the soil sample collection.
- G. The name of the Certified Industrial Hygienist, certified to perform lead-testing services, that will monitor air quality inside and outside of the containment area during the demolition operations.
- H. A copy of the bill of lading for each load of steel leaving the site.

- I. A copy of the manifest for any hazardous waste leaving the site.
- J. Submit a certificate for each worker and supervisor, signed and dated by the training provider stating that the employee has received the required lead training specified in 29 CFR 1926.62(1).
- K. Proposed Plan for transportation and disposal of lead-based paint. The plan shall include names and permits for transporters, storage and disposal facilities. In addition, the plan shall include procedures, location and security measures for storage of waste, including temporary on-site storage, written acknowledgement from disposal facility stating awareness of lead containing materials and acceptance all of materials for disposal. The plan shall be in accordance with these Contract Documents and all applicable regulations. In the event of a discrepancy between these Contract Documents and existing regulations, the more stringent requirement shall apply.
- L. Confined space entry program 29 CFR 1910.146.
- M. Health and Safety Plan 29 CFR Part 1910.120.
- N. Recycled Concrete Quality Control Plan: The producer shall submit to the Engineer a Quality Control Plan for approval prior to production. The plan shall include but not be limited to the operational techniques and procedures performed to produce the RC product. Quality control includes the sampling and testing performed to validate the quality of the product and daily testing of pH during production operations. Recycled Concrete Quality Assurance: The Engineer will perform Quality assurance by visual inspection, sampling, and testing at the point of processing/reclamation. Additional visual inspection and compaction control of the processed material will be performed at the project by the Engineer. RC shall not be than larger than 6 inches in diameter or contain reinforcing steel or other debris. Once material is approved and accepted at the processing/reclamation location, the material shall be considered a captive stockpile, no additional material shall be added without retesting and reapproval of the stockpile.
- O. Recycled Concrete Producer Firm Qualifications: Document that the firm has specialized in demolition work similar in material and extent to that indicated for this Project.

1.6 DESCRIPTION OF WORK

- A. Demolition of the existing round concrete tank, painted steel roof, related structures, piping, and valves.
- B. The Work includes demolition of structural concrete, foundations, structural steel, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, fencing, and similar existing facilities. Structures to be removed or abandoned, include but are not limited to: tank, altitude valve vault, pipe cutting, pipe capping and perimeter fencing.
- C. Provide an orderly sequence of demolition and removal to ensure the uninterrupted progress of operations.
- D. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition.
- E. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- F. Pre-Recycled Concrete Conference: Conduct conference at Project site to review methods and procedures related to, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be recycled.
 - 2. Review waste debris not to be recycled.

1.7 EXISTING TANK

- A. Contractor shall familiarize themselves with the existing tank site and tank to determine the overall dimensions of the concrete tank and details of the roof framing.
- B. The existing paint on the inside and outside of the metal roof and the concrete coating on the tank have been tested for lead. The coatings on the metal roof, interior and exterior, have been determined to contain lead. See Reports and Drawings Known to Owner, Helm Street Tank Site, Bedford VA for the results of the lead paint testing.

1.8 JOB CONDITIONS

- A. Conditions:
 - 1. The Contractor shall visit the site and carefully and thoroughly inspect all existing facilities and take into account, in the preparation of his bid, all conditions that may affect his work. The Contractor shall satisfy himself as to the limits of removal, replacement or modification of the existing facilities required to complete the Work as indicated on the Plans and as specified regardless of whether such limits are specifically indicated or specified. Failure to do so will in no way relieve the Contractor of the responsibility of furnishing all labor and materials required.

2. Conditions of Site Improvements: The Owner assumes no responsibility for the actual condition of site improvements to be demolished.
 3. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner in so far as practicable.
- B. Damage: Promptly repair damage caused to adjacent facilities and/or property by demolition operations to the satisfaction of the Owner. Contractor is responsible for coordination with and protection of adjacent properties and shall exercise care.
 - C. The tank wall composite samples resulted in non-detection for lead. See Reports and Drawings Known to Owner Helm Street Tank Site, Bedford VA for the results of the composite samples.
 - D. Demolition working hours on the existing tank site to be conducted in accordance with the general and supplemental conditions.
 - E. All valves shall be opened or closed by BRWA staff as needed.
 - F. Contractor shall maintain a neat work site during demolition operations.

1.9 PERMITS/APPROVALS

- A. Comply with applicable requirements of the Town of Bedford, Bedford County, the Virginia Department of Health, the Virginia Department of Environmental Quality and other local, state and federal agencies having jurisdiction.
- B. Haul Routes shall be submitted to the Owner for review before hauling of any materials.

1.10 LEGAL REMOVAL, REUSE, OR RECLAMATION OF STEEL WITH LEAD-CONTAINING PAINT:

- A. The Contractor shall legally remove the steel (including the lead-containing paints on the steel) from the site and reclaim or reuse the steel in accordance with all Federal, State and Local laws including, but not limited to RCRA, Toxic Substance Control Act (TSCA), Hazardous Materials Transportation Act (HMTA), United States Environmental Protection Agency (USEPA) and Virginia Department of Health, Solid & Hazardous Waste Management Division (VDH) regulations. The steel shall not be disposed of as waste.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Reclaimed/Recycled Concrete (RC):
 - 1. RC shall not be used as aggregate for the following:
 - a. Tank Foundation
 - b. Against any metal pipe
 - c. Near Wetlands areas
 - d. Embankment Construction
 - 1) Within one foot of the top surface of any area that is to be vegetated.
 - 2. RC may be used for the following with the written approval of the Owner:
 - a. Graded Aggregate Base
 - b. Select Borrow
 - c. Capping Borrow
 - d. Modified Borrow
 - 3. RC Requirements:
 - a. RC shall meet the grading requirements when used for Graded Aggregate Base, Select Borrow, Capping Borrow, Modified Borrow, and any application within the pavement structure. RC shall have a pH of 7.0 ± 1.5 for all applications.

PART 3 - EXECUTION

3.1 DEMOLITION, GENERAL

- A. Protection of surrounding areas
 - 1. Perform demolition and removal Work in a manner that prevents damage or injury to property, structures, occupants, the public, and facilities. Do not interfere with the use of, and free and safe access to and from, structures and properties.
 - 2. Provide temporary barriers, lighting, and other necessary protection.
- B. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - 2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by the Owner or governing authorities. Return adjacent areas to condition existing prior to the start of the work.
- C. Explosives: The use of explosives will not be permitted.
- D. Burning: Burning of any demolition debris will not be permitted.

- E. Contractor shall provide temporary fencing around the limits of construction to secure the Work site during all phases of his demolition operations. The existing fencing can be used in conjunction with temporary fencing.
 - 1. Temporary fence shall be 6-foot chain link fencing to provide adequate site security.
- F. Existing Utilities:
 - 1. Water Piping: Before proceeding with demolition, locate and cap all potable and non-potable waterlines serving the tank or structure being demolished.
 - 2. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as gas, electric and communications, serving the building or structure being demolished.
 - 3. Shutdown or relocation of utility services shall be coordinated by the Contractor, assisted by Engineer and Owner as required relative to contacting Utility Owners.
 - 4. Provide caps on ends of remaining piping:
 - a. Where used in this Section, the term “cap” means the appropriate type of closure for the piping or ductwork being closed, including caps, blind flanges and other closures.
 - b. Caps shall be compatible with the piping to which they are attached, fluid-tight, and appropriate for the fluid conveyed in the pipe.
 - c. Unless otherwise shown or indicated, caps shall be mechanically fastened, fused, or welded to pipe or duct.
- G. All material and items removed and not salvaged shall become the property of the Contractor and shall be removed from the site in accordance with these Contract Documents and all applicable regulations.
- H. The Contractor shall perform all work within the boundaries of the limit of disturbance shown in the Contract Documents. The Contractor shall supply and install temporary fencing to enclose the Contractor’s work area. The fence shall remain in place for the duration of the project. The existing fencing can be used in conjunction with temporary fencing.
- I. Prevent soil contamination from compressors, welding machines, etc. (i.e. solvents, oils, organic compounds, and other contaminants) by placing compressors, welding machines, etc. on 2 layers of 6-mil polyethylene. In the event that any of the aforementioned contaminants are spilled on the site, they shall be immediately removed and cleaned up by the Contractor at no additional expense to the Owner.

- J. The job site shall be kept in a clean and safe condition at all times. Hazards shall be protected at all times. Double layers of plastic sheeting (each at least 6 mil thick) shall be placed under the tank, "tank laydown area", and surrounding area to catch paint and other debris which falls from the tank during demolition. Any paint and debris collected on the plastic sheeting shall be cleaned up and stored at least daily in covered leak-proof containers lined with polyethylene and disposed of in accordance with all applicable laws and regulations. Upon completion of the Work, the job site and all nearby sites impacted by the Work activities shall be left clean of all debris, cleaning residue or any other items resulting from the operations of the Contractor. The cost of any cleanup which must be done by the Owner shall be deducted from funds due the Contractor.
- K. It is the Contractor's responsibility to familiarize himself with the potential hazards of the tank demolition job including, but not limited to the following:
 - 1. Lead based paint
 - 2. High wind velocity
 - 3. Potential fires due to sparks from cutting and welding activities
 - 4. Proximity of residences, businesses, overhead power lines, streets and schools
- L. The Contractor shall perform all work in strict accordance with the following regulatory requirements and these Contract Documents. These regulatory requirements are not meant to be a complete listing of all requirements; it is the Contractor's responsibility to familiarize themselves with the following and any additional regulatory requirements that may apply:
 - 1. If, at any time during dismantlement/demolition the Contractor will enter the tank/building interior, the Contractor shall prepare and have available at the site at all times a program describing Confined Space Entry procedures in accordance with 29 CFR Part 1910.146. In addition, the Contractor shall comply with all local, state and federal regulations that may be applicable. In the event that there is a conflict between the regulations and the Confined Space Entry Program, the more stringent requirement shall apply.
 - 2. It shall be the Contractor's responsibility to familiarize themselves with and follow in strict accordance safe working practices for cleaning, burning, welding, handling lead-based and nonlead-based coated steel and all additional health and safety regulations of 29 CFR Part 1926.62. In addition, the Contractor shall comply with all state and local regulatory agencies, Safety Data Sheets (SDS) and the paint and abrasive manufacturers.
 - 3. Medical surveillance shall be implemented by the Contractor in accordance with the requirements of 29 CFR Part 1926.62.

3.2 DEMOLITION OF THE EXISTING PAINTED STEEL ROOF

- A. Contractor shall maintain the following documentation on-site during the demolition activities.
1. A written Compliance Program for lead.
 2. A written Respiratory Protection Program.
 3. Documentation of respirator fit tests for Contractor employees.
 4. A written confined space entry program.
 5. Documentation from a licensed health care professional that indicates that Contractor employees are permitted to wear respirators.
 6. Contractor shall be required to maintain a report on-site during demolition activities that describes the following: start and completion dates; names, addresses, license numbers and signatures of supervisors; names and addresses of licensed firms and laboratories that will conduct sample collection and analysis; description of de-leading methods; and identification of storage and disposal site for hazardous waste.
 7. Obtain all necessary Federal, State and Local permits associated with dismantling, demolishing and legal removal of facilities, including scrap metal transportation and disposal.
 8. Provide and operate all rigging necessary to safely dismantle the elevated tank. The Contractor shall assume all responsibility in using any existing or added attachments to the tank for the purposes of rigging.
 9. Perform all work in such a manner that it conforms with all Federal, State and Local laws, rules and regulations pertaining to health, safety and protection of the environment with special attention to those associated with disturbance to and disposal of lead based paint and lead contaminated waste. The Contractor shall not receive any additional compensation for changes in or interpretation of the laws, rules and regulations. In addition, any fines imposed on the Owner, Engineer, or representative of the Owner due to noncompliance by the Contractor shall be the sole responsibility of the Contractor and shall be paid or reimbursed by the Contractor.
 10. Provide a ground crew at all times to monitor the dismantling operation and be fully prepared to immediately put out any fires caused by torch cutting of the steel. The crew shall be fully trained and equipped with fire suppression equipment. Fire watch to be maintained for 30 minutes after completion of any hot work.

11. Provide DOT approved containers (i.e., 55-gallon drums, roll-off, etc.) for the disposal of all lead-based paint (LBP) waste and debris and all lead-contaminated waste and debris. If waste is placed in roll-off(s), the roll-off shall be lined with a minimum of 2 layers of 6-mil polyethylene prior to placing any waste in it and covered with a liquid tight cover. Each container shall be labeled to identify the type of waste as identified in 49 CFR Part 172.
 12. Prior to dismantling the tank, the Contractor shall confirm that all electrical appurtenances have been de-energized and required lock-out/tag-out activities are complete. All electrical appurtenances shall be removed from the tank prior to dismantling the tank.
 13. It shall be the Contractor's responsibility to assure that no hazards are caused for anyone within the proximity of the tank and no damage is caused to adjacent structures, equipment, paving and materials that are to remain.
 14. The Contractor shall remove and legally dispose of all demolition debris from the tank site at no additional cost to the Owner in accordance with these Contract Documents and all applicable regulations.
 15. During demolition of the tank painted metal shall not be placed on bare soil for staging. Rather, loaded directly into a truck or place on two layers of 6-mil polyethylene.
- B. Performance of the Work
1. The Contractor shall completely disassemble the steel roof by means to cause the least amount of interference with streets, homes, businesses, and other potential hazards. Cut roof sections of the tank shall be brought to the ground using a controlled or restrained method to prevent danger to persons or property.
 2. Contractor shall take all necessary precautions to protect workers and the public from exposure to lead based paint materials and shall follow all Federal, State and Local laws regarding the presence of lead during the performance of the Work.
 3. Contractor shall provide containment for all loose and peeling paint. Contractor shall brush free all loose paint prior to disassembly, provide containment of entire structure, lower large sections to a ground-level worksite, etc. If at any time the containment system should fail, the Contractor shall suspend work and shall take all actions necessary to correct the cause of failure prior to resuming work. Should paint debris fall on adjacent property or public right-of-way, Contractor shall be responsible to collect debris at no additional cost to Owner.

4. Contractor shall drum all collected paint debris as necessary, and seal and label each drum as required. Debris shall be collected and drummed minimum daily and shall be stored on-site in a secure and an approved location until the waste is classified. All collected paint debris shall be analyzed by an approved independent laboratory for the Toxic Characteristic Leachate Profile (TCLP) test to determine the waste classification. Contractor shall provide copies of all test results to the Engineer. All waste generated from the Work, regardless of classification, shall be disposed by the Contractor in accordance with all applicable Federal, State and Local laws that govern such disposal. For each load leaving the site, provide the manifest to the Engineer. Coordinate with the Engineer who will provide a trained individual to sign the manifest before any hazardous waste leaves the site. The Engineer reserves the right to approve or disapprove the final disposal site.

C. Lead Based Paint Containment

1. The Contractor shall assume that all paint present on the metal roof is lead-based paint. At the Contractor's option and expense, additional testing may be conducted to determine lead content in paint using laboratory testing of paint chips or X-ray fluorescence (XRF) techniques. Testing for lead in paint using alternative methods, including color change indicator chemical tests, shall not be permitted unless approved in advance by the Owner. Results of all testing shall be submitted to the Engineer and the Owner upon receipt.
2. The Contractor shall prevent discharge of lead or lead-contaminated materials into the air, water, soil, or adjacent properties.
3. Lab test results for the paint at particular locations in the project site are included in Reports and Drawings Known to Owner Helm Street Tank Site Bedford, VA. Upon completion of removal and waste disposal activities, the Owner shall collect twelve (12) comparable representative soil samples from similar locations for analysis of lead content. The soil samples shall be analyzed in accordance with RCRA 8, on a total lead basis. Lead levels greater than 400 PPM as any single sample location, shall require the Contractor to perform soil remediation, at his expense, in order to restore lead in soil concentrations to no greater than original background concentrations.
4. The Contractor shall be responsible for all worker protection (including personnel air monitoring) and record keeping associated with handling lead-based paint as may be required by the applicable regulations.
5. The Contractor shall not permit the discharge of any lead- contaminated water, generated from within the work area enclosure, to any body of water, storm sewer, or sanitary sewer. The Contractor shall be responsible for obtaining all necessary sewer discharge permits for other wastewater generated.

6. The Contractor shall dispose of all waste materials generated as a result of demolition operations. Disposal of waste as hazardous or non-hazardous material shall be based upon Toxicity Characteristic Leaching Procedure (TCLP) testing provided by the Contractor and conducted by an independent, certified laboratory. Results of all TCLP testing shall be furnished to the Engineer prior to transporting the waste off-site. Transport and disposal of all waste shall be in strict accordance with this specification and all applicable regulations.
7. Dilution of waste materials prior to TCLP testing shall not be permitted. Use of lead stabilizing or binding agents prior to TCLP testing shall not be permitted unless requested in writing by the Contractor and approved by the Owner prior to TCLP testing. Lead Stabilizing or binding agents, if utilized, shall be used on waste materials in strict accordance with the manufacturer's instructions. Copies of MSDS data sheets shall be furnished to the Engineer and shall be available on-site throughout the work.

D. Disposal of Waste/Scrap

1. Lead Based Paint and Lead-Contaminated Waste and Debris Cleanup: At the conclusion of work each day, lead based paint waste and debris and lead-contaminated waste and debris shall be collected and placed in hazardous waste containers on site.
 - a. The Contractor shall conduct the sampling, testing, and analysis of waste to determine classification of material in accordance with applicable EPA requirements and SSPC- Guide 7 (Guide for the Disposal of Lead-Contaminated Surface Preparation Debris). The sample analysis shall be performed in accordance with EPA Method 1311, Toxicity Characteristic Leaching Procedure (TCLP) to determine if the waste is hazardous or non-hazardous in accordance with EPA Regulations.
 - b. No waste shall be disposed of until analysis is complete and reviewed.
 - c. If the waste is classified as hazardous, the Contractor shall obtain an EPA identification number for the Owner, and the transportation, treatment and disposal of the waste shall be the responsibility of the Contractor, and done in complete conformance with all local, state and federal regulations and guidelines associated with hazardous waste disposal. The Contractor shall provide the Owner with the proper manifests and records required for hazardous waste disposal.
 - d. If the waste is classified as non-hazardous, the transportation and disposal shall be the responsibility of the Contractor, and done in complete conformance with all local, state, and federal regulations and guidelines. The Contractor shall provide the Owner and EPA with the tracking document associated with disposal of the waste.

- e. The Contractor shall furnish to the Engineer a signed copy of all transport and disposal manifests within thirty days of the removal of waste from the site, including removal for storage at another location or a transfer station. Final payment will not be processed prior to receipt of manifests.
- E. Scrap Metal Cleanup:
 - 1. The transportation and disposal of the scrap metal shall be in compliance with all local, state and federal laws, rules and regulations.
 - 2. Steel with lead-containing paint shall be removed from the site by the Contractor and reclaimed or reused in accordance with all applicable Federal, state and local laws and regulations. The Contractor shall dispose of all steel with lead-containing paint as hazardous waste; the steel shall not be disposed of as general waste.
 - 3. The Contractor shall provide all proper manifests and records associated, along with a letter of certification indicating that the disposal was in accordance with all associated laws, rules and regulations, and the location/name of the disposal facility.
- F. Non-Hazardous Material Cleanup:
 - 1. Provide dumpster type containers located in convenient locations approved by the Engineer for offsite removal of waste, litter and debris. Empty containers offsite as soon as they are full or at regular intervals of at least once a week. Keep area around containers clean. During filling and emptying of containers, spillage shall be immediately picked up and area cleaned.
 - 2. Upon completion of the work, the Contractor shall remove all construction debris, equipment and materials from the site. The general area surrounding the work area shall be policed to pick up any stray rubbish, etc. This material shall be containerized and removed from the site.

3.3 DEMOLITION OF THE CONCRETE TANK

- A. Quality Assurance: The Engineer may sample and test the stockpiles of millings and crushed asphalt for gradation. Once the test results for gradation are completed, they will be reviewed by the Engineer for approval. The RC stockpiles may also be visually inspected for consistency and to ensure the stockpile is not frozen. The control test strip and production RC shall not contain more than 5 percent soil, brick, and portland cement concrete material by mass except when used as Common Borrow.
- B. Construction of Test Strip: The control test strip shall have a maximum length of 100 ft and be at least 12 ft wide. The maximum compacted lift thickness of RC materials shall be 6 inches. The subgrade of the control test strip shall be prepared

in accordance with the Specifications. The control strip shall not be constructed on frozen subgrade.

The equipment and methods used to construct the control test strip shall be the same as those used in subsequent construction. The location, equipment, and methods used to construct the control test strip shall be subject to approval by the Engineer.

After placement of the RC for the control test strip, the RC shall be compacted by one pass of the roller. The density after one pass of the roller shall be measured by the nuclear density gauge (backscatter method) at five random locations on the control test strip selected by the Engineer. The measurements shall be recorded and locations marked for future reference. The density test locations shall be distributed across the length and width of the control test strip.

The control test strip shall be compacted by a second pass of the roller. The density shall be measured and recorded again after the second roller pass at the exact locations previously tested and as described above. A plot of density vs. number of passes shall be prepared. This process shall continue until the maximum dry density of the control strip is established.

There should be no drop in average density during construction of the control test strip on each lift. A drop in the average density of greater than 2 pcf during construction of the control test strip is an indication that the material is not properly compacting. Once the maximum density is achieved through compaction operations, the rolling operations should not continue further.

The Engineer may require the Contractor to cut into the control test strip so that the cross-section of the compacted millings may also be visually inspected.

- C. **Compaction Control:** The roller pattern and number of passes used to construct the test strip shall be used to compact the RC for production placement. The density of the compacted RC shall be measured using the nuclear gauge (backscatter method) at the frequency for capping material. The density of the compacted RC for production work shall be at least 97% of the maximum density obtained from the control test strip. If the density is less than 97% of the maximum density obtained from the control test strip, the density of the production work shall be rechecked. If the second density does not meet the 97% requirement, a new control test strip shall be constructed. If the measured

density of the compacted RC for production work exceeds 105% of the maximum density, a new control test strip shall be constructed.

Control test strips shall be constructed for each of the specific conditions where RC will be used on the project. Examples include:

Based on the control test strips, one rolling pattern shall be established to achieve maximum density for each use. The ground on which the control test strip, and subsequent production placement of RC is placed, may not be frozen.

Any samples and results that were previously identified prior to the construction of the new stockpiles will not be considered.

- D. Contractor shall remove all reinforced concrete tank foundation footings for the tank to a minimum depth of 24-inches below finished grade. Reinforced concrete shall be removed by jackhammering, saw cutting, lifting, etc.

3.4 DEMOLITION OF SITE IMPROVEMENTS

- A. Valve Vaults: Structures shall be removed 24-inches below grade. Existing water main piping and valves shall be removed.
- B. Perimeter fencing: Fencing at the existing tank site shall be removed. Completely remove below-grade posts and concrete.
- C. Yard Hydrant: To be removed as shown on the demolition plan along with the water meter.

3.5 SITE RESTORATION

- A. Filling of holes, pits, and foundations: Fill with suitable material to within 4 inches of finished grade in lawn areas, compact to 95% density and topsoil to finished grade.
- B. Backfilling: The final 4" of fill shall be topsoil material as defined in Section 02930 – Fine Grading and Seeding. The Contractor shall be responsible for repairing any settlement of the topsoil for a period of one (1) year from substantial completion as defined in the general and supplemental conditions.
- C. All areas disturbed by the Contractor's operations shall be seeded in accordance with the BRWA Master Specifications.
- D. The site shall be final graded (including topsoil) to match site grading.

END OF SECTION

SECTION 03300 CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

- A. Coordinate with BRWA Master Specification section 01 33 00 Submittal Procedures
- B. Product Data: For each type of product.
- C. Design Mixtures: For each concrete mixture.
- D. Manufacturer's Data: Submit manufacturer's data with installation instructions for all materials, including but not limited to, admixture, curing compound materials, coatings, waterstops, vapor retardant and joint materials.
- E. Delegated Design Submittals: Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Formwork Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer licensed in Virginia responsible for their preparation, detailing fabrication, assembly, and support of forms.
 - 2. Water Storage Tank Foundation Design: Detailed drawings and supporting calculations prepared by, and signed and sealed by, a qualified professional engineer licensed in Virginia responsible for their preparation, including analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.03 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

- A. Comply with ACI 301.
- B. Comply with ACI 117.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150, Type I/II.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Slag Cement: ASTM C989, Grade 100 or 120.
 - 4. Blended Hydraulic Cement: ASTM C595, Type IS, Portland blast-furnace slag cement.
- B. Normal-Weight Aggregate: ASTM C33, 1-inch nominal maximum aggregate size.
- C. Air-Entraining Admixture: ASTM C260.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494, Type A.
 - 2. Retarding Admixture: ASTM C494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017, Type II.
- E. Water: ASTM C94.

- F. Waterstops shall be Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.04 RELATED MATERIALS

- A. Vapor Retarder: Plastic sheet, ASTM E1745, Class A or B.
- B. Vapor Retarder: Polyethylene sheet, ASTM D4397, not less than 15 mils thick; or plastic sheet, ASTM E1745, Class C.
- C. Joint Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.
- D. Elastomeric Joint Sealant: ASTM D6690, Type M, Class 25, Use T.

2.05 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

2.06 CONCRETE MIXTURES

- A. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: 4500 psi at 28 days.
 - 2. Maximum W/C Ratio: 0.45.
 - 3. Cementitious Materials: Use fly ash, pozzolan, slag cement, and blended hydraulic cement as needed to reduce the total amount of Portland cement, which would otherwise be used per ACI 318.
 - a. Slump Limit: 4 inches plus or minus 1 inch.

4. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.07 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94, and furnish batch ticket information.
 1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 VAPOR-RETARDER INSTALLATION

- A. Install, protect, and repair vapor retarders according to ASTM E1643; place sheets in position with longest dimension parallel with direction of pour.
 1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.04 STEEL REINFORCEMENT INSTALLATION

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Control Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness.

3.06 CONCRETE PLACEMENT

- A. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
- B. Do not add water to concrete during delivery, at Project site, or during placement.
- C. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

3.07 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch.
 - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed-finished as-cast concrete where indicated:
 - 1. Smooth-rubbed finish.
 - 2. Grout-cleaned finish.
 - 3. Cork-floated finish.

- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
 - 1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, Portland cement terrazzo, and other bonded cementitious floor finishes unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Slip-Resistive Broom Finish: Apply a slip-resistive finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.09 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301.
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

3.11 WATERSTOPS

- A. The configuration and location of waterstops shall be as shown.
- B. Waterstops shall be of continuous lengths without splices where possible. Connect all adjoining waterstops including vertical and horizontal runs in such a manner to provide a continuous water barrier in accordance with the manufacturer's recommendation.
- C. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
 - 1. Install in longest lengths practicable.
 - 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 - 3. Protect exposed waterstops during progress of the Work.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Metal bollards.
5. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

1.02 SUBMITTALS

A. Product Data: For the following:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.
4. Manufactured metal ladders.
5. Metal bollards.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation, registered in the Commonwealth of Virginia.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Aluminum Ladders: Ladders shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36.
- C. Stainless Steel Bars and Shapes: ASTM A276, Type 304.
- D. Steel Tubing: ASTM A500, cold-formed steel tubing.
- E. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- F. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.
- G. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

- C. Post-Installed Anchors: As indicated on drawings.

2.04 MISCELLANEOUS MATERIALS

- A. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.
- D. Non-Shrink Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.

- 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, not less than 8 inches from ends and corners of units and 24 inches o.c.

2.06 SHELF ANGLES

- A. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- B. Galvanize shelf angles located in exterior walls.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.07 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
 - 1. Space siderails 18 inches apart unless otherwise indicated.
 - 2. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
 - 3. Provide nonslip surfaces on top of each rung.
 - 4. Within vaults, aluminum ladders, including brackets.

5. On tank, painted steel ladders integral with tank construction.

2.08 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with 1/4-inch-thick steel.

2.09 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.10 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Galvanize loose steel lintels located in exterior walls.

2.11 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.

2.13 STEEL FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.
 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

- B. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with anchor bolts.
- D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

3.03 INSTALLATION OF METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.04 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.05 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

SECTION 07920

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Urethane joint sealants.

1.02 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product test reports.

E. Preconstruction compatibility and adhesion test reports.

F. Preconstruction field-adhesion test reports.

G. Field-adhesion test reports.

H. Warranties.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Pre-installation Conference: Conduct conference at Project site.

1.04 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

- A. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.02 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Building Systems.
 - b. Pecora Corporation.
 - c. Polymeric Systems, Inc.
 - d. Sika Corporation; Construction Products Division.
2. Type: Single component (S)] or multicomponent (M).
3. Grade: Pourable (P) or nonsag (NS).
4. Class: 50.
5. Uses Related to Exposure: Traffic (T) or Nontraffic (NT), depending on context and location.

2.03 JOINT SEALANT BACKING

- A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance).

2.04 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.02 INSTALLATION

- A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
- F. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.03 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints between different materials listed above.
 - c. Other joints as indicated.
 2. Joint Sealant: Urethane.
 3. Joint-Sealant Color: Gray.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:

- a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between different materials listed above.
 - e. Perimeter joints between materials listed above and frames of doors and louvers.
 - f. Control and expansion joints in ceilings and other overhead surfaces.
 - g. Other joints as indicated.
 2. Joint Sealant: Urethane.
 3. Joint-Sealant Color: Match color of field to which sealant is applied.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 2. Joint Sealant: Urethane.
 3. Joint-Sealant Color: Grey.
- D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
 - d. Joints on underside of plant-precast structural concrete planks.

- e. Perimeter joints between interior wall surfaces and frames of interior doors.
 - f. Other joints as indicated.
- 2. Joint Sealant: Urethane
- 3. Joint-Sealant Color: Match color of field to which sealant is applied.

END OF SECTION

SECTION 09900

TANK PAINTING

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Work contained in this section consists of furnishing all labor, materials, tools, equipment and services necessary for the satisfactory field application of the coating system of all tank surfaces and miscellaneous ferrous surfaces, as shown on the drawings and as specified herein.
- B. The Contractor shall furnish all labor, materials, tools, equipment, services and incidentals necessary for the surface preparation and painting of the water storage tank, exposed piping and miscellaneous appurtenances as specified herein.
- C. The Contractor shall furnish all labor, materials, tools, equipment, services and incidental necessary to erect, maintain and remove a containment system or confinement methods around the tank as specified herein.

1.02 STANDARD SPECIFICATIONS

- A. The latest edition of the following standards and specifications shall be used with regard to materials, application, inspection, and testing to the extent specified herein.

AWWA D100	Standard for Welded Steel Tanks for Water Storage
AWWA D102	Standard for Painting Steel Water Storage Tanks
AWWA C652	Disinfection of Water Storage Facilities
SSPC-PA1	Steel Structures Painting Council Surface Preparation Specification
SSPC-PA2	Measurement of Dry Paint Thickness with Magnetic Gauges
SSPC-VIS1	Visual Standards for Abrasive Blast Cleaned Steel
SSPC-VIS3	Visual Standards for Power and Hand Tool Cleaned Steel
SSPC-SP6	Commercial Blast Cleaning
SSPC-SP10	Near-White Blast Cleaning
SSPC –SP11	Power Tool Cleaning to Bare Metal

1.03 QUALITY ASSURANCE

- A. All work, including surface preparation and painting, shall be performed in a workmanlike manner by experienced workmen, and in a manner recommended by the material manufacturer.
- B. The Contractor shall coordinate the compatibility of shop applied primer coat and subsequent field applied coats. Unsatisfactory finishes resulting from incompatibility of coatings shall be rectified by the Contractor, to meet the approval of the Owner, at no additional cost to the Owner.
- C. Each paint system shall be from a single manufacturer. The paints and paint products specified herein are manufactured by Tnemec.
- D. Thinners shall be as specified by the paint manufacturer. When possible, thinners should be manufactured by the paint manufacturer.
- E. All painting shall be in accordance with AWWA D102, the Steel Structures Painting Council Specifications, approved paint manufacturers specifications, and as specified herein.
- F. Painting shall be performed by a firm with a minimum of five (5) years experience in painting steel water storage tanks with at least five (5) projects of similar style and of equal or greater capacity, completed by the painting contractor within the last ten (10) years.
- G. Methods of application are at the discretion of the Contractor as long as the materials are applied in accordance with the manufacturer's published product data and the end results are in compliance with these specifications (including all others inferred by reference). However, the Contractor is advised to consult the manufacturer's published product data concerning the length of hose and difference in elevation of the pump and spray gun when applying a zinc coating. Application equipment (including air and airless sprayers, rollers and brushes) shall be good quality, in good condition and shall be as recommended by the coating manufacturer.
- H. Prior to the field cleaning or painting of any surface, the Contractor shall present a written plan to the Owner and Engineer concerning how blasting debris and/or paint overspray or droplets will be confined to the tank site. Reasonable care shall be exercised by the Contractor to prevent damage, nuisance, or hazardous conditions to the adjacent or nearby property owners. The cost of this containment shall be included in the Base Bid. The Owner reserves the right to stop work or to require additional confinement methods, if the Contractor's operations create a nuisance in the sole opinion of the Owner, Engineer Field Observer, the Owner's designated representative, any regulatory agency or neighbor. Any damage resulting from paint or blast materials escaping the tank site will be corrected/cleaned by the Contractor at no additional cost to the Owner.

1.04 SUBMITTALS

- A. All submittals shall be made in accordance with the BRWA Master Specifications Section 013300 – Submittal Procedures.
- B. Submit a complete list of materials proposed to be furnished and installed under this Section.
- C. Submit manufacturer's specifications, cut sheets and other data required to demonstrate compliance with the specified requirements.
- D. Submit color samples, from the approved paint manufacturer, to the Owner for review and selection. Manufacturer's color charts shall be submitted to the Owner at least 30 days prior to paint application.
- E. Product data shall be submitted as follows:
 - 1. Written description and catalog cuts describing each type of proposed abrasive for the interior and exterior surfaces. Include technical data sheets to substantiate compliance with the specifications.
 - 2. Written description and catalog cuts describing each coating in the system. Information shall include: product delivery, storage and handling, application and curing instructions and limitations. Include technical data sheets to substantiate compliance with the specifications.
 - 3. Written description and catalog cuts describing each thinner proposed for use with each coating system. Also include thinner or solvent proposed for use in cleaning paint equipment. Include technical data sheets to substantiate compliance with the specifications.
 - 4. Written description and catalog cuts describing the proposed underwater curing epoxy gel for the interior wet surfaces at the First Anniversary Inspection. Include technical data sheets to substantiate compliance with the specifications.
- F. Provide certification, signed by the supplier of the coating, attesting that the coating system proposed meets the specifications. The Contractor shall obtain certification from the manufacturer certifying that all coatings, including the final cured zinc coating, will not contain more than 0.06% of lead (or any lead compounds) in the cured coating for each coat applied. Certifications shall be submitted to the Engineer.
- G. Prior to field cleaning or painting of any surface, the Contractor shall present a written plan to the Owner and Engineer concerning how paint and/or abrasive damage to automobiles and property will be handled. The Plan shall include at a minimum, the claims process, a

process for quick removal of paint or abrasive, and who will do the work. This approval in no way will relieve the Contractor from the responsibility of settling claims for damage, but is intended as an avenue to expedite and minimize said claims.

- H. Prior to the field cleaning or painting of any surface, the Contractor shall present a written plan to the Owner and Engineer concerning how blasting debris and/or paint overspray or droplets will be confined to the tank site. Reasonable care shall be exercised by the Contractor to prevent damage, nuisance, or hazardous conditions to the adjacent or nearby property owners. The cost of this containment shall be included in the Bid. The Owner reserves the right to stop work or to require additional confinement methods, if the Contractor's operations create a nuisance in the sole opinion of the Owner, Engineer Field Observer, the Owner's designated representative, any regulatory agency or neighbor. Any damage resulting from paint or blast materials escaping the tank site will be corrected/cleaned by the Contractor at no additional cost to the Owner.

1.05 WARRANTY

- A. The Contractor shall warranty the coating system for a minimum period of one year from the date of Final Completion. The date of Final Completion shall be the date shown on the Certificate of Completion.
- B. Prior to the one year anniversary, the tank shall be drained, washed out and evaluated by the Contractor. The inspection shall be performed per AWWA D100. The Contractor shall be responsible for any coating repairs that are required as determined during the evaluation at no additional cost to the Owner. The Contractor shall be responsible for disinfection of the tank and dechlorination of discharge water, at no charge to the Owner. Owner, free of charge to the Contractor, shall furnish sufficient water for the one (1) sterilization.
- C. The Contractor shall power wash the exterior of the tank, at the time of the one year anniversary inspection and repairs, to clean and remove streaking on the coating. Scrubbing and other methods may be required to remove some staining. Owner, free of charge to the Contractor, shall furnish sufficient water for the exterior tank power wash.

PART 2 – PRODUCTS

2.01 GENERAL

- A. All materials shall be brought to the job site in original factory sealed containers. Containers shall be labeled with contents and batch numbers.
- B. Containers shall be subject to inspection by the Engineer. Any previously opened or partially full containers shall be removed from the job site and disposed of at the Contractor's expense. Left over paint from other projects shall not be allowed.

- C. Upon completion of the job the Contractor shall furnish to the Engineer certification from the paint manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all the surfaces requiring painting to the dry film thickness specified herein.
- D. Silica sand will not be allowed for use as the abrasive for blasting. Grit, if used, shall be grade "Fine" and as specified for "grit blasting" by the supplier. Sand abrasive may not be recycled.
- E. Non-silica abrasive shall be steel shot, aluminum oxide or garnet. Non-silica abrasives may be recycled.
- F. Primer shall be lead free and selected by the paint manufacturer to be compatible with the intermediate and finish coats. Successive coats shall be of different shades to provide contrast during application.
- G. The Dry Film Thickness (DFT) values shown are minimum values subject to variation in thickness based on industry practice and manufacturer's recommendations. The actual DFT values measured may vary from these minimums but may not exceed the maximum value established by the manufacturer.
- H. Material Safety Data Sheets (MSDS) shall be posted at the job site for each chemical product on the job site, including but not limited to abrasives, coatings, thinners and other solvents, welding materials and disinfecting agents. MSDS for each chemical product on the job site shall also be submitted to the Engineer and Owner prior to starting any work.
- I. Paint systems to be used for the different environments and materials, including requirements for types of coating, prime, intermediate, topcoat and coating thickness are described and listed herein. Paint manufacturers may change mil thicknesses for the different coats but shall not change number of coats and minimum total coating thickness. Surface preparation for the different surfaces is described in Execution herein. Paint coats are expressed in dry film thickness in mils.

Except where hereinafter specifically named as being the product of some other manufacturer, painting materials shall be those of Tnemec Company, Inc. All coatings for the entire project shall be from a single manufacturer.

2.02 EXTERIOR COATING SYSTEM

A. Shop Primer – Aromatic Urethane – Zinc-Rich

1. Tnemec Series 94-H₂O Hydrozinc, (greenish gray), 2.5 to 3.5 mils DFT.

B. Field Intermediate Coat – Acrylic Urethane

1. Tnemec Series 73 Endura-Shield, 2.5 to 3.0 mils DFT. Color to slightly contrast finish coat.

C. Field Finish Coat – Fluoropolymer Urethane

1. Tnemec Series 700 HydroFlon, 2.5 to 3.0 mils DFT. Color to be selected by Owner from manufacturer's standard color chart.

D. Total System coating thickness – 8.0 to 9.5 mils.

2.03 INTERIOR COATING SYSTEM

A. Shop Primer – Aromatic Urethane, Zinc Rich

1. Tnemec Series 94-H2O Hydro-Zinc, 2.5 to 3.5 mils DFT.

After application of field primer the weld seams on the Interior Wet Area only shall receive a stripe coat using Tnemec Series L140-1255 beige or L140F for cold weather application. Stripe coat shall be brushed applied with material thinned up to 10%.

B. Field Intermediate Coat – Polyamidoamine Epoxy

1. Tnemec Series L140-1255 Pota-Pox Plus, 4.0 to 6.0 mils DFT. Color to be Beige.

C. Field Finish Coat - Polyamidoamine Epoxy

1. Tnemec Series L140-15BL, 4.0 to 6.0 mils DFT. Color to be Tank White.

D. Total System coating thickness – 10.5 to 15.5 mils.

E. All interior paints and coatings shall meet NSF Standard 61.

2.04 ABRASIVES

- A. Expendable abrasives shall conform to SSPC-AB 1 Type I or Type II Class A except silica and quartz sands will not be allowed. The abrasive shall not contain any of the heavy metals listed in 40 CFR 261.24 Table 1 in excess of 20 times the specified regulatory limits.
- B. Recyclable abrasives, newly manufactured or re-manufactured steel, shall conform to the requirements of SSPC-AB 3. Recycled abrasives shall be checked by the Contractor for oil contamination prior to the start of work each day and at least once per 8-hour shift in

accordance with the requirements of VTM-82. Recycled abrasive shall not contain non-abrasive residue in excess of the requirements of SSPC-AB 2.

- C. The abrasive shall be of a grit size to produce the profile recommended by the paint manufacturer for the coating system being applied.
- D. The use of abrasive on the exterior of the tank shall be based not only on its compliance with the technical application of the coating, but also on its lack of nuisance to surrounding property.
- E. The abrasive shall be free of contaminants, such as excessive fine particles, paint, earth, moisture, oil or chlorides, which can cause premature failure of the coating system.
- F. The Contractor shall submit the method of blasting, type and size of abrasive, and the paint manufacturer's approval that the methods proposed will attain the required surface profile.

2.05 THINNERS

- A. Thinners shall be used only in accordance with the manufacturer's instructions. Only thinners furnished by the coating system manufacturer supplying coatings for this project shall be used.

2.06 LETTERING AND LOGO

- A. The tank will not have any lettering or logo.

PART 3 – EXECUTION

3.01 GENERAL

- A. No paint shall be applied when the temperature of the surface to be painted is below the minimum temperature specified by the paint manufacturer or less than five (5) degrees above the dew point temperature. Paint shall not be applied to wet or damp surfaces or when the relative humidity exceeds 85%. Follow the paint manufacturer's recommendations for the specific paint system used.
- B. All surfaces blasted or power tool cleaned in the field shall be coated the same day (maximum 8 hours) before any rusting occurs.
- C. The Contractor shall provide all equipment, tools and facilities necessary and proper for the work and the safety of the workmen.

- D. No holes will be allowed in the tank to facilitate rigging or for other reasons. Equipment may be attached to the tank using rigging attachments or to the attachments built into the tank.
- E. The tank shall be surrounded by a containment system during painting and blasting to prevent the escape of over-spray or blast material. The Contractor shall submit to the Engineer a plan for supporting, installing and maintaining the containment system curtain during painting and blasting.
- F. Spray equipment and tip size used shall be as recommended in the paint manufacturer's instructions.
- G. Compressed air for blasting and painting shall be free from detrimental amounts of oil or water. Contractor shall supply adequate traps and/or dryers to prevent contamination of the compressed air supply.
- H. Air hoods, respirators and sufficient forced ventilation shall be provided during blasting, painting and curing to prevent a hazard to the workmen.
- I. Spray pole guns over 3 feet long will not be allowed. Rigging shall provide proper close accessibility to all portions of the tank.
- J. Coating Thickness
 - 1. The coating thickness of each type of paint is essential to the system's integrity. Thickness of the coatings shall be in accordance with manufacturer's recommendations for the system applied.
 - 2. The addition of mils in a succeeding coat to make up for thin preceding coat(s) shall not be allowed except where required to hide the underlying darker color. No coats shall exceed the coating manufacturer's maximum thickness limit.
 - 3. Dry mil thickness greater than the specified allowable shall also not be considered to be in conformance with the specifications if it will be detrimental to the appearance, life or recoatability of the system.
 - 4. Coating thickness measurement procedures shall be as outlined in SSPC-PA 2.
 - 5. If determined to be in the best interest of the project, the Field Observer may make dry film thickness measurements in excess of the amounts permitted by SSPC-PA 2.

3.02 SAFETY REQUIREMENTS

- A. The Contractor shall comply with the requirements and standards of the Occupational Safety and Health Act and all other, local, state and federal laws, codes and Ordinances regulating all work to be provided under the Contract Documents.
- B. The Contractor shall comply with the paint manufacturer's safety requirements for paint materials in use and storage. Such requirements shall be strictly observed.
- C. All safety precautions in AWWA D102, Section 7 – "Safety Precautions" shall be strictly adhered to and in particular the section pertaining to ventilation.
- D. The Contractor shall provide adequate air exhaust equipment to eject sandblast dusts and solvent fumes from the tank interior. Ventilation shall prevent the accumulation of solvent fumes that might retard the curing process or create an explosion and fire hazard.
- E. The Contractor shall provide adequate lighting inside the tank and curtain, as determined by the Inspector, to properly allow safety, workmanship and inspection.

3.03 SURFACE PREPARATION

- A. General
 - 1. Exterior – Exterior surfaces of the tank shall be abrasive blasted per SSPC-SP6/NACE 3 Commercial Blast Cleaning. Abrasive blasting procedures shall consist of using a non-silica abrasive and using various means and blasting equipment.
 - a. Wet abrasive blasting procedures shall consist of using a non-silica abrasive by using various means and equipment such as slurry blast, wet jet blast, water ring blast, and water blast with abrasive injection. If wet abrasive blasting is used, an inhibitor shall be used in the water to prevent flash rusting. The Tnemec approved inhibitor shall be "Holdtight 102".
 - 2. Interior – All surfaces shall be abrasive blasted to "near white" per SSPC-SP10.
 - 3. Blasting shall not be conducted when steel surface is less than 50° F. above the dew point.
 - 4. All cleaned surfaces shall be primed the same day (within 8 hours) before any rusting occurs. If rust forms on any blasted surface before priming, the surface shall be re-cleaned and dried before application of primer.
 - 5. Cleanliness of blasting shall be judged by SSPC-VIS 1 and 3.

6. Any existing weld burrs or spatter shall be ground smooth.
7. Surface profile of blasted steel shall be measured using replica tape as per NACE Std. RPO287.
8. Before the start of blasting inlet/outlet pipe openings shall be covered and tightly sealed. Items that do not require painting, e.g. screens, safety climb rails/cables, mechanicals, non-carbon steel surfaces, gaskets, etc. shall be removed or protected from all abrasive and paint damage.

B. Shop Blasting and Priming

1. Remove all oil and grease from surface prior to blasting.
2. All surfaces shall be abrasive blast cleaned, in accordance with SSPC Specifications, as follows:
 - a. Exterior Paint System – SSPC-SP6 – Commercial
 - b. Interior Paint System – SSPC -SP10 – Near White
3. Clean the surface of the blasted material in accordance with SSPC-PA1.
4. Within the time limits specified and in accordance with the paint manufacturer's instructions and dry film thickness specified, the prime coat shall be applied by brush, roller, or spray equipment.

C. Field Blasting and Painting

1. After erection and prior to field touch-up priming, all surfaces shall be cleaned to remove surface contamination including oil, grease, dust, dirt and other foreign matter. Weld slag, weld spatter and other sharp projections shall be removed. All rusted, abraded and unpainted exterior areas shall be abrasive blast cleaned to a Commercial finish in accordance with SSPC-SP6, minimum for exterior surfaces, or SSPC-SP10, minimum for interior surfaces.
2. All rivets, welds, seams, plate edges, and pits shall first receive a "mist" coat after blasting; then followed by a full prime coat.
3. No paint shall be applied when the surrounding air temperature, as measured in the shade, is below 50⁰ F. No paint shall be applied when the temperature of the surface to be painted is below 40⁰ F.

4. Paint shall not be applied to wet or damp surfaces and shall not be applied in rain, snow, fog or mist or when the relative humidity will exceed 85% within 18 hours after application.
5. Dew moisture condensation should be anticipated, and if such conditions are prevalent, painting shall be delayed until mid-morning to be completed well in advance of the time of day when condensation will occur.
6. Drying times between coats shall be strictly adhered to and shall follow the manufacturer's specifications. Force air ventilation shall be provided during all drying and the final cure. Proper, safe, and sufficient forced air ventilation must be provided during blasting and painting.

3.04 TESTING

- A. Contractor shall provide testing of the tank coating by a third-party NACE certified inspector. After the finish coat has been allowed to properly cure, all steel which will be submerged shall be tested with wet sponge, low-voltage holiday detector. The Contractor shall perform the test under the full observation and direction of the Owner and Inspector. Holiday locations shall be properly marked and then repaired on dry steel. Testing and repair procedure shall be per the paint manufacturer's recommendations and NACE Std. RPO 188. All surface preparation and coatings testing shall be performed by an independent third-party NACE certified inspector. All costs for testing shall be included in the Contractor's bid.

3.05 INSPECTION

- A. All cleaning and painting shall be subject to inspection by the Owner or his designated representative. The Inspector shall have sole and final authorization to accept or reject the Contractor's work in compliance with repair, cleaning and painting specifications. Contractor may not continue to work until each phase has been inspected and approved.
- B. Contractor shall provide access to all areas for inspection by the use of proper and safe rigging. The Contractor shall maintain adequate rigging facilities, for use by the Inspector, including scaffolding, boatswain chairs, spiders or other rigging. If removed prior to inspection, rigging equipment shall be replaced, at the Contractor's expense, as required by the Inspector for thorough inspection of the work. All rigging equipment shall be equipped with safety lines as required by applicable provisions of the Occupational Safety and Health Act.
- C. Neither the inspection nor the supervision of the work, nor the presence or the absence of an Inspector shall relieve the Contractor of any of his obligations under the Contract or of making his work conform to the specifications.

3.07 CLEANING

- A. Upon completion of the Work, the job site shall be left clean of all debris, blasting abrasive or any other items resulting from the operations of the Contractor.
- B. The cost of any cleanup which must be done by the Owner will be deducted from funds due the Contractor.
- C. Any material in the inlet/outlet, drain or overflow piping at the time the tank is placed in service shall be removed at the expense of the Contractor, and not released into the system.

END OF SECTION

SECTION 09960

HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
- B. Paint exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Engineer will select from standard colors or finishes available.
 - 1. Painting includes field-painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
 - 1. Prefinished items not to be painted include the following factory-finished components:
 - a. Finished mechanical and electrical equipment.
 - 2. Finished metal surfaces not to be painted include:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.

- d. Copper.
 - e. Bronze.
 - f. Brass.
 - g. Galvanized Steel.
- 3. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 5 - Metals
 - 2. Divisions 15 and 16: Painting mechanical and electrical work is specified in Divisions 15 and 16, respectively.

1.03 SUBMITTALS

- A. General: Submit the following according to BRWA Master Specifications – Section 01 33 00 – Submittal Procedures
- B. Product data for each paint system specified, including block fillers and primers.
 - 1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage, and application of each material proposed for use.
 - 2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.
 - 3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- C. Samples for Verification Purposes: Provide samples of each color and material to be applied, with texture to simulate actual conditions.
 - 1. Provide a list of material and application for each coat of each sample. Label each sample as to location and application.

1.04 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.
- B. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in the manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.06 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F and 95 deg F.

- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

- A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- B. Material Quality: Provide the manufacturer's best-quality paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Match colors indicated by reference to the manufacturer's standard color designations or custom colors to match those specified.

2.02 PAINT SYSTEMS

- A. Paint systems to be used for the different environments and material, including requirements for types of coating, prime, intermediate, topcoat and coating thickness are described and listed herein. Paint manufacturers may change mil thicknesses for the different coats but shall not change number of coats and minimum total coating thickness. Surface preparation for the different surfaces is described in Execution herein. Paint coats are expressed in dry film thickness in mils.

Bids shall be based on the specific brand of painting materials named herein. Except where hereinafter specifically named as being the product of some other manufacturer, painting materials shall be those of Tnemec Company, Inc. Equivalent products proposed for use shall be submitted to the Engineer for approval and shall contain the full name for each product, directions for use and complete descriptive literature including

composition, performance criteria and physical properties. No request for substitution will be considered which decreases the number of coats to be applied, or which offers a change from the color range and general type of coatings specified.

2.03 COLOR SYSTEM MATERIAL IDENTIFICATION

<u>Item</u>	<u>Generic Color</u>	<u>Tnemec Color</u>
Potable Water Piping	dark blue	11SF True Blue/Safety
Bollards	yellow	02SF Lemon Yellow/Safety

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.
 - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected.
 - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify the Engineer about anticipated problems using the materials specified over substrates primed by others.

3.02 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease

prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer's instructions for each particular substrate condition and as specified.
1. Non-Ferrous Metals: Brush-off Blast Cleaning or SSPC-SP1 Solvent Cleaning using Clean & Etch by Great Lakes Laboratories, Inc.
 2. Provide barrier coats over incompatible primers or remove and reprime. Notify Engineer in writing about anticipated problems using the specified finish-coat material with substrates primed by others.
 3. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer. Thick film systems $\frac{1}{8}$ inch or $\frac{1}{4}$ inch must be sand blasted or blast tracking or vacuum blast.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner to achieve 100 grit sandpaper finish. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 4. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).
 - a. Blast steel surfaces clean as recommended by the paint system manufacturer and according to requirements of SSPC specification SSPC-SP10 for immersion and SSPC-SP6 for non-immersion.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment

wash coat before priming.

- c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
- D. Materials Preparation: Carefully mix and prepare paint materials according to manufacturer's directions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
 3. Use only thinners approved by the paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.03 APPLICATION

- A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Provide finish coats that are compatible with primers used.
 3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
 4. Apply additional coats if undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give

- special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 6. Paint surfaces behind movable equipment the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment with prime coat only.
 7. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
 8. Sand lightly between each succeeding enamel or varnish coat.
 9. Omit primer on metal surfaces that have been shop-primed and touch-up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- D. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to the manufacturer's directions.
1. Brushes: Use brushes best suited for the material applied.
 2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- E. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.
 2. Insulation.
 3. Supports.
 4. Motors and mechanical equipment.
 5. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with specified requirements.

3.04 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
 2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

- a. Quantitative materials analysis.
 - b. Abrasion resistance.
 - c. Apparent reflectivity.
 - d. Flexibility.
 - e. Washability.
 - f. Absorption.
 - g. Accelerated weathering.
 - h. Dry opacity.
 - i. Accelerated yellowness.
 - j. Recoating.
 - k. Skinning.
 - l. Color retention.
 - m. Alkali and mildew resistance.
3. If test results show material being used does not comply with specified requirements, the Contractor may be directed to stop painting, remove noncomplying paint, pay for testing, repaint surfaces coated with rejected paint, and remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are incompatible.

3.05 CLEANING

- A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
- 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.06 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Engineer.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.07 PAINT SYSTEM SCHEDULE

No.	Item to be Painted	Coat	Tnemec Product	Dry Film Mills per Coat	Total Item Dry Film Thickness
1.	Steel – Structural Steel, Pipes and Equipment Exterior Exposure (Non-Immersion)	Surface Prep	SSPC-SP6		
		Prime	Series 1 Omnithane	2.5 to 3.5	
		Intermediate	Series L69 Epoxoline II	4.0 to 6.0	
		Final	Series 1075 Color EnduraShield II	2.0 to 4.0	8.5 to 13.5
2.	Steel – Structural Steel, Pipes and Equipment Exterior Exposure (Non-Immersion) – Equipment that only comes with a Manufacturer's Standard Paint	Surface Prep	SSPC-SP6		
		Prime	Manufacturer's Standard	1.5 to 2.0	
		Intermediate	Series L69 Epoxoline II	4.0 to 6.0	
		Final	Series 1075 Color EnduraShield II	2.0 to 4.0	7.5 to 12.0
3.	Steel – Structural Steel, Pipes and Equipment Interior Exposure (Non-Immersion)	Surface Prep	SSPC-SP6		
		Prime	Series 1 Omnithane	2.5 to 3.5	
		Intermediate	Series L69 Epoxoline II	3.0 to 4.0	
		Final	Series L69 Epoxoline II	3.0 to 4.0	8.5 to 11.5
4.	Steel – Structural Steel, Pipes and Equipment Immersion - Non-Potable Water	Surface Prep	SSPC-SP10		
		Prime	Series 1 Omnithane	2.5 to 3.5	
		Intermediate	Series L69 Epoxoline II	3.0 to 4.0	
		Final	Series L69 Epoxoline II	3.0 to 4.0	8.5 to 11.5

No.	Item to be Painted	Coat	Tnemec Product	Dry Film Mills per Coat	Total Item Dry Film Thickness
5.	Concrete Interior Exposure (Non- Immersion)	Surface Prep	SSPC – SP13		
		1 st Coat	Series 1026 Enduratone	2.0 to 3.0	
		2 nd Coat	Series 1026 Enduratone	2.0 to 3.0	4.0 to 6.0
6.	Concrete Masonry Units Interior Exposure	Surface Prep	Clean and Dry		
		1 st Coat	Series 130 Envirofill	60 to 80 sq. ft. per gallon	
		2 nd Coat	WB Tnemec Series 113	4.0 to 6.0	
		Final Coat	WB Tnemec Series 113	4.0 to 6.0	N.A.
7.	Insulated Pipe Interior Exposure	Surface Prep	Clean and Dry		
		1 st Coat	WB Tnemec Series 115	3.0 to 4.0	
		2 nd Coat	WB Tnemec Series 115	3.0 to 4.0	6.0 to 8.0

END OF SECTION

SECTION 11268

TANK MIXING SYSTEM

PART 1 – GENERAL

1.01 EQUIPMENT OVERVIEW

- A. These specifications provide the requirements to furnish and place into operation a potable tank mixer for the 1.0 MG Helm Street tank.

1.02 REFERENCES

- A. Occupational Safety and Health Administration, OSHA
- B. Department of Transportation, DOT
- C. NSF / ANSI Standard 61
- D. Underwriters Laboratories Inc., UL 508

1.03 QUALITY ASSURANCE

- A. Continuous Operation Equipment: The mixer shall operate continuously, all day and all night, using 120 VAC as the power source.
- B. No Visual Defects: The mixer shall have no visual defects, and shall have high quality welds, assembly, and corrosion resistant finish.
- C. Qualified US Manufacturer: The manufacturer of the mixer shall have extensive experience in the production of such equipment, and the equipment shall be manufactured in the continental United States.
- D. Factory Startup Services: Delivery, placement and startup services shall be available, and shall be included in the bid. For factory delivery and placement, services shall be performed by full time factory employees experienced in the operation of this equipment and who have completed OSHA safety trainings applicable to this type of placement.
- E. Warranty: The mixer shall be warranted to be free of defects in materials and workmanship for a period of 5 years. This equipment warranty would run directly from the manufacturer of the equipment to the owner. The equipment warranty would not be part of the contract or any required bond.

1.04 SUBMITTALS

- A. General: Submit the following according to BRWA Master Specifications – Section 01 33 00 Submittal Procedures
- B. The awarded Bidder shall provide an electronic copy of the following documents: Upon acceptance of these documents by the Engineer, the Bidder will be issued a Notice to Proceed, and may then proceed to place the equipment.
 - 1. Manufacturer Qualification Document
 - 2. List of Supplied Equipment
 - 3. Manufacturer Product Sheets
 - 4. Electric Power Source Requirements
 - 5. NSF / ANSI Standard 61 Documentation
 - 6. Warranty Statement
 - 7. Operation Manuals

1.05 FIELD SERVICES

- A. Placement and startup: Equipment manufacturer shall offer placement and startup performed by equipment manufacturer's full time factory employees trained in the operation of the mixer who have completed OSHA safety trainings applicable to this type of equipment placement and startup.

PART 2 – PRODUCT SPECIFICATIONS

2.01 MANUFACTURER

- A. Specified Equipment: The mixer shall be manufactured by Ixom Watercare, Inc. or Pax Water Technologies.

2.02 PERFORMANCE AND FEATURES

- A. Mixer shall achieve a complete homogeneous blending of the water volume within the 1.0 MG tank.

B. Complete Water Circulation Required: To meet the project objectives, the tank or reservoir circulation shall be achieved by a single unit within the tank capable of providing long distance circulation of water. The mixer shall have a direct measurable flow rate where suction shall enter specified mixer's intake positioned within 2 inches of reservoir floor and discharging water vertically in a sheet flow pattern to induce a large volume, low velocity flow to reach the tank or reservoir water surface. The mixer must be placement flexible in design to allow best hydraulic positioning for tank or reservoir conditions to prevent hydraulic short circuiting within tank or reservoir. Suction not within 2 inches of tank or reservoir floor is not allowed.

C. Number of units required: To meet the project objectives, the following number of mixers are required.

Qty	Model	Tank or Reservoir
1	GridBee GS-12 or Pax PWM400	Helm Street 1.0 MG Tank

D. Complete Mix: The mixer manufacturer guarantees that the subject tank will be completely mixed by the mixer. In continuous operation of the mixer:

1. at least once per 24 hours all water temperatures within the tank shall converge to within max of 0.8 degrees C, and
2. at least once per 72 hours all chlorine concentrations within the tank shall converge to within 0.20 mg/l.

E. Fit Through Small Hatch Opening: The mixer shall be capable of fitting through the tank hatch without requiring disassembly or assembly.

F. Continuous Operation With 120VAC, 20 Amp Power Source: The mixer shall operate continuously during day and night while connected to electric grid power.

G. Stainless Steel Construction: The mixer shall be constructed primarily of Type 316 stainless steel metal for strength and superior corrosion resistance.

H. Motor: The mixer shall be mechanically operated by a submersible motor that meets the following criteria:

1. Direct Drive, with no gearbox and no lubrication maintenance required.
2. Designed for submersible operation.
3. Designed for Continuous Operation without overheating or compromising motor life expectancy. Constant, full speed operation, variable frequency drive or other method of speed reduction not required and not allowed.

4. 115 or 120 VAC (depending on mixer requirement), 20 Amp power source shall be supplied by others and not the mixer manufacturer.
- J. Low Elevation Intake: The mixer shall be supplied with an intake capable of being positioned at the lowest elevation of the tank or reservoir floor.
- K. Restraint System: The mixer shall not require any brackets, penetrations, rope, ties, or fixed connections to the tank or reservoir columns, walls, or floor below the overflow elevation. The mixer shall allow for placement and servicing without requiring tank or reservoir to be drained. The mixer shall not require the use of a diver or diving team to enter the tank or reservoir to complete placement or service of the specified equipment.
- L. Functional for All Water Levels: The mixer shall function properly and not be negatively impacted by fluctuating water levels down approximately 3' of water depth.
- M. SCADA and Controls: The mixer shall have the option to add an Electric Control Box including a motor current indicator in a 4-20mA analog output and remote on/off control via 24VDC relay.
- N. Electrical Control Box: The mixer equipment shall be supplied with a Control Box capable of disconnecting 115 or 120 VAC outgoing power to the mixer equipment and meeting the following criteria:
 1. NEMA type 4 or 4x enclosure shall be provided that is weather resistant.
 2. Control Box shall be UL 508 Listed for sound electrical design and safety.
 3. Control Box shall include exterior mounted HOA switch, definite purpose contactor for mixer control, exterior display showing green run, red fault indication, and motor operating amperage, grounding lug, 115 or 120 VAC standard three-prong male molded plug, and locking latch for security.
 4. Control Box shall include dry contact output (Normally Open and Normally Closed) for run and fault indication, 4-20 mA analog output scaled signal for motor current, and HOA switch position auxiliary dry contacts. Control Box shall allow for remote on and off control of the mixer. Integration of inputs/outputs to site PLC/RTU shall be provided by others and not by the mixer equipment manufacture.
 5. Control Box requires a 115 or 120 VAC power source, Minimum 20 Amp rated service located near the final placement of the Control Box. SCADA and control functions of the Control Box include 24 VDC power for automatic operation, run and fault indication, and 4-20 mA current output. The 115 or 120 VAC power source shall be supplied by others and not the mixer equipment manufacturer.

- O. The complete mixer shall be NSF / ANSI Standard 61 and NSF / ANSI Standard 372 listed for safe contact with potable water. The mixer shall be NSF / ANSI Standard 61 listed to be safely in contact with a potable water volume as low as 5,000 gallons.
- P. Maintenance Requirements: The mixer shall operate normally with the following maintenance features.
 - 1. No scheduled lubrication is required of any system components including motor.
 - 2. No spare parts shall be required to be kept on hand.
- Q. Equipment Support: The mixer manufacturer shall offer full factory support with the following staff and support services.
 - 1. Customer Service, Application Engineering, and Equipment Engineering staff available by email or toll free phone.
 - 2. Field personnel for placing and servicing the specified mixer.
 - 3. Public website with detailed information available describing the mixer for this project and related applications of this equipment into potable water tanks and reservoirs.
 - 4. Service plans for preventative maintenance and continued technology improvements for the specified mixer.

PART 3 – EXECUTION

3.01 FACTORY PLACEMENT

- A. For Factory Placement, Startup, and Service, include the information below:
 - 1. Factory Personnel: The placement and startup shall be performed by full time factory employees trained in the operation of the mixer.
 - 2. Safety: Placement and service personnel shall have received job-specific safety training on (a) Working over Water, (b) Boating Safety, (c) Disinfecting Procedures, (d) Confined Space Entry, (e) Fall Protection, (f) Self Rescue, and (g) DOT Compliance.
 - 3. Safety Equipment: Placement and service personnel shall be equipped with job-specific safety equipment to complete the placement and startup of specified mixer following all OSHA safety regulations. Safety equipment shall include confined space, fall protection, rescue, decontamination, and communication tools such as (air monitor, ventilation fan,

tri-pod, winches, FBH's, retractables, ropes, lanyards, descenders, radios, hard hats, step pools, disinfectant sprayer, etc.)

END OF SECTION

SECTION 11269

CHLORINE ANALYZERS

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Online Free Residual Chlorine Analyzer
 - a. Free Residual Chlorine Sensor
 - b. Analyzer

1.02 SYSTEM DESCRIPTION

- A. An online chlorine sensor capable of continuously monitoring the free residual chlorine level in a sample stream.
- B. An analyzer that provides a readout of the free residual chlorine level with the ability to transmit the readings to a SCADA/DCS system.

1.03 SUBMITTALS

- A. General: Submit the following according to BRWA Master Specifications – Section 01 33 00 Submittal Procedures
- B. Manufacturer name and model number of equipment.
- C. Detailed specifications and dimensions.
- D. Operation and maintenance instructions.

1.04 WARRANTY

- A. The provided analytical equipment shall be guaranteed free from defects in material and workmanship for a period of one year from the date of shipment from the manufacturer.

PART 2 – PRODUCTS

2.01 SENSOR

A. Manufacturer:

1. Chemtrac, Inc. – Norcross, GA
2. Free Residual Chlorine Sensor

B. Features:

1. The sensor shall utilize a membrane covered, amperometric, three electrode design comprised of a gold cathode, stainless steel anode and silver/silver halide working electrode.
2. The sensor shall be capable of measuring free residual chlorine in a range from 0.01 to 5.0 mg/l (ppm).
3. The sensor shall incorporate automatic temperature compensation via an integrated thermistor.
4. The sensor shall have a resolution of 0.01 mg/l for any of the ranges listed above.
5. The sensor shall not require a zero calibration.
6. The sensor shall have an operating range of 41 to 113°F.
7. The sensor shall operate in a range of pH 4 to pH 9.
8. The sensor shall have no moving parts and not require the use of reagents.

C. Accessories:

1. A sensor interconnect cable, length to-suit required installation, shall be included.
2. A sensor flow cell, made of clear acrylic to allow visual inspection, shall be included.
3. A 2 year supply of free chlorine electrolyte shall be included.

2.02 Analyzer

A. Manufacturer and Model:

1. Manufacturer: Chemtrac, Inc. – Norcross, GA
2. Model: HydroACT 4 Analyzer

B. Features:

1. The analyzer shall have a high resolution, graphical, 24-bit color display.
2. The analyzer shall provide 2 configurable alarms and 2 configurable thresholds for each reported parameter.
3. The analyzer shall be capable of internally logging up to 1 million data points and allow expandable storage with the use of a MicroSD card.
4. The analyzer enclosure shall be rated NEMA 4X / IP65.
5. The analyzer shall include minimum of one (1) configurable, 4 to 20 mA analog output, configured to residual chlorine level
6. The analyzer shall include minimum of four (4) electromechanical SPST relays, rated for 380 VAC, 6 Amps.
7. The analyzer shall include minimum of four (4) digital inputs.
8. The analyzer shall include the ability to digitally communicate with the SCADA/DCS system via:
 - a. Modbus TCP via Ethernet.

C. Accessories:

1. Analyzer Installation:
 - a. Panel mount kit.

2.03 Enclosure

A. Manufacturer:

1. Hubbell, Inc.
2. Hot Box – Fiberglass Flip Top Enclosure – Model HB1T

B. Accessories:

1. Concrete Pad
 - a. Concrete pad for hot box enclosure shall be 36"x22" minimum, 6" minimum depth
2. Heat Tape
 - a. Hubbel, Heat Trace Tape – length and quantity to-suit required installation, shall be included

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Chlorine sensor, Chlorine analyzer, hotbox and heat trace tapes shall be installed as shown on Contract Drawings and per the manufacturer's installation instructions.

END OF SECTION

SECTION 11975

TANK SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Work in this section covers the furnishing and installation of safety equipment for climbing ladders and working at high elevations. All ladders are to be provided with a safe climbing system.

1.2 SHOP DRAWINGS

- A. The Contractor shall submit shop drawings for all safety equipment. Shop drawings shall include dimensioned drawings, descriptive literature, performance data, and in general all information necessary to prove compliance with the specifications, shall be submitted as required in the BRWA Master Specifications – Section 01 33 00 Submittal Procedures. Each shop drawing shall contain a summary sheet delineating specification compliance and areas of exception taken. Shop drawings submitted without the summary sheet will be rejected prior to review.
- B. Where indicated, provide complete Operation and Maintenance Manuals as specified in the BRWA Master Specifications – Section 01 33 00 Submittal Procedures.

PART 2 - MATERIALS

2.1 FULL BODY HARNESS

- A. Full body harness shall be designed to distribute the impact force of a fall over the thighs, buttock, chest and shoulders.
- B. Harnesses shall be constructed of woven nylon. Buckles and “D” rings shall be forged steel. “D” rings shall be provided front, back and on each shoulder. Shoulder straps shall be adjustable and padded. Harnesses shall conform to ANSI Z359.1 - Safety Requirements for Personal Fall Arrest Systems, Subsystems & Components and ANSI A10.14.
- C. Contractor shall supply two (2) harnesses – one (1) medium and one (1) large.

- D. Harnesses shall be 3M DBI-SALA ExoFit X300 Tower Climbing Harness, Model 1403094 (medium) and 1403095 (large).

2.2 LANYARD

- A. Lanyard allows a worker to attach to the structure, ladder rungs, stringers, or other suitable anchor points, when detached from the security of the ladder safety device
- B. The lanyard shall be 5/8" diameter nylon rope or woven nylon web with double-locking snap hooks at each end. Lanyard shall have rebar hook on one end. Lanyard shall meet the requirements of OSHA 1910.66 Appendix "C" and ANSI Z359.1-1992. Deceleration during a fall shall be provided by tear stitch type webbing. The lanyard shall be 72" in length. The lanyard shall also meet the requirements of OSHA 1915 and 1926.
- C. Contractor shall supply two (2) lanyards.
- D. Lanyard shall be manufactured by 3M DBI-SALA or approved equal.

2.3 LADDER CLIMBING SYSTEM

- A. Ladder climbing system shall be a cable type system. Climbing system shall consist of a cable and sliding sleeve. The sliding sleeve shall fit on the cable and stop falls within inches. Climbing system shall provide hands free operation.
- B. The fall protection system shall be a cable type system equal to Lad-Saf as manufactured by DBI-SALA or approved equal. All components to be manufactured from 316 stainless steel.
- C. The system should incorporate a tension indicator and means of adjustment.
- D. The attachment device shall pass intermediate cable guides automatically when ascending or descending, promoting hands-free operation.
- E. Contractor shall supply two (2) attachment devices/sleeve. The sleeves shall be manufactured by 3M DBI-SALA

2.4 WELDED SWIVEL ANCHOR

- A. A "Welded Swivel Anchor" provides a tie-off point on the roof when transitioning from tank ladders.

- B. The device shall be designed with a minimum breaking strength of 45.5kN (5,000 lbs).
- C. The welded swivel anchor shall be, Model SWS100S and the weld on puck shall be SWP100N-316KIT as manufactured by Climb Tech or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All installation shall be in accordance with the climbing system manufacturer's instructions.
- B. Wherever there are connections between dissimilar metals, dielectric separators shall be used.

END OF SECTION

SECTION 13220

WATER STORAGE TANK

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section specifies the design, fabrication, construction, and testing of the welded carbon steel water storage tank, concrete foundation, associated appurtenances, and cleaning and disinfection required by AWWA and/or the Virginia Department of Health.
- B. Design and construction of the Water Storage Tank shall conform to all requirements of AWWA D100 Standard for Welded Carbon Steel Tanks for Water Storage, except as modified by the requirements of these contract documents. The Contractor may not use Section 14 of the AWWA D100 as a part of the design.
- C. Cast-in-place concrete, external piping, and tank painting are specified in other specification sections.

1.02 QUALIFICATIONS

- A. The design and construction of the Water Storage Tank shall only be undertaken by a Tank Contractor with a minimum of ten years of experience in the design and construction of tanks meeting the specifications; and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The company constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of five (5) tanks of one million gallon size or larger, which meet these specifications and which are now giving satisfactory service.
- B. The Tank Contractor shall have on its staff a full-time professional structural engineer registered as such in the Commonwealth of Virginia, who shall have no less than five (5) years experience in the design and field construction of tanks meeting the specifications of the tank to be constructed, and who shall be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the Commonwealth of Virginia seal of such registered professional engineer and his signature.
- C. The entire tank, including all portions of the floor, wall, and roof, shall be built by the Tank Contractor, using its owned trained personnel and equipment. The tank foundation may be subcontracted.

1.03 SUBMITTALS

- A. Furnish detailed shop drawings for all items specified herein in accordance with the BRWA Master Specifications – Section 01 33 00 Submittal Procedures. Submittals shall include:
1. Detailed drawings of the tank and of the foundation sealed by a Professional Engineer registered in the Commonwealth of Virginia. Drawings shall include tank, roof, shell openings, safety railings, ladders, and all accessories to be furnished including all piping and piping connections to the tank.
 2. Affidavit of compliance of steel pipe in accordance with AWWA C200.
 3. Design data and calculations including structural analysis data signed and sealed by a Professional Engineer registered in the Commonwealth of Virginia. The design coefficients and resultant loads for snow, wind and seismic forces, and the methods of analysis shall be documented.
 4. Concrete mix designs
 5. Chlorination procedures and bacteriological test reports
 6. Welder's certifications shall be submitted in accordance with AWWA D100.
 7. Final report on weld x-ray testing in accordance with AWWA D100 Section 11.21.1

1.04 REFERENCE STANDARDS

- A. All work on the water storage tank shall fully conform to the requirements of the latest published editions of the following Standard Specifications:
1. AWWA (American Water Works Association) D100 Standard for Welded Carbon Steel Tanks for Water Storage.
 2. AWWA D102 - Standard for Painting Steel Water Storage Tanks.
 3. AWWA C652 - Standard for Disinfection of Water Storage Facilities.
 4. AWS (American Welding Society) D1.1
 5. NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.

6. Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice,
7. Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
8. ACI 318 - Building Code Requirements for Reinforced Concrete
9. ACI 301 –Specifications for Structural Concrete

1.05 TANK DESIGN CRITERIA

- A. Reservoir: 1 million gallons
- B. Tank Diameter: Approximately 106' or per manufacturer's design
- C. Height of Tank (max): 16' (from top of foundation to top of tank wall, excluding tank vent)
- D. Wind Load: Wind pressure shall be determined in accordance with AWWA D100, Section 3.1.4. Basic wind speed used in the Wind Pressure formula shall be determined using the mapped site location and Figure 1 of AWWA D100.
 1. Basic Wind Speed (BWS) = 100 MPH
- E. Seismic Load: Seismic loads shall be determined in accordance with AWWA D100, Section 13.
- F. Snow Load: Snow load shall be in accordance with AWWA D100 and based on 25 pounds per square foot.

1.06 TANK FOUNDATION

- A. A Geotechnical investigation has been carried out at the site and a copy of the report is included with Reports and Drawings Known to Owner, Helm Street Tank Site, Bedford, VA.
- B. The Contractor shall retain the services of a Geotechnical Engineer to verify the adequacy of the bearing stratum after the Contractor has carried out the excavation and before any concrete or reinforcement is placed. The concrete foundation shall be designed and constructed by the Tank Contractor.

PART 2 – PRODUCTS

2.01 STEEL TANK

- A. The tank shall be a vertical, cylindrical, flat bottom type of all-welded construction.
- B. Minimum Plate Thickness: The minimum thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water.
- C. Tank Roof: The tank roof shall be designed as per the project drawings. All interior lap joints will be sealed by means of continuous seal welding. The interior lap joints shall be defined to include roof plate laps. If roof is supported by rafters, the rafter shall be welded to the roof plates as required structurally. Any unwelded rafter to plate joints shall be sealed by caulking. The minimum thickness for roof plates not in contact with water will be 3/16".

2.02 ACCESSORIES

- A. All accessories shall be guaranteed by the Contractor for five (5) years.
- B. Overflow: One 12" diameter overflow, equipped with an anti-vortex entrance detail shall be provided. Overflow pipe shall extend along the exterior wall of the tank and shall have suitable support brackets. The pipe shall terminate above grade and be provided with a 316 stainless steel wire screen.
- C. Roof Vent:
 - 1. Roof vent to be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not develop during maximum flow rate of water entering or leaving the tank. For the design, the vent shall be considered the only passage of air in and out of the tank.
 - 2. Roof vent shall have 24" diameter opening at base of vent.
 - 3. The vent shall be aluminum construction and be screened with stainless steel 16 mesh screen. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent shall be easily dismantled for cleaning.
 - 4. The vent shall be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after the pressure or vacuum is relieved.
- D. Ladders:

1. Provide one fixed ladder on the exterior of the tank be attached to the tank shell extending from approximately 8' above top of foundation to the top of the shell. Provide lockable ladder guard to prevent unauthorized use of ladder.
 2. Provide one fixed ladder on the interior of the tank, extending from the tank bottom to the roof.
 3. Ladder side rails shall be a minimum 3/8 inch by 2-1/2 inches with an 18 inch clear spacing. Rungs shall be not less than 1 inch, round or square, spaced at 12 inch centers. The surface of the rungs shall be knurled, dimpled or otherwise treated to minimize slipping. Ladders shall be secured to the tank by brackets located at intervals not exceeding 10 feet. Brackets shall be of sufficient length to provide a minimum distance of 7 inches from the center of the rung to the nearest permanent object behind the ladder.
- E. Fall Protection: All exterior ladders are to be provided with a safe climbing system in accordance with Section 11975 – Tank Safety Equipment. No climbing system is required for the interior ladder.
- F. Roof Hatches:
1. Provide two access hatches on the roof of the tank:
 - a. The first hatch shall be 30-inch diameter and allow access from the roof to the interior of the tank. The hatch will be hinged and equipped with a hasp for locking and hold open arm. The cover shall have a handle on the exterior to assist in opening the hatch. The hatch cover shall have a 2 inch downward edge.
 - b. A second hatch will be 24-inch diameter and flanged with a removable cover so constructed that an exhaust fan may be connected for ventilation during painting operations.
 2. The openings shall have a minimum 4 inch curb. The cover shall overlap the frame at least two inches.
 3. The hatches shall be capable of being secured with a standard padlock.
 4. Hatches shall be of similar construction as the roof and painted with the rest of the tank.
 5. Hatches shall be watertight and airtight.

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- G. Shell Access Manhole: Provide two 30-inch diameter shell manholes shall near grade level to allow access to the tank interior. The manholes are to be located 180 degrees apart. The manhole lid shall be hinged or otherwise self-supported and open outward.
- H. Painter's Rail: A painter's rail attached to the roof or shell, pipe couplings with plugs in the roof or other attachments that provide complete access for painting shall be furnished.
- I. Tank Identification Plate: A tank identification plate shall be mounted above a shell manhole. The identification plate shall be corrosion resistant and contain the following information:
1. Tank Contractor
 2. Tank capacity
 3. Tank diameter and height to High Water Level
 4. Date constructed
- J. Cathodic Protection System:
1. Contractor shall furnish and install a year-round, ice-resistant, submerged cathodic protection system. Any entrance penetrations for the cathodic protection system shall be cut and extra-heavy couplings and shall be installed in the openings with continuous fillet welds on both interior and exterior surfaces. The location of all attachments and fittings shall be in accordance with the Engineer reviewed drawings for the approved cathodic protection system. Submerged anode support devices shall be welded to the interior of the tank prior to painting of the tank.
 2. The submerged cathodic protection system shall be in accordance with Section 13500 – Cathodic Protection System.
- K. Tank Mixing System: The mixing system shall be as specified under Section 11268 – Tank Mixing System.
- L. Handrail: provide angle safety handrail on the tank roof around the entire circumference of the roof while providing access from tank ladder.
1. Handrail shall conform to all applicable OSHA standards including Standard 1910.29 – Fall protection systems and falling object protection – criteria and practices.

2.03 TANK PIPING

- A. Steel pipe used for inlet/outlet and overflow piping shall be supplied in accordance with AWWA C200. The minimum thickness of all steel pipe shall be as required for a 150 psi design rating unless otherwise shown or specified.
- B. Provide connections to join the steel pipe inside the tank to the underground ductile iron pipe outside the tank. Connections shall prevent any corrosion potential due to dissimilar metals.
- C. All steel piping shall be welded joints in accordance with AWWA C206.
- D. The exterior of all steel piping, including the overflow piping, shall be coated. The coatings shall be as specified for the tank.

PART 3 – EXECUTION

3.01 CONSTRUCTION

- A. Concrete Foundation - The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included herein at the end of these specifications. The concrete foundation shall be constructed in accordance with ACI 301.
- B. Steel Tank Construction
 - 1. The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.
 - 2. All field welding shall conform to AWS and Section 10, AWWA D100. The contractor shall ensure welders or welding operators are qualified in accordance with ASME Section IX.
 - 3. All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.
 - 4. Erection:
 - a. All weld joints inside the tank shall be seal-welded, including the underside of the roof plate and roof structure.
 - b. Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper

curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.

- c. Joints in bottom of tank shall be continuously lap welded on top side only. The bottom ring of the tank wall shall be continuously welded to the floor plate both inside and outside.

3.02 INSPECTION AND TESTING

- A. Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. Sectional segments will not be allowed. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all cost included in the Contractor's bid and paid by the Contractor.
- B. All joints in the tank bottom shall be vacuum tested by the Contractor prior to painting as described in AWWA D100 Section 11.

3.03 PAINTING

- A. Surface preparation and coating of all steel surfaces shall be in accordance with Section 09900 – Tank Painting.

3.04 TESTING AND DISINFECTION

- A. Contractor shall allow for a minimum of seven days following the application of the final painting coat on the interior surface before the tank is sterilized or filled with water. In addition, the Contractor shall provide a certification letter from the paint manufacturer's representative stating that sufficient curing has occurred.
- B. Water from the tank supply line shall flow through the 6-inch backflow preventer on the 6-inch bypass line. Until the tank is put in service, the 6-inch backflow preventer shall be used between the water supply and water tank.
- C. The Contractor shall first clean the tank of all equipment, tools, scaffolding and debris and broom clean the floor in accordance with Section 4 of AWWA C652. All interior surfaces shall be thoroughly washed with water to remove dirt, dust and other contaminants.
- D. No separate filling of the tank will be required for the purpose of testing for leakage. Should the Contractor elect to test in this manner, the cost of the water shall be borne by the Contractor.

- E. The Contractor shall disinfect per the requirements of AWWA C652 - "Disinfection of Water Storage Facilities" (latest edition), Section 4-3. Chlorination Method No. 2 shall be used. Alternate chlorination methods shall be requested by the Contractor and approved by the Owner prior to use.
- F. The Owner, free of charge to the Contractor, shall furnish sufficient water for one (1) testing and sterilization of the tank. Water will be supplied at the proper pressure to fill the tank to the maximum working level. Any tank leaks disclosed by testing shall be repaired by gouging out the defective areas and rewelding. Tank repairs shall be made at no additional expense to the Owner. No repair work shall be done on any joint unless the water in the tank is at least two feet below the joint being repaired. Any paint damaged by repairs shall be properly restored in accordance with Section 09900 – Tank Painting. The Owner shall require the Contractor to pay for any water required for re-testing and/or re-sterilization due to leakage.
- G. Upon completion of the disinfection procedure, two satisfactory bacteriological samples, collected 24 hours apart, must be obtained from the storage tank and subject to satisfactory bacteriological testing, appropriate chlorine residual, and acceptable aesthetic water quality as described in Section 5 of AWWA C652, until the water may be delivered to the distribution system. The tank shall not be put into service until safe test results are obtained. The disinfection procedure will be repeated, at no additional cost to the Owner, if the bacteriological testing fails. The disinfection will be repeated until the bacteriological tests pass.
- H. Highly chlorinated water required for tank disinfection shall not be allowed into the BRWA's distribution system nor into the tank drain for discharge. The Contractor shall be responsible for providing the dichlorination of the 1 MG tank which will be dumped after the bac-t tests are completed. The Contractor shall notify the owner of their intended method of dichlorination and coordinate with the Owner when draining the tank.
- I. The Owner shall make every effort to provide water in a timely manner. However, the water delivery rate shall be dependent upon the system demand. Summer demands may be higher and water may only be available at night. The Contractor shall consider system demand when planning testing.

3.05 FIRST ANNIVERSARY INSPECTION

- A. The Owner, in concert with the Contractor, will conduct a First Anniversary Inspection during the 11th month after final acceptance of the tank. The Contractor shall be given at least 3 weeks notice prior to the inspection. Defective work shall be repaired by the Contractor at no cost to the Owner in accordance with AWWA D102. Any holidays or damage to the interior of the tank shall be recoated with the same coating system as specified for the original construction in Section 09900 – Tank Painting, or an approved alternative coating system from the same manufacturer.

3.04 GUARANTEE

- A. The Contractor shall guarantee its work for a period of one year from the substantial completion date as described in the supplementary and general conditions of the contract documents to the extent that it will repair any defects caused by faulty design, workmanship or material furnished under the specifications.

END OF SECTION

SECTION 13500

CATHODIC PROTECTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide and install a submerged floating anode system manufactured by Freeman Industries, Inc. The purpose of the system shall be to automatically control corrosion of the submerged interior surfaces of the water tank.

1.02 SYSTEM SUPPLIER

- A. The cathodic protection system supplier shall be Freeman Industries, Inc or approved equal.

1.03 PERFORMANCE REQUIREMENTS

- A. The intent of these specifications is to procure a quality product by an established manufacturer of the latest design. The cost of equipment shall include all royalty costs arising from patents and licenses associated with furnishing the specified equipment. All material shall be designed to withstand the stresses created under ice conditions. The system shall be designed to be ice free and designed for use on tanks with ice conditions.

1.04 SUBMITTALS

- A. The Contractor shall submit to the Engineer for approval, catalog cuts of all materials to be supplied in accordance with the BRWA Master Specifications – Section 01 33 00 Submittal Procedures.
- B. The Contractor shall submit to the Owner, field test reports of the initial and final cathodic protection system field tests.

PART 2 - PRODUCTS

2.01 CATHODIC PROTECTION SYSTEM

- A. The Cathodic Protection System shall be provided by Freeman Industries, Inc. or approved equal

Freeman Industries, Inc.
Phone: 440-858-2600
<http://www.freemanindustriesinc.com>
2061 State Route 193
P.O. Box 10
Dorset, OH 44032

PART 3 - EXECUTION

3.01 CRITERIA FOR PROTECTION

- A. After the system has been set into operation by an authorized manufacturer's representative, complete potential test will be performed to confirm that protection is being achieved in conformance with criteria established by the National Association of Corrosion Engineers in the NACE Standard RP0388, current revision.

3.02 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by the Owner or a designated representative who shall be advised 5 days prior to performing each field test. Quality control for the cathodic protection system shall consist of the following:
1. Initial field-testing by the Contractor upon construction. Cathodic protection system manufacturer shall provide a NACE certified technician to perform all tests. Cost for the technician shall be included in the Bid.
 2. Warranty period field-testing by the Contractor.
 3. Final field-testing by the Contractor after one year of service.
- B. Initial Cathodic Protection System Field Testing
1. Upon completion of the installation, fill tank to maximum working level, and the Contractor shall test and inspect the cathodic protection system in the presence of the Owner or his approved representative. Record test data, including date, time, and location of testing and submit to the Owner. Contractor shall correct and retest, at no additional cost to the Owner, deficiencies in the materials and installation observed during the tests and inspections. Measurements shall be made with voltmeters having input impedance not less than 10 megohm. Testing shall include the following:
 - a. Base potentials: Before energizing of the cathodic protection system, measure the base structure-to-water potentials of the tank. The locations of these measurements shall be identical to the locations specified for measuring energized structure-to-water potentials.
 - b. Permanent reference electrode: Verify proper operation and calibration of the reference electrode(s) including the entire reference electrode wiring circuit.

2. Rectifier testing: Upon completion of the installation, energize and adjust the rectifier to provide current to the anode at a level that will protect the tank in accordance with the criteria listed. Measure D.C. output of the rectifier and current output of each anode at different rectifier settings. Measure the current outputs across the installed shunts. Verify these readings using portable, calibrated meters and shunts. This testing shall demonstrate if the rectifier system is capable of functioning properly as required to provide effective cathodic protection.
3. Energized tank-to-water potentials: After the cathodic protection system has been placed into operation, perform the tank-to-water measurements with a portable reference electrode using an IR drop corrector circuit, as manufactured by Freeman Industries to ensure that tank-to-water potentials meet the criteria for protection.

C. Initial Cathodic Protection System Field Test Report

1. The Contractor shall submit a field test report of the cathodic protection system. All rectifier measurements, anode output current measurements, and structure-to-be-electrolyte measurements, including initial potentials, shall be recorded on applicable forms. Identification of rectifiers, anode junction boxes, test location, and test stations shall coordinate with the as-built drawings and be provided on system drawings included in the report. The Contractor shall locate, correct, and report to the Owner any short circuits encountered during the checkout of the installed cathodic protection system.

D. Two Year Warranty Period Testing

1. For the first year the cathodic protection system will be turned off. The Contractor shall de-energize the system after completing the initial set-up and field test. The Contractor shall warranty the system for the first year.
2. In the second year, the cathodic protection system manufacturer shall monitor the cathodic protection system quarterly over the second year to ensure its continued conformance with the criteria outlined below. The performance period for these tests shall commence upon completion and acceptance of the one-year tank inspection by the Owner and Contractor. During the first year, at the recommendation of the coating manufacturer, the cathodic protection system shall remain turned off. Copies of the Two-Year Warranty Period Cathodic Protection System Field Test Report, including field data, and certified by the Manufacturer, shall be submitted to the Owner. The 2nd year warranty certificate shall be included in the O&M manual.
3. Cathodic protection system manufacturer shall provide certified technician to perform all tests. Cost for the technician shall be included in the Bid.

E. Final Field Testing

1. Conduct final field testing of the cathodic protection system utilizing the same procedures specified under, "Initial Cathodic Protection System Field Testing." The Contractor shall inspect, test, and adjust the cathodic protection system after one year of operation to ensure its continued conformance with the criteria outlined below. The performance period for these tests shall commence upon preliminary acceptance for the cathodic protection system by the Owner. Copies of the Final Cathodic Protection System Field Test Report, certified by the Contractor, shall be submitted to the Owner.

3.03 GUARANTEE

- A. The Cathodic Protection System shall be guaranteed against all defects in materials and workmanship for a period of two (2) years. During the first year, at the recommendation of the coatings manufacturer, the Cathodic Protection System will not be turned on to allow for a through testing of the coating system. The Cathodic Protection System manufacturer shall extend the warranty for one (1) additional year beyond the Contractor's standard warranty.

3.04 SERVICE CONTRACT

- A. The proper operation of cathodic protection systems depends on adequate periodic maintenance and testing. As an additional submittal the Contractor shall supply an annual service contract to cover all maintenance requirements for the installed system for a period of five years from Final Completion. The contract shall provide for the following:
 1. Inspection and adjustment of the equipment once per year during the period covered by the proposal.
 2. Complete maintenance of the equipment by furnishing all labor and equipment to replace or repair, all parts worn or damaged so as to impair the operation of the system, except those parts damaged through fire, natural disasters, negligence, tampering or other fault of the purchaser.

END OF SECTION

SECTION 15000

GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The provisions of this entire section of the specifications are intended to govern the quality of design, fabrication, workmanship, operation, etc., of all materials, equipment and appurtenances to be provided under the various sections of the mechanical specifications and all other sections that include mechanical equipment as part of the specified items.

1.02 SUBMITTALS

- A. Shop drawings, including dimensioned drawings, descriptive literature, performance data, electrical characteristics, and in general all information necessary to prove compliance with the specifications, shall be submitted as required the BRWA Master Specifications – Section 01 33 00 Submittal Procedures.

1.03 GUARANTEE

- A. Guarantee materials, equipment, workmanship and performance for the period and in accordance with the provisions in Division 0 and 1.

1.04 MANUFACTURER'S CERTIFICATES

- A. Furnish Manufacturer's Certificates for all equipment items as required in Division 1.

1.05 OPERATION AND MAINTENANCE MANUALS

- A. Provide manufacturer's operation and maintenance manuals as required in Division 1.

1.06 STANDARDS

- A. References to standards, codes and specifications including amendments and errata are the latest edition at the time the bids are taken. A list of these References is listed below:

AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing Materials
AWS	American Welding Society
AWWA	American Water Works Association
IEEE	Institute of Electrical & Electronics Engineers
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Act
SMACCNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriters Laboratories, Inc.

1.07 GENERAL DESIGN OF EQUIPMENT AND MACHINERY

- A. Equipment and machinery provided shall be of the latest and most improved design suitable for the service of which it is to be used. Equipment and machinery shall be designed and constructed to operate efficiently, continuously and quietly under the specified requirements with a minimum of labor, power, maintenance, renewals and repairs. The design and construction of equipment and machinery shall be such as to permit operation with minimum noise, wear and vibration (maximum velocity of 30 feet per second unless otherwise specified) when properly installed.
- B. Ample room for erecting, repairs, inspecting and adjusting all equipment and machinery shall be provided. The design, construction and installation of equipment and machinery shall conform to and comply with the latest safety codes and regulations.
- C. The design and construction of the several units shall be such that they shall present a uniform appearance and the arrangement shall be such that their operation shall be in harmony in every respect. Fittings and fixtures of the same make and model shall be used. Equipment of identical type and service shall be the product of the same manufacturer.
- D. Equipment selected shall be of such size and general arrangement to suit the space in which it is to be installed.
- E. The various parts of the equipment and machinery shall be of plain shape and good lines, especially designed and constructed for strength and durability. Castings shall be designed and constructed to cool uniformly without shrinking strains and shall have good sized fillets at all re-entrant corners. Sudden change of section shall be avoided.
- F. Whenever possible, parts of each unit shall be made to gauge and be a duplicate of and interchangeable with the same parts of other machines of the same size and kind.

- G. The workmanship shall be of the highest class throughout.
- H. All assemblies shall be completely shop fabricated and structural steel parts shall be shop erected. Assemblies and structural steel parts shall be matchmarked before being disassembled for shipment. Parts shall be shipped assembled in as large unit as possible to minimize field re-assembly. All parts shall be amply proportioned for all stresses which may occur during operation, and for any additional stresses which may occur during fabrication and erection.
- I. Unless otherwise specified, welding shall be in accordance with the latest standard specifications for "Gas Tight Welding" of the American Welding Society.
- J. Unless otherwise specified, galvanizing shall be hot-dipped, in accordance with the latest standard specifications for "Zinc Coating" of the ASTM, Serial Designation A-123.
- K. Unless otherwise specified, starters, H-O-A switches, pushbuttons and other electrical devices shall be specified in Division 16, and shall be arranged as shown on the Contract Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Unless otherwise specified, materials shall be in accordance with the following latest Standard Specifications of the ASTM:

Structural Steel	A-36
Iron Castings	A-48 or A-126
Welding Steel Pipe	A-53
Zinc (Hot-Galvanizing)	A-123
Steel Bolts	A-307
Babbitt	B-23
Bronze Castings	B-30
Bronze (Silicone)	B-98
Bronze (Manganese)	B-138
- B. All materials shall, if required, be tested and shall fulfill all requirements specified. Physical tests may be made by the Owner. The Contractor at his own expense shall furnish test pieces and samples in the number, shape, size and finish required by the Engineer. All broken material shall become the property of the Owner. The failure of test specimens to fully conform to the requirements of the specifications shall be sufficient cause for rejection of the whole melt or stock from which samples were obtained.

- C. Iron castings shall be smooth, clean and free from scale, lumps, blisters and other defects. No plugging, welding or filling will be allowed.
- D. The alloy grade number of all babbitt shall be that bearing alloy of a composition recommended by the manufacturer of the equipment or machinery for the service required, subject to the approval of the Engineer.
- E. All bronze shall be made of new material and shall be free from objectionable imperfections. If the materials show signs of improper mixing when being machined, the castings will be rejected.

2.02 JOURNALS, BEARINGS AND KEYS

- A. Journals and bearing surfaces shall be of sufficient size and properly proportioned for the least wear and to avoid heating under all conditions, and where necessary, provisions shall be made for easy removal and for proper adjustments. Journals shall be suitable boxes which, where necessary, shall be lined with babbitt metal hammered into grooves and bored in place. If bearings are of the ball bearing type, both inner and outer races as well as the balls shall be heat treated steel to resist wear. The balls shall be of ample size to carry the maximum loads with a large factor of safety to prevent flaking, spalling, or crushing. The balls shall be properly spaced and held in position by rugged continuous spacing or retainer rings.
- B. Pins and keys shall be properly proportioned. Keys, nuts and all other parts which might otherwise work loose shall be secured with approved locking devices.
- C. Unless otherwise specified, all anti-friction bearings, including ball, roller, and tapered roller bearings, shall have a minimum AFBMA B-10 life rating of 50,000 hours. Rating life is defined as the number of hours that 90% of a group of bearings will complete or exceed before the first evidence of fatigue develops in the material of either ring or any of the rolling elements. Furnish PE certified Bearing Life calculations.

2.03 LUBRICATION

- A. All bearings, except those specifically requiring oil or water lubrication shall be pressure grease lubricated. All lubrication points shall be readily accessible, away from locations dangerous to workmen. Pressure grease lubrication fittings shall be the "Alemite" type as made by the Stewart Warner Corporation, or approved equal with plastic caps to protect fittings from corrosion and debris. The pattern of the fitting shall be selected for accessibility in lubricating and shall meet the approval of the Engineer. Housings of grease lubricated bearings shall be automatically exhausted to atmosphere to prevent excessive greasing.

- B. Furnish one Alemite Professional Series grease gun with whip hose Product No. 500-E, or approved equal, one Alemite grease gun holder and the necessary Alemite adapters and Extensions to accommodate the grease fittings on the provided equipment. Submit for engineer review.
- C. Furnish lubrication charts and schedules for each piece of equipment or machinery. The charts and schedules shall designate each point of lubrication, the type of lubricant to be applied and the frequency of lubrication. Charts and schedules shall be submitted to the Engineer in quadruplicate, bound in folios, with each chart and schedule protected by a transparent plastic envelope.
- D. Furnish 1 year's supply of each type of premium lubricant required. A typewritten list shall be furnished with the lubricants, designating the specific lubricant to be used with each piece of equipment. This is in addition to the required operating and maintenance manuals, which will also contain lubrication requirements.
- E. Provide stainless steel grease header blocks and extension hoses that are supported and properly secured for grease fittings that are located in difficult to reach locations or near rotating and dangerous equipment. The header block shall be adjacent to the equipment and easily accessible as determined by the Engineer.

2.04 MOTORS AND CONTROLS - GENERAL

- A. Motors and controls shall conform to the latest requirements of IEEE and NEMA, and where applicable, shall be UL listed. Minimum sizes are specified with the driven equipment. Motor starting and control equipment is specified either with the motor which is controlled or in an electrical specification section. Consult all specification sections to determine responsibility for motors and controls and provide complete motor performance specifications with shop drawings submittal data. All shop drawings and motor submittal data shall identify motor duty type and model in addition to nameplate data and performance specifications, including efficiencies and power factors.
- B. Motors shall be designed, built and tested in accordance with the latest revision of NEMA Standard MG 1.
- C. Motors shall be suitable for use under the conditions and with the equipment to which applied, and designed for operation on the electrical systems indicated.
- D. Motor capacities shall be such that the horsepower rating and the rated full-load current is not exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplate.
- E. Motor sizes noted in the individual equipment specifications are minimum requirements only. It is the responsibility of the equipment manufacturers and of the Contractor to provide motors, electrical circuits, breakers and equipment of ample capacity to operate

- the equipment without overload, without exceeding the rated full-load current, or overheating at full-load capacity under the most severe operating service of this equipment. Motors shall have sufficient torque to accelerate the total WR^2 of the driven equipment to operating speed.
- F. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.
 - G. Motors shall be designed for operation on 60 hertz power service. Unless otherwise specified or shown, motors less than 1/2 horsepower shall be single phase, and motors 1/2 horsepower and larger shall be 3 phase.
 - H. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.
 - I. Single phase motors smaller than 1/20 horsepower shall be ball or sleeve bearing, drip-proof, totally enclosed or explosion proof, as indicated, 115 volts, permanent split capacitor or shaded pole type. These motors shall not be used for general power purposes and shall only be provided as built-in components of such mechanical equipment as fans, unit heaters, humidifiers and damper controllers.
 - J. Single phase motors 1/20 horsepower and larger shall be ball bearing, drip-proof, totally enclosed or explosion proof, as indicated, with Class A or B insulation, as standard with the motor manufacturer; 115, 115/230, 208 or 230 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type.
 - K. Except as otherwise specified in the various specification sections, 3 phase motors shall meet the requirements of this paragraph. Motors shall be NEMA design B squirrel cage induction type. Insulation shall be Class F and motor shall be rated at no greater than 50 deg. C rise for open motors and 65 deg C rise for closed motors both above an ambient temperature of 45 deg. C. At 40 deg. C ambient temperature explosion-proof and totally enclosed motors shall have a 1.00 service factor and dripproof motors shall have a service factor of 1.15 or higher. Motors specified for operation at 480 volts shall be nameplated 460 volts.
 - L. Unless otherwise specified, three phase motors shall be the NEMA Premium™ type. Minimum three phase motor efficiencies at full load for motors having nominal rated speeds of:

<u>HP</u> <u>ODP MOTORS</u>	<u>RPM</u>		
	<u>3600 (2-pole)</u>	<u>1800 (4-pole)</u>	<u>1200 (6-pole)</u>
1	--	85.5	82.5
1-1/2	84	86.5	86.5
2	85.5	86.5	87.5

3	85.5	89.5	88.5
5	86.5	89.5	89.5
7-1/2	88.5	91.0	90.2
10	89.5	91.7	91.7
15	90.2	93.0	91.7
20	91.0	93.0	92.4
25	91.7	93.6	93.0
30	91.7	94.1	93.6
40	92.4	94.1	94.1
50	93.0	94.5	94.1
60	93.6	95.0	94.5
75	93.6	95.0	94.5
100	93.6	95.4	95.0
125	94.1	95.4	95.0
150	94.1	95.8	95.4
≥ 200	95.0	95.8	95.4

RPM

TEFC MOTORS	<u>3600 (2-pole)</u>	<u>1800 (4-pole)</u>	<u>1200 (6-pole)</u>
1	77.0	85.5	82.5
1-1/2	84.0	86.5	87.5
2	85.5	86.5	88.5
3	86.5	89.5	89.5
5	88.5	89.5	89.5
7-1/2	89.5	91.7	91.0
10	90.2	91.7	91.0
15	91.0	92.4	91.7
20	91.0	93.0	91.7
25	91.7	93.6	93.0
30	91.7	93.6	93.0
40	92.4	94.1	94.1
50	93.0	94.5	94.1
60	93.6	95.0	94.5
75	93.6	95.4	94.5
100	94.1	95.4	95.0
125	95.0	95.4	95.0
150	95.0	95.8	95.8
≥ 200	95.4	96.2	95.8

Three phase motors shall be the Premium Efficiency Motor of U.S. Electrical Motors, the MAC II High Efficiency motor of Westinghouse Electric Corporation, or equal.

- M. Motors 25 horsepower and larger shall be as specified with the driven equipment in these specifications.
- N. Belt-connected motors shall have adjustable bases and set screws to maintain proper belt tension. All fan motors shall have adjustable sheaves for speed adjustment.

2.05 FLANGES AND BOLTS

- A. Flanges, where threaded on pipe shall be of the same material as the pipe and bolt holes shall be drilled and spot-faced on the back. Stud holes shall not be drilled through. Flanges shall be uniform in thickness and shall come fair and, if required, shall be turned or chipped in a neat and workmanlike manner.
- B. Jacking screws shall be provided for covers, etc. where required, and also suitable eye bolts for lifting. Bolts and nuts shall be of the best quality of open hearth, free machining steel. Bolts shall have good, sound well-fitting threads; nuts shall be cold pressed. Where noted as galvanized, all heads, nuts and threads shall be of the American Standard regular sizes.

2.06 COUPLINGS

- A. Except where otherwise specified for a particular item of equipment, all equipment where flexible couplings are specified or are required for the purpose, a standard self-aligning forged steel coupling with sealed lubrication, as manufactured by Thomas, Koppers, Falk, Sier-Bath, or equal shall be provided between each motor and its driven equipment. One hub of the coupling shall be firmly fixed and keyed to the equipment shaft with the other hub similarly secured to the abutting drive shaft. Couplings shall be placed as close as possible to the driven equipment and the motor bearings to make compactly arranged units. Couplings shall be of all metal construction and shall be moisture-proof and dustproof. Arrangement of couplings shall be such that there is sufficient room to place a dial indicator for alignment checking of shafts of the motor driven equipment. Each coupling shall be provided with an easily removable guard meeting all OSHA requirements.
- B. All equipment and motors/drives shall be field aligned using a dial indicator in accordance with the procedures established by the latest revision of the Hydraulic Institute Standards. Parallel and angular misalignment shall not exceed the limits recommended by both the equipment and the coupling manufacturer.

2.07 EQUIPMENT BEDPLATES

- A. All items of mechanical equipment mounted on masonry floors shall be provided with a concrete pad four inches high, or higher, as required to accommodate piping connections to equipment. Where motors 10 horsepower and larger, and equipment driven by motors 10 horsepower and larger, are to be mounted on a raised reinforced concrete pad,

L-shaped threaded mounting studs shall be cast into the concrete; insert type anchors installed after setting of the concrete will not be acceptable for these applications.

- B. The various items of motor driven equipment, such as pumps, shall be mounted on structural steel bedplates. The bedplates shall be adequate size to accommodate the equipment and its motor, to form an integral rigid mounting platform. Steel or brass shims shall be used to level equipment bedplates mounted in contact with concrete pads or floors. Jacking bolts or jacking (leveling) nuts on mounting studs shall not be used in lieu of shims. Bedplates shall be grouted to the concrete base and shall be filled with grout in all instances where the manufacturer has made provision for introducing grouting mixture into bedplate cavities. It shall be the contractor's complete responsibility to determine the proper method, to provide all materials and components required, and to coordinate the work, to set, couple, align and install all equipment in a satisfactory manner.
- C. All centrifugal fans and air compressors shall be mounted on steel springs or rubber-in-shear vibration isolation units as recommended by the manufacturer. These may be either shop provided with the equipment or separately field mounted.

2.08 CONTROLS

- A. Controls shall be as described in Division 13 and 16 and as shown on Contract Drawings.

PART 3 - EXECUTION

3.01 MANNER OF INSTALLATION

- A. The general arrangement of pipe and equipment shall be as shown on the Drawings. Detailed drawings of proposed departures due to actual field conditions or other causes shall be submitted to the Engineer for approval. The Contractor shall carefully examine the drawings and shall be responsible for the proper fitting of materials and equipment as indicated, without substantial alteration. Because of the small scale of the drawings, it is not possible to indicate the exact location of piping, all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the space requirements for proper clearances and the structural and finish conditions affecting his work and shall arrange such work accordingly, furnishing such offsets, fittings, valves and accessories as may be required to meet such conditions.
- B. Contractor shall determine for each trade the location, size, etc. of all chases and openings required for the proper installation of its work, and shall see that such are provided. Where it is necessary to run pipes or ductwork through walls or fittings, the trade performing the work shall notify the Contractor so that proper provisions can be made for same. Each trade shall provide and set all inserts, sleeves, hanger supports, etc. required for its work and shall be responsible for their proper and permanent location.

- C. All piping and ductwork exposed to view shall be run generally parallel with the lines of the structure and as close to walls and columns as may be practical and consistent with proper grade and the maintenance of proper clearances for access to all parts requiring servicing.
- D. The Contractor, in the prosecution of the work, shall do no cutting of masonry, concrete or other materials after same have been installed, without the written permission of the Engineer.

3.02 TESTING

- A. After erection, the Contractor shall adjust and balance all equipment and systems, and shall demonstrate that all equipment is operating in a satisfactory manner. Adjustments shall be made as necessary. All defective parts on machinery shall be replaced.
- B. The Engineer shall be notified in advance of all tests and all tests shall be conducted to his entire satisfaction.
- C. See Paragraph 1.04, Manufacturer's Certificates, for further requirements on selected major items of equipment.

3.03 ALIGNMENT

- A. Journeymen shall perform alignment of equipment provided. Carpenters, laborers, or any other trades are specifically excluded from performing this work. In locations where such trades are not available, the Contractor shall retain the services of a firm specializing in this type of work to perform the setting and alignment work.

3.04 MISCELLANEOUS

- A. Finished parts shall be well protected in the shop, during transportation and before and after erection to prevent damage of any kind. Damaged parts which in the opinion of the Engineer are damaged or which cannot be refitted, shall be promptly replaced by the Contractor without expense to the Contract. All exposed finished parts of machinery shall be greased or oiled before shipment.
- B. Furnish all tools of special nature which are required for making adjustments (by the Owner after the work has been turned over to him) to equipment but will not be required to furnish standard tools that are typically available from most home improvement stores.
- C. Exposed belts, gears, and drives shall be protected with guards. Guards may be of the equipment manufacturer's standard design, and comply with OSHA Standards.

3.05 PAINTING AND LABELING

- A. Fabricated or assembled surfaces normally painted shall be thoroughly dry and free from all rust, grease, dirt or scale. Unless otherwise specified, shop prime painting and field finish painting shall be as specified in Division 9. The Contractor is reminded to correlate the selection of shop prime coats to be compatible with subsequent field applied coats of paint. The Contractor shall "touch-up" paint any item damaged.
- B. Control panels, valve operators, etc., shall have identifying nameplates screwed or bolted to the enclosure. Nameplates shall be minimum 3/4 inches high plastic with white background and 1/4 inch high engraved black letters.

3.06 ADJUSTMENTS TO RELATED WORK

- A. The final work shall include any adjustment that may be required by the approved equipment furnished, with modifications made to concrete shapes and to dimensions shown on the contract drawings as may be required to suit the details of the approved equipment furnished, all at no additional cost to the Contract.

3.07 CERTIFICATION OF WELDERS

- A. Welding piping systems shall be done by experienced operators who are skilled and have had experience in the method and materials used. All welders shall be qualified as specified in the ASME Code for Unfired Pressure Vessels, Paragraph U-70.
- B. For field welding, the Contractor shall submit to the Engineer for his review and approval a certified statement, from an approved testing agency for each welder he proposes to use for welded piping. Each certified statement shall indicate that the welder has, within six months from proposed employment on this project, been successfully qualified under the requirements of Section IX of the ASME Boiler Construction Code. All certificates and qualifications shall be at the Contractor's expense. The Engineer will return the certified statements to the Contractor for retention on job in the Contractor's field office. Work installed by an individual who is not qualified by the testing agency and approved by the Engineer shall be removed by the Contractor and shall be replaced with work installed by qualified and approved welders at the Contractor's expense.
- C. Care shall be exercised during all welding operations to prevent injury or damage to personnel and property.

3.08 SCAFFOLDING - RIGGING - HOISTING

- A. Unless otherwise specified, the Contractor shall design and provide scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of materials and equipment. Remove from the premises when no longer required.

3.09 SUPPLEMENTARY SUPPORTING STEEL

- A. Contractor shall provide supplementary supporting steel required to support ducts, piping, electrical services, equipment, etc.

3.10 OPERATING INSTRUCTIONS

- A. Upon completion of all work and testing, furnish the necessary technicians, skilled laborers and helpers and operate all systems and equipment for the period specified in Division 1. During this period, fully instruct the Owner and his representatives in the operation, maintenance, lubrication and adjustment of all systems and equipment.
- B. The Operating and Maintenance Manuals shall be available at the time of the instruction period.
- C. Schedule the instruction period for a time mutually agreeable with the Owner and Engineer.

3.11 FOUNDATIONS – SUPPORTS – PIERS

- A. Contractor shall provide foundations, supports, pads, bases and piers required for all piping, pumps, tanks, compressors and for all other equipment provided, and shall submit drawings to the Engineer for approval before purchase, fabrication or construction of same. Construction of foundations, supports, pads, bases and piers, where mounted on the floor, shall be of the same materials and same quality of finish as the adjacent and surrounding flooring material.

3.11 RECORD DRAWINGS

- A. Provide Record Drawings as delineated in Division 1.
- B. Record Drawings for interior piping systems showing all equipment, piping and valves, shall show:
 - 1. Valve Tag identification numbers and letters
 - 2. Equipment identification numbers and letters
 - 3. Construction deviations/field modifications for all items.
 - 4. Confirmed pipe, equipment, and control elevations and dimensions. Confirmed elevations shall be based on surveyed structure elevations.

- C. Maintain a set of construction markups at the job site for the Engineer and Owner to periodically review and provide comment on during the progress meetings. Make the drawings available at each progress meeting.

END OF SECTION

SECTION 15060

PIPE, VALVES AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE

- A. Work in this section includes all interior piping, valves and appurtenances within vaults and inside the pump station building. All exterior buried piping, valves and appurtenances are specified in Division 33 – Utilities of the BRWA Master Specifications.
- B. The Contractor shall furnish and install all materials, equipment and appurtenances necessary for the complete and satisfactory installation of all piping systems within and under structures, as shown on the Contract Drawings and as required for a complete installation as specified herein.

1.02 SHOP DRAWINGS

- A. Shop drawings: shall be submitted for items specified herein in accordance to the BRWA Master Specifications – Section 01 33 00 Submittal Procedures.
- B. Layout Drawings

1. Piping Layout Drawings

A layout of all systems requiring piping 4-inches and larger shall be submitted. Layouts of the other piping systems inside the building shall not be submitted except where (in congested areas, or for other purposes) specifically requested by the Engineer. All piping layout drawings shall be two line drawings accompanied by a bill of materials. Single line piping drawings are not acceptable.

2. Piping Support Layout Drawings

Certain pipe support systems are required to be designed by the Contractor, see paragraph 1.04 for requirements. Piping support layout drawings are required to be submitted for these systems. Drawings shall show location of each support, sway brace, hanger, guide, component, and anchor. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number. Single line piping drawings are not acceptable. Piping support systems shall be designed and Shop Drawings prepared and sealed by a Registered Professional Engineer in the state having jurisdiction over the project.

- C. The following qualifications and procedures shall be submitted:

1. Weld Inspection and Testing Agency: Certification and qualifications.
2. Welding Inspector: Certification and qualifications.
3. Welders: List of qualified welders and welding operators, and current test records for qualified welder(s) and weld type(s) for factory and field welding.
4. Weld Procedures: Records in accordance with ASME Boiler and Pressure Vessel Code, Section IX for weld type(s) and base metal(s).
5. Nondestructive inspection and test procedures.
6. Certified welding inspection and test results.

1.03 EQUIPMENT DESIGN

1. Equipment design, workmanship, testing and operation shall be as specified under Section 15000 - General Mechanical Requirements.

1.04 PIPE SUPPORT DESIGN REQUIREMENTS

A. General:

1. Design, size, and locate piping support systems throughout facility, whether shown or not.
2. Piping Smaller than 18 Inches: Supports are shown only where specific types and locations are required; additional pipe supports shall be required.
3. Piping 18 Inches and Larger: Support systems have been designed for piping shown.
4. Meet requirements of MSS SP 58, MSS SP 69, MSS SP 89, and ASME B31.3 or as modified by this section.

B. Pipe Support Systems:

1. Pipe support systems shall be designed for gravity and thrust loads imposed by weight of pipes or internal pressures, including weight of fluid in pipes and insulation.
2. Seismic loads in accordance with governing codes and as shown on Structural Notes Drawing.

3. Wind loads in accordance with governing codes and as shown on Structural Notes Drawing.
 4. Maximum support spacing and minimum rod size in accordance MSS SP-69 Table 3 and Table 4.
- C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support. Working load imposed upon anchor devices shall not exceed 75% of rated anchor capacity. Adhesive anchors shall not be used where subject to sustained tension loads.
- D. Vertical Sway Bracing: 10-foot maximum centers or as shown.

1.05 GENERAL NOTES

- A. Unless otherwise specified herein, starters, H-O-A switches, pushbuttons, and other electrical devices shall be specified and provided under Division 16, Electrical of the specifications, and shall be arranged as shown on the Contract Drawings.
- B. Unless otherwise specified herein, motors shall meet the requirements specified in Section 15000, General Mechanical Requirements. Type of enclosure (open drip proof, totally enclosed, etc.) shall be as specified herein.
- C. Exterior and buried piping systems are specified under section, Division 33 – Utilities, in the BRWA Master Specifications.
- D. Selected miscellaneous piping systems may be specified in other sections of the specifications. Miscellaneous piping systems which may not be described specifically by any section of these specifications shall be of the type of pipe and fittings as directed by the Engineer or as shown on the drawings.
- E. The Contractor shall verify all dimensions of valves, special castings and fittings, pipe, equipment, etc., so that all of the pipe work performed will fit together properly and will conform to the arrangement as shown on the Drawings. In selecting laying lengths of fittings, the Contractor shall be guided by the dimensions of equipment to which connections are made and by the indicated dimensions on the Drawings. All pipe and specials shall be accurate to the dimensions shown. Hubs, spigots, and flanges shall be at right angles to the axis of the opening, and openings shall be at the exact angle specified.
- F. All piping shall be subject to inspection and approval by the Engineer upon delivery. Broken, cracked, misshaped or otherwise damaged or unsatisfactory piping shall not be accepted.

- G. Pipe, flanges, and fittings shall be supplied by a single pipe manufacturer.
- H. It is to be noted that in the relatively small piping systems, the Drawings do not necessarily show all fittings, offsets, unions, hangers, supports, etc. All such items shall be furnished and installed, however, as required for complete and satisfactory installation of the equipment shown.
- I. Where eccentric reducers are indicated to be used, the reducer shall be installed with its straight side at the top of the piping system, unless otherwise shown.

1.06 VALVES - GENERAL

- A. Valves specified herein shall have the type of ends specified or as indicated on the drawings or as required by equipment connections.
- B. No valves shall be installed with stems in the vertical down position.
- C. All valves on vertical pipes shall have their stems oriented to give maximum operational clearance, or shall be oriented as directed by the Engineer.
- D. Each piece of equipment or appliance shall be separately valved so that supply and return services can be shut off and the piece of equipment or appliance removed if desired, without disturbing the piping systems. Valves shall be located so as to be easily accessible to operator of equipment. Valves shall be installed whether shown on the drawings or not.
- E. All valves 2" and smaller used for throttling services shall be globe type except as shown or specified otherwise. Gate valves shall be used for cutoff or stop service except as shown or specified otherwise.
- F. Check valves shall be protected by isolation valves unless otherwise shown on the Drawings so that they may be repaired without removal from the line.
- G. Where extension stems are required, they shall be doweled or otherwise securely attached to the valve stem.
- H. The valve and operator shall be the responsibility of the valve manufacturer.
- I. Unless otherwise noted, all valves shall open left, counterclockwise.
- J. All manually operated valves located 6 feet or higher above the floor shall have chain wheel operators with chains to the floor, unless otherwise shown on the Drawings.

1.07 FITTINGS - GENERAL

- A. All fittings shall be of the type indicated on the drawings unless otherwise specified. Ferrous piping shall be provided with ferrous fittings; copper tubing shall be provided with bronze, wrought copper or brass fittings. In general, all fittings shall be as specified hereinafter in Pipe and Fittings Schedule.
- B. Nipples shall be extra heavy and of same material as piping system in which they are installed. Close nipples are not acceptable.
- C. Malleable iron ground joint unions, brass to iron seat, of approved make, shall be used on all connections, up to and including 3" in diameter, to risers, appliances and equipment. Flanged connections shall be used for piping larger than 3".
- D. Wherever the sizes of pipes are reduced, fittings shall be used for reductions without the use of bushings.
- E. All flange faces shall be parallel to each other. Pipe axis shall be the same as adjoining pipe section. The piping shall not be sprung to make a joint. Gaskets for flanged joints shall be as specified under Joints.
- F. In general, soft copper tubing shall have flared type fittings, and hard copper tubing shall have soldered joint fittings, or "Swagelok" for 1" tubing or less.
- G. Screwed type systems shall contain ample unions in piping at equipment and valving of the system to allow easy removal of the equipment or disassembly of the system.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS SCHEDULE

- A. Pipe and fittings shall be as indicated on the Drawings and as listed in the following schedule. Schedule is intended to serve as a general guide and is not necessarily a complete listing of every piping system. Systems which may not be listed shall be comprised of the same kind of pipe and fittings as in similar systems which are listed, or as directed by the Engineer. The following schedule describes pipe and fittings that are interior or exposed exterior to a facility. Underground piping shall be as specified in Division 2, Sitework.

SERVICE	PIPE		FITTINGS		TYPE JOINTS
	<u>Material</u>	<u>Spec. Ref.</u>	<u>Material</u>	<u>Spec. Ref.</u>	
<u>First Group</u>					
a. Potable Water	Ductile Iron	ANSI A21.51	Ductile Iron	ANSI A21.10	Flanged

Notes for First Group:

1. Pipe and fittings: shall be lined cement lined in accordance with ANSI Specification A21.4, with curing to be effected by application of a bituminous seal coating which shall cover and seal the cement mortar. The thickness of the cement lining shall be double the standard thickness specified.
2. Pipe shall be Class 53.
3. Fittings 4" and larger shall be rated for minimum 150 psi.
4. For description of exterior surfaces, see paragraph Ductile Iron Pipe and Fittings.
5. Flanges shall be drilled and faced for ANSI B16.1, Class 125.

SERVICE	PIPE		FITTINGS		TYPE JOINTS
	<u>Material</u>	<u>Spec. Ref.</u>	<u>Material</u>	<u>Spec. Ref.</u>	
<u>Second Group</u>					
a. Hot Water b. Cold Water c. Non Potable Water 3" and smaller	Copper Tube Type L (Aboveground) Type K (Below Grade) Hard	ASTM B-88	Wrought Copper	ASME B16.22	Soldered or Threaded

SERVICE	PIPE		FITTINGS		TYPE JOINTS
	<u>Material</u>	<u>Spec. Ref.</u>	<u>Material</u>	<u>Spec. Ref.</u>	
<u>Third Group</u>					
a. Plumbing Drains and Vents within buildings	PVC	ASTM D2665 Sch. 40	PVC Drainage Pattern	ASTM D2665	Socket with Solvent Cement

2.02 COPPER TUBE AND FITTINGS

- A. Potable water piping and components shall comply with NSF14, NSF 61, and NSF 372.
- B. Aboveground piping shall be hard copper tube, ASTM B 88, Type L water tube, drawn temper. Underground piping shall be soft copper tube, ASTM B8 8, Type K water tube, annealed temper.
- C. Wrought-copper, solder-joint fittings shall be ASME B16.22 wrought copper pressure fittings. Copper unions shall be cast copper alloy, hexagonal stock body, and comply with MSS SP-123. Unions shall have ball and socket, metal to metal surfaces with solder joint or threaded ends.

2.03 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be suitable for the pressures, connections, and linings specified in the pipe schedule above. Buried piping is specified in the BRWA Master Specifications.
- B. Ductile iron pressure pipe shall be made of ductile iron of good quality and of such character as shall make the metal castings strong, tough and of even grain and soft enough to satisfactorily permit drilling, tapping and cutting. All piping shall be smooth, free from cold shuts, scale, lumps, blisters, and sand holes and defects of every nature which make it unfit for the use intended. All piping shall be straight and shall be true circles in section with its inner and outer surfaces concentric. No plugging, filling, burning-in or welding shall be allowed.
- C. Each piece of ductile iron pipe shall have the weight and class designation conspicuously painted on it as near as possible to flange or bell end of the pipe and these designations shall be clearly legible.
- D. Where required or shown, the Contractor shall provide ductile iron specials. Specials shall in general consist of spool pieces, less than standard lengths of flanged, spigot end, or bell end pipe, or combination of ends, and nonstandard fittings. The specials shall conform in material, thickness and finish to the pipe in which they are installed. Tapped reinforced bosses shall be provided as an integral part of fittings, when shown or specified.
- E. All gaskets for flanged pipe, valve and fitting joints shall be 1/8-inch thick synthetic rubber, full faced or ring gaskets in accordance with ANSI/AWWA C115/A21.15 Appendix A. Gaskets shall be suitable for pressures listed in pipe schedule. See additional requirements in Article Joints specified hereinafter.

- F. Flange nuts and bolts shall be in accordance with ANSI/AWWA C115/A21.15 Appendix A. Nuts and bolts shall be suitable for pressures listed in pipe schedule. See additional requirements in Article Joints paragraph specified hereinafter.
- G. Flanges may be cast integrally with the ductile iron pipe, or screwed on type flanges may be used. Threaded flanges shall be the same material as the pipe. Field installation of threaded flanges or the use of "uniflanges" shall not be permitted. Flanges shall be faced after the flange is installed on the pipe.
- H. Joints for buried pipe shall conform to ANSI/AWWA C111/A21.11 and shall conform to requirements specified in Division 2.
- I. Wherever ductile iron pipe is specified or shown as having a spigot end, plain end will be acceptable.
- J. Fittings and Pipe shall not be directly tapped and threaded. To tap into a fitting or pipe a tapping boss or tapping saddle shall be used. Tapping saddle shall be rated for the same pressure as the pipe that it is connecting to and painted.

2.04 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. Those piping systems listed in the preceding schedule and where noted on the drawings as being "PVC" shall be unplasticized polyvinyl chloride normal impact type, conforming to ASTM Specifications D-1784 and D-1785 for Class 12454-B. Unless otherwise noted in the preceding schedule, pipe shall be Schedule Eighty (80). Pipe shall be that of the Spears MFG Co., Charlotte Pipe, or equal, and each length shall be clearly labeled with the manufacturer's name, PVC Type, Schedule and Size. Pipe shall be extruded. Welded seams will not be permitted.
- B. Fittings shall be PVC normal impact type for use with Schedule 80 pipe and shall be as manufactured by Spears MGF. Co., Charlotte Pipe, or equal. All fittings shall be solid molded. Welded seams shall not be permitted.
- C. Generally, all PVC pipe and fittings shall have socket type joints with solvent cement. Joints shall be made in accordance with the manufacturer's instructions. Where specifically noted on the drawings, or where required for connections to equipment for special reasons, pipe and fittings shall have threaded ends, or flanged joints. Threaded joints shall be made using the pipe manufacturer's recommended thread lubricant joint compound. Flanges may be the socket type, and shall be complete with rubber gaskets and galvanized steel bolts and nuts.
- D. Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds the requirements of ASTM F656 and as recommended by the pipe and fitting manufacturer, except solvent

weld cement for PVC pipe joints in sodium hypochlorite service shall be free of silica filler and shall be certified by the manufacturer to be suitable for that service. Certification shall be submitted.

- E. The Contractor shall demonstrate to the full satisfaction of the Engineer that applicable personnel are adequately skilled in making the joints specified above, prior to installation of any PVC piping.
- F. The Owner reserves the right to direct the Contractor to have tests conducted on PVC pipe and fittings. These tests, if required, shall be conducted at the manufacturer's plant and shall be at the Contractor's expense. Tests shall be sufficiently complete to prove conformance with the requirements of Commercial Standard CS-256-63, and the following additional quality requirements shall be similarly met:
 - 1. A parallel plate flattening test to the extent that face to face contact of the interior wall surface is made. The formation of cracks shall be considered failure.
 - 2. Immersion in a mixture of 15% by volume of dimethyl formamide in anhydrous acetone for twenty (20) minutes. The specimen shall exhibit no visible flaking upon completion of the test.
 - 3. Fittings and couplings shall meet burst pressure requirements of Table 6 of ASTM Specification D1785 for pipe when tested with end plugs inserted to a distance no more than 1/3 of the socket depth.

2.05 JOINTS

- A. All joints at equipment shall conform to the equipment requirements. No direct welded connections shall be made to valves or other equipment. Right and left couplings, long screws, or caulking of pipe threads or gasket joints will not be permitted. Mitered joints for elbows and notching straight runs of pipe for tees or elbows will not be permitted.
- B. Soldered or brazed joints shall be made with solder and a noncorrosive paste flux. The solder mixture will be of 95-5 (tin-antimony) content. The use of acid core solder shall not be permitted. The application of excess heat shall be avoided to prevent undue softening or burning of the fittings or tubing when making connections. All soldering operations shall be performed in strict accordance with best accepted practices. Tubing shall be square cut and reamed to remove all burrs. The inside of the fittings and the outside of the tubing at each end shall be well cleaned immediately prior to soldering to remove all traces of oxidation, regardless of how clean the surfaces of the pipe and fittings may appear.
- C. Threads shall be standard, clean-cut and tapered. All pipe shall be reamed free from burrs and kept free from scale and dirt. Unless otherwise specified, threaded joints shall be

made up with "Permatex" type 2, black, nonhardening pipe joint compound applied to the male thread only. The use of red lead or white lead will not be permitted. The complete threaded joint shall not have more than two threads exposed when made tight. Threads shall comply with ANSI B2.1.

- D. Except where special couplings are indicated, piping requiring screwed connections shall be connected with screwed, malleable iron, ground joint, brass seat, 150 psi unions; for piping requiring flanged connections, flanged malleable iron unions shall be used. The finish of all unions shall match piping in which they are installed. Unions shall be provided at equipment and where required otherwise to facilitate removal of piping or equipment.
- E. All gaskets between flanged connections and fittings shall be synthetic rubber, full face or ring gaskets, 1/8 inch thick as specified herein.
- F. Flanges shall be of the same material as the piping on which installed, and bolts, nuts and washers shall be of mild steel, with good sound well-fitting threads; the nuts shall be cold punched, hexagonal, trimmed and chamfered. Heads, nuts and threads shall be U.S. Standard sizes. Bolts shall be of such length as to project 1/4 inch beyond the nut when the flanged joint with gasket is assembled. All hardware shall be galvanized. For submerged or exterior, exposed flanged joints, all bolts and nuts shall be of 304 18-8 stainless steel. Hardware for connecting stainless steel flanges shall be stainless steel, compatible with the pipe material. All gaskets between flanges shall be synthetic rubber full face or ring gasket, 1/8 inch thick. The flange joint system (bolts, nuts, gaskets and installation) are to be suitable for the intended service and have a minimum pressure rating of 150 psi.
- G. Welded joints, if required in the project, shall be made by the electric arc or oxyacetylene gas process. Only thoroughly experienced certified pipe welders shall be employed for the work. After being welded, the piping, when tested as specified hereinafter, shall show no indication of leakage, weakness, and other defects. Welding and welders shall be in accordance with the Article Certification of Welders specified hereinbefore.
- H. Mechanical joints shall be made up with rubber gaskets conforming to ANSI A 21.11. Glands shall be bituminous coated and bolts and nuts shall be of high strength cast iron or high strength low alloy steel.

2.06 VALVES SMALLER THAN 4 INCHES

- A. All valves shall be provided with the type of ends indicated, unless otherwise specified. All valves of any one classification shall be of the same manufacturer.
- B. Unless otherwise specified for specific items, valves shall be as follows. Manufacturer and model numbers listed are to establish material requirements. Valves from the following

are also acceptable: Stockham, Crane, Kennedy, Nibco, Spence Engineering, Golden Anderson, Cashco, Cla-Val, Apollo or equal.

- | | | |
|-----|--|--|
| 1. | Gate, on ferrous piping
smaller than 3", threaded | Stockham No. B105(screwed ends) |
| 2. | Gate, on non-ferrous piping,
soldered | Stockham Cat. No. B124 |
| 3. | Check, on ferrous piping,
threaded | Stockham Cat No B319Y |
| 4. | Check, on non-ferrous piping,
soldered | Stockham Cat. No. B309Y |
| 5. | Pressure regulating, 2½" and
larger | Golden Anderson 43-D
Spence Engineering Co. Type D34 |
| 6. | Pressure regulating, 2" and
smaller | Golden Anderson 45-D
Spence Engineering Co. Type D34 |
| 7. | Pressure reducing, 3" and
smaller | Spence Engineering Co. Type D34;
Cashco. Type 8310 |
| 8. | Pressure relief, air | Lunkenheimer Fig. 1226 or 1227;
StraVal Rvi-05 |
| 9. | Pressure relief, liquid | Lunkenheimer Fig. 286 or 65B
Crispin PL or AR; Cla-Val CRL, or 5F |
| 10. | Globe, on 2" and smaller
non-ferrous piping, threaded | Stockham Cat. No. B-29 |
| 11. | Globe, on 3" and 2 ½" ferrous
piping | Lunkenheimer No. 1021-PS |
| 12. | Ball Valve, Bronze Soldered,
2" and Smaller | Apollo Series 77-200
Stockham S-285 |
| 13. | Ball Valve, Bronze Threaded,
2 ½" and Smaller | Apollo Series 77-100
Stockham T-T285 |

- | | | |
|-----|---|---|
| 14. | Ball Valve, Bronze Threaded or Soldered, 2 ½" and Smaller (Potable, Non-potable, and Tepid service) | Apollo Series 77-100
Stockham T-T285
Apollo Series 77-200
Stockham S-285 |
| 15. | Ball Valve, Carbon Steel (Flanged), 2" thru 4" | Apollo Series 87-100 |
| 16. | Ball Valve, Stainless 2" and Smaller | Stockham 1802
Apollo Series 76F-100 |
| 17. | Hose Valves | Crocker Series 5000
Dixon Powhatan
Guardian Series 5000 |

2.07 DOUBLE CHECK VALVE

- A. A Double Check Valve Assembly shall be installed at the noted location to prevent the unwanted reversal of polluted water into the potable water supply. The main valve body shall be manufactured from 300 series stainless steel to provide corrosion resistance. The check valves shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The check valves shall utilize a single torsion spring design to minimize pressure drop through the assembly. The check valves shall be modular and shall seal to the main valve body by the use of an O-ring. There shall be no brass or bronze parts used within the check valve assembly. The valve cover shall be held in place through the use of a single grooved style two-bolt coupling. The main assembly shall consist of two independently operating torsion spring check assemblies, two resilient seated isolation valves, and four ball valve type test cocks.
- B. The assembly shall be a Watts Series 774.

2.08 FLEXIBLE COUPLINGS

- A. Unless specified or shown otherwise on the drawings, flexible couplings shall be designed and constructed to withstand an internal line pressure equal to that of the pipeline in which it is to be installed. The various flexible couplings shall be suitable for the class and size of ductile iron pipe or steel pipe as required at the various locations, and shall be without pipe stops. The Contractor shall provide and install flexible couplings in addition to those shown, as required, for flexibility in installing the various piping systems. Locations of additional couplings shall be as directed by the Engineer. Flexible Couplings shall be Dresser Style 38, similar of Rockwell, Romac, or equal.
- B. Tie rods shall be provided across all flexible couplings unless otherwise specifically noted on the Contract Drawings to be omitted, and shall be as detailed on the Contract Drawings.

2.09 RESTRAINED FLANGE ADAPTORS

- A. Unless specified or shown otherwise on the drawings, flange adaptors shall be designed and constructed to withstand an internal line pressure equal to that of the pipeline in which it is to be installed. The flange adaptors shall be suitable for the class and size of ductile iron pipe or steel pipe as required at the various locations, and shall be without pipe stops. The Contractor shall provide and install flange adaptors in addition to those shown, as required, for flexibility in installing the various piping systems. Locations of additional adaptors shall be as directed by the Engineer. Flange adaptors shall be Dresser Style 128, similar of Rockwell, Romac or equal.
- B. Tie rods shall be provided across all flange adaptors unless otherwise specifically noted on the Contract Drawings to be omitted, and shall be as detailed on the Contract Drawings.

2.10 DISMANTLING JOINTS

- A. Dismantling joint shall be a telescoping, flanged spool piece with tie rod restraints. A minimum of 1" of telescoping movement shall be provided by the dismantling joint.
- B. Flanges shall be AWWA Class D steel ring flange compatible with ANSI Class 125 and 150 bolt circles.
- C. Gaskets shall be rubber in accordance with ASTM D2000.
- D. Tie rods shall be high tensile steel per ASTM A193 Grade B7. Nuts and bolts shall be ASTM A588.
- E. Dismantling joints shall be coated with NSF 61 certified, holiday tested, fusion bonded epoxy.
- F. Dismantling joints shall be ROMAC DJ400, or approved equal.

2.11 EXPANSION JOINTS

- A. Expansion joints shall be able to remove stress from piping systems. The assembly shall consist of two 150 lb drilled containing-ring type flanges and a natural rubber expansion joint. Expansion joints for sewage or other solids bearing liquids shall have filled arches to prevent obstruction and reduced flexibility.
- B. Standard length shall be 6 inches. Approximate movement capabilities shall be 1/4 inch axial compression, 1/8 inch axial extension, 1/4 inch lateral deflection, 5 degrees angular

movement and 2 degrees torsional movement. Maximum allowable working pressure shall be 165 psig. Rated temperature shall be 250 degrees F, minimum.

- B. Tie rods shall be provided across all expansion joints unless otherwise noted, and shall be as detailed on the Contract Drawings.
- C. Installation misalignment shall not exceed 1/8 inch in any direction. The expansion joint shall be located close to the stationary equipment or source of vibration and the other mating flange relatively close to an anchoring type support. Prior to installation all mating flanges shall be clean, dry and flat-faced.
- D. Expansion joints shall be Mercer series 500, similar of Proco, General Rubber, Red Valve or equal.

2.12 WALL CASTINGS AND SLEEVES

- A. Castings or sleeves shall be provided in walls and floors for the passage of all pipes.
- B. Wall and floor sleeves for pipes smaller than 4 inches shall be schedule 40 galvanized steel pipe, conforming to ASTM A53, except where otherwise shown on the drawings. Sleeves passing through floors shall extend approximately 4 inches above the finish floor and sleeves extending through walls shall be flush. Chromium plated escutcheon plates, of a suitable pattern, shall be provided to conceal ends of all exposed pipe sleeves above the floors of finished rooms. Sleeves shall be of ample size to permit passage of pipe and insulation (where required) and allow for thermal expansion. Space between pipe and sleeves shall be sealed with a modular mechanical type seal, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal shall be watertight and provide electrical insulation between the pipe and the wall, thus reducing chances of cathodic reaction between these two members. The inside diameter of each wall or floor opening shall be sized as recommended by the manufacturer to fit the pipe and mechanical seal to ensure a watertight tight joint. Mechanical seal shall be Thunderline Link Seal, or equal. Where mechanical seals cannot be used, the space between pipe and sleeves shall be caulked, concrete grouted or other method as approved by the Engineer. Low melting point asphaltic materials will not be permitted for caulking.
- C. Generally, except where otherwise noted on the drawings, wall castings shall be ductile iron or steel to match corresponding piping with the type of ends shown on the Drawings, and shall be complete with water stop flange or thrust collar as indicated. The wall castings shall be of lengths shown.
- D. Generally, except where otherwise noted on the drawings, for pipes four (4) inches and larger passing through walls or floors, sleeves shall be schedule 40 galvanized steel pipe conforming to ASTM A53. Except that no escutcheon plates will be required, these

sleeves and their arrangement shall be as specified above for sleeves for pipes smaller than four (4) inches. Space between pipe and sleeves shall be sealed with mechanical seal as specified above.

- E. The Contractor shall not be allowed to box-out the concrete for installation of any wall castings or sleeves, except with the Engineer's permission for each specific location involved. Castings or sleeves shall be securely fastened in place so that pouring of concrete will not disturb their position in any manner. The Contractor shall correlate with the other trades (particularly concrete work) to assure that all wall castings and wall and floor sleeves are properly set. When boxed-out sections are allowed, the boxed-out section shall be filled with non-shrink grout and treated in general as specified for "Construction Joints" in Division 3, Concrete.

2.13 DRAINS AND VENTS

- A. All piping systems (which do not include other convenient means of draining) shall include 3/4 inch hose valves at each low point to facilitate draining of the system. All piping systems, which do not include by nature of the systems a means of venting the air (for example, faucets at sinks are a means of venting), shall be provided with either a 1/2-inch manual ball valve or an automatic air vent valve, as directed by the Engineer, and located at each high point.

2.14 PIPE SUPPORTS

- A. All supports shall conform to MSS SP-69. The following support models are based on Anvil International Catalog. Similar models from PHD, B-Line or Tolco, or equal are acceptable.
- B. Clevis Hangers: Clevis hangers shall be of galvanized carbon steel construction. Hangers shall be adjustable and suitable for piping 4 through 24 inches. Clevis hangers for ductile iron or cast iron pipe shall be Figure 590. Clevis hangers for steel or plastic pipe shall be Figure 260.
- C. Steel Yoke Pipe Roll Hanger: Yoke pipe rolls shall have cast iron rolls and carbon steel yoke, roll rod and hex nuts. All components shall have a galvanized finish. Rolls shall be suitable for piping 3 through 24 inches. Yoke pipe rolls shall be Figure 181.
- D. Swivel Ring, Split Ring Hanger: Hangers shall have galvanized carbon steel construction. Split ring hangers shall be adjustable and suitable for piping 3/4 through 8 inch. Swivel ring, split ring hangers shall be Figure 104.
- E. Pipe Stanchion and Saddle: Saddles for pipe 4 through 12 inches shall be cast iron with steel u-bolt and nuts. Saddles for pipe 14 through 36 inches shall be carbon steel saddle and u-bolt. All saddles shall have galvanized finish. Pipe stanchion saddles shall be Figure

259. Saddles shall be used with carbon steel stanchion with baseplate Figure 63P. Baseplate shall be drilled with holes for anchoring into the concrete wall.
- F. Adjustable Pipe Saddle: Saddles for pipe 4 through 12 inches shall be cast iron with steel u-bolt and nuts. Saddles for pipe 14 through 36 inches shall be carbon steel saddle and u-bolt. All saddles shall have galvanized finish, steel locknut nipple, and cast iron reducer. Adjustable pipe saddles shall be Figure 265. Adjustable saddles shall be used with carbon steel stanchion with threaded connection and baseplate Figure 63T.
- G. Riser Clamps: Clamps shall be carbon steel construction with galvanized finish. Clamps shall be suitable for $\frac{3}{4}$ through 8 inch pipe and shall be Figure 261.
- H. Offset Pipe Clamps: Clamps shall be galvanized carbon steel construction suitable for piping $\frac{3}{4}$ through 8 inch. Offset pipe clamps shall be Figure 103.
- I. Wall Brackets: All brackets shall be galvanized carbon steel construction. Light duty brackets shall be suitable for maximum 750 pound load and shall be Figure 194. Medium duty brackets shall be suitable for maximum 1,500 pounds load and shall be Figure 195. Heavy duty wall brackets shall be suitable for maximum 3,000 pounds load and shall be Figure 199.
- J. Ceiling Flanges and Plates: Ceiling flanges shall be malleable iron construction, suitable for $\frac{3}{8}$ inch rod with minimum 450 pound load and $\frac{1}{2}$ through $\frac{3}{4}$ inch rods with a minimum load capacity of 1,000 pounds. Flange shall have three mounting holes and provide 1 inch adjustment of hanger rod. Ceiling flanges shall be Figure 153. Ceiling plates shall be galvanized carbon steel construction suitable for $\frac{3}{8}$ through $1\frac{1}{4}$ inch rod with corresponding maximum load of 730 and 9,500 pounds, respectively. Plates shall have either clevis attachment or rod attachment and shall be respectively Figures 49 or 52.
- K. Concrete Inserts: Inserts shall be of galvanized malleable iron construction and shall be universal type allowing a minimum of 1 inch rod adjustment. Insert shall be suitable for $\frac{3}{8}$ through $\frac{7}{8}$ inch rods suitable for maximum load of 730 pounds and 1,140 pounds, respectively. Inserts shall be Figure 282.
- L. Beam Clamps: Clamps shall be either galvanized carbon steel construction suitable for beam flanges 4 through 12 inch, Anvil Figure 133, or equal, or malleable iron construction for beam flanges $2\frac{3}{8}$ through 7 inch, Anvil Figure 218 with Figure 157 extension piece, or equal.
- M. Strut Channel: Strut channel shall be either galvanized steel or fiberglass as indicated on the Drawings. Channel size shall be selected to suit applied loads. Channels shall have a continuous slot to allow for insertion of pipe clamps, straps, and other support components Galvanized channel shall be hot dipped conforming to ASTM A123.

- N. Anchors: Shall be standard products of Hilti or Powers, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING, HANGERS AND SUPPORTS

- A. Proper and suitable tools and appliances for the safe and convenient handling of pipe and specials shall be used. All pipe and castings shall be carefully examined for defects before laying and no pipe or casting known to be defective shall be laid in the line.
- B. During construction, the Contractor shall keep all ends of pipes, including those extending above the roof, and all drains and fixtures, closed with caps, plugs or wooden flange covers, so as to prevent dirt, building material or other foreign matter from getting into pipe and traps.
- C. All hangers, supports, and guides shall be of types as approved by the Engineer, arranged to maintain the required grading and pitching of lines, to prevent vibration and sagging, to provide for expansion and contraction, and to provide for complete support of the pipes. See paragraph 1.04 for additional requirements.
- D. Unless shown otherwise on the Drawings, pipes shall be supported in accordance with the following:
1. Maximum support spacing and minimum rod size in accordance MSS SP-69 Table 3 and Table 4.
 2. Soft copper tubing shall be supported at sufficiently frequent intervals to prevent sag or pockets.
 3. Vertical lines shall be supported at their bases, using either a suitable hanger placed in the horizontal line near the riser or a base type fitting set on a pedestal, foundation or support. All vertical lines extending 6 feet or more shall be supported with riser clamps, offset clamps, pipe stanchion saddles, or adjustable pipe saddles.
 4. All horizontal piping on vertical walls and all piping near walls for which ceiling anchorage is not practicable, subject to the Engineer's approval, shall be properly supported by steel brackets securely anchored into the wall construction. Horizontal pipe (or pipe covering) on vertical walls shall be held at a minimum of one inch from the walls to protect them from wall sweating.
 5. Supports and anchor bolts subject to submergence or water spray shall be of Type 304 stainless steel.

6. All hangers shall be secured in unpainted inserts wherever practicable. Hangers and/or rod supports, inserted in the concrete slab, shall be capable of sustaining the hanger rod load.
7. Anchor bolts shall be properly aligned with the work and shall not be bent to mate up with the opening.
8. Drilling of holes for anchors, supports, hangers, etc., in portions of the building which may affect the structural soundness of that portion will be done only after the Contractor has secured permission from the Engineer to do so.
9. All pipes, valves, fittings and equipment 6 inches in diameter and larger and located relatively close to the various floors, shall be supported by concrete or steel supports where shown on the Contract Drawings, or where directed by the Engineer.
10. Neoprene isolating mats shall be provided between concrete supports and metallic pipe, valves, fittings and equipment. Thickness of mats shall be not less than 1/8 inches.
11. Hangers which support galvanized pipe shall be galvanized and hangers which support copper pipe shall be copper-plated.
12. All piping connected to pumps shall be supported as near the pump as practicable such that the weight of the pipe is not supported by the pump casing.

3.02 MINIMUM SLOPES

- A. Waste and drainage piping shall be sloped not less than 1/4-inch per foot in direction of flow unless otherwise indicated on the drawings.

3.03 CONNECTION AT DISSIMILAR METALS

- A. Wherever pipes of dissimilar metals join, there shall be provided an insulating union, coupling or flange connector for corrosion control. Connectors shall include an approved type dielectric separator. Connectors shall be the product of Dresser Corporation, Capitol Manufacturing, EPCO, Watts, Central Plastics, Calpico, or equal. Stainless steel nuts, bolts, and washers shall be used at all places at which such dielectric separators are used.
- B. Provide dielectric isolators where flanged piping transitions from inside pipe to buried pipe. Provide UV inhibitors for installations that are exposed to sunlight or artificial UV. Furnish the properties of the system for engineers review.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provision of the Contract, including General and Supplementary Conditions, General Requirements and Division 1, apply to work specified in Division 16.
- B. This section describes General Provisions for electrical work included in Division 16. This section applies to sections of Division 16.

1.02 SCOPE

- A. Provide labor, materials, equipment and perform operations for complete installation of electrical work and related systems indicated or required ready for continuous and complete operation.
- B. Provide labor and materials, although not specifically mentioned, but necessary for the completion of work and operation of the system, as if specifically called for at no additional cost to Owner.

1.03 GENERAL DESCRIPTION

- A. Work includes, but not be limited to, providing the following:
 - 1. Secondary service feeders as indicated.
 - 2. Load centers and electrical distribution system as indicated.
 - 3. Complete wiring system, including branch circuits and load centers for power and other special connections.
 - 4. Internal and external disconnect switches, junction boxes, pull boxes, conduit, wiring, and accessories.
 - 5. Grounding system.
 - 6. Lightning Protection.

1.04 WORK OF OTHERS

- A. For work specified in other divisions, or furnished or provided under separate contracts, cooperate and coordinate with other trades as if work were specified in this division.
- B. The following items of labor, materials related to or incidental to the installation of the electrical work will be provided under other divisions:
 - 1. Finish painting of equipment conduit in exposed areas.
 - 2. Control cables and related equipment, which will be provided by others under direct negotiations with Owner.
 - 3. Equipment indicated as "N.I.C." (not included in contract).
 - 4. Motors and motor driven equipment.

1.05 REFERENCES AND DEFINITIONS

- A. Following are definitions of terms and expressions used in Electrical Sections:
 - 1. OWNER – Bedford Regional Water Authority
 - 2. ENGINEER - Whitman, Requardt and Associates, LLP
 - 3. PROVIDE - "furnish and install completely"
 - 4. DIRECTED - "directed by Owner"
 - 5. INDICATED - "indicated in Contract Documents"
 - 6. CONCEALED - "hidden from normal sight"
 - 7. EXPOSED - "not concealed"
 - 8. WIRING - includes wire, fittings, conduit boxes and other accessories which comprise system
 - 9. APPROVAL - Owner's acceptance of particular shop drawing, material and method providing subject matter is in conformance with design concept and standard practice

10. OR EQUAL - a product, material or system with same general attributes as item specified and meeting Contract Documents as to capacity, performance, dimensions, general construction, and must be submitted to Owner for review
- B. References to catalogs, standards, codes, specifications, and regulations are latest edition in effect at date of invitation to bid.

1.06 CODES, REGULATIONS AND PERMITS

- A. Owner shall secure and pay for required permits and inspections required by local authorities, and make applications required.
- B. Materials furnished and work installed shall comply with latest issue of codes, rules, regulations, and recommendations of the following bodies, unless otherwise noted:
 1. American National Standards Institute (ANSI)
 2. American Society of Testing and Materials (ASTM)
 3. BOCA Basic Building Code
 4. Electrical Testing Laboratories (ETL)
 5. Factory Mutual (FM)
 6. Insulated Cable Engineer Association (ICEA)
 7. Institute of Electrical and Electronics Engineers (IEEE)
 8. Illumination Engineering Society (IES)
 9. National Board of Fire Underwriters' (NBFU)
 10. National Electrical Codes (NEC)
 11. National Electrical Manufacturers Association (NEMA)
 12. National Fire Protection Association (NFPA)
 13. National Electrical Safety Code (NESC)
 14. Occupational Safety and Health Agency (OSHA)

15. Underwriters Laboratories, Inc. (UL)
 16. Local Power Company
 17. Local Telephone Company
 18. Applicable City, County, State and Federal Codes
- C. Electrical installation shall be inspected and approved by the authority having jurisdiction and certificates documenting approval shall be furnished to Owner before requests for final payment. Allow inspections at any time. Impedance or interference with inspections shall not be permitted.
- 1.07 MATERIALS LIST AND SHOP DRAWINGS
- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Within 15 days after award of contract, submit to Owner and Engineer for approval list of manufacturer's names for proposed material and equipment. In the event any item of material or equipment contained in the list fails to comply with specification requirements, such item will be rejected. If prior to expiration of 15-day period or any duly authorized extension thereof, failure to submit schedule of acceptable material or equipment covering items occurs, Engineer will select items and such selection shall be final and binding as a condition of contract. Rejected items shall be resubmitted within 15 days of receipt of notice of rejection.
- C. After receiving approval of equipment manufacturers and prior to delivery of any material to job site, submit for approval detailed dimensioned shop drawings, together with descriptive specifications, engineering data sheets and catalog cuts showing construction size, arrangement, operating clearances, performance characteristics and capacity of electrical materials, equipment and systems. Each item of equipment proposed shall be a standard catalog product of approved manufacturer, unless otherwise noted.
- D. Shop drawings, specifications, catalogs, and pamphlets, and other documents submitted for approval shall be properly labeled indicating specific service for which material or equipment is to be used, section and article number of specifications governing, and Contractor's name, name of job, and date submitted.
- E. Shop drawings, specifications, catalogs, pamphlets and other documents submitted for approval describing items shall contain detailed and specific information which shall demonstrate fully that the material, equipment or system conforms to contract documents. Each shop drawing, specification, catalog and pamphlet shall be clearly marked in ink to identify item submitted. Data of general nature is not acceptable.

- F. If material or equipment is installed prior to receipt by Contractor of pertinent shop drawings marked "No Exceptions Taken" or "Furnish as Corrected," material or equipment shall be removed, and approved material or equipment provided at no extra charge to Owner.
- F. Acceptance of shop drawings shall not relieve Contractor from responsibility to provide labor, material, equipment and systems required by contract documents. Owner and Engineer will not be responsible for errors or omissions on shop drawings furnished by Contractor, even though such drawings containing errors or omissions are inadvertently accepted.
- G. Owner or Engineer will not act as coordinator between suppliers and subcontractors. Coordination shall be responsibility of Contractor. See other sections of these specifications for additional detailed requirements for wiring diagrams, schematic diagrams, interconnection diagrams and similar shop drawings for systems and equipment such as:
 - 1. Load center(s)
- H. Provide shop drawings for following:
 - 1. Load centers
 - 2. Circuit Breakers
 - 3. Safety Switches
 - 4. Wiring Devices
 - 5. Wire Splicing Kits and Schedule
 - 6. Framing Channels
 - 7. Wire and Cable
 - 8. Cabinets and Enclosures
 - 9. Conduit and Fittings
 - 10. Pull Boxes and Junction Boxes
 - 11. Lightning Protection Components

12. Grounding System

13. Underground Distribution System Components

- I. Provide spare parts and tools for electrical equipment indicated. Submit list of spare parts and tools as part of shop drawing requirements.
- J. No materials or equipment shall be released for shipment or installed until suitable action has been taken by Engineer as indicated by stamp and signature.

1.08 OPERATING AND MAINTENANCE MANUALS

- A. Assemble four hard copy sets and a complete digital (.pdf) copy of the Operating and Maintenance Manuals for electrical systems and equipment to be delivered to Owner upon completion of work and prior to occupancy by Owner. Owner reserves right to withhold final payment until Operating and Maintenance Manuals are delivered.
- B. Bind each copy of Operating and Maintenance Manual in durable, hardback binder, with data sheets individually punched and entered. Provide loose leaf 3-ring type with black plastic coated covers.
- C. Data sheets shall have an identifying label on front cover and shall include following:
 - 1. Index.
 - 2. One copy of approved materials list.
 - 3. One copy of each approved shop drawing and associated data.
 - 4. One copy of nameplate data for each motor and overload protection device.
 - 5. One copy of each system or equipment manufacturer's recommended preventive maintenance, if any.
 - 6. One copy of each panelboard directory typed on separate sheets.
 - 7. One copy of time-current characteristic curve for each type of fuse, overload device, circuit breaker and protective relay.
 - 8. One copy of each system and component operating instruction (where applicable).
- D. Refer to BRWA Master Specification Section 01 33 00 – Submittal Procedures.

1.09 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Upon completion of work and tests, instruct Owner's representative in operating, adjustment and maintenance of electrical systems and equipment furnished. Provide instruction as directed by Owner and divided into six 4- hour sessions, each at time directed by Owner.
- B. Instructor shall be factory trained and thoroughly familiar with all parts of system and equipment on which instruction is given.
- C. Instructions shall include name or label, location and general description of each system together with specific instructions describing operating modes, routine and emergency procedures required of building personnel for operating and maintaining each system. Listing of names, addresses, and phone numbers of service organizations for each item of equipment and typewritten maintenance schedule for each item of equipment shall be included.

1.10 RECORD DRAWINGS

- A. Maintain at construction site one set of prints, carefully record actual locations of each piece of electrical equipment, control devices, switches, outlets, wires, cables, conduits, and accessories, including dimensions to locate, where different from contract drawings. Upon completion of work, deliver this "as built" set of prints to Owner. Owner reserves right to withhold final payment until "as built" drawings are received.
- B. Refer to BWRA Master Specifications 01 33 00 – Submittal Procedures.

1.11 SITE VISIT

- A. Prior to preparing bid visit site and become familiar with existing conditions, make necessary investigations as to locations of existing structures, equipment, ductwork, piping, utilities, work to be removed, and matters which can affect work under Contract. No additional compensation will be paid as a result of failure to be completely familiar with existing conditions under which work must be performed. Notify Owner of discrepancies prior to bidding.
- B. Base measurements, both horizontal and vertical, from established lines and levels. Work shall agree with these established lines and levels. Verify conditions at site.
- C. See instructions to Bidders.

1.12 DRAWINGS

- A. Drawings are diagrammatic and indicate general arrangement and manner of connections. They do not show all details of construction or exact location of work.
- B. Carefully examine contract documents and ensure proper fitting of materials and equipment, as indicated.
- C. Although location of materials and equipment may be indicated in a certain place, construction may develop conditions that render this location inaccessible or impractical. In such cases, before fabricating and installing work, call condition to attention of Owner for further direction. When requested by Owner detailed drawing of proposed departure due to field conditions, and their causes, shall be submitted for approval. Engineer shall make all final written decisions as to conditions which require changing of work.
- D. Minimal shifting in locations of outlets, before installation, is to be expected and shall be done at no increased cost to Owner.
- E. Conflicting points in contract documents shall be called to attention of Owner prior to execution of work to a point where changes will affect additional cost to Owner.

1.13 WARRANTY

- A. Unless otherwise indicated, materials and equipment provided under this Division shall be free from defects in workmanship and materials for a period of time as described in the General and Supplementary Conditions of the Contract. Correct defects in workmanship, materials and performance which appear within warranty period on notice from Owner without cost to Owner. In default thereof, Owner may have such work done and charge cost of same to Contractor.
- B. During warranty period, make proper adjustments, calibrations and service to electrical systems, equipment and apparatus installed and do all work necessary to ensure efficient and proper functioning of systems and equipment.
- C. Warranties shall be strictly adhered to, and Contractor shall be responsible for any service and replacement required in connection with warranty of items. Warranties shall commence after date of certification of completion and acceptance of work.
- D. Contractor shall be responsible for electrical systems and related damages possible and hold harmless Owner, and consultants from malfunctions of systems and equipment installed under this contract, as defined by State laws pertaining to real property for period of time as defined by law.

- E. It is possible that certain areas of building or certain systems will be accepted at a time different than as specified above. Date of acceptance by Owner for beneficial use of Owner for these building areas or systems will be adjusted accordingly.
- F. During guarantee period, adjust, calibrate and service equipment provided under this contract.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Electrical materials and equipment shall be new, carry U.L. label when such material, equipment or system are of type or class listed by Underwriters Laboratories, Inc., and shall be suitable for conditions and duties imposed on them at site. If U.L. label is not available from manufacturer, when requested or required by local authority having jurisdiction, equipment shall be tested by an approved electrical testing company in accordance with NEC at no additional cost to Owner. Submit data indicating compliance with standards prior to installation. Description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in following sections.
- B. Component parts of each item of equipment and device shall bear manufacturer's nameplate, giving name of manufacturer, description, size, type, serial number, model number, and electrical characteristics, in order to facilitate maintenance or replacement. Nameplate of subcontractor or distributor is not acceptable.
- C. In specifying materials, the following general procedures are used:
 - 1. Where material or equipment is specified by name or other identifying information and one name brand only is used, it is considered that use of that particular item is essential to project, and Contractor shall base proposal on cost of that item.
 - 2. Where material or equipment is specified by brand name and other identifying information and two or more brand names are given, it is considered that any one of brands named will perform as desired, and Contractor shall base proposal on one of named brands.
 - 3. Where material or equipment is specified with phrase "...or equal..." after a brand name and other identifying information, it is intended that brand name used is for purpose of establishing minimum acceptable standard of quality and performance, and Contractor may base proposal on any item which is in all respects equal to that specified and presents essentially same appearance, size, operation and performance.

4. Where material is specified as complying with requirements of published "Standard Specification" of trade associations, ANSI, ASTM, and government specifications, Contractor shall base proposal on any item which can be shown to comply in all respects with referred "Standard Specification."

D. Acceptable materials, equipment and methods:

1. Engineer will determine whether any materials, equipment and methods offered for approval as an equal are equal to those specified and will fit space available.
2. Decision of Engineer on questions of equality is final.
3. Provide acceptable material, equipment and methods at no increase in cost to Owner.

- E. Upon receipt of written notice from Engineer, that material, equipment and methods have been reviewed and accepted ("No Exceptions Taken" or "Furnish as Corrected"), Contractor may precede with accepted equal material, equipment and methods, providing Contractor assumes full responsibility for and makes, at no cost to Owner, any change or adjustment in construction that may be required by use of such materials, equipment or methods including services provided under other divisions. In event of any adverse decisions by Engineer, no claim of any sort shall be made or allowed against Owner.

2.02 EQUIPMENT SUPPORTS, FOUNDATIONS AND STANDS

- A. Provide supports, foundations and stands required for electrical equipment and provide and set all necessary anchor bolts.
- B. Where equipment is indicated to be wall-mounted, provide brackets, constructed of structural steel shapes suitable for application, securely anchored to building construction.

2.03 LABELS AND NAMEPLATES

- A. Provide load centers, circuit breakers, safety switches, control equipment and instrumentation with engraved laminated phenolic nameplates (white background with black letters) with beveled trim. Data and installation shall be approved by Owner. Provide nameplates with minimum 1/4-inch high etched letters. For indoor applications, fasten nameplates with screws. For outdoor applications, attach to equipment enclosure with silicone and stainless steel machine screws, washer, and nuts on inside. Labels shall include:

1. EQUIPMENT DESIGNATION
 2. VOLTAGE
 3. SERVED FROM (equipment designation)
 4. CIRCUIT (number), LOCATED (location)
- B. Mount typewritten schedule of circuits, with legend as indicated in suitable frame on inside of lighting and appliance panel cabinet doors under clear plastic. Provide nameplates for distribution load center circuits.
- C. Space or Pole Numbers (SOPN) for load centers indicated are for purpose of clarifying grouping of wiring into circuits. Where load centers are not marked with SOPN locations, provide permanent label on each device in load center.
- D. Junction boxes and pull boxes, except those directly located at fixture or equipment to which system is connected, shall be identified with 1" high stenciled lettering to indicate voltage and circuiting on which installed.
- E. Identify conduit at points not more than 20 feet on center by means of plastic identification labels. Apply labels within one foot of penetration wherever conduits leave and enter load centers, junction boxes, pull boxes and similar items and at each side of penetrations of walls, partitions and floors. Labels shall indicate system voltage and type of service (i.e., Control Circuits, Power). Install labels in accordance with manufacturer's instructions, with label sizes to match conduits to which they are applied.
- F. Provide wire identification marking on each phase, neutral, and ground wire at each accessible point along its length (i.e. load centers, junction boxes, pull boxes, and other enclosures.) Labels shall indicate circuit numbers, terminal numbers, and pole numbers of each conductor. Mark wire identification code on back cover of each pull and junction box to indicate phase, neutral, and ground wires enclosed by box.
- G. Wire identification shall be permanent black letters and numerals on white background (printed plastic pressure sensitive strips wrapped around wire, hot stamped PVC sleeves slipped on or split and tied around wire, or other equivalent methods). Write-on tags are not acceptable.

PART 3 - EXECUTION

3.01 COORDINATION OF WORK

- A. Continually check, layout, and superintend installation of work indicated. Provide information regarding locations and sizes of chases and openings and be responsible for

accuracy of information. Lay out and superintend installation of hangers, inserts, sleeves and other work in masonry and concrete in advance of and during construction, coordinating work of other trades to prevent interference in location of other equipment.

- B. Coordinate exact locations of electrical equipment and conduits with all other trades so that there will be no interference with material and equipment by other trades. Where conflicts between trades result, resolve to Owner's satisfaction and at no expense to Owner.
- C. Remain completely informed of progress of general construction at all times, and install work that is to be concealed without delay to work of other trades. During wall construction, install conduit indicated as concealed in masonry construction.
- D. Examine work of other trades insofar as their work comes into contact with or is covered by work installed under this specification section. In no case attach to, cover up or finish against any defective work, or install work in a manner which will prevent proper installation of work of other trades.

3.02 HANDLING AND STORAGE OF MATERIALS

- A. Proper and suitable tools, equipment and appliances for safe and convenient handling and placing of materials and equipment shall be used. During loading, unloading and placing, care shall be taken in handling equipment and materials so that no equipment and materials, including Owner furnished and existing, are damaged.
- B. Electrical material and equipment delivered to job site shall be stored under roof or other approved covering, on pedestals above ground. Enclosures for material and equipment shall be weatherproof.
- C. Materials and equipment, which are damaged or affected as a result of improper handling or storage, shall be subject to removal at direction of Owner and replaced with new materials, at no cost to Owner.

3.03 DAMAGE TO OTHER WORK

- A. Contractor shall be held responsible for any damage to work already in place due to work or negligence of workers. Patching and repairing of damaged work shall be done by trade, which originally installed work at expense of Contractor under this Division.

3.04 MOUNTING HEIGHTS

- A. In general, use mounting heights indicated however, field conditions may dictate changes. Where these special conditions occur, final mounting height shall be brought to attention of Owner for further direction.

3.05 EQUIPMENT CONNECTIONS

- A. Equipment requiring electrical service shall be installed and connected in accordance with approved methods and in accordance with manufacturer's recommendations.
- B. Equipment connections indicated shall be considered diagrammatic. Actual connections shall be approved for each case and minimized space used.
- C. Conduit, wiring, fittings and accessories for connections to electrical equipment shall be provided. Should equipment of different ratings be furnished, adjust circuit components accordingly, at no expense to Owner, after approval by Owner. Confirm proper size and location of equipment connections before fabrication and installation of work.

3.06 COMBINING CIRCUITS INTO COMMON RACEWAY

- A. Circuits may be combined into common raceways in accordance with the following requirements:
 - 1. Analog control circuits from devices in same general area to same destination.
 - a. No power or AC discrete control circuits shall be combined in same conduit with analog circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
 - c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
 - d. Raceways shall not exceed 40 percent.
 - 2. Discrete control circuits from devices in the same general area to the same destination.
 - a. No analog control circuits shall be combined in same conduit with discrete circuits.
 - b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
 - c. Raceways shall not exceed 40 percent.
 - 3. Power circuits from loads in same general area to same source location (such as: load center).

- a. All Power Circuits: Do not combine power circuits unless shown on the Contract Drawings or without authorization of Engineer.
- 4. All changes to the Contract Documents shall be documented on record drawings.

3.07 WATERPROOFING

- A. Waterproofing and dampproofing of building shall be held unharmed by installation of work under this Division. Wherever any work or conduits under this Division pierce waterproofing or dampproofing including outside walls, such penetration shall be made only when approved by Owner and pierced surface shall be made watertight. Replace waterproofing damaged or destroyed at no expense to Owner.

3.08 CUTTING, PATCHING AND PAINTING

- A. Cutting, patching and painting necessary for installation of electrical work shall be done under this Division. Any damage done to work already in place shall be repaired at no cost to Owner. Patching shall be uniform in appearance and shall match existing finish and paint.
- B. Holes and openings created as a result of demolition work shall be patched uniformly and shall match existing finish and paint.
- C. Exposed equipment, including conduit installed under this Division, shall be cleaned and left in condition ready for painting under other Divisions. Items not provided with corrosion-resistant finish shall be painted. Electrical load centers, control equipment, and supporting framework except as otherwise indicated, shall have light gray enamel finish which may be manufacturer's standard gray, if acceptable to the Owner. Touch-up or repaint scratched or marred finishes, to match original finish as directed by Owner. Particular caution shall be exercised not to obscure nameplate data.

3.09 SLEEVES AND PLATES

- A. Provide sleeves for installation of raceways. Carefully locate in advance of construction of walls and floors where new construction is involved. Provide cutting and patching to set sleeves which are not placed prior to construction.
- B. Provide sleeves for raceways passing through concrete, masonry, plaster and gypsum wallboard construction. Caulk annular space of sleeves with an elastic fire resistant caulking compound to make installation fire, air and water tight.
- C. Fasten sleeves securely in construction to prevent displacement when concrete is poured and when other construction is built around them. Take precautions to prevent concrete,

plaster and other materials being forced into space between raceway, and sleeve during construction.

- D. At sleeves where objectionable noise can be transmitted, at smoke barriers, at walls above ceilings that extend to underside of structure of floor above, and at fire rated separations, seal openings between raceways and corresponding sleeves to prevent sound transmission and to maintain fire rating. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval.
- E. Where watertight sleeves are indicated, or required, to suit installation on above grade raceway penetrations, provide Link Seal rubber seals, as manufactured by Thunderline Corporation, between pipe and sleeves. Where watertight sleeves are indicated, or required, to suit installation on below grade wall and floor raceway penetrations, provide OZ/Gedney Type WSK and Type FSK fittings.
- F. Where conduit motion due to expansion and contraction can occur, make sleeves of sufficient diameter to permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths to suit following:
 - 1. Terminate sleeves flush with walls, partitions and ceilings.
 - 2. Terminate sleeves 2 inches above finished floor in equipment rooms, kitchen and wet floor areas.
 - 3. In other areas, terminate sleeves 1 inch above finished floors, unless otherwise indicated or directed.

3.10 EXCAVATING AND BACKFILLING

- A. Provide excavation and backfill necessary to install underground electrical work included in this Division. Establish lines and grades required for proper location of work, and shall be responsible for correctness thereof. Check elevations of utilities before starting work. Excavation and backfill shall be performed in accordance with other Divisions.
 - 1. Trenches shall be excavated to width and depth required by NEC or as indicated. Trench subgrade shall be such as to allow bedding of conduit or duct with uniform and continuous bearing on solid, undisturbed earth for full length of each run.
 - 2. Trenches in fill areas shall not be excavated until embankment construction has been completed to minimum 2 feet above top of conduit or duct being placed.
 - 3. Any part of trench excavated below specified subgrade shall be backfilled at no cost to Owner, using approved bedding materials. Wherever wet or otherwise unstable subgrade is encountered below elevation of original ground surface which existed

prior to time of construction, soil shall be removed to depth and extent directed by Engineer and trench backfilled with approved bedding material.

3.11 PLACING IN SERVICE

- A. At completion of work a thorough test, as indicated, shall be made in presence of Owner with equipment, machinery and appliances in operation and entire electrical system proven satisfactory for operation and free from defects.
- B. After building is in full operation by Owner, provide continuously recorded voltmeter and ammeter readings for period of one week at such feeder and service points, as directed by Owner.
- C. Gather in one place and at one time loose equipment, keys, record drawings, and spare parts to be turned over to Owner. Label items and provide typed list ready to be signed by an authorized representative of Owner.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 NOTE

- A. The requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - shall apply to all work specified under this section.

1.02 SCOPE

- A. Provide all labor, materials, equipment, and services necessary for the installation of a complete ground system.
- B. The ground system shall consist of all required ground rods, or cold water pipe grounds, and copper conductors, including all necessary connections to load centers, building steel, etc.
- C. There is a single point (the earth ground reference point) connection for each system.
- D. Provide ground for neutrals of each separately derived alternating-current system, metallic structures, enclosures, devices, and utilization equipment permanently and effectively in accord with requirements of the National Electrical Code, and as shown and required. All grounding and bonding connections shall be solderless. Welding of conduit and fitting will not be allowed for bonding purposes.
- E. The neutrals of each separately derived alternating-current system shall be connected grounded at one point only. Service ground shall be extended from this single point of connection to the electrode system as indicated on the drawings.

1.03 SUBMITTALS

- A. Submit shop drawings, manufacturer's product data, etc., in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 GROUND CONDUCTORS

- A. Wire between the grounding electrode system and other points of the system shall be uninsulated copper with conductor properties, as required, by the National Electrical Code. The minimum size wire for connection to the grounding electrode system shall be 4/0.

2.02 GROUND RODS

- A. Ground rods shall be copper-clad steel as manufactured by Copperweld Steel Company, or equivalent, 3/4-inch minimum diameter and 10-foot minimum length.

2.03 EXOTHERMIC WELD

- A. All cable to ground rod connections and all connections elsewhere herein specified or shown on the drawings shall be accomplished by the exothermic welding process.
- B. Furnish all materials and molds necessary to properly perform all required exothermic welds.
- C. Furnish exothermic welding systems from the Cadweld Division of Erico Products, Inc., or Burndy Corporation.

PART 3 - EXECUTION

3.01 GENERAL

- A. Conduits, load centers, metal boxes, cabinets, and other metal enclosures surrounding or containing electrical equipment, motors or apparatus with metal frames shall be securely grounded in accordance with the National Electrical Code.
- B. An equipment ground conductor shall be run with all three-phase branch circuits as shown in schedules on the drawings; the ground conductor shall be connected to the ground bus at the control centers and to the motor frame or equipment frame at the load. The new grounding system shall be provided as shown on the drawings and/or as specified herein.

3.02 INSTALLATION

- A. The electrical continuity of all metal raceways shall be insured by means of properly installing locknuts, bonding straps or other approved means. Provide a separate green conductor in all circuits installed in flexible conduit and bond the conductor to the cabinet,

- outlet box, etc., at each end of the run. Ground connections shall be made by means of welded or bolted ground clamps or grounding-type bushings.
- B. Equipment grounding conductors shall be provided with green colored insulation in accordance with the National Electrical Code.
 - C. The service shall be grounded in accordance with Article 250 of the National Electrical Code. The size of the grounding conductor shall be in accordance with paragraph 250-94 of the Code and/or as noted on the drawings.
 - D. Ground rods shall be installed after the finished grade is in place. Ground rods shall be placed no closer to a structure than two (2) feet nor any farther away than ten (10) feet. Locations for ground rods shall be adjusted to avoid interdiction of underground piping, services, or structures.
 - E. All connections to ground rods shall be by exothermic welding only.
 - F. Splices in ground grid cable and any connections which will be concealed by earth or construction shall be by exothermic welding only.
 - G. Measure resistance to ground. If the value is more than 5 ohms, provide additional ground rods until the ground resistance is 5 ohms or less at no additional cost to Owner.

END OF SECTION

SECTION 16120

WIRE, SPLICES AND TERMINATIONS (600V OR LESS)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - apply to work specified under this section.

1.02 SCOPE

- A. Work includes labor, materials, equipment and services for installation of complete system of conductors for the electrical installation as indicated.

1.03 SUBMITTALS

- A. Submit manufacturer's product data in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Submit detailed sheets of kits, materials, splicing and terminating methods and instructions. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 INSULATED SINGLE CONDUCTOR CABLES

- A. Secondary wiring within buildings shall be soft drawn copper with 600 volt insulation, and shall be manufactured in accordance with requirements of the NEC, UL, ASTM, NEMA, and ICEA.
- B. Wire and cable shall be delivered to job site in full coils or reels, each bearing a tag containing UL approval stamp, name of manufacturer, trade name, code, type of wire, and month and year of manufacture.
- C. Conductor insulation shall be NEC type "THWN-2", "XHHW-2", or "THHN", adequately color coded for identification, unless otherwise indicated. Conductor size shall be as defined by standard American Wire Gauge (AWG) numbers or circular mils where indicated.
- D. Conductors #8 and larger shall be stranded.
- E. Minimum size for power circuits shall be #12. Minimum size for 120 volt control circuits shall be #14.
- F. For vibrating equipment, wiring shall be stranded.

2.02 BARE SINGLE CONDUCTOR CABLES

- A. Bare copper ground wire shall be soft drawn copper and shall conform to ASTM B-3.
- B. All conductors #2 and smaller shall be solid. Conductors #1 and larger shall be stranded and shall conform to ASTM B-8.

2.03 TERMINATION AND SPLICING FITTINGS

- A. Fittings for termination or splicing stranded wire shall be solderless and designed for stranded wire circumferential compression type fittings. Thomas and Betts, Brundy, Square D, or equivalent.
- B. Splices (junctions which occur below grade (including those in NEMA 4 junction boxes)) shall be 3M "Scotch-cast" insulated.
- C. Splices in branch circuit and control wiring #10 and smaller shall be made with insulated spring connectors, Ideal "Wirenuts" or equivalent.

2.04 PULLING COMPOUND

- A. Pulling compound shall be UL approved, "Y-ER-EASE", or equivalent. Soap, grease or any substance other than specified shall not be permitted.

PART 3 - EXECUTION

3.01 GENERAL

- A. All wire shall be installed in raceways.

3.02 INSTALLATION

- A. No wiring shall be installed until building is under roof.
- B. Do not install wire in raceways until after concrete work or plastering is completed. Raceways, in which moisture has collected, must be swabbed out before pulling in wire.
- C. Wiring exposed to temperatures higher than 30 degrees Celsius shall have insulation properly rated for temperatures it must withstand (i.e., wiring in lighting fixtures or electric heating equipment, unless provided by fixture or equipment manufacturer shall be type THHN, AVB, or other).
- D. Phase wires shall be color coded. Phase wires #8 AWG and smaller shall be color coded throughout entire length. Phase wires larger than #8 AWG may be color coded by applied sleeves or taped at each splice and termination, and at maximum 3 feet intervals for any

accessible segment and within 2 inches of wire terminations. Color coding shall be as follows:

<u>PHASE</u>	<u>208Y/120V</u>
PHASE A	BLACK
PHASE B	RED
PHASE C	BLUE
NEUTRAL	WHITE
GROUND	GREEN

- E. Green colored insulated equipment grounding "Green Wire" conductors shall be provided for feeders and for branch circuits. "Green Wire" grounding and neutral wires shall be color coded throughout entire length. Provide "Green Wire" grounding conductor, in addition to grounding provided by raceway system enclosing branch circuit or circuits. Size of "Green Wire" grounding conductor shall conform to NEC requirements. Ground conductor shall interconnect grounding terminal of each equipment enclosure containing circuit and grounding bus or terminal at point of origin of respective circuit. "Green Wire" grounding conductor shall be run with each respective feeder and branch circuit conductor group and with each multiwire branch circuit conductor group.
- F. Branch circuits shall be provided only as single or combined wiring groups, as follows:
1. One section of raceway shall not enclose more than one branch circuit or multiwire branch circuit, unless otherwise indicated.
 2. Where more than one branch circuit or multiwire branch circuit share common enclosure (i.e., pull box or junction box or wiring trough). Wiring comprising each branch circuit and multiwire branch circuit shall be secured as group by "ties" or other grouping devices at intervals not to exceed 3 inches, where accessible.
 3. Where branch circuits and multiwire branch circuits are routed in wireway, increase wiring size, as required, to comply with derating requirements of NEC.
- G. Wire sizes for 20 ampere, 120 volt branch circuits shall be based on circuit total lengths (measured horizontally and vertically along path from load center to load), as follows:

<u>Wire</u>	<u>120V to Ground</u>
<u>Size</u>	<u>Max Total Length</u>
#12	75' or less

#10	100'
#8	over 100'

1. Where wire size is specifically indicated and voltage drop is in accordance with NEC, length restrictions noted above do not apply (i.e., motor branch circuits).
2. Where wire size is increased only to accommodate length relationships noted above, taps (i.e., pigtails to devices) up to 10' long may be made with #12 at utilization points.

3.03 WIRE IDENTIFICATION

- A. Provide wire identification in accordance with Section 16010 - ELECTRICAL GENERAL PROVISIONS.

3.04 SPLICES AND TERMINATIONS

- A. Screw-on "Wirenut" type fittings shall not be used for connecting stranded wiring, unless strands are twisted for each conductor before installing "Wirenut".
- B. Aluminum fittings shall not be used for wire connections.
- C. Where stranded wires are terminated in screw pressure connection, approved fittings and installation methods shall be used to avoid separating strands.
- D. No splices or joints will be permitted in either feeders or branches, except at outlets and accessible junction boxes. Joints in branch-circuit shall be mechanically and electrically secure with solderless connectors as listed by UL, as pressure type, 600-volt rating, compression or indent type. Connectors shall be insulated by approved preformed type with integral or separate cover, or by means of taping with approved plastic or rubber and friction tapes to provide insulating value equal to that of conductors being joined. In making of splice, connectors shall be brought up securely upon the conductor, ensuring conductors are equally engaged, the insulation is not ruptured, no bare wires are exposed or have "back-off" due to application of pressure and connector will not loosen due to cycling or vibration, in order to insure an efficient splice. Number, size and combinations of conductors permitted by UL, as listed on manufacturer's packaging of connector, shall be strictly complied.
- E. Splice connectors shall be manufactured and installed so that conductor insulation will not be reduced when conductor is positioned in final location. Tools used to compress fittings shall be type which requires proper compression before tool can be released.
- F. Insulating materials for splices and connections such as rubber, friction, glass and synthetic tapes, putties, resins, splice cases, compositions, and other materials shall be approved for

that particular use, location, voltage, and installed in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - apply to work specified under this section.
- B. Requirements of this section of specification apply to and form part of individual electrical sections of the specification.

1.02 SCOPE

- A. Work includes labor, materials, equipment and services for installation of complete raceway system.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Section 16120 - WIRE, SPLICES AND TERMINATIONS (600V OR LESS)
- B. Refer to Section 16411 - UNDERGROUND RACEWAYS AND DUCTBANKS

1.04 SUBMITTALS

- A. Submit shop drawings and manufacturer's product data, in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications, installation instructions and general recommendations for each type of raceway required. Include data substantiating that proposed materials comply with specified requirements for each type of raceway.
- B. Submit dimensioned shop drawings of raceway systems showing layout of raceways, fittings and spatial relationships to associated equipment (variable frequency drive) and adjoining raceways. Show connections to electrical panels, feeders, and motors.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Raceways shall be UL listed and bear the UL label, unless otherwise indicated.

2.02 RIGID METAL CONDUIT (RMC) RACEWAY

- A. RMC raceway shall also be known as galvanized rigid steel raceway (GRS). RMC raceway shall be steel, zinc coated for corrosion protection and shall comply UL 6, Federal Specification WWC-581 and ANSI Specification C80.1. Threads shall be protected from corrosion as soon as possible after they are cut by plated or painted finish.

2.03 COUPLINGS AND FITTINGS FOR STEEL RACEWAYS

- A. Couplings shall be steel finished with coatings inside and outside of zinc or cadmium.
- B. Couplings for RMC, except where encased in concrete, shall be threaded (solid or split). Couplings for EMT, except where encased in concrete, shall be threaded compression ring type. Where encased in concrete or within masonry, couplings for RMC raceway shall be solid (not split in half or down one side) threaded steel fittings only. Where encased in concrete or within masonry, couplings for EMT raceway shall be solid concrete tight steel either indentor or compression ring type employing OZ/Gedney "A" bushings, or equivalent, where provided with male hub threads.
- C. Provide type "A" insulating bushings by OZ/Gedney, or equivalent, on RMC raceway terminations. Provide "SBT" bushings by OZ/Gedney, or equivalent, on EMT raceway not terminating in metal enclosure.
- D. Box connectors for FMC raceway shall comply with Federal Specification WF 406B, and shall be 2-screw clamp type or Thomas & Betts "Tite-Bite" with insulated throats, or equivalent.
- E. Box connectors for LT/FMC raceway shall comply with Federal Specification WF 406B and shall be liquid tight with insulated throat as manufactured by Sepco, or equivalent. Provide straight or 90 degree connectors suitable for use in its intended application.
- F. Fittings shall be compatible with raceway and box accommodated. Fittings for RMC shall be threaded and shall conform to Federal Specification W-C-408. Fittings for EMT shall conform to Federal Specification W-C-408. Fittings for FMC shall meet Federal Specification W-F-406 Type I, Type III or Type IV, class and style as required. Fittings for LT/FMC shall meet Federal Specification W-F-406, Type I, Class 3, style as required.
- G. Expansion fittings for use with RMC raceway shall be type AX or EX by OZ/Gedney, or equivalent. Expansion/deflection fittings for use with RMC shall be type DX by OZ/Gedney, or equivalent. Expansion fittings for EMT raceway shall be type TX by OZ/Gedney, or equivalent. Type of fitting shall be properly chosen for type of movement anticipated.

2.04 CONDUIT OUTLET BODIES FOR STEEL RACEWAYS

- A. Conduit outlet bodies shall conform to UL 514, Federal Specification W-C-586b and ANSI Specifications C80.4 and C33.84.
- B. Conduit outlet bodies shall be hot-dipped zinc galvanized iron alloy where used with RMC and EMT galvanized steel raceway.
- C. Conduit outlet bodies for RMC conduit systems shall be provided complete with threaded hubs, neoprene gaskets and cast covers.

2.05 POLYVINYLCHLORIDE RIGID NONMETALLIC CONDUIT (PVC) RACEWAY

- A. PVC raceway shall be heavy wall polyvinylchloride type 40 conforming to NEMA TC-2 and Federal Specification WC-1094. PVC raceway shall be suitable for concrete encased or direct burial underground applications. PVC raceway shall have reduced emissions of smoke and HCL under fire conditions.

2.06 COUPLINGS AND FITTINGS FOR PVC RACEWAYS

- A. Couplings and fittings for PVC raceway shall conform to NEMA TC-3.
- B. Couplings and fittings for PVC raceway encased in concrete, for direct burial applications or within masonry shall provide watertight connections and shall be suitable for encasement in concrete.

2.07 ELBOWS AND OFFSETS

- A. Preformed elbows and offsets shall conform to same standards as respective raceway.

2.08 MISCELLANEOUS

- A. Cable Supports shall be OZ/Gedney type "S", or equivalent.
- B. Wall entrance seals shall consist of hot-dipped galvanized sealing gland assembly capable of providing seal around conduit to withstand 50-foot head of water without leakage. Shell of seal shall have at least two cast collars at right angle to sleeve that is embedded in concrete. Entrance seals shall be OZ/Gedney. Suitable for use with new or existing construction as applicable.
- C. Conduit seals shall be as manufactured by Crouse-Hinds, Appleton, or equivalent.

PART 3 - EXECUTION

3.01 GENERAL

- A. Install wiring in raceways, unless otherwise indicated.
- B. Provide labeling in accordance with Section 16010 - ELECTRICAL GENERAL PROVISIONS

3.02 RACEWAY METHODS

- A. RMC raceway shall be used under the following conditions:
 - 1. In concrete slabs.
 - 2. Exposed in crawl spaces or in other damp or wet locations.
 - 3. Where required by NEC in hazardous areas and similar locations.
 - 4. As indicated on Drawings.
- B. Concealed raceway run below finish grade shall be PVC and shall be direct burial or encased in minimum of 3" of concrete on sides, as noted on drawings and as indicated in Section 16411 - UNDERGROUND RACEWAYS AND DUCTBANKS.
- C. Aluminum Raceways shall not be permitted for any application on this project.

3.03 INSTALLATION REQUIREMENTS

- A. Provide cable supports in conduit raceway risers, as required, by NEC or as indicated.
- B. Raceway sizes shall be in accordance with NEC, except as follows:
 - 1. Minimum 3/4".
 - 2. Where indicated.
- C. Raceway shall be installed with no interference with other trades. Raceways shall be supported at interval, as required, by NEC but not greater than 10 feet. Raceway supports shall be in accordance with the following:
 - 1. Exposed raceways shall be run parallel on wall or ceiling and shall follow contours of surface to which they are attached. Support raceways employing steel two-hole pipe clamps securely fastened to surface to which raceway is attached.
 - 2. Suspended raceways shall be supported by hangers used only for raceway support. Hanger rods shall not penetrate air ducts or equipment of other trades. Raceways shall not be supported from ducts, pipes or hangers provided under other divisions for support of pipes, ducts, etc.
 - a. Individual exposed raceway 1 1/4" and smaller shall be supported from 1/4" steel rod employing Kindorf 6H series hangers, or equivalent.

- b. Individually supported exposed and concealed raceway 1 1/2" and larger shall be supported from 1/4" steel rod employing two-piece hinged malleable iron "F&M" hangers with threaded sockets to receive support rod, or equivalent.
- 3. Where two or more suspended raceways are run together, they shall be suspended from structure by means of "trapeze" hangers. Hangers shall consist of angle or channel iron employing "U" bolts to secure raceway at each support. Supports for "trapeze" hangers shall be suitably sized steel rods.
- 4. Parts and hardware used for support of equipment, conduits, and fittings shall be galvanized steel for dry locations. Provide galvanized steel fasteners for dry locations and stainless steel (grade 316, minimum) fasteners for exterior, damp, or wet locations.
- D. No raceway shall pass through beams, unless so indicated by Engineer. Raceway shall be located minimum of 6" from steam and hot water piping.
- E. Raceway passing from heated to unheated spaces, conditioned spaces to unconditioned spaces, exterior spaces, refrigerated spaces, cold section plenums of air conditioning units, shall be suitably sealed by means of "Duxseal" or sealing fittings to prevent accumulation of condensation.
- F. Raceways passing through boundaries, which are indicated as requiring vermin proofing, shall be sealed internally with Johns-Manville "Duct-Seal", or equivalent. Pack annular spaces between raceways and building construction with mineral wool or fiberglass, caulked at both sides with Pecora "Synthacaulk" or Proseal "Ultrasite", or equivalent, in general areas.
- G. Cap raceways immediately after installation to prevent entrance of debris and moisture.
- H. Raceways turning from slab to enter partition shall be totally concealed.
- I. Provide No. 14 AWG zinc-coated steel or 1/8" polypropylene pull cord having not less than 200 pound test strength in empty raceways 2" diameter or less. Provide 3/16" 3-strand polypropylene pull cord having not less than 800 pound test strength in empty raceways greater than 2" diameter. Provide minimum of 2 feet of slack pull cord at each end of raceway.
- J. Provide expansion fittings or expansion/deflection fittings in each raceway crossing building expansion joint or as required by installation to accommodate expansion, contraction or deflection of raceway.

END OF SECTION

SECTION 16131

BOXES AND CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - apply to work specified under this section.

1.02 SCOPE

- A. Work includes labor, materials, equipment and services for installation of complete system of outlet, pull and junction boxes.

1.03 SUBMITTALS

- A. Submit shop drawings and manufacturer's product data, in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide suitable box at outlets especially designed to receive type of fixtures and devices to be mounted thereon. Provide fixture outlets with fixture supports of size and type required for fixture to be hung. Fixture studs, generally, shall be 3/8 inch.
- B. Boxes shall be of type approved for particular purpose intended.
- C. Recessed wall outlet boxes shall be at least 4 inches square, except where otherwise indicated.
- D. Provide box covers to fit outlet box installed of required depth so edge of ring is flush with finished plaster, masonry, acoustical material, and other finishes.

2.02 PULL AND JUNCTION BOXES

- A. Provide junction or pull boxes where indicated, and where required to facilitate wire pulling and connection. Provide labels in accordance with Section 16010 - ELECTRICAL GENERAL PROVISIONS.

- B. Pull and junction boxes less than 100 cubic inches shall be as specified for outlet boxes.
- C. Pull and junction boxes 100 cubic inches and larger shall be fabricated from 12-gauge minimum galvanized steel and equipped with screw cover unless otherwise noted. Sheet metal boxes shall be adequately supported to maintain shape. Interior boxes shall be NEMA 12 construction, unless otherwise noted. Exterior boxes or boxes exposed to excessive moisture shall be NEMA 4X construction. Outdoor flush junction boxes shall be watertight (NEMA 4) outside flanged recessed cover type "YR" as manufactured by OZ/Gedney, or equivalent.
- D. Sheet metal boxes shall be supported to maintain shape. Larger boxes shall be formed of structural bracing into rigid assembly to maintain alignment in shipment and installation.
- E. Drain fittings shall be provided in NEMA 4X boxes. Crouse-Hinds, Killar, or equivalent.

2.03 CABINETS

- A. Provide cabinets for telephone terminal boards, instrumentation terminal boards as indicated.
- B. Key all cabinet locks.
- C. Cabinets shall be NEMA 12 construction with gasketed door and constructed of code gauge 304 stainless steel, unless otherwise indicated. Fronts shall be fitted with continuous side hinged door and stainless steel flush lock with pin tumbler. Control panel cabinets shall be fitted with rear door where indicated. Doors greater than 48 inches in height shall be equipped with three-point latch and vault lock. Cabinets in exterior locations or in areas exposed to excessive moisture shall be code gauge 304 stainless steel NEMA 4X construction with gasketed doors.

PART 3 - EXECUTION

3.01 GENERAL

- A. Boxes and cabinets shall be sized in accordance with NEC, or as indicated.
- B. Floor mounted cabinets shall be mounted on 4-inch high concrete pad in accordance with manufacturer's recommendations. Install where indicated and level in place.

3.02 INSTALLATION

- A. Each box shall be securely supported at two or more points and two or more sides to prevent movement in all directions.
- B. Boxes shall support devices and face plates. Face plates and devices shall not be used to support boxes.

- C. Where box is concealed in stud wall, securely attach it to full depth stud (or section of stud) on each side of box.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.01 NOTE

- A. The requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - shall apply to all work specified under this section.

1.02 SCOPE

- A. The work includes all labor, materials, equipment and services necessary for the installation of complete system of wiring devices.
- B. All devices shall be the product of the same manufacturer, unless of a specified type especially approved for the purpose which is not manufactured by the manufacturer selected for most of the other devices.

1.03 SUBMITTALS

- A. Submit shop drawings, manufacturer's product data, etc. in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Devices shall comply with UL, NEMA and IEEE standards.
- B. Wiring devices shall be as manufactured by Leviton, Cooper, Pass and Seymour, or Hubbell, unless otherwise noted.

2.02 DEVICE PLATES

- A. Device plates and blank plates for junction boxes in finished areas shall be .040 inch thick minimum grade 302 stainless steel with satin finish, and shall be UL listed.
- B. Device plates and blank plates for junction boxes in finished areas shall be thermoplastic similar to Hubbell P series shall be UL listed. Plates shall be Black in color, unless otherwise indicated or directed by the Owner.

- C. Device plates and blank plates in unfinished areas shall be galvanized steel.
- D. Device plates and blank plates in damp areas shall be thermoplastic.

PART 3 - EXECUTION

3.01 GENERAL

- A. See Section 16120 - WIRE, SPLICES AND TERMINATIONS - 600V for requirements regarding wiring for switches and receptacles.

END OF SECTION

SECTION 16410

DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 NOTE

- A. The requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - shall apply to all work specified under this section.

1.02 SCOPE

- A. The work includes all labor, materials, equipment and services necessary for the installation disconnect switches.
- B. Provide complete items with all components needed for proper operation.

1.03 SUBMITTALS

- A. Submit shop drawings, manufacturer's product data, etc., in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Switches shall be equipped with a cover interlock to prevent operation with cover open. All switches shall be designed to permit padlocking in the off or open position.
- B. Switches located where they are affected by outdoor weather (such as those above the roof) or in damp locations, shall be NEMA 4X and shall have stainless steel enclosures.
- C. Switches shall be UL listed, and shall bear the UL label.

2.02 SAFETY SWITCHES

- A. Safety switches shall be meet all the applicable requirements of Federal Specification W-S-865 and shall be horsepower rated in conformance with Table III.
- B. Safety switches shall be fused or unfused types, as indicated, and shall be enclosed in NEMA 12 steel enclosures, unless otherwise indicated. Safety switches for 208 volt service shall be heavy-duty type. Safety switches for 480 volt service shall be heavy-duty. Switches

shall be front operated type, cover interlocked with switch. All nonconductive parts shall be finished, or otherwise protected against corrosion.

- C. All switches shall be visible blade, externally operated with all current carrying parts silver or tin plated. All switches shall have provisions for not less than two external padlocks and capable of accepting copper or aluminum cables.
- D. Heavy-duty switches employing current limiting fuses shall be rated to withstand let through currents of 200,000 R.M.S. symmetrical amperes at 480 volts. General duty switches employing current limiting fuses shall be rated to withstand let through currents of 100,000 R.M.S. symmetrical amperes at 208 volts.
- E. Units shall be manufactured by Square D, Cutler-Hammer, G. E., or Siemens.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide as indicated.

3.02 INSTALLATION

- A. Furnish and install one (1) complete set of fuses for each fused unit.

END OF SECTION

SECTION 16411

UNDERGROUND RACEWAYS AND DUCTBANKS

PART 1 - GENERAL

1.01 NOTE

- A. The requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - shall apply to all work specified under this section.

1.02 SCOPE

- A. The work includes all labor, materials, equipment and services necessary for the installation of a complete underground raceway system.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Section 16130 - RACEWAYS.

1.04 SUBMITTALS

- A. Submit shop drawings, manufacturer's product data, etc., in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.

PART 2 - PRODUCTS

2.01 RACEWAYS

- A. Raceways for "power" and "signal" shall be PVC type 40 with rigid galvanized steel turnups to points above grade (or at grade), or where penetrating a wall or vertical surface of a structure, which is not part of and not supported as part of the underground raceway.

2.02 DUCT SPACERS

- A. Spacers for conduits shall be made with an engineering polymer and designed in such a fashion that the fitting performs the function of base and intermediate spacer no matter how the conduits are arranged. Spacers shall be Wunpeece Spacer by Underground Devices, or equivalent.

PART 3 - EXECUTION

3.01 GENERAL

- A. Raceways for "Power" wiring shall not be combined with raceways for "Signal" wiring.
- B. Raceways for "Power" wiring shall not be closer than 6" to raceways for "Signal" wiring.
- C. Provide 3/16" 3-strand polypropylene pull cord having not less than 800 pound test strength in all empty raceways. Provide a minimum of two (2) feet of slack pull cord at each end of the raceway.

3.02 INSTALLATION

- A. Where each raceway penetrates the building floor, building wall, manhole or equipment mounting pad, it shall be rigid galvanized steel. The exposed end shall terminate in a flush coupling which shall be plugged when the raceway is empty. The portion of the raceway in the wall or pad shall be sealed tightly in place with nonshrink grout. The raceway shall be joined to the rest of the underground raceway via a watertight coupling.
- B. Underground raceways shall be installed to be at least 24 inches below finished grade or paving at any point, unless otherwise noted. The 24 inches shall be measured from the top surface of the raceway. They shall be laid to a minimum grade of 6 inches per 100 feet to drain into a manhole whenever possible. Changes in direction shall be accomplished with long sweep bends, and the minimum bend radius shall be equal to or greater than the values scheduled in the NEC for rigid metal conduit for lead sheathed wire.
- C. Raceways shall be thoroughly cleaned before laying and during construction, the ends shall be plugged to keep the interior clean.

3.03 RECORD DRAWINGS

- A. Provide Record Set data of the actual elevation of the top of each end of each raceway at the midpoint, at no more than 100' intervals, where changes in elevation are less than 2' between data points or 10' intervals when the elevation between intervals is different by 2' or more between data points.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - apply to work specified under this section.

1.02 SCOPE

- A. Work includes labor, materials, equipment and services for the installation of complete load center assembly as indicated.

1.03 SUBMITTALS

- A. Submit shop drawings, manufacturer's product data, etc., in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements.
- B. Shop drawings shall indicate dimensions, gutter space, bus bar arrangement, metal gauge, and other details.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide load center of types indicated and with features, types and sizes of cutouts as indicated. Provide ground bus in load centers. Load center buses shall be hard drawn copper of 95% conductivity. The term "load center" shall apply to all types of "load centers".
- B. Each circuit breaker (main or branch) in load center shall be rated to interrupt minimum AIC indicated for load center, unless otherwise noted.
- C. Outer trims of load center covers shall have piano hinge or load center covers shall have door-in-door construction. Provide doors with concealed hinges and flush tumbler lock and catch on panelboards. Key panelboards alike.
- D. Finish surface mounted load center boxes and trim with ANSI 61 gray enamel over rust inhibiting primer treatment or use galvanized surface mounted boxes, which have had treatment applied to galvanizing to prepare surface for painting with paint to match

adjoining walls. Recessed load center boxes and trims shall be similar to surface mounted equipment.

- E. Where "space" is called for on schedule, provide bus, device supports and connections for future circuit breaker or cutout.
- F. Branch circuit breakers within load center shall have same mounting.
- G. Provide 100% neutral bus in load centers. Neutral bus in each load center shall be isolated from cabinet to prevent neutral grounds at cabinet.
- H. Provide 50% ground bus in each load center cabinet. Each ground bus shall be bonded to cabinet. Bolt and screw heads of ground bus lugs shall be painted green. In addition, provide nameplates in each load center, designating neutral and ground bus.
- I. Load centers shall be constructed in accordance with NEMA PB1, Federal Specifications W-P-115A and WC-375B and appropriate UL requirements, and shall bear UL label.
- J. Load centers shall be suitable for surface or flush mounting, as indicated.
- K. Where feeders to branch circuit load centers feed through and tap to panel gutters shall have minimum width, as per NEC.
- L. Main breaker shall be separately mounted above or below branch breakers.
- M. Series routing of load centers not permitted.

2.02 LIGHTING AND APPLIANCE PANELBOARDS

- A. Appliance branch circuit load centers shall be equipped with plug-in thermal-magnetic circuit breakers. Two or three-pole breakers shall be common trip type and not composed of single pole units with handle-tie. Tandem breakers shall not be permitted.
- B. Load centers shall be ABB, Square D, Cutler-Hammer, or Siemens.

2.03 MASTER NAMEPLATE

- A. Provide master nameplate giving load center designation, voltage, amperes, phase, wire, short circuit rating, generic order number and manufacturer's name.

PART 3 - EXECUTION

3.01 GENERAL

- A. Provide load centers for power feeders and branch circuits as indicated.
- B. Provide labels in accordance with Section 16010 - ELECTRICAL GENERAL PROVISIONS.

3.02 INSTALLATION

- A. Circuit numbers indicated on branch wiring on plans are to indicate grouping of loads on circuits, and do not necessarily indicate actual circuit numbers in load center. Circuits shall be so arranged that loads are balanced as closely as practical over phases, and that branch circuit neutral conductor does not serve as common for two or more single phase circuits connected to same phase in load center.
- B. Conduits entering flush load centers shall be located away from front edge of load center to allow approximately 2" between finished wall surface and conduit.

END OF SECTION

SECTION 16670

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 NOTE

- A. The requirements of Section 16010 - ELECTRICAL GENERAL PROVISIONS - shall apply to all work specified under this section.

1.02 SCOPE

- A. The work includes all labor, materials, equipment and services necessary for the furnishing and installation of a complete lightning protection system for the water tank.
- B. The Contractor shall coordinate the installation of lightning protection system with other trades to insure proper fit and adequate clearances.
- C. The installation shall be made by a Contractor regularly engaged and experienced in the installation of lightning protection systems. Installation shall be made by fully licensed technicians.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Refer to Section 16060 - GROUNDING AND BONDING
- B. Refer to Section 16120 - WIRE, SPLICES AND TERMINATIONS (600V OR LESS)
- C. Refer to Section 16130 - RACEWAYS
- D. The Contractor shall coordinate the work as specified herein this section with work to be performed and equipment to be furnished under other Divisions of the Specifications to insure a complete and satisfactory lightning protection system installation.

1.04 REFERENCES

- A. NFPA 780 - Lightning Protection Code - Latest Edition.
- B. UL 96 - Standard for Installation Requirements for Lightning Protection Systems - Latest Edition.

1.05 SUBMITTALS

- A. Submit manufacturer's product data, etc., in accordance with provisions of Section 16010 - ELECTRICAL GENERAL PROVISIONS and BRWA Master Specification 01 33 00 – Submittal

Procedures. Manufacturer's data shall include specifications and installation instructions. Include data substantiating that proposed materials comply with specified requirements. Submittals for the lightning protection system shall include, but not be limited to, at least the following:

1. Cables or Conductors
 2. Air terminals and mounting bases
 3. Grounding Terminal Plates and Terminal Lugs
 4. Thru-roof or wall connectors and cable support/fasteners
 5. Pipe clamps, bonding plates and cable tap clamps
- B. The Contractor shall furnish calculations and a complete scaled plan shop drawing showing complete installation, in addition to the required catalog cuts. Drawings shall indicate location of surge suppressors to meet UL standards.
- C. After completion of the installation, provide the Owner with a UL Master Label covering the installation.
- D. Upon completion of the project, Contractor shall prepare AS BUILT drawing indicating locations of all air terminals and connection details.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All components in the Lightning Protection System shall be Listed by UL and shall bear the UL Label.

2.02 AIR TERMINALS

- A. Air terminals shall be 1/2" x 24" solid aluminum and shall extend at least 18" above the object to be protected. All air terminal bases shall be cast aluminum with stainless steel bolt-pressure cable connectors.
- B. The air terminals in the water tank area shall be 1/2" x 24" solid aluminum with a proper brace.
- C. Air terminal bases for flat roof areas shall be of the adhesive type.
- D. The air terminals shall be spaced so as not to exceed 20' apart around the outside perimeter of the roof or the ridge and not over 50 square feet apart through the center of flat roof areas.

2.03 LIGHTNING CONDUCTORS

- A. The conductors shall consist of Listed 37 strands of 13-gauge aluminum wire weighing 200 pounds per 1,000 feet for roof conductors, and 28 strands of 14-gauge copper wire weighing 375 pounds per 1,000 feet for downlead conductors. A perimeter cable shall be installed around the entire water tank. Each perimeter cable shall be connected to at least two (2) down leads, providing a two-way path to ground from each air terminal. All down lead conductors shall be copper. All center roof air terminals shall be interconnected with conductors to the outside perimeter cable. Conductors on the water tank areas may be run exposed. Ground connections shall be made around the perimeter of each roof and to the main down conductor at a maximum of 100' on center. Irregularly shaped structures may require extra down conductors to provide a two-way path to ground from each air terminal.

2.04 MISCELLANEOUS COMPONENTS

- A. Conductor fasteners shall be an approved type of noncorrosive metal, have ample strength to support conductors and shall be spaced not to exceed 3' on center.
- B. All cable connectors shall be cast aluminum with screw-pressure type stainless steel bolts and nuts.
- C. All threaded fasteners, unless otherwise specified, shall be alloy A1S1 Type 316 stainless steel.
- D. All concrete embedded cable interconnections, cable to rebar bonding connections, cable to ground grid connections, and all similar connections drawings shall be accomplished by exothermic welding as specified in Section 16450 - GROUNDING SYSTEMS.

2.05 MANUFACTURERS

- A. All components of the Lightning Protection System, with the exception of exothermic welds, ground grid components, grounding terminal plates and lighting poles shall be the products of one of the following manufacturers:
 - 1. Thompson Lightning Protection, Inc.
 - 2. VFC Lightning Protection
 - 3. Harger
 - 4. Erico International Corporation
 - 5. Heary Brothers Lightning Protection Co., Inc.

- B. Manufacturers of equipment ancillary to the Lightning Protection System shall be as indicated.

PART 3 - EXECUTION

3.01 GENERAL

- A. All downlead conductors shall be run concealed, unless otherwise indicated. Concealed conductors shall be installed in 1" diameter PVC type 40 raceway. Provide pitch pans wherever conduit penetrates the roof.

3.02 BONDING

- A. All metal bodies within 6' of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.
 - 1. Bonding of all metallic objects and systems at roof levels and elsewhere on the structure shall be complete. Primary bonds for metal bodies of conductance shall be bonded with appropriate fittings and full-size conductor and shall consist of, but not be limited to, the following:
 - a. Rail systems
 - b. Roofladders

3.03 INSTALLATION

- A. Wherever aluminum-to-aluminum, aluminum-to-bronze or aluminum-to-iron or steel connections are made, an antioxydant/deoxydant (e.g. DE-0X or PENETROX joint compounds) shall be applied to all contact surfaces immediately prior to assembly of connection.
- B. Each Lightning Protection System installed pursuant to this specification section shall be awarded the UL Master Label (Label C).
- C. Provide additional devices as necessary to obtain Master UL Label. Contractor shall be totally responsible for obtaining Master UL Label.
- D. Provide UL Master Label after successful installation of Lightning Protection System.

END OF SECTION

SECTION 17000

INSTRUMENTATION AND CONTROLS GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section includes general work requirements for all instrumentation and control work including Division 17.

1.02 GENERAL REQUIREMENTS

- A. Contractor shall coordinate and obtain all drawings and information required to properly install all equipment for a properly functional system.
- B. Associated excavating and backfilling work shall be performed in accordance with other application Sections.
- C. Prior to commencing work at any facility, the Contractor shall perform a Pre-Construction Field Inspection to verify existing facility conditions and functions of existing equipment.
- D. Repair or replace any damaged equipment or components as a result of the work to prior condition.

1.03 RELATED SECTIONS

- A. Division 15 Specifications
- B. Division 16 Specifications
- C. Division 17 Specifications

1.04 REFERENCES

- A. Reference materials and installation of all items under Division 17 shall be in accordance with the latest revisions of the following applicable codes, standards, specifications, except where more stringent requirements have been specified:
 - 1. ANSI – American National Standards Institute
 - 2. ASTM – American Society for Testing and Materials
 - 3. ETL – ETL Testing Laboratory (Intertek Testing Services)
 - 4. FM – Factory Mutual

5. IEEE - Institute of Electrical & Electronic Engineers, Inc.: 802.3, Telecommunication and Information Exchange Between Systems.
6. ISA – International Society of Automation
7. ISO - International Organization for Standardization
8. NEC – National Electric Code
9. NEMA – National Electrical Manufacturers Association
10. NFPA – National Fire Protection Association
11. Telecommunications Industry Association (TIA); Electronics Industry Association (EIA):
 - a. 492, Specifications for Optical Waveguide Fibers.
 - b. 568, Commercial Building Telecommunications Cabling Standard.
 - c. 607, Commercial Building Grounding and Bonding Requirements for Telecommunications.
12. UL – Underwriter’s Laboratory, UL 508A

1.05 DEFINITIONS

A. Abbreviations:

1. AI: Analog Input point (variable input monitoring)
2. AO: Analog Output point (variable output control)
3. CSI: Controls System Integrator
4. DI: Discrete Input point (on/off monitoring)
5. DO: Discrete Output point (on/off control)
6. HMI: Human-Machine (graphical) Interface.
7. H-O-A: Hand-Off-Auto
8. HVAC: Heating, Ventilating, and Air Conditioning.
9. I&C: Instrumentation and Control.
10. I/O: Input and Output.

11. L-O-R: Local-Off-Remote
12. MCC: Motor Control Center
13. O&M: Operation and Maintenance.
14. P&ID: Process and Instrument Diagram.
15. PC: Personal Computer.
16. PLC: Process Control System
17. PLC: Programmable Logic Controller
18. SCADA: Supervisory Control and Data Acquisition.
19. SAT: Site Acceptance Test
20. UPS: Uninterruptable Power Supply
21. VFD: Variable Frequency Drive
22. Control Panel: refers to the fabricated assembly of enclosure, console, cabinet, or instrument housing, back panel and enclosed control components.
23. Local: when referred to, local shall be understood as control initiated locally at the motor control device.
24. Remote: when referred, remote shall be understood as control initiated from a device not located at the motor control device.
25. Rising/Falling: Define action of discrete devices about their setpoint.
 - a. Rising: Contacts close when an increasing process variable rises through setpoint.
 - b. Falling: Contacts close when a decreasing process variable falls through setpoint.

1.06 QUALITY ASSURANCE

A. Uniformity

1. Unless otherwise specified, equipment or material of the same type or class used for the same purpose shall be the product of a single manufacturer.

B. Design

1. Provide only new, unused, current production equipment and materials unless specifically indicated otherwise. Equipment and materials shall be delivered to the site in new, unused condition in original packaging. Store and protect equipment against damage, theft, dirt, moisture and extreme temperatures.

C. Installation

1. All work shall be installed in a neat, workmanlike and professional manner; align, level and adjust for satisfactory operation. Install such that parts are easily accessible for inspection, operation, maintenance and repair.

1.07 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Administrative, Shop Drawings, Samples, Quality Control, and Contract Closeout Submittals shall conform to the requirements of all specification sections.
- C. Submittals must include sheets and catalog literature describing the hardware to be provided.
- D. Refer to specific sections of Division 17 Specifications and the BRWA Master Specifications for submittal requirements.

1.08 CONTRACT DRAWINGS

A. Approximate Locations

1. The locations of equipment shown on the Contract Drawings are approximate only. The Control System Integrator (CSI) shall coordinate final locations of equipment and conduit with other trades to avoid conflicts. No additional compensation will be made for relocations, reconnections or additional work required as a result of failure to coordinate with other trades.
2. Where the Engineer determines that the CSI has installed equipment that is not "conveniently accessible" for operation and maintenance, equipment shall be removed and reinstalled as directed by the Engineer at the CSI's expense.
 - a. "Conveniently accessible" is defined as operable without the use of ladders, without climbing over or crawling under obstacles such as equipment, structures, piping and ductwork. Readout devices shall be installed so that the centerline of the readout is 5 feet 6 inches above finished floor.

B. Diagrammatic Drawings

1. The circuit diagrams shown on the Contract Drawings are diagrammatic and functional only and are not intended to show exact circuit or wiring layouts, number of relay contacts or fittings or other installation details. The CSI shall furnish all labor and materials necessary to install and place in satisfactory operation a fully complete functional system.
2. The motor circuit diagrams shown on the contract drawings are not intended to show all the requirements and features of the motor starter or VFD. The CSI shall furnish motor features in compliance with Electrical Division.
3. The number of conductors shown on the contract drawings is not necessarily the correct number required. The CSI shall install as many conductors as required for the complete and satisfactory operation of all systems.

1.09 PROTECTED WORK

A. Dry Locations

1. Dry locations are areas that are normally not subjected to dampness or wetness. An area designated as dry may temporarily be subjected to dampness or wetness, as in the case of a building under construction.
2. All equipment and enclosures installed in Dry Locations shall be NEMA Type 12.

B. Wet Locations

1. Where installed outdoors or areas designated as Wet Locations, all work shall meet the requirements of the NEC for Wet Locations.
2. All equipment and enclosures installed in Wet Locations shall be NEMA Type 4X, unless otherwise indicated on the Contract Drawings.
3. All equipment and enclosures installed in locations that may have the possibility of total submersion shall be NEMA type 6P, unless otherwise indicated on the Contract Drawings.

C. Corrosive Areas

1. Areas identified as corrosive are areas where corrosive gases and/or liquids can potentially come in contact with and corrode equipment and materials. Corrosive areas shall include rooms that house chemical storage tanks and/or chemical feed equipment or pumps.
2. All equipment and enclosures installed in Corrosive Areas shall be NEMA Type 4X polycarbonate.

PART 2 PRODUCTS (Not used)

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION SITE INSPECTION

- A. Prior to starting any construction activities at a site, the Contractor shall conduct a pre-construction Field Inspection that site.
 - 1. Contractor shall coordinate with the Owner for access and demonstration of existing functions during the Inspection.
- B. The Field Inspection shall document equipment that will be modified or accessed through the SCADA project, discrepancies between the contract documents and the existing conditions, and any defects or broken equipment. The intent of this inspection is to document the condition of existing facilities and discrepancies prior to the Contractor beginning field work to limit claims or liabilities of damage. Unless otherwise noted on pre-construction site inspection reports, it shall be assumed that all existing equipment is functional and operating as required.
- C. The Field Inspection shall include coordinating locations for installation of the SCADA system and instrumentation hardware, coordination of existing instrumentation, network hardware and connections points for terminations of new equipment, etc.
- D. Inspections shall include the development of a SCADA system changeover plan. This plan shall document the running of the new and existing SCADA systems in parallel, and/or what devices or applications will need to be taken offline to install the new SCADA hardware devices and integration of the new SCADA system software.
- E. Provide written inspection results detailing discrepancies or no discrepancies as applicable, and a detailed SCADA system changeover plan. All discrepancies shall be noted to and reviewed by Owner during the inspection.

END OF SECTION

SECTION 17010

CONTROL SYSTEM INTEGRATOR

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the requirements and responsibilities of the Control System Integrator (CSI). All work specified under Division 17 of the Specifications shall be provided by a single CSI.
- B. The Contractor shall retain the services of the specified CSI to furnish, program and configure the control system hardware, software, communication components and provide system start-up, testing, training, documentation and overall integration of the SCADA systems as required in Division 17 of the Specifications.
- C. The CSI shall provide the integration services, programming modifications, communications, system start-up, testing, and documentation as required for the control system with the existing SCADA as shown on the drawings, and as required in Division 17 of the Specification.
- D. It shall be the responsibility of the CSI to be the single point of contact for the coordination of the control system and the equipment provided by within the scope of work.

1.02 RELATED SECTIONS

- A. Division 15 Specifications
- B. Division 16 Specifications
- C. Division 17 Specifications

1.03 SUBMITTALS

- A. Provide submittals as defined in the related sections of Division 17 and in accordance to BRWA Master Specification 01 33 00 – Submittal Procedures.
- B. Pre-Construction Site Inspection Report
 - 1. Provide written report of completion of site inspection and testing of equipment. Report shall detail discrepancies found during testing. Details shall include broken or inoperative equipment; missing devices; cracked or broken pavement; and other issues found at site that the Contractor should advise the Owner of

prior to commencement of construction activities.

2. Reports without any found discrepancies shall indicate no discrepancies found.
3. Report shall indicate if equipment was not able to be tested and for what reason it was not.

1.04 QUALIFICATIONS

- A. The following firm has been identified by the Owner as having suitable experience with the existing SCADA hardware, software and programming requirements. The contractor must obtain their services. No substitutions shall be allowed.

Fairwinds Automation
2821 Elkton Farm Road
Forest, VA 24551
Telephone: 1-434-942-4632
Attention: Mr. Joe Carlin
Email: joe@fairwindsautomation.com

1.05 QUALITY ASSURANCE

- A. The integration services for control, instrumentation, and SCADA systems shall be provided by a single source CSI.
- B. All equipment shall be of the latest version available at the time of bid.
- C. All like equipment shall be provided by the same manufacturer to the fullest extent possible to achieve a standardization of equipment, maintenance and spare parts.
- D. All packaged equipment provided by manufacturers shall be coordinated to properly function with the control systems and network infrastructure.
- E. As much as is reasonable, assigned personnel to remain on the project throughout the project duration. Any personnel changes must be presented to the Owner and Engineer two (2) weeks before expected change. Replacement personnel must meet all the requirements for CSIs as described in the specifications.

1.06 WARRANTY

- A. Correct defects in hardware, software, and workmanship that develop within a period of time as described in the General and Supplementary Conditions of the Contract.
- B. Upon written notice, furnish labor and materials to immediately replace and make good of the faulty materials or equipment without additional expense to the Owner.

- C. Include warranty against defects of design, workmanship and material.
- D. Provide original equipment manufacturer warranties from the time equipment is received until two (2) years after final acceptance. Include technical support and services of field service personnel.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 SUMMARY OF WORK

- A. Perform all work including programming, configuration, installation, testing, and startup for all instrumentation, control, and SCADA systems as shown on the Contract Drawings and as described in the specifications.
 - 1. All completed systems must function as described in and in accordance with all the requirements of Specification 17600: Control Narratives.
 - 2. Execute all requirements and provide all quality control documentation described in Specification 17166: Site Acceptance Testing.
 - 3. Furnish O&M manuals in accordance with Section 17120: Operations and Maintenance Documentation. O&M manuals shall reflect the final, as-installed conditions as accepted by the Owner.
- B. Provide all software source code in original file format used on the project to the Owner prior to field installation work and again after system acceptance reflecting all modifications made since the initial source code delivery.
 - 1. Source code as referenced in this Section includes all programming and configuration required to implement and document the installed software, including:
 - a. Fully annotated PLC ladder logic.
 - b. Tag database.
 - c. PLC I/O point lists
 - d. Communication settings.
 - 2. Provide software programming and configuration in the following three formats:
 - a. The original source files in standard programming software file format as needed for immediate support of the system.

- b. Printed documentation of all source code in an easy to read, word-searchable electronic version of Adobe PDF.
 - c. One paper copy of the printed documentation of all source code. It is acceptable to include this format under the O&M Manual specified elsewhere.
- C. Provide all instrumentation.
- D. Provide all hardware and software as specified in other sections Division 17 and as shown on the contract drawings, including manufacturing, installation assistance, testing, startup and demonstration of equipment and software. Provide operations and maintenance manuals and specified training as specified for all provided equipment and software.
- E. Provide all incidental hardware and software accessories, including connectors, cables, switches, converters, adapters, drivers, and programming software necessary to assemble and program a complete and functional control system.
- F. Furnish spare parts as defined in the Specifications.
- G. Provide insurance and protection of all equipment, materials, and documentation until delivered to Owner.
- H. Should a discrepancy occur, assist the Contractor to resolve the discrepancy to provide proper operation.

3.02 COORDINATION MEETING

- A. Control System Coordination Meeting:
 - 1. Timing: A minimum of 60 days prior to panel fabrication of any System Integrator or Manufacturer-supplied panels.
 - 2. Purpose: Discuss the details of programming for the new PLC control panel and OIT touchscreen interface. The meeting shall consist of:
 - a. Review and finalize the Sequence of Operations, Control Narratives and requirements of the process control system.
 - b. Determine the requirements, arrangement and functions of the new PLC panel OIT graphical interface, including the requirements of the exchange of data between the new PLC panel and the existing SCADA system.
 - c. Determine the Owner's requirements and coordinate programming

requirements for integration of the new PLC control panel into the existing SCADA system. Discuss modifications necessary to the existing SCADA system and HMI software.

- d. Determine the requirements and arrangements of the communications of the new cellular data connection between the new PLC panel and the existing SCADA network. Discuss any modifications required to existing SCADA network switches and hardware.

3.03 SEQUENCE AND SCHEDULING

- A. Schedule and perform the work to minimize adverse effects on the operations of the Owner's facilities as described here-in.
- B. Schedule the work so as to allow ample time for development and configuration of the Human Machine Interface (HMI) software, and review of such development and configuration by the Owner, or designated representative.
- C. Any work that will require an interruption to normal operation of the Owner's facilities shall be approved at least one (1) week prior to planned interruption.
- D. CSI must provide to Contractor and Engineer a list of required project milestones that must be completed before on-site software implementation and commissioning can begin. Delays caused by incomplete milestones are not the responsibility of the Owner.

3.04 INSTALLATION

- A. The CSI's assigned project field service engineer must guide and assist in the handling, placement, installation and checkout of the instrumentation, control, and SCADA system.
- B. Before installation of any hardware, equipment, or instrumentation, the CSI's assigned project field service engineer must visually inspect all delivered equipment for damage or product inconsistencies. Report any discrepancies or defectives.
- C. The CSI's assigned project field service engineer must be on-site whenever any instrumentation, control, and SCADA system equipment is being installed.
- D. The CSI's assigned project field service engineer must coordinate all communications equipment, communications link and network cable terminations and connections with the Network System Integrator.
- E. The CSI must coordinate with the Contractor and all other subcontractors to provide a complete exchange of information as necessary to install all equipment and instrumentation, and to program and configure all hardware and software provided.

3.05 FIELD QUALITY CONTROL

- A. The CSI must provide the following on-site services in conjunction with, and support of the Contractor's field quality control requirements.
1. Certify in writing that the equipment has been installed per the manufacturers' drawings and recommended installation procedures, the equipment power and grounding requirements have been satisfied, and that field wiring and terminations to the equipment are properly installed and correctly identified. Report any discrepancies.
 2. Certify in writing that each system is ready for site acceptance testing.
 3. Assist in resolving interface discrepancies between the input/output subsystem and panels, equipment, instrumentation, or final control devices.
 4. Attend progress meetings as requested by the Contractor.
 5. Prior to delivery of provided equipment, it is the CSI's responsibility to coordinate with Contractor and verify that the site is prepared to install equipment or has arranged storage that will keep equipment safe from vandalism or theft as well as in an environment that is appropriate for equipment storage, per the manufacturers' recommendations.
 - a. Equipment includes factory assemblies as well as all of the devices used as part of the final assembly.
 - b. Equipment also includes any manufactured device or instrumentation.
 6. Conduct all system testing including site acceptance testing. See specification section 17166: Site Acceptance Testing.
 7. Perform and/or provide training for equipment and software provided under Division 17 of the Specifications.
 8. It is the CSI's responsibility to repair or correct shipping defects as well as conducting additional trips to resolve shipping problems at no additional cost to the Owner.
 9. Certify in writing that the equipment is ready for operation and that operating personnel have been suitably instructed in the operation and care of equipment prior to placing equipment in service.

END OF SECTION

SECTION 17120

OPERATIONS AND MAINTENANCE DOCUMENTATION

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the requirements for the Instrumentation, Control, and SCADA operations and maintenance (O&M) documentation.
- B. It is the Contractor's responsibility to provide documentation for all equipment and systems furnished and installed under Division 17.

1.02 RELATED SECTIONS

- A. Division 17 Specifications

1.03 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Outline
 - 1. Provide an outline of the O&M documentation including a complete list of the manuals to be provided. Indicate title, content, and Specification sections covered.
 - 2. Provide formats and samples of representative pages of manuals.
 - 3. Outline must be submitted for the Engineer's review prior to the submittal of the Preliminary O&M.
- C. Preliminary O&M
 - 1. The preliminary O&M must include documentation for all equipment and systems furnished and provided under Division 17, including schematic drawings, operator's manual, software manual and engineer's manual.
 - 2. Preliminary O&M must be provided after shop drawings are approved but before the site acceptance test.
 - 3. Preliminary O&M must be submitted for the Engineer's review prior to the submittal of the Final O&M.

D. Final O&M

1. In addition to all documentation approved in the Preliminary O&M submittal, provide as-built information of control system hardware that includes all the wiring diagrams, programming information, input/output lists, drawings, catalog cuts and other relevant information with any changes that have taken place in the field during construction.
 - a. "As-built" refers to documentation reflecting the exact type, configuration and installation furnished and provided.
2. Final O&M must be submitted after the control panels and instrumentation are installed, adjusted and tested in the field.
3. The Engineer must approve the final O&M documentation before a final inspection of the work will be conducted, and prior to Final Acceptance.

PART 2 PRODUCTS

2.01 GENERAL CONTENTS

- A. For equipment that will function as part of a system, assemble data in a manner that describes the operation and maintenance of the entire system. Include catalogs, brochures, bulletins, charts, schedules, description and approved shop drawings corrected to record conditions, assembly drawings and wiring diagrams.

2.02 OPERATIONAL AND MAINTENANCE INFORMATION

- A. Include O&M information for all systems, equipment, and software. Include descriptions for operation (start-up, running, shut down), maintenance, and other information necessary for the Owner to establish an effective operating and maintenance program.
- B. For control panels, include all installed devices and components in O&M. Include the following:
 1. Routine maintenance requirements for control panels and all installed components.
 2. Detailed instructions for operating the control panels. Submit preliminary and final versions of the O&M for the control panels.

2.03 SITE / PROCESS AREA OPERATION'S MANUALS

- A. One operations manual shall be provided per facility area where modifications or upgrades to an existing control panel have been performed.
- B. Provide manuals for use by the systems operators and SCADA system maintenance personnel.
 - 1. Bind these manuals separately from other information and provide information necessary for an operator to perform operating functions.
 - 2. Make the preliminary manuals available at the time of Site Acceptance Testing and final manuals available for the operator's training course to be used for instruction.
- C. Operations manuals shall include the following information at a minimum:
 - 1. A complete set of "As-built" documentation reflecting the exact type, configuration and installation furnished and provided to include the following at a minimum:
 - a. Panel Elevations
 - b. Power and Control Wiring Diagrams
 - c. Network Architecture Diagrams showing both LAN and WAN connections, cables, and equipment.
 - d. PLC Input/Output Points List
 - e. Control System Hardware
 - f. Catalog cuts for provided hardware and software
 - g. Other relevant information including any changes that have taken place in the field.
 - 2. A block diagram showing the interaction of the system or site with all dependent subsystems.
 - 3. Overall control narrative of the system and dependent subsystems, including special techniques and general philosophies of the operational controls.
 - 4. Include a copy of the completed and signed Site Acceptance Testing documentation.
 - 5. An electronic copy on USB flash drive of the final PLC and OIT configurations and

logic. This copy shall be capable of being downloaded into the PLC (or OIT) resulting in a fully functional operating device.

6. Hardcopies and an electronic copy on USB flash drive of the final DNP3 communication configuration (as applicable). The electronic copy shall be capable of being downloaded into applicable communication module (or device) resulting in a fully functional communication module (or device).
7. An electronic copy on USB flash drive of the final network hardware configurations.
8. Operation and maintenance documentation shall be submitted in accordance with Section 16010 – Electrical General Provisions.

2.04 QUANTITIES

- A. Provide one (1) electronic copy of the O&M outline.
- B. Provide two (2) hard copies and one (1) electronic copy of the Preliminary O&M.
- C. Provide two (2) hard copies and one (1) electronic copy of the Final O&M.
- D. Any electronic copy must be complete and submitted on a USB Flash Drive.

PART 3 EXECUTION

3.01 USER LIST

- A. Place the Owner on a user's mailing list to receive notices of hardware and software updates and revisions to documentation. Do not charge the Owner for this service through the end of the maintenance contract period.

END OF SECTION

SECTION 17166

SITE ACCEPTANCE TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. This section describes the requirements for field-testing of the SCADA, instrumentation, and process control systems.

1.02 COORDINATION

- A. The Control System Integrator (CSI) shall be responsible for coordinating Site Acceptance Testing (SAT) with all parties including the Electrical and General Contractors, and the Network System Integrator (NSI) such that each party is responsible to be present for testing as required. The CSI shall be responsible for the testing with assistance from equipment suppliers, the General Contractor and the sub-contractors to ensure a complete working SCADA and instrumentation system.
- B. SAT shall be a collaborative effort between the Contractor, the CSI, the Engineer, and the Owner.
- C. Coordinate testing with the CSI and NSI to ensure compatibility between the Information Technology (IT) and Operational Technology (OT) sub-systems. Ensure transmission of data between all PLCs and the SCADA system server PCs.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Include the following information in the submittal for all test specified in this section:
 - 1. A detailed step-by-step test procedure of each test at least two weeks in advance of each scheduled test date. Include sign-off sheets and punch list forms. Procedure documents shall:
 - a. Contain, in the Contractor's format, the test ID number, name, and description.
 - b. Contain testing schedule and checklists including logical step-by-step procedures, methodology and equipment required to be used for testing with expected response at each step and provide space for recording of actual results.

- c. Provide space for approval of each test.
 - d. Contain minimal reference to other documents.
 - e. Generally, be structured such that simpler tests are run first.
 - f. Be written such that they can be used by the Owner's personnel during SAT.
 - g. Describe any steps necessary to simulate inputs required by the test.
- 2. Confirm, in writing, times and dates two weeks before a test.
- 3. Within two weeks following completion of any field tests, submit the completed test sign-off form to the Engineer.
- 4. A list of required diagnostic or calibration tools that will be used by the CSI as part of the test procedure. In addition to the list, each tool must also have a calibration report.
 - a. All diagnostic/calibration tools must have been calibrated within the previous one year of the date of testing.

1.04 GENERAL

- A. Conducting field testing shall be the responsibility of the CSI. The Engineer will actively participate in the test at the request of the Owner. The Engineer reserves the right to test any specified function whether or not explicitly stated in the test submittal. The Owner reserves the right to reject the system if any portion of the system operation is deemed unsatisfactory by the Engineer.
- B. Meet the following criteria prior to the start of the SAT.
 - 1. Complete submittals and resolve disputes.
 - 2. As-built factory drawings for all control panels.
 - 3. Complete preliminary O&M manuals per Specification 17120, O&M Documentation.
 - 4. Power provided to all control panels.
 - 5. Have the Engineer reviewed and approved test procedures and schedules.
 - 6. All control wire pulled, labeled, and terminated.
 - 7. All network cables are pulled, labeled, and connected.

8. All instruments are installed, field calibrated, and ranges verified.
9. Set a test date that is agreeable to all.
10. All parties agree that the complete system is ready for testing.

C. Test Schedule

1. Testing must be conducted during regular business hours unless approved, in writing, by the Owner.
2. Testing must not exceed eight (8) hours unless approved, in writing, by the Owner.
3. Each test day must begin with a meeting to review the day's test schedule.
4. Each test day must end with a meeting to review the day's test results and to review or revise the next day's test schedule.
5. Tests shall not be scheduled until all pre-testing requirements are successfully fulfilled and approved by the Engineer.
6. Testing shall be scheduled to complete an entire system or sub-system as a whole. Piece-meal or component testing will not be acceptable.
7. Final testing schedules shall be agreeable and acceptable to all parties required to attend.
8. The Engineer may redirect testing from one facility, area, or unit process to another. Make no claim for delay or additional costs for testing if the testing effort is redirected to a different facility, area, or unit process provided the following conditions are met:
 - a. The redirection does not cause more than a one-hour interruption to the testing to move test equipment and test personnel to the new facility, area, or unit process.
 - b. There is no change in the amount of test equipment or personnel requirements.
 - c. The redirection is not arbitrary. Process operational constraints, personnel availability, and other's work are valid reasons for redirection.
 - d. The redirection does not occur more than once in any workday subsequent to the daily scheduling meeting.

9. Perform no testing which may affect facility operations without the Engineer and the Owner concurrence.
10. At the end of the test, meet to review the list of deficiencies. The Engineer will indicate those items that must be corrected prior to proceeding to the next test.

PART 2 PRODUCTS

2.01 GENERAL

- A. The CSI shall furnish all testing equipment and software required to fully test, verify and document system operation. Provide use of the following diagnostic/calibration tools at a minimum:
 1. At least one computer running the software applications.
 2. Multimeter
 3. Analog Signal Generator
 4. Any special calibration devices or equipment
- B. Provide software required to test and document network communications and wireless signal strengths.
- C. At time of testing, Contractor must have on-site, labeled, and properly stored, spare parts, expendables and test equipment pertinent to the part of the system being tested.
- D. During testing, provide use of the following documentation:
 1. One copy of each submittal applicable to the equipment to be tested.
 2. One copy of the Drawings and Specifications together with addenda and change orders.
 3. One master copy of the test procedure.
 4. A complete inventory of the equipment to be tested including make, model and serial number.
- E. Provide use of the following test equipment:
 1. Off-line diagnostic and test programs.
 2. At least one computer running the software applications.

PART 3 EXECUTION

3.01 GENERAL

- A. Testing shall be performed under the real, as-installed conditions. The use of temporary wiring, power supplies or communications links will not be acceptable for use for the final testing requirements. Components or devices replaced in a system or sub-system will require retesting of the entire system or sub-system as directed by the Engineer.
- B. Meet the following conditions prior to the start of any testing:
 - 1. Have documentation on-site pertinent to the part of the system being tested.
 - 2. Have on-site, labeled, and properly stored, spare parts, expendables and test equipment pertinent to the part of the system being tested.
 - 3. Have the Engineer reviewed and approved test schedules and test procedures.
 - 4. Have all parties certify that the system has been checked and is ready for testing.
 - 5. Schedule testing with the Engineer. Tests shall be scheduled with minimum of two-week advanced notice.
- C. Perform field-testing to verify the operation of the SCADA instrumentation systems. Begin testing immediately after completed installation of each major system or subsystem. Perform field-testing sequentially and organize by facility, area and the sequence of constructions as specified.
- D. Perform tests by following the operation and maintenance manuals word-for-word unless approved otherwise by the Engineer. Lack of complete, detailed manuals will be cause for declaring the test to have failed regardless of the actual test results.
- E. Begin testing by performing the following steps:
 - 1. Check equipment against shop drawing lists and submittals.
 - 2. Verify that the equipment has been installed in accordance with Contract Documents and manufacturer's directions.
 - 3. Power up the equipment and run diagnostics to verify error-free operation.
 - 4. Load all software.
- F. The Owner will participate in all testing activities at the Owner's discretion.
 - 1. This participation will serve as a learning experience for the Owner's operations and maintenance personnel.

2. This participation does not relieve the Contractor from the specified requirements for testing.
3. Recognize and adjust for Owner involvement in developing test procedures and schedules.
4. The Owner's participation and use will be such that it does not adversely affect specified testing requirements. Make no claim for delay unless the following conditions are met:
 - a. The Owner and the Engineer are notified verbally that the Owner's action could cause delay if continued.
 - b. The Owner persists in the delaying action.
 - c. Submit written documentation within 24 hours to describe the Owner's action and corresponding impact.

3.02 INSTRUMENTATION CALIBRATION/TESTING

- A. All analog and discrete instruments and all control system equipment must be field calibrated and tested after installation and prior to Loop Testing.
- B. The CSI shall provide all equipment, software, and tools to perform calibration of the provided instrumentation. Instruments shall be calibrated at a minimum of three (3) points, using test equipment to simulate inputs and test for instrumentation outputs.
- C. All instruments must meet the accuracy requirements of the manufacturer's published performance specifications and tolerances.
- D. Submit a calibration report for each instrument detailing all calibration points and certifying the instrument has been properly calibrated per the manufacturer's recommendation and best industry practices.

3.03 LOOP TESTS

- A. Loop tests shall be performed for each discrete or analog signal to/from field devices and panels, and shall demonstrate the proper operation of each signal, instrument, and control loop associated with an I/O point or hardwired interlock.
 1. Tests shall include each new and existing process instrument, field interface device or circuit, interface wiring and associated I/O hardware.
 2. All field instruments and equipment interfacing with the equipment under test shall have been calibrated and/or tested in accordance with the requirements of the individual specification sections.

- B. Check each loop from the end element to the respective control display. Include instruments, control devices, panels, termination cabinets, I/O cards and other devices in the loop to ensure proper operation.
- C. Document loop checks and submit to the Engineer. Include the following information:
 - 1. Loop number.
 - 2. Loop description.
 - 3. Termination information.
 - 4. Loop drawing reference.
 - 5. Type of test(s) performed.
 - 6. Date tested.
 - 7. Problem description, if any.
 - 8. Signature of tester and date.
 - 9. Signature of Engineer and date.
- D. Summarize loops found to contain defective or inoperable equipment on separate sheets and submit to the Engineer.
 - 1. Correct and recheck work.
 - 2. The Engineer will coordinate correction of defective work by others. Perform rechecking as a part of this Contract.
 - 3. Limit rechecking of defective work by others to 10 percent of the total number of loops. Do not perform additional checkout work unless directed by the Engineer.

3.04 COMMUNICATIONS LINK TESTING

- A. Communications link testing is intended to verify adequate signal strength for all wireless communication installations and verification of network communications between specified locations.
- B. Communications testing shall be performed by simulating final installed conditions to the extent possible. Communications testing shall be completed before final installation of external antennas and/or cable.
- C. Perform communications testing at each remote facility PLC/network location using test

equipment to verify communication signal strength and network connectivity. Wireless connectivity tests shall verify the transfer of data between the PLC's, OIT, and SCADA servers via the wireless network communication system.

- D. Wireless communication surveys shall measure communications signal strengths at all remote facilities with an antenna mounted as shown on the Contract Drawings.
- E. Perform network connectivity tests at specified sites to verify the transfer of data between PLC, SCADA and network hardware and software equipment. Perform testing to demonstrate that specified performance levels for communication equipment are met.
- F. Verify communications between ethernet networked devices by pinging all respective devices that communicate with a central device and verifying response from each IP address.
- G. Document testing and submit to the Engineer. Include:
 - 1. Communication link description.
 - 2. Communication link address.
 - 3. Signal Strength (wireless communications)
 - 4. Drawing reference.
 - 5. Type of test(s) performed.
 - 6. Problem description, if any.
 - 7. Signature of tester and date.
 - 8. Signature of Engineer and date.

3.05 FUNCTIONAL ACCEPTANCE TESTING

- A. General:
 - 1. Testing shall demonstrate the proper wiring, configuration, operation of monitoring and control, data and signal handling functions, power circuits, controller functions, communication functions.
 - 2. Tests shall be performed in conjunction with the Owner and any third party manufacturers required for controls PLC programming functions. Demonstrate test results at the site on a programmer unit linked to the equipment being tested.

- B. The following shall have been successfully completed prior to the start of Functional Acceptance Testing:
1. Loop and Communications Link testing completed.
 2. All field instruments and equipment interfacing with the equipment under test shall have been wired, terminated, calibrated and/or tested in accordance with the requirements of the individual specification sections.
 3. All communications to other facilities or sites that interface with the testing site to provide the signals/data necessary for functional control of the facility shall have been tested and verified.
- C. Functional Tests:
1. Functional tests shall demonstrate the control logic as defined in Specification 17600, Control Narratives. The tests shall demonstrate all control system functions, interlocks and interdependencies between facilities.
- D. Equipment Tests:
1. 120V Power and Ground connections
 2. Branch circuits and circuit breakers
 3. UPS functionality and UPS Bypass modes
 4. 24VDC Power supplies: Power Supply 1, Power Supply 2, and Power supply redundancy functionality
 5. Interior Control Panel light
 6. Panel exhaust fan and space heater
 7. Document and submit demonstrations to the Engineer. Include:
 - a. Description of function.
 - b. Signature of tester and date.
 - c. Signature of Engineer and date.
 - d. Problem description, if any.
- E. Maintenance/Support Tests:
1. Include a demonstration of the following:

- a. System power fail.
 - b. Operation on UPS.
 - c. Restoration of utility power.
- 2. Document and submit demonstrations to the Engineer. Include:
 - a. Description of function.
 - b. Signature of tester and date.
 - c. Signature of Engineer and date.
 - d. Problem description, if any.
- F. Testing shall include network communications as defined above under Communication Link Test.
- G. Testing shall include loop tests defined above under Loop Testing.

END OF SECTION

SECTION 17250

PROGRAMMABLE LOGIC CONTROLLERS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section describes the requirements of the Programmable Logic Controllers (PLC).
- B. Related sections include:
 - 1. Division 17 Specifications

1.02 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Include the following information in the submittal for this section:
 - 1. Data sheets and catalog literature.
 - 2. Describe how the PLC functions. Include a description of the PLC input/output functions, addressing system and card layout, including any special configuration rules and limitations, instruction sets, and programming procedures.
 - 3. Describe each communication interface. Include protocols, the type of network, the error recovery routines, and the available utility functions.
 - 4. Describe how faults are detected, isolated and corrected. Describe on-line diagnostic tests and off-line tests.
 - 5. Dimensional data.
 - 6. Interface and cable data.
 - 7. List of spare parts being provided.
 - 8. PLC programming software information.
 - 9. Annotated PLC ladder logic in hard copy format and in native format on USB drive for final documentation records.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Furnish and install PLCs for data acquisition and control. Provide PLCs which are part of a standard line of PLC products. Provide ruggedized components designed specifically for industrial environments.
- B. Provide manufacturer's standard parts and assemblies to house the processor, power supply, communications modules and input/output subsystem.
- C. Provide equipment of modular design using plug-in assemblies. Wherever possible, provide interchangeable assemblies and sub-assemblies for equipment performing similar functions.
- D. Identify major assemblies and sub-assemblies, circuit boards, and devices using permanent labels or markings to indicate the catalog number and manufacturing date code.
- E. Use manufacturer-supplied chassis or cable connections for data communication between components.
- F. The PLC network shall be configured as shown on the Contract Drawings.

2.02 MANUFACTURER

- A. Allen-Bradley Micro800 series.
- B. No substitutions allowed.

2.03 PLC PROCESSOR

- A. The PLC shall be provided with the following features:
 - 1. Minimum 5 MB of memory
 - 2. 1- USB mini type B port
 - 3. 1 – EtherNet/IP ports

2.04 POWER SUPPLIES

- A. Power supplies must be compatible with PLC Chassis.
- B. Input Voltage – As shown on the drawings.
- C. Power –Sized for PLC chassis requirements.

2.05 CHASSIS

- A. Sized as required for all active and spare IO, and for applicable communication module.

2.06 INPUT/OUTPUT COMPONENTS

- A. IO modules must be provided with the following features:

1. Compatible with PLC and chassis.
2. Screw terminals.
3. Front module status LEDs.
4. Removable terminal block where possible with standard products

- B. Digital Input Modules:

1. 24 VDC or 120 VAC.
2. Use 24 VDC where possible with standard products.

- C. Digital Output Modules:

1. 24 VDC or 120 VAC, or Relay Output
2. Use Relay Output where possible with standard products.

- D. Analog Input Modules:

1. 4-20mA or 0-10 VDC Signals
2. 24-bit resolution minimum where possible with standard products.

- E. Analog Output Modules:

1. 4-20mA or 0-10 VDC Signals
2. 16-bit resolution
3. Individually Isolated Outputs where possible with standard products.

2.07 COMMUNICATION MODULES

- A. EtherNet/IP Communication Module:

1. Media: Copper Ports

2. Communication Rate: 10/100 Mbps

3. TCP/IP Connections: 128

2.08 SPARE PARTS

A. Provide the following spare parts:

1. One (1) spare I/O Module of each type provided.

2. One (1) spare Power Supply of each type provided.

2.09 MAINTENANCE

A. Provide special tools necessary for normal operation, maintenance and calibration.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install PLCs and input/output components in panels as shown on the drawings.

B. PLC shall be programmed using the latest version of the Studio 5000 software by Rockwell Automation. All PLC programming shall be done in ladder logic form.

END OF SECTION

SECTION 17441

CONTROL SYSTEMS HARDWARE

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the equipment and installation practices for all control system hardware.

1.02 RELATED SECTIONS

- A. Division 15 Specifications
- B. Division 16 Specifications
- C. Division 17 Specifications

1.03 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Instrumentation and Controls shop drawings include, but are not limited to:
 - 1. Complete terminal identification diagrams and schedules.
 - 2. Complete point-to-point interconnection diagrams.
 - 3. Complete single line and elementary wiring diagrams for all panels.
 - 4. Terminal point and wire identification for nodes and interconnections and all shop drawings must be identical to related terminal point and wire identifications on equipment panels. NO deviation from this requirement will be permitted.
- C. Panel shop drawings shall contain the following:
 - 1. Panel
 - a. Top and base plan, showing location of equipment and all conduits to and from equipment, supports, doors and clearances.
 - b. Front and rear elevations, showing general arrangement, complete with dimensions.

- c. Elevation sections (right and left sides' minimum, others as required).
- d. Mounting details of all principal equipment.
- e. All panel and accessory drawings must be drawn to a scale not less than 1-inch equals 12-inch.
- f. All principal items must be identified with an encircled number which will correspond to an individual item in a "List of Principal Equipment".
- g. The panel information must be printed on the instrumentation and control shop drawings. Separate submission of anything other than the instrumentation and controls shop drawings, or in any form other than herein before described, will NOT be acceptable.

2. Schematic

- a. A complete schematic, elementary drawing with all wiring numbers corresponding to the wire numbers on the wiring diagram shall be submitted.
- b. Submit a complete wiring diagram showing all electrical apparatus, both within the equipment and connections to external equipment.
- c. All wires on a drawing must be shown continuous from end to end and identified by numbers.
- d. A wire connected to one side of a contact such as pushbuttons, relays or selector switches shall change its identifying number when leaving the opposite side of such contact.
- e. Any and all wires passing from panel to panel across the panel joints, which must be disassembled for shipping, must have matching terminal blocks at these joints. The matching terminal blocks must be identified with the respective wire numbers.
- f. All wires entering and/or leaving the equipment must be brought to the terminal blocks and identified.
- g. Wireless or numbered type diagrams will not be accepted, nor will blank blocks with separate drawing reference numbers be considered.

D. Record Drawings

- 1. Record drawings are the final version of the Contract Drawings.

2. Record drawings shall include all changes to the original documents, including addenda issued during bidding and change orders or other field changes issued during construction to reflect actual construction.
3. Contractor must submit a set of record drawings prior to Final Acceptance.
4. Diagrams must be oriented to display the general arrangement and location of wiring and equipment which is seen when facing the appropriate panels for maintenance an adjustment purposes. Examples: for panels wired and serviced from the front, diagrams shall depict a front view, and for panels wired and serviced from the rear, diagrams shall depict a rear view. Mirror image diagrams are prohibited.
5. All submittals must include a list of deviations from the specifications. Deviation list must include a list of items that are being submitted as “approved equal” to the specified device.

1.04 QUALITY ASSURANCE

- A. It is the responsibility of the equipment manufacturer to obtain wiring diagrams of all foreign equipment and coordinate or reproduce these diagrams into complete panel wiring diagrams. The physical relationship of all controls must be identical to the finally developed wiring diagrams.
- B. All information described herein must be shown on the instrumentation and controls shop drawings. Separate submission of electrical information on anything other than the instrumentation and controls shop drawings or in any form other than described herein will NOT be acceptable.
- C. The instrumentation and controls shop drawings must be developed to provide a complete understanding of the construction, maintenance, repair, and operation of any basic component.
- D. All instrument and controls electrical components, terminals, wires and enclosures must be UL recognized or UL listed as applicable.
- E. All control panels shall bare UL listing mark stating: “Listed Enclosed Industrial Control Panel” per UL 508A.

PART 2 PRODUCTS

2.01 CONTROL ENCLOSURES

- A. General

1. All Enclosures must conform to NEMA ratings as defined in NEMA 250 and as specified herein.
2. Panel construction and interior wiring must be in accordance with the National Electrical Code (NEC), UL 508, state and local codes, and applicable sections of NEMA, ANSI, and ICECA.

B. Enclosure Types

1. Type 4 or 12 Panels:
 - a. Painted mild steel, 16 ga. minimum
2. Type 4X Panels:
 - a. 316 stainless steel, 16 ga. minimum
3. Type 7 Panels:
 - a. Provide in Class I, Division 1 hazardous locations
 - b. Cast aluminum type
 - c. Corrosion resistant, high strength steel cover bolts
4. Type 6P (IP68) Panel:
 - a. Enclosure to be provided with environmental seals for water submersion applications.
 - b. Rated for 1 meter of submersion for 24 Hours, and/or 10-60 feet of submersion.
 - c. Panel Construction: 304 stainless steel, 16 ga. minimum
 - d. Stainless Steel hex bolts for securing the enclosure door to the enclosure.
 - e. Manufacturer:
 - i. NEMACO, Model N6P
 - ii. Approved equal

C. Enclosure Back Panel

1. 12 ga. carbon steel, finished with white polyester powder paint or a conductive,

corrosion-resistant coating.

D. Enclosure Doors

1. Three-point latching mechanisms in accordance with NEMA 250 Type 1 and 12 panels with doors higher than 18 inches.
2. For other doors, stainless steel quick release clamps.
3. For type 7 panels, provide external flange with corrosion resistant fasteners.
4. All doors must be rubber-gasketed with continuous hinge.
5. Cutouts must be cut, punched, or drilled and finished smoothly with rounded edges.

E. Enclosure Access

1. Access must be front of panel, with back and sides adjacent to or in contact with other surfaces, unless otherwise specified.
2. Provide and install intrusion detection switch on all enclosures.
3. Hasp and staple for padlocking. Locks to be provided by Owner.

F. Temperature Control and Ventilation

1. It is the supplier's responsibility to determine the temperature control requirement for each panel supplied. If the supplier determines that temperature control is necessary, temperature control devices must conform to the following:
 - a. Louvers
 - i. Washable, aluminum type.
 - ii. Provide 1 can of filter spray adhesive for every enclosure.
 - b. Fans
 - i. Forced ventilation type with washable aluminum air filters and finger guards.
 - ii. Service: Minimum of 40,000 hours of continuous operation.
 - iii. Power: 115 VAC at 60 Hz. Include thermal protection.

c. Exhaust Grills

- i. Provide exhaust grilles with filters.
- ii. Provide 1 can of filter spray adhesive for every enclosure.

G. Heaters

1. Applications:

- a. Condensation Control: Where enclosures are mounted outside or in unheated areas, provide them with thermostatically controlled heaters, adjustable from 40 to 80 degrees F, that will maintain the inside temperature above 40 degrees F unless otherwise specified.
- b. Freeze Protection: Provide heaters for as required.

2. Type:

- a. Thermostatically controlled, fan driven.

3. Sizing:

- a. Size heaters per manufacturers recommendations based on the panel location. Size heaters to maintain a minimum temperature differential of 10 degrees F between the exterior ambient temperature and interior enclosure in order to prevent humidity and condensation.

4. Installation:

- a. Mount heaters near the bottom center of the enclosure. Do not mount electronic components closer than 6 inches to the heater.

5. Power:

- a. 115 VAC at 60 Hz

H. Breathers and Drains

- 1. Furnish with NEMA 250, Type 4 and 4X panels in high-humidity or hazardous/classified areas with low humidity requirements that require moisture prevention or drainage from panels.
- 2. Purpose: Removes and prevents condensation inside panels. The breather portion maintains a dust seal trap that prevents entry of dust, while allowing a free flow of air to maintain an equilibrium of pressure between the inside and

outside of the panel it is located in. The drain portion maintains an outlet following the dust seal trap that allows collected moisture inside the panel to leave, while blocking any moisture that attempts to come in.

3. Size: ½ inch diameter
4. Hazardous Area Certification: As required by the Contract Drawings.
5. Manufacturers
 - a. Eaton Crouse-Hinds
 - i. Breather: ECDI N4B
 - ii. Drain: ECDI N4D
 - b. Appleton-Emerson
 - i. Breather: BRTB4X
 - ii. Drain: ECD50B4X
 - c. Approved equal
- I. Lighting
 1. Provide a minimum of one (1) door-controlled internal LED light for enclosures of 12 cubic feet and larger. Light shall provide minimum of 400 lumens and be 24VDC powered.
- J. Finish
 1. Metallic External Surfaces (Excluding Aluminum and Stainless Steel): Manufacturer's standard gray unless otherwise specified.
 2. Internal Surfaces: White enamel.
- K. Equipment Mounting Racks
 1. Must be provided as required to mount and support equipment and where specifically shown on the Contract Drawings.
- L. Keys
 1. In the case that a piece of equipment is provided with a keyed entry, all copies of the key must remain with the piece of equipment until accepted by the Owner.

M. Enclosure Accessories

1. Print Pocket

- a. A large print pocket shall be provided on interior face of each enclosure door(s). Where this cannot be accommodated due to windows and other control devices mounted on the door, the print pockets shall be mounted on the interior side of the control panels.

2. Panel Window Kits

- a. Panel windows shall be provided for control panels and enclosures where shown on the Contract Drawings. The window shall be sized to allow visual inspection of controls and components mounted on the interior swing-out panel as shown on the Contract Drawings.
- b. Panel windows shall be factory installed. Installation of panel windows shall maintain the rating of the control panel or enclosure. The panel window frame shall be fabricated from heavy gauge steel and painted to match the enclosures finish. The window shall be fabricated from clear acrylic plastic with a minimum thickness of 1/4 inch. The window frame shall hold a neoprene gasket to provide a watertight seal around the entire window.

3. Floor Stand Kits

- a. Floor stand kits shall be provided where shown on the Contract Drawings or where required for free standing panels. Floor stand kits shall be constructed of the same materials as the enclosure with a reinforcing bottom plate. Floor stand kit dimensions shall be coordinated with the overall enclosure dimensions.

4. Rain Hoods

- a. Rain hoods shall be provided for outdoor control panels and instrument enclosures where shown on Contract Drawings or specified.

5. Retractable Shelf

- a. Enclosures shall be provided with retractable shelf for temporary use of laptop programming terminals where shown on Contract Drawings or specified.

N. Manufacturers

1. Hoffman
2. Austin Enclosures
3. Rittal
4. Approved equal

2.02 CIRCUIT BREAKERS

- A. Furnish main circuit breaker and a circuit breaker on each individual branch circuit distributed from power panel.
- B. Locate to provide clear view of and access to breakers when door is open.
- C. Coordinate for fault in branch circuit to trip branch breaker, and not main breaker.
- D. Rated Current: Select based on full load of all devices powered by respective branch or main circuit breaker. Size in accordance with UL-580A requirements.
- E. Manufacturer and Product:
 1. Allen Bradley; 1489-M Series.
 2. Eaton; FAZ Series.
 3. Approved equal.

2.03 WIRING INTERFACE

- A. For analog and discrete signal, terminate at numbered terminal blocks.
- B. For special signals, terminate power (240 volts or greater) at manufacturer's standard connectors.
- C. For panel, terminate at equipment on/with which it is mounted.
- D. Refer to Section 17442: Low Voltage Control Conductors and Cables for additional requirements.

2.04 SIGNAL CHARACTERISTICS

- A. Analog Signals:

1. 4 to 20 mA DC, in accordance with compatibility requirements of ISA S50.1.
2. Unless otherwise specified or shown, use Type 2, two-wire circuits.
3. Transmitter: Load resistance capability conforming to Class L.
4. Fully isolate input and output signals of transmitters and receivers.

B. Discrete Signals:

1. Two-state logic signals.
2. Utilize 120 VAC or 24 VDC sources in accordance with the Contract Drawings for control and alarm signals.
3. Alarm signals must be normally open, close to alarm, with isolated contacts rated for 5 A at 120 VAC and 2 A at 30 VDC.

C. Pulse Frequency Signals:

1. DC pulses whose repetition rate is linearly proportional to process variable over 10:1 range.
2. Generate pulses by contact closures or solid-state switches.
3. Power Source: Less than 30 VDC.

2.05 TERMINAL BLOCKS:

A. General:

1. Grouping: Group to keep 120 VAC circuits separate from 24 VDC circuits.
2. Connections: Vibration proof, hardened steel, screw down compression clamp. NO exception will be allowed.
3. Screws: Hardened steel, captive, and self-locking.
4. Current Bar: Copper or treated brass.
5. Insulation: Thermoplastic rated for minus 67 to plus 230 degrees F.
6. Mounting: DIN-rail, removable without displacing adjacent blocks.

7. End Stops: One at each end of rail, minimum.
 8. Spares:
 - a. Wire all spare or unused panel-mounted elements to their panels' terminal blocks.
 - b. Install spare terminals equal in number to a minimum of 20 percent of the terminals used for each type of wiring, that is: DC signal wiring, DC control wiring, and AC power and AC control wiring.
 9. Wire Preparation: Stripping only.
 10. Wire Termination: no more than two (2) wires are allowed per terminal block's terminal.
 11. Jumpers: Allow jumper installation without loss of space on terminal or rail.
 12. Marking System:
 - a. Terminal number shown on both sides of terminal block.
 - b. Allow use of preprinted and field marked tags.
 - c. Terminal strip numbers shown on end stops.
 - d. Mark terminal block and terminal strip numbers as shown.
- B. Terminal Block, Feed-Through:
1. Rated Voltage and Current: 600 VAC, 30A.
 2. Wire Size: 22 through 10 AWG.
 3. Rated Wire Size: 10 AWG.
 4. Color: Gray body.
 5. Spacing: 0.25 inch, maximum.
 6. Manufacturer and Product:
 - a. ABB/Entelec; Type M4/6.

- b. Phoenix Contact; UT-4.
- C. Terminal Block, Ground:
 - 1. Wire Size: 22 through 12 AWG.
 - 2. Rated Wire Size: 12 AWG.
 - 3. Color: Green and yellow body.
 - 4. Spacing: 0.25 inch, maximum.
 - 5. Grounding: Electrically ground terminal blocks to the mounting DIN rail.
 - 6. Manufacturer and Product:
 - a. ABB/Entelec; Type M4/6-P.
 - b. Phoenix Contact; UT-4 PE.
- D. Terminal Block, Blade Disconnect Switch:
 - 1. Use: Provide one for each discrete input and output field interface wire.
 - 2. Rated Voltage and Current: 300 VAC, 20 A.
 - 3. Wire Size: 22 through 12 AWG.
 - 4. Rated Wire Size: 12 AWG.
 - 5. Color: Gray body, orange switch.
 - 6. Spacing: 0.25 inch, maximum.
 - 7. Manufacturer and Product:
 - a. ABB/Entelec; Type M4/6-SNB.
 - b. Phoenix Contact; UT-4 MT.
- E. Terminal Block, Fused, 24 VDC:
 - 1. Rated Voltage: 600 VDC.
 - 2. Rated Current: 6.3 A,.
 - 3. Wire Size: 22 through 12 AWG.

4. Rated Wire Size: 12 AWG.
 5. Color: Gray Body.
 6. Fuse: 5 by 20 GMA fuses.
 7. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 8. Indication: LED diode 24 VDC.
 9. Leakage Current: 5.2 mA, maximum.
 10. Spacing: 0.32 inch, maximum
 11. Manufacturer and Product:
 - a. ABB/Entelec; Type M4/6-SFD.
 - b. Phoenix Contact; UT-4-HESI GY.
- F. Terminal Block, Fused, 120 VAC:
1. Rated Voltage: 600 VAC.
 2. Rated Current: 6.3 A.
 3. Wire Size: 22 through 12 AWG.
 4. Rated Wire Size: 12 AWG.
 5. Color: Gray body.
 6. Fuse: 5 by 20 GMA fuses.
 7. Fuse Marking: Fuse amperage rating shown on top of terminal block.
 8. Indication: Neon lamp 110 VAC.
 9. Leakage current: 1.8 mA, maximum.
 10. Spacing: 0.32 inch, maximum
 11. Manufacturer and Product:
 - a. ABB/Entelec; Type M4/6-SFL.
 - b. Phoenix Contact; UT-4-HESI GY

- G. Grounding: Internal copper grounding bus for ground connections on panels, consoles, racks, and cabinets.

2.06 RELAYS:

A. General:

1. Mounting: Plug-in type socket.
2. Enclosure: Provide dust cover.
3. Terminals: Blade.
4. Socket Type: Screw terminal interface with wiring.
5. Socket Mounting: Rail.
6. Furnish hold down clips.
7. Provide relay type with quantity of contacts as required by Contract Drawings.

B. Control circuit Switching Relay, Non-latching:

1. Type: Compact general purpose plug-in.
2. Contact Arrangement: minimum 2 Form-C contacts.
3. Contact Rating: 10A at 28 VDC or 240 VAC.
4. Contact Material: Silver cadmium oxide alloy.
5. Coil Voltage: As noted or shown.
6. Coil Power: 1.8 watts (DC), 2.7VA (AC).
7. Expected Mechanical Life: 10,000,000 operations.
8. Expected Electrical Life at Rated Load: 100,000 operations.
9. Indication Type: Neon or LED indicator lamp.
10. Push-to-test button.
11. Manufacturer and Product:
 - a. Allen Bradley; Bulletin 700-HK or 700-HC

b. Square D; Harmony RXM Series

C. Control Circuit Switching Relay, Latching:

1. Type: Dual coil mechanical latching relay.
2. Contact Arrangement: minimum 2 Form-C contacts.
3. Contact Rating: 10A at 28 VDC or 120 VAC.
4. Contact Material: Silver cadmium oxide alloy.
5. Coil Voltage: As noted or shown.
6. Coil Power: 2.7 watts (DC), 5.3VA (AC).
7. Expected Mechanical Life: 500,000 operations.
8. Expected Electrical Life at Rated Load: 50,000 operations.
9. Manufacturer and Product:
 - a. Allen Bradley; Bulletin 700-HK or 700-HB.
 - b. Square D; 8501 Type R.

D. Control Circuit Switching Relay, Time Delay:

1. Type: Adjustable time delay relay.
2. Contact Arrangement: minimum 2 Form-C contacts.
3. Contact Rating: 10A at 240 VAC.
4. Contact Material: Silver cadmium oxide alloy.
5. Coil Voltage: As specified or shown.
6. Operating Temperature: Minus 10 to 55 degrees C.
7. Repeatability: Plus or minus 2 percent.
8. Delay Time Range: Select range such that time delay setpoint fall between 20 to 80 percent or range.
9. Time Delay Setpoint: As specified or shown.

10. Mode of Operation: As specified or shown.
11. Adjustment Type: Integral potentiometer with knob external to dust cover.
12. Manufacturer and Projects:
 - a. Allen Bradley; Bulletin 700-HT Series
 - b. Square D; 9050 JCK Plug-in Timers

E. Alternating Relay

1. Type: SPDT Alternating Relay
2. Contact Rating: 10A at 30 VDC or 240 VAC.
3. Coil Voltage: As noted or shown.
4. Operating Temperature: -20°F to 155°F.
5. Expected Mechanical Life: 10,000,000 operations.
6. Expected Electrical Life at Rated Load: 100,000 operations.
7. Indication Type: Two LED indicator lamps.
8. Options: Selector switch to lockout load.
9. Manufacturer and Product:
 - a. Eaton; Series D85.
 - b. Allen Bradley; 700-HTA

2.07 FRONT-OF-PANEL DEVICES

A. Indication Lights:

1. Watertight, heavy duty, corrosion-resistant industrial type.
2. LED, full voltage.
3. Lens Color: As specified herein, unless otherwise shown on Contract Drawings.
4. Size: 30.5 mm.
5. Legend Plate: Standard size white background with black 1/8" size text.

6. Rating: NEMA 250, Type 4X
 7. Construction: Plastic, with finger-safe guards on terminals.
 8. Push-to-Test Circuitry: For each push-to-test indication light, provide a fused push-to-test circuit.
 9. Die cast aluminum bushings and mounting rings with 316 stainless steel operating shafts and O-ring seal.
 10. Flanged sealing wells.
 11. Manufacturers and Products:
 - a. Square D; Type SK.
 - b. Allen-Bradley; Type 800H.
- B. Pushbutton, Momentary:
1. Watertight, heavy duty, corrosion-resistant industrial type.
 2. Bootless flush head design.
 3. Size: 30.5 mm.
 4. Legend Plate: Standard size white with black 1/8" size text.
 5. Rating: NEMA 250, Type 7.
 6. Construction: Plastic, with finger-safe guards on terminals.
 7. Operator Type: Bootless flush head.
 8. Color Cap: Black, unless noted otherwise on Contract Drawings.
 9. Contact Blocks: Quantity as required by Contract Drawings.
 10. Die cast aluminum bushings and mounting rings with 316 stainless steel operating shafts and O-ring seal.
 11. Flanged sealing wells.
 12. Manufacturers and Products:
 - a. Square D; Type SK.

b. Allen-Bradley; Type 800H.

C. Pushbutton, Maintained (Mushroom Type):

1. For all emergency stop pushbuttons, unless otherwise noted on the Contract Drawings.
2. Watertight, heavy duty, corrosion-resistant industrial type.
3. Legend Plate: Standard size white with black 1/8" size text.
4. Size: 30.5 mm.
5. Release Type: Push-pull.
6. Push-Pull Type, Mushroom head.
7. Color: Red
8. Legend Plate: Standard size white with black 1/8" size text.
9. Rating: NEMA 250, Type 7.
10. Construction: Plastic, with finger-safe guards on terminals.
11. Contact Blocks: Quantity as required by Contract Drawings.
12. Die cast aluminum bushings and mounting rings with 316 stainless steel operating shafts and O-ring seal.
13. Flanged sealing wells.
14. Manufacturers and Products:
 - a. Square D; Type SK.
 - b. Allen-Bradley; Type 800H.

D. Selector Switch

1. Watertight, heavy duty, corrosion-resistant industrial type.
2. Single-hole mounting, accommodating panel thicknesses from 1/16th to 1/4 inch.
3. Size: 30.5 mm.

4. Legend Plate: Standard size white with black 1/8" size text.
5. Rating: NEMA 250, Type 7
6. Construction: Plastic, with finger-safe guards on terminals.
7. Knob Color: Black.
8. Knob Insert Color: White.
9. Contact Blocks: Quantity as required by Contract Drawings.
10. Die cast aluminum bushings and mounting rings with 316 stainless steel operating shafts and O-ring seal.
11. Flanged sealing wells.
12. Manufacturer and Products:
 - a. Square D; Class 9001, Type SK.
 - b. Allen-Bradley; Type 800H.

2.08 ELECTRICAL SURGE AND TRANSIENT PROTECTION

- A. General: Equip control panels with surge-arresting devices to protect equipment from damage due to electrical transients induced in interconnecting lines from lightning discharges and nearby electrical devices.
- B. Suppressor Locations:
 1. At point of connection between each equipment item, including AC powered transmitters and their power supply conductors (direct wired equipment).
 2. Upstream of 120V power feeding PLCs or other critical control system hardware.
 3. On analog pairs at each end when the pair travels outside of building.
 4. On ethernet cables, at each end where the cable travels outside of building.
 5. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to design of equipment.
- C. 120VAC Power Feeding Control Equipment:

-
1. Surge Rating: Up to 12 kA per phase, minimum.
 2. Integral electrical noise pollution reduction.
 3. Thermal and short circuit protection.
 4. "Power Protected" LED status indication.
 5. Mounting Style: DIN-rail
 6. Warranty: 10 years
 7. UL1449, 5th edition compliant
 8. Manufacturers:
 - a. Eaton, Crouse Hinds MTL MA15 Series
 - b. Approved Equal
- D. 24VDC Analog Signal Cable Suppressor Assemblies:
1. Protects 4-20 mA analog signals from being damaged by overvoltage and passes excess voltages during surges to ground.
 2. Mounting Style: DIN-rail, compact design.
 3. Flame retardant.
 4. Nominal Discharge Current (line-line): 5 kA minimum.
 5. Nominal Discharge Current (line-earth): 5 kA minimum.
 6. Response Time: Less than 1 nanosecond.
 7. Manufacturers and Products:
 - a. Phoenix Contact, TTC-6 Series
 - b. Bourns, 1800 Series
 - c. Approved Equal
- E. Ethernet Data Communications Cable Suppressor Assemblies:
1. Zinc die-cast housing.

2. Surge protection suitable for CAT6 cabling.
 3. Rated for Gigabit Ethernet (Up to 10 Gbps).
 4. RJ45 attachment plug with separate grounding cable and ground connection snap-on foot.
 5. DIN-rail mounted.
 6. Manufacturers and Products:
 - a. Eaton, Bussmann Series
 - b. Phoenix Contact
 - c. Approved Equal
- F. Grounding: Coordinate surge suppressor grounding in field panels and field instrumentation as specified in Division 16, and suppressor manufacturer's requirements. Furnish control panels with an integral copper grounding bus for connection of suppressors and other required instrumentations.
- 2.09 IDENTIFICATION
- A. Panel nameplates and front of panel devices shall be provided with labels that correspond with the labels shown on panel elevations on the Contract Drawings.
 - B. Enclosure Nameplates: Provide white laminated nameplate with beveled edges and 1/2-inch black letters.
 - C. Panel Mounted Devices Nameplates: Provide laminated, beveled edge, plastic white nameplates with 1/4-inch black letters for each front panel mounted device.
 - D. On NEMA 1, 2, 5, 12, and 12K equipment, secure plastic laminate and nameplate to equipment front using stainless steel screws in addition to adhesive mounting.
 - E. On NEMA 3, 3R, 3S, 4, 4X, 6, 6P, 11, 13, 7, 8, 9, and 10 equipment, use industrial grade double face adhesive tape or glue to permanently bond the nameplate to the mounting surface. Surface shall be cleaned free of dirt, oil or other contaminants prior to adhering the nameplate.
 - F. Tag all interior instruments including door-mounted devices and other components with engraved, white laminated plastic nameplates with 1/8-inch minimum black letters. Legends shall be consistent with component designations on as-built wiring and layout drawings. Nameplates shall be attached with permanent adhesive to the panel near the

device.

- G. Where indicated on Contract Drawings, nametags shall bear entire ISA tag number.
- H. Field Mounted Nametags: Engraved Type 316 stainless steel, 22 gauge minimum thickness, attached with stainless steel.
- I. Attach front panel nameplates with both a permanent adhesive and stainless steel machine screws into tapped holes. Attach interior nameplates with a permanent adhesive only.
- J. Number and label each wire within the control panel at both ends. Each wire shall have its own individual, unique number. Numbers must directly correspond to the as-built submitted wiring diagrams. All labels shall be machine printed on heat shrink wire and cable labels.
 - 1. If incorrect label occurs, the incorrect label shall be removed before the correct label is applied. No exceptions will be allowed.
 - 2. If an existing label requires a new label, the existing label shall be removed before the new label is applied. No exception will be allowed.
- K. For control panels that contain multiple sources of 120VAC power, provide a laminated orange nameplate with beveled edges and 1/4-inch lettering, engraved with the following: "WARNING: CONTAINS MULTIPLE SOURCES OF POWER."
- L. Standard Light Colors and Inscriptions: Unless otherwise specified in individual equipment specifications, use the following color code and inscriptions:

Tag	Inscription(s)	Color
ON	ON	Green
OFF	OFF	Red
OPEN	OPEN	Green
CLOSED	CLOSED	Red
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	Yellow
REMOTE	REMOTE	White
RUNNING	RUNNING	Green

- M. Standard Pushbutton and Selector Switch Colors and Inscriptions: Unless otherwise specified in individual equipment specifications or shown on the Contract Drawings, use the following:

Tag Function	Inscription(s)	Color
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

2.10 ANALOG SIGNAL ISOLATORS

- A. Provide signal isolators for 4-20 mA loops to prevent ground loop or circuit load problems.
- B. DIN rail mount.
- C. 12 to 36VDC loop-powered.
- D. Accuracy: $\pm 0.10\%$ of output span
- E. Ambient temperature range: -25 to 70 degrees C.
- F. Field adjustable zero and span
- G. Where circuit loading exceeds the maximum allowable resistance for the circuit, provide 4-wire type isolators with 120 VAC input.
- H. Manufacturer and model: Acromag 600T Series or approved equal or as required for circuit loading.

2.11 PANEL MOUNTED ALARM HORN

- A. Must be NEMA 4X rated.
- B. Must be corrosion resistant.
- C. Must have the following certifications: UL Listed and FM approved.
- D. Sound Level: 101 dBA
- E. Must be mountable on panel
- F. Performance Requirements:
 - 1. Must operate on 24VDC +/-10%
 - 2. Must operate at a minimum of 101dB or more at 10 feet
- G. Manufacturers:
 - 1. Edwards Signaling 877-G1
 - 2. Allen Bradley
 - 3. Approved Equal

2.12 PANEL MOUNTED STROBE LIGHT

- A. Lamp Color: Blue or as indicated on Contract Drawings.
- B. Must be NEMA 4X rated.
- C. Must be corrosion resistant.
- D. Must have polycarbonate lens for shatter resistance.
- E. Must be mountable on panel.
- F. Performance Requirements:
 - 1. Must operate on 24V DC
 - 2. Must operate on 0.35A or less
 - 3. Must operate from -30°F to 140°F
 - 4. Must have 175,00 peak candlepower or higher

G. Manufacturers

1. Edwards Signalinga 125 Class Strobe 125STR Series
2. Approved Equal

2.13 UNINTERRUPTIBLE POWER SUPPLY SYSTEM (TOWER):

- A. Provide Online, Double Conversion UPS with static transfer switch and a separate make before break maintenance bypass switch.
- B. The Contractor shall size the UPS such that the operating load is not more than 70% of the full load and the UPS shall provide power to all connected equipment for a minimum of 20 minutes. Submit load calculations with control panel submittal.
- C. Provide UPS relay interface with dry contacts for the monitoring points indicated on the Contract Drawings.
- D. Perform a full load test and include the test results with each unit.
- E. Manufacturers and Products:
 1. American Power Conversion; Model Smart-UPS series.
 2. Best Power; Model Fortress series.
 3. Or approved equal.

2.14 PANEL MOUNT INDUSTRIAL TOUCH SCREEN COMPUTER

A. General

1. Provide panel mounted industrial touch screen computers for all remote facilities as indicated on the contract drawings.
2. Features:
 - a. Panel PC Dimensions: As indicated on the contract drawings.
 - b. Type: LED backlit TFT LCD, Touchscreen
 - c. Resolution: Minimum 1920 x 1080
 - d. Processor: Intel Core i5, minimum
 - e. Graphics: Intel HD Graphics

- f. Operating System: Windows 10 IoT Enterprise (64-bit)
 - g. RAM: 8GB
 - h. Storage: 128GB, SATA with external expansion, No RAID required
- 3. Communication Interface:
 - a. Minimum (2) USB
 - b. Minimum (2) Ethernet, RJ45
- 4. Power Supply:
 - a. Nominal supply voltage of 24VDC
- 5. Operating Temperature: Minimum 0°C to 50°C
- 6. Protection Rating: IP66 (front)
- 7. Manufacturer:
 - a. Phoenix Contact, Panel PC
 - b. Rockwell Automation, VersaView
 - c. Schneider Electric, Harmony Series
 - d. Or Approved Equal

2.15 UNINTERRUPTIBLE POWER SUPPLY SYSTEM (DIN RAIL MOUNT)

A. General

- 1. Compact, DIN rail mountable UPS, which provides conditioned AC power to sensitive electronic equipment in an industrial environment. Power supply must provide power to connected equipment with stepped approximation to sinewave input during power outage to simulate the power generated by the utility.

B. Performance

- 1. Capacity: 850VA
- 2. Input Voltage: 120 VAC

3. Back-Up Time: Minimum 2 minutes at full load, 10 minutes at half load.
4. Operating Temperature: 0 to 50 degrees Celsius
5. Audible Noise: Less than 40dBA (beyond 1 meter from surface)
6. Surge Protection: Meet IEEE C62.41, Category A

C. Features

1. Power on/off/test button
2. Battery warning / overload indication LED
3. On battery indication LED
4. AC input normal indication LED
5. Integral input circuit breaker protection from AC overload and short circuit. UPS shut down with auto recovery.
6. Sealed, non-spillable, maintenance-free lead acid battery
7. DIN-rail mounted

D. Accessories:

1. Dry Contact relay output card. Provide inputs to PLC for UPS monitoring as shown on the contract drawings.
2. Perform a full load test and include the test results with each unit.
3. Warranty: 2 years

E. Manufacturers and Products:

1. Sola HD SDU 850 Series.
2. Or approved equal.

2.16 DIGITAL PANEL METERS

A. General:

1. Provide 4-20 mA, loop-powered digital LCD analog panel meters where shown on the contract drawings.

2. Meter shall be programmable via free, PC-based USB programming software or via front of the meter panel
3. Enclosure shall be NEMA 4X, high impact plastic with Lexan polycarbonate film over entire faceplate and silicone rubber user interface buttons.
4. Programmable password, capable of restricting modifications to meter configuration.
5. Non-volatile memory, minimum of ten 10 years back up upon power loss.
6. 3-year warranty on all parts and labor.

B. Electrical:

1. Input: 4-20 mA, 24 VDC
2. Accuracy: Plus/minus 0.02% of span
3. Voltage drop, 1.5 V max
4. Integral overcurrent protection up to 1 A maximum
5. Low flow cutoff: 0.0 to 999,999
6. Noise filtering and integral dampening compensation.

C. Display:

1. Dual-line LCD with backlight, backlight powered by 4-20 mA loop.
2. Display units and process value on screen.

D. Manufacturers:

1. Precision digital, Model PD6600
2. Red Lion
3. Approved equal

2.17 24VDC POWER SUPPLY:

- A. Function: Provide redundant 24 VDC power supplies as indicated on the Contract Drawings.

1. Features:
 - a. Nominal Input Voltage: 100-240 VAC.
 - b. Nominal Output Voltage: 24 VDC +/- 1%
 - c. Output Current: 10 A (up to 60 Deg C).
 - d. DIN-rail mounted.
 2. Manufacturer and Product:
 - a. Phoenix Contact, Model, QUINT
 - b. Or approved equal.
- B. Power supplies shall be tied in redundant pairs with manufacturer's smart redundancy module where shown on the Contract Drawings. Redundancy modules shall be provided with Auto Current Balancing and Power Boost Technologies.
1. Redundancy module shall be manufactured by:
 - a. Phoenix Contact – Quint Diode
 - b. Or approved equal

2.18 ELAPSED TIME METER

- A. Device shall have the following features:
1. Figures: 6-digits, 0.125"; hours – white on black, tenths – red on white
 2. Voltage: 90-240 VAC
 3. NEMA 4X, 12 enclosure rating with gasket
- B. Device must be Redington Counter Model 722-0001 with gasket kit and hardware.

2.19 SIMPLEX RECEPTACLE

- A. Provide a minimum of one 120 V GFCI simplex receptacle for each enclosure.
- B. Manufacturers: Allen Bradley; 1492-REC15G or approved equal.

2.20 JUNCTION BOXES

- A. Provide and install junction boxes in accordance with the manufacturer's recommendations for each component part and as required by all specifications and Contract Drawings.
- B. Terminals and cable tray that host Analog and Discrete signal conductors must be separated.
- C. Size junction boxes as shown below:

Total Number of Terminations (Combined)	Minimum Panel Size
1-48	16"H x 20"W x 6"D
1-96	20"H x 24"W x 6"D
97-192	30"H x 24"W x 6"D
193-312	42"H x 24"W x 8"D

PART 3 EXECUTION

3.01 ELECTRICAL POWER AND SIGNAL WIRING

- A. Restrain control and signal wiring in control panels by plastic ties or ducts. Secure hinge wiring at each end so bending or twisting will occur around the longitudinal axis of wire. Protect bend area with a sleeve.
- B. Arrange wiring neatly, cut to proper length, and remove surplus wire. Install abrasion protection for wire bundles passing through holes or across edges of sheet metal.
- C. Use manufacturer's recommended tool with sized anvil for crimp terminations. No more than one wire may be terminated in a single crimp lug. No more than two lugs may be installed on a single screw terminal.
- D. Do not splice or tap wiring except at device terminals or terminal blocks.

3.02 DISCONNECT

- A. Provide a disconnect for each source of power to the control panel. Disconnect must be

mounted inside the enclosure. Disconnect must be circuit breaker type.

3.03 SPARE PARTS

- A. 1 spare 24 VDC control system power supply.
- B. 5 spare control relays for each type used.
- C. 5 fuses of each type and rating.

3.04 INSTALLATION

- A. Contractor shall assemble the enclosures according to the approved shop drawings in accordance with UL-508 and other specifications herein.
- B. Install devices, equipment and control panels in accordance with the manufacturer's recommendations.

3.05 FIELD QUALITY CONTROL

- A. The completely integrated control system and all field devices or equipment must be tested as a system to verify that all equipment is operating in accordance with "Section 17600: Control Narratives". Provide a test report on which controls have passed and which controls failed.
- B. Perform a test of the UPS, simulating a power outage, demonstrating that the control system components continue to function during this time period.
- C. Adjust and calibrate the analog I/O of the control panel and the field devices or equipment.
- D. Correct deficiencies make necessary adjustments, and retest. Verify that specified requirements are met.
- E. Remove and replace malfunctioning devices and retest.
- F. Engineer shall witness the tests.

END OF SECTION

SECTION 17442

LOW-VOLTAGE CONTROL CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the requirements for control wires, cables, splices, connectors, and terminations rated 600VAC and less.
- B. Related sections include:
 - 1. Division 16 Specifications
 - 2. Division 17 Specifications

1.02 SUBMITTALS

- A. Submittals shall be in accordance with this Section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to the submittal requirements specified in BRWA Master Specifications Section 01 33 00 – Submittal Procedures.
 - 1. Product Data: for each type of product indicated.
 - 2. Qualification Data: for testing agency.
 - 3. Field quality-control test reports.
 - 4. Provide all submittals, shop drawings, technical data, descriptive product literature, job-specific details, instructions, etc. to thoroughly and completely describe and document the construction, quality and suitability of all equipment and accessories proposed under this Section, as well as the installation, operation and maintenance of the equipment
 - 5. Warranty Certificate: Submit manufacturer's sample warranty certificate with product data submittal for Engineer's review. Warranty certificate shall reflect the warranty requirements and duration and as specified herein.

1.03 QUALITY ASSURANCE

- A. Comply with the National Electrical Code (NEC) for installation requirements.

1.04 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- B. Testing: the Contractor shall conduct testing in the presence of the Engineer. Testing, at the Contractor's expense, shall be conducted by a firm or individuals whose qualifications are subject to the approval of the Engineer. The Contractor shall document the testing results and submit to the Engineer for approval.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. AC Circuits:
 - 1. Type (Panel Interior Wiring): 600V, MTW stranded copper.
 - 2. Type (Interior Distribution Wiring): 600V, THWN stranded copper.
 - 3. Type (Exterior Distribution Wiring): 600V, XHHW stranded copper.
- B. Analog Signal Circuits:
 - 1. Type: 300V, Type 2 stranded copper, twisted shielded pairs.
- C. Other DC Circuits:
 - 1. Type (Panel Interior Wiring): 600V, MTW stranded copper.
 - 2. Type (Interior Distribution Wiring): 600V, THWN stranded copper.
 - 3. Type (Exterior Distribution Wiring): 600V, XHHW stranded copper.
- D. Manufacturers
 - 1. Belden Inc.
 - 2. Allied Wires & Cables
 - 3. Southwire Company
 - 4. Approved equal
- E. Wire Identification:

1. Numbered and tagged at each termination.
2. Wire Tags: Machine printed, heat shrink.
3. Manufacturers
 - a. Brady PermaSleeve
 - b. Tyco Electronics
 - c. Approved equal

F. Conductor Sizing and Color

1. All control conductors shall be sized in accordance with UL 508A and NEC requirements.
2. All control wiring shall be as follows:

	Type	Color	Size (Gauge)
1	Line and load circuits (AC or DC power)	Black	#12 AWG
2	Neutral	White	#12 AWG
3	AC Control Circuits	Red	#16 AWG
4	DC Control Circuits (+)	Blue	#16 AWG
5	DC Control Circuits (-)	White with Blue Stripe	#16 AWG
6	Interlock control circuits energized from external power source	Yellow	#16 AWG
7	Grounding Conductors	Green	#12 AWG
8	Analog Signal (Twisted Shielded Pairs)	Black/Red	#18 AWG
<u>Note:</u> The wire gauges listed in this table are the minimum size required. Actual wire sizes may be larger based on full-current load of equipment being supplied power. For single loads, circuit conductors shall be sized for an ampacity not less than 125% of the full-load current. For multiple loads, such as multiple motors or a motor with other loads, power circuit conductors shall be sized for an ampacity not less than 125% of all loads plus 125% of the largest load plus the full-load ampere ratings of all remaining motors and other loads that are simultaneously operable.			

2.02 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity, voltage rating, material, type, and class for application and service indicated.
- B. Manufacturers
 - 1. Burndy
 - 2. Hubbell Power Systems, Inc
 - 3. 3M; Electrical Products Division
 - 4. Approved equal

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUCTORS AND CABLES

- A. Separate 24VDC analog circuits at least 6 inches from any 120VAC power and control wiring.
- B. Network and communication wiring shall be separated from other wiring.
- C. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables, conduits, or raceways.
- F. Where conduits will be entering a control enclosure, a suitable opening shall be cleanly punched in the bottom. Holes drilled, cut with a saw, torch, etc. in the field shall not be acceptable. Conduit entrances shall be towards the back of the enclosure to provide a shelf area on the bottom of the enclosure. Conduit nuts with sealing rubber gaskets shall be used on all conduits entering control boxes and cabinets.
- G. Maintain separation of all analog and discrete signals and power wires using separate conduits and wireways. If separate conduits are not possible, wires shall be separated with vertical barriers to maintain separation.
- H. Clean all panels, boxes and surrounding areas of wire clippings, metal shavings, dirt and other trash. Panels shall be wiped clean and all labels and nameplates installed. Wires shall be bundled and secured in a neat and orderly manner with wire markings clearly visible.

- I. Identify and color-code conductors and cables according to the "Identification for Electrical Systems" Section from Division 16 Specification.
- J. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- K. Install control wiring in raceways/conduits as indicated on the Contract Drawings.
- L. Comply with requirements specified in "Raceways and Boxes for Electrical Systems" Section from Division 16 Specification.

3.02 WIRE AND CABLE MARKERS

- A. Markers shall be machine-printed wire label heat-shrink sleeve type wire markers with black print on white background.
- B. Power branch or feeder circuits shall be as numbered on the drawings.
- C. Control circuits shall match that indicated on schematic and interconnection diagrams on shop drawings.

3.03 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.04 GROUNDING

- A. For control-voltage wiring and cabling, comply with requirements in "Grounding and Bonding for Electrical Systems" Section from Division 16 Specification

3.05 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

END OF SECTION

SECTION 17500

INSTRUMENTATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section includes requirements for field instrumentation to be installed throughout this project as well as control stations and associated controls for installation in control panels, and miscellaneous instruments and controls not specified elsewhere. All equipment and components specified herein must be furnished by the Control Systems Integrator (CSI) unless otherwise specified.

1.02 REFERENCES

- A. Work covered by this Section must comply with all relevant portions of the following regulations and standards:
1. American Petroleum Institute (API)
 2. American Society for Testing and Materials (ASTM)
 3. Instrument Society of America (ISA)
 4. International Standards Organization (ISO)
 5. National Electrical Manufacturers Association (NEMA)
 6. Underwriters Laboratories, Inc. (UL)
 7. National Electric Code (NEC)
 8. Institute of Electrical and Electronic Engineers (IEEE)

1.03 SUBMITTALS

- A. Submittals shall be in accordance with this section and the BRWA Master Specifications. In case of conflict, the more stringent requirement shall apply.
- B. Include the following information in the submittal for each instrument specified in the section.
1. Tag number and description.
 2. Manufacturers wiring and electrical connection diagrams.

3. 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 format similar to those shown.
 4. Mounting details, including all dimensions, installation methods, elevations and sections.
 5. Range, size, weight, outline and dimension drawings, materials of construction, enclosure classification.
 6. Description of any integral instrument controls.
 7. Methods and materials required for installation. Include power and signal connection details with complete wiring diagrams.
 8. List of recommended spare parts.
 9. List of optional accessories.
- C. Include the following information in the final operations and maintenance manuals for each instrument specified in the section.
1. Operation and maintenance manuals for each instrument.
 2. Specific arrangement and dimension drawings for the installation of each instrument. Include locations of each instrument or device.
 3. Installation certifications.
 4. Manufacturer's calibration certification for each instrument.
 5. Calibration/Data sheets.
 6. Tag data to be included on instrument tag.
- D. Provide the original copy of the Manufacturers Calibration Certificate for each instrument to the Owner. Color copies shall be provided in O&M manuals.
- E. Exceptions to the specifications or drawings shall be clearly defined by the supplier. Failure to clearly indicate exceptions shall be basis for rejection of the submittal.
- F. Submittals shall be reviewed with respect to their conformance with the Contract Documents. Unless provided for reference or clarification of unspecified items, submittals which do not address specific Specification items will not be acceptable. Address items in each Specification or note specifically which items are omitted.

1.04 SYSTEM DESCRIPTION

- A. All instrumentation supplied must be of the most current and proven design. Specifications and drawings call attention to certain features but do not intend to cover all details entering into the design of the instrumentation equipment.
- B. All necessary fuses and cables required for instrumentation equipment must be provided with the equipment.
- C. Provide instruments that operate on 24 VDC power, except where specifically noted. Provide instruments which return automatically to accurate measurement upon restoration of power after a power failure.
- D. Provide and install transmitter power supplies in local panels or enclosures as required.
- E. Provide two wire instrument transmitters which produce isolated 4-20 mA 24VDC analog signals. Follow ISA-S50.1-1982. All analog transmitter and controller outputs must be capable of driving into at least 800 Ohms unless otherwise specified.
- F. Provide alarm and status points with isolated contacts. Contacts shall be closed when the normal, non-alarm condition to be sensed is true, unless shown otherwise on the Contract Drawings.
- G. Provide instruments that are constructed so that they are impervious to damage by dust, moisture, fungus and airborne contaminants.
- H. Provide instruments complete with mounting hardware, floor stands, wall brackets, or instrument racks.
- I. Mount all instruments with stainless steel hardware only, unless specifically indicated on the Contract Drawings or elsewhere herein.
- J. Local indicators must provide direct readings utilizing the same range, scale and units as that reported via the control system. Instruments selected must have ranges and indications appropriate to the process.
- K. Instruments and equipment installed in Class I, Division I or Class I, Division II hazardous areas shall meet at least one of the following requirements, in addition to requirements in accordance with the NEC:
 - 1. Where intrinsically safe wiring practices are not used, the instrument or device must be enclosed in an explosion-proof, NEMA 7 rated enclosure.
 - 2. Where intrinsically safe wiring practices are used to satisfy hazardous area requirements, the instrument shall be rated for intrinsically safe wiring and the Contractor shall be responsible for providing suitable intrinsically safe barriers or

relays in the enclosure from where the instruments power is sourced.

1.05 QUALITY ASSURANCE

- A. Provide only new, standard, first-grade materials throughout, conforming to standards established by Underwriters Laboratories (UL), Inc. and National Electrical Manufacturers Association (NEMA) and so marked or labeled.
- B. All instruments supplied shall be UL listed.
- C. Provide material and equipment in accordance with applicable codes and standards, except as modified by the Specifications.
- D. Use a single source manufacturer for each instrument type. Use the same manufacturer for different instrument types whenever possible.
- E. Coordinate instrumentation to assure proper interface and system integration. Provide signal equipment, to include, but not to be limited to, transducers, signal converters and power supplies. Coordinate with various subcontractors, equipment suppliers, and manufacturers.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Have each manufacturer or supplier package instrumentation to protect against shipping damage, dust, moisture, and atmospheric contaminants. Include a shipping label which contains the following information:
 - 1. Tag number and description.
 - 2. Instructions for unloading, transporting, storing, and handling at the site.
- B. Receive instrumentation at the site. Inspect instrumentation for damage in shipment. Return all damaged instrumentation to the manufacturer for replacement at no cost to the Owner.
- C. Do not store instrumentation out-of-doors. Provide dry, permanent storage facilities and pay storage cost.

PART 2 PRODUCTS

2.01 PRESSURE INSTRUMENTATION

- A. Pressure Indicating Transmitter
 - 1. General
 - a. Function: Measures pressure of liquids. Liquid enters the device and

presses on the sensing diaphragm, causing a change in resistance that directly correlates to a 4-20mA signal.

- b. Type: Electronic variable capacitance or silicon strain gauge.
- c. Service: Rated for location and application as shown on the Contract Drawings.

2. Performance

- a. Pressure Range: Operating pressure range as shown on Contract Drawings must be as close to 80% of transmitter's full-scale range as possible, but shall not exceed the upper range limit (URL).
- b. Accuracy: +/- 0.05% of adjusted span or better.
- c. Ambient Operating Temperature: -40°F to 175°F, with integral thermometer.
- d. Process Operating Temperature: -40°F to 250°F
- e. Humidity: 0 to 100 percent relative humidity
- f. Update Speed: 0.25 seconds or faster
- g. Display: LCD with 4 Digits or greater. Display to be configurable to either percent or engineering units.
- h. Loop resistance: 250 Ω or less
- i. IEC 61508 Certified

3. Features

- a. Gauge pressure type, as shown on Contract Drawings.
- b. Adjustable damping.
- c. Integrated pressure diaphragm.

4. Construction

- a. Transmitter Housing: Powder coated aluminum, NEMA 4X rated
- b. Wetted Metallic Parts: Type 316 stainless steel
 - i. Includes drain/vent valves, process flanges and adapters, and

process isolating diaphragm.

- c. Wetted O-Rings: Glass filled TFE, graphite filled PTFE, or Viton
- d. Bolts and Nuts (if required): Type 316 stainless steel
- e. Fill Fluid: Silicone
- f. Arrangement: Inline or coplanar type, bottom entry only.

5. Installation and Accessories

- a. Process Line Size: As shown on Contract Drawings.
- b. Electrical Connections: 1/2" FNTF, unless otherwise shown on the Contract Drawings.
- c. Gauge Pressure Units: Provide manufacturers 2-valve in-line style block and bleed manifold.
- d. All diaphragm seals shall be industrial rated for the application location shown on the Contract Drawings.
- e. Mounting Bracket: Stainless steel, suitable for mounting to panel or 2-inch pipe. Coordinate with Contract Drawings.

6. Electrical

- a. Power Supply: 24VDC, 2 wire loop-powered
- b. Signal Interface: 4-20mA 24VDC analog signal, linearly proportional to pressure range.

7. Calibration and Warranty

- a. Calibration: Factory calibration with NIST traceable certification.
- b. Warranty: 5 years from date of shipment to site.

8. Manufacturers and Products

- a. Gauge Pressure:
 - i. Rosemount, 3051T Series
 - ii. Endress & Hauser, Cerabar PMP71B Series

iii. Approved Equal

B. Pressure Gauge

1. General

- a. Function: Local pressure indication.
- b. Type: Bourdon tube.
- c. Service: Rated for location and application as shown on the Contract Drawings.

2. Performance

- a. Scale Range: As shown on the Contract Drawings.
- b. Accuracy: +/- 0.50% of span.

3. Features

- a. Dial: 4-1/2-inch diameter.
- b. Pointer: Adjustable by removing ring and window.
- c. Pointer Vibration Reduction: Glycerin liquid filled gauge front.
- d. Case Type: Solid front with pressure relief, blow-out back.
- e. Threaded reinforced polypropylene front ring.

4. Construction

- a. Window: Shatter proof acrylic.
- b. Pointer: Aluminum.
- c. Case Material: Black thermoplastic.
- d. Materials of Wetted Parts (including element, socket/process connection, and throttling device (if required)): Stainless steel.

5. Installation and Accessories

- a. Mounting: Lower stem.
- b. Size: 1/2-inch MNPT, unless otherwise shown on the Contract Drawings.

- c. Throttling Device
 - i. Provide where gauge is subject to rapid pressure fluctuations or vibrations or where shown on Contract Drawings.
 - ii. Type: Suitable for the intended service.
 - iii. Install in gauge socket bore.
- 6. Warranty
 - a. 10 years from date of shipment.
- 7. Spare Parts
 - a. Provide 1 spare gauge of each range provided.
- 8. Manufacturers and Products
 - a. Ashcroft, Duragauge 1279 Series
 - b. Wika.
 - c. Approved Equal

2.02 FLOW INSTRUMENTATION

A. Tank Overflow Sensor

- 1. General
 - a. Function: Sensor installed in water storage tank overflow piping to provide indication of tank overflow / emergency high level.
 - b. Type: Capacitive switch.
 - c. Service: Rated for location and application as shown on the Contract Drawings.
- 2. Performance
 - a. Sensing Range: 15 mm +/- 10%
 - b. Hysteresis: No more than 15% of sensing range.
 - c. Switch Point Drift: No more than 15% of sensing range.

- d. Ambient Temperature Rating: -13°F to 158°F
 - e. Contact Arrangement: NC or NO, as shown on Contract Drawings.
- 3. Construction
 - a. Housing: 30mm size; PBT, IP65 rated
 - b. Electrical Signal Cable: PVC coated, integral to sensor with flying lead wires for interface, length to-suit installation detail requirements as shown on Contract Drawings.
- 4. Features
 - a. Built-in RF immunity
 - b. Power-on status indication via LED
- 5. Installation
 - a. Electrical Connections: via flying lead wires from integral cable, unless otherwise shown on Contract Drawings.
 - b. Refer to Contract Drawings for installation detail requirements.
- 6. Electrical
 - a. Power Supply: 24VDC, 2-wire device.
 - b. Signal Interface: 2-wire 24 VDC discrete output, via same 2 wires as power supply.
 - c. Contact Arrangement: NC or NO, quantities and type as required by the Contract Drawings.
 - d. Max Voltage Drop Switching Output: 8 VDC
 - e. Current Rating of Switching Output: 200 mADC
- 7. Calibration and Warranty
 - a. Warranty: 2 years from date of accepted installation on Site.
- 8. Spare Parts
 - a. Provide (1) spare switch of each type and range provided.

9. Manufacturers and Products

- a. IFM, Efector KI series
- b. Approved Equal

2.03 LEVEL INSTRUMENTATION

A. Level Switch (Float Switch)

1. General

- a. Function: Switch that mechanically actuates upon rising or falling liquid level to indicate a flood condition or that a setpoint level has been reached.
- b. Type: Float with electromechanical or snap-action switch, point level.
- c. Service: Rated for location and application as shown on the Contract Drawings.

2. Performance

- a. Operating Temperature: 32 to 170°F
- b. Mercury-free
- c. Watertight
- d. Shock-proof
- e. Impact resistant

3. Construction

- a. Housing: Polypropylene
- b. Connecting Cable: #18AWG, 3 wire stranded copper SJOW flexible cable, provide suitable length for installation as shown on the Contract Drawings.

4. Installation and Accessories

- a. Electrical Connections: 1/2" FNTF, unless otherwise shown on Contract Drawings.
- b. Refer to Contract Drawings for additional installation requirements.

- c. Cables must be provided in sufficient length to mount the float switches in the locations shown on the Contract Drawings plus an additional 10 feet (minimum) of cable. Cables must be provided in continuous length between the floats and the associated junction box or control panel.
- 5. Electrical
 - a. Power Supply: 120VAC, 2-wire device.
 - b. Signal Interface: 120VAC / 24VDC, 10A rated form C dry contacts; 1 N.C. and 1 N.O.
 - c. Contact Arrangement: NC or NO, quantities and type as required per the Contract Drawings.
- 6. Manufacturers and Products
 - a. Anchor Scientific, Eco-Float Series
 - b. Conery MFG Inc, Mechanical Control Duty Series
 - c. Approved Equal

2.04 MONITORING INSTRUMENTATION

A. Hatch Intrusion Switches

- 1. General
 - a. Function: Opens contacts of switch upon disturbance of magnetic field when a hatch is opened.
 - b. Type: Magnetic, tamper-proof
- 2. Performance
 - a. Minimum Life Cycle: 100,000 cycles
 - b. Must be rated for outdoor use.
- 3. Features
 - a. Resistant to external magnetic tampering.
 - b. Hatch Switches
 - i. 1/2" threaded NPT connection.

4. Construction
 - a. Switch Enclosure: Folded steel
 - b. Hermetically sealed and encapsulated in polyurethane
5. Installation and Accessories
 - a. Surface mounted where indicated on Contract Drawings.
 - b. Required mounting hardware and stainless steel fasteners shall be provided by manufacturer.
 - c. Where installed outdoors, switch shall be provided with suitable interposing relay in the panel supplying voltage to the field.
 - d. Where installed in Classified Areas, switch shall be rated for intrinsically safe wiring and provided with suitable intrinsically safe relays in the panel supplying voltage to the field.
6. Electrical
 - a. Surge Protection: 2400 VDC or greater
 - b. Power Supply: None required, magnetically actuated
 - c. Signal Interface: One (1) N.O. contact minimum
 - i. Contact shall be rated for 24VDC at 0.1A
 - ii. N.O. contact shall close when door/hatch is fully closed, and open when door/hatch is not fully closed.
7. Warranty
 - a. 1 year from date of shipment to site
8. Spare Parts
 - a. Provide one (1) spare switch and set of required hardware for each type (door and/or hatch) provided
9. Manufacturers and Products
 - a. Hatch Switches
 - i. Edwards Signals, GuardSwitch 371 Series

ii. Approved equal

2.05 INSTRUMENT NAMEPLATES

- A. Each instrument must be provided with 316 stainless steel tag attached to the instrument with 16 gauge 316 stainless steel wire or stainless steel screws. Letters must be 3/16 inch high, fully impressed so that all characters are completely formed, crisp and deep. Instrument tag number must be as shown in instrument index for each site. The following information must be included on the tag:
 - 1. Tag number and description.
 - 2. Manufacturer.
 - 3. Model and serial number.
- B. An instrument nameplate schedule must be submitted to the Engineer for approval prior to performing any engraving.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install all controls and instrumentation in accordance with the manufacturer's recommendations and as shown on the Contract Drawings and as specified herein.
- B. The CSI shall be responsible for installation and programming to interface existing Control System with installed Control Panels and equipment.
- C. The CSI shall coordinate system interface programming and installation schedule with the Owner and the Engineer.
- D. The CSI shall be responsible to coordinate integration and connection requirements to all instrumentation and control components that interface with the Control Panels provided. This includes connected equipment not specifically provided by the CSI. Drawings must show detailed termination points for all devices.

3.02 FIELD QUALITY CONTROL

- A. The completely integrated control system, with the Control Panel and all field devices or equipment must be tested as a system to verify that all equipment is operating in accordance with the Sequence of Operations. Provide a test report on which controls have passed and which controls have failed.
- B. All instruments installed must be field calibrated and tested after installation. Field calibration and calibration certificates must be performed as defined in section "17166

Site Acceptance Testing”.

3.03 INSTRUMENT TAGS

- A. Instrumentation tags shall be 1-1/2” diameter, 3/8” thick solid brass stamped with the instrument tag number.
- B. Instrument tags shall be secured to the instrument with ty-raps.

END OF SECTION

SECTION 17600

CONTROL NARRATIVES

PART 1 GENERAL

1.01 SUMMARY

- A. Control of the facility's different process areas will be accomplished through a combination of hardwired relay interlocks and programmable logic controllers. Hardwired interlocks will be located local to the process devices and panels as indicated on Contract Drawings. This specification section provides the general programming requirements to complete the operational functions for the PLC control logic and graphical user interface.
- B. The Input/Output Points List for all required I/O Points are included in this section.

1.02 SYSTEM DESCRIPTION

- A. The system components shall consist of:
 - 1. Onsite (at facility): PLCs, OITs, field I/O devices, various control panels local to process equipment.
 - 2. Offsite: SCADA at a remote water distribution center.
 - 3. Onsite and offsite shall exchange data through communication.
- B. Component Functions
 - 1. PLC Panels
 - a. Interface with field I/O devices and various control panels local to process equipment for monitoring and control of system processes via digital signals, analog signals, and communication as shown on Contract Drawings.
 - 2. OIT's
 - a. Local Monitoring and Control
 - i. View of the local process system
 - ii. Control, operate and adjust system settings.
 - 3. SCADA

- a. Communicate with onsite PLC panels to collect various data for monitoring, historically logging and trending of system processes.
- C. All PLC software programming, development and testing shall be performed by the approved Control System Integrator (CSI).

1.03 SUBMITTALS

- A. Provide programming structure outline showing data block assignments, I/O listings and proposed sub-routine arrangements.
- B. Submit color prints of documented PLC program logic and graphical interface screens. Include address and rung descriptions, cross reference listing, tag addresses, navigation points, data entry and display fields, etc.
- C. Provide USB flash drive with soft back-up of all PLC and OIT application programming prior to making any changes and/or additions.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 MODIFICATIONS TO EXISTING PROGRAMMING

- A. The CSI shall be responsible to test existing control logic that is to be modified prior to making any modifications. Testing shall be witnessed by the Owner to verify operation of existing systems prior to making modifications to existing PLC and OIT programs.
- B. Existing operational PLC logic, OIT and SCADA applications shall be backed up and dated prior to making any changes and/or additions to the existing applications.

3.02 TYPICAL CONTROL FUNCTIONS

- A. In addition to the automatic sequencing of process equipment as described in this specification, equipment controlled by a PLC shall be provided with typical control functions as described within.
- B. Control Power:
 - 1. PLC Panels shall be provided with a control power status relay energized directly by the incoming 120 V-AC control power and not by the UPS protected power.
 - a. The N.O. contact from this relay shall provide a discrete input to the PLC. Loss of this input shall cause the PLC to create a "Control Power Failure" alarm.

2. 24 V-DC power supplies shall be monitored as shown on Contract Drawings. Provide PLC alarm if power supply fails.

C. UPS Power Backup Systems:

1. PLC Panels shall be provided with UPS systems with alarm contacts interfaced to discrete input points on the PLC as shown on Contract Drawings.
2. The PLC shall be programmed to provide an alarm in the event of a contact closure.

3.03 PLC GENERAL REQUIREMENTS

- A. Changes to setpoints, alarm values, timer values, control loop tuning parameters, and other numeric values used within PLC programs shall not require modification to any instructions within PLC ladder logic program.
- B. Unless specified otherwise, procedures for control power fail restart for equipment shall be as follows:
1. Equipment shall shut down and return to fail/safe condition on loss of PLC control power.
 2. Upon restoration of power, previously running equipment shall be restarted using same sequence of startup used for automatic control.
 3. Equipment running in PLC-manual control shall not restart following power restoration.
 4. Restart of multiple like equipment shall be sequenced through use of timers to prevent simultaneous restart.
- C. Control equipment from PLC only when PLC control is selected.
- D. Monitor and log data in any control mode.
- E. Provide adjustable digital filtering of analog inputs to eliminate process upsets due to noise. Use minimum time constant required to remove noise.
- F. Provide adjustable timers for alarm display points to prevent nuisance alarm. Timer values shall be 0-30 seconds. Initial setting, unless otherwise specified, shall be 5 seconds.
- G. Data exchange between the facility's PLCs and the remote SCADA shall include the following as minimum:

1. All system status, process status and alarms from the PLCs to the remote SCADA.
2. No control from the remote SCADA to the PLCs.
 - a. Log-in credentials shall be required to acknowledge and reset alarms remotely at the SCADA.

3.04 CIRCULAR STORAGE TANK WITH TANK MIXER CONTROL

A. General Description

1. One (1) Circular Storage Tank will be provided. The tank shall be equipped with:
 - a. Manufacturer-provided: mixer and motor, and local control panel
 - b. Level transmitter (via pressure) for level indicator, control and alarming.

B. Control Narrative

1. [HAND] Control
 - a. HAND control will allow operators to manually start the mixer locally from the control panel.
 - b. With the Hand/Off/Auto (HOA) selector switch in the HAND position, the mixer will start to run.
 - c. HAND mode shall override the automatic control functions.
2. [AUTO] Control
 - a. AUTO control shall be initiated when the local HOA selector switch is in the AUTO position. Automatic control functions will not be available when the HOA selector switch is not in the AUTO position.
 - b. Automatic start and stop of the mixer shall be performed by the PLC.
 - c. The PLC shall automatically start the mixer when the tank's level rises above the mixer-run level setpoint.
 - d. The PLC shall automatically stop the mixer when the tank's level falls below the mixer-stop level setpoint.
 - i. When the tank's level remains below a low level alarm setpoint for a low level alarm delay timer:
 - a) A "low level" alarm shall be annunciated at the PLC OIT.

- b) The low level alarm setpoint shall be below the mixer-to-run level setpoint.

3.05 INPUT/OUTPUT (I/O) LIST

#	I/O Tag Name	I/O Description	I/O Type	Data Field 1 (Digital Logic 1 or Analog Signal Type)	Data Field 2 (Digital Logic 0 or Analog Process Range)	Note
1	JFN-810	PLC Panel - Utility Power On	DI	Power On	Power Off	Alarm if loss of power
2	JFN-811	PLC Panel - UPS on Battery	DI	On Battery	Normal	Alarm if loss of power
3	JFN-812	PLC Panel - UPS Fault	DI	Faulted	Normal	Alarm if faulted
4	JFN-821	PLC Panel - 24VDC Power Supply Fail	DI	Failure	Normal	Alarm if fail
5	ZNO-831	PLC Panel - Panel Intrusion	DI	Intruded	Normal	Alarm if intruded
6	AN-901	Chlorine Concentration Indication	AI	4 to 20mADC	(coordinate with equipment or process requirement)	-
7	FN-902	Future - Circular Tank Flow Indication	AI	4 to 20mADC	Future	-
8	FNH-902	Future - Circular Tank Flow Direction Inlet	DI	Future	Future	-
9	ZNO-902	Future – Altitude Valve Open Indication	DI	Future	Future	-
10	LNH-904	Altitude Valve Vault Flood	DI	Normal	Flooded	Alarm if flooded
11	ZNO-905	Altitude Valve Vault Intrusion	DI	Intruded	Normal	Alarm if intruded
12	ZNO-906	Check Valve Vault Intrusion	DI	Intruded	Normal	Alarm if intruded
13	QNF-911	Cathodic Protection Fault	DI	Faulted	Normal	Alarm if faulted
14	ZNO-912	Circular Tank Intrusion	DI	Intruded	Normal	Alarm if intruded
15	FNH-913	Circular Tank Overflow	DI	Overflow	Normal	Alarm if overflow
16	LN-914	Circular Tank Level Ind	AI	4 to 20mADC	0 to 100%	-
17	HNA-915	Circular Tank Mixer in Auto Mode	DI	Auto	Hand/Off	Alarm if not in auto

#	I/O Tag Name	I/O Description	I/O Type	Data Field 1 (Digital Logic 1 or Analog Signal Type)	Data Field 2 (Digital Logic 0 or Analog Process Range)	Note
18	IN-915	Circular Tank Mixer Motor Current Ind	AI	4 to 20mADC	(coordinate with equipment or process requirement)	-
19	MCN-915	Circular Tank Mixer Run Cmd	DO	Run Cmd	Off Cmd	-
20	MNR-915	Circular Tank Mixer Running	DI	Running	Off	-
21	LN-924	Square Tank Level Ind	AI	4 to 20mADC	0 to 100%	-

END OF SECTION

APPENDIX A

PERMITS



COUNTY OF BEDFORD, VIRGINIA

COUNTY ADMINISTRATION BUILDING
122 EAST MAIN STREET, SUITE G-03
BEDFORD, VIRGINIA 24523

KEVIN A. LEAMY, PE, CFM
NATURAL RESOURCES ENGINEER

DEPARTMENT OF COMMUNITY DEVELOPMENT DIVISION OF NATURAL RESOURCES

10/12/23

RE: LD23-0214
Helm Street Water Storage Tank
Replacement

Bedford Regional Water Authority
Attn: Rhonda English, P.E.
1723 Falling Creek Road
Bedford, VA 24523

Ms. English:

The Erosion and Sediment Control\Stormwater Management Plan for the above referenced project has been reviewed and approved with the following site-specific conditions. The permit will not be issued until all conditions below have been met:

1. All erosion and sediment control practices shall be properly installed and maintained in accordance with the *Virginia Erosion and Sediment Control Handbook* specifications, including a construction entrance **prior to grading**.
2. The project shall conform to the Minimum Standards of the Virginia Erosion and Sediment Control Regulations (available upon request).
3. Final site stabilization shall be in accordance with the Bedford County Erosion and Sediment Control Ordinance.
4. No debris may be buried on-site.
5. The Land Disturbing Permit shall be posted on-site in clear view from the road at all times.
6. **Preconstruction Conference:** An on-site preconstruction conference including the owner/developer, designer/engineer, contractor and Department of Natural Resources representatives involved in the project shall be required prior to the issuance of the Land Disturbing Permit.
7. **RLD Requirement:** Per Section 10.1-563 and 10.1-566 of the Code of Virginia, the Land Disturbance Permit shall not be issued until the owner has provided proof of certificate of competence for the party responsible for carrying out the land-disturbing activity.

COUNTY OF BEDFORD, VIRGINIA

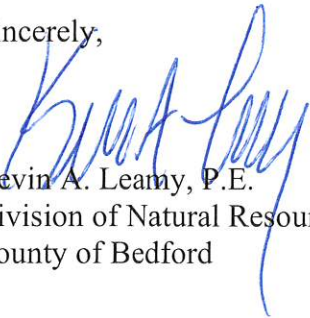
DEPARTMENT OF COMMUNITY DEVELOPMENT DIVISION OF NATURAL RESOURCES

Page 2

Your site will be randomly inspected to monitor progress and to validate the integrity of structural and vegetative controls. If at any time the project is deemed in violation, you will be notified and required to resolve the problem. If the specified measures should fail or are ineffective, changes or additional measures may be required.

We wish you success on your project. Please feel free to contact this office at (540) 586-7616 if you should have any further questions pertaining to this matter.

Sincerely,



Kevin A. Leamy, P.E.
Division of Natural Resources
County of Bedford

APPENDIX B
APPLICATIONS and FORMS



BUILDING PERMIT APPLICATION

Detailed Description
\$

Owner Name

Landowner Name

Phone

Mailing Address

Owner Name

Phone

Mailing Address

% Address

Choose all that apply:

Commercial ☐ Residential ☐ New Structure ☐ Addition ☐ Alteration, Renovation or Repair ☐

Estimated Value: _____

In a Flood Zone: Yes ☐ No ☐

Water: Public ☐ Well ☐

Sewer: Public ☐ Septic ☐

Square Footage:

Finished Area: _____

Change of Use or Occupancy:

Unfinished Area: _____

Decks / Porches: _____

Home Occupation:

Manufactured Home

****Skirting must be up within 60 DAYS of issuance of the Certificate of Occupancy.**

☐ Singlewide ☐ Doublewide Year _____ Size _____ x _____ Value \$ _____

***Email for Inspection Results:** _____

Contractor Information

Customer Name on Electric Bill

General Contractor	VA License Number	Phone	Address
Structural / Framing	VA License Number	Phone	Address
Electrician	VA License Number	Phone	Address
Plumber	VA License Number	Phone	Address
Mechanical / HVAC	VA License Number	Phone	Address
Mechanic Lien Agent	Address		Phone

I (Print Name) _____ hereby certify that I am the owner, designer, contractor or the authorized agent of, and that I (we) agree to conform to all applicable state and local regulations and that I (we) are aware of, and in compliance with, Virginia contractor license requirements and the exemptions thereto, under the terms of Section 54.1-1100 of the Code of Virginia, as well as the state requirements for asbestos inspections as per Section 36-99, for buildings constructed prior to 1985 and the exemptions thereto, and that additional regulations may still apply under the Virginia Department of Labor and Industry.

This application expires in 6 months after the date of submittal.

By checking this box, I acknowledge my digital signature below:

Signature _____ Date _____



TOWN OF BEDFORD
OFFICE OF BUILDING INSPECTIONS
215 East Main St. (540) 587-6024
www.bedfordva.gov gmciver@bedfordva.gov

STATEMENT OF SPECIAL INSPECTIONS
Pursuant with VUSBC 111.2 and Chapter 17 of the VCC

Project Name: _____

Project Address: _____

Permit Number: _____ **General Contractor:** _____

Registered Design Professional In Charge:

Name: _____ **Firm:** _____

Special Inspections Engineer in Charge:

Name: _____ **Firm:** _____

Inspections and Testing (check and complet all applicable):

☐ **Concrete**

Agency or Individual: _____ **Phone:** _____

Address: _____

☐ **Steel**

Agency or Individual: _____ **Phone:** _____

Address: _____

☐ **Masonry**

Agency or Individual: _____ **Phone:** _____

Address: _____

☐ **Other**

Agency or Individual: _____ **Phone:** _____

Address: _____

Submitted by:

Printed Name: _____ **E-Mail:** _____

Signature: _____ **Date:** _____



BEDFORD REGIONAL WATER
AUTHORITY