

TOWN OF EMMITSBURG WATER TREATMENT PLANT CLARIFIER

PROJECT MANUAL



January 5, 2024

**TOWN OF EMMITSBURG
300A South Seton Avenue
Emmitsburg, Maryland 21727**



PREPARED BY:

**RK&K, LLP
700 East Pratt Street, Suite 500
Baltimore, MD 21202
Phone: 410.728.2900**



Professional Certification: I hereby certify that these documents were prepared or approved by me, and that I am a Duly Licensed Professional Engineer under the Laws of the State of Maryland. License No. 20566
Expiration Date: 09/06/2024

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SECTION I

BID DOCUMENTS

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ADVERTISEMENT FOR BIDS
Town of Emmitsburg
Emmitsburg, Maryland
Water Treatment Plant Clarifier

General Notice

The **Town of Emmitsburg** (Owner) is requesting Bids for the construction of the following Project:

New Water Treatment Plant Clarifier
Project 24-01

Bids for the construction of the Project will be received at the **Town of Emmitsburg** located at **300A South Seton Ave., Emmitsburg, MD 21727**, until **Wednesday, February 28, 2024 at 4:00 P.M.** local time (EST). The time and date of receipt by the Owner shall be stamped or handwritten on the outside of the bid proposal package by the Owner upon receipt. Bids shall remain unopened until Thursday, February 29, 2024 at 11:00 A.M. At that time the Bids received will be **publicly** opened and read.

The Project includes the following Work:

Furnishing all labor, materials, equipment and performance of work for construction of the new Water Treatment Plant Clarifier.

Bids are requested for the following Contract: **New Water Treatment Plant Clarifier/Project 24-01**

Owner anticipates that the Project's total bid price will be approximately \$2.0 Million - \$2.5 Million. The Project has an expected duration of 360 days.

Obtaining the Bidding Documents

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

https://www.emmitsburgmd.gov/null/public_bidding.php

Bidding Documents may be downloaded from the designated website. The designated website will be updated periodically with addenda, 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

A pre-bid conference for the Project will be held on **Wednesday, January 24, 2024 at 10:00 A.M** at the **Town Water Treatment Plant, 8585 Crystal Fountain Road, Emmitsburg, Maryland 21727**. Attendance at the pre-bid conference is encouraged but not required.

In the event of inclement weather on February 16, 2023, the pre-bid conference for the Project will be re-scheduled to be held on **Friday, January 26, 2024 at 10:00 A.M** at the **Town Water Treatment Plant, 8585 Crystal Fountain Road, Emmitsburg, Maryland 21727**. Attendees are encouraged to check the website at https://www.emmitsburgmd.gov/null/public_bidding.php for inclement weather updates at 5 PM on the evening of January 23, 2024.

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.

American Iron and Steel

Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials.

The following waivers apply to this Contract:

De Minimis,
Minor Components,
Pig iron and direct reduced iron

This Advertisement is issued by:

Owner: **Town of Emmitsburg**

By: **Cathy Willets**

Title: **Town Manager**

Date: **January 10, 2024**

INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

- 2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). 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 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.
- 2.04 "Deleted"
- 2.05 "Deleted"
- 2.06 *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 Version 2020 or later. 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.

C. "Deleted"

ARTICLE 3—QUALIFICATIONS OF BIDDERS

3.01 "Deleted"

3.02 "Deleted"

3.03 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.

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

3.05 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 "Deleted"

4.02 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.

4.03 "Deleted"

4.04 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.
4. *Geotechnical Investigation Report*: The Bidding Documents contain a Geotechnical Investigation Report dated December 1, 2021 and prepared by Finding, Inc.
 - a. As set forth in the Supplementary Conditions, the Geotechnical Investigation Report describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.
 - b. The Baseline Conditions in the Geotechnical Investigation Report are intended to reduce uncertainty and the degree of contingency in submitted Bids. However,

Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the Geotechnical Investigation Report, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.

- c. Nothing in the Geotechnical Investigation Report is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.
- d. As set forth in the Supplementary Conditions, the Geotechnical Investigation Report is a Contract Document containing data prepared by or for the Owner.

5.

- 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. "Deleted"
- B. "Deleted"
- C. "Deleted"
- D. "Deleted"
- E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

- A. "Deleted"
- B. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference.
- C. "Deleted"
- D. Bidders visiting the Site are required to arrange their own transportation to the Site.
- E. "Deleted"
- F. "Deleted"
- G. "Deleted"
- H. "Deleted"
- I. "Deleted"

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, through the Engineer, may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.
- 7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:
 - A. **Via email to Bill Gross, PE at bgross@rkk.com and copy John C. Moore, PE at jmoore@rkk.com; Cathy Willets at cwillets@emmitsburgmd.gov; and Madeline Shaw at mshaw@emmitsburgmd.gov.**
- 7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.
- 7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of **Five (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. Bid Security must be at least 5% of the Bidder's maximum Bid price.

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

ARTICLE 10—SUBSTITUTE AND "OR EQUAL" ITEMS

- 10.01 "Deleted"
- 10.02 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. Each such request shall include the Manufacturer's Certification for Compliance with AIS. Refer to the Manufacturer's Certification form provided in these construction Contract Documents. 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. Substitutes and "or-equal"

materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.05 and 7.06 of the General Conditions after the Effective Date of the Contract. Each such request shall include Manufacturer's Certification letter to document compliance with AIS requirements of Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

- 10.03 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 "Deleted"

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. **Cast-in-place concrete, electrical, pre-engineered metal building, dissolved air floatation clarifier supplier.**

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, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, without an increase in Bid price.

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 not constitute grounds for forfeiture of the Bid security of any Bidder.

11.05 The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.07A.

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. The corporate seal must be affixed and attested by the corporate secretary or an assistant corporate secretary.
- 12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.
- 12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.
- 12.06 A Bid by an individual must show the Bidder's name and official address.
- 12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.
- 12.08 All names must be printed in ink below the signatures.
- 12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.
- 12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.
- 12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.
- 12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 *Lump Sum*

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

13.02 "Deleted"

13.03 "Deleted"

13.04 "Deleted"

13.05 *Unit Price*

- A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.06 *Allowances*

- A. For cash allowances the Bid price must include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

13.07 "Deleted"

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

ARTICLE 16—OPENING OF BIDS

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

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.
- 18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.
- 18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.
- 18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.
- 18.05 *Evaluation of Bids*
- A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

- B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner will announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.
 - C. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.
 - D. 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.
 - E. “Deleted”
 - F. “Deleted”
- 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.

ARTICLE 21—SALES AND USE TAXES

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

ARTICLE 22—CONTRACTS TO BE ASSIGNED

22.01 Recipient shall not entertain the use of the businesses that are listed on the “Excluded Parties List System” at www.sam.gov in accordance with 2 CFR Part 1532 and Subpart B and C of 2 CFR Part 180.

ARTICLE 23—FEDERAL REQUIREMENTS

23.01 If the contract price is in excess of \$100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.

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

23.03 American Iron and Steel requirements apply to this project.

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BID OPENING REQUIREMENTS

Guidelines for Bid Opening Checklist:

The bid opening procedure shall be a two envelope system. The system shall consist of two separate and distinct envelopes, each with proper identification. The envelopes shall be identified as “**Bid Documents**” and the other as “**Bid Form**”. Both shall be submitted in a single large envelope, labeled with Contractor’s name, address, and name of project with contract numbers. The first envelope shall contain **four (4) copies** the following items complete as shown in the following checklist:

Bid Opening Requirement Checklist

1. Bid Submitted on Time
2. Required Bid security in the form of a Bid Bond (EJCDC No. C-430) or Certified Check (circle type of security provided);
3. Evidence of authority to do business in the state or jurisdiction of the Project; or a written covenant to obtain such license within the time frame for acceptance of Bids:
4. Contractor’s License No. for State of Maryland;
5. List of References;
6. List of Sub-Contractors;
7. Certificate of Receipt of Addenda;
8. Affidavit of Qualification to Bid;
9. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in paragraph 18.10 of the General Conditions;
10. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions (AD-1048).
11. ~~If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans. NOT REQUIRED~~
12. Free Competitive Bidding Affidavit:
13. Qualification Statement

The second envelope (“**Bid Form**”) shall consist of **four (4) copies** solely of the bid form. In the event that **all** the items are not complete on the Checklist from the first envelope, then the second envelope shall be returned to the Contractor not opened. At that time, the Engineer will declare the bidder non-responsive. Then, the lowest responsive, responsible bidder shall be the bidder who has completed **all** the requirements of the first envelope and has the lowest total on his bid forms.

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BID FORM FOR CONSTRUCTION CONTRACT

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

ARTICLE 1—OWNER AND BIDDER

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

ARTICLE 2—ATTACHMENTS TO THIS BID

- 2.01 The following documents are submitted with and made a condition of this Bid:
- A. Required Bid security;
 - B. List of Proposed Subcontractors;
 - C. List of Proposed Suppliers;
 - D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;
 - E. Contractor's license number as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;
 - F. Required Bidder Qualification Statement with supporting data;
 - G. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplementary Conditions of the Construction Contract (EJCDC C-800);
 - H. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048);
 - I. ~~If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q Exhibit A-1, Certification for Contracts, Grants, and Loans.~~ NOT REQUIRED. NO USDA FUNDING
 - J. EEO Certification;
 - K. List of References; and
 - L. Certification of Receipt of Addenda;

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

- 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), together with any Unit Prices indicated in Paragraph 3.02:

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	\$
--------------------	----

3.02 *Unit Price Bids*

A. Bidder will perform the following Work at the indicated unit prices:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
	N/A				\$
	N/A				\$
	N/A				\$
	N/A				\$
	N/A				\$
Total of All Unit Price Bid Items					\$

B. Bidder acknowledges that:

1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and
2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

3.03 *Total Bid Price (Lump Sum and Unit Prices)*

Total Bid Price (Total of all Lump Sum and Unit Price Bids)	\$
---	----

ARTICLE 4—“DELETED”

ARTICLE 5— “DELETED”

ARTICLE 6—TIME OF COMPLETION

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

6.02 “Deleted”

6.03 “Deleted”

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

ARTICLE 7—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *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.

7.02 *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.

7.03 *Receipt of Addenda*

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

Addendum Number	Addendum Date

ARTICLE 8—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

8.01 *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.

8.02 *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) _____

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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: Town of Emmitsburg, Maryland Address <i>(principal place of business)</i> : 300A South Seton Avenue Emmitsburg, Maryland 21727	Bid Project <i>(name and location)</i> : Water Treatment Plant Clarifier 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) (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) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.</i>	

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.

**INSERT COPY OF
MARYLAND
CONTRACTOR'S LICENSE**

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INSERT

LIST OF REFERENCES

List at least three (3) references for similar projects preferably.

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

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INSERT

PROPOSED LIST OF SUBCONTRACTORS

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

Name of Company: _____

Address: _____

Contact Person: _____

Phone Number: _____

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CERTIFICATION OF RECEIPT OF ADDENDA

In submitting this Bid, Bidder Represents, as more fully set forth in the Agreement, that:

- (a) Bidder has examined copies of all the Contract Documents and the following addenda:

<u>Date</u>	<u>Number</u>
_____	_____
_____	_____
_____	_____

(Receipt of all of which is hereby acknowledged) and also copies of the Advertisement or Invitation to Bid and the Instruction of Bidders.

- (b) Bidder has examined the site and locality where the work is to be performed, the legal requirements (federal, state and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the work and has made such independent investigations as Bidder deems necessary.
- (c) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation: Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid: Bidder has not solicited or induced any person, firm or corporation to refrain from bidding: and Bidder has not sought by collusion to obtain from himself any advantage over any other Bidder or over Owner.

Contractor

Signature

Date

Name and Title of Signer (Please Type)

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ENVELOPE NO. 1
WATER TREATMENT PLANT CLARIFIER

AFFIDAVIT OF QUALIFICATION TO BID

I hereby affirm that:

1. I am the _____ and the duly authorized representative
(Title)
of the firm of _____ Whose address
(Name of Corporation)

Is _____ and that I
possess the legal authority to make this affidavit on behalf of myself and the firm for which
I am acting.

2. Except as described in Paragraph 3 below, neither I nor the above firm, nor to the best of
my knowledge, any of its officers, directors, or partners, or any of its employees directly
involved in obtaining contracts with the State or any county, bi-county or multi-county
agency, or subdivision of the State have been convicted of, or have pleaded nolo
contendere to a charge of, or have during the course of an official investigation or other
proceeding admitted in writing or under oath acts or omissions which constitute bribery,
attempted bribery, or conspiracy to bribe under the provisions of Article 27 of the
Annotated Code of Maryland or under the laws of any state or the federal government
(conduct prior to July 1, 1977 is not required to be reported).

3. (State "none" or, as appropriate, list any conviction, plea, or admission described in
paragraph 2 above, with the date; court, official, or administrative body; the individuals
involved and their position with the firm, and the sentence or disposition, if any.)

ENVELOPE NO. 1
WATER TREATMENT PLANT CLARIFIER

I acknowledge that this affidavit is to be furnished to the Town of Oakland and, where appropriate, to the Board of Public Works and to the Attorney General under Section 16D of Article 78A of the Annotated Code of Maryland. I acknowledge that, if the representations set forth in this affidavit are not true and correct, the Town of Oakland may terminate any contract awarded and take any other appropriate action. I further acknowledge that I am executing this affidavit in compliance with Section 16D of Article 78A of the Annotated Code of Maryland, which provides that certain persons who have been convicted of or have admitted to bribery, attempted bribery, or conspiracy to bribe may be disqualified, either by operation of law or after a hearing, from entering into contracts with the State or any of its agencies or subdivisions.

I do solemnly declare and affirm under the penalties of perjury that the contents of this affidavit are true and correct.

(Signature)

(Date)

U.S. DEPARTMENT OF AGRICULTURE

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

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulations may be obtained by contacting the Department of Agriculture agency with which this transaction originated.

(BEFORE COMPLETING CERTIFICATION, READ INSTRUCTIONS ON REVERSE)

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

Organization Name

PR/Award Number or Project Name

Name(s) and Title(s) of Authorized Representative(s)

Signature(s)

Date

Instructions for Certification

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

RD Instruction 1940-Q
Exhibit A-1

CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS

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

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

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

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

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

(signature)

(name)

(date)

(title)

oOo

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FREE COMPETITIVE BIDDING AFFIDAVIT

Section 112 (c) of Title 23, United States Code

State of _____

County of _____

I, _____ (Contractor) by _____
_____ (Name and title of authorized representative), being
duly sworn to depose, say and certify: That said contractor has not, either directly or indirectly,
entered into any agreement, participated in any collusion, or otherwise taken any action in
restraint of free competitive bidding in connection with the contract for Project _____
_____ in _____ County.

Contractor

Name and Title of Authorized Representative

Taken, subscribed and sworn to me before this ____ day of _____, 20 __.

Notary Public

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

QUALIFICATIONS STATEMENT



Endorsed By



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National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882
www.nspe.org

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723
www.asce.org

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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:		<input type="checkbox"/> Sole Proprietorship <input type="checkbox"/> Partnership <input type="checkbox"/> Corporation							
<input type="checkbox"/> Limited Liability Company <input type="checkbox"/> 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?					<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending				

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

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

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

Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> 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
<input type="checkbox"/> Disadvantaged Business Enterprise		
<input type="checkbox"/> Minority Business Enterprise		
<input type="checkbox"/> Woman-Owned Business Enterprise		
<input type="checkbox"/> Small Business Enterprise		
<input type="checkbox"/> Disabled Business Enterprise		
<input type="checkbox"/> Veteran-Owned Business Enterprise		
<input type="checkbox"/> Service-Disabled Veteran-Owned Business		
<input type="checkbox"/> HUBZone Business (Historically Underutilized) Business		
<input type="checkbox"/> Other		
<input type="checkbox"/> None		

ARTICLE 4—SAFETY

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

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

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

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

ARTICLE 5—FINANCIAL

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

Financial Institution:			
Business address:			
Date of Business’s most recent financial statement:		<input type="checkbox"/> Attached	
Date of Business’s most recent audited financial statement:		<input type="checkbox"/> Attached	
Financial indicators from the most recent financial statement			
Contractor’s Current Ratio (Current Assets ÷ Current Liabilities)			
Contractor’s Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)			

ARTICLE 6—SURETY INFORMATION

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

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	<input type="checkbox"/> Yes <input type="checkbox"/> 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? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

ARTICLE 7—INSURANCE

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

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

ARTICLE 8—CONSTRUCTION EXPERIENCE

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

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

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

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

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

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

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

ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

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

ENVELOPE NO. 1
Water Treatment Plant Clarifier

- E. Attachments providing additional information as required by Paragraph 8.02.
- F. Schedule A (Current Projects) as required by Paragraph 8.03.
- G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.
- H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.
- I. Additional items as pertinent.

**ENVELOPE NO. 1
Water Treatment Plant Clarifier**

This Statement of Qualifications is offered by:

Business: _____
(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(date signed)

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

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Designated Representative:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address: _____

Phone: _____

Email: _____

Schedule A—Current Projects

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

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

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

Schedule B—Previous Experience with Similar Projects

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

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

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

Schedule B—Previous Experience with Similar Projects

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

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

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

Schedule C—Key Individuals

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

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

SECTION II

CONTRACT DOCUMENTS

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

This Agreement is by and between **Town of Emmitsburg** (“Owner”) and **[name of contracting entity]** (“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: **Furnishing all labor, materials, equipment and performance of work for construction of the Water Treatment Plant Clarifier**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Water Treatment Plant Clarifier**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **Rummel, Klepper & Kahl, LLP (RKK)** (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

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

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 “Deleted”

4.03 *Contract Times: Days*

A. The Work will be substantially complete within **450** 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 **480** days after the date when the Contract Times commence to run.

4.04 “Deleted”

4.05 *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 **\$1,000.00** 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 **\$1,250.00** for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- 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.
- C. "Deleted"

4.06 *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 **[\$number]**.

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

- B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

Unit Price Work					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
	N/A			\$	\$
	N/A			\$	\$
	N/A			\$	\$
	N/A			\$	\$
	N/A			\$	\$
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					\$

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

- C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) \$[number].
- D. For all Work, at the prices stated in Contractor’s Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

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

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor’s Applications for Payment on or about the **5th** 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).

1) "Deleted"

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

B. Upon Substantial Completion of the entire construction to be provided under the construction Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, 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 rate of **5** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

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

1. This Agreement.

2. Bonds:

a. Performance bond (together with power of attorney).

b. Payment bond (together with power of attorney).

3. General Conditions.

4. Supplementary Conditions.

5. Specifications as listed in the table of contents of the project manual (copy of list attached).

6. Drawings (not attached but incorporated by reference) consisting of **[number]** sheets with each sheet bearing the following general title: **Water Treatment Plant Clarifier**.

7. "Deleted"

8. Addenda (numbers **[number]** to **[number]**, inclusive).

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

a. **[list exhibits]**

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

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

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:

Contractor:

(typed or printed name of organization)

(typed or printed name of organization)

By: _____
(individual's signature)

By: _____
(individual's signature)

Date: _____
(date signed)

Date: _____
(date signed)

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

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

Attest: _____
(individual's signature)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Address for giving notices:

Designated Representative:

Designated Representative:

Name: _____
(typed or printed)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Title: _____
(typed or printed)

Address:

Address:

Phone: _____

Phone: _____

Email: _____

Email: _____

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

License No.: _____
(where applicable)

State: _____

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PERFORMANCE BOND

<p>Contractor</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>
<p>Owner</p> <p>Name: Town of Emmitsburg, Maryland</p> <p>Mailing address (<i>principal place of business</i>): 300A South Seton Avenue Emmitsburg, Maryland 21727</p>	<p>Contract</p> <p>Description (<i>name and location</i>): Water Treatment Plant Clarifier</p> <p>Contract Price: _____</p> <p>Effective Date of Contract: _____</p>
<p>Bond</p> <p>Bond Amount: _____</p> <p>Date of Bond: _____ <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 16</p>	
<p>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.</p>	
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: _____
<p><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></p>	

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: **[Describe modification or enter “None”]**

PAYMENT BOND

<p>Contractor</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address (<i>principal place of business</i>): _____</p>
<p>Owner</p> <p>Name: Town of Emmitsburg, Maryland</p> <p>Mailing address (<i>principal place of business</i>): 300A South Seton Avenue Emmitsburg, Maryland 21727</p>	<p>Contract</p> <p>Description (<i>name and location</i>): Water Treatment Plant Clarifier</p> <p>Contract Price: _____</p> <p>Effective Date of Contract: _____</p>
<p>Bond</p> <p>Bond Amount: _____</p> <p>Date of Bond: _____ <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 18</p>	
<p>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.</p>	
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: _____
<p><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></p>	

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: **[Describe modification or enter “None”]**

NOTICE OF AWARD

Date of Issuance:

Owner:

Owner's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Bidder:

Bidder's Address:

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

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is \$**[Contract Price]**. 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.

[Number of copies sent] 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 **[number of copies sent]** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): **[Describe other conditions that require Successful Bidder's compliance]**

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: **[Full formal name of Owner]**

By (signature): _____

Name (printed): _____

Title: _____

Copy: Engineer

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NOTICE TO PROCEED

Owner: Town of Emmitsburg, MD Owner's Project No.: _____
Engineer: RK&K Engineer's Project No.: 20119
Contractor: _____ Contractor's Project No.: _____
Project: Project 24-01
Contract Name: Water Treatment Plant Clarifier
Effective Date of Contract: _____

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** 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: **[Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]**

The number of days to achieve Substantial Completion is 450 days from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of **[date, calculated from commencement date above]**; and the number of days to achieve readiness for final payment is **[number of days, from Agreement]** from the commencement date of the Contract Times, resulting in a date for readiness for final payment of **[date, calculated from commencement date above]**.

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

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

Owner: Town of Emmitsburg, MD
By (signature): _____
Name (printed): _____
Title: _____
Date Issued: _____
Copy: Engineer

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Contractor's Application for Payment No. _____

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

Application For Payment Change Order Summary

Approved Change Orders	1. ORIGINAL CONTRACT PRICE.....	\$ _____
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

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

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

Payment of:	\$	_____
		(Line 8 or other - attach explanation of the other amount)
is recommended by:	_____	_____
	(Engineer)	(Date)
Payment of:	\$	_____
		(Line 8 or other - attach explanation of the other amount)
is approved by:	_____	_____
	(Owner)	(Date)
Approved by:	_____	_____
	Funding Agency (if applicable)	(Date)

CHANGE ORDER NO.: [Number of Change Order]

Owner: _____ Owner's Project No.: _____
 Engineer: _____ Engineer's Project No.: _____
 Contractor: _____ Contractor's Project No.: _____
 Project: _____
 Contract Name: _____
 Date Issued: _____ Effective Date of Change Order: _____

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

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	Change in Contract Times [State Contract Times as either a specific date or a number of days]
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)

Accepted by Contractor

By: _____

Title: _____

Date: _____

Authorized by Owner _____ Approved by Funding Agency (if applicable) _____

By: _____

Title: _____

Date: _____

FIELD ORDER NO.: [Number of Field Order]

Owner:

Owner's Project No.:

Engineer:

Engineer's Project No.:

Contractor:

Contractor's Project No.:

Project:

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:

[Description of the change to the Work]

Attachments:

[List documents supporting change]

Issued by Engineer

By: _____

Title: _____

Date: _____

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WORK CHANGE DIRECTIVE NO.: [Number of Work Change Directive]

Owner: _____ Owner's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Contractor: _____ Contractor's Project No.: _____
Project: _____
Contract Name: _____
Date Issued: _____ Effective Date of Work Change Directive: _____

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

Description:

[Description of the change to the Work]

Attachments:

[List documents related to the change to the Work]

Purpose for the Work Change Directive:

[Describe the purpose for the change to the Work]

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

Notes to User—Check one or both of the following

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: _____

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: _____ Owner's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Contractor: _____ Contractor's Project No.: _____
Project: _____
Contract Name: _____

This Preliminary Final Certificate of Substantial Completion applies to:

All Work The following specified portions of the Work:

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

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:

[List amendments to Owner's Responsibilities]

Amendments to Contractor's Responsibilities: None As follows:

[List amendments to Contractor's Responsibilities]

The following documents are attached to and made a part of this Certificate:

[List attachments such as punch list; other documents]

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: _____

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NOTICE OF ACCEPTABILITY OF WORK

Owner: _____ Owner's Project No.: _____
Engineer: _____ Engineer's Project No.: _____
Contractor: _____ Contractor's Project No.: _____
Project: _____
Contract Name: _____
Notice Date: _____ Effective Date of the Construction Contract: _____

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated **[date of professional services agreement]** ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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SECTION III

FEDERAL REQUIREMENTS AND CONTRACT DOCUMENTS

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By



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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

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

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

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

9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

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

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;
 - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

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

8.03 *Legal Relationships*

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

- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
 - 1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 - 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

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

9.03 *Furnish Data*

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

9.04 *Pay When Due*

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

- 9.05 *Lands and Easements; Reports, Tests, and Drawings*
- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
 - B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
 - C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.
- 9.06 *Insurance*
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 *Change Orders*
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 *Inspections, Tests, and Approvals*
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 *Limitations on Owner's Responsibilities*
- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- 9.10 *Undisclosed Hazardous Environmental Condition*
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 *Evidence of Financial Arrangements*
- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).
- 9.12 *Safety Programs*
- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
 - B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

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

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

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

10.04 *Engineer's Authority*

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

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

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

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

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

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

11.02 *Change Orders*

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

11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

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

11.06 *Unauthorized Changes in the Work*

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

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will be determined as follows:
1. A mutually acceptable fixed fee; or
 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

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

11.09 *Change Proposals*

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

B. *Change Proposal Procedures*

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

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

3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

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

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
 - 1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 - 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
 - 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

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

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 - 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
 5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
- 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
- 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 and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

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

13.03 Unit Price Work

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

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

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

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

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

- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

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

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

14.03 *Defective Work*

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

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

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

14.05 *Uncovering Work*

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

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 Owner May Correct Defective Work

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

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

15.01 Progress Payments

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

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

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

C. *Review of Applications*

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

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

D. *Payment Becomes Due*

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

E. *Reductions in Payment by Owner*

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

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

15.02 *Contractor's Warranty of Title*

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

15.03 *Substantial Completion*

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

submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

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

15.04 *Partial Use or Occupancy*

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

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

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

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*

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

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

15.07 *Waiver of Claims*

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

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

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

15.08 *Correction Period*

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

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

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

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

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

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

16.03 *Owner May Terminate for Convenience*

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

16.04 *Contractor May Stop Work or Terminate*

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

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

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

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

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

18.02 *Computation of Times*

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

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

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

18.08 *Assignment of Contract*

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

18.09 *Successors and Assigns*

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

18.10 *Headings*

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

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). 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."

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

~~No suggested Supplementary Conditions in this Article.~~

SC-1.01.A.8. Add the following language at the end of the Paragraph 1.01.A.8:

The Change Order form to be used on this Project is EJCDC C-941 (2018). Agency approval is required before Change Orders are effective.

SC-1.01.A.30 Add the following language at the end of the Paragraph 1.01.A.30:

For the purposes of Rural Development, this term is synonymous with the term "Applicant" as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the federal programs.

SC-1.01.A.50 Add the following language at the end of the Paragraph 1.01.A.50:

The Work Change Directive form to be used on this Project is EJCDC C-940 (2018). Agency approval is required before a Work Change Directive is issued.

SC-1.01.A.51 Add the following new paragraph immediately after Paragraph 1.01.A.50:

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

SC-1.01.A.52 Add the following new paragraph with the title "American Iron and Steel Definitions" immediately after Paragraph 1.01.A.51:

52.a *American Iron and Steel (AIS)* – Requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference for "iron and steel products," meaning the following products, if made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and

Construction Materials. AIS requirements apply in each of the several states, the District of Columbia, and each federally recognized Tribe, but not the U.S. Territories.

- 52.b *Coating* – A covering that is applied to the surface of an object. If a Coating is applied to the external surface of a domestic iron or steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any Coating processes that are applied to the external surface of Iron and Steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the Coating processes occur, provided that final assembly of the project occurs in the United States. This exemption only applies to Coatings on the external surface of Iron and Steel components. It does not apply to Coatings or linings on internal surfaces of Iron and Steel products, such as the lining of lined pipes. All Manufacturing Processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.
- 52.c *Construction Materials* – Those articles, materials, or supplies made primarily of iron and/or steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. Note: Mechanical and electrical components, equipment and systems are not considered Construction Materials. See definitions of Mechanical Equipment and Electrical Equipment.
- 52.d *Contractor’s Certification* – Documentation submitted by the Contractor upon Substantial Completion of the Contract that all Iron and Steel projects installed were produced in the United States.
- 58.e *De Minimis* – Various miscellaneous, incidental low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of *De Minimis* components could include small washers, screws, fasteners (such as “off the shelf” nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc. Cost for such *De Minimis* components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in the incorporated into a project.
- 52.f *Electrical Equipment* – Typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does not apply to Electrical Equipment.
- 52.g *Engineer’s Certification* – Documentation submitted by the Engineer that Drawings, Specifications, and Bidding Documents comply with AIS.
- 52.h *Iron and Steel products* – The following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials. Only items on the above list made primarily of iron and steel, permanently incorporated into the project must be Produced in the United States. For

example, trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. iron or steel.

- 52.i *Manufacturer* – A Supplier, fabricator, distributor, materialman, or vendor is an entity with which the Owner, Contractor or any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by Owner, Contractor or a subcontractor.
- 52.j *Manufacturer’s Certification* – Documentation provided by the Manufacturer stating that the Iron and Steel projects to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a Supplier, distributor, vendor, etc. from the Manufacturer directly, then the Supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certifications to the parties purchasing the products.
- 52.k *Manufacturing Processes* – Processes such as melting, refining, pouring, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic Iron and Steel project is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by AIS requirement, and the material(s), if any being applied as a Coating are similarly not covered. Non-Iron or Steel components of an Iron and Steel project may come from non-US sources. For example, for products such as valves and hydrants, the individual non-Iron and Steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap iron, and scrap steel, can come from non-U.S. sources.
- 52.l *Mechanical Equipment* – Typically equipment which has motorized parts and/or is powered by a motor. AIS does not apply to Mechanical Equipment.
- 52.m *Minor Components* – Components within an iron and/or Steel project otherwise compliant with the American Iron and Steel requirements; this waiver is typically used by Manufacturers. It differs from the *De Minimis* definition in that *De Minimis* pertains to the entire project and the minor component definition pertains to a single product. This waiver allows use of non-domestically produced miscellaneous Minor Components comprising up to five percent of the total material cost of an otherwise domestically produced Iron and Steel product. However, unless a separate waiver for a product has been approved, all other Iron and Steel components in said project must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only Minor Components within said product and the Iron or Steel components of the project must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of Minor Components could include items such as pins and spring in valves/hydrants, bands/straps in couplings, and other low-cost items such as small fasteners etc.
- 52.n *Municipal Castings* – Cast iron or Steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.
- 52.o *Primarily Iron or Steel* – A project is made of greater than 50 percent Iron or Steel on a materials cost basis. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF,

AWWA) must be met. If a product is determined to be less than 50 percent iron and/or steel, the AIS requirements do not apply. For example, the cost of a fire hydrant includes:

- The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
- The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:

- The additional material costs for the non-iron or steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.,) and
- The cost to assemble the internal workings into the hydrant body.

52.p *Produced in the United States* – The production in the United States of the iron or steel products used in the project requires that all manufacturing processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

52.q *Reinforced Precast Concrete* – Reinforced Precast Concrete structures must comply with AIS, regardless of whether it consists of at least 50 percent iron or steel. The reinforcing bar and wire must be produced in the United States and meet the same standards as for any other iron or steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered construction materials and must be produced in the United States.

52.r *Steel* – An alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

52.s. *Structural Steel* – Rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees,

and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

- 52.t *Unclassified Excavation* – Excavation not defined within Standard Specifications' classifications, including, but not limited to, rock, logs, stumps, water, debris. Included in this definition is all excavation of all utility Trenches to subgrade.

ARTICLE 2—PRELIMINARY MATTERS

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.

2.02 *Copies of Documents*

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

Owner shall furnish to Contractor - **five (5)** printed copies of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF).

2.06 *Electronic Transmittals*

SC-2.06 Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

- B. *Electronic Documents Protocol:* The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.

1. *Basic Requirements*

- a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
- b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.
- c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using

non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.

- d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
- e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
- f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.
 - 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **20 MB**. Attachments larger than that may be exchanged using large file transfer functions or physical media.
 - 2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.
- b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
- c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in

EJCDC® C-800, Supplementary Conditions of the Construction Contract.

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the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.

- d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
- e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
- f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.
- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

C. *Software Requirements for Electronic Document Exchange; Limitations*

- 1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.
 - a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.
- 2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. *Requests by Contractor for Electronic Documents in Other Formats*

1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.
2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:
 - a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.
 - b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.
 - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.
3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor-requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at **\$191**

per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01.A Delete the last sentence of paragraph.

4.05 *Delays in Contractor’s Progress*

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. *Weather-Related Delays*

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

Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information listed in SC 4.05.C.5.b

- b. The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:
 - 1) Every workday on which one or more of the following conditions exist will be considered a “bad weather day”:
 - i) Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds 1.5 inches of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled Foreseeable Bad Weather Days; such table is hereby incorporated in this SC-4.05.C by reference.
 - ii) Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: 7 degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: 95 degrees Fahrenheit.

- 2) Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by **EMMITSBURG 2 SE, MD US** weather monitoring station at Elev: 403 ft. Lat: 39.6762° N Lon: -77.2844° W
- 3) Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit B—Foreseeable Bad Weather Days.
- 4) In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table in Exhibit B—Foreseeable Bad Weather Days will be considered as “abnormal weather conditions.” The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor’s then-current Progress Schedule’s critical path for the Project.

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

5.03 *Subsurface and Physical Conditions*

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
Boring Logs and Laboratory Results	<u>December 1, 2021</u>	Borings, Particle Size Distribution Reports, Bearing Ratio Test Reports, Uniaxial Compression of Rock Core included as Appendix A to Technical Specifications

- 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:

Drawings Title	Date of Drawings	Technical Data
		No Technical Reports Available

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
		No Technical Reports Available

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

Drawings Title	Date of Drawings	Technical Data
		No Technical Reports Available

ARTICLE 6—BONDS AND INSURANCE

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

SC-6.01 Add the following sentence onto the end of paragraph 6.01.C:

The evidence of authority must also show that the Surety is authorized to provide bond in the State where the project is located. Documentation shall be any one of the following:

1. Resident Agent Designation with power of attorney to act on behalf of Surety (must be resident of State where project is located).
2. Authorization or License to provide insurance for State Insurance Commissioner of State where project is located.
3. Current dated printout from website of State Insurance Commissioner where project is located which designates Surety as “current” or “active”.

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 the Owner and Engineer as additional insureds.

- 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
Bodily injury by accident—each accident	\$1,000,000
Bodily injury by disease—aggregate	\$1,000,000
Employer's Liability	
Each accident	\$500,000
Each employee	\$500,000

- F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.
 6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and

CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.

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

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

I. *Commercial General Liability—Minimum Policy Limits*

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

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

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

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

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

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	\$1,000,000
General Aggregate	\$1,000,000

- L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer’s liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy’s policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of \$[specify amount] after accounting for partial attribution of its limits to underlying policies, as allowed above.
- M. *Contractor’s Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor’s operations and completed operations. This insurance must be maintained for no less than three years after final completion.

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

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

Contractor’s Professional Liability	Policy limits of not less than:
Each Claim	\$1,000,000

Contractor's Professional Liability	Policy limits of not less than:
Annual Aggregate	\$1,000,000

O. *Other Required Insurance: None*

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). If this coverage is subject to a sublimit, such sublimit will be a minimum of **[\$amount]**.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of **[\$amount]**.
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, Engineer, 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:
11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:
 - a. **NONE**

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

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

1. Regular working hours will be 7:00 a.m. to 5:00 p.m.
2. Owner's legal holidays are:
 - New Years Day – January 1st
 - Memorial Day – Last Monday in May
 - Independence Day – July 4th
 - Labor Day – First Monday in September
 - Thanksgiving Day – Last Thursday in November
 - Christmas Day – December 25th

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "...all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, , or any legal holiday."

SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

- C. In the absence of any Laws or Regulations to the contrary, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.

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

- D. **Contractor** shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day. If Contractor is responsible but does not pay, or if the parties are unable to agree

as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

6.02 *Services, Materials, and Equipment*

SC-7.04.D – Add the following new paragraph immediately after Paragraph 7.04.C:

D. All Iron and Steel products must meet American Iron and Steel requirements.

SC-7.04.E – Add the following new paragraph immediately after Paragraph 7.04.D.

E. For projects utilizing a *De Minimis* waiver, Contractor shall maintain an itemized list of non-domestically produced iron or steel incidental components and ensure that the cost is less than 5% of total materials cost for project.

6.03 *“Or Equals”*

SC-7.05.A Amend the third sentence of paragraph by striking out the following words:

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

SC-7.05.A.1.a.3 – Amend the last sentence of Paragraph a.3 by striking out “and;” and adding a period at the end of Paragraph a.3.

SC-7.05.A.1.a.4 – Delete paragraph in its entirety and insert “Deleted.”

SC-7.05.B – Add the following at the end of paragraph:

Contractor shall include a Manufacturer’s Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer’s Certificate Letter provided in these Contract Documents.

6.04 *Substitutes*

SC-7.06.A.3.a.2 – Remove “and” from the end of paragraph.

SC-7.06.A.3.a.3 – Add “; and” to the end of paragraph.

SC-7.06.A.3.a.4 – Add the following new paragraph immediately after Paragraph 7.06.A.3.a.3

4. Comply with American iron and Steel by providing Manufacturer’s Certification letter of American Iron and Steel compliance, if applicable. Refer to Manufacturer’s Certification Letter provided in these Contract Documents.

6.05 *Concerning Subcontractors and Suppliers*

SC-7.07.A – Amend by adding the following to the end of the paragraph:

The total amount of work subcontracted by the Contractor shall not exceed fifty percent of the Contract price without prior approval from the Owner, Engineer and Agency.

SC-7.07.B – Delete paragraph in its entirety and insert “Deleted”

SC-7.07.E – Delete the second sentence of paragraph and insert the following in its place:

Owner may not require that Contractor use a specific replacement.

SC-7.12.A – Amend paragraph by adding the following after “written interpretations and clarifications,”:

Manufacturers’ Certifications,

7.13 Owner-Authorized Changes in the Work

SC.7.16.A.1.c – Amend paragraph by deleting the last period and adding:

, including Manufacturer’s Certification letter for any item in the submittal subject to American Iron and Steel requirements and include the Certificate in the submittal. Refer to Manufacturer’s Certification letter provided in these Contract Documents.

SC-7.16.C.9 – Add new paragraph immediately after Paragraph 7.16.C.8:

9. Engineer’s review and approval of a Shop Drawing or Sample shall include review of Manufacturers’ Certifications in order to document compliance with American Iron and Steel requirements, as applicable.

6.06 *Owner-Authorized Changes in the Work*

SC.7.17.F – Add new paragraph immediately after Paragraph 7.17.E:

- F. Contractor shall certify upon Substantial Completion that all Work and Materials have complied with American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Contractor shall provide said Certification to Owner. Refer to General Contractor’s Certification Letter provided in these Contract Documents.

ARTICLE 7—OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

ARTICLE 8—OWNER’S RESPONSIBILITIES

No suggested Supplementary Conditions in this Article.

ARTICLE 9—ENGINEER’S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

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

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor’s safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 4. *Review of Work; Defective Work*
 - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
 5. *Inspections and Tests*
 - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
 6. *Payment Requests:* Review Applications for Payment with Contractor.
 7. *Completion*
 - a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 10—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

10.01 Change Orders

SC-11.02.C – Add new paragraph immediately after Paragraph 11.02.B:

- C. The Engineer or Owner shall contact the Agency for concurrence on each Change Order prior to issuance. All Contract Change Orders must be concurred on (signed) by Agency before they are effective.

10.02 Work Change Directives

SC-11.03.A.2 – Add new Paragraph 11.03.A.2 immediately after Paragraph 11.03.A, which shall be renamed Paragraph 11.03.A.1:

2. The Engineer or Owner shall contact the Agency for concurrence on each Work Change Directive prior to issuance. Once authorized by Owner, a copy of each Work Change Directive shall be provided by Engineer to Agency.

10.05 Owner-Authorized Changes in the Work

SC-11.05.B – Add the following at the end of Paragraph 11.05.B:

For Owner-authorized changes in the Work, the Contractor will provide the Manufacturer's Certification(s) for materials subject to American Iron and Steel requirements except when sole-source is specified, in which case the Engineer will provide the Manufacturer's Certification(s).

10.09 Change Proposals

SC-11.09.B.2.c. – Add new paragraph immediately after Paragraph 11.09.B.2.b:

- c. Change orders involving materials subject to American Iron requirements shall include supporting data (name of Manufacturer, city and state where the product was manufactured, description of product, signature of authorized

Manufacturer's representative) in the Manufacturer's Certification letter, as applicable.

ARTICLE 11—CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 12—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 Cost of the Work

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of Rental Rate Blue Book for Construction Equipment.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:

- a. For purposes of this paragraph, "small tools and hand tools" means any tool or equipment whose current price if it were purchased new at retail would be less than \$500.

13.02 Allowances

SC-13.02.C – Delete Paragraph 13.02.C in its entirety and insert "Deleted".

13.03 Unit Price Work

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

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the extended price of a particular item of Unit Price Work amounts to 20 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 20 percent from the estimated quantity of such item indicated in the Agreement; and
 - 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 13—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

~~No suggested Supplementary Conditions in this Article.~~

SC-14-03.G Add new paragraph immediately after Paragraph 14.03.F

- G. Installation of materials that are non-compliant with American iron and Steel requirements shall be considered defective work.

ARTICLE 14—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 Progress Payments

SC-15.01.B.4 Add the following language at the end of subparagraph 15.01.B.4:

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

SC-15.01.B.5 - Add new paragraph after 15.01.B.4:

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

SC-15.01.B.6 - Add new paragraph immediately after Paragraph 15.01.B.5

6. By submitting an Application for Payment based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials are compliant with American Iron and Steel requirements. Manufacturer's Certification letter for materials satisfy this requirement. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-15.01.C.2.d – Add the following new paragraph immediately after Paragraph 15.02.C.2.c:

- d. The materials presented for payment in an Application for Payment comply with American Iron and Steel requirements.

SC-15.01.D.1 – Delete the paragraph in its entirety and insert the following in its place:

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

15.02 Contractor's Warranty of Title

SC-15.02.A – Amend the paragraph by striking out the following text: "7 days after".

15.03 Substantial Completion

SC-15.03.A – Modify the paragraph by adding the following after the last sentence of Paragraph 15.03.A

Contractor shall also submit the General (Prime) Contractor's Certification of Compliance certifying that to the best of the Contractor's knowledge and belief all substitutes, equals, and all

Iron and Steel projects proposed in the Shop Drawings, Change Orders, and Partial Payment Estimates, and those installed for the Project, are either Produced in the United States or are the subject of an approved Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.08 *Correction Period*

SC-15.08 Add the following new Paragraph 15.08.G:

- G. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be 2 years after Substantial Completion.

ARTICLE 15—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 16—FINAL RESOLUTIONS OF DISPUTES

17.02 *Arbitration*

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

17.02 *Arbitration*

- A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of \$100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.
- B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

- C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.
- D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.
- E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.
- F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.
- G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:
 - 1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;
 - 2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;
 - 3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and
 - 4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.
- H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.
- I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].

17.03 *Attorneys' Fees*

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

ARTICLE 17—MISCELLANEOUS

SC-18.11 – Add the following new paragraph immediately after Paragraph 18.10:

18.11 *Tribal Sovereignty*

- A. No provision of this Agreement will be construed by any of the signatories as abridging or debilitating any sovereign powers of the (insert name of Tribe) Tribe; affecting the trust-beneficiary relationship between the Secretary of the Interior, Tribe, and Indian landowner(s); or interfering with the government-to-government relationship between the United States and the Tribe.

SC-19 – Add the following new Article 19 immediately after Article 18

ARTICLE 19 – FEDERAL REQUIREMENTS

19.01 *Agency Not a Party*

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

19.02 *Contract Approval*

- A. Owner and Contractor will furnish Owner's attorney such evidence as required so that Owner's attorney can complete and execute the "*Certificate of Owner's Attorney*" before Owner submits the executed Contract Documents to Agency for approval.
- B. Agency concurrence is required on both the Bid and the Contract before the Contract is effective.

19.03 *Conflict of Interest*

- A. Contractor may not knowingly contract with a Supplier or Manufacturer if the individual or entity who prepared the Drawings and Specifications has a corporate or financial affiliation with the Supplier or Manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest

or other interest in or a tangible personal benefit from the Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or Subcontractors.

19.04 *Gratuities*

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

19.05 *Small, Minority and Women's Businesses*

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor will take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps will include:
 - 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;
 - 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.

19.06 *Anti-Kickback*

- A. Contractor shall comply with the Copeland Anti-Kickback Act (40 USC 3145) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or Subcontractor shall

be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

19.07 *Clean Air Act (4. U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended*

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (43 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

19.08 *Equal Employment Opportunity*

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

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

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

19.10 *Environmental Requirements*

- A. When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions.
 - 1. *Wetlands* – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
 - 2. *Floodplains* – When disposing of excess, spoils, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.

3. *Historic Preservation* – Applicants shall ensure that Contractors maintain a copy of the following inadvertent discovery plan onsite for review:
- a. If during the course of any ground disturbance related to any Project, any post review discovery, including but not limited to, any artifacts, foundations, or other indications of past human occupation of the area are uncovered, shall be protected by complying with 36 CFR § 800.13 (b)(3) and (c) and shall include the following:
 - i. All Work, including vehicular traffic, shall immediately stop within a 50 ft. radius around the area of discovery. The Contractor shall ensure barriers are established to protect the area of discovery and notify the Engineer to contact the appropriate RD personnel. The Engineer shall engage a Secretary of Interior (SOI) qualified professional archeologist to quickly assess the nature and scope of the discovery; implement interim measures to protect the discovery from looting and vandalism; and establish broader barriers if further historic and/or precontact properties, can reasonably be expected to occur.
 - ii. The RD personnel shall notify the appropriate RD environmental staff member, the Federal Preservation Officer (FPO), and State Historic Preservation Office (SHPO) immediately, Indian tribe(s) or Native Hawaiian Organization (NHOs) that have an interest in the area of discovery shall be contacted immediately. The SHPO may require additional tribes or NHOs who may have an interest in the area of discovery also be contacted. The notification shall include an assessment of the discovery provided by the SOI qualified professional archeologist.
 - iii. When the discovery contains burial sites or human remains, the Contractor shall immediately notify the appropriate RD personnel who will contact the RD environmental staff member, FPO, and the SHPO. The relevant law enforcement authorities shall be immediately contacted by onsite personnel to reduce delay times, in accordance with tribal, state, or local laws including 36 CFR Part 800.13; 43 CFR Part 10, Subpart B; and the Advisory Council on Historic Preservation’s Policy Statement Regarding treatment of Burial Sites, Human Remains, or Funerary Objects (February 23, 2007).
 - iv. When discovery contains burial sites or human remains, all construction activities, including vehicular traffic shall stop within a 100 ft. radius of the discovery and barriers shall be established. The evaluation of human remains shall be conducted at the site of discovery by a SOI qualified professional. Remains that have been removed from their primary context and where that context may be in question may be retained in a secure location, pending further decisions on treatment and disposition. RD may expand this radius based on the SOI professional’s assessment of

the discovery and establish broader barriers if further subsurface burial sites, or human remains can reasonable be expected to occur. RD, in consultation with the SHPO and interested tribes or NHOs, shall develop a plan for the treatment of native human remains.

- v. Work may continue in other areas of the undertaking where no historic properties, burial site, or human remains are present. If the inadvertent discovery appears to be a consequence of illegal activity such as looting, the onsite personnel shall contact the appropriate legal authorities immediately if the landowner has not already done so.
 - vi. Work may not resume in the area of the discovery until a notice to proceed has been issued by RD. RD shall not issue the notice to proceed until it has determined that the appropriate local protocols and consulting parties have been consulted.
 - vii. Inadvertent discoveries on federal and tribal land shall follow the processes required by the federal or tribal entity.
4. *Endangered Species* – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.
5. *Mitigation Measures* – The following environmental mitigation measures are required on this project: (Insert mitigation measures from the Letter of Condition here).

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

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor will comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor will compute wages every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic will be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, contracts for transportation or transmission of intelligence.

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

- A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance

with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

19.13 *Procurement of Recovered Materials*

- A. The Contractor will comply with 2 CFR Part 200.322, "Procurement of Recovered Materials".

19.14 *American Iron and Steel*

- A. Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A – Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Material.
- B. The following waivers apply to this Contract:
 - 1. *De Minimis*,
 - 2. Minor Components,
 - 3. Pig iron and direct reduced iron, and
 - 4. (add project specific waivers as applicable).

EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	
Notes				
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.			
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.			
Key				
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies			
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)			
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version 2020 or later compatible with Bluebeam Revu 2020			
DWG	Autodesk® AutoCAD .dwg format Version 2020			
DOC	Microsoft® Word .docx format Version 365			
EXC	Microsoft® Excel .xls or .xml format Version 365			
DB	Microsoft® Access .mdb format Version 365			

EXHIBIT B—FORESEEABLE BAD WEATHER DAYS

Month	Number of Foreseeable Bad Weather Days in Month Based on Precipitation as Rain Equivalent (inches) (1)	Ambient Outdoor Air Temperature (degrees F)	
		Number of Foreseeable Bad Weather Days in Month Based on Low Temperature (at 11:00 a.m.)	Number of Foreseeable Bad Weather Days in Month Based on High Temperature (at 3:00 p.m.)
January	2	2	0
February	2	1	0
March	2	0	0
April	2	0	0
May	2	0	0
June	2	0	0
July	2	0	3
August	2	0	1
September	1	0	0
October	1	0	0
November	1	0	0
December	2	0	0

Notes:

1. Two inches of sleet equal one inch of rain. Five inches of wet, heavy snow equal one inch of rain. Fifteen inches of “dry” powder snow equals one inch of rain.

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PREVAILING WAGE RATES

**STATE OF MARYLAND
DIVISION OF LABOR AND INDUSTRY
HIGHWAY RATES – JANUARY 2024**

**“APPLICABLE WAGE RATES WILL BE
UPDATED WHEN FINAL ADDENDUM IS ISSUED”**

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INFORMATIONAL WAGE RATES

The wage rates listed below are published by the State of Maryland, Division of Labor and Industry, Prevailing Wage Unit.

The wage rates posted on this site are provided for **informational** purposes ONLY.

The wage and fringe rates may change between the time of issuance of the wage determinations and the award of the public works contract. Therefore, prior to the award of the public works contract, verification must be made with the public body, to insure that the rates contained in this determination are still prevailing.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds \$250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

FREDERICK COUNTY	HIGHWAY CONSTRUCTION				Print Date Jan 05, 2024
CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT	
CARPENTER	AD	\$33.21		\$14.03	
CARPENTER - SHORING SCAFFOLD BUILDER	AD	\$33.21		\$14.03	
CEMENT MASON	AD	\$27.54	031	\$6.87	
DRYWALL - SPACKLING, TAPING, & FINISHING	AD	\$33.21	031	\$14.03	
IRONWORKER - STRUCTURAL	AD	\$42.36		\$34.46	
LABORER - AIR TOOL OPERATOR	AD	\$29.15		\$8.82	
LABORER - ASPHALT PAVER	AD	\$29.15		\$8.82	
LABORER - ASPHALT RAKER	AD	\$28.45		\$8.82	
LABORER - BLASTER - DYNAMITE	AD	\$29.15		\$8.82	
LABORER - BURNER	AD	\$29.15		\$8.82	
LABORER - COMMON	AD	\$28.45		\$8.82	
LABORER - CONCRETE PUDDLER	AD	\$28.45		\$8.82	
LABORER - CONCRETE SURFACER	AD	\$29.15		\$8.82	
LABORER - CONCRETE TENDER	AD	\$28.45		\$8.82	
LABORER - CONCRETE VIBRATOR	AD	\$28.45		\$8.82	
LABORER - DENSITY GAUGE	AD	\$28.45		\$8.82	
LABORER - FIREPROOFER - MIXER	AD	\$28.45		\$8.82	
LABORER - FLAGGER	AD	\$28.45		\$8.82	
LABORER - GRADE CHECKER	AD	\$28.45		\$8.82	
LABORER - HAND ROLLER	AD	\$28.45		\$8.82	
LABORER - HAZARDOUS MATERIAL HANDLER	AD	\$29.15		\$8.82	
LABORER - JACKHAMMER	AD	\$28.45		\$8.82	
LABORER - LANDSCAPING	AD	\$28.45		\$8.82	
LABORER - LAYOUT	AD	\$28.45		\$8.82	
LABORER - LUTEMAN	AD	\$28.45		\$8.82	
LABORER - MASON TENDER	AD	\$29.15		\$8.82	
LABORER - MORTAR MIXER	AD	\$28.45		\$8.82	
LABORER - PIPELAYER	AD	\$29.15		\$8.82	
LABORER - PLASTERER - HANDLER	AD	\$28.45		\$8.82	
LABORER - SCAFFOLD BUILDER	AD	\$29.15		\$8.82	
LABORER - TAMPER	AD	\$28.45		\$8.82	

MILLWRIGHT	AD	\$37.65	033	\$14.86
PAINTER - BRIDGE	AD	\$42.93		\$15.58
POWER EQUIPMENT OPERATOR - BACKHOE	AD	\$32.20		\$12.85
POWER EQUIPMENT OPERATOR - BOOM TRUCK	AD	\$34.77	033	\$9.97
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	AD	\$29.24		\$12.85
POWER EQUIPMENT OPERATOR - BULLDOZER	AD	\$32.20		\$12.85
POWER EQUIPMENT OPERATOR - CRANE	AD	\$40.00		\$17.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	AD	\$32.20		\$12.85
POWER EQUIPMENT OPERATOR - EXCAVATOR	AD	\$32.20		\$12.85
POWER EQUIPMENT OPERATOR - FORKLIFT	AD	\$29.24		\$12.85
POWER EQUIPMENT OPERATOR - GRADALL	AD	\$33.20	033	\$12.85
POWER EQUIPMENT OPERATOR - GRADER	AD	\$33.20	033	\$12.85
POWER EQUIPMENT OPERATOR - GUARD RAIL POST DRIVER	AD	\$24.85	031	\$8.69
POWER EQUIPMENT OPERATOR - LOADER	AD	\$32.20		\$12.85
POWER EQUIPMENT OPERATOR - MECHANIC	AD	\$33.20		\$12.85
POWER EQUIPMENT OPERATOR - MILLING MACHINE	AD	\$31.46	033	\$11.51
POWER EQUIPMENT OPERATOR - PAVER	AD	\$24.00		\$7.00
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	AD	\$24.07		\$7.00
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	AD	\$29.24		\$12.85
POWER EQUIPMENT OPERATOR - SCRAPER	AD	\$31.30	033	\$12.85
POWER EQUIPMENT OPERATOR - SHOULDER MACHINE	AD	\$31.30	033	\$12.85
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	AD	\$29.24		\$12.85
POWER EQUIPMENT OPERATOR - SKIDDER	AD	\$35.81	033	\$19.70
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	AD	\$36.30		\$14.05
STONE MASON	AD	\$43.16	033	\$20.48
TILE & TERRAZZO FINISHER	AD	\$27.68	033	\$11.83
TILE & TERRAZZO MECHANIC	AD	\$33.41	033	\$12.87
TRUCK DRIVER - DUMP	AD	\$22.50		\$7.00
TRUCK DRIVER - DUMP - ARTICULATING	AD	\$22.50		\$7.00
TRUCK DRIVER - FLATBED	AD	\$22.36	031	\$7.84
TRUCK DRIVER - LOWBOY	AD	\$28.98	033	\$9.58
TRUCK DRIVER - TACK/TAR TRUCK	AD	\$24.81		\$7.00
TRUCK DRIVER - TANDEM	AD	\$30.13	033	\$5.80
TRUCK DRIVER - TRACTOR TRAILER	AD	\$23.39		\$7.00
TRUCK DRIVER - WATER	AD	\$23.03		\$7.00

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement for bids or onsite job posting for a public work contract that exceeds \$250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

- (AD) 17-209 Annual Determination from Survey Wage Data Received
- (CH) 17-211 Commissioners' Hearing
- (CR) 17-208 Commissioners' Review
- (SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see <http://www.census.gov/datamap/fipslist/AllSt.txt>

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dllr.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

END OF REPORT

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SECTION IV

CONSTRUCTION SPECIFICATIONS

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TECHNICAL SPECIFICATIONS

Town of Emmitsburg, Maryland Water Treatment Plant Clarifier



PROFESSIONAL CERTIFICATION. I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND,
LICENSE NO. 20566, EXPIRATION DATE: 09/06/2024

JANUARY 2023

Prepared By:

RK&K

700 East Pratt Street, Suite 500
Baltimore, Maryland 21202

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TECHNICAL SPECIFICATIONS

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**SECTION 01000
GENERAL REQUIREMENTS**

PART 1 – GENERAL

1.01 USE OF GENERAL REQUIREMENTS

- A. These General Requirements of the Special Provisions are hereby made a part of the Contract.

1.02 DESCRIPTION OF WORK

A. WORK COVERED BY CONTRACT DOCUMENTS

1. The work to be done under this contract includes furnishing all labor, materials and equipment and performing all work required for the construction of the Water Treatment Plant Clarifier project complete in place, and ready to operate.
2. The Town of Emmitsburg, MD (Town) owns and operates a conventional water treatment plant (WTP) that treats surface water primarily from the Town's Rainbow Lake Reservoirs.
3. The Town desires to construct a new stand-alone clarifier facility upstream of the existing water treatment plant to provide pretreatment of the raw water prior to final treatment at the water treatment plant. The objective of the project is to clarify the raw water to increase filter run durations at the water treatment plant.
4. The work under this Contract generally includes, but is not limited to:
 - Construct a new Clarifier Facility to include two Dissolved Air Flootation (DAF) clarifier units housed within a pre-engineered building.
 - All other work required to complete the proposed improvements identified in the contract drawings and specifications.
5. The work includes all requirements to provide a fully finished and operable facility including miscellaneous items and operations as shall be indicated, shown, specified or required to complete the work in strict conformity with the Contract Documents. The work also includes all specified, indicated and shown mechanical and electrical equipment, appliances, appurtenances, furnishings, instrumentation and controls, accessories, tests and sundry parts and material as shall be necessary and required for a completely operable installation satisfactory to the Engineer.

6. The Drawings and written Contract Documents are intended to indicate as clearly as practicable the work to be done. The Contractor must realize, however, that construction details cannot always be accurately anticipated and that in executing the work, field conditions may require reasonable modifications in the details of the Drawings and the work involved. Work under the Contract shall be carried out to meet these field conditions to the satisfaction of the Engineer and in strict conformance with his instructions, the Drawings, the Specifications, and conditions and covenants of the Contract Documents in accordance with their true intent and full meaning.

1.03 NOT USED

1.04 BORINGS AND TEST PITS

- A. A geotechnical investigation consisting of two soil borings and a geotechnical engineering report was performed for this project. The locations of the borings are identified on the contract drawings and a copy of the geotechnical engineering report prepared by Findling, Inc. dated December 1, 2021 is included under Appendix A of these specifications. Neither the Town nor the Engineer warrants or guarantees the subsurface conditions and/or materials that will be encountered in the prosecution of the work and/or any part thereof.
- B. All known subsurface lines, pipes, conduits and structures are shown on the plans and profiles. These lines are shown based upon the best available plans and maps. The locations have not been verified by test pits and the Town assumes no responsibility for the accuracy of the Drawings. In any area where the Contractor must make connections to or cross existing lines, it shall be his responsibility to test pit the lines and verify the locations to his satisfaction. In the event that lines are not found located as shown on the plans, the Contractor shall notify the Engineer so that an evaluation can be made as to the magnitude and methods of any adjustments in the plans.
- C. The Contractor shall be solely responsible for all damage to underground or aboveground lines encountered in any manner during construction. When crossing and working in the vicinity of existing lines, it shall be the Contractor's responsibility to properly support and maintain the operation of the lines. Extreme care must be exercised in excavation and backfill operations. The Contractor shall correct, at his own expense, all damage caused to existing lines.

1.05 INTERFACE WITH EXISTING FACILITIES

- A. The Contractor's attention is directed to the fact that the existing raw water pipeline is an integral component of the Water Treatment Plant. The treatment plant must be maintained in continuous operation at all times during the course of work under this contract, except for the shutdown periods permitted under the conditions described in this section.

1.06 COORDINATION OF TRADES

- A. Where the work of any trade will be installed in close proximity to the work of other trades, or where there is evidence that the work of any trade will interfere with the work of other trades, the Contractor shall work out space allocations to make satisfactory adjustment. If so ordered by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale, not less than ¼-inch equals one foot, clearly showing how work is to be installed in relation to the work of other trades. If the Contractor permits any work to be installed before coordinating with the various trades or so as to cause interference with the work of other trades, he shall make necessary changes in the work to correct the condition without extra cost to the County.
- B. The Contractor shall arrange that each trade determine 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.

1.07 PRECONSTRUCTION CONFERENCE

- A. Before starting the work, a conference will be held to establish procedures for coordination/interfaces, handling shop drawings and other submissions, and for the processing of applications for payment. Among those present at the conference will be the Contractor and his Superintendent, Town Representatives, and the Engineer.
- B. The Engineer will arrange for and organize the preconstruction conference.
- C. The purpose of the conference is to designate responsible personnel and establish lines of communication. Matters requiring coordination will be discussed and procedures for handling such matters established. The preliminary agenda will include:
 - 1. Contractor's Progress Schedule and Schedule of Values
 - 2. Transmittal, review and distribution of Contractor's submittals
 - 3. Maintaining record documents
 - 4. Critical work sequencing
 - 5. Field decisions and change orders
 - 6. Use of premises, office and storage areas, security, housekeeping and the Town's needs
 - 7. Major equipment deliveries and priorities
 - 8. Contractor's assignments for safety and first aid
- D. The Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

1.08 PROGRESS MEETINGS

- A. Project progress meetings will be held monthly to review the progress and schedule of the work. The Contractor shall make his Project Manager and Field Superintendent available for said progress meetings and to meet the Town and Engineer on-site.

1.09 AUTHORITY OF FACILITY SUPERINTENDENT

- A. The Water Treatment Plant (WTP) Superintendent is responsible for the public health and safety of Town plant personnel, the security of the plant property and compliance with the facility. He exercises sole authority over plant personnel and, may as required, control the conduct of the Contractor's forces by request to the Engineer.
- B. The WTP Superintendent has the authority to modify or stop operations of the Contractor's work forces which might cause contamination of the plant water supply or interfere with plant processes. Such orders will be relayed through the Engineer except in case of an emergency.
- C. The WTP Superintendent will not direct the Contractor or his work forces in areas of the Contractor's responsibility for construction, workmanship and progress of work or changes in contract scope. Such direction if and as appropriate will be provided solely by the Engineer.
- D. All requests by the Contractor for operation of valves, gates, pumps or other plant equipment will be coordinated by the WTP Superintendent or his designated representative through the Engineer.

1.10 ADDITIONAL MATERIAL AND/OR EQUIPMENT

- A. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting his work and shall arrange his work accordingly, providing such fittings, valves, transitions, pull or junction boxes, and accessories as may be required to meet such conditions, at no additional cost to the County.

1.11 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 equipment as are required to complete the installation.

1.12 EQUIPMENT UNIFORMITY

- A. All pumps, valves and other multiple-unit equipment within its use category shall be the product of a single manufacturer.

1.13 SPARE PARTS AND TOOLS

- A. Spare parts shall be provided as specified in the various sections of the Special Provisions. Spare parts lists and books 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.
- 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 Town, and shall place them in the storage areas designated by the Town. 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 written instructions necessary for the proper care of spare parts in storage.

1.14 NOT USED

1.15 NOT USED

1.16 NOT USED

1.17 CERTIFICATION OF MATERIALS AND INSTALLATIONS

- A. The Contractor shall furnish certification from each manufacturer, or from an approved testing laboratory, that all material used in the work is in accordance with these and all referenced specifications. Upon completion of the work, and before acceptance by the Town, the Contractor shall furnish the Town with a certificate from each of the manufacturers that the equipment and material furnished by him has been erected and installed in a satisfactory manner and is ready for continuous service and operation.
- B. Machinery and equipment for which manufacturer certification is specified will not be accepted, nor payment made therefore, without such certification. The Engineer reserves the right, however, to reject such certification when in his judgment, equipment and materials have been improperly installed or show evidence of unsatisfactory operation.

- C. Certification shall be prepared as follows:

“Having inspected the following items of equipment (Insert here serial number and complete description of equipment) at rest and in operation, and having made all requisite service adjustments and calibrations, I hereby certify that the above listed items have been properly installed, serviced, adjusted and calibrated and are ready for continuous operation under specified conditions of service when maintained in accordance with the manufacturer’s published instructions attached hereto.”

Date

Name

- D. Certification shall be provided on the manufacturer’s letterhead.

1.18 FACILITY START-UP, DEMONSTRATION PERIOD AND OPERATOR TRAINING

- A. When specified in individual sections of these Special Provisions, upon completion of all work for a particular section, the Contractor shall furnish at no extra cost to the Town, the necessary manufacturer’s engineers, representatives, technicians, skilled labor and helpers and shall perform all startup activities as required. During startup, the manufacturer’s designated personnel shall fully inspect, test, calibrate, lubricate, operate and certify the equipment for which they are responsible.
- B. When a manufacturer’s representative is not required to perform startup activities for a particular piece of equipment, the Contractor shall perform any required startup activities in strict accordance with the manufacturer’s instructions.
- C. If the Operation and Maintenance Manuals specified hereinafter are not available at the time of the startup, the Contractor shall provide one copy of the manufacturer’s operating literature for each system or item of equipment. Installation and operating sheets or booklets normally shipped with equipment may be used for this purpose.
- D. Prior to starting up and operating any and all equipment installed, the Contractor shall notify the Town. All lubrication and starting up of the equipment shall be done in the presence of and to the complete satisfaction of authorized representatives of the Town, and in accordance with all manufacturer’s recommendations.
- E. The Contractor shall schedule the startup for a time mutually agreeable with the Engineer and the Town, and shall provide a minimum of one week notice prior to the desired date.
- F. Prior to beginning the 30-day demonstration period, the Contractor shall complete the following:
1. All shop drawings shall be submitted and approved.
 2. All equipment Warranty and Certification Forms and manufacturer’s certifications shall be completed and submitted, and all witness testing conducted and completed as required.
 3. All startup activities shall be completed.

4. All test reports shall be submitted and approved.
 5. All project photographs shall be submitted.
 6. All Operation and Maintenance Manuals shall be submitted and approved.
 7. A final walk-through of the facility shall be conducted by the Contractor with the Town and Engineer in order to generate the Deficiency List for the project. Provide the Town and Engineer two weeks notice prior to the desired date.
 8. Any items on the Deficiency List that are designated as requiring completion prior to the 30-day demonstration period shall be completed.
 9. Any item on the Deficiency List not designated as requiring completion prior to the 30-day demonstration period shall be completed prior to the end of the 30 –day demonstration period.
 10. All spare parts shall be delivered to the Town, and signed receipts submitted for record.
 11. All SCADA communications between the new Chemical Building and the control room located in the main WTP building shall be installed and fully operational.
 12. The site shall be thoroughly cleaned, and any finishes requiring touchup shall be completed.
 13. The 14-day reliability test specified in Division 16 shall be completed and approved by the County and the Engineer.
- G. After all the above items have been successfully completed, the Contractor shall receive notice from the Town that he may begin the 30-day demonstration period.
- H. During the 30-day demonstration period, the Contractor shall conduct all required training for the newly installed equipment. Training activities shall be performed separately from manufacturer’s startup activities, and shall be held on separate days unless approved otherwise. Coordinate schedule of training with County and provide a minimum of two weeks notice for each session.
- I. If problems occur during the 30-day demonstration period that are designated by the Town and Engineer to be of significant magnitude, the problems shall be satisfactorily corrected, and the 30-day demonstration period shall restart from the beginning.
- J. After Successful completion of the 30-day demonstration period, as shall be at the sole discretion of the Engineer, all required training, all Deficiency List work, and all final cleanup, the Contractor shall schedule a follow up walk-through with the Town and Engineer to verify compliance with all requirements.

1.19 MATERIAL SAFETY DATA SHEETS

- A. The Contractor shall submit to the Engineer a Material Safety Data Sheet (MSDS) for all materials brought onto the site. All MSDS sheets will be in a clearly labeled binder (MSDS Sheets) in alphabetical order and turned over to the Engineer. The Engineer will place the MSDS Sheets in a location so that all personnel have access to the information.

1.20 WORKING AREA

- A. The Contractor shall not occupy with men, tools, equipment, or materials any part of the WTP property outside of the designated areas shown on the Drawings or established by the Engineer and the Town.

1.21 CONTRACTOR STORAGE AREA

- A. A storage area has been assigned on the plant site, as generally shown on the Drawings, for use by the Contractor for storage of his materials, tools, equipment, and other items necessary for construction. The exact limits of the areas will be designated in the field by the Engineer. The Contractor shall be fully responsible for the security of this area, including fencing, watchmen, and other means of security. Under no circumstances will the Town be responsible for the security of any property belonging to the Contractor, his subcontractors, or any of his work force.
- B. The Contractor shall not use any portion of the plant site for storage of his property, except as specified.
- C. The Contractor shall grade and stabilize a portion of the assigned storage area for a temporary mobilization and parking area for his use during the contract period and shall restore the entire storage area to its original condition upon completion of the project.

1.22 NOT USED

1.23 CONFINED SPACE REQUIREMENTS

- A. The Contractor shall follow all confined space procedures in accordance with the Contractor's confined space program.
- B. A copy of the Contractor's confined space program shall be submitted to the Engineer for information purposes at the pre-construction meeting.

1.24 WORKING HOURS

- A. Work shall be performed according to and completed within the contract time stipulated in the Proposal, including weekends and holidays. The contract time stated herein shall include the time needed by the Contractor for preparation and approval of shop drawings and procurement and assembly of equipment and materials as well as construction Work.
- B. Work shall be limited to weekdays (Monday through Friday) and shall commence no earlier than 7:00 A.M. nor proceed later than 5:00 P.M. The Contractor shall obtain prior written approval from the Engineer to conduct work outside this timeframe for Work that requires existing plant shutdown. During plant shutdown periods, the Contractor may work modified periods and times as approved by the Engineer to

complete the Work within the limited shutdown duration. Work is subject to other limitations in this contract.

- C. No work requiring the presence of the Engineer or an Inspector will be permitted on Sunday, on legal County holidays, or on County designated Service Reduction Days, except in cases of emergency, and then only to such extent as is absolutely necessary and with written permission of the Engineer.
- D. In case the Contractor desires to work on any Saturday, Sunday or legal holiday, he shall so inform the Engineer in writing at least two full work days in advance. He shall indicate the nature of the emergency, his desire to work and the location at which work will be conducted.

1.25 SCHEDULE OF VALUES

- A. In order to determine the amount of the monthly estimate, the successful Contractor shall furnish a complete breakdown of his total bid, also referred to as a Schedule of Values. The Contractor shall furnish this information within ten (10) days after receipt of Notice-to-Proceed. The breakdown will, in general, follow the outline of the specification items. Upon approval by the Engineer, the breakdown shall be the basis for calculating the amount of monthly estimates specified in the Standard Specifications.

1.26 CONSTRUCTION SEQUENCING, COORDINATION AND SCHEDULING

- A. Construction shall interfere to the least extent possible with the operation of the Water Treatment Plant. As the plant is essential to the treatment of drinking water supply for Town of Warrenton, changes or disruption to the plants normal operational procedures and schedule must be avoided whenever possible to ensure compliance with water quality and production requirements.
- B. Shutdown periods permitted for connection of new equipment and facilities to existing equipment and facilities shall be as described herein. Shutdown durations shall be mutually agreed upon by the WTP Superintendent and the Contractor.
- C. The Water Treatment Plant is operational typically 16-hours every day generally between the hours of 6:00 am and 9:00 pm. The water treatment plant must remain in service during these times. Shutdowns shall be restricted to weekdays between the nighttime hours of 10:00:00 AM – 5:00 PM. All plant shutdowns shall be subject to Town approval based on system operating conditions at the time of construction.
- D. The Contractor shall submit a written request for each plant shutdown for Engineer and Town approval at least four (4) weeks in advance. Contractor submitted requests for plant shutdown shall include a schedule and written detailed description of the proposed construction procedures to occur 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.

- E. In order to reduce each shutdown period to a minimum, the Contractor shall, prior to each shutdown request expedite the 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. Insofar as possible, equipment and facilities shall be tested and in operating condition before the final tie-ins are made which connect new equipment and facilities to existing equipment and facilities.
- G. If work during any shutdown period is not done satisfactorily, or as planned, or within the maximum time allocated, or if operation is adversely affected, the Town may order the Contractor to place the facility or operation back in service and reschedule the work. The Town may order the work required to place the facility or operation back in service to be completed with other forces at the Contractor's expense.
- H. The Contractor shall prepare a project schedule in Gantt Chart format which indicates the critical path. The schedule shall indicate when the shop drawing submittal list will be submitted. The schedule shall reflect the following requirements and constraints, which was developed to enable water treatment to be maintained to the maximum extent possible during construction.

1.27 PHOTOGRAPHIC REPORTS

- A. The Contractor shall submit each month during construction not less than ten (10) 8" x 10" digital photographs (color prints and electronic files) to the Town, as outlined and stipulated hereinafter. All color prints shall have a 2" x 3" label in the lower right corner with the contract number, job name, Owner's name, Engineer's name, date and a short description.
- B. The Town, or its representative, shall have the right to designate the origin points of the photographs and the desired scope or perception of the photographs which are intended to give a complete picture of the status of the project. The photographs shall be taken by a person or firm experienced in such work and approved by the Engineer.
- C. The cost of the aforementioned will not be a pay item, but shall be included in the lump sum price bid and no additional compensation to the Contractor will be considered.

1.28 NAMEPLATES

- A. The Contractor shall provide and install corrosion-resistant metal nameplates, with data engraved or stamped, for permanent attachment on all equipment. The data shall include the manufacturer, product name, model number, serial number, capacity, size, operating and power characteristics, and other essential data, as applicable for the particular equipment. The nameplates shall be permanently

fastened to the equipment in a location that is accessible and visible, in a manner suitable for the particular equipment.

- B. In addition to the manufacturer's nameplates, all equipment, including such items as unit heaters, fans, pumps, compressors, tanks, etc. shall be permanently identified by name and number corresponding to the as-built drawings with nameplates which shall be engraved and laminated black-on-white finish phenolic nameplates. Data and installation shall be approved by the Engineer. Nameplate letters shall be minimum 2-inch high etched white letters and beveled white trim. Nameplates for motor control center, and control and metering or instrument panels shall be provided with 3/8-inch high letters. Motors shall be identified by the same number as the driven unit. Identifying characters shall be not less than 2-inches high and shall be painted. Decals, Rotex, or Dymo field applied labels will not be acceptable. All nameplate data shall be reproduced in the Operating and Maintenance Manuals.
- C. The Contractor shall provide Department of Transportation (DOT) Hazardous Information Placards conforming to the National Fire Protection Association (NFPA) Code No. 704M and Federal Standard 313. One placard each (two total) shall be installed in easily visible locations as directed by the Engineer on the exterior of the Filter Building and the Chemical Building. Placards shall be made of premium outdoor grade vinyl, 10 ¾ inch square and indicate following hazards:
- | | | |
|---------------------------|-----|----------------------|
| Fire Hazard (red) = | 0 | (Will not burn) |
| Health Hazard (blue) = | 1 | (Slightly hazardous) |
| Reactivity (yellow) = | 0 | (Stable) |
| Specific Hazard (white) = | OXY | (Oxidizer) |
- D. The Contractor shall provide the building nameplate sign "**CHEMICAL BUILDING**" to be installed on the exterior of the Chemical Building. Specific location shall be as directed by the Engineer. Building nameplate sign shall be white and shall match the existing building sign on the Filter Building in size, material, font and appearance.

1.29 OPERATION OF EXISTING VALVES

- A. Any existing valves that need to be operated during the course of construction shall be operated by County personnel only. The Contractor shall notify the Town a minimum of one week prior to the date for operation of the valves.

1.30 MEASUREMENT AND PAYMENT

A. GENERAL

Measurement and payment shall be in accordance with General Provision GP-9. Work completed under this Contract will be made at the lump sum and unit prices bid as shown on the Proposal and as described in this section. Except where a specific unit price bid item is provided for in the Proposal, all work shall be included in the lump sum items shown. The absence from the Proposal form of bid items

specifically described in the Contract Documents shall be interpreted as meaning that the cost of any such work contemplated by the Contract Documents shall be included in the lump sum prices bid. The Total Bid Amount shall include all lump sum bid items and contingency items.

The method of measurement and payment described in this section supersedes the "METHOD OF MEASUREMENT" and "BASIS OF PAYMENT" portion of each section in the Standard Specifications Divisions 1 through 10, unless specifically noted otherwise. Thereby, DELETE the provisions of "METHOD OF MEASUREMENT" and "BASIS OF PAYMENT" from each section of the Standard Specifications in Divisions 1 through 10, unless specifically noted otherwise.

The lump sum and unit prices shall include the furnishing of all labor, tools, equipment, materials and services and the performance of all work required to complete the Contract as indicated and specified in accordance with all requirements of the Contract Documents and to the satisfaction of the Engineer.

B. BID OR PROPOSAL PAYMENT ITEMS

Item No. 1 – Mobilization

1. Mobilization shall be as specified in Section 01100 of the Standard Specifications.
2. Payment for work completed under this item will be made at the lump sum price bid for Item No. 1 – "Mobilization" on the Proposal

TO BE COMPLETED

PART 2 – PRODUCTS

(NOT USED)

PART 3 – EXECUTION

(NOT USED)

END OF SECTION 01010

**SECTION 01300
SUBMITTALS**

PART 1 - GENERAL

1.01 DESCRIPTION

This Section includes general requirements and procedures related to the Contractor's responsibilities for preparing and transmitting Submittals to the Engineer to demonstrate that the performance of the Work will be in accordance with the Contract requirements. Submittals include Samples, Manuals, Methods of Construction, and Record Drawings. Other requirements for submittals are specified under applicable sections of the Contract Documents.

1.02 SUBMITTAL REQUIREMENTS

- A. Within 10 days after the date set forth in the Notice to Proceed, submit a Construction Schedule.
- B. Submittals shall be scheduled and coordinated with the Contractor's Construction Schedule.
- C. A complete submittal schedule and list of required submittals shall be submitted with the first submittal but not later than 20 days after the Notice to Proceed. The schedule for submission of submittals shall be arranged so that related equipment items are submitted concurrently.
- D. Procedure for submittals concerning substitutions shall be as stated in Section 01600.
- E. Transmit all submittals to: Rummel, Klepper & Kahl, LLP, 700 E. Pratt Street, Suite 500, Baltimore, Maryland 21202.

1.03 CONTRACTOR'S DRAWINGS

A. Shop Drawings

Shop drawings shall show types, sizes, accessories, layouts including plans, elevations and sectional views, component, assembly and installation details, and all other information required to illustrate how applicable portions of the Contract requirements will be fabricated and/or installed. In case of fixed mechanical and electrical equipment, layout drawings drawn to scale, shall be submitted to show required clearances for operation, maintenance and replacement of parts. Include manufacturer's certified performance curves, catalog cuts, pamphlets, descriptive literature, installation and application recommendations, as required. Additional shop drawings and information required for electrical and mechanical equipment will be listed in appropriate Specification Sections. Shop drawings for continually furnished items such as pipe, fittings, valves, precast structures and metal work will be waived provided the Contractor submits a letter naming the manufacturer who will furnish

these items and provided this manufacturer has on file a certified standard drawing containing the above information which has been approved by the Engineer. If the Standard Details or Specifications change, new submittals will be required.

B. Catalog Data

Manufacturer's catalog, product and equipment data shall be certified and shall include materials type, performance characteristics, voltage, phase, capacity, and similar data. Provide wiring diagrams when applicable. Indicate catalog, model and serial numbers representing specified equipment. Provide complete component information to verify all specified required items.

C. Working Drawings

1. Submit working drawings as required for changes, substitutions, contractor design items, and Contractor designed methods of construction. Requirements for working drawings will be listed in appropriate Specification Sections. Drawings shall be accompanied by calculations or other information to completely explain the structure, machine or system described and its intended use. Review and approval of such drawings by the Engineer shall not relieve the Contractor from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor and the Engineer shall have no responsibility therefore.
2. Working drawings and calculations as submitted shall be sealed, dated and signed by a Professional Engineer registered in the State of Virginia.

D. Method of Construction

When so specified or directed by the Engineer, submit proposed method of construction for specific portions of the Work for review and approval. This submittal shall include detailed written description of all phases of the construction operation to fully explain to the Engineer the proposed method of construction. If required by the Specifications, submit working drawings to supplement description. Review and approval by the Engineer will be in accordance with approval process herein and shall not relieve the Contractor from his responsibility with regard to fulfillment of the terms of the Contract. All risks associated with the proposed method remain the Contractor's responsibility and the Engineer shall have no responsibility therefore. After review and approval, if, in the opinion of the Contractor, modifications are necessary, submit such modifications in detail including reasons for the modifications. Modifications shall not be implemented without review and approval by the Engineer.

E. Manufacturer's Installation Recommendations

Manufacturer's installation recommendations and instructions shall provide written detail, step-by-step preparation and installation of the materials, and products including recommended tolerances and space for maintenance and operation.

F. Submittal Process

1. General

Each Contractor's drawing submitted by the Contractor shall be accompanied by a transmittal letter and the shop drawing shall have affixed to it the following Contractor's Stamp, signed by the Contractor:

Statement:

_____ (Contractor's name) represents that we have determined and verified all field dimensions and measurements, field construction criteria, materials, catalog numbers, and similar data, and that we have checked and coordinated such submittals with the requirements of the work and the contract documents.

By: _____ Date: _____

2. Identification

With the first submittal, submit a Contractor's drawing submittal schedule, listing as near as practicable by Specification Section number, all submittals required and approximate date submittal will be forwarded. All submittals for approval shall have the following identification data, as applicable, contained thereon or permanently adhered thereto.

- a. Project Name
- b. Submittal Numbers. Number sequentially as submitted. Resubmittals shall bear original submittal number and be lettered sequentially.
- c. Product identification
- d. Drawing Title, Drawing Number, Revision Number, and date of drawing and revision.
- e. Applicable Contract Drawing Numbers and Specification Section and Paragraph Numbers.
- f. Subcontractor's, Vendor's and/or Manufacturer's Name, Address and Phone Number.
- g. Contractor's Certification Statement.

For catalog product data or brochures submitted in packages of multiple items need the identification only on the exterior. In such instances the identification shall include page and catalog item numbers for items submitted for approval. If one or more of the items in such a submittal are not approved, resubmittal of only the unapproved items is required. Catalog, product data or brochures containing various products, sizes and materials shall be highlighted to show the particular item being submitted. Likewise, items not applicable to the Contract shall be marked "not applicable" or

crossed out.

3. Number of Copies

For original submittal and each subsequent resubmittal that may be required, submit a minimum of five (5) legible prints each of all shop and working drawings, and catalog data, method of construction and manufacturer's installation recommendation to the Engineer for approval. The Contractor may furnish greater than the minimum if required for subcontractors and vendors.

4. Approval Process

Each submittal shall be in accordance with the Contractor's drawings submission schedule. Allow 20 working days for checking and appropriate action by the Engineer.

Contractor's drawings will be returned, stamped with one of the following classifications:

REVIEWED: no corrections, no marks

REVIEWED AS NOTED: a few minor corrections. All items may be fabricated as marked without further resubmission.

RESUBMIT: Resubmit drawings as per original submission with corrections noted. Allow 10 working days for checking and appropriate action by the Engineer.

REJECTED: requires corrections or is otherwise not in accordance with the Contract Documents. No items shall be fabricated. Correct and resubmit drawings as per original submission. Allow 10 working days for checking and appropriate action by the Engineer.

1.04 SAMPLES

A. General

As soon as practicable after the Notice to Proceed, submit samples required by the Specifications or requested by the Engineer. Unless otherwise specified, the original submittal shall be one (1) sample of each item. Approval shall be obtained prior to delivery of the material to the Contract site. Such samples shall be representative of the actual material proposed for use in the project and of sufficient size to demonstrate design, color, texture, and finish when these attributes will be exposed to view. If samples deviate from the Contract Documents, the Contractor, shall so advise the Engineer in writing with the submittal and state the reason therefore.

B. Identification

1. Each sample shall have the following identification data permanently attached.

- a. Contract Number
- b. Project Name
- c. Product Identification
- d. Applicable Contract Drawing and Specification Section Number
- e. Subcontractor's, Vendor's and/or Manufacturer's Name, Address and Phone Number

2. Mail under separate cover a letter submitting each shipment of samples containing the identification information listed herein. Enclose a copy of this letter with the shipment.

C. Approval Process

To enable the Engineer to take appropriate action and/or testing, 20 working days will be allowed for sample approval. Certain samples may be tested for specified requirements by the Owner before approval is given. Failure of a sample to pass such tests will be sufficient cause for refusal to consider further samples of the same brand and make of that material. Rejected samples will be returned upon request and any or all resubmittals required shall consist of three new samples and an additional 20 days. Only one test of each sample proposed for use will be made at the expense of the Owner. When originally submitted sample fails, retesting of additional samples will be made by the Owner at the expense of the Contractor. Upon approval, one sample so noted will be returned and the remainder will be retained by the Engineer until completion of the Work. When requested, all approved samples will be returned for installation provided their identity is maintained in approved manner until Final Acceptance of the Project.

Samples of various material or equipment delivered to the site or during placement may be taken by the Engineer for testing. Samples failing to meet Contract requirements will automatically void previous approvals and resubmittal of samples will be required.

1.05 RECORD DRAWINGS (AS-BUILTS)

- A. The Contractor shall provide record drawings for all work performed and keep one record copy of all Contract Documents, at the site in good order and annotated to show all revisions made during construction. Such annotations shall be kept current and are subject to unannounced review by the Engineer and Owner. Failure to maintain current record drawings will be cause to delay progress payments. Record drawings shall be available to the Engineer at all times during the life of the Contract. Upon request, the Engineer will provide one set of reproducibles of the original Contract Drawings and a sample record drawing showing required style and quality, for this purpose.

All drawings shall be made a part of the record drawings and shall include the following:

1. Contract Drawings

Annotate or redraft, as required, to show all revisions, substitutions,

variations, omissions and discrepancies made or discovered during construction concerning location and depth of utilities, piping, conduits, pumps, valves, vaults and other equipment. Revisions shall be made and shown on all drawing views with actual dimensions and elevations established to permanent points.

2. Working Drawings

Same as requirements for contract drawings, when working drawings are required. Include, for example, actual layouts of conduit runs between various items of electrical equipment for power, control and instrumentation; wire sizes, numbers and functions; configuration of conduits; piping layouts; and duct layouts. Sections and details shall be added as required, for clarity. Drawings of motors, control centers and other equipment shall be revised to show actual installations.

Prior to preliminary inspection, furnish a reproducible of the record drawings to the Engineer. At the completion of the Contract and before final payment is made, furnish the Owner and Engineer one set of reproducibles of the record drawings reflecting all revisions herein described.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. Furnish Operation and Maintenance Manuals for all equipment and systems to the Owner. Two preliminary copies shall be provided no later than the date of equipment shipment. The final copies shall be provided prior to equipment startup.

Six (6) copies of each manual shall be provided. A separate manual shall be furnished for each piece of equipment and/or system. The manual shall include complete information necessary to operate, maintain and repair the specific equipment and/or system furnished under this Contract and shall include the following specific requirements:

1. Contents:

- Table of Contents and Index
- Brief description of the equipment/system and principal components
- Starting and stopping procedures both normal and emergency
- Installation, maintenance and overhaul instructions which shall include detailed assembly drawings with parts list and numbers, and recommended spare parts list with recommended quantity, manufacturer's price, supplier's address and telephone number
- Recommended schedule for servicing including technical data sheets that indicate weights and types of oil, grease or other lubricants recommended for use and their application procedures
- One copy of each component wiring diagram and the system-wiring diagram showing wire size and identification
- One approved copy of each submittal with any changes made during construction properly noted including test certificates, characteristic curves, factory and field test results
- For electrical systems include dimensioned installation drawings,

single line diagrams, control diagrams, wiring and connection diagrams, list of material for contactors, relays and controls, outline drawings showing relays, meters, controls and indication equipment mounted on the equipment or inside cubicles, control and protective schematics and recommended relay settings

2. Material:

Covers: oil, moisture, and wear resistant 9 X 11-1/2 inches size

Pages. 32-pound paper 8-1/2 X 11 inches size with minimum of two punched holes 8-1/2 inches apart reinforced with plastic cloth or metal

Fasteners: Metal screw post or Acco metal strap type

Diagrams and illustrations, attach foldouts, as required
Legible original quality, reproduced by dry copy method.

The Operation and Maintenance Manual shall also be provided to the Town in electronic format as an Adobe Acrobat file. The document shall be searchable and "intelligent" with appropriate scanned images of the submittals as necessary.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION 01300

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SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
1. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security, and protection for this Project.
 2. Temporary construction and support facilities: Including installation, maintenance and removal are to be handled by the Contractor.

1.02 RESPONSIBILITIES

- A. Contractor shall provide the following temporary construction, utilities, facilities, and controls for the use by the Engineer.
1. Telephone service for one public phone.
 2. Field office adequate for progress meetings (and sole use of the Engineer).
 3. Temporary heat prior to building enclosure.
 4. Temporary enclosures to enclose building.
 5. Sanitary facilities including drinking water and wash facilities.
 6. Waste disposal services at building locations.
 7. Rodent and pest control.
 8. Engineering and building layout.
 9. Environmental Protection.
 10. Project Identification Sign.
- B. Contractor shall pay for electric, water, sewer and basic telephone. Utility costs for heat after building enclosure shall be paid by Contractor until the building is accepted by the Owner. Long distance and other charges in excess of basic telephone service shall be paid by entity utilizing the service.
- C. The Contractor may use the following existing facilities for which he will be back-charged by the Owner:

1. Electric and lighting. (The Contractor shall install an electric meter for the monitoring of electric used).
- D. Contractor shall provide the following:
1. Heat for the construction area after the permanent heating system is complete. Provide heating required to maintain 60°F in winter.
 2. Provide additional heat or relocate existing heat supply when existing heat is interrupted for construction.
 3. Equipment warranty not to start until building is accepted by Owner.
 4. Water service and distribution, including (site and) building.
 5. Storm and sanitary sewer connections.
 6. Protect pipes exposed during construction as required to prevent freezing.
 7. Temporary electric service to the building, including construction trailers and field office.
 8. Construction lighting where daylight is not adequate.
- E. Contractor shall be responsible for the implementation of safety programs and initiatives. These documents do not intend to define any Contractor's responsibility to safety. It is expected that the Contractor will perform their activities in a safe manner and in accordance to industry regulations including those imposed by OSHA. Similarly, these Specifications shall not be construed as defining security measures.

1.03 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility within 15 days of the date established for commencement of the work.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
 1. Building code requirements.
 2. Health and safety regulations.

3. Utility company regulations.
 4. Police, fire department and rescue squad rules.
 5. Environmental protection requirements.
- B. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to be inspected, tested or approved, the Contractor shall give the Engineer timely notice of its readiness and of the date arranged, so the Engineer may observe such inspection, testing or approval. The Contractor shall bear all costs of such inspections, test and approvals unless otherwise provided.
- C. If, after commencement of the Work, the Engineer determines that any work requires special testing, he will, upon written authorization from the Owner, instruct the Contractor to order such special testing. If such special testing reveals a failure of the work to comply (1) with the requirements of the Contract Documents, or (2) with respect to the performance of the work with laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, the Contractor shall bear all costs thereof, including Engineer's additional services made necessary by such failure; otherwise, the Owner shall bear such costs, and an appropriate supplement shall be issued.
- D. Required certificates of inspection, testing or approval shall be secured by the Contractor and promptly delivered by him to the Engineer.
- E. Neither the observations of the Engineer nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the work in accordance with the Contract Documents.

1.05 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities or permit them to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.01 ROADWAYS

- A. Existing Roadways: The Contractor shall maintain and clean, regularly, roadways, drives and parking areas within the site. Any damage caused by the use of these areas for construction purposes shall be repaired by the Contractor at his expense.
- B. Temporary Roadways: The Contractor shall construct and maintain roadways and parking areas within the site, as required, in order to provide proper access to building or structure(s). The roadways and parking areas shall be constructed in accordance with base course specified and shall be kept in a usable condition throughout the period of construction. Location(s) shall be coordinated with the Owner.

2.02 FIELD OFFICE

- A. The Contractor shall furnish and maintain, from 5 days prior to the start of work at the project site to the date of Engineer's approval of final payment, a fully operable separate temporary field office on the construction site for the exclusive use of the Engineer; said field office and equipment shall be positioned on a proper foundation at a location acceptable to the Engineer with adjacent parking space for automobiles. Provide ground surface treatment to facilitate parking and access to the field office.
- B. Cost of the temporary office, complete as hereinafter provided, including cost of heat, air conditioning, lighting and utilities shall be paid by the Contractor and included in the Contract Price.
- C. The temporary field office shall present a neat business-like appearance, be structurally sound and weathertight, and complete with windows with louvered blinds, approved sanitary facilities, ventilation, heating, air conditioning, overhead lighting, duplex wall outlets and telephone service; all satisfactory to the Engineer. A mobile type office will be acceptable. The field office shall be identified by a sign, fabricated and painted.
- D. Size of office shall be approved by Engineer as being adequate. Minimum allowable size shall be 10 ft. x 36 ft.
- E. The temporary field office shall be secured with lock and key, each entrance with one UL 40A:10B:C dry chemical fire extinguisher, and be complete with the following items of equipment and furniture for the exclusive use of the Engineer:

- One 30"x60" Steel 2-pedestal desk w/locking drawers
- One executive swivel desk chair
- One 36"x60" drafting table and swivel drafting stool w/backrest
- One 4-drawer fireproof file cabinet w/locking drawers
- One vertical plan file rack
- One Restroom
- One 36"x72" folding meeting table

- Ten folding chairs
- One water cooler with instant hot water attachment
- One refrigerator - office size
- One telephone instrument with 8 foot cord
- One full size color copy, print and scan machine on dedicated line such as Xerox Model 7346 or Equal.
- Toner cartridges
- One telephone answering message recording service that will record all telephone calls that are received when the telephone is currently in use or unattended.
- One book case, minimum four shelves.
- Provide paper towels
- F. Provide a containerized tap-dispense bottled water type drinking unit with instant hot water in field office; maintain adequate supply of bottles.
- G. Computer Hardware: Equip the field office with one MS-DOS Computer System with the following minimum requirements.
 - 1. i.7-2620M Intel Core Processor
 - 2. 4 GB RAM
 - 3. 250 GB Hard Disk
 - 4. 17" Color LCD Monitor
 - 5. 48x CD-Rom Drive
 - 6. 1 Parallel Port
 - 7. 2 Series Ports
 - 8. 2 USB Ports
 - 9. Microsoft Compatible Mouse
- H. Xerox Machine Interface Cable
- J. Software (Either the version shown or the latest version)
 - 1. Operating System: Microsoft Windows 7 Professional
 - 2. Microsoft Word
 - 3. Microsoft Excel
 - 4. Adobe Acrobat
 - 5. Mozilla Firefox
 - 6. AutoCAD 2011

- 7. Norton Internet Security
- K. Computer Supplies/Accessories
 - 1. 6-Outlet Power Strip w/Surge Protection
 - 2. Dust covers for Computer, Keyboard, and Printer
 - 3. Mouse Pad
 - 4. (4) Boxes DVD-R 4.7 GM Disks
 - 5. 8-1/2"x11" Laser Paper (2000 sheets)
- L. Computer Furniture
 - 1. 30"x72" Computer Table (typing height)
 - 2. Height-adjustable, Posture-back Swivel Computer Chair
- M. All furniture and equipment items shall be clean, serviceable, and satisfactory to the Engineer when installed in the field office. Maintenance service, or replacement, for equipment and furniture that become unserviceable during use shall be provided within 24 hours. The Contractor shall ensure a continuous supply of disks, copy and printer paper, ink, etc. for the equipment."N. The Contractor shall provide weekly janitorial service including the disposal of trash, vacuuming and/or sweeping floors, dusting tables, desks, chairs, counters, etc.
- O. Failure to provide any service/supply within the time allotted will result in the Engineer securing the needed service/supply and crediting the Contractor's Contract Price.
- P. An exterior temperature gauge shall be provided on the field office, and said gauge shall be used as official temperature in exterior work.
- Q. Equipment furnished for field office shall be returned to the Contractor at completion of project.
- R. Contractor shall maintain a separate office of his use.

2.03 TEMPORARY TELEPHONE

- A. Contractor shall have one (1) telephone installed in Engineer's field office and pay for all costs incurred, for duration of the Contract. Contractor shall provide separate telephone service for his use.
- B. Contractor will provide a dedicated service for Fax machine.

2.04 SANITARY PROVISIONS

- A. Contractor shall provide and maintain, in a neat and sanitary condition, suitable toilet accommodations for the use of persons on the Project, complying with the requirements or regulations of the governing body having jurisdiction thereof.

2.05 TEMPORARY UTILITIES AND FACILITIES

- A. The Contractor may arrange with the Owner to use existing utilities including water, heat, light and power as temporary services for the duration of the Contract.
- B. Use of electric service shall be arranged and maintained by Contractor.
- C. The Contractor shall provide extension cords and hoses for extending the existing services as required for his own use.
- D. The Owner reserves the right to terminate the use of existing facilities at any time if in the Owner's opinion the facilities are being abused.

2.06 TEMPORARY WATER SUPPLY

- A. The Contractor shall, at his own cost and expense, provide, protect and maintain an adequate non-potable water supply, for construction use on the Project during the period of construction, either by means of the permanent water supply line or by the installation of a temporary water supply.
- B. If there is a charge for water, said charge shall be paid by the Contractor.

2.07 TEMPORARY ELECTRICAL LIGHT AND POWER

- A. The Contractor shall, at his own cost and expense, install, operate, protect, have inspected and maintain a temporary electric service for construction light and power.
- B. The service to be provided, unless otherwise specifically provided, shall be a minimum 200 Amp service, single phase, three wire, 120/240 volts with fused safety switch protection and the necessary disturbing facilities and meter, if required.
 - 1. Provide electric service required for building heat during dry-in.
 - 2. All 120-volt, single phase, 15 Amp and 20 Amp receptacle outlets shall have ground fault circuit interrupter protection.
- C. The Contractor, at all times, shall provide and pay for all maintenance, servicing, operation and supervision of the service and distributing facilities necessary for maintaining temporary heat and ventilation, after same is required in the building.

2.08 TEMPORARY HEAT AND VENTILATION

- A. The temporary heat and ventilation requirements on this Project are divided into two (2) categories, i.e., (1) temporary heat and ventilation required prior to the enclosure

- of the building(s) or portions thereof, which shall be the responsibility of the Contractor, (2) temporary heat and ventilation required subsequent to the enclosure of the building(s) or portions thereof, which shall be the responsibility of the Contractor.
- B. A building or portion thereof shall be considered to be enclosed when the roof is on and tight, the exterior walls have been completed, and when openings, doors and windows are closed with permanent or temporary closures which will affect the retention of heat within the building.
- C. Prior to enclosures of building(s) or portions thereof and when weather conditions indicate the necessity for temporary heat, the Contractor shall provide, maintain, operate and pay all costs, including fuel, for a sufficient number of approved portable heaters, so the progress of the Work is not impeded and proper protection of all Work from freezing is maintained.
- D. The Contractor shall either operate the permanent heating and ventilating systems, if installed and operable, or he shall provide and operate portable heaters and portable ventilators. When the performance and protection of the Work require prolonged or continuous twenty-four (24) hour a day heat and ventilation in the building, the same shall be provided by the Contractor. The heat shall be provided to a minimum temperature of 50°F or to such higher temperature as may be required. Provide heat and ventilation for the proper installation of materials/equipment and for the proper conduct of the Work. The Contractor shall pay for and be responsible for the maintenance, operation and supervision of the heating and ventilating systems throughout the period that the heat and ventilation are needed and until final acceptance of the Project by the Owner.
1. The permanent HVAC system air handling units and related ductwork distribution system shall not be used for temporary heat in any area until the final wall finish is complete and ceiling support grid (where occurs) is in place; when carpet is being installed, the air handling units (in that and adjacent areas) shall be de-energized.
 2. The Contractor shall issue a written statement to the Engineer stating the Contractor has inspected and performed specified start-up, testing and balancing, and commissioning of the equipment and ductwork distribution system before it is put into service.
 3. Obtain written approval from the Engineer 48 hours before using the permanent HVAC system equipment and accessories for temporary heat.
- E. The Contractor shall be responsible to pay for all water, electricity and fuel required for the operation of the permanent systems for temporary heat and ventilation.
- F. All permanent heating and ventilating equipment used to supply temporary heat and ventilation shall be completed, cleaned and reconditioned by the Contractor prior to final acceptance. Traps, valves and filters used in a temporary system during the period of its operation to supply temporary heating shall not be reinstalled in the permanent system.

- G. The Contractor, at his own cost and expense, shall remove all soot, smudges and other deposits from walls, ceilings and exposed surfaces which are the result of the use of any temporary heating and ventilating equipment, including the use of the permanent heating and ventilating system for temporary purposes. He shall not do any finish work until all such surfaces are properly cleaned and cured.

2.09 ADDITIONAL VENTILATION IN OCCUPIED AREAS

- A. The Contractor shall provide and operate portable ventilators for additional ventilation under the following conditions:
 - 1. When the performance and protection of the Work require prolonged or continuous twenty-four (24) hour a day ventilation for the proper installation of materials or equipment.
 - 2. When permanent ventilation is interrupted in occupied areas.
 - 3. Whenever adhesives, thinners or other hazardous materials are used.
- B. In occupied building, notify the Owner a minimum of forty-eight (48) hours in advance of scheduled Work involving use of hazardous materials.
- C. The Contractor shall pay for and be responsible for the maintenance, operation and supervision of the portable ventilating units throughout the period until acceptance of the Project by the Owner.

2.10 PROJECT IDENTIFICATION SIGNS

- A. The Contractor shall provide and maintain project identification signs. The signs shall be erected at a location of high public visibility as directed by the Engineer. The Contractor shall obtain all necessary permits at no additional cost.
- B. Project identification sign shall be approved by Engineer for construction, graphic design, colors, and lettering and shall include:
 - 1. Title of Project
 - 2. Name of Owner
 - 3. Engineer
 - 4. Contractors
- C. Restriction of Signs: No advertising signs may be installed anywhere on the site. The Contractor's name and other information will be placed on the job sign.
- D. Remove signs upon completion of construction.
- E. The Contractor shall provide sign(s) as follows:

1. One Construction Site Sign, in accordance with Owner requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they shall serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required when requested by the Engineer.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITIES

- A. The Contractor shall furnish and install all equipment, wiring, accessories, etc. to maintain all temporary electric, telephone, gas, water and sewer utilities required for general construction, start-up, and initial operation of the plant improvements including those temporary utilities required for temporary offices of the Owner and Engineer and temporary facilities to keep the existing treatment plant in operation. Temporary utilities shall be provided throughout the construction period until Substantial Completion of the entire project. All costs for providing temporary utilities required for the general construction shall be paid by the Contractor and included in the Contract Price. The Owner will pay all utility costs associated with keeping the existing treatment plant facilities in operation during the construction period.

3.03 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Costs or use charges for temporary facilities are not chargeable to the Owner or Engineer, and will not be accepted as a basis of claims for a Change Order.

- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use. Installation, maintenance and removal are by the Contractor.
 - 1. Disinfection: Disinfect temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide waterproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switch gear. Installation, maintenance and removal, including any fees, are by the Contractor. The Contractor shall be responsible for the monthly usage costs.
- D. Temporary Lighting: Wherever overhead floor or roof deck has been installed, provide temporary lighting with local switching. Installation, maintenance and removal are by the Contractor.
 - 1. Install, maintain, and operate temporary lighting that shall fulfill security and protection requirements, without operating the entire system, and shall provide adequate illumination for construction operations and traffic conditions.
- E. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off the site in a lawful manner. Installation, maintenance and removal are by the Contractor, including any installation fees.
 - 1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
 - 2. Connect temporary sewers to the municipal system as directed by the sewer department officials.
 - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. Following heavy use, restore normal conditions promptly.
- F. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.04 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity; select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- D. Heating Facilities: Except where use of the permanent system is authorized, Contractor shall provide vented self-contained LP gas or fuel oil heaters with individual space thermostatic control. All heaters must be acceptable to the Fire Marshal.
 1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- E. Change, Storage and Fabrication Sheds: Install change, storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on the site.
- F. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best service the Project's needs. Use of pit-type toilets will not be permitted.
 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.
- G. Wash Facilities: Contractor shall install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition, except asbestos removal.
 1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
- H. Temporary Enclosures: Provide temporary enclosure for protection of construction and existing building from exposure to inclement weather.

1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Install tarpaulins securely with incombustible wood framing and other materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood framed construction.
 4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire retardant treated material for framing and main sheathing.
- I. Temporary Lifts, Hoists, and Scaffolding: Contractor shall assume responsibility for hoisting materials and employees. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities. Coordinate placement and use.
- J. Project Identification and Temporary Signs: Prepare temporary signs of the size required; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood. Do not permit installation of unauthorized signs.
1. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- K. Collection and Disposal of Waste: Collect waste from the site daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80°F (27°C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. Dumpster shall be placed in locations directed by the Engineer.

3.05 PARKING AND TRAILER LOCATION

- A. All construction traffic, including employee traffic, trucking, and delivery of materials and equipment, shall be controlled by the Contractor and shall enter the site only by routes prescribed by the Contractor. Access to the site by other routes will be prohibited.
- B. The Contractor shall take all precautions to prevent tracking of mud and debris onto the streets.

3.06 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against predictable and controllable fire losses.
 - 1. Locate fire extinguishers where convenient and effective for their intended purpose.
 - 2. Store combustible materials in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 - 4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- E. Security Enclosure and Lockup: Contractor shall provide protection against vandalism, theft and similar violations of security; Owner shall not be responsible for costs associated with these occurrences.
- F. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by means that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints.

3.07 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

- C. Termination and Removal: Unless the Contractor or Engineer requires that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of the party furnishing the facility
 - 2. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters, and clean inside of ductwork and housings.
 - b. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01500

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**SECTION 01700
PROJECT CLOSEOUT**

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
1. Inspection procedures.
 2. Project record document submittals.
 3. Operating and maintenance manual submittal.
 4. Release of liens.
 5. Submittal of warranties.
 6. Final cleaning.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

Conduct cleaning and disposal operation to comply with codes, ordinances, regulation, and anti-pollution laws.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 3. Advise the Owner of pending insurance change-over requirements.
 4. Submit to the Engineer specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.

5. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
6. Submit to the Engineer record drawings, maintenance manuals, and similar final record information.
7. Deliver spare parts, extra stock, and similar items to the Owner via the Engineer.
8. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change-over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
9. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

1.04 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
 1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.
 4. Submit consent of surety to final payment.
- B. Reinspection Procedure: The Engineer will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1.05 RECORD DRAWINGS

- A. The Contractor is required to keep an up-to-date set of Record Drawings (As-Constructed Drawings) for the project. In addition, the Contractor shall identify the location of all new piping installed, existing piping to remain and existing piping to be abandoned as it is installed or uncovered during the construction period. No trenching for piping shall be backfilled until the piping has been located by the Contractor. The Contractor shall also identify the location of all buried or

embedded conduits and duct banks including new work and existing to remain or to be abandoned as it is installed or uncovered during the construction. Up-to-date is defined as containing modifications for work performed within the past 30 days. The record drawing information shall include but not be limited to the following:

1. All dimensional changes. Degree of dimensioning shall equal that of the original drawing except for the yard piping and site electrical drawings. The Record Drawing dimensioning for the yard piping and site electrical (buried or embedded conduits and duct banks) drawings shall include as a minimum both horizontal locational dimensioning from above grade permanent structure and elevation at each location where the process piping and electrical work enters or leaves a structure and at each change in direction. In addition, where the buried process piping and electrical work parallels the wall of a structure, horizontal dimension from the structure and elevation shall be provided at a minimum of two locations.
 2. Electrical breaker designations for each circuit such as receptacles, lights, heaters, etc.
 3. All internal piping valve and fitting modifications. Degree of detail shall be equal to that of the original drawing.
 4. All structural reinforcement modifications.
 5. All electrical conduit size and routing wire size and wiring quantity modifications, wiring number and tagging assignments.
 6. All site work modifications such as roadways, sidewalks, grading, etc.
- B. The Engineer will review the status of the Contractor's record drawings on a monthly basis. If the record drawings do not meet the requirements stated above, 10% of the succeeding progress payments, in addition to the normal contract retaining, will be withheld until such time as the record drawings are brought into compliance.
- C. The Contractor shall make the record drawings available to the Engineer whenever requested for reproduction by the Engineer so that he can begin preparation of the final record drawings to be supplied to the Owner.
- D. At the end of the project, the Contractor's record drawing set shall be turned over to the Engineer.

1.06 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours.
- B. Record Drawings: A clean, undamaged set of blue or black line prints of Contract Drawings will be maintained by the Contractor. The Contractor shall mark the set

to show the actual installation where the installation varies from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Record Drawings. Give particular attention to concealed elements that work be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
 2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Upon completion of the work, submit Record Drawings to the Engineer for the Owner's records.
- C. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Engineer for the Owner's records.

1.07 GUARANTEES, CERTIFICATES, OPERATION AND MAINTENANCE MANUALS

- A. During the course of the work and within 6 weeks after approval of Shop Drawings, Contractor shall collect and assemble six (6) copies each of the guarantees, manufacturers' specification sheets and/or working drawings, operation and maintenance instructions, parts list including exploded views, recommended safety procedures, and recommended list of spare parts. The Contractor shall submit all copies, with an itemized listing, to the Engineer.
- B. Operation and Maintenance Manuals shall include all mechanical and electrical equipment specified.
- C. Operation and Maintenance Manuals shall include all electronically operated features.
- D. The Operation and Maintenance Manuals shall be assigned a value of 10% of the equipment cost, and this assigned amount will be retained from progress payments until the manuals are submitted to and approved by the Engineer and the equipment is delivered to the site.
- E. Furnish Operation and Maintenance Manuals on 8-1/2" x 11" sheets or booklets, loose bound in 3-ring binders with front and back page lifters, with binder contents indicated on the front and spine of the binder cover. All loose sheets shall be in vinyl page protectors with reinforced binding edge. Furnish drawings included in the manuals on 11" x 17" sheets laminated and folded to 8-1/2" x 11" or folded

and placed in vinyl "envelope pockets" incorporated into the binder. All materials in manuals shall be original print quality manufacturer's literature. Photostatic copies of printed materials are not acceptable. Provide an index of the contents of each manual or a master index for a system consisting of several manuals. Provide printed and laminated, reinforced index tabs for each manual. Indexed sections to include Installation, Start-up, Operation, Troubleshooting, Maintenance, Parts List, Recommended Spare Parts and Miscellaneous Components. Submit no less than six (6) copies.

- F. Include a detailed description of function of each principal component, procedures for starting, operation, overhaul and maintenance. Include safety precautions, test procedures and a catalog cross-reference to commercially available parts.
- G. Submit a Preventive Maintenance and Lubrication Schedule for the equipment furnished which specifically explains the duties to be fulfilled by the Owner during the guarantee period. List the manufacturer's recommended lubricant plus two equal substitutes for all equipment. Shall be included in the O&M Manuals.

1.08 RELEASE OF LIENS

- A. The Contractor shall deliver to the Engineer a blanket release of liens covering all work performed under this Contract, including that of subcontractors, sub-subcontractors, vendors, and other suppliers of materials and labor. Execute the release of liens on documents similar to AIA Document G706, "Contractor's Affidavit of Payment of Debtors and Claims", and AIA Document G706A., "Contractor's Affidavit of Release of Liens".
- B. The forms shall be executed by the authorized officer and notarized. All required attachments shall be included as noted on AIA Document G706. If exceptions are listed in either AIA Document G706 or Document G706A, the Contractor shall furnish bond satisfactory to the Owner for each exception.

1.09 PROJECT CLOSEOUT SUBMITTALS

- A. Submit two copies of Project Closeout submittals bound in three-ring binders, clearly labeled to the type of submittal. Provide pocket folders for folded information.
- B. Submittals shall be submitted within ten days of Substantial Completion and prior to final Application for Payment.
 - 1. Exception: Operation and Maintenance Manuals shall be submitted within six weeks after approval of shop drawings or within ten days of Substantial Completion, whichever is earlier.
- C. Warranties and Bonds
 - 1. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers.
 - 2. Except for items put into use the Owner's permission, leave date of

beginning of time of warranty until the date of Substantial Completion is determined.

3. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual; identify the number and title of the Specification Section in which product is specified.
4. Separate each warranty or bond with index tab sheets keyed to Table of Contents. List subcontractor, supplier, and manufacturer, with name, address and telephone number of responsible principal.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS

- A. Use only those materials which will not create hazards to health or property, and which will not damage finishes and surfaces.
- B. Use only materials and methods recommended by manufacturer of material being cleaned.

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Each installer of equipment that requires regular maintenance shall arrange to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items.
 1. Operation and maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants
 6. Fuels
 7. Identification systems
 8. Control sequences
 9. Hazards

10. Cleaning
 11. Warranties and bonds
 12. Maintenance agreements and similar continuing commitments.
- B. As part of instruction for operating equipment, demonstrate the following procedures:
1. Start-up
 2. Shutdown
 3. Emergency operations
 4. Noise and vibration adjustments
 5. Safety procedures
 6. Economy and efficiency adjustments
 7. Effective energy utilization
- C. Training by factory representatives shall be video taped by the Contractor in a VHS format, and the tapes then turned over to the Engineer upon completion of training.

3.02 INITIAL OPERATION

The Contractor shall place the completed Project, equipment and systems into initial operation. The schedule and sequence of the initial operation procedures shall be included in the Project Schedule. Coordinate the initial operation procedures with the Owner's operating personnel.

3.03 FINAL CLEANING

- A. All final cleaning shall be performed by the Contractor, unless otherwise specified.
- B. Remove temporary protection and labels not required to remain.
- C. Clean surfaces free of grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces, bringing them to a state or readiness for Owner occupancy.
- D. Clean transparent glossy materials to a polished condition; remove foreign substances. Polish reflective surfaces to a clear shine.
- E. Clean surfaces of equipment; remove excess lubrication.
- F. Electrical Devices:

1. Clean the faces of all electrical devices and cover plates for same, including power receptacles, switches, computer outlets, computer and TV outlets, TV outlets, telephones, communication speakers, fire alarm speakers, fire alarm pull stations, fire alarm flashing lights, smoke detectors, clocks, speaker volume control switches, security system motion detectors, and fire alarm horns.
 2. Clean the fronts of all electrical panelboards and the main distribution switchboard.
- G. Remove waste, foreign matter and debris from areaways and drainage systems.
- H. Remove waste, debris, and surplus materials from site. Clean grounds; remove stains, spills, and foreign substances from paved areas and sweep. Rake clean other exterior surfaces.

3.04 TERMINAL INSPECTION

- A. Two months prior to expiration of the one year guarantee period, the Contractor shall make an inspection of the work in the company of the Engineer and the Owner. The Engineer and the Owner shall be given no less than five days' notice prior to the anticipated date of terminal inspection.
- B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Engineer and the Owner, even though the date of completion of the corrective work may extend beyond the expiration date of the guarantee period.
- C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner nor the replacement of parts necessitated by normal wear in use.

END OF SECTION 01700

**SECTION 02200
EARTHWORK**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:
1. Excavation and backfill for structures
 2. Dewatering
 3. Sheeting and shoring
 4. Site grading
 5. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008. Work not in the State Highway Right-of-Way shall be in accordance with this specification section.
- B. Related Work Specified Elsewhere
1. Section 02100 - Clearing and Grubbing
 2. Section 02221 - Trenching, Backfilling & Compacting
 3. Section 02850 - Finish Grading and Seeding
 4. Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008
- C. Classification of Excavation
- All excavation work under this Contract shall be unclassified, and includes excavation and removal of all soil, fill, and all other materials encountered of whatever nature.

1.02 QUALITY ASSURANCE

- A. Testing Agency: Density testing will be performed by an independent soils testing laboratory engaged and paid for by the Contractor.
- B. Referenced Standards
1. American Society for Testing and Materials (ASTM)

- a. D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

1.03 JOB CONDITIONS

- A. The locations shown for utility facilities are approximate. Proceed with caution in the areas of utility facilities and expose them by hand or other excavation methods acceptable to the utility owner.
- B. Erect sheeting, shoring, and bracing as necessary for protection of persons, improvements, and excavations.
- C. Furnish and maintain barricades, signs and markings for excavated areas.
- D. Select and install a system of dewatering to accomplish groundwater control in excavations.
- E. Preserve, protect and maintain operable existing drainage ways, drains and sewers.

1.04 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Certificates
 - 1. Submit a Certificate of Compliance, together with supporting data, from the materials supplier attesting that the composition analysis of backfill materials meets specification requirements.
 - 2. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.
 - 3. Submit certified density testing results from the soils testing laboratory.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

- A. On-site or imported natural soils as approved by Engineer.
- B. Load bearing fill is defined as earth fill or rock fill required for bearing loads imposed by structures, or pavement subject to motor traffic and all earth materials necessary to raise the grade from an existing elevation or prepared foundation elevation to the finished elevation in a designated fill area which cannot tolerate settlement.
- C. Nonbearing fill shall be free of roots, rock larger than 3" in size and building debris, capable of minimum 90% compaction at optimum moisture content.

2.02 MATERIALS FOR BACKFILLING, LOAD BEARING FILLS OR EMBANKMENTS

- A. Well-graded soil aggregate mixture consisting of Groups SW, SC, and SP soils of the Unified Soils Classification.
- B. Total content of gravel or rock fragments larger than ¾" shall not exceed 30% by weight of the mass.
- C. Backfill shall not contain topsoil, organic matter, debris, cinders, or frozen material.

2.03 PERVIOUS MATERIAL

- A. Compacted stone under slabs.
- B. Stone shall be granular material and shall comply with AASHTO #57, Section 901 of Maryland Department of Transportation State Highway Administration Standard Specifications.
- C. Pervious stone fill shall be provided beneath all concrete tanks having groundwater pressure relief valves as shown on the drawings.
- D. Pervious stone fill shall be provided beneath all concrete tanks that do not have groundwater pressure relief valves as shown on the drawings.

2.04 SELECT STONE FILL

- A. Compacted in areas of over excavation in load bearing areas.
- B. Crushed stone or gravel aggregate conforming to Fine Aggregate, Section 901, Table 901A of Maryland Department of Transportation State Highway Administration Standard Specifications.

2.05 GEOTEXTILE FABRIC

Geotextile fabric, also referred to as filter cloth, is to be installed under pervious material (stone under slab). The filter cloth shall be placed over the newly exposed subgrade or over the select stone backfill, prior to placement of pervious material, and shall conform to the following requirements:

Fabric Property	Test Method	Minimum Value
Grab tensile strength	ASTM D1682	400 x 250 lb.
Grab tensile elongation	ASTM D1682	35 lb.
Trapezoidal tear strength	ASTM D3786	110 x 55 lb.
Mullen burst strength	ASTM D3786	490 psi
Puncture strength	ASTM D3787	130 lb.
Abrasion Resistance	ASTM D3884	155 lb.
Coef. of permeability, K	CFMC-GET-2	.015 cm/sec
Water flow rate	CFMC-GET-2	60 gal./min./sf
EOS	COE-CW-02215	70-100 US Std. Sieve

Fabric Property	Test Method	Minimum Value
Open area	COE Method	4.3%
Ultraviolet resistance	ASTM G26/D1682	90%

2.06 SOURCE OF MATERIALS

- A. Use materials for fill which were excavated for the construction of structures or utilities on the project site if they meet the requirements specified herein. If sufficient material meeting these requirements is not available from required excavation, obtain requisite material from other sources.
- B. Use only material which has been approved as to quality, location of source and zone of placement in the fill.
- C. The Engineer has the right to reject material at the job site by visual inspection, pending sampling and testing.

2.07 TESTS

- A. The Contractor shall hire an independent inspection agency and testing laboratory for inspection and testing of soils and compaction. The agency's responsibilities shall include:
 - 1. Inspection of exposed subgrade prior to preparation of site.
 - 2. Testing and approving all materials used for fill and/or backfill and borrow.
 - 3. Maintaining accurate records in regard to excavation and fill or backfill for ordered undercutting or over-excavation.
 - 4. Approving all backfilling procedures and mechanical compaction equipment.
 - 5. Verifying compaction by in-place density tests. Tests to be submitted to the Engineer for review. A minimum of one (1) density test per ASTM D 1557 shall be performed for each 5,000 square feet of lift area or pavement area or more often if directed by the inspection agency. At least one density test per ASTM D 1557 shall be performed per lift in structural areas or more often if directed by the inspection agency.
 - 6. Observe and inspect all proof rolling operations and determine whether additional excavation and backfilling is required. Inspect and test excavation for structure footings to determine that the design bearing pressures are available and that no voids, loose or soft pockets exist beneath the bearing surface. Approve the bearing surfaces or recommend undercutting and structural fills as necessary.
 - 7. Submitting weekly written reports as to the status of the backfill or fill.
 - 8. Submit a final report indicating that the backfill or fill meets the requirements of the Specifications.

9. Determine all earthwork quantities for which unit price payments apply.
- B. It shall be the responsibility of the Contractor to notify the inspection agency three (3) days prior to the beginning of work so that the inspection agency can have a soils technician on the site during the work. The Contractor shall pay for all costs of this inspection service.
- C. No backfill or fill to support structures or pavements shall be placed or compacted except in the presence of a qualified representative of the independent testing agency.

PART 3 - EXECUTION

3.01 PREPARATION AND LAYOUT

- A. Establish and identify required lines, levels, contours and datum.
- B. Maintain bench marks, monuments and other reference points.
- C. Protect trees, shrubs, lawns and other features remaining as portion of final landscaping.

3.02 ROUGH GRADING

- A. Rough grade to uniform contours; form foundations for embankments and load bearing fills.
- B. Construct the finished subgrade to vary not more than 1" above or below the elevation shown.
- C. Rough grade to prevent ponding of water in any area; install temporary swales if necessary to improve surface drainage.
- D. Complete embankment slopes to vary not more than 6" from the slope line shown.
- E. In situ areas indicating sponginess and instability during earth moving operations shall be excavated and prepared to receive acceptable fill materials as specified; material excavated due to unsuitability shall be removed from site.
- F. Excavated subsoil materials to be used for fill materials shall be approved by Project Engineer; materials rejected by Project Engineer shall be removed from the site.

3.03 FOUNDATION PREPARATION OF LOAD BEARING AREAS

- A. A load bearing area is defined as an area supporting loads of a structure or pavement area subject to motor traffic.
- B. The entire exposed natural soil of the load bearing area shall be proof-rolled with no less than 10 complete coverage's of vibratory compaction equipment (minimum of

(1) 10,000 lb. smooth drum roller capable of a combined active and passive pressure of 30,000 pounds); all soft spots or irregularities within the natural soil, disclosed as the proof-rolling progresses, shall be excavated to sound material and then backfilled or leveled to grade as hereinafter specified; Project Engineer shall be so advised by Contractor that additional excavation is necessary to achieve satisfactory proof-rolling; additional excavation required will be paid for by a Change Order.

- C. Backfill in load bearing areas shall be select stone fill.
- D. All backfill shall be compacted to 95% of maximum density at $\pm 2\%$ optimum moisture as determined by ASTM D1557.
- E. Conduct load bearing testing to demonstrate compliance with load bearing design criteria shown in 03400.

3.04 SHORING, SHEETING AND BRACING

- A. Install shoring, sheeting and bracing to comply with Federal, State and local code requirements. Responsibility for the safety of the work, personnel and structures rests solely with the Contractor.
- B. Carry the bottom of the support system to depth below the main excavation, adequate to prevent ground movement.
- C. Follow the excavation closely with sheeting and shoring placement.
- D. Perform excavation for the installation of sheeting carefully to minimize the foundation of voids.
- E. If unstable material is encountered during excavation, take measures to contain it in place and prevent ground displacement.
- F. Have sufficient quantity of material on hand at all times for sheeting, shoring, bracing and other operations for the protection of the work and for use in case of accident or emergency.
- G. Leave sheeting and shoring in place as long as possible, compatible with the placing and compacting of backfill.

3.05 EXCAVATION - GENERAL

- A. Excavate to the neat lines or setback lines for mixed face conditions and grades indicated on the Contract Drawings.
- B. Excavate in sequence and stages which will not subject permanent or temporary structures, installations, or surfaces to unstable conditions.
- C. Excavate as required to provide sufficient working space to permit placing, inspection, and completion of the structures.

- D. Shape excavations accurately to the cross-sections and grades indicated.
- E. Support the sides of excavations as specified or required.
- F. Keep excavations free from water.
- G. Where excess excavation is required to remove unsuitable material at bottom of foundation or structure excavations, fill to foundation/structure bearing or bottom of pervious material elevation with select stone fill material; properly compact select stone fill by methods acceptable to the Project Engineer to 95% of the maximum density at $\pm 2\%$ of the optimum moisture as determined by modified proctor test.
- H. If rock is exposed at design footing grades, the rock shall be over-cut one foot and replaced with select stone fill.
- I. Fill all openings and fractures in the excavation bottom and sides with cement grout. Obtain Project Engineer's written approval of the foundation excavation before placing any foundation stone bedding or construction concrete.
- J. The Contractor's failure to maintain dewatering operations for structure excavations shall not be a basis for payment for removal and replacement of unsuitable materials.

3.06 EXCAVATION WITHIN LOAD BEARING FILL AREAS

- A. After completion of the fill placement and compaction specified under this Specification and as approved by the Project Engineer, footing excavation can begin.
- B. Footing Inspections: The Project Engineer shall inspect the footing excavations for the building foundations; he shall verify that the design bearing pressures are available and that no loose pockets exist beneath the bearing surfaces of the footing excavations.
- C. Backfilling:
 - 1. Any excavation (such as for utilities, walls, footings, etc.) done within the controlled fill area shall be backfilled with controlled fill material with placement and compaction as described in this Section.
 - 2. Where controlled backfill is placed against walls, either (1) the difference in elevation of the top of the controlled fill on either side of the wall shall not be allowed to exceed 1'-0" or (2) the wall shall be adequately braced.

3.07 BLASTING

No blasting will be permitted.

3.08 BACKFILL STRUCTURES

- A. Do not commence backfilling around any structure until such structure has been examined and approved by the Project Engineer.
- B. Do not place backfill until the requirements for concrete curing and waterproofing have been complied with and, if required, until the test cylinders for the particular structure indicate that the concrete has attained the compressive strength specified.
- C. When backfilling against structures and where applicable, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures. Place material in uniform increments over fill area.
- D. Protect structures from damage by construction activity, equipment, and vehicles. Repair or replace damaged structures to the satisfaction of the Owner.
- E. Backfill shall be compacted to 95% of maximum density at $\pm 2\%$ optimum moisture as determined by ASTM D1557.

3.09 DISPOSAL OF EXCAVATED MATERIAL

Surplus excavated materials shall become the property of the Contractor and be removed from the project site. Surplus excavated materials is defined as: 1. Excess excavated unsuitable materials, and/or 2. Excess excavated suitable materials.

3.10 MOISTURE CONTROL

- A. Control moisture content of fill materials to $\pm 2\%$ of the optimum moisture content as determined by ASTM D1577; material that is too wet may be spread and scarified on the fill surface and permitted to dry, until the moisture content is within specified limits; when fill material is too dry, sprinkle each layer of the fill and work moisture into the material until a uniform distribution within the specified limits is obtained; if, in the opinion of the Project Engineer, the top surface of a partial fill section becomes too dry to permit a suitable bond, scarify loosen the dried surface, dampen the loosened material and compact the moistened material.
- B. Keep the top plane of load bearing fill areas under construction sloped for drainage; when rain or inclement weather is expected, flat roll the top of embankment to seal it.

3.11 SURFACE DRAINAGE

- A. Intercept and divert surface drainage away from the excavation by the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- C. Remove the surface drainage system when no longer required.

- D. Remove debris and restore the site or sites to original condition.

3.12 DRAINAGE AND DEWATERING OF EXCAVATED AREAS

- A. Provide and maintain ditches to collect surface water and seepage which may enter the excavations and divert.
- B. Install a dewatering system to keep excavations dry and free of water.
- C. Maintain water level below subgrade until concrete work or backfill, or both, have been completed to offset uplift pressures.
- D. Dispose of precipitation and subsurface water clear of the work. Comply with provisions of the Sediment and Erosion Control Plan.
- E. Backfill drainage ditches and sumps when no longer required with granular material or other material as approved by the Project Engineer.

3.13 FINISHING

- A. On completion of the work, clean ditches and channels and finish the site in a neat and presentable condition. Slope areas to provide positive drainage.
- B. Place topsoil and seed all areas disturbed by construction as specified in Section 02485, Finish Grading and Seeding, unless otherwise indicated.

3.14 PLACEMENT OF PERVIOUS MATERIAL - STONE UNDER SLAB

- A. Grade pervious material smooth and even, free of voids, compacted, and to required thickness and elevation; provide final grades within a tolerance of 1/2" when tested with a 10-foot straightedge.
- B. Compaction shall continue until all compaction marks are eliminated and the course is thoroughly and properly compacted.

END OF SECTION 02200

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**SECTION 02221
TRENCHING, BACKFILLING AND COMPACTING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Work Of This Section Includes, But Is Not Limited To:
1. Trench excavation, backfill and compaction
 2. Support of excavation
 3. Pipe bedding requirements
 4. Control of excavated material
 5. Restoration of unpaved surfaces
 6. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008.
- B. Related Work Specified Elsewhere
1. Section 02100 - Clearing and Grubbing
 2. Section 02220 - Earthwork
 3. Section 02850 - Finish Grading and Seeding
 4. Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008
- C. Applicable Standard Details
1. Pipe Bedding Details
 2. Pipe Trench Detail
 3. Concrete Cradle and Encasement Details
 4. Thrust Block for Vertical Bends
 5. Thrust Block for Bends, Tees, and Caps

1.02 QUALITY ASSURANCE

- A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Referenced Standards
 - 1. American Society For Testing And Materials (ASTM)
 - a. D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - b. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
 - c. D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - d. Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods
- C. Density Testing
 - 1. Conduct ten density tests plus one test for each 1,000 linear feet of pipeline. Conduct density tests at locations as directed by the Engineer during backfilling operations.
 - 2. Determine density by ASTM D1556 or ASTM D2922 in areas other than state highways and shoulders.

1.03 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Certificates
 - 1. Submit, prior to delivery of the material to the job site, a Statement of Compliance from the materials supplier, together with supporting data, attesting that the composition analysis of pipe bedding and select material stone backfill materials meets specification requirements. Should a change in source of materials be made during construction, submit a new Statement of Compliance from the new source for approval before the material is delivered to the job site.
 - 2. Submit certified density testing results from the soils testing laboratory.
- C. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.

- D. Agreements with Property Owners: Prior to storing or disposing of excavated materials on private property, submit a copy of the written agreement with the property owner.
- E. Contractor to provide to the Engineer for review and approval a grain size distribution curve, result of Atterberg limit testing, and ASTM D1557 Modified Proctor test results prior to delivery of select soil at the project site. Classification testing indicated above shall be provided for each on-site and borrow source proposed to be used as select borrow.

1.04 JOB CONDITIONS

- A. Classification of Excavation: All excavation work performed under this contract is unclassified, and includes excavation and removal of all soil, shale, rock boulders, fill, and all other materials encountered of whatever nature.
- B. Protection of Existing Utilities and Structures:
 - 1. Take all precautions and utilize all facilities required to protect existing utilities and structures. Advise each Utility at least 3 working days in advance of intent to excavate, do demolition work and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
 - 2. Advise each person in physical control of powered equipment used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
 - 3. Immediately report to the Utility and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
 - 4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

PART 2 - PRODUCTS

2.01 PIPE BEDDING MATERIAL

Type II and Type IV Bedding Material: Crushed stone or gravel aggregate conforming to AASHTO No. 8.

2.02 BACKFILL MATERIAL

- A. Select Material Backfill: Crushed stone or gravel aggregate conforming to Fine Aggregate, Section 901, Table 901A of Maryland Department of Transportation State Highway Administration Standard Specifications or a select soil with a maximum dry density of at least 105-pcf in accordance with ASTM D1557, maximum

percent passing the No. 200 sieve of 30-percent, maximum liquid limit of 34, and a maximum plasticity index of 7.

B. Suitable Backfill Material

1. From top of pipe bedding material to 24" over top of pipe

a. Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic materials.

2. From 24" above pipe to subgrade elevation

a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

C. Unsuitable Backfill Material: where the Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material stone backfill as specified in paragraph 2.02A or suitable foreign backfill material.

PART 3 - EXECUTION

3.01 MAINTENANCE AND PROTECTION OF TRAFFIC

A. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008.

B. Maintain access to all streets and private drives.

C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.

D. Comply with State and local codes, permits and regulations.

3.02 CUTTING PAVED SURFACES

A. Where excavation includes breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench. Saw cut concrete surfaces; saw cut other hard surfaces or make straight cuts with jackhammer. No paving shall be broken except that which has been previously cut.

B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

3.03 BLASTING

No blasting will be permitted.

3.04 TRENCH EXCAVATION

- A. Topsoil Stripping and Stockpiling: Strip topsoil encountered during trench excavation to its full depth and stockpile for reuse.
- B. Depth of Excavation
 - 1. Gravity Pipelines: Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
 - 2. Pressure Pipelines:
 - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide 4' from the top of the pipe to the finish ground elevation, except where specific depths are otherwise indicated on the Contract Drawings.
 - b. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
 - c. Where the Contractor, by error or intent, excavated beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.
- C. Width of Excavation
 - 1. Excavate trenches to a width necessary for placing and jointing the pipe and for placing and compacting bedding and backfill around the pipe.
 - 2. Shape trench walls completely vertical from trench bottom to at least 24" above the top of pipe.
 - 3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
 - 4. Where rock is encountered in the sides of the trench, remove the rock to provide a minimum clearance between the pipe and rock of 6".
- D. Length of Open Trench: Do not advance trenching operations more than 50' ahead of completed pipeline.
- E. Pipes Install in Fills

Except where multiple pipes are installed in one trench no pipe or utility may be laid except in a prepared trench excavation having a top elevation at least one

foot above the top of the highest pipe or utility in the trench. Where pipes or utilities are to be placed entirely or partly in fills, the fill must be properly compacted and brought up to the required elevation before the trench excavation is performed.

3.05 SUPPORT OF EXCAVATION

- A. Support excavations with sheeting, shoring, and bracing or a “trench box” as required to comply with Federal and State laws and codes. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Contractor in any other manner shall be repaired at the Contractor’s expense.
- B. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Engineer.

3.06 CONTROL OF EXCAVATED MATERIAL

- A. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008.
- B. Keep the ground surface within a minimum of 2' of both sides of the excavation free of excavated material.
- C. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.
- D. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- E. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.

3.07 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Maintain storm drainage facilities, gutters, and natural surface watercourses open and in operation. Provide and install temporary facilities to maintain excavations free of water as

required. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. When mechanical equipment is utilized to control water conditions, provide and maintain sufficient standby units onsite.

- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control. Comply with the Sediment and Erosion Control Plan.

3.08 PIPE BEDDING REQUIREMENTS

- A. Type II Bedding
 - 1. Depth of bedding material aggregate as shown on Standard Detail.
 - 2. Provide Type II bedding as minimum for all pipe materials except plastic pipe, unless otherwise authorized by the Engineer.
- B. Type IV Bedding
 - 1. Depth of bedding material aggregate as shown on Standard Detail.
 - 2. Provide Type IV bedding when using ABS, PE, and PVC pipe.
- C. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

3.09 PIPE LAYING

Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 THRUST RESTRAINT

Provide pressure pipe with concrete thrust blocking or use restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Specifications, Contract Drawings, and Standard Details.

3.11 BACKFILLING TRENCHES

- A. After pipe installation and inspection, backfill trenches from trench bottom or from the top of pipe bedding material, whichever is greater, to 12" above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified density around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.
- B. Exposed Joints for Testing
 - 1. The Contractor has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2'

of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.

2. If the Contractor elects to completely backfill the trench prior to testing, the shall be responsible for locating and uncovering leaks which may cause the test to fail.

C. Lift thickness Limitations

1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.
2. Compact each layer of material to 95% of the maximum density at \pm two percent ($\pm 2\%$) of the optimum moisture content as determined by ASTM D698.
3. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

3.12 UTILITY MARKING TAPE

Install detectable utility marking tape as specified in Section 15060 above all plastic pressure pipelines, 12"-18" below final grade.

3.13 DISPOSAL OF EXCAVATED MATERIAL

Excavated material remaining after completion of backfilling shall remain the property of the Contractor, removed from the construction area and legally disposed.

3.14 RESTORATION OF UNPAVED AREAS

- A. Restore unpaved surfaces disturbed by construction to equal the final grade shown on the Contract Drawings.
- B. Restore grassed areas in accordance with Section 02485, Finish Grading and Seeding.
- C. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008 for work in the State Right-of-Way.

3.15 COMPACTION FOR SELECT BACKFILL MATERIAL

- A. Select backfill material shall be compacted to 95-percent of the Modified Proctor (ASTM D1557) using loose lifts not to exceed 8-inches in thickness.

END OF SECTION 02221

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**SECTION 02240
DEWATERING**

PART 1 - GENERAL

1.01 SUMMARY

- A. The work to be performed under this section includes, but is not limited to, the furnishing of all materials, labor, tools and equipment necessary to provide construction dewatering to keep all excavations and structures free from water during excavation and construction.

1.02 PERFORMANCE REQUIREMENTS

- A. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control surface water and groundwater flows into excavations and permit construction to proceed on dry, stable subgrades.
1. Dewatering plans, including detailed shop drawings, shall be prepared, sealed and signed by a qualified Professional Engineer registered in the State of Maryland.
 2. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 3. Prevent groundwater and surface water from entering excavations.
 4. Accomplish dewatering without damaging existing buildings, pavements, utilities, and other improvements adjacent to excavations.
 5. Remove dewatering system when no longer needed.

1.03 SUBMITTALS

- A. Shop Drawings for Information Only: Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water. Shop drawings shall be prepared, sealed and signed by a qualified Professional Engineer for dewatering systems.
1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 2. Include a written report outlining control procedures to be adopted if dewatering problems arise.

- B. Qualification Data: For the Professional Engineer and the dewatering system installer.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining improvements that might be misconstrued as damage caused by dewatering operations.
- D. Record drawings identifying and locating any capped utilities and other subsurface conditions performed during dewatering, including locations and capping depth of wells and well points.
- E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that the dewatering system is capable of meeting performance requirements.

1.04 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving the existing pumping station or other facilities unless permitted in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: Geotechnical soil borings obtained in the project site area during design, if any, are available for information purposes only. The soil borings, and opinions expressed in any accompanying reports, are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests and results of analyses conducted by the geotechnical engineer for design purposes only. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data. The Contractor shall make his own test borings and conduct other exploratory operations as necessary for providing dewatering systems.
- C. Survey adjacent structures and improvements, employing a qualified Professional Engineer or Land Surveyor, and establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent improvements.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, pavements, and other facilities and improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during dewatering operations.
 - 1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering systems to ensure minimum interference with roads, streets, alleys, walks, driveways, residences and other adjacent occupied or used facilities. Do not close or obstruct roads, streets, alleys, walks, driveways and other adjacent occupied or used facilities without permission of the Owner and authorities having jurisdiction.
- C. Promptly repair damages to adjacent facilities or improvements caused by dewatering operations at no additional cost to the Owner.

3.02 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below groundwater level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers and structures have been constructed and fill materials placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers and other excavations. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations. Maintain piezometric water level a minimum of 24-inches below surface of excavation.

- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to the Owner.
- G. Remove dewatering system upon completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36-inches below overlying construction.

3.03 OBSERVATION WELLS

- A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers necessary and additional observation wells as may be required by authorities having jurisdiction.
- B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
- C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation well risers to demonstrate that observation wells are functioning properly.
- D. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

END OF SECTION 02240

**SECTION 02700
EROSION AND SEDIMENT CONTROL**

PART 1 - GENERAL**1.01 DESCRIPTION**

- A. The Work of This Section Includes, But Is Not Limited To
 - 1. Erosion and Sediment Controls: This work consists of temporary methods to control water pollution such as berms, dikes, dams, sediment basins, crushed stone gravel, mulches, grasses, straw bales, silt fence and other erosion devices as indicated on the contract Drawings.
- B. Related Work Specified Elsewhere
 - 1. Section 02200 - Earthwork
 - 2. Section 02850 - Finish Grading and Seeding

1.02 SUBMITTALS

- A. Submit shop drawings and material certificates of compliance in accordance with Section 01300.

1.03 REGULATORY REQUIREMENTS

- A. Erosion Controls: Erosion controls shall be as indicated on the Contract Drawings.
- B. Erosion Controls shall be in accordance with all Local requirements.

PART 2 - PRODUCTS**2.01 MATERIALS - GENERAL**

- A. All products and materials shall comply with Maryland Department of the Environment (MDE) Standards.

PART 3 - EXECUTION**3.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and roadways.
- B. Inspect, repair and maintain erosion and sedimentation control measures during

construction until permanent vegetation has been established.

- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Provide erosion and sedimentation control measures for stockpiled material, which will remain in place longer than 30 days.
- E. Maintain erosion and sedimentation measures throughout the life of the Contract.
- F. Comply with the provisions of the Storm Water Pollution Prevention Plan.

3.02 RESTORATION

- A. Seed, mulch and fully restore all disturbed areas within 15 days after final grading. In no case shall a construction area be denuded for more than 60 days.

END OF SECTION 02700

**SECTION 02850
FINISH GRADING AND SEEDING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this Section includes, but is not limited to:
 - 1. Placing topsoil
 - 2. Soil conditioning
 - 3. Finish grading
 - 4. Seeding
 - 5. Maintenance
 - 6. Termite Control
 - 7. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008. Work not in the State Highway Right-of-Way shall be in accordance with this specification section.
- B. The "Seeding Restoration Table" shown on the Contract Drawings lists specified seeding restoration requirements.
- C. Related Work Specified Elsewhere
 - 1. Section 02100 - Clearing and Grubbing
 - 2. Section 02200 - Earthwork
 - 3. Section 02221 - Trenching, Backfilling & Compacting

1.02 QUALITY ASSURANCE

- A. Soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Collect soil samples under the direction of the Engineer.
- C. Reference Standards:
 - 1. Maryland Department of Transportation - Standard Specifications for

Construction and Materials, July 2008.

2. Maryland State Board of Agriculture, "Seed Regulations", as Amended.
3. Requirements of Turf Grass Law and Regulations, Publication No. 41.
4. Maryland Standard Method of Procedure.

1.03 SUBMITTALS

A. Certificates

1. Prior to use or placement of material, submit a Statement of Compliance from the materials suppliers, together with supporting data, attesting that the composition of the following products meets specification requirements.
 - a. Topsoil analysis - State pH, texture, and organic content.
 - b. Fertilizer - analysis content and percent of each.
 - c. Lime - analysis content and percent of each.
 - d. Seed mixture(s) - State percentage of mixtures, purity, germination and maximum weed seed content of each grass mixture.
2. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory's recommended soil supplement formulation.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Seed

1. Deliver seed fully tagged and in separate packages according to species or seed mix.
2. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

PART 2 - PRODUCTS

2.01 TOPSOIL

- #### **A.**
- All topsoil stripped from the site and stockpiled may be reused provided the following requirements are met:
1. Have a pH of between 6.0 and 7.0; contain not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
 2. Fertile friable loam, sand loam, or clay loam which will hold a ball when

squeezed with the hand, but which will crumble shortly after being released.

3. Free of clods, grass, roots, or other debris harmful to plant growth. Free of pests, pest larvae, and matter toxic to plants.
4. Topsoil shall comply with the requirements of Section 920.01.01 of the Maryland Department of Transportation, State Highway Administration Standard Specifications.

2.02 SEED

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing.
- B. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance.
- C. All seeds will be subject to analysis and testing.
- D. Seed shall be certified by the Maryland State Board of Agriculture and shall conform to requirements of Maryland Turf Grass Law and Regulations, Publication No. 41.
- E. Seed mix shall be in accordance with Maryland Department of Transportation Standard Specifications, Sections 705.01.02 and 920.04.02.
- F. Seeding shall be accomplished in accordance with Maryland Department of Transportation Standard Specifications, Section 701.01.03.
- G. Seed shall comply with Maryland Department of Transportation Standard Specifications, Section 920.04.01.

TABLE 1 - GRASS AND AGRICULTURAL SEEDS			
Species	Minimum Guaranteed Purity (Percent)	Maximum Weed Seed (Percent)	Minimum Guaranteed Germination (Percent)
Kentucky Bluegrass (<i>Poa pratensis</i>) Domestic origin min. 21 lb. per bushel	90	0.20	80
Perennial Ryegrass (<i>Lolium perenne</i> , var. Pennfine)	98	0.15	90
Kentucky 31 Fescue (<i>Festuca elatior</i> arundinacea)	98	0.25	85
Crownvetch (<i>coronilla varia</i> , var. Penngift)	99	0.10	70
Pennlawn Red Fescue (<i>Festuca rubra</i> , var. Pennlawn)	98	0.15	85
Annual Ryegrass (<i>Lolium multiflorum</i>)	95	0.15	90
Timothy (<i>Phleum pratense</i>)	98	0.25	95

2.03 FERTILIZER

- A. Liquid formulations may be used in lieu of dry formulations, provided the rate of application is adjusted to apply the same quantities of nitrogen, phosphorus and potassium per unit area as specified for dry formulations.
- B. Fertilizer in accordance with Section 920.03 of the Standard Specifications for Construction and Materials, Maryland Department of Transportation, 2008, and applied in accordance with Section 705.03.01(e).
- C. Contractor may submit soils samples to an approved laboratory for fertilizing recommendations. Recommendations shall be submitted to Owner for his review and decision relating to modifying the application rate as shown on the Restoration Table.

2.04 LIME

- A. Conform to Section 920.02 of the Standard Specifications for Construction and Materials, Maryland Department of Transportation, July 2008, and apply in accordance with Section 705.03.03.
- B. All lime in accordance with application rates shown in the Restoration Table.

2.05 INOCULANT

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

2.06 EROSION CONTROL FABRIC

- A. Shall be a knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with 4-mil opaque polyethylene base as protection for outdoor storage.
- B. Fabric 0.2 pound per square yard.

2.07 JUTE MATTING

Shall be heavy weight, minimum 0-9 pound per square yard, jute mesh with 1" opening.

2.08 FABRIC/MATTING ANCHORS

Staples for fastening fabric to ground shall be minimum 11 gauge wire, "U" shaped, with a 1" crown and 6" legs.

2.09 MULCHING MATERIALS

- A. Mulches for seeded areas shall be one, or a combination, of the following:
 - 1. Timothy hay or mixed clover and timothy hay, or wheat, or oat straw; thoroughly threshed.
 - a. Cured to less than 20% moisture content by weight.
 - b. Containing no stems of tobacco, soybeans, or other coarse or woody material, free of mature seed bearing stalks or roots of prohibited or noxious weeds.
 - 2. Wood Cellulose
 - a. Containing no growth or germination-inhibiting substances.
 - b. Green-dyed and air-dried.
 - c. Packages not exceeding 100 pounds.

- d. Moisture Content: 12% \pm 3%
 - e. Organic Matter (Dry oven basis) 98.6% \pm 0.2%
 - f. Ash Content: 1.4% \pm 0.2%
 - g. Minimum Water-Holding Capacity: 100%
3. Mushroom Manure:
- a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
 - b. Organic Matter: 20% minimum
 - c. Water-Holding Capacity: 120% minimum
 - d. pH: 6.0
- B. Mulch Binders
- 1. Emulsified Asphalt AASHTO M140, Grade SS-1.
 - 2. Cut Back Asphalt AASHTO M81, RC 250.
 - 3. Nonasphaltic Emulsion - Natural Vegetable Gum Blended with Gelling and Hardening Agents
 - 4. Polyvinyl Acetate Emulsion Resin, Containing 60% (\pm 1%) total Solids by Weight.

2.10 SOIL TREATMENT MATERIALS

- A. Chemicals
- 1. Soil treatment chemicals shall be one of the following:
 - a. Dursban TC: To be used at a concentration of 1.0%, applied in water emulsion.
 - b. Dragnet TC: To be used at a concentration of 0.5%, applied in water emulsion.
 - c. Pryfon 6: To be used at a concentration of 0.75% applied in water emulsion.
 - 2. Soil treatment chemicals used shall be mixed in the following proportions:
 - a. Dursban TC: 1.0% water emulsion, 2 gallons of Dursban TC per 98 gallons of water.

- b. Dragnet TC: 0.5% water emulsion, 1.25 gallons of Dragnet TC per 98.75 gallons of water.
- c. Pryfon 6: 0.75% water emulsion, 1 gallon of Pryfon 6 with 96 gallons of water.

PART 3 - EXECUTION

3.01 TIME OF OPERATIONS

Conduct seeding operations during the times specified in the Seeding Restoration Table.

3.02 PREPARATION OF SUBGRADE

- A. "Hard pan" or heavy shale
 - 1. Plow to a minimum depth of 6".
 - 2. Loosen and grade by harrowing, discing, or dragging.
 - 3. Handrake subgrade.
 - 4. Remove stones over 2" in diameter and other debris.
- B. Loose loam, sandy loam, or light clay
 - 1. Loosen and grade by harrowing, discing, or dragging.
 - 2. Handrake subgrade.
 - 3. Remove rocks over 2" in diameter and other debris.

3.03 PLACING TOPSOIL

- A. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation.
- B. Final compacted thickness of topsoil not less than thickness shown on Drawings.
- C. Roller weight over 120 pounds per foot of width shall not be used for compaction.
- D. Handrake topsoil and remove all materials unsuitable or harmful to plant growth.
- E. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry; do not handle topsoil when frozen or muddy.
- F. Material unsuitable for finish grading which accumulates during spreading and raking shall be removed and legally disposed of off site by Contractor.
- G. Finish surface of topsoil shall be smooth, even and true to lines and grades with no

ponding areas.

3.04 TILLAGE

- A. After seed bed areas have been brought to proper compaction elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods.
- B. Do not work topsoiled areas when frozen or excessively wet.
- C. Liming
 - 1. Distribute limestone uniformly at the rate indicated on the Seeding Restoration table.
 - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4" as a part of the tillage operation.
- D. Basic Fertilizer
 - 1. Distribute basic fertilizer uniformly at the rate indicated on the Seeding Restoration Table.
 - 2. Incorporate into soil to depth of 4" by approved methods as part of tillage operation.
- E. Liming and fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

3.05 FINISH GRADING

- A. Remove unsuitable material larger than 2" in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Rework areas which puddle by the addition of topsoil and fertilizer; rake.
- D. Distribute starter fertilizer at the rates indicated on the Seeding Restoration Table.
- E. Incorporate starter fertilizer into the upper 1" of soil.

3.06 SEEDING

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder or hand-operated seeder, or by hand.
- B. Do not seed when winds are over 15 mph.
- C. Upon completion of sowing, cover seed to an average depth of 1/4" by hand

reraking or approved mechanical methods.

- D. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 65 pounds per foot width of roller.

3.07 MULCHING

- A. Mulch within 48 hours of seeding.
- B. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
- C. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper or plastic nets.
- D. Emulsified asphalt or cut back asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
- E. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
- F. Apply approved chemical mulch binders at the manufacturer's recommended rate.
- G. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards; incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- H. Spread mushroom manure uniformly to a minimum depth of ½" or to the depth indicated on the Contract Drawings.
- I. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length.
- J. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".
- K. Asphalt Mix Method
 - 1. Apply the mulch by blowing.
 - 2. Spray the asphalt binder material into the mulch as it leaves the blower.
 - 3. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
 - 4. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
 - 5. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.

6. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

3.08 MAINTENANCE

- A. Contractor shall be responsible for maintenance of seeded work.
- B. Maintenance includes watering, weeding, initial mowing, cleanup, edging, and repair of washouts or gullies.
- C. Keep seeded areas wet, close to the saturation point, to a depth of 3" for a period of 10 days following seeding and sodding.
- D. Those areas which do not show a prompt catch of grass within 10 days of seeding or sodding shall be reseeded or resodded until complete grass catch occurs.
- E. When the grass reaches an average height of 2-1/2", cut to a height of 1-1/2"; irregularities or depressions which show up at this time shall be leveled and reseeded.
- F. Contractor's maintenance shall continue until all areas are grassed and free from bare spots or off-color areas, and all work under this Contract is complete and accepted.

3.09 SOIL TREATMENT

- A. Application
 1. Treat all soil under floor slabs of building and at footings and foundation walls.
 2. Treatment should not be made (1) when the soil or fill is excessively wet or (2) directly following rains, as, in such instances, it will not penetrate to the desired depth, and some of the chemical may be lost through surface runoff.
 3. At Foundation Wall:
 - a. Along the outside of the foundation wall, before backfilling, apply the treatment by pouring at bottom of trench.
 - b. Backfill approximately 6", tamp and again apply the treatment.
 - c. Repeat until backfilling has been brought to proper grade.
 - d. All treatment shall be covered with earth.
 - e. Application shall be at the rate of 4 gallons per 5 linear feet total for

all pours.

4. Rate of Application for Slab-on-Ground Type of Construction
 - a. Apply 1 gallon per each 10 square feet of soil surface as an overall treatment prior to pouring the slab.
 - b. Unless the treated soil or fill is to be covered promptly with a vapor barrier or by the slabs, precautions must be taken to prevent disturbance of the treatment by humans or animals.
- B. Apply soil treatment at the rate of 2 gallons per 5 lineal feet at the following areas
 1. Immediately below expansion joints, control joints and all areas where slab will be penetrated by construction features.
 2. When exterior facings or veneers extend below grade level, along the exterior side of all foundation walls, or where unit masonry foundation construction is used.

END OF SECTION 02850

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**SECTION 02900
CHAIN-LINK FENCE AND GATES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes requirements for providing chain-link fence, gates, and accessories, as indicated herein and as shown on the drawings, to include the tie in to the existing fencing and posts that are to remain in order to provide a completely functional system. Fence fabric shall be galvanized.

1.02 SUBMITTALS

- A. Submit the following shop drawings:
 - 1. Plan layout including spacing of posts and other components, locations of gates, post foundation dimensions, abrupt changes in grade, locations of corner, end and pull posts, hardware anchorage, and schedule of components.
 - 2. Cross sectional dimensions of posts, braces, rails, fittings, gates and accessories.
 - 3. Design of gates and details of gate hardware and accessories.
- B. Product data on fabric, post, fittings, accessories and hardware. Contractor shall take accurate field measurements to confirm existing fence fabric mech opening size and fabric height prior to submission to the Engineer for approval.
- C. Two (2) samples of fence fabric, 12 x 12 inches in size, illustrating construction.

1.03 PROJECT RECORD DOCUMENTS

- A. Submit as-built drawings of the fence and gates.
- B. Accurately record actual locations of perimeter posts relative to property lines.

1.04 PRODUCT DELIVERY, STORAGE AND PROTECTION

- A. Materials shall be delivered to the site in an undamaged condition. Materials shall be carefully stored off the ground to provide proper protection against oxidation caused by ground contact. Defective or damaged materials shall be replaced by the Contractor at no expense to the Owner.

PART 2 - PRODUCTS

2.01 FENCE FABRIC

- A. Fence fabric shall be made from galvanized fabric in accordance with ASTM A392. Fence fabric shall be woven in 2-inch mesh. Contractor shall take accurate field measurements to confirm existing fence fabric mesh opening size prior to submission to the Engineer for approval. Fabric shall be fabricated of 9-gauge wire. Fabric height shall be 7-feet. Contractor shall take accurate field measurements to confirm and match existing fabric height prior to product submission to the Engineer for approval. Fabric shall be knuckled on the top and bottom selvages.

2.02 GATES

- A. Gates shall be the types and sizes as shown on the drawings. Gate frames shall be ASTM 1043 Group 1C pipe with zinc external coating Type B, minimum nominal pipe size (NPS) 1 5/8-inch. Swing gates shall be galvanized steel welded fabrication in accordance with ASTM F900 and horizontal slide gate shall be in accordance with ASTM F1184. Gates shall be same height as fencing.
- B. Swing gate leaves more than 8-feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8-feet wide shall have truss rods or intermediate braces.
- C. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached to the gate frame by method standard with the manufacturer, except that welding will not be permitted.
- D. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gates. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates. Stops shall be provided for holding the gates in the open position.

2.03 SLIDE GATES

- A. Slide gates shall be the cantilever type with sizes as shown on the drawings. Slide gates shall be in accordance with ASTM F1184, Type II, Class 2 - Internal Roller Design. Gate frames shall be ASTM F1043 Group 1C steel pipe with zinc external coating Type B minimum nominal pipe size (NPS) 2 3/8-inch. Gates shall be same height as adjacent chain link fencing.
- B. Design Criteria:
 - 1. Gate track system shall be keyed to interlock into gate frame member. When interlocked with and welded to the "keyed" frame top member, gate track shall form a composite structure.

2. Gate shall have a minimum counterbalance length of 50% of the opening.
 3. Gate shall have intermediate vertical members with spacing less than 50% of the gate frame height.
 4. Entire gate frame, including the counterbalance section, shall include two adjustable stainless steel cables (minimum 3/16-inch diameter) per bay to allow complete gate frame adjustment.
 5. Gate truck assemblies shall be tested for continuous duty and shall have zinc plated steel bearings meeting ASTM B117 salt spray test with no red rust after 790 hours. Bearings shall be specifically designed for roller applications with full complement ball bearings, shock resistant outer races, and captured seals.
 6. Gate truck assemblies shall be supported by a minimum 5/8-inch diameter zinc plated steel bolt with self-aligning capability, rated to support a 2,000-pound reaction load.
 7. Hanger brackets shall be hot-dipped galvanized steel with a minimum 3/8-inch thickness and gusseted.
 8. Gate top track and supporting hanger bracket assemblies shall be designed to withstand a 2,000-pound vertical reaction load without exceeding allowable stresses.
- C. Gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3" x 5" aluminum structural tube extrusion weighing not less than 3.0 lb/ft. This frame member shall be keyed to interlock with a keyed track member. If fabricated as a single horizontal piece, the bottom members shall be a 2" x 5" aluminum structural tube weighing not less than 2.0 lb/ft. If fabricated in two horizontal pieces, the bottom member shall be a 5" aluminum structural channel weighing not less than 2.65 lb/ft.
- D. Major vertical members at the ends of the opening portion of the frame shall be "P" shaped in cross section with a nominal base dimension of no less than 2" x 2" and weighing not less than 1.6 lb/ft. Major members shall separate each bay and be spaced at intervals less than the gate height. Intermediate vertical members weighing not less than 0.82 lb/ft shall alternate between the 2" x 2" major members.
- E. The gate frame shall have separate semi-enclosed keyed tracks extruded from 6005A-T61 or 6105-T5 aluminum alloy, and weighing not less than 2.9 lb/ft. Track members are to be located on each side of the top member. When interlocked and welded to the keyed top member, it shall form a composite structure with the top of the gate frame. Welds shall be placed alternately along the top and side of the track at 9-inch centers with welds being a minimum of 2-inch long. All welds shall

conform to AWS D1.2 Structural Welding Code and all welders shall be certified to AWS D1.2 Structural Welding Code.

- F. Gate Mounting:
1. Gate frame shall be supported from the track by four (4) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
 2. The bottom of each support post shall have a bracket equipped with a pair of 3-inch UHMW guide wheels. Wheel cover protectors shall be included with bottom guides to comply with UL325.
 3. Gap protectors compliant with ASTM F2200 shall also be provided.
 4. The slide gate shall slide on the inside of the fence.
 5. Provide lockable catch assembly. Latches, catches, keepers, rollers, and other hardware items shall be furnished as required for the fully functional operation of the gate. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates.
- G. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached at each end of the gate frame by standard fence industry tension bars and tied at each 2" x 2" vertical member with standard fence industry ties. There shall be no leading or bottom edge protrusions in accordance with ASTM F2200.

2.04 POSTS

- A. Posts shall be zinc-coated Group IC steel pipe conforming to the requirements of ASTM F1043 and F1083. Minimum sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate posts shall be for the gate type indicated to the limitations specified in ASTM F900 and ASTM F1184, with minimum NPS of 2 1/2-inch for line posts, 3-inch for terminal posts, and 4-inch for gate posts.

2.05 BRACES AND RAILS

- A. Braces and top rails shall be zinc coated Group IC steel pipe minimum NPS 1 5/8-inch conforming to the requirements of ASTM F1043.

2.06 WIRE

- A. Tension wire shall be 0.177-inch diameter, Type II, Class 2 coating, in accordance with ASTM A824.

2.07 ACCESSORIES

- A. All accessories shall be in accordance with ASTM F626. Ferrous accessories shall be zinc-coated with minimum thickness of 0.006-inch and maximum thickness of 0.015-inch.
- B. Tension and brace bands shall be galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge, minimum width of 3/4 inch and minimum zinc coating of 1.20 oz/ft².
- C. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Truss rods shall be minimum 3/8-inch diameter steel with a minimum zinc coating of 1.2 oz/ft², assembly capable of withstanding a minimum tension of 2,000 lbs.
- D. Tension bars shall be galvanized steel with minimum zinc coating of 1.2 oz/ft². Bars for 2 inch mesh shall be a minimum cross section of 3/16 inch by 3/4 inch.
- E. Tie wire for attaching fabric to rails, braces, and posts shall be 9-gauge steel wire and match the coating of the fence fabric.
- F. Miscellaneous hardware coatings shall conform to ASTM A153 unless modified.
- G. Barbed wire arms shall be corrosion-resistant, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts or integral with post cap; for each post. Line posts shall have arms that accommodate top rail or tension wire. Fence corner posts shall have corner arms. Barbed wire arms shall be Type I, single slanted arm.

2.08 BARBED WIRE

- A. Zinc-coated steel barbed wire shall be in accordance with ASTM A121, chain-link fence grade for standard three-strand barbed wire. Barbed wire shall consist of 0.099-inch diameter line wire with 0.080-inch diameter, 4-point round barbs spaced not more than 5-inches on center.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fence shall be installed to the lines and grades indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM

A780.

3.02 EXCAVATION

- A. Post holes shall be cleared of loose material. Waste material shall be disposed of by the Contractor. Ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain no clearance between the bottom of the fence fabric and finish grade.

3.03 POSTS

- A. Posts shall be set plumb and in alignment. Posts shall be set in concrete to the depth indicated on the Contract Drawings. Hole diameters shall be not less than 16-inches for terminal posts and not less than 12-inches for line posts. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure a minimum of seventy-two (72) hours prior to attachment of any item to the posts.

3.04 RAILS, TENSION WIRE, BRACES AND TRUSS RODS

- A. Top rails shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail.
- B. Tension wire shall be installed in accordance with ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- C. Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal compression braces and diagonal tension truss rods shall be installed. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

3.05 FABRIC

- A. Chain-link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to all rails and tension wires at approximately 12-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a

single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be to the finished grade, but not more than 2-inch above the ground.

3.06 GATES

- A. Gates shall be installed at the locations shown on the drawings. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal. Slide gate shall be installed in accordance with ASTM F1184, and as recommended by the manufacturer.

3.07 EXISTING FENCE AND MESH

- A. Take extreme caution to not damage the existing fence, to include all posts and mesh to remain in order to tie in the new fence mesh and all other necessary fence components to the nearest fence post to the 100-year floodplain line on the property (and outside of the 100-year floodplain) as shown on the drawings. This would include the nearest fence post near Property Corner Coordinate 8 and the nearest fence post nearest Control Coordinate 1029 and not within the 100-year floodplain.
- B. Provide all components as necessary to complete the fence tie in so that there is no gap in the fencing between the existing and new fence and mesh. Ensure existing fence is securely fastened to the existing post to remain.

3.08 ERECTION TOLERANCES

- A. Maximum Variation from Plumb: 1/4-inch.
- B. Maximum Offset from True Position: 1-inch.

3.09 GROUNDING

- A. Install fence grounding at maximum intervals of 750-feet by driving a grounding rod vertically until the top is 6-inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location. Ground fence on each side of gate openings. Bond metal gates to gate posts using No. 2 AWG wire and bury it at least 18-inches below finished grade. Connect bonding jumper between gate post and gate frame. Make connections so possibility of galvanic action or electrolysis is minimized.

3.10 BARBED WIRE

- A. Install barbed wire uniformly spaced and angle outward. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.11 ADJUSTING AND DEMONSTRATION

- A. Adjust gate to operate smoothly, easily, and quietly, free of binding, warping, excessive deflection, distortion, non-alignment, misplacement, disruption, or malfunction, throughout the entire operating range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

END OF SECTION 02900

**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
1. Footings.
 2. Foundation walls.
 3. Slabs-on-grade.
 4. Miscellaneous concrete.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.03 REFERENCED STANDARDS AND SPECIFICATIONS

- A. American Concrete Institute (ACI)
1. 117 Standard Specifications for Tolerances for Concrete Construction and Materials
 2. 201.1 Guide for Making a Condition Summary of Concrete In Service
 3. 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
 4. 214 Guide to Evaluation of Strength Test Results of Concrete
 5. 301 Specifications for Structural Concrete
 6. 302.1R Guide to Concrete Floor and Slab Construction
 7. 304 Guide for Measuring, Mixing, Transporting, and Placing Concrete
 8. 305R Guide to Hot Weather Concreting
 9. 306R Guide to Cold Weather Concreting

10. 308R Guide to External Curing of Concrete
 11. 309R Guide for Consolidation of Concrete
 12. 315R Guide to Presenting Reinforcing Steel Design Details
 13. 318 Building Code Requirements for Structural Concrete and Commentary
 14. 347R Guide to Formwork for Concrete
- B. American Society for Testing and Materials (ASTM)
1. A615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 2. A1064 Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
 3. C31 Standard Practice for Making and Curing Concrete Test Specimens in the Field
 4. C33 Standard Specification for Concrete Aggregate
 5. C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
 6. C42 Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 7. C88 Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
 8. C94 Standard Specification for Ready-Mixed Concrete
 9. C138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
 10. C143 Standard Test Method for Slump of Hydraulic-Cement Concrete
 11. C150 Standard Specification for Portland cement
 12. C171 Standard Specification for Sheet Materials for Curing Concrete
 13. C172 Standard Practice for Sampling Freshly Mixed Concrete
 14. C173 Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method

15. C231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
 16. C260 Standard Specification for Air-Entraining Admixtures for Concrete
 17. C309 Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete
 18. C494 Standard Specification for Chemical Admixtures for Concrete
 19. C535 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
 20. C881 Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
 21. C1017 Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
 22. C1064 Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
 23. C1240 Standard Specification for Silica Fume Used in Cementitious Mixtures
 24. D1752 Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
 25. D2240 Standard Test Method for Rubber Property-Durometer Hardness
 26. E154 Standard Test Methods for Water Vapor Retarders used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
 27. E1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact With Soil or Granular Fill Under Concrete Slabs
- C. American Welding Society (AWS)
1. D1.4 Structural Welding Code – Reinforcing Steel
- D. American Association Of State Highway and Transportation Officials (AASHTO)
1. M182 Standard Specification for Burlap Cloth Made From Jute or Kenaf and Cotton Mats

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Design Mixtures: For each concrete mixture in accordance with ACI 301 and ACI 318. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional Engineer detailing fabrication, assembly, and support of formwork.
- E. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- F. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Waterstops.
 - 6. Curing compounds.
 - 7. Bonding agents.
 - 8. Adhesives.
 - 9. Vapor barriers.
 - 10. Repair materials.
- G. Field quality-control test and inspection reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spilling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.02 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 1064, plain, fabricated from as-drawn steel wire into flat sheets.

2.03 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.04 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I or Type II.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

2.05 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. Total chloride ions from admixtures and other measures shall be no greater than 0.1 percent by weight of cement in the concrete mix, immediately prior to service exposure. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Retarding Admixture: ASTM C 494, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.07 VAPOR RETARDERS

- A. Polyethylene sheet not less than 10 mils thick. ASTM E1745.

2.07 CURING MATERIALS

- A. Evaporation Retarder
 1. Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 2. Products (or equal)
 - a. "AquaFilm"; Dayton Superior
 - b. "VaporAid"; Kaufman Products, Inc.
 - c. "SikaFilm"; Sika Corporation
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 1. Products: (or equal)
 - a. "MasterKure" Series; Master Builders Solutions US LLC
 - b. "Kurez"; Euclid Chemical Co.
 - c. "Clear Resin Cure J11W"; Dayton Superior

2.08 RELATED MATERIALS

- A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.09 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Combined Fly Ash and Pozzolan: 25 percent.
 - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
 - 5. Silica Fume: 10 percent.
 - 6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
 - 8. Admixtures: Use admixtures according to manufacturer's written instructions.
 - a. Use water-reducing admixture in concrete, as required, for placement and workability.
 - b. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - c. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES

- A. For all concrete:

1. Minimum Compressive Strength: 4,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.42
3. Slump Limit: 3 inches prior to mid-range water reducer
4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete:
1. Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.
 2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing:
1. Measure, batch, and mix concrete materials and concrete according to ASTM C 94.
 2. Mix concrete materials in appropriate drum-type batch machine mixer.
 3. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 4. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 5. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
- F. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Install keyways, reglets, recesses, and the like, for easy removal.
- G. Do not use rust-stained steel form-facing material.
- H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- J. ACI 301 requires chamfers, unless otherwise specified.
 - 1. Chamfer exterior corners and edges of permanently exposed concrete.
 - 2. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

- 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.
- B. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- C. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.03 REMOVING AND REUSING FORMS

- A. Period of 24 hours is halved to 12 hours in ACI 347R.
- B. Commentary in ACI 318 recognizes 12 hours for concrete using regular Portland cement but advises that this period may be insufficient for concrete using Type II and Type V Portland cements or ASTM C 595 blended hydraulic cements, concrete with retarding admixtures, and concrete using ice during mixing.
- C. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- D. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
- E. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- F. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- G. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Engineer.

3.04 VAPOR RETARDER

- A. Lap joints 6 inches and seal with manufacturer's recommended tape.

- B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch.
 - 1. Place and compact a 1/2-inch- thick layer of fine-graded granular material over granular fill.

3.05 STEEL REINFORCEMENT

- A. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Weld reinforcing bars according to AWS D1.4, where indicated.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging.
- F. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.06 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints
 - 1. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Engineer.
 - 2. Place joints perpendicular to main reinforcement.
 - 3. Continue reinforcement across construction joints, unless otherwise indicated.
- C. Doweled Joints
 - 1. Install dowel bars and support assemblies at joints where indicated.
 - 2. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.07 CONCRETE PLACEMENT

A. General

1. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Engineer.
3. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
4. Do not add water to concrete after adding high-range water-reducing admixtures to mixture. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
5. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
6. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
7. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
8. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
9. Maintain reinforcement in position on chairs during concrete placement.

10. Screed slab surfaces with a straightedge and strike off to correct elevations.
11. Slope surfaces uniformly to drains where required.
12. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
13. Do not further disturb slab surfaces before starting finishing operations.

B. Cold-Weather Placement:

1. Comply with ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement

1. Comply with ACI 301 and ACI 305R, and as follows:
 - a. Maintain concrete temperature below 90 deg F at time of placement.
 - b. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.
 - c. Using liquid nitrogen to cool concrete is Contractor's option.
 - d. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete.
 - e. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish:

1. As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched.
 2. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 3. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish
1. As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 2. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 3. 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
1. Apply the following to smooth-formed finished as-cast concrete where indicated:
 - a. Smooth-Rubbed Finish (SRF): Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - b. Grout-Cleaned Finish (GCF): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 - c. Cork-Floated Finish (CFF): Wet concrete surfaces and apply a stiff grout. Mix one part Portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces

1. 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.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.09 FINISHING FLOORS AND SLABS

A. General

1. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
2. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
3. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

B. Slip-Resistive Finish

1. Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps.
2. Apply according to manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in 1 or 2 applications. Tamp aggregate flush with surface, but do not force below surface.
 - b. Revise float finish in first subparagraph below to trowel finish if required.
 - c. After broadcasting and tamping, apply float finish.
 - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In

1. Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs
 - 1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations
 - 1. Provide machine and equipment bases and foundations as shown on Drawings.
 - 2. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Cast-in inserts and accessories as shown on Drawings.
- E. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

- A. General
 - 1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R for cold-weather protection and ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder
 - 1. Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations.
 - 2. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces
 - 1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms.
 - 2. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces
 - 1. Begin curing immediately after finishing concrete.

2. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
3. Cure concrete according to ACI 308R, by one or a combination of the following methods:
 - a. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - 1) Water.
 - 2) Continuous water-fog spray.
 - 3) Absorptive cover, water saturated, and kept continuously wet.
 - 4) Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - b. Moisture-Retaining-Cover Curing
 - 1) 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.
 - 2) Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 3) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - 4) Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - 5) Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
 - c. Curing Compound
 - 1) Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

- 3) After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 - 4) Curing and sealing compound in subparagraph below is usually for floors and slabs and may act as a permanent surface finish.
- d. Curing and Sealing Compound:
- 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete

1. Repair and patch defective areas when approved by Engineer.
2. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.

B. Patching Mortar

1. Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
2. Insert provision for testing repair technique on a mockup or surface to be concealed later, before repairing surfaces.

C. Repairing Formed Surfaces

1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

2. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth.
3. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
4. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
5. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Engineer.
6. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
7. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports. See Section 01400.
- B. Inspections:
 1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Headed bolts and studs.
 4. Verification of use of required design mixture.
 5. Concrete placement, including conveying and depositing.
 6. Curing procedures and maintenance of curing temperature.
 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests

1. Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - a. 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.
 - b. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump
 - a. ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
3. Air Content
 - a. ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39
7. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate

operations and provide corrective procedures for protecting and curing in-place concrete.

- c. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- d. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

8. Nondestructive Testing

- a. Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.

D. Additional Tests

- 1. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer.
- 2. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Engineer.
- 3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 4. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- 5. Measure floor and slab flatness and levelness according to ASTM E within 48 hours of finishing.

END OF SECTION 03300

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**SECTION 03410
PRECAST STRUCTURAL CONCRETE**

PART 1 - GENERAL

1.01 SUMMARY

- A. Contractor shall provide all materials, labor, equipment and services necessary to design, construct and install precast concrete structures, as shown on the Contract Drawings.
- B. The structures shall be constructed of precast reinforced concrete. They shall be watertight, non-corrosive, durable and structurally sound. All inlet and outlet connections shall be sealed.

1.02 SUBMITTALS

- A. Shop Drawings: Submit detailed fabrication and installation drawings certified by a Professional Engineer registered in the State of Maryland prior to fabrication. Show plans, elevations, dimensions, cross sections, openings, joint design, and indicate location, size and type of reinforcing steel.
- B. Calculations: Submit manufacturer's complete design calculations certified by a Professional Engineer registered in the State of Maryland, including load calculations, buoyancy calculations, and concrete mix design.
- C. Certifications: Submit manufacturer's certifications and laboratory test reports including mill certification for the reinforcing steel, certificates of compliance for all flexible connectors and/or inlet and outlet seals, and certified test reports specified in referenced ASTM Standards.
- D. Watertightness test procedures and test results data.

1.03 DESIGN CRITERIA

- A. All precast structures shall be designed in accordance with ACI 350 "Building Code Requirements for Environmental Engineering Concrete Structures."
- B. Top slab must be separate and removable from structure. Structures shall be designed to accommodate pumps, piping, valves and other equipment, as shown or specified.
- C. Loads:
 - 1. Live Load: MDSHA HS-27 (135% of AASHTO HS20-44 Loading).

- 2. Dead Load: Earth at 125-pcf with an at rest coefficient equal to 0.53. Hydrostatic pressure should be included as applicable.
- D. Flotation design shall have a factor of safety of 1.5 minimum.
- E. Wall thicknesses shown on Contract Drawings are the minimum.
- F. All mechanical connections between precast units and any cast-in-place concrete or precast units shall be 316 stainless steel.
- G. Precast structures shall be designed to account for all reaction loads resulting from hoisting equipment, handrails, hatches, and other equipment, either embedded or attached to the structure, with a minimum thickness to fully embed all sleeves, bases, frames, anchors and other items that will impact the design.
- H. The base with riser walls and shelf shall be cast monolithically as a single unit. Rectangular vaults with an interior width dimension greater than 6'-0" or interior length dimension greater than 12'-0" may have a cast-in-place concrete bottom in-lieu of a monolithic cast bottom, provided the design is in accordance with the Contract Documents and is included in the design calculations as required above. The interface between the cast-in-place and precast units shall be sealed to provide a watertight structure, and all mechanical connections between the precast units and cast-in-place concrete bottom shall be 316 stainless steel.

1.04 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabrication shall be by a firm experienced in the manufacturing of precast concrete units similar to the ones indicated for this project and with a record of successful in-service performance.
- B. Design Standards: Comply with ACI 350 "Building Code Requirements for Environmental Engineering Concrete Structures" and the design recommendations of PCI MNL 120, "PCI Design Handbook—Precast and Prestressed Concrete".

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store precast concrete units at the project site in a manner to prevent cracking, distorting, warping, or other physical damage, and so that markings are visible.
- B. Lift and support precast concrete units only at designated lifting and supporting points as shown on approved shop drawings.

1.06 JOB CONDITIONS

- A. Verify dimensions at the project site and prepare shop drawings to reflect actual field conditions and dimensions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers that may be used include:
1. Concrete Pipe & Precast,
 2. Gillespie Precast,
 3. Monarch Products Company, Inc.

2.02 MATERIALS

- A. Concrete Materials
1. Portland Cement: ASTM C150, Type II.
 2. Aggregates: Except as modified by PCI MNL 116, use ASTM C33 coarse aggregates.
 3. Water: Potable, in accordance with ACI 318 and 350.
 4. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
 5. Water-Reducing; Retarding; Water-Reducing and Retarding; High-Range, Water-Reducing; and High-Range, Water-Reducing and Retarding Admixtures: ASTM C494.
 6. Fly Ash or Natural Pozzolans: ASTM C618.
 7. Silica Fume: ASTM C1240.
 8. Calcium chloride or admixtures containing chlorides shall not be used.
- B. Reinforcing Steel
1. Reinforcing Bars: ASTM A615, Grade 60, deformed, epoxy coated.
 2. Welded Wire Reinforcement: ASTM A1064, furnish in flat sheets, epoxy coated or galvanized.
 3. Epoxy Coating: Epoxy coated reinforcing steel shall be fusion bonded epoxy powder. The epoxy protective coating shall be a one coat, heat curable, thermosetting powdered coating that is electro-statically applied on metal surfaces. For reinforcement steel the color shall be a bright color to contrast

with the normal color of reinforcement steel and rust (e.g., orange, red, green, yellow, etc., and not brown or any color in the rust family). If reinforcement steel is coated before fabrication, all hairline cracks and minor damage on fabrication bends shall be patched, even if there is no bond loss. Epoxy coatings shall conform to ASTM D3963.

C. Joints

1. Joints between precast concrete units shall comply with ASTM C990, and shall be sealed watertight using CS-102 as Manufactured by Concrete sealants, Inc., or approved equal.

2.03 CONCRETE MIXES

- A. Compressive Strength: 5,000 psi at 28-days.
- B. Maximum Water-Cement Ratio: 0.40.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air-content as follows, with a tolerance of plus or minus 1½ percent:
 1. Air Content: 5 percent for 1½-inch nominal maximum aggregate size.
 2. Air Content: 6 percent for ¾-inch nominal maximum aggregate size.
 3. Air Content: 7 percent for ½-inch nominal maximum aggregate size.

2.04 COATINGS

- A. Coat exterior surface of precast concrete units with Carboline Bitumastic 300-M, or approved equal, 32 mil minimum thickness. Coat interior surfaces in accordance with Section 09900 unless drawings call for an interior coating in accordance with Section 09960.

2.05 FABRICATION

- A. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing and supporting reinforcement.
- B. Mix concrete according to PCI MNL 116. After concrete batching, no additional water may be added.
- C. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in the precast concrete units. Comply with PCI MNL 116 for measuring, mixing, transporting, and placing concrete.

- D. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.
- E. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- F. Product tolerances: Fabricate precast concrete units straight and true to size and shape with exposed edges and corners precise and true so the finished units comply with PCI MNL 116 product tolerances.
- G. Pipe Openings:
 - 1. Pipe openings 12" and smaller can be core drilled in the field, provided that the Contractor coordinates the locations of pipe openings with the precast concrete manufacturer to ensure that the structural and watertight integrity of the unit remains intact. Modular casing seals shall be used to seal the annular space around pipe penetrations to maintain the watertight integrity of the unit. The distance of the core drilled hole from a riser joint, another hole, or edge of a wall or slab shall be a minimum of 4" in all directions. Otherwise, all pipe penetrations shall be cast into the precast units as described below.
 - 2. All pipe openings cast into the precast units shall be provided with a gasket cast integrally into the structure. Gasket shall be rubber, meeting the requirements of ASTM C923, and manufactured by A-Lok Products Corp., Vertex Inc., or approved equal. Pipe opening elevations are fixed. Non-standard riser units shall be provided, as necessary, so that joints do not occur within 6" of pipe openings.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install precast concrete units on undisturbed soil with a stone bedding, which has been leveled and compacted as shown on the Contract Drawings. Excavation shall be free of standing water until backfilling is complete.
- B. Install precast concrete units level, plumb, square and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete".

3.02 WATERTIGHTNESS OF STRUCTURES

- A. The provisions of this section are applicable to precast concrete structures used as underground vaults that are intended to be dry, and precast concrete structures used as tanks that are intended to be wet.
- B. The Contractor shall provide all labor, materials, tools, equipment and devices for testing the water-tightness of new structures, constructed under this Contract. Testing shall be performed prior to the acceptance or placing the structure in operation. All structures, both water holding and dry, are meant to be watertight and free from discernible infiltration and exfiltration.
- C. Structures Designed to Contain Liquid
 - 1. Structures designed to contain liquid shall be thoroughly cleaned prior to the introduction of water for test purposes. Before testing a structure, all pipelines connecting to the structure shall have been tested and approved for leakage. All structures shall be tested for leakage and shall be tested in accordance with ACI 350.1. Testing shall be conducted prior to back filling soil around structures, unless otherwise noted.
 - 2. If any structure fails to meet the above requirements for water tightness, then the Contractor shall drain the structure, locate and repair all leaks and retest the structure as many times as is necessary to obtain a watertight structure as defined herein, all to the satisfaction of the Engineer and at no extra cost to the Owner.
- D. Structures designed to be dry shall have the interior thoroughly cleaned below finished grade and pumped dry if necessary. Openings below grade shall be bulkheaded and made tight. After a period of 5 days, interior surfaces will be inspected for accumulation of moisture and any excess accumulation indicative of defects in the structure in the judgment of the Engineer shall be repaired by the Contractor at no cost to the Owner and to the satisfaction of the Engineer.
- E. All leaks and defects in structures shall be repaired or remedied without additional compensation at whatever time during the course of the Contract they become apparent.
- F. Potable water shall be used for filling structures for leakage tests. It shall be the Contractor's responsibility to convey all water from hydrants or other approved source, as needed for the leak testing. The Contractor shall notify and coordinate with the appropriate Fire Department prior to using hydrants.
- G. No separate payment will be made for testing structures neither for water tightness nor for the cost of the water used. The cost thereof shall be considered as included in the lump sum bid for this Contract.

END OF SECTION 03410

**SECTION 03600
GROUT**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes grouting as indicated on the drawings or specified in other sections. Unless otherwise specified, all grouting shall be done with non-shrinking grout.

1.02 REFERENCES

- A. American Concrete Institute:
 - 1. ACI 308, Recommended Practice for Curing Concrete.
- B. American Society for Testing and Materials:
 - 1. ASTM C33; Concrete Aggregates.
 - 2. ASTM C109; Test Method for Compressive Strength of Hydraulic Cement Mortars (Using two inch or 50-mm Cube Specimens).
 - 3. ASTM C150; Specification for Portland Cement.
 - 4. ASTM C191; Test Method for Time of Setting of Hydraulic Cement by Vicat Needle.
 - 5. ASTM C596; Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - 6. ASTM C827; Test Method for Early Volume Change of Cementitious Mixtures.

1.03 SUBMITTALS

- A. Submit a statement of compliance, together with supporting data, from the materials suppliers attesting to the conformance of products and ingredients with these specifications.
- B. Submit manufacturer's instructions for mixing, handling, surface preparation, and placing the epoxy type and the non-shrink, non-metallic type grouts.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Grout manufacturer shall furnish copies of current independent laboratory test results showing the non-shrink, non-metallic grout as non-shrink from time of placement according to the following:

1. The grout indicates no expansion after final set according to ASTM C827.
2. The grout indicates 4,000-psi strength developed with a trowelable mix within 24 hours according to ASTM C109.
3. The grout indicates placement time limitation based on initial set of not less than 60 minutes according to ASTM C191.
4. Test results, as supplied by the grout manufacturer, shall indicate that in projects of similar scope and size, the effective bearing area was between 95 and 100 percent.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Provide protection for the products to prevent moisture damage and contamination of the grout materials.
- B. Store the grout in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.06 PROJECT CONDITIONS

- A. Protect freshly poured grout against high and low temperatures and unfavorable environmental conditions in accordance with ACI Standards 308.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Portland Cement: ASTM C150, Type II.
- B. Water: Potable; containing no impurities, suspended particles, algae, organic substances, acids, alkalis, or dissolved natural salts in quantities that will cause:
 1. Corrosion of steel,
 2. Volume change that will increase shrinkage cracking,
 3. Efflorescence,
 4. Excess air entraining.
- C. Fine Aggregate:
 1. Washed natural sand.
 2. Gradation in accordance with ASTM C33 and represented by a smooth granulometric curve within the required limits.

- 3. Free from injurious amounts of organic impurities as determined by ASTM C40.

2.02 RAPID-CURING EPOXY GROUT

- A. High strength, three-component epoxy grout formulated with thermosetting resins and inert fillers.
- B. Grout shall be rapid curing, have high adhesion, and be resistant to ordinary chemicals, acids and alkalis.

<u>Physical Properties</u>	<u>Reference Spec.</u>
Compressive Strength 12,000 psi (7-day)	ASTM C579
Tensile Strength 2,000 psi minimum	ASTM C307
Coefficient of Expansion 3×10^{-6} in/in/°F	ASTM C531
Shrinkage None	ASTM C827

2.03 NON-SHRINK, NON-METALLIC CEMENTITIOUS GROUT

- A. Pre-mixed ready for use formulation requiring only the addition of water; non-shrink, non-corrosive, non-metallic, non-gas forming, no chlorides. No more water shall be used than is necessary to produce a flowable grout.
- B. Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with Corps of Engineers Specification CRD-C621, for Type D non-shrink grout:

Setting Time:	Initial	2 hours (Approx.)
ASTM C191	Final	3 hours (Approx.)
Expansion:		0.4% Maximum
Compressive Strength:	1 day	4,000 psi
CRD-C621	7 days	7,000 psi
	28 days	10,000 psi

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

- A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until a sound, clean concrete surface is achieved. Perform additional surface preparation in accordance with non-shrink, non-metallic grout manufacturer's instructions.
- B. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.
- C. Remove foreign materials from metal surfaces in contact with grout.
- D. Align, level and maintain final positioning of components to be grouted.

- E. Take special precautions during periods of extreme weather conditions in accordance with the manufacturer's written instructions.
- F. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

3.02 FORMWORK

- A. Construct leakproof forms anchored and shored to withstand grout pressures, so that no movement is possible.
- B. Provide clearance between the formwork and the area to be grouted to permit proper placement of grout.
- C. Forms shall be provided where structural components of baseplates or bedplates will not confine the grout.
- D. Pre-treat wood forms with forming oils so that they do not absorb moisture.
- E. Remove supports only after grout has hardened.

3.03 MIXING

- A. Portland Cement Grout:
 - 1. Prepare grout composed of Portland cement, sand and water; do not use ferrous aggregate or staining ingredients in grout mix.
 - 2. Use proportions of 2 parts sand and 1 part cement, measured by volume.
 - 3. Prepare grout with sufficient water to obtain consistency to permit placing and packing.
 - 4. Mix water and grout in two steps; pre-mix using approximately 2/3 of the water; after partial mixing, add the remaining amount of water to bring mix to the desired placement consistency and continue mixing 2-3 minutes.
 - 5. Mix only that quantity of grout that can be placed within 30 minutes after mixing.
 - 6. After the grout has been mixed, do not add more water for any reason.
- B. Epoxy Grout & Non-Shrink Cementitious Grout: Mix and prepare epoxy grout and non-shrink cementitious grout in strict accordance with the manufacturer's instructions.
- C. Mix grout components as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

3.04 PLACING

- A. Unless otherwise specified or indicated on the drawings, the thickness of grout under baseplates shall be 1-1/2 inches. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the top of baseplates and bedplates are completely filled, without voids.
- B. Place grout material quickly and continuously.
- C. Do not use pneumatic-pressure or dry-packing methods.
- D. Apply grout from one side only to avoid entrapping air. The final installation shall be thoroughly compacted and free of air pockets.
- E. Do not vibrate the placed grout mixture, or permit it to be placed if the area is being vibrated by nearby equipment.
- F. In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate, bedplate, member, or piece of equipment.
- G. Do not remove leveling shims for at least 48 hours after grout has been placed.
- H. Unless otherwise noted in the drawings, anchor bolts and threaded rod anchors shall be epoxy grouted in holes drilled into hardened concrete. Diameters of holes shall be as follows:

<u>Item</u>	<u>Diameter of Hole</u>
Threaded Rod Anchors	1/8 inch larger than the bar or rod outside diameter
Anchor Bolts	Per manufacturer's instructions

- I. The embedment depth for epoxy grouted anchor bolts and threaded rod anchors, shall be not less than 15 bolt or rod diameters, unless otherwise indicated on the drawings. Holes shall be prepared for grouting as recommended by the grout manufacturer.
- J. Anchor bolts and threaded rod anchors shall be clean, dry, and free of grease and other foreign matter at time of installation. The bolts, rods, and bars shall be set and positioned, and the epoxy grout shall be placed and finished in accordance with the recommendations of the grout manufacturer. Particular care shall be taken to ensure that all space and cavities are filled with epoxy grout, without voids.
- K. During assembly of all threaded stainless steel components, anti-seize thread lubricant shall be liberally applied to the threaded portion not embedded in concrete.

3.05 CURING

- A. After grout has attained its initial set, keep damp for a minimum of 3 days.
- B. Prevent rapid loss of water from the grout during the first 48 hours by the use of an approved membrane-curing compound or with the use of the wet burlap method.

END OF SECTION 03600

**SECTION 04100
MORTAR AND MASONRY GROUT**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and specified herein.
- B. Principal items of work include:
 - 1. Mortar for unit masonry work.
 - 2. Grout for grouting masonry.
 - 3. Mortar for pointing and touchup.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04150 - Masonry Accessories
- B. Section 04200 - Unit Masonry

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of the Specifications, the Work shall conform to the applicable requirements of the following documents:
 - 1. ASTM C91 Standard Specification for Masonry Cement
 - 2. ASTM C144 Standard Specification for Aggregate for Masonry Mortar
 - 3. ASTM C150 Standard Specification for Portland Cement
 - 4. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes
 - 5. ASTM C270 Standard Specification for Mortar for Unit Masonry
 - 6. ASTM C476 Standard Specification for Grout for Masonry
 - 7. ASTM C979 Pigments for Integrally Colored Concrete
 - 8. ASTM C1019 Standard Methods of Sampling and Testing Grout
 - 9. ACI 530.1/ASCE 6 Specification for Masonry Structures

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:
 - 1. Manufacturer's data and mixing instructions for each product.
 - 2. Certificate of compliance with these specifications for each material specified below.
 - 3. Test reports.
 - 4. Samples of colored masonry mortar.

1.05 DELIVERY AND STORAGE

- A. Deliver materials in manufacturer's original containers, bearing labels indicating product and manufacturer's name.
- B. Store cementitious materials in waterproof locations to prevent damage by elements. Reject containers showing evidence of damage.
- C. Store aggregates in separate bins to prevent intrusion of foreign particles. Do not use bottom 6 inches of sand or other aggregate stored in contact with the ground.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Specifications provide products manufactured by Blue Circle Cement, Inc., Marietta, GA; Lehigh Portland Cement Company, Allentown, PA; Holnam, Inc., Dundee, MI, or equal.

2.02 MATERIALS

- A. Mortar and Grout Materials
 - 1. Portland Cement: ASTM C-150, Type I above grade and Type II below grade.
 - 2. Hydrated lime: ASTM C-207, Type "S".
 - 3. Sand: Clean, coarse, free of loam, salt, organic and foreign matter and conforming to ASTM C-144.
 - 4. Coarse and fine aggregates for grout: ASTM C-404.
 - 5. Masonry Cement: ASTM C 91, Type S and meet the following criteria:

- a. Prepackaged masonry cement shall contain Portland Cement, hydrated lime and plasticizing admixtures or hydraulic hydrated lime. Masonry cements which contain other materials, including ground limestone, ground slag, or other cementitious and non-cementitious materials, are not acceptable.
 6. Water - clean, fresh, potable and free from injurious amounts of oil, acids, alkalies, salts, organic matter or other deleterious substances.
- B. Admixtures
1. Do not use calcium chloride.
 2. Do not use admixtures, without written approval of Engineer.
 3. Mortar shall contain water repellent that is compatible with the split-face block.
- C. Mortar pigment
1. Natural or synthetic iron oxide and chromium oxides meeting the requirements of ASTM C979.
 2. Pigment shall not exceed 10% of the weight of portland cement. Carbon black shall not exceed 2% of portland cement.
 3. Color shall be selected by the Owner from the manufacturer's full range of colors.

2.03 GROUT AND MORTAR MIXES

- A. Masonry mortar shall be Type "S" according to ASTM C-270. Proportions for masonry mortar shall be one of the following:
1. Proportions by volume: 1 part Portland cement to 1/4 - 1/2 parts hydrated lime, and aggregate volume of not less than 2-1/4 or more than 3 times the sum of the volumes of cement and lime.
 2. Proportions by volume: 1/2 part Portland cement to 1 part masonry cement, and aggregate volume of not less than 1-1/4 or more than 3 times the sum of the volumes of cement and lime.
- B. Proportions for pointing mortar.
1. Proportions by volume: 1 part Portland cement to 1/4 part hydrated lime and 2 parts extra fine sand.
- C. Masonry Grout shall conform to the requirements of ASTM C 476 and ACI 530.1/ASCE 6, Section 4. Strength of grout, tested in accordance with ASTM C 1019 shall be equal to f'_m as specified in Section 04200, but not less than 2000 psi.

1. Test grout for every 5000 square feet of masonry, with a minimum of one test per structure.

PART 3 - EXECUTION

3.01 FIELD MORTAR MIXING

- A. Mixing shall be by mechanically operated batch mixer. Entirely discharge before recharging. Mix sand, lime, cement and admixtures dry for two (2) minutes minimum, add water and mix for three (3) minutes minimum. Control batching procedures by measuring materials by volume. Measurement by shovel count shall not be permitted. Mix mortar with less water than the maximum amount, consistent with workability, to provide near maximum tensile bond strength. Mix only quantity that can be used before initial set, or within the first one-half hour.
- B. Mixers, wheel barrows, mortar boards, etc., shall be kept clean.
- C. Retempering of mortar will not be permitted and mortar allowed to stand more than one (1) hour shall not be used.

3.02 INSTALLATION

- A. Install mortar and grout in accordance with ACI 530.1/ASCE 6.

3.03 REPOINTING MORTAR

- A. Prehydrate the mortar by mixing ingredients together dry, and then add only enough water to make a damp, stiff mix that will retain its form when pressed into a ball. After one to two hours, add water to bring it to the proper consistency.

END OF SECTION 04100

**SECTION 04150
MASONRY ACCESSORIES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and specified herein.
- B. Principal items of work include:
 - 1. Metal joint reinforcement for masonry.
 - 2. Accessories for masonry construction.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04100 - Mortar and Masonry Grout
- B. Section 04200 - Unit Masonry

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of these specifications, Work shall conform to the applicable requirements of the following documents:
 - 1. ASTM A82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
 - 2. ASTM A153 Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware
 - 3. ASTM D1056 Standard Specification for Flexible Cellular Materials - Sponge or Extruded Rubber
 - 4. ACI 530.1/ASCE 6 Specifications for Masonry Structures

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300, Submittals, submit the following:
 - 1. Provide manufacturers complete product data.
 - 2. Provide manufacturer's certification attesting compliance of material and source of each material specified below.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS FOR MASONRY REINFORCEMENT

A. Manufacturers

Subject to compliance with the Specifications, provide products manufactured by AA Wire Products, Company, Chicago, IL; Dur-O-Wal, Inc., Arlington Heights, IL; Heckmann Building Products, Inc., Chicago, IL; Holman and Barnard, Inc., Hauppauge, NY, or equal..

2.02 MATERIALS

A. Multi Wythe Joint Reinforcement

Steel truss type reinforcement with adjustable pintel and eye assembly; 3/16 inch side rods and 9 gauge continuous cross rods; manufactured with wire conforming to ASTM A 82, with widths 2-inches less than nominal wall thickness.

B. Anchors: Cast into concrete or weld to steel.

1. Dovetail Slot shall be 1 inch back by 1 inch deep by 5/8 inch throat, 22 gauge, foam filled.
2. Dovetail Anchor - accessory for anchoring triangular flexible tie to dovetail slot, shall be 1/8 inch by 1 inch wide 1/2 inch long dovetail section.
3. Wire/Strap Anchor - 1/4 inch wire or 12 gauge x 3/4 inch x length required, welded or mechanically attached to back up structure.
4. Top of Partition Masonry Anchor – 3/8 inch diameter rod attached to dovetail anchor for anchoring to dovetail slot; hot-dip galvanized finish; clear butyrate tube with compressible filter to be placed over rod anchor.

C. Ties

1. Triangular Flexible Tie: 3/16 inch wire, sized to suit application.
2. Adjustable Tie: Pintel and eye full tie; properly sized for application, 3/16 inch cold drawn steel.

D. Finish

1. Reinforcements, anchorages and ties shall be hot dipped galvanized, Class B-2, after fabrication in accordance with ASTM A153.

2.03 ACCESSORIES

A. Expansion and Joint Filler Material

1. Closed cell neoprene material conforming to ASTM D 1056, with a minimum compressibility of 50%. Horizontal joint filler shall be 1/4 inch thick. Expansion joints shall be a minimum 3/8" thick.

B. Weep and Vent Holes

1. Open head joints for brick and half-head joints for concrete masonry veneer.

C. Control Joint

1. Wide flange rapid preformed neoprene gasket.

D. Hardware Cloth

1. Waterproof paper backed with 1/2 inch hardware cloth.

E. Cavity Drainage Protection

1. Cavity drainage protection shall be fluid conducting, non-absorbent, mold and mildew resistant polymer mesh consisting of 100% recycled polymer with PVC binder as manufactured by CavClear Masonry Mat by CavClear, Mortairventor by Advanced Building products, or equal. Thickness shall be as shown on the Drawings.

PART 3 - EXECUTION

3.01 REINFORCEMENT AND ANCHORAGE

- A. In masonry wall panels, place horizontal joint reinforcement at a vertical spacing of 16 inches on center, unless otherwise noted.
- B. Lap side rods at each end joint a minimum of 6 inches.
- C. Install prefabricated corner and tee assemblies at each wall corner and intersection.
- D. Mitre and butt end joints are prohibited.
- E. Place horizontal joint reinforcement in approximate center of out-to-out wall assembly and assuring a 5/8 inch, minimum, mortar coverage on exterior face and 1/2 inch on interior face.
- F. Adjustable anchor assemblies may be offset no more than that which is stated in manufacturer's published instructions. Pintles may be installed either up or down.

- G. Install horizontal joint reinforcement continuous, terminating only at vertical control joints.
- H. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend 24 inches minimum each side of opening.
- I. Place joint reinforcement continuous and at 8 inches on center vertically above roof.
- J. Place reinforcing bars supported and secured against displacement. Maintain position with ½ inch to true dimension.
- K. Coordinate and verify that dowels and anchorages embedded in concrete and attached to structural steel members are properly placed.
- L. Provide wall ties for masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place at maximum 8 inches on center each way around perimeter of openings, within 12 inches of openings.
- M. Masonry adjacent to steel and concrete columns to be attached to the column with masonry anchors at 16 inches on center. Anchors to be attached to each face of the column which is adjacent to a masonry wall, unless otherwise noted.

3.02 DOVETAIL SLOTS AND ANCHORS

- A. Provide dovetail slots to concrete contractor for placement into the concrete construction. Dovetail slots shall be placed vertically and spaced 16 inches on center horizontally.
- B. Remove slot filler after forms are removed.
- C. Hook dovetail anchor into slots and set in masonry joints at 16 inches on center.
- D. Install top of partition masonry anchors per manufacturer's instructions.

3.03 BENDING, CUTTING AND SPLICING REINFORCEMENT

- A. Make bends and splices in reinforcement only where indicated, or prior-approval by Engineer. Bend reinforcement only when cold, and prior to any placement in construction, forming around a steel pin of diameter at least 6 times the reinforcement size. Cut bars only by approved sawing, shearing or welding methods.
- B. Make ends of reinforcement straight, square, clean and free of defects before splicing. Do not heat or weld bends and splices at points of maximum stress. Clip and bend any tie wires as required to direct the ends away from external surfaces of masonry walls.
- C. Where welding is necessary, provide materials and perform welding in accordance with AWS requirements.

- D. All lap splices to be 48 bar diameters, unless otherwise noted.
- 3.04 CAVITY DRAINAGE MAT**

- A. Install cavity drainage mat in air-space between insulation and masonry veneer in all masonry veneer construction.
- B. Cavity drainage mat shall be adhered to back-up in accordance with manufacturer's instructions.

END OF SECTION 04150

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**SECTION 04200
UNIT MASONRY**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and specified work.
 - 1. Principal items of work include:
 - a. Exterior masonry wall construction.
 - b. Installation of masonry reinforcement and accessories.
 - c. Masonry unit lintels.
 - d. Installing insulation, flashing and work required to be built into masonry work.
 - e. Building into masonry work all anchors, inserts, hangers and the like provided under other Sections.
 - f. Pointing and cleaning of exposed masonry surfaces.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04100 - Mortar and Masonry Grout
- B. Section 04150 - Masonry Accessories
- C. Section 07210 - Building Insulation
- D. Section 07600 - Flashing and Sheet Metal

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of the Specifications the Work shall conform to the applicable requirements of the following documents:
 - 1. ACI 530.1/ASCE 6 Specifications for Masonry Structures
 - a. ACI 530.1/ASCE 6, jointly published by the American Concrete Institute and the American Society of Civil Engineers, hereafter referred to as ACI 530.1 shall be considered minimum specifications for all materials, workmanship, methods and techniques for all masonry work.

- b. Obtain a copy of the above Specifications prior to beginning any work in this Section.
2. ASTM C62 Standard Specification for Building Brick
 3. ASTM C90 Standard Specification for Load-Bearing Concrete Masonry Units
 4. ASTM C140 Standard Methods for Sampling and Testing Concrete Masonry Units
 5. ASTM C216 Standard Specification for Facing Brick
 6. ASTM C744 Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units
 7. ANSI A41.1 R70 Code Requirements for Masonry

1.04 TESTING

A. Tests

The Owner reserves the right to have the Contractor test materials for compliance with these specifications. Sampling and testing will be done in accordance with the ASTM standard, by an independent testing agency employed by the Contractor and approved by the Engineer. Materials that fail to meet requirements are considered defective. Subsequent tests to establish compliance (of the same or new materials) shall be paid for by the Contractor. All testing shall be at no cost to the Owner.

1.05 SUBMITTALS

A. Submit the following:

1. Samples of each material to be used showing full range of colors.
2. Manufacturer's specifications and certifications of compliance to the Specifications, including results of tests on masonry units showing such compliance, for each type of masonry. Provide handling, storage, and installation instructions along with protection instructions. Indicate by transmittal that installer has received copies of each instruction.
3. Cold and/or hot weather construction procedures in accordance with ACI 530.1/ASCE 6 sections 2.3.2.2. and 2.3.2.3.
4. Cleaning procedures and cleaner for each masonry type.

1.06 MOCK-UPS

- A. Build mock-ups at the site, where directed, full thickness and approximately 4 feet x 4 feet, indicating the proposed color range, texture and workmanship for each type of masonry. Obtain Engineer's acceptance of visual qualities of the mock-up before start of masonry work. Do not alter, move or destroy mock-ups until Work is completed and removal is directed by the Engineer.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in the manufacturer's original unbroken, undamaged and unopened packaging with labels bearing the name of the manufacturer and the product. Masonry units and brick shall be factory packaged and strapped, delivered to the site and stored on skids.
- B. Store and handle materials to prevent inclusion of water or foreign matter and to prevent damage of any nature.
- C. Distribute materials on floor slabs to prevent overloading. Designated live loads shown for floor shall not be exceeded.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide special shape, type or size indicated or for application requiring a form, size or finish which cannot be produced from standard masonry units by sawing. Provide solid units where masonry unit is exposed.

2.02 MATERIALS

- A. Mortar and Masonry Grout
 - 1. In accordance with Section 04100 - Mortar and Masonry Grout
- B. Masonry Accessories
 - 1. In accordance with Section 04150 – Masonry Accessories
- C. Concrete Masonry Units
 - 1. Provide units conforming to ACI 530.1 unless otherwise specified.
 - 2. Provide normal weight units meeting the requirements of ASTM C90, Type II, for hollow and solid load bearing CMU.
 - 3. Manufacture units of Portland Cement, conforming to ASTM C-150 and light weight aggregate conforming to ASTM C331 and ASTM C33. Weight of unit shall not exceed 105 lb. per cu. ft. when measured in accordance

with provisions of ASTM C140. Units shall be nominally 8 inches x 16 inches x thicknesses shown or as required. Masonry units shall be manufactured not less than 30 days prior to being used and stored under cover until shipment. All units shall have true, sharp edges and corners, free from cracks or other defects unless otherwise noted. Provide bullnose shapes for external corners, sills and jambs. Provide half special sizes and shapes as required by the Drawings or to meet job conditions.

4. Net area compressive strength of concrete masonry units shall be a minimum of 2,800 psi when tested in accordance with ASTM C140. Compressive strength of masonry (f_m) shall be a minimum of 2,000 psi in accordance with ACI 530.1 when these units are used with the mortar specified in Section 04100.

D. Concrete Masonry Lintels

Specially formed units with reinforcing bars and mortar fill provided where shown and wherever openings in masonry are indicated without structural steel or other supporting lintels.

E. Brick, General:

1. Provide modular size brick (7-1/2 inches long x 2-1/4 inches high x 3-3/4 inches wide) ASTM C-216, Grade SW, Type FBS, color as selected by the Owner.
2. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related areas.
3. Coring: At Contractor's option, provide solid cored brick for brickwork. Do not use cored brick with net cross-sectional area less than 75 percent of gross area, or with core holes closer than 3/4-inch from any edge.

F. Building or Common Brick: ASTM C62-84, Grade SW. Concealed units, Grade MW.

G. Miscellaneous Materials:

1. Weepholes: Shall be 3/8-inch outer diameter clear, nonstaining plastic tubing.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine areas and conditions under which masonry is to be installed and notify the Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
- B. Do not wet concrete masonry units.
- C. Brick having absorption rates in excess of 0.025 oz. per square inch per minute (as determined per ASTM C 67) shall be wetted sufficiently so that the rate of absorption, when brick is laid, does not exceed this amount.
- D. Clean reinforcing, removing loose rust, ice or other coatings from bars, before placement.
- E. Thickness of cavity and composite walls, and other masonry construction shall be the full thickness shown. Build single wythe walls to the actual size of masonry units.
- F. Build chases and recesses as shown and as required for the work of other trades.
- G. Build other work into masonry work as shown, fitting masonry units around other work and grouting to assure anchorage.
- H. Cut masonry units with motor driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units as required to provide pattern shown or specified, and to fit adjoining work neatly.
- I. Cold and hot weather construction.
 - 1. No masonry shall be erected when ambient temperature has dropped below 45°F unless it is rising and at no time when it has dropped below 40°F. Provisions shall be made for heating and drying of materials, and the complete work shall be protected in accordance with the ACI 530.1/ASCE 6 Section 2.3.2.2. Masonry shall not be laid with ice or frost on its surfaces, and no masonry shall be laid on frozen work. Any work which freezes before the mortar has set shall be removed and replaced at the Contractor's own expense. Do not use any admixtures or antifreeze in the mortar.
 - 2. When the temperature is above 100°F or 90°F with a wind velocity greater than 8 mph, mortar beds shall be spread no more than 4 feet ahead of masonry and masonry units shall be set within one minute of spreading mortar.

3.02 CONSTRUCTION TOLERANCES

- A. Variation from plumb: For vertical lines and surfaces of columns, walls and arises do not exceed 1/4" in 10', or 3/8" in a story height not to exceed 20', nor 1/2" in 40' or more. For external corners, expansion joints, control joints and other conspicuous lines, do not exceed 1/4" in any story or 20' maximum, nor 1/2" in 40' or more. For vertical alignment of head joints do not exceed plus or minus 1/4" in 10', 1/2" maximum.
- B. Variation from level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines do not exceed 1/4" in any bay or 20' maximum, nor 1/2" in 40' or more. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10' or 1/16" within width of a single unit.
- C. Variation of Linear Building Line: For position shown on plan and related portion of columns, walls, and partitions, do not exceed 1/2" in any bay or 20' maximum, nor 3/4" in 40' or more.
- D. Variation in Cross Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4" nor plus 1/2".
- E. Variation in Mortar Joint Thickness: Do not exceed bed joint thickness indicated by more than plus or minus 1/8", with a maximum thickness limited to 1/2". Do not exceed head joint thickness indicated by more than plus or minus 1/8".

3.03 LAYING MASONRY WALLS

- A. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half size units at corners, jambs, and wherever possible at other locations.
- B. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.
- C. Pattern Bond: Lay exposed masonry in the bond pattern shown or, if not shown, lay in running bond with vertical joint in each course centered on units in courses above and below.
- D. Stopping and Resuming Work: Rack back 1/2 unit length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, and remove loose masonry units and mortar prior to laying fresh mortar.
- E. Cover top of walls at the end of each day. Protect wall from water infiltration from the top until wall is capped.
- F. Built-In Work: As work progresses, build-in items specified under this and other sections of these Specifications. Fill in solidly with masonry around built-in items.

1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of hardware cloth in the joint below and rod grout into core.
3. Fill cores in hollow masonry units with grout 3 courses (24") under bearing plates, beams, lintels, posts and similar items, unless otherwise noted.
4. Seal masonry tight around wall penetrations such as beams, joists, pipes, ducts, and conduit by cutting masonry units to fit as tightly as possible, then closing final gap all around with mortar, or joint filler and caulking as necessary.

3.04 MORTAR BEDDING AND JOINTING

- A. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also bed webs with mortar in starting courses on footing or floors, and where adjacent cells are to be reinforced or filled with grout. For starting courses where cells are not grouted, spread full mortar bed including areas under cells.
- C. Maintain joint widths of 3/8", except for minor variations required to maintain bond alignment.
- D. Tooling: Joints shall be tooled to a uniform concave joint. Head joints first and then the bed joints.
- E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners and jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean and reset in fresh mortar.

3.05 JOINT REINFORCING

- A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints not more than 16" o.c. vertically.
- B. Parapets: Use continuous horizontal joint reinforcement installed in horizontal joints at 8" o.c. vertically.
- C. Reinforced masonry openings greater than 12" wide, with horizontal joint reinforcing placed in 2 horizontal joints immediately above the lintel and immediately below the sill. Extend reinforcements 2'-0" beyond jambs of the opening except at control joints.

- D. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
- E. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, pipe enclosures and other special conditions.
- F. Intersecting Load-bearing Walls: Provide rigid steel anchors at not more than 2'-0" o.c vertically. Embed ends in mortar-filled cores.
- G. Non-loadbearing Interior Partitions: Build full height of story to underside of solid floor or structure above, unless shown otherwise. Fill joint with mortar after dead load deflection of structure above approaches final position.

3.06 CONTROL AND EXPANSION JOINTS

- A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown, or where not shown as recommended by brick and concrete masonry unit manufacturer. Notify Engineer prior to providing joints in addition to those specified in the Contract Documents. Build-in related items as the masonry work progresses.

3.07 LINTELS

- A. Install galvanized steel lintels where indicated.
- B. Provide masonry lintels where shown and wherever openings of more than 8" for brick size units and 1'-4" for block size units are shown without structural steel or other supporting lintels. Provide precast or poured-in-place masonry lintels. Cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.
- C. For hollow concrete masonry unit walls, use specially formed "U"-shaped lintel units with reinforcement bars placed as shown and filled with grout.
- D. Provide minimum bearing of 8" at each jamb.

3.08 FLASHING

- A. Provide flashing as shown and as specified in Section 07600, Flashing and Sheet Metal.

3.09 REINFORCED UNIT MASONRY

- A. Vertical reinforcement shall be held in place by means of frames or other suitable means. Place horizontal joint reinforcement as masonry work progresses. Provide minimum clear distance between longitudinal bars equal to nominal diameter of bar. Minimum thickness of mortar or grout between masonry and reinforcement shall be 1/4", except 6 gage or smaller wires may be laid in 3/8" mortar joints. Collar joints which contain both horizontal and vertical

reinforcement shall have a minimum width of 1/2" larger than the diameter of the horizontal and vertical reinforcement.

- B. Bar splices shall be contact lap splices. Length of splice shall be a minimum of 24" for #4 bars and 30" for #5 bars, unless noted otherwise in the contract documents.
- C. Low lift grouting shall be used when grout space is less than 2" in width. Place grout at maximum intervals of 24" in lifts of 6 to 8 inches as the work progresses. Cores to be grouted shall be clean of mortar, mortar dropping and debris. Agitate grout to assure complete filling and coverage of reinforcement. Hold grout 1 1/2 inches below to top of masonry if work is discontinued for more than a hour.
- D. High lift grouting may be used when the grout space is greater than 2". Grout shall not be placed in lifts greater than 4 feet. Grout core shall be kept clean of mortar, mortar dripping and debris. Provide cleanout holes as required for inspection and cleaning. Replace cleanout plugs after inspection and acceptance. Do not place grout until entire wall has been in place a minimum of 3 days. Hold grout 1 1/2 inches below top of masonry if work is discontinued for more than an hour.
- E. Forms and shoring shall be substantial and tight to prevent leakage of mortar or grout. Brace and shore forms to maintain position and shape. Do not remove forms or shoring until masonry gains enough strength to sufficiently carry its own weight and any other loads, temporary or permanent, placed on it during construction.

3.10 BRICK UNITS

- A. All joints between bricks shall be completely filled with mortar: Bed joints shall be formed of a thick layer of smooth or slightly furrowed mortar, applied to the units previously laid, with the brick then shoved in place; or bed joints may be formed as specified for cross joints. Cross joints shall be formed by applying to the brick to be laid, a full coat of mortar on the entire end or the entire side, as the case requires, and then shoving the mortar-covered end and/or side of the brick tightly against the bricks previously laid. The practice of buttering the corners of brick and then throwing mortar scrapings into the empty joints will not be permitted. All brick shall be laid without disturbing the brick previously laid. Dry or butt joints will not be permitted. Grouting shall be done only as necessary.
- B. Wetting: Brick having absorption rate of more than 0.025 ounce per square inch per minute shall be wetted sufficiently so that the rate of absorption when laid does not exceed this amount. All units shall be free from water adhering to their surfaces when they are laid in the wall. Do not wet concrete masonry units.

3.11 CAVITY WALLS

All exterior walls, unless otherwise indicated, shall be cavity walls of thickness indicated, with continuous 2-inch cavity, except for returns at windows, columns, control joints and as detailed, indicated.

- A. Two wythes of cavity walls shall be securely tied together by joint reinforcement as herein specified.
- B. Cavity between facing and backing wythe shall be kept clean and clear of all mortar droppings, and no mortar ledges shall project into the cavity. Temporary wood strips, cut to width of cavity and fitted with lift-up wires, shall be laid on the joint reinforcement and carefully lifted out before placement of the next layer or reinforcement. Any projecting mortar shall be spread over the back of the outer wythe immediately following the setting of the masonry unit.
- C. Weepholes shall be provided in mortar joints of the exterior wythe of all cavity walls in the first course above top of flashing along the bottom of cavity walls, over foundations, bond beams, shelf angles and water stops by placing 3/8-inch nominal diameter plastic weephole tubing 32 inches on center in each row.

3.12 COORDINATION WITH OTHER TRADES

- A. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching. Build in work specified under other sections of the Specifications as the work progresses. Provide recesses at walls where required for piping, louvers, ducts, etc., install and set all bolts, plates, anchors, flashing reglets and items to support other work to follow masonry.
- B. Set steel lintels which bear on masonry. Lintels shall have beds of mortar and flashed as required by Drawings.

3.13 WALL FLASHING

- A. Shall be set with full bed of mortar above and below flashing and installed in strict accordance with manufacturer's specifications. Flashing shall extend a minimum of 8 inches beyond all masonry openings of each jamb at head and sill. Flashing shall be laid in all cases, extending down one course minimum from the back-up course and out to within 1/2-inch of face of wall.

3.14 PROTECTION OF WORK

- A. Exposed masonry surfaces shall be protected from staining. Tops of wall shall be covered with nonstaining waterproof coverings when work is not in progress. Installed material shall be secure in high winds.
- B. Protection shall be provided for all openings in the walls to prevent damage to sills, jambs, etc., from all causes. Aluminum or steel frames and other finish materials shall be protected from damage during masonry work.

3.15 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install fresh mortar or grout, pointed to eliminate evidence of replacement.

- B. Pointing of Masonry: At the completion of the masonry work, all holes in exposed masonry shall be pointed. Defective joints shall be cut out and tuckpointed solidly with mortar. Pointing and tuckpointing shall be done with a pre-hydrated mortar. The mortar cement shall be controlled so that, after curing of the mortar, no difference in texture or color exists with that of adjacent masonry.
- C. Masonry Cleaning: While laying masonry units, good workmanship and job housekeeping practices shall be used so as to minimize the need for cleaning the masonry work. Protect the base of the wall from mud splashes and mortar droppings. The technique for laying masonry shall be such that mortar does not run down the face of the wall or smear onto the face.
1. After the joints are tooled, cut off mortar failings with the trowel and brush excess mortar burrs and dust from the face of the masonry, use a bricklayer's brush made with medium soft hair.
 2. Remove all large mortar particles with a hardwood scraper.
 3. If, after using the above outlined techniques, additional cleaning of the walls is found necessary, allow the walls to cure one month prior to initiating further cleaning processes.
- D. Clean masonry to comply with the masonry manufacturer's directions and applicable NCMA "Tek" bulletins or BIA technical notes and the following requirements.
1. Saturate the wall with clean water. The wall shall be thoroughly saturated prior to and at the time the cleaning solution is applied.
 2. Clean masonry with an approved cleaning solution for each type of masonry applied with a brush, starting at the top of the wall. Approved cleaners shall be composed primarily of detergents, wetting agents, buffering agents, and a maximum of 10% muriatic acid. Do not use acids on masonry surfaces that will be damaged by use of an acid cleaner. The use of any of the above cleaning agents shall first be approved in writing by the manufacturer of the masonry being cleaned and the Program Manager. The concentration, method of application of the cleaning solution, and method of scraping shall be as outlined on the container by the manufacturer.
 3. High pressure water and sandblasting shall not be used for cleaning except with the recommendation of the masonry manufacturer and the written approval of the Engineer.
 4. Immediately after cleaning a small area, the wall shall be rinsed thoroughly with quantities of water.
 5. Protect adjacent surfaces and materials during masonry cleaning operations.

6. After the walls are cleaned, take the necessary precautions to ensure that other contractors and subcontractors do not damage or soil the walls. Mud protection around the base of walls shall be left in place until the grading work is done.

END OF SECTION 04200

**SECTION 05500
METAL FABRICATIONS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes the following:
1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 2. Shelf angles.
 3. Loose bearing and leveling plates.
 4. Steel weld plates and angles for casting into concrete not specified in other sections.
 5. Miscellaneous steel trim including steel angle corner guards, steel edgings and loading-dock edge angles.
 6. Aluminum stairs and stair systems.
 7. No attempt is made to enumerate each item required, but to indicate parts and describe general construction and certain special items; perform work in strict conformity with the Contract Documents, approved Shop Drawings, and the Specifications; obtain field measurements of adjoining work required to locate and fit work.
- B. Products furnished, but not installed, under this Section include the following:
1. Loose steel lintels.
 2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete."
 2. Division 04 Section "Unit Masonry."
 3. Division 05 Section "Structural Steel Framing."
 4. Division 05 Section "Metal Gratings."

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Structural Performance of Stairs: Provide metal stairs and a complete stair system, capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft.
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Limit deflection of treads, platforms, and framing members to L/360 deflection ratio or ¼ inch, whichever is less.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails:
 - a. Uniform loads of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 3. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Uniform load of 25 lsf/sq. ft. applied horizontally.

- c. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."
- E. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings and treads.
 - 3. Paint products.
 - 4. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 - 2. Provide templates for anchors and bolts specified for installation under other Sections.
 - 3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the registered professional engineer, in the Commonwealth of Virginia, responsible for their preparation.
 - 4. Concrete Anchor Installer Qualifications and Procedures: Submit installer qualifications. Drilled-in anchors shall be installed by an installer with a minimum of five years' experience performing similar installations. Submit a letter of procedure stating method of drilling, the product proposed for use, the complete installation procedure, manufacturer training date, and a list of the personnel to be trained on anchor installation.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.

- D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- E. Welding certificates.
- F. Qualification Data: For professional engineer, registered in the Commonwealth of Virginia.

1.04 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.06 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

1.07 PRODUCT DELIVERY, HANDLING AND STORAGE

- A. Deliver all materials in good condition. Store in dry place, off ground; keep dry at all times. Handle materials to prevent damage to product or structure.
- B. Deliver all materials to the job site properly marked to identify the structure for which they are intended and at such intervals to insure uninterrupted progress of the work. Marking shall correspond to markings indicated on the shop drawings.

PART 2 - PRODUCTS

2.01 METALS, GENERAL

- 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.

2.02 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. W-Shapes: ASTM A 992, Grade 50.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. Steel Tubing: ASTM A 500, Grade B, cold-formed steel tubing.
- F. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads. Paragraph below describes typical component of metal channel framing systems such as that manufactured by Unistrut Corporation, or equal.
- G. Cast Iron: ASTM A 48, Class 30, unless another class is indicated or required by structural loads.

2.03 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26, Alloy 443.0-F.
- E. All Aluminum used in an exterior application shall be anodized.

2.04 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers, galvanized in accordance with ASTM A 153.
- C. High Strength Bolts: ASTM A 325, galvanized (Type 3 for corrosive locations).
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593, Type 304, Condition CW1 or CW2 for bolts and ASTM F 594 for nuts. Washers shall be ASTM A 666, Type 304.
- E. Provide a passive coating for all stainless steel fasteners and hardware.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Bolts: ASME B18.2.1.
- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. Concrete Fasteners and Anchors: Fasteners and Anchors shall be of the type and size shown on the Contract Drawings, and are specified as follows:

Anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

- 1. Anchor Bolts.
 - a. 304 Stainless Steel, unless noted otherwise on the Contract Drawings.
 - b. Size and configuration as shown on the Contract Drawings.
- 2. Mechanically Fastened Anchors.

- a. Expansion anchors shall have embedment lengths as shown in the Contract Drawings.
 - (1) 304 Stainless Steel, Condition CW1 or CW2, unless noted otherwise in the Contract Drawings.
 - (2) Acceptable manufacturers:
 - (a) "Kwik Bolt TZ" by Hilti, Inc.
 - (b) Or Equal.
 - b. Request for an alternate expansion anchor shall include the following:
 - (1) Building Code Compliance Certifications
 - (2) International Code Council Approvals
 - (3) Product Description
 - (4) Material Specifications
 - (5) Allowable Tension and Shear Static Loads
 - (6) Technical Data
 - (7) Anchor Spacing and edge Distance Reduction Factors
3. Chemically Fastened Anchors/Reinforcing Bars
- a. Sizes and embedments of chemically fastened anchors /reinforcing bars shall be as shown in the Contract Drawings.
 - b. Acceptable manufacturers:
 - (1) "HIT RE 500 Epoxy Anchoring System" as manufactured by Hilti, Inc.
 - (2) Or Equal.
 - c. Request for an alternate fastening system shall include the following:
 - (1) Building Code Compliance Certifications
 - (2) International Code Council Approvals
 - (3) Product Description
 - (4) Material Specifications
 - (5) Technical Data
 - (6) Allowable Loads
 - (7) Ultimate Strengths
 - (8) Spacing and Edge Distance Reduction Factors
 - (9) Influence of Temperature on Strength
 - (10) Resistance to Chemicals
 - (11) Installation Guidelines
4. Substitutions of the anchor types shown on the Contract Drawings shall not be permitted without approval of the Engineer

2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 09 painting Sections.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.06 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 true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.07 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.
 - 1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
 - 2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.08 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. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels in accordance with ASTM A 123.

- D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

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 plates after fabrication in accordance with ASTM A 123.
- C. Prime plates with zinc-rich primer.

2.10 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 not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Prime exterior and interior miscellaneous steel trim with zinc-rich primer.

2.12 LADDER SAFETY CAGES

- A. General:
 - 1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
 - 2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
 - 3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.
- B. Aluminum Ladder Safety Cages:
 - 1. Primary Hoops: 1/4-by-4-inch flat bar hoops.

2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 1/4-by-2-inch flat bars secured to each hoop.

2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123, for galvanizing steel and iron products.
 2. ASTM A 153, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. Dull Satin Finish: No. 6.

- E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.16 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
- D. Grind weld joints smooth with adjacent finish surface.
- E. Coat aluminum in contact with dissimilar metals, masonry or lime products with one-coat of bituminous paint.

2.17 RAILING

- A. Railing

The pipe railing shall be constructed with mechanically fastened, flush-fit INTERNA-RAIL aluminum fitting system as regularly manufactured by Hollaender Manufacturing Co., or equal. The fittings shall be internally connected to the pipe by means of an internal double tang, expanded by an austenitic 302 alloy stainless steel, internal, reverse knurl, cup point, hexagon socket set screw. Pop rivets, sheet metal screws and adhesives shall not be acceptable. The fittings shall be machined of austenitic stainless steel bar stock of 302 alloy conforming to ASTM A 582, or machined castings of high tensile aluminum-magnesium alloy 535.0 manufactured in compliance with ASTM B 26, cast from high purity ingot 535.2 conforming to ASTM B 179. Flanges shall be sand cast from high-tensile aluminum-magnesium alloy 535.0 and fastened directly to the pipe by means of an external, reverse knurl, cup point, hexagon socket set screw.

Aluminum: railing shall be fabricated of standard 6061-T6 allow, Schedule 40 extruded aluminum structural pipe, in accordance with ASTM B 221; pipe shall be nominal 1-1/2", with 1.9" O.D. and 0.145" wall thickness. Pipe posts shall be 1-1/2" diameter, 80 gauge.

- B. Railing shall be a two rail system designed to meet OSHA standards. Provide additional intermediate rails where indicated on the drawings. Unless otherwise noted on the drawings, the centerline of top rail shall be 3'-6" above the walking surface and the centerline of the second rail shall be installed at mid-height. Top rail for stairs shall not be more than 34" not less than 30" above tread. Provide minimum 3" clearance on single pipe stairway handrails supported on brackets from a wall.

- C. Post spacing shall be adequate to meet loading requirements but shall not exceed 6'-0" o.c. maximum.
- D. The top surface of the top rail shall be smooth and shall not be interrupted by projecting fittings.
- E. Provide removable stainless steel chains with snap hooks were indicated.
- F. Provide expansion and contraction joints in the railing. Expansion joints must align with those in the structure to which the handrail is attached. Post spacing shall be located 1'-0" maximum to the right or left of expansion and contraction joints.
- G. Railing shall be capable of withstanding a concentrated load of at least 200 pounds applied in any direction at any point on the rail, or 50 pounds per linear foot applied in any direction at any point on the rail.
- H. Handrail post shall be base flange mounted.
- I. Removable Setting: Railing shall be set in close-fitting sleeves, bolted to sides of concrete walkways or aluminum walkway support structure.
- J. Permanent setting in concrete shall have posts set in sleeves and set in non-shrink grout.
- K. Finish: Aluminum: Clear satin anodized, 0.7 mil thickness, AS-M21C22A41. Ship the rail plastic wrapped. Remove plastic wrap after erection.
- L. Furnish 316 stainless steel safety chains across opening.
- M. A gap shall be provided at joints not to exceed 1/4". A neoprene gasket shall be provided at all gaps. Gap intervals and distance shall be as recommended by the manufacturer.

2.18 TOE BOARD

- A. Provide toe boards a minimum of 4" high at the following locations. Where stairs or stairways are exposed with open areas below. Where platforms, runways or catwalks cross over open areas or open tanks. Where indicated on the drawings.
- B. Toe boards shall be minimum 4" high extruded aluminum and attached to the posts with clamps or brackets which allow for lateral movement due to expansion and contraction between posts. Toe boards shall be set 1/4" above the walking surface. Notch toe boards as required at posts base plates.
- C. Where toe board sections terminate, splice toe board sections using a minimum 4" long bracket. The splice connection shall be a snap fit to allow expansion and contraction. Bolt, rivet, etc., type fasteners at the splice shall not be permitted. Provide a gap between the adjoining tow board sections at the splice of the dimension recommended by the manufacturer for the installation temperature.

2.19 ALUMINUM STAIRS

- A. Fit and shop assemble stair in the largest practical sections for delivery to the job site.
- B. Miter the stringers at changes in direction with joints tightly fitted and secured by continuous welds and grind with #3 NOMMA Finish. Make exposed joints butt tight. Ease exposed edges to a small uniform radius.
- C. Close and fit the ends of stringers at the floor or landing to the floor surface. On the landing and platforms where they are part of the stair framing, carry the wall stringers around and above the finished level of the platform to form a base of the height as shown.
- D. Provide standard prefabricated aluminum grating treads and aluminum nosings with extruded reinforced profile with non-slip ribs.
 - 1. Mechanically fasten grating treads with aluminum bearing angle to stringers.
 - 2. Grating bearing bars shall be spaced 1-3/16 inches on center and cross bars shall be spaced at 4 inches on center. Cross bars shall be flush at top with bearing bars.
 - 3. All grating edges shall be banded.
 - 4. Unless noted otherwise, all grating at treads and landings will not be welded to supports, provide saddle clips as required for attachment. Limit weight of each section to no more than 50 pounds.
 - 5. Provide aluminum riser plate welded to grating tread, unless indicated otherwise.

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 bolts, 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.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: 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 operable partitions securely to and rigidly brace from building structure.
- C. 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.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.03 INSTALLING 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 grout.
 - 1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 INSTALLING ALUMINUM STAIRS

- A. Install metal stair in accordance with the manufacturer's recommendations and approved shop drawings.
- B. Install components plumb and level, accurately fitted, free from distortion or defects.
- C. Securely bolt or anchor, plates, angles, hangers, and struts required for connecting stairs to structure.
- D. Provide welded field joints where specifically indicated or shop drawings. Perform field welding in accordance with the appropriate AWS Specification.
- E. Obtain written approval prior to site cutting or creating adjustments not scheduled.

3.05 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

**SECTION 05530
METAL GRATINGS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes the following:
 - 1. Extruded-aluminum bar gratings.
 - 2. Metal frames and supports for gratings.
 - 3. Prefabricated unpunched aluminum heavy duty plank gratings.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications"

1.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
 - 2. Walkways and Elevated Platforms: Uniform load of 100 lbf/sq. ft.
 - 3. Limit deflection to L/360 or 1/4 inch, whichever is less.
 - 4. Unpunched aluminum heavy duty plank grating shall be designed to be removable.

1.03 SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded-aluminum bar gratings.
 - 2. Clips and anchorage devices for gratings.
 - 3. Unpunched aluminum heavy duty plank gratings.
 - 4. The Contractor shall submit the manufacturer's catalog pages including load tables, anchor details and standard installation details.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Provide templates for anchors and bolts specified for installation under other Sections.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, registered in the Commonwealth of Pennsylvania, responsible for their preparation.
 - 3. Drawings for the fabrication and erection of all gratings. Include plans, elevations, and details of sections and connections as required. Show type and location of all fasteners.
 - 4. Samples of gratings and anchorage systems.
- C. Mill Certificates: Signed by manufacturers certifying that products furnished comply with requirements.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.04 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."
 - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 - 4. AWS D1.6, "Structural Welding Code--Stainless Steel."
- C. Manufacturer Qualification: A company specializing in the manufacture of metal bar gratings with not less than 10 years of documented experience.

1.05 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. No field trimming or fitting of grating is permitted.

1.06 COORDINATION

- A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Extruded-Aluminum Bar Gratings:
 - a. McNichols Company
 - b. Alabama Metal Industries Corporation.
 - c. IKG Industries; a Harsco Company.
 - d. Ohio Gratings, Inc.
 - e. Or equal

2.02 FERROUS MATERIALS

- A. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

2.03 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bars and Shapes: ASTM B 221, alloys as follows:
 - 1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
 - 2. 6061-T1, for grating crossbars.
- C. Aluminum Sheet: ASTM B 209, Alloy 6061

2.04 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts.
- D. Plain Washers: Round, ASME B18.22.1.
- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- F. Anchors: Provide cast-in-place, chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.05 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.06 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. 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 material 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 from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and 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.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop, unless otherwise indicated.
 - 2. Fabricate toeplates for attaching in the field.
 - 3. Toeplate Height: 4 inches, unless otherwise indicated.

2.07 METAL BAR GRATINGS

- A. Aluminum I-Bar Grating: Fabricated by swaging crossbars between bearing bars.
 - 1. Bearing Bar Spacing: 15/16 inch o.c.
 - 2. Bearing Bar Depth: 2 inch.
 - 3. Bearing Bar Flange Width: 1/4 inch.
 - 4. Crossbar Spacing: 2 inches o.c.
 - 5. Traffic Surface: Grooved.
 - 6. Aluminum Finish: Class I, clear, anodized finish.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
 - 1. Provide not less than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
 - 2. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16

- inch or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
3. Provide not less than 4 weld lugs for each grating section composed of rectangular bearing bars 3/16 inch or less in thickness and spaced less than 15/16 inch o.c., with each lug shop welded to 3 or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
 4. Provide not less than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
 5. Furnish threaded bolts with nuts and washers for securing grating to supports.
 6. Furnish self-drilling fasteners with washers for securing grating to supports.
 7. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
 - a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc., or equal.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.
- E. Unpunched Aluminum Heavy Duty Plank Grating:
1. Six inch wide extruded aluminum plank with support bars spaced 1.2" on center, fabricated with banding into panels of standard width to fill areas shown on the drawings.
 - a. Plank Depth: based on loading requirements and clear span.
 - b. Top Surface: Slip Resistant.
 - c. Type: Removable.
 - d. Finish: A-41 Clear Anodized.

2.08 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.
- B. Galvanize steel frames and supports in the following locations:
 - 1. Exterior, unless noted otherwise.
 - 2. Interior, unless noted otherwise.

2.09 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker complying with AAMA 611.

2.10 STEEL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.
- C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 - 1. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. 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.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- H. Contractor shall take field measurements prior to preparation of final shop drawings and fabrication where required to ensure proper fitting of the work.

3.02 INSTALLING GRATINGS

- A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.
- B. Attach grating units to supporting members by bolting at every point of contact.
- C. Prior to grating installation, Contractor shall inspect supports for correct alignment and conditions for proper attachment and support of grating. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the Engineer prior to placement.
- D. Install grating in accordance with the approved shop drawings and standard installation clearances as recommended by ANSI/NAAMM MBG-531 "Metal Bar Grating Manual."

- E. Protection of Aluminum from Dissimilar Materials:
1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or use of other approved insulating material.
 2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or use of other approved insulating material.

3.03 ADJUSTING AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05530

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**SECTION 06100
ROUGH CARPENTRY**

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

This section includes the requirements for rough carpentry work shown on the Drawings and whatever rough carpentry may be required to properly construct the project. Materials and installation requirements shall be as specified and accepted practices of the trade for work and materials commonly assigned to rough carpentry and as specified in other sections of the work.

- A. Rough carpentry work includes, but is not limited to, the following:
 - 1. Wood framing and/or blocking of walls, roofs, parapets and decks.
 - 2. Wood grounds, nailers, blocking and sleepers.
 - 3. Temporary railings, enclosures, forms and rough hardware and anchoring devices.
 - 4. Installation of hollow metal frames.

1.03 QUALITY ASSURANCE

- A. Lumber Standards: Shall comply with PS-20-70 for each indicated use, including moisture content not to exceed 19 percent, and actual size related to the indicated nominal sizes, except as otherwise indicated.
- B. Plywood Standards: Shall comply with PS-1-74 and APA's requirements, except as otherwise indicated for each use.
- C. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.
- D. Certificate of inspection and grading by a recognized agency may be submitted with each shipment, in lieu of factory marking at Contractor's option.

1.04 SUBMITTALS

- A. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for proper use and handling of treated material.
- B. Submit certification of drying to 19 percent moisture content after treatment.

- C. For pressure treatment of each type specified, submit certificates of compliance from the treating plant stating chemicals and process used, net amount of salts retained and conformance to the following specifications:
 - 1. Wolmanized (CCA), meeting AWPA.
 - 2. Standard P-5 and conforming to AWPA.
 - 3. Standard LP-2

1.05 PRODUCT HANDLING

Keep rough carpentry materials dry during delivery, storage, and handling. Store lumber and plywood in stacks with provisions for air circulation within stacks. Protect bottom of stacks against contact with damp surfaces. Protect exposed materials against weather.

1.06 JOB CONDITIONS

- A. Time delivery and installation of carpentry work to comply with protection and storage requirements.
- B. Examine substrates and supporting structure and conditions under which work is to be installed and notify Engineer in writing of conditions detrimental to work. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Correlate location of furring, nailers, blocking, grounds and similar supports so that attached work will comply with design requirements.

PART 2 - MATERIALS

2.01 MATERIALS

- A. All materials that could be exposed to moisture, such as roof blocking, plates, grounds, etc., shall be wolmanized treated.
- B. Light Framing: For framing 2 inches to 4 inches thick and not exceeding 6 inches in width, provide:
 - 1. Southern Pine, Grade Number 2.
 - 2. Douglas Fir-Larch, Grade Number 2.
- C. Board Lumber:
 - 1. Where lumber less than 2 inches in nominal thickness is shown or specified, provide boards dressed S4S, Grade Number 2, Southern Pine.
 - 2. Moisture Content: 19 percent maximum, mark boards "S-DRY".

- D. Miscellaneous Lumber:
1. Provide wood for support or attachment of other work such as cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of the sizes shown or specified, worked to shapes shown and as follows:
 2. Grade: Construction Grade light framing size lumber of any species or board size lumber as required. Provide Construction Grade boards or Number 2 boards (SPIB or WWPA).
- E. Anchorage and Fastening Materials: Select proper type, size material and finish for each application. Comply with the following:
1. Nails and Staples: FS FF-N-105.
 2. Wood Screws: FS FF-S-111.
 3. Bolts and Studs: FS FF-B-575.
 4. Nuts: FS FF-N-836.
 5. Washers: FS FF-W-92.
 6. Lag Screws or Lag Bolts: FS FF-B-561
 7. Masonry Anchoring Devices: For expansion shields, nails, and drive screws, comply with FS FF-S-325.
 8. Bar and Strap Anchors: ASTM A575 carbon steel bars.
 9. Framing Anchors: Shall be of the type best suited for the connection or detailed as manufactured by Simpson, Silver, Hickman, or equal, having ICBO approval, or proper gauge and galvanized metal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General
1. Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with a minimum of joints or the optimum joint arrangement.
 2. Fit carpentry work to other work. Scribe and cope as required for accurate fit.

3. Set carpentry work accurately to required levels and lines with members plumb and true.
 4. Shim with metal or slate for bearing on concrete and wood shakes at masonry substrates. Where indicated, grout with one part Portland cement to three (3) parts sand for full bearing.
 5. Securely attach carpentry work to substrates by anchoring and fastening as shown and as required such as Hilti pneumatic fastening, or equal.
 - a) Provide washers under bolt heads and nuts in contact with wood.
 - b) Nail plywood to comply with the recommendations of the American Plywood Association.
 - c) All fasteners exposed to exterior shall be galvanized or cadmium plated.
 6. Store all timber open-stacked in piles at least one foot above the ground surface, properly supported to prevent warping. Timber shall be covered to shed water and for protection from weather. Timber shall not be stored in flood prone areas.
- B. Fasteners: Use common wire nails, except as otherwise shown or specified herein. Use finishing nails for exposed work. Do not wax or lubricate fasteners that depend on friction for holding power. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required. Do not drive threaded friction type fasteners; turn into place. Tighten bolts and lag screws at installation and retighten as required for tight connections prior to closing in or at completion of work.
- C. Wood Grounds, Nailers, Blocking and Sleepers:
1. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached or screeded.
 2. Coordinate location with other work; refer to shop drawings of such work if applicable.
 3. Attach to substrates securely with anchor bolts or other attachment devices as shown and as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry as work progresses, cutting to fit masonry unit size involved. Anchor to formwork before concrete placement.

4. Provide grounds of dressed, key bevelled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required. Where indicated as permanent grounds, provide treated lumber.

D. Wood Furring:

1. Install plumb and level with closure strips at edges and openings. Shim with wood as required.
2. Fire stop furred spaces on walls at each floor level with wood blocking or incombustible materials accurately fitted to close furred spaces. Comply with governing regulations. Use only as necessary.
3. Tolerance: Shim and level wood furring to a tolerance of 1/8-inch in 10 feet.
4. Installation shall be provided where shown and as necessary for facing materials specified. Except as shown otherwise, furring strips shall be 1-inch by 3-inches continuous, and spaced 24 inches on center. Furring shall be erected vertically or horizontally as necessary. Furring strips shall be nailed to trusses and to masonry. Wood plugs shall not be used. Furring strips shall be anchored near ends and at a 2 foot interval between. Furring strips shall be provided around openings, behind bases, and at angles and corners. Furring shall be plumb, rigid and level, and shall be shimmed as necessary to provide a true, even plane with surfaces suitable to receive the finish required. Furring for cornices, offsets and breaks in walls or ceilings shall be formed on 1-inch by 3-inch wood strips spaced 16 inches on center.

- E. Plywood: Comply with recommendations of American Plywood Association for fabrication and installation of plywood work. Provide thickness shown, or if not shown, provide as recommended by APA "Guide to Plywood Sheathing for Floors, Walls, and Roofs" for spacing of supports and types of substrates involved in the work.

END OF SECTION 06100

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**SECTION 07190
VAPOR BARRIER**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, material, equipment and appliances required for complete execution of Work shown on Drawings and specified herein.
- B. Principal items of work include:
 - 1. Vapor barrier below structural slabs on grade.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03300 - Cast-in-Place Concrete

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:
 - 1. Manufacturer's data and installation instructions.

PART 2 - PRODUCTS

2.01 VAPOR BARRIER

- A. Vapor Barrier: A reinforced laminate membrane with a minimum tensile strength of 75 lbs/in. in accordance with ASTM D-882, vapor transmission rating of 0.02 perms in accordance with E-96, and a puncture resistance of 25 lbs in accordance with ASTM D-4833.
- B. Adhesive/Tape: Type approved by the Manufacturer of the vapor material.

PART 3 - EXECUTION

3.01 VAPOR BARRIER

- A. Vapor barrier shall be placed on top of 4 inches minimum of compacted structural fill stone, free of debris and protrusions, as shown on the Drawings for structural slabs.
- B. Lap edges 12 inches and seal with adhesive tape. Lay with seams perpendicular to and lapped in the direction of placement. Do not penetrate vapor barrier.

- C. Protect from damage until concrete is placed. Punctures and tears in vapor barrier shall be repaired using patches of the material which overlaps puncture or tear a minimum of 12 inches; seal with tape or adhesive.

END OF SECTION 07190

**SECTION 07900
SEALANTS AND CAULKING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section includes requirements for providing sealant, caulking, and related accessories to weather seal and fill joints in accordance with the Contract Documents.

1.02 PERFORMANCE REQUIREMENTS

- A. Provide joint sealant that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.03 SUBMITTALS

- A. Submit the following information in accordance with the General Conditions:
 - 1. Manufacturer's descriptive product data and certification of compliance with referenced specification.
 - 2. Manufacturer's detailed description for handling, recommendation on intended use and installation recommendations.
- B. Submit samples in accordance with the General Conditions for the following:
 - 1. One cartridge of each type of sealant and caulking compound.
 - 2. One pint of each primer.
 - 3. One linear foot of backup material.
 - 4. One linear foot of compression seal.
 - 5. One cartridge of expansion joint material.
- C. Submit full range of manufacturer's colors of each sealant and caulking compound to be used for selection by the City.

1.04 QUALITY ASSURANCE

- A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of project joints.
- C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original unopened containers with labels intact along with referenced specification number, type and class as applicable.
- B. Handle and store product in accordance with manufacturer's recommendations.
- C. Maintain sealant and caulking at a temperature of at least 70 degrees F. for a period of not less than 24 hours prior to installation.

1.06 WARRANTY

- A. Special Installer's Warranty: Installer'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 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: Five years from date of Substantial Completion.

1.07 JOB CONDITIONS

- A. Environmental Requirements

Unless otherwise recommended by the manufacturer, do not apply sealant and caulking when temperature is below 40 degrees F. and when there is ice, frost or dampness visible on surfaces to be sealed.

- B. Safety Requirements

Avoid contact with skin. Wear protective clothing, goggles, gloves and/or barrier creams. Avoid breathing vapors in confined areas.

PART 2 - PRODUCTS

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

Sealant, caulking, primers and accessories shall be the non-staining type and of a color specified or selected by the City from the Manufacturer's standard color chart.

2.01 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric 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.
- C. Single-Component Pourable Neutral-Curing Silicone Sealant:
 - 1. Type and grade: S (single component) and P (pourable).
 - 2. Class: 100/50.
 - 3. Uses Related to Exposure: NT and T (traffic).
 - 4. Uses Related to Joint Substrates: M, A, and O, as applicable to joint substrates indicated.
- D. Single-Component Neutral-Curing Silicone Sealant:
 - 1. Type and Grade: S (single component) and NS (nonsag).
 - 2. Class: 25.
 - 3. Use Related to Exposure: NT (nontraffic).
 - 4. Uses Related to Joint Substrate: M, G, A, and O, as applicable to joint substrates indicated.
- E. Single-Component Acid-Curing Silicone Sealant:

1. Type and Grade: S (single component) and NS (nonsag).
 2. Class: 25.
 3. Use Related to Exposure: NT (nontraffic).
 4. Uses Related to Joint Substrate: G, A, and O, as applicable to joint substrates indicated.
- F. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
1. Type and Grade: S (single component) and NS (nonsag).
 2. Class: 25.
 3. Use Related to Exposure: NT (nontraffic)
 4. Uses Related to Joint Substrates: M, G, A, and O, as applicable to joint substrates.

2.02 LATEX JOINT SEALANTS

- A. Latex Sealant: Comply with ASTM C 834, Type O P, Grade NF.

2.03 PRIMERS AND ACCESSORIES

- A. Primers, where applicable, shall be in accordance with caulking/sealant manufacturer's recommendations.
- B. Provide backup materials, fillers and joint packing compatible with caulking/sealant and primer.
1. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) O (open-cell material) B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer of joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 3. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

4. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.
5. Use back-up material to control caulking/sealant depth as recommended by the caulking/sealant manufacturer.
6. Unless otherwise specified use closed-cell tube or rope shaped stock expanded polyethylene or polyurethane foam.
7. The width or diameter of backup material shall be 1-1/3 to 1-1/2 times the width of the joint.
8. Use semi-rigid vinyl or polyethylene foam, solid neoprene rod or similar approved backing for joints subject to horizontal traffic or puncture.
9. Do not use bituminous or oily product as a backup material.

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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Inspect joint surfaces before starting work. Verify surfaces are dry and meet caulking/sealant manufacturer's requirements.
- B. Clean joint surfaces immediately before installation of gaskets and sealant. Remove dirt, moisture, frost, coatings and other foreign substances that will interfere with performance of compression seal and sealant.
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

- a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
2. Remove laitance and form-release agents from concrete.
 - a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- C. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.
- D. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experiences. 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.
- E. Confine primer or sealer to areas of the compression seal and sealant bond area.
- F. Masking Tape: Use masking tape where required to prevent contact of sealant 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 APPLICATION

- A. General
 1. Install material in accordance with manufacturer's recommendations for materials intended use and instructions using appropriate and approved equipment, except where more stringent requirements are shown or specified.
 2. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 3. Install sealant backings of type 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.
 - a. Do not leave gaps between ends of sealant backings.

- b. Do not stretch, twist, puncture, or tear sealant backings.
 - c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 4. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
 5. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - a. Place sealants so they directly contact the fully wet joint substrates.
 - b. Completely fill recesses in each joint configuration.
 - c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
 6. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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.
 - a. Remove excess sealant from surfaces adjacent to joints.
 - b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - c. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 7. 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.
 8. Prevent caulking, sealant and compounds from spilling onto adjoining surfaces or to migrate into voids of exposed finishes by using masking tape or other methods. Clean spill on adjoining surfaces immediately.
- B. Sealant and Accessories
 1. Sealant shall be used on slab and wall control and expansion joints, pipe sleeves through walls and roofs, and on joints and cracks.
 2. Install backup material to control caulking depth in accordance with sealant manufacturer's instructions.
 3. Place sealant in a manner that will fill the joint without air pockets and form a smooth surface. For exposed surfaces of gun and knife grade sealant that

cannot be made smooth during initial application, smooth with tool moistened with either water or sealant solvent.

4. Prepare sealant mixtures in quantities that can be applied within the time period recommended by the manufacturer. Materials mixed and not used within this time period shall be discarded.
5. Finish joint to a smooth concave surface slightly lower than adjoining surfaces except horizontal surfaces shall have joints finished so moisture and debris will not be entrapped. Finished surface shall be free of wrinkles and sags.

3.03 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior vertical and horizontal nontraffic construction joints in cast-in-place concrete.
 1. Joint Sealant: Single-component neutral-curing silicone sealant.
 2. Joint Sealant Color: Match adjacent surfaces.
- B. Joint-Sealant Application: Exterior vertical control and expansion joints in unit masonry.
 1. Joint Sealant: Single-component neutral-curing silicone sealant.
 2. Joint Sealant Color: Match mortar color.
- C. Joint-Sealant Application: Exterior perimeter joints between masonry, concrete and frames of doors, windows and louvers.
 1. Joint Sealant: Single-component neutral-curing silicone sealant.
 2. Joint Sealant Color: As selected by the Engineer from the manufacturer's available full range of colors.
- D. Joint-Sealant Application: Exterior control and expansion joints in ceilings and other overhead surfaces.
 1. Joint Sealant: Single-component neutral-curing silicone sealant.
 2. Joint Sealant Color: As selected by the Engineer from the manufacturer's available full range of colors.
- E. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.
 1. Joint Sealant: Single-component neutral-curing silicone sealant.

2. Joint Sealant Color: As selected by the Engineer from the manufacturer's available full range of colors.
- F. Joint-Sealant Application: Interior perimeter joints of exterior openings.
1. Joint Sealant: Single-component neutral-curing silicone sealant.
 2. Joint Sealant Color: As selected by the Engineer from the manufacturer's available full range of colors.
- G. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors and counters.
1. Joint Sealant: Single-component mildew-resistant neutral curing silicone sealant.
 2. Joint Sealant Color: As selected by the Engineer from the manufacturer's available full range of colors.

3.04 CURING AND PROTECTION

- A. Cure joint sealers and accessories in accordance with manufacturer's instructions.
- B. Protect joint sealers during construction period to prevent damage, soiling or deterioration other than normal wear and weathering up to time of final acceptance. Replace or restore joint sealers damaged, soiled or deteriorated, as directed.

3.05 CLEANUP

- A. Clean adjacent surfaces of sealant and soiling resulting from the joint sealer operations. Use cleaning materials and methods recommended by manufacturer for the different surfaces.

END OF SECTION 07900

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**SECTION 08225
FIBERGLASS DOORS AND FRAMES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and appliances required for the complete execution of the Work as shown on Drawings and specified herein.
- B. Principal Items of work include:
 - 1. Fiberglass frames and doors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 04200 - Unit Masonry
- B. Section 08710 - Finish Hardware
- C. Section 08800 - Glass and Glazing

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:
 - 1. Samples shall include:
 - a. Corner sections of frames and trim.
 - b. Corner sections of doors.
 - c. Finish and color charts.
 - 2. Shop Drawings shall include, but not be limited to:
 - a. Complete layout and installation drawings and schedules with clearly marked dimensions. Indicate details of construction, profiles, gauges, reinforcing and location of all doors and frames.
 - 3. Manufacturer's literature.

1.04 WARRANTY

- A. The Manufacturer shall unconditionally guarantee the fiberglass reinforced-plastic doors and frames for five (5) years against failure due to corrosion by environmental

conditions. Under this guarantee a new door will be offered replacement or the original factory price will be refunded at the discretion of the manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be boxed or crated and suitably protected prior to shipment from the factory. Protect all hardware which may be attached.
- B. Protect products against damage during delivery, storage, and handling. Stack materials on blocking clear of ground, tilted to permit water drainage and protected from corrosion and construction abuse.
- C. Frames and doors, after being set shall be protected with heavy Kraft paper or other approved means in such manner to prevent damage. Protection shall be maintained until such time as directed by the Engineer.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, provide products from one of the following manufacturers:
 - 1. FIB-R-Door Systems
 - 2. Chem Proof Door Company
 - 3. Or Equal.

2.02 MATERIALS

- A. Provide doors and frames from the same manufacturer.
- B. Fiberglass reinforced plastic doors and frames shall be resin transfer molded (RTM). The doors shall be molded in one piece with gel-coat, fiberglass reinforcement, resin and core material molded together. Window openings, door hardware openings and flush hinge recesses shall be molded in. Secondary cutting and coating will not be allowed. Continuous stainless steel bars shall be molded in during the initial molding. The steel plates shall be pretapped to receive screws for attachment of hardware. Door hardware shall be stainless steel.
- C. Fiberglass reinforcement shall consist of a surfacing mat followed by continuous stand mat wrapped around rigid closed cell polyurethane foam core material. The outer surface shall consist of 30 mils of high quality commercial grade polyester gel-coat. Fiberglass laminate shall be a minimum of 1/8 inch on all sides and edges. The outer surface of the finished door and frame shall have a matte finish and be free of pits, porosity, blisters, wrinkles, dry glass, cracks or crazing.

- D. The fiberglass laminate shall have the following minimum physical properties using the applicable ASTM Standards.

Tensile strength	9,000 psi	ASTM D638
Flexural strength	20,000 psi	ASTM D790
Flexural modulus	1.0x10 ⁶	ASTM D790
Impact, Notched Izod foot pound per inch	15.0	ASTM D256
Barcol hardness	40 min. average	ASTM D2583
Water Absorption, degrees 24 Hours	0.1 percent	ASTM D570
Average coefficient of thermal expansion inch per inch per degree fahrenheit	10.5x10 ⁶	ASTM D696
Flame Spread	25 or less	ASTM E84

2.03 FIBERGLASS REINFORCED PLASTIC DOOR FRAMES

- A. FRP frames shall be solid fiberglass. The stop and frame will be molded in one piece. The frame shall be integrally gel-coated to the Owner's color when molded. Mortises will be molded in. It is not permitted to rout in mortises or remove any material from the head or jambs, to provide mortises.
- B. Reinforcement for mounting hinges, closers, etc., shall be of mild steel plates strategically located and buried in the resin-glass matrix so they will not be exposed to the elements.
- C. The jamb shall be flat on the backside (against the opening) and uniform in thickness as to provide a solid, uniform surface against the wall opening. No wood blocks or spacers are permitted.
- D. Frame shall meet the industry accepted design details of a standard frame profile which is 5-3/4 inches overall jamb depth with a two inch face, 5/8 inch stop and 5/8 inch return for both wrap around or butt mounting.
- E. The gel-coat shall be of .025 thick resin rich surface of an isophthalic or chemical-resistant polyester resin which is resistant to moisture, ultra violet sunlight and many industrial acids, alkalies and solvents and protects the glass reinforcements from degradation.

2.04 DOORS

- A. Fiberglass doors shall be flush type of 1-3/4 inch thickness. Doors shall be constructed with a gel-coat surface of 0.25 resin rich surface of an isophthalic or chemical resistant to moisture, ultra violet sunlight and many industrial acids, alkalies and solvents and protects the glass reinforcement from degradation. The Fiberglass laminate of 1/8 inch thickness shall be the primary structural component of the door. Color shall be selected from manufacturer's standard colors.
- B. The core shall be continuously bonded to the laminate for structural support and rigidity. To enhance this bond, the core shall be perforated so that resin posts are formed during the molding process which additionally ties the outer laminates together.
- C. The fiberglass door shall be formed to size to produce a totally seamless door. All hinge pockets, openings for windows (lites), louvers, locksets and flush bolts are molded in place.
- D. The fiberglass door shall have continuous steel reinforcement for hinge mounting. The lock edge of the door shall be the same steel reinforcement, except it will be interrupted at the lock location for lock installation. The manufacturer shall provide a 1/8 inch thick, 5-inch high x 18 inch long steel reinforcement for closer mounting. Totally encapsulated reinforcements in fiberglass.
 - 1. The door shall be prepared for hardware specified in Section 08710 - Finish Hardware.

2.05 FIRE RETARDANT

- A. The doors and frame shall be "Fire Resistant" and will not support combustion.

2.06 ANCHORS

- A. Jamb anchors shall be 14 gauge galvanized, flat, "T" anchors to suit frame size with legs not less than three inches by 10 inches. Set anchors at every three masonry courses, a minimum of three per jamb.
- B. For cast-in-place concrete, anchor frame jambs with 3/8 inches minimum counter-sunk bolts into expansion shield or inserts, with crush-proof sleeves. Provide a minimum of three per jamb.
- C. Floor anchors at doors shall be 16 gauge galvanized sheet steel at each jamb. Clip type anchors with two holes to receive fasteners.

PART 3 - EXECUTION

3.01 FRAME INSTALLATION

- A. Install plumb, level and true to line, rigidly secured in openings. Set frames in masonry walls prior to beginning masonry work.

3.02 DOOR INSTALLATION

- A. Install plumb, level and true to line. Apply and adjust hardware to achieve quiet and smooth operation.
- B. Doors shall fit snugly and close without forcing or binding. Door clearances shall not exceed 1/8 inch at jambs and heads and meeting stiles at pairs of doors. Clearance between bottom of door and finished floor material or threshold shall not exceed 1/4 inch. Frames shall be manufactured and machined to within 1/32 inch for all dimensions.

3.03 PROTECTION

- A. Protect installation from damage and touch up scratched areas with same paint used for shop coats. Damaged work shall be repaired or replaced.

END OF SECTION 08225

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**SECTION 08330
ROLL-UP DOORS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish labor, materials, equipment and appliances required for complete execution of Work shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 08710 - Finish Hardware
- B. Section 09900 - Painting
- C. Electrical connections for motors, and accessories are specified in Division 16.

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:
 - 1. Manufacturer's literature and installation instructions.
 - 2. Drawings showing details of the products, connections to adjoining materials, and schedules showing sizes and types.
 - 3. Finish and color samples.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original and unbroken packages, containers, or bundles bearing the name of the manufacturer.
- B. Store materials carefully in an area that is protected from the elements, and in a manner that will prevent damage or marring of the door.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with these specifications provide products from one of the following manufacturer:
 - 1. Cornell Iron Works, Inc.

2. Atlas Roll-lite Door Corporation.
3. The Cookson Company.
4. Overhead Door Corporation.
5. Or Equal.

2.02 MATERIALS

A. Door Curtains

Provide insulated aluminum curtain slats with interlocking sections designed to meet 20 psf minimum windload. Provide high strength endlocks on alternating slats and windlocks as required to meet design windload. Bottom bar as recommended by manufacturer for type of curtain specified with combination weatherstrip and reversing edge for motor operated doors.

B. Guides

Form from aluminum angles with a minimum 3/16 inch thickness. Provide windlock bars as required to meet design windload. Attach guides to jamb with not less than 3/8 inch steel bolts anchored not more than 30 inches on center.

C. Counterbalance Assembly

Counterbalance by means of adjustable steel helical torsion springs, mounted around a steel shaft and mounted in a spring barrel and connected to the door curtain with the required barrel rings. Use grease -sealed ball bearings or self-lubricating graphite bearings for all rotating members.

1. Fabricate spring barrel of hot-formed, structural-quality carbon steel, galvanized welded or seamless pipe, of sufficient diameter and wall thickness to support the roll-up of curtain without distortion of slats and limit barrel deflection to not more than .03 inches per foot of span under full load.
2. Fabricate spring balance of one or more oil-tempered, heat-treated steel helical torsion springs.
3. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold the fixed spring ends and carry the torsional load.
4. Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bellmouth guide groove for curtain.

D. Door Hoods

Formed of 0.02" aluminum with baked on polyester primer. Form to enclose coiled curtain at opening head. Reinforce top and bottom edges. Provide closed ends for surface mounted units. Provide intermediate supports as required to prevent excessive sag.

E. Operation: Manual hand chain operator.

1. Endless hot-dip galvanized hand chain of length so bottom of chain is four feet above finished floor. Provide sprockets and reduction gears for ease of operation and a maximum pull of 35 pounds.
2. Locks: Provide with a slide bolt lock.

F. Weatherstripping

Equip bottom bar with vinyl weatherstrip. Provide motor operated doors with vinyl sensing/weather edge. Equip end guides with weatherstripping to seal both faces of door curtain. Equip hood with neoprene air baffle to close top of hood with curtain.

G. Finish

Aluminum to be baked-on Kynar 500 finish. Galvanized steel to be chemically cleaned and shop primed. Parts inaccessible after installation shall be given an additional coat in the shop. Color shall be selected by Owner from full range of colors.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine substrates and adjoining conditions, where roll-up door is to be installed. Correct unsatisfactory conditions prior to proceeding with the work.

3.02 INSTALLATION

- A. Install units and operating equipment complete with necessary hardware, jamb, and head moldings, anchors, inserts, hangers and equipment supports in accordance with final approved shop drawings, manufacturer's printed instructions and as specified herein.
- B. Field touch-up shop applied finishes of surfaces scratched or abraded during installation.
- C. Do all cutting, drilling, fitting and other work of similar character required for fitting and setting units in connection with this work and adjoining work of other trades.

3.03 PROTECTION, CLEANING AND ADJUSTMENT

- A. Protect units prior, during and after installation.
- B. After installation, lubricate, test and adjust to operate easily and freely from warps, twists or distortion and weathertight fit.

END OF SECTION 08330

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**SECTION 08710
FINISH HARDWARE**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work as shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 08225 - Fiberglass Doors and Frames
- B. Section 08330 - Roll-Up Doors

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of these specifications, the Work shall conform to the applicable requirements of the following documents:
 - 1. ANSI/BHMA 156

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300 - Submittals, submit the following:
 - 1. Manufacturers' data for each item of hardware. Include installation and maintenance instructions.
 - 2. Furnish templates to fabricators of other work which is to receive hardware.
 - 3. Hardware schedule organized into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date in order to facilitate the fabrication of other work (such as hollow metal frames) which may be critical in the project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with shop drawings for other work, delivery schedules, and similar information has been completed and accepted.
 - 4. Prepare a keying schedule in consultation with the Owner.

1.05 QUALITY ASSURANCE

- A. Provide materials, assemblies, equipment and services from a single source for each category except that locksets, latchsets and cylinders must originate from the same manufacturer.
- B. Replace any item of finish hardware which cannot be installed or will not function properly.
- C. Provide hardware complying with NFPA 80 and UL labeled for fire rated openings.
- D. Furnish templates or information to door and frame manufacturer. Coordinate between the manufacturers where two or more articles of hardware are to be mounted on the same door. Verify all dimensions, new and existing.
- E. Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Handle, store, distribute, protect and install hardware in accordance with manufacturer's instructions or recommendations. Deliver packaged materials in original containers with seals unbroken and labels intact.
- B. Properly mark or label, so each piece of hardware is readily identifiable with the approved hardware schedule. Tag each change key or otherwise identifying the door of which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and hardware schedule.
- C. Provide secure storage area for hardware.

PART 2 - PRODUCTS

2.01 MATERIALS AND FABRICATION

- A. Hand of Door
 - 1. Drawings show swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish hardware for proper installation and operation of door.
- B. Manufacturer's Name Plate
 - 1. Do not use manufacturer's products which have name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels.

C. Base Metals

1. Produce hardware units of the basic metal and forming method indicated, using manufacturer's non-corrosive metal alloy, composition, temper and hardness but in no case of lesser quality material than specified.

D. Fasteners

1. Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self tapping sheet metal screws, except as specifically indicated.
2. Furnish stainless steel fasteners for installation with each hardware item. Exposed finish (under any condition) to match hardware finish or surfaces of adjacent work. Match the finish of adjacent work as closely as possible, including surfaces to receive painted finish.
3. Provide fasteners which are compatible with unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.

E. Tools for Maintenance

1. Furnish a complete set of specialized tools as needed for Owner's continued adjustment, maintenance, removal and replacement of builder's hardware.

F. Hardware Finishes

1. Stainless steel, US32D unless otherwise noted.
2. Closers shall have a USP finish unless otherwise noted.

G. Field Checks

1. Make periodic checks during installation of finish hardware to ascertain the correctness of the installation. After completion of the work, certify in writing, that all items of finish hardware have been installed, adjusted and are functioning in accordance with Specification requirements.

2.02 DESCRIPTION OF PRODUCTS

A. Hinges

1. Stainless steel full mortise concealed oil impregnated ball bearing type, five knuckle with non-rising pins for interior doors, and non-removable and non-rising pins for exterior doors. Tips shall be flat.
2. Sizes and weights of hinges:

- a. Doors up to 36 inches - 4-1/2 inches regular weight.
 - b. Doors 36 inches to 40 inches - 5 inches regular weight.
 - c. Doors 40 inches to 48 inches - 5 inches heavy weight.
3. Provide three hinges per door leaf up to and including 90 inches and one additional hinge for each 30 inches of additional height.
 4. Acceptable Manufacturers: Stanley Hardware, Hager Hardware, or Equal.

B. Locksets and Latchsets

1. Stainless steel, heavy-duty mortise type conforming to ANSI A156.13 Series 1000, Grade 1.
2. Wrought steel box strikes.
3. Stainless steel deadbolt with 1 inch throw, approval.
4. 2 3/4 inch back set, 3/4 inch throw, two-piece anti-friction latchbolt.
5. Non-ferrous critical internal parts.
6. Cylinders shall be manufactured to conform to grand master key program.
7. Trim Design: Provide LWM (lever) by Corbin\Russwin or equal.
8. Acceptable Manufacturers: Yale, Corbin\Russwin, Schlage, or Equal.

C. Keys and Keying

1. Provide construction keyed, removable core master key system as directed by the Owner.
2. Furnish ten core removal keys and a quantity of master keys as directed by the Owner, not to exceed ten each per group. Furnish a minimum of 15 change keys per cylinder.
3. Furnish cylinders with six pin cores.
4. Provide a key schedule showing all key numbers and spaces to which each permits entry. The schedule and key cabinet, along with key gathering envelopes containing keys for each lock endorsed with lock number and space designation, shall be turned over to the Owner. Install keys with proper tags in the key cabinet. Establish a construction master key, and apply to locks and cylinders, except for closets, within major spaces. Locks for closets shall be shipped unlocked and the keys delivered to the Owner with the balance of the keys.
5. Acceptable Manufacturers: Yale, Corbin\Russwin, Schlage, or Equal.

D. Key Cabinet

1. Provide a wall mounted key cabinet with baked enamel interior finish and exterior prime coat with cylinder keyed to project master key system. Cabinet shall accommodate all keys in the project, plus twenty (20) percent additional.
 - a. Provide cabinet with key control system consisting of permanent key markers, temporary key markers, "out" key control tags, and cross indexing cards. Instruct Owner personnel how to use system.
 - b. Acceptable Manufacturers: Yale, Bommer, or Equal.

E. Panic Hardware

1. Heavy duty push bar exit device, U.L. labeled, with corrosive resistant construction.
2. ANSI A156.3, Grade 1.
3. Exterior trim to closely match locksets.
4. Single/active doors: mortise type.
5. Double doors: concealed vericle rod.
6. ANSI Function 08.
7. Acceptable manufacturer's: Von-Duprin, Adams Rite Manufacturing Company, Corbin/Russwin, Or Equal.

F. Closers

1. Cast iron case with seamless one-piece forged steel spring tub.
2. Heavy duty forged steel arm.
3. Non-sized fully adjustable from size 1-6.
4. Backcheck intensity and location valves.
5. Delayed action closing.
6. Full metal cover.
7. Mechanical hold open device, except at fire rated doors.
8. ANSI 156.4, Grade 1.

9. Conforms to ADA 5 lbf. maximum door opening force requirement for non-fire rated interior doors.
10. Provide mounting brackets, and fasteners required for proper attachment.
11. Acceptable manufacturers: Corbin/Russwin, LCN, Norton, Or Equal.

G. Overhead Door Holder

1. Heavy duty bronze, surface mounted with positive grip holder.
2. Track: extruded bronze.
3. Degree of opening: 85 - 110.
4. Finish: Satin Chrome Plated.
5. Acceptable manufacturers: Corbin/Russwin, Glynn-Johnson, Norton, Or Equal.

H. Door Stops and Bumpers

1. Finish: Satin chrome plated.
2. Floor mounted door stops.
 - a. Acceptable manufacturers and products: H.B. Ives 444, Hager Hardware Model 267F, Glynn-Johnson Model FB36, Or Equal.
3. Wall bumpers
 - a. Acceptable manufacturers and products: H.B. Ives Model 407, Hager Hardware Model 234W, Glynn-Johnson Model 60C, Or Equal.

I. Flush Bolts

1. U.L. listed.
2. Forged brass construction, 1/2" diameter flattened bolt tip, 12" long rod.
3. Fit standard ANSI door preparation.
4. Provide dustproof strikes.
5. Acceptable manufacturers: Glynn-Johnson, Hager Hardware, H.B. Ives, Or Equal.

J. Coordinator

1. U.L. labeled and tested for 100,000 cycles.

2. Stop mounted, provide filler strips to fully cover stop.
3. Adjustable holding power and override feature.
4. Acceptable manufacturers: Glynn-Johnson, Hager Hardware, H.B. Ives, Or Equal.

K. Kickplates

1. Stainless steel, 0.050" thick, beveled 3 sides, 8" high, width 2 inches less than door width.
2. Acceptable manufacturers: H.B. Ives, Hager Hardware, Builders Brass Works, Or Equal.

L. Silencers

1. Rubber silencers: 3 for each single door and 2 for each double doors.
2. Acceptable manufacturers and products: Glynn-Johnson Models 64 or 65, Hager Hardware Models 308D or 307D, H.B. Ives Models 20 or 21, Or Equal.

M. Thresholds

1. Extruded aluminum saddle type with stainless steel fasteners. Six inches wide or as shown on drawings.
2. Acceptable manufacturers: Pemko, National Guard Products, Incorporated, Zero International, Or Equal.

N. Door Bottom Seal

1. Extruded aluminum with neoprene seal.
2. Acceptable manufacturers and products: Pemko Model 57, Zero International Model 328 and National Guard Products, Inc. Model 96, Or Equal.

O. Weatherstripping

1. Extruded aluminum with neoprene seal.
2. U.L. Labeled.
3. Acceptable manufacturers and products: Pemko Model 294, National Guard Products, Inc. Model 190, and Zero International Model 328, Or Equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Templates

1. After the hardware schedule is approved furnish to the various manufacturers, required blueprint templates for fabrication purposes. Templates shall be made available not more than ten (10) days after receipt of the approved hardware schedule.

B. Packaging and Marking

1. Ship hardware with proper non-corrosive fastenings for secure application. Each package of hardware shall be legibly marked indicating the part of the work for which it is intended. Markings shall correspond with the item numbers shown on the approved hardware schedule. Keys shall be tagged within each package set and plainly marked on the face of the envelope with the key control number, door designation and all identification as necessary.

3.02 INSTALLATION

A. Install hardware in a manner which will eliminate cracks on surfaces.

B. Mount hardware units at heights recommended in "Recommended Locations for Builders Hardware" by BHMA, except as otherwise indicated or required to comply with governing regulations.

C. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on the substrate.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as is necessary for proper installation and operation.

E. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with factory standards.

F. Cut and fit thresholds and floor covers to profile of door frames, with mitered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.

G. Screw thresholds to substrate with No. 10 or larger screws, of the proper type for permanent anchorage and of bronze or stainless steel which will not corrode in contact with the threshold metal.

H. Set thresholds in a bed of either butyl rubber sealant or polyisobutylene mastic sealant to completely fill concealed voids and exclude moisture. Do not plug drainage holes or block weeps. Remove excess sealant.

3.03 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door to ensure proper operation or function. Lubricate moving parts as recommended by manufacturer. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application.
- B. Final Adjustment
 - 1. One week prior to acceptance or occupancy make a final check and adjustment of all hardware items. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices and compensate for final operation of heating and ventilating equipment.
- C. Instruct Owner personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.04 HARDWARE SETS

- A. The door hardware sets on the Drawings indicates functional and general requirements. Items shall be quality and finish as specified. Hardware set identification refers to set numbers indicated on the Drawings. Consult Drawings for set number required.
- B. Hardware shall be as follows:

Hardware Sets

- 1. HW-1 Roll Up Overhead Doors
 - Cylinder (Provide Padlocks for Roll Up Doors)
 - Remainder of hardware by door manufacturer.
- 2. HW-2 Exterior Entrance Door (Double Doors)
 - Hinges
 - Entrance Lockset
 - Panic Hardware
 - Overhead Door Closer Holder (each leaf)
 - Flush Bolts w/Dustproof Strikes
 - Coordinator
 - Kickplate
 - Threshold
 - Door Bottom Seal
 - Weatherstripping
 - Astragal w/Weatherstripping

3. HW-3 Exterior Secondary Door (Single Door)
 - Hinges
 - Entrance Lock Set
 - Panic Hardware
 - Door Closer
 - Kickplate
 - Threshold
 - Door Bottom Seal
 - Weatherstripping

4. HW-4 Interior Door
 - Hinges
 - Passage Latchset
 - Kickplate
 - Silencers
 - Door Bumpers

END OF SECTION 08710

**SECTION 09900
PAINTING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes furnishing coatings and coating systems for painting and finishing, preparation of surfaces to receive coatings, and application of coatings on interior and exterior surfaces.
- B. Work Included - The work of this section includes but is not limited to painting the following surfaces:
 - 1. Interior and exterior masonry surfaces
 - 2. Concrete
 - 3. Miscellaneous metalwork
 - 4. Interior and exterior piping, valves and appurtenances
 - 5. Mechanical equipment
- C. Work Not Included - The following related items shall not be painted under this Section of the Contract:
 - 1. Anodized aluminum, stainless steel or fiberglass.
 - 2. Any surface or equipment that has received finish coat of paint at factory, if such finish is undamaged and matches the color schedule.
 - 3. Manufacturer's serial number or identification plates on equipment when such plates are pre-finished or polished type. (This does not include cast or embossed names on equipment castings.)
 - 4. Machined or polished surfaces of equipment where such surfaces are susceptible to rolling or sliding friction.

1.02 DEFINITIONS

- A. The term "paint" as used herein includes emulsions, enamels, epoxies, paints, stains, varnishes, sealers and other coatings, whether organic or inorganic, indicated as prime, intermediate or finish coats in this specification and other documents made a part thereof.
- B. "Submerged" is defined as below the elevation of the top of the wall of a structure containing liquid. In all cases, the decision of the Engineer shall be final in determining classification of surfaces.

1.03 QUALITY ASSURANCE

- A. Include on label of each container:
 - 1. Manufacturer's name
 - 2. Type of paint
 - 3. Manufacturer's stock number
 - 4. Color
 - 5. Instructions for reducing, where applicable.

- B. Applicable Industry Standards
 - 1. Steel Structures Painting Council (SSPC) - Steel Structures Painting Manual, Volume 2, "Systems & Specifications", 1982 Edition

- C. Field Quality Control
 - 1. Request review by Engineer of first finished room, space, or item of each color scheme required for color, texture, and workmanship.
 - 2. Use first acceptable room, space, or item as product standard for each color scheme.
 - 3. For spray application, paint surface not smaller than 100 square feet as project standard.

1.04 SUBMITTALS

- A. Submit color chart for the paint system to the Engineer for selection of colors.

- B. Submit manufacturer's product data listing materials properties, application recommendations, and environmental conditions required for use.

1.05 PRODUCTS DELIVERY, STORAGE AND HANDLING

- A. Deliver paint products in sealed containers with manufacturer's labels legible and intact.

- B. Store products in ventilated dry areas, protected from contact with soil and from exposure to the elements. Keep products dry at all times. Restrict storage to paint materials and related equipment. Comply with health and fire regulations.

1.06 JOB CONDITIONS

A. Environmental Requirements

Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems may be applied.

Do not apply paint in areas where dust is being generated.

B. Protection

Cover or otherwise protect finished work, surfaces not being painted concurrently or not to be painted.

C. Factory Painted Surfaces

1. The surface preparation and painting of materials and equipment will be to manufacturer's standard unless otherwise specified in applicable portions of these specifications.
2. Assure compatibility of coatings applied at the project site with coatings provided by manufacturers and suppliers.

PART 2 - PRODUCTS

2.01 REFERENCE STANDARDS

- A. Paint and coatings provided under this Contract list Tnemec as the basis of design.. Products of Carboline, Sigma Coatings or other manufacturers of comparable quality and specified type will be acceptable if said paints are submitted for approval to the Engineer with satisfactory data on past performance in wastewater treatment plants, certification of composition & performance criteria, and detailed directions for application and use including recommended coverages.
- B. Coatings shall be comparable to the products of:
 1. Tnemec Company, Inc.
 2. Sherwin-Williams Company
 3. Carboline
 4. or Equal
- C. Apply coatings to surfaces as listed in the Schedule at the end of this Section.

PART 3 - EXECUTION

3.01 INSPECTION

- A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as included in paragraph 3.03, Surface Preparation.
- B. Do not proceed with surface preparations or coating application until environmental conditions are suitable.

3.02 TEMPORARY CONSTRUCTION

- A. Furnish, install, and remove upon completion of painting all scaffolding, ladders or other facilities required to complete painting work.
- B. Temporary heating and ventilating facilities will be required in damp areas or confined spaces. These facilities and all other methods or equipment required to facilitate painting work or afford protection of workmen or work shall be furnished, installed and removed at the completion of work as part of this contract.

3.03 SURFACE PREPARATION

- A. Remove or protect hardware, hardware accessories, plates, lighting fixtures and similar items placed prior to painting; reposition or remove protection upon completion of each space. Disconnect equipment adjacent to walls; where necessary, move to permit painting of wall surfaces and, following completion of painting, replace and reconnect.

- B. Metal Surfaces

Metal to be painted that has not been shop primed shall have all rust, scale, dust, loose or foreign substances removed by wire brushing with power tools, chipping or sandblasting. Cleaned metal shall be field primed immediately after cleaning to prevent new rusting.

Clean galvanized metal surfaces shall be cleaned in accordance with SSPC-SP1 Solvent Cleaning to remove oily residue and ASTM D 6386-99 Brush-Off Blast Cleaning. Dry with a clean cloth.

Touch-up paint structural steel, miscellaneous metal, hollow metal doors and frames, and other materials which have been prime coated, as required, where shop coat has been damaged by welding or handling and erection; paint rivets, bolts and welds which are unpainted after assembly and erection.

Prepare steel substrates in accordance with the Steel Structures Painting Council surface preparation number indicated in the application schedule and as outlined below, unless otherwise required by the coating manufacturer's most recent printed application instructions:

1. SSPC-SP1 Solvent Cleaning - Thoroughly wipe with aromatic/ketone solvent using clean rags and clean solvent.
2. SSPC-SP6 Commercial Blast Cleaned Steel (for non-immersion, exterior and interior exposure steel)
3. SSPC-SP13, ICRI, CSP 3-9 profile. Brush blast concrete surfaces using the appropriate blasting medium; sand or grit to obtain the proper surface profile.
4. SSPC-SP10 Near-White Metal Blast Cleaned Steel (Immersion and chemical exposures)

To minimize potential for flash rusting, steel surfaces shall be at least 50°F above the dew point before surface preparation and priming begin.

C. Masonry

Fill cracks and irregularities with Portland cement grout to provide uniform surface texture.

Etch with 5% solution (by weight) of muriatic acid. Flush, neutralize, rinse and allow to dry thoroughly.

Fill concrete masonry unit surfaces with block filler.

3.04 APPLICATION

A. General

Apply paint in strict accordance with manufacturer's instructions and in a manner satisfactory to the Engineer.

Apply each coating at rate specified by manufacturer. If material has thickened or must be diluted for application by spray gun, build up coating to the same film thickness achieved with undiluted material. Correct deficiencies in film thickness by application of additional coats of paint.

Drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of weather or because painting must be done in confined spaces, longer drying times will be required. Do not apply additional coats of paint or place unit in service until paint is thoroughly dry.

Where thinning is necessary, only the products of manufacturer furnishing the paint, and for particular purpose, will be allowed. Thin paint in strict accordance with manufacturer's instructions and only with the full knowledge and approval of the Engineer.

Do not apply final coats until after other trades, whose operations would be detrimental to finish painting, have finished work in the areas to be painted and the areas have been approved by the Engineer for painting.

Slightly vary the color of successive coats. Sand and dust between each coat to remove defects visible from a distance of 5 feet.

Finish coats shall be smooth, free of brush marks, streaks, drips, laps or pile up of paints, and skipped or missed areas.

Finished metal surface shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector.

Mask edges of paint adjoining other materials or color to obtain sharp, clean division without overlapping.

B. Finishing

Do not apply additional coats until completed coat has been examined by the Engineer.

Change colors at corner of stop where colors differ between adjoining spaces or rooms and where door frames match wall color.

Refinish whole wall where portion of finish has been damaged or is not acceptable.

Adjust stained and natural finishes as necessary to obtain uniform appearance.

3.05 CLEANING

A. Touch-up and restore finish where damaged. Remove spilled, splashed, or splattered paint from all surfaces.

B. Leave storage space clean and in condition required for equivalent spaces in project.

3.06 SCHEDULE

A. The finish schedule and color schedule shall be as indicated on the drawings or as directed by the Engineer. Paint any work not specifically named, but required by the intent of the drawings and specifications to be painted, in accordance with similar items.

B. Omit the first coats specified hereinafter, except for touch-up, if surfaces have been primed at the mill, factory or shop. For touch-up, use primer of the same composition as the mill, factory or shop primer.

C. Apply paints to surfaces in accordance with the Schedule.

- D. Masonry
- E. Paint only those masonry surfaces designated on the drawings for painting.
- F. Concrete
- G. Coat all concrete surfaces inside the buildings not otherwise designated for painting with a concrete sealer.
- H. Piping
- Paint piping as indicated on the Schedule for ferrous metals.
- Color selections for piping systems will be made by the Owner. Paint all valves, handwheels and operating handles of all valves, associated meters, pumps and equipment, etc. the same color as the piping system.
- For ductile or cast iron piping with a bituminous primer, apply the appropriate number of coats of the manufacturer's recommended sealer to prevent bleed through.
- I. Equipment and Control Panels
- Paint factory finished equipment and control panels where necessary to match colors.
- Paint process equipment the same color as their respective piping systems.
- J. Physical Hazards
- Comply with OSHA Standard 1910.144 for identification and color code marking of all physical standards.

(SEE ATTACHED PAINT/COATING SCHEDULE)

PAINTING/COATING SCHEDULE NEW OR PREVIOUSLY UNPAINTED SURFACES						
SYSTEM NUMBER	SURFACE	PREPARATION	GENERIC	COATS	TNEMEC	
					NAME	DFT
3	Interior Masonry	Clean & Dry	Water Base Epoxy	Prime	130-6602 Masonry Filler	(60-80 Sq. Ft. (Gal.)
				Intermediate	Series 66HS	2.0-3.0 mils
				Finish	Series 66HS	2.0-3.0 mils
4	Exterior Masonry	Clean & Dry	Modified Epoxy	Prime	Series 180/181	(60-80 Sq. Ft. (Gal.)
				Finish	Series 180/181	8.0-10.0
6	Interior Non-Submerged Ferrous Metal	SSPC-SP-6	Acrylic Urethane	Shop Prime*	Series 1	2.5-3.0 mils
				Field Touchup	Series 1	2.5-3.05 mils
				Intermediate	Series 27	2.0-3.0 mils
				Finish	Series 73	2.0-3.0 mils
7	Exterior Non-Submerged Ferrous Metal	SSPC-SP-10	Epoxy Acrylic Urethane	Shop Prime	Series 1	2.5-3.5 mils

PAINTING/COATING SCHEDULE NEW OR PREVIOUSLY UNPAINTED SURFACES						
SYSTEM NUMBER	SURFACE	PREPARATION	GENERIC	COATS	TNEMEC	
					NAME	DFT
				Field Touchup	Series 1	2.5-3.5 mils
				Intermediate	Series 27	2.0-3.0 mils
				Finish	Series 73	2.0-3.0 mils
8	Submerged Ferrous Metal	SSPC-SP-10	Epoxy-Amine Cure	Prime	Series 104	8.0-10.0 mils
				Finish	Series 104	8.0-10.0 mils
9	Factory Paint Equipment & Machinery	Dull Clean & Dry	Barrier Coat Epoxy Polyamine	Prime	Series 27	2.0-3.0 mils
				Intermediate	Series 27	2.0-3.0 mils
				Finish	Series 73	2.0-3.0 mils
11	Non-Submerged Concrete	Brush Blast	Conformal Stain	Prime	Series 617	150-175 ft ² /gal
				Finish	Series 617	150-175 ft ² /gal
12	Interior & Exterior Galvanized	SSPC-SP-1	Epoxy Polyamide	Prime	Series 27	2.0-3.0 mils
				Finish	Series 73	2.0-3.0 mils
13	Interior & Exterior Mill Finish Aluminum	Clean & Dry/SSPC-SP-1. & Uniform scarification	Epoxy Polyamide	Prime	Series 27	2.0-3.0 mils

PAINTING/COATING SCHEDULE NEW OR PREVIOUSLY UNPAINTED SURFACES						
SYSTEM NUMBER	SURFACE	PREPARATION	GENERIC	COATS	TNEMEC	
					NAME	DFT
				Finish	Series 73	2.0-3.0 mils
15	Interior Concrete Floor	Bush-Off Blast Clean & Dry	Epoxy Polyamide (Non-Skid)	Prime	Series 201	6.0-8.8 mils
				Finish	Series 281	6.0-8.0 mils
17	Interior & Exterior Copper	Clean & Dry	Epoxy	Prime	Series 27	2.0-3.0 mils
				Finish	Series 73	2.0-3.0 mils
18	Secondary Containment concrete floor and walls up to height of secondary containment division walls	ICRI CSP 3 via grind or abrasive blast	Epoxy	Base Coat	Series 239	8.0-12.0 mils
				Intermediate Coat	Series 239	8.0-12.0 mils
				Top Coat	Series 239	6.0-8.0 mils

Note: Limits of painting of a headspace shall include the interior top slab and terminate 2-feet below the operating WSL.

END OF SECTION 09900

**SECTION 10522
FIRE EXTINGUISHERS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish and install fire extinguishers as shown on the Drawings and specified herein.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of these Specifications the Work shall conform to the applicable requirements of the following documents:
 - 1. NFPA 10 - Portable Fire Extinguishers

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01300, Submittals, submit the following:
 - 1. Complete detail and installation drawings for Fire Extinguisher Cabinets.
 - 2. Manufacturer's data sheets and verification of U.L. ratings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Specifications provide products from one of the following manufacturers:
 - 1. Kidde Fire Extinguisher Company
 - 2. Ansul Fire Protection
 - 3. Potter - Roemer
 - 4. J. L. Industries
 - 5. Or Equal.

2.02 MATERIALS

- A. Dry Chemical (DC) Fire Extinguishers
 - 1. Provide where indicated on drawings, 10 lb. capacity, hand portable, with heavy-duty wall mount, tri-class dry chemical type, with Underwriters' Laboratories rating of 4-A: 60 BC.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Fire extinguishers shall be installed where directed by the Engineer.
- B. Wall mounts for extinguishers shall be securely mounted to masonry with lag bolts and shields.
- C. Fire extinguishers shall be installed so that the top of the fire extinguisher is not more than 5 feet above the floor.

END OF SECTION 10522

**SECTION 10523
FIRST AID CABINETS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish and install first aid cabinets as specified herein. Coordinate work in this Section with painting and marking as specified in Section 09900, Painting. Certain equipment items will be field located by Owner, if not otherwise shown on the Drawings.

1.02 SUBMITTALS

- A. Submit Shop Drawings, Performance Affidavit, Operation and Maintenance Instructions and other information as specified for all items of equipment in this Section in accordance with Sections 11000 through 11750 and Section 01300, Submittals. Shop Drawings shall also include complete erection, installation, and adjustment instructions and recommendations.

1.03 MANUFACTURERS

- A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings and operated per manufacturers' recommendations.

PART 2 - PRODUCTS

2.01 FIRST AID CABINETS

- A. The first aid cabinets shall be a Fisher Scientific Co. Catalog #19-035-116, Uline model H-3795, or equal. Two first aid cabinets shall be provided. Mounting brackets for masonry mounting shall be provided. Cabinets shall be field located as directed by the Owner

PART 3 - EXECUTION

3.01 INSTALLATION

- A. First aid cabinets shall be installed where shown on the Drawings or as directed by the Owner. Where required by OSHA regulations, the background of the mounting location shall be painted the appropriate color.

END OF SECTION 10523

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**SECTION 10524
EMERGENCY EYEWASH STATION**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish and install emergency eyewash station as shown on the Drawings and as specified herein. Certain equipment items will be field located by Owner, if not otherwise shown on the Drawings.

1.02 SUBMITTALS

- A. Submit Shop Drawings, Performance Affidavit, Operation and Maintenance Instructions and other information as specified for all items of equipment in this Section in accordance with Section 01300, Submittals. Shop Drawings shall also include complete erection, installation, and adjustment instructions and recommendations.

1.03 MANUFACTURERS

- A. The materials covered by these Specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Drawings and operated per manufacturers' recommendations.

PART 2 – PRODUCTS

2.01 PORTABLE EMERGENCY SHOWER/EYEWASH STATIONS

- A. Portable emergency eyewash/drench hose unit uses air pressure to deliver 10 gallons (37.5 liters) of water for 15 minutes. Portable eyewash stations shall be installed where shown on the Contract Drawings.
- B. Tank: 15 gallon (56L) stainless steel tank. Tank shall have built-in carrying handles, air intake valve, pressure gauge and pressure relief valve.
- C. Eyewash: Capable of washing user's eyes for 15 minutes. Unit shall be furnished with (2) GS-Plus low flow spray heads with "flip top" dust covers, integral flow controls and filters. Valve is ½" IPS chrome plated brass ball valve with flag handle. User's hands can be free while eyewash is in operation.
- D. Drench Hose: For rinsing any part of the user's eyes, face or body. Furnished with single GS-Plus spray head, self-closing valve with handle and 6 foot (2m) reinforced PVC hose.

- E. Discharge Time: Eyewash delivers .7 GPM (2.6L/min) for 15 minutes. Drench hose delivers 1.7 GPM (6.4L/min) for 6 minutes.
- F. Portable eyewash stations shall be Model G1562 as manufactured by Guardian, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Portable eyewash stations shall be installed where shown on the Drawings or as directed by the Engineer. Where required by OSHA regulations, the background of the mounting location shall be painted the appropriate color.

END OF SECTION 10524

**SECTION 11101
GENERAL PROCESS MECHANICAL REQUIREMENTS**

PART 1 - GENERAL

1.01 DESCRIPTION

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 furnished and installed under the various sections of the process mechanical specifications and all other sections that include process mechanical equipment as part of the specified items.

1.02 SUBMITTALS

A. Shop Drawings and Product Data

Shop drawings, including dimensioned drawings, descriptive literature, performance data, electrical characteristics, and in general all information necessary to provide compliance with the specifications, shall be submitted as required in Section 01300.

B. Maintenance Data and Operating Instructions

Submit an Operation and Maintenance Manual for the equipment furnished including a detailed description of the function of each principal component, procedures for operation, instructions for overhaul and maintenance in accordance with Section 01300. Include lubrication schedule, safety precautions, test procedures, electrical schematics, and parts lists.

1.03 GUARANTEE

All materials, equipment, workmanship and performance shall be guaranteed for the period and [in accordance with the provisions of Section 00800](#).

1.04 MANUFACTURER'S OPERATION AND MAINTENANCE MANUALS

The Contractor shall provide manufacturer's operation and maintenance manuals as required in Section 01300.

1.05 STANDARDS

Where standards, codes or specifications are referred to, the reference is to particular standards, codes or specifications together with all the latest amendments and errata applicable at the time the bids are taken. These are listed below:

I.E.E.E.	Institute of Electrical & Electronics Engineers
A.S.T.M.	American Society for Testing Materials
A.S.M.E.	American Society of Mechanical Engineers

A.N.S.I.	American National Standards Institute
A.W.S.	American Welding Society
A.W.W.A.	American Water Works Association
N.F.P.A.	National Fire Protection Association
N.E.M.A.	National Electrical Manufacturer's Association
Federal	Federal Government Specifications
O.S.H.A.	Occupational Safety and Health Act
U.L.	Underwriters Laboratories
A.A.B.C.	Associated Air Balance Council
A.D.C.	Air Diffusion Council
A.G.A.	American Gas Association
A.R.I.	Air Conditioning and Refrigeration Institute
C.S.	Commercial Standard
I.B.R.	Institute of Boiler and Radiator Manufacturers
M.S.S.P.	Manufacturers Standards Society of the Valve and Fitting Industry
S.M.A.C.N.A.	Sheet Metal and Air Conditioning Contractors National Association
N.E.C.	National Electrical Code

1.06 GENERAL DESIGN OF EQUIPMENT AND MACHINERY

- A. All equipment and machinery furnished under this contract shall be of the latest and most improved design suitable for the service of which it is to be used. All 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 all equipment and machinery shall be such as to permit operation with minimum noise, wear and vibration (maximum amplitude of 3.0 mils 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 all 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. Whenever possible, fittings and fixtures of the same make and model shall be used for the several units and their connections. All equipment of identical type and service shall be the product of the same manufacturer.
- D. All 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. Casting 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, part 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 reassembly. 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.

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
Welding Steel Pipe	A-53
Iron Castings	A-48
Babbitt	B-23
Bronze Castings	B-30
Bronze (Manganese)	B-138
Bronze (Silicone)	B-98
Steel Bolts	A-307
Hot Dip Zinc Coating	A-123
Stainless Steel Bolts	A-193, Grade B, Type 2
- 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 each 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.

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 equal. 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. The Contractor shall furnish three Alemite Hydraulic guns, or equal.
- B. The Contractor shall furnish lubrication charts or schedules for each piece of equipment or machinery. The charts or 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 or schedule protected by a transparent plastic envelope.
- C. The Contractor shall furnish one (1) year's supply of each type of lubricant. A typewritten list shall be furnished with the lubricants, designating the specific lubricant to be used for each piece of equipment. This is in addition to the required operating and maintenance manuals, which will also contain lubrication requirements.

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. The Contractor is advised to consult all specification sections to determine responsibility for motors and controls.

- 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 specified or indicated.
 - 1. Motor capacities shall be such that the horsepower rating and the rated full-load current will not be exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplate.
 - 2. 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 furnish motors, electrical circuits 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 driven equipment to operating speed.
 - 3. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.
 - 4. Motors shall be designed for operation on 60-hertz power service. Unless otherwise specified or shown, motors less than ½ horsepower shall be single phase, and motors ½ horsepower and larger shall be 3 phase.
 - 5. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.
- D. Single phase motors smaller than 1/20 horsepower shall be ball or sleeve bearing, drip-proof, totally enclosed or explosion proof, as specified, 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.
- E. Single phase motors 1/20 horsepower and larger shall be ball bearing, drip-proof, totally enclosed or explosion proof, as specified, with Class A or B insulation, as standard with the motor manufacturer; 115, 115/230, 200 or 230 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type.
- F. 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 degrees C rise for open motors and 65 degrees C rise for closed motors both above an ambient temperature of 45 degrees C. At 40 degrees C ambient temperature explosion proof and totally enclosed motors shall have a 1.00 service factor and drip proof motors shall have a service factor of 1.15 or higher. Motors specified for operation at 480 volts shall be name plated 460 volts.

- G. Minimum three phase motor efficiencies at full load for motors having nominal rated speeds of 1200 RPM and higher shall be as follows:

<u>Horsepower</u>	<u>Minimum Efficiency</u>
1	80.0
1-1/2	81.5
2	82.5
3	84.0
4	85.5
5	87.5
7-1/2	87.5
10	87.5
15	88.5
20	90.2
25	91.0
30	91.0
40	91.7
50	92.4
60	93.0
75	93.0
100	93.6
125	93.6
150	94.1
200	94.5
250	95.0

Three phase motors shall be E-plus Energy Efficient Standard Duty Motor of the Electric Motor Division of Goulds, Inc., the MAC II High Efficiency motor of Westinghouse Electric Corporation, the equivalent product of Baldor Company, or equal.

- H. Motors seventy-five (75) horsepower and larger shall be as specified with the driven equipment in these specifications.
- I. Belt-connected motors shall have adjustable bases and setscrews to maintain proper belt tension. All fan motors shall have adjustable sheaves for speed adjustment.

2.05 FLANGES AND BOLTS

- A. Flanges, except as otherwise specified, shall be cast solid, and boltholes 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. All heads, nuts and threads shall be of the American Standard regular sizes. All ferrous bolts and nuts shall be galvanized by the hot dipped process.
- C. Bolts and nuts connecting pumps, valves and meters (as in flange connections) shall be Stainless Steel- Grade 316.

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

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.

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. Each trade shall determine 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 furnish 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 building and as close to walls and column 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 woodwork, masonry, concrete or other materials after same have been installed, without the written permission of the Engineer. No waterproofing shall be cut for any purpose except on written approval 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. All rotating equipment shall be lubricated according to recommendations of the manufacturer and all adjustments shall be made to suit anticipated station operating conditions. Each piece of machinery shall be tested to show that it operates quietly, without vibration, overheating, or sign of distress at full-specified capacity. 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.

3.03 MISCELLANEOUS

- A. Finished parts shall be well protected in the shop, during transportation and before and after erection to prevent injury of any kind. Injured 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 Owner. All exposed finished parts of machinery shall be greased or oiled before shipment.
- B. The Contractor shall 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.
- C. All exposed belts, gears, and drives shall be protected with guards. Guards may be of the equipment manufacturer's standard design, but must meet all the OSHA Standards.

3.04 PAINTING AND LABELING

- A. All fabricated or assembled surfaces normally painted shall be thoroughly dry and free from all rust, grease, dirt or scale. 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 during shipping or installation.
- B. Each piece of equipment (including mechanical operators, and electrical switches for the equipment) shall be identified by hand painting or stenciled, two-inch letters and numbers, to indicate the service or function. Unless specified otherwise in the mechanical and electrical sections of these specifications, each motor and motor controller shall be similarly numbered (or lettered) to correspond to the number (or letter) of the driven unit.

3.05 ADJUSTMENTS TO RELATED WORK

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 Owner.

END OF SECTION 11101

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**SECTION 11170
LIQUID CHEMICAL METERING PUMP SYSTEMS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish and install chemical metering pumps at the locations shown on the Drawings and as specified herein.
- B. The complete installation shall be free from excessive vibration, cavitation, noise, and oil or water leaks.
- C. For chemical applications, the pump supplier shall be responsible for the supply of tubing, piping, fittings, adapters, appurtenances, and accessories starting from the chemical drum, through the metering pump, and ending at the injection quill, inclusive. These shall include, but not be limited to, the pump table, couplings, controls, pressure gauges, calibration columns, isolation valves, Y-strainers, flow indicators, check valves, backpressure/anti-siphon valves, pressure relief valves, and pulsation dampeners as indicated on the Drawings, or as otherwise required. The supplier is responsible for ensuring the chemical compatibility of the materials provided. The supplier shall certify all of the above equipment as a coordinated system with an Equipment Guarantee and Certification Form. The pump supplier's scope of responsibility does not include rigid vent piping connected to calibration columns.
- D. Equipment shall be provided in accordance with the requirements of Section 11100, General Process Mechanical Requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15060 – Pipe and Pipe Fittings
- B. Section 15080 – Valves and Piping Specialties

1.03 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

- a. Pump Performance and Design Requirements

Parameter	Polyaluminum Chloride (PACl)
Application Points	Raw Water Pipe in Prop. Clarifier Building
Pump Type	Peristaltic
No. of Pumps (including 1 spare)	2

Parameter	Polyaluminum Chloride (PACl)
Normal Operating Range, gpd	1.0 - 10
Capacity shall not exceed: gph	18.0
Pump Speed shall not exceed:	150 rpm
Normal Discharge Pressure	<10 psig
Working Pressure Rating (capability)	100 psig
Motor Horsepower shall not exceed:	1/8 hp
Drive Type	Variable Speed DC

1.04 SUBMITTALS

- A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to, the submittal requirements specified in Section 01300 - Submittals; and Section 11100 - General Process Mechanical Requirements:
1. The Contractor shall obtain and submit to the Engineer certification from the chemical pump Manufacturer and equipment Supplier that the equipment meets the requirements of the Contract Drawings and Specifications. This certification form is included at the end of this Section.
 2. Pump dimensions, general cutaway section, and performance data (discharge pressure, strokes per minute, etc.). Also provide the manufacturer's estimated relationship of pump speed versus flow rate for the particular pump and tube submitted, noting the pressures used for the estimation.
 3. Submit the pump flow rate versus pump speed shop test results for approval before shipment of pumps.
 4. Catalog cut sheets and brochures of all equipment.
 5. Assembly Drawings of the pump table and arrangement of chemical feed equipment on the pump table.
 6. Details on materials of construction of all components including applicable ASTM designations.
 7. Chemical resistance data for all wetted pump parts and accessories including, but not limited to; pump housing, pump liquid end material, pump diaphragms, pump tubes, isolation valves, check valves, check valve balls and o-rings.
 8. Sizing calculations for pulsation dampeners.
 9. Equipment shop coating systems, interior and exterior.
 10. Details of sealing system.
 11. The total uncrated weight of the equipment plus the approximate weight of shipped materials.
 10. Motor data sheet indicating motor horsepower; enclosure type; voltage; insulation class; temperature rise and results of dielectric tests; service-rating; rotative speed; motor speed-torque relationship; efficiency and power factor at $\frac{1}{2}$, $\frac{3}{4}$, and full load; slip at full load; running, full load, and locked rotor current values; and safe running time-current curves.

11. Equipment and motor protective device details. Connection diagrams for motor and all protective devices.
 12. Complete wiring diagrams
 13. Complete control descriptions for pump operation
 14. Complete erection, installation, and adjustment instructions and recommendations.
 15. Warranty documentation including statement of duration of warranty period and contact phone numbers and addresses for warranty issues. Such warranty shall be submitted for pumps and all other equipment and accessories.
- B. Submit all installation and start up test results to the Engineer for review.
- C. Operation and Maintenance Manuals for the chemical metering pump systems shall be submitted in accordance with Section 01300 - Submittals, and 11101 - General Process Mechanical Requirements. The manufacturer shall provide estimates of pump tube life based on installation conditions.
- D. The Contractor shall be responsible for coordinating all interfaces with related mechanical, structural, electrical and instrumentation and control work. The Contractor shall be responsible for all work associated with installation of the equipment.
- E. Shop drawings shall include all pumps and accessories and shall be submitted as a complete system. Partial submittals will be unacceptable.

1.05 WARRANTY AND GUARANTEE

- A. The pump manufacturer shall warrant the pump for materials and workmanship for a period of three (3) years after the Substantial Completion of the project. Warranty shall be submitted with the Shop Drawings. The pump manufacturer shall replace or repair the defective or unsatisfactory drive train during the warranty period at no cost to the Owner.
- B. All equipment and accessories shall be warranted for materials and workmanship for a period of one (1) year after Substantial Completion of the project.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. The Manufacturer shall be a company specializing in manufacture, assembly, and field performance of mechanical metering pumps with a minimum of five years experience.

- B. The chemical peristaltic metering pumps shall be ProSeries Flex-Pro M-224 manufactured by Blue-White Ind., Qdos manufactured by Watson Marlow Pumps, or approved equal.

2.02 GENERAL

- A. All parts of the equipment furnished shall be designed and constructed for the maximum stresses occurring during fabrication, transportation, installation, testing, and all conditions of operation. All materials shall be new, and both workmanship and materials shall be entirely suitable for the service to which the units are to be subjected and shall conform to all applicable sections of these Specifications.
- C. Equipment and appurtenances shall be designed in conformity with ASTM, ASME, AIEE, NEMA, and other generally accepted applicable standards.
- D. All equipment which contacts the liquid chemicals or raw water shall be NSF 61 approved.

2.03 MATERIALS: CHEMICAL PERISTALTIC PUMPS

- A. METERING PUMPS shall be a positive displacement, peristaltic type tubing pump with a variable speed DC motor, non-spring loaded roller assembly located in the pumphead, integral tube failure detection system, and peristaltic pump tubing assembly with attached connection fittings.
 - 1. Within the pumphead, there shall be no valves, diaphragms, springs, or dynamic seals in the fluid path. Process fluid shall contact the pump tubing assembly and connection fittings only.
 - 2. Capable of self-priming at the maximum rated pressure of up to 100 PSI (8.6 bar).
 - 3. Capable of running dry without damage.
 - 4. Pump rollers shall be capable of operating in either direction at the maximum rated pump pressure.
 - 5. Pump rollers shall be capable of operating in either direction without output variation.
 - 6. Suction lift shall be 30 feet of water.
- B. PUMPHEAD shall be a single, unbroken track with a clear removable cover.
 - 1. Tube failure detection sensors shall be wholly located in the pumphead and be capable of sending an alarm signal to the control system. Tube failure detection system shall not trigger with water contact. Float switch type switches alone shall not be used. Process fluid waste ports or leak drains alone shall not be provided as the sole means of protection.

2. Squeeze rollers with encapsulated ball bearings shall be directly coupled to a one piece thermoplastic rotor. The roller diameters and occlusion gap shall be factory set to provide the optimum tubing compression; field adjustment shall not be required.
3. Rotor assembly shall be installed on a D-shaped motor shaft and removable without tools.
4. For tubing installation and removal, rotor assembly shall be rotated by the motor drive at 6 RPM maximum when the pumphead cover is removed. Hand cranking of the rotor assembly shall not be required.
5. Pump head and tubing compression surface shall be corrosion resistant thermoplastic.
6. The pump head cover shall be clear, annealed acrylic thermoplastic with an integral ball bearing fitted to support the overhung load on the motor shaft. Cover shall include an imbedded magnetic safety interlock which will limit the motor rotation speed to 6 RPM when removed.

C. PUMP TUBE ASSEMBLY

1. To ensure pump performance and accuracy, only tubing provided by the manufacturer is acceptable.
2. Connection fittings shall be permanently attached to the tubing at the factory. To prevent tubing misalignment and ensure accuracy, fittings shall insert into keyed slots located in the pump head and secured in place by the pump head cover.
3. Tube maintenance should be limited to replacement of the tube assembly only. Replacement of the entire pump head assembly shall not be acceptable.

2.04 ELECTRICAL AND CONTROLS REQUIREMENTS FOR CHEMICAL PUMPS

- A. DRIVE SYSTEM shall be factory installed and totally enclosed in a NEMA 4X, (IP66) wash-down enclosure. Capable of operating on 110/130VAC 50/60 Hz, or 208/250VAC 50/60 Hz, single phase supply, user configurable via a selection switch located in the junction box.
1. Motor
 - a. Reversible, DC gear motor rated for continuous duty.
 - b. Motor shall include overload protection.
 2. Enclosure
 - a. Rated NEMA 4X (IP66).

- b. Provide extended height brackets for mounting pump 4 to 6 inches above surface level.
- c. A wiring compartment shall be provided for connection of input/output signal wires and alarm output loads to un-pluggable type terminal block connectors. Terminal board shall be positively secured to the rear of the pump housing by two polymeric screws and fully enclosed by the wiring compartment cover. The terminal board shall not be disturbed by the removal of the wiring compartment cover. Ribbon cables shall not be used in the wiring compartment. Conduit hubs, liquid-tight connectors, connector through holes and tapped holes shall be sized in U.S. inches.

3. Control Circuitry

- a. Control circuitry shall be integral to the pump and capable of adjusting the pump motor speed from 0.5 % to 100.00% in 0.1% increments.
- b. The pump output shall be capable of being placed in MANUAL control using the front control panel touchpad. While in manual control, the pump motor speed shall be adjustable from 1.0 % to 100.00% in 0.1% increments using the front control panel touchpad.
- c. The pump output shall be capable of being placed in REMOTE 4-20mA control using the front control panel touchpad. While in remote control via 4-20mA analog input, the input resolution shall be 0.1 of input value and capable of adjusting the pump motor speed from 0% to 100.0% motor speed in 0.1% increments. Four values shall be user configurable to define the low and high points on the output slope; a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
- d. The pump output shall be capable of being placed in REMOTE high-speed pulse input control using the front control panel touchpad. While in remote control via high-speed TTL/Cmos type digital pulse inputs or AC Sine wave type input pulses, the frequency resolution shall be 1 Hz and capable of adjusting the pump motor speed from 0% to 100.0% motor speed in 0.1% increments. Four values shall be user configurable to define the low and high points on the output slope; a low input value, the required pump percentage of motor speed at the low input value, a high input value, the required pump percentage of motor speed at the high input value.
- e. The pump output shall be capable of being placed in REMOTE pulse triggered batch input control using the front control panel

touchpad. While in remote control via pulse triggered batch input, the pump shall accept a TTL/Cmos digital pulse type input or a contact closure type pulse input in the range of 1 to 9999 pulses per batch. The batch time shall be adjustable from 1 to 999.9 seconds or minutes. The pump motor speed during the batch shall be adjustable from 0% to 100.0% motor speed in 0.1% increments.

- f. The pump shall be capable of being remotely controlled via any of the following optional communications modules, Profibus DPV1, Modbus RTU, Modbus-TCP, EtherNet/IP, or Profinet RT I/O. The optional communications module hardware shall install into the junction box of the pump. The pump shall be field upgradable at any time with any of the communications protocols.
- g. The pump operating firmware shall be field upgradable. New firmware shall be downloadable via the Internet. A serial communications port shall be provided on the pump terminal board, which when connected to the user's computer, will permit the uploading of the new firmware into the pump.
- h. Provide a 9-button front panel user touchpad control for stop/start, configuration menu access and navigation, operating mode selection, motor reverse, tube life hour display, and auto priming.
- i. Provide a back-lit LCD display for menu configuration settings, current pump operating mode, pump output volume, tube timer hour counter, tube failure detection (TFD) system and flow verification system (FVS) alarms status, motor direction and remote input signal values.
- j. The pump output volume display shall be programmable to indicate the volume in ml/min, L/hr, Oz/min or Gal/hr units of measure.
- k. Provide for remote stop/start pump via 6-30 VDC powered loop or non-powered contact closure loop.
- l. Provide a 4-20mA output signal which is scalable and proportional to pump output volume.
- m. Provide a contact closure alarm output rated at 3A-250VAC (3A-30VDC) that will energize when the TFD (Tube Failure Detection) or FVS (Flow Verification system) is triggered.
- n. Provide an auto-prime function that will run the pump at 100% motor speed for 60 seconds maximum when the PRIME button is pressed.

B. SAFETY

1. The pump shall be listed to UL standard 778 as a motor operated pump and CSA standard C22.2 as process control equipment.
2. Tube Failure Detection (TFD) system sensors shall be wholly located in the pumphead. TFD system will stop the pump within three seconds of leak detection. To prevent false alarms due to rain, wash-down, condensation, etc., sensors shall be wholly located in the pumphead. The tube failure detection system shall not trigger with water contact. Float switch type switches alone shall not be used. Process fluid waste ports or leak drains alone shall not be provided as the sole means of protection.
3. Pumphead cover shall include an imbedded magnetic safety interlock which will stop the pump when removed. Pump rotor speed shall be limited to 6 RPM when cover is removed.

C. RAW WATER PUMP

1. Raw water sample pump shall have adjustable flow rate. If variable frequency drive and panel are not integral to the pump assembly, the manufacturer shall supply them and they shall be installed on the same pump table with the pump.

2.05 METERING PUMP ACCESSORIES

- A. The metering pump supplier shall furnish accessory equipment as specified herein, as specified in Section 15080 – Valves and Piping Specialties, and as shown on the Drawings, including but not limited to the following below.
- B. PRESSURE: All supplied components on both the suction and discharge side of the chemical feed pumps, including tubing and fittings, shall be pressure rated at least to the same “Working Pressure Rating (Capability)” listed in Tables 1.02.B of this Section.
 1. Tubing and Fittings.
 2. PVC Piping – Not all solvent cements are suitable for the chemical applications. Use a specially formulated solvent cement suitable for sodium hypochlorite for solvent welded joints for ALL chemicals. Use IPS Weld-On 724, or approved equal for ALL chemicals, not just sodium hypochlorite. Use IPS’s recommended primer, P-70, or approved equal.
 3. Pump Table – Pump manufacturer shall supply pump skid platform system with a back wall which can hold equipment mounted to it. If the pump supplier’s skid platform does not have legs, the Contractor may submit a design for Engineer’s approval which provides four (4) galvanized steel strut channel legs to raise the skid platform to operator level. The table surface shall be 29 to 36 inches high above the floor level. Table shall be bolted to floor with concrete anchors. Support pump

on raised mounting feet secured to table surface. Table material shall be FRP, PE, or PP, or metal with protective coating.

4. Pressure Gauges - Gauges with diaphragm seals shall be provided on the discharge of metering pumps. Gauges shall be the product of one manufacturer.
 5. Pressure Relief Valves.
 6. Anti-Siphon/Back Pressure Valves. Each of these valves shall function to provide both back pressure and prevention of siphoning.
 7. Ball Valves
 8. Diaphragm valves
 9. Y-Strainers
 10. Flow Indicators – Shall be visual ball type.
 11. Check Valves.
 12. Pulsation Dampeners - Each dampener shall be equipped with a charging valve and gas pad pressure gauge. Sizing of the pulsation dampeners shall be the responsibility of the manufacturer, and calculations shall be submitted with Shop Drawings.
 13. Calibration Column – Calibration columns shall be constructed of transparent material. Graduations shall be in mL. Each calibration column shall be sized such that at 50% pump capacity, the calibration column will be emptied in 1.5 to 2.5 minutes.
 14. Injection Quill – Shall be retractable and the injection pipe passes through a valve which is connected to the process pipe saddle. This valve can be closed when the injection pipe is removed for maintenance. Select injection pipe length which dispenses chemical as close to center of process pipe as possible without voiding warranty. End tip shall be cut slanted at 45°. Shall be Saf-T-Flo or approved equal.
- B. All of the above valves shall have internal components that cause tight sealing to prevent unintentional internal leakage.

2.06 TOOLS, SUPPLIES, AND SPARE PARTS

- A. The equipment manufacturer shall furnish all special tools necessary to disassemble, service, repair and adjust the equipment.
- B. Spare parts shall be provided in accordance with Section 11101, General Process Mechanical Requirements and shall include the following:

1. One (1) spare pump for each chemical and pump type, per pump quantity requirements described in this Section.
 2. Two (2) complete sets of gaskets and O-ring seals for each size and material combination offered.
 3. One (1) spare valve for each valve type and chemical.
 4. Three (3) peristaltic pump tubes for each peristaltic pump supplied (not including spare pumps).
- C. Spare parts shall be delivered at the same time as the equipment to which they pertain. Spare parts shall be stored separately in a locked area, maintained by the Contractor, and shall be turned over to the Owner in a group prior to substantial completion. All of these materials shall be properly packed, labeled (including by chemical), and stored where directed by the Owner and Engineer.

2.07 SHOP TESTING

- A. All equipment shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents and that it will operate in the manner specified or implied.
1. Perform shop tests with water on all chemical feed pumps (except duplicate spares) which confirm pump capacity while the suction pressure is 0 psi and the discharge pressure is equal to the "Normal Discharge Pressure" listed in Tables 1.02.B in this Section.
 2. Test all pressure relief valves and backpressure valves to ensure that they are set as shown in the Drawings.
- B. No equipment shall be shipped to the project until the Engineer has been furnished a certified copy of test results and has notified the Contractor, in writing, that the results of such tests are acceptable.
- C. Three (3) certified copies of the manufacturer's actual test data and interpreted results thereof shall be forwarded to the Engineer for review.
- D. Shop testing of electric motors shall be in accordance with applicable requirements of Section 16050 - Basic Materials and Methods.

PART 3 - EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

- A. The services of a qualified manufacturer's technical representative shall be provided as follows:

Service	Number of Trips	Number of Days/Trip
Startup and Training	1	1

- B. The Contractor shall be fully informed and shall be responsible to ensure that all Contractor's employees, agents, and/or subcontractors are fully informed as to the hazards and proper procedures associated with working with and around the specified chemicals.
- C. Any additional time required to achieve successful installation and operation shall be at the expense of the Contractor. The manufacturer's representative shall sign in and out with the Owner on each day he is at the project.
- D. A written report covering the representative's findings and installation approval shall be mailed directly to the Engineer covering all inspection and outlining in detail any deficiencies noted.
- E. The times specified are exclusive of travel time to and from the facility and shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

3.02 STORAGE OF EQUIPMENT AND MATERIALS

- A. Contractor shall store his equipment and materials at the job site in strict accordance with the manufacturer's recommendations and as directed by the Owner or Engineer, and in conformity to applicable statutes, ordinances, regulations, and rulings of the public authority having jurisdiction. Equipment and materials shall not be delivered to the site prior to 90 days in advance of the scheduled installation. Partial payment requests will not be processed for materials delivered prior to 90 days before installation or for materials that are not properly stored.
- B. Material or equipment stored on the job site is stored at the Contractor's risk. Any damage sustained of whatever nature shall be repaired to the Engineer's satisfaction at no expense to the Owner. Stored electrical equipment is to be protected from the elements and shall have space heaters energized.

3.03 INSTALLATION

- A. The Contractor shall furnish and install the metering pumps and all associated equipment and accessories as required and specified herein in accordance with manufacturer's instructions and in accordance with Section 11101 - General Process Mechanical Requirements.
- B. The Contractor shall have on hand sufficient personnel, proper construction equipment, and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character. To minimize field erection problems, mechanical units shall be factory-assembled insofar as practical.

- C. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Drawings.
- D. All equipment sections and loose items shall be match-marked prior to shipping.
- E. The Contractor shall support piping adjacent to pumps such that no weight is carried on pump casings.

3.04 TESTING, CLEANING, AND START-UP

- A. The Contractor shall demonstrate to the Engineer that the completed systems meet the functional requirements intended and that all components of the system are properly calibrated.
- B. After installation of piping and accessories but before connection of chemical piping to the storage tank, pumps, and process piping, the Contractor shall completely flush the system to clean and remove all foreign matter from the piping system.
- C. Complete system hydrostatic tests and operational tests shall be completed with potable water. The Contractor shall check the functioning of all pump accessories, valves, and feed points and shall repair or replace all malfunctioning or unsatisfactory components. The Contractor shall repair all leaking joints and components identified during the test and through the guarantee period.
- D. Before connection of the chemical tubing/piping to the storage tank, pumps, and process piping, perform hydrostatic pressure tests for all assembled tubing, piping, and valving systems, including on the suction side of the pump, at a pressure of 25 psi for 24 hours. Then drain the piping and tubing of all test water before placing into chemical service.
- E. After pressure testing the chemical tubing/piping system, but before placing the chemical feed system into service of injection into the process pipes, test the flow rate of the installed pumps with chemical (not water) within the completely assembled system as follows:
 - 1. Ensure that chemical storage tank is at least half full of chemical.
 - 2. Ensure that the chemical feed piping and valving system is completely assembled and connected to the storage/day tanks per design and ready for normal operation, with the exception that the injection point is disconnected so that chemical will not enter the ultimate process piping. Disconnect the piping/tubing immediately prior to the injection quill, which usually will be at a portion of flexible tubing which can be disconnected. If there is no flexible tubing near the injection quill, use a capped rigid test port near the quill and shut off the valve to the process pipe. During testing, chemical will flow out at these points (not into process pipe) and the Contractor shall be responsible for capturing, disposing of or reusing the pumped chemical flows during testing. Ensure sufficient ventilation of

- the area and minimize fumes. Use personal protective equipment as needed.
3. Run the chemical feed pumps to fill the feed piping system. Remove trapped air in the lines.
 4. Perform flow rate tests with the chemical to determine the pump flow rate as a function of pump speed (rpm) and percentage (%). Test at least at approximately 25%, 50%, 75%, and 100% of the upper limit of the Normal Operating Range as shown in Tables 1.02.B of this Section. Provide charts of this data and a linear regression equation relating the variables. The flow rate may be measured using the calibration column or by precisely measuring the waste chemical leaving the piping system.
- F. Final acceptance tests shall demonstrate the following:
1. The pumps have been properly installed and are in proper alignment.
 2. The pumps operate without overheating or overloading of any parts and without objectionable vibration. Vibration shall be within the Hydraulic Institute limits, or manufacturer's limits if more stringent.
 3. The pump motors can meet the specified operating conditions. All pumps shall be checked at maximum speed for amperage. The rated motor nameplate current shall not be exceeded at any point. Pumps with drive motors rated at less than five horsepower shall only be tested for overcurrent when overheating or other malfunction becomes evident in general testing.

3.05 FAILURE OF EQUIPMENT TO PERFORM

- A. Any defects in the equipment, or failure to meet the guarantees or performance requirements of the Specifications shall be promptly corrected by the Contractor by replacements or otherwise.
- B. If the Contractor fails to make these corrections, or if the improved equipment shall fail again to meet the guarantees or specified requirements, the Owner, notwithstanding his having made partial payment for work and materials which have entered into the manufacture of said equipment, may reject said equipment and order the Contractor to remove it from the premises at the Contractor's expense.
- C. The Contractor shall then obtain specified equipment to meet the contract requirements or upon mutual agreement with the Owner, adjust the contract price to reflect not supplying the specific equipment item.
- D. In case the Owner rejects said equipment, then the Contractor hereby agrees to repay to the Owner all sums of money paid to him for said rejected equipment on progress certificates or otherwise on account of the lump sum prices herein specified.

- E. Upon receipt of said sums of money, the Owner will execute and deliver to the Contractor a bill of sale of all his rights, title, and interest in and to said rejected equipment; provided, however, that said equipment shall not be removed from the premises until the Owner obtains from other sources other equipment to take the place of that rejected.
- F. Said bill of sale shall not abrogate Owner's right to recover damages for delays, losses, or other conditions arising out of the basic contract.

END OF SECTION 11170

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**SECTION 11220
IN-LINE STATIC MIXING EQUIPMENT**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish, pressure test, install and place in satisfactory operation, in-line static mixers as shown in the Drawings and described herein: complete with mixing elements and housing pipe.

1.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

- A. Mixer Schedule

Application:	Alum Rapid Mix Coagulation
Quantity of mixers	1
Main Process Fluid	"Raw" untreated water from reservoir, pH = 6-9
Main Pipe Diameter	6"
Main Process Flow Rate Range, gpm	50 – 300
Mixer Pressure Rating (also test pressure), psi	150
Chemical Added	Polyaluminum Chloride solution
Chemical Flow Rate Range, gpd	3 - 10
Mixing performance Requirement within Flow Rate Ranges described above	At least 95% mixing completion at the end of the mixer outlet, as defined by Coefficient of Variation
Pressure (Head) Loss at Maximum Flow Rate shall not exceed:	4 psi
Length Requirements	None
Minimum Liquid Temperature	40°F

1.03 SUBMITTALS

- A. The Contractor shall submit the following in accordance with Section 01300 - Submittals:
1. Detailed manufacturer's design data, including all materials and coatings.
 2. Dimensional drawings.
 3. Performance data. Provide chart of flow vs. mixing performance and head loss. List pressure rating.

4. Cutsheets and/or brochures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Static mixers shall be manufactured by Koflo, Komax, or Statiflo.

2.02 DESIGN

- A. The mixer shall be the static in-line type with no moving parts. The mixer shall contain fixed static mixing elements inside of a circular pipe spool piece.
- B. Mixing shall be by stationary, rigid elements arranged to split and recombine streams to provide a near-homogeneous stream at the mixer outlet.
- C. The mixer shall be flanged on both sides, compatible with surrounding piping.
- D. Mixer shall be structurally sound and suitable to withstand typical stresses associated with the intended installation arrangement.
- E. Materials of construction, inside and outside, shall be stainless steel, epoxy-coated carbon steel, or epoxy-coated ductile iron. All materials in contact with process liquid shall be NSF 61 approved.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. The mixers shall be installed and supported as indicated on the Drawings and as recommended by the manufacturer.

3.02 EXTERIOR COATINGS

- A. The exterior of the static mixer housing shall be epoxy coated (unnecessary for stainless steel) and shall have a different color than the surrounding piping, but the color shall still be a tint of blue, green, or olive. Stencil "Static Mixer" label onto the mixer body.

END OF SECTION 11220

**SECTION 11340
CHEMICAL SCALES**

PART 1 – GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish, test, install and place in satisfactory operation a chemical drum scale for coagulant (Polyaluminum Chloride), complete with all spare parts, accessories, and appurtenances as specified or shown in the Contract Documents.
- B. Equipment shall be provided in accordance with the requirements of Section 11100, General Process Mechanical Requirements.

1.02 OPERATING CONDITIONS AND PERFORMANCE REQUIREMENTS

Digital Drum Scale(s) shall be provided for weighing chemical drums and cylinders. Scale shall be of the digital readout/electronic load cell type with a net capacity of 1000 lbs. (kg). Scale shall be of the single load cell design.

1.03 SUBMITTALS

- A. The following items shall be submitted with the Shop Drawings in accordance with, or in addition to, the submittal requirements specified in Section 01300, Submittals, and Section 11101, General Process Mechanical Requirements:

1.04 WARRANTY AND GUARANTEE

- A. Warranty and Guarantee shall be as specified in Section 11101, General Process Mechanical Requirements, with the exception that the warranty period shall be for five (5) years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Drum scales shall be as manufactured by Scaleton Industries, LTD, or equal.
- B. Digital indicators shall be model 4040-26 as manufactured by Scaleton Industries, LTD, or equal.

2.02 GENERAL REQUIREMENTS

- A. All equipment shall be suitable for the intended chemical service specified in 1.02A.
- B. Scales

1. Day tank scales shall be used to measure the weight of the coagulant chemical tank.

2.03 DAY TANK SCALE DESIGN REQUIREMENTS

- A. Tank scales shall be of the digital readout/electronic load cell, dual cylinder type. Full-scale accuracy of the scales shall be equal to or better than ¼ of 1%.
- B. The single, NTEP approved load cell shall be of the shear beam strain gauge type. A minimum of 20 feet of flexible cable shall be provided to connect the load cell to the digital indicator.
- C. Scale platform shall be sized to accept up to an 26” diameter drum or cylinder. Scale must have a rugged, steel frame that is protected by a corrosion resistant coating. Coating system shall consist of a zinc oxide primer and dry powder epoxy that is resistant to chemicals, moisture and UV light. The decking shall be solid, 1/4" thick PVC to protect scale base from abrasion. All hardware shall be stainless steel. The platform height shall not exceed 1.81" (46 mm) so as not to require a pit or ramp. A stainless steel leveling foot shall be supplied with the load cell. A heavy-duty adjustable shall be provided to facilitate centering of drums and cylinders on the platform. There must be a provision for securing weigh frame to floor.
- D.

2.04 DIGITAL INDICATOR DESIGN REQUIREMENTS

- A. Each scale shall be provided with a digital indicator which shall be used to display tote or day tank weight.
- B. Digital indicators shall be designed to withstand exposure to the chemicals being stored in the respective totes and day tanks.
- C. Display & Operation: Indicator must be electronic with a 6 digit, 1 line LED display with characters at least 0.56" high for weight value, plus a 2 line, 16 characters per line, alphanumeric LCD display for status and features. The indicator shall give operator the ability to monitor chemical by weight or volume in pounds, kilograms, gallons or liters. Indicator shall have 10 numeric and 10 function keypad with audible, tactile and visual confirmation for programming and setting tare weights, while all operations shall be menu prompted for ease of use. Indicator shall have a redundant memory back-up so that it does not need to be reprogrammed in the event of a power loss.

2.05 ELECTRICAL AND CONTROL REQUIREMENTS

- B. Electrical Requirements

Parameter	Tote Bin-Scales	Day Tank Scales
Power Requirements	N/A	110/240VAC, 1 ph, 60 Hz

Indicator Enclosure	N/A	NEMA 4X
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PART 3 - EXECUTION

3.01 MANUFACTURER'S FIELD SERVICES

- A. Startup and training shall be coordinated with the Owner, and the Owner shall have final approval authority for the scheduled date(s).

END OF SECTION 11340

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SECTION 11500
DISSOLVED AIR FLOTATION CLARIFICATION EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Dissolved Air Flotation equipment
 - 1. This section specifies the furnishing and commissioning of a dissolved air flotation (DAF) system complete with pressurization system, recirculation pumps, pneumatic panel, continuously stirred tank reactor (CSTR) with mixer, equipment control panel, special equipment and appurtenances including, but not limited to, skimming device, sludge collector mechanisms, and factory wiring as specified herein to provide a complete and operable system for algae removal, in accordance with the requirements of the Contract Documents.

1.02 SUBMITTALS

- A. Submit three (3) copies of the following descriptive information with the Bid:
 - 1. Proposed equipment supply list with electrical characteristics of motor driven equipment.
 - 2. Make, model number and catalog information of all process equipment, including, but not limited to, recirculation pumps, sludge pumps, instrument and sensors, and appurtenances
- B. Submit Shop Drawings and descriptive literature in accordance with Section 013300. Submit the following within seven (7) calendar days of receipt of purchase order:
 - 1. Layout drawings including all proposed system components with dimensions, clearances required and sizes indicated and total weights of the equipment with off-loading instructions.
 - 2. Detailed specifications and data describing the materials of construction.
 - 3. Complete information on electric motors furnished including make and type of motor, brake horsepower and locked rotor current at full voltage.
 - 4. Complete electrical wiring diagrams and data on controls to be furnished.
 - 5. Pump performance curves.
 - 6. Complete installation instructions, with dimensional drawings, points of electrical and plumbing connection requirements clearly shown in Field Installation Assembly drawings.
- C. Submit Operation and Maintenance Data in accordance with Section 013300 within forty-five (45) calendar days of receipt of purchase order.

1.03 QUALITY ASSURANCE

- A. The manufacturer shall have dissolved air flotation units of the type specified herein successfully operating on algae removal applications for a minimum of five (5) years in the USA.
- B. In lieu of the specific experience requirement listed in 1.3 A, furnish a performance bond in the name of the Owner in the amount of 150% of the dissolved air flotation equipment cost to provide for replacement of the equipment if necessary within the first five (5) years of operation.
- C. Compliance with the performance requirements of the specifications shall not relieve the vendor of his responsibilities of supplying equipment having the specified structural, mechanical, corrosion resistance and operational features.
- D. All electrical equipment and materials specified herein shall be approved by Underwriters Laboratories (UL) for the purpose for which they are used and shall bear the UL label. Labels from other electrical testing laboratories will be acceptable if approved by the local electrical inspection authority.

1.04 WARRANTY

- A. Guarantee the equipment against defects in material and workmanship under normal use and service for a period of one (1) year after start up not to exceed eighteen (18) months after shipment during which time repairs or replacements are to be made without charge.
- B. Further, provide an additional four (4) year warranty (total of five (5) years) for the dissolved air flotation vessels and their coatings, the CSTRs and their coatings and the aeration systems and their coatings.

1.05 COORDINATION

- A. Provide at least one (1) calendar weeks' notice prior to equipment installation to the Owner and Engineer.
- B. Provide at least two (2) calendar weeks' notice prior to manufacturer training.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Protect all equipment during delivery and during storage on site. Store equipment on suitable blocking to maintain parts clear of the ground and cover to insure drainage of all rainwater

PART 2 - PRODUCTS

2.01 DISSOLVED AIR FLOATATION

- A. Manufacturers:
1. Sulzer Chemtech USA Inc. dba as FRC Systems International
 2. Or approved equal
- a. Specifications and equipment arrangements for DAF system are based on Sulzer Chemtech USA Inc. dba as FRC Systems International. Changes to the arrangement indicated in the specifications and in the plan set or any redesign required from the Engineer shall be at the expense of the installing Contractor. No change orders will be issued to the contractor for modifications to the laying length, footprint, concrete layout, electrical, mechanical, etc.
- B. Schedule
1. DAF16001
 2. DAF26001
- C. General
1. The manufacturer shall supply two (2) complete working dissolved air floatation systems including all integral piping, wiring, instrumentation, controls and related accessories for the process specified herein and identified in the plans.
 2. Air compressor shall be provided by the DAF manufacturer with air quality adequate for the use as required. Type and grade: S (single component) and P (pourable).
- D. Performance and Design Requirements
1. The dissolved air floatation (DAF) system shall be a high-rate separator system with plate packs for dissolved air assisted separation of free and/or flocculated solids.
 2. Design Requirements:
 - a. Maximum flow rate (per unit): 150 gpm
 - b. Maximum influent Turbidity concentration: 100 NTU
 - c. Hydraulic loading rate shall not exceed 1 gpm/ft² of effective separation area. The recycle flow rate shall be included in the total loading rate of 1 gpm/ft².
 - d. Effective separation area: ≥ 250 ft²
 - e. Solids loading rate: 2.5 lb/ft² /hr (max)
 - f. Recycle flow rate (min): 44 gpm

- g. Compressed air requirement for each DAF: Approx. 1 SCFM at 100 psi
- 3. The system package shall include the DAF unit, the CSTR, instrumentation, pneumatic control panels, control system and spare parts with ancillary equipment and features as specified in the following paragraphs.

E. Dissolved Air Floatation Unit

- 1. Each vessel shall be constructed of 304 stainless steel, with approximate overall dimensions of 10 ft long by 8 ft wide by 12 ft high. Units having other dimensions will be considered but may not fit within the available space.
- 2. Vessel shall be constructed in accordance with the following:
 - a. Minimum 30 ft² of free surface area.
 - b. Full surface skimming system with skimmer blades.
 - c. Bottom settled solids removal system.
 - d. Manually adjustable effluent weirs.
 - e. Stainless steel plate pack system
- 3. An aeration system shall be provided for each DAF system. The aeration system shall recycle water from the effluent compartment of the DAF unit to the inclined air dissolving tube.
- 4. Furnish with a pneumatic control panel for each DAF unit with pressure switches, air flow solenoid valves and pressure gauges for monitoring and control of air to the system.
- 5. Provide a dedicated equipment control panel for each DAF with operator interface terminal (OIT)

F. Aeration System

- 1. Each aeration system shall be a complete functioning system with two (2) ANSI type centrifugal recirculation pumps with flexible-coupled motors, air dissolving mechanism, aeration header, valves and appurtenances. Pumps shall be furnished as one (1) operating and one (1) standby for each aeration system. No narrow tolerance pumps shall be allowed nor aspirating pumps with air dissolving capability. The recirculation pumps shall increase the water pressure to approximately 90 psig.
- 2. Each recycle pump shall be 10 hp (max).
- 3. Compressed air shall be introduced into the recycle water stream in the air dissolving tube and the air saturated recycle water shall be distributed to various points within the DAF unit. The air pressure shall be 7-10 psig greater than the pressure of the water in the recycle stream.
 - a. Air shall dissolve into the recycle water stream over the entire length of the air dissolving tube.

- b. Air flow meters and adjusting valves shall be provided in the pneumatic panel for each DAF unit to allow for regulation of the air volume metered into the air dissolving tube.
- c. The recycle water, saturated with air, shall be dosed through the aeration header to strategic points within the DAF unit, including the wastewater inlet to the unit and the final bays near the skim ramp. The recycle water dosing system shall be designed to provide sufficient air bubbles to provide buoyancy to the floc and to create an air cushion below the float mat.
- d. Depressurization shall occur through specifically designed inlet devices resulting in fine air bubbles to adhere and carry very small to large particulate contaminants upward to the float mat.

G. Skimming And Grit/Sludge Collection and Removal System

- 1. Each DAF unit shall have a float dewatering/skimming system (SC16005, SC26005) with adjustable outlet weirs for regulating the solids content of the skimmed material.
 - a. The adjustable outlet weirs shall be located downstream of a retention baffle which holds the float mat within the dewatering zone.
 - b. A grid thickening system shall be provided above the inclined plate pack to allow for thickening or partial dewatering of the scum mat before it is taken off by the skimmer blades.
 - c. A scraper system consisting of skimmer blades on a chain assembly shall be provided to continuously or intermittently remove the thickened float. An adjustable timer shall be provided to allow the float mat to build and thicken or dewater between scraping cycles if continuous operation does not provide a satisfactory solids concentration.
 - d. Skimmer drive shall be rated 1 HP and TEFC 460V/60Hz/3-Phase.
- 2. Each DAF unit shall be provided with a bottom and grit collection/removal system. The grit collection/removal system shall be located at the base of the influent compartment.

H. CSTR

- 1. Materials of construction shall be stainless steel.
- 2. CSTR tank to be dual-chambered with each chamber having a minimum volume of 3,000 gallons.
- 3. Furnish CSTR complete with inlet flange, outlet flange, drain, and two (2) reactor tank mixers rated at 2 HP.

I. Accessories

- 1. The DAF system shall include all required accessories necessary for operation including but not limited to the following:

- a. Pneumatic panels, valves and related appurtenances for integral air service
 - b. Aeration system plumbing
 - c. Applicable pressure indicators
 - d. E-stops
- J. Local Control Panel
- 1. Provide a single equipment control panel for automatic or manual operation of both DAFs. Control panel shall be designed for mounting near the DAFs.
 - 2. Each control panel shall be a NEMA 4 painted steel enclosure complete with the following components:
 - a. Main panel electrical disconnect rated per the NEC.
 - b. Terminal blocks for all field wiring to instrumentation, control devices and pressurization system.
 - c. Wire management system for internal panel wiring.
 - d. Audible alarm horn (piezo type).
 - e. Control transformer and circuit breakers as required.
 - f. Programmable logic controller to control the flight speed, operational cycle times, equipment control valves, pressurization pumps, chemical feed pumps, etc. PLC shall be an Allen Bradley / Rockwell Compactlogix with Ethernet communication capability.
 - g. Each PLC output including pilot lights must be individually fused if not individually fused on the output card of module.
 - h. Operator Interface Terminal (OIT) in the face of control panel door – Allen Bradley Panelview with Ethernet communication capability (10" screen, 128MB of memory minimum).
 - i. Provide Ethernet switch in the panel to allow for remote Ethernet communications to main SCADA PLC and to allow access via laptop to locally modify program as required.
 - j. Provide, as required, control transformer(s), properly sized for the application.
 - 3. The local electrical control panel OIT shall be set to provide graphical screens depicting the following information, alarms, control functions:
 - a. Main Operations Screen for DAFs:
 - i. Start/stop control of DAFs & Pressurization System
 - ii. Adjustment of time cycle for skimmer
 - iii. Chemical feed rate into each DAF
 - iv. Run indication status of skimmers, chemical feed pumps, and other ancillary equipment for each DAF
 - v. General system alarm indication for each DAF.
 - b. Alarm Screen
 - i. Alarm and horn acknowledge/reset
 - ii. Recirculation water pressure low
 - iii. Low air pressure
 - iv. Skimmer stopped fault for each

4. Scope of supply shall include any and all components, accessory devices, valves and controls required for a complete and functional installation.
- K. Surface Protection
1. Provide completely corrosion resistant materials of construction (stainless steel) and protective coatings and coverings such that shop or field applied paint coating is not required.
 2. Provide completely corrosion resistant miscellaneous parts such as brackets, spacers, guards, etc. fabricated from type 304 stainless steel.
 3. Provide items such as motors, gear reducers, pumps, air compressors, etc. with standard manufacturer's finish coatings

PART 3 - EXECUTION

3.01 FACTORY ACCEPTANCE TEST

- A. The factory acceptance test shall include tank and piping leakage tests, motor voltage and rotation checks and complete testing of control function.

3.02 INSTALLATION

- A. Installation to be performed according to manufacturer instructions.
- B. Install the dissolved air flotation system in accordance with the contract drawings, shop drawings and the manufacturers' field service and installation manual.
- C. Include the recommended oil and grease for the first twelve (12) months of operation.
- D. Nameplates, plant equipment identification and maintenance direction signs must be clearly visible after finish painting. Apply manufacture supplied warning and maintenance instructions in conspicuous locations.

3.03 DEMONSTRATION AND START-UP

- A. The services of a factory trained engineer/technician shall be provided to supervise the installation of the equipment, test the equipment, supervise the initial operation of the treatment system, demonstrate the performance of the equipment, and to instruct the Owner's personnel in the operation of the equipment. Factory services shall include three (3) 8 hour days on-site during installation, start-up and performance demonstration.
- B. Prior to plant startup, all installed equipment shall be inspected for proper alignment, proper connection and satisfactory performance.

- C. The equipment manufacturer shall make all initial adjustments to the equipment and shall operate the equipment continuously for seventy-two (72) hours, to demonstrate that the system performs its intended functions. During this performance period, no less than four (4) representative samples per day shall be tested for effluent solids concentration. Solids feed rates and chemical consumption shall be recorded.

3.04 OPERATOR TRAINING

- A. At least one (1) training session of six (6) hours in length shall be arranged to instruct the Owner's personnel in the operation and maintenance of the system. Training of the Owner's personnel shall be done by an experienced factory engineer. Training shall include a hands-on demonstration of all aspects of the operation and a simulation of all control and alarm functions.
- B. Owner can request additional training as needed.

3.05 CLEANING

- A. Remove all dirt and markings from equipment.

END OF SECTION 11500

**SECTION 13341
METAL BUILDING SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Insulated Metal roof panels.
3. Insulated Metal wall panels.
4. Metal soffit panels.
5. Personnel doors and frames.
6. Accessories.

B. Related Requirements:

1. Section 08330 "Roll-Up Doors" for sectional vehicular doors in metal building systems.

1.2 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.3 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

- a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
 3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Insulated Metal roof panels.
 - b. Insulated Metal wall panels.
 - c. Metal soffit panels.
 - d. Personnel doors and frames.
 - e. Roof ventilators.
 - f. Louvers.

- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.
 - c. Show translucent panels.
 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
1. Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.
- E. Door Schedule: For doors and frames. Use same designations indicated on Drawings. Include details of reinforcement.
1. Door Hardware Schedule: Include details of fabrication and assembly of door hardware. Organize schedule into door hardware sets indicating complete designations of every item required for each door or opening.

2. Keying Schedule: Detail Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
- F. Delegated Design Submittal: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector manufacturer.
- B. Welding certificates.
- C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
1. Name and location of Project.
 2. Order number.
 3. Name of manufacturer.
 4. Name of Contractor.
 5. Building dimensions including width, length, height, and roof slope.
 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, in accordance with governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- D. Erector Certificates: For qualified erector, from manufacturer.
- E. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shop primers.
 5. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control reports.

- H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.
- I. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited in accordance with the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 - 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. Land Surveyor Qualifications: A professional land surveyor who practices in jurisdiction where Project is located and who is experienced in providing surveying services of the kind indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with

positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed in accordance with manufacturers' written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: **25** years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Basis of Design: Nucor Building Systems. <http://www.nucorbuildingsystems.com>

2. Varco-Pruden Buildings; a division of BlueScope Buildings North America, Inc.
 3. Vulcan Steel Structures, Inc.
- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
- B. Primary-Frame Type:
1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
- C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns..
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.
- E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings.
- G. Roof Slope: 1 inch per 12 inches (1:12).
- H. Roof System: Manufacturer's standard foamed-insulation-core metal roof panels.
1. Basis of Design: NUCOR High Rib HR3 Standing Seam insulated Panel
 2. AWI "HR3" Insulated Panel: A through-fastened roof sandwich panel with 1 ¼ inch (32mm) ribs at 12 inches (305mm) on center. The area between the ribs is reinforced to prevent oil canning. Tested in accordance with ASTM E 283 and E 331 for water penetration and air infiltration.
 - a. Exterior panel gauge: 26 (Std).
 - b. Interior panel gauge: 26 (Std).
 - c. Size/ Thermal Value: 40 inches (1016mm) wide by 4 inches (102mm) high (R-33)
1. Color: To be chosen by Architect from Manufacturer's Full Selection.

3. Standard Finish:
 - a. Exterior: Smooth with Mesa profile
 - b. Interior: Light Embossed with Mesa profile
- 4.
- I. Exterior Wall System: Manufacturer's standard foamed-insulation-core metal wall panels.
2. Basis of Design: NUCOR Double Mesa Profile (DM40)
3. AWI "DM40" Insulated Panel: A through-fastened wall sandwich panel with concealed fasteners.
 - a. Exterior panel gauge: 26 (Std.)
 - b. Interior panel gauge: 26 (Std.)
 - c. Size / Thermal Value: 40 inches (1016mm) wide by 3 inches (76mm) high (R-24)
4. Color: To be chosen by Architect from Manufacturer's Full Selection.
5. Standard Finish:
 - a. Exterior: Light Embossed with Mesa profile
 - b. Interior: Light Embossed with Mesa profile

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a licensed professional engineer licensed in the State of Maryland to design metal building system.
- B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated in accordance with procedures in MBMA's "Metal Building Systems Manual."
 1. Design Loads: As indicated on Drawings and in accordance with IBC 2018.
 2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 3. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
 - c. Metal Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of 1/100 of the building height.

- C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 and IBC 2018.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E1592:
 - 1. Wind Loads: As indicated on Drawings.
- F. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested in accordance with ASTM E1680 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 4.0 lbf/sq. ft..
- G. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested in accordance with ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 4.0 lbf/sq. ft. .
- H. Water Penetration for Metal Roof Panels: No water penetration when tested in accordance with ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 8.0 lbf/sq. ft..
- I. Water Penetration for Metal Wall Panels: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 8.0 lbf/sq. ft. .
- J. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- K. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Approval's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.
 - 1. Fire/Windstorm Classification: Class 1A-90.

2. Hail Resistance: SH.

2.4 STRUCTURAL-STEEL FRAMING

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
 - a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.
 2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
 3. Frame Configuration: Single gable.
 4. Exterior Column: Tapered.
 5. Rafter: Tapered.
- E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- (64-mm-) wide flanges.

- a. Depth: As needed to comply with system performance requirements.
 2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- (64-mm-) wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch (76-by-51-mm), fabricated from zinc-coated (galvanized) steel sheet.
 7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
 9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.
- G. Bracing: Provide adjustable wind bracing using any method as follows:
1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50 (345); or ASTM A529/A529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
 2. Cable: ASTM A475, minimum 1/4-inch- (6-mm-) diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 5. Fixed-Base Columns: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
 6. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels.
- H. Anchor Rods: Headed anchor rods as indicated in Anchor Rod Plan for attachment of metal building to foundation.
- I. Materials:
1. Primary Framing Steel:

- a. Steel for hot rolled shapes must conform to the requirements of ASTM Specifications A-36, A-572 or A-992, with minimum yield of 36 or 50 ksi, respectively.
 - b. Steel for built-up sections must conform to the requirements of ASTM A-1011, A-1018, A-529, A-572 or A-36 as applicable, with minimum yield of 42, 46, 50, or 55 ksi as indicated by the design requirements.
 - c. Round Tube must conform to the requirements of ASTM A-500 Grade B with minimum yield strength of 42 ksi.
 - d. Square and Rectangular Tube must conform to the requirements of ASTM A-500 Grade B with a minimum yield strength of 46 ksi.
 - e. Steel for Cold-Formed Endwall "C" sections must conform to the requirements of ASTM A-1011 or A-1039 Grade 55, or ASTM A-653 Grade 55 with minimum yield strength of 55 ksi.
 - f. X-bracing will conform to ASTM A-36 or ASTM A-529 for rod and angle bracing or ASTM A-475 for cable bracing.
2. Secondary Framing Steel:
- a. Steel used to form purlins, girts and eave struts must meet the requirements of ASTM A-1011 or ASTM A-1039 Grade 55 for primed material or ASTM A-653 Grade 55 for galvanized material with a minimum yield of 55 ksi.
 - b. Design Thicknesses – Gauge to be determined by design to meet specified loading conditions.
3. Panels:
- a. Roll-formed Galvalume®, pre-painted Galvalume® or Galvanized G90 Exterior-Side and G60 Interior-Side.
 - b. Standing Seam Panels must have: 50 percent minimum aluminum-zinc alloy-coating and conform to ASTM A-792 or ASTM A-653 with a minimum yield of 50 ksi.
 - c. Through-fastened panels must have: 50 percent minimum aluminum-zinc alloy coating and conform to ASTM A-792 or ASTM A-653 with a minimum yield of 50 ksi.
4. Panel Finish:
- a. PVDF Finish: 70% PVDF paint system with a 30-year finish warranty.
5. Panel Fasteners:
- a. For Galvalume® and Painted finished roof panels: Long Life Cast Zinc head.
 - b. For wall panels: Coated carbon steel.
 - c. Color of exposed fastener heads to match the wall and roof panel finish.
 - d. Concealed Fasteners: Self-drilling type, of size required.
6. Flashing and Trim: Match material, finish, and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and a finished appearance.
7. Roof Clips:

- a. All clips must have factory-applied mastic and designed so that movement between the panel and the clip does not occur.
 - b. Short or Tall Fixed clips; shall be either 3 ½ inches (89mm) or 4 ½ inches (114mm) in height. Used for applications where only a moderate amount of thermal expansion and contraction in the roof panel is expected.
 - c. Short or Tall Sliding clips: shall be either 3 ½ inches (89mm) or 4 ½ inches (114mm) in height and provide either 1-7/8 inches from neutral position or 3 3/4 total inches of travel for panel thermal expansion and contraction, depending on clip choice.
 - d. Super Tall Sliding clips: shall be 5 ½ inches (140mm) in height and provide either 1-7/8 inches from neutral position or 3 3/4 total inches of travel for panel thermal expansion and contraction.
8. Sealant And Closures:
- a. Sidelaps: Factory applied non-skinning Butyl mastic.
 - b. Endlaps, Eave, Ridge Assembly, and Gable Flashings: Field applied 100% solids butyl-based elastomeric tape sealant, furnished in pre-cut lengths.
 - c. Outside Closures: Closed-cell, plastic or metal
 - d. Inside Closures: Closed-cell, plastic or metal
- J. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.
- 1. Clean and prepare in accordance with SSPC-SP2.
 - 2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil (0.025 mm).
 - a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.

2.5 METAL SOFFIT PANELS

- A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
- B. Metal Soffit Panels: Match profile and material of metal wall panels.
 - 1. Finish: Match finish and color of metal wall panels.

2.6 PERSONNEL DOORS AND FRAMES

- A. Swinging Personnel Doors and Frames shall be as specified in Section 08225 – Fiberglass Doors and Frames.
- B. Roll-Up Doors shall be as specified in Section 08330 – Roll-Up Doors

- C. Door hardware shall be as specified in Section 08710 – Finish Hardware.

2.7 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 - 2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
 - 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from [steel] sheet.
 - 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 - 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.
- C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.
 - 1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

- D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- E. Gutters: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match roof fascia and rake trim. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch- (2438-mm-) long sections, sized in accordance with SMACNA's "Architectural Sheet Metal Manual."
1. Gutter Supports: Fabricated from same material and finish as gutters.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- F. Downspouts: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10 foot- (3-m-) long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters.
- G. Roof Ventilators: Gravity type, complete with hardware, flashing, closures, and fittings.
1. Continuous or Sectional-Ridge Type: Factory-engineered and -fabricated, continuous unit; Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match metal roof panels. Fabricated in minimum 10-foot- (3-m-) long sections. Provide throat size and total length indicated, complete with side baffles, ventilator assembly, end caps, splice plates, and reinforcing diaphragms.
 - a. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire; or aluminum, 1/2-inch- (13-mm-) square mesh, 0.063-inch (1.6-mm) wire.
 - b. Dampers: Manually operated, spring-loaded, vertically rising type; chain and worm gear operator; with pull chain of length required to reach within 36 inches (914 mm) of floor.
 - c. Throat Size: as standard with manufacturer, and as required to comply with ventilation requirements.
- H. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

I. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
 - a. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
 - b. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless steel or self-tapping, Type 304 stainless steel or zinc-alloy-steel hex washer head, with EPDM sealing washers bearing on weather side of metal panels.
 - c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - d. Blind Fasteners: High-strength aluminum or stainless steel rivets.
2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:
 - a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.8 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
1. Make shop connections by welding or by using high-strength bolts.
 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 5. Shop Priming: Prepare surfaces for shop priming in accordance with SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming in accordance with SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.9 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.
1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed in accordance with Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 - 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted in accordance with manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system in accordance with manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, in accordance with AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.

3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.
- H. Steel Joists: Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction in accordance with SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
1. Before installation, splice joists delivered to Project site in more than one piece.
 2. Space, adjust, and align joists accurately in location before permanently fastening.
 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
 5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
 6. Joist Installation: Weld joist seats to supporting steel framework.

7. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 1. Tighten rod and cable bracing to avoid sag.
 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate in accordance with equipment manufacturer's written instructions and to comply with details shown.
- C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 2. Install metal panels perpendicular to structural supports unless otherwise indicated.

3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Locate metal panel splices over structural supports with end laps in alignment.
 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.
1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
- F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
1. Install ridge caps as metal roof panel work proceeds.
 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
1. Install clips to supports with self-drilling or self-tapping fasteners.
 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 6. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge caps.
- C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 ft. (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Insulated Metal Wall Panels: Install insulated metal wall panels on exterior side of girts. Attach panels to supports at each panel joint using concealed clip and fasteners at maximum 42 inches (1067 mm) o.c., spaced not more than manufacturer's written instruction. Fully engage tongue and groove of adjacent insulated metal wall panels.
1. Install clips to supports with self-tapping fasteners.

2. Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels as weather seal.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 ft. (6 mm in 6 m), noncumulative; level, plumb, and on location lines; and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 METAL SOFFIT PANEL INSTALLATION

- A. Provide metal soffit panels the full width of soffits. Install panels perpendicular to support framing.
- B. Flash and seal metal soffit panels with weather closures where panels meet walls and at perimeter of all openings.

3.8 DOOR AND FRAME INSTALLATION

- A. General: Install doors and frames plumb, rigid, properly aligned, and securely fastened in place in accordance with manufacturers' written instructions. Coordinate installation with wall flashings and other components. Seal perimeter of each door frame with elastomeric sealant used for metal wall panels.
- B. Personnel Doors and Frames: Install doors and frames in accordance with NAAMM-HMMA 840. Fit non-fire-rated doors accurately in their respective frames, with the following clearances:
 1. Between Doors and Frames at Jambs and Head: 1/8 inch (3 mm).
 2. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
 3. At Door Sills with Threshold: 3/8 inch (9.5 mm).
 4. At Door Sills without Threshold: 3/4 inch (19.1 mm).
 5. At fire-rated openings, install frames in accordance with, and doors with clearances specified in, NFPA 80.
- C. Door Hardware:
 1. Install surface-mounted items after finishes have been completed at heights indicated in DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 2. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 3. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
 4. Set thresholds for exterior doors in full bed of sealant complying with requirements for concealed mastics specified in Section 079200 "Joint Sealants."

3.9 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1524 mm) o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
 2. Tie downspouts to underground drainage system indicated.
- E. Continuous Roof Ventilators: Set ventilators complete with necessary hardware, anchors, dampers, weather guards, rain caps, and equipment supports. Join sections

with splice plates and end-cap skirt assemblies where required to achieve indicated length. Install preformed filler strips at base to seal ventilator to metal roof panels.

- F. Louvers: Locate and place louver units level, plumb, and at indicated alignment with adjacent work.
 - 1. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
 - 2. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.
 - 3. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of corrosion-resistant paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
 - 4. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
- G. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.11 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.12 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

- C. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- F. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.
- G. Louvers: Clean exposed surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
 - 1. Restore louvers damaged during installation and construction period so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - a. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 13341

**SECTION 15060
PIPE AND PIPE FITTINGS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish and install all materials, equipment and appurtenances necessary for the complete and satisfactory installation of all piping systems, including tubing systems, as shown on the drawings and as required for a complete installation as specified herein.
- B. This Section applies to all interior, exterior, buried, and exposed (non-buried) piping and tubing systems. This Section also applies to all chemical-related piping and tubing.
- C. The Contractor shall provide all labor, materials, equipment and services necessary to install the piping systems as specified herein and as shown on the Contract Drawings.

1.02 GENERAL REQUIREMENTS

- A. Sizes shown are nominal diameter, unless indicated otherwise.
- B. Drawings do not show all fittings, offsets, unions, hangers, supports, and other appurtenances. Provide as required and show on shop drawings.
- C. Verify exact dimensions of valves, fittings, and equipment to assure Work will fit together properly and conform to the general arrangement shown on the Drawings.
- D. Determine the following prior to fabricating piping systems:
 - 1. Determine dimensions required to correctly locate pipe.
 - 2. Determine dimensions required to fit pipe to equipment and valves.
 - 3. Proper location and orientation of pipe sleeves and wall castings.
 - 4. Determine dimensions required to avoid obstructions and conflicts with other Work.
- E. Use the actual dimensions of equipment to which connections will be made, and the indicated dimensions on the drawings, as a guide in selecting laying lengths of pipes and fittings.
- F. When connecting to existing piping:

1. Do not reuse existing gaskets, bolts, pipes, or fittings.
 2. Field verify the exact point of connection to the existing pipe.
- G. For small piping systems (<4"), 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.
- H. Piping for plumbing and HVAC systems is specified in other sections of the specifications.
- I. 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.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 – Earthwork
- C. Section 09900 – Painting
- D. Section 11100 – General Process Mechanical Requirements
- E. Section 15080 - Valves and Piping Specialties
- F. Section 15094 – Pipe Supports
- G. Section 15190 - Testing Piping Systems

1.04 QUALITY ASSURANCE

- A. Reference Standards
 1. American Welding Society (AWS).
 - a. AWS 2.4, Standard symbols for welding, brazing and nondestructive examination
 - b. AWS B2.1, Welding Procedure and Performance Qualifications
 - c. AWS D1.1, Structural Welding Code - Steel
 - d. AWS D10-9, Qualification of welding procedures and welders for piping and tubing
 - e. AWS QC1, Standard for AWS Certification of Welding Inspectors
 2. American Society of Mechanical Engineers (ASME).
 - a. Boiler and Pressure Vessel Codes (BPVC)

- b. ASME B31.3, Chemical Plant and Petroleum Refinery Piping
 - c. ASME B31.2, Fuel Gas Piping
 - d. ASME B31.8, Gas Transmission and Distribution Piping Systems
3. American National Standards Institute (ANSI).
- a. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800
 - b. ANSI B16.3, Malleable Iron Threaded Fittings Class 150 and 300
 - c. ANSI B16.5, Pipe Flanges and Flanged Fittings
 - d. ANSI B16.9, Factory-Made Wrought Steel Buttwelding Fittings
 - e. ANSI B31, Code for Pressure Piping
 - f. ANSI B31.2, Fuel Gas Piping
 - g. ANSI B31.3, Chemical Plant and Petroleum Refinery Piping
 - h. ANSI B31.8, Gas Transmission and Distribution Piping Systems
4. American Water Works Association (AWWA).
- a. AWWA C104, Cement-mortar lining for ductile-iron pipe and fittings for water
 - b. AWWA C110, Ductile-iron and gray-iron fittings, 3 in. Through 38 in. For water and other liquids
 - c. AWWA C111, Rubber-gasket joints for ductile-iron pressure pipe and fittings
 - d. AWWA C115, Flanged ductile-iron pipe with threaded flanges
 - e. AWWA C150, Thickness design of Ductile-iron pipe
 - f. AWWA C151, Ductile-iron pipe, centrifugally cast, for water and other liquids
 - g. AWWA C606, Grooved and shouldered joints
5. Steel Structures Painting Council (SSPC)
- a. SSPC-SP-1, Solvent Cleaning
 - b. SSPC-SP-3, Power Tool Cleaning
6. American Society for Testing and Materials (ASTM)
- a. ASTM A 48, Specification for Iron Castings
 - b. ASTM A 53, Specification for Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - c. ASTM A 74, Specification for Cast Iron Soil Pipe and Fittings
 - d. ASTM A 105, Specification for Carbon Steel Forging for Pipe Components
 - e. ASTM A 106, Specification for Seamless Carbon Steel Pipe for High-Temperature Service
 - f. ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
 - g. ASTM A 182, Specification for Forged Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
 - h. ASTM A 183, Specification for Carbon Steel Track Bolts and Nuts
 - i. ASTM A 193, Specification for Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service

- j. ASTM A 194, Specification for Alloy Steel Nuts for Bolts for High Pressure and High-Temperature Service
 - k. ASTM A 197, Specification for Cupola Malleable Iron
 - l. ASTM A 234, Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
 - m. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
 - o. ASTM A 536, Specification for Ductile Iron Castings
 - p. ASTM A 563, Specification for Carbon and Alloy Steel Nuts
 - q. ASTM B 32, Specification for Solder Metal
 - r. ASTM D 1784, Specification for Rigid PVC Compounds and CPVC Components
 - s. ASTM D 1785, Specification for PVC Plastic Pipe, Schedules 40, 80, and 120
 - t. ASTM D 2997, Specification for Centrifuagally Cast "Fiberglass" Pipe
 - u. ASTM D 3517, Specification for "Fiberglass" Pressure Pipe
 - v. ASTM D 3567, Practice for Determining Dimensions of "Fiberglass" Pipe and Fittings
 - w. ASTM F 437, Specification for Threaded CPVC Plastic Pipe Fittings, Schedule 80
 - x. ASTM F 439, Specification for Socket Type CPVC Plastic Pipe Fittings, Schedule 80
 - y. ASTM F 441, Specification for CPVC Plastic Pipe, Schedules 40 and 80
 - z. ASTM F 493, Specification for Solvent Cements for CPVC Plastic Pipe and Fittings
 - aa. ASTM A403, Specification for Wrought Austenitic Stainless Steel Piping Fittings.
- B. Install piping to meet the requirements of state and local building codes and in accordance with PFM of TW, Va.
- C. Materials contaminated with gasoline, lubricating oil, liquid or gaseous fuels, aromatic compounds, paint solvent, paint thinner, or acid solder will be rejected.
- D. All contractor personnel that will prepare solvent cemented joints for PVC shall be qualified for such bonding practices according to the bonding qualification procedure described in ASME B 31.3, Chapter VII for bonding of plastic piping.

1.05 SUBMITTALS

- A. The following items shall be submitted with the Shop drawings in accordance with, or in addition to, the submittal requirements specified in Section 01300 - Submittals.
- 1. Manufacturer's product data, specifications, and installation instructions.

2. Detailed shop drawings for system material and equipment. Show complete information concerning fabrication, installation, anchoring, fasteners and other details.
 3. Fabrication drawings for shop fabricated piping.
 4. Layout drawings for each piping system, indicating the following as a minimum:
 - a. Piping material, class, grade and joint type.
 - b. Anchors, supports, hangers, saddles, straps, and other accessories.
 - c. Fittings, couplings, joints, and joint harnesses.
 - d. Centerline elevations.
 - e. Location, size, and type of anchor bolts.
 - f. Wall and floor penetrations, including sleeves, castings, sealant, escutcheons, and other accessories.
 - g. Bill of materials.
 - h. Orientation of valves and valve operators.
 - i. Critical clearances.
 - j. Thrust restraints - Details to include materials, sizes, assembly ratings, and pipe attachment methods.
 - k. Expansion compensation.
 - l. Insulation.
 - m. Pipe coatings.
 - n. Pipe identification.
 - o. Valve tags and tag numbers.
 - p. Miscellaneous details required for complete installation and understanding.
 5. Thrust restraint system details, as applicable.
 6. For all chemical flexible tubing and tubing fittings, submit documentation from the manufacturer, either by general brochure/literature or by special letter, explicitly stating that the flexible tubing and tubing fittings are suitable for the particular chemical and chemical concentration for which it is installed, and that the fitting type used is compatible with the tubing.
 7. Approval of the shop drawings will not relieve the Contractor of any responsibility for accuracy of dimensions and detail.
- B. Submit manufacturer's instructions for installation of adapters and assembly of mechanical and push-on joints, including the manufacturer's maximum recommended deflection per joint.
- C. Quality Control Submittals:
2. Piping system test reports, including the following:
 - a. Pipe pressure tests.
 - b. Valve tests.
 - c. Dielectric joint tests.

- 5. Certificates:
 - a. Manufacturer's certification of compliance for each pipe material.

D. Contract Close-out Submittals:

- 1. Project Record Documents.
- 2. Operating and Maintenance Manuals, including warranty information.

1.06 PRODUCT DELIVERY HANDLING AND STORAGE

- A. During loading, transporting, unloading, and storage on site, exercise care to prevent damage to piping materials.
- B. Do not drop pipe or fittings.
- C. Store materials on site in enclosures or under protective coverings.
- D. Assure that materials are kept clean and dry; do not store materials directly on the ground.

1.07 REGULATORY REQUIREMENTS

- A. Materials and coatings used in the construction of any pipe or pipe fitting in contact with process water, chemicals, or potable water shall be NSF 61 Certified and approved for use in potable water installations.

PART 2 - PRODUCTS

2.02 GENERAL NOTES – FITTINGS

- A. All fittings shall be of the type indicated on the drawings unless otherwise specified. Ductile iron piping shall be provided with ductile iron fittings; carbon steel piping shall be provided with carbon steel fittings; C/PVC pipe shall be provided with C/PVC fittings, copper tubing shall be provided with bronze, wrought copper or brass fittings.
- B. Nipples shall be extra heavy of same material as piping system in which they are installed. Close nipples are not acceptable.
- D. Except for near connections between chemical tubing and rigid piping, wherever the sizes of pipes are reduced, the fittings shall be "reducers" made to suit these changes without the use of bushings.
- E. All flanges shall come fairly face to face, the pipe in perfect line, the pipes shall not be sprung to make a joint. Gaskets for flanged joints shall be as specified under "Joints". All joints shall be neatly made and with great care.

- 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.
- H. Screwed type systems shall contain ample unions in piping at equipment to allow easy removal of the equipment.

2.03 DUCTILE IRON PIPE AND FITTINGS

A. General

1. All ductile iron pipe shall be manufactured per AWWA C150.
2. All ductile iron joints shall adhere to AWWA C111.
3. Pipe and fittings shall be cement-mortar lined inside per AWWA C104, with curing to be effected by an application of a bituminous seal coating which shall cover and seal the cement mortar. The thickness of the cement lining shall be “Double Thickness”, which is double the standard thickness.
4. Ductile iron pressure pipe shall be made of ductile iron of good quality and of such character as shall make the metal casings strong, tough and of even grain and soft enough to satisfactorily permit drilling, tapping and cutting. All piping shall be smooth, free from 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. All piping shall be subject to inspection and approval by the Engineer upon delivery, and no broken, cracked, misshaped or otherwise damaged or unsatisfactory piping will be accepted.
5. Each piece of pressure 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.
6. 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. Taped reinforced bosses shall be provided as an integral part of fittings, when shown or specified.

B. Buried Pipe

1. All pipe shall be manufactured and supplied in accordance with AWWA C151.
2. All pipe sizes shall be Class 54 greater.

3. Pipe and fittings shall be asphaltic coated.
4. Fittings
 - a. All ductile iron fittings and specials shall be manufactured in accordance with AWWA C110 generally, or AWWA C153 for compact fittings.
 - b. The pressure rating for ductile iron fittings shall be the same as that for the main pipe.
5. Joints
 - a. Buried joints shall be restrained, mechanical joint type. Using Megalugs or similar restraint as approved by the Engineer.
 - d. All buried nuts, bolts, and other associated hardware shall be 316 SS or steel coated in fluoropolymer, FluoroKote#1 by Metal Coatings Corp., or approved equal.

B. Exposed Pipe

1. Unless otherwise stated on the Drawings, all pipe shall be manufactured and supplied in accordance with AWWA C115.
2. All ductile iron pipe shall be Class 54 or greater.
3. Pipe and fittings shall not be asphaltic coated. Pipe and fittings shall be supplied with the manufacturer's shop prime coat of paint which shall be compatible with the final field coat of paint. Pipe and fittings shall receive final field painting per Section 09900 - Painting.
4. Fittings
 - a. All ductile iron fittings and specials shall be manufactured in accordance with AWWA C110 generally.
5. Joints
 - a. All joints shall be flanged. Flanges may be cast integrally with the ductile iron pipe or screwed on type. Pipe compound of the manufacturer's recommendation shall be used at each threaded joint on flanges.
 - b. Interior flanged joints shall have hot dipped galvanized carbon steel nuts, bolts, and other associated hardware.
 - c. Exterior flanged joints shall use nuts, bolts, and other associated hardware which is either 316 stainless steel or carbon steel coated in fluoropolymer, FluoroKote#1 by Metal Coatings Corp., or approved equal.

2.07 BLACK AND GALVANIZED STEEL PIPE (GENERAL USE)

- A. Pipe: ASTM A53, Seamless. Schedule 40, unless otherwise indicated on the contract drawings.
- B. Fittings
 - 1. Threaded: Malleable Iron, ANSI B16.3, 150# Class
 - 2. Flanged: Cast Iron, ANSI B16.1, 125# Class
 - 3. Socket Welded: Forged Steel, ANSI B16.11.
- C. Unions: Threaded, Forged Carbon Steel, MSS SP-83.

2.08 COPPER PIPE

- A. Pipe: ASTM B42, Seamless, Regular Weight, Temper H80
 - 1. H80 - Hard Drawn, 1/8" - 2" dia.
- B. Tubing: ASTM B88, Seamless, Temper H, Type K
- C. Fittings
 - 1. Wrought Copper and Bronze, Solder Joint: ANSI B16.22
 - 2. Cast Bronze, Solder Joint, Pressure: ANSI B16.18
 - 3. Cast Bronze, Threaded: ANSI B16.15, 125# Class
 - 4. Bronze Flanges/Flange Fittings ANSI B16.24, 150# Class
 - 5. Cast Bronze, for Flared Copper Tube: ANSI B16.26
- D. Brazing Filler Material: AWS 5.8.
- E. Brazing Flux: Federal Specification O-F-499, Type B.
- F. Soldering Flux: Federal Specification O-F-506, Type I.
- G. Joints in copper tubing or pipe shall be made using 95-5 tin-antimony solder conforming to ASTM B32.

2.09 POLYVINYL CHLORIDE (PVC) PROCESS PIPE (12" NOMINAL PIPE SIZE AND SMALLER)

- A. Material shall be ASTM D2241, PVC 1120 (12454-B) or PVC 1220 (12454-C) or PVC 2120 (14333-D).

- B. PVC pipe and fittings shall be manufactured from virgin rigid PVC vinyl compounds and shall be Type 1 Grade 1 conforming to ASTM D 1784 and D 1785. Fittings shall conform to the following standard specifications:
 - Socket Type (Schedule 40); ASTM D 2466
 - Socket Type (Schedule 80); ASTM D 2467
 - Threaded Type (Schedule 80); ASTM D 2464
- C. Fittings shall generally be socket cement weld type, but may be flanged or threaded type only as needed to connect to valves, adapters, equipment, and appurtenances.
- D. Flanged fittings shall be of the same material as the specified pipe and material conforming to ANSI B16.5. Gasket materials shall be suitable for the chemical application.
- E. Non-chemical Applications: solvent cement for socket type joints shall conform to ASTM D 2564 for PVC pipe and fittings.
- F. Chemical Service joints require special materials. All socket type, solvent cement joints for all chemical service piping and fittings shall utilize primer and cement which is specially formulated for chemical resistance and which is suitable for bleach (sodium hypochlorite) application, even if the particular application is not bleach. Only cements and primers which have documented performance testing with bleach, caustic soda, and strong acids from an independent third party laboratory testing at at least 100 psi for 2,500 hours shall be considered for approval. Use IPS Weld-On CPVC 724 cement and IPS Weld-On P-70 primer for all chemical applications, pressurized and non-pressurized, or approved equal.

2.10 CHLORINATED POLYVINYL CHLORIDE (CPVC) PROCESS PIPE (12" NOMINAL PIPE SIZE AND SMALLER)

- A. CPVC shall be manufactured in accordance with ASTM D 1785, D 1784 and F 441, "normal impact" pipe, Schedule 40 or 80 as specified.
- B. Fittings used with this pipe shall be socket type or flanged type as specified herein or indicated on the Drawings.
- C. CPVC pipe shall be Type 4, Grade 1, Schedule 80, conforming to ASTM D 1784 and ASTM F 441. CPVC fittings shall be socket type conforming to ASTM F 439.
- D. Solvent cement for socket type joints shall conform to ASTM F 493 for CPVC pipe and fittings.

2.11 POLYVINYL CHLORIDE (PVC) PROCESS PIPE (LARGER THAN 12" NOMINAL PIPE SIZE)

- A. Gravity Sewer Pipe and Fittings
 - 1. Pipe 15" Diameter and Smaller: ASTM D3034, SDR-35.

- | | | |
|----|-----------------------------|-------------------|
| 2. | Pipe 18" to 27" Diameter: | ASTM F679, SDR-35 |
| 3. | Flexible Elastomeric Seals: | ASTM D3212 |
| 4. | Seal Material: | ASTM F477 |

2.12 PVC DOUBLE WALL CONTAINMENT PIPING SYSTEM

- A. The PVC double wall piping system shall be a pre-fabricated containment piping system as manufactured by (Guardian Systems, MI) Division of IPEX Industrial, or approved equal. The system shall be designed, fabricated, installed and tested in accordance with manufacturer's recommendations and as specified herein and shall be suitable for the intended chemical service. Manufacturer shall have a minimum of five (5) years experience in manufacturing double containment piping systems. Contractor shall not design and or fabricate the piping system.
- B. Each contained piping system shall consist of gray Schedule 80 PVC primary piping system supported within a gray Schedule 80 PVC secondary containment piping system. PVC materials shall meet requirements of the above subsection on general PVC pipe and fittings. Carrier fitting sizes ½" through 4" will utilize Centra-Lok molded supports minimizing the number of (factory assembled) carrier fitting joints. Each system shall be provided with suitable drains and vents and be designed to provide complete drainage of the secondary containment piping. Interstitial supporting devices shall be made from Polypropylene Centra-Guide supports and shall be provided within the secondary containment pipe. Supports shall be designed to allow continuous drainage in the annular space to the drain points.
- C. All joints shall be solvent welded cement type. All solvent cement and primer for primary and secondary piping shall be specially designed for chemical applications and be that which is described in the above subsection on general PVC joints for chemicals (IPS Weld-On or approved equal).

2.13 PVC TUBING AND FITTINGS

- A. PVC tubing shall be clear braided reinforced and flexible, with an inner and outer wall. Nylon reinforcing braid shall be completely bonded within the inner and outer wall to eliminate ballooning, bursting and separating of the tubing. Inner and outer wall surfaces shall be smooth and free from abrasions to reduce material buildup.
- B. All tubing and fittings shall have a working pressure of at least 100 psi.
- C. Fittings shall be rigid PVC, barbed insert type. Secure joints with stainless steel clamps, two on each barbed insert, rotated 180° apart.
- D. See submittal section above for requirements of verifying chemical suitability for tubing and fittings.

2.17 POLYETHYLENE (PE) TUBING AND FITTINGS

- A. PE tubing shall be flexible and suitable for the chemical application.
- B. All tubing and fittings shall have a working pressure of at least 100 psi.
- C. See submittal section above for requirements of verifying chemical suitability for tubing and fittings, and for verifying compatibility of fittings type and tubing type.

2.18 CAST IRON SOIL PIPE

- A. Pipe and Fittings: ASTM A74, Service Class. Hub and Spigot or Double-Hub.
- B. Joints: Double-Seal Compression Gaskets
 - 1. Gaskets: ASTM C564

2.20 JOINTS

- A. General
 - 1. 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 matching straight runs of pipe for tees or elbows will not be permitted.
 - 2. Soldered or brazed joints shall be made with solder and a noncorrosive paste flux. The solder mixture shall 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.
 - 3. Threads shall be standard, clean-cut and tapered. All pipe shall be teamed free from burrs and kept free from scale and dirt. Unless otherwise specified, non-chemical application 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.
 - 4. 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.

6. Flanges shall be of the same material as the piping on which installed. Heads, nuts and threads shall be U.S. Standard sizes. Bolts shall be of such length as to project $\frac{1}{4}$ inch beyond the nut when the flanged joint with gasket is assembled. Unless otherwise specified in the individual sections, all metallic hardware shall be as follows:
 - a. Flanged Interior Pipe, general non-chemical: Hot Dipped Galvanized Carbon Steel
 - b. Flanged Exterior Pipe, general non-chemical: 316 Stainless Steel.
 - c. Alum, caustic soda, and sodium hypochlorite: Polyethylene-coated Titanium.
 - d. Fluoride and Polyphosphate: Polyethylene-coated Hastelloy C.
7. For chemical applications, joint gaskets shall be:
 - a. Alum and Caustic Soda: EPDM.
 - b. Sodium Hypochlorite, Fluoride, and Polyphosphate: Viton.

B. Flexible Couplings

1. Unless specified or shown otherwise on the drawings, flexible couplings shall be the Style 38 of the M&H Manufacturing Division, No. 411 or 441 of Rockwell International, or equal. Each shall be so 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.
2. Harnesses shall be provided across all flexible couplings and all flanged adapters.

C. Flange Coupling Adapters

1. Flanged coupling adapters shall be furnished as required and as shown on the Drawings for joining plain-end pipe to flanged valves, fittings and pumps. They shall be flanged on one end and have gasketed coupling on the other end.
3. Pressure rating shall be the same as the rating on the connected piping.
4. Materials shall be ductile iron or steel.

5. Flanged adapters shall be shop primed with a premium quality primer compatible with the field paint system specified in Section 09900 - Painting. Field painting of wetted area shall be done prior to installation.
6. T-head bolts and nuts shall be low alloy steel.
7. Restrained flanged coupling adapters 12" and smaller shall be restrained by heat treated lugs on the gland which grip the pipe. Restrained flanged coupling adapters larger than 12 inches in diameter shall be harnessed by tying the adapter to the nearest pipe joint flange using threaded rods and rod tabs.
8. Flanged adapters shall be as manufactured by Dresser Industries, Style 127 or 128, Smith Blair Corporation, or equal. Restrained Flanged Coupling Adapters shall be as manufactured by Romac Industries, Inc., or approved equal.

E. Sleeve Type Couplings

1. Sleeve type, flexible couplings of the double-ring, steel follower, rubber compounded wedge-gasketed, steel flared middle ring type shall be furnished and installed where shown on the Drawings or otherwise required to resist internal operating pressures. In addition to that specified herein, harnessed, sleeve type flexible couplings shall be provided on all exposed pipe 3 inches and larger in diameter that spans any expansion joint in a building or structure.
2. Materials shall be of high strength steel and couplings shall be rated for the same pressures as the connecting piping.
3. Gaskets shall be rubber. Bolts and nuts shall be alloy steel, corrosion-resistant and prime coated.
4. Couplings shall be shop primed with a premium quality primer compatible with the painting system specified in Section 09900 - Painting. Field painting of wetted area shall be done prior to installation.
5. Harnessing
 - a. Harness couplings to adjacent flanges as shown, specified or otherwise required to restrain all pressure piping.
 - b. Dimensions, sizes, spacing and materials for lugs, tie rods, washers, and nuts shall conform to the standards for the pipe size, and design pressure specified.
 - c. No less than two (2) bolts shall be furnished for each coupling.
 - d. Tie bolts, nuts and washers shall be ASTM A 193, Grade B7 steel or better.

- e. Harness rods shall have lengths less than 10 feet between adjacent flanged joints on fittings and shall be coated in accordance with Section 09900 – Painting.
 - 6. Couplings shall be as manufactured by Dresser Industries, Style 38, or equal as required and shown on the Drawings. All couplings shall be provided without interior pipe stop.
- F. Transition Couplings
- 1. To connect pipes of different outside diameters.
 - 2. High-grade steel middle ring with ductile iron follower flanges with rubber compounded wedge section gaskets. Mechanical Joint, ANSI/AWWA C111/A21.11.
- G. Solid Sleeve Couplings
- 1. Solid sleeve couplings shall be used to connect buried service piping where shown on the Drawings. Solid sleeves shall be ductile iron, long body and shall conform to the requirements of ANSI A21.10 (AWWA C110). Unless otherwise shown or specified, solid sleeve couplings shall be Style A11760 as manufactured by American Cast Iron Pipe Co., or equal.
- I. UNIONS
- 1. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.
 - 2. For copper piping, unions shall have ground joints and conform to ANSI B16.18.
 - 3. For PVC and CPVC piping, unions shall be socket weld type.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Install all materials and piping in full accordance with the manufacturer's recommendations for installation. No field bending or distortion of the pipe is permitted.
- B. Buried Pipe:
 - 1. Install ductile iron pipe per AWWA C600.

2. Perform trench excavation to the line and grade indicated on the Contract Drawings and as specified in Section 02201 – Trenching, Backfilling and Compacting.
3. Unless otherwise indicated on the Drawings, provide a minimum cover of 4'-0" above the top of piping laid in trenches.
4. Provide pipe bedding as specified in Section 02201 for each type of pipe used.
5. Provide Type IV bedding for all PVC and other plastic pipe. Place aggregate in a manner to avoid segregation, and compact to the maximum practical density so that the pipe can be laid to the required tolerances.

3.02 LAYING PIPE IN TRENCHES

- A. Give ample notice to the Engineer in advance of pipe laying operations.
- B. Use laser alignment equipment during pipe laying operations.
- C. Lower pipe to trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to the pipe; do not drop pipe.
- D. Lay pipe proceeding upgrade with the bell or groove pointing upstream.
- E. Lay to a uniform line with the barrel of the pipe resting solidly in bedding material throughout its length; excavate recesses in bedding material to accommodate joints, fittings and appurtenances; do not subject pipe to a blow or shock to achieve solid bedding or grade.
- F. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to avoid offsets in the flow line.
- G. Pipe Joining
 1. Clean and inspect each pipe and fitting before joining; assemble to provide tight, flexible joints that permit movement caused by expansion, contraction and ground movement.
 2. Use lubricant recommended by the pipe or fitting manufacturer for making joints.
 3. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, reclean joint components, and reassemble joint.
- H. Assemble mechanical joints in accordance with ANSI/AWWA C111/A21.11, Appendix A; if satisfactory seating of the joint is not obtained at maximum torque, disassemble the joint, reclean, and reassemble using a new gasket.

- I. Check each pipe installed as to line and grade in place; correct deviation from grade immediately; deviation from the designed grade and alignment as indicated on the Contract Drawings will be cause for rejection.
- J. Do not deflect joints in pressure piping more than the maximum recommended by the pipe manufacturer.
- K. Place sufficient backfill on each section of pipe, as it is laid, to hold pipe firmly in place.
- L. Clean the interior of the pipe as the work progresses; where cleaning after laying is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull forward past each joint immediately after joining has been completed.
- M. Keep trenches and excavations free of water during construction.
- N. When the work is not in progress, and at the end of each workday, securely plug ends of pipe and fittings to prevent trench water, earth or other substances from entering the pipe or fittings.

3.03 CRADLES AND ENCASEMENT

- A. Provide concrete cradle and encasement for pipeline where indicated on the Contract Drawings; construct in accordance with Standard Detail.

3.04 BACKFILLING TRENCHES

- A. Backfill pipeline trenches only after examination of pipe laying by the Engineer.
- B. Backfill trenches as specified in Section 02221, Trenching, Backfilling and Compacting.
- C. Install detectable utility marking tape above all plastic pressure pipeline, 12" to 18" below final grade.

3.05 INTERIOR PROCESS PIPING INSTALLATION

- A. Pipe Layout in Building
 - 1. Coordinate work to prevent interference between architectural, structural, electrical and mechanical features; the Contract Drawings are generally diagrammatic due to their small scale.
 - 2. Provide such offsets, fittings and other items as may be required to suit conditions.
 - 3. Do not place joints or fittings over switchboards, panels, motors or other electrical equipment.

4. The completed installation shall present a neat, orderly appearance; do not block openings or passageways; run piping parallel to the walls of buildings or structures.
6. Orient handwheels, levers, valve operators and other valve actuators for convenience of operation; set gate valves with the stem above the horizontal.
7. Cut pipe to measurements established at the site and install without springing or forcing; make changes in direction with fittings.

B. Equipment Connections

1. Make connections to pumps and other equipment in a manner to eliminate strains on piping and equipment.
2. Install unions or flanges adjacent to equipment and wherever their use will facilitate removal of equipment.

D. Sleeves

1. Unless shown otherwise, all piping passing through walls and floors shall be installed in sleeves or wall castings accurately located before concrete is poured, or placed in position during construction of masonry walls. Sleeves passing through floors shall extend from the bottom of the floor to a point 3 inches above the finished floor, unless shown otherwise. Water stop flanges are required on all sleeves located in floors or walls which are continually wet or under hydrostatic pressure on one or both sides of the floor or wall.
2. Sleeves shall be cast iron, black steel pipe, or fabricated steel in accordance with details shown on the Drawings. If not shown on the Drawings, the Contractor shall submit to the Engineer the details of sleeves he proposes to install; and no fabrication or installation thereof shall take place until the Engineer's approval is obtained. Steel sleeves shall be fabricated of structural steel plate in accordance with the standards and procedures of AISC and AWS. Steel sleeve surfaces shall receive a commercial sandblast cleaning and then be shop painted in accordance with Section 09900 – Painting.
3. When shown on the Drawings or otherwise required, the annular space between the installed piping and sleeve shall be completely sealed against a maximum hydrostatic pressure of 20 psig. Seals shall be mechanically interlocked, solid rubber links, trade name "Link-Seal", as manufactured by the Thunderline Corp., Wayne, Michigan, or equal. Rubber link, seal-type, size, and installation thereof, shall be in strict accordance with the manufacturer's recommendations. For non-fire rated walls and floors, pressure plate shall be glass reinforced nylon plastic with EPDM rubber seal and 304 stainless steel bolts and nuts. For fire rated walls and floors, two independent seals shall be provided consisting of

low carbon steel, zinc galvanized pressure plates, silicon rubber seals and low carbon steel, zinc galvanized bolts and nuts.

E. Flanged Joints

1. Tighten flange bolts so that the gasket is uniformly compressed and sealed; do not distort flanges; do not exceed manufacturer's recommended maximum torque.
2. Leave flange bolts with ends projected 1/8" to 1/4" beyond the face of the nut after tightening.

G. Threaded Joints: ANSI B2.1, NPT

1. Cut threads full and clean with sharp dies; ream ends of pipe after threading and before assembly to remove burrs; leave not more than three pipe threads exposed at each connection; for non-chemical application, use joint compound or thread tape on the male thread only.

H. Solder Joints

1. Ream or file pipe to remove burrs; clean and polish contact surfaces of joints.
2. Apply flush to both male and female end; insert end of tube into fittings full depth of socket.
3. Bring joint to soldering temperature, in as short a time as possible, forming continuous solder bead around entire circumference of joint.

- I. Solvent Cemented Joints (PVC): Make joints in pipe and fittings in accordance with the procedures and techniques in ASTM D2855.

3.06 CONNECTION AT DISSIMILAR METALS

- A. Wherever pipes of dissimilar metal 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, or equal. Stainless steel nuts, bolts, and washers shall be used at all places at which such dielectric separators are used.

3.07 PIPE SUPPORTS

- A. Pipe supports and bracing shall be provided as indicated in Section 15094 Pipe Supports.

3.08 TESTING

- A. The following piping systems shall be water pressure tested per AWWA C600 Section 5.2, and at the following test pressures:

Piping System	Test Press. (psi)
Raw Water Piping and Recycle Water Piping	150
All chemical piping and tubing systems which carry liquid chemical. (For tank outlet piping and tubing between the bottom of storage tank and the chemical pump suction, test the chemical line while it is connected to the tank, but close the tank outlet valve. If a piping or tubing system does not have a permanent valve to isolate during the pressure test, utilize a temporary valve or cap to conduct pressure test before making permanent connections). Do not conduct pressure tests while piping/tubing is connected to chemical pump.	100
Raw Water Sample Line	100
Potable Water Service to and inside of Prop. Chemical Building, except piping after a pressure reducing valve	250
Potable Water Service inside Prop. Chem. Bldg. after PRV	150

- B. Cleaning and Testing for Double Wall PVC pipe
1. Upon completion of the installation, the primary piping system shall be pressure tested per the above general requirements. Additionally, the system shall be tested during the installation at intervals to be determined by the manufacturer. All tests shall be done in strict accordance with the recommendations of the manufacturer, including the sequence and duration of such tests.
 2. Upon completion of the installation, the secondary containment piping shall be pneumatically tested at a minimum duration of 2-1/2 hours. The external joints should be soaped and visually inspected for leaks. It is imperative that a working pressure regulator be used during the pneumatic test to insure over pressurization of the PVC beyond 10 psi cannot occur. Also, all precautions should be taken to protect against the hazards of a possible brittle fracture of PVC under compressed gas. Both the preliminary and final test shall be done in strict accordance with the recommendations of the manufacturer, including sequence and duration of such test.
 3. Following installation of the systems, the primary piping system shall be flushed clean. The contractor shall check the operation of all valves.

3.09 DISINFECTION

- A. Disinfect all pipes and accessories in contact with filtered or potable water per AWWA C651.

END OF SECTION 15060

**SECTION 15080
VALVES AND PIPING SPECIALTIES**

PART I – GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to:

Furnish and install all valves, hose connections, hydrants, valve boxes, and other piping specialties as specified, as indicated on the contract drawings, and as necessary to provide complete piping systems as intended that are not expressly specified in other sections of these specifications.
- B. This Section applies to potable water service, nonpotable water service, chemical service, buried installment, exposed (non-buried) installment, interior, and exterior installments.
- C. Related work specified elsewhere:
 - 1. Section 15060 - Pipe and Pipe Fittings
 - 2. Section 11170 - Liquid Chemical Metering Pumps

1.02 QUALITY ASSURANCE

- A. Products shall be new, the latest standard product of reputable manufacturers, and shall have replacement parts available.
- B. Potable water and raw water system materials shall bear the seal of approval of the National Sanitation Foundation (NSF).
- C. Materials contaminated with gasoline, lubricating oil, liquid or gaseous fuels will be rejected.
- D. The manufacturer of each valve shall have a minimum of 5 years of experience in manufacturing the type of valve supplied.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01300.
- B. Shop Drawings and Product Data
 - 1. Submit manufacturer's catalog data, literature, illustrations and specifications.
 - 2. Submit shop drawings of valves and valve operators including dimensions,

net assembled weight of each size valve furnished, construction details, and materials of components.

3. Submit manufacturer's installation instructions.
4. Submit manufacturer's maintenance instructions and complete parts lists.
5. For all chemical valves and pipe specialties, submit documentation from the manufacturer, either by general brochure/literature or by special letter, explicitly stating that the products are suitable for the particular chemical and chemical concentration for which it is installed.

C. Certificates

Submit a Certificate of Compliance, together with supporting data, from the materials supplier(s) attesting that valves, accessories, and specialties meet or exceed specification requirements.

D. Submit post-installation field tests to Engineer.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver valves and accessories to the job site in the manufacturer's boxes or crates. Mark each valve as to size, type and installation location.
- B. Seal valve ends to prevent entry of foreign matter into valve body.
- C. Store valves and accessories in areas protected from weather, moisture and possible damage.
- D. Do not store materials directly on the ground.
- E. Handle valves and accessories to prevent damage to interior and exterior surfaces.

1.05 JOB CONDITIONS

- A. Investigate conditions affecting this work and coordinate with other contractors to prevent interference between architectural, structural, mechanical and electrical features.
- B. The contract drawings for small diameter pipe are generally diagrammatic and it is not possible to indicate all fittings, valves, and other items required for a complete operating system. Provide all such valves, fittings and specialties to complete the systems as intended.
- C. Provide necessary valve wheels, keys, wrenches, levers and stem extensions. Locate to assure accessibility and operability throughout the operating range without interference. Install valve stem supports, guides and operators. Provide valve accessories of the same manufacturer as the valve, unless specified elsewhere.

- D. Provide chain operators for valves 4" size and larger that are located 6'-0" or more above finished floor level.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide valves and piping specialties of the size and type indicated on the contract drawings.
- B. Cast iron valve material shall meet or exceed the requirements of ASTM A126, Class B.
- C. Valve flanges shall conform to ANSI B16.10, (125# and 250# class) as applicable.
- D. Mechanical joint valve ends shall conform to ANSI/AWWA C111/A21.11.
- E. Screwed valve ends shall conform to ANSI B2.1; American Standard Taper pipe threads.
- F. Valves shall be of a design that requires no more than 50 lbs. pull on the handwheel or standard valve wrench to provide positive shutoff against rated working pressure.
- G. All valves and pipe specialties which come in contact with treatment chemicals, potable water, or raw water shall be NSF 61 approved.
- H. For all chemical valves and specialties, at least the following material requirements shall be adhered to for all materials in contact with the chemical. If the manufacturer's chemical resistance guide is more stringent, then the manufacturer's guide shall be followed.

Chemical	Body shall be:	Seats/Seals/Gaskets shall be:	Metal, if any, shall be:
Alum	PVC, CPVC, PP, or PVDF	EPDM or Viton	Titanium if available; if not, then Hastelloy or 316 SS
Caustic Soda	PVC, CPVC, or PP	EPDM or PTFE	Titanium if available; if not, then Hastelloy or 316 SS
Sodium Hypochlorite	PVC, CPVC, or PVDF	PTFE or Viton	Hastelloy C
Fluoride	PVC, PP, or PVDF	Viton or PTFE	Hastelloy C or 316 SS
Polyphosphate	PVC, CPVC, PP, or PVDF	Viton, EPDM, or PTFE	Hastelloy C
Potassium Permanganate	PVC, CPVC, PP, or PVDF	Viton, EPDM, or PTFE	Hastelloy C

Materials shall follow these requirements:

PVC Conforming to ASTM D1784 Cell Classification 12454A
CPVC – Conforming to ASTM D1784 Cell Classification 23567A
PP Conforming to ASTM D4101 Cell Classification PP0210B67272
PVDF Conforming to ASTM D3222 Cell Classification Type II
FKM – Viton® Fluorocarbon Rubber
EPDM – Ethylene Propylene Diene Terpolymer Rubber
PTFE – Teflon® Polytetrafluoroethylene

2.02 GATE VALVES

- A. Flanged, Mechanical Joint, or Push-On Gate Valves
1. Iron body, bronze mounted, solid wedge, tapered seat, non-rising stem, O-ring packing. ANSI/AWWA C509, 250 psi min. working pressure. Open counterclockwise.
 2. Valves shall be provided without bypasses except as noted below.
 3. Gate valves sixteen (16) inches and larger shall be gear operated. Valves fourteen (14) inches and smaller need not be geared.
 4. Valves located higher than six (6) feet above its operating slab shall be chain operated, with the chain extending to within five (5) feet above the slab. Valves located lower than six (6) feet above its operating slab shall be handwheel operated. Extension stems with two inch square operating nuts and steady bearings shall be provided where shown on the drawings. Floor boxes shall be provided where shown on the drawings. All valves shall open with counterclockwise rotation of the handwheel, chainwheel, or extension stem.
 5. All buried gate valves shall have stainless steel exterior bolts.
- B. Threaded and Soldered Gate Valves
1. Threaded or soldered joint.
 2. Bronze body, Class B; non-rising bronze stem, ASTM B584.

2.03 CHECK VALVES

- A. Threaded and Solder Joint Check Valves for Use with Copper or Steel Water Piping, 2" or less:
1. Horizontal swing check type. Bronze body, renewable bronze disc. 200 psi working pressure.
- B. Swing Check Valves for Water Service, 2.5" or greater:
1. Valves shall adhere to AWWA C508.

2. Valve shall be pressure rated to at least 150 psi.
3. Valves shall have resilient-to-metal seating.
4. Valves shall have assisted closing with lever and weight or spring. Valves shall have air-cushioned cylinders attached to levers to dampen closure.

C. Swing Check Valves for Chemical Service

1. Swing check valves shall have an external lever and weight, or spring assist, to aid in closing quickly and tightly.
2. Valves shall be capable of top entry to facilitate cleaning and repair without removal from the line.
3. Valve shall incorporate a single disc design suitable for horizontal or vertical applications.
4. Valve shall be pressure rated to at least 150 psi.
5. Valves shall be as manufactured by ASAHI/AMERICA, Spears Manufacturing Co., or approved equal.

D. Ball Check Valves for Chemical Service

1. Ball check valves shall have a ball which allows flow in one direction, but which seats against a seal to prevent flow in the other direction.
2. Valve shall be suitable for both horizontal and vertical installation.
3. Valve shall at least one integral union.
4. Valves shall be pressure rated to at least 100 psi.
5. Valves shall be as manufactured by ASAHI/AMERICA, Spears Manufacturing Co., or approved equal.

2.04 BALL VALVES

A. Ball Valves for Chemical Service

1. Ball valves shall have two way isolating capability and have elastomeric backing cushions behind the seats for low stem torque. Valve shall allow full port unobstructed flow when open.
2. Valve stems shall feature 2 stem O-rings.
3. Valves shall be operated with a lever. Valves shall have removable handles.
4. Valves shall be pressure rated to at least 150 psi.

5. Electrically actuated ball valves shall:
 - a. Adhere to the ball valve requirements in this section.
 - b. Have a time of closure/opening >5 seconds.
 - c. Mechanical and LED position indication.
 - d. Be Series 17 by Asahi/America or approved equal.
 6. Valves shall be as manufactured by ASAHI/AMERICA, Spears Manufacturing Co., or approved equal.
- B. Metal-Body for Water Service
1. Ball valves shall have two way sealed elastomeric isolating capability and allow full port unobstructed flow when open.
 2. Body to be made of lead-free bronze or lead-free brass.
 3. Valve shall be pressure rated to at least 250 psi.

2.05 DIAPHRAGM VALVES FOR SODIUM HYPOCHLORITE

- A. The valves shall come standard with position indicator, travel stop, and bonnet O-ring sealing arrangement. The valve shall be Weir type, square body/bonnet sealing design, and 1/4 turn bayonet style diaphragm/compressor connection. Valve shall be handwheel operated.
- B. Diaphragms shall be 3-layer style with PTFE wetted diaphragm, PVDF gas barrier, and EPDM Backing cushion. The PVDF Gas Barrier shall be between the EPDM and PTFE layers and prevent against gas migration outside of the valve.
- C. Valve shall be pressure rated to at least 150 psi.
- D. Valve shall be Type 14 by Asahi/America, Inc., or approved equal.

2.06 BUTTERFLY VALVES

- A. Metal Bodied for Water Service
 1. Butterfly valves shall be of the rubber-seated, tight-closing type conforming to the latest revision of AWWA C504.
 2. Butterfly valves shall be Class 150B, unless otherwise indicated on the Drawings, and of the short body design with mechanical joint or flanged ends, as shown on the Drawings.
 3. The exterior of the valve shall be shop coated with primer compatible with final field coat.

4. The interior shall be epoxy coated.
 5. All butterfly valves shall be the product of one manufacturer. Butterfly valves shall be as manufactured by DeZurik, Valmatic, Pratt, or equal.
- B. For Chemical Service
1. Valves shall be wafer type, lever operated.
 2. The valve shall have a liner that has full seat design fully molded around the body where as only the Disc and Seat are wetted parts and feature raised convex rings on the face and be utilized as the mating flange gaskets.
 3. Valve body shall have integral molded body stops and seat relief area to prevent over-tightening of the mating flanges.
 4. Valves shall accept flat faced flanges in accordance with ANSI B16.5 bolt pattern for 150 lb flanges.
 5. Valve stem shall be non-wetted, and have engagement over the full length of the spherically designed disc.
 6. Valve shall be pressure rated to at least 150 psi.
 7. Valve shall be as manufactured by ASAH/AMERICA, Spears Manufacturing Co., or approved equal.

2.06 AIR RELEASE VALVE

- A. Float operated to automatically release air from water piping system.
- B. ARV shall adhere to all requirements in AWWA C512.
- C. Body and Cover: Cast iron or ductile iron.
- D. Internal Parts and Float: Stainless steel.
- E. Valve shall be designed for at least 150 psig operating pressure.
- F. Acceptable Manufacturers: APCO – Valve and Primer Corp., Val-Matic Valve Co., or equal.

2.07 PRESSURE RELIEF, REDUCING AND REGULATING VALVES

- A. Pressure relief valves (not for chemical service) 1 inch and under shall have bronze bodies and above 1 inch shall have cast iron bodies, bronze fitted with grey iron diaphragm base and straight chamber and phosphorus bronze diaphragm. The ratio of the diaphragm area to the seat area shall be adequate to overcome sticking. The seat disc shall be of non-corrodible, non-sticking material capable of withstanding extreme temperatures. Valves shall permit dismantling for repairs and cleaning

without being removed from the line. Valves shall conform to the ASME Boiler Construction Code as approved by both the Underwriters Lab., and the National Board of Boiler Pressure Vessel Inspectors. All valves shall be designed for a minimum working pressure at least equal to the working pressure of the corresponding pipeline and shall have adjustment over a range of at least 20 percent above or below the required setting pressure of the installation.

- B. Pressure reducing and regulating valves (water service) 1/2-inch and under shall be bronze and above 1/2-inch shall have cast iron bodies bronze fitted. Valves shall be constructed with full openings and capable of supplying a full flow of water at reduced pressure. Valves shall be so constructed that repairs can be made without removing the valves from the line. The valves shall be equipped with a sedimentation chamber and stainless steel or bronze strainer. Pressure reducing and regulating valves shall be the back pressure sustaining type and shall operate over a range at differential pressures from 5 to 120 psi. Reducing and regulating valves shall meet or exceed the requirements of ASSE 1003 (ANSI A112.26.2) and shall be Model 616R, as manufactured by Fisher Controls, WATTS Series 25 AUB, GA, or equal.
- C. Overflow Relief Valve for Chemical Service
 - 1. Overflow relief valves shall be installed at the end of all chemical tank overflow pipes. Valve shall be same size as overflow pipe.
 - 2. Valve shall prevent chemical fumes from leaving overflow pipe using a spring-loaded plug which seals against a seat to produce a normally closed and sealed status.
 - 3. It shall "crack" open with a pressure of 0.5 psi, after which flow shall easily cross through the valve.
 - 4. The valves shall be "flange insert" type inserted between two mating flanges. Use flange gaskets which are suitable to the chemical. If the outlet mating flange does not already direct flow downward (instead of splattering sideways), add a 2" long nipple pipe to the end so that overflow liquid goes neatly downward.
 - 5. Valve shall be the Flange Insert Valve manufactured by Check All Valve Manufacturing Co., or approved equal.
- D. Pressure Relief Valves for Chemical Service
 - 1. Valves shall utilize an internal spring and a diaphragm to create the seal.
 - 2. Valve pressure setting shall be field adjustable without the need to remove the valve from service.
 - 3. Valve shall be by Griffco Valve, Inc. or equal.

2.08 BACKPRESSURE AND ANTI-SIPHON VALVE FOR CHEMICAL SERVICE

- A. One valve shall provide the dual function of supplying backpressure and preventing siphoning in the forward flow direction.
- B. Valves shall utilize an internal spring and a diaphragm to create the seal.
- C. Valve backpressure setting shall be field adjustable without the need to remove the valve from service.
- D. Valve shall be by Unibody Series manufactured by Griffco Valve, Inc. or equal.

2.09 INLINE Y-STRAINERS

- A. Water Service:
 - 1. Y-Strainers shall be Y-pattern cast iron body, flanged or screwed ends with stainless steel or Monel, 20 mesh strainers. Strainers shall be 200 psi, cold-water service strainers, as manufactured by WATTS, Crane Co., Zurn, or equal.
- B. Chemical Service:
 - 1. Strainers shall be Y-pattern and allow replacement of strainer screen without removing valve body from pipe line.
 - 2. Strainer body and screen shall be nonmetallic.
 - 3. Free area shall be at least 150% of pipe cross sectional area.
 - 4. Perforations in strainer shall be 1/32" diameter.
 - 5. Pressure rating shall be at least 150 psi.

2.10 HOSE BIBBS EXTERIOR

Cast brass with integral wall plate. Replaceable valve set, stainless steel shaft, nylon washer. 3/4" NPT outlet. Fixed operating wheel.

2.11 VALVE BOXES

- A. The Contractor shall furnish and install valve boxes as shown on the Drawings and specified herein.
- B. All valve boxes shall be placed so as not to transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve. The ground in the trench upon which the valve boxes rest shall be thoroughly compacted to prevent settlement. The boxes shall be fitted together securely and set so that the cover is flush with the finished grade of the adjacent surface. A concrete pad as detailed on the Drawings shall be provided around the valve box, sloped outwards.
- C. All valve boxes shall be 2-piece cast iron, sliding type, 5-1/4" shaft, with heavy duty traffic weight collar and the lid marked with the appropriate carrier product (i.e.:

WATER).

- D. East Jordan Iron Works or Bingham and Taylor.

2.12 CAM AND GROOVE (aka QUICK CONNECT) COUPLINGS FOR CHEMICAL SERVICE

- A. All C&G couplings for chemical service shall be made of polypropylene, even those for sodium hypochlorite.
- B. Gasket material shall be according to material requirements per chemical as specified elsewhere in this Section.

2.13 BACKFLOW PREVENTER

- A. Double check valve principal backflow preventers shall be of the size shown on the Drawings, and shall be WATTS 709, or equal.
- B. Reduced pressure zone backflow preventers shall be of the size shown on the Drawings, and shall be in accordance with AWWA Standards C510 and C511, with two (2) independent operating spring loaded check valves and one (1) spring loaded, diaphragm actuated, differential pressure relief valve installed between the check valves. Backflow preventers shall be bronze body construction, with EPT rubber discs and Buna-N and nylon diaphragm. Screws and springs shall be of stainless steel. End connections shall be flanged, unless otherwise specified or shown on the Drawings. The reduced pressure backflow preventers shall be as manufactured by Beeco Division, Hersey Products Inc., Aergap Model 6CM, WATTS 909, or equal.
- C. Backflow preventer installations shall include isolation valves and four test cocks, furnished as an assembly. For backflow preventers less than 2-1/2" the installation assembly shall also include a strainer. Isolation valves for backflow preventers shall be ball valves, except for sizes 2-1/2" and larger which shall be resilient seat gate valves. Test cocks shall be located as recommended by the manufacturer to facilitate functional testing of the assembly.

2.14 SERVICE SADDLES

- A. Service saddles shall be used with all chemical injection quills.
- B. Saddles shall adhere to AWWA C800 and be designed to be compatible with the pipe on which it is to be installed.
- C. Saddles shall be pressure rated to at least 100 psi.

2.15 UNIONS

- A. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.
- B. For copper piping, unions shall have ground joints and conform to ANSI B16.18.

2.16 FLEXIBLE EXPANSION JOINT FOR CHEMICAL SERVICE

- A. Flexible Expansion Joint bellows shall be made of PTFE for all chemicals, even for alum.
- B. Expansion joints shall have at least 3 convolutions.
- C. Expansion joints shall be rated to at least 100 psi and have limit rods installed.
- D. Expansion joint shall be Style 443-BD by Proco Products, Inc., or equal. Spring stiffness rates for all motion types shall not exceed 110% of those spring rates in this model.

2.17 FLEXIBLE PVC COUPLINGS FOR CHEMICAL SERVICE

- A. Couplings shall be made of single piece molded flexible PVC and secured with stainless steel band clamps.
- B. Couplings shall conform to ASTM D 5926, C 1173 and CSA B602.
- C. Couplings shall be manufactured by Fernco, Inc., or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install valves and accessories in accordance with the manufacturer's instructions.
- B. Inspect joint surfaces for structural soundness and thoroughly clean before installation.
- C. Pressure test all valves, while installed, along with the general piping system pressure tests.
- D. Test overflow relief valves to ensure that the cracking pressure is set properly. Do this by filling the vertically situated overflow pipe (before attaching it to tank) and determining what level of water is required to start opening the valve.
- E. Butterfly Valves

Each valve shall be performance and leak tested as specified in AWWA C504, revised as follows: In addition to the testing requirements of AWWA C504, each butterfly valve shall be thoroughly cleaned and opened and closed at least three (3) times prior to testing. Certified copies of the test results shall be submitted to the Engineer for approval prior to shipment of the valve.

3.02 ADJUSTMENT

Check and adjust valves and accessories for smooth operation.

END OF SECTION 15080

**SECTION 15094
PIPE SUPPORTS**

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes requirements for providing pipe hangers, brackets, supports, and spacing of expansion joints in piping systems as indicated in accordance with the Contract Documents. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.

1.02 JOB CONDITIONS

- A. In certain locations, pipe supports and anchors are shown on the drawings, but no attempt has been made to indicate every pipe support and anchor. It shall be the Contractor's responsibility to provide complete system of pipe supports and to anchor all piping in accordance with this section.
- B. Concrete and fabricated steel supports shall be as indicated on the drawings, as specified in other sections, or, in the absence of such requirements, as permitted by the Engineer.
- C. All piping shall be rigidly supported and anchored so that there is no movement or visible sagging between supports.
- D. Pipe supports and expansion joints are not required in buried piping, but concrete blocking or other suitable anchorage shall be provided as indicated on the drawings or specified in other sections.

1.03 SUBMITTALS

Submit the following Contractor's drawings in accordance with [Section 01300](#).

- A. Layout drawings in conjunction with [Section 15060](#) showing the location of all pipe supports for pipes two-inches and larger.
- B. Catalog data for all pipe support components to be used.
- C. Manufacturer's installation instructions.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Pipe supports shall comply with ANSI/MSS SP-58 and MSS SP-69 and Federal Specification WW-H-1713. Load carrying and coating tests will not be required.

- B. Pipe supports specified are identified by manufacturer's name and catalog number.
- C. Pipe supports shall be manufactured for the size and type of pipe to which they are applied. Straphangers will not be acceptable. Threaded rods shall have threading to permit the maximum adjustment available in the support item.
- D. All hangers and supports shall be capable of adjustment after installation. Types of hangers and supports shall be kept to a minimum.
- E. Pipe supports shall be furnished complete with all necessary inserts, bolts, nuts, rods, washers, and other accessories.
- F. Contact between dissimilar metals, including contact between stainless steel and carbon steel, shall be prevented. Supports for brass or copper pipe or tubing shall be copper plated. Those portions of pipe supports which contact other dissimilar metals shall be rubber or vinyl coated.
- G. Stainless steel supports fabricated by welding shall be AISI Type 304L or 316L material.
- H. All hardware, anchors, bolts, etc used for fastening or anchoring supports at the floor shall be 316 stainless steel.

2.02 DESCRIPTION

- A. Pipe support types and application shall comply with the following.

	Description or Size	MSS SP-69	Manufacturer and Model
A.	Hangers		
	2-1/2-inch and smaller pipe,		
	adjustable J	5	B-Line Fig. B3690, Grinnell Fig. 104, or equal.
	clevis	1	Grinnell Fig. 65, B-Line Fig. B3104, or equal.
	3-inch through 10-inch pipe		
	clevis	1	Grinnell Fig. 260, B-Line Fig. B3104, or equal.
	12 inch and larger pipe		

	Description or Size	MSS SP-69	Manufacturer and Model
	clevis	1	Grinnell Fig. 260, B-Line Fig. B3102, or equal
B.	Standard weight and extra strong steel pipe and stainless steel pipe (all sizes)		
	uninsulated, steel pipe clamp	4	Elcen "1", Fee & Mason "236", ITT Grinnell "212", or equal
C.	Concrete Rod Attachment Plate, 6-inch and smaller pipe	19	Grinnell Fig. 52, or equal.
D.	Turnbuckles, Steel	13	Elcen 81, Fee & Mason 2382, Grinnell Fig. 230, or equal
E.	Hangar Rods, Carbon Steel, threaded both ends, ½-inch minimum size	--	Elcen 72, Fee & Mason 267, Grinnell Fig. 140, or equal.
F.	Wall Supports and Frames, steel 12 inch and smaller pipe brackets	33,34	Grinnell Fig. 195 & 199; B-Line Fig. B3066 & B3067, or equal.
	prefabricated channels, galvanized	--	12 gauge, 1-5/8" x 1-5/8" with suitable brackets and pipe clamps.
	offset pipe clamp, 1-1/2-inch and smaller pipe, galvanized	--	1-1/4" x 3/16" steel, with 3/8" bolts.
	offset pipe clamp, 2-inch to 3-1/2-inch pipe, galvanized	--	1-1/4" x 3/16" steel, with 3/8" bolts.
G.	Pipe Riser Clamps		

	Description or Size	MSS SP-69	Manufacturer and Model
	cold piping system	–	Pipe Shields, Inc., "E1000", or equal
	copper tubing	–	CT-121 or CT-121C
	other piping systems	–	Grinnell "261", or equal
H.	Floor Supports, steel or cast iron, 6-inch and smaller pipe	38 (with base)	Grinnell Fig. 259; B-Line Fig. B-3095, or equal.
	8 inch through 30 inch pipe	38	B-Line "B3093", Grinnell "264", or equal

2.03 FRP STRUT SUPPORT SYSTEM

- A. Non-metallic support system shall be a heavy duty channel framing system. Channel frames shall be manufactured by the pultrusion process using corrosion grade polyester or vinylester resins. All fiberglass construction shall include suitable ultraviolet inhibitors for UV exposure and shall have a flame spread rating of 25 or less per ASTM E84. Piping accessories, pipe clamps, clevis hangers, support posts, support racks, fasteners, etc., shall be constructed of vinylester or polyurethane resin. Non-metallic support systems shall be standard make Aickinstrut by Aickinstrut, Inc., Unistrut Fiberglass by Unistrut, Inc., Enduro Fiberglass Systems, or equal. The Contractor shall submit data on the types and sizes of approval. Unless otherwise shown or specified the Contractor shall provide support spacing in conformance with the pipe and support system manufacturer's requirements.

PART 3 - EXECUTION

3.01 LOCATION AND SPACING

Piping shall be supported approximately 1-1/2 inches out from the face of walls and at least 3 inches below ceilings or beams. The maximum spacing for pipe supports and expansion joints shall be:

Type of Pipe	Pipe Support Maximum Spacing, Feet	Maximum Run without Expansion Joint, Loop or Bend, Feet (See Note 1)	Expansion Joint Maximum Spacing, Feet (See Note 2)	Type of Expansion Joint
<u>Ductile Iron</u>	15	80	80	Mechanical Couplings
<u>Steel:</u>				
1-1/4-inch and smaller	7	30	100	Note 3
1-1/2 to 4- inch	10	30	100	Note 3
<u>Copper:</u>				
1-inch and smaller	5	--	--	None required
Over 1-inch	7	50	100	Note 3
<u>PVC:</u>				
1/8- and 1/4-inch	Continuous Support	20	60	None required
1/2- to 2-inch	4	20	60	None required
Over 2-inch	6	20	60	None required
<u>Cast Iron Soil Pipe:</u>	10	-	-	None required

- Notes:
1. Unless otherwise permitted, an expansion joint shall be provided in each straight run of pipe having an overall length between loops or bends exceeding the maximum run specified herein.
 2. Unless otherwise permitted, the spacing between expansion joints in any straight pipe run shall not exceed the maximum spacing specified herein.
 3. Expansion joint fittings as specified in the miscellaneous piping section.
 4. At least two properly padded supports for each pipe section.
 5. At least one support for each pipe section.

3.02 INSTALLATION

- A. Concrete inserts or L-shaped anchor bolts shall be used to support piping from new cast-in-place concrete. Expansion anchors shall be used to fasten supports to masonry.
- B. Design loads for inserts, brackets, clamps, and other support items shall not exceed the manufacturer's recommended loads.

- C. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchorage for temperature changes shall be centered between elbows used as expansion joints.
- D. Provide dielectric isolation. Do not allow copper and other metals to make contact with each other.
- E. All piping and pipe supports located in sewage wetwells shall be stainless steel.
- F. All piping shall be supported and anchored so that there is no movement or visible sagging between supports.
- G. Hanger rods shall be straight and vertical. Chain, wire, strap, or perforated bar hangers shall not be used. Hangers shall not be suspended from other piping.
- H. Vertical Piping:
 - 1. Secure at sufficiently close intervals to keep pipe in alignment and to support weight of pipe and its contents.
 - 2. Support vertical iron and steel pipe on maximum 5'-0" centers with steel pipe riser clamps.
 - 3. Support vertical copper tubing at no more than 10'-0" spacing, using plastic coated steel pipe riser clamps or pipe clamp hangers at end of runs and at intermediate points as installation dictates.
 - 4. Support vertical plastic pipe at 4'-0" centers, using plastic coated pipe riser clamps or pipe clamp hangers at end of runs and at intermediate points as installation dictates.
 - 5. Vertical piping shall be supported at each floor and between floors by stays or braces to prevent rattling and vibration.
- I. Horizontal Piping:
 - 1. Support at sufficiently close intervals to prevent sagging, thrust, and vibration.
 - 2. Install hangers or supports at ends of runs or branches and at each change of direction or alignment.
 - 3. Install steel clevis-type pipe hangers for horizontal iron and steel pipe on maximum 10'-0" centers.

4. Install steel clevis-type pipe hangers for copper tubing on 6'-0" centers for 1-1/4" size and smaller, and on 10'-0" centers for copper tubing larger than 1-1/4" size.
 5. Install plastic coated ring-type pipe hangers for horizontal plastic pipe on maximum 4'-0" centers, close to every joint, at ends of each branch, and at each change in direction of elevation; hangers shall not compress, distort, cut or abrade plastic piping and shall permit free movement of the pipe.
- J. The Contractor is responsible for properly bracing piping against lateral movement or sway. The Engineer shall review with the Contractor and approve method of bracing of piping at each location prior to Contractor proceeding with the installation of the bracing. Bracing shall be installed at all locations where sway is anticipated and as directed by the Engineer.
- K. Rubber hose and flexible tubing shall be provided with continuous angle or channel support.

END OF SECTION 15094

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**SECTION 15190
TESTING PIPING SYSTEMS**

PART I - GENERAL

1.01 DESCRIPTION

- A. The work of this section includes, but is not limited to
 - 1. Gravity Pipe Low-Pressure Air Testing
 - 2. Pressure Pipe Hydrostatic Testing
 - 3. Disinfection of Potable Water Piping
- B. Related Work Specified Elsewhere
 - 1. Section 02200 - Earthwork
 - 2. Section 15060 - Pipe and Pipe Fittings
 - 3. Section 15080 - Valves and Piping Specialties

1.02 GENERAL REQUIREMENTS

- A. The Engineer shall be notified in advance of all tests and all tests shall be conducted to his entire satisfaction. All tests shall be made prior to insulating piping.
- B. Repairs to the various systems shall be made with new materials. No caulking of threaded joints, cracks or holes will be acceptable. Where it becomes necessary to replace pieces of pipe, the replacement shall be the same material and thickness as the defective piece. Tests shall be repeated after defects disclosed thereby have been made good or the work replaced.
- C. All piping shall be adequately braced and supported during the tests so that no movement, displacement or damage shall result from the application of the test pressure. Relief devices in the various systems shall be capped or plugged during the tests.
- D. All equipment used in testing shall be subject to the approval of the Engineer, and shall be such as to properly develop, maintain and measure test procedures.

1.03 QUALITY ASSURANCE

- A. Reference Standards
 - 1. American Society for Testing and Materials (ASTM) C828 Low-Pressure Air Test of Vitrified Clay Pipelines

2. American National Standards Institute (ANSI); American Water Works Association (AWWA)
 - a. ANSI/AWWA C600 Section 4 - Hydrostatic Testing
 - b. ANSI/AWWA C651 Disinfecting Water Mains
- B. Test Acceptance
 1. No test will be accepted until leakage rate is below specified maximum limits.
 2. The Contractor shall determine and correct the cause of test failures and retest until successful test results are achieved.

1.04 SUBMITTALS

- A. Submit in accordance with [Section 01300](#).
- B. Submit the following prior to start of testing:
 1. Test Procedures
 2. List of Test Equipment
 3. Testing Sequence Schedule
 4. Certification of test pressure gauge calibration and accuracy.
 5. Certification of composition of chlorination products.

PART 2 - PRODUCTS

2.01 DISINFECTION PRODUCTS

- A. Liquid Chlorine: AWWA B301.
- B. Calcium Hypochlorite and Sodium Hypochlorite: AWWA B300.

2.02 AIR TESTING EQUIPMENT

- A. Air Compressor
- B. Air Supply Lines
- C. Test Connections
- D. Pressure Regulator

- E. Pressure Relief Valve
- F. Pressure Gauge Calibrated to 0.1 lb/sq. inch.

2.03 HYDROSTATIC TEST EQUIPMENT

- A. Hydro Pump
- B. Pressure Hose
- C. Test Connections
- D. Pressure Relief Valve
- E. Pressure Gauge Calibrated to 0.1 lb/sq. inch.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Backfill trenches in accordance with [Section 02200](#).
- B. Provide concrete reaction support blocking, cured a minimum of 7 days, or a minimum of 3 days if high early strength concrete is used, for the pipeline to be tested.
- C. Flush pipeline to remove debris; collect and dispose of flushing water and debris in a manner conforming to Regulatory Agency requirements.

3.02 AIR TESTING GRAVITY FLOW PIPELINES

- A. Test each section of gravity flow pipeline between structures; plug all pipeline outlets; brace plugs to offset thrust.
- B. Slowly introduce air to the plugged pipeline until internal air pressure is approximately 4.0 psig.
- C. If groundwater is present, determine its elevation above the springline of the pipe by means of a piezometric tube; for every foot of groundwater above the springline of the pipe, increase the starting test pressure reading by 0.43 psig; do not increase pressure above 10 psig.
- D. Allow air pressure to stabilize for at least five minutes; adjust pressure to 3.5 psig or to the increased test pressure as determined above if groundwater is present; start the test.
- E. Determine the test duration for a section with a single pipe size from the following table:

AIR TEST TABLE			
Minimum Test Time For Various Pipe Sizes			
Nominal Pipe Size	T (time) min/100 ft.	Nominal Pipe Size	T (time), min/100 ft.
3"	0.2	18"	2.4
4"	0.3	21"	3.0
6"	0.7	24"	3.6
8"	1.2	27"	4.2
10"	1.5	30"	4.8
12"	1.8	33"	5.4
15"	2.1	36"	6.0

- F. Record the drop in pressure during the test period; if the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed; if the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued and the line will be accepted.
- G. If the line fails, determine the source of the air leakage, make corrections and retest. After the leaks are repaired, retest the entire section.
- H. The Contractor has the option to test the section in incremental stages until the leaks are isolated.
- I. Testing Pipe Over 36" Diameter

Pipe larger than 36" diameter shall be subjected to a visual interior inspection.

3.03 HYDROSTATIC LEAKAGE TESTING PRESSURE FLOW PIPELINES

- A. Applicable to pressure flow yard piping.
- B. Hydrostatically test each section of pressure pipeline at the pressure designated on yard piping plan, based on the elevation of the lowest point in the pipeline corrected to the elevation of the test gauge, for a minimum period of one hour.
- C. Slowly fill the section with water, expelling air from pipeline at the high points; install corporation cocks at high points if necessary; after all air is expelled, close air vents and corporation cocks and raise the pressure to the specified test pressure.
- D. Observe joints, fittings and valves under test, remove and renew cracked pipe, joints, fittings, and valves showing visible leakage; retest.

- E. After visible deficiencies are corrected, continue testing at the same test pressure for an additional two hours to determine leakage rate.
- F. Maintain pressure within plus or minus 0.5 psig of test pressure.
- G. Leakage is defined as the quantity of water supplied to the pipeline necessary to maintain test pressure during the period of the test and shall not exceed that determined by the following formula:

$$L = \frac{ND (P)^{0.5}}{7,400}$$

Where: L is the allowable leakage in gallons per hour

N is the number of joints in the section tested

D is the nominal diameter of pipe in inches

P is the average test pressure in psig.

- H. If the test of the pipeline indicates leakage greater than that allowed, locate the source of the leakage, make connections and retest until leakage is within the allowable limits.
- I. Correct visible leaks regardless of the amount of leakage.

3.04 HYDROSTATIC TESTING PRESSURE PIPING SYSTEMS

- A. Applicable to chlorine solution piping system, potable water pressure system, chemical feed systems, and all process piping systems within the water treatment plant or raw water pumping station.
- B. Fill entire systems with water and vent air from the system at least 24 hours before the actual test pressure is applied.
- C. Apply the required test pressure when the water and average ambient temperatures are approximately equal and constant.
- D. Test piping at pressures listed on Yard Piping Plan; avoid excessive pressure on safety devices and mechanical seals.
- E. Maintain test pressure for a minimum of 2 hours without drop after the force pump has been disconnected.
- F. Visually inspect joints, fittings, and valves while pipe is under test pressure.
- G. Correct all visible leaks and retest as often as necessary until satisfactory results are achieved.

3.05 DISINFECTION OF POTABLE WATER PIPING

- A. Conduct disinfection of potable water system after completion of satisfactory pressure and leakage testing.

- B. Disinfect in accordance with recommended practice established by AWWA C651.
- C. Preliminary Flushing
 - 1. Flush the line at a rate of flow of 2.5 feet per second for a period of 15 minutes; refer to table at end of this Section for the rates of flow to produce a velocity of 2.5 fps.
 - 2. Provide and install one hydraulically propelled polyurethane "pig" in each line 4 inches or greater in diameter prior to flushing and flush the "pig" through the line; pig shall have the ability to negotiate fabricated mitered bends and short radius elbows and pass through tees, crosses and multi-dimensional sizes of pipe and valves.
 - 3. Dispose of flushing water in compliance with Federal, State and Local laws.
- D. Chlorine Form
 - 1. The chlorine form to be applied to the system shall be either liquid chlorine, calcium hypochlorite or sodium hypochlorite.
 - 2. The Engineer's written approval of the chlorine form to be used is required.
- E. Chlorine Application
 - 1. Introduce the chlorine to the system by use of the continuous feed method.
 - 2. Feed water and chlorine to the line at a constant rate so that chlorine concentration in the pipe is a minimum of 50 mg/L available chlorine.
 - 3. Continue chlorine applications until the entire system is filled with the chlorine solution.
 - 4. During the 24-hour treatment, operate all valves, stops, and hydrants in the section treated.
 - 5. At the completion of the 24-hour treatment, the water shall contain a minimum of 25 mg/L chlorine throughout the line.
 - 6. Repeat the disinfection process until the specified minimum available chlorine is present at the end of the treatment sequence.
- F. Final Flushing
 - 1. Flush the heavily chlorinated water from the system under treatment until the chlorine concentration in the water leaving the system is less than 1 mg/L.
 - 2. Comply with federal, state and local laws when discharging the flushed disinfecting chlorine solution.

G. Bacteriological Testing

1. After final flushing is completed and before the water main is placed in service, test the line for bacteriologic quality.
2. Collect a minimum of 2 samples in sterile bottles treated with sodium thiosulfate.
3. Provide bacteriological test reports to the Owner and the Engineer; failure to meet State Health Standard requirements will be cause for the Contractor to rechlorinate and retest the system, at no additional cost to the Owner.

TABLE				
Required Flow to Flush Pipelines *(a)				
Pipe Diameter (Inches)	Flow Required to Produce 25 fps Velocity in gpm	Size of Tap on Main (inches) *(b)	Hydrant Outlets	
			Number	Size (Inches)
4	100	15/16	1	2-1/2
6	220	1-3/8	1	2-1/2
8	390	1-7/8	1	2-1/2
10	610	2-5/16	1	2-1/2
12	880	2-13/16	1	2-1/2
*(a) With a 40 psi pressure in main, hydrant flowing to atmosphere, a 2-1/2" hydrant outlet will discharge approximately 1,000 gpm.				
*(b) Size of tap on main with no length of discharge piping.				

END OF SECTION 15190

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SECTION 15500
BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, equipment and material for the complete installation of the heating, ventilation, air conditioning, piping, etc. as indicated on the drawings and specified herein.
- B. Air conditioning systems shall be furnished and installed to operate as a system. The Contractor shall coordinate all requirements between manufacturers to insure unit responsibility and compatibility of the systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 5 - Metals
- B. Division 9 - Painting
- C. Division 16 - Electrical
- D. Division 17 - Control and Instrumentation Systems

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings on all equipment, accessories and appurtenances and all fabrication work or other mechanical and air conditioning work required, all in accordance with the requirements of Section 01300, Submittals.
- B. Data to be submitted shall include but not be limited to:
 - 1. Catalog data consisting of specifications, illustrations and a parts schedule that identifies the materials to be used for the various parts and accessories. The illustrations shall be in sufficient detail to serve as a guide for assembly and disassembly.
 - 2. Complete assembly, and installation drawings with clearly marked dimensions. This information shall be in sufficient detail to serve as a guide for assembly and disassembly and for ordering parts.
 - 3. Weight of all component parts and assembled weight.
 - 4. Electrical characteristics, wiring, diagrams, etc.
 - 5. Sample data sheet of equipment nameplate(s) including information contained thereon.

6. Insulation materials, coating, jackets, detail density, thermal conductivity and thickness of all insulation materials to be furnished.
 7. Details of special fasteners and accessories.
 8. Type of adhesives, binders, joint cement, mastics.
 9. Proposed insulation procedures and installation methods.
 10. Spare parts list
 11. Special tools list
- C. The Contractor shall obtain from the manufacturer and submit to the engineer copies of the results of all certified shop tests.
- D. The Contractor shall obtain from the manufacturer and submit to the engineer copies of certified letters of compliance in accordance with the Specifications.

1.04 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall submit operation and maintenance manual in accordance with the procedures and requirements set forth in the General Conditions and Division 1.
- B. Operation and Maintenance Manuals shall be submitted for all equipment

1.05 MANUFACTURER'S INSTRUCTIONS

- A. Installation of all equipment shall be in accordance with manufacturer's data.
- B. All changes from the installation procedures in manufacturers' data shall be submitted for approval in accordance with the requirements for shop drawings.
- C. Keep all manufacturers' data provided in a secure manner at the job site at all times. Catalog and index this data for convenient reference.
- D. Manufacturers' data shall be available for the information of the Owner, Engineer, and the use of other trades.
- E. Turn over all data to the Owner through the Owner's representative at completion of the Work and final testing.
- F. Furnish Owner, indexed and bound in loose leaf binders, three (3) complete sets of Operating and Maintenance Instructions and pertinent manufacturers' literature and information on all of the apparatus and equipment under this Division of the Specifications.
- G. Submit all instruction books and manuals in accordance with Division 1.

1.06 CODES, PERMITS AND STANDARDS

- A. The Contractor shall obtain and pay for all permits and shall comply with all laws and codes that apply to the Work.
- B. The Contractor shall be responsible for all added expense due to his choice of equipment, materials or construction methods.
- C. All work and materials shall be in full accordance with the latest State rules and regulations or publications including those of the State Fire Marshall, the Uniform Plumbing Code, and all local codes. Nothing in the Plans and/or Specifications shall be construed to permit work not conforming to the above codes, rules and regulations.
- D. All equipment, materials and installations shall conform to the requirements of the most recent edition with latest revisions, supplements and amendments of the following, as applicable:

Air Conditioning and Refrigeration Institute (ARI)

Air Diffusion Council (ADC)

Air Moving and Conditioning Association (AMCA)

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

American Society of Mechanical Engineers (ASME)

Factory Mutual (FM)

National Electric Code (NEC)

NFPA 90A - Air Conditioning and Ventilation Systems

Occupational Safety and Health Standards (OSHA)

Sheet Metal & Air Conditioning Contractors National Association (SMACNA)

Standard Building Code - latest edition

Standard Mechanical Code - latest edition

Standard Plumbing Code - latest edition

State and local codes, ordinances and statutes

Underwriters Laboratories (UL)

Others as designated in the specifications.

1.07 QUALITY ASSURANCE

- A. All material and equipment shall be the latest design, new, undeteriorated, and the first quality standard product of manufacturers regularly engaged in the production of such material and equipment.
- B. When two or more units of the same class of material or equipment are required, they shall be products of a single manufacturer.
- C. All work shall be performed in a neat and workmanlike manner by workers skilled in their respective trades, and all materials and equipment shall be installed as recommended by the manufacturers and in accordance with specified codes and standards.
- D. Touch up and/or repaint to match original finishes all factory finished or painted equipment and materials, which are scratched or marred during shipment or installation.

1.08 IDENTIFICATION MARKERS

- A. Provide manufacturer's standard laminated plastic, color coded duct markers. Conform to the following color codes:
 - Yellow/Green: Supply air
 - Blue: Exhaust, outside, return and mixed air
 - Nomenclature: Include the following:
 - Direction of airflow.
 - Duct service (supply, return, exhaust, etc.)

1.09 GASKETS AND CONNECTORS

- A. Provide new gaskets wherever gasketed mating equipment items or pipe connections have been dismantled. Gaskets shall be in accordance with manufacturer's recommendations.
- B. Replace all assembly bolts, studs, nuts and fasteners of any kind which are bent, flattened, corroded or have their threads, heads or slots damaged.
- C. Furnish all bolts, studs, nuts and fasteners for make-up of all connections to equipment and replace any of these items damaged in storage, shipment or moving.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Each item of equipment shall be furnished and installed complete with all supports, mounting frames, duct work, piping, louvers, panels, grilles, electric drive units and controls, mechanical equipment, electrical work, insulation and appurtenances ready for operation.
- B. All equipment and appurtenances shall be anchored or connected to supporting members as specified or as indicated on the Plans.
- C. All mechanisms or parts shall be amply proportioned for the stresses, which may occur during operation, or for any other stresses, which may occur during fabrication and erection. Individual parts furnished which are alike in all units shall be alike in workmanship, design, and materials and shall be interchangeable. All equipment shall be of the manufacturer's top line, industrial-commercial grade.
- D. The Contractor shall ascertain that all chassis, shafts, and openings are correctly located, otherwise he shall cut all new openings required at his own expense. Cutting of new openings shall be coordinated with other trades. Proposed new cutting shall be submitted to the Engineer for review and acceptance prior to cutting.
- E. The Plans shall be taken as diagrammatic. The Contractor shall check the Structural Plans and sections for detail dimensions and clearances. Sizes of ducts and their locations are indicated, but not every offset, fitting, or structural obstruction is shown.
- F. Alignment of ducts may be varied where necessary to account for slight architectural changes or to avoid conflict with the Work of other trades without additional expense to the Owner.
- G. All supports required for the proper installation of the equipment, but not forming an integral part of the building structure, shall be provided, unless specifically noted otherwise. Equipment shall be supported on spring-type vibration isolators.

PART 3 - EXECUTION

END OF SECTION 15500

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**SECTION 15590
POWER VENTILATORS**

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. Provide exhaust fans which have been tested and rated in accordance with AMCA standard, and bear AMCA Certified Ratings Seal.
- B. Provide exhaust fans which are listed by UL and have UL label affixed, and which are designed, manufactured, and tested in accordance with UL 705 "Power Ventilators".
- C. Provide motors and electrical accessories complying with NEMA standards.
- D. Exhaust fans shall be standard prefabricated units of the type, size and arrangement indicated on the Drawings. All fans shall be rated and constructed in accordance with the Air Moving and Conditioning Association. Special construction materials, coatings and multi-speed fan motors shall be provided as indicated on the Drawings.
- E. The propellers shall be rigidly constructed, accurately balanced dynamically and statically and free from objectionable vibration or noise.
- F. Fans shall have no overloading characteristics for the horsepower indicated.
- G. V-belt drives shall be rated at least 50 percent greater than the rated motor horsepower, and shall have sheaves which can vary the fan speed by 10 percent above or below the rating point. The fan motor shall be mounted on an adjustable heavy steel mounting plate.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 15500 - Basic HVAC Requirements.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings on all equipment, accessories and appurtenances and all fabrication work required for all equipment specified in this section in accordance with Section 01300, Submittals. Additional required information shall include: the horsepower, voltage, and rotative speed of motors and the total weight of the equipment plus the approximate weight of the shipped materials. Shop drawings shall also include complete erection, installation, and adjustment instructions and recommendations.
- B. Operation and Maintenance Manuals

1. The Contractor shall submit complete operation and maintenance manuals in accordance with the procedures and requirements set forth in Section 01300, Submittals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The materials covered by these specifications are intended to be standard equipment of proven reliability and as manufactured by reputable manufacturers having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with the best practices and methods and shall operate satisfactorily when installed as shown on the Contract Drawings and operated per manufacturer's recommendations.

2.02 GENERAL INFORMATION AND DESCRIPTION

- A. All parts of the equipment furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation. All materials shall be new and both workmanship and materials shall be of the very best quality, entirely suitable for the service to which the unit is to be subjected and shall conform to all applicable sections of these specifications. All parts of duplicate equipment shall be interchangeable without modification. Manufacturer's design shall accommodate all the requirements of these specifications.
- B. All anchor bolts, washers, clips, clamps and fasteners of any type shall be constructed of 316 stainless steel. All anchor bolts shall be a minimum of 1/2-inch diameter.

2.03 CENTRIFUGAL FANS

- A. Centrifugal fans shall be backwardly inclined, non-overloading blades of aluminum construction. Inlets shall be deep spun for nonturbulent entrance condition.
- B. Fans shall be V-belt or direct driven as indicated on the drawings or as contained herein.
- C. Motors on V-belt units shall be supported on the exterior of the fan casing with bearings encased within the fan tube. All models shall incorporate a 100 percent gasketed panel to permit access to interior direct drive motor. Motors shall be protected and cooled from outside the unit by forced ventilation.
- D. V-belt fans shall be supported by channel supports or brackets for ceiling suspension or wall mounting and provided with extended lubrication fittings and suitable vibration isolation provisions.
- E. Fans shall have internal terminal box mounted on the exterior for ready wiring.
- F. Centrifugal fans shall be as manufactured by Greenheck Fan Corp., Loren Cook Co., Penn Ventilator Co., or equal.

2.04 INLINE FANS

- A. Duct mounted supply, exhaust or return fans shall be of centrifugal belt driven in-line type. The fan housing shall be of the square design constructed of aluminum and shall include square duct mounting collars.
- B. Fan construction shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.
- C. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.
- D. Motors shall be heavy-duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. Motors and drives shall be mounted out of the airstream.
- E. Precision ground and polished stainless steel fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed.
- F. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for system balancing.

2.05 ADDITIONAL REQUIREMENTS

The following additional requirements shall apply to all fans.

- A. Backdraft or motor-operated dampers shall be provided and installed in the openings as indicated on the Contract Drawings.
- B. All fans shall be provided with either integral or supplementary vibration or sound-absorbing mountings.
- C. Provide removable bird screen, 3/4 inch mesh, 12 gauge aluminum wire.
- D. Provide factory wired non-fusible type disconnect switch at motor in fan housing. Provide conduit chase within unit for electrical connection. The disconnect switch for outdoor fans shall be NEMA 4X stainless steel.
- E. Unless otherwise shown or specified all roof mounted exhaust fans shall be mounted on a prefabricated roof curb.

2.06 DAMPERS

- A. All exhaust fans shall include a damper. Dampers shall be coordinated to operate and interface with the fan being furnished. All dampers shall be low leakage type. Dampers shall be gravity or motor operated where indicated. Motor operators shall be rated for use on 120 VAC and shall be as manufactured by Honeywell, Barber-Coleman, or equal.
- B. Dampers shall have aluminum frames and blades with sealing edges and couplings at both ends with tie-rods. Dampers shall be predrilled to match the fan or louver. Damper finish colors shall be selected by the Engineer from the manufacturer's standard color chart.
- C. Dampers shall be sized to fit the specified openings.

PART 3 - EXECUTION

3.01 INSTALLATION OF POWER AND GRAVITY VENTILATORS

- A. Contractor shall install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.
- B. Contractor shall coordinate ventilator work with work of walls, and ceilings, as necessary for proper interfacing.
- C. Connect ducts to ventilators in accordance with manufacturer's installation instructions.

3.02 FIELD QUALITY CONTROL

- A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 15590

**SECTION 15604
ELECTRIC SPACE HEATING UNITS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into satisfactory operation all electric space heating units as required for a complete electric installation as specified herein and indicated on the Drawings.
- B. The extent of the electric unit heaters work is indicated on the Drawings and further defined by the requirements of this Section. The Contractor shall reference the Electric Space Heating Units Schedule included herein or indicated on the Drawings for quantities, electrical ratings, ventilation ratings, and other unit specific information.

1.02 TESTING

- A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:
 - 1. Witnessed Shop Tests
None required.
 - 2. Certified Shop Tests
The electric space heating units shall be given routine factory tests in accordance with the requirements of the appropriate standards.
 - 3. Field Tests
- B. Field tests shall be performed in accordance with the requirements specified in the General Conditions, Division 01, and Section 16000, Basic Electrical Requirements. The tests shall be made by the Contractor who shall also furnish the required testing equipment

1.03 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the General Conditions, the Contractor shall obtain from the equipment manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Spare Parts List

3. Special Tools List
 4. Reports of Certified Shop Tests
 5. Operation and Maintenance Manuals
- B. Each submittal shall be identified by the applicable Specification section.
- C. Shop Drawings
1. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.
 2. Partial, incomplete or illegible submittals will be returned to the Contractor without review for resubmittal.
 3. Shop drawings shall include but not be limited to:
 - a. Equipment specifications and product data sheets identifying all materials used and methods of fabrication.
 - b. Example equipment nameplate data sheet.
 - c. Complete wiring diagrams showing all devices requiring electrical connection, wire numbers, terminal block numbers and other pertinent wiring information.
- D. Operation and Maintenance Manuals
1. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions and Division 1.

1.04 TOOLS, SUPPLIES AND SPARE PARTS

- A. The electric space heating units shall be furnished with all special tools necessary (one set per like piece of equipment) to disassemble, service, repair and adjust the equipment. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.
- B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.
- D. Spare parts lists, included with the Shop Drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.

- E. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.05 IDENTIFICATION

- A. Each electric space heating unit shall be identified with the identification number on the Drawings (e.g. UH-1, UH-2, etc.). A nameplate shall be securely affixed in a conspicuous place on each unit. Nameplates shall be as specified in Section 16195, Electrical-Identification.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable firms regularly engaged in the manufacturing of electric space heating units, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 CORROSION RESISTANT UNIT HEATERS

- A. The cabinets shall be of 20 gauge Type 304 stainless steel. Individual adjustable louvers shall be furnished to provide desired control of discharge air. Adjustable louvers shall be finished with one coat of zinc chromatic primer and two coats of corrosion resistant paint for added moisture and corrosion resistance.

Unit heaters shall be furnished and installed with an electrical compartment sealed to allow the unit to be hosed down.

- B. The heating coils shall consist of monel fintube elements attached to junction box with leak-proof, threaded fittings for maximum corrosion resistance. A built-in, automatic reset, thermal overload protective device shall be provided for instantaneous operation of the power contactor holding coil in the event of an overload.
- C. Motors shall be totally enclosed continuous fan duty, sleeve bearing type equipped with built-in thermal overload protection. Each unit shall be equipped with a combination fan guard/motor support resiliently mounted at four (4) points to absorb any motor vibrations. The fan motor shall be wired within the unit heater to the electric heating coil power supply, thus eliminating the need for external motor starters or a separate fan motor circuit to the unit. Each unit heater shall be furnished with a NEMA 4X stainless steel disconnect switch.

- D. Fans shall be broad bladed aluminum directly connected to the fan motor, dynamically balanced and designed for the unit heater application. Fan shall be finished same as the adjustable discharge air louvers.
- E. On/off type operation shall be provided by interrupting the heater power supply with a contactor of suitable size as required by the equipment. The contactor holding coil shall in turn be operated by a thermostat. A pilot light shall be furnished and installed on the front of the unit to indicate energizing of the contactor coil and heating coil(s).
- F. The unit heater shall be supplied with a separate pilot duty wall mounted type thermostat unless otherwise indicated. The control circuit shall operate on 120 VAC, single phase, 60 hertz derived from a control power transformer furnished and installed with the unit.
- G. All heaters shall be UL listed and meet the requirements of the National Electrical Code. Electrical components for unit heaters shall be listed and labeled by U.L.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall handle the unit heaters and components carefully to prevent damage, breaking, denting and scoring. Contractor shall not install damaged electric unit heaters or components.
- B. The Contractor shall store the unit heaters and components in a clean dry place, which will adequately protect the units from weather, dirt, fumes, water, construction debris, and physical damage.
- C. The Contractor shall comply with the manufacturer's rigging and installation instructions for unloading unit heaters, and moving them to final location.

3.02 INSTALLATION

- A. The Contractor shall install unit heaters as indicated on the Drawings, in accordance with the manufacturer's installation instructions, and shall verify that the manufacturer's nameplate data corresponds with the unit designation.
- B. The Contractor shall hang/support the units from substantial structural components of the building (e.g. walls, floors, columns, beams, etc.). Units shall not be hung from piping. The Contractor shall mount the unit heaters as high as possible to maintain the greatest headroom possible unless otherwise indicated. The unit shall be supported with rod-type hangers anchored to building structural components and shall be protected with a protective cover during the balance of construction.

3.03 ADJUSTING AND CLEANING

- A. After installation is completed, the Contractor shall clean all exposed unit surfaces, vacuum the heating coils and vacuum the inside of the cabinets.

END OF SECTION 15604

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**SECTION 15605
LOUVERS AND DAMPERS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Furnish all labor, materials, equipment, and appliances required for the complete execution of additions, modifications, alterations, to existing buildings and new construction work as shown on the Drawings and specified under the several sections of the Specifications.
- B. Principal items of work include:
 - 1. Combination louver damper.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01300 – Submittals

1.03 REFERENCE CODES, SPECIFICATIONS AND STANDARDS

- A. Without limiting the generality of these Specifications, work shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of the Bid.
 - 1. All work shall comply with the Standard Building Code and the requirements of all other authorities having jurisdiction.
 - 2. All units shall conform to AA-Aluminum Standards and Data, latest edition.
 - 3. Louvers shall bear the AMCA Seal with ratings in accordance with AMCA Standard 500 which applies to air performance ratings and water penetration ratings.
 - 4. All louvers, fasteners and supports shall be designed to meet a wind loading in accordance with the local building codes, but shall not be less than 25 pounds per square foot.

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the General Conditions, City Standard Specification 4-1, and Division I, the Contractor shall submit the following:
 - 1. Samples
 - 2. Shop Drawings

- B. Each submittal shall be identified by the Specification Section Number.
- C. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed materials compliance with the Contract Documents.
- D. Partial, incomplete or illegible submissions will be returned to the Contractor without review for resubmission.
- E. Samples shall include:
 - 1. Color and finish samples for each finish type required.
- F. Shop Drawings shall include but not be limited to:
 - 1. Complete detail drawings showing materials, methods of fabrication and clearly indicating all dimensions.
 - 2. Detailed installation drawings showing all methods of attachment.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Brace and support units to prevent deformation during delivery.
- B. Factory wrap units with approved materials to protect finish during delivery and storage.
- C. Handle units with care to prevent bending or scratching.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Specifications, provide products manufactured by the following:
 - 1. Construction Specialties, Inc.
 - 2. Ruskin, Philips Industries, Inc.
 - 3. Airolite Company, Marietta, Ohio

2.02 FABRICATION

- A. Extruded aluminum 6063-T52 alloy, extruded within commercial tolerances and free of defects, minimum .081 inches thick with reinforcing bosses. All corners of frames shall be reinforced and welded.

- B. Hardware and fasteners shall be of Type 316 stainless steel placed through nylon bushings.
- C. The louvers shall be architectural style, combination drainable type.
- D. The stationary blades and adjustable blades shall be contained within a single 6 inch louver frame. Adjustable section shall include low leakage blades and jamb seals.
- E. Frames shall be 0.125 inches thick, stationary front section 0.081 inch wall thickness. Adjustable rear section 0.125 inch wall thickness through 48 inch blade width, 0.140 inch wall thickness 48 inch to 60 inch blade width.
- F. Louver and damper assemblies which are to be placed in openings exceeding 5 feet in width shall have slidable interlocked heavy gauge extruded aluminum mullions at mid span of integral tongue and groove construction.
- G. Electrically operated damper shall be standard with the approved manufacturer. Electrical characteristics to be coordinated with the Electrical Sections of Division 16 and the Engineer.
- H. Coordinate louver sizes and free area requirements with the HVAC work.
- I. Provide blanked off sections as required.
- J. Bird screens shall be 1/2-inch square FRP or aluminum mesh P.V.C. coated, placed in removable .081-inch thick folded aluminum frames standard with the manufacturer.

2.03 FINISH

- A. Extruded aluminum louvers and damper frames and blades to receive finish in accordance with the Aluminum Designation AA-M12-C22-A44, anodic coating Architectural Class I.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Anchor louver frames using stainless steel bolts into holes drilled and tapped in channel or angle subframes and suspended lintels, or with strap anchors to masonry in accordance with the manufacturer's approved directions.
- B. Isolate aluminum from contact with masonry or dissimilar metals with heavy coat of bituminous paint or neoprene gaskets.
- C. Mount bird screens on inside face with clips, machine screwed into frames.
- D. All frames shall be installed with aluminum (or compatible) screws, bolts, anchors, etc., in such a manner that the frames are removable.

3.02 CUTTING AND FITTING

- A. Do all cutting and fitting required for the installation in a neat manner.

3.03 CLEANING

- A. Upon completion remove any and all protective coatings, clean off all parts of the work and leave entire installation in orderly condition.

END OF SECTION 15605

**SECTION 16010
ELECTRICAL GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. All items of labor, materials and equipment, not specified in detail or shown on drawings but necessary for complete installation and proper operation of work described or implied, shall be furnished and installed.
2. Test all electrical conductors, after completion of installation of wiring and apparatus, to ensure continuity, proper splicing, freedom from grounds, except "made grounds" and those required for protection and insulation resistance. Use testing instruments, i.e. megger. Activation of each circuit will be required as final test. Testing shall be done at no additional expense to the Owner.
3. Drawings are indicative of work to be installed but do not indicate all bends, fittings, boxes, etc. that will be required in this Contract. The structural and finished conditions of the project shall be investigated prior to construction.
4. Coordinate work with other trades to avoid interference between piping, ducts, equipment, architectural or structural features. In case of interference, the Engineer decides which work is to be relocated, regardless of which is first installed.
5. Visit the site to determine actual conditions. No extra compensation will be allowed by failure to determine existing conditions.

B. Additional Circuits:

1. A sum of money shall be included in the Base Bid for the Contract for five (5) additional circuits. Each additional circuit shall include the following:
 - a. 100' of 3/4" rigid aluminum conduit, and associated fasteners and connectors.
 - b. 300' of #14 THHN/THWN wire, or 100' of 1 PR. #18 shielded cable.
 - c. (1) PVC coated cast outlet box/pull box/junction box
 - d. 6' of 3/4" flexible, liquid-tight conduit

- e. Final connections to motor, receptacle, lighting control switch, instrument, control or power wiring circuit
- 2. The additional circuits shall be included in the Contractor's schedule of Values.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

- 1. The installation must comply with all Federal and State, municipal or other authority's laws, rules and/or regulations.
- 2. Inspections by the required authorities shall be made. Original final wiring certificates with two copies shall be submitted to the Owner.
- 3. The electrical inspections shall be made by the Middle Department Inspection Agency, or other inspection agency approved by the Owner.
- 4. All electrical equipment and its components and materials shall meet all applicable UL criteria and bear the appropriate label of the Underwriters' Laboratory.
- 5. All electrical equipment or apparatus of any one system shall be of the same quality as produced by one or more manufacturers, suitable for use in a unified system. The term "manufacturer" shall be understood as applying to a reputable firm who assumes full responsibility for its products.

1.03 SUBMITTALS

A. General:

- 1. Submit in accordance with Section 01300.

B. Shop Drawings:

- 1. All shop drawings shall be submitted to the Engineer for review. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in

these specifications. All pertinent specification and drawing requirements shall be indicated on the shop drawings. If incorrect, they shall be resubmitted in quantity according to Contract conditions until satisfactory. Work shown on shop drawings shall not be executed until such drawings are approved. Electrical items shall not be installed until final approval of the shop drawings has been given by the Engineer.

2. See specific sections for a breakdown of shop drawing items.
3. Submit certification that all equipment is UL listed.
4. Shop drawings shall indicate adequate clearance for operation, maintenance and replacement of operating equipment devices.
5. The Engineer reserves the right to request additional shop drawings.

C. Installation, Operation and Maintenance Manuals:

1. Submit required number of installation, operation and maintenance manuals for all equipment being provided for the electrical system. These manuals shall be submitted in electronic pdf format and in 3-ring loose-leaf binders. The manuals shall be complete, neat, orderly and indexed.
2. The installation, operation and maintenance manuals shall include a copy of the approved shop drawings for all electrical items installed on the project.

1.04 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Product Handling:

1. Deliver all materials in good condition. Store in dry place, off ground, and keep dry at all times.

B. Protection of Installation:

1. All unfinished installations, construction materials and equipment shall be protected during construction.

PART 2 - PRODUCTS

2.01 SEE SPECIFIC SECTIONS FOR PRODUCTS

PART 3 - EXECUTION

3.01 INSTALLATION

A. Protection of Installation:

1. All equipment shall be protected during construction. All damaged equipment caused by noncompliance with this requirement shall be repaired at no expense to the Owner.

B. Openings and Chases:

1. Determine locations of chases and openings prior to construction so that same may be provided where required. If openings or chases are made after building construction is accomplished, such cutting and repairing of the building shall be made by this Contractor in complete coordination with other trades on the job site to match original conditions in quality, color and type of materials used, and at no additional expense to the Owner.

C. Position of Outlets and Equipment:

1. The Engineer shall determine the position of all relocated outlets and equipment if the required location differs from that indicated on the drawings.

D. Moving Outlets Equipment:

1. The Owner reserves the right to move any outlets, equipment enclosure, a distance of ten feet before roughing in, at no additional expense.

E. Methods and Materials:

1. All work shall be installed in a first-class, neat and workmanlike manner by skilled mechanics. All materials shall be new. Firmly support all materials and equipment.

F. Cutting, Repairing and Finishing:

1. All cutting, repairing, finishing and painting required for the installation of work under this Contract shall be performed under this Contract.
2. All disturbed surfaces shall be repaired and finished to match adjacent surfaces by skilled mechanics working in their respective fields.

G. Excavation and Backfilling:

1. Excavation and backfilling shall be in accordance with the requirement of Division 2 and as required to complete the work according to details on drawings.

- H. Concrete:
1. Concrete work shall be in accordance with the requirements of Division 3 and as required to complete the work according to details on drawings.
- I. Cutting and Patching of Concrete Areas:
1. Openings in concrete required for Electrical construction shall be made by taking extreme precautions to prevent excessive damage to existing facilities. Prior to completion, all disturbed areas shall be closed, restored to normal and finished to match surrounding areas.
- J. Access:
1. Install all conduit, wire, cable, wiring devices and equipment to preserve access to all equipment installed under this Contract.
- K. Layout of Wiring:
1. The layout of wiring as shown on the drawings shall not be considered as absolute. It shall be subject to changes where necessary to overcome obstacles in construction. Where a major deviation from the plans is indicated by practical consideration, shop drawings shall be submitted showing all deviations in detail to clearly indicate the necessity or desirability for the change.
- L. Miscellaneous Supports:
1. Furnish and install all necessary angles, beams, channels, hanger rods or other supports for equipment and piping furnished under this Contract requiring support or suspension from building structure. All supports shall be 316 stainless steel.
- M. Clean Up:
1. Upon completion of all work under the electrical specifications, furnish labor, materials and incidentals to accomplish the following: remove all dirt, foreign materials, stains, fingerprints, etc. from all lighting fixtures, glassware, panelboards, wall plates, system equipment, floors, walls and ceilings adjacent to the above equipment and leave the electrical work in such a condition that no cleaning will be required by the Owner. The complete system shall be subject to inspection and approval by the Owner.

END OF SECTION 16010

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**SECTION 16050
BASIC MATERIALS AND METHODS**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. All items of labor, materials and equipment, not specified in details on Drawings but necessary for complete installation and proper operation of work described or implied, shall be furnished and installed.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electrical Code of National Fire Protection Association
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
UL	Underwriters' Laboratories

B. Qualification of Manufacturers:

1. Various materials specified herein shall be as supplied by manufacturers listed under PRODUCTS.

C. Quality Control:

1. All equipment shall be new and limited to products regularly produced and recommended for service ratings in accordance with engineering data or other comprehensive literature made available and in effect at time of bidding. In all cases where device, or devices, or part of equipment is herein referred to in singular, reference shall apply to as many items as required to complete installation.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit in accordance with General Requirements. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation

methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections.

2. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each item being submitted is in compliance with all requirements on the drawings and in these specifications. All pertinent specification and drawing requirements shall be indicated on the manufacturer's drawings.
3. Submit manufacturer's latest publications for the following items:
 - a. Conduit and Fittings
 - b. Wire
 - c. Instrumentation Cable
 - d. Outlet Boxes
 - e. Junction Boxes
 - f. Pull Boxes
 - g. Convenience Receptacles
 - h. Local Control Switches
 - i. Panelboards
 - j. Manual Starter Switches
 - k. Disconnect Switches
 - l. Uni-Strut
 - m. Conduit Link Seals
 - n. Conduit Labels

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Conduit:
 1. PVC conduit shall be Schedule 40, suitable for installation underground in a concrete duct bank.
 2. Rigid steel conduit shall be mild steel piping, zinc coated, and of sufficient weight and toughness to withstand cracking and peeling during bending. Galvanizing to be a coating of zinc of uniform thickness applied by either electrolytic or hot metal dip process.
 3. Rigid aluminum conduit shall be 6063-T1 aluminum alloy and shall comply with Federal Specification WW-C-540C.
 4. Each piece of rigid conduit to be straight, free from blisters and defects, cut square and taper reamed, finished in 10' lengths and threaded at each end. Couplings shall be supplied at one end and a protective sleeve for the other end. All threads shall be clearly cut. Each length of conduit shall bear Underwriters' Label.

5. PVC coated galvanized rigid steel conduit shall have a permanent plastic coating factory applied to a minimum thickness of 40 mils and a urethane internal coating. PVC coated conduit shall be Plasti-Bond Red H₂O_T as manufactured by Robroy Industries, Ocal Blue as manufactured by the Occidental Coating Company, or Perma-Cote Supreme as manufactured by Perma-Cote Industries.
 6. Flexible nonmetallic conduit shall conform to Articles 350 and 351 of the NEC and shall be UL listed. All flexible nonmetallic conduit shall have nonmetallic screw-in type connectors and couplings. All flexible conduit shall be liquid-tight type.
 7. Minimum size of rigid conduit shall be 3/4". Minimum size of flexible conduit shall be 1/2".
- B. Wire:
1. Wire shall be type THHN/THWN, except for underground wiring, which shall be type XHHW. All wiring shall be stranded, copper with 600 volt insulation. Aluminum wire will not be acceptable.
 2. Wire shall be 90°C, suitable for wet or dry locations.
- C. Instrumentation Cable:
1. Instrumentation cable for analog signal wiring shall be #18 AWG twisted shielded pairs with tinned copper conductors, 300 volt polyethylene insulation, a continuous foil shield with 100% coverage, and a tinned copper drain wire.
 2. The instrumentation cable shall be Beldon #8760, or equal.
- D. Conduit Fittings:
1. Conduit fittings for steel conduit shall be made of rust resisting alloy of iron or steel. An iron fitting shall be cast malleable iron thoroughly coated with metallic zinc or cadmium inside and outside after all machine work is completed.
 2. Conduit fittings for aluminum conduit shall be made of aluminum.
 3. Conduit fittings for PVC conduit shall be PVC.
 4. Each conduit fitting shall be provided with heavy threaded hubs to fit the conduit used. A cast fitting shall be used on all exposed conduit runs except at impractical locations where factory ells may be used.
 5. All conduit fittings used for PVC coated conduit shall be PVC coated and shall be Form 8 with encapsulated screws.

6. All fittings in wet locations shall be gasketed.

E. Outlet Boxes:

1. Each outlet box shall be sized in accordance with current editions of all Federal, State and local codes.
2. All outlet boxes shall have mounting lugs or ears for mounting wiring devices and covers. Each outlet box shall be equipped with an appropriate cover.
3. Outlet boxes shall be cast type of same construction as cast fittings described above.

F. Junction Boxes:

1. Junction boxes shall be cast type, and shall be of same construction as cast fittings, unless noted otherwise on the Drawings.
2. Junction boxes identified on the Drawings as NEMA 4X aluminum shall be constructed of Type 5052 H-32 aluminum, and shall have gasketed shoe box type covers with stainless steel screws.
3. Label all junction boxes with an engraved nameplate fastened to the junction box. Nameplate shall be black with 1/4" white lettering.

G. Pull Boxes:

1. Pull boxes identified on the Drawings as NEMA 4X aluminum shall be constructed of Type 5052 H-32 aluminum, and shall have gasketed shoe box type covers with stainless steel screws.
2. Pull boxes identified on the Drawings as fiberglass shall be Hoffman, or equal.
3. Label all pull boxes with an engraved nameplate fastened to the pull box. Nameplate shall be black with 1/4" white lettering.

H. Panelboards:

1. Panelboards shall be dead front automatic circuit breaker type suitable for connection to the system characteristics and with circuit breakers as called for on the panel schedules. Circuit breakers shall be thermal-magnetic type with quick-make, quick-break operating mechanism and with trip indication. Trip indication shall be clearly indicated by breaker handle taking a position between "ON" and "OFF". All 2-pole and 3-pole breakers shall be common trip. Breakers shall be plug-in type. Breakers used as switches shall be rated for that purpose.

2. Bus bars and lugs shall be plated copper. The ampere rating of the main bus bars and lugs on each panelboard schedule shall be considered a minimum. Larger ampere rating main bus bars and lugs may be required to accommodate the number of poles indicated on the panelboard schedules or to accommodate large wire sizes.
 3. Panelboard box shall be made of code gauge galvanized steel, factory assembled as a complete unit and large enough to provide ample wiring space.
 4. Panelboard front shall be complete with door and flush chrome plated pin type cylinder lock and catch. All panelboards shall be keyed alike. Front shall have adjustable indicating trim clamps which are completely concealed when the door is closed. Door shall be mounted with completely concealed hinges.
 5. Panelboards shall have a minimum interrupting capacity as indicated on the Drawings, and boxes with a minimum width of 20".
 6. Panels shall be factory prime coated and finish coated with baked acrylic enamel. Label all panelboards with an engraved nameplate fastened to the front of the panel. Nameplate shall be black with 1/4" white lettering.
 7. Panelboards shall be furnished with a surge protective device (SPD) where indicated on the Drawings. The SPD shall have a minimum 160kA rating.
 8. Panelboards shall be installed in a NEMA 4X fiberglass enclosure where indicated on the Drawings.
 9. Panelboards shall be Square D or Eaton.
- I. 15 Ampere, 120 Volt, Single Receptacles, NEMA 5-15R:
1. Single receptacles shall be corrosion resistant, 20 ampere, 3 wire, U-ground to meet Federal Specification WC-596. Receptacle color shall be yellow.
 2. Single receptacles shall be Arrow Hart #5361-CR, Hubbell #53CM61, Leviton #5361-CR, or equal.
- J. 20 Ampere, 120 Volt, Duplex Receptacles, NEMA 5-20R:
1. Duplex receptacles shall be 3 wire, U-ground, to meet Federal Specification WC-596. Receptacle color shall be ivory.
 2. Receptacles shall be Arrow Hart #5362, Bryant #5362, Hubbell #5362, Leviton #5362, Pass & Seymour #5362, or equal.
- K. 20 Ampere, 120 Volt, Duplex Receptacles, NEMA 5-20R (G.F.I. Type):

1. All receptacles noted, as G.F.I. receptacles shall be 20 Amp ground fault circuit interrupter receptacles. Receptacles shall be the "Standard" End-of-Line" type, which protects itself only. "Feed-Thru" installation will not be permitted. Devices shall be Class A, UL listed.
 2. Provide a weatherproof cover for G.F.I. receptacles where indicated on the Drawings. Cover shall be self-closing and UL listed.
- L. Switches:
1. Local control switches, other than those mounted on a panelboard, shall be 20 ampere, 120-277 volt, AC, meeting Federal Specification WS-896E. Switch color shall be ivory.
 2. Switches shall be single pole, double pole, three-way, four-way or type as noted. Switches shall be Arrow Hart #1221, Bryant #4901, Hubbell #1221, Leviton #1221, Pass & Seymour #20AC, or equal.
- M. Wall Plates:
1. Local control switches, receptacles and similar wiring devices shall be provided with stainless steel wall plates with beveled edges. Plates shall be same manufacturer as wiring device used.
 2. At locations where FS condulets are used for switches or receptacle outlets, an FS condulet plate shall be used. Plates shall have beveled or rounded edges and shall fit flush with all sides of the FS condulet.
- N. Manual Starter Switches:
1. Manual starter switches shall consist of a single pole snap switch and a thermal overload device. Size of overload element shall be based on the nameplate rating of the motor it is to protect. Switches shall be furnished with a red pilot light and an H/O/A switch. Switches shall be mounted in an outlet box where wiring is concealed and in a condulet box where wiring is exposed.
 2. Manual starter switches shall be rated for 1 hp at 120V AC and shall be manufactured by Square D or Allen-Bradley.
- O. Disconnect Switches:
1. Disconnect switches shall be non-fusible, size and NEMA enclosure as indicated on the Drawings, quick-make, quick-break, heavy-duty. Provide a ground lug in each disconnect switch.
 2. NEMA 4X disconnect switches shall be 316 stainless steel.
 3. Label all disconnect switches with an engraved nameplate fastened to the disconnect switch.

4. Disconnect switches shall be Square D or Eaton.
- P. Uni-strut:
1. Uni-strut shall be used where indicated on the drawings to support conduit and electrical equipment. Uni-strut shall be stainless steel or fiberglass, as indicated on the Drawings.
 2. Stainless steel uni-strut shall be 316 stainless steel.
 3. Fiberglass uni-strut shall be manufactured by Enduro, or equal.
- Q. Conduit Link Seals:
1. Conduit link seals shall be installed in all core-drilled holes for sealing around the conduit. All link seal bolts shall be stainless steel.
- R. Conduit Labels:
1. Conduit labels shall be PVC sleeves that wrap around conduit. Labels shall indicate the voltage of the wiring inside the conduit.
- S. Fire Resistant Foam Sealant:
1. All penetrations through floors and walls shall be sealed with Nelson Firestop Products CLK, Cat. #AA492, silicon based sealant, or equal.
 2. All wall or floor penetration openings shall be as small as possible.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Conduit:
1. All direct buried conduit shall be PVC coated galvanized rigid steel, unless noted otherwise on Drawings.
 2. All conduits in concrete duct banks shall be PVC Schedule 40.
 3. All conduits embedded in concrete slabs shall be PVC. Where conduits turn up out of the slab, they shall be PVC coated galvanized rigid steel.
 4. All buried conduit for motor feeders from VFDs shall be PVC coated galvanized rigid steel.
 5. All exterior exposed conduit shall be rigid aluminum.
 6. All exposed conduit in the Clarifier Building, shall be rigid aluminum.

7. All wiring shall be run in conduit.
8. Install conduit so wires may be removed and replaced at a later date.
9. Short runs of flexible nonmetallic conduit with separate ground wire shall be used for connection of motors and instrumentation. Approximately 18" runs of flexible nonmetallic conduit shall be used for connection of all HVAC equipment. No rigid connection to HVAC equipment will be permitted.
10. Running threads will not be permitted. Use an approved threaded coupling or a suitable union where required. Setscrew couplings will not be permitted.
11. Space supports for conduit not more than 5' apart. Support conduit by one-hole malleable iron pipe straps or beam clamps. Where it is impractical to use beam clamps and where conduit is installed on building surfaces, use back straps and approved fastening devices with malleable iron pipe straps. All straps and clamps for PVC coated conduit shall be permanently PVC coated by same manufacturer as conduit.
12. Where it is necessary to cross building expansion joints, provide conduit runs with suitable expansion fittings.
13. Provide conduit expansion fittings in aluminum conduit at 30'-0" intervals.
14. No horizontal runs of conduit will be permitted in masonry walls.
15. All conduit penetrations into electrical equipment enclosures shall be made using conduit hubs. PVC coated rigid steel conduit systems shall use PVC coated conduit hubs.
16. Bend conduit only by use of an approved pipe bending machine or hickey so the conduit will always retain its cylindrical shape. PVC coated conduit shall be bent and threaded only with tools manufactured for that purpose.
17. If the PVC coating on conduit and fittings is damaged during installation, the damaged conduit or fitting shall be replaced in its entirety by the contractor. Repairing damaged conduit with touch-up paint will not be acceptable.
18. Install metallic electrical warning tape above all underground duct banks and conduit. Tape shall be 6" wide with red background and black letters. Letters shall read "CAUTION ELECTRICAL LINE BURIED BELOW". Install tape 6" below finished grade.
19. Label all exposed conduits at each end of the conduit run.

B. Outlet Boxes:

1. An outlet box shall be furnished and installed at each outlet, firmly in place, and set true and square.
2. All outlet boxes shall be supported from the building structure, independent of the entering conduit. All unused knockouts must remain closed.

C. Wiring:

1. The voltage drop at the end of any circuit shall not exceed 3% of the normal line voltage under full load. No wires smaller than #12 AWG shall be used for branch circuits; pilot and control circuits shall not be smaller than #14 AWG.
2. Care shall be exercised in pulling wire into conduit so as not to injure insulation. Use pulling compound as required.
3. Conductors to be continuous from outlet to outlet. Splice only within outlet or junction boxes.
4. Balance circuits across the phase wires of the branch and distribution panels. Run separate neutral wires for all circuits.
5. Switches shall not be connected to the neutral conductor.
6. Power and control wiring shall be run in separate conduits. AC and DC circuits shall be run in separate conduits.
7. All wiring shall conform to the following color code:

240 Volt, 3 Phase: Black, Red, Blue - Phase Wires
 White - Neutral Wire

240 Volt, 1 Phase: Black, Red - Phase Wires

120 Volt, 1 Phase: Black - Phase Wire
 White - Neutral Wire

Control Wires: 120V AC - Red
 24V dc – Blue

Ground Wires: Green
8. AC control wires energized from a source external to the control panel power source shall be yellow.
9. All control wiring shall be identified at each end with a legible permanent coded wire-marking sleeve. Sleeves shall be heat-shrink white PVC tubing with machine printed black marking, as manufactured by Brady Markings

shall be in accordance with the wire numbers and terminal numbers shown on the control panel wiring diagrams.

- D. Splices:
1. Make all splices using solderless connectors. Use wire nut connectors composed of expandable spring steel shell and PVC insulator for size #14 through #8. Temperature rating shall be 105°C. For size #6 and larger, use bolted-type tinned copper pressure connectors, either the straight coupling type or the split bolt type.
 2. All connectors #6 and larger shall be wrapped with UL approved liner-less rubber splicing tape rated to 69 KV and vinyl plastic electrical tape to the same thickness as the insulation of the wire. Electrical tape shall be Scotch 33+, or equal.
- E. Lugs:
1. All lugs used with copper wire and cable shall be tinned copper. Aluminum will not be accepted.
- F. Panels:
1. Furnish a typed list identifying all circuits and insert in frames provided inside of panel doors.
- G. Mounting Heights:
1. Mounting heights and exact locations of all equipment to be verified by the Owner before roughing in.
 2. Unless otherwise instructed, outlets shall be located as follows:
 - a. Local Lighting Control Switches: Locate all outlets for single or gang switches 3'-4" above finished floor on strike side of door. If this location places the switch group partly in tile or other finishes, the outlet shall be lowered or raised to place the plate entirely on a flat surface.
 - b. Duplex Receptacles: 36" above finished floor, unless noted otherwise on the Drawings.
 - c. Panelboards: 6'-0" above finished floor to top of panel.
 - d. Disconnect Switches: 4'-6" above finished floor to top of switch, unless noted otherwise on the Drawings.

END OF SECTION 16050

**SECTION 16060
GROUNDING SYSTEM**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish all labor and materials required to complete all work necessary for an electric service and branch distribution grounding system. System shall include but not be limited to all grounding electrodes, ring conductors, connectors, and miscellaneous accessories such as bonding lugs, bushings and jumpers in accordance with the current edition of the National Electrical Code and as specified herein.
2. In addition to grounding/bonding connections required to comply with NEC provisions, a grounding ring system shall be installed as indicated herein or on the Drawings. This system is intended to provide bonding between all process and structural components and the electrical distribution system grounding. The description "process piping" where included herein shall be understood to mean all metallic piping systems where they occur on the site. Other process and structural components shall be grounded as specifically described herein to provide a complete system with all metallic components at the site bonded together.

1.02 QUALITY ASSURANCE

A. Regulations, Standards and Publications:

ANSI	American National Standards Institute, Inc.
ASTM	American Society for Testing and Materials
IEEE	Institute of Electrical and Electronic Engineers
NEC	National Electrical Code of National Fire Protection Association
UL	Underwriters' Laboratories

1.03 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings and types of materials.
2. All shop drawing submittals shall clearly indicate, using arrows and/or highlighting on all copies, which item(s) are being submitted and that each item being submitted is in compliance with all requirements on the Drawings and in these Specifications. All pertinent Specification and

Drawing requirements shall be indicated on the manufacturer's drawings.
Submit shop drawings on the following:

- a. Grounding Electrodes
- b. Grounding Conductors
- c. Grounding Conductor Connectors
- d. Conduit Grounding Bushings
- e. Conduit Grounding Jumpers
- f. Exothermic Weld Process and Components
- g. Grounding System Resistance Test Equipment
- h. Grounding System Test Point Sleeves

B. Literature:

1. Submit manufacturer's latest publications for each item.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Grounding Electrodes:

1. Grounding electrodes shall be 10'-0" long, 3/4" diameter copper clad steel. Exterior shall be electrolytic copper metallicity bonded to a round one-piece carbon steel rod. The electrodes shall be fabricated so as to prevent mushrooming of rod head during driving, or a steel-driving stud, manufactured for such a purpose, shall be used.
2. Electrodes shall conform to the requirements of UL Specification No. 467 (ANSI C-33.8-1972).
3. Electrodes shall be Blackburn, Carolina or equal.

B. Ground Conductors:

1. Electric service ground conductor shall be sized in accordance with NEC Article 250-66 and shall be connected to the associated building/structure grounding ring as well as all other equipment and building components required by the NEC.
2. The grounding rings shall be annealed temper, stranded, bare, copper, uncoated type. Individual members of stranded conductor shall meet the requirements of ASTM B3, and the overall fabrication shall meet the requirements of ASTM B8 for stranded conductors.
3. Size of grounding ring conductors shall be #4/0 AWG.
4. All connections between the grounding ring and the individual equipment or building/structure components called for to be grounded herein shall be

made using #2/0 AWG copper cable of the same type as the grounding rings.

- C. Grounding Jumpers:
1. UL listed jumpers shall be provided on all metallic conduit expansion fittings whether or not the circuit is provided with a separate ground conductor. Jumpers shall be braided, tinned copper, factory connected as a single assembly to two galvanized steel U-bolts. OZ Gedney Type "BJ" (for steel conduit), or equal.
- D. Grounding Bus:
1. All power distribution equipment, motor control centers, panelboards, load centers, terminal boxes, transformers, etc. shall be furnished with a factory installed grounding bus or termination point.
- E. Electrical Conduit Grounding Bushings:
1. Conduit connectors shall be insulated bushing type for grounding and bonding. Fitting shall have ground lug terminal as well as a bonding setscrew in the circumference of the bushing. Appleton "G1B" series, OZ Gedney "BLG" series, Steel City "BG" series or equal.
- F. Exothermic Weld Connections:
1. All underground grounding system connections shall be exothermically welded, including all cable connections to grounding electrodes (rods), concrete reinforcing and any other utilities required to be grounded but are not accessible from above grade.
 2. The welding process shall use a mixture of copper oxide and aluminum packaged according to connection type in plastic tubes. The packages shall be nonexplosive and shall not be subject to spontaneous ignition.
 3. All welding materials used shall be Cadweld as manufactured by Erico Products, Inc. or equal and shall meet or exceed the requirements of IEEE Standards 80 and 837 and as listed in MIL 419.
- G. Exposed Mechanical Type Grounding System Connectors:
1. The following equipment, structural and nonstructural components at the site shall be connected with a #2/0 AWG, soft-drawn, stranded, tinned copper, bare grounding conductor with the described materials or fitting to the associated building or structure grounding ring. (These items are in addition to the electrical distribution grounding requirements described elsewhere herein.) In addition to the component and fitting manufacturers listed herein and on the Standard Details, fittings and components manufactured by Burndy, OZ Gedney, Dossert or Teledyne/Penn-Union will also be accepted:

- a. Concrete slab reinforcing steel
 - b. Panelboard
 - c. DAF Control Panel
2. Components used for grounding conductor connections shall be as indicated herein or on the Drawings.
- H. Grounding Conductor Connection Lugs:
1. Grounding conductor connection lugs shall be aluminum for all connections to aluminum materials. Grounding conductor connection lugs for connections to all other materials shall be copper. All aluminum-to-copper connections shall be made according to the lug manufacturer's recommendations using an appropriate cleaning and oxidation prevention compound, Penetrox A-13 or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General:
1. Grounding system shall comply with the current edition of the National Electrical Code, the current edition of the National Electrical Safety Code and as specified herein.
 2. Flexible conduit to motors shall not be used as a ground conductor.
 3. All ground conductors shall be copper and sized according to the requirements of the NEC, Table 250-66 and Table 250-122 as applicable.
 4. All conduits shall be furnished with a separate ground conductor. Conduits shall not be used as a ground conductor.
 5. All metallic electrical conduits shall be bonded to the equipment ground terminal, ground wire or ground bus using an insulated ground bushing and jumpers sized as required by the NEC. Bond shall be provided at all conduit terminations.
 6. Flexible jumpers (bonding straps) shall be installed where conduit expansion fittings occur.
 7. Ground conductors shall be green, insulated stranded type where installed in conduit.
 8. Grounding ring and all associated conductors shall be soft drawn, stranded copper, size 4/0, bare type.

9. Unless otherwise indicated on the drawings or in the specifications, all copper-to-copper or copper-to-steel splices and terminations for ground ring and connections to the ground ring shall be made by controlled exothermic reaction welding process, using the appropriate fittings for the process employed. Steel shall be ground or filed, and copper conductors shall be cleaned, to ensure all surfaces are clean, dry and free from oxide before welding process is performed.
10. System ground ring and top of ground electrodes shall be direct buried to a minimum depth of 24" and a maximum depth of 30". Electrodes shall be driven straight down, perpendicular to the finished grade.
11. Ground electrodes in the ground ring shall be installed at no less than 10' intervals nor greater than 20' intervals.
12. The term "grounding ring" shall be understood to mean a copper conductor, as specified of this Section, buried and connected to grounding electrodes (driven rods) at + 15'-0" intervals, to completely encircle the associated building or structure. Splices in and connections to the copper conductor and grounding electrodes shall be made using an exothermic weld process, as described of this Section.
13. All metallic water piping systems shall be connected to the building's associated ground ring at two locations. Where flow meters, valves, flexible piping or any type of nonmetallic connection occur in a piping system, a bonding jumper shall be installed around the device to ensure ground continuity. Jumpers installed under other portions of these specifications, such as reference grounds for process flow meters, etc., shall not be used to replace or be considered as grounding system jumpers.
14. Rebar in concrete structures shall be connected to the grounding ring at two locations for each structure.
15. The ground ring shall be furnished with test points as indicated on the drawings. The test points shall consist of a 6" diameter, Schedule 40 PVC conduit brought flush with finished grade and extending down to 4" below point on ground rod where ring conductor is attached. The PVC shall be notched as required to prevent stress on the ground ring conductor if the PVC conduit is pushed downward from grade for any reason. Provide threaded end cap on top of PVC conduit. End cap shall be labeled "GROUND TEST POINT".
16. Testing of actual ground resistance shall be made by the Contractor before any finish landscaping is accomplished. Testing shall not be performed until after all underground connections are made and buried and after all structural steel has been connected to the ground ring. Test shall be made at the ground ring using a megger type ground tester and the "fall of potential" test method. Maximum resistance at the test point shall be 5 ohms unless otherwise noted. Where measured values exceed the above figures, the Contractor shall install additional electrodes at no additional

cost to the Owner until further tests indicate the ground resistance has been reduced to the specified limit.

END OF SECTION 16060

**SECTION 16500
LIGHTING FIXTURES**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
1. Furnish all labor and materials for a complete lighting fixture installation as indicated on the Drawings and specified herein.
 2. Fixtures of size and type specified herein shall be supplied, installed and connected as indicated on the Drawings. Provide accessories for each fixture as required for a complete installation.
 3. Furnish and install LEDs in each fixture.

1.02 QUALITY ASSURANCE

- A. Regulations, Standards and Publications:
1. Fixtures shall be U.L. listed.
 2. All fixtures shall meet all Federal, State and local required criteria.
 3. All light fixtures shall be mounted in accordance with manufacturer's recommendations.
 4. The installation must comply with the amended National Electrical Code of the National Fire Protection Association.
- B. Qualification:
1. Provide manufacturer specified for each light fixture type. Substitutes will not be accepted without approval prior to the bid.
 2. When more than one name of manufacturer of fixture is listed in these specifications, the first manufacturer and number determine the style and quality.

1.03 SUBMITTALS

- A. Shop Drawings:
1. Submit manufacturer's latest publication of each fixture; construction details and light distribution details and/or coefficients.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. LED Drivers:
 - 1. LED light driver shall be high efficiency type.
 - 2. LED light driver shall allow operation of all other LEDs in the event of an LED failure.

- B. Light Fixture Schedule:
 - 1. SA: Pendant mounted, 120 volt, low profile high efficiency LED, nominal 8" x 4', totally enclosed gasketed fixture suitable for wet locations. Fixture shall be provided with an electronic driver. Fixture shall produce a minimum of 8,000 initial lumens and have a color temperature of 4000K. Housing shall be one-piece high impact plastic to provide durability and corrosion resistance. The lens shall be one-piece, low profile, frosted acrylic, resistant to damage. Fixture shall have plastic latches to apply positive, uniform pressure on the gaskets to seal against dust and moisture. Provide gasketed conduit hubs. Fixture shall be Holophane #EMSL48-8000LM-LPAFL-MD-MVOLT-GZ10-40K-80CRI-WLFEND2 or Lithonia #FEM-L48-8000LM-LPAFL-MD-MVOLT-40K-80CRI-WLFEND2.
 - 2. WA: Wall mounted, 120 volt, high efficiency LED fixture. The fixture shall produce a minimum of 8000 initial lumens and have a color temperature of 4000K. The fixture housing shall be constructed of die-cast copper-free aluminum with a bronze powder coated finish. Fixture shall have a tempered glass lens and be provided with photoelectric control. Fixture shall be Holophane #W4GLED-30C1000-40K-T3M-MVOLT-SPD-BZSDP-PE.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation:
 - 1. Contractor shall furnish and install supports for the light fixtures. Light fixtures shall be supported with formed channels, angles, rods, clamps, washers, etc. of sufficient size and strength to support weight of fixtures from the building overhead structural members, independently from the ceiling system.
 - 2. The fixture manufacturer's catalog numbers describing the various types of fixtures shall be used as a guide only and do not include all the required accessories or hardware that may be required for a complete installation.

The Contractor shall be responsible for furnishing, at no additional cost to the Owner, all required accessories and hardware for a complete installation.

3. All inoperable lamps shall be replaced with new lamps during the course of construction, up to and including the date of final acceptance by the Owner and Engineer.

END OF SECTION 16500

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**SECTION 16530
BATTERY EMERGENCY LIGHTING UNITS**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
1. Furnish, install and connect a complete system of conduits, conductors, unit type battery emergency lighting units and all other materials and equipment necessary for the installation of an emergency lighting system.
 2. Provide manufacturer specified for each fixture type. Substitutes will not be accepted without approval prior to the bid.

1.02 QUALITY ASSURANCE

- A. Regulations, Standards and Publications:
- | | |
|-----|--|
| NEC | National Electrical Code of National Fire Protection Association |
| UL | Underwriters' Laboratories |
| FM | Factory Mutual Engineering Corp. |
- B. Qualification:
1. The complete system shall be of a type, which has been in satisfactory service for at least one year under automatic emergency lighting conditions.
 2. When more than one name of manufacturer of fixture is listed in these specifications, the first manufacturer and number determine the style and quality.

1.03 SUBMITTALS

- A. Shop Drawings:
1. Submit manufacturer's latest publication of the following:
 - a. Wet Location Battery Emergency Lighting Units
 - b. Battery Exit Fixtures

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wet Location Battery Units:

1. EA: Battery emergency light fixtures shall have a nonmetallic housing. Fixture shall be provided with a test switch, status indicator and a rechargeable Nickel Cadmium battery. The battery shall provide 90 minutes of emergency illumination. Fixture shall operate on 120 volts and shall be furnished with two 2-watt LED lighting heads. Fixture shall be Holophane #DM30-WL-LED or Crouse-Hinds #N2LPSM212222.

B. Exit Fixtures:

1. EB: Exit fixtures shall be back mounted, single faced with red high intensity LED lamps and a sealed nickel cadmium battery. The fixture housing shall be white polycarbonate. The exit fixtures shall operate on 120 VAC power and shall be Holophane Magellan #QM-R-HORO or Sure-Lites #LPX7.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Battery Units:

1. Battery units shall be firmly fastened to walls. Mounting height to be determined in field.

B. Wiring:

1. Wiring on low voltage side of unit shall be no smaller than #10.
2. Connect combination exit fixture/battery emergency light fixture to lighting circuit for area being protected ahead of all local control switches.

END OF SECTION 16530

**SECTION 16900
EXHAUST FAN CONTROL PANEL**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Furnish and install an exhaust fan control panel as shown on the Drawings. The control panel shall be complete and include all components and wiring as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Regulations and Standards:

ANSI	American National Standards Institute
IEEE	Institute of Electrical and Electronic Engineers
ISA	International Society of Automation
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
UL	Underwriters' Laboratories

- B. The control panel components shall be of the most current and proven design. Specifications and Drawings call attention to certain features but do not purport to cover all details entering into the design of the control panels. The components shall be compatible with the functions required and shall form a complete working system.
- C. The control panels shall be UL listed as a complete assembly in accordance with UL-508.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings on the control panels in accordance with the General Requirements. Shop drawings shall be complete in all respects and shall include a complete bill of material, catalog information, descriptive literature of all components, wiring diagrams, and panel layout drawings showing dimensions to all devices.

PART 2 - PRODUCTS

2.01 CONTROL PANEL COMPONENTS

A. Control Panel Enclosure:

1. The control panel enclosure shall be designed and sized in accordance with the requirements of the Drawings and as specified herein. Control panel enclosures shall be manufactured by Hoffman, Saginaw, or Rittal.
2. Wall-mounted stainless steel control panel enclosures shall be NEMA Type 4X, constructed of 14 gauge, Type 316 stainless steel.
3. The control panel components shall be properly identified with an engraved nameplate mounted on the inside of the panel. All components not mounted on the front of the panel shall be mounted to a subpanel. All wiring shall be installed in a neat, workmanlike manner and shall be grouped, bundled, supported and routed horizontally and vertically to provide a neat appearance. All wires leaving the panel shall be terminated at the terminal strips inside the enclosure. Terminals and wires shall be identified in accordance with the panel wiring diagrams.
4. Provide a copper grounding plate inside the control panel for terminating all ground wires.
5. Provide a plastic data pocket inside each control panel.

B. Control Circuit Breakers:

1. Circuit breakers shall be quick-make, quick-break thermal magnetic molded case type, individually mounted and identified. Circuit breakers shall be Allen-Bradley Bulletin 1492-CB, or equal by Square D or Eaton.

C. Selector Switches:

1. Selector switches shall be 30.5mm, heavy-duty, non-illuminated. Switches shall have double-break silver contacts. Switches shall be maintained contact type unless otherwise indicated on the Drawings. Provide auxiliary contact blocks on switches where indicated on the Drawings or in the Description of Operation. Provide a legend plate for each switch with white marking as indicated on the Drawings. Selector switches shall be Allen-Bradley Bulletin 800H, NEMA 4X, or equal by Square D.

D. Push Buttons:

1. Push buttons shall be 30.5mm, heavy-duty, non-illuminated. Push buttons shall have double-break silver contacts. Push buttons shall be momentary contact type, color-coded as indicated on the Drawings. Push buttons shall have flush heads. Provide a gray legend plate for each push button with

white marking as indicated on the Drawings. Push buttons shall be Allen-Bradley Bulletin 800H, NEMA 4X, or equal by Square D.

E. Pilot Lights:

1. Pilot lights shall be 30.5mm, heavy-duty, push to test, transformer type with LED lamps. Voltage rating shall be 120 volts. Lens color shall be as indicated on the Drawings. Provide a gray legend plate for each pilot light with white engraving as indicated on the Drawings. Pilot lights shall be Allen-Bradley Bulletin 800H, NEMA 4X, or equal by Square D.

F. Relays:

1. Relays shall be heavy-duty general-purpose type with 10 amp contacts. Relays shall have terminals, which plug-in to a socket, mounted to the inside of the panel enclosure. Terminals for relays having AC coils shall be pin type, and terminals for relays having DC coils shall be blade type. Contact configuration shall be 3PDT.
2. Relay coils shall operate on 120 volts AC or 24 volts dc as indicated on the Drawings.
3. Relays shall have an LED indicator light and a mechanical flag to indicate the relay coil is energized.
4. Relays shall be Idec RR Series, Eaton, or Zelio.

G. Fuses:

1. All fuses shall be sized as required for the circuit they are protecting. Fuses shall be Bussmann, touch-safe type, or equal.

H. Terminal Blocks:

1. Terminal blocks shall be provided in each control panel for terminating field wiring. All terminal blocks shall be rated for 600 volts AC, and shall be identified with a permanent machine printed marking in accordance with the terminal numbers shown on the panel wiring diagrams.
2. Terminal blocks for 24vdc inputs shall be blue.
3. Provide 20% spare terminal blocks in the control panel.
4. Terminal blocks shall be Allen-Bradley Bulletin 1492-W4, or equal.

I. Wiring:

1. All wiring shall be stranded copper. Control wiring shall be 16 gauge, 600 volt, Type MTW. Power wiring shall be 600 volt, Type MTW, sized as required.

2. All analog signal wiring shall be 18 gauge twisted pairs with foil shield and drain wire, with 300 volt, 90°C insulation. Drain wires shall be grounded at one end only.
 3. All wiring and terminal strips shall be isolated by voltage levels to the greatest extent possible.
 4. All wiring shall conform to the following color code:
 - a. 120 volt, 1 phase: Black, White
 - b. 24vdc: Blue
 - c. 120 VAC Control Wires: Red
 - d. Ground Wires: Green
 5. 120 VAC control wires energized from a source external to the control panel power source shall be yellow.
 6. All control wiring shall be tagged at each end with a legible permanent coded wire-marking sleeve. Sleeves shall be white PVC tubing with machine printed black marking. Markings shall be in accordance with the wire numbers shown on the control wiring diagrams, and shall match terminal strip numbers.
- J. Nameplates:
1. Provide laminated phenolic nameplates on the front of each control panel. Nameplates shall be black with white engraved letters. Engraving shall be as indicated on the Drawings. Minimum size of engraving shall be 1/4".

2.02 SPARE PARTS

- A. Provide the following spare parts for the control panel:
 1. Six (6) fuses for each type and size utilized
- B. Spare parts shall be packaged individually in boxes that are clearly labeled with part name and manufacturer's part/stock number.

PART 3 - EXECUTION

3.01 FIELD SERVICES

- A. Start-up and Testing:
 1. Test the operation of the control panel and all controls.
 2. Start-up the control panel and place the control panel into operation.

3. All start-up and testing shall be performed in the presence of the Owner and the Engineer.

END OF SECTION 16900

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**SECTION 16920
INSTRUMENTATION**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included:
1. Furnish and install all instrumentation and provide services as specified herein or as indicated on the Drawings.

1.02 QUALITY ASSURANCE

- A. Regulations and Standards:
- | | |
|------|--|
| UL | Underwriters' Laboratories |
| NEC | National Electrical Code |
| NEMA | National Electrical Manufacturers Association |
| ANSI | American National Standards Institute |
| IEEE | Institute of Electrical and Electronic Engineers |
| ISA | Instrument Society of America |
- B. All instrumentation equipment supplied shall be of the most current and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the instrumentation equipment. The equipment provided by the System Supplier shall be compatible with the functions required for the Process Control System.
- C. All necessary fuses and cables required for instrumentation equipment shall be provided with the equipment.

1.03 SUBMITTALS

- A. Shop Drawings:
1. Submit shop drawings on all instrumentation in accordance with the requirements of Section 17010. Shop drawings shall be complete in all respects and shall indicate all dimensions, installation methods, size, weight, capacity, ratings, integral controls and types of materials, elevations, and sections. Submittals shall include a complete bill of material, catalog information, descriptive literature of all components and wiring diagrams.

PART 2 - PRODUCTS

2.01 INSTRUMENTATION

A. Magnetic Flow Meters:

1. Magnetic flow meters shall be of the low frequency and short form characterized coil design. The characterized field principle of electro-magnetic induction shall produce a positive DC pulsed signal directly and linearly proportional to the flow rate.
2. The metering tube shall be constructed of Type 304 stainless steel. The meter body shall be carbon steel. The flow meter shall have a flanged body to fit between ANSI Class 150 pipe flanges. The flow meter shall have a polyurethane liner and Type 316 stainless steel electrodes. The electrodes shall be flush mounted type. Liners and electrodes shall be suitable for raw water. Provide all required mounting hardware, stainless steel grounding rings and grounding straps for the installation of each magnetic flow meter.
3. The coils, which generate the field, shall be inside the pipe wall and shall be encapsulated in epoxy resin and encased behind the meter lining material. The ratio of flow velocity to reference voltage signals generated shall be compatible with the readout instrument without the necessity of circuit modifications. The meter shall have an average power consumption of 60 watts. Accuracy of the meter shall be $\pm 0.5\%$ of rate.
4. The meter housing shall be splash-proof and weather resistant design. The meter shall be capable of accidental submergence in up to 30 feet of water for up to 48 hours without damage to the electronics.
5. Complete zero stability shall be inherent characteristic of the meter system. This shall eliminate the requirement for valving downstream of the meter for creating a full pipe zero flow condition for calibration purposes. Meter systems requiring field zero adjustment will not be acceptable.
6. The magnetic flow meters shall be factory calibrated on an approved test stand with certified accuracy traceable to NIST, compliant with the ISO 17025 standard, and third party accreditation by a national verification agency such as A2LA. Calibration curves shall be submitted for each flow meter for 3 points within the specified flow range.
7. The flow meter shall have a remote mounted microprocessor based, NEMA 4X flow transmitter. The flow transmitter shall be powder coated cast aluminum. The flow transmitter shall have an LCD display to indicate the flow rate. The flow transmitter shall convert the meter's DC pulsed signal to a linear 4-20mA dc signal which is proportional to the flow rate.
8. The flow meter shall be capable of being programmed remotely using HART protocol.

9. The flow meter transmitter shall operate on a 120V AC, 60 Hz power source and shall have RFI protection. Provide a signal cable to connect the signal converter to the flow meter. Length of cable shall be as required for the installation (See Electrical Drawings).
10. The Magnetic Flow Meters shall be Endress & Hauser Proline Promag W400, or Rosemount Model 8750WA.

SCHEDULE OF MAGNETIC FLOW METERS

<u>Size</u>	<u>Flow Range</u>	<u>Location</u>	<u>Service</u>
6"	0 – 400 GPM	Clarifier Building	Raw Water Flow

B. Radar Level Transmitters:

1. The radar level transmitters shall reliably and accurately sense the liquid level in a tank.
2. The level transmitter shall be a true 2-wire device with 24 volt DC power being derived from the control panel power supply. The electronic unit shall be of modular plug in design utilizing integrated circuitry. The transmitter output shall be a linear 4-20mA dc signal.
3. The level transmitter shall be a pulsed time of flight radar transmitter which shall operate at 26 GHz using 2-wire technology for level measurement and provide a 4-20 mA HART output.
4. The transmitter housing shall have dual compartments and shall be die cast aluminum with a powder Epoxy coating.
5. The transmitter shall employ multi echo tracking algorithms for reliable level measurement.
6. The unit shall not be affected by changing media, changing temperatures, gas blankets or vapors. The transmitter shall measure almost completely independent from product properties.
7. The transmitter shall contain a gas tight feed through to prevent process from intruding into the housing from the process vessel when required.
8. The transmitter shall have a 4 line LCD display. All programming and set-up shall be done by the three buttons on the display. The unit shall have the capability of mapping out any object that causes an interference the in the radar reflections.
9. FDT based software shall be provided for optional remote method of configuration, set-up and storage of parameters via a computer.

10. The display module shall be capable of data backup, data comparison and data transfer functions. It shall be possible to view a graphical representation of the actual signal and envelope curve on the display.
11. The transmitter will have a 32 point linearizer to correct output to represent volume measurement or use as a strapping table for level correction.
12. The unit shall have a measuring range up to 30 feet.
13. The unit shall be suitable for process temperatures up to 100° F.
14. The transmitter shall have a built-in HistoRom which will store the configuration data and be capable of logging 20 events based on programmed triggers.
15. The level transmitter shall have a 6" stainless steel mounting flange for flange mounting the transmitter on top of the tank.
16. The radar level transmitter shall be Endress & Hauser Micropilot M FMR 54, or equal.

SCHEDULE OF RADAR LEVEL TRANSMITTERS

<u>Location</u>	<u>Service</u>
Sludge Collection Tank	Sludge Collection Tank Level

C. Float Switches:

1. Each float switch shall consist of a single pole, mechanical switch in a smooth, chemical resistant polypropylene casing with integral 2-wire cable. The switch shall be furnished in a normally open or closed configuration and shall be permanently molded to the signal cable at the factory. The float switches should be normally closed.
2. Signal cable shall be minimum #18 AWG. Length of cable shall be as indicated on schedule below.
3. Specific gravity of sensors shall be 0.95-1.10. Sensors shall remain operable at temperature down to 0°C and up to 90°C. The switch contacts shall operate on 24 volts DC.
4. Provide a 316 stainless steel mounting bracket for each float switch.
5. The float switches shall be Anchor Scientific Roto-Float, Conery, or equal.

SCHEDULE OF FLOAT SWITCHES

<u>Qty.</u>	<u>Type</u>	<u>Cable Length</u>	<u>Mounting Bracket</u>	<u>Service</u>
1	S	20 feet	WMS	Flow Monitor Tank High Level

2.02 INSTRUMENT NAMEPLATES

- A. Provide a laminated phenolic nameplate for each instrument. The nameplates shall be black with white engraved letters, and they shall be mounted on the front of each instrument or instrument enclosure, or where applicable attached to the instrument with a plastic wire tie. An instrument nameplate schedule shall be submitted to the Engineer for approval prior to performing any engraving.

PART 3 - EXECUTION

3.01 INSTALLATION ASSISTANCE AND INSPECTION

- A. Provide the services of manufacturer's service representatives to assist in installation for all instrumentation specified herein.
- B. Each manufacturer's representative shall inspect the installation of each of their instruments, and shall issue an installation certificate to the Owner and the Engineer for each instrument certifying that the instrument has been installed in accordance with the manufacturer's recommendations.

3.02 CALIBRATION

- A. Provide the services of manufacturer's service representatives to calibrate all instrumentation provided. All calibration shall be performed in the presence of the Owner and the Engineer. The calibration of each instrument shall be performed after the instrument installation certificate has been issued.
- B. Each manufacturer's representative shall issue a calibration certificate to the Owner and the Engineer for each instrument certifying that the instrument has been calibrated and is ready to be placed into service. The calibration certificates shall indicate the calibrated range or setpoint for each instrument.

3.03 TRAINING

- A. Provide four (4) hours of training on the instrumentation provided.

- B. All training shall be performed by a representative from the manufacturer and shall be specific to the instruments provided. Training shall include theory of operation, maintenance requirements, calibration methods and function of instrument in the Process Control System.

END OF SECTION 16920

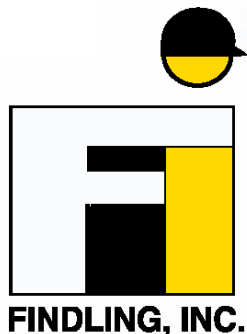
APPENDIX A
GEOTECHNICAL ENGINEERING REPORT

GEOTECHNICAL INVESTIGATION REPORT
FOR
TOWN OF EMMITSBURG WATER TREATMENT PLANT
NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND
Findling Project No.: 21-1055

PREPARED FOR:

RK&K
700 EAST PRATT STREET, SUITE 500
BALTIMORE, MARYLAND 21202

December 1, 2021



Findling Inc.

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December 1, 2021

RK&K
700 East Pratt Street, Suite 500
Baltimore, Maryland 21202

Attention: Mr. John Moore, P.E.
Director, Water

Re: Geotechnical Investigation Report
Town of Emmitsburg Water Treatment Plant New Clarifier
8585 Crystal Fountain Road, Emmitsburg, Maryland
Findling Project No.: 21-1055

Dear Mr. Moore:

Findling, Inc. is pleased to submit this report containing the results of our geotechnical investigation for the Town of Emmitsburg Water Treatment Plant New Clarifier located at 8585 Crystal Fountain Road, Emmitsburg, Maryland. The work described within this report was performed in accordance with our Proposal No. 21093, dated May 19, 2021.

We wish to advise you that we will store the soil samples obtained from the soil test borings for a period of thirty (30) days from the date of this report, during which time the samples will be available for inspection. After that time, they will be discarded unless other disposition is requested.

We appreciate the opportunity to be of service to you during the design phase of this project. During the continuation of the design phase and the construction phase, we would like to provide our geotechnical analysis, design and review services, testing and inspections services, etc. so as to verify the assumptions made on both the subsurface conditions and the geotechnical design parameters. Should you have any questions or if we can be any further help to the project team, please call us.

Sincerely,

FINDLING, INC.

Amsalu Birhan, Ph.D., P.E.
Senior Geotechnical Engineer

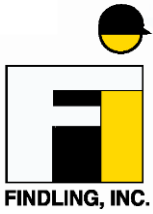
M. Surendra
M. Suri Surendra, Ph.D., P.E.
Chief Engineer





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Figures(6 Pages)

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Seismic Site Classification (2 Pages)

Boring Logs (2 Pages)



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EXECUTIVE SUMMARY

A brief summary of the important geotechnical findings and recommendations contained within this report are provided below. The executive summary is not all inclusive and the entire report must be read for the proper use of this report.

Proposed Construction:
(Section 1.1)

It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. We understand that the building will house two 8 ft. diameter circular flocculation tanks, and two 150-GPM DAFs (Dissolved Air Flotation).

Subsurface Conditions:
(Section 3.0)

The subsurface explorations indicated that the site is underlain by a surface layer of Man-Placed Fill ($7.5\pm$ to $9\pm$ ft. thick), which in turn is underlain by the Residual soils to depths of 20 to 30 ft. below the ground surface (i.e., to EL + $792\pm$ to EL + $806\pm$). Disintegrated rock was encountered to the refusal depth for B-1 at 21 ft. below the ground surface, and to the bottom depth of 36.5 ft. below the ground surface for B-2.

Groundwater:
(Section 3.3)

The groundwater depths vary from 1.1 ft. to 5 ft. below the existing ground surface (i.e., elevations from EL + $817\pm$ to EL + $824\pm$). It should be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity.

Seismic Site Class:
(Section 4.0)

The site is considered a Site Class D as per IBC 2015.

Foundation System:
(Section 5.0)

Spread foundations installed as discussed in this report are recommended.

Floor Slab:
(Section 6.0)

The floor slab subgrades are expected to consist of existing fill soils or newly placed compacted structural fill. Prior to placement of the floor slabs, the suitability of the slab subgrades should be determined by proofrolling under the supervision of a Geotechnical Engineer.



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The slab on grade can be designed using a modulus of subgrade reaction (k) of 100 pci.

Earthwork:
(Section 7.0)

Excavation of this site is expected to be performed using conventional earthmoving equipment. However, cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.

The visual classification and the laboratory tests conducted on the on-site fill materials indicated that the existing fill soils classify predominantly as Clayey SAND (SC) and Sandy SILTS (ML). These soils can be reused as site and structural backfill materials. Boulders and cobbles may be encountered in the site fill soils. This may require screening of soils. Boulders and cobbles are encountered in the existing fills soils, and the amount of required fill material for the project may not be that significant, and hence imported fill soils may be preferred.

At the time of our field investigation, groundwater was encountered within 5 ft. below existing grade. Therefore, dewatering during construction is generally anticipated. However, depending on the seasonal variations, water may not be encountered in shallow excavations. Therefore, provisions should be made in the project specifications for dewatering. Based on the observation from the test borings, rock excavation is not expected.

**Construction
Considerations:**
(Section 7.0)

The area of proposed building site is currently a wooded area, with scattered boulders and large stones. Cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders as discussed in Section 7.5.

This report is based on information available to us on the proposed construction at the time of writing the report. If the project characteristics are changed from those indicated herein, our recommendations may require some modifications. Please advise us of any changes in the proposed construction. The report is prepared in accordance with contemporary geotechnical engineering practices and Findling makes no warranties, either expressed or implied, as to the professional services provided under the terms of our agreement and included in this report. In addition, it is



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recommended that the following statement be included in the project specification: "The geotechnical report has been prepared for this project by Findling, Inc. only for design purposes and may not be sufficient to prepare an accurate bid for construction. The report shall be used by the prospective bidders and/or contractors for informational purposes only."



GEOTECHNICAL INVESTIGATION REPORT

Town of Emmitsburg Water Treatment Plant New Clarifier 8585 Crystal Fountain Road, Emmitsburg, Maryland Findling Project No.: 21-1055

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the Town of Emmitsburg Water Treatment Plant New Clarifier project located at 8585 Crystal Fountain Road, Emmitsburg, Maryland (see Figure 1: Site Vicinity Map, in the Appendix). This work was performed for RK&K pursuant to our Proposal No. 21093, dated May 19, 2021.

1.1 Project Description

It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. We understand that the building will house two 8 ft. diameter circular flocculation tanks, and two 150-GPM DAFs (Dissolved Air Flotation). A holding tank and a valve vault are also planned as shown in Figure 2: Project Location Plan, which is included in the Appendix.

1.2 Project Site Condition

The project site is located very close to the Hampton Valley Road. It is currently a wooded area, with scattered boulders and large stones. The existing ground surface elevations gently grades down going North. In the proposed building area, the existing ground surface slopes down from EL + 830 \pm to EL + 822 \pm (See Figure 2).

1.3 Purpose and Scope

The purpose of this study was to prepare a geotechnical report containing geotechnical related design and construction considerations for the proposed project. This report contains recommendations that pertain to the construction activities associated with the new building for the clarifier at the site. The report is based on the evaluation of two test borings performed on the project site, available geologic data and our experience in the area.

Two building borings (B-1 and B-2) were drilled at the site. The locations of these test borings are shown on the Boring Location Plan included as Figure 4 in the Appendix. The test borings were drilled to depths of 21 ft. to 36.5 ft. below the existing grade. The scope also included conducting laboratory tests in order to classify and establish engineering properties of the underlying materials.



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2.0 SUBSURFACE EXPLORATION

2.1 Utility Clearance

Prior to the drilling operation, the public utilities were marked and cleared by “Miss Utility”. The area of proposed borings was scanned for existing underground utility lines and the lines that were detected were marked. The boring locations were then offset from the detected underground utility lines.

2.2 Field Investigation

The subsurface investigation was performed on October 6 and October 7, 2021. Two building borings (B-1 and B-2) were drilled at the site. The boring locations were selected by RK&K and staked by Findling, Inc. as shown on Figure 4: Boring Location Plan, which is included in the Appendix. The borings were drilled using a CME Truck 45 drill rig (with automatic hammer to obtain SPT samples). The depth of the borings ranges from 21 ft. to 36.5 ft. below the existing grade. The test borings were monitored for groundwater level during the drilling operations and one of the test borings after 24 hrs.

2.3 Soil Test Borings

The borings were advanced using hollow-stem augers (3-¼ inch I.D. HSA) and soil samples were recovered from the borings at selected intervals by driving a 1-3/8-inch ID (2-inch OD) split-spoon sampler in accordance with ASTM D-1586 specifications. The sampler was first seated about 6 inches to penetrate through the loose cuttings and then driven an additional 1 foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler 1 foot after the initial 6 inches is typically designated as the Standard Penetration Test resistance (N) value. The penetration resistance is an index of the soil’s strength, density and behavior under applied loads.

The test borings were backfilled with auger soil cuttings upon completion of drilling. Soils obtained from the sampling device were sealed in glass sample jars and transported to our soils testing laboratory. The recovered soil samples were identified by a Geotechnical Engineer using visual examination and manual tests in general accordance with techniques outlined in ASTM D-2488 and the Unified Soil Classification System (USCS), which is adopted by ASTM D-2487 for classification and identification of soils for general engineering purpose. A description of the soils and conditions encountered at each test boring location is presented on the Boring Logs included in the Appendix. The



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USCS classifications indicated in the logs are based on the ASTM D-2488, and should be considered approximate.

2.4 Laboratory Testing

Soil samples recovered from the field explorations were transported to our soil testing laboratory and selected soil samples were tested to determine additional engineering characteristics of the existing on-site soils. The laboratory tests that were conducted on selected soil samples included natural moisture content test (ASTM D2216), Atterberg limits (ASTM D4318), sieve analysis (ASTM D422), Moisture vs. Density relations (ASTM D698/1557) and California Bearing Ratio (ASTM D1883). All tests were performed in general accordance with the ASTM procedures. The results of these laboratory tests are included in the Appendix, along with a results summary table (Table 2.1).

Note that the soil samples obtained from the soil test borings and which were not used for the soil laboratory testing will be stored for a period of thirty (30) days from the date of this report, during which time they will be available for inspection. After that time, the samples will be discarded unless other disposition is requested.



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3.0 SUBSURFACE CONDITIONS

3.1 Stratification

The Boring Logs included in the Appendix contain details related to the subsurface conditions encountered at the various boring locations. It should be noted that stratification lines shown on the Boring Logs represent approximate transitions between material types. Strata changes can occur gradually or at different levels than those shown on the Boring Logs and depict conditions at the indicated locations and depths at the time of our subsurface exploration program. Groundwater levels are variable and are influenced by the existing soil conditions, seasonal and climatic changes.

The test boring data, visual and laboratory classification of the sampled soils, and our knowledge of local geology was used to separate the soils into the following generalized strata to the depths investigated. The specific subsurface conditions relating to the proposed structures are discussed under foundations and general consideration sections of this report.

3.1.1 Stratum A: Man-Placed Fill

Man-Placed Fill was encountered in all of the test borings. The fill material was observed to consist of Sandy CLAY and Clayey SAND with varying percentages of gravel, cobbles and rock fragments. The fill appears to have been placed during past construction and grading activities at the site. The fill stratum extended to depths ranging from 7.5_± to 9_± ft. below existing grade (i.e., elevations of EL + 813_± to EL + 818.5_±). The penetration resistance in the fill indicated medium dense to very dense density with standard penetration resistance (SPT) N-values ranging from 18 blows per foot (BPF) to 40 BPF. Higher blow counts of up to 59 BPF were observed, which probably resulted from encountering gravels, boulders, rock fragments, and cobbles.

3.1.2 Stratum B: Residual Soils

Residual soils were encountered below the Man-Placed Fill soils to depths of 20 ft. to 30 ft. below the ground surface (i.e., to EL + 792_± to EL + 806_±). The residual soils were predominantly classified as Clayey SAND (SC). Silty Poorly Graded SAND (SP-SM) were also encountered. The density of these soils varied significantly due to degree of weathering within the profile, with SPT values of 7 to 21 BPF.



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3.1.3 Stratum E: Disintegrated Rock

The disintegrated rock is defined as residual material with SPT values of greater than 60 blows per foot. This rock like material was encountered to the refusal depth for B-1 at 21 ft. below the ground surface, and to the bottom depth of 36.5 ft. below the ground surface for B-2.

3.1.4 Stratum F: Bedrock

The bedrock surface was defined as where the SPT blow count exceeded 100/2 inches. and was encountered at a depth of 21 ft. below the ground surface on test boring B-1.

3.2 Site Geology

The site is located within the Blue Ridge Physiographic Province of Maryland, specifically in Northern Blue Ridge Section, Catoctin-South Mountain Region. The lithologies are quartzite, sandstone, siltstone, graywacke, phyllite, or shale, *Geologic Structures of large*, north-plunging anticline overturned to the west; several major faults, including Triassic Border Fault marking the eastern boundary. Available general geological information suggests that the soils below the site consist of the Catoctin Formation consisting of main rock type metabasalt (PCcb). Several textural varieties of greenish gray, and grayish metabasalt are included, as shown on Figure 3, in the Appendix.

Based on the test borings a site-specific geology suggests that underlying the Man-Placed Fill (7.5± to 9± ft. deep) is a layer of Residual soil profile, predominantly classified as Clayey SAND (SC). Disintegrated rock and Bedrock were encountered below the Residual soils.

3.3 Groundwater Conditions

Groundwater levels were noted in the borings during drilling operations, immediately and after 24 hrs. of completion of drilling. Groundwater was observed on the drill rods and samples during drilling operations in most of the test borings. Groundwater readings at the end of drilling and after the HSA auger is pulled out were noted. One of the test borings was left open for the 24 hrs. stabilized groundwater reading. The groundwater depth and the corresponding groundwater reading time were recorded. These are included in the boring logs and are summarized in Table 3.1, which are included in the Appendix. The groundwater depths vary from 1.1 ft. to 5 ft. (i.e., elevations from EL + 817± to EL + 824.9±. It should be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity. In addition, the highest

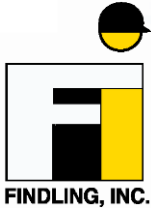


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groundwater observations are normally encountered in late winter and early spring. Fluctuations of water table or the development of a perched water table at shallower depths above less permeable layers (within the Fill stratum) may occur depending upon the amount of precipitation and water runoff to the site from higher elevations, during wet season.



4.0 SEISMIC SITE CLASS

The seismic site class and design parameters are provided below for this project site per 2015 International Building Code (IBC). The U.S. Geological Survey Seismic Design Maps-Earthquake Hazards Program is used to get mapped acceleration parameters for the site with coordinates 39.696872°N, 77.386902°W. Table 4-1 has values of Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for Site Class B and 5% of Critical Damping. These values incorporate a target risk of structural collapse equal to 1% in 50 years.

Table 4-1: Mapped Spectral Response Acceleration Values for Soil Factors of 1.0		
Description	Period (Sec)	S _a
Mapped Short Period Spectral Response Acceleration (S_S)	0.2	0.125 g
Mapped 1-Second Period Spectral Response Acceleration (S_1)	1.0	0.052 g

The Seismic Site Classification influences the determination of the Site Coefficients, the Design Spectral Response Acceleration values, and ultimately the Seismic Design Category. Note that the Seismic Site Classification is based on the characteristics of the upper 100-ft. of soils and rock below the site. The IBC requires the use of Standard Penetration Test Resistance (test borings), Shear Wave Velocity (geophysical methods), and/or Undrained Shear Strength (soil laboratory testing) to categorize the Seismic Site Classification.

Based on the explored soil properties in the test borings performed for this site, the Seismic Site Classification was determined to be Site Class D. For Site Class D and mapped spectral acceleration values obtained above, calculated Site Coefficient values and the Maximum and Design Spectral Response Acceleration values as per IBC Section 1613.5 are given in Table 4-2.

Table 4-2: Site Class, Site Coefficients, and Design Spectral Response Acceleration	
Site Class	D
Soil Profile	Stiff Soil Profile
Site Coefficient (F_a)	1.6
Site Coefficient (F_v)	2.4
Short Period, Maximum Spectral Response Acceleration (S_{MS})	0.200 g
1 Second Period, Maximum Spectral Response Acceleration (S_{M1})	0.124 g
Short Period, Design Spectral Response Acceleration (S_{DS})	0.134 g
1 Second Period, Design Spectral Response Acceleration (S_{D1})	0.083 g



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Design spectral response acceleration values are used with occupancy category (IBC 2015, Table 1604.5) of the building or structure to determine the Seismic Design Category. Additional seismic data can be obtained on the result summary provided in the Appendix.



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5.0 FOUNDATION DESIGN CONSIDERATIONS

It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. The project site is located very close to the Hampton Valley Road. It is currently a wooded area, with scattered boulders and large stones. The existing ground surface elevations gently grades down going North. In the proposed building area, the existing ground surface slopes down from EL + 830 \pm to EL + 822 \pm (See Figure 2).

At the time of writing this report we do not have the foundation loads. We assumed a maximum column load of 100 kips per column and a maximum wall load of 6 kips per ft. to prepare the foundation recommendation presented in this report. We also assumed that the finish floor elevation of the building for the clarifier is at the existing ground surface elevation level.

The evaluations and recommendations presented in the subsequent sections of this report were based on our understanding of the proposed construction and on the general subsurface conditions indicated by the subsurface exploration program. Should the project characteristics be altered significantly from those discussed or should different subsurface conditions be encountered during construction, our office should be consulted, as the evaluations and recommendations presented herein may no longer be valid.

Shallow spread footings as discussed below are recommended for the support of the building structure.

5.1 Spread Footings founded on Natural soils or Compacted Soil Fill

With the ground finished floor elevation of the proposed structures at approximately the existing ground surface elevation, the foundation subgrade for spread footings is expected to be on the existing fill soils (i.e., Stratum A soils). The SPT blow counts observed on the fill soils appear to be good for the support of the spread footings at a footing depth of greater than or equal to 30 inches. The exposed foundation subgrades should be inspected by a Geotechnical Engineer using a dynamic cone penetrometer (DCP), or other methods to verify that the subgrade is capable of providing the recommended design bearing capacity to support the foundations of the proposed structure. If soft soils or otherwise unsuitable soils (such as wet soil or soils containing deleterious components) are encountered, then those soils should be undercut to a suitable subgrade to provide an adequate bearing subgrade (the maximum undercutting depths of 3 ft. below the proposed foundation subgrades) to establish a firm foundation subgrade. The undercut foundation subgrade can then be reestablished using compacted fill or lean concrete. Unit rates and



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an allowance should be established for undercutting of unsuitable soils. The undercut and backfill should be performed in accordance with the recommendations contained in Section 7.2. A design net soil bearing pressure of 2.0 ksf is recommended for footings founded on the natural residual soils or on new compacted fill, when installed as described herein.

5.2 Spread Footings - General

All exterior shallow spread footings (and footings in un-heated areas) should be located at a minimum depth of 30 inches below exterior finish grade for protection against frost penetration. Interior footings in heated areas can be located at nominal depths below the floor slab. In order to preclude punching type bearing capacity failures, wall footings shall have minimum widths of 24 inches, and any column footings shall have minimum widths of 36 inches. A maximum slope of 2H: 1V should be maintained between the bottom edges of adjacent footings where foundation grades are at different levels. It is also recommended that wall footings be provided with adequate reinforcement such that sufficient bending strength is available to span across isolated pockets of soft or loose soils (that may go undetected during construction).

The lateral load resistance for the spread foundation can be derived from the passive pressure on the side of footings (below the frost depth of 30 inches for exterior footings and on the total side area on interior footings), and the base friction. The passive earth pressure coefficient of $k_p = 2.0$ and coefficient of the base friction of 0.35 can be utilized.

5.3 Settlement

Based on the boring data and the anticipated structural loads, we estimate that total settlements for the foundations should not exceed one inch with differential settlement expected to be less than half the total settlement. The magnitude of differential settlements will be influenced by the distribution of loads and the variability of underlying materials. These settlement values are based on our engineering experience of the soil and the anticipated structural loading and are to guide the structural engineer with his design. Quality control during construction is considered to be extreme importance to ensure that subsequent settlements, following the construction process, are kept to a minimum.



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6.0 FLOOR SLAB SUPPORT CONSIDERATIONS

6.1 Floor Slab Support

Assuming that the finished floor elevations of the building is at the existing ground surface level. We expect that slabs will be installed essentially at the existing grade. As such the slabs will be supported by existing fill soils or structural fill soils. Prior to placement of the floor slabs, the suitability of the slab subgrades should be determined by proofrolling. Proofrolling should be performed using the heaviest construction equipment, for example a loaded 20-ton dump truck or equivalent (at least a 3,000-lb. walk-behind roller), which can access the area and under the observation of a Geotechnical Engineer. Any additional loose or unsuitable soils found during proofrolling should be removed and replaced with compacted fill. Compacted structural fills under the slabs should be placed following the recommendations contained under Section 7.2 of this report.

Floor slabs on grade may be designed using a modulus of subgrade reaction, k equal to 100 pci. Groundwater is estimated to be within 5 ft. below the proposed finished floor grades and a special under-floor subdrainage system designed to collect groundwater around the perimeter walls and below the floor slab of the structure is required to maintain groundwater below the floor level. The proposed subdrainage system is discussed below.

A minimum 4-inch-thick granular drainage layer containing less than 5 percent by dry weight passing the No. 200 sieve size is recommended to be placed directly beneath the floor slab. In addition, a vapor barrier should be placed beneath the floor slab as discussed below.

6.2 Subdrainage System

The building structure will have a finished floor elevation approximately at the existing grade and the groundwater was encountered within 5 ft. depth below the existing grade at the time of our ground investigation. It is to be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity. The highest groundwater observations are normally encountered in late winter and early spring. Fluctuations of water table or the development of a perched water table at shallower depths above less permeable layers may occur depending upon the amount of precipitation and water runoff to the site, during wet season.



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A subdrainage system designed to collect groundwater below the floor slab of the structure is required to maintain groundwater below the floor level. A typical subdrainage system sketch (Figure 6), intended to graphically depict our recommendations, is included in the Appendix. General requirements of the drainage system are outlined below. The use of both a waterproofing system and underfloor subdrainage system is recommended.

Underslab drain lines should consist of a minimum of 4-inch diameter, perforated, corrugated polyethylene tubing according to ASTM F405 with a maximum slot width of ¼ inch. Tubing should be placed with slots down using straight section and standard available connections. It should be noted that inspection of the subdrainage system should occur and the system may require flushing at periodic intervals if soil particles infiltrate the pipes. Clean out access should be installed at all sharp bends and at approximately every 100 ft. for straight runs to allow flushing of the system. A grit collection chamber should be installed upstream of the sump to reduce the amount of granular materials reaching the pumps.

Drainage lines may be placed without a slope, with inverts at least 6 inches below final floor grades. The subdrainage system may drain by gravity to daylight or to a storm drainage line provided that provisions are made to avoid back pressures from acting in the event storm sewers flow full. Preferably, underslab drain lines should be sloped at a minimum of 1% and be underlain by a minimum of 6 inches of bedding stone, with a minimum of 8 inches of cover. A maximum spacing of 20 ft. on center between the lateral subdrainage lines below the floor slab should be maintained. We recommend that the perimeter and under-slab drain system for the proposed structure be designed to flow to at least one permanent sump at a location to be determined by the design team.

A uniformly graded stone filter (washed gravel) or clean sand material having a gradation compatible with the size of the opening utilized in the drain lines and the surrounding soils to be retained, should be placed around the perforated drainage line. This stone filter should have a thickness of at least 6 inches at the bottom and sides and 2 inches of cover. The stone filter should have uniform gradation and AASHTO M43, Size No. 67 or 7 is recommended. The stone drainage filter should also be wrapped in geotextile. The geotextile (Mirafi® 140N or equivalent) shall have an apparent opening size of greater than an equivalent opening size of the No. 70 sieve. A minimum of 3-inch-thick stone drainage filter should be provided between the drain pipe and the geotextile wrap.

The use of a waterproofing membrane such as Paraseal®, which is a Bentonite HPDE composite (15 mils of HDPE and expandable, granular bentonite), or equivalent is recommended directly below the floor slab if a subdrainage system is installed. This



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membrane can be placed directly on the washed gravel drainage layer. All penetration and seals should be performed in accordance with the manufacturer's recommendations. This waterproofing membrane is to provide a seal that will minimize moisture vapor transmission through the floor slab. Alternatively, a "true" vapor barrier similar to 15-mils Stego Wrap Vapor Barrier can be used.

The subdrainage system should be placed shortly before slab construction to minimize damage to the piping from construction operations.

In most projects, there exists a significant lag time between the initial grading and the placement of the floor slab. Environmental conditions and construction traffic often disturb the soil subgrade during this lag time. The contractor should make provisions in the construction specifications for the restoration of the subgrade to a stable condition prior to the placement of the floor slab at no additional cost to the owner.



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7.0 GENERAL GRADING CONSIDERATIONS

7.1 Site Preparation

Subgrade Preparation

Site preparation will consist of removal of any topsoil, etc. in the area of the proposed structures, usually extending horizontally up to 5 ft. beyond the footprint peripheral line of the structures. Some existing utilities that may interfere with the proposed grading scheme should be removed/relocated and the utility trenches should be backfilled with compacted select fill. Minimal cuts and fills are anticipated.

Inspection of Subgrades and Undercutting:

Following the excavation to establish the proposed subgrade level of the structures, the exposed subgrade should be inspected and tested for adequate support conditions. As discussed previously, undercutting of the soft or loose soils may be required in order to establish the suitable bearing surface.

Exposed subgrades must be sloped to facilitate surface runoff away from construction area and to prevent ponding of surface water. If ponding of surface water does occur, it should be removed by pumping, ditching or as otherwise directed by the inspecting geotechnical engineer. During periods of anticipated inclement weather, exposed surfaces shall be graded and sealed to preclude infiltration of surface water. Subgrades, which become disturbed due to inclement weather or construction traffic and require over-excavation, should be reworked at no additional cost to the project.

Proofrolling:

Following removal of topsoil and any unsuitable existing fill materials, the subgrade (for slabs, pavements, etc.) should be thoroughly proofrolled under the observation of a qualified Geotechnical Engineer. Proofrolling should be performed using a heavily loaded, rubber-tired piece of construction equipment, such as a fully loaded 20-ton tandem-axle dump truck or equivalent (at least a 3,000-lb. walk-behind roller), to detect any soft, loose or otherwise unstable deposits. The areas subject to proofrolling should be traversed by the equipment in two orthogonal directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. Any unstable soils, manifesting significant pumping or rutting, should be removed and replaced with structural compacted fill. The approved subgrade should then be scarified and moisture conditioned to within 3 percent of the soil's optimum moisture content and re-compacted to 95% per ASTM D-1557 prior to placement of any new fill.



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Excavations and low areas can then be raised to the proposed grades with structural compacted fill that is selected, placed and compacted in accordance with project specifications. Site preparation, placement and compaction of structural fill should be performed under engineering-controlled conditions in accordance with project specifications and approved by a qualified Geotechnical Engineer.

7.2 Fill Selection, Placement, and Compaction

All materials to be used as fill or backfill should be inspected, tested and approved by the Geotechnical Engineer. Earthwork is recommended to take place in the warmer, drier months between May and October. The use of scarification and drying techniques, or additives such as quick lime, kiln dust, fly ash, or Portland Cement may also be useful in expediting fill operations in inclement weather.

On-Site Materials:

The visual classification and the laboratory tests conducted on the on-site fill materials indicated that the existing fill soils classify predominantly as Clayey SAND (SC) and Sandy SILTS (ML). These soils can be reused as site and structural backfill materials. Boulders and cobbles may be encountered in the site fill soils. This may require screening of soils. Boulders and cobbles are encountered in the existing fills soils, and the amount of fill material required for the project may not be that significant, and hence imported fill soils may be preferred.

Borrow Material

Compacted structural fill and backfill for use below structures should consist of satisfactory soils classified as SM or better in accordance with the Unified Soil Classification System, ASTM D-2487. Soils meeting this requirement are classified as SM, SP, SW, GM, GP, GW and combinations of these groups. GC and SC materials may be utilized as compacted structural fill if they contain less than 35% passing the No. 200 sieve and a Plasticity Index (PI) of less than 15. Unsatisfactory soils are those classified as OL, OH, CH, CL, MH, and ML. The soils classified as CL, ML; and CH / MH with a maximum Liquid Limit of 60% and Plasticity Index of 30%, can be used as structural fills at depths greater than 4 ft. below pavement subgrades and within non-structural areas. In addition, these soils can be used as a fill for site grading.

Soils used for compacted fill should be free of unsuitable materials such as topsoil, debris and other organics, rubble, and rocks larger than 3 inches in diameter. Open graded



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materials, such as Gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric.

Fill Compaction:

Compacted structural fill should be placed in approximately horizontal layers, each layer having a loose thickness of not more than 8 inches. All structural fill should be compacted to 95% of the maximum dry density in accordance with ASTM D1557, Modified Proctor. The contractor should select appropriate compaction equipment to achieve the required compaction. Fill placement should commence at the toe of the proposed slopes and progress upwards as additional fill is placed in horizontal lifts.

Field moisture contents of the fill may have to be adjusted in order to obtain suitable degrees of compaction. It is anticipated that field moisture contents of fill materials will need to be controlled to the range of optimum moisture content, plus or minus 3 percent, if stable fills with adequate degrees of compaction are to be obtained.

We recommend that compacted structural fill be placed to at least 5 ft. beyond the edge of the building or pavement structure. All fill placement and compaction operations in critical areas (i.e., structural areas) should be monitored by an experienced Soils Inspector on a full-time basis to ensure that fill materials are being placed and compacted in compliance with the project specifications. Should any compaction problems develop during grading operations, the Geotechnical Engineer should be consulted for an evaluation of the problems. Findling, Inc. should be called on to inspect and document the fill compaction.

Fill Placement Considerations:

Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen or frost-heaved materials at the time of placement. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned. At the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils. Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year,



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if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils.

We recommend that the earthwork contractor have equipment on site for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

7.3 Construction Dewatering

At the time of our field investigation, groundwater was encountered within 5 ft. below existing grade. Therefore, dewatering during construction is generally anticipated. However, depending on the seasonal variations, water may not be encountered in shallow excavations. Therefore, provisions should be made in the project specifications for dewatering.

The on-site soils could lose their in-situ strength with an increase in moisture content. Therefore, adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation soils. All pavement or parking areas should be sloped away from the structure to prevent ponding of water around the structures and paved areas. The site drainage should also be such that the run-off onto adjacent properties is controlled properly.

7.4 Excavation Considerations

Excavation of this site is expected to be performed using conventional earthmoving equipment. However, cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.

If a depth of excavation will be greater than 5 feet for the foundation installation, temporary excavations should be sloped at an angle of 1.5H:1V or flatter, where possible. Excavations deeper than 5 feet will require lateral support if the excavations cannot be laid back on a slope of 1.5 horizontal: 1 vertical, in accordance with applicable OSHA regulations. The temporary support can consist of methods such as sheeting and shoring. The actual stability of the excavations should be evaluated by the contractor in accordance with OSHA and MOSHA regulations, and excavation supports system(s) will require design by a Professional Engineer.



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7.5 Boulders and Cobbles within the Fill Soils

The area of proposed building site is currently a wooded area, with scattered boulders and large stones. Cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.



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8.0 ENVIRONMENTAL CONSIDERATIONS

The scope of this work did not include an environmental investigation at the site. Health and Safety issues, if any, should be determined by others.

9.0 LIMITATIONS

This geotechnical study has been conducted in accordance with generally accepted geotechnical engineering practices. The geotechnical study report has been prepared to aid in the evaluation of the site for the proposed building project, in Emmitsburg, Maryland. It is intended for the exclusive use of RK&K for the design and construction of the proposed structure as described herein. This report includes both factual and interpreted information. It is considered that adequate recommendations have been provided to serve as a basis for design and preparation of plans and specifications. Additional recommendations can be provided as needed.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions in other areas will differ from those at the boring locations and the conditions may not be as anticipated by the designers. Additionally, the construction process may alter the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork and foundation construction to verify that the conditions anticipated in design actually exist in the field at the time of construction. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

These analyses and recommendations are based on information made available to us at the time of our investigation and the actual conditions encountered at the test boring locations at that time. General assumptions have been made that the limited exploratory test borings represent the site conditions in relation to the lateral extent and depths of the borings. It should be noted, however, that the actual subsurface conditions between the test boring locations might vary from the conditions indicated on the appended test boring logs. Should the actual conditions encountered during construction differ significantly from those indicated by the test boring logs, we should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary.



APPENDIX

Figures

- Figure 1: Site Vicinity Map (1 Page)
- Figure 2: Project Location Plan (1 Page)
- Figure 3: Site Geology (1 Page)
- Figure 4: Boring Location Plan (1 Page)
- Figure 5: Subsurface Profile (1 Page)
- Figure 6: Typical Subdrainage Detail (1 Page)

Tables

- Table 2.1: Summary of Laboratory Test Results (1 Page)
- Table 3.1: Summary of Boring Data (1 Page)

Laboratory Test Results

- Gradation Curves (6 Pages)
- Proctor Compaction Curve (1 Page)
- California Bearing Ratio (CBR) Curves (3 Pages)

Seismic Site Classification

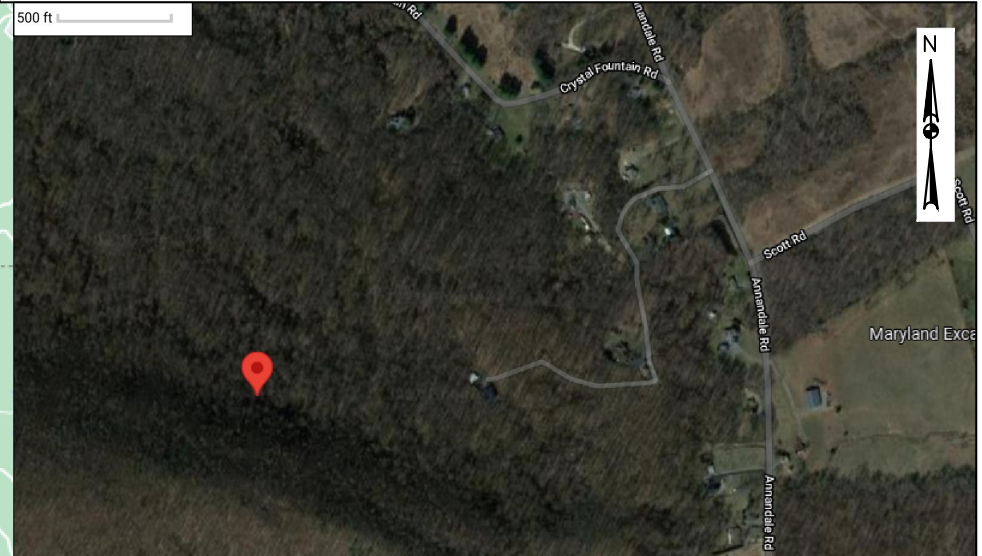
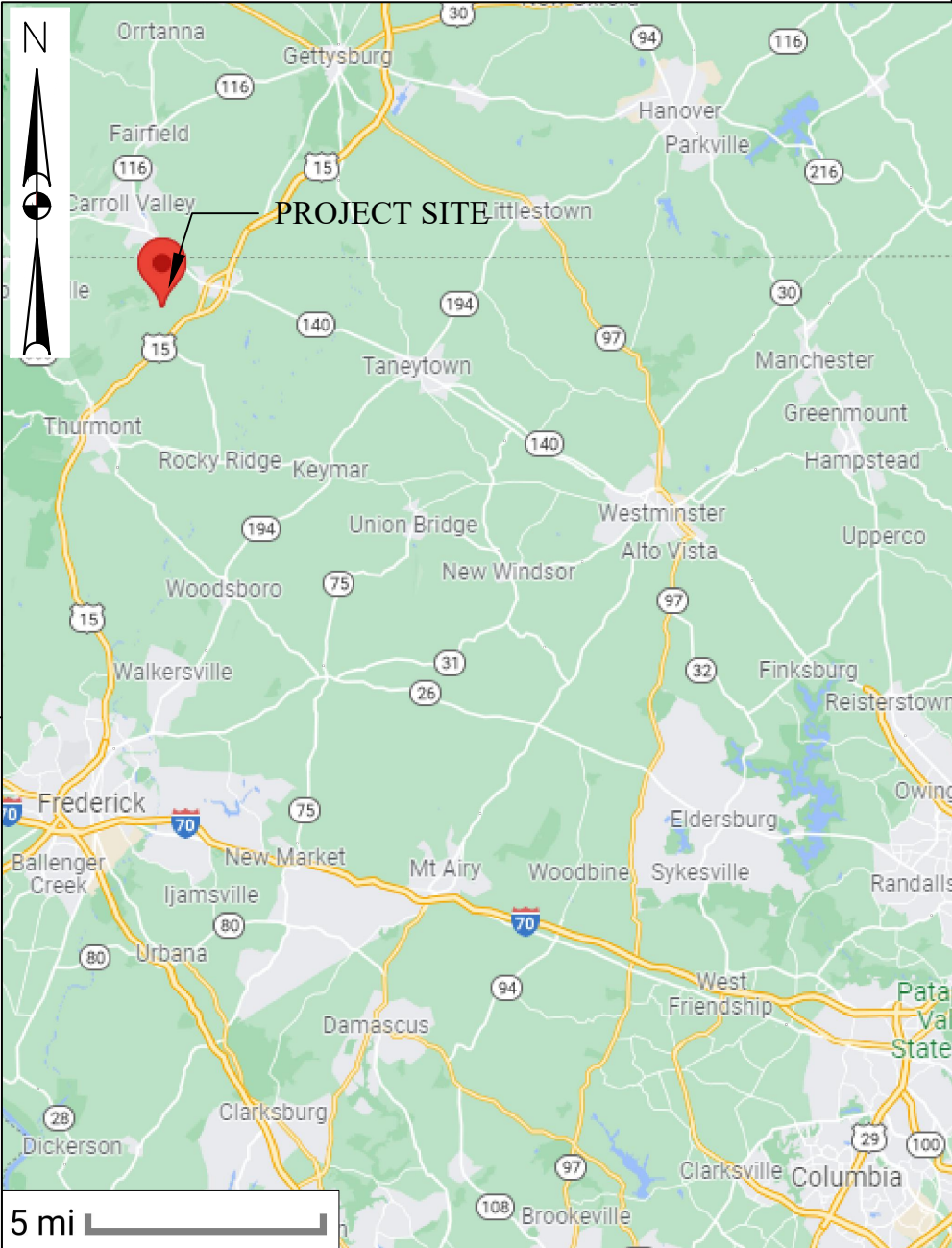
- Seismic Site Class and Design Parameters (2 Pages)

Boring Logs

- Boring Logs (2 Pages)

Figures

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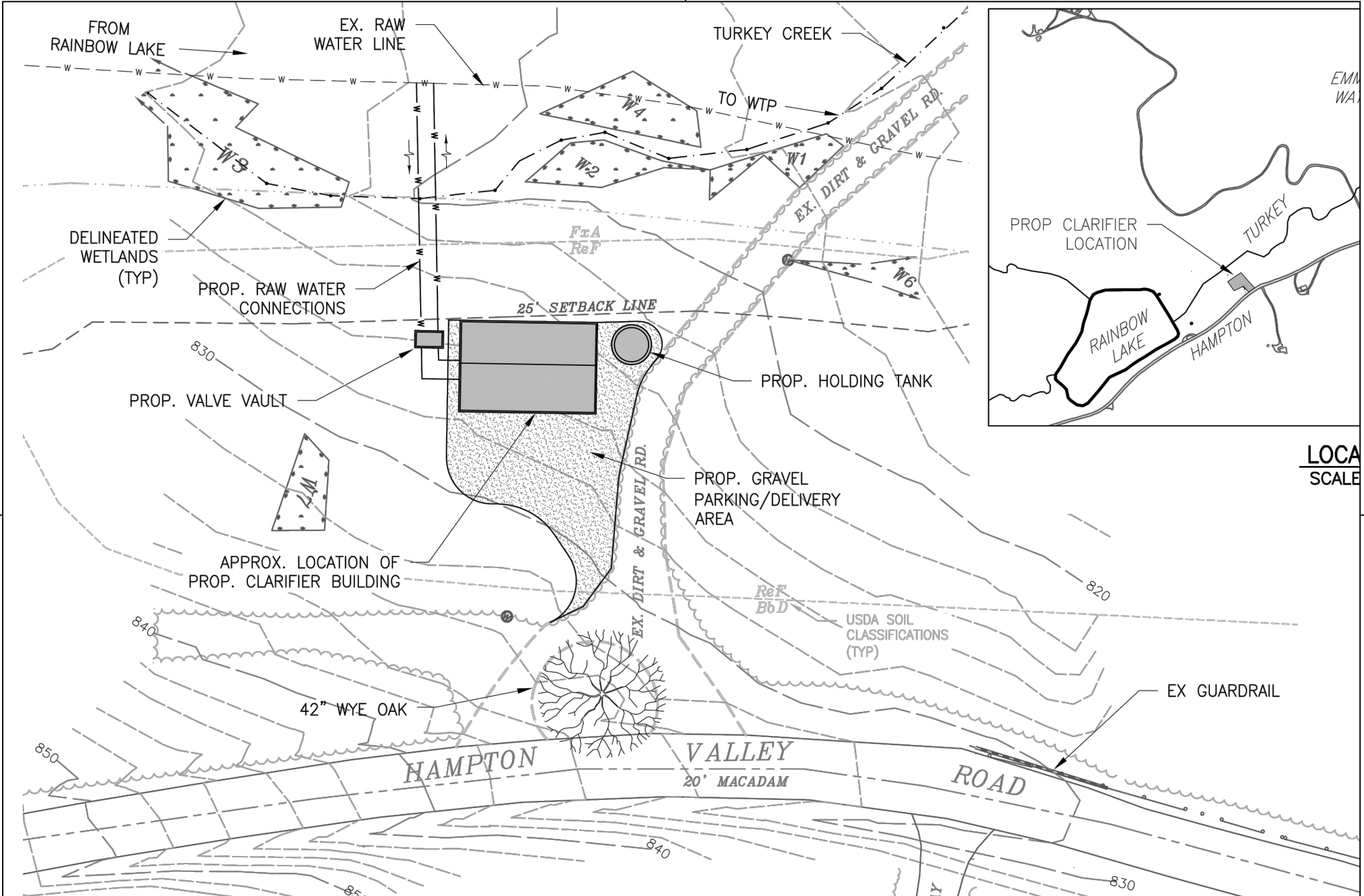



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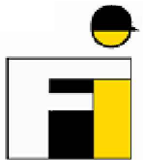
NOTE:
 FOR ILLUSTRATION PURPOSES ONLY.
 39.696872, -77.386902

SITE VICINITY MAP		
TOWN OF EMMITSBURG WATER TREATMENT PLANT—NEW CLARIFIER 8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND		
PROJECT NUMBER:	21-1055	REVIEWED BY: MSS
DATE:	NOVEMBER 2021	SCALE: NOT TO SCALE
		DRAWN BY: AB
		FIGURE: 1

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LOCAL SCALE



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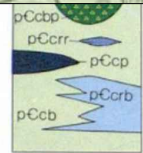
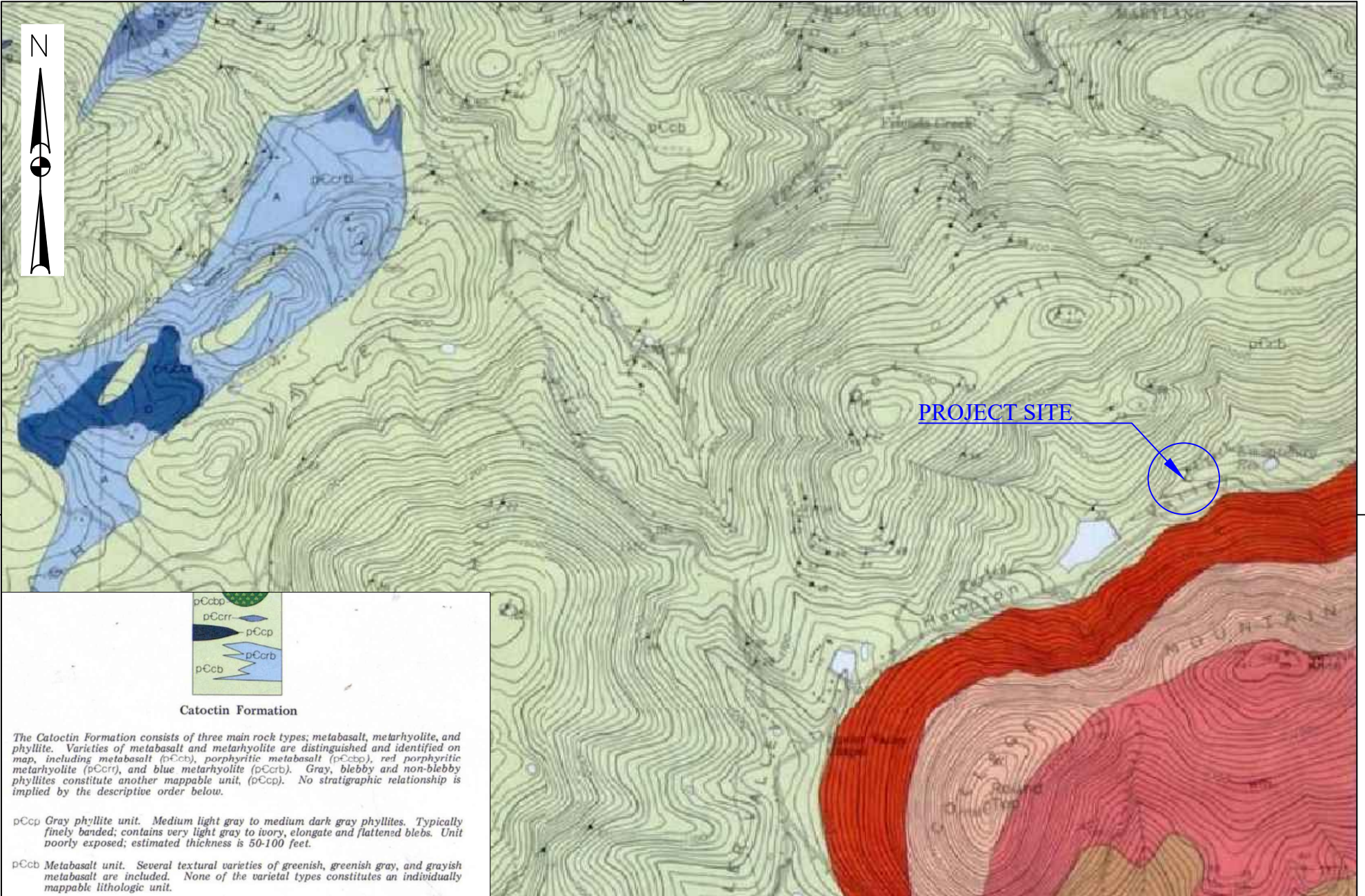
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BALTIMORE, MD 21215 • 410.367.1400

NOTE:
FOR ILLUSTRATION PURPOSES ONLY.
ADAPTED FROM DRAWING PROVIDED BY PBA/WBCM JV

PROJECT LOCATION PLAN

TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21-1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 2

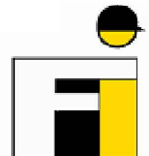


Catoclin Formation

The Catoclin Formation consists of three main rock types; metabasalt, metarhyolite, and phyllite. Varieties of metabasalt and metarhyolite are distinguished and identified on map, including metabasalt (pCcb), porphyritic metabasalt (pCcbp), red porphyritic metarhyolite (pCcr), and blue metarhyolite (pCrb). Gray, blebby and non-blebby phyllites constitute another mappable unit, (pCcp). No stratigraphic relationship is implied by the descriptive order below.

pCcp Gray phyllite unit. Medium light gray to medium dark gray phyllites. Typically finely banded; contains very light gray to ivory, elongate and flattened blebs. Unit poorly exposed; estimated thickness is 50-100 feet.

pCcb Metabasalt unit. Several textural varieties of greenish, greenish gray, and grayish metabasalt are included. None of the varietal types constitutes an individually mappable lithologic unit.

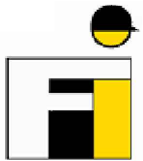
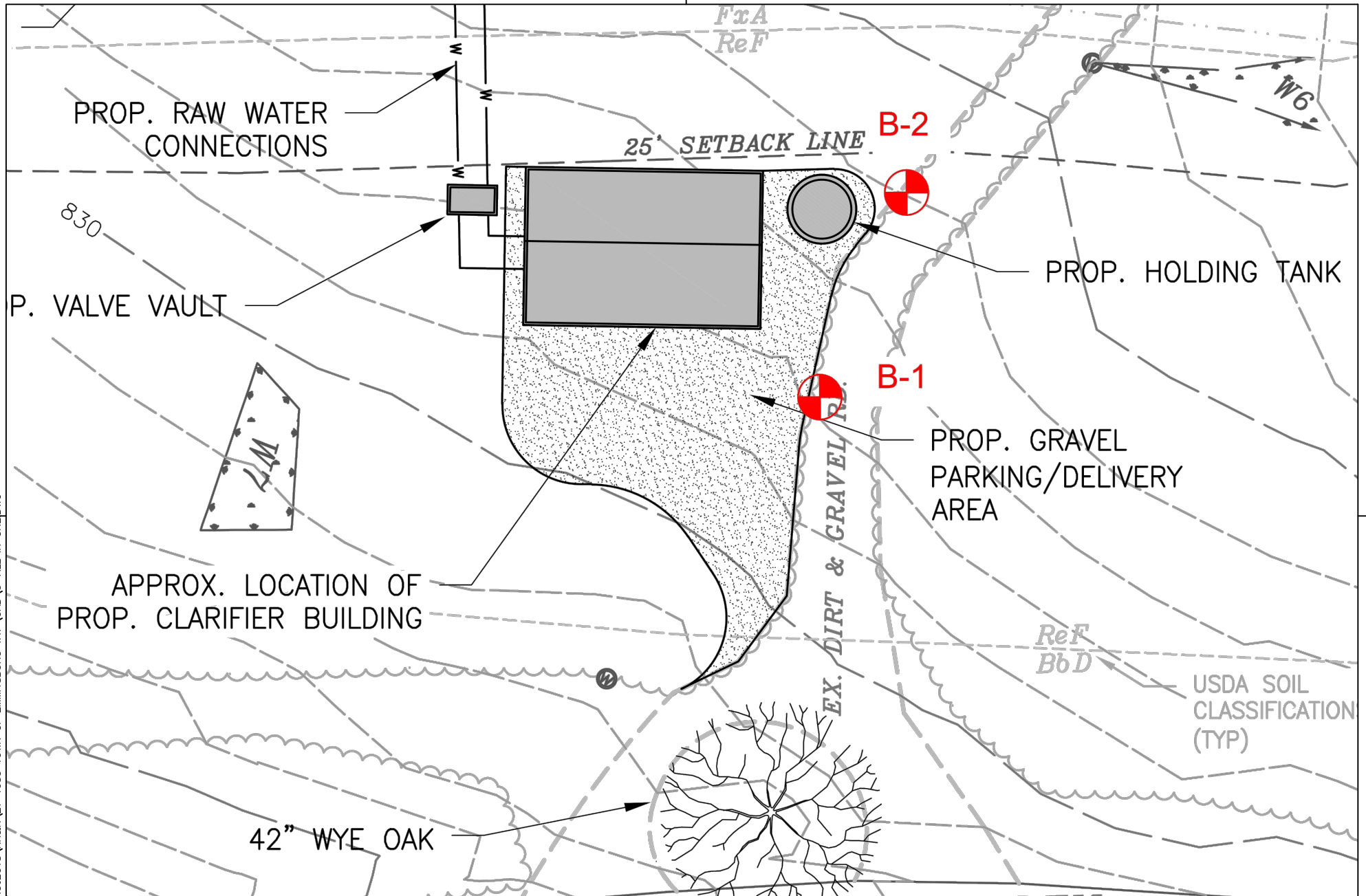


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NOTE:
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 39.696872, -77.386902
 SOURCE: STATE OF MARYLAND DEPARTMENT OF NATURAL RESOURCES
 MARYLAND GEOLOGICAL SURVEY
 GEOLOGICAL MAP OF HOWARD COUNTY

SITE GEOLOGY		
TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER 8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND		
PROJECT NUMBER:	21-1055	REVIEWED BY: MSS
DATE:	NOVEMBER 2021	DRAWN BY: AB
		SCALE: NOT TO SCALE
		FIGURE: 3

FILE =>P:\FINDING\PROJECTS\VR&K\21-1055 TOWN OF EMMITSBURG WTP\CAD\0-ALL IN ONE.DWG

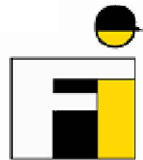
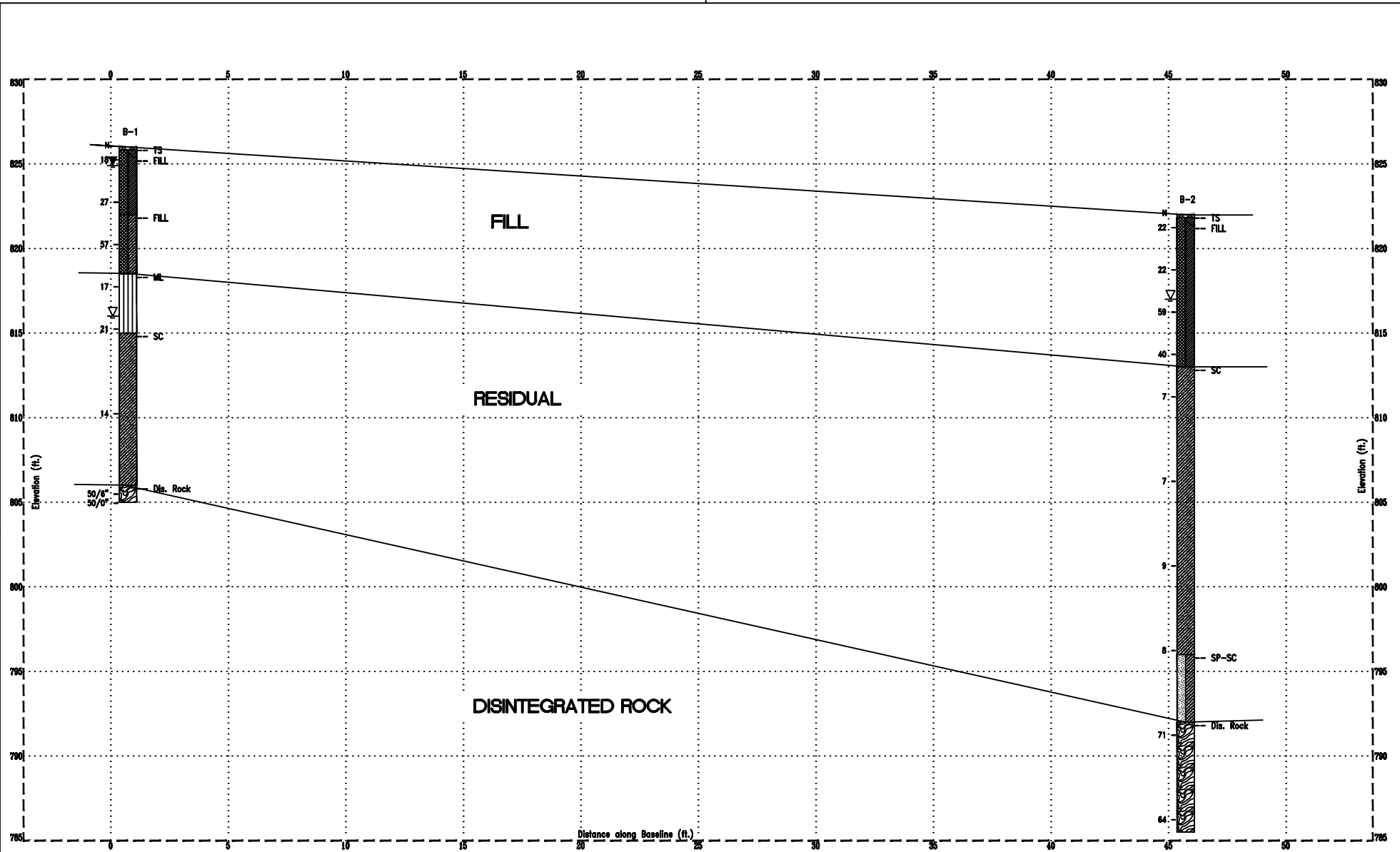


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BORING LOCATION PLAN		
TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER		
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND		
PROJECT NUMBER:	REVIEWED BY:	SCALE:
21-1055	MSS	NOT TO SCALE
DATE:	DRAWN BY:	FIGURE:
NOVEMBER 2021	AB	4

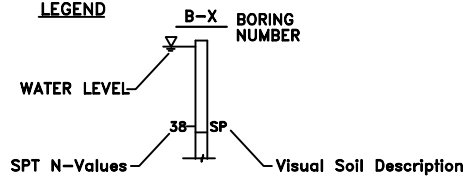
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LEGEND



SUBSURFACE PROFILE

TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21-1055

REVIEWED BY: MSS

SCALE: NOT TO SCALE

DATE: NOVEMBER 2021

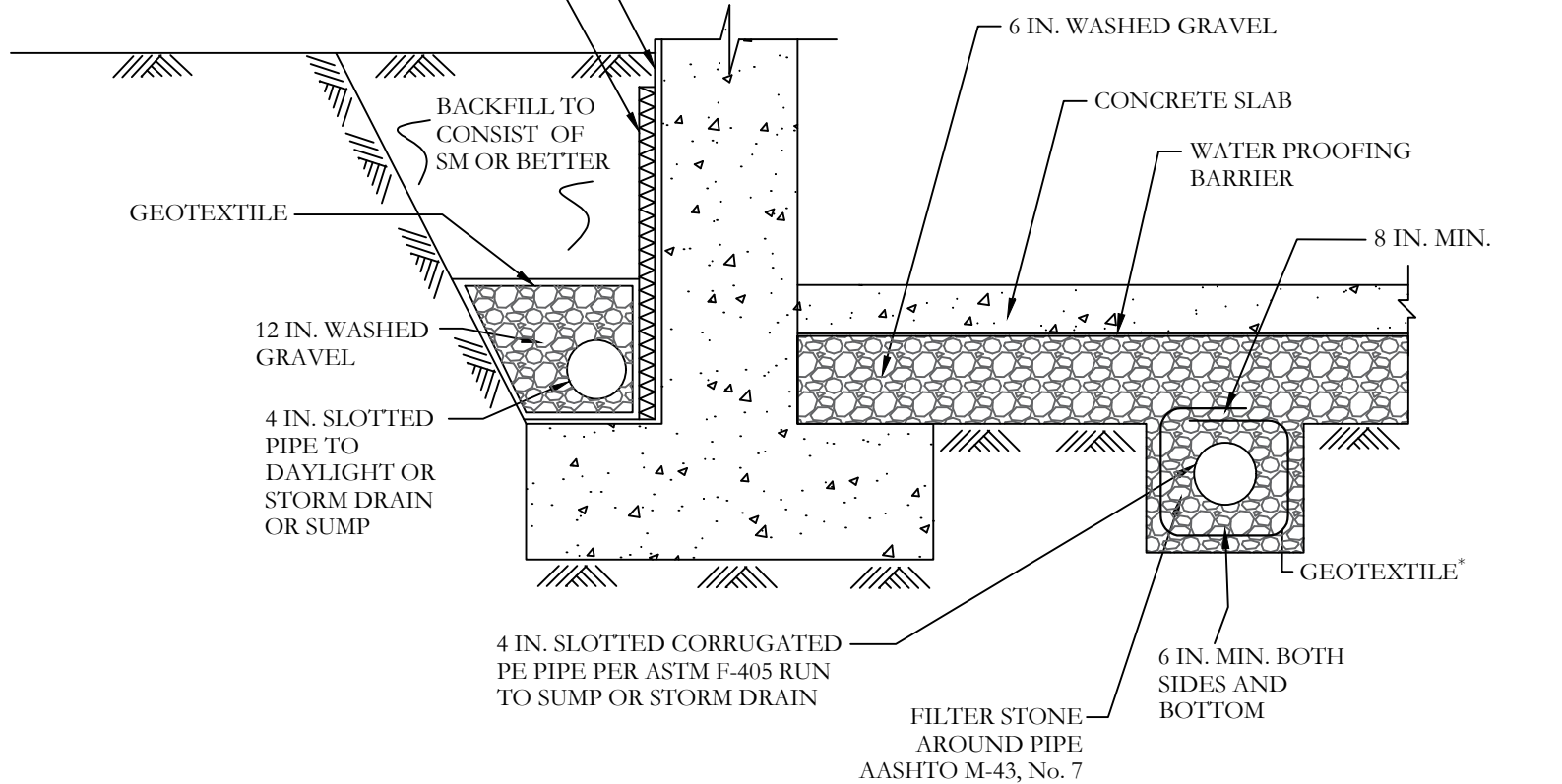
DRAWN BY: AB

FIGURE: 5 (a)
SECTION A-A'

FILE =>P:\FINDLING\PROJECTS\RK&K\21-1055 TOWN OF EMMITSBURG WTP\CAD\0-ALL IN ONE.DWG

WATERPROOFING (FULL BELOW GRADE WALL HEIGHT)

DRAINAGE BOARD
(FULL WALL HEIGHT WITHIN 2' OF TOP OF GROUND SURFACE)



GEOTEXTILE* - MIRAFI 140N OR EQUIVALENT WITH 4" MINIMUM OVERLAP

PRODUCTS SPECIFIED MAY BE SUBSTITUTED WITH AN APPROVED EQUIVALENT PRODUCT



FINDLING, INC.

3401 CARLINS PARK DRIVE
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NOTE:
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TYPICAL SUBDRAINAGE DETAIL-SLAB

TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21-1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 7

Tables



Table 2.1: Summary of Laboratory Test Results

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier
 Location: 8585 Crystal Fountain Road, Emmitsburg, MD
 Findling, Inc. Project No. : 21-1055

Boring No.	Sample ID	Sample Depth	Natural Moisture Content, %	Atterberg Limits			Grain Size Distribution			Modified Proctor (ASTM D1557) (AASHTO T-180)		California Bearing Ratio (CBR)	USCS Classification	AASHTO Classification
				LL	PL	PI	GRAVEL (%)	SAND (%)	FINES (%)	Max Dry Density, pcf	Optimum Moisture Content, %			
B-1	Bulk	0.0 - 10.0	14.0	33	16	17	7.3	42.3	50.4	128.3	10.1	5.6	CL	A-6(5)
B-1	S-1	0.0 - 1.5	10.3											
B-1	S-2	2.5 - 4.0	12.4	41	23	18	31.5	31.8	36.7				SC	A-7-6(2)
B-1	S-3	5.0 - 6.5	13.9											
B-1	S-4	7.5 - 9.0	13.0	33	18	15	13.0	44.9	42.1				SC	A-6(3)
B-1	S-5	10.0 - 11.5	18.1											
B-1	S-6	15.0 - 16.5	14.7											
B-1	S-7	20.0 - 21.0	13.6											
B-2	Bulk	0.0 - 10.0	10.2	39	20	19	9.8	36.7	53.5				CL	A-6(7)
B-2	S-1	0.0 - 1.5	8.6											
B-2	S-2	2.5 - 4.0	15.8											
B-2	S-3	5.0 - 6.5	9.0	35	19	16	40.1	31.7	28.2				GC	A-2-6(1)
B-2	S-4	7.5 - 9.0	12.9											
B-2	S-5	10.0 - 11.5	14.0											
B-2	S-6	15.0 - 16.5	9.9	25	16	9	29.1	52.7	18.2				SC	A-2-4(0)
B-2	S-7	20.0 - 21.5	13.8											
B-2	S-8	30.0 - 31.5	15.0											
B-2	S-9	35.0 - 36.5	7.3											



3401 Carlins Park Drive
 Baltimore, MD 21215
 TEL: 410-367-1400 FAX: 410-466-6867
 info@findlinginc.com

Table 3.1 : Summary of Boring Data
 Towson University Union Expansion
 Towson, Maryland 21252
 Findling Contract No.: 16-1043

Boring No.	Ground Surface Elev (±ft.)	Bottom of Explored Strata						Groundwater Level **						Caved-in Depth (±ft.)*	Boring Depth (±ft.)*	Bottom of Boring Elev (±ft.)	
		Stratum A Fill		Stratum B Residual		Disintegrated Rock		During Drilling		End of Drilling		After 24 hrs.					
		Depth (±ft.)*	Elev (±ft.)	Depth (±ft.)*	Elev (±ft.)	Depth (±ft.)*	Elev (±ft.)	Depth (±ft.)*	Elev (±ft.)	Depth (±ft.)*	Elev (±ft.)	Depth (±ft.)*	Elev (±ft.)				
B-1	826.0	7.5	818.5	20.0	806.0	21.0	805.0	10.0	816.0	10	816.0	1.1	824.9	9.9	816.1	21.0	805.0
B-2	822.0	9.0	813.0	30.0	792.0	36.5	785.5	10.0	812.0	5	817.0	-	-	13.2	808.8	36.5	785.5

Key: * Below the existing ground surface.
 * Groundwater elevation could fluctuate due to seasonal conditions.
 NE : Not Encountered within depth of boring.
 NA : Not Applicable.

Laboratory Test Results



CALIFORNIA BEARING RATIO (CBR) TEST

(ASTM D 1883)

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055
BORING NUMBER: B-1

SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)

LAB SAMPLE ID: BULK
DEPTH, (FT): 0'-10'

CBR TEST METHOD: ASTM, D1883 (96 Hours Soaked) **WEIGHT DURING SOAKING:** 25 lbs. (~127 psf)

MAX. DRY DENSITY (pcf): 128.3 **OPT. MOISTURE CONTENT:** 10.1%
 (Modified Proctor, D-1557)

TEST-1 (56 BLOWS PER LAYER)

MOLDED

DRY DENSITY (pcf): 125.7
MOISTURE CONTENT: 11.2%
% COMPACTION OF MAX. DENSITY: 98.0%
CBR @ 0.1": 6.8 **CBR @ 0.2":** 12.5

SOAKED

DRY DENSITY- SOAKED (pcf): 123.7
MOISTURE CONTENT(SOAKED): 13.0%
% COMPACTION OF MAX. DENSITY: 96.4%
% SWELL: 0.9%

TEST-2 (10 BLOWS PER LAYER)

MOLDED

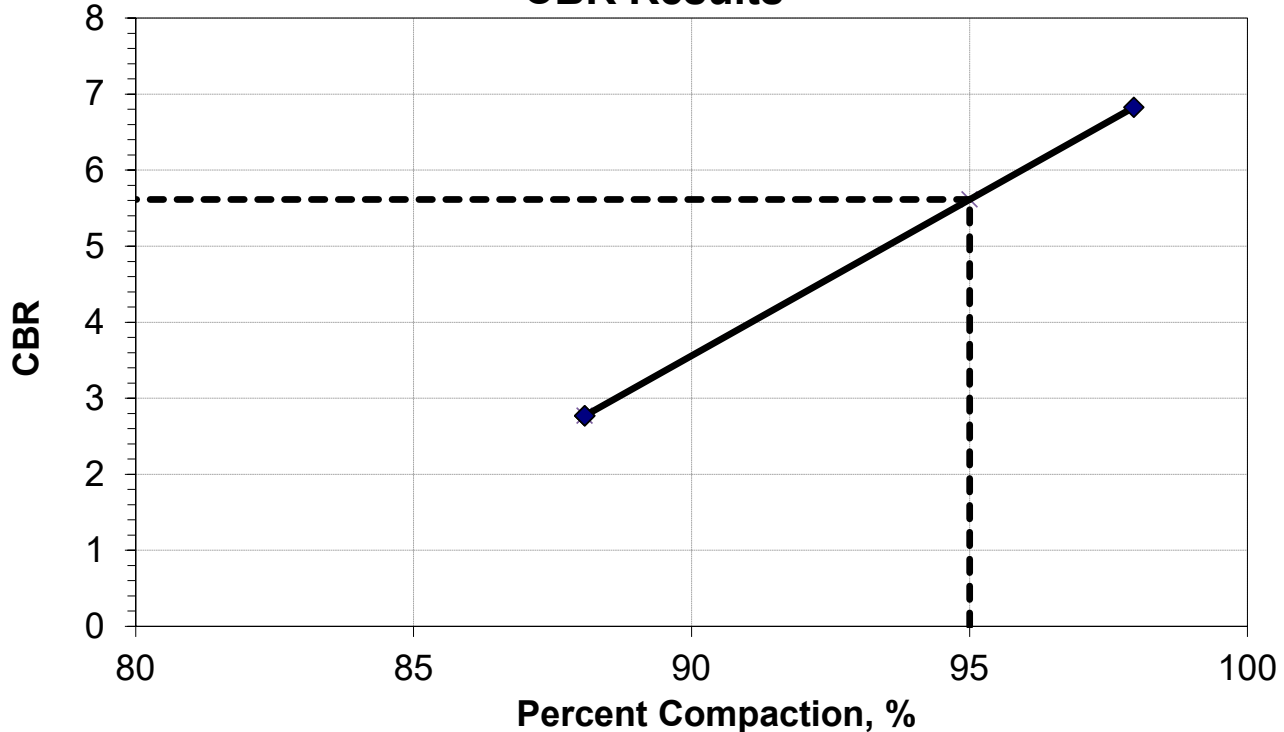
DRY DENSITY (pcf): 113.0
MOISTURE CONTENT: 10.9%
% COMPACTION OF MAX. DENSITY: 88.1%
CBR @ 0.1": 2.8 **CBR @ 0.2":** 3.0

SOAKED

DRY DENSITY- SOAKED (pcf): 107.2
MOISTURE CONTENT(SOAKED): 16.9%
% COMPACTION OF MAX. DENSITY: 83.6%
% SWELL: -0.1%

CBR at 95% Compaction = 5.6

CBR Results





CALIFORNIA BEARING RATIO (CBR) TEST

(ASTM D 1883)

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055
BORING NUMBER: B-1
LAB SAMPLE ID: BULK
WEIGHT DURING SOAKING: 25 lbs. (~127 psf)

SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)

MAX. DRY DENSITY (pcf): 128.3
(Modified Proctor, ASTM D 1557)

OPT. MOISTURE CONTENT: 10.1% DEPTH, (FT): 0'-10'

DRY DENSITY (pcf): 125.7

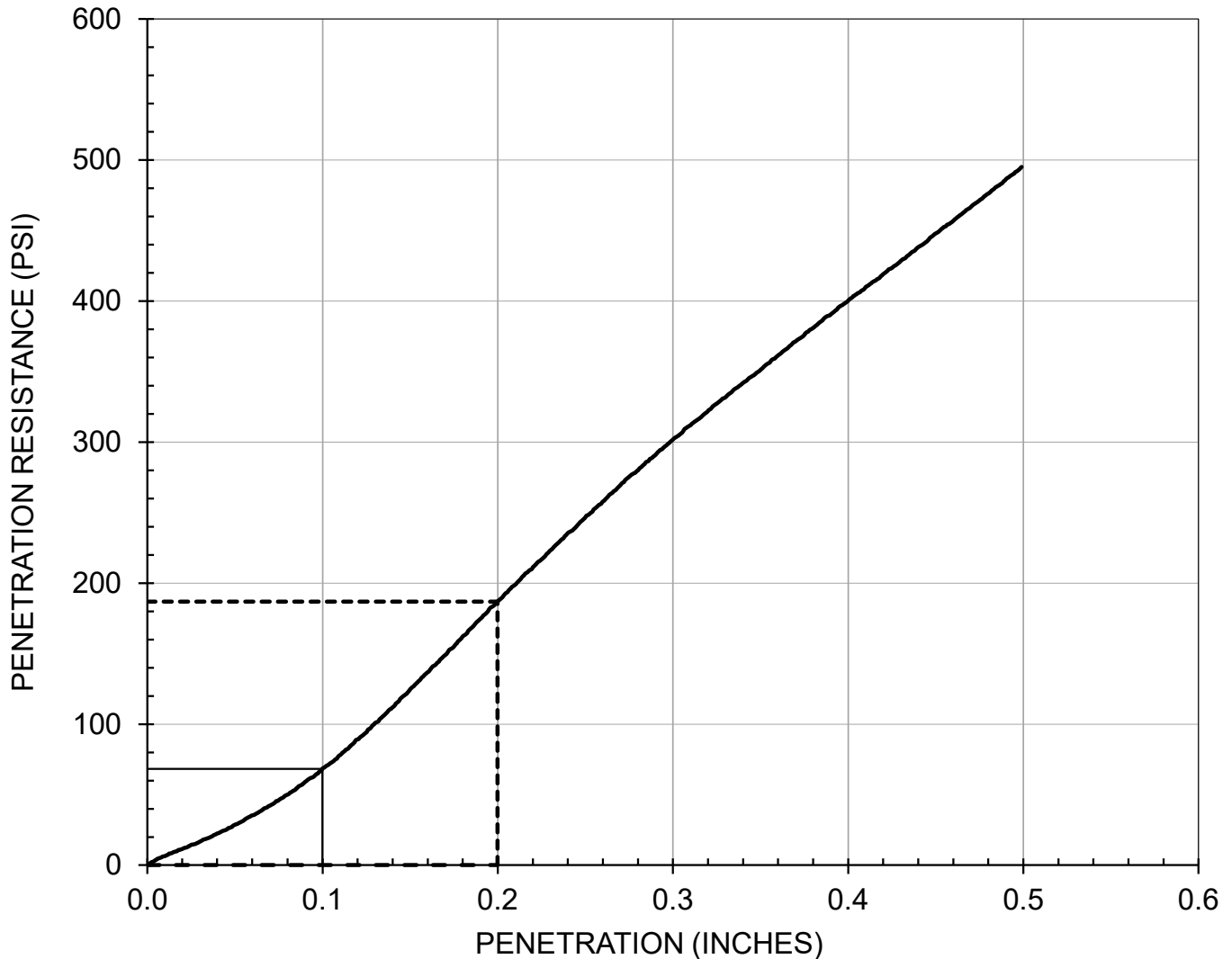
MOISTURE CONTENT: 11.2% % SWELL: 0.9%

CBR @ 0.1: 6.8

CBR @ 0.2: 12.5 Blows/layer: 56

METHOD: ASTM, D1883 (96 Hours Soaked) % COMPACTION OF MODIFIED PROCTOR (T-180): 98.0%

CBR TEST





CALIFORNIA BEARING RATIO (CBR) TEST

(ASTM D 1883)

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055

BORING NUMBER: B-1

LAB SAMPLE ID: BULK

SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)

WEIGHT DURING SOAKING: 25 lbs. (~127 psf)

MAX. DRY DENSITY (pcf): 128.3
(Modified Proctor, ASTM D 1557)

OPT. MOISTURE CONTENT: 10.1% DEPTH, (FT): 0'-10'

DRY DENSITY (pcf): 113.0

MOISTURE CONTENT: 10.9% % SWELL: -0.1%

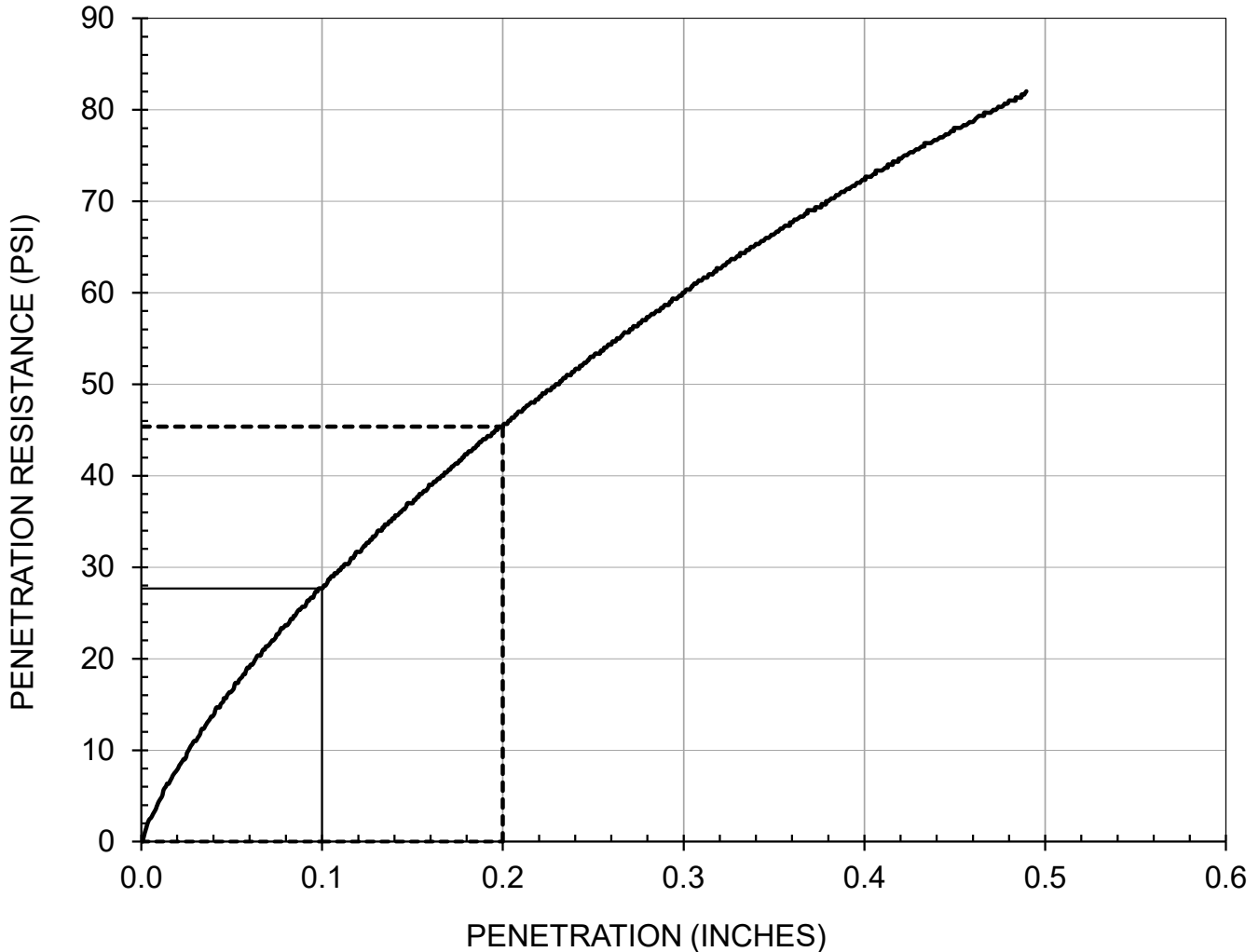
CBR @ 0.1: 2.8

CBR @ 0.2: 3.0 Blows/layer: 10

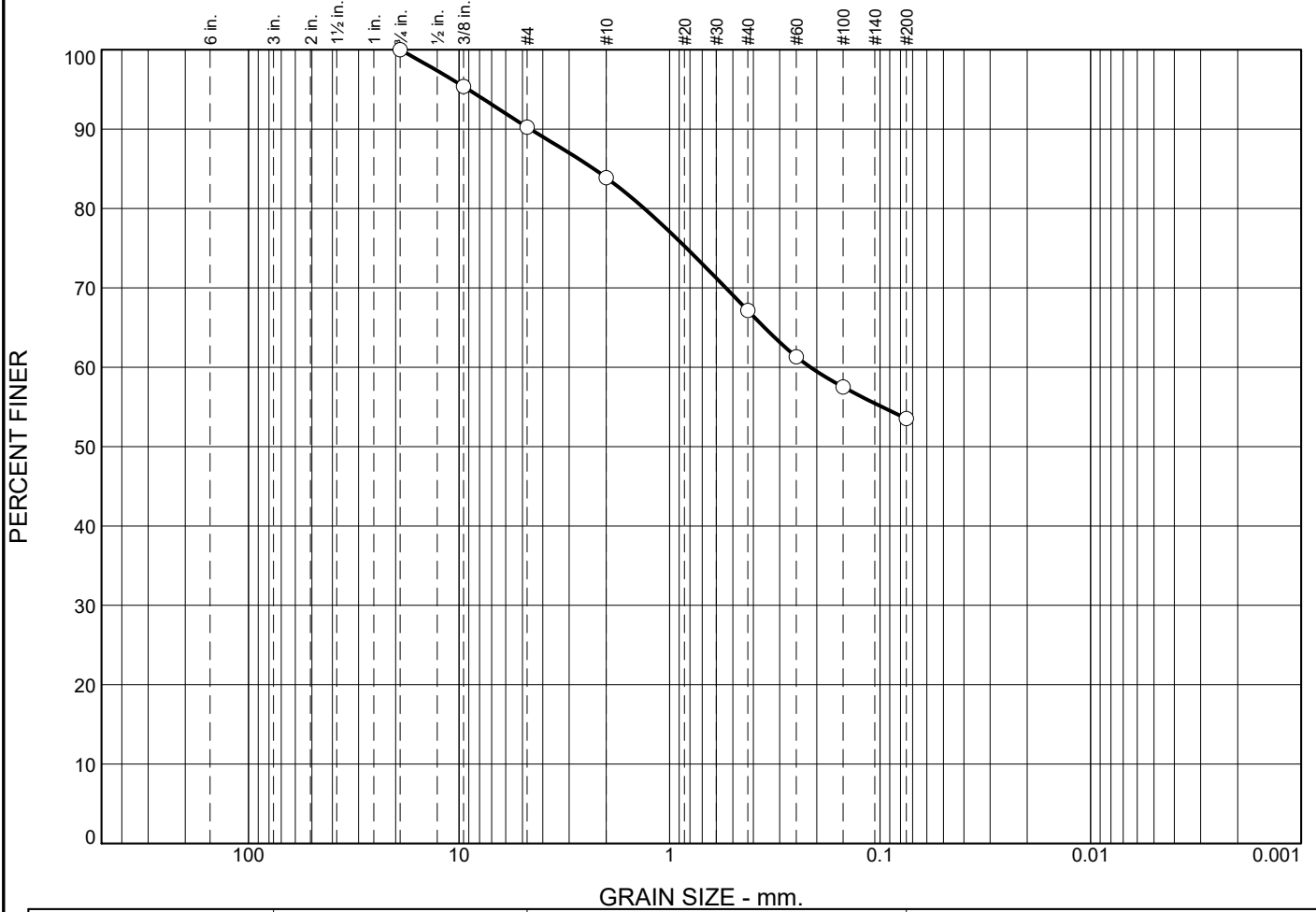
METHOD: ASTM D1883, 96 Hours Soaked

% COMPACTION OF MODIFIED PROCTOR (T-180): 88.1%

CBR TEST



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	9.8	6.3	16.8	13.6	53.5	

<input checked="" type="checkbox"/> Colloids	LL	PL	D ₈₅	D ₆₀	D ₅₀	D ₃₀	D ₁₅	D ₁₀	C _c	C _u
<input type="checkbox"/>	39	20	2.2956	0.2144						

Material Description	USCS	AASHTO
<input type="checkbox"/> Light brown Sandy CLAY	CL	A-6(7)

<p>Project No. 21-1055 Client: RK & K</p> <p>Project: Town of Emmitsburg Water Treatment Plant-New Clarifier</p> <p><input type="checkbox"/> Source of Sample: B-2 Depth: 0.0'-10.0' Sample Number: Bulk</p> <p>Date: <input type="checkbox"/> 10/6/21</p> <p style="text-align: center;">Findling, Inc.</p> <p style="text-align: center;">Baltimore, Maryland</p>	<p>Remarks:</p> <p><input type="checkbox"/> Natural Moisture Content= 10.2%</p>
---	--

Seismic Site Classification



Town of Emmitsburg Water Treatment Plant New Clarifier

Latitude, Longitude: 39.696872, -77.386902



Date	11/19/2021, 12:31:41 PM
Design Code Reference Document	IBC-2015
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.125	MCE_R ground motion. (for 0.2 second period)
S_1	0.052	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.2	Site-modified spectral acceleration value
S_{M1}	0.124	Site-modified spectral acceleration value
S_{DS}	0.134	Numeric seismic design value at 0.2 second SA
S_{D1}	0.083	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.06	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.096	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
$SsRT$	0.125	Probabilistic risk-targeted ground motion. (0.2 second)
$SsUH$	0.14	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
$S1RT$	0.052	Probabilistic risk-targeted ground motion. (1.0 second)
$S1UH$	0.057	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
$S1D$	0.6	Factored deterministic acceleration value. (1.0 second)
PGA_d	0.6	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.895	Mapped value of the risk coefficient at short periods
C_{R1}	0.908	Mapped value of the risk coefficient at a period of 1 s

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Boring Logs



FINDLING, INC.

BORING LOG

Sheet 1 of 1

Boring of 2

Project No.: 21-1055 Project Description: Town of Emimitsburg WTP - New Clarifier

Boring No. B-2 Station: , ' Ground Surface Elevation: 822.0 ft

Easting: Northing: Logged by:

Date Started: 10/6/21 Date Completed: 10/7/21

Inspector: Driller: D. Pryor

Rig Type	<u>CME Truck 45</u>
Rig No.	<u>R-2</u>
Drive Hammer Weight	<u>140</u> LB
Auger Size	<u>3.25</u> IN
Size of Core	<u> </u> IN
Size of Bit OD	<u> </u> IN
Hammer Energy Ratio	<u> </u> %
Auger Depth	<u>36</u> FT

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
<u>5.00</u>	<u>817.00</u>	<u>END</u>	<u>10/6/21</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

CAVE-IN TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
<u>13.20</u>	<u>808.80</u>	<u>END</u>	<u>10/6/21</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

21-1055 RK&K TOWN OF EMIMITSBURG WTP NEW CLARIFIER FOR WATER TREATMENT PLANT.GPJ-10/29/21

DEPTH IN FEET	ELEV. IN FEET	MATL	MATERIAL DESCRIPTION	SPT SPOON/ROCK CORE			REC. SPT(in) of Core (%)	LAB. INDEX TESTS			REMARKS	
				SAMPLE NO.	BLOWS/RQD	SAMPLE DEPTH		NMC (%)	LL (%)	PI (%)		
0.2	821.83		Topsoil = 2" thick	1	5-15-7	0.0-1.5	8				Bulk Sample 0'-7'. Due to cobbles enough soil was not collected from 0'-5'.	
			Brown, gray, mosit, medium stiff to stiff Sandy Clay, little to some Silt and Gravel, some cobbels (FILL)	2	9-12-10	2.5-4.0	7					
				3	7-13-46	5.0-6.5	18					
9.0	813.00				4	3-28-12	7.5-9.0	6				
			Brown, wet, medium dense Clayey SAND (SC), some Silt and stone fragments	5	2-2-5	10.0-11.5	16				Water on rods@10'	
				6	5-4-3	15.0-16.5	16					
				7	4-5-4	20.0-21.5	18					
26.0	796.00				8	2-3-5	25.0-26.5	11				
				Brown, wet, very dense, Clayey Sand (Disintegrated Rock)	9	21-24-47	30.0-31.5	12				
30.0	792.00					10	18-38-26	35.0-36.5	18			
36.5	785.50		Bottom of Boring @ 36.5'									

Legend: NMC - Natural Moisture Content PI - Plasticity Index REC - Recovery MATL - Material Graphics SPT - Standard Penetration Test
 RQD - Rock Quality Designation LL - Liquid Limit Elev - Elevation Geotech - Geotechnical OD - Outside Diameter

Boring and Sampling Conforms to ASTM/AASHTO:

(Blank Page – End of Report)

APPENDIX B
EQUIPMENT QUOTATION FOR DAF CLARIFIERS
&
FLOCCULATION TANK



A Sulzer Brand

Trusted Wastewater Solutions™

DAF System

Proposal



Project: DAF System

Emmitsburg, MD

Proposal Number: 21011511CB-D

Date: November 6, 2023

Sulzer Chemtech USA Inc. dba FRC Systems International
PO Box 3147 • Cumming, GA 30028 Phone: 770.534.3681 Fax: 770.783.8632
www.frcsystems.com

SULZER CONFIDENTIAL



Proposal Number: 21011511CB-D

Date: November 6, 2023

<p>Proposal for: John C. Moore, P.E. Director, Water RK&K 700 East Pratt Street, Suite 500 Baltimore, MD 21202 410.728.2900 P 410.462.9479 D www.rkk.com</p>	<p>Proposal Presented by: Adriaan van der Beek President FRC Systems International PO Box 3147 Cumming, GA 30028</p> <hr/> <p>Project: DAF System – Emmitsburg, MD</p>
---	---

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If these conditions are not acceptable to the receiving party, all copies of the document are to be immediately returned to FRC.

Content

1. Project Rationale.....4

2. System Information6

3. Technical Details.....8

4. Commercial Details 13

5. Items Not Included in Scope of Supply 15

6. Terms..... 16

Enclosures

- a) Process & Instrumentation Diagram (P&ID)
- b) Specification for PCL-15 DAFs

1. Project Rationale

Dear John,

Please find enclosed the technical and commercial details of the PCL-15 DAF systems for the Emmitsburg, MD water treatment plant. [Revision D of this proposal updates pricing from Revision C \(March 2022\).](#)

Since only 240V, 1-phase power is available, we need to provide a different electrical control panel with VFDs that can run the 3-phase motors. Instead of proposing one (1) PCL-30 DAF which could not do that, we are offering a system of two parallel PCL-15 units.

We are also offering CSTRs (stirred reactor tanks) in front of each DAF unit for coagulation. Each tank will have a 10 minute residence time at 300 gpm. It has been discussed that the owner would like these CSTRs to have capability to operate in series or parallel (interconnecting piping by others).

A small sludge recycle pump will come with each DAF to return some of the separated solids back into the CSTR system to aid in the formation of larger flocs to enhance separation.

As a standard, we build the support structures and access catwalks for our own equipment out of durable schedule 304 stainless steel.

We design the electrical control panels for our systems in-house. Our standard panel includes Allen Bradley PLC & HMI, motor starters, and a NEMA 4-rated enclosure.

We perform FATs for all equipment we manufacture in-house. Our clients are always invited to come to our factory and observe these tests in person.

Custom materials and configurations are available, don't hesitate to ask if you have materials challenges or requests. Please contact us if you have any questions, comments, or concerns regarding our proposal or attached documents. We look forward to working with you!



Proposal Number: 21011511CB-D

Date: November 6, 2023

Respectfully,

Adriaan van der Beek

President

FRC Systems International

PO Box 3147

Cumming, GA 30028

Office: (770) 534-3681

Cell: (678) 983-6422

Adriaan.vanderBeek@sulzer.com

Crystal Brokaw

Applications Engineer

FRC Systems International

PO Box 3147

Cumming, GA 30028

Office: (770) 534-3681

Direct: (770) 203-4421

Crystal.Brokaw@sulzer.com

2. System Information

2.1 Design Information

The design of the proposed treatment system is based on information provided by client. Client should inform FRC if the system information does not reflect the actual situation.

Parameter	Minimum	Average	Maximum
Flow rate [gpm]	125	150	300
Turbidity [NTU]	≤10	-	11-100
pH	6	-	7.5

2.2 Utility Information

Available at Plant	Quantity
Power Supply	230 V/60 Hz/1 phase
Control Voltage	120 VAC
Air Supply	From Compressor Offered by FRC @ 100 psi
City Water	For Commissioning/Start-up



2.3 Equipment Information

Property	Quantity
Power Installed	<u>CSTR Mixers (Qty. 2)</u> 2 HP – each CSTR Mixer <u>PCL-15 DAF (Qty. 2)</u> 1 HP – each Skimmer Drive 10 HP – each Recycle Pump (2 per DAF) ¾ HP – each Sludge Pump
Approx. Weight of PCL-15 DAF (Empty)	5,100 lbs.
Approx. Weight of PCL-15 DAF (Full)	17,900 lbs.
Air usage by Each DAF Process	Approx. 1 scfm @ 100 psi, dry filtered
Recommended Coagulant	PAC

3. Technical Details

Technical summary of equipment supply for wastewater treatment plant:

3.1 Continuously Stirred Reactor Tanks (CSTR)

- Tag ID : T3001A/B
- Type : Flat bottom, open top
- Material of construction : SS304
- Working Capacity : 3,000 gal
- Includes Mixer Bridge
- Quantity : Two (2)

3.2 CSTR Mixers

- Tag ID : MX3001A/B
- Power : 2 HP
- Impeller : Stainless Steel
- Shaft : Stainless Steel
- Voltage : 230V/60Hz/1ph
- Quantity : Two (2)

3.3 FRC DAF system, model PCL-15

- Tag ID : DAF16001/26001
- Materials : SS 304
- Quantity : Two (2)

Rotating top-skimmer

- Skimmer drive
 - Tag ID : SC16005/26005
 - Power : 1 HP
 - Motor : TEFC
 - Voltage : 230V/60Hz/1ph
 - Quantity : One (1) per DAF
- Chain : Polyacetal
- Sprockets : Nylon

White water aeration system including:

- Recycle pump

- Tag ID : P16001A/B ; P26001A/B
- Manufacturer/Model : Sulzer CPE 11-1 ANSI w/ C-Flange
- Type : End Suction Centrifugal ANSI
- Recycle flow : 44 gpm @ 185 ft
- Volute/Casing Cover : Ductile Iron
- Impeller : Duplex Stainless Steel
- Shaft : Duplex Stainless Steel
- Mechanical Seal : SS316 Gland, C/SiC Faces, EPDM
- Motor : ABB NEMA Severe Duty 215T TEFC
- Coupling : Rexnord Viva
- Max Power : 10 HP
- Voltage : 230V/60Hz/3ph
- : (VFD In: 230V/1ph Out: 230V/3ph)
- Location : Installed on DAF skid
- Quantity : One (1) + one (1) standby per DAF
- Recycle pump isolation valves : Two (2) 316SS manual valves per pump
- Air Dissolving Tube : SS304
- Manifold : SS304
- Bleed off valves
- Pressure gauges
- White water hosing
- Isolation and aeration valves

Sand drain valve:

- Tag ID : V16103/26103
- Type : Double actuating plug valve
- Size : 4"
- Quantity : One (1) per DAF

Bottom drain valve:

- Tag ID : V16104/26104
- Type : Double actuating plug valve
- Size : 6"
- Quantity : One (1) per DAF

Plate pack system

- Material of construction : SS304
- Free area : 33 ft²
- Effective area : 258 ft²

Pneumatic control panel including

- Pressure Regulator/Filter
- Air Rotameter
- Air Check Valve
- Pressure Switches for:
 - Compressed Air
 - Recycle Pump
- Solenoids for:
 - Inlet Solids Drain
 - Bottom Solids Drain
 - Air supply to DAF

Float Chamber (Sludge Collection)

3.4 Level Probes for DAF Sludge Hopper

- Tag ID : LSL/LSH16001 ; LSL/LSH26001
- Measurement type : Conductivity probes
- Location : installed on DAF Sludge compartment
- Manufacturer : Warrick
- Probe material : SS 316
- Quantity : Two (2)

3.5 Sludge Recycle Pumps

- Tag ID : P18001/28001
- Type : Progressive Cavity
- Capacity : 5 gpm @ 15 psi
- Material of Construction : Cast Iron
- Motor : TEFC
- Installed Power : ¾ HP
- Voltage : 230V/60Hz/1ph
- Including dry run protection

- Quantity : Two (2)

3.6 E-Panel for FRC Supplied Equipment

- NEMA 4, Painted Steel Enclosure
- PLC (Allen Bradley – CompactLogix)
- HMI (Allen Bradley – 10” PanelView)
- E-Panel will include the 3-phase power distribution block and motor controls
- Includes required I/O cards for equipment on attached P&ID
- VFDs for recycle pump motors will be DuraPulse Drives with single phase, 230VAC line voltage and 230VAC three phase load voltage.
- All E-panel design and PLC/HMI programming will be done in-house by FRCs dedicated electrical controls engineering team.
- Quantity : One (1)

3.7 E-Shaped DAF Mounted OSHA Compliant Catwalk with Stairs

- Access to 2 sides and 1 end of each DAF
- Access to 1 side of each CSTR
- Frame : 304 Stainless Steel Square Tube
- Handrail : 304 Stainless Steel Square Tube
- Kick Plates : 304 Stainless 11 gauge
- Stairs : 304 Stainless Steel (45 degree w/ 8” riser)
- Grating : Non-Slip 1” Thick FRP
- Quantity : One (1)

3.8 Design Engineering

- Detailed design and consultation for installed treatment system
- Including:
 - Equipment dimensional drawings (top view, side view, influent/effluent sides)
 - 3D drawings (of DAF only)
 - Dimensional drawing & I/O list for control panel
 - Electrical control narrative document
 - Process & Instrumentation Diagram (PID)
 - Two (2) copies of Operation & Maintenance Manuals
 - Drawings and instructions for installation

3.9 Air Compressor

- Tag ID : CMP7001
- Manufacturer : CAS
- Capacity : 36 cfm @ 100 psi
- Tank Capacity : 120 gallons
- Installed Power : 2x 5 HP
- Electrical Service : 230V/60Hz/1ph
- Including inlet air filter, dryer mounted on discharge, automatic compensated drain valve
- Quantity : One (1)

Optional

3.10 On-site Mechanical Services

- Supervision of Installation
- Operator Training
- General Field Services

4. Commercial Details

Item #	Description	Line Total
Main Scope		
3.1-3.8	<ul style="list-style-type: none"> • <u>PCL-15 DAF – SS304 Construction</u>: Qty.2 <ul style="list-style-type: none"> ○ Dissolved Air (Whitewater) System <ul style="list-style-type: none"> ▪ Air Dissolving Tube – SS304 ▪ Recycle Pumps – Duplex Stainless Steel Impeller & Shaft, DCI Casing, Duty/Standby Configuration ○ Sludge Removal <ul style="list-style-type: none"> ▪ Chain & Flight Top Skimmer ▪ PC Sludge Pump: 5 gpm @ 15 psi ▪ Sludge Level Probes: 316SS Probe-type level switch ○ Settled Solids Removal <ul style="list-style-type: none"> ▪ Drain Valves – Plug-style, Pneumatically Actuated • <u>Flocculator – CSTR (SS304)</u>: Qty.2 <ul style="list-style-type: none"> ○ Working Volume 3,000 Gallons ○ Mixer for Each Tank • <u>Control Panel</u>: Qty.1 <ul style="list-style-type: none"> ○ NEMA 4 Enclosure ○ PLC & HMI <ul style="list-style-type: none"> ▪ PLC: Allen Bradley – CompactLogix ▪ HMI: Allen Bradley – 10” PanelView ▪ In-house Programming ○ 230V power with recycle pump VFDs as DuraPulse Drives 	



	<ul style="list-style-type: none"> • <u>Catwalk – SS304 with FRP Grating</u>: Qty.1 <ul style="list-style-type: none"> ○ E-shaped to Access All Sides of Both DAFs, Access to both CSTRs on One Side ○ OSHA Compliant • <u>Engineering and Documentation</u>: Qty.1 <ul style="list-style-type: none"> ○ Equipment dimensional drawings (top view, side view, influent/effluent sides) ○ 3D drawings (of DAF only) ○ Dimensional drawing & I/O list for control panel ○ Electrical control narrative document ○ Process & Instrumentation Diagram (P&ID) ○ Two (2) copies of Operation & Maintenance Manuals ○ Drawings and instructions for installation 	
3.9	<ul style="list-style-type: none"> • <u>Air Compressor</u>: Qty. 1 <ul style="list-style-type: none"> ○ 36 scfm @ 100 psi ○ Duplex motor for duty/standby configuration 	
Extra	Transport DAP Emmitsburg, MD	TBD
Optional Scope		
Extra	<ul style="list-style-type: none"> • <u>NET ADDER to Line Item 3.9</u>: Quiet Air Compressor rated for 32 scfm @ 100 psi, duplex motor for duty/standby configuration 	
3.10	<ul style="list-style-type: none"> • On-site Mechanical Services 	\$1,450/day + expenses*

*Expenses include travel, travel-associated costs, per diem, and 10% administration fee. One 'day' is defined as 8 working hours. Holiday, weekend, and overtime work billed extra. Per diem rate based on those established by the US GSA: <http://www.gsa.gov/portal/category/100120>

5. Items Not Included in Scope of Supply

- Any seismic calculations, civil work, anchor bolts or concrete work
- Any site preparation, building and/or structures to house equipment, landscaping, or painting
- Any cast-in piping or conduit
- Any installation, labor, or material
- Any hoisting or lifting work during unloading and during installation
- Any chemicals or chemical storage totes
- Any influent or effluent piping, valves, fittings or supports
- Any process water piping, valves, fittings or supports, calibration columns etc. for dosing equipment
- Any pump alignment
- Any sludge handling system
- Any solids transfer piping, valves
- Any electrical work, including cables and connections between control panel and equipment
- Any local disconnects required at motor locations for equipment
- Any heat tracing or insulation of pipes or equipment
- Any water for on-site hydrostatic testing of vessels
- Any applicable state, federal or local taxes
- Any signing or sealing of engineering documents by professional engineer
- *All other items unless specifically mentioned in this proposal*

6. Terms

6.1 Payment Terms

- 40% with the PO
- 60% with the delivery of the equipment

6.2 Equipment Delivery*

To be agreed upon. Our goal is to meet your project timing, please do not hesitate to contact us if you have specific delivery or timing requirements so we can verify whether expedited delivery is feasible or not.

Please use following guideline:

- Engineering Submittal : 2-3 weeks
- Manufacturing : 20-24 weeks from submittal approval*
- FAT : 2 days
- Packing & Delivery : 1 week

*Based on current supply conditions

6.3 Delivery Terms

Transport DAP Emmitsburg, MD to be paid by customer.

6.4 Terms and Conditions of Sale

Attached Terms and Conditions of Sale are to be considered part of the proposal. A copy of these terms and conditions can also be found at <https://frcsystems.com/terms>.

6.5 Validity

30 days from date of proposal.

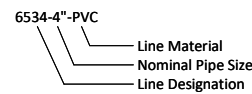
INSTRUMENT IDENTIFICATION

LETTERS	PRIMARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY LOCATION NORMALLY ACCESSIBLE TO OPERATOR
Discrete Instruments			
Shared Display, Shared Control			
Programmable Logic Control			

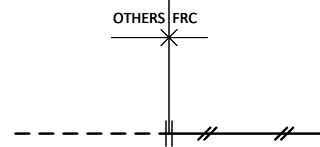
INSTRUMENT IDENTIFICATION LETTERS

LETTERS	PROCESS OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	Analysis		Alarm		
C	Conductive			Control	Close, Closed
D	Density	Differential			
E	Voltage	Emergency	Primary Element		
F	Flow Rate	Ratio			
G	Gauge				
H	Hand(Manual)				High
I			Indicate		
L	Level				Low
N	Turbidity		Middle/Intermediate		
O	User's Choice		Orifice		Open
P	Pressure(or Vacuum)				
S	Speed or Frequency	Safety		Sw itch	Stop
T	Temperature			Transmitter	
V	Viscosity			Valve or Damper	
Y	Status			Relay or Compute	
Z	Position			Drive or Actuate	

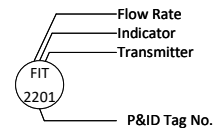
LINE NUMBERS



TURNKEY PIPELINE LIMITS



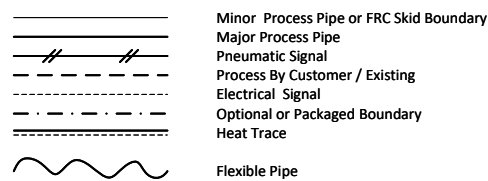
INSTRUMENT IDENTIFICATION LETTERS



LINE MATERIAL ABBREVIATIONS

CL	By Client
SS	Stainless Steel
CS	Carbon Steel
PVC	Polyvinyl Chloride
CPVC	Chlorinated Polyvinyl Chloride

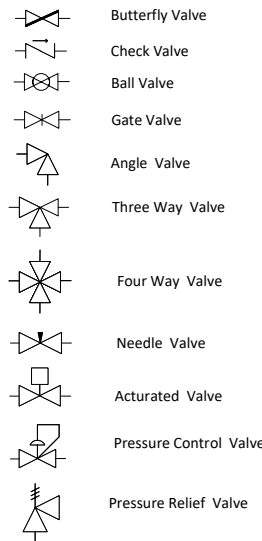
LINE LEGEND



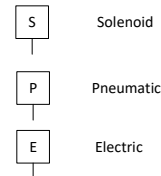
EQUIPMENT & VALVE ABBREVIATIONS

T	Tank or Sump
RS	Rotary Screen
P	Pump
PMA	Polymer Make Up (Automatic)
MX	Mixer
PF	Pipe Flocculator
DAF	Dissolved Air Flotation Unit
CMP	Compressor
BW	Blower
SC	Skimmer Drive
AU	Auger Drive
SP	Saturation Pipe
CLF	Clarifier
BP	Belt Press Filter
FP	Filter Press
V	Valve
SV	Solenoid Valve

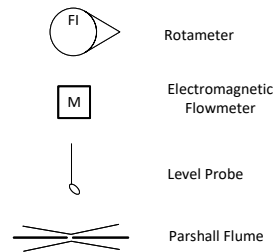
VALVE SYMBOLS



ACTUATOR SYMBOLS



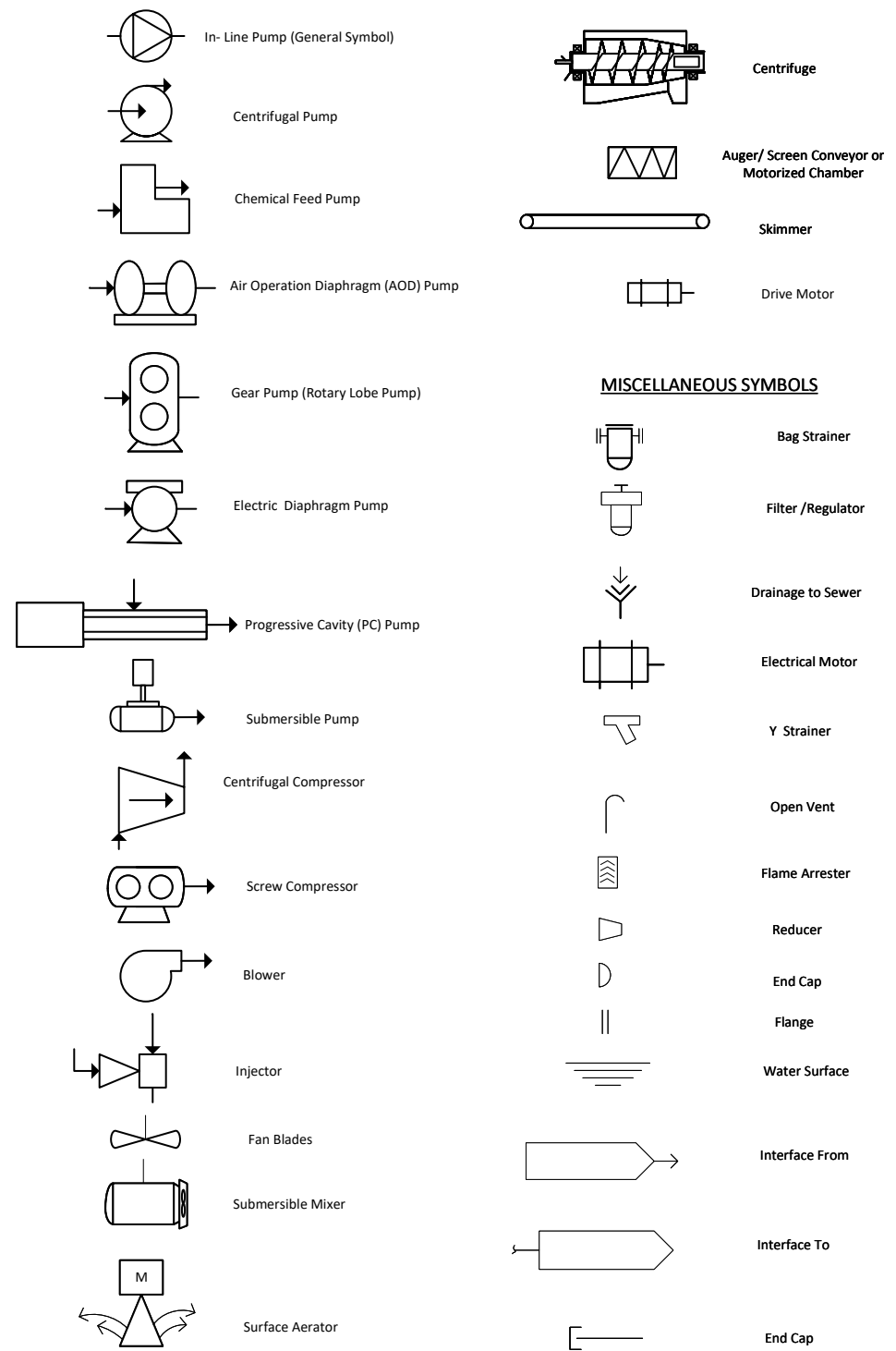
PRIMARY ELEMENT SYMBOLS



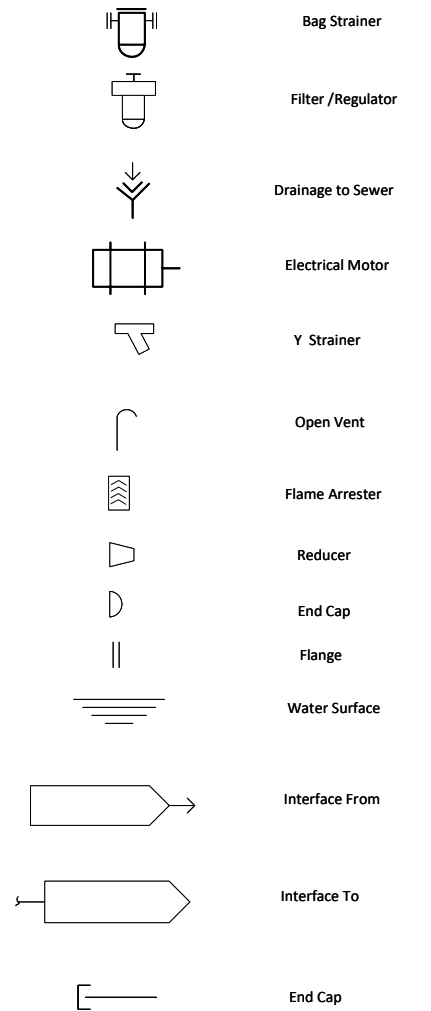
ABBREVIATIONS & LETTER SYMBOLS

MNPT	Male Nominal Pipe Thread
FNPT	Female Nominal Pipe Thread
POTW	Public Owned Treatment Works
VFD	Variable Frequency drive

ELECTRICAL EQUIPMENT SYMBOLS



MISCELLANEOUS SYMBOLS



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 Fax: (770) 783-8632
www.frcsystems.com

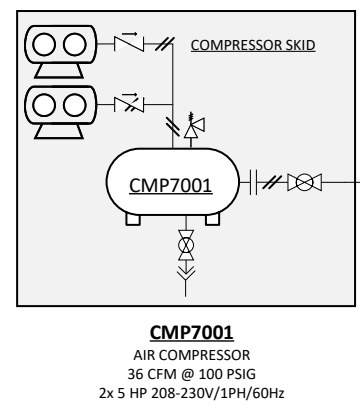
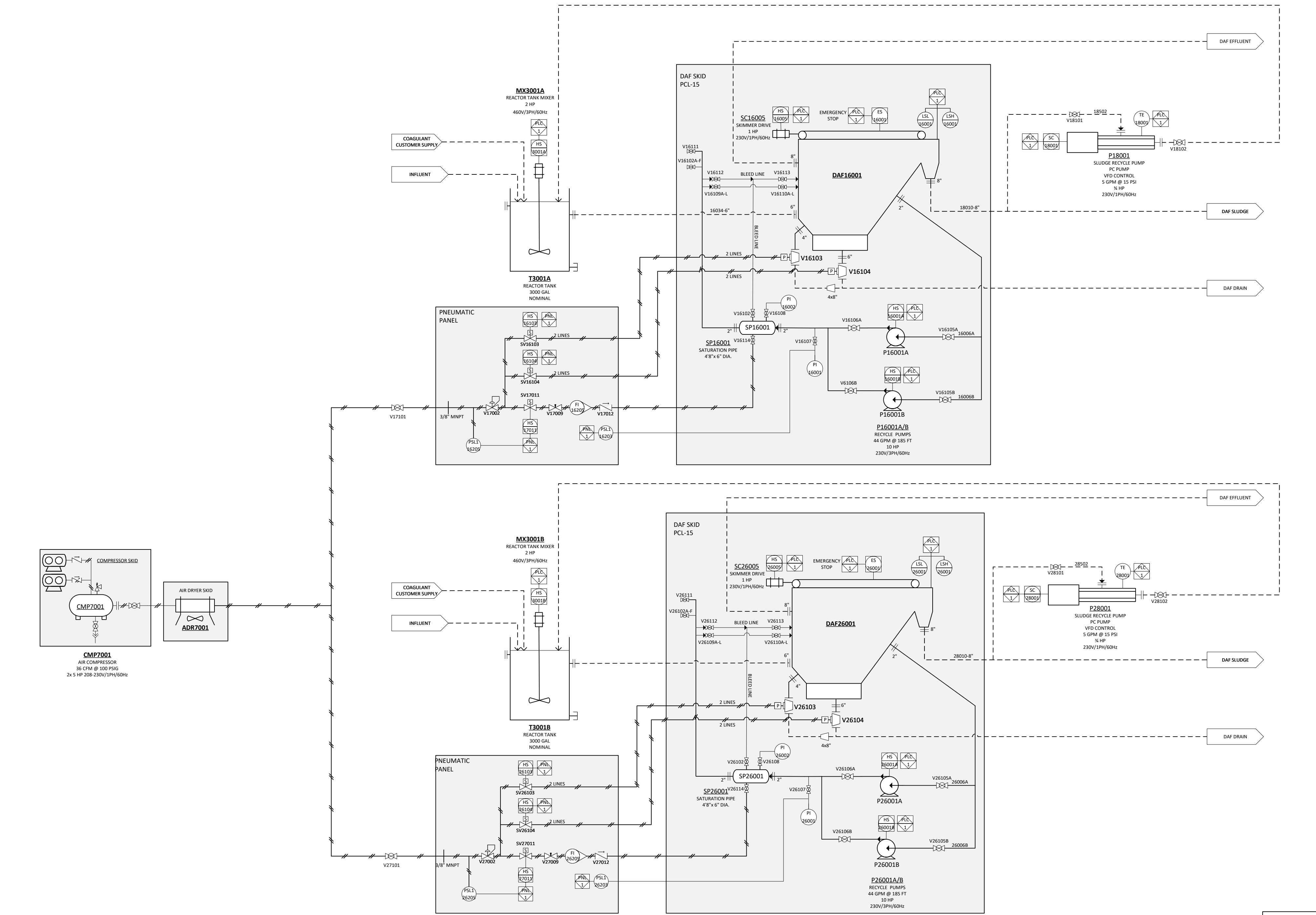
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REV.	DESCRIPTION	DATE	BY

NOTES:

PROCESS & INSTRUMENTATION DIAGRAM LEGEND			
SCALE	DRAWN BY	DWG NO	REV
N/A		P&ID - LEGEND	
SIZE	11 x 17	SHEET	



 = SKIDDED EQUIPMENT
 SKIDDED EQUIPMENT IS INCLUDED IN FRC SCOPE OF SUPPLY (INCLUDING SKIDDED VALVES.)
 NON-SKIDDED MANUAL VALVES ARE BY OTHERS EXCEPT WHERE OTHERWISE MENTIONED.



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REV.	DESCRIPTION	DATE	BY
D	PRICING UPDATE	11/6/23	CB

- NOTES:**
- Dashed piping is installed in field by others.
 - Equipment in blocks is skidded by FRC.
 - Skids may require some field assembly.
 - Each chemical line to go through its own cast-in conduit tube.

EMMITSBURG, MD			
PROCESS & INSTRUMENTATION DIAGRAM			
SCALE	DRAWN BY	DWG NO	REV
N/A	CB	21011511CB - P&ID	D
SIZE	ANSI C	6 NOV 2023	SHEET 1 OF 1

PRELIMINARY